Mercedes-Benz

Service

Electrical Troubleshooting Manual USA

Model 201 Model Years 1984 - 1993

Mercedes-Benz of North America, Inc.

S-2372-092

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Service and Parts Literature

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INTRODUCTION

This manual contains schematic diagrams and component locations for models 201.024/028 (190 E 2.3), 201.029 (190 E 2.6), 201.034 (190 E 2.3–16), 201.122 (190 D 2.2), 201 .126 (190 D 2.5) and 201 .128 (190 D 2.5 Turbo). Also included is information on: How To Use This Manual, Symbols, Troubleshooting Procedure and Automatic Climate Control.

The index for schematic diagrams appears on page 101.
The index for component locations appears on page 201.
The index for Tempmatic Climate Control appears on page 301.

Schematic diagrams should be referred to when diagnosing a problem (see Troubleshooting Procedure).

The information contained within this manual is accurateto the best of our knowledge at the time of printing. All rights are reserved to make production, design and specification changes at any time without notice and without obligation to give notice. Any such changes will not be contained within this manual

It is a general assumption that the reader is familiar with basic mechanical and electrical repair procedures and Mercedes-Benz vehicles.

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HOW TO USE THIS MANUAL

How to Read Schematic Diagrams

Electrical components which work together are shown together. Schematic drawings are arranged so that current flows from positive at the top of the page, to negative at the bottom. Fuses are shown at the top of the page. All wires, connectors, switches, and motors are shown in the flow of current to ground at the bottom of the page. The "hot" labels appearing at the top of fuses or components show the Ignition Starter/Switch positions which supply power to the point. (See Circuit Identification, page 9.)

The terminal number "30" appearing on the Ignition/Starter Switch and Exterior Lamp Switch means that these terminals are always supplied with power. The terminal number "15" on the Ignition/Starter Switch means that this terminal is supplied with power only when the Ignition/Starter Switch is in the "Run" or "Start" positions.

Component and Wire Representation

All wiring between components is shown exactly as it exists on the vehicle. Wiring inside complicated components has been simplified to aid in understanding their electrical operation. Transistorized components are shown as plain boxes labeled with a solid state symbol. Switches and sensors are shown "at rest," as if the Ignition Starter/Switch were off. Notes are included which describe how switches and other components work.

Circuits Which Share Power and/or Grounds

Each circuit is shown completely on one schematic diagram. Wires common to different schematics are cross referenced and marked with arrows. To find other circuits which might share fuse terminals or screw terminal blocks, look on the Power Distribution or Fuse Block Details schematics. To find other circuits which might share connections to ground terminals, look on the Ground Distribution schematics.

Power Distribution and Ground Distribution Diagrams

The Power Distribution diagrams show connections from the Battery and Alternator to the fuses, and to the Ignition Starter/Switch and Exterior Lamp Switch. This will tell you how each circuit gets its power, and what circuits share common fuses. Ground Distribution diagrams show how several circuits are connected to common grounds.

Component Identification

Component names are found underlined next to or above each component. Above the component name, you will find a Component Identification Code Number.

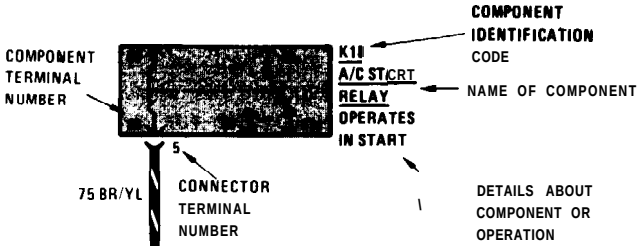
REVISIONS:

SYMBOLS

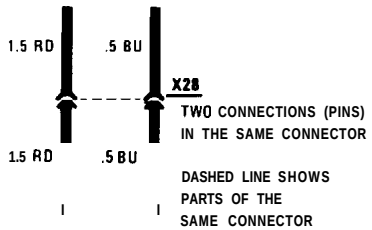
ONE POLE,
TWO POSITION
SWITCH

SWITCHES THAT
MOVE TOGETHER

OASHEO LINE SHOWS
A MECHANICAL
CONNECTION
BETWEEN SWITCHES



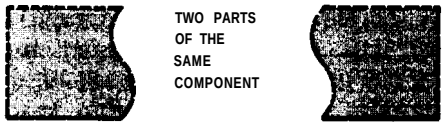
WIRE INSULATION	
COLOR	ABBREVIATIONS
BLACK	BK
BROWN	BR
RED	RD
YELLOW	YL
GREEN	GN
BLUE	BU
VIOLET	VI
GRAY	GY
WHITE	WT
PINK	PK



TWO CONNECTIONS (PINS)
IN THE SAME CONNECTOR

DASHED LINE SHOWS
PARTS OF THE
SAME CONNECTOR

SCREW
TERMINAL
BLOCK



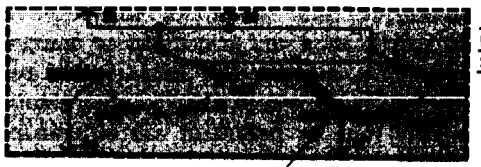
TWO PARTS
OF THE
SAME
COMPONENT

WIRE SIZE CONVERSION CHART	
METRIC (CROSS SECTIONAL AREA IN MM 2)	AWG (AMERICAN WIRE GAUGE)
.5	20
15	18
1	16
1.5	14
2	14
2.5	12
4	10
6	8
8	8
16	4
20	4
25	2
32	2

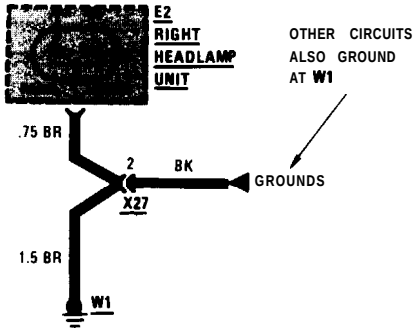
RELAY SHOWN WHEN COIL IS
WITH NO ENERGIZED, SWITCH
CURRENT IS PULLED CLOSED
FLOWING
THROUGH
COIL

DIODE
CURRENT CAN
FLOW ONLY IN
THE DIRECTION
OF THE ARROW

TWO
POLE,
FOUR
POSITION
SWITCH



"R" IS ENERGIZED
IN ACCV. RUN OR START

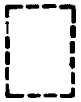


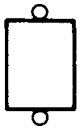
ALL MODELS

REVISIONS.

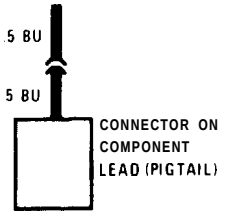
SYMBOLS

ENTIRE COMPONENT SHOWN

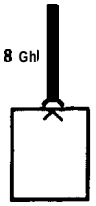

PART OF A COMPONENT SHOWN


COMPONENT WITH SCREW TERMINALS

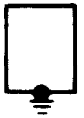
TRANSISTORIZED COMPONENT



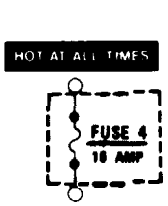
CONNECTOR ON COMPONENT LEAD (PIGTAIL)



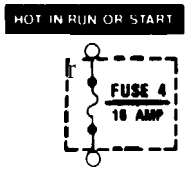
CONNECTOR ATTACHE0 TO COMPONENT


COMPONENT CASE IS DIRECTLY ATTACHED TO METAL PART OF CAR (GROUNDED)

FUSE WITH SCREW TERMINALS

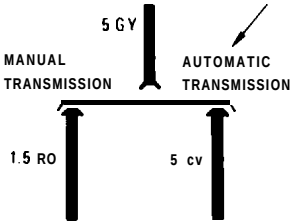


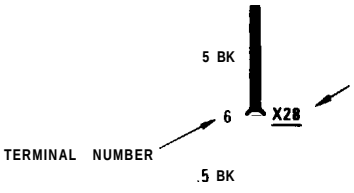
INDICATES THAT FUSE 4 IS ALWAYS SUPPLIED WITH POWER



INDICATES THAT FUSE 4 IS SUPPLIED WITH POWER WITH THE IGNITION SWITCH IN THE RUN OR START POSITIONS

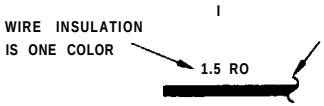
WIRE CHOICES FOR OPTIONS ARE SHOWN AN0 LABELEO





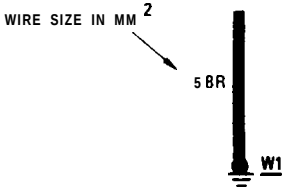
CONNECTOR REFERENCE NUMBER FOR COMPONENT LOCATION CHART

CHART ALSO SHOWS TOTAL NUMBER OF CONTACTS POSSIBLE: X28(6 PIN)



A WAVY LINE MEANS A WIRE IS TO BE CONTINUED

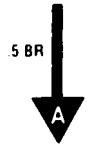
WIRE INSULATION IS ONE COLOR WITH ANOTHER COLOR STRIPE (RED WITH YELLOW1



WIRE IS ATTACHED TO METAL PART OF CAR (GROUNDED)

GROUND IS NUMBEREO FOR REFERENCE ON COMPONENT LOCATION CHART

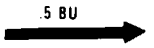
OTHER CIRCUITS THAT SHARE A GROUNO ARE SHOWN IN GROUNO DISTRIBUTION



TO TACHOMETER, PAGE 115/3

CURRENT PATH IS CONTINUED AS LABELEO THE ARROW SHOWS DIRECTION OF CURRENT FLOW AN0 IS REPEATED WHERE CURRENT PATH CONTINUES.

A WIRE WHICH CONNECTS TO ANOTHER CIRCUIT

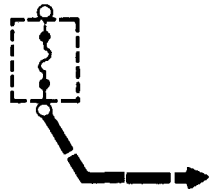


LAMPS: TURN/ HAZARD/STOP, PAGE 113

ALL MODELS

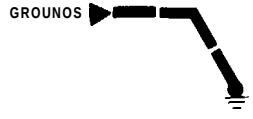
REVISIONS:

SYMBOLS



THIS FUSE FEEDS OTHER CIRCUITS WHICH ARE NOT SHOWN HERE THESE CIRCUITS ARE IDENTIFIED IN "POWER DISTRIBUTION"

POWER DISTRIBUTION



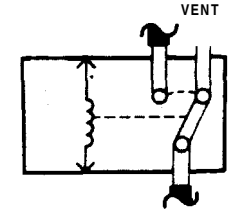
CIRCUITS NOT SHOWN HERE SHARE THIS CROUNO THESE CIRCUITS ARE IDENTIFIED IN " CROUNO DISTRIBUTION "

VACUUM RESTRICTOR

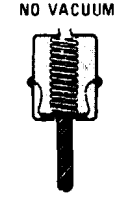
VACUUM RESTRICTORS ARE POROUS BRASS PLUGS IN THE VACUUM HOSE. THE RESTRICTOR SLOWS THE VACUUM FLOW

CHECK VALVE

VACUUM CAN FLOW EASILV IN THE DIRECTION OF THE ARROW. VACUUM CANNOT FLOW AGAINST THE ARROW.



A SWITCHOVER VALVE IS A SOLENOID OPERATED VACUUM VALVE THE VALVE IS VENTEO WHEN THE COIL OF THE SOLENOID IS OE ENERGIZED



VACUUM ELEMENTS PUSH OR PULL A SHAFT BETWEEN TWO FIXED POSITIONS WHEN VACUUM IS APPLIED. THE SHAFT IS PULLEO IN WHEN NO VACUUM IS PRESENT, THE SHAFT IS PUSHEO OUT BY A SPRING

INDUCTIVE SENSOR

TEMPERATURE SENSOR

ALL MODELS

REVISIONS:

TROUBLESHOOTING PROCEDURE

1. VERIFY THE COMPLAINT
   Operate the problem circuit in all modes to check the accuracy of the complaint. This may give a clue as to the extent, nature, and location of the problem.
2. CHECK THE FUSE AND RELATED CIRCUITS
   Determine the extent of the problem by operating circuits which share the same fuse. If the other circuits work, the fuse is good. The cause must be within the wiring unique to the problem circuit.
3. REFER TO THE E.T.M. AND ANALYZE THE CIRCUIT
   Study the circuit schematic to learn how the circuit should operate. The schematic will tell you:
   - Where the circuit receives current.
   - What circuit protection is involved.
   - What switches control current flow.
   - How the loads operate.

   Understanding the total circuit is necessary if you are to troubleshoot efficiently. Determine possible problem areas and testing locations. The Component Location table tells where components and ground points are located.
4. SYSTEMATICALLY TEST THE CIRCUIT IN ORDER TO ISOLATE THE PROBLEM
   As a general guideline:
   - If the fault affects a single component of a circuit, start to test at that component.
   - If the fault affects a number of components of a circuit, start to test at the point where the circuit gets its power.
5. MAKE THE REPAIR
   After you have narrowed the problem down to a specific cause, repair as necessary.
6. VERIFY CIRCUITOPERATION
   First operate the repaired circuit in all modes to be sure you have fixed the entire problem. Next, operate all circuits which share the same fuse. Be sure that this does not cause the problem to reappear.

TESTING TOOLS

A VOLTMETER is used to measure voltage at various points within a circuit. If an analog VOLTMETER is used, it must have a resistance of at least 20,000 ohms per volt in the low range. Any digital VOLTMETER may be used.

Use of an OHMMETER should be limited to harness wiring, connections and switches. It should not be used on solid state components or relays. An OHMMETER measures a circuit for its resistance to current flow. Since an OHMMETER has an internal battery that provides current to the circuit under test, it is first necessary to disconnect the car battery. This will ensure that there is no voltage already present in the circuit.

An AMMETER measures the current flowing within a circuit. There are two types of AMMETERS: the SERIES AMMETER and the INDUCTIVE (clamp-on) AMMETER (e.g. Sun DMM-5). The INDUCTIVE AMMETER is clamped around a wire in the circuit under test. The SERIES AMMETER must be connected into the circuit.

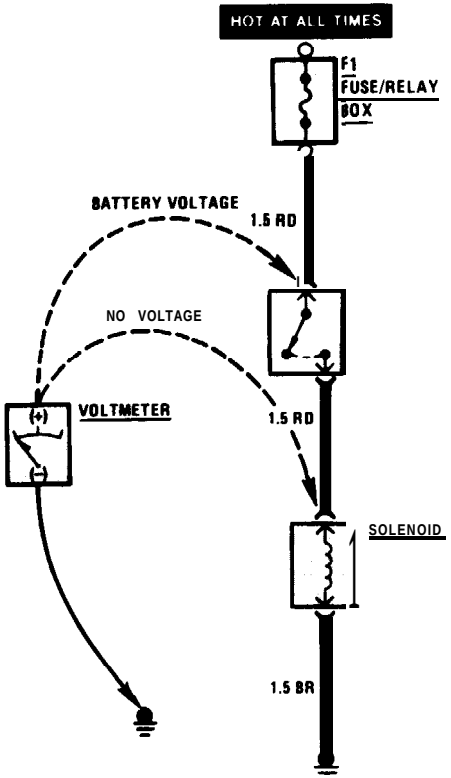
A SERIES AMMETER must never be connected in parallel with a component. This can cause a short circuit and damage the meter.

REVISIONS:

TESTS

Voltage Test

1. Connect the negative lead of the VOLTMETER to a known good ground or negative (-) battery terminal.
2. Connect the positive lead of the VOLTMETER to a point (connector or terminal) you wish to test.
3. If the meter registers, there is voltage pre sent. This voltage should be within one volt of measured battery voltage. A loss of more than one volt indicates a problem. A loose connection is a likely cause. Take readings at several points along the circuit to isolate the problem.

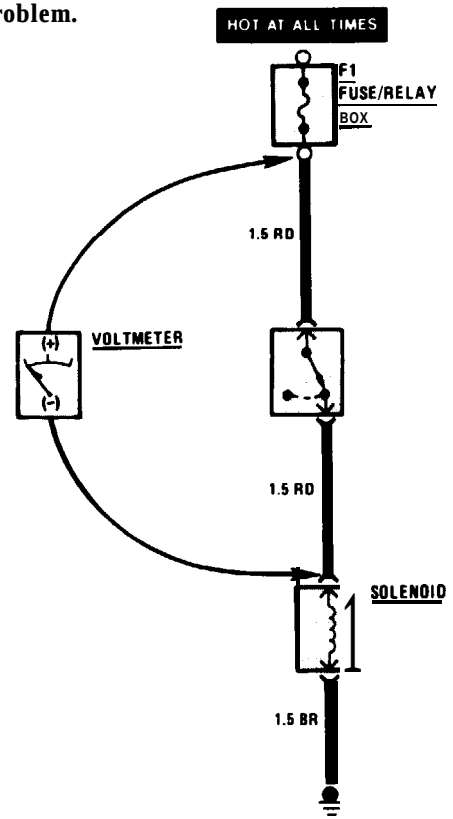


Voltage Test

Voltage Drop Test

This test checks for voltage being lost along a wire, or through a connection or switch.

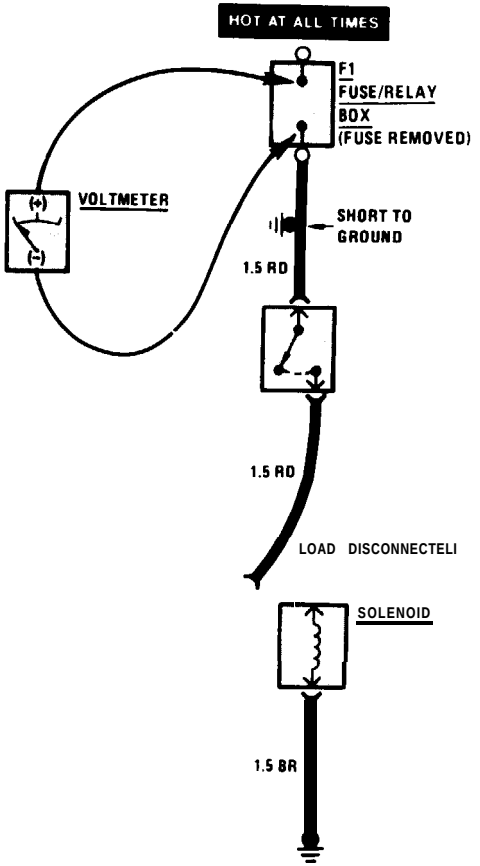
1. Connect the positive lead of the VOLTMETER to the end of the wire, or to the side of the connection which is closest to the battery.
2. Connect the negative lead to the other end of the wire, or the other side of the connection.
3. When the circuit is operated, the VOLTMETER will show the difference in voltage between the two points. A difference (or drop) of more than one volt indicates a problem.



Voltage Drop Test

Testing For Short to Ground With a Voltmeter

1. Remove the blown fuse and disconnect the load.
2. Connect the VOLTMETER across the fuse terminals.
3. Beginning near the fuse box, move the harness from side to side while watching the VOLTMETER.
4. If the meter registers, there is a short to ground in the wiring.



Testing for Short with Voltmeter

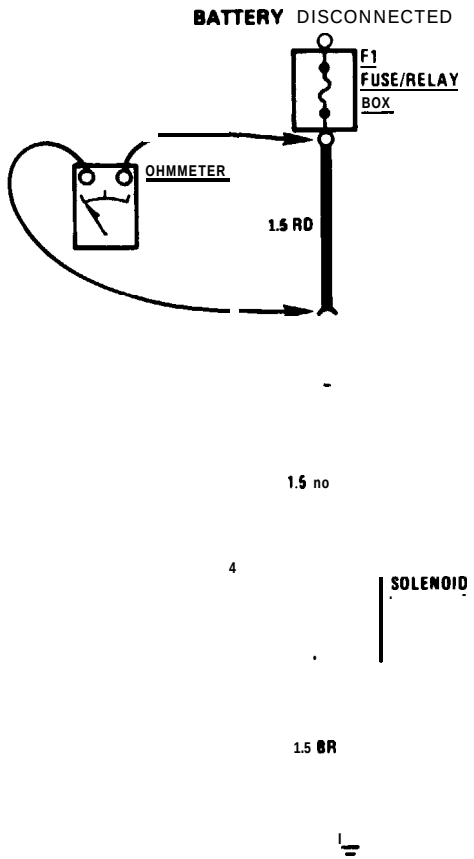
ALL MODELS

REVISIONS:

TROUBLESHOOTING

Continuity Test

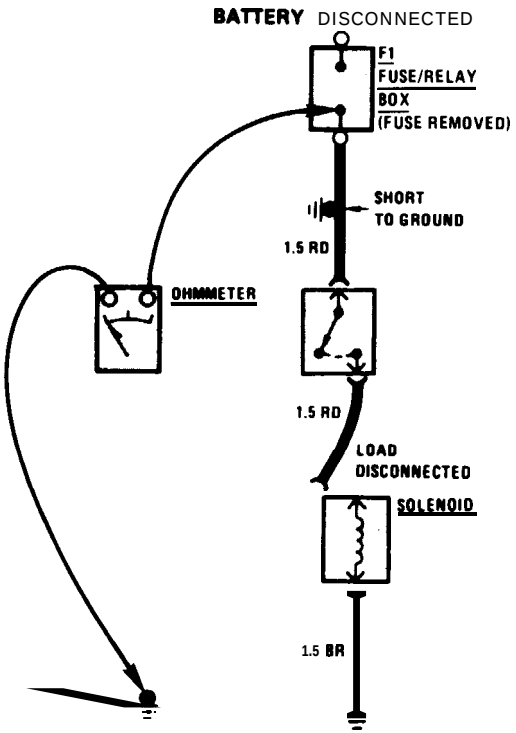
1. Check OHMMETER by adjusting the needle to zero while holding the leads together.
2. Disconnect the car battery.
3. Connect one lead of the OHMMETER to one end of the part of the circuit you wish to test.
4. Connect the other lead to the other end.
5. If the meter shows low or no resistance, there is continuity.



Continuity Test

Testing For Short to Ground With an Ohmmeter

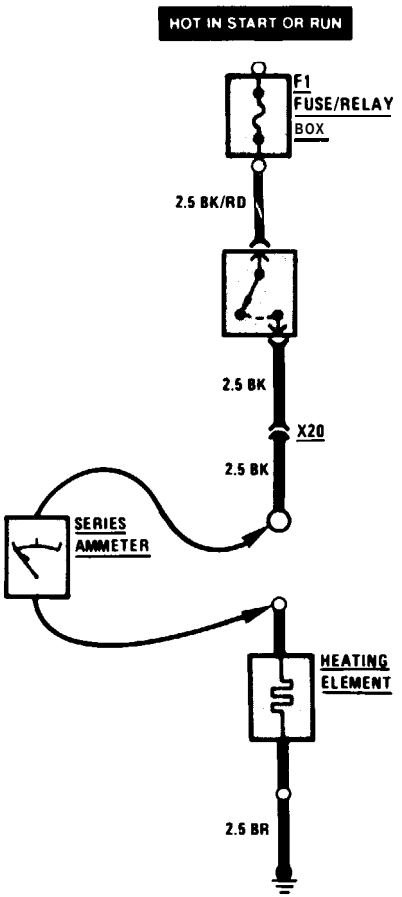
1. Calibrate OHMMETER by adjusting the needle to zero while holding the leads together.
2. Remove the blown fuse and disconnect the battery and load.
3. Connect one lead of the OHMMETER to the fuse terminal on the load side.
4. Connect the other lead to a known good ground.
5. Beginning near the fuse box, move the harness from side to side, while watching the OHMMETER.
6. If there is no short, the meter will show infinitely high resistance. If the meter reg isters low or no resistance, there is a short to ground in the wiring.



Tenting **for Short with Ohmmeter**

Current Test With a Series Ammeter

1. Disconnect the circuit at a convenient point such as a connector.
2. Connect a lead of the AMMETER to one side of the open circuit.
3. Connect the second lead of the AMMETER to the other side of the open circuit. The AMMETER completes the circuit.
4. With the circuit operating, the AMMETER will show how much current is flowing in the circuit.

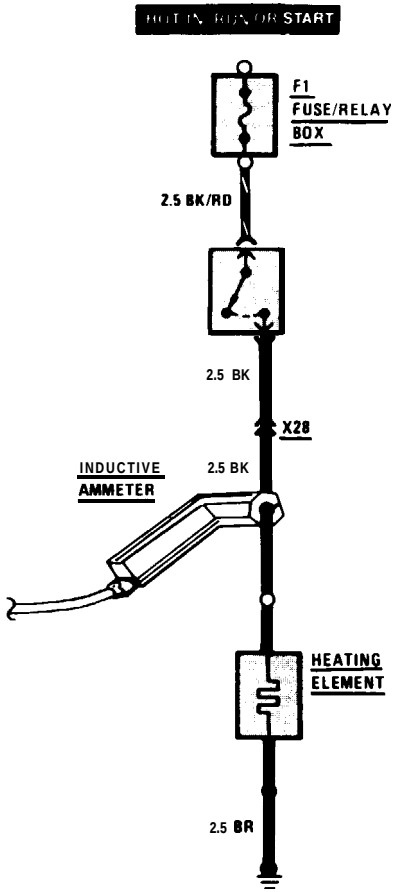


Current Test (Series Ammeter)

REVISIONS:

Current Test **With** an Inductive Ammeter

1. Clamp the AMMETER pliers around the **wire under test in the circuit.**
2. With the circuit operating, the AMMETER will show how much current is flowing in the circuit.

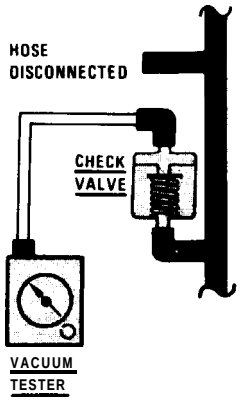


Current Test (**Inductive** Ammeter)

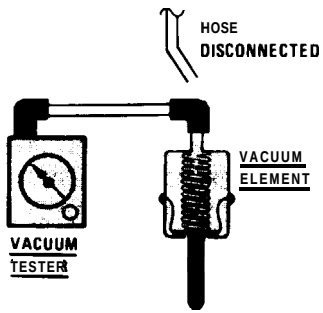
Troubleshooting Vacuum Components

A VACUUM TESTER is used to apply vacuum to vacuum components. The tester (M-B part no. 589 25 2100) registers in mbar of vacuum. Two typical applications of this **tester** are shown below.

PERMISSIBLE LEAKS	
Check Valves	50 mbar in 10 min. et 300 mbar vacuum
Other Vacuum Components	20 mbar/min. at 300 mbar vacuum



ONCE VACUUM IS APPLIEO, THE READING SHOULO REMAIN STABLE WITHIN THE LIMITSSHOWN ABOVE.

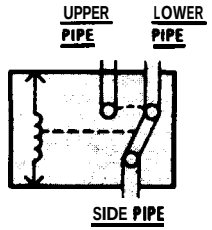


ELEMENT SHAFT SHOULD RETRACT AS VACUUM IS APPLIED BY TESTER. ONCE VACUUM **IS APPLIED,** THE READING SHOULD REMAIN **STABLE** WITHIN THE LIMITSSHOWN ABOVE.

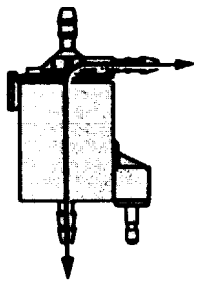
Switchover Valves (as of MY 1984)

The former switchover valves on all models are replaced by a standard switchover valve.

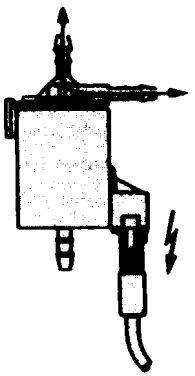
When de-energized (no current), the side and the lower pipes are connected to each other. When energized, the upper pipe connects to the side pipe. If only two pipes are used, a standard protective cap with vent is plugged onto the third pipe.



SCHEMATIC SYMBOL FOR **SWITCHOVER** VALVE



SWITCHOVER VALVE DE-ENERGIZE0



SWITCHOVER VALVE ENERGIZED

REVISIONS:

CIRCUIT IDENTIFICATION

Circuit	Description
1	Negative side of ignition coil (low voltage).
4	Output of ignition coil (high voltage).
15	Battery voltage; ignition/starter switch in "Run" (pos. 2) of "Start".
15R	Battery voltage; ignition/starter switch in ''Accy'' (pos. 1), "Run" (pos. 2) or "Start".
15R/30	Power feed for Power Seat Motors and Telescopic Steering Wheel.
15x	Battery voltage; ignition/starter switch in "Run" (Pos. 2).
16	Ignition switching unit connection from negative side of coil.
30	Battery voltage; "hot" at all times.
31	Ground.
31b	Switched ground.
49	Turn signal/hazard flasher input.
49a	Turn signal/hazard flasher output.
50	Starter motor control.
56	Power feed for headlamps.
56a	Headlamps; high beam and indicator lamp.
56b	Headlamps; low beam.
56d	Headlamp flasher.
58D	Instrument lamp output; from Electronic Control Unit.
58d	Instrument lamp output; from Rheostat.
58L	Parking, tail, side marker lamps; left side.
58R	Parking, tail, side marker lamps; right side.
58N	Fog lamps.
61	Charge indicator.
85	Relay winding; ground side.
86	Relay winding; positive side.
87	Relay output; normally open.
87a	Relay output; normally closed.
K, K30	Battery voltage; exterior lamp switch in "Parking" or "Headlamp" position.
L	Turn signal lamps; left side.
LA	Preglow indicator.'
N	Fog lamp switch; output.
NSE	Fog lamp switch; input.
	Battery voltage with exterior lamp switch in "Parking" or "Headlamp" position.
P30	Power feed for R and L standing lamps; battery voltage with ignition/starter switch in "Off" or "Accessory" position.
R	Turn signal lamps; right side.
TD	Engine speed signal.
	NOTE: Circuit identification numbers will appear on schematics inside component boxes. Connector terminal numbers will appear on schematics outside component boxes.

REVISIONS:

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REVISIONS:

FUSE CIRCUIT LIST

Fuse Information

No.	Amps (Color)	Circuits Protected	Connection to Circuit
1	④	Auxiliary Fan/Coolant Fan Tempmatic Climate Control	15X
2	8 AMPS (WT)	Auxiliary Fan/Coolant Fan Tempmatic Climate Control ③	15T
3	16 AMPS (PK)	Auxiliary Fan/Coolant Fan	30
4	8 AMPS (WT)	Headlamps (Right High Beam)	56a
5	8 AMPS (WT)	Headlamps (Left High Beam)	56a
6	16 AMPS (PK)	Rear Defogger	30
7	16 AMPS (PK)	Power Windows (Left Front/ Right Rear)	15R
8	16 AMPS (PK)	Power Windows (Right Front/ Left Rear)	15R
9	8 AMPS (WT) ⑤	Anti-Lock Brake System ① Backup Lamps Center Console ② Cruise Control Gauges Stop Lamps Warning Indicators	15

Fuse Information

No.	Amps (Color)	Circuits Protected	Connection to Circuit
10	⑤ 8 AMPS (WT) without Heated Seats 16 AMPS (PK) with Heated Seats or Fuse Bridge	Anti-Theft Alarm System ② Auxiliary Fan/Coolant Fan Cruise Control Electronic Engine Control ② Heated Seats Orthopedic Seats ① Outside Heated Mirrors ① Right Outside Mirror Tachometer Wiper/Washer Outside Temperature Gauge	15
11	8 AMPS (WT)	Horn Tempmatic Climate Control Turn Signal Lamps Warning System	15
12	8AMPS (WT)	Anti-Theft Alarm System Central Locking System courtesy Lamps, Rear Reading Lamp, Power Seats	30
13	8 AMPS (WT)	Automatic Antenna Clock Courtesy Lamps Hazard Lamps Radio/CD Player Trunk Lamp Warning System	30

(CONTINUED ON FOLLOWING PAGE)

REVISIONS: ① AS OF MODEL YEAR 1985
② AS OF MODEL YEAR 1986, 190E 2.3-16 ONLY (201.034)
③ AS OF MODEL YEAR 1987
④ MODEL YEARS 1984 TO 1988 16 AMPS (PK)
MODEL YEARS 1987 TO 1989 25 AMPS (BU)
AS OF MODEL YEAR 1990 8 AMPS (WT)
⑤ UP TO CHASSIS END NUMBERS 1 A 3 13825 AND 1 F 2298 14 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

(CONTINUED FROM PAGE 102)

Fuse Information

No.	Amps (Color)	Circuits Protected	Connection to Circuit
14	8 AMPS (WT)	Illumination: Instrument Cluster/Center Console Headlamp Wiper/Washer Lamps: Park/Tail/Side Marker (Right Side)/ License/Shift Pattern Warning System	58R
15	8 AMPS (WT)	Lamps: Park/Tail/Side Marker (Left Side)/License/ Shift Pattern	58L
16	8 AMPS (WT)	Fog Lamps	58N
17	8 AMPS (WT)	Headlamps (Right Low Beam)	56b
18	8 AMPS (WT)	Headlamps (Left Low Beam)	56b
19	8 AMPS (WT) without Sliding Roof 16 AMPS (PK)	Cigar Lighter Glove Box Lamp Radio Rear Defogger Sliding Roof	15R
20	16 AMPS (PK)	Headlamps Headlamp Wiper/Washer Wiper/Washer	15R

Fuse Information

No.	Amps (Color)	Circuits Protected	Connection to Circuit
Aux. Relay Box	25 AMPS (BU)	Front Power Seat Switches: Front Height, Forward-Backward	15R/30
	25 AMPS (BU)	Front Power Seat Switches: Rear Height, Backrest Control Unit	15R/30
Aux. Fuse Holder (F22/1)	16 AMPS (PK)	Heated Seats ②	30
	25 AMPS (BU)	Tempmatic Blower Switch ①	15X
	8 AMPS (WT)	Cellular Telephone (TRU)	30

REVISIONS: 1 AS OF MY 1987
8 ASOFMY 1989

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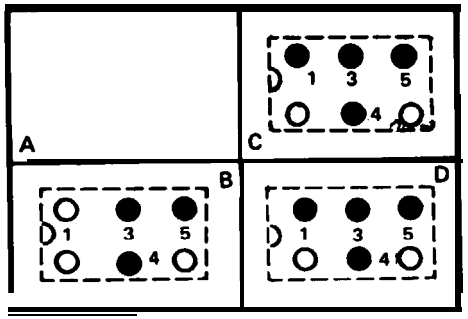
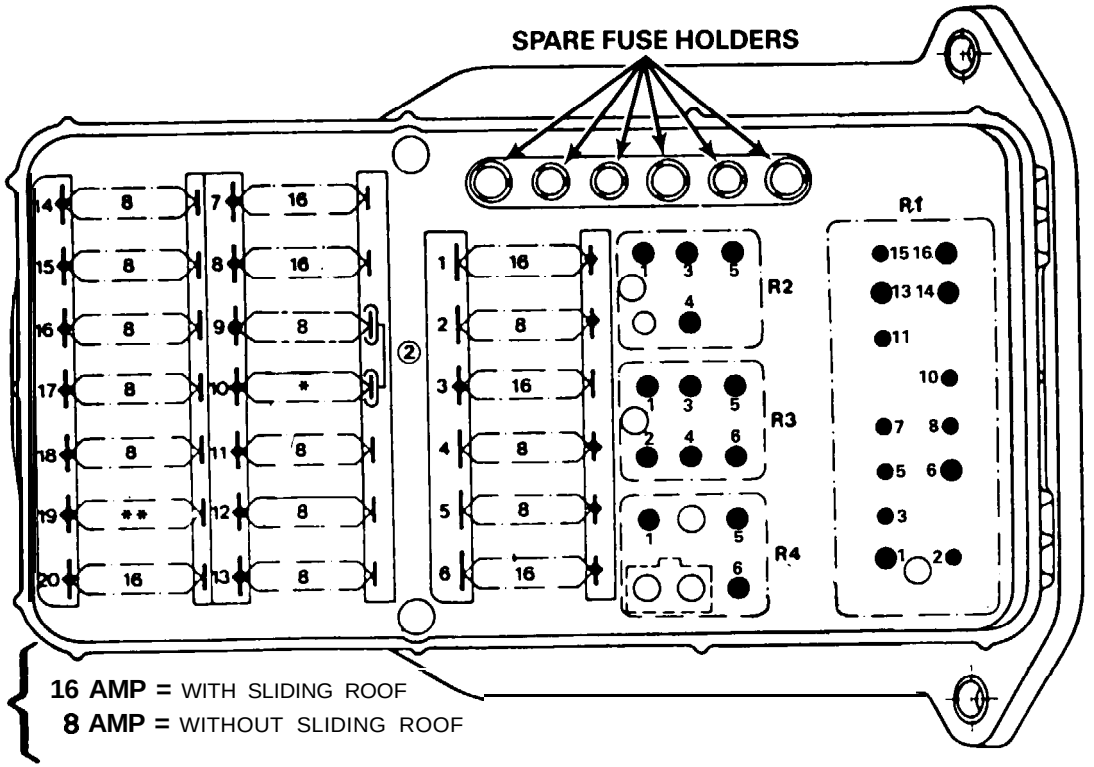
REVISIONS:

ELECTRICAL CENTER (FUSES/RELAYS)/AUXILIARY RELAY BOX TOP VIEW



Auxiliary Relay Box



** 16 AMP = WITH SLIDING ROOF
8 AMP = WITHOUT SLIDING ROOF

* 16 AMP = WITH HEATED SEATS OR FUSE BRIDGE
8 AMP = WITHOUT HEATED SEATS

RELAY CODE	RELAY USE
A	Not Used
B	F13 Auxiliary Fuse Holder (Power Seats)
C	K10 Auxiliary Fan High Speed Relay
D	K5 Power Seat Relay

RELAY CODE	RELAY USE
R1	N10 Combination Relay (Rear Defogger Timer, Wiper/Washer, Hazard/Turn Signal Flasher)
R2	K4 Power Window Relay
R3	①
R4	Not Used

REVISIONS: ① K9 AUXILIARY FAN RELAY – MODEL YEARS 1984 AND 1985, AND AS OF MY 1988

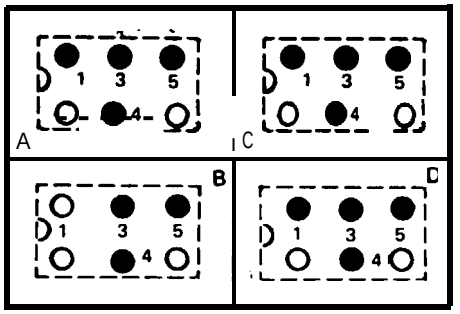
② UP TO CHASSIS END NUMBERS 1 A 313825 AND 1 F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

ELECTRICAL CENTER (FUSES/RELAYS)/AUXILIARY RELAY BOX

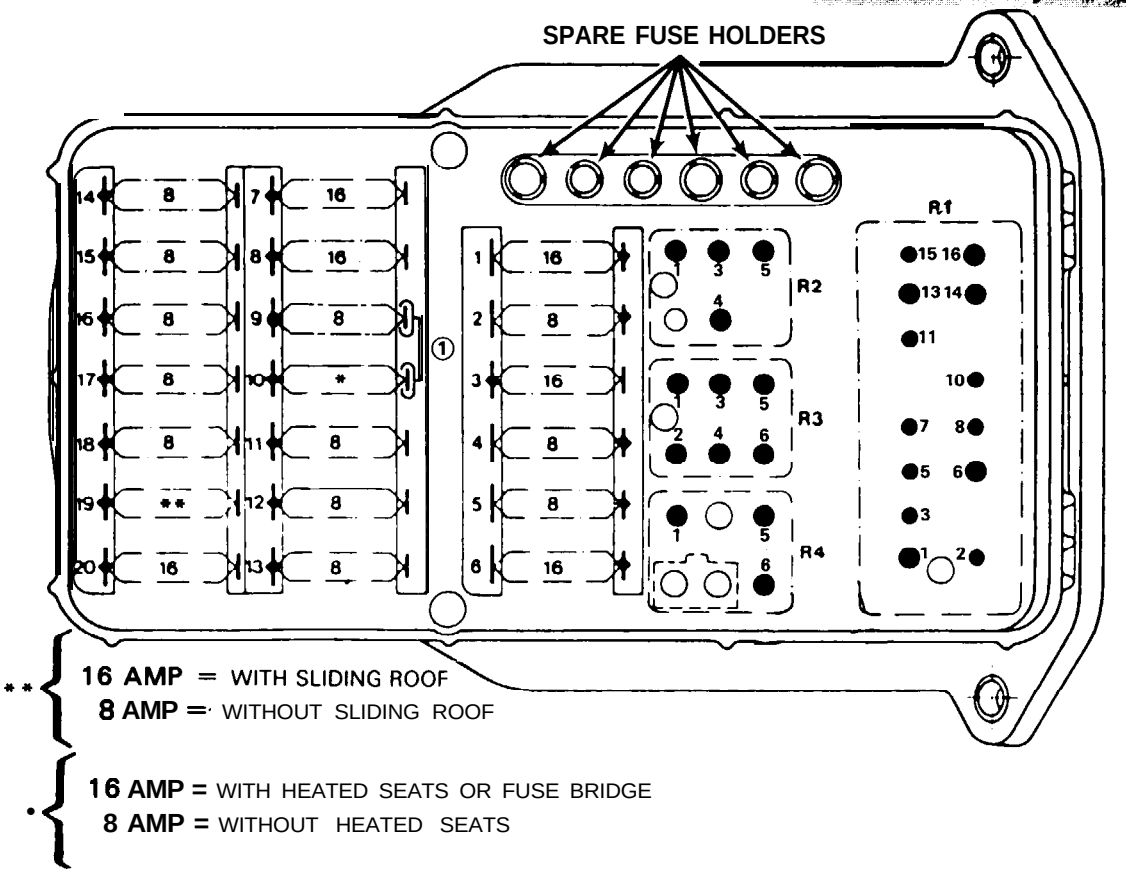
MY 1986

190E 2.3-16/190D 2.5

TOP VIEW



Auxiliary Relay Box



RELAY CODE	RELAY USE
A	K10 Auxiliary Fan High Sped Relay
B	F13 Auxiliary Fuse Holder (Power Seats)
C	K5 Power Seat Relay
D	Anti-Theft Fuse Holder

RELAY CODE	RELAY USE
R1	N10 Combination Relay (Rear Defogger, Timer, Wiper/Washer, Hazard/ Turn Signal Flasher)
R2	K4 Power Window Relay
R3	K9 Auxiliary Fan Relay
R4	Not Used

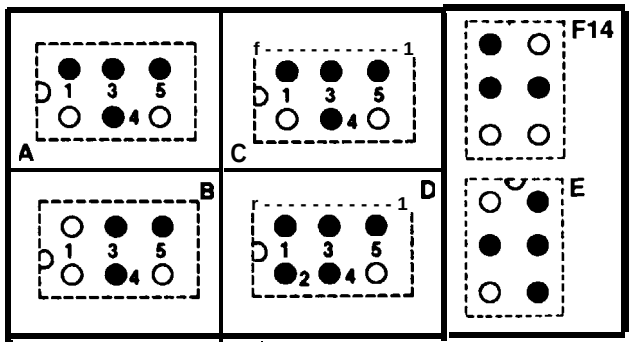
REVISIONS: ① UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

ELECTRICAL CENTER (FUSES/RELAYS)/AUXILIARY RELAY BOX

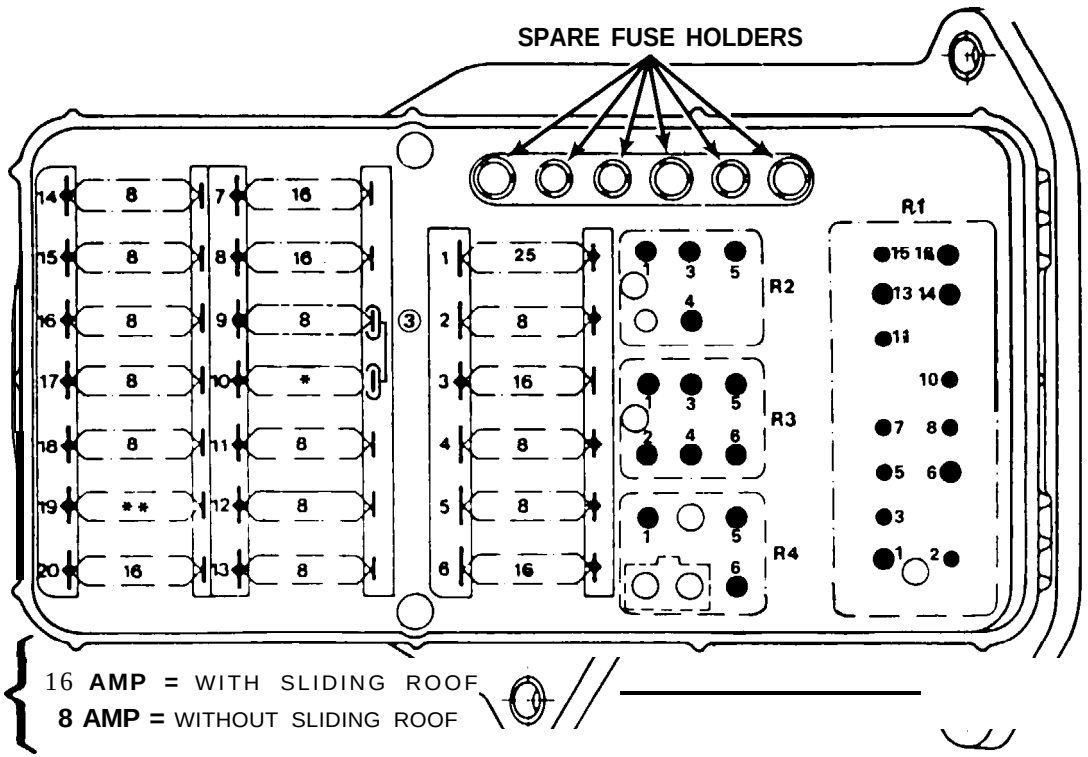
AS OF MY 1987

TOP VIEW

8 AMP – WHITE
16 AMP – PINK
26 AMP – BLUE

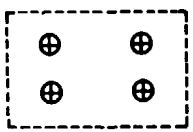


RELAY CODE	RELAY USE
A	K5 Power Seat Relay
B	F13 Auxiliary Fuse Holder (Power Seats)
C	①
D	K2 Headlamp Washer Relay
E	K3/1 Intake Manifold Pre-heater ⑥
F14	Anti-Theft Alarm (ATA)



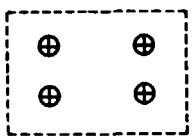
RELAY CODE	RELAY USE
R1	N10 Combination Relay (Turn/Hazard Signal, Heated Rear Window Wiper Motor)
R2	K4 Power Window Relay
R3	②
R4	Not Used

F22/1 AUXILIARY FUSE HOLDER



HEATED SEATS (16A) ④

TCC BLOWER (25A) ④



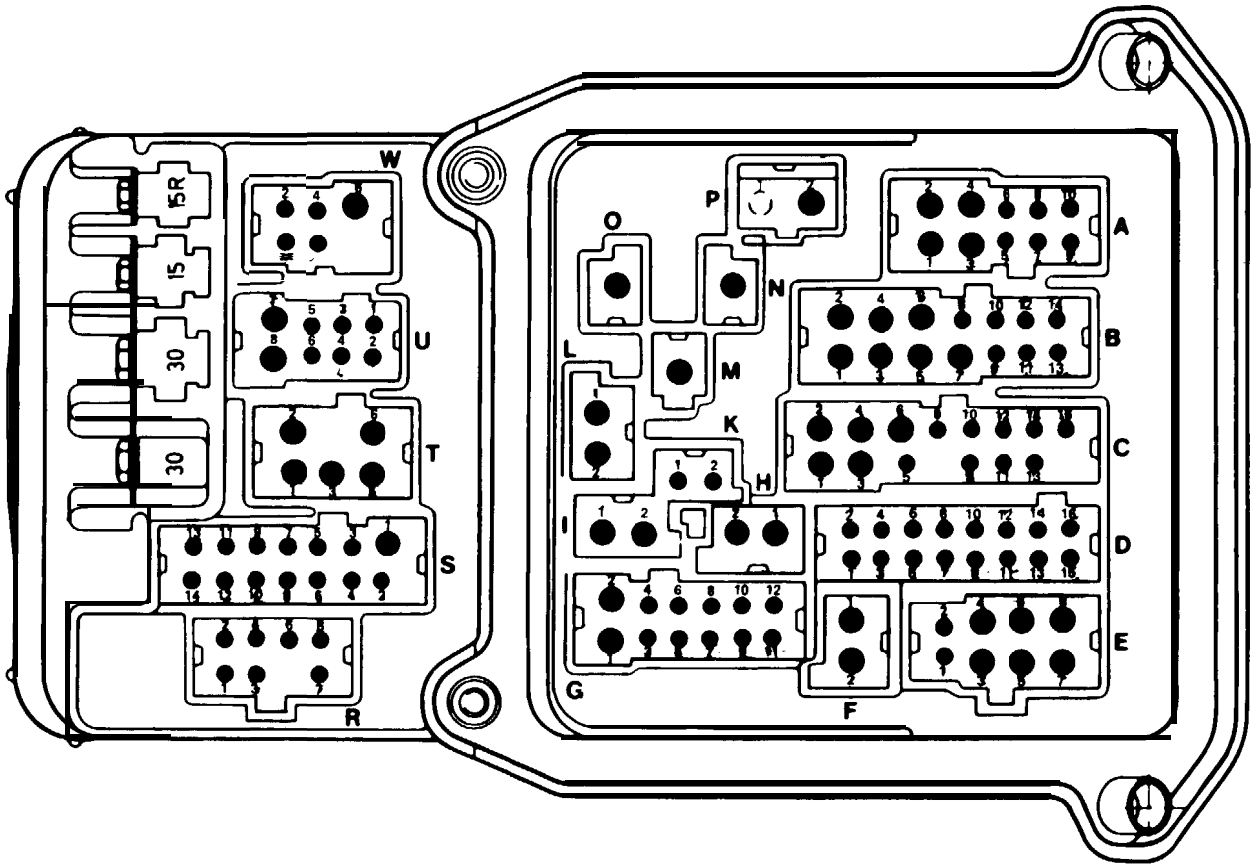
CELLULAR TELEPHONE (8A) ⑤

OPEN

REVISIONS:
① K9 AUXILIARY FAN RELAY (MODELS 201.028/.034)
K8/1 RELAY FOR DUAL AUXILIARY FAN (MODEL 201.029)
② K8 DOUBLE CONTACT RELAY FOR AUXILIARY FAN, MAGNETIC CLUTCH FOR ENGINE FAN (MODELS 201.028/.034)
K10 AUXILIARY FAN PRERESISTOR RELAY (ALL OTHER MODELS)
③ UP TO CHASSIS END NUMBERS 1A 313929 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10
④ AS OF MY 1989
⑤ AS OF MY 1992
⑥ AS OF MY 1991. MODEL 190E 2.3

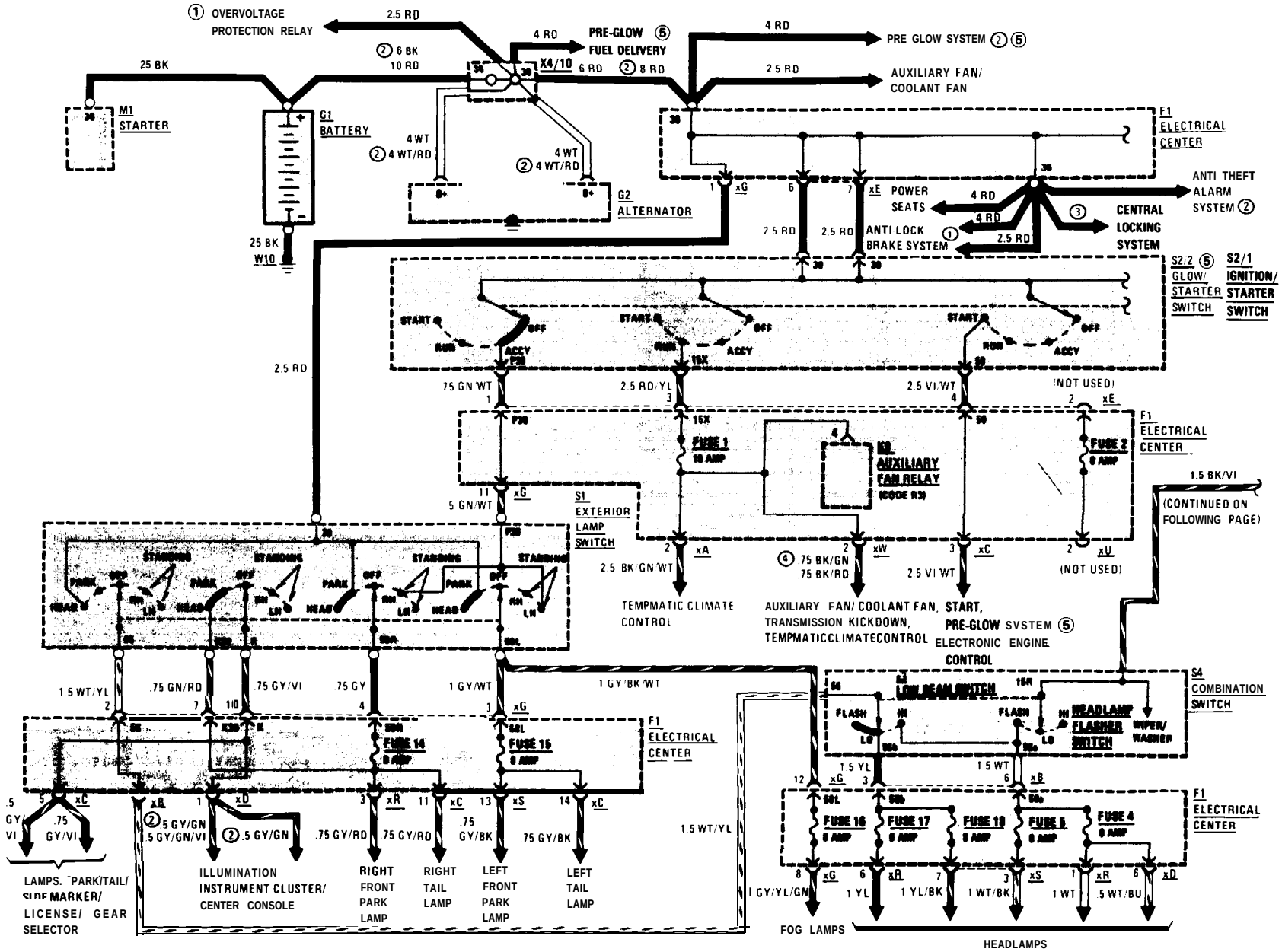
ELECTRICAL CENTER (CONNECTORS/TERMINALS)
BOTTOM VIEW

AS OF MY 1984

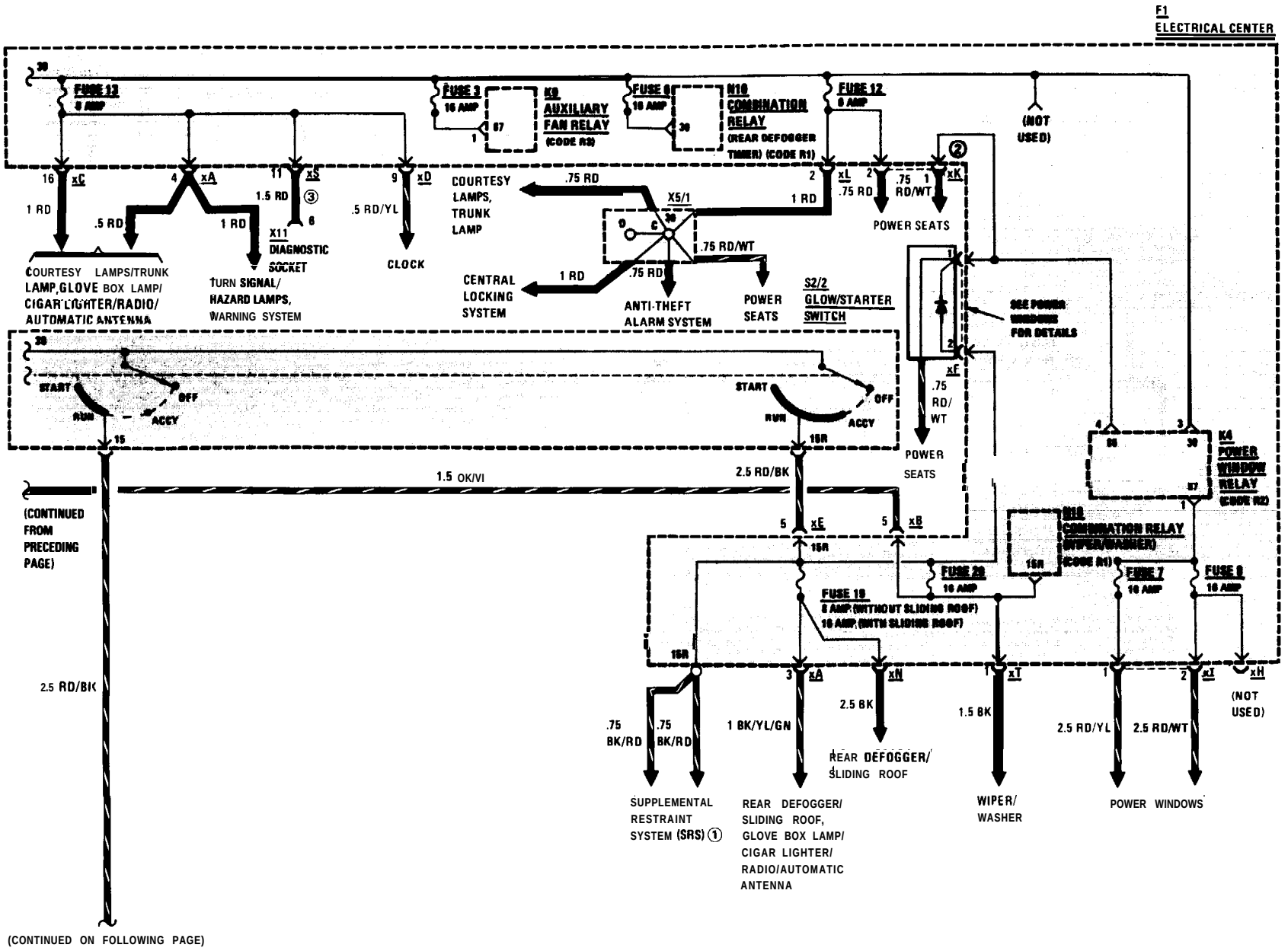


REVISIONS:

POWER DISTRIBUTION



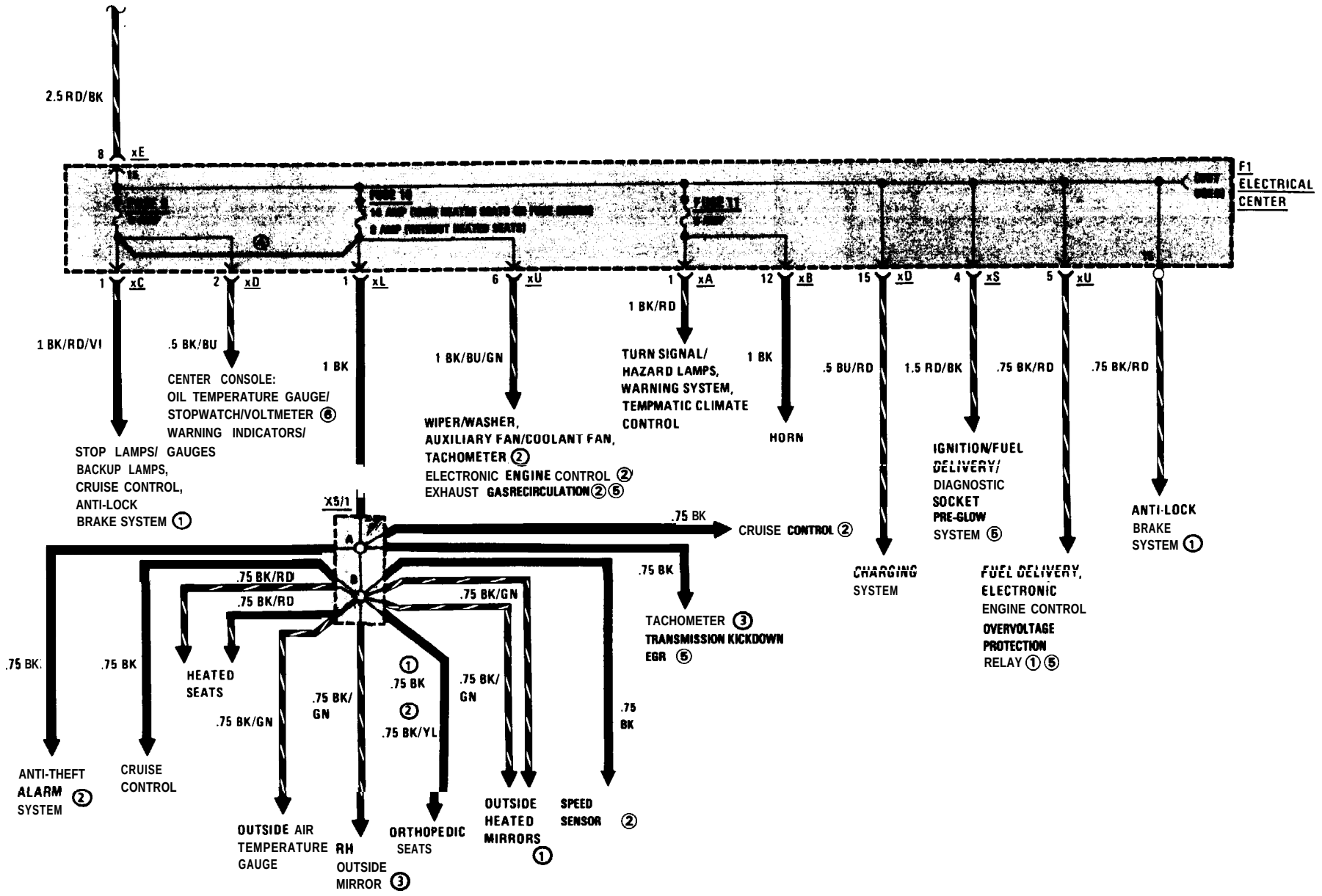
REVISIONS:
① AS OF MODEL YEAR 1985
② AS OF MODEL YEAR 1986
③ 1 RD (MODEL YEAR 1984), .5RD (MODEL YEAR 1985)
④ MODEL YEAR 1984
⑤ DIESEL MODELS



REVISIONS: ① WITH AIR BAG AS OF MODEL YEAR 1995
② CONNECTOR xK, PIN 1 (MODEL YEAR 1994) NOT USED
③ MODEL 201.034 ONLY

POWER DISTRIBUTION

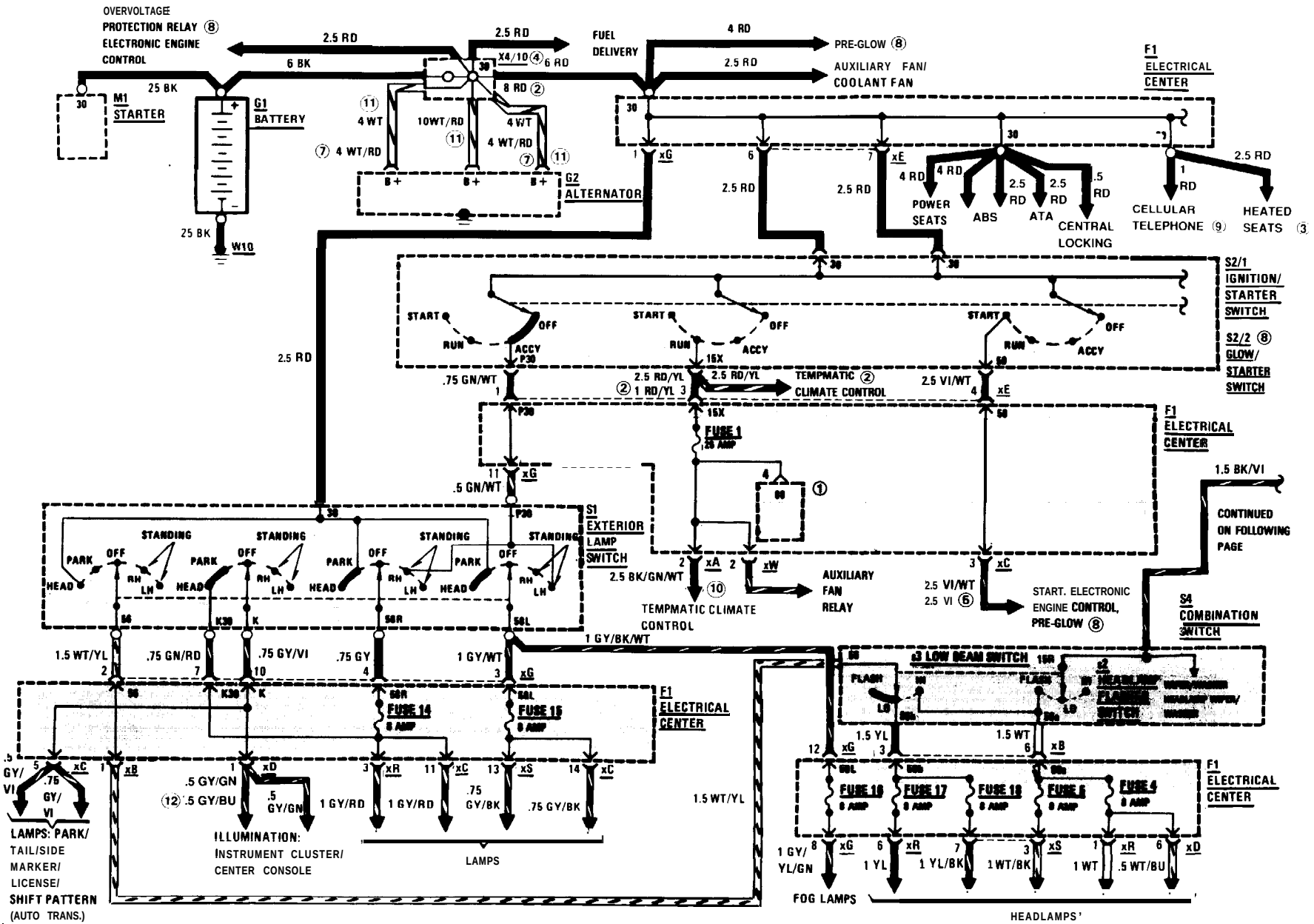
(CONTINUE0 FROM PRECEDING PAGE)



REVISIONS: ① ASDF MODEL YEAR 1985 ② AS OF MODEL VEAR 1986 ③ MODEL YEAR 1984 ONLY ④ UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10 ⑤ DIESEL MODELS ⑥ MODEL 201.034

POWER DISTRIBUTION

AS OF MY 1987



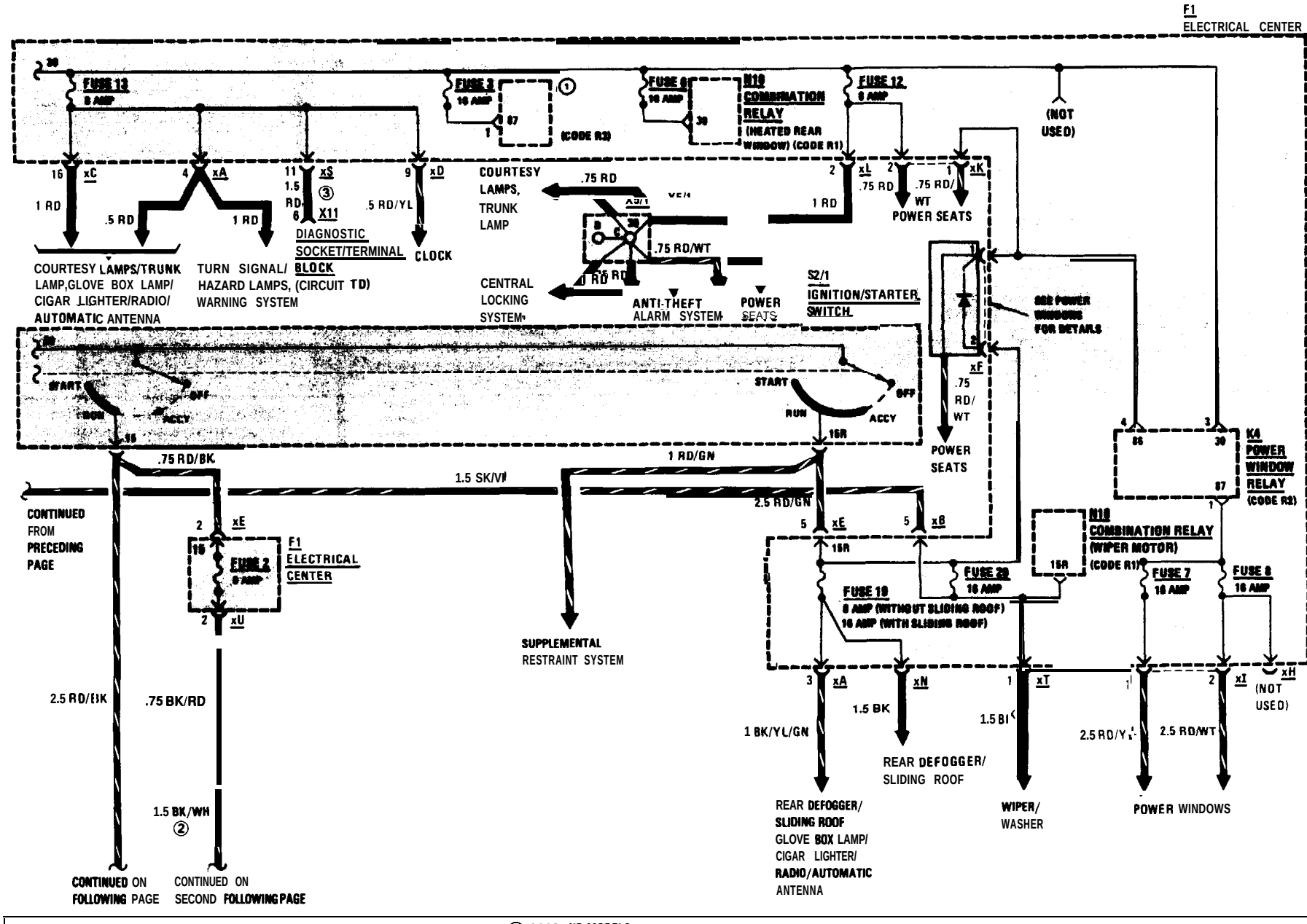
REVISIONS: ① K8 DOUBLE CONTACT RELAY FOR AUXILIARY FAN, MAGNETIC CLUTCH FOR ENGINE FAN FOR MODELS 201.028, 201.034 K10 AUXILIARY FAN PRERESISTOR RELAY FOR MODEL 201.029

② AS OF MY 1988
③ AS OF MY 1989
④ AS OF MY 1990, SEE START
⑤ MANUAL TRANSMISSION ONLY

@AS OF MY 1991, MODEL 201.028
⑦ MODEL 201.126
@DIESEL MODELS
⑨ AS OF MY 1992

⑩ MY 1987-1986 ONLY
⑪ AS OF MY 1992, A SINGLE 10 WT/RD WIRE IS USED
@AS OF MY 1990

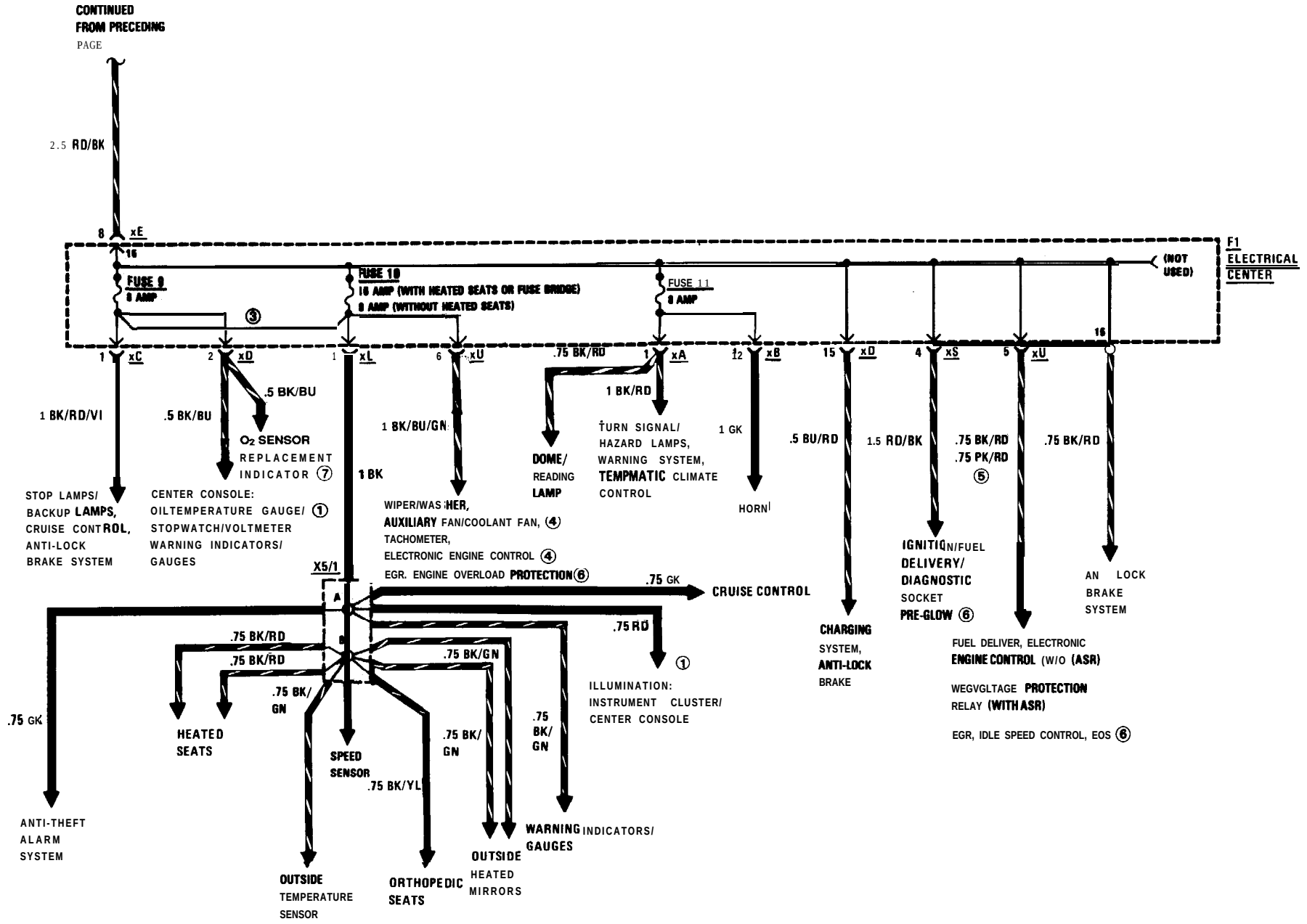
POWER DISTRIBUTION



REVISIONS: ① K8 DOUBLE CONTACT RELAY FOR AUXILIARY FAN, MAGNETIC CLUTCH FOR ENGINE FAN FOR MODELS 201.028, 201.034
K10 AUXILIARY FAN PRERESISTOR RELAY FOR MODEL 201.028
② AS OF MY 1990, MODEL 201.028 ONLY
③ GASOLINE MODELS

POWER DISTRIBUTION

AS OF MY 1987



REVISIONS:

① MODEL 281.034 (190E2.3-16) ONLY

②K8/1 RELAY FOR DUAL AUXILIARY FAN (MODEL 201.029)
K9 AUXILIARY FAN RELAY (MODEL 201.034 AND MODEL 201.0281

③ UP TO CHASSIS ENO NUMBERS 1A 313825 AND IF 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

④ UP TO 1989

⑤ AS OF MY 1990

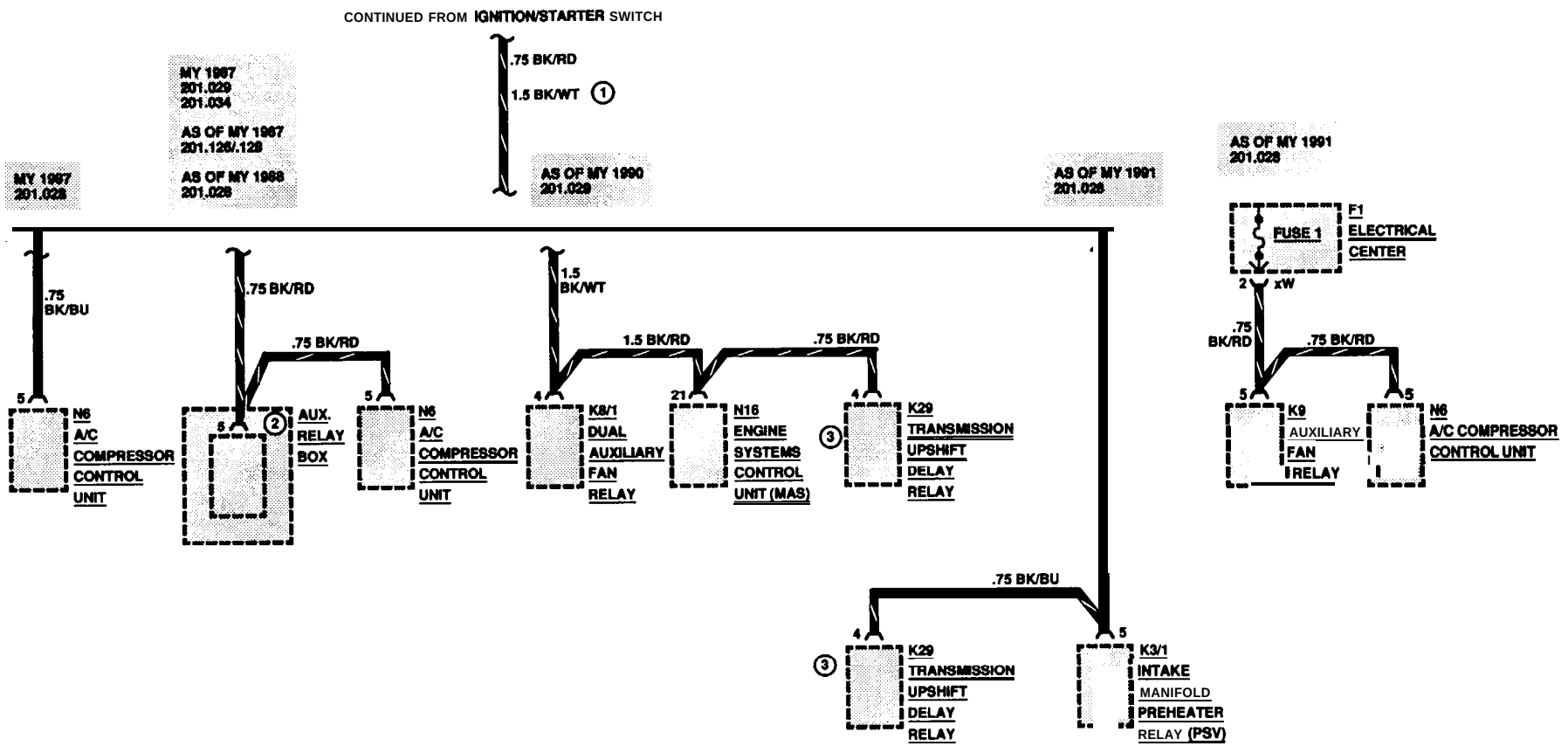
⑥ DIESEL MODELS

⑦ AS OF MY 1992, 201.028 CALIFORNIA

POWER DISTRIBUTION

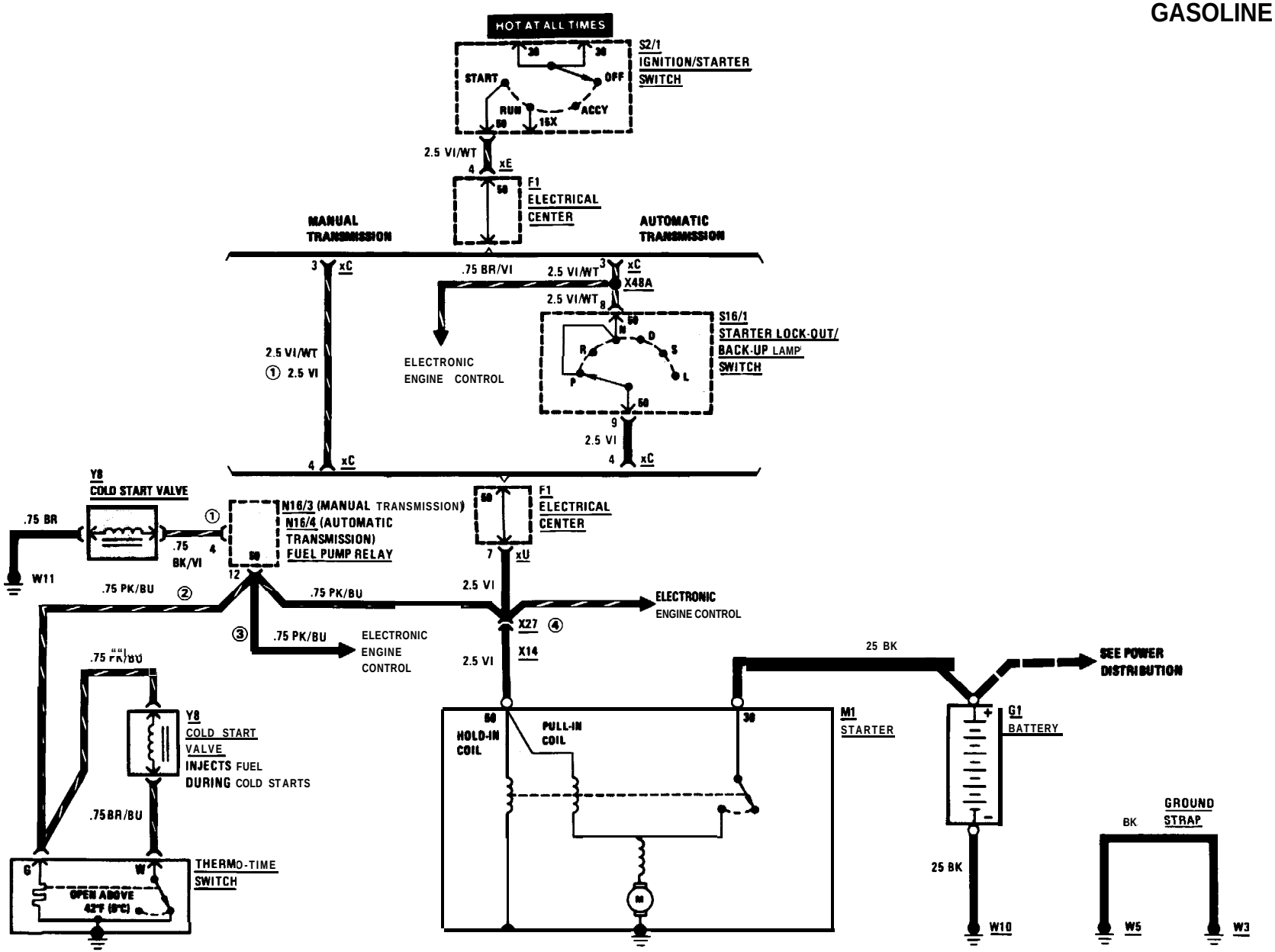
AS OF MY 1987

190E 2.3, 2.6, 2.3-16



REVISIONS: (1) MY 1990-1991, MODEL 201.029 ONLY (3) AUTOMATIC TRANSMISSION ONLY

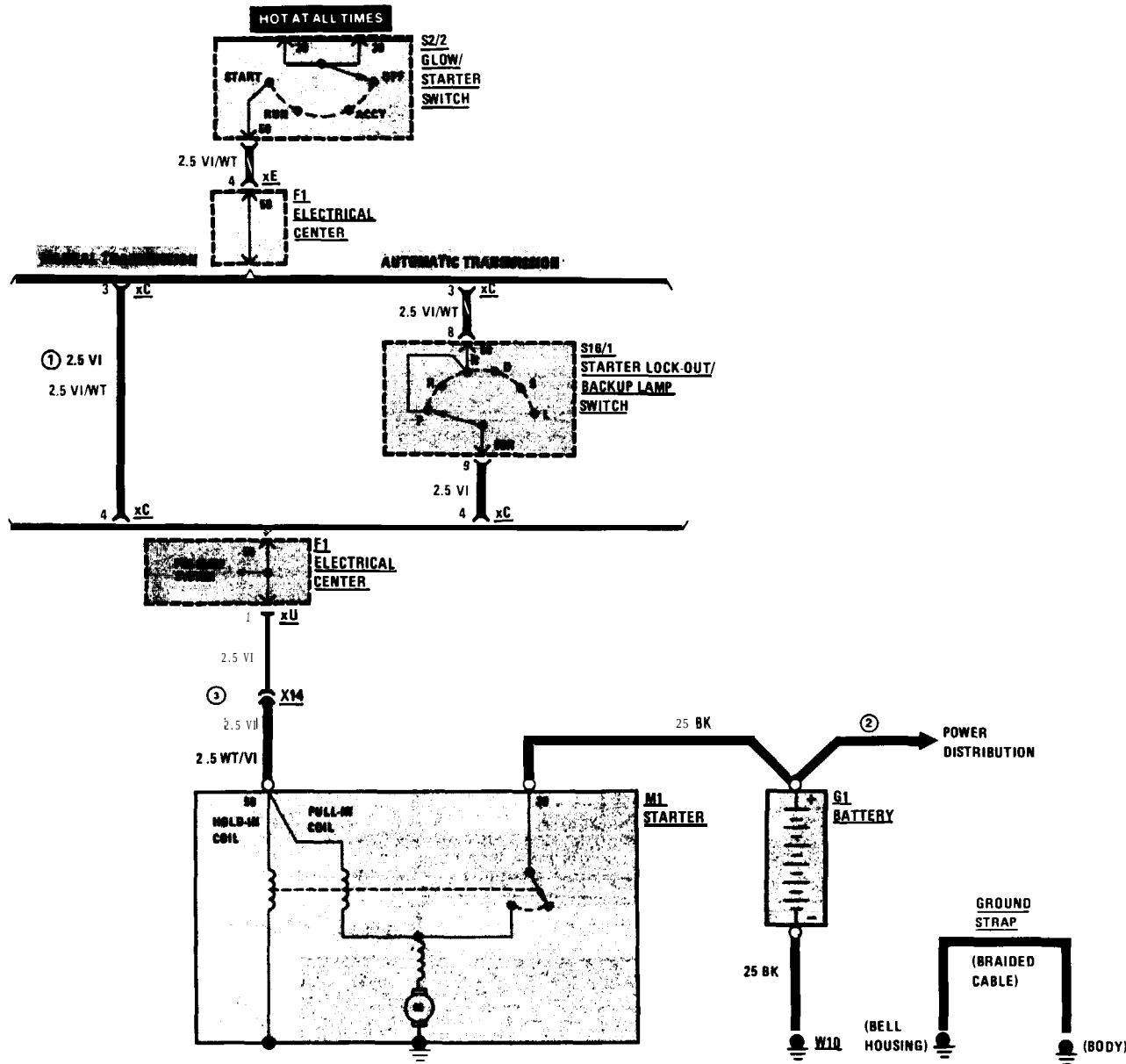
(2) K8/1 DUAL AUXILIARY FAN RELAY (201.029)
K9 AUXILIARY FAN RELAY



REVISIONS:
① AS OF MY 1985
② MY 1994 ONLY
③ UP TO MY 1986
④ AS OF MY 1989

START

AS OF MY 1984
DIESEL



201.1

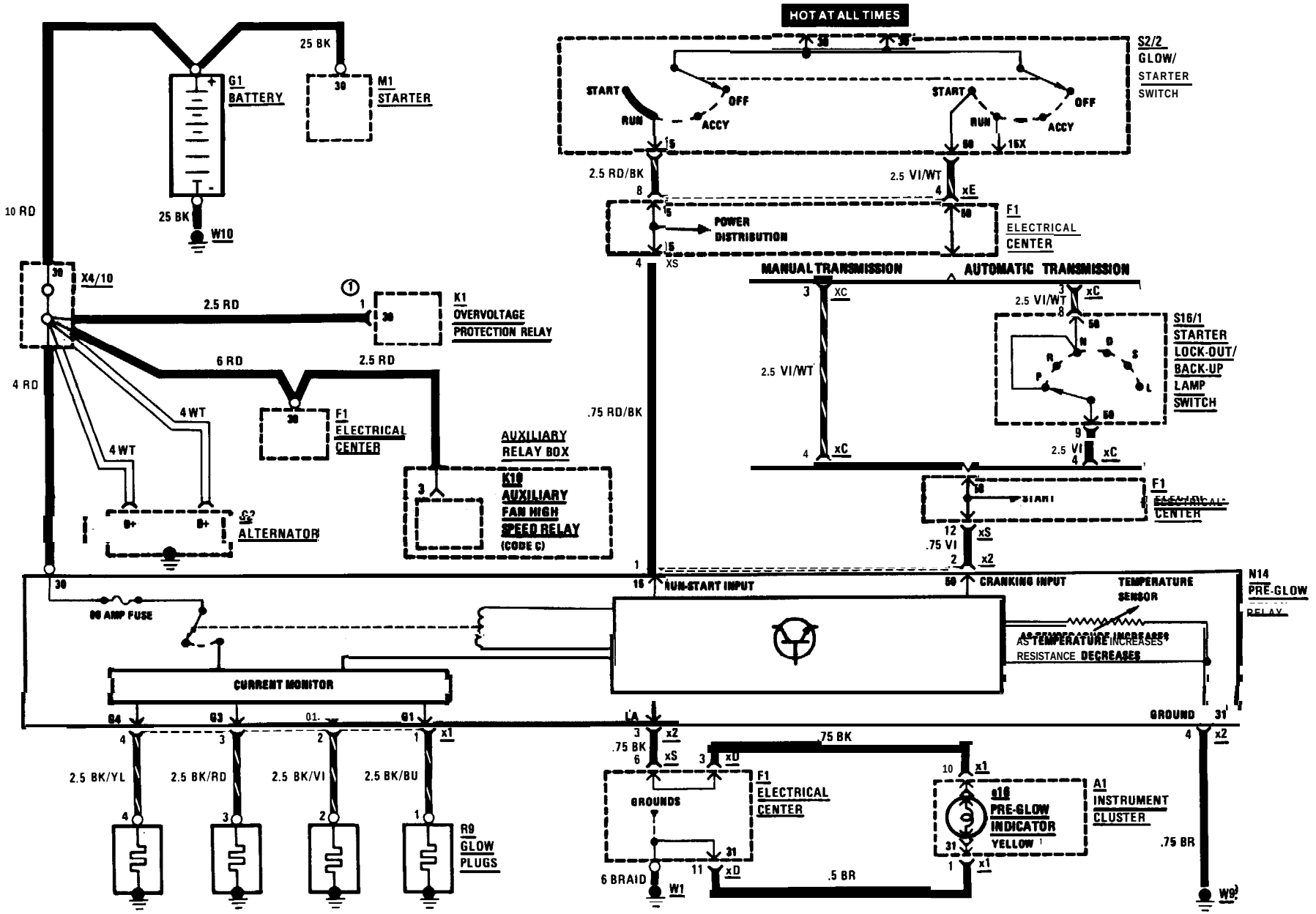
106/1

REVISIONS: ① AS OF MY 1986 EXCEPT 201.128
② MODEL 201.126 6 BK
MODEL 201.128 10 BK
MOOEL201.122 10 RD
③ AS OF MODEL YEAR 1987

PREGLOW SYSTEM

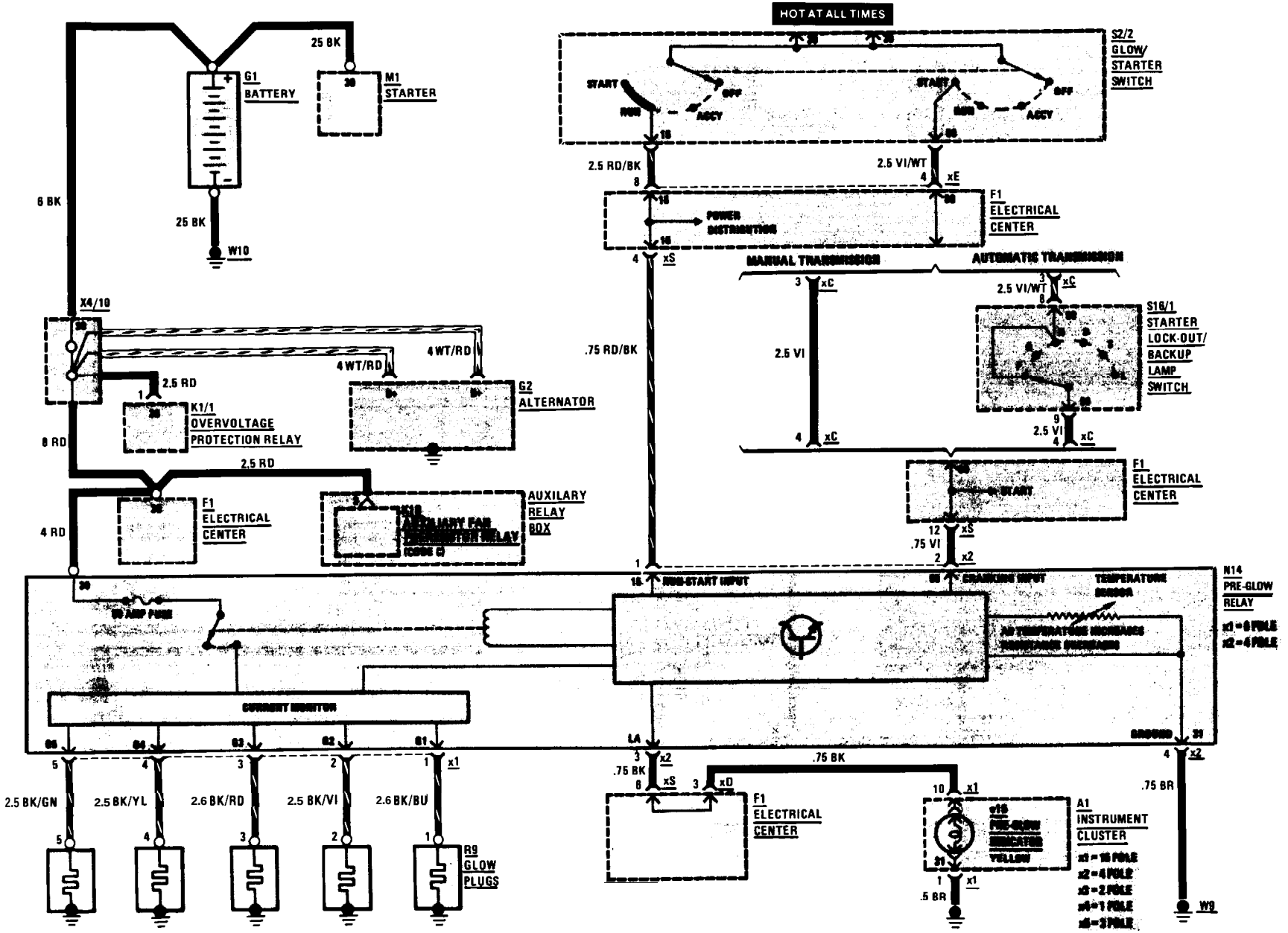
MY 1984 AND MY 1985

190D 2.2



REVISIONS: ① AS OF MODEL YEAR **1985**

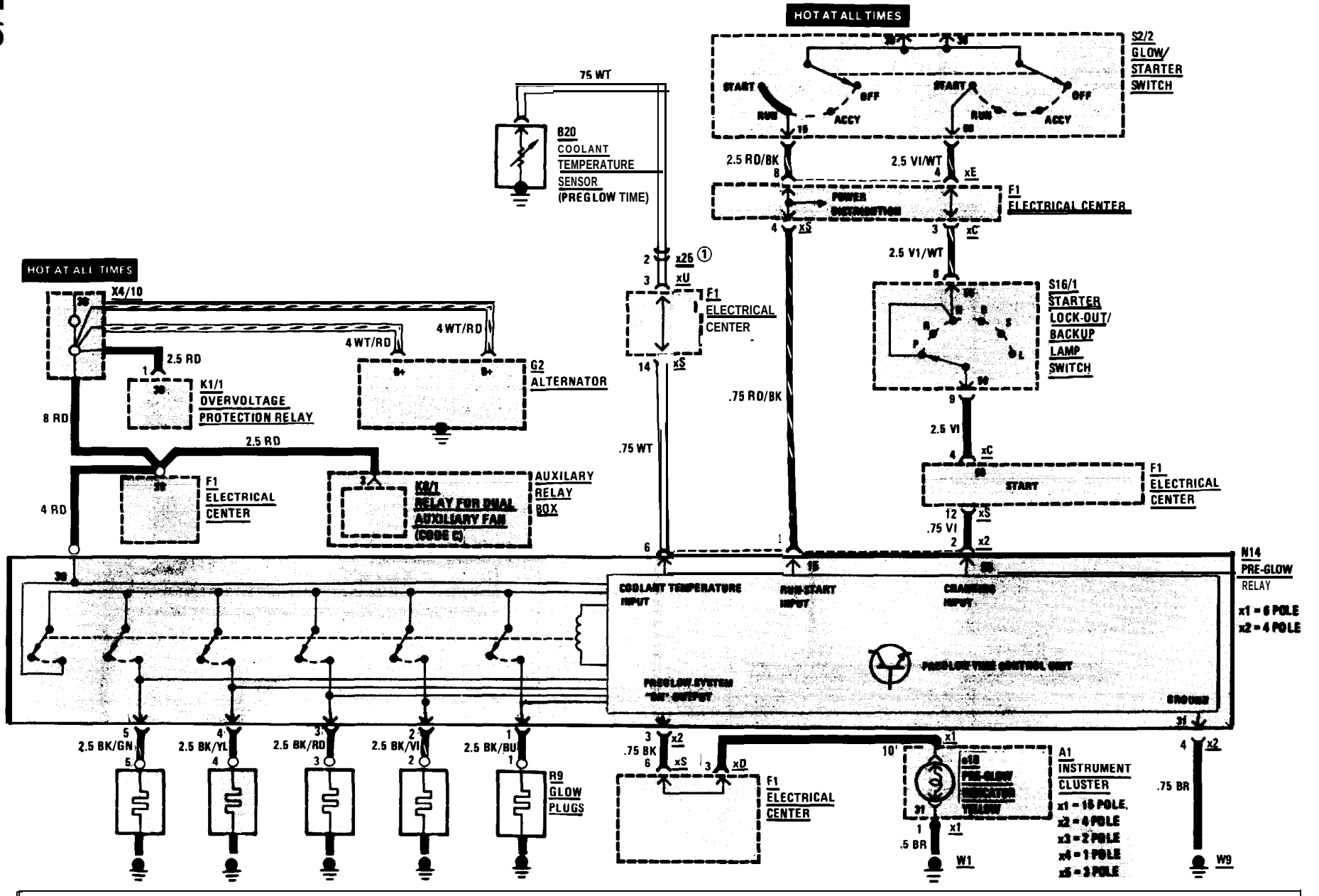
PREGLOW SYSTEM



REVISIONS:

PREGLOW SYSTEM

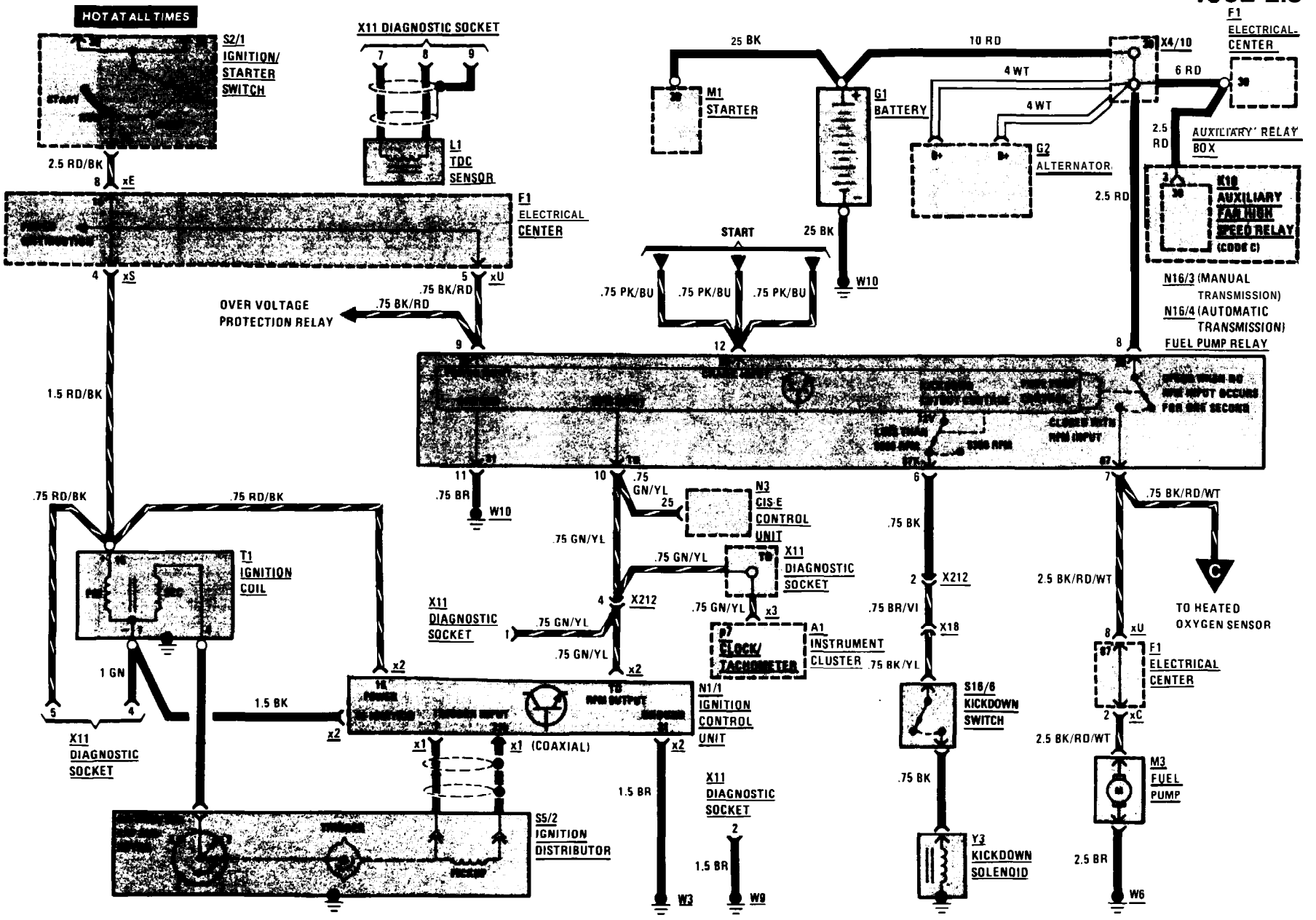
MY 1987 **190D2.5 TURBO**
AS OF **MY** 1989 19002.5



REVISIONS: ① x25 USED AS OF MY 1999

IGNITION/FUEL DELIVERY/DIAGNOSTIC SOCKET/TRANSMISSION KICKDOWN

190E 2.3

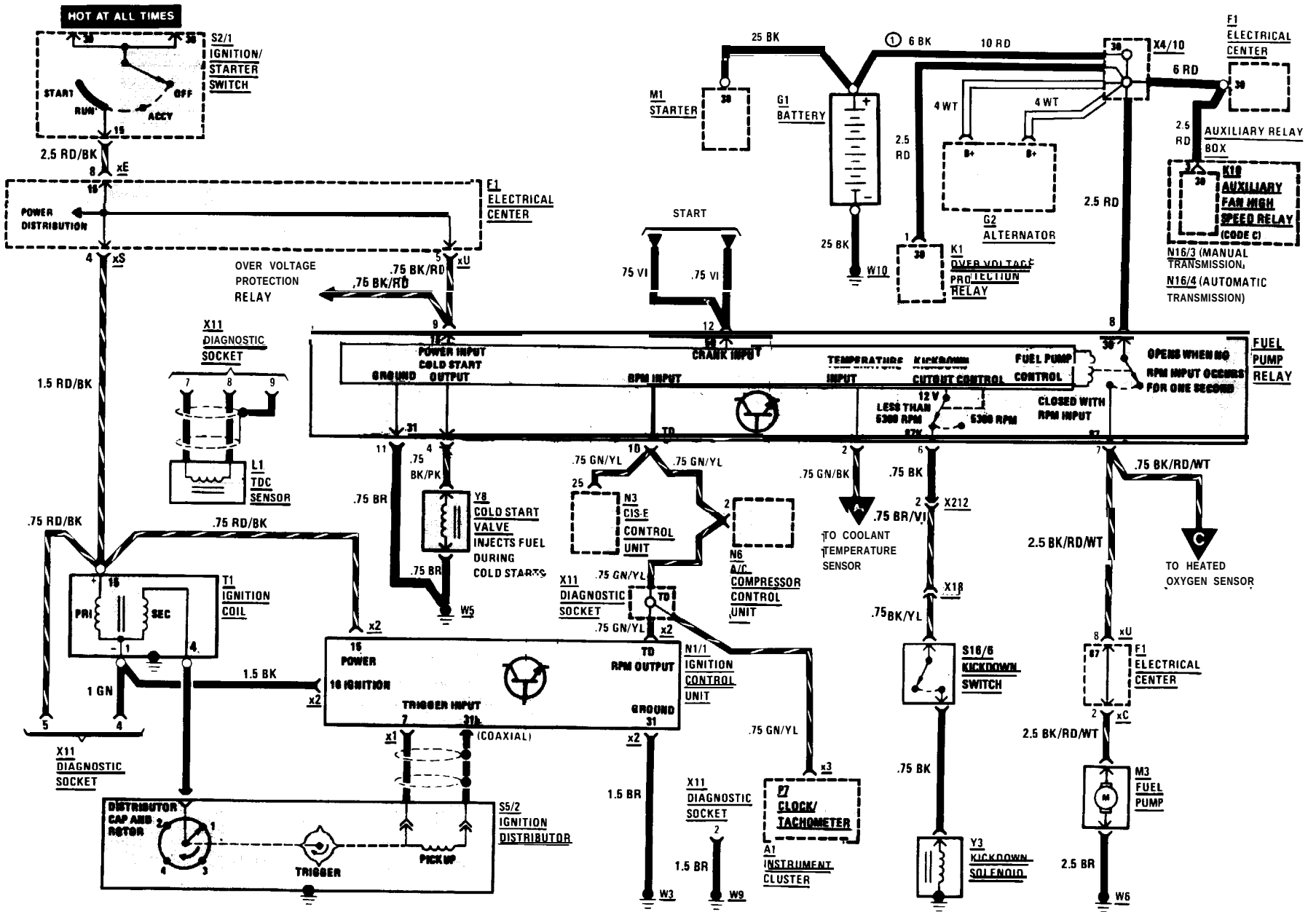


REVISIONS:

IGNITION/FUEL DELIVERY/DIAGNOSTIC SOCKET/TRANSMISSION KICKDOWN

MY 1985-I 986

190E 2.3

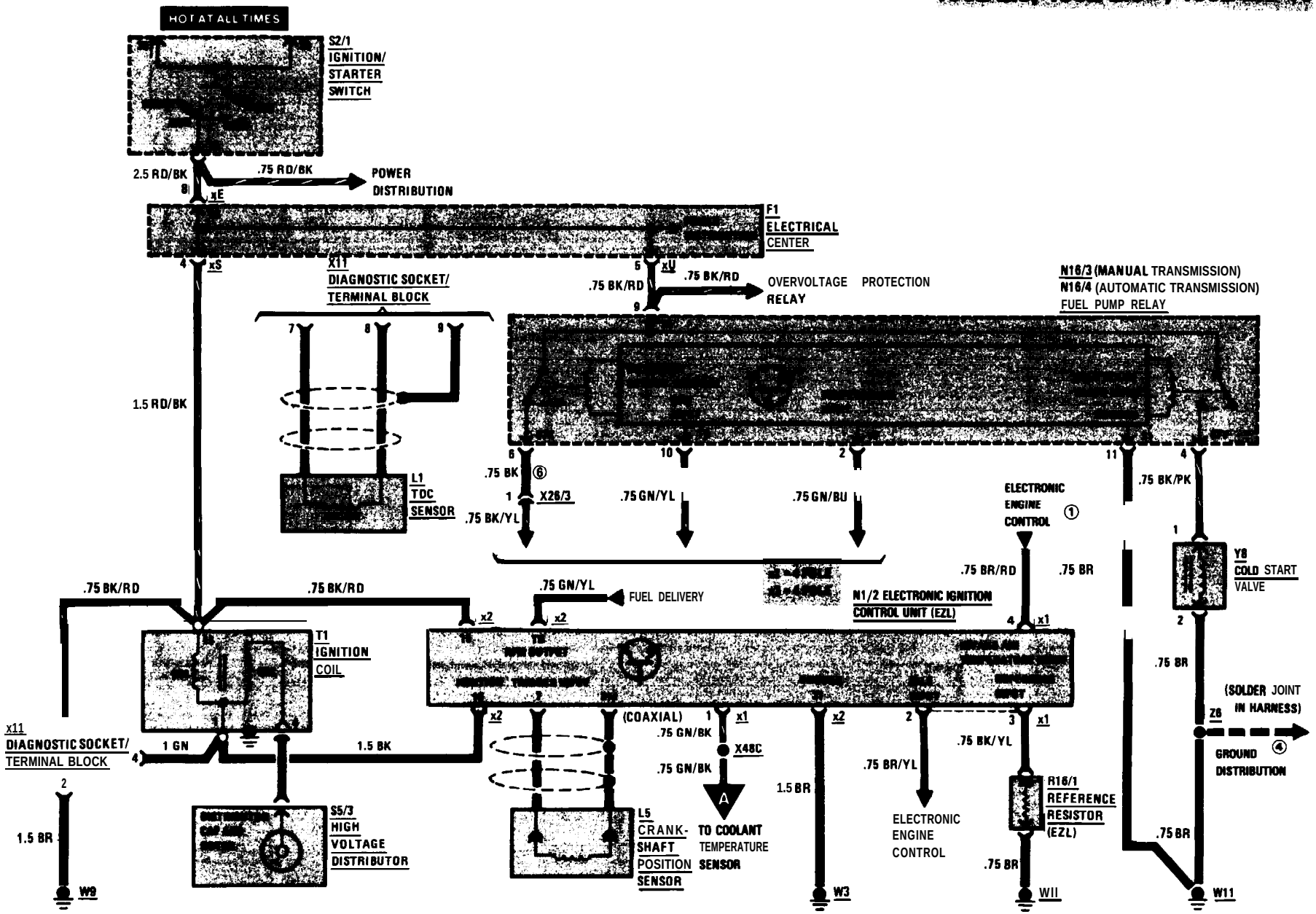


REVISIONS: ① AS OF MODEL YEAR 1996

IGNITION/FUEL DELIVERY/DIAGNOSTIC SOCKET

AS OF MY 1989

190E 2.3, 190E 2.6, 190E 2.3-16

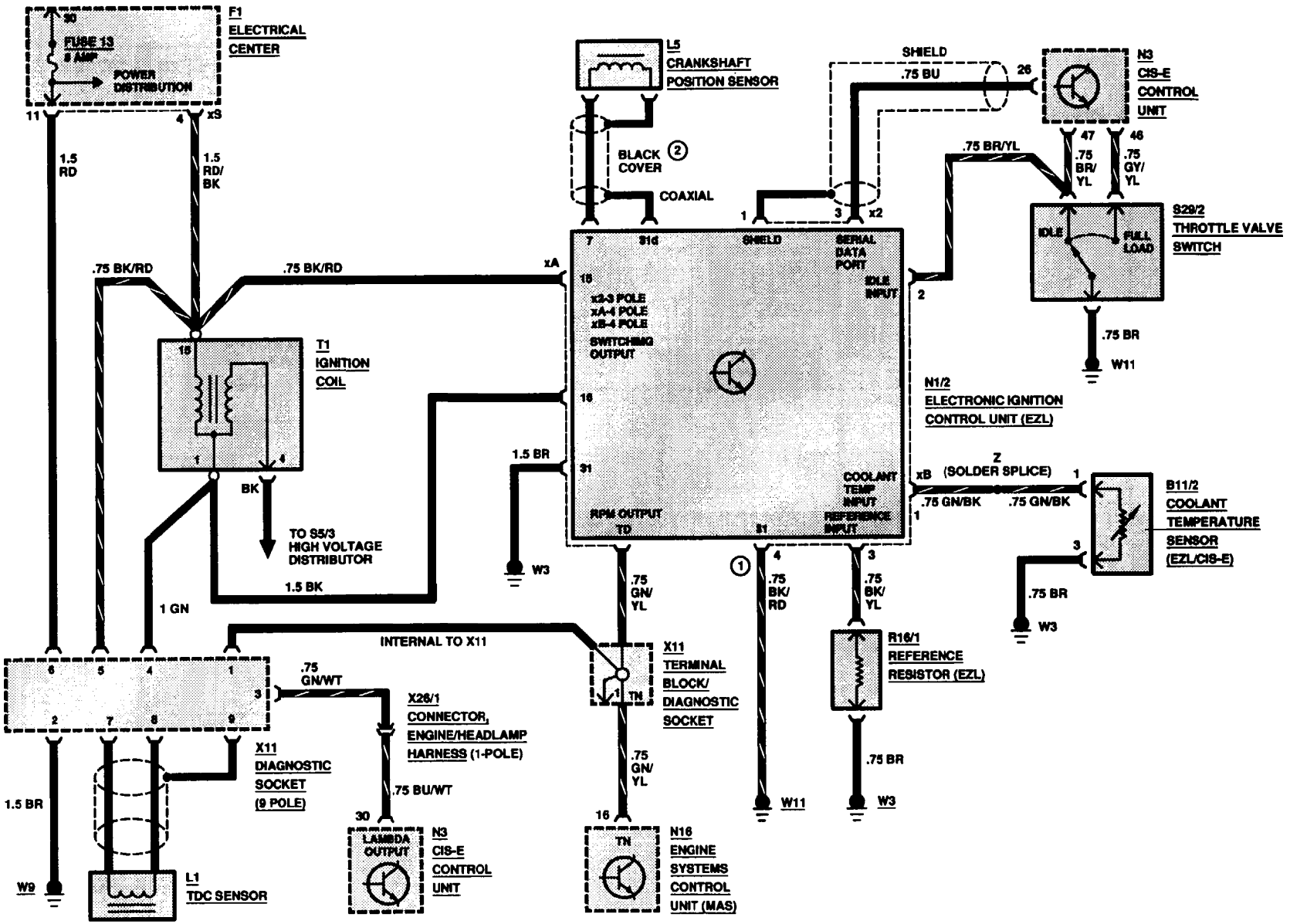


REVISIONS:
① 190E 2.3-16(201.034) ONLY
② 190E 2.6 (201.029) AND 190E 2.3-16(201.034) ONLY
③ 190E 2.3 (201.028) ONLY
④ 190E 2.6 ONLY
⑤ AS OF MY 1990, SEE FOLLOWING PAGE
⑥ AUTOMATIC TRANSMISSION ONLY

GNITION / DIAGNOSTIC SOCKET

AS OF MY 1990

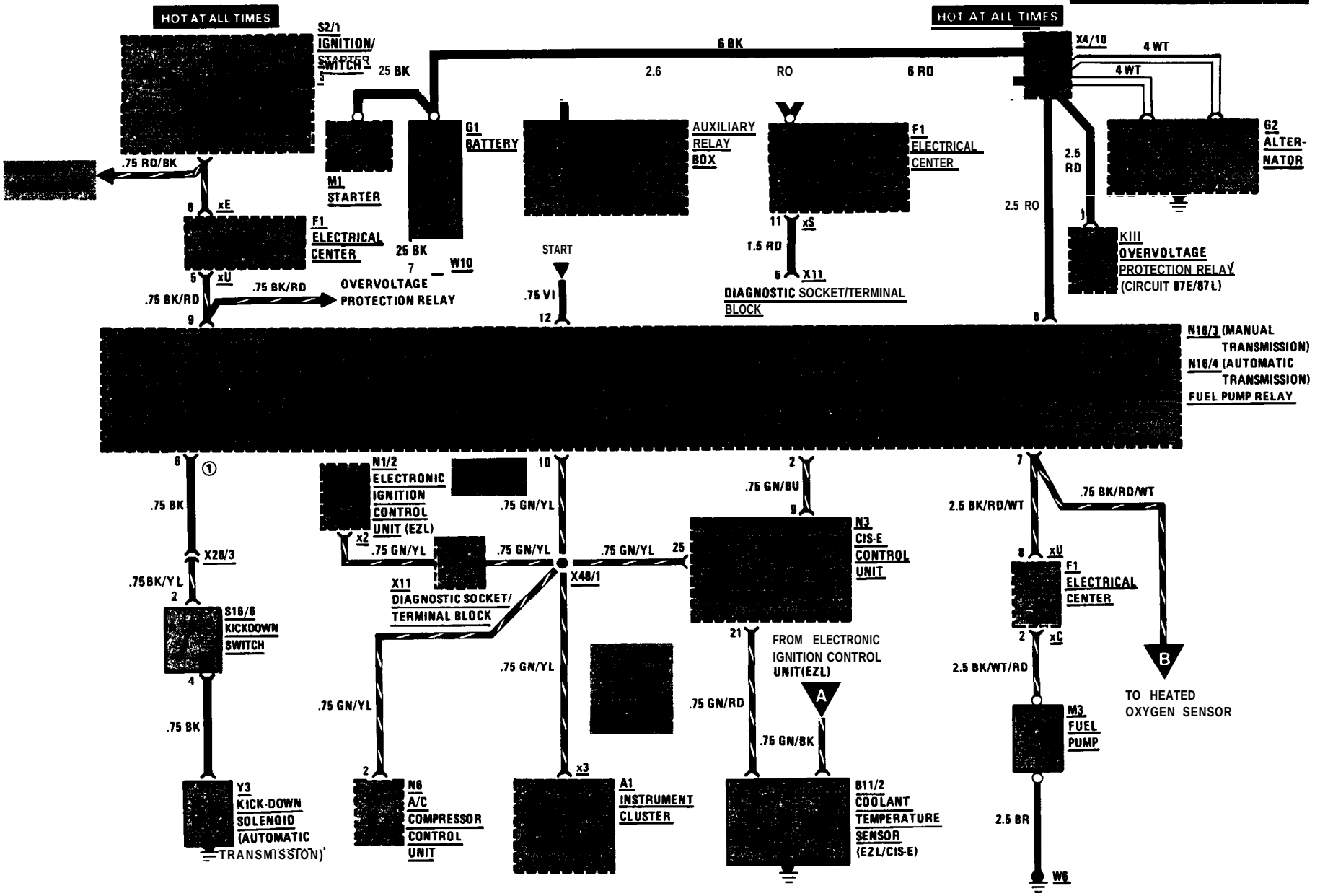
190E 2.6



REVISIONS: ① NOT WITH MANUAL TRANSMISSION

② GREEN COVER UP TO MY 1992

FUEL DELIVERY

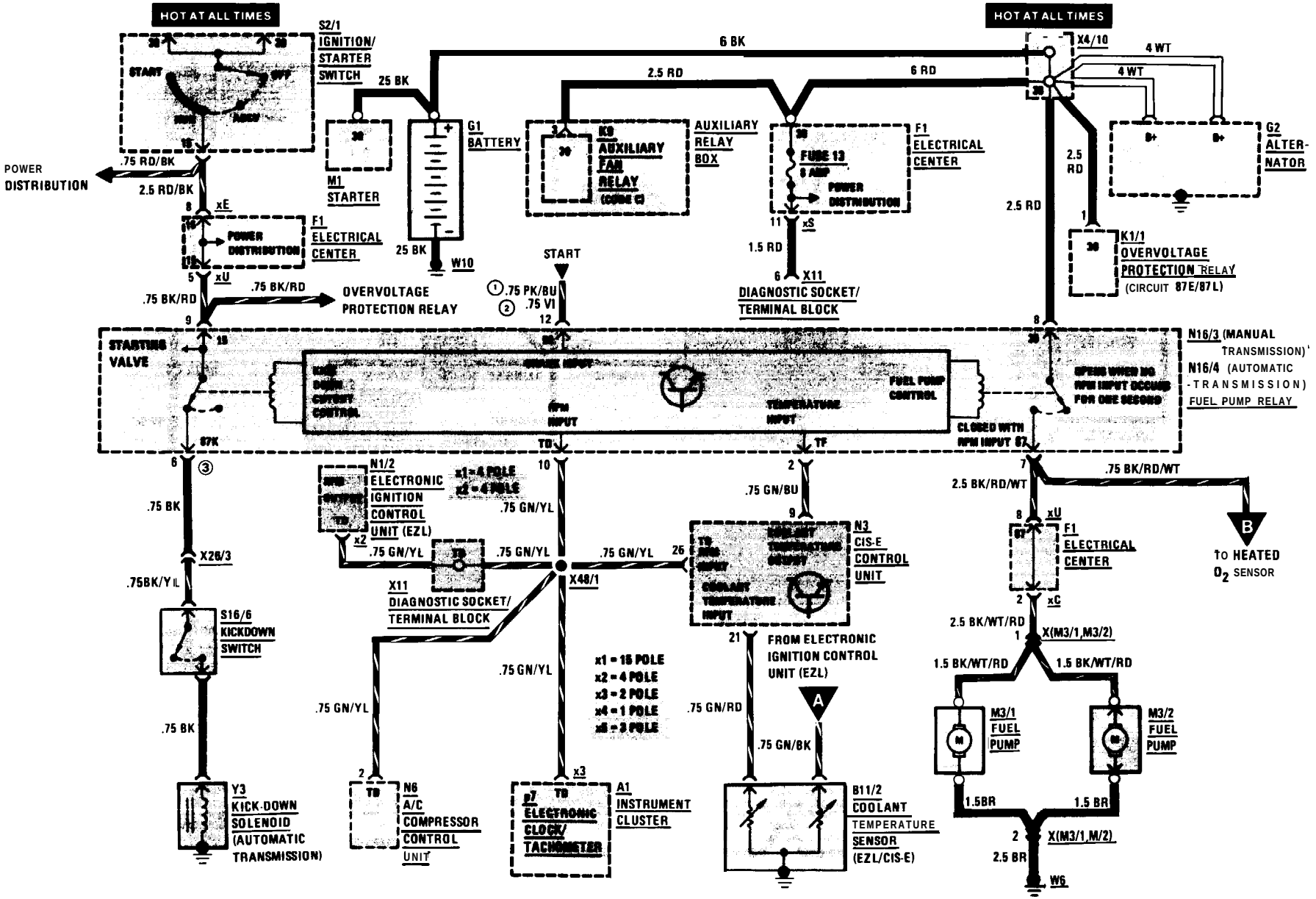


REVISIONS: ① FOR MANUAL **TRANSMISSIONS, PIN 6 IS NOT USED**

FUEL DELIVERY

MY 1987-I 989

FEDERAL **190E** 2.6 AND **190E** 2.3-16

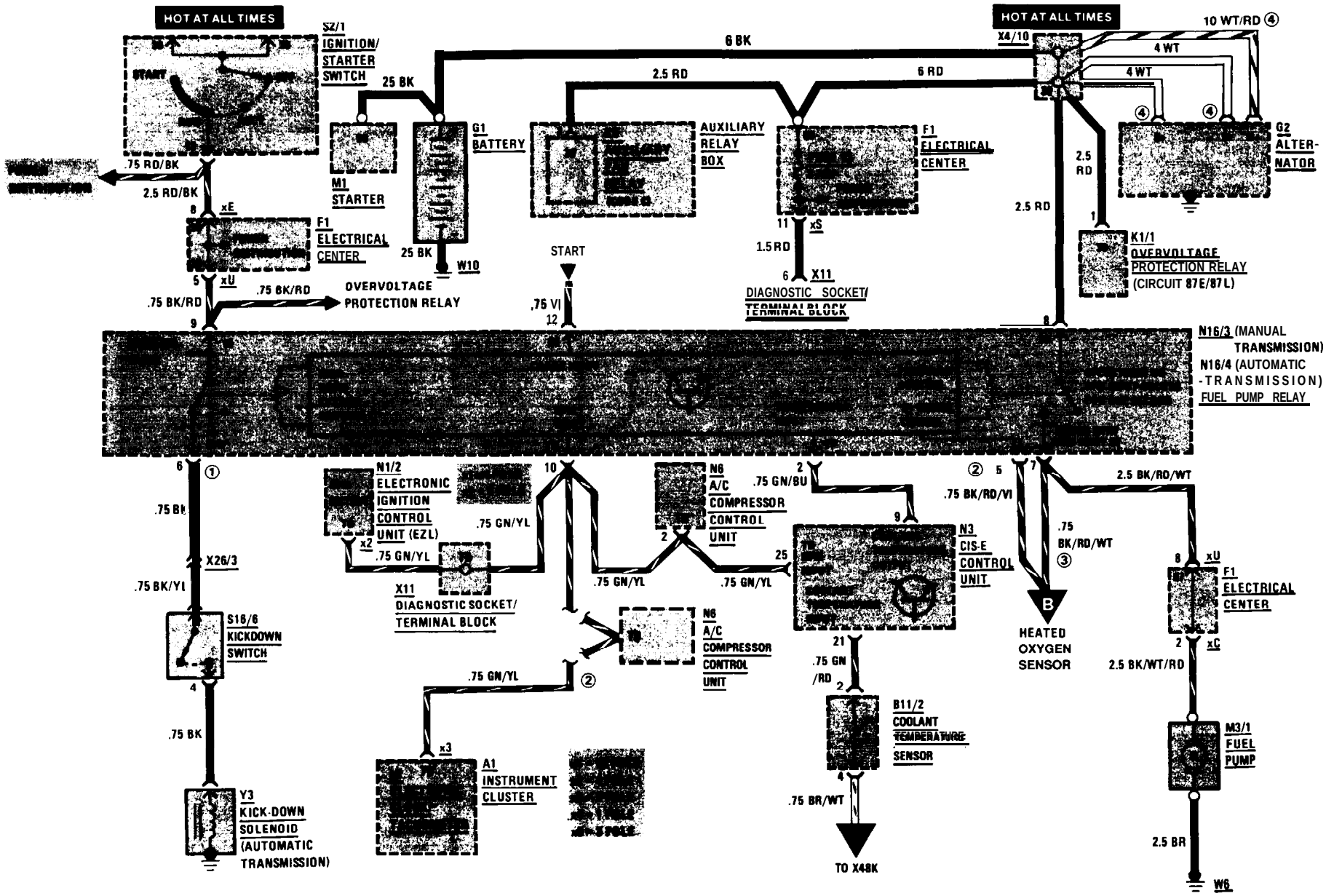


REVISIONS: ①**190E 2.3-16** 1201.0349)
②**190E** 2.6 **(201.029)**
③ FOR MANUAL TRANSMISSIONS. **PIN 6** IS NOT USED

FUEL DELIVERY

MY [illegible]

AS OF MY 199[illegible] (CALIF. & FED.)

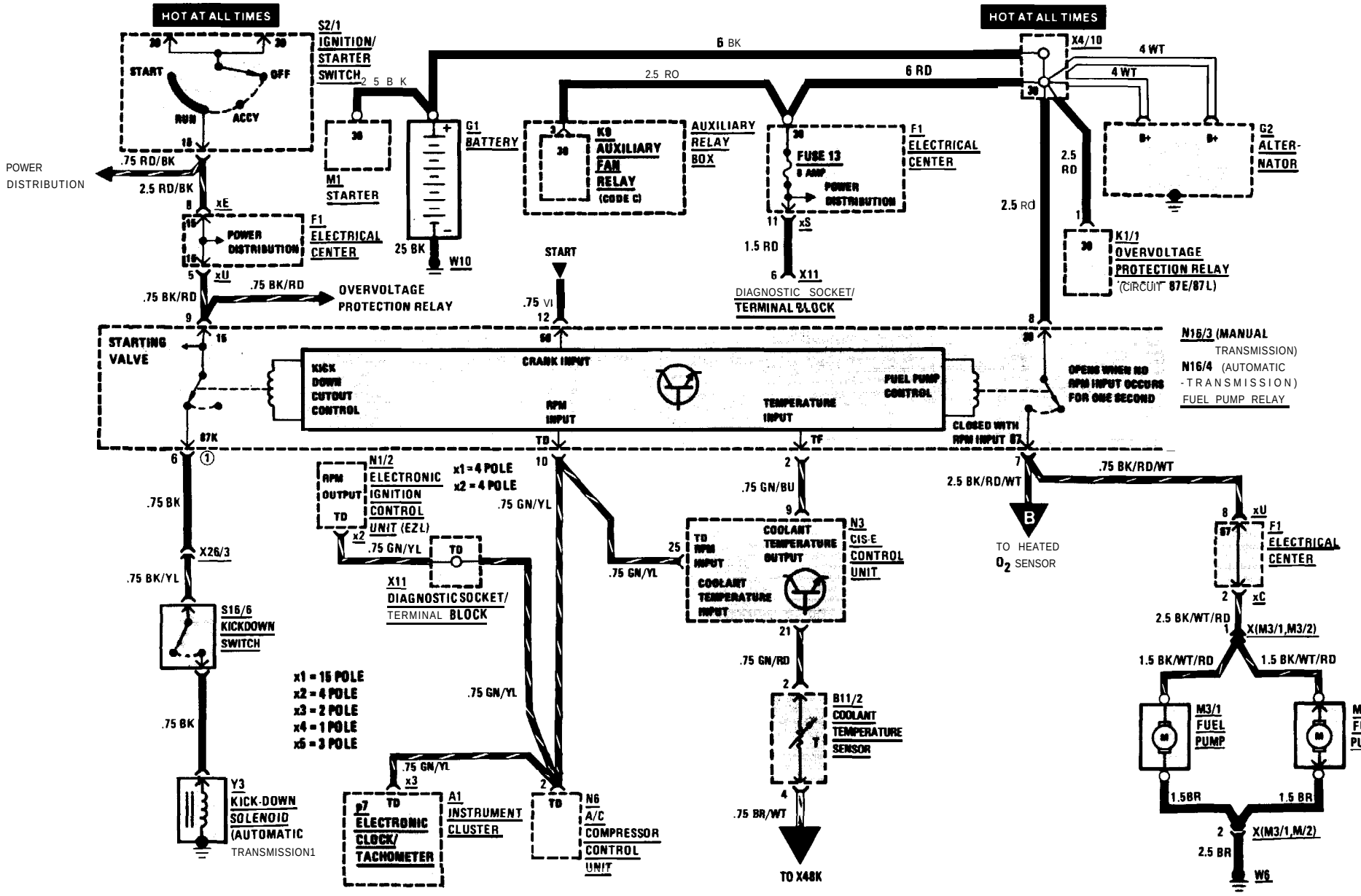


REVISIONS: ① FOR MANUAL TRANSMISSIONS, PIN 6 IS NOT USED
② AS OF MY 1991
③ MY 1991 ONLY
④ AS OF MY 1992, A SINGLE 10 WT/RD WIRE IS USED

FUEL DELIVERY

MY 1988-1989

CALIFORNIA 190E 2.6

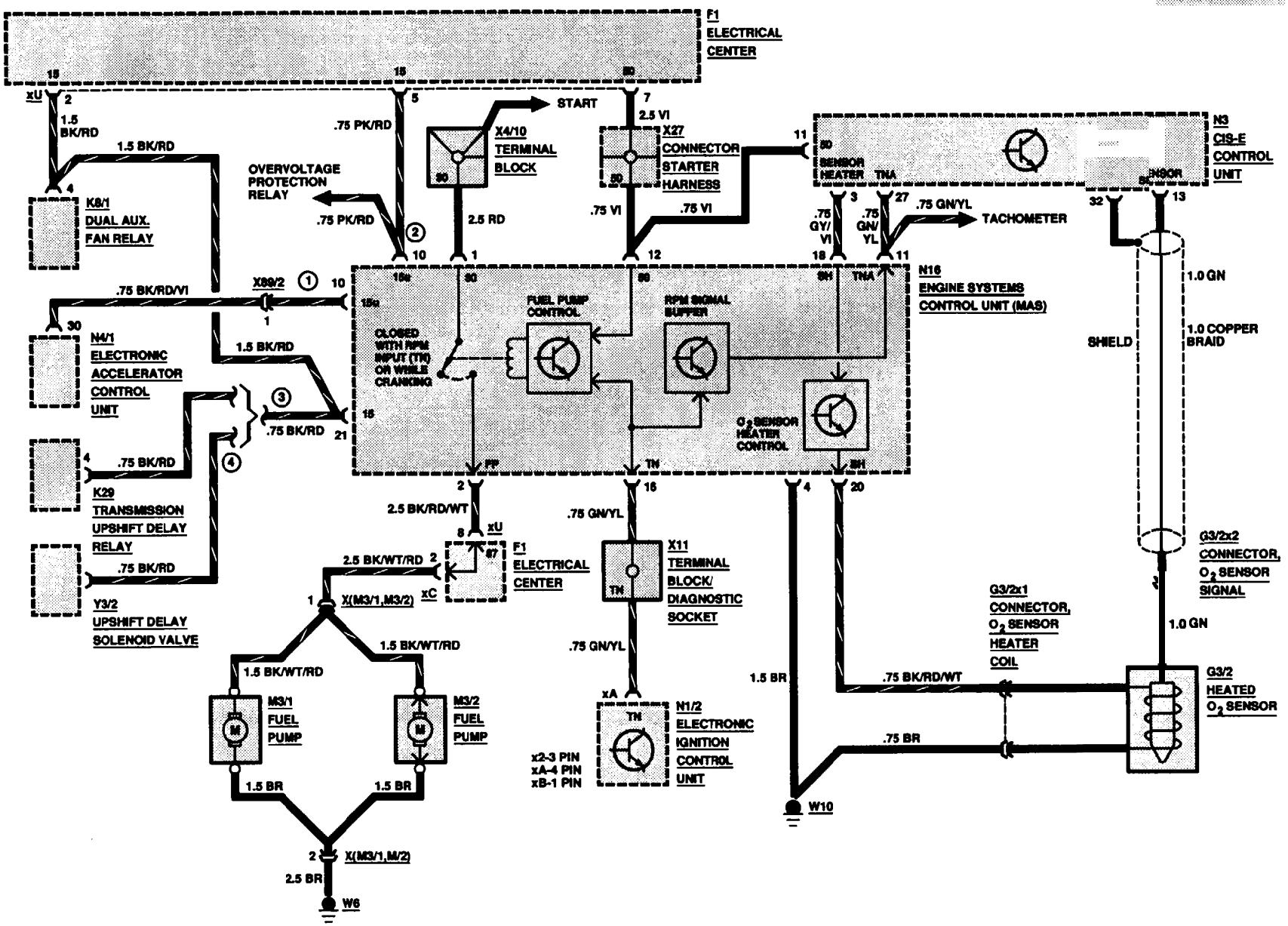


REVISIONS: ① FOR MANUAL **TRANSMISSIONS,** PIN **6** IS NOT **USED**

FUEL DELIVERY/OXYGEN SENSOR

AS OF MY 1990

190E 2.6



REVISIONS: (1) VEHICLES WITHOUT ASR (3) AUTOMATIC TRANSMISSION ONLY
(2) VEHICLES WITH ASR (4) AS OF MY 1992

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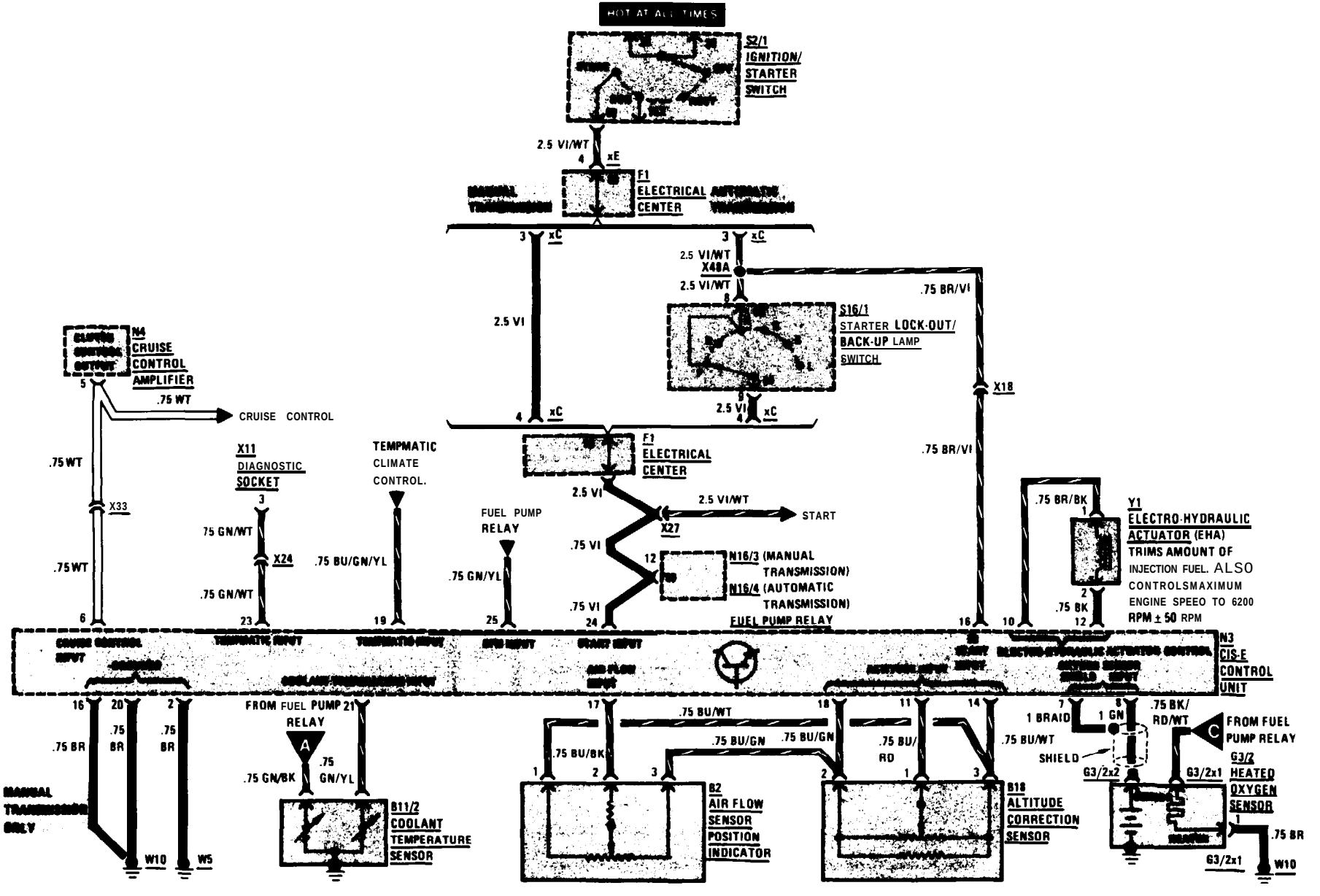
ELECTRONIC ENGINE CONTROL

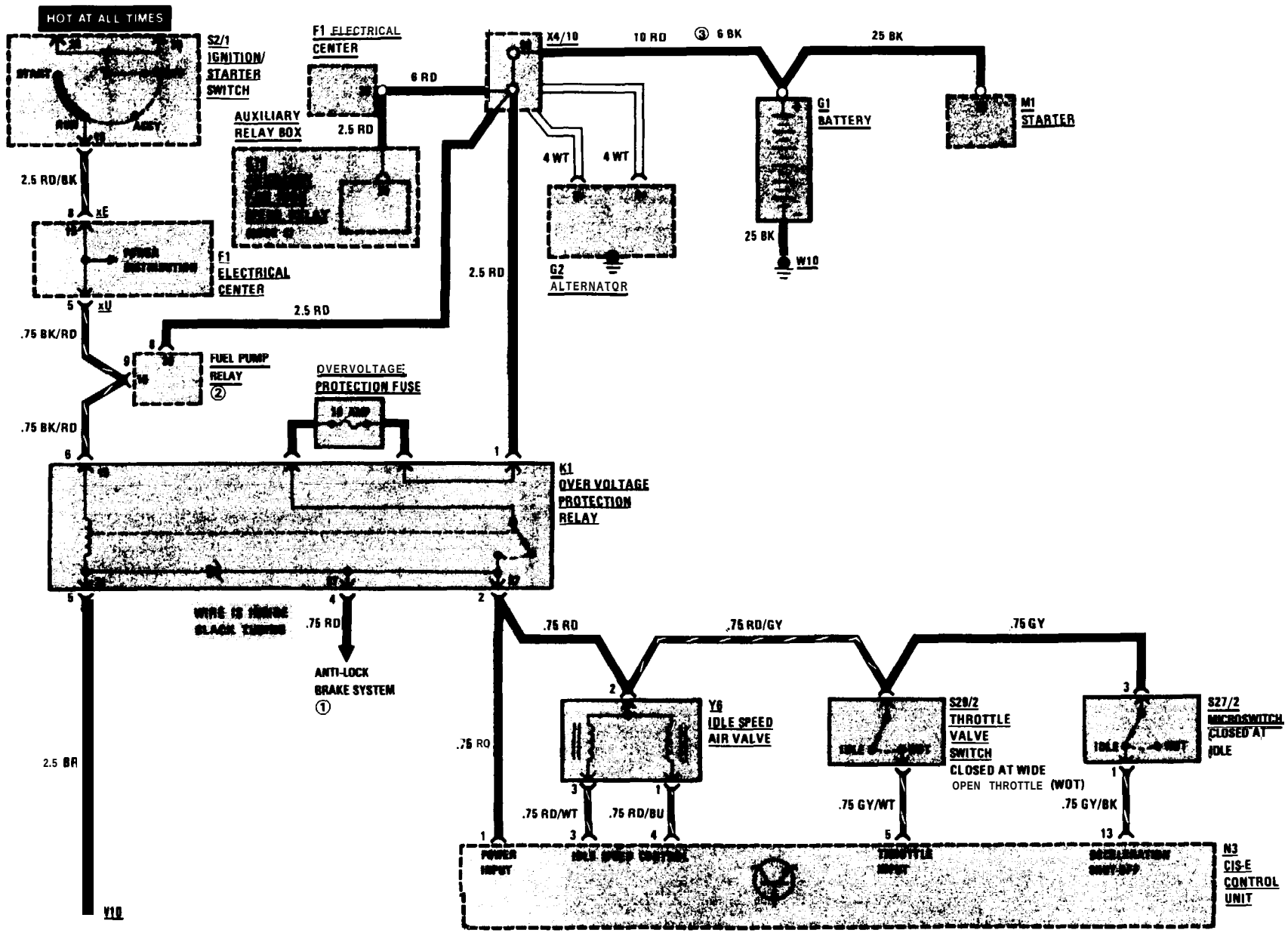
MY 1984-1988

190E 2.3



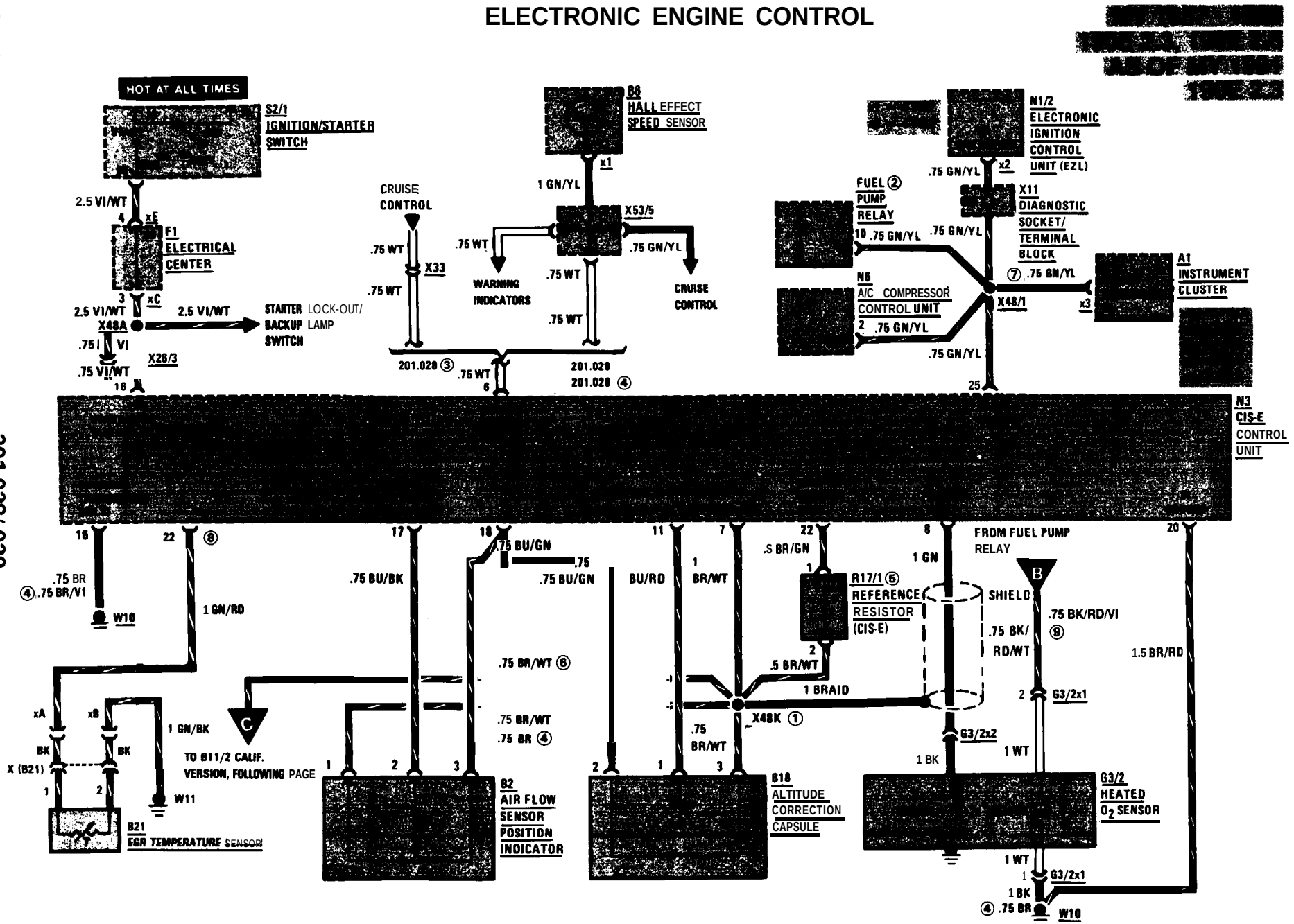
REVISIONS:

ELECTRONIC ENGINE CONTROL



REVISIONS: ① AS OF MODEL YEAR 1995
② N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)
③ A9 OF MODEL YEAR 1999

ELECTRONIC ENGINE CONTROL



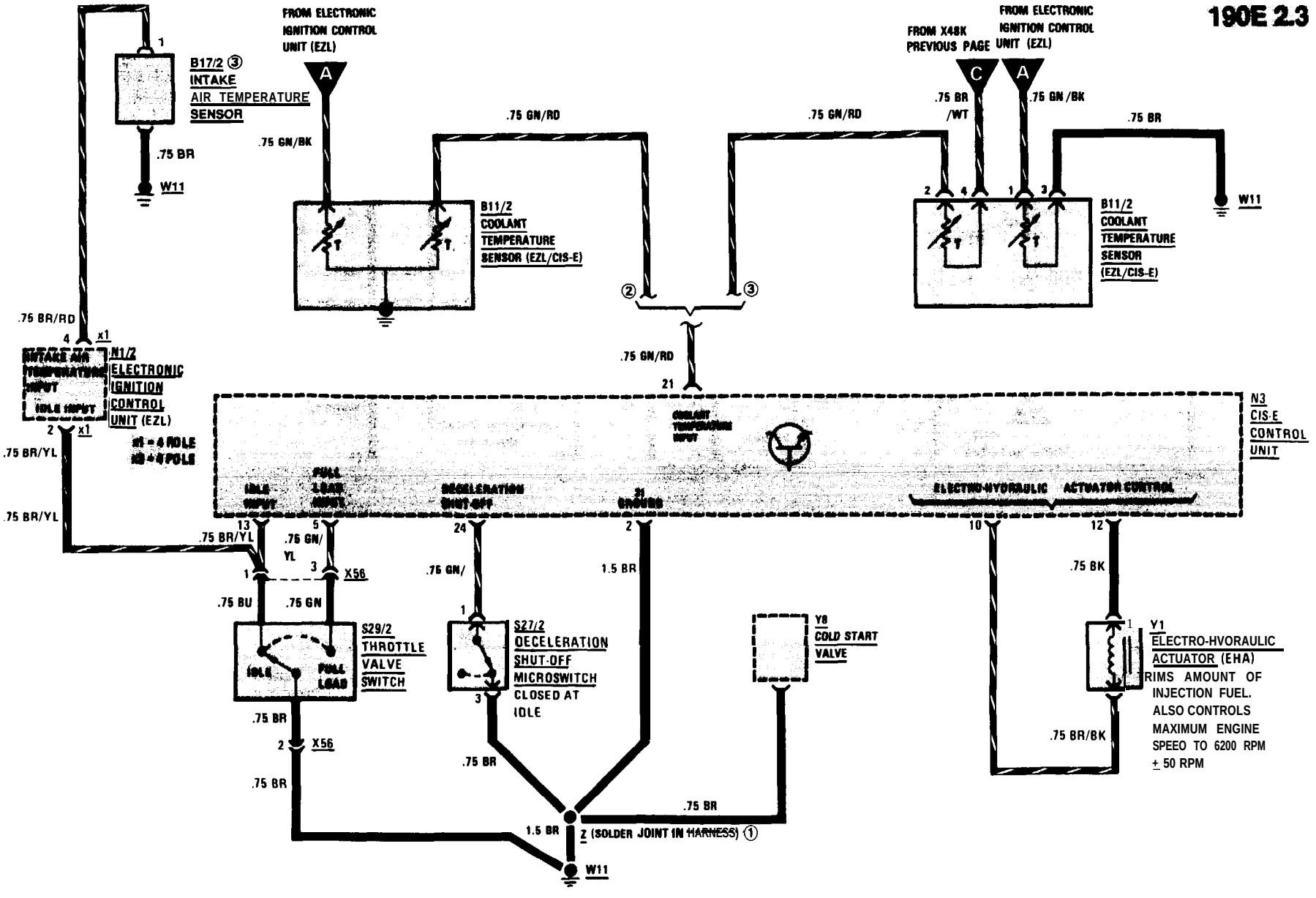
201.028/.029

109/2

REVISIONS
① SPLICE LOCATED INSIDE CIS-E CONTROL UNIT CONNECTOR
② N16/3 FUEL PUMP RELAY (MANUAL TRANSMISSION) N16/4 FUEL PUMP RELAY (AUTOMATIC TRANSMISSION)
③ MY 1987
④ AS OF MY 1988
⑤ R17/1 NO LONGER USED AS OF MY 1986
⑥ CALIFORNIA AS OF MY 1988
⑦ FOR CALIFORNIA VERSIONS AS OF MY 1988 AND ALL VERSIONS AS OF MY 1991 SEE FUEL DELIVERY
⑧ AS OF MY 1991 CALIFORNIA VERSION ONLY
⑨ VEHICLES WITH ASR

ELECTRONIC ENGINE CONTROL

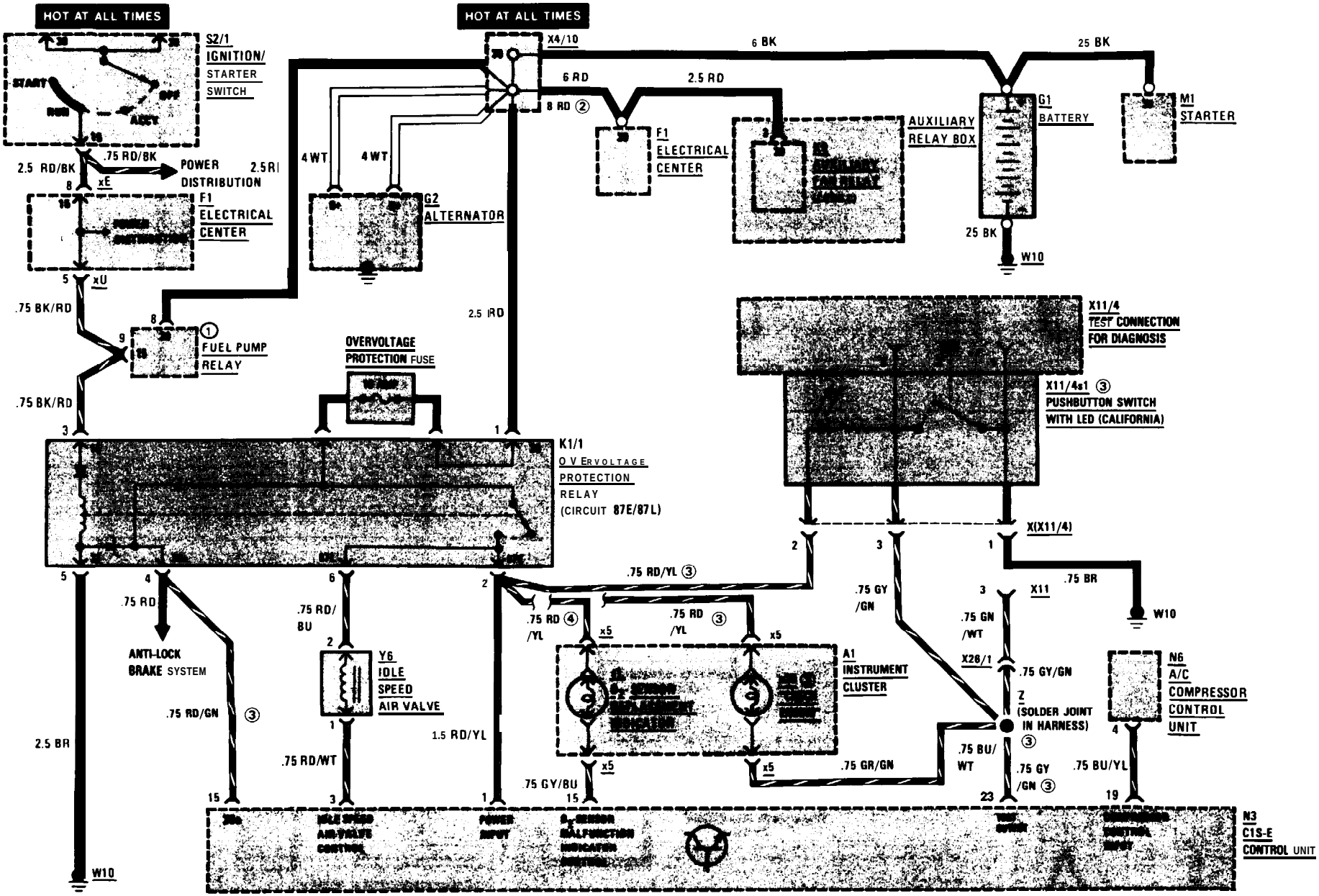
MY 1987 - 1989
190E 2.3, 190E 2.6
AS OF MY 1991
190E 2.3



REVISIONS: ① 190E 2.6 (201.028) ONLY
OTHER MODELS HAVE COMPONENTS DIRECTLY TIED TO W11.
② FEDERAL
③ CALIFORNIA AS OF MY 1888 AND ALL VERSIONS AS OF MY 1881

ELECTRONIC ENGINE CONTROL

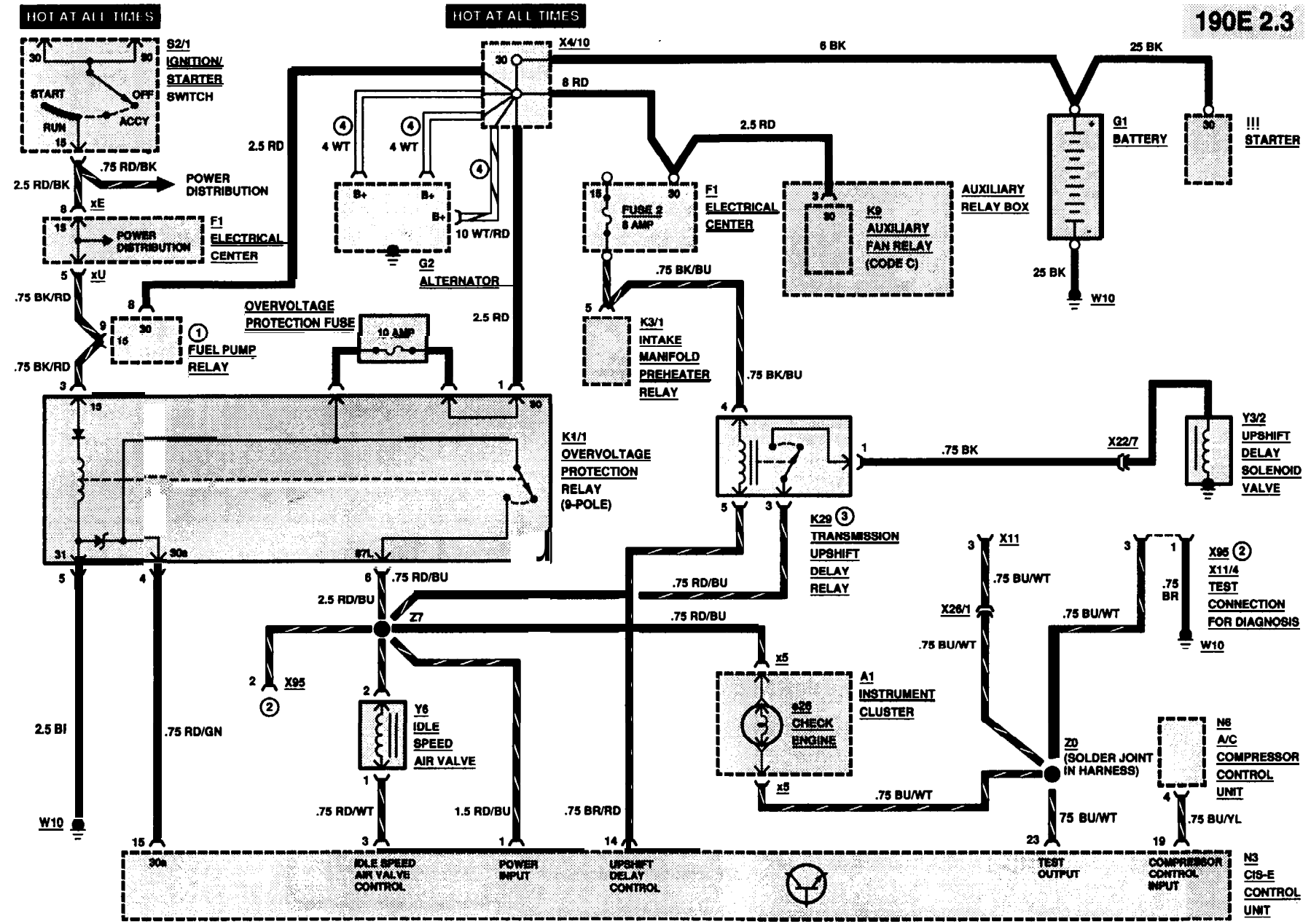
MY 1987 - 1989
190E 2.3, 190E 2.6



REVISIONS: ① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)
② AS OF MY 1988
③ CALIFORNIA ONLY AS OF MY 1999
④ FEDERAL

ELECTRONIC ENGINE CONTROL/TRANSMISSION UPSHIFT DELAY

MY 1991
190E 2.3

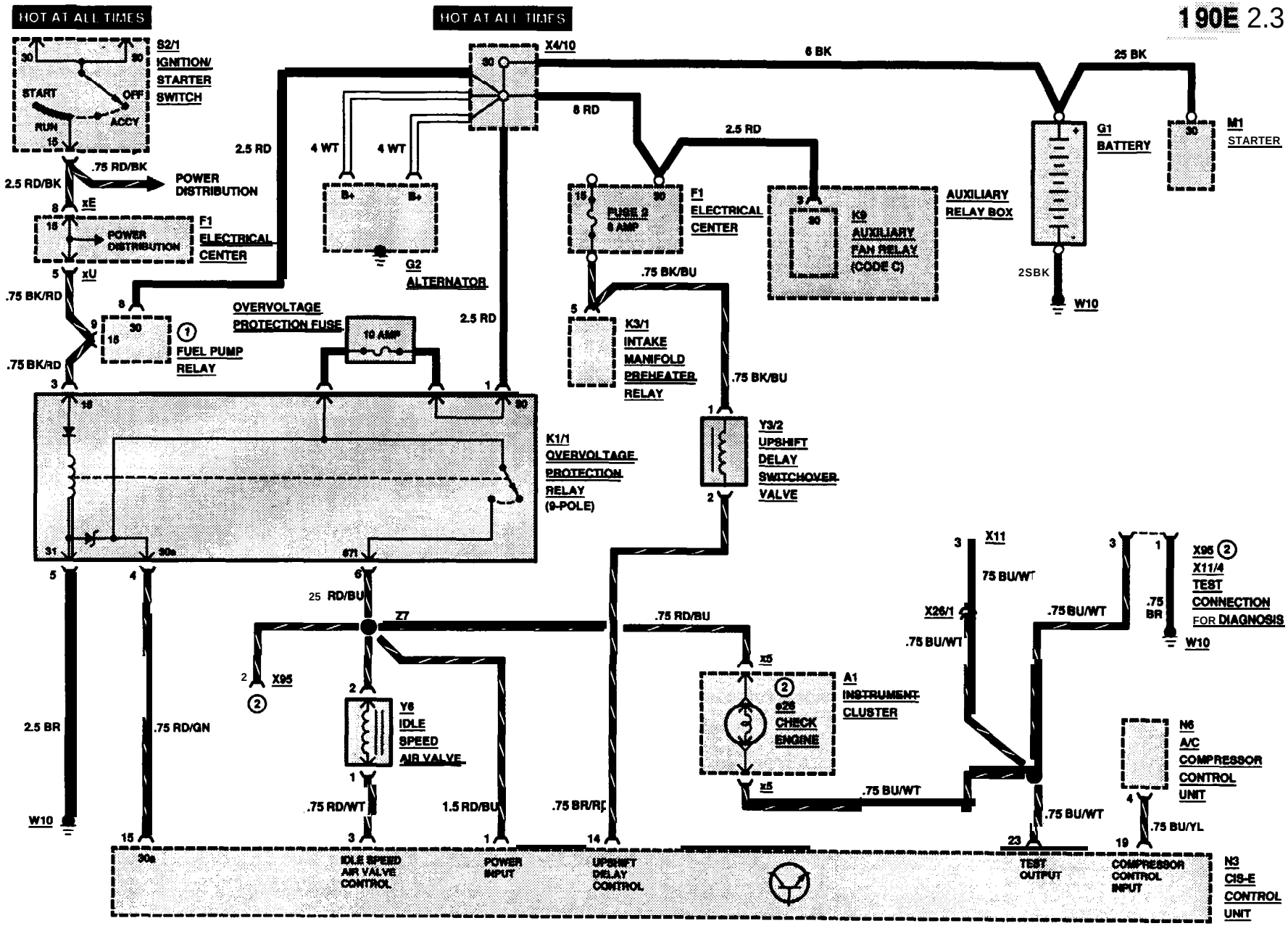


REVISIONS:
① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)
② CALIFORNIA ONLY
③ AUTOMATIC TRANSMISSION ONLY
④ AS OF MY 1992, A SINGLE 10 WT/RD WIRE IS USED

ELECTRONIC ENGINE CONTROL/TRANSMISSION UPSHIFT DELAY

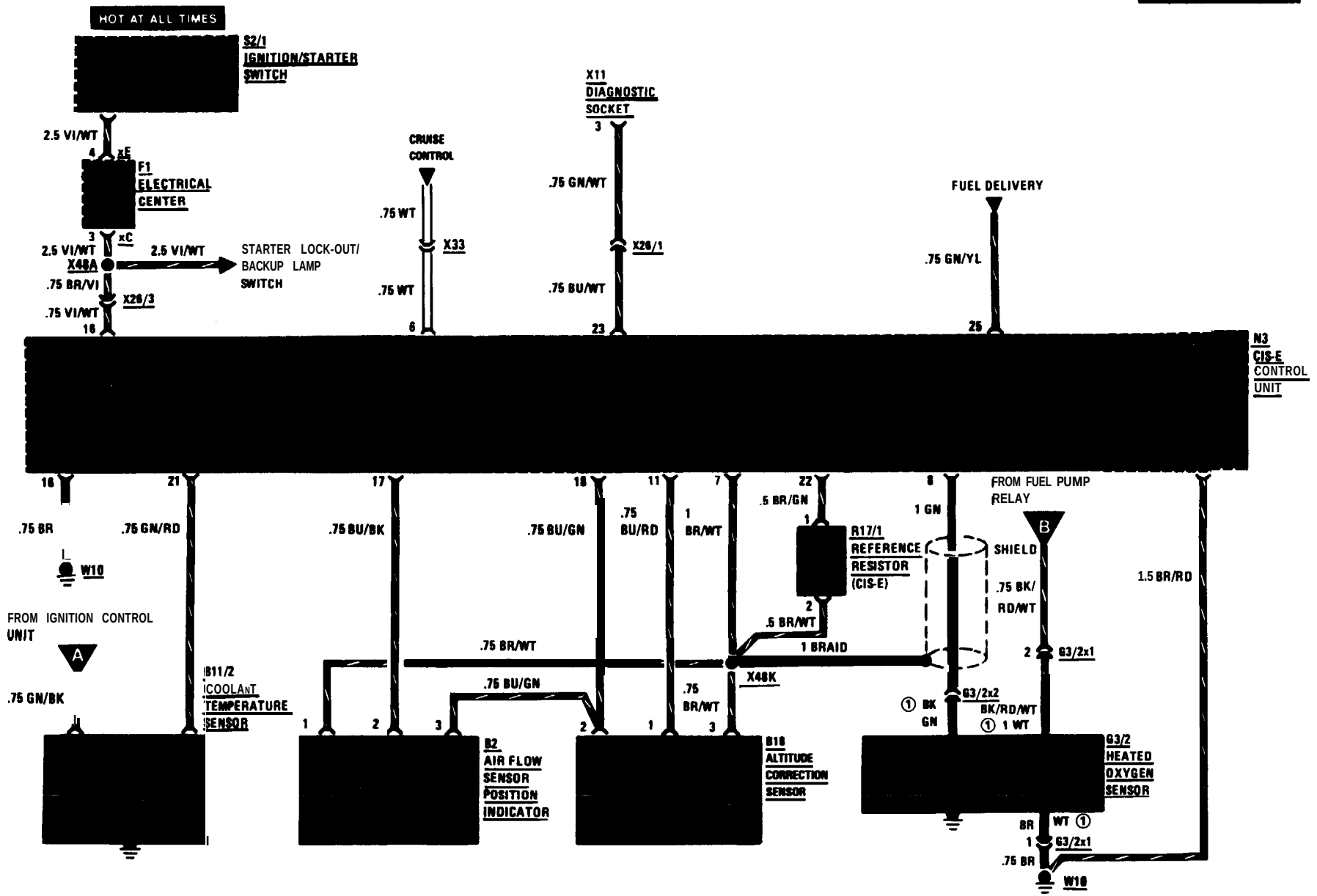
AS OF MY 1992

190E 2.3



REVISIONS:
(1) N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)
(2) CALIFORNIA ONLY
(3) AUTOMATIC TRANSMISSION ONLY

ELECTRONIC ENGINE CONTROL

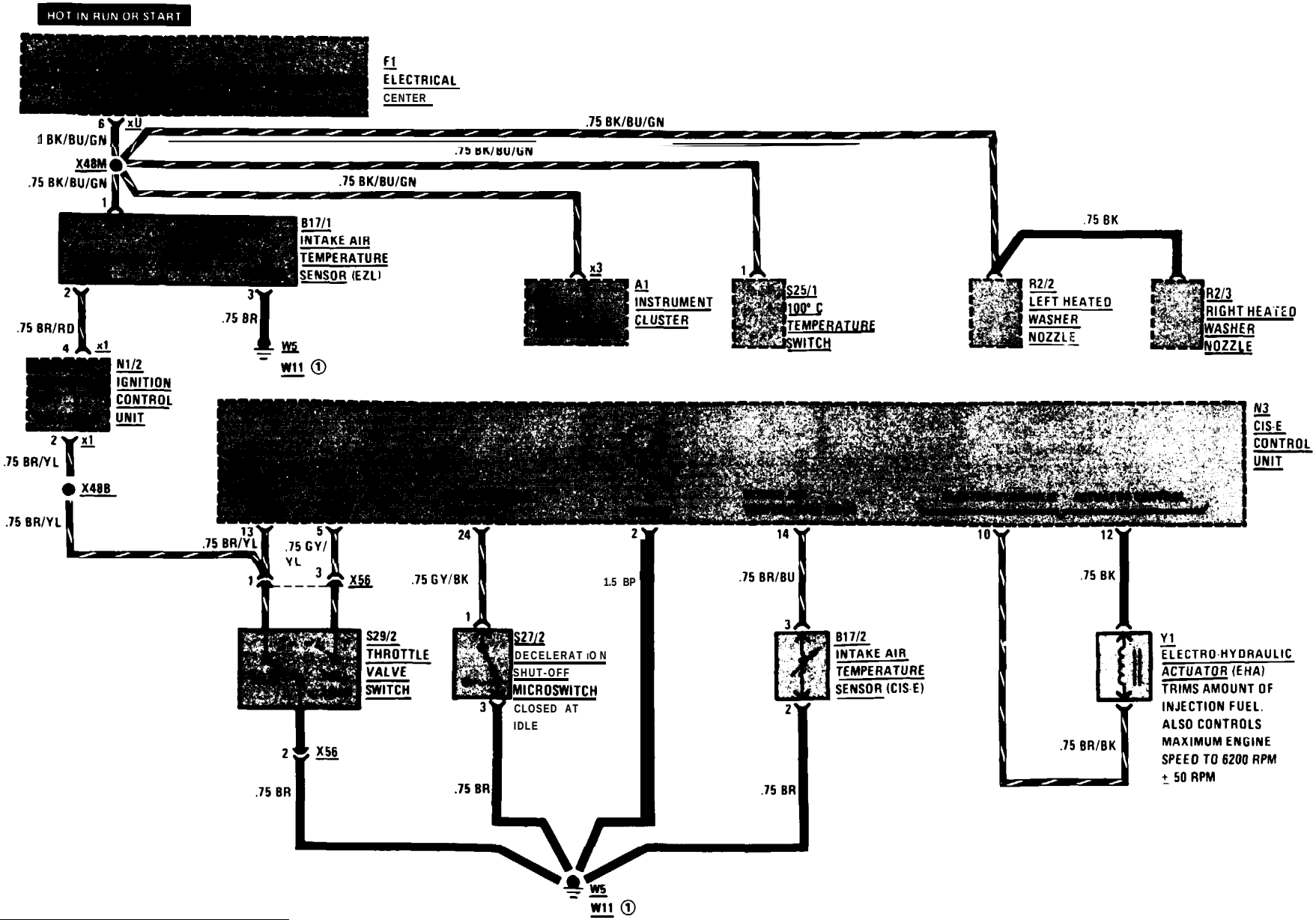


REVISIONS: ① AS OF MY 1987

ELECTRONIC ENGINE CONTROL

AS OF MY 1988

190E 2.3-16

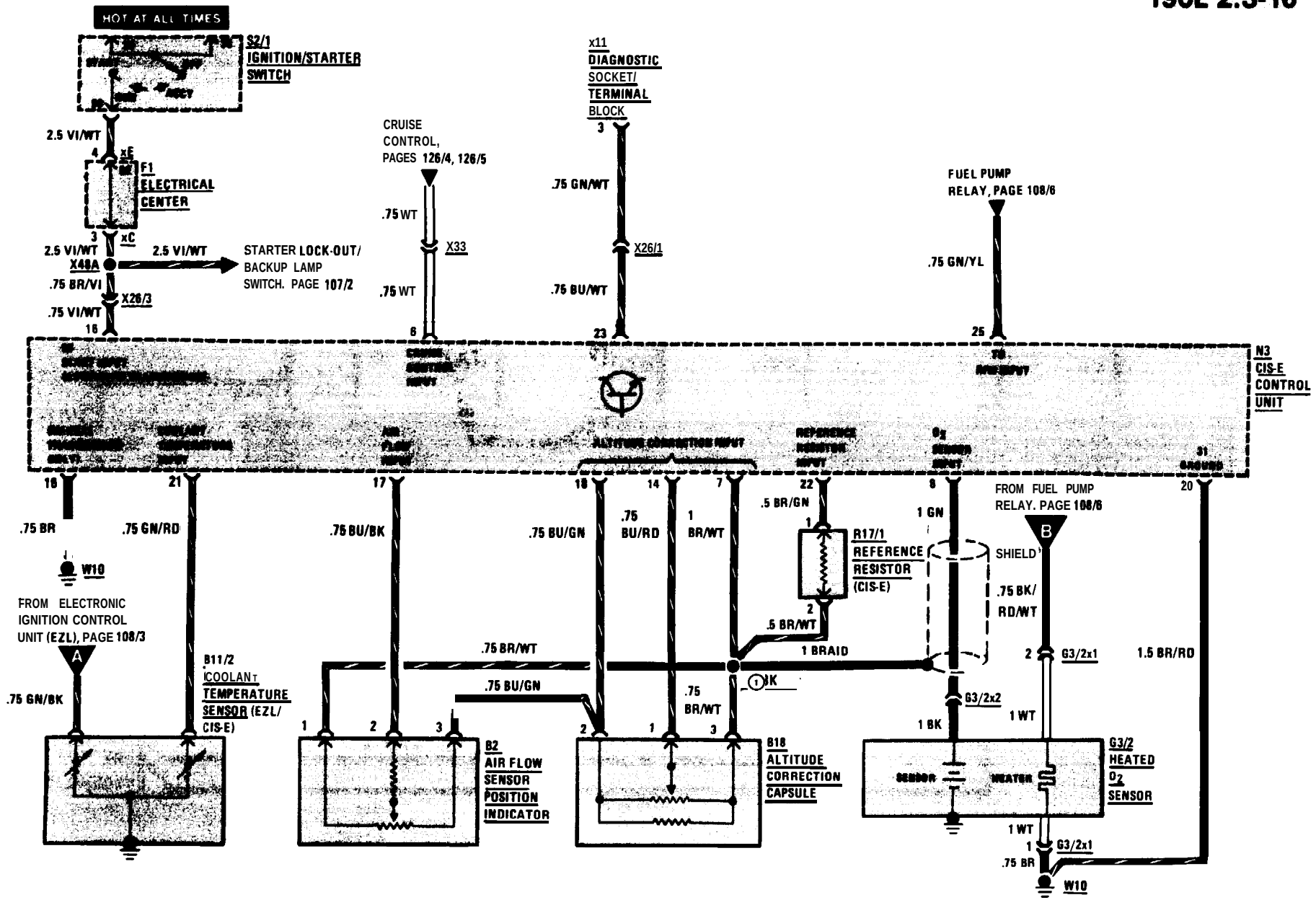


201.034

109/8

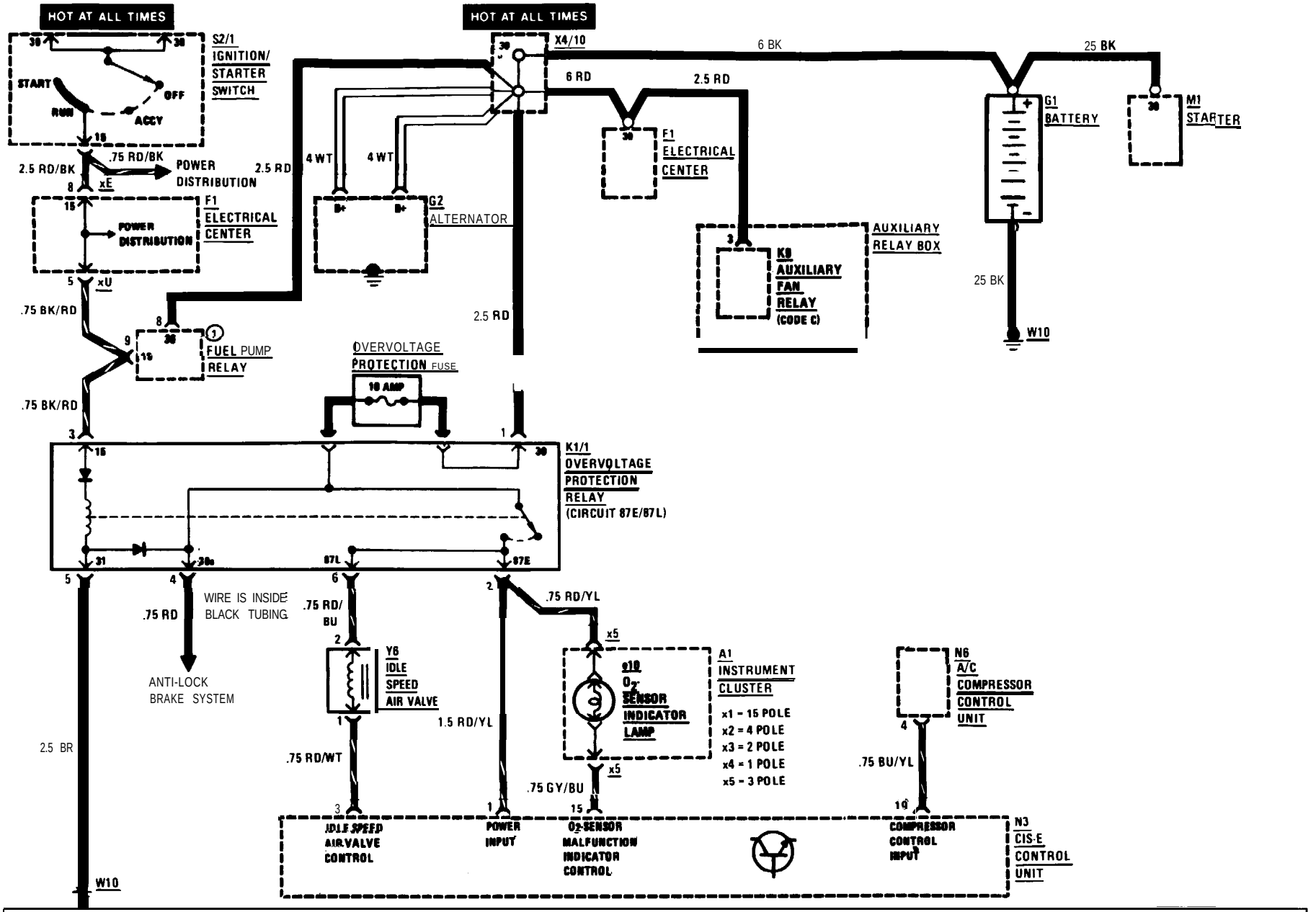
REVISIONS: ① AS OF MY 1987

ELECTRONIC ENGINE CONTROL



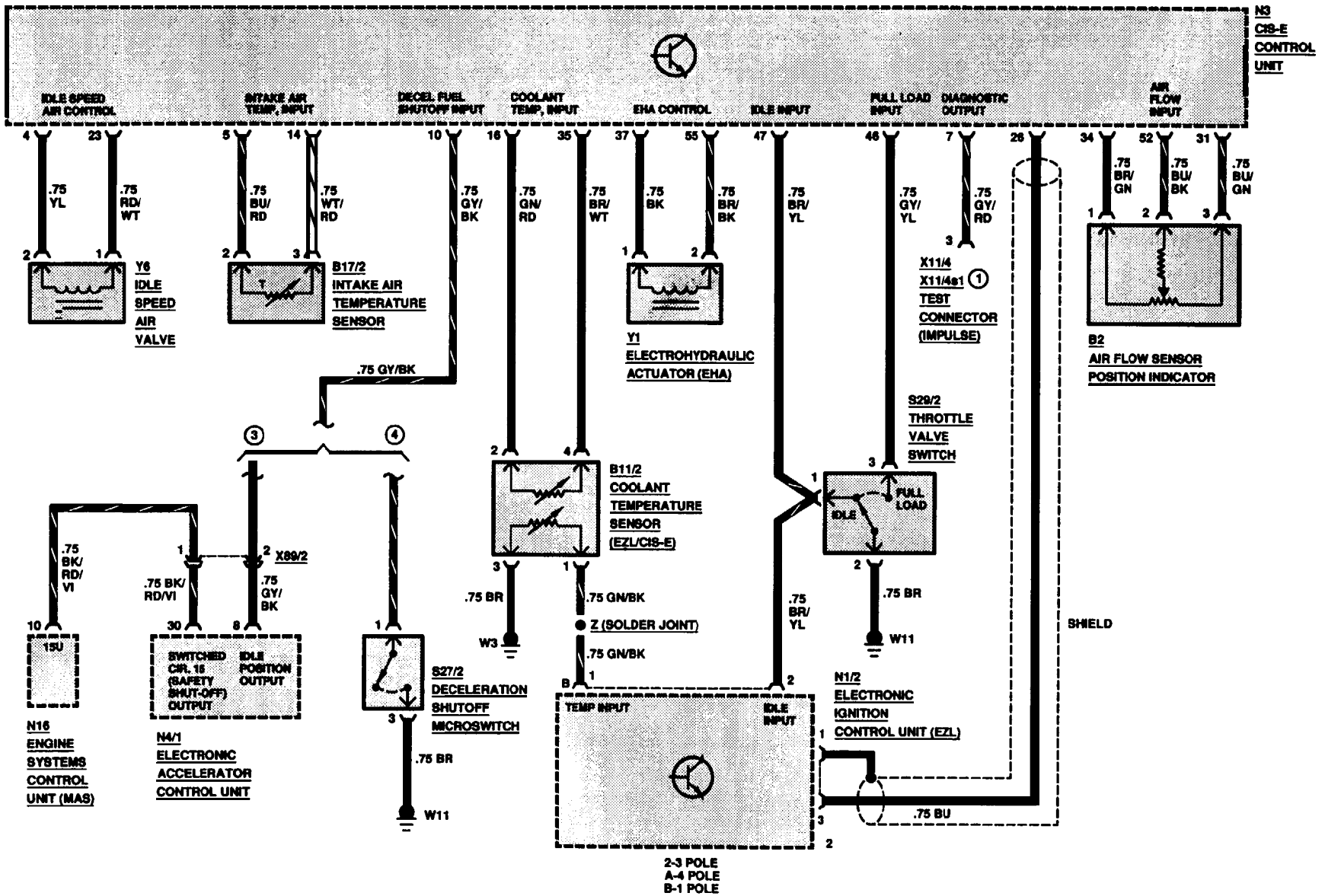
REVISIONS: ① SPLICE LOCATED INSIDE CIS-E CONTROL UNIT CONNECTOR

ELECTRONIC ENGINE CONTROL

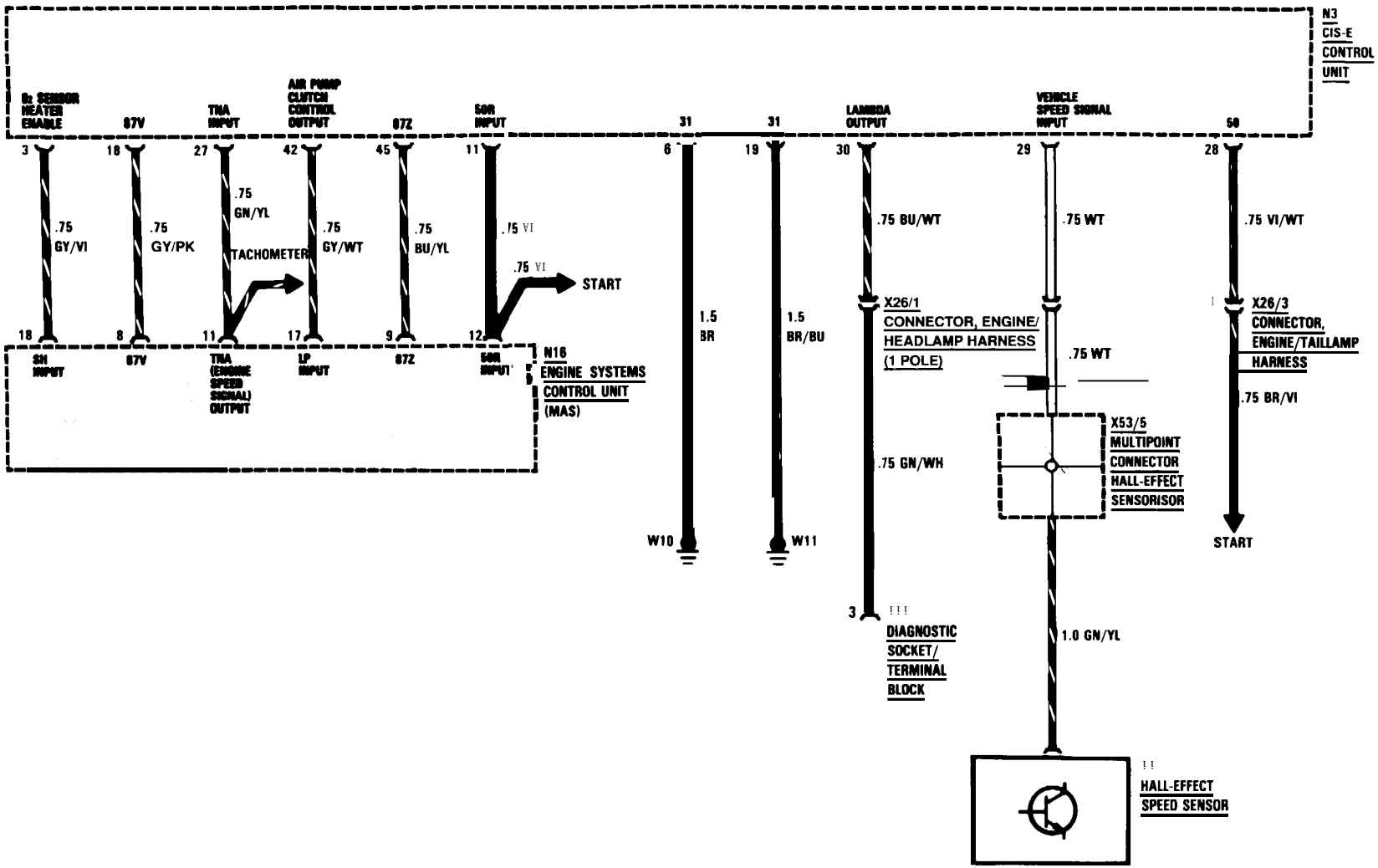


REVISIONS: ① **N16/3** (MANUAL TRANSMISSION), **N16/4** (AUTOMATIC TRANSMISSION)

ELECTRONIC ENGINE CONTROLS

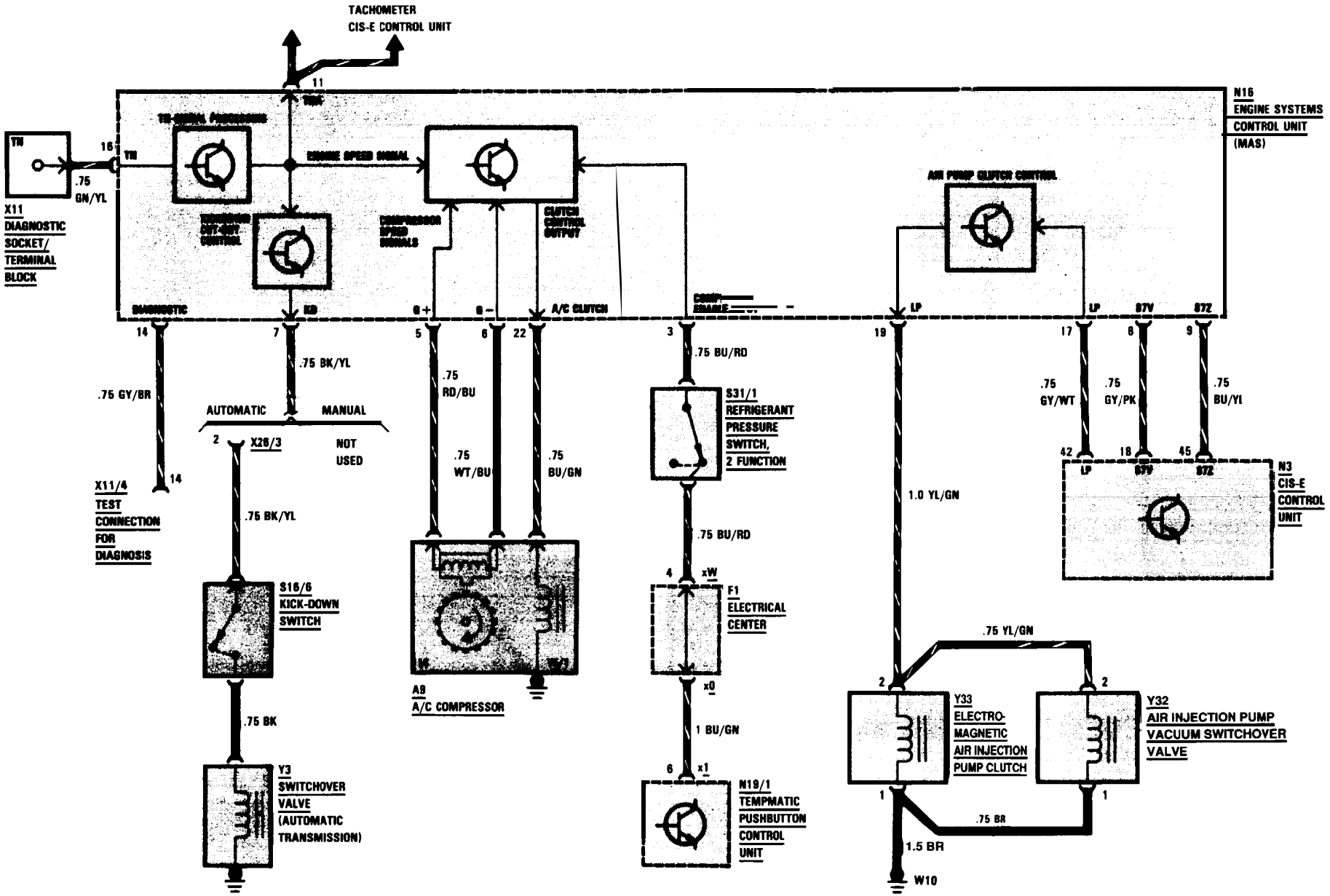


REVISIONS:
(1) CALIFORNIA ONLY
(2) NOT WITH MANUAL TRANSMISSION
(3) VEHICLES WITH ASR
(4) VEHICLES W/O ASR


N3
CIS-E
CONTROL
UNIT
O2 SENSOR HEATER ENABLE
87V
TNA INPUT
AIR PUMP CLUTCH CONTROL OUTPUT
87Z
50R INPUT
31
31
LAMBDA OUTPUT
VEHICLE SPEED SIGNAL INPUT
50
3
18
27
42
45
11
6
19
30
29
28
.75 GY/VI
.75 GY/PK
.75 GN/YL
.75 GY/WT
.75 BU/YL
.75 VI
.75 VI
TACHOMETER
START
1.5 BR
1.5 BR/BU
.75 BU/WT
.75 WT
.75 VI/WT
X26/1
CONNECTOR, ENGINE/ HEADLAMP HARNESS (1 POLE)
X26/3
CONNECTOR, ENGINE/TAILLAMP HARNESS
.75 WT
.75 BR/VI
X53/5
MULTIPOINT CONNECTOR HALL-EFFECT SENSORISOR
.75 GN/WH
START
18
8
11
17
9
12
SH INPUT
87V
TNA (ENGINE SPEED SIGNAL) OUTPUT
LP INPUT
87Z
50R INPUT
N16
ENGINE SYSTEMS CONTROL UNIT (MAS)
W10
W11
3
DIAGNOSTIC SOCKET/ TERMINAL BLOCK
1.0 GN/YL
HALL-EFFECT SPEED SENSOR

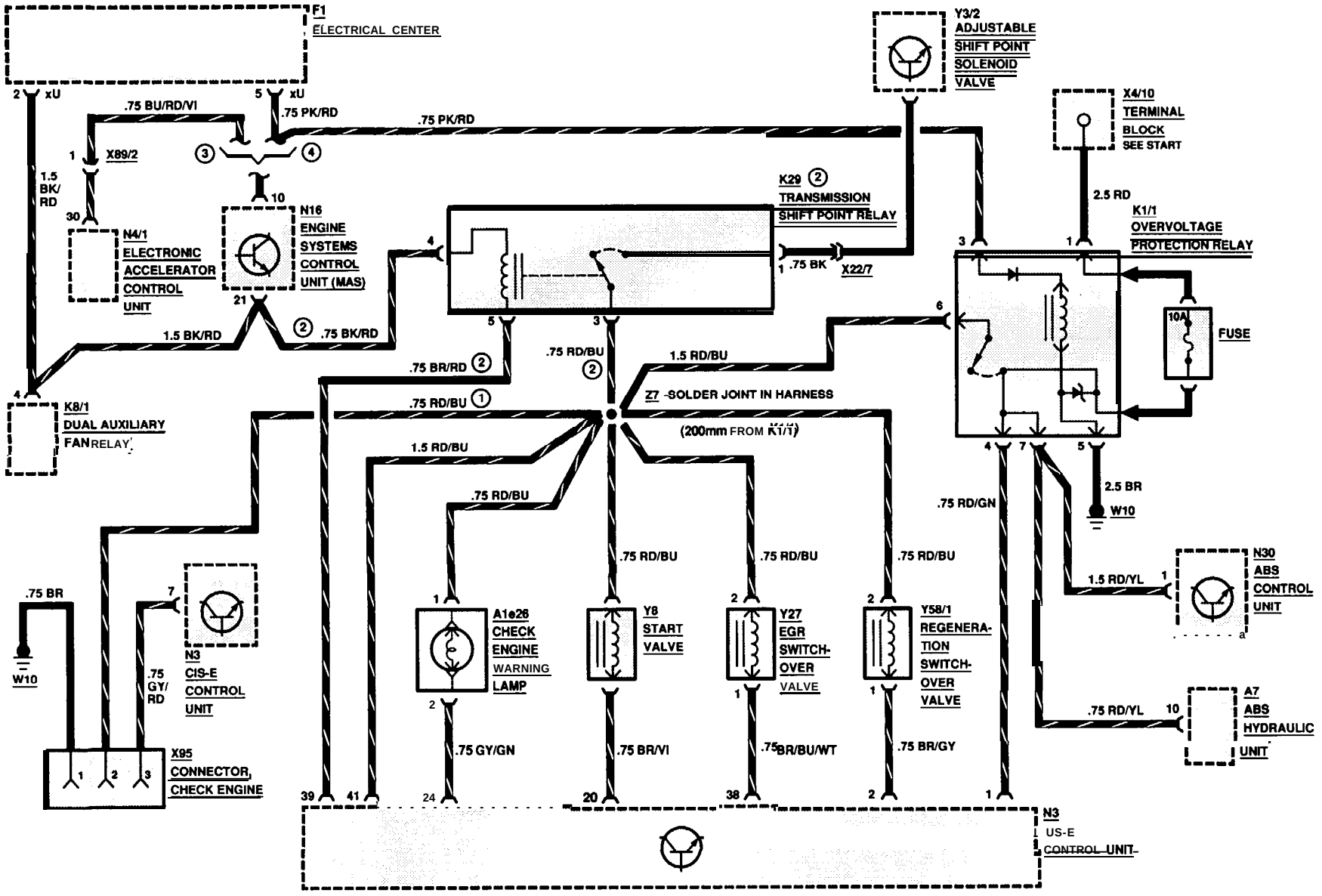
REVISIONS:

ELECTRONIC ENGINE CONTROLS
(A/C COMPRESSOR, AIR INJECTION, KICKDOWN)



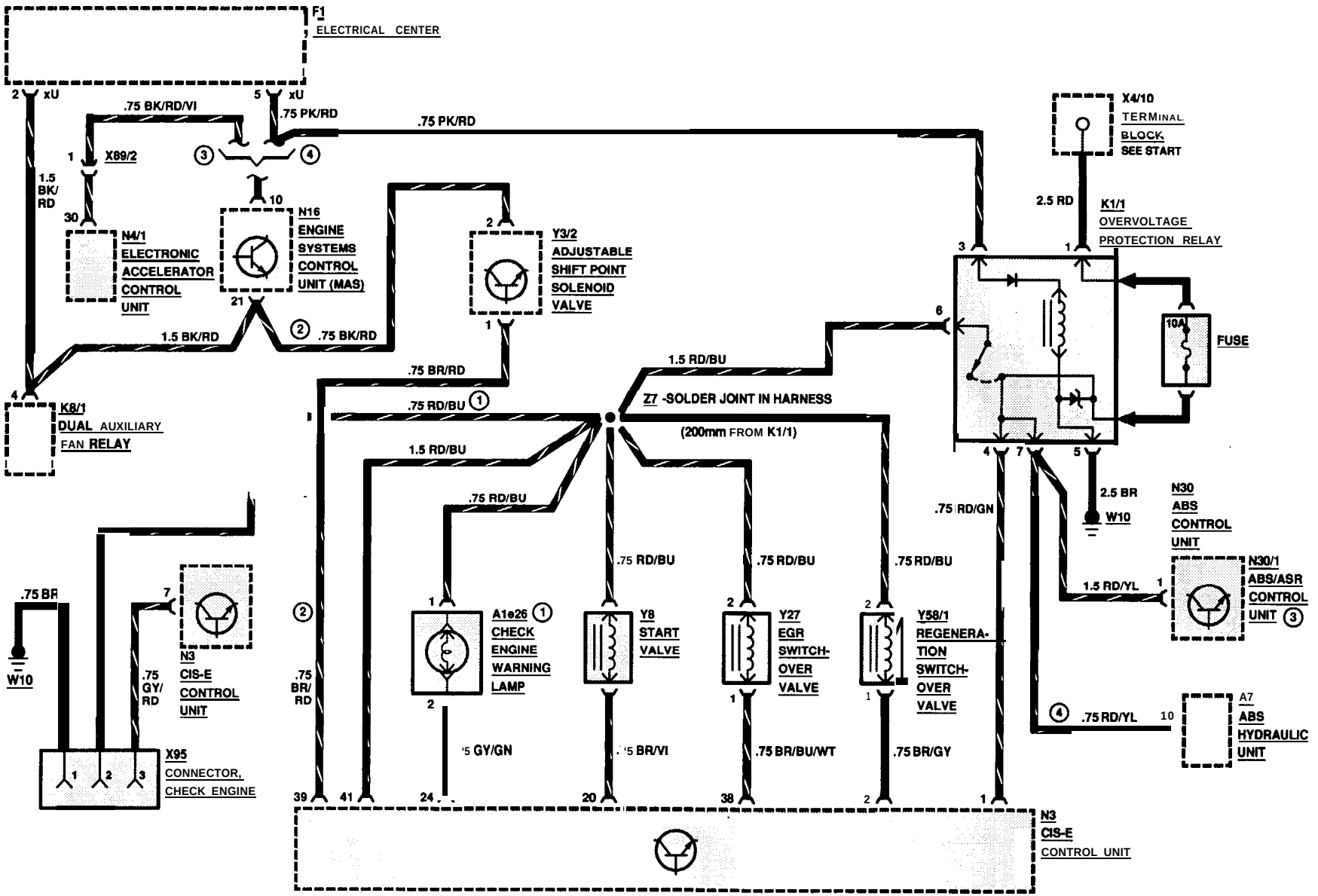
REVISIONS:

ELECTRONIC ENGINE CONTROLS/TRANSMISSION UPSHIFT RELAY/OVERVOLTAGE PROTECTION RELAY



REVISIONS: 1 CALIFORNIA ONLY
0 2 AUTOMATIC TRANSMISSION ONLY
0 3 VEHICLES WITH ASR
0 VEHICLES W/O ASR

ELECTRONIC ENGINE CONTROLS/TRANSMISSION UPSHIFT DELAY/OVERVOLTAGE PROTECTION RELAY



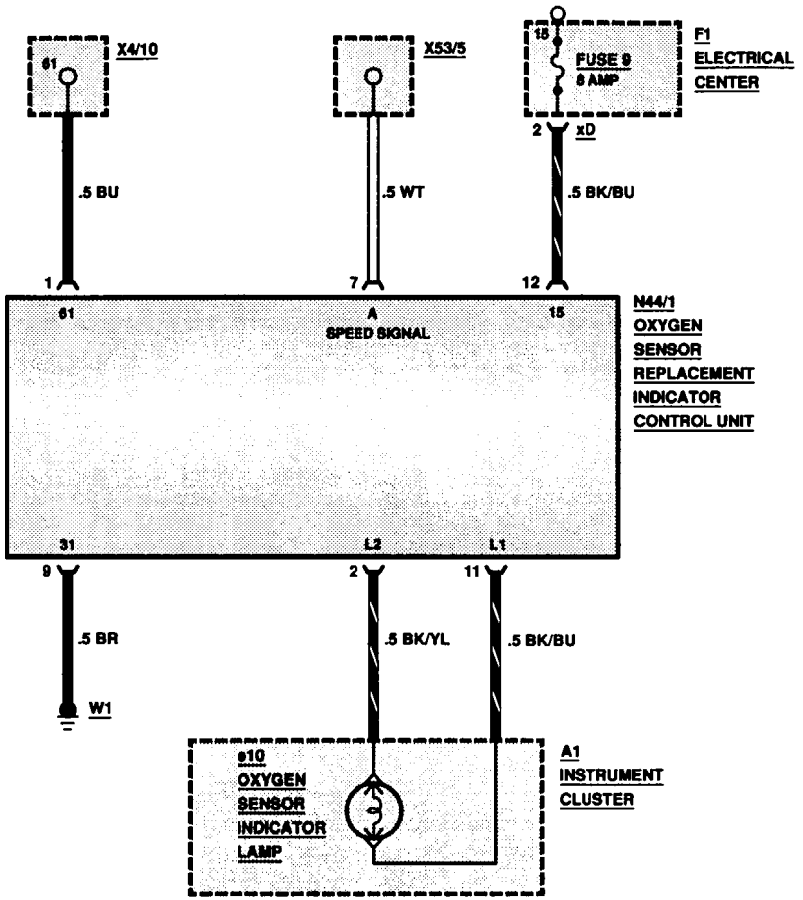
REVISIONS: (1) NOT INSTALLED ON MY 1992 FEDERAL VEHICLES (4) VEHICLES W/O ASR

(6) AUTOMATIC TRANSMISSION ONLY

(8) VEHICLES WITH ASR

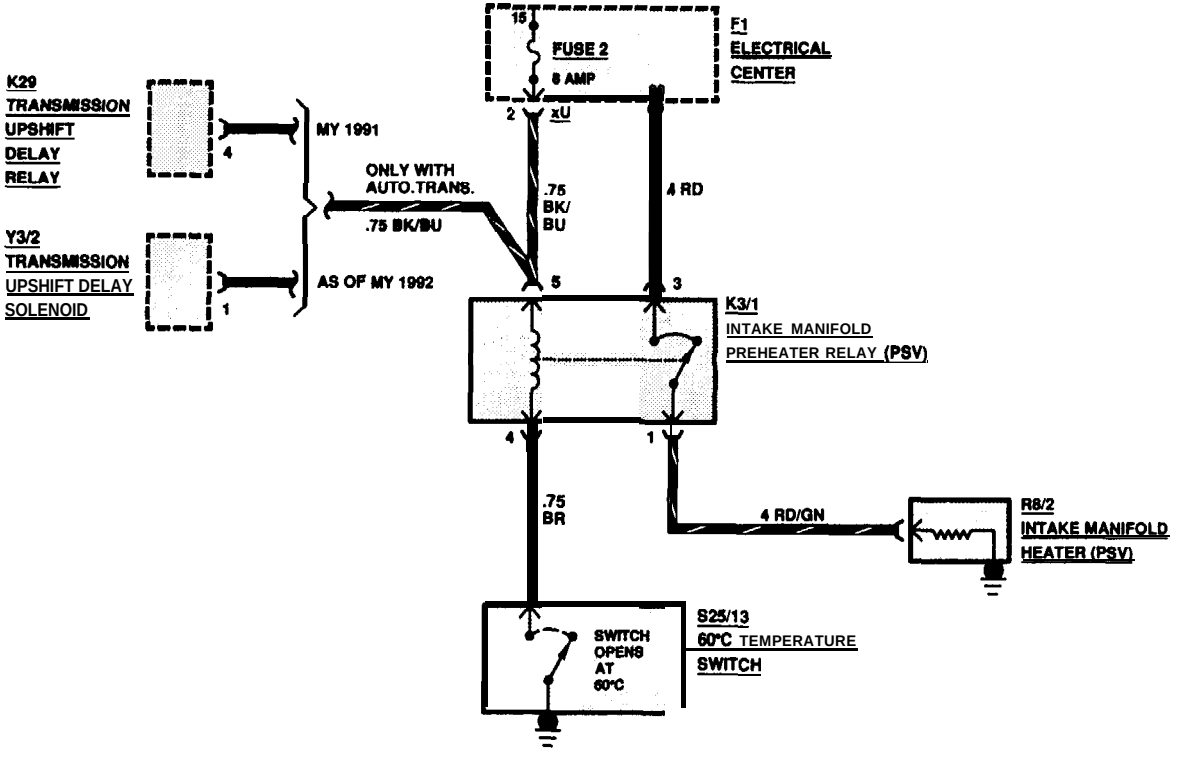
OXYGEN SENSOR REPLACEMENT INDICATOR

AS OF MY 1992
190E 2.3
CALIFORNIA



REVISIONS:

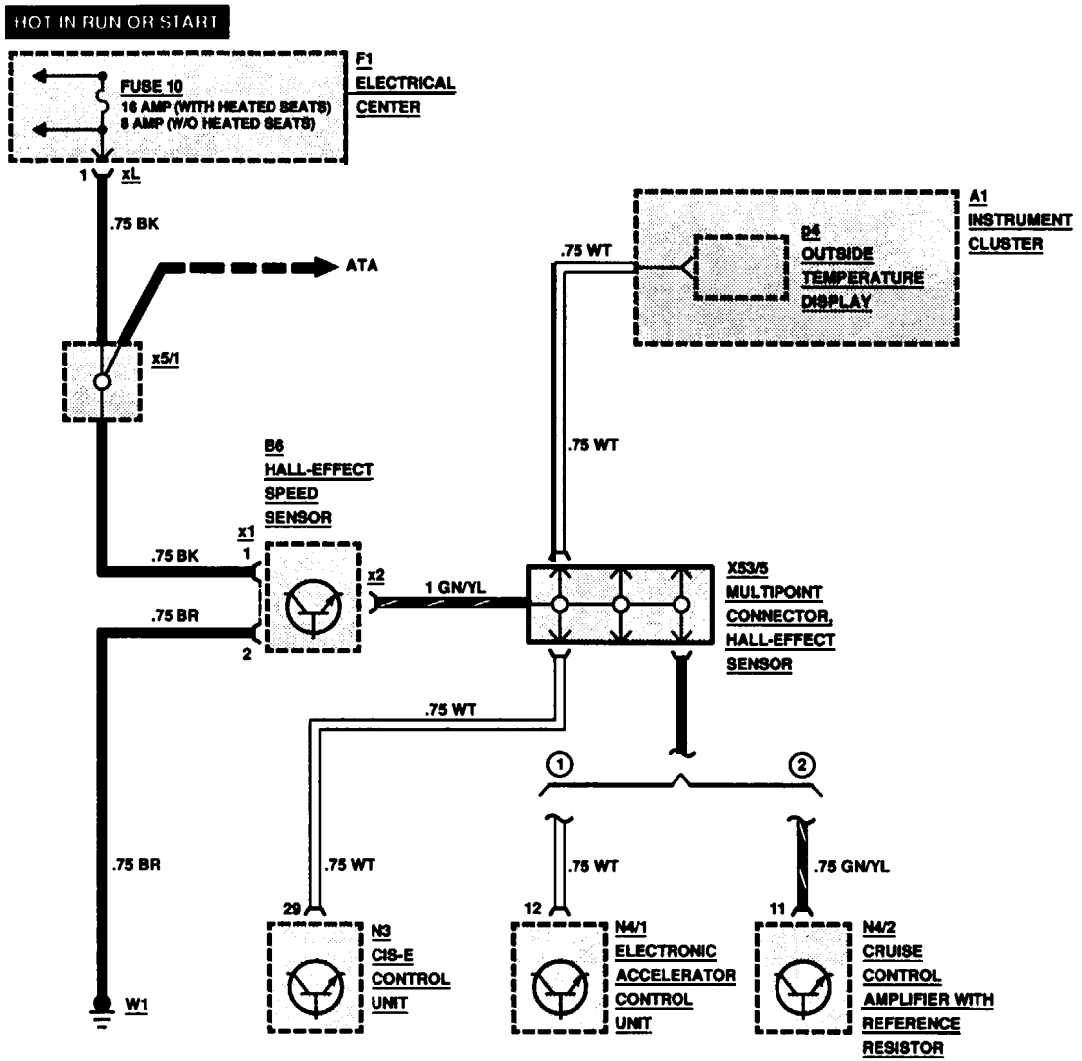
INTAKE MANIFOLD PREHEATER



REVISIONS:

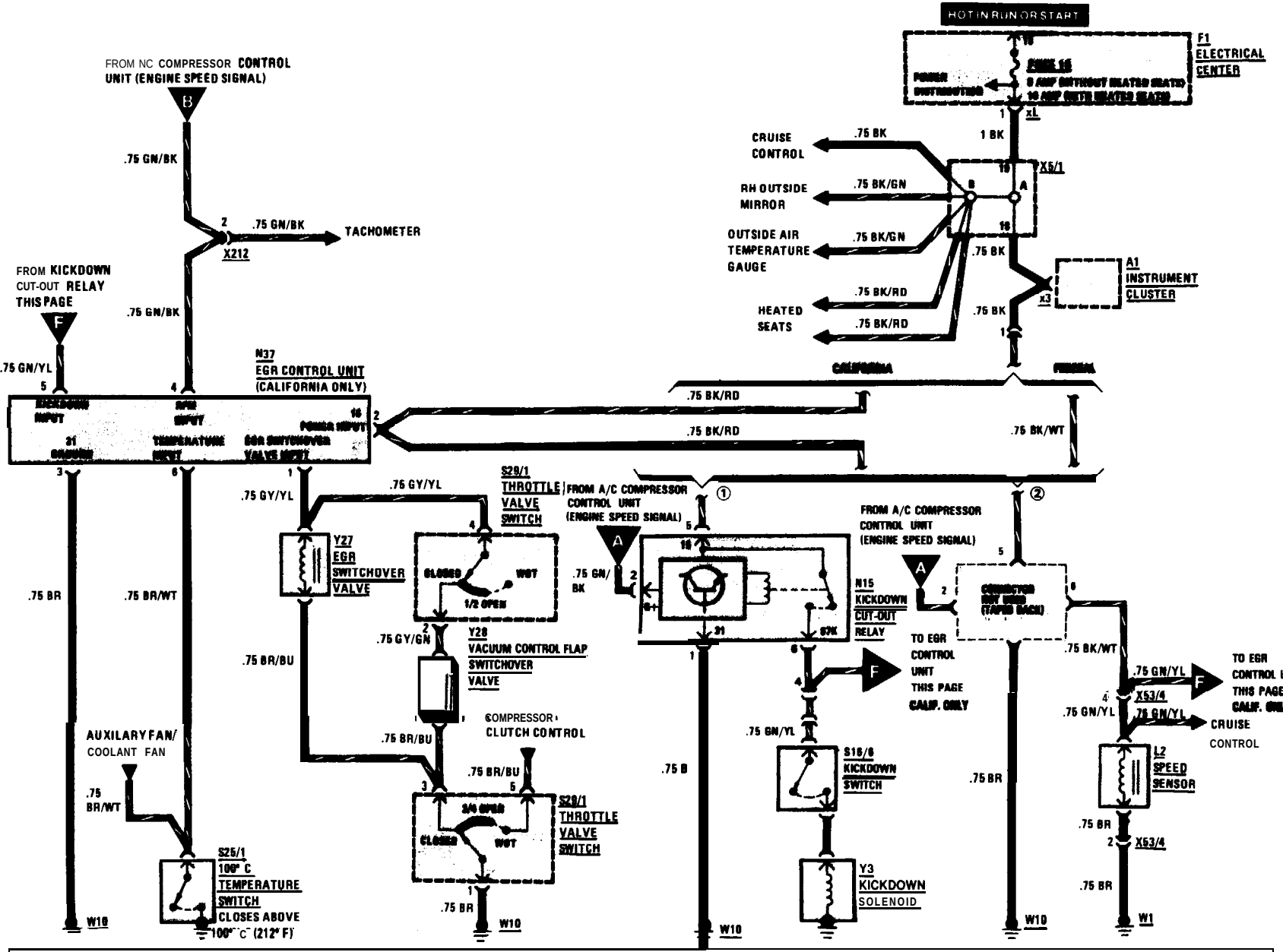
HALL-EFFECT SPEED SENSOR

AS OF MY 1991



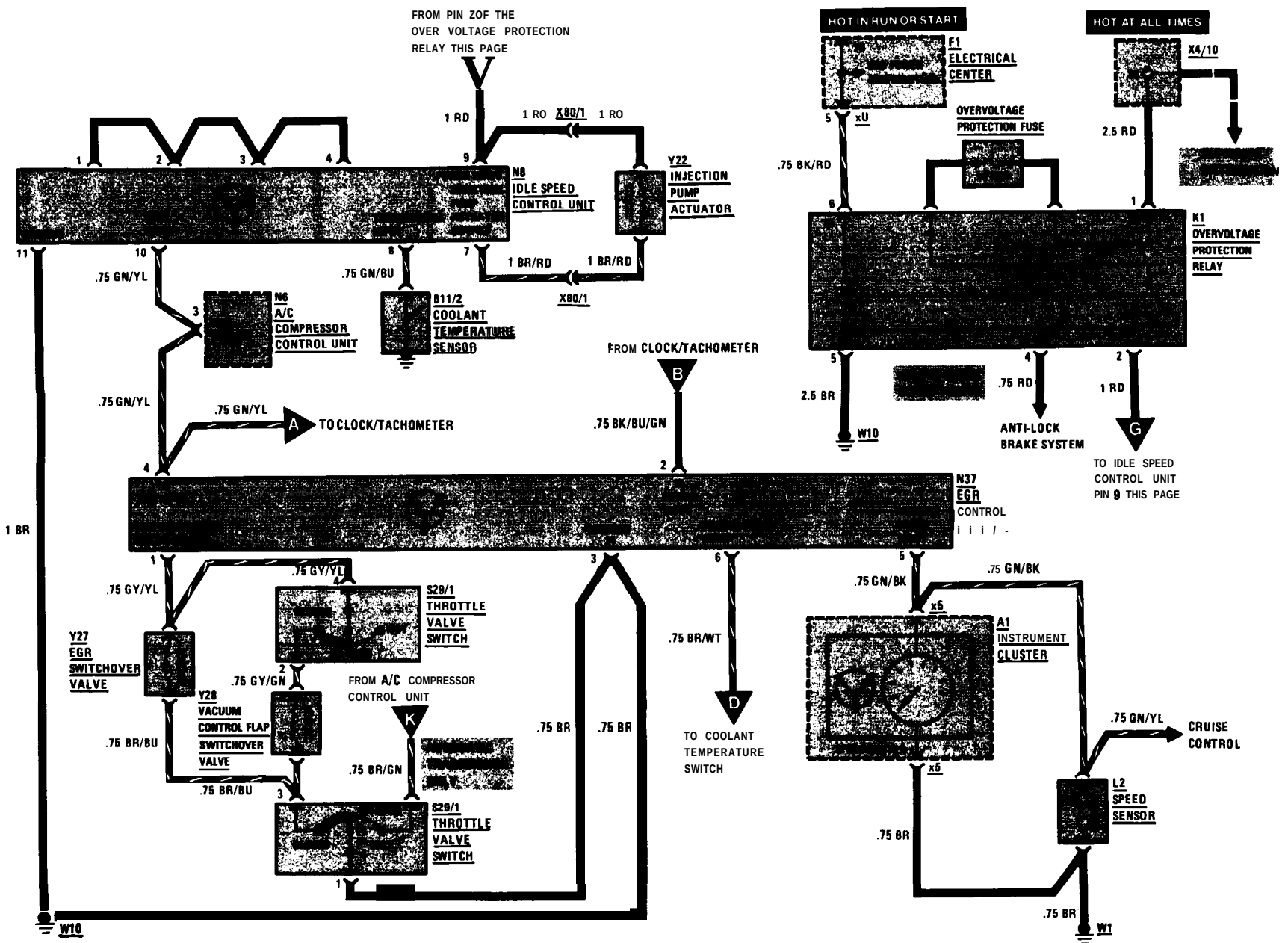
REVISIONS:
① WITH ASR
② WITHOUT ASR

EXHAUST GAS RECIRCULATION (CALIF. ONLY WITH MANUAL TRANSMISSION)



REVISIONS: ① WITH AUTOMATIC TRANSMISSION
② WITH MANUAL TRANSMISSION

EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL

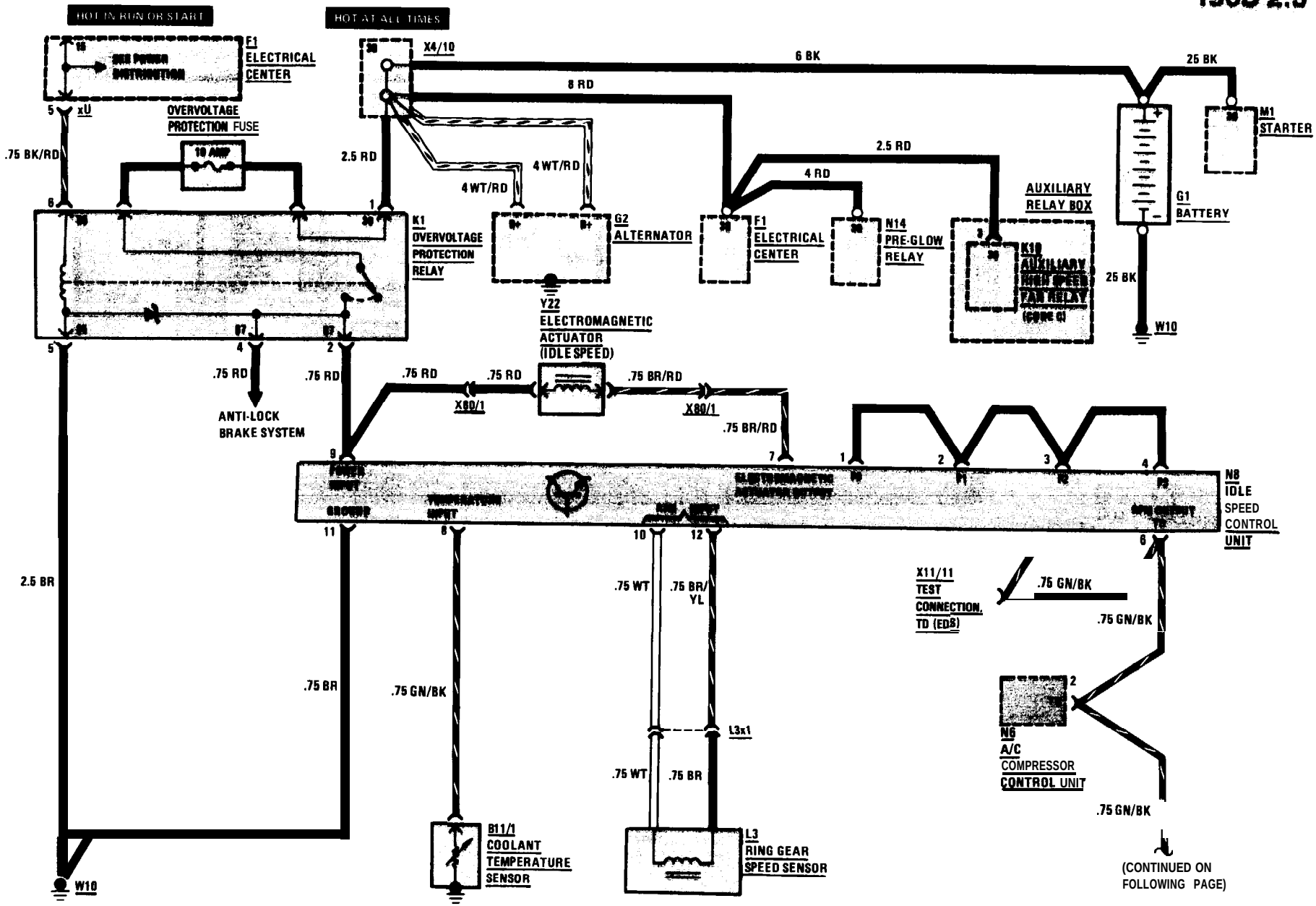


REVISIONS:

EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL

(For Component Locations See Page 206)

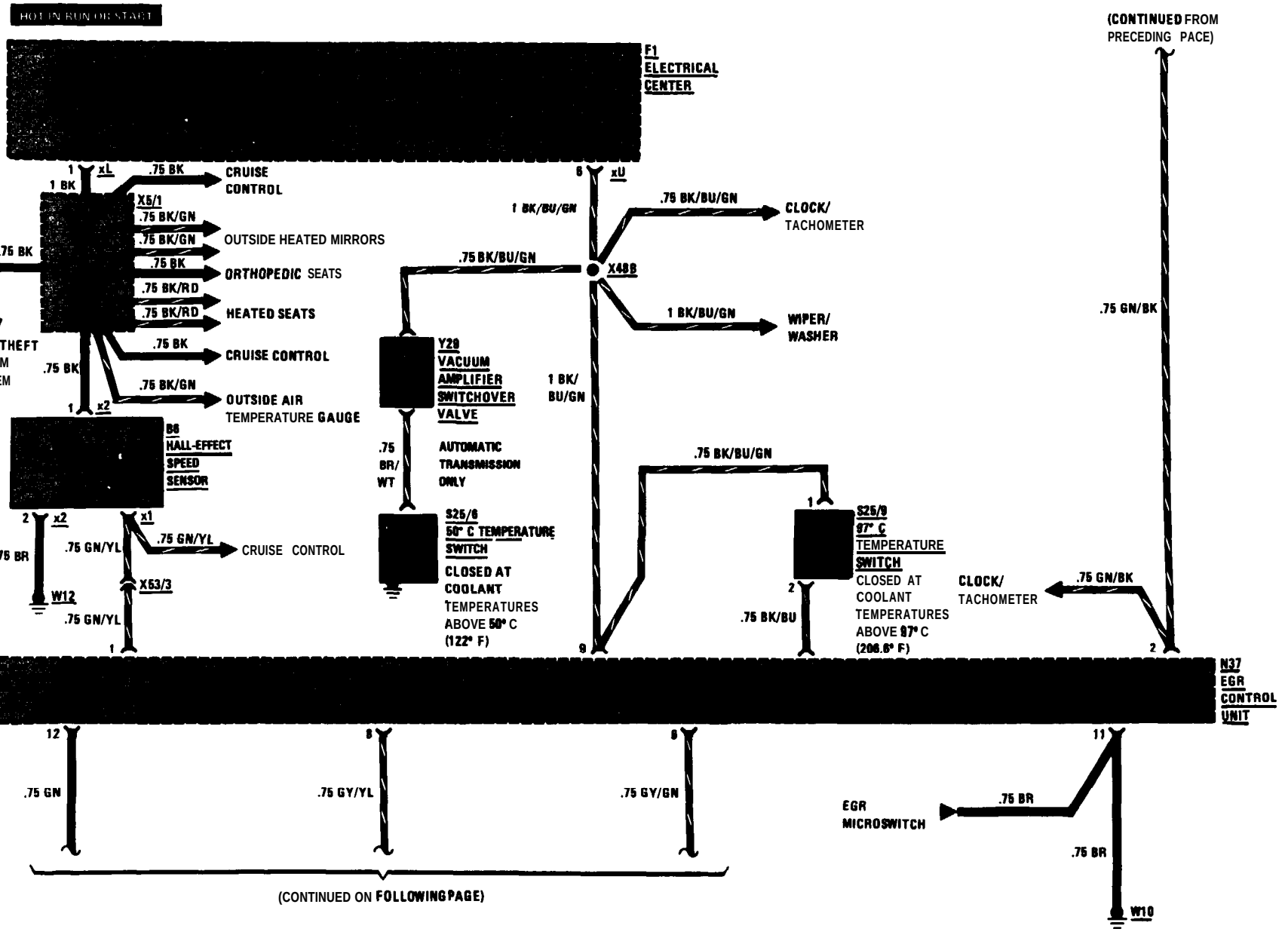
MY 1986
190D 2.5



201.126

REVISIONS:

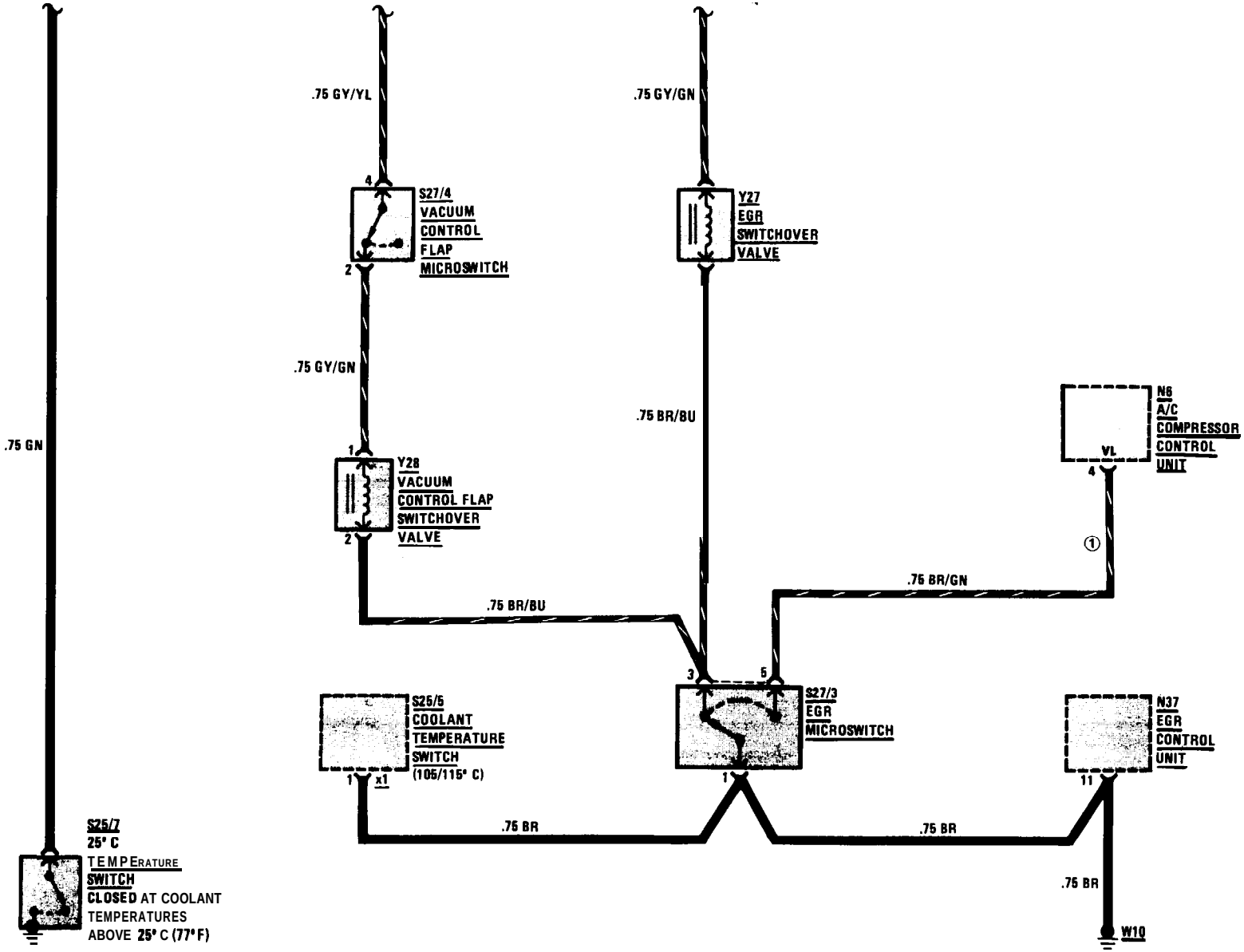
EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL



REVISIONS:

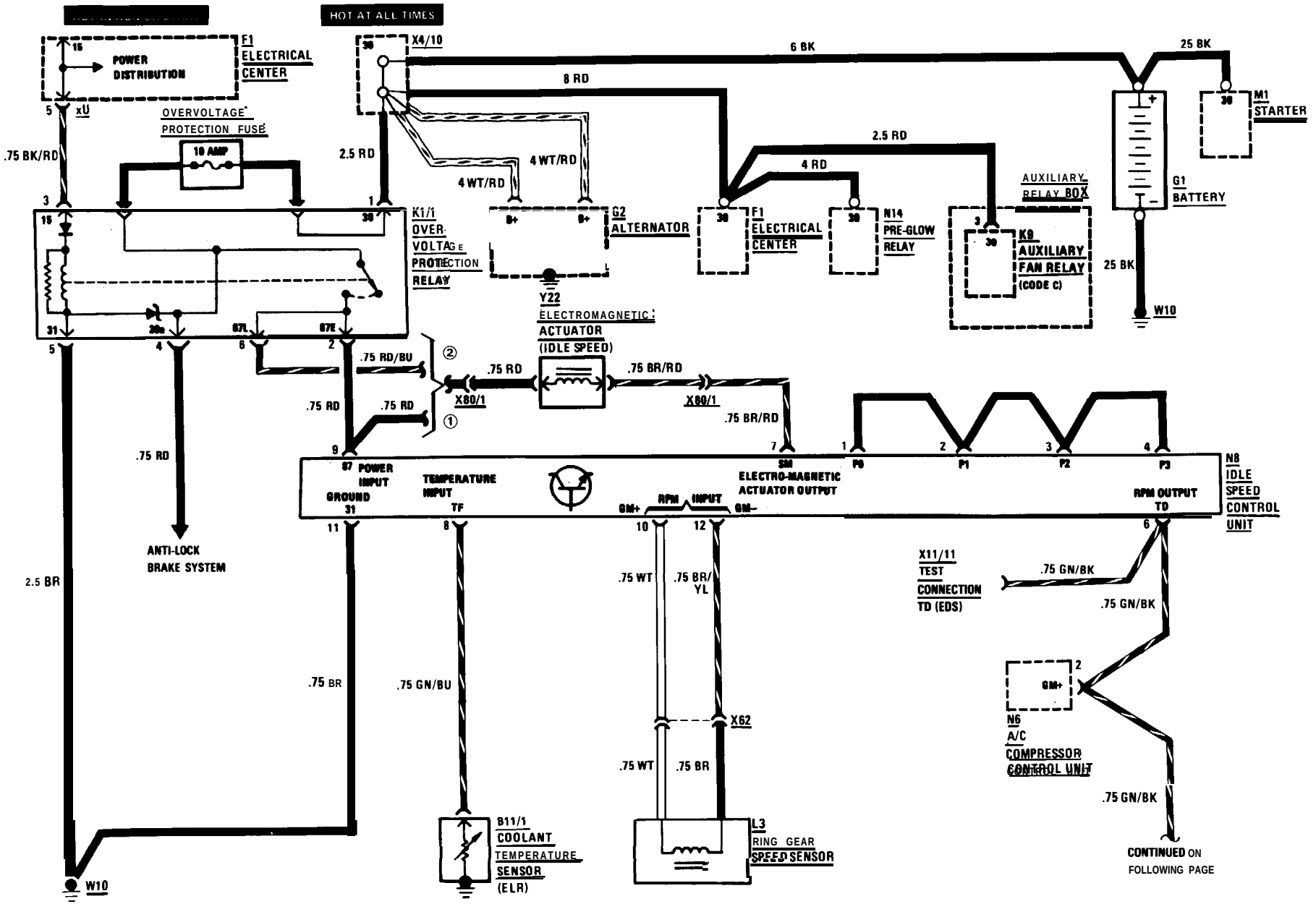
EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL

(CONTINUED FROM PRECEDING PAGE)



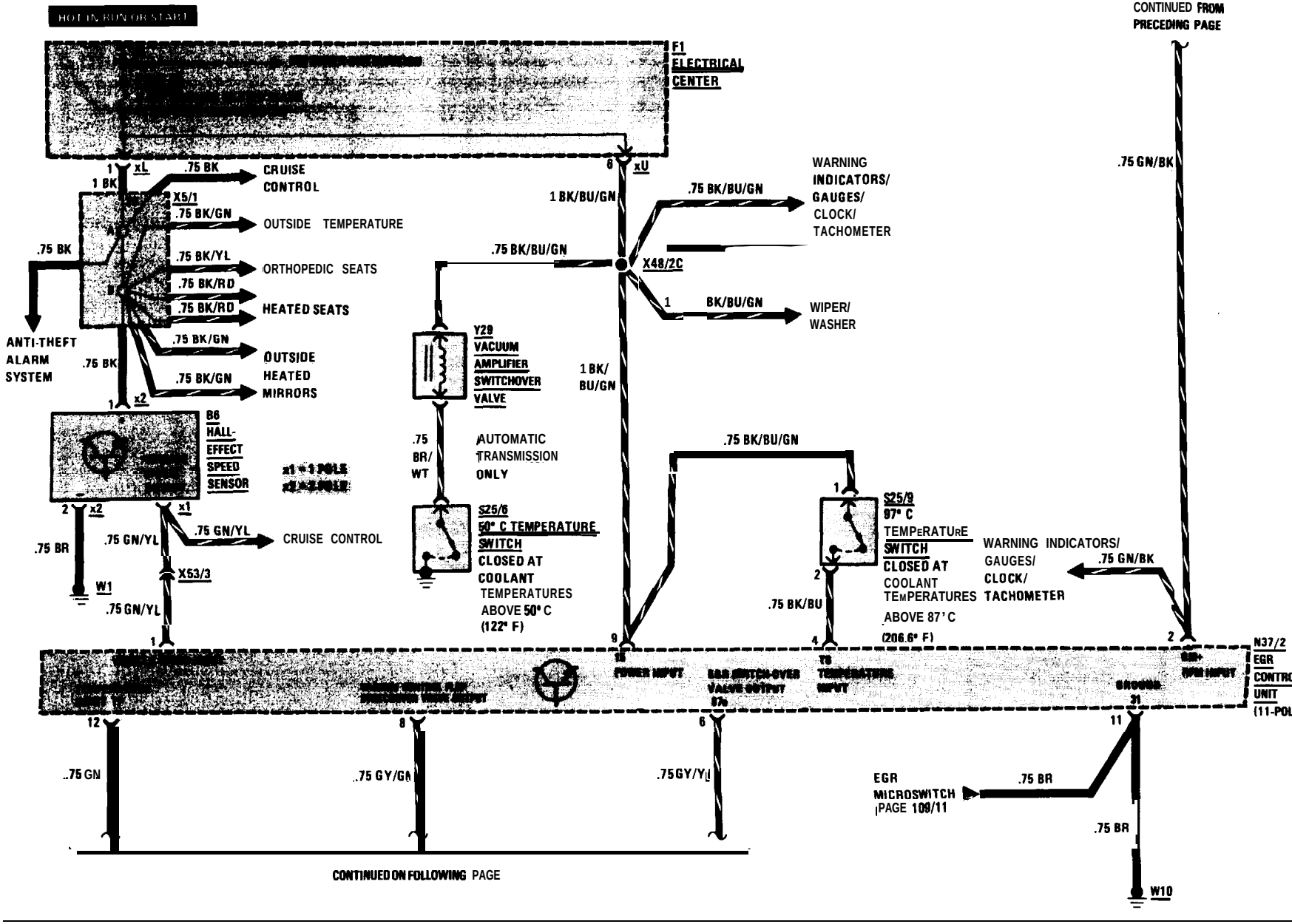
REVISIONS: ① **AUTOMATIC** TRANSMISSION ONLY

EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL



REVISIONS: ① MY 1997
② ASOFMY 1988

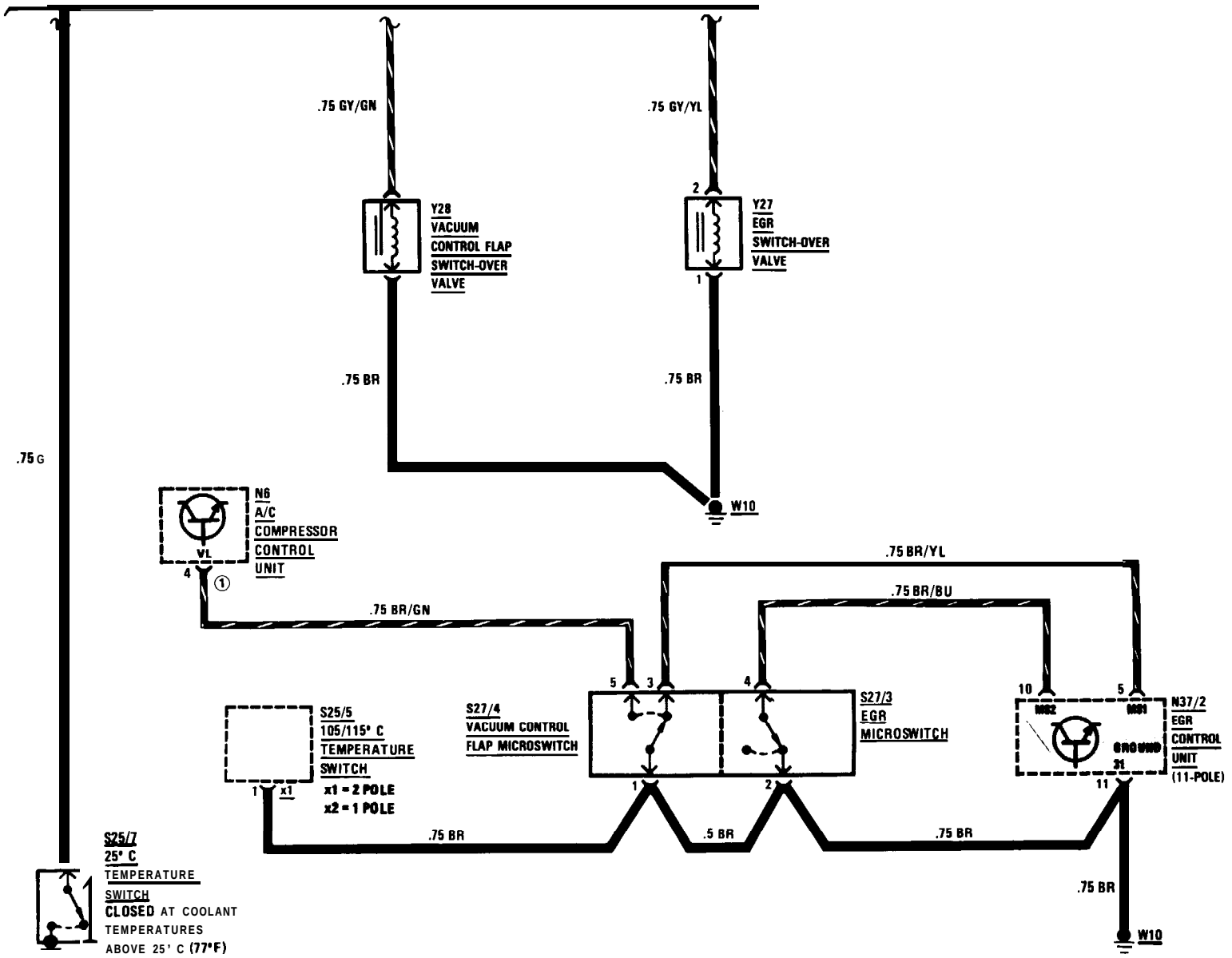
EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL



REVISIONS:

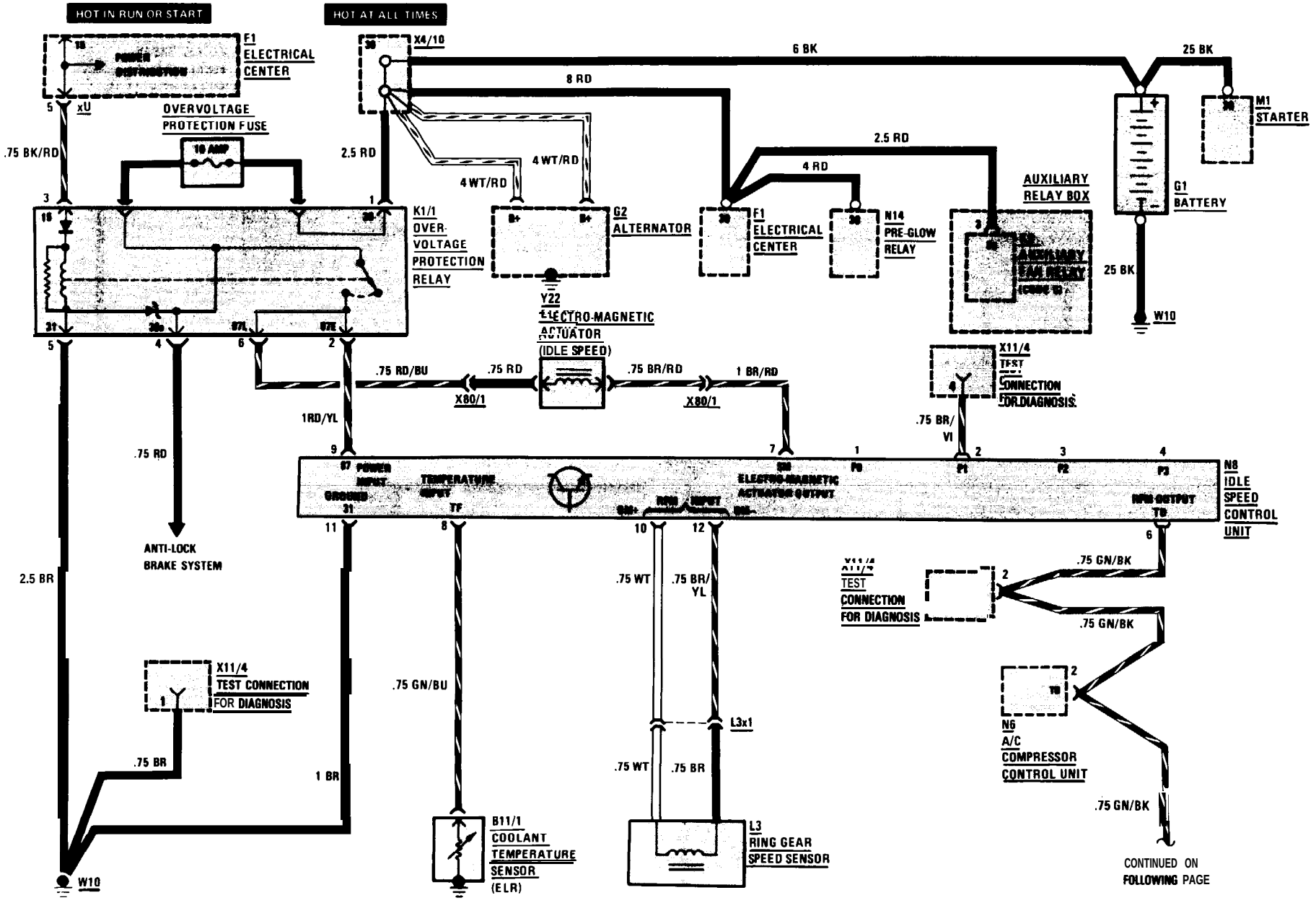
EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL

CONTINUED FROM PRECEDING PAGE



REVISIONS: ① AUTOMATIC TRANSMISSION ONLV

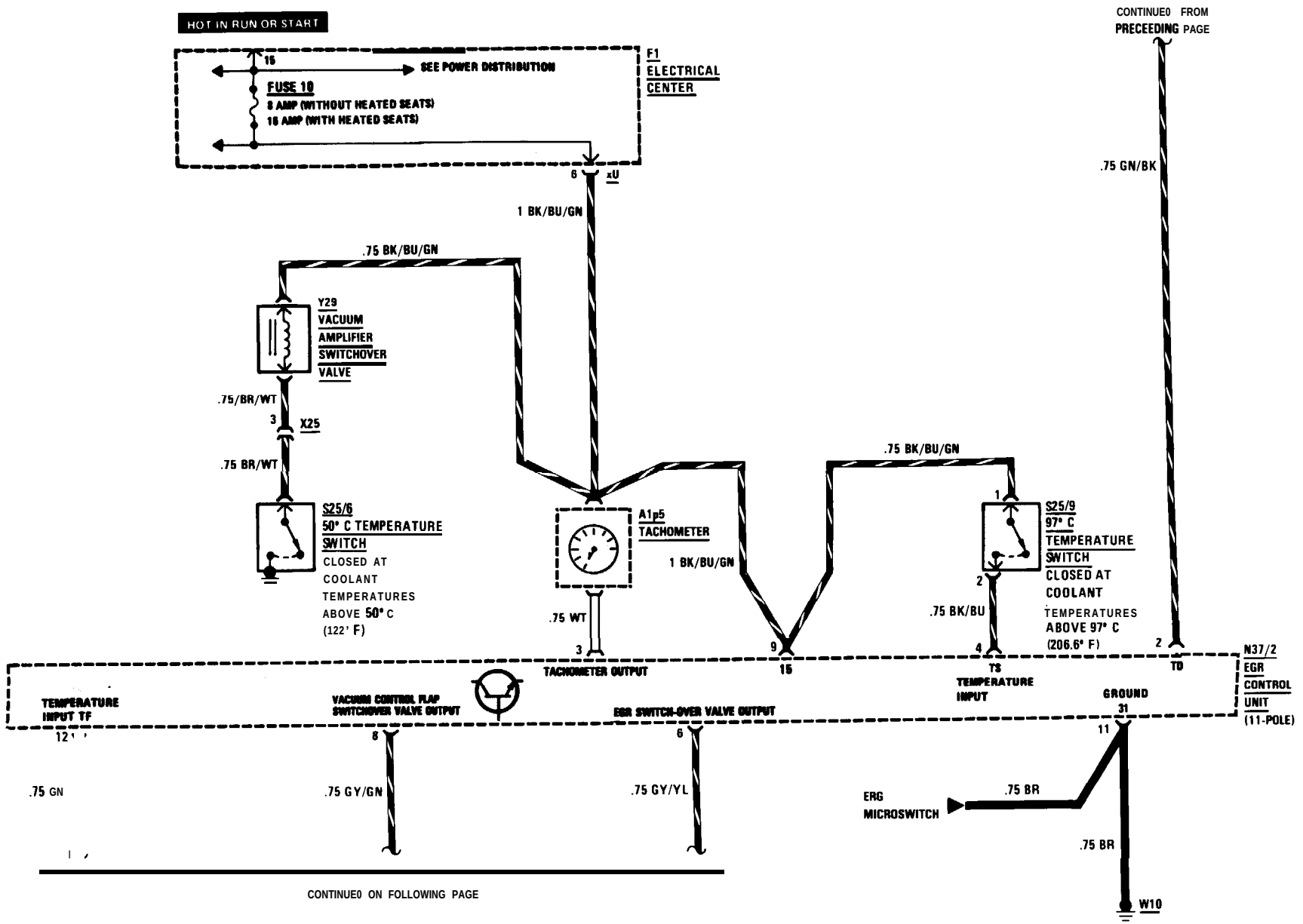
EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL



REVISIONS:

EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL

AS OF MY 1989
190D 2.5



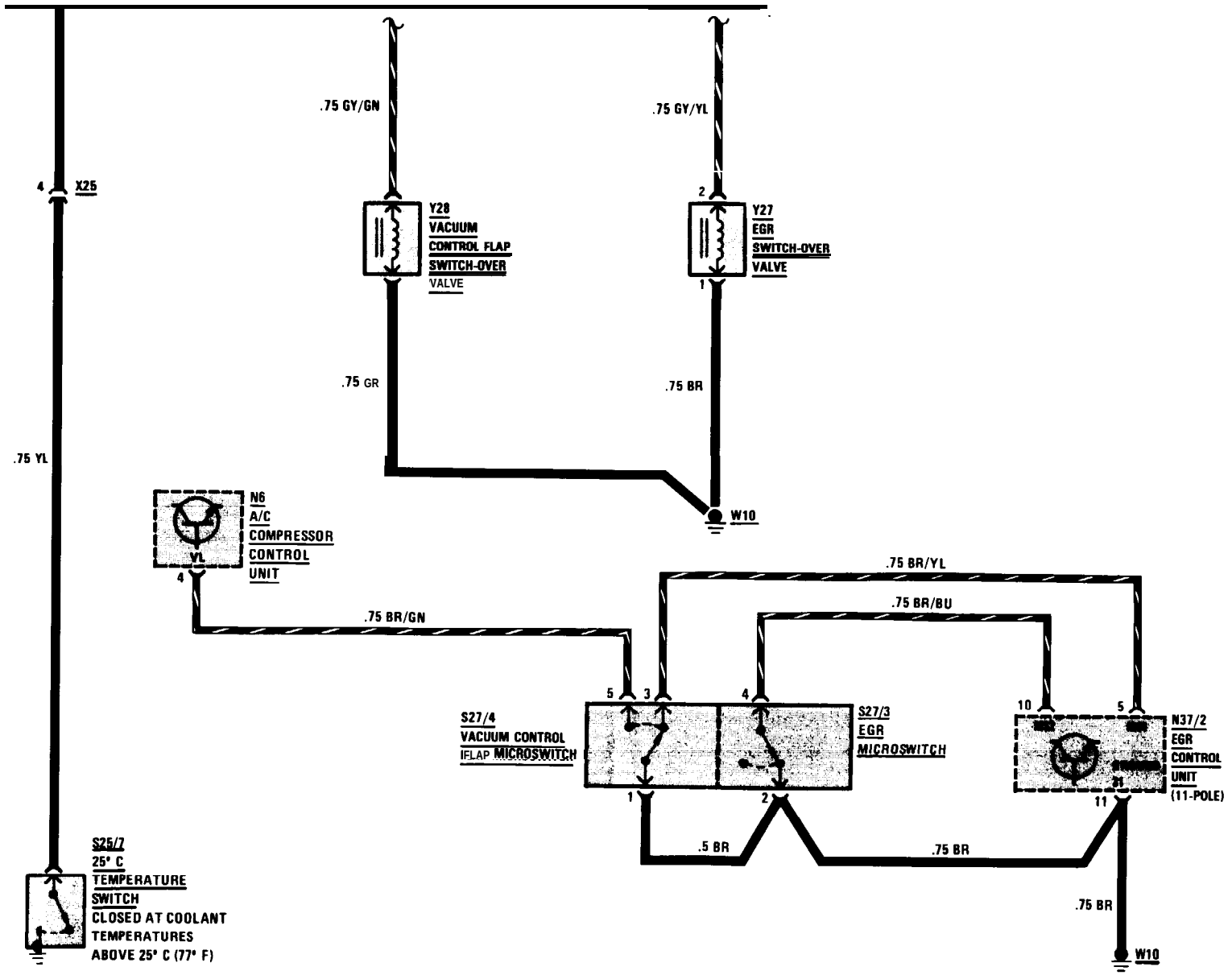
REVISIONS:

EXHAUST GAS RECIRCULATION/ELECTRONIC IDLE SPEED CONTROL

AS OF MY 1989

190D 2.5

CONTINUED FROM PRECEEDING PAGE

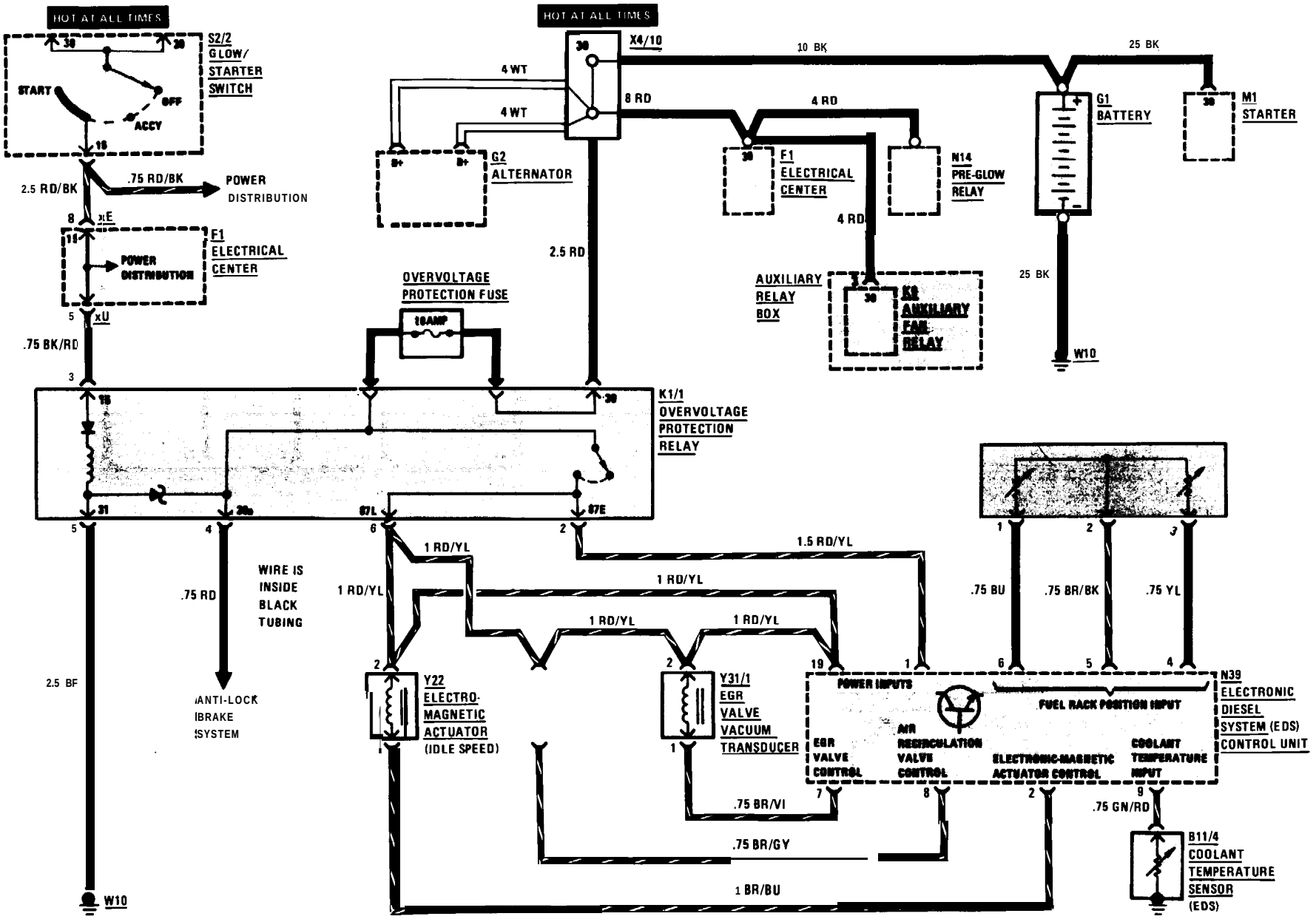


REVISIONS:

ELECTRONIC DIESEL SYSTEM (EDS)

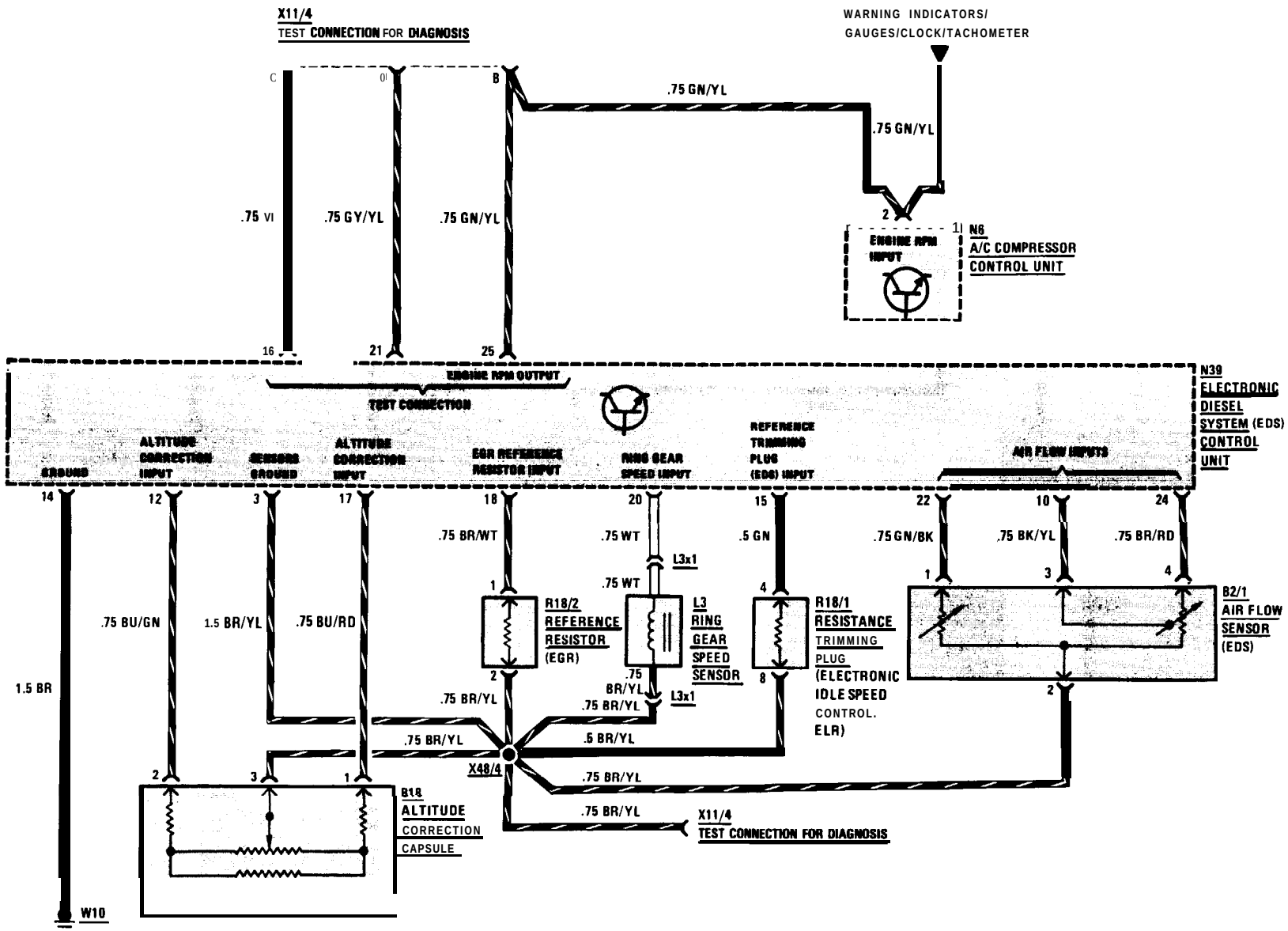
MY 1981

190D 2.5 TURBO



REVISIONS:

ELECTRONIC DIESEL SYSTEM (EDS)

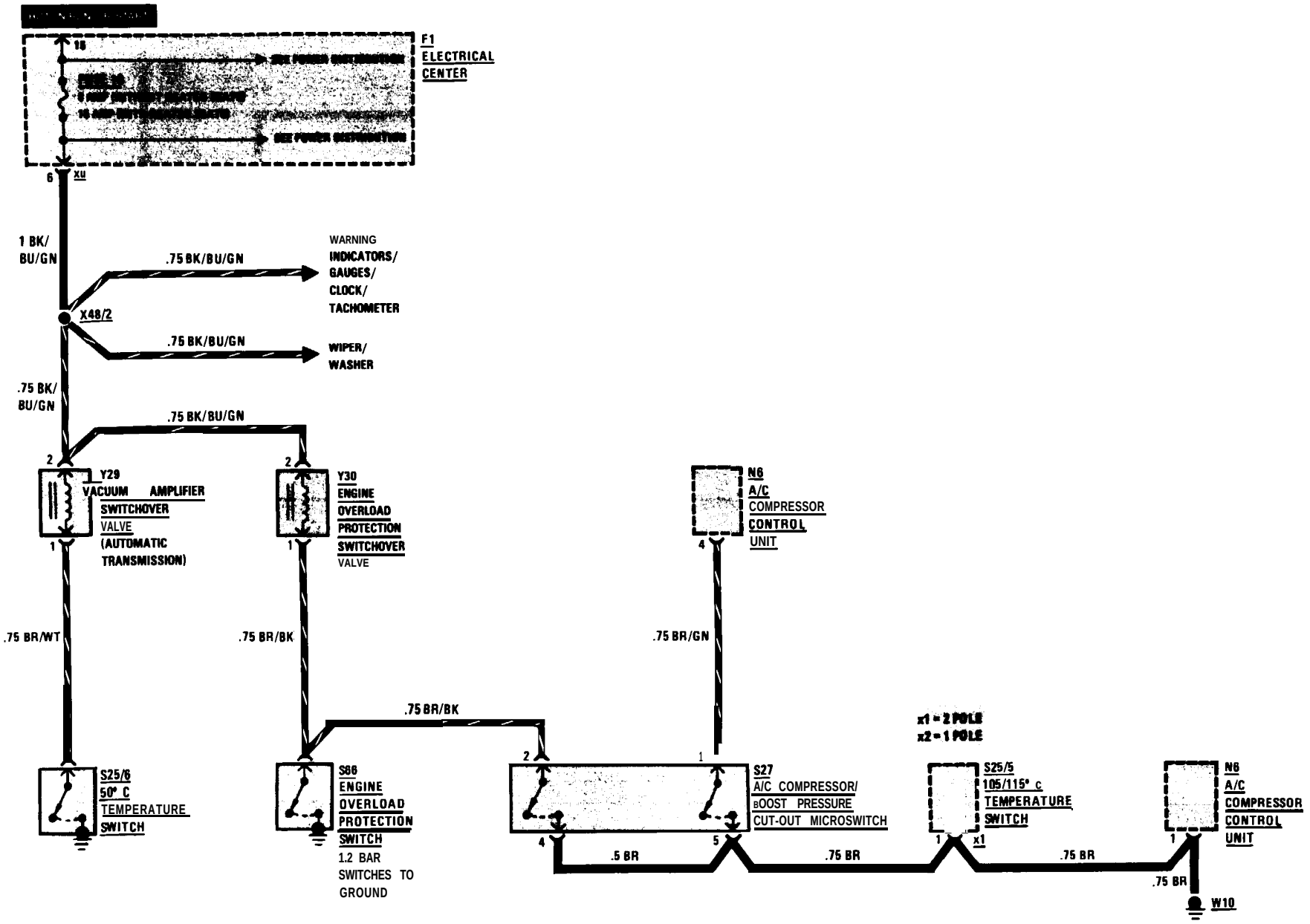


REVISIONS:

ENGINE OVERLOAD PROTECTION

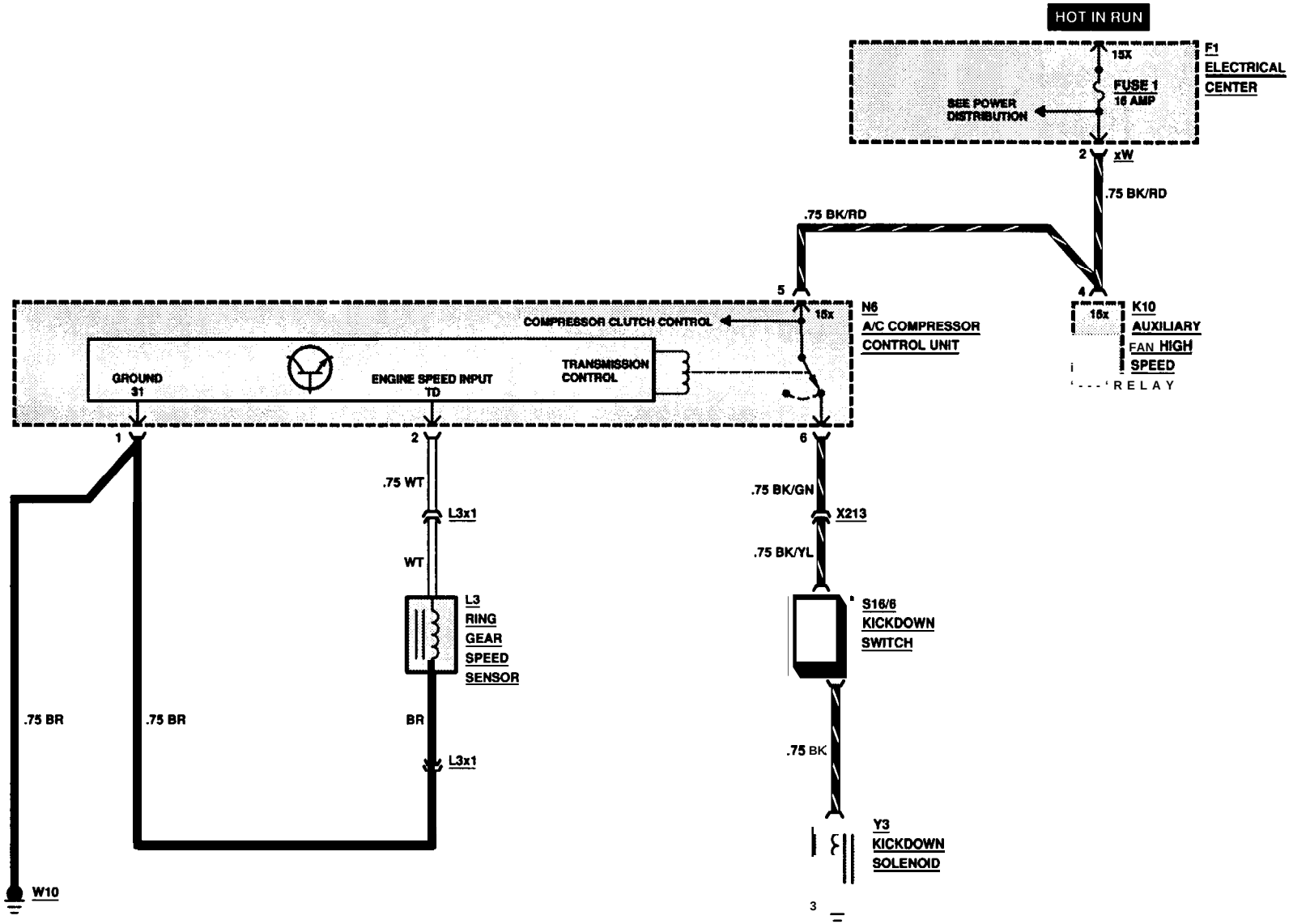
MY 1987

190D 2.5 TURBO



REVISIONS:

TRANSMISSION KICKDOWN (AUTOMATIC TRANSMISSION)

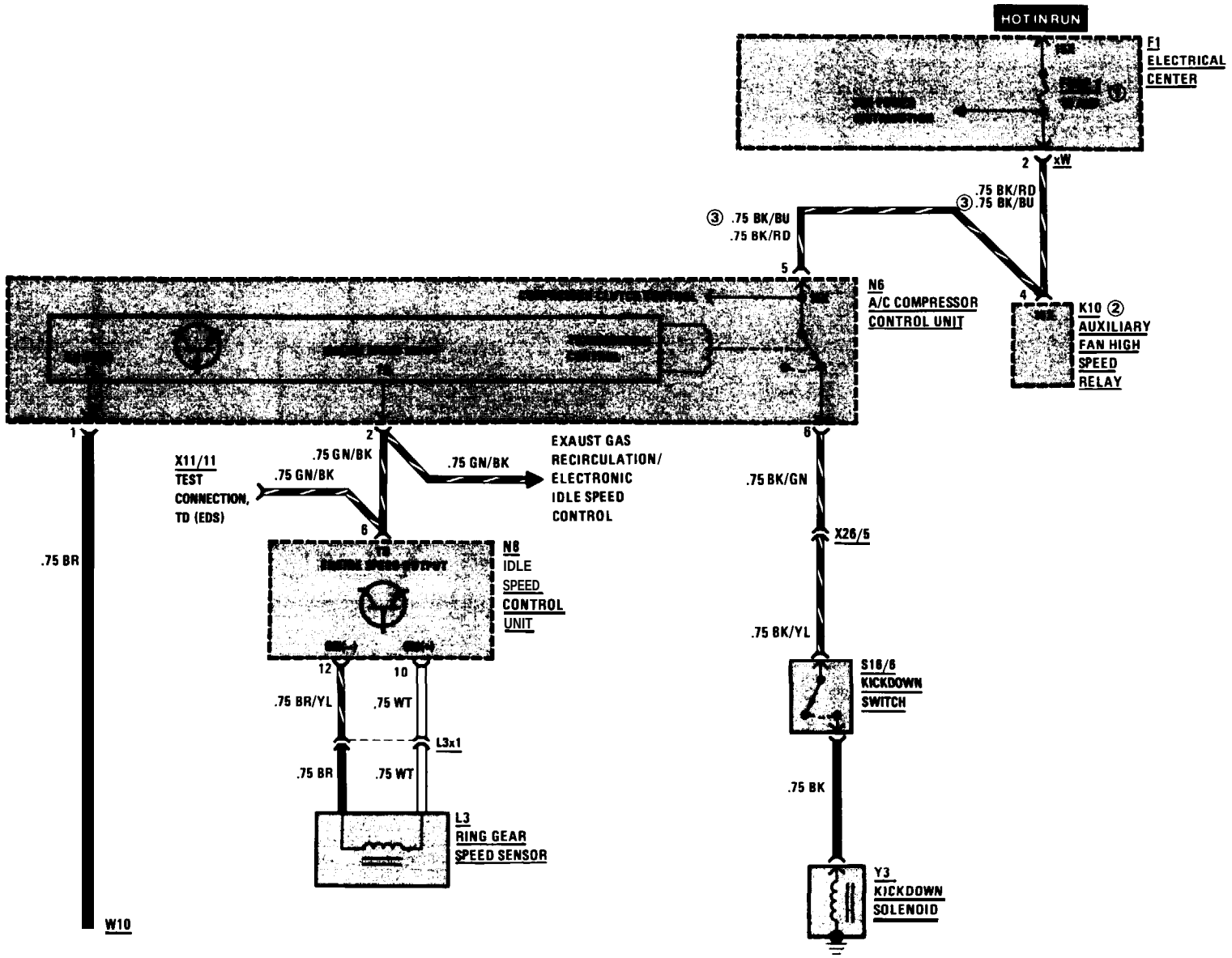


REVISIONS:

TRANSMISSION KICKDOWN (AUTOMATIC TRANSMISSION)

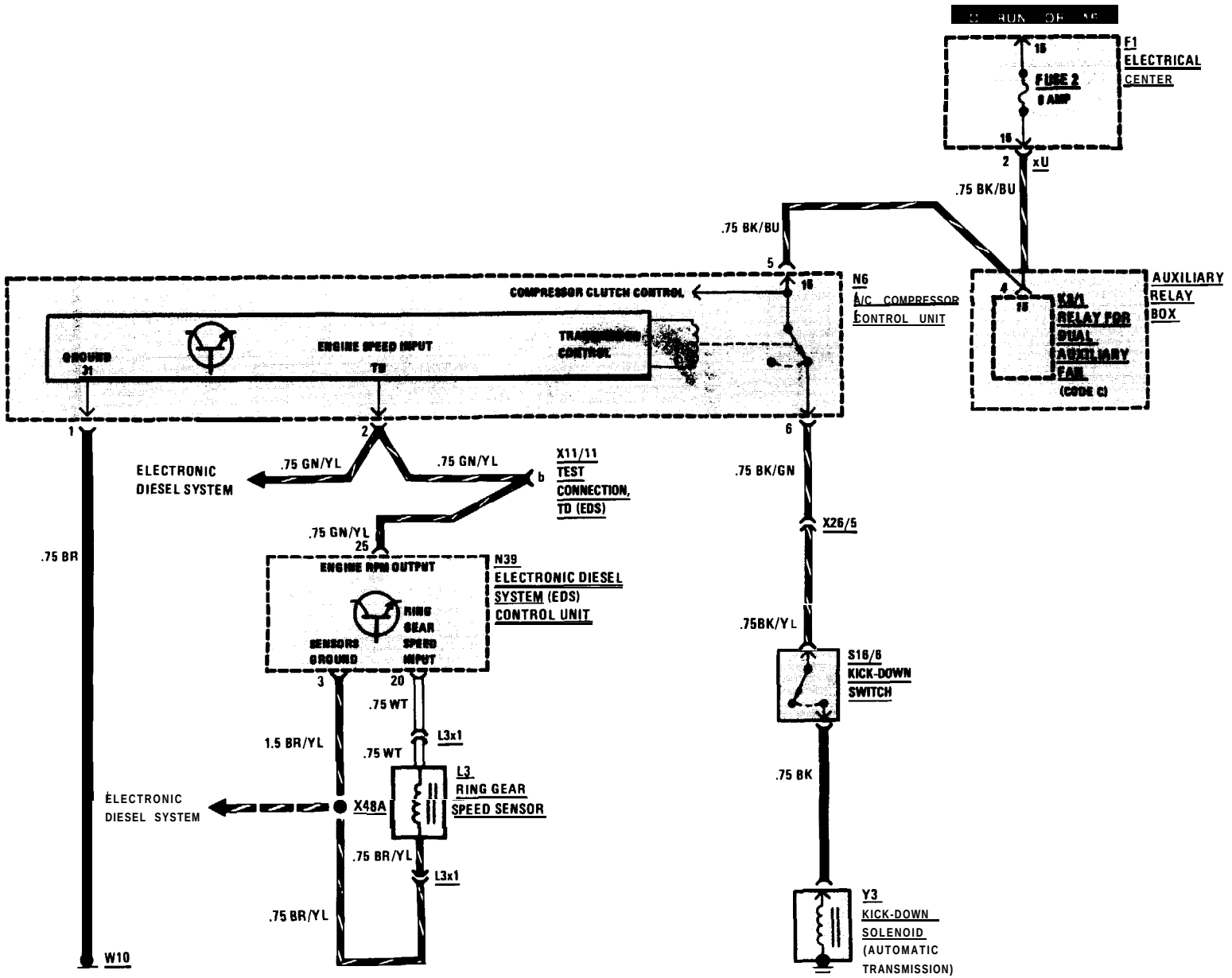
MY 1986-1988

190D 2.5



REVISIONS: ① AS OF MY 1887, FUSE 2 (8 AMP)
② AS OF MY 1887. K9
③ AS OF MY 1987

TRANSMISSION KICK-DOWN (AUTOMATIC TRANSMISSION)

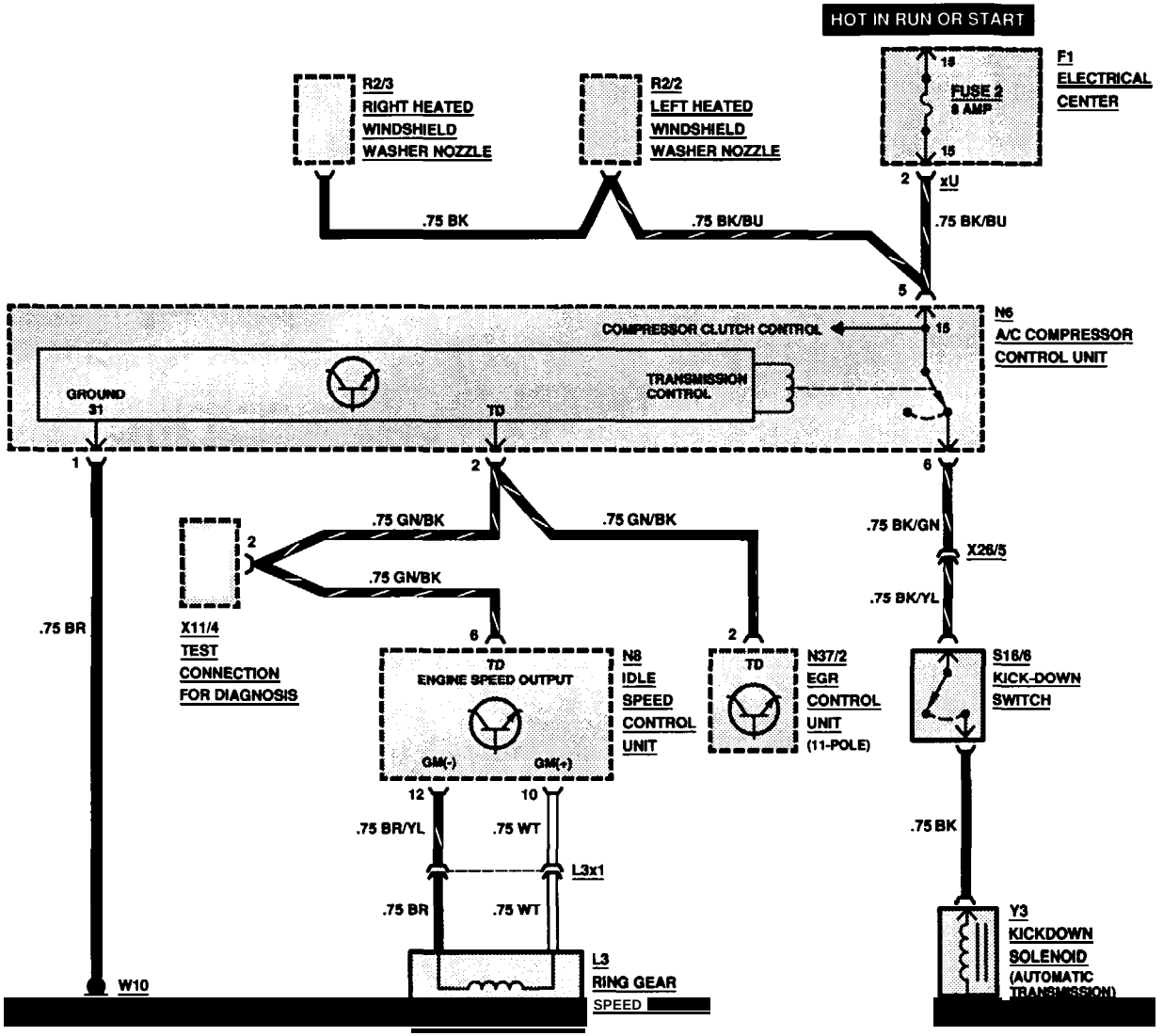


REVISIONS:

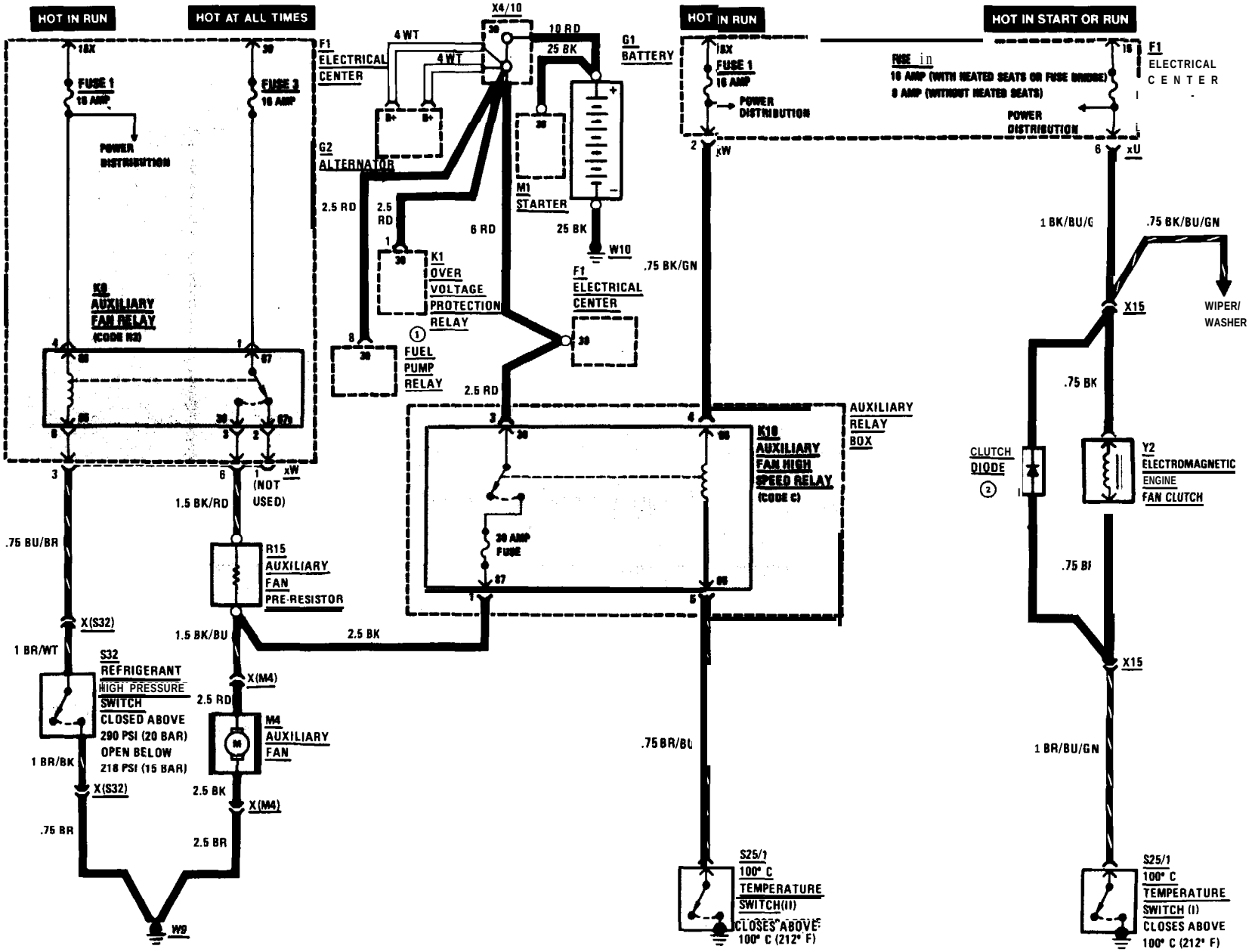
TRANSMISSION KICKDOWN (AUTOMATIC TRANSMISSION)

AS OF MY 1999

190D 2.5



AUXILIARY FAN/COOLANT FAN

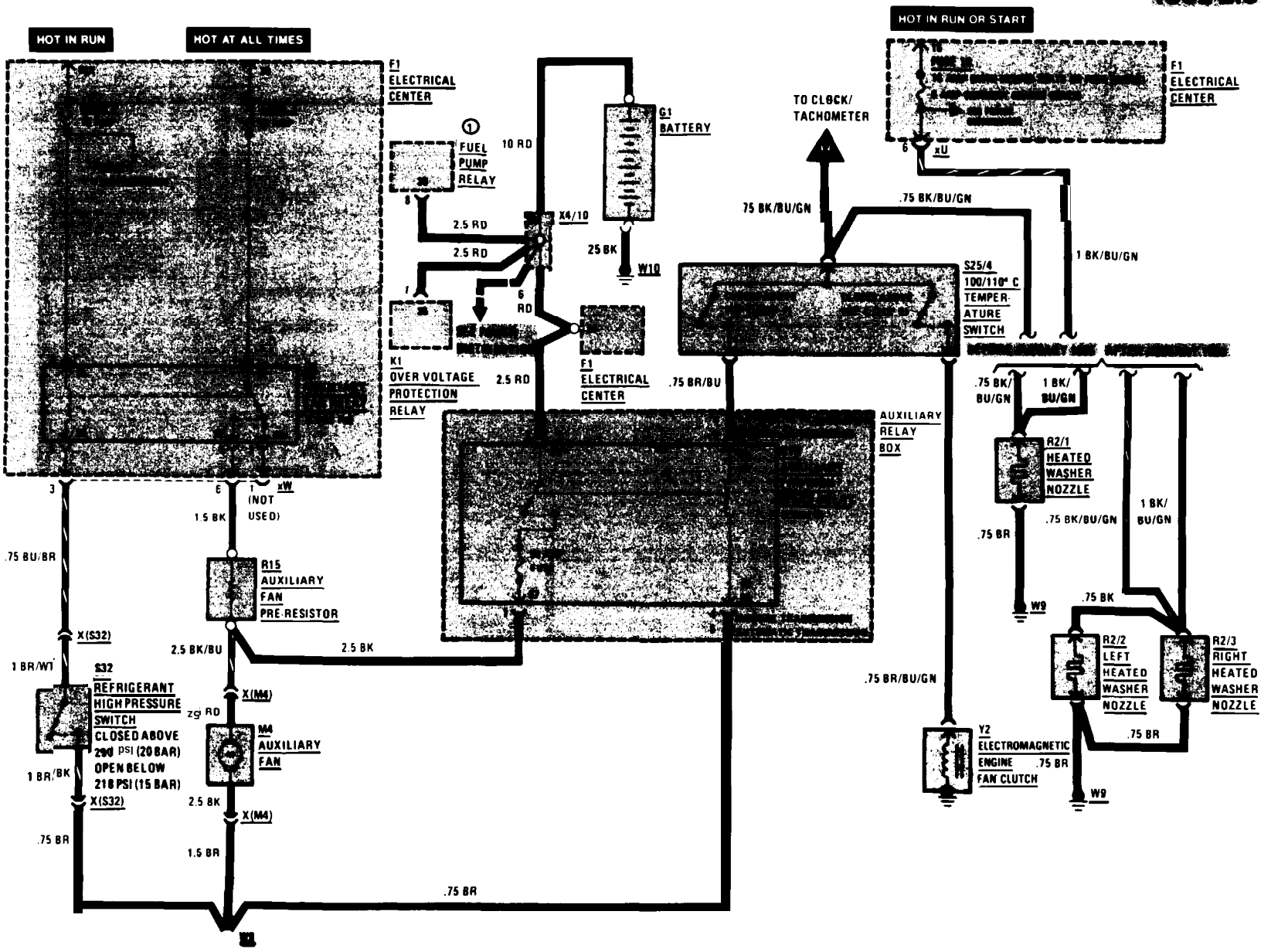


REVISIONS: ① N16/3 MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)

@CLUTCH DIODE IS LOCATED IN CONNECTOR XI5

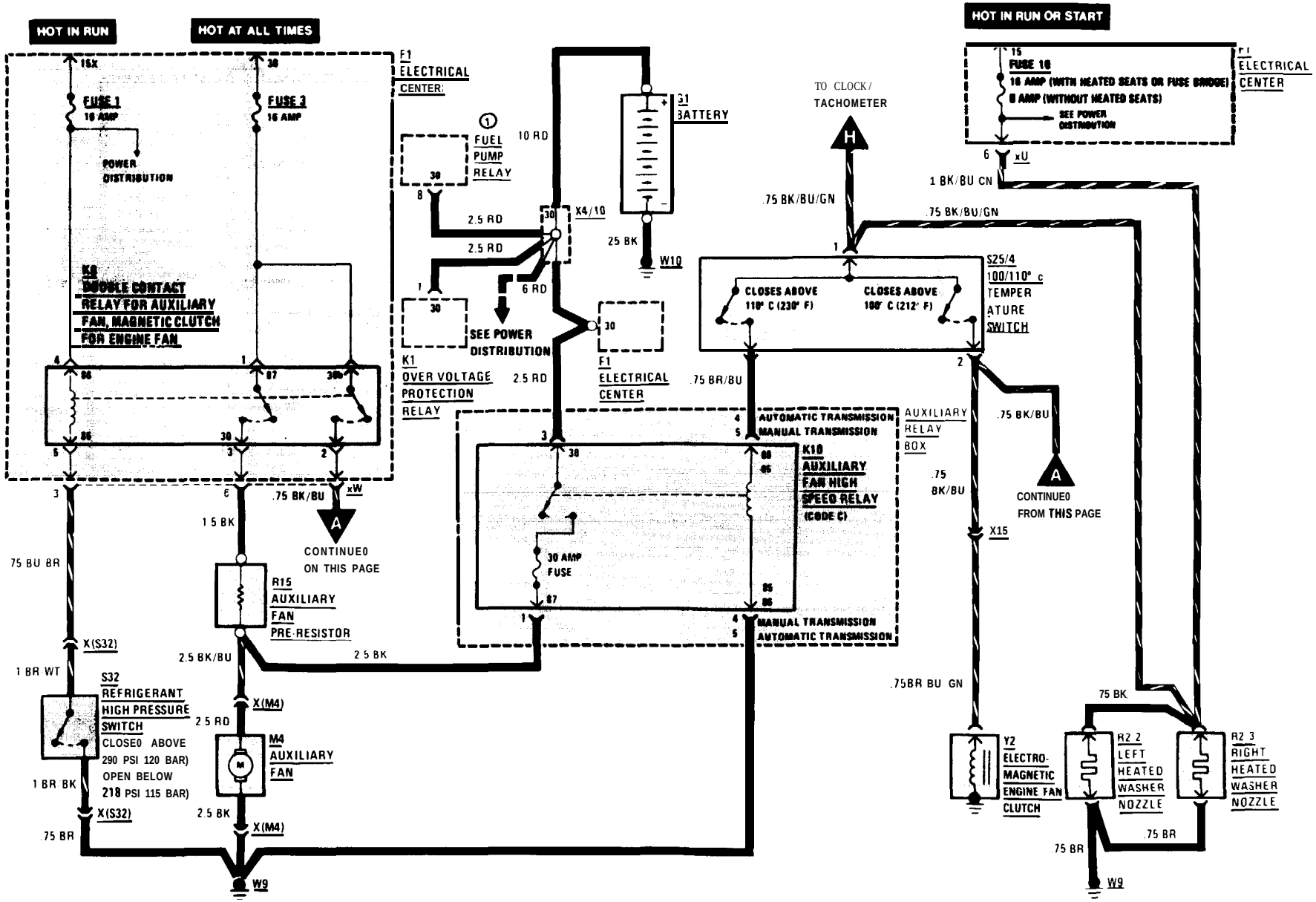
AUXILIARY FAN/COOLANT FAN

MY1995
1.8/2.3



REVISIONS: ① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)

AUXILIARY FAN/COOLANT FAN

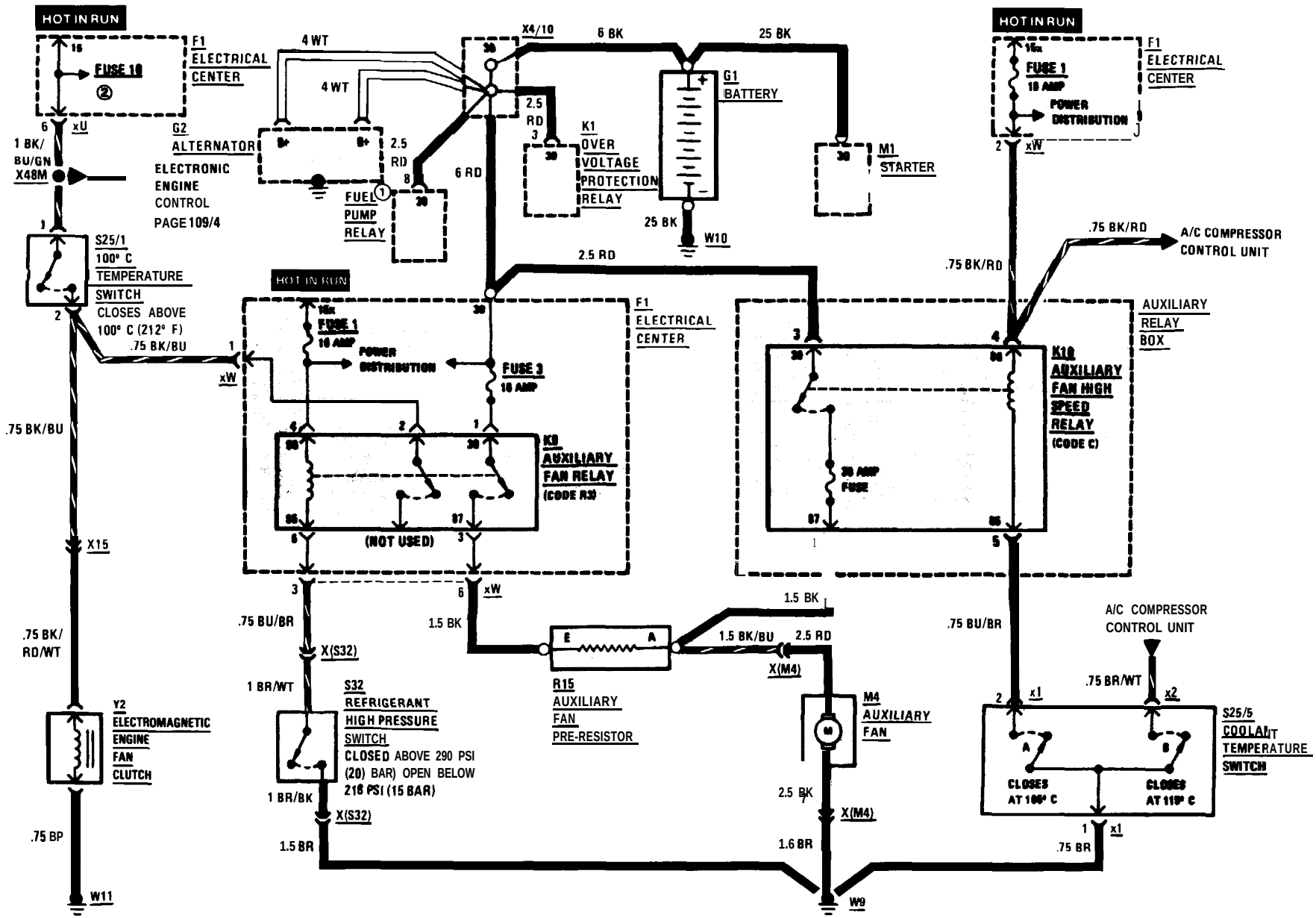


REVISIONS: ① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)

AUXILIARY FAN/COOLANT FAN

MY 1986

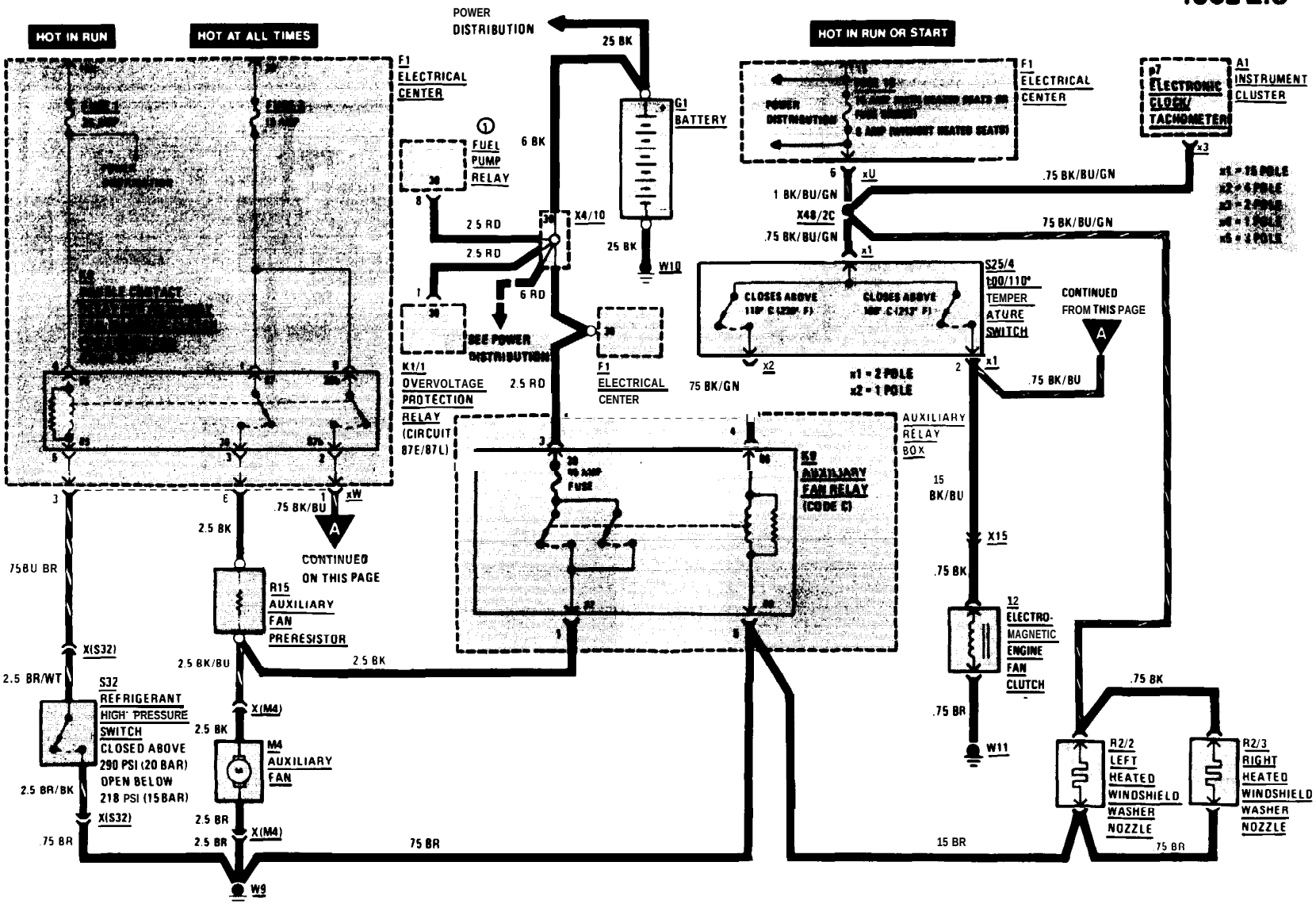
190E 2.346



REVISIONS: ① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)

② 16 AMP (WITH HEATED SEATS OR FUSE BRIDGE)
8 AMP (WITHOUT HEATED SEATS)

AUXILIARY FAN/COOLANT FAN

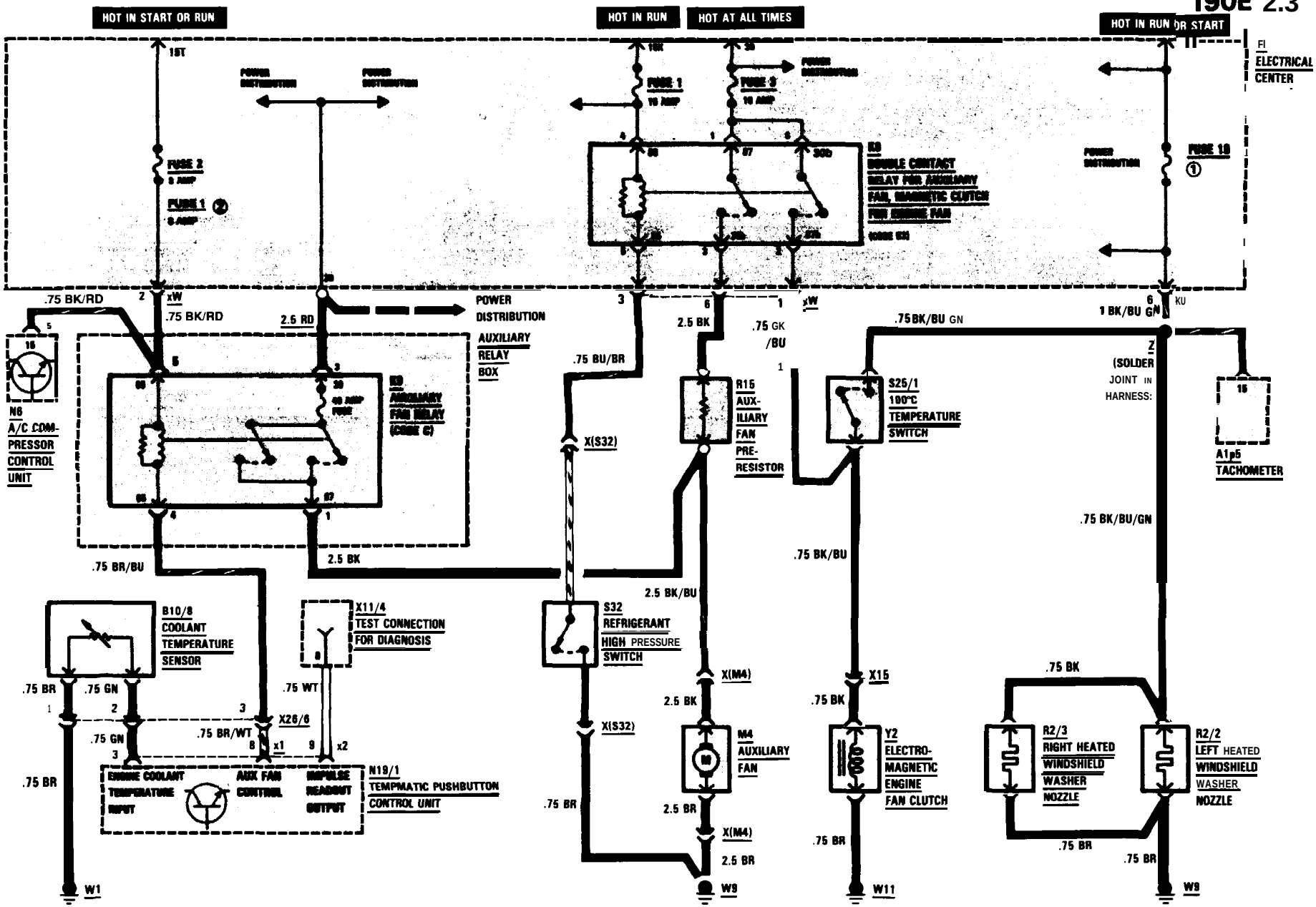


REVISIONS: ① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)

AUXILIARY FAN/COOLANT FAN

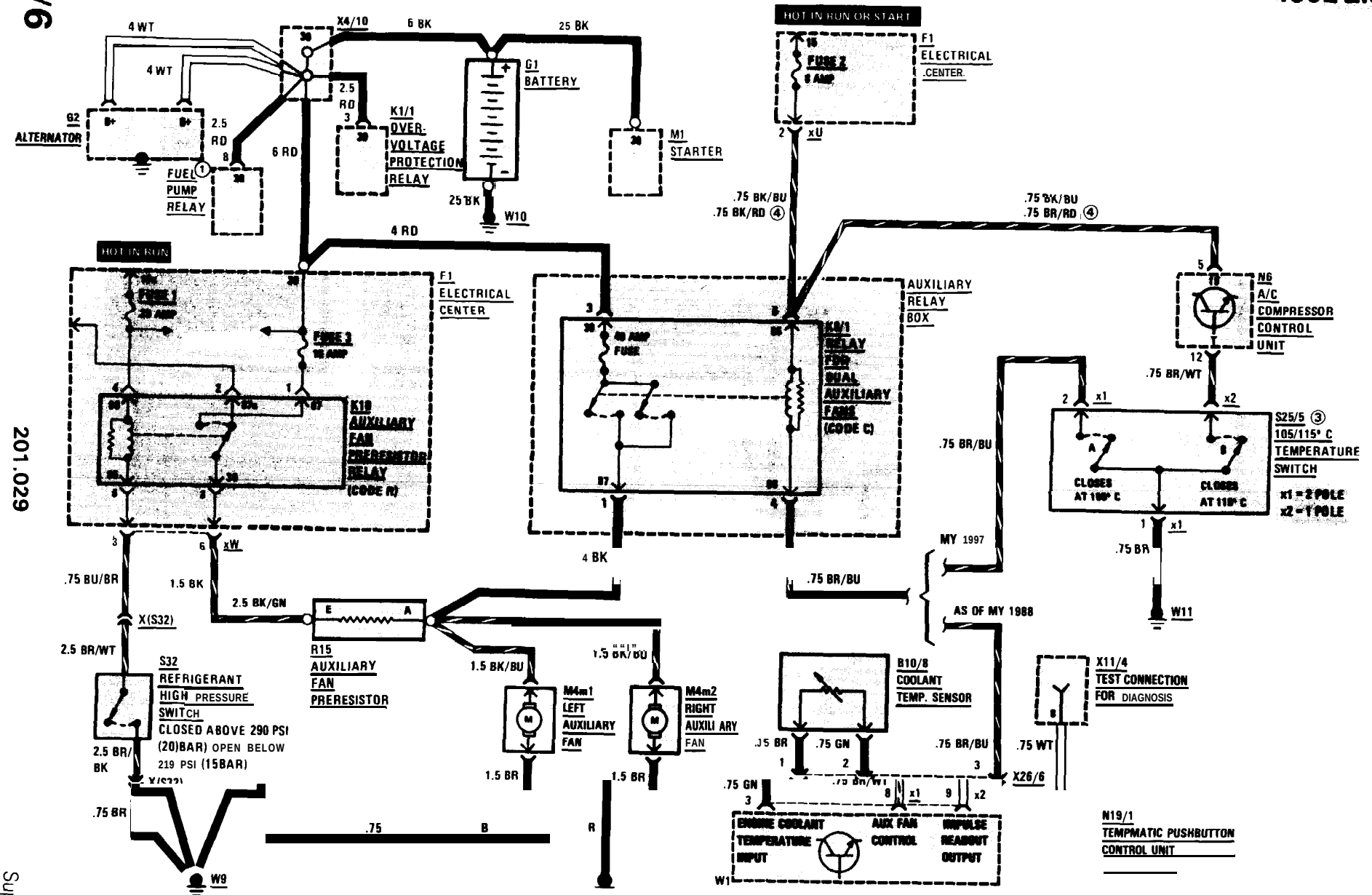
AS OF MY 1988

190E 2.3



REVISIONS: ①16 AMP (WITH HEATED SEATS OR FUSE BRIDGE)
8 AMP (WITHOUT HEATED SEATS)
@AS OF MY 1991

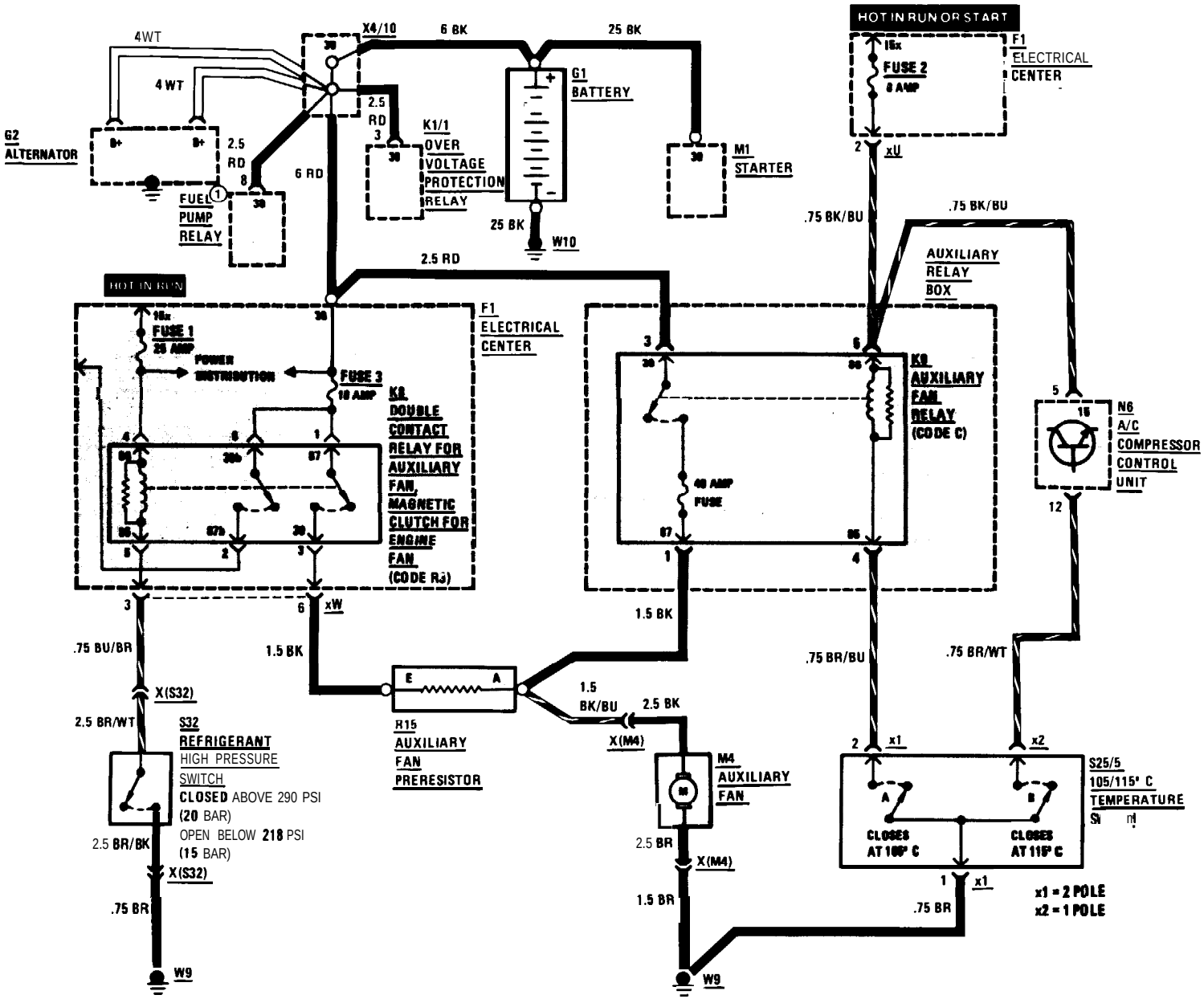
AUXILIARY FAN/COOLANT FAN



201.029

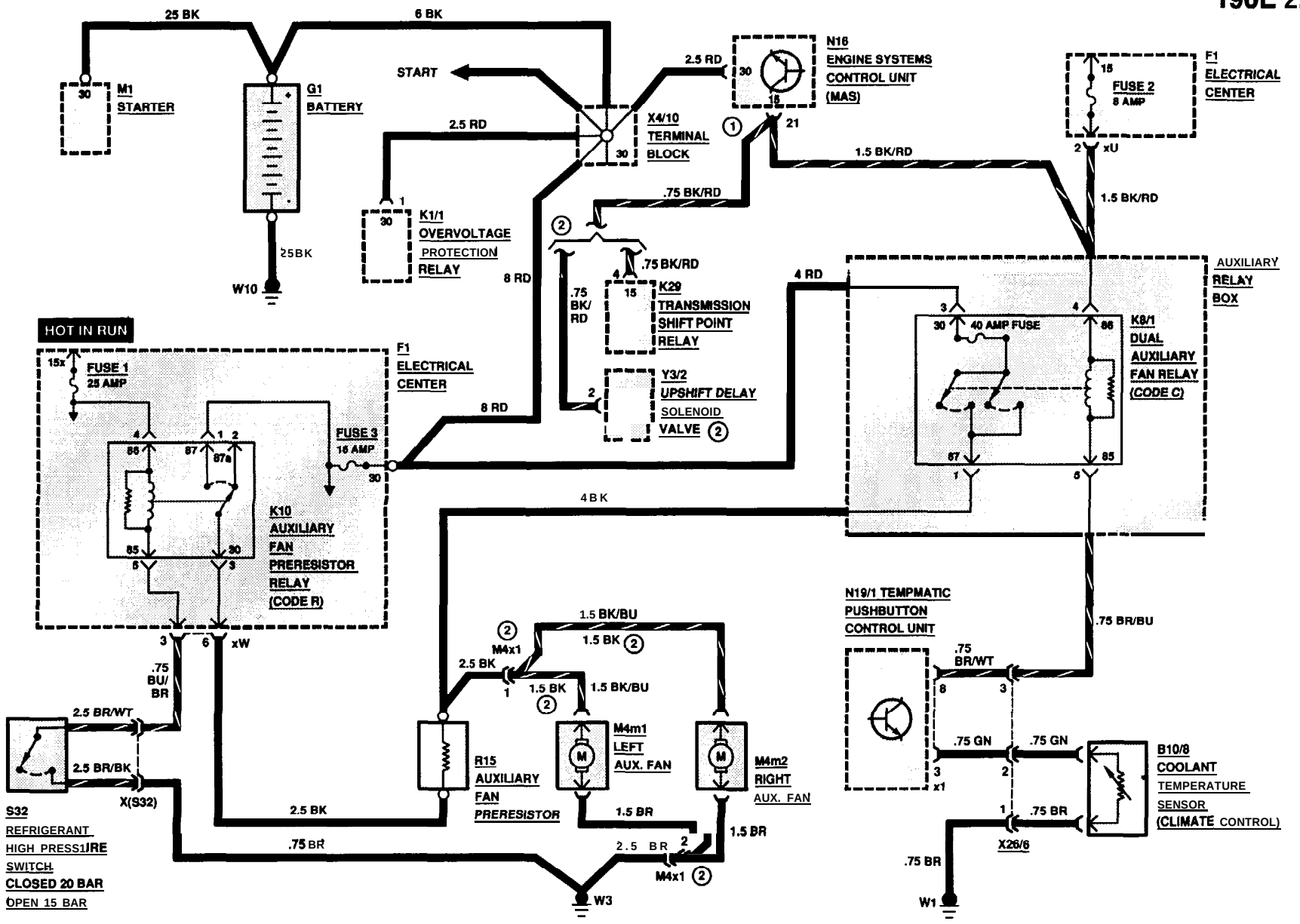
REVISIONS:
① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)
② 8 AMP (WITHOUT HEATED SEATS)
16 AMP (WITH HEATED SEATS)
③ MY 1987
④ AS OF MY 1988

AUXILIARY FAN/COOLANT FAN



REVISIONS: ① **N16/3** (MANUAL TRANSMISSION), **N16/4** (AUTOMATIC TRANSMISSION)

AUXILIARY FAN/COOLANT FAN

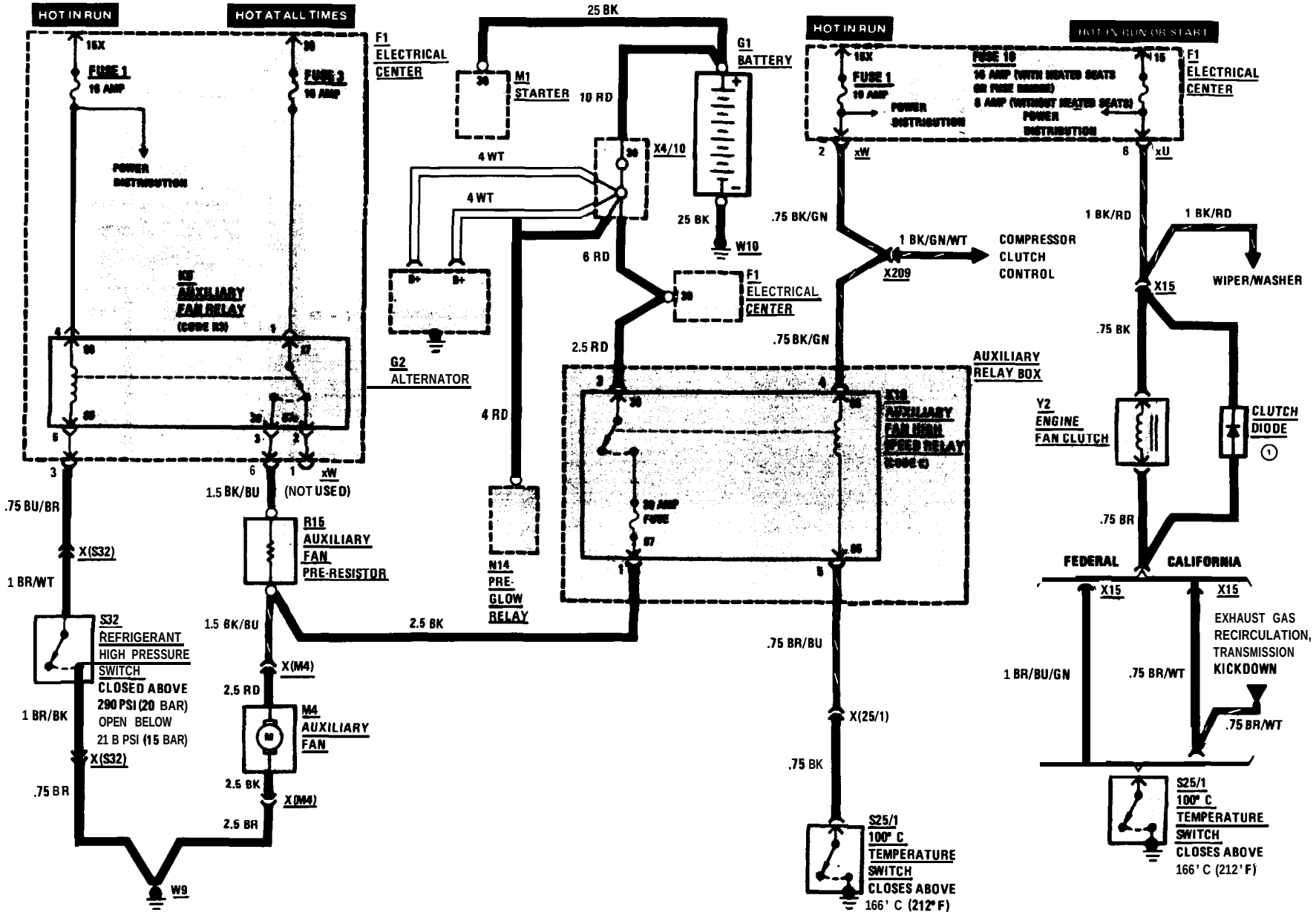


REVISIONS: (1) ONLY WITH AUTOMATIC TRANSMISSION

(3) ASOFMY 1992

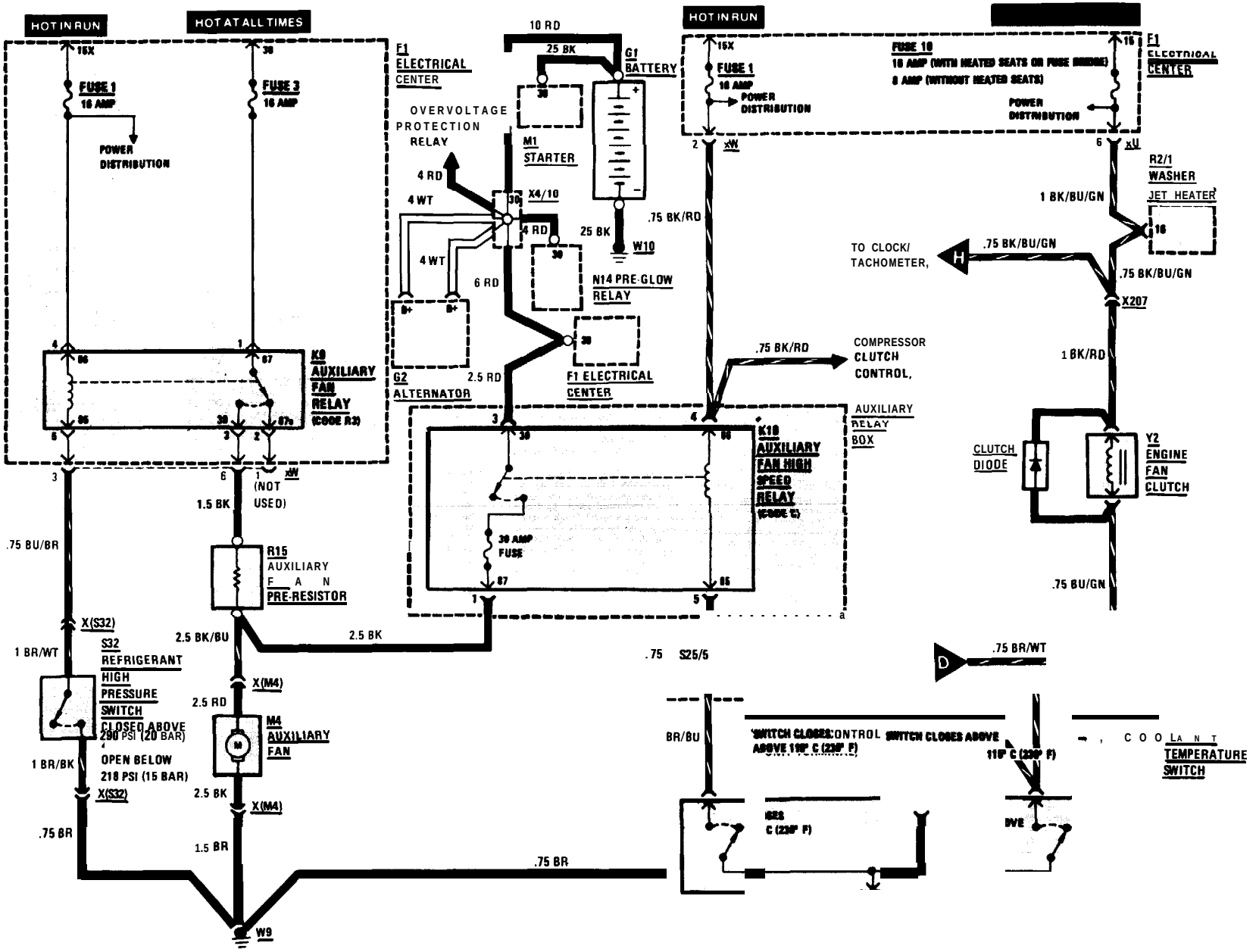
AUXILIARY FAN/COOLANT FAN

MY 1984
190D 2.2



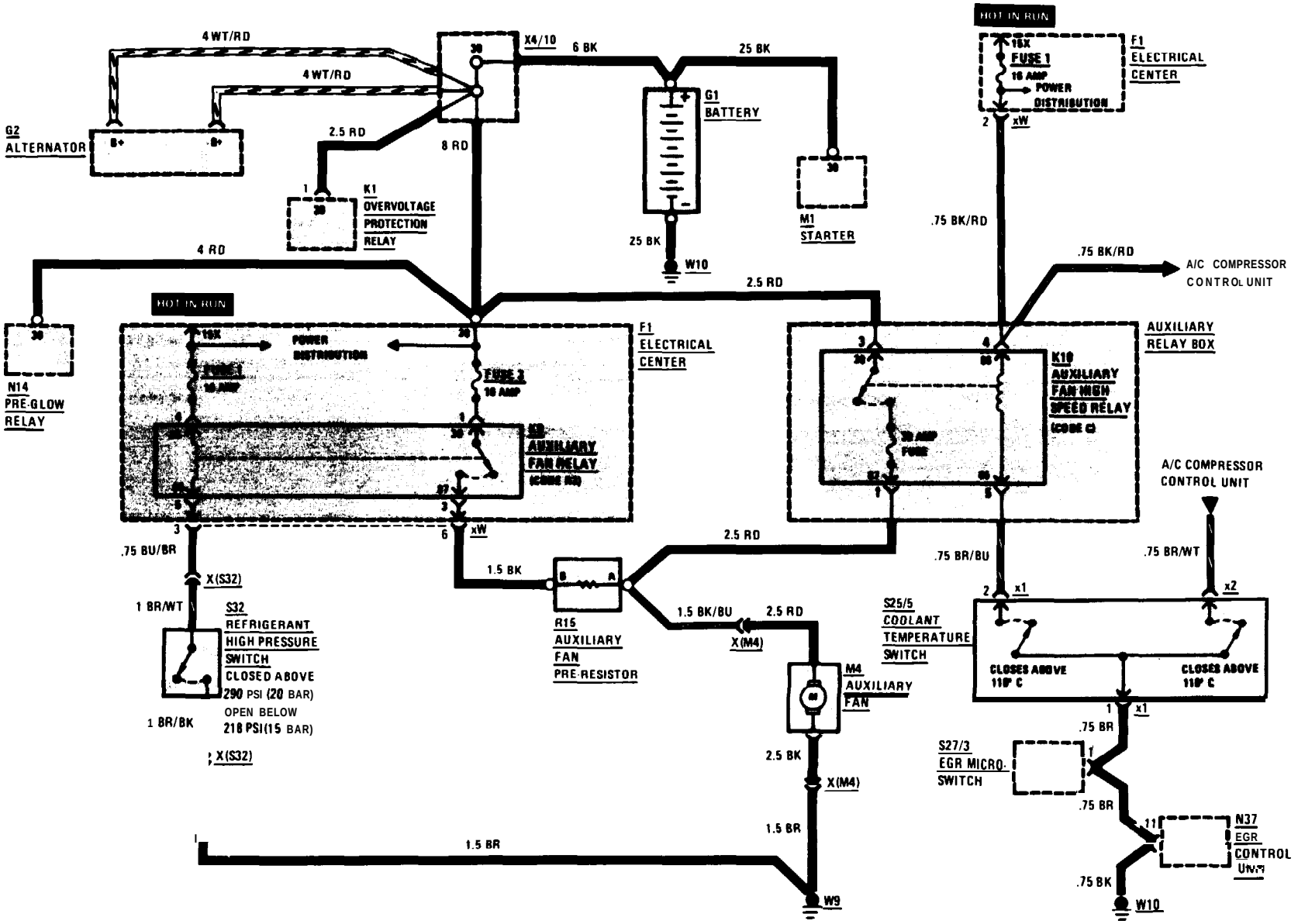
REVISIONS: ① CLUTCH DIODE IS LOCATE0 IN CONNECTOR XI5

AUXILIARY FAN/COOLANT FAN



REVISIONS:

AUXILIARY FAN/COOLANT FAN

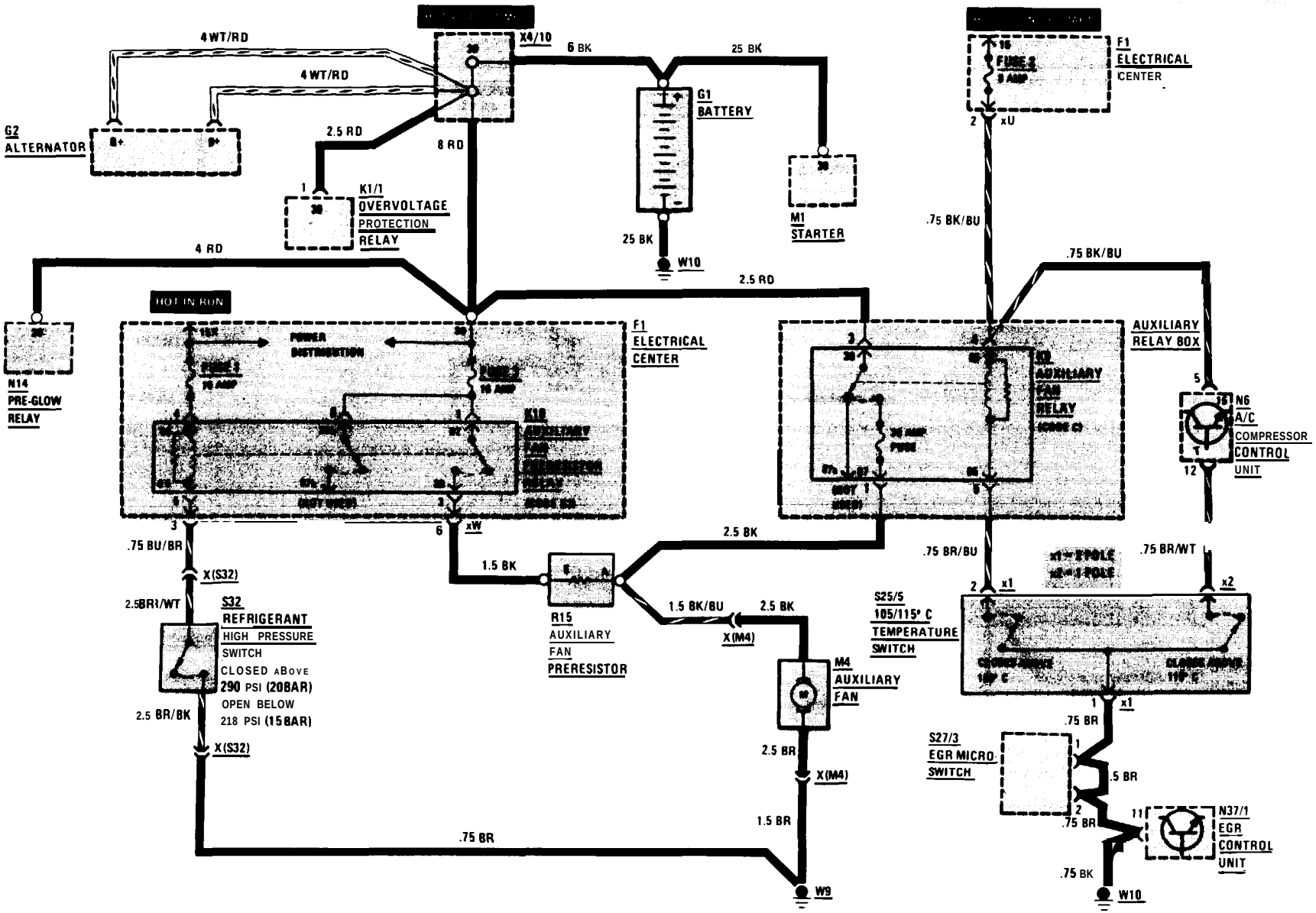


REVISIONS:

AUXILIARY FAN

(For Component Locations See Page 203)

MY 1987
190D 2.5

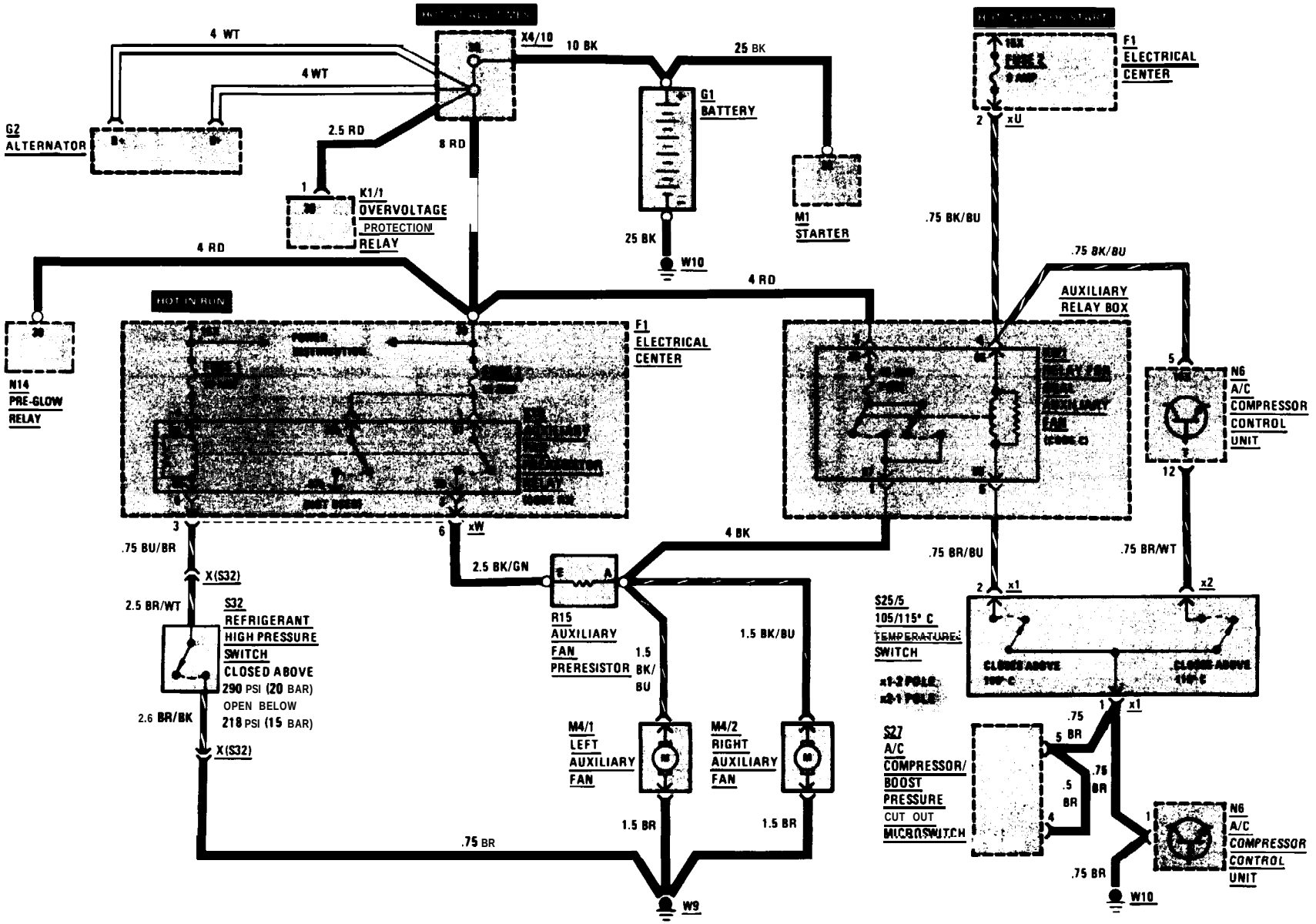


REVISIONS:

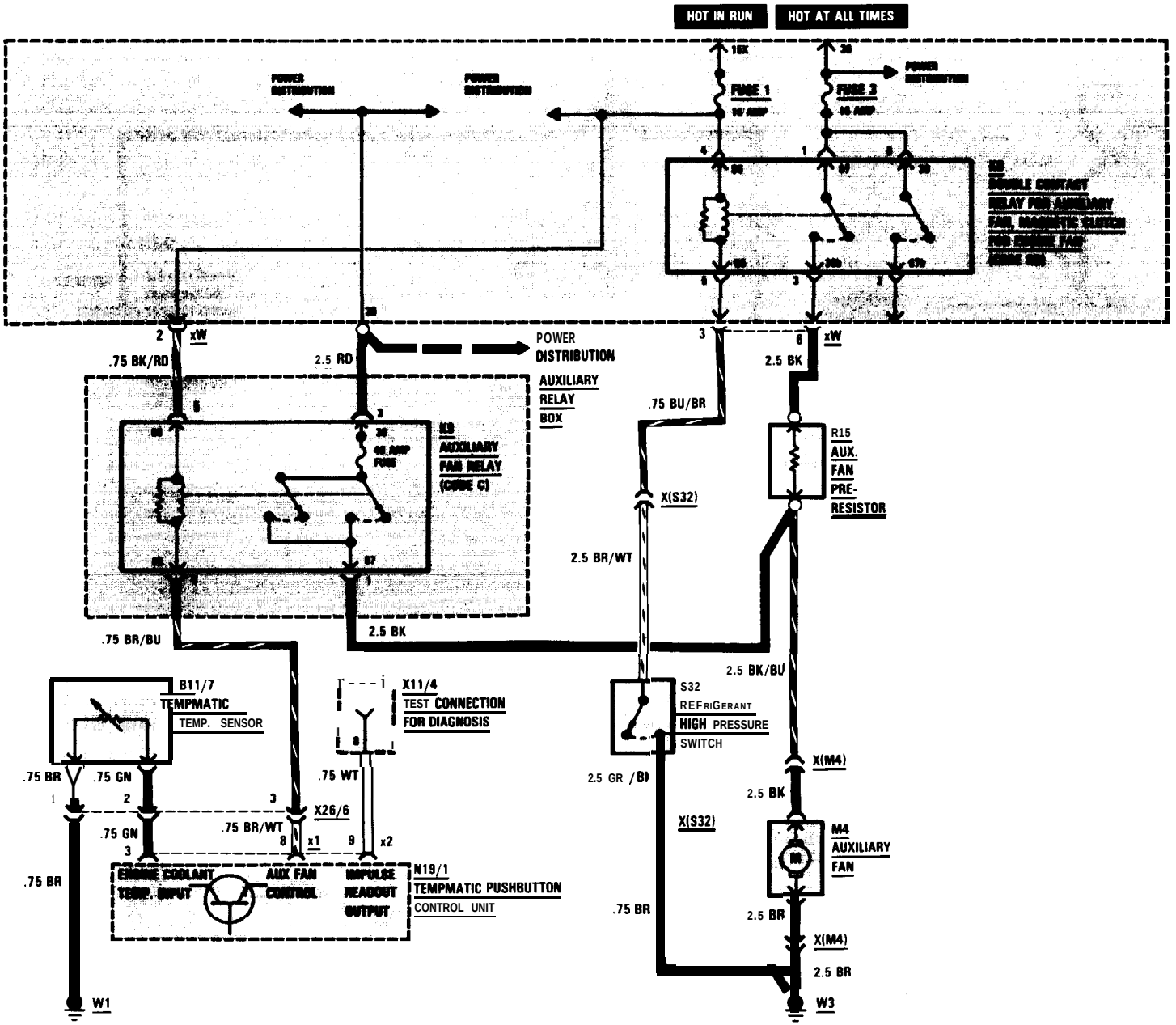
AUXILIARY FAN

MY 1987

190D 2.5 TURBO



REVISIONS:



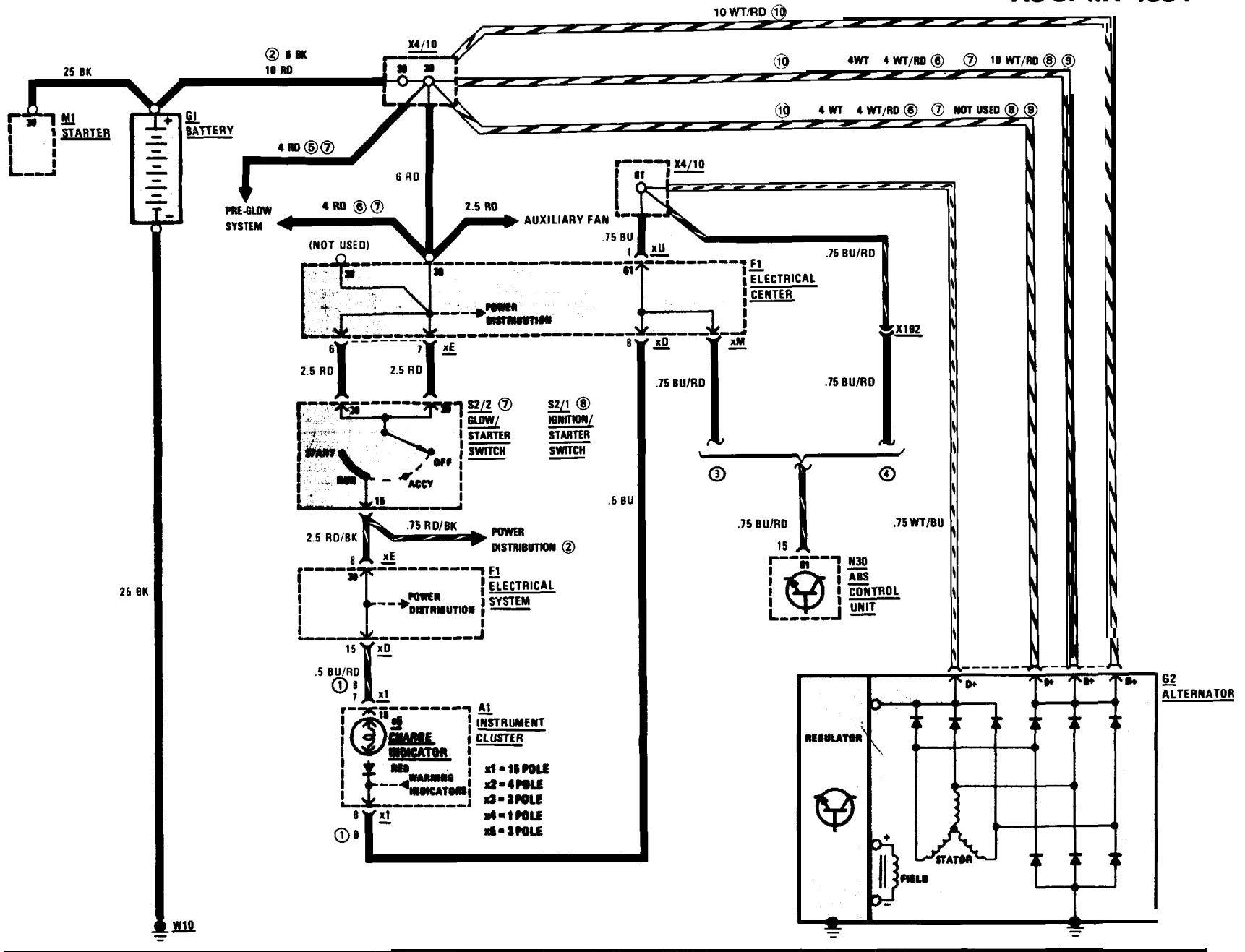
201.126

Supplement 7

REVISIONS:

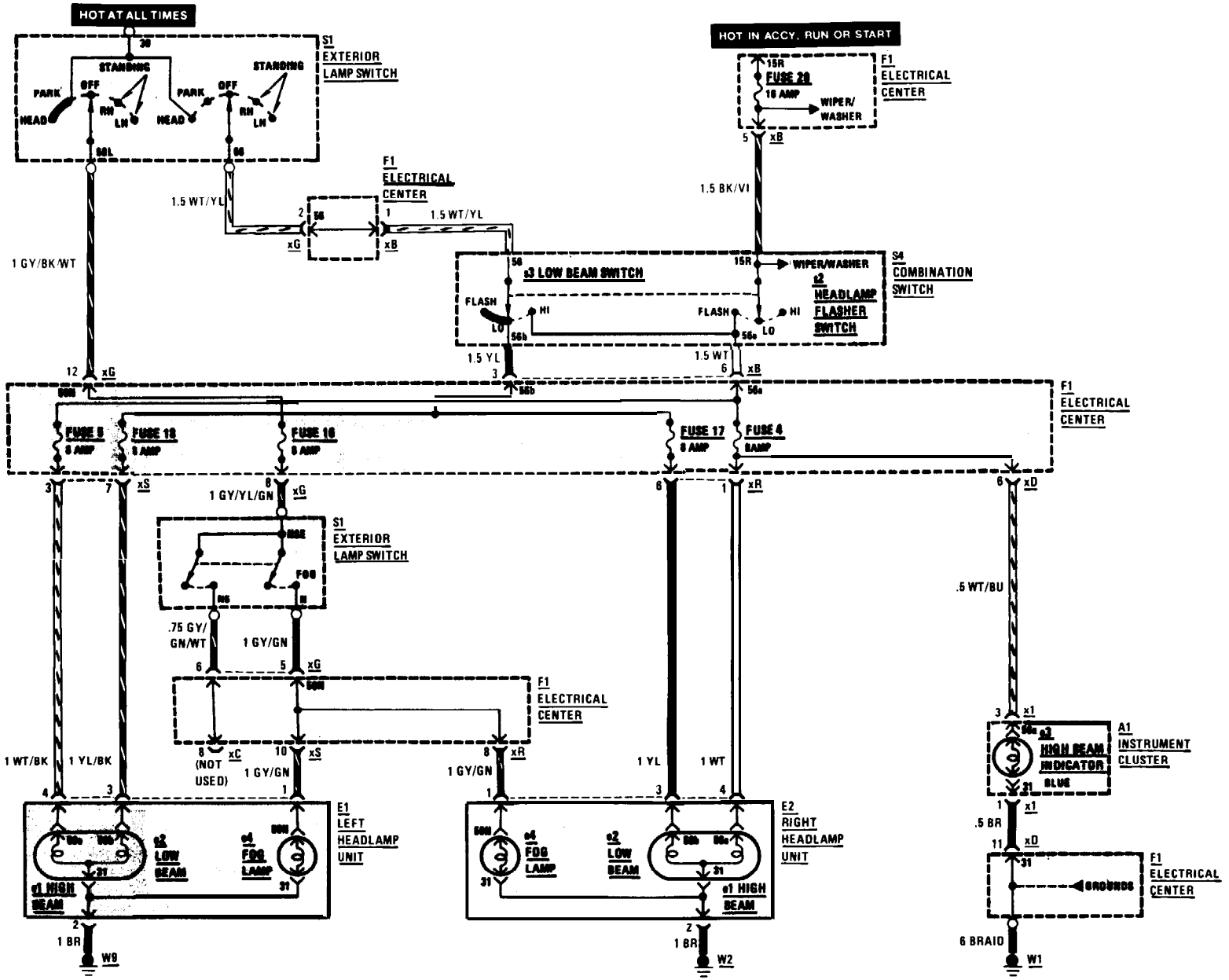
CHARGING SYSTEM

AS OF MY 1984



REVISIONS:
① AS OF MODEL YEAR 1985
② AS OF MY 1987
③ EARLY MODEL YEAR 1985 PRODUCTION
④ ALL CARS AFTER EARLY MODEL YEAR 1985 PRODUCTION
⑥ MY 1984, 1985
⑧ AS OF MY 1986
⑦ DIESEL
⑧ GASOLINE
⑨ AS OF MY 1989
⑩ AS OF MY 1992, A SINGLE 10 WT/RD WIRE IS USED

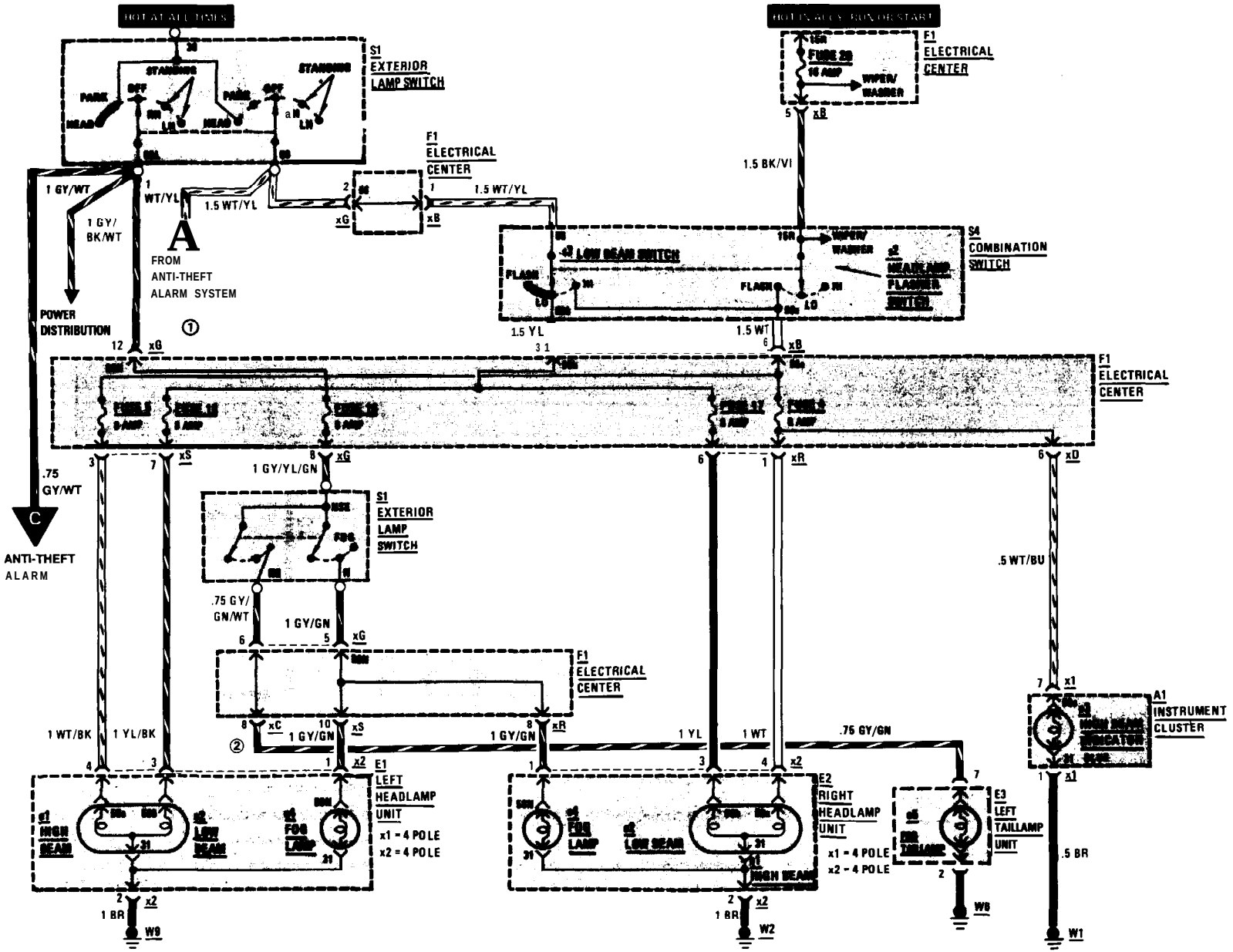
HEADLAMPS/FOG LAMPS



REVISIONS:

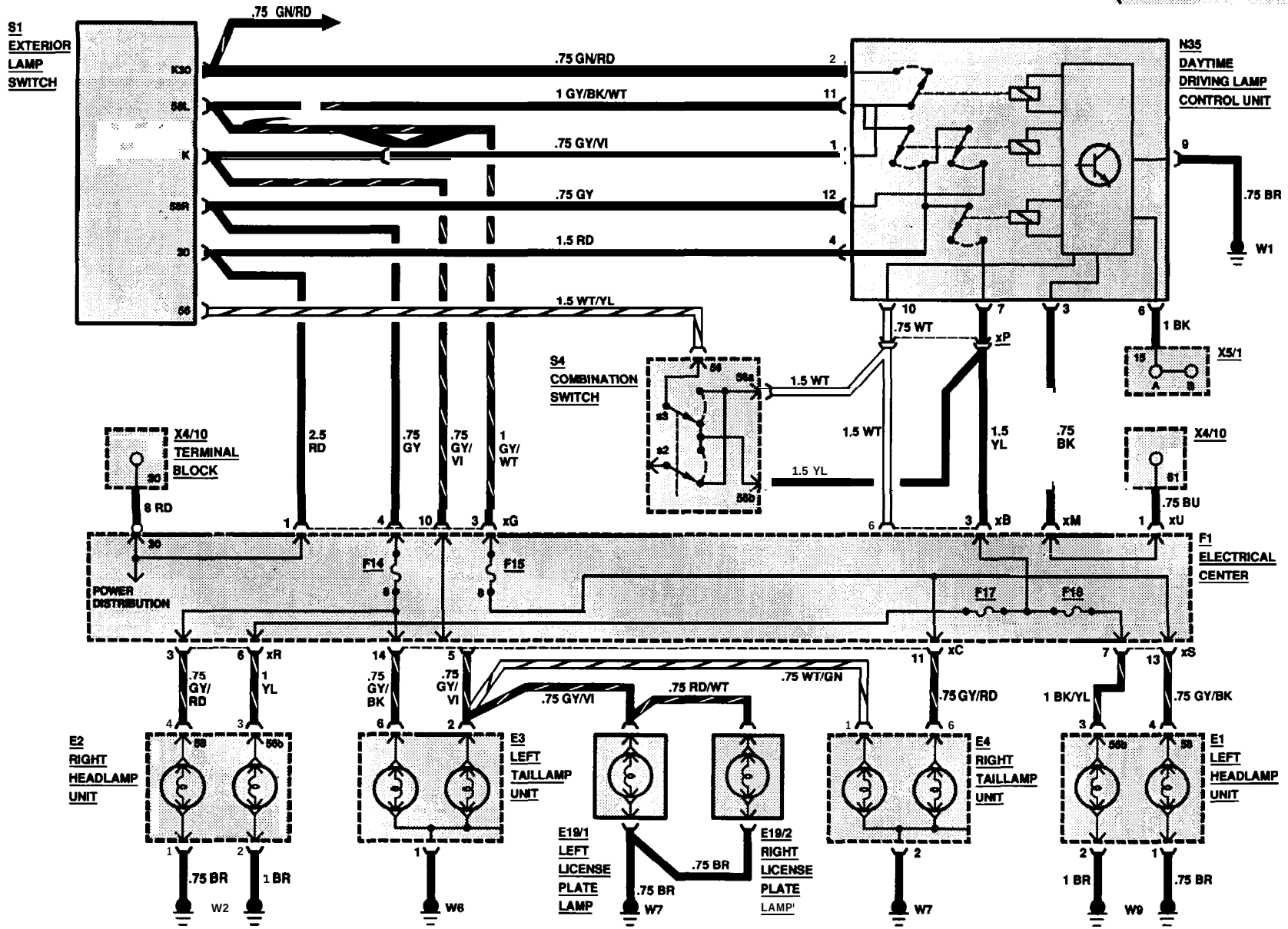
HEADLAMPS/FOG LAMPS

AS OF MY 1985



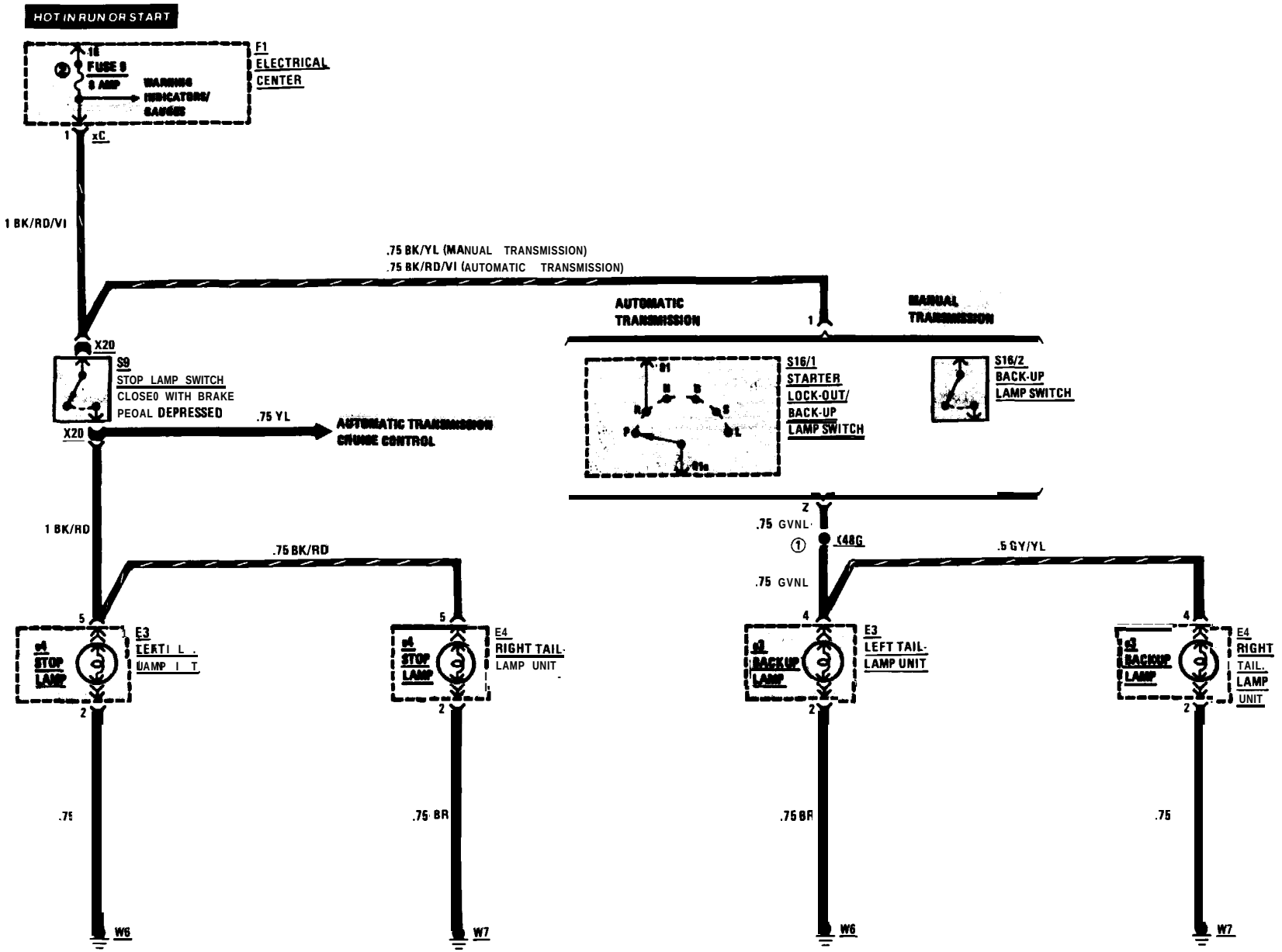
REVISIONS: ① AS OF MODEL YEAR 1986
② AS OF MY 1991, NOT USED IN EARLIER MODELS

DAYTIME DRIVING LAMPS (CANADA ONLY)



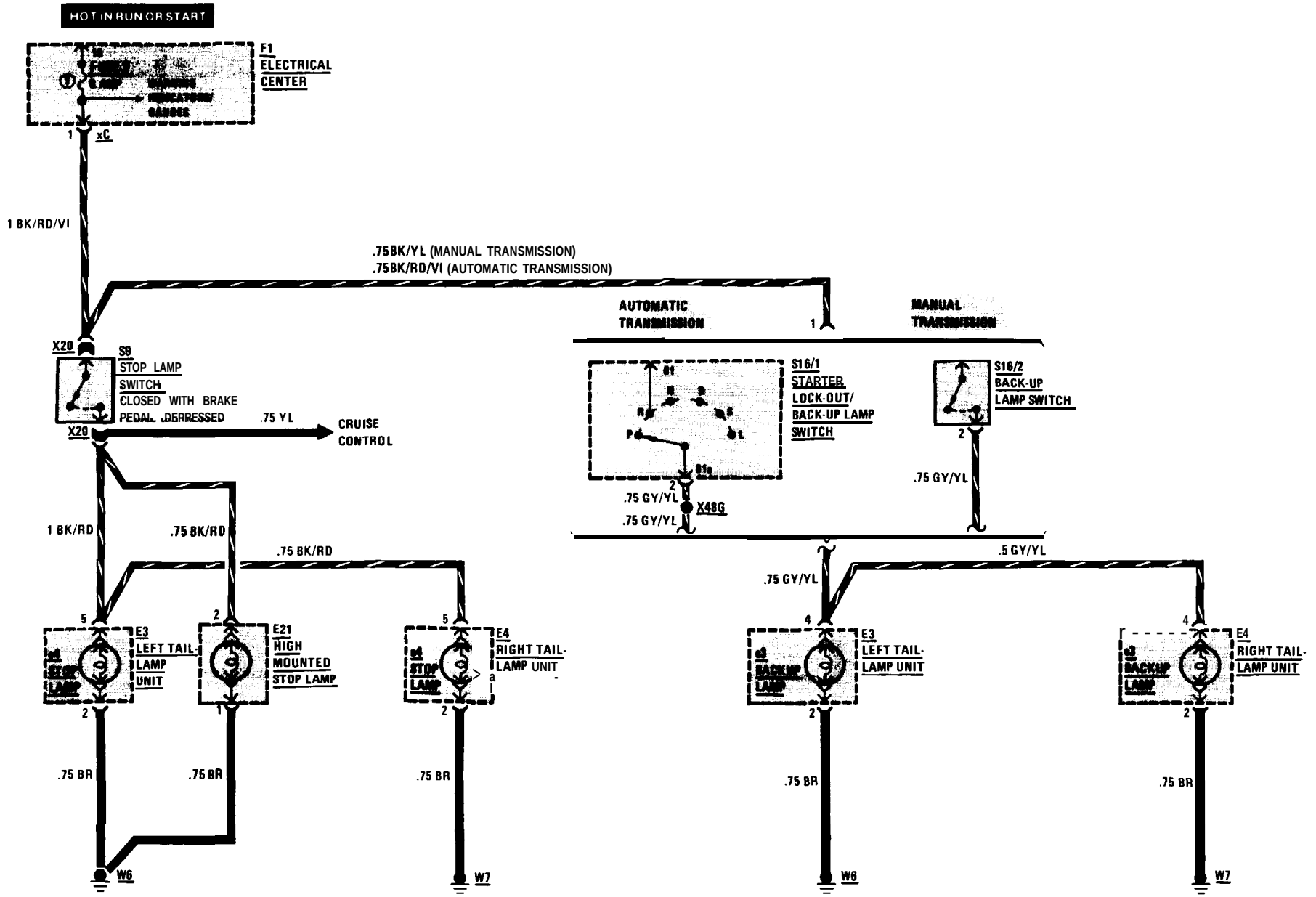
REVISIONS:

STOP LAMPS/BACK-UP LAMPS



REVISIONS: ① MANUAL TRANSMISSION (SPLICE OMITTED)
② UP TO CHASSIS END NUMBERS 1A 3131125 AND 1F 223514 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

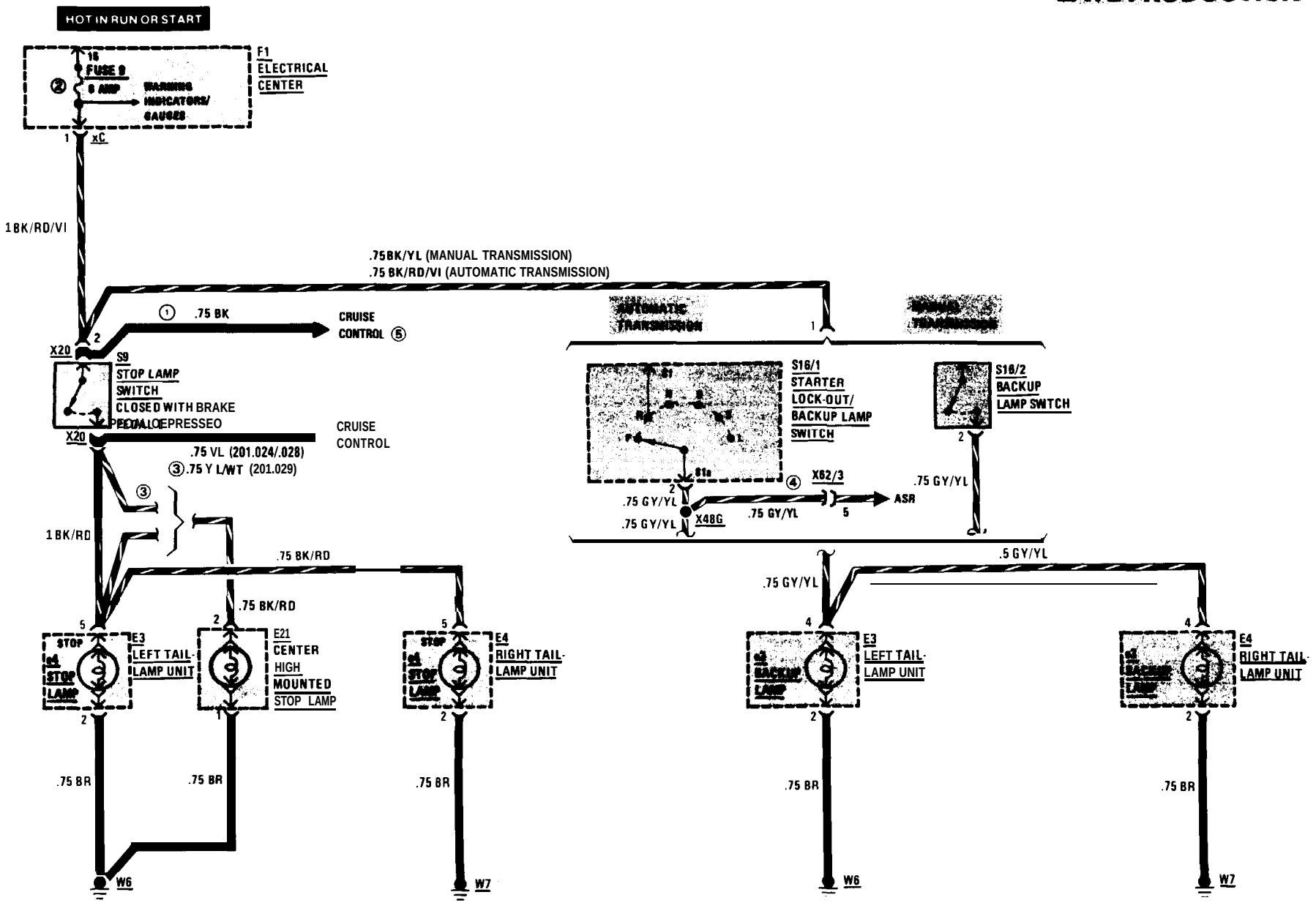
STOP LAMPS/BACKUP LAMPS



REVISIONS: ① UP TO CHASSIS END NUMBERS **1A** 313925 AND **1F** 229914 FUSE NO. 9 IS REMOVED AND A BRIDGE IS **INSTALLED** BETWEEN FUSE NO. 9 AND 10

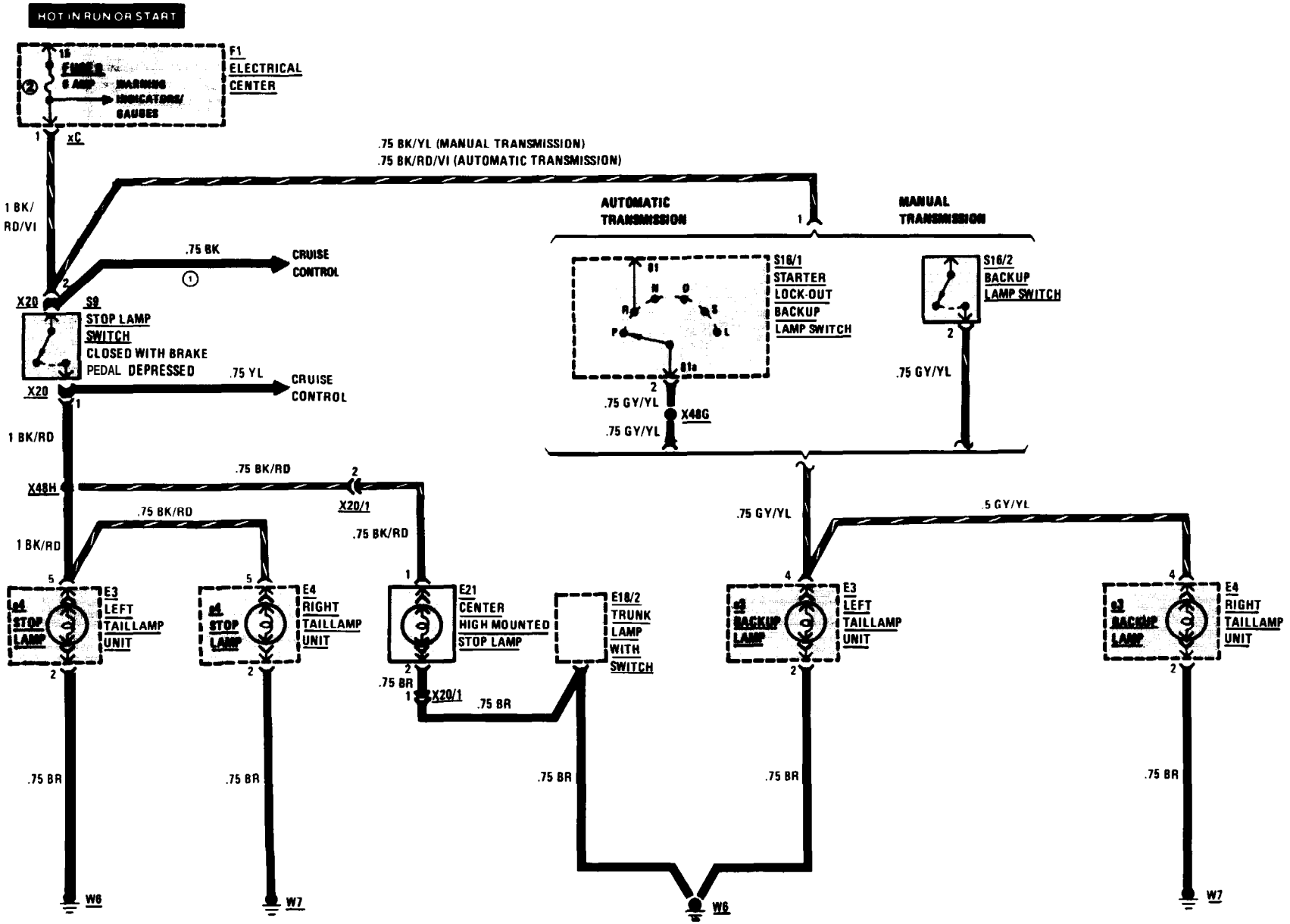
STOP LAMPS/BACKUP LAMPS

AS OF MY 1986 LATE PRODUCTION



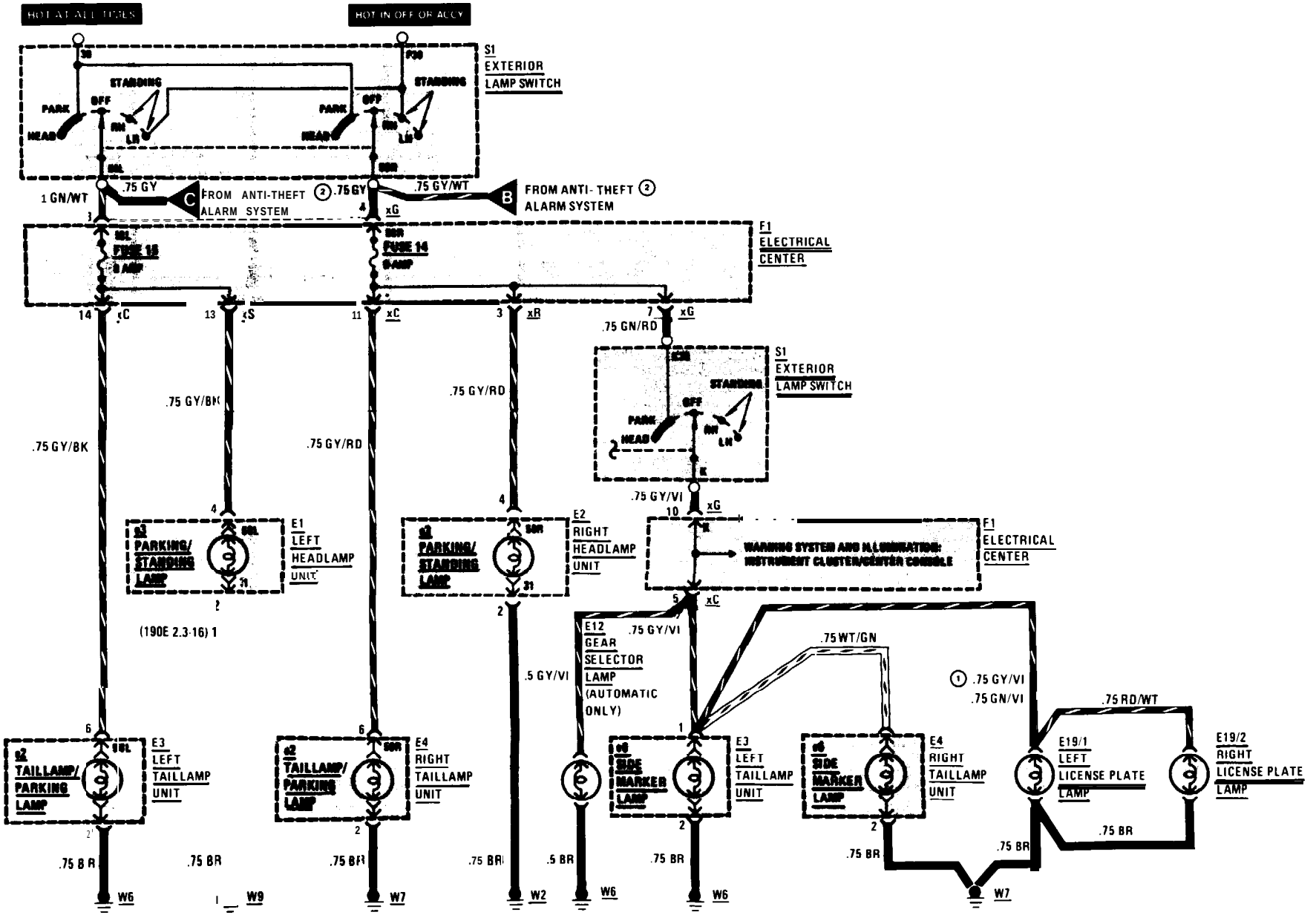
REVISIONS: ① AS OF MODEL YEAR 1987
② UP TO CHASSIS END NUMBERS **1A** 313825 AND **1F** 229814 FUSE NO. 9 IS REMOVED AND A **BRIDGE** IS INSTALLED BETWEEN FUSE NO. 9 AN0 10
③ AS OF MY 1991
④ **ONLY** WITH ASR
⑤ **WITHOUT ASR**

STOP LAMPS/BACKUP LAMPS



REVISIONS: ① AS OF MY 1997
② UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

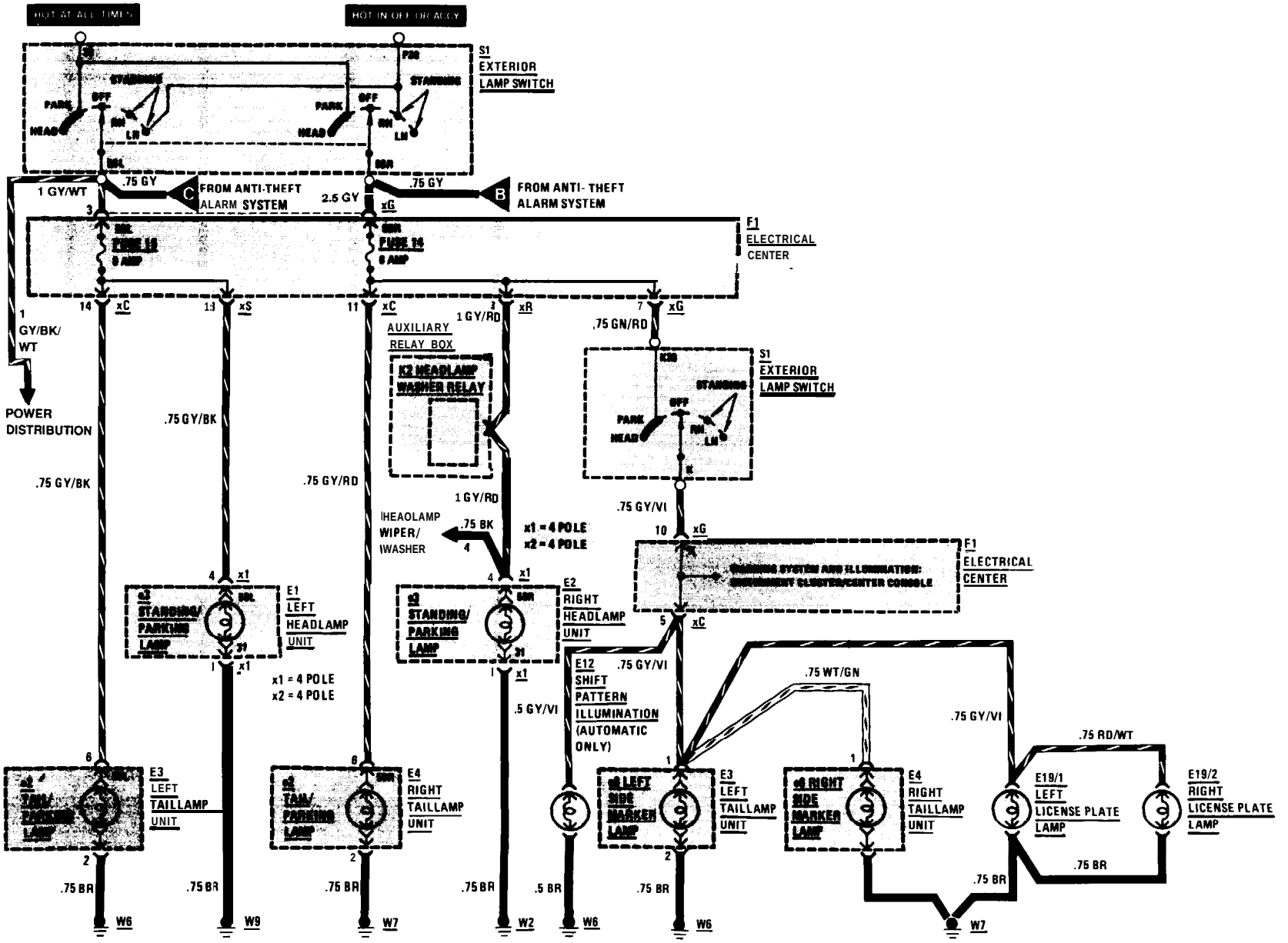
LAMPS: PARK/TAIL/SIDE MARKER/LICENSE/GEAR SELECTOR



REVISIONS: (1) AS OF MODEL YEAR **1985**
(2) AS OF MODEL YEAR **1986**

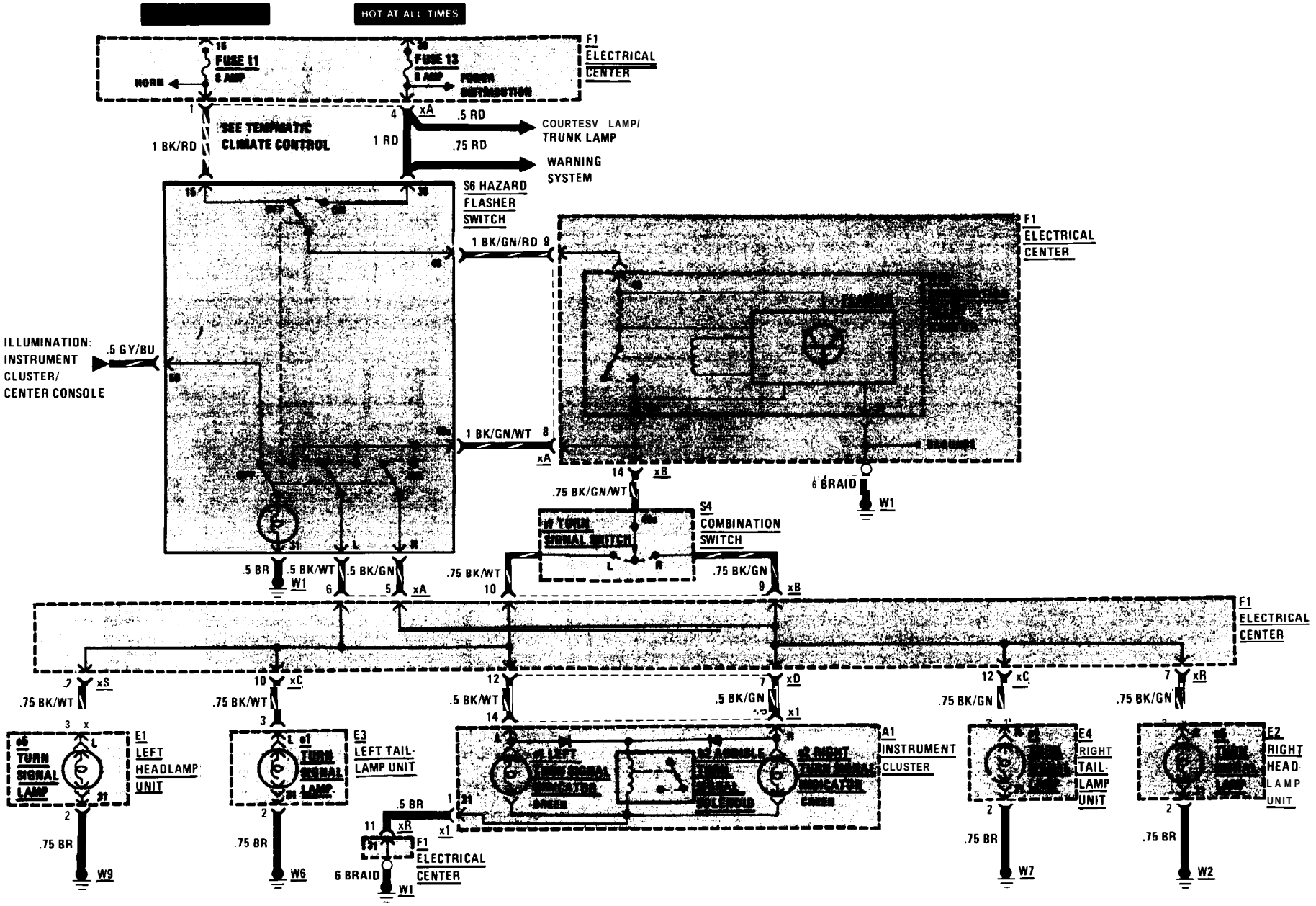
119/1

201.0/1



REVISIONS:

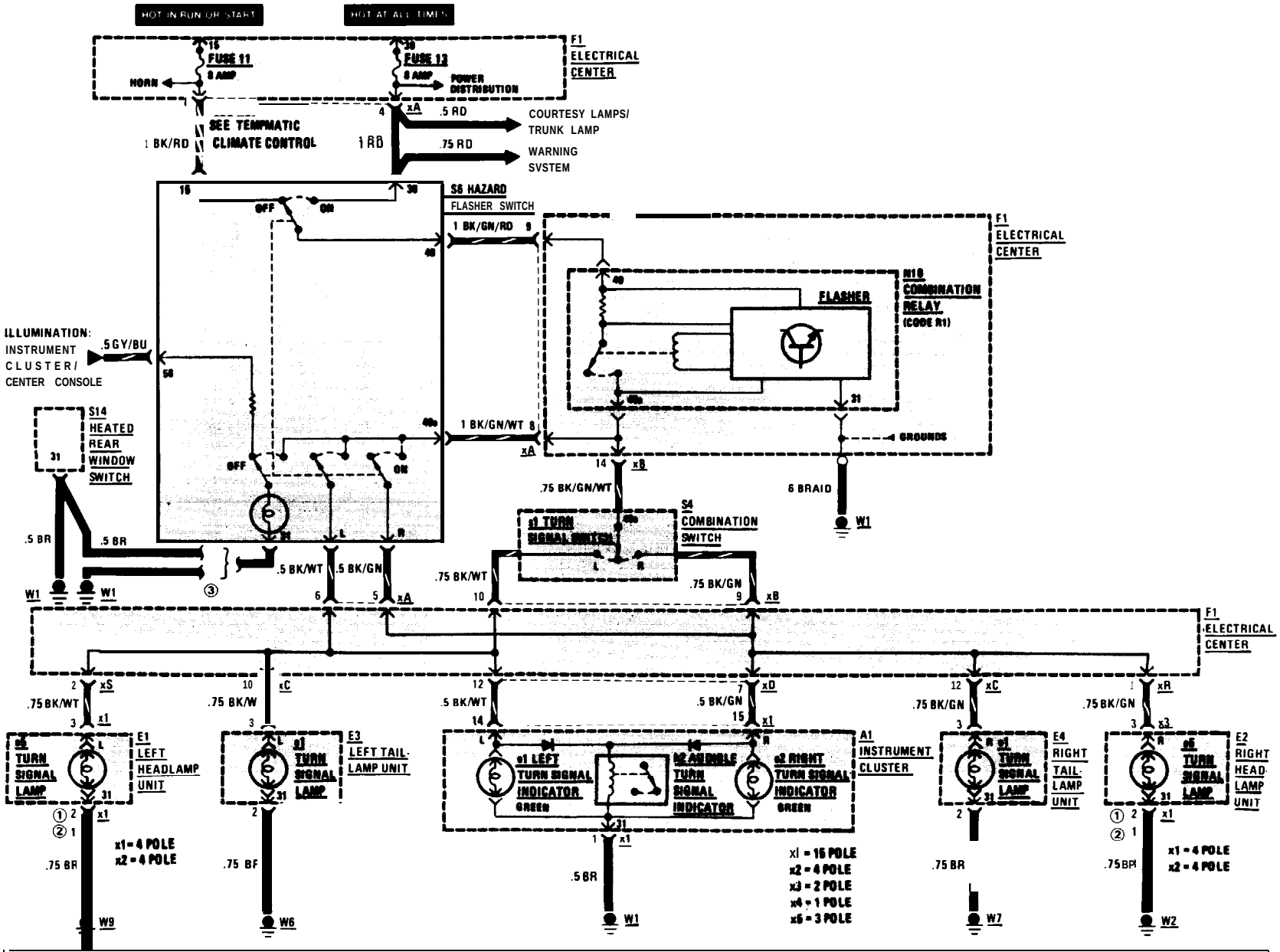
TURN SIGNAL/HAZARD LAMPS



REVISIONS:

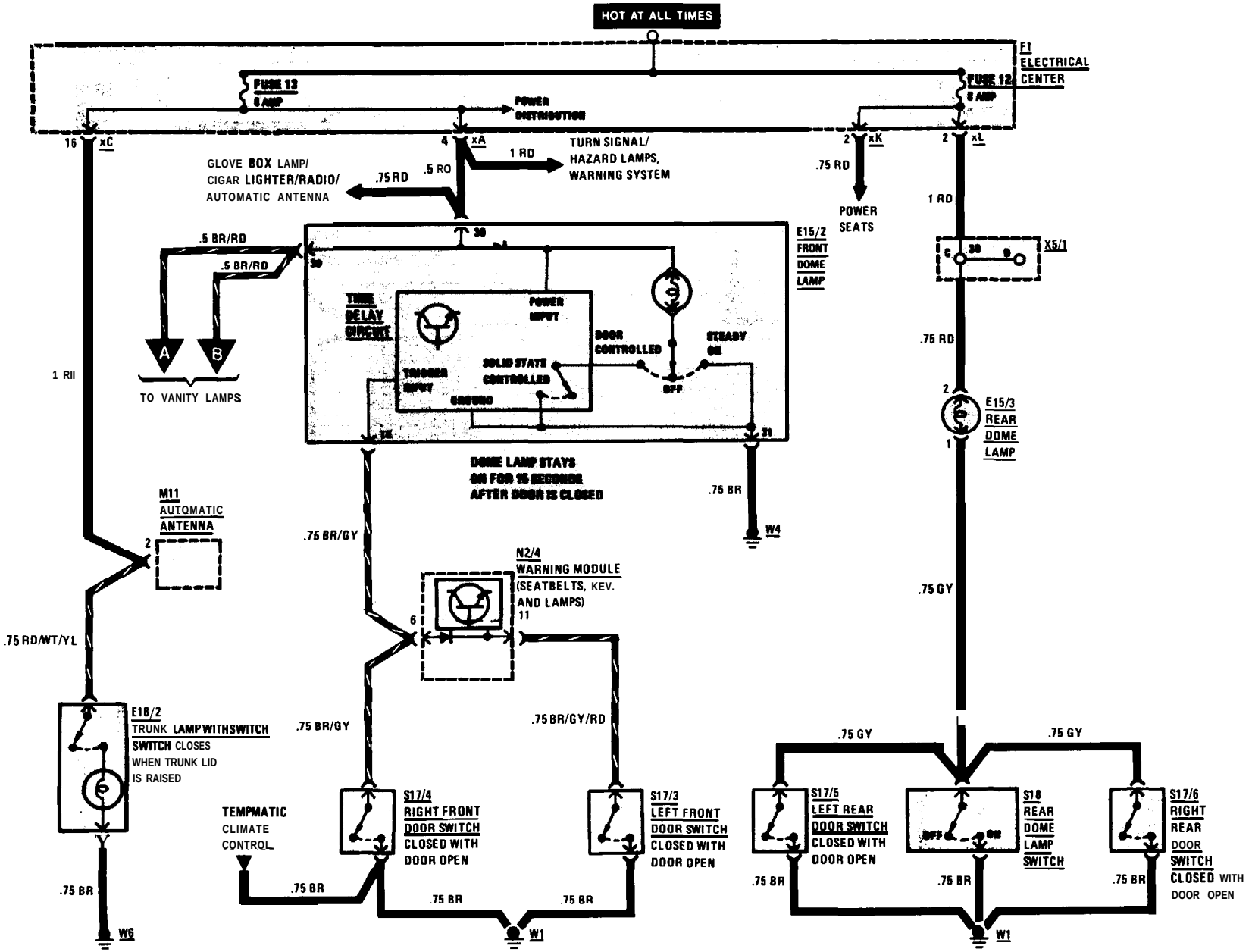
TURN SIGNAL/HAZARD LAMPS

AS OF MY 1985



REVISIONS: ① MODEL YEAR 1995
② AS OF MODEL YEAR 1996 190E 2.3-16 (201.0341
AS OF MODEL YEAR 1997 ALL OTHER MODELS
③ AS OF MY 1990

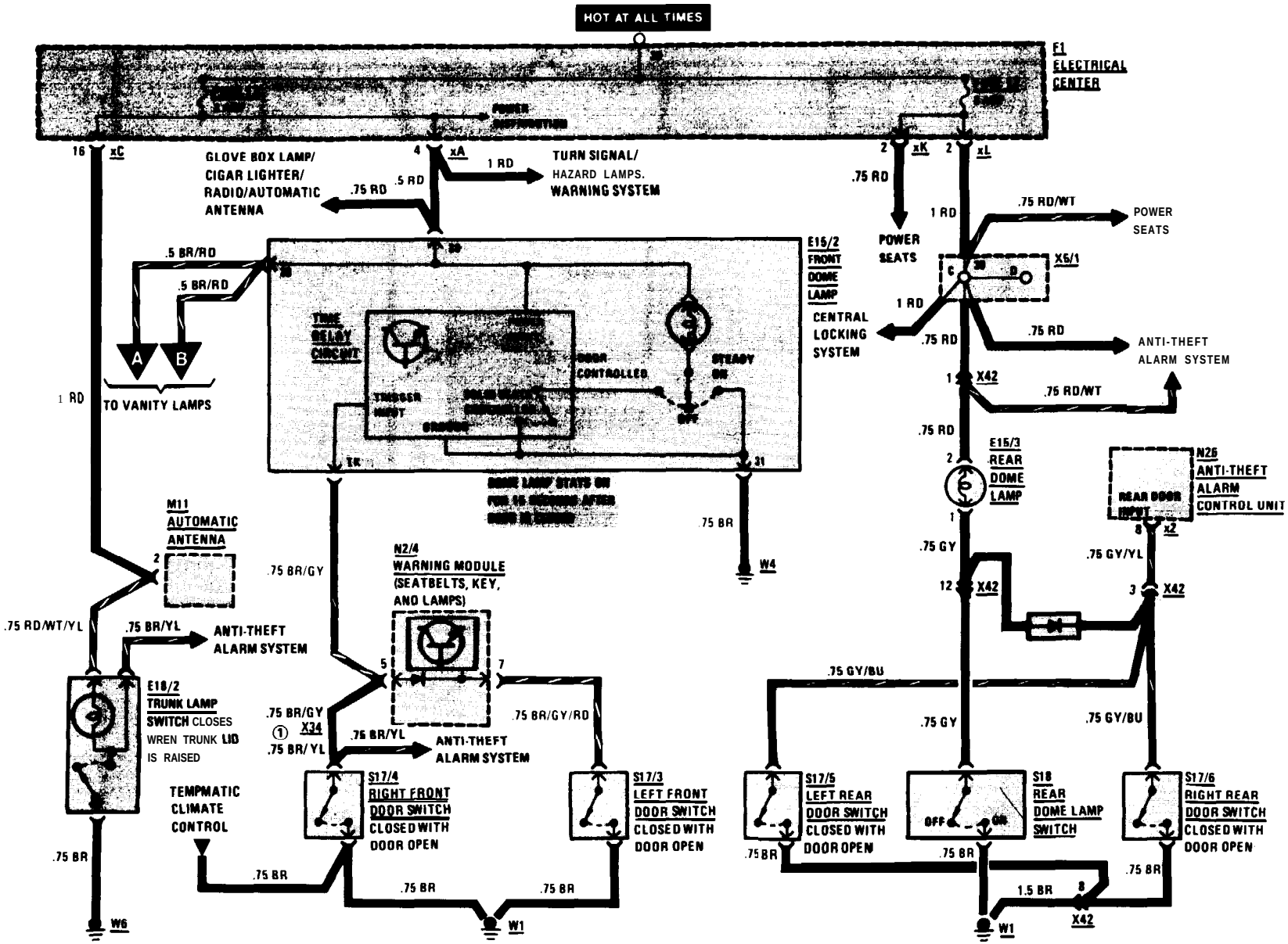
COURTESY LAMPS/TRUNK LAMP



REVISIONS:

COURTESY LAMPS/TRUNK LAMP

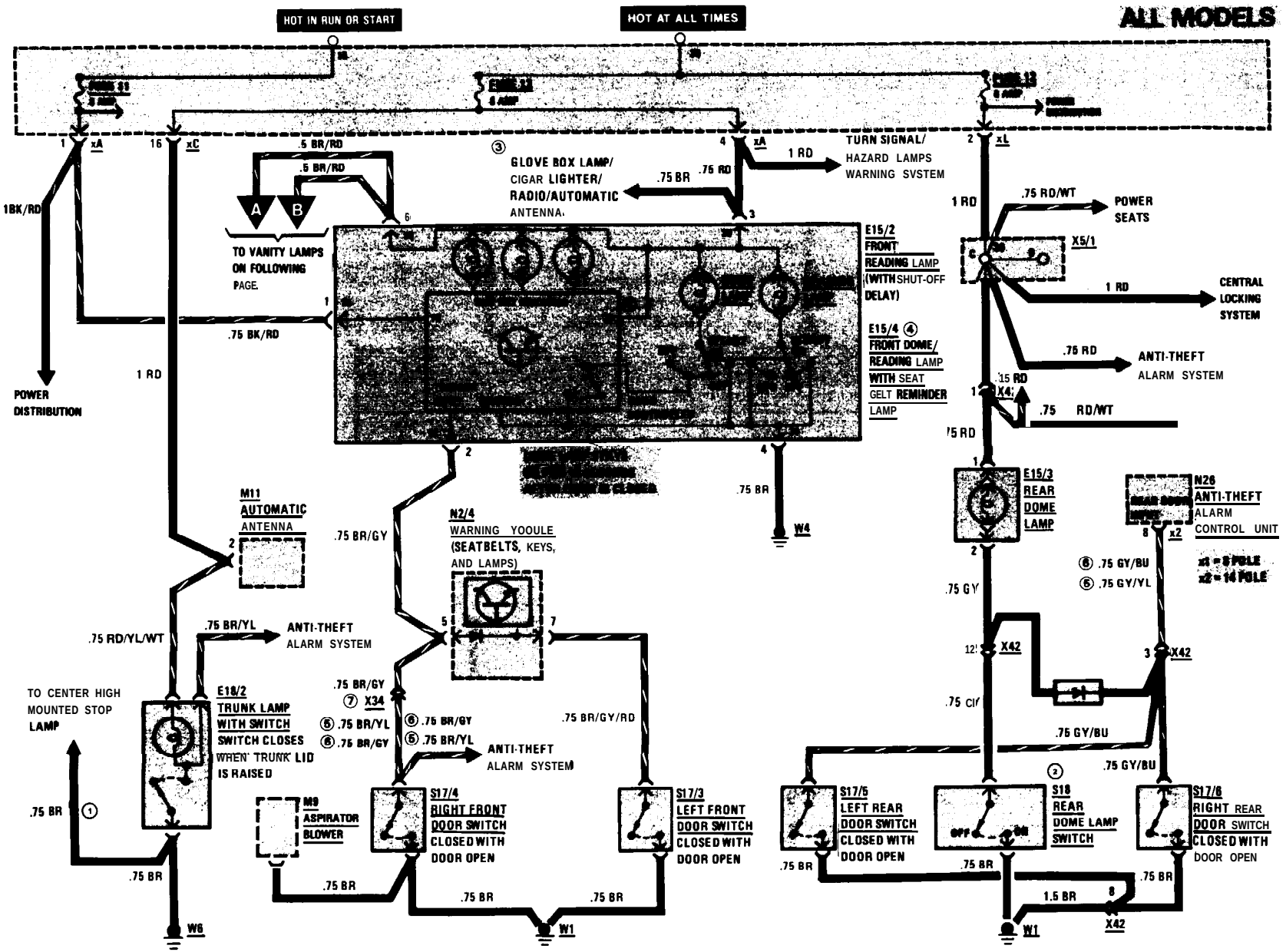
MY 1986



REVISIONS: ① VEHICLES WITH **ATA ONLY**

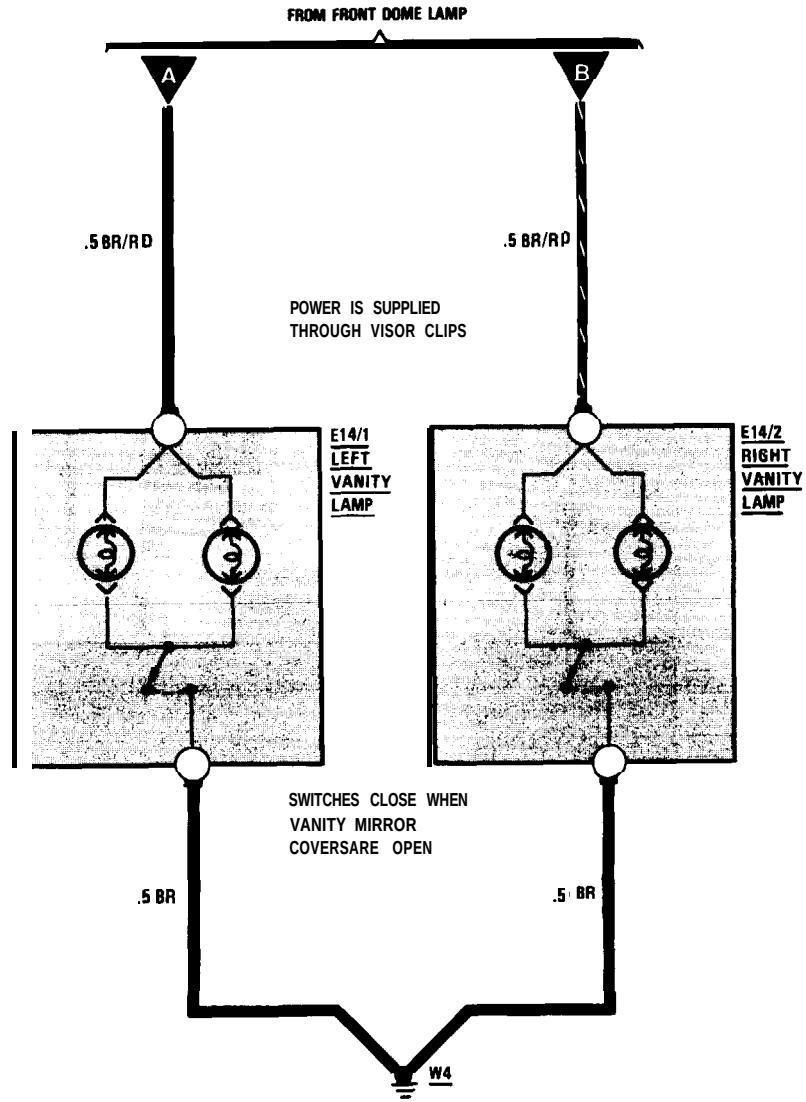
COURTESY LAMPS/TRUNK LAMP

AS OF MY 1986 190E 2.3-16
AS OF MY 1987
ALL MODELS



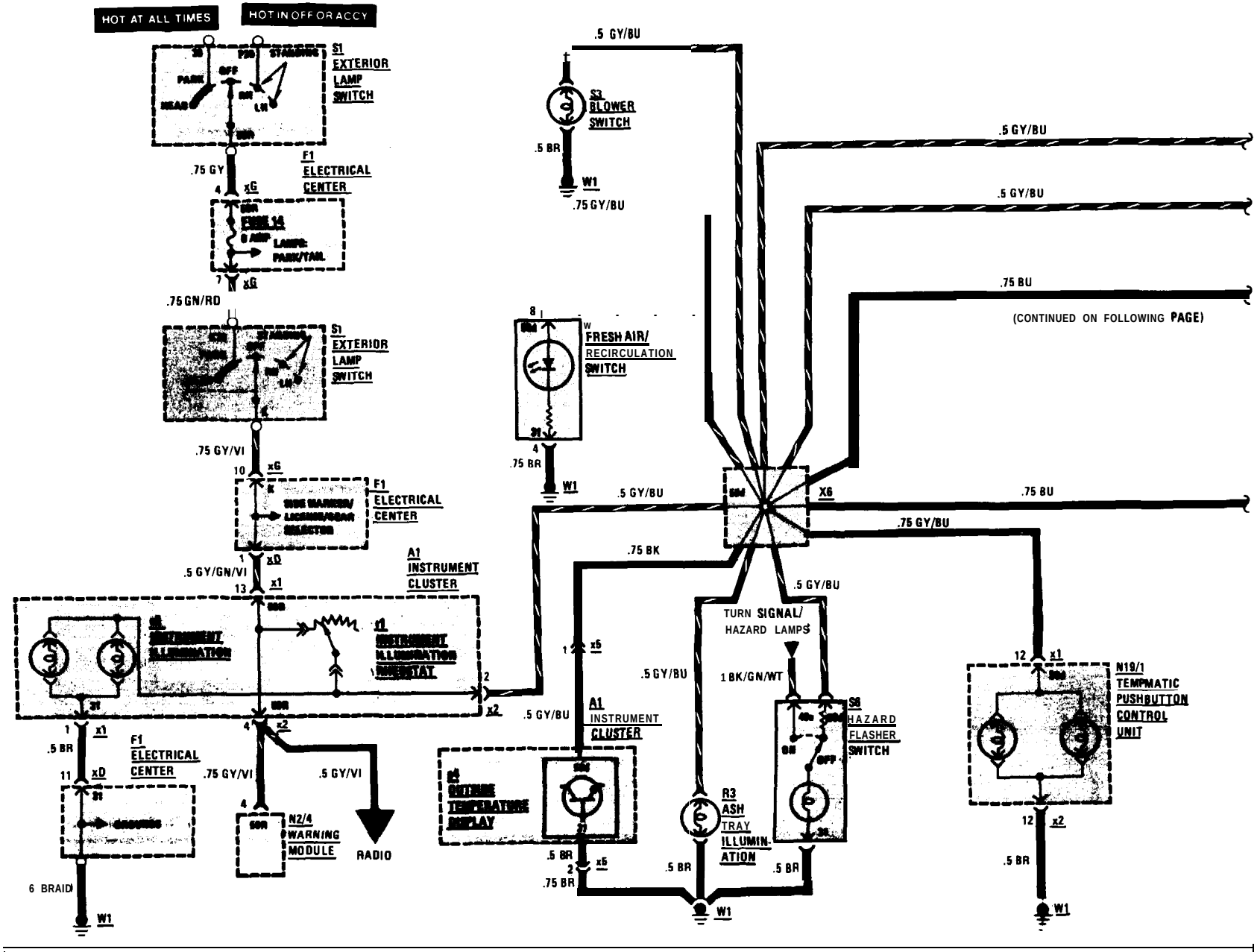
REVISIONS: ① 190E 2.3-16 (201.0340 ONLY
② REAR DOME LAMP SWITCH IS ILLUMINATE0 FROM THE INSTRUMENT CLUSTER BY MEANS OF A FIBER OPTIC CABLE
③ MODEL VEAR 1987
@AS OF MODEL VEAR 1988
⑤ MV 1987/MY1988
⑥ AS OF MY 1989
⑦ VEHICLES WITH ATA ONLY

VANITY LAMPS



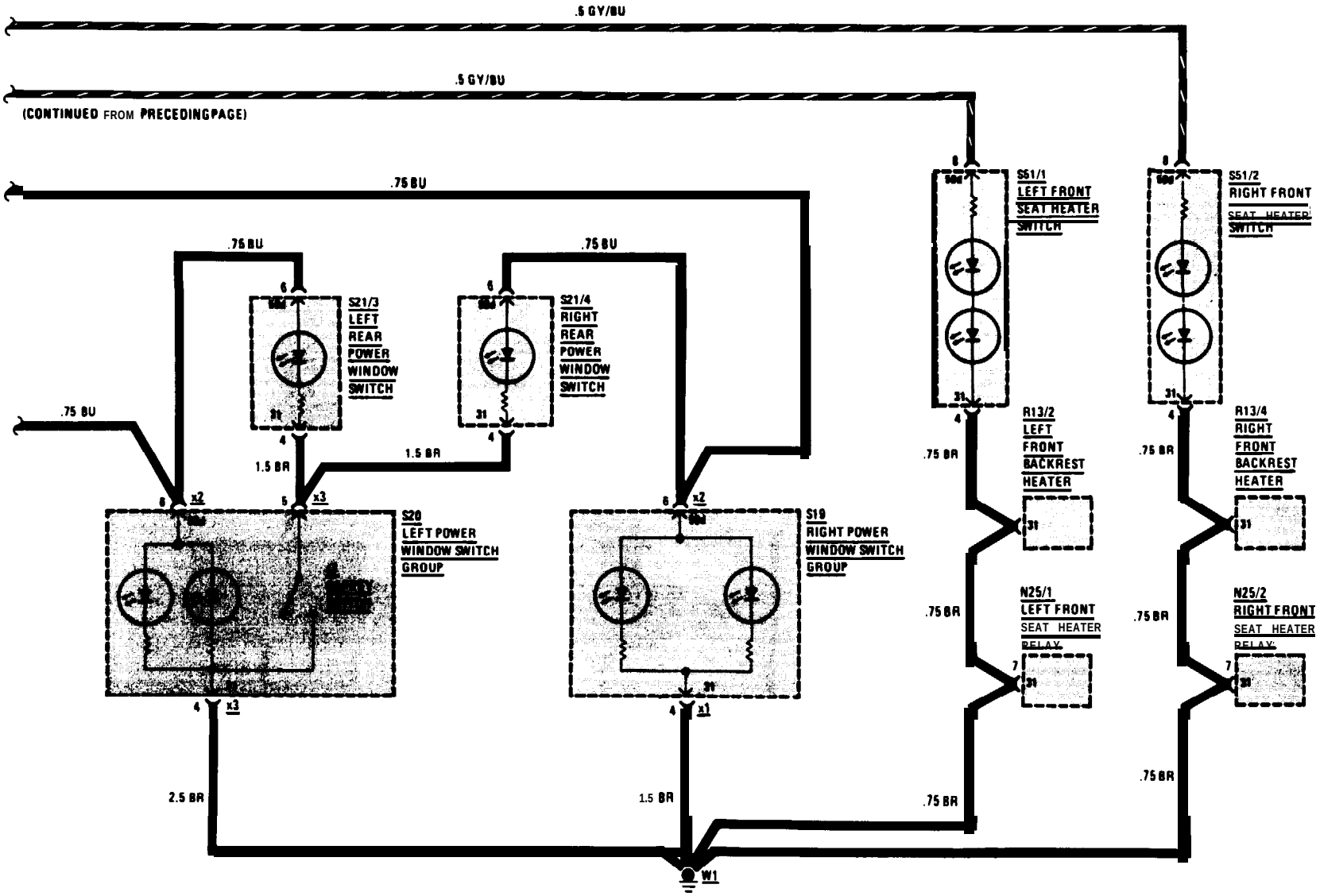
REVISIONS:

ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE



REVISIONS:

ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE

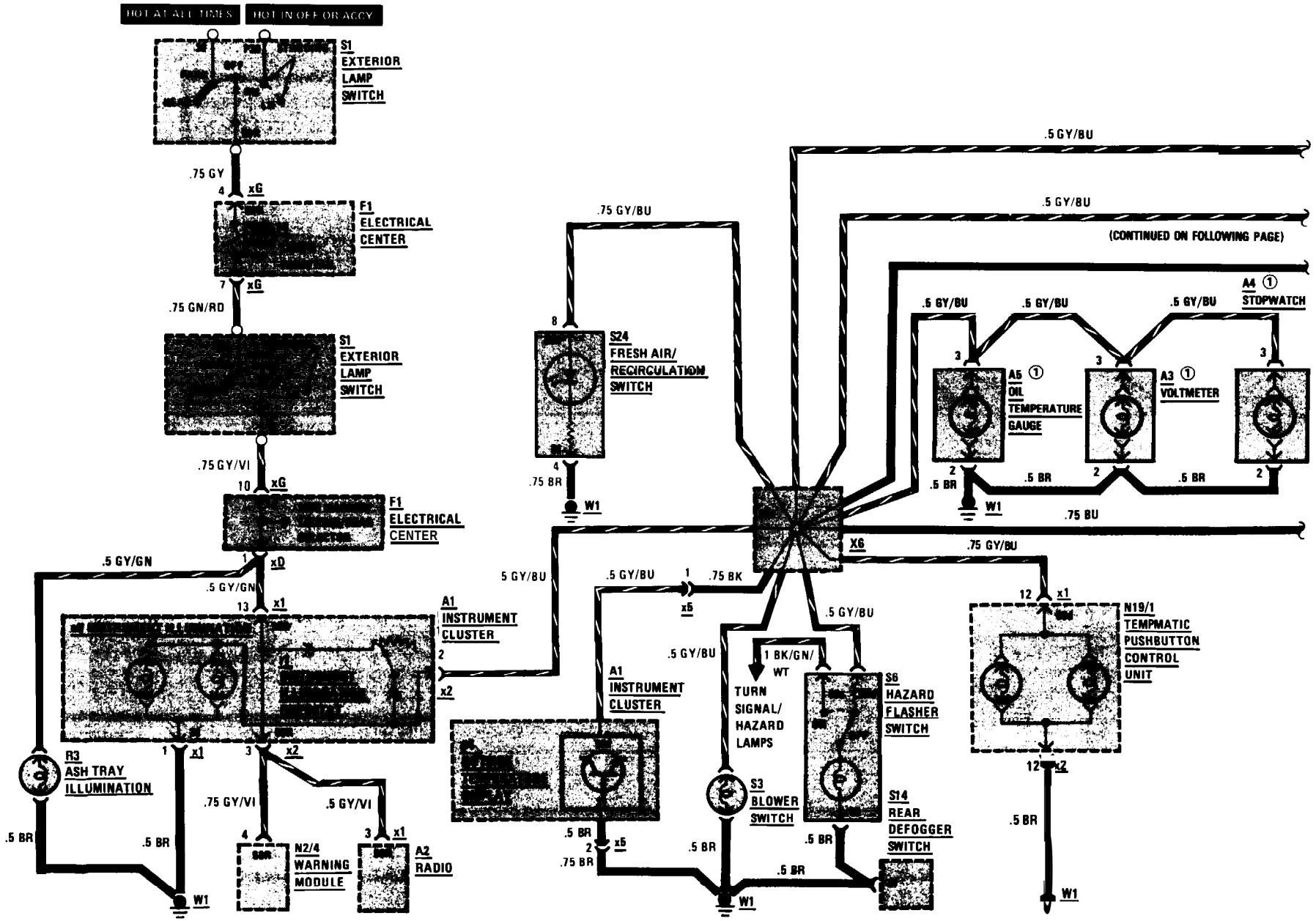


REVISIONS:

ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE

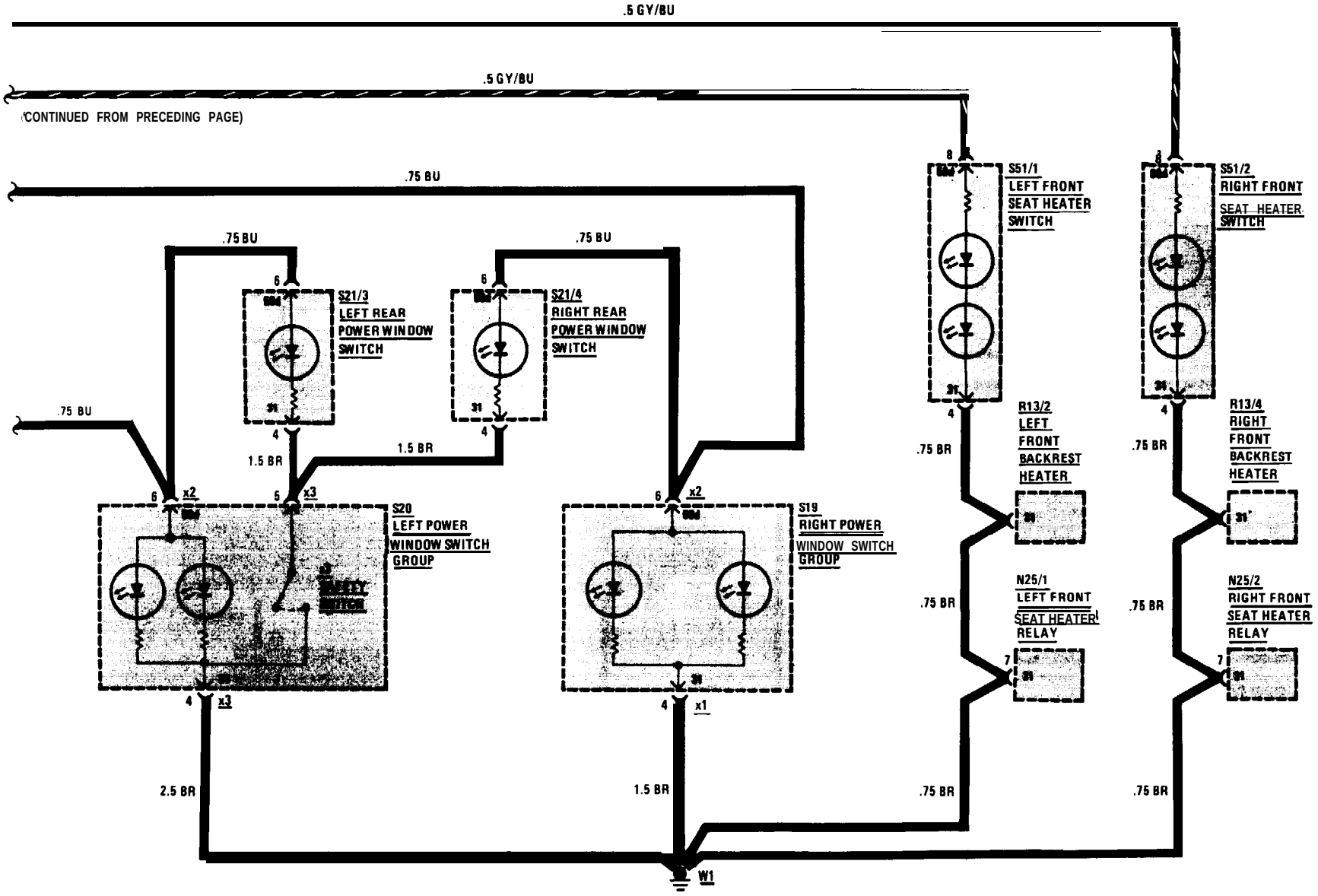
MY 1986

'EARLY PRODUCTION



REVISIONS: ① MODEL 201.034 ONLY

ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE

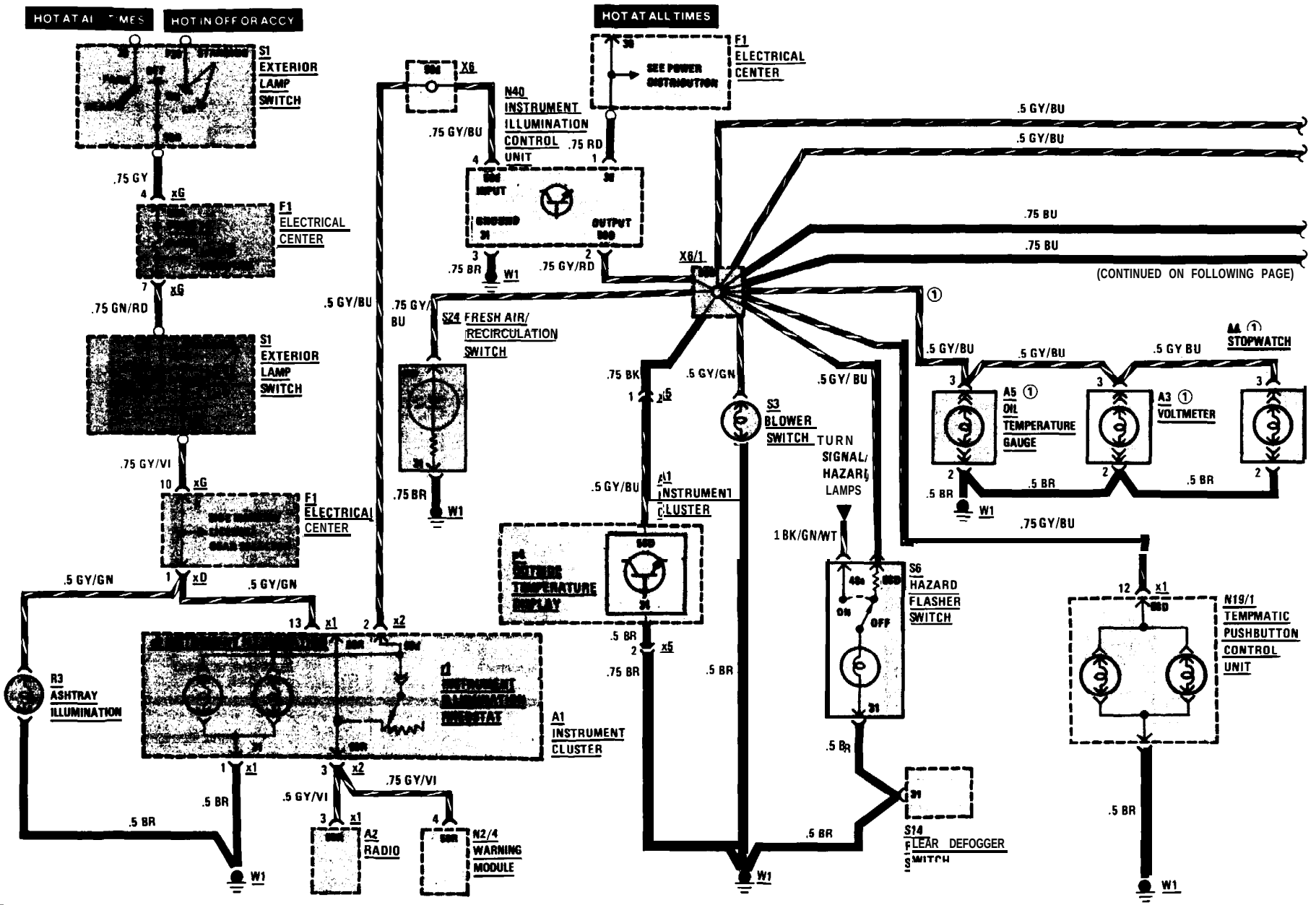


REVISIONS:

ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE

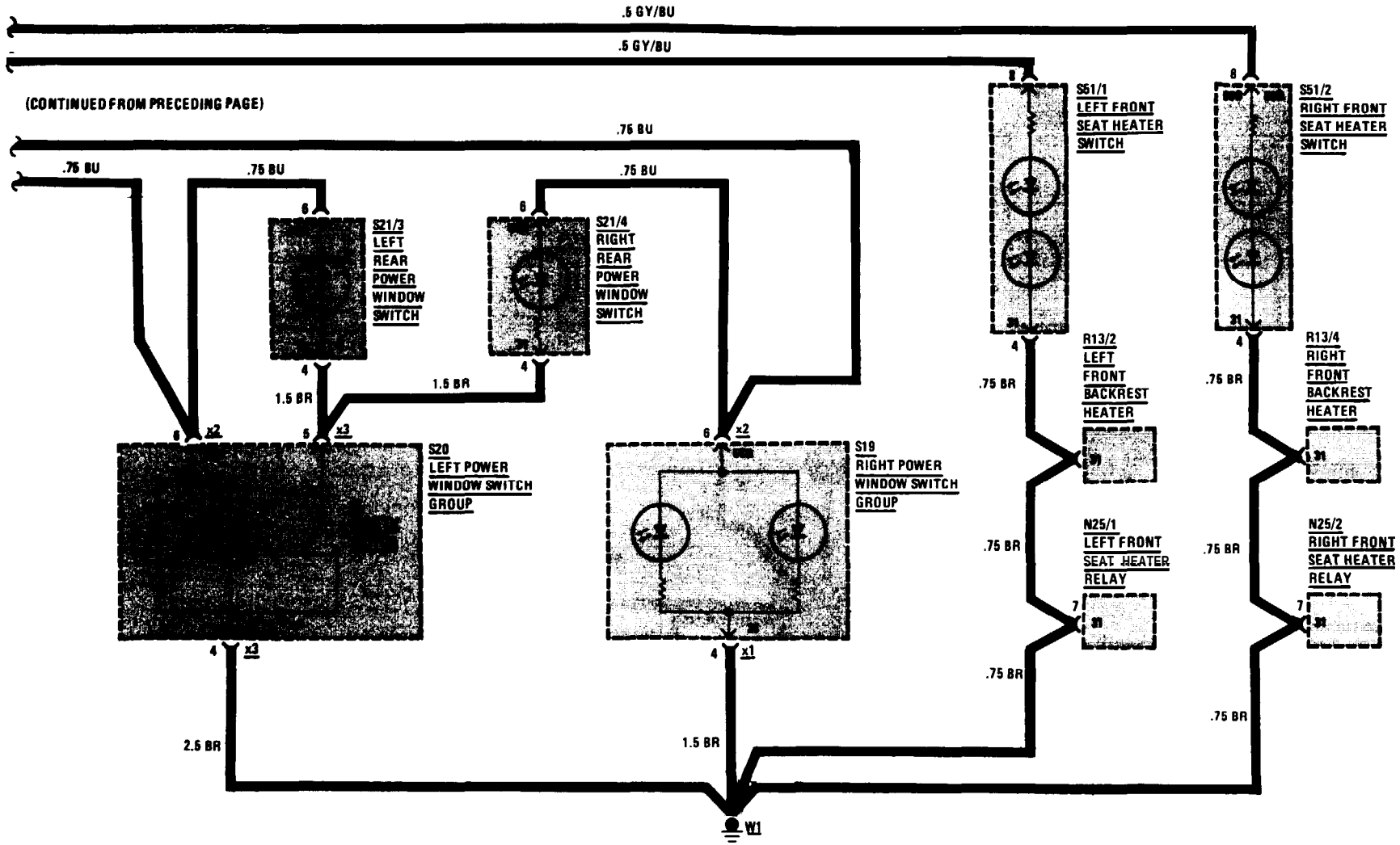
MY 1986

LATE PRODUCTION



REVISIONS: ① MODEL 201.034 ONLY

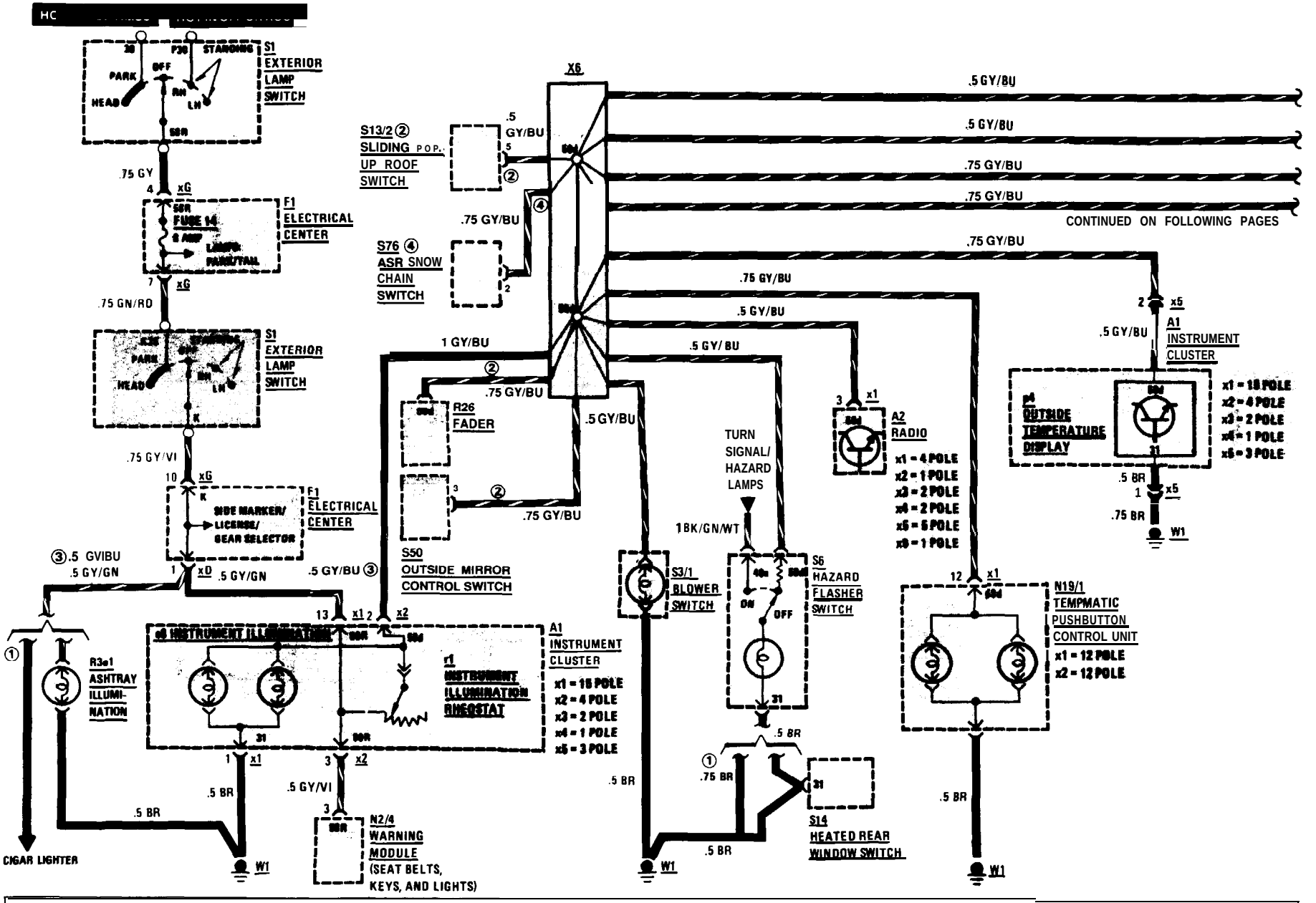
ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE



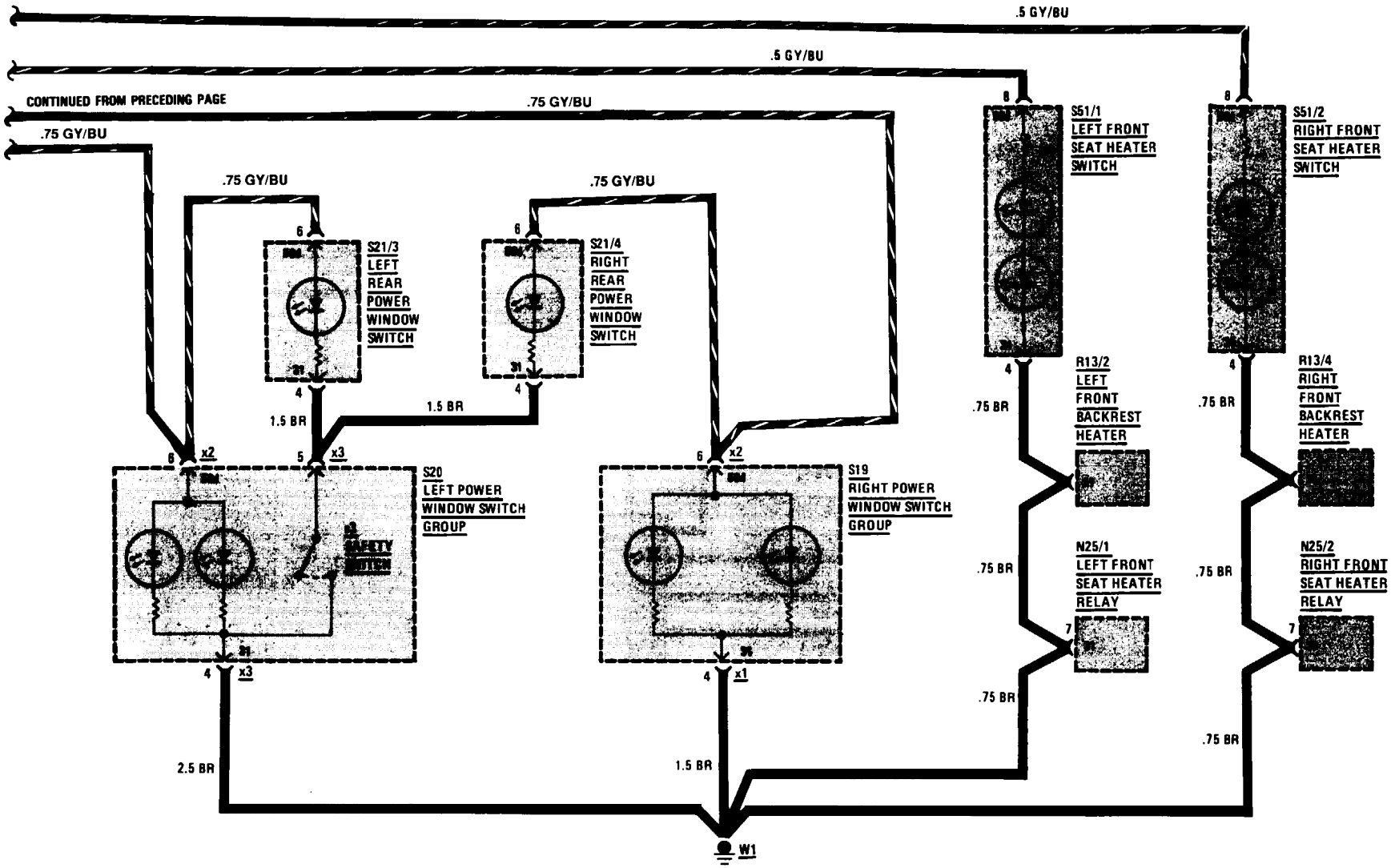
REVISIONS:

ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE

AS OF MY 1987



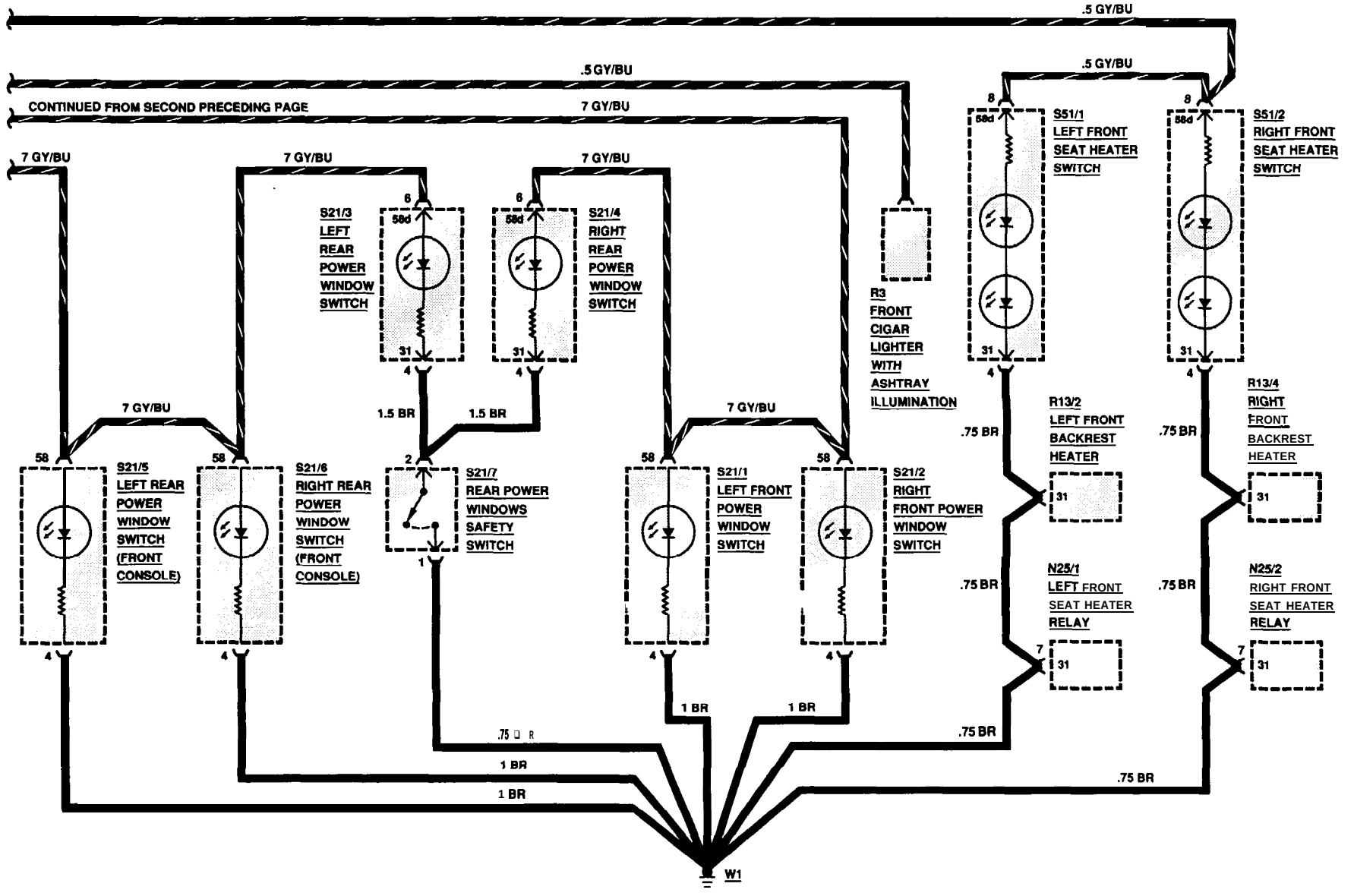
REVISIONS: @AS OF MODEL YEAR 1990 ③ AS OF MY 1990
② AS OF MY 1999 @AS OF MY 1991


.5 GY/BU
.5 GY/BU
CONTINUED FROM PRECEDING PAGE
.75 GY/BU
.75 GY/BU
.75 GY/BU
.75 GY/BU
S21/3 LEFT REAR POWER WINDOW SWITCH
S21/4 RIGHT REAR POWER WINDOW SWITCH
S51/1 LEFT FRONT SEAT HEATER SWITCH
S51/2 RIGHT FRONT SEAT HEATER SWITCH
1.5 BR
1.5 BR
.75 BR
.75 BR
R13/2 LEFT FRONT BACKREST HEATER
R13/4 RIGHT FRONT BACKREST HEATER
.75 BR
.75 BR
N25/1 LEFT FRONT SEAT HEATER RELAY
N25/2 RIGHT FRONT SEAT HEATER RELAY
.75 BR
.75 BR
S20 LEFT POWER WINDOW SWITCH GROUP
S19 RIGHT POWER WINDOW SWITCH GROUP
2.5 BR
1.5 BR
W1

REVISIONS:

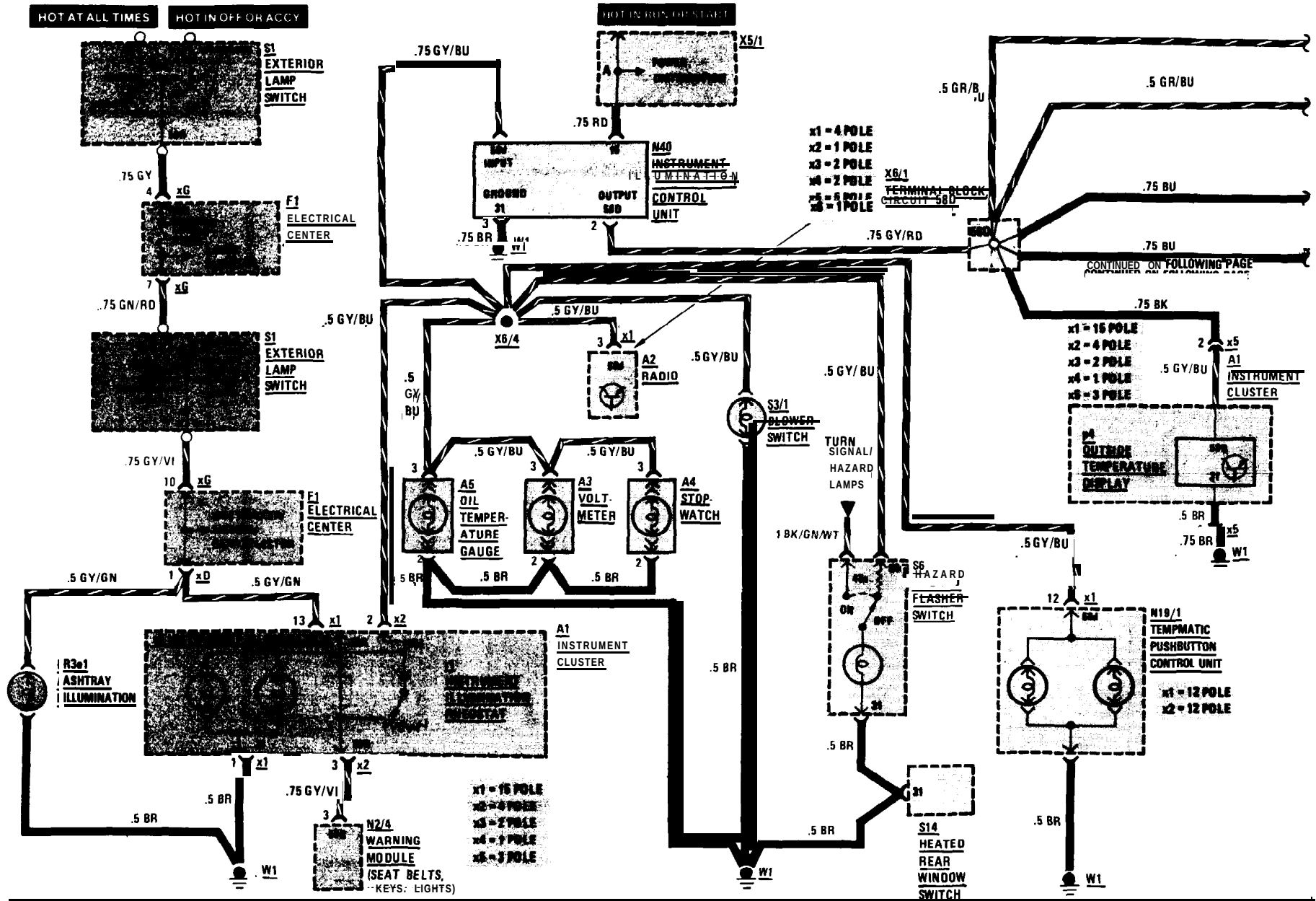
ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE

AS OF MY 1990



REVISION3

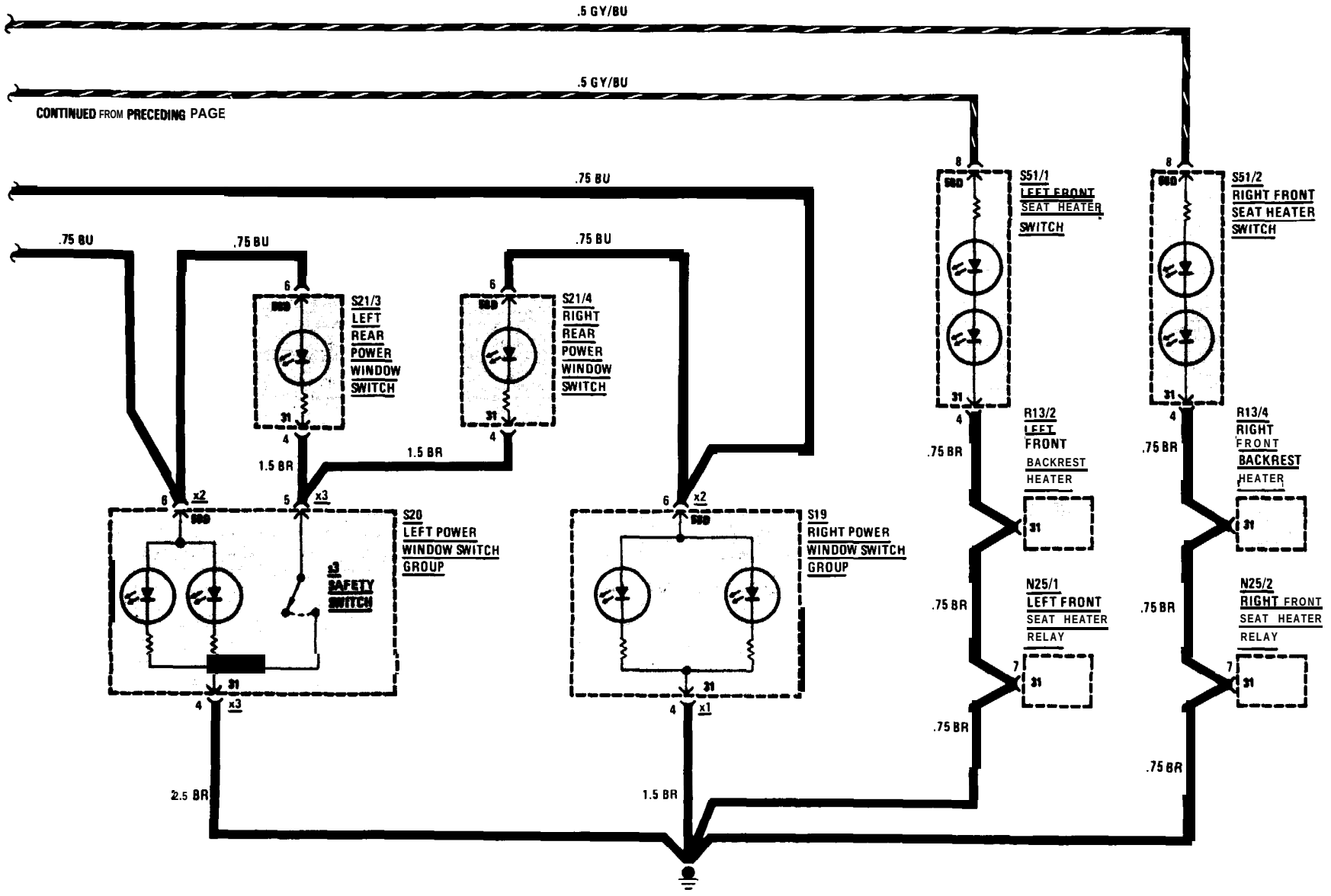
ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE



REVISIONS:

ILLUMINATION: INSTRUMENT CLUSTER/CENTER CONSOLE

MY 1987
190E 2.3-16



REVISIONS:

123/11

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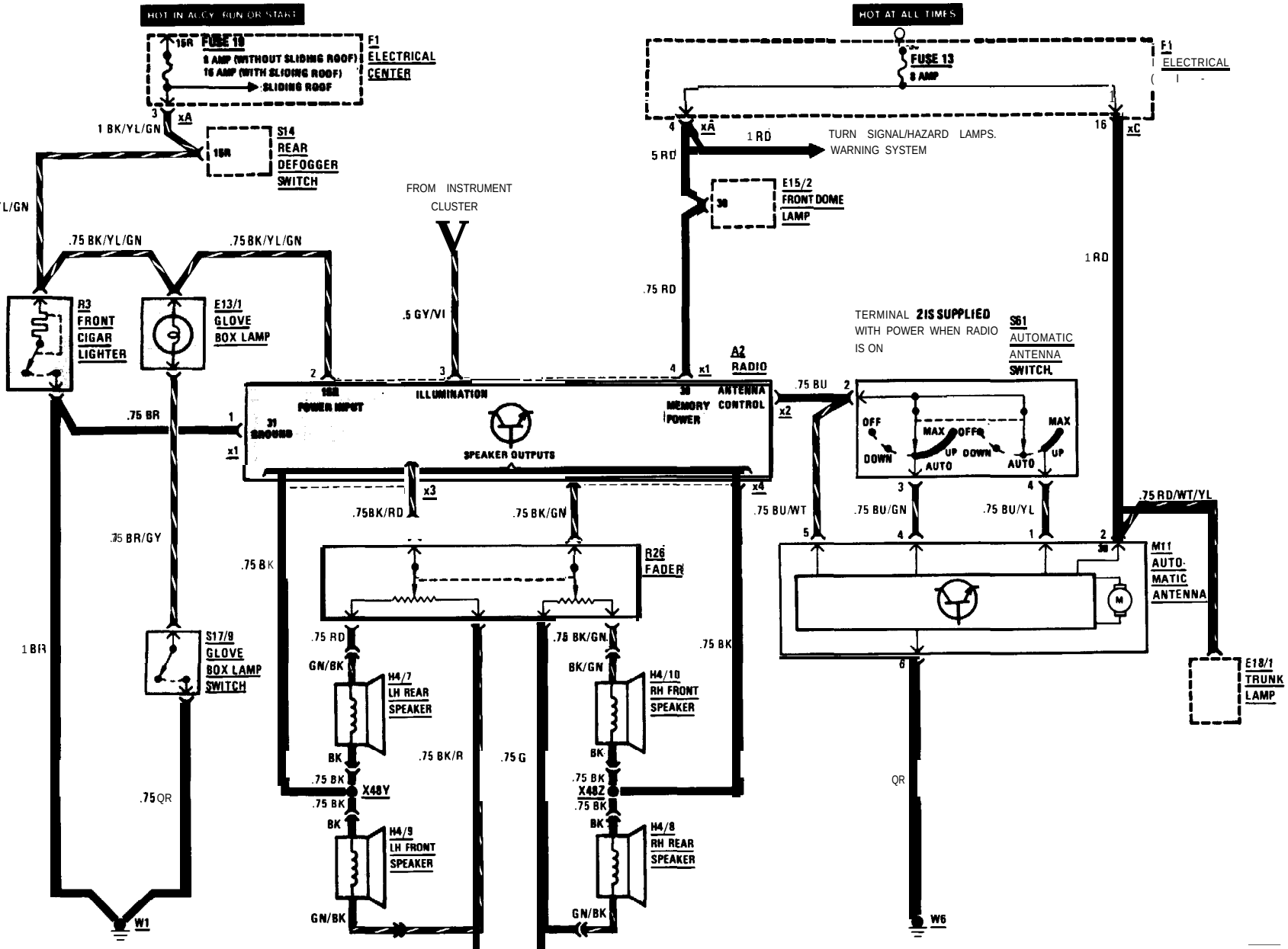
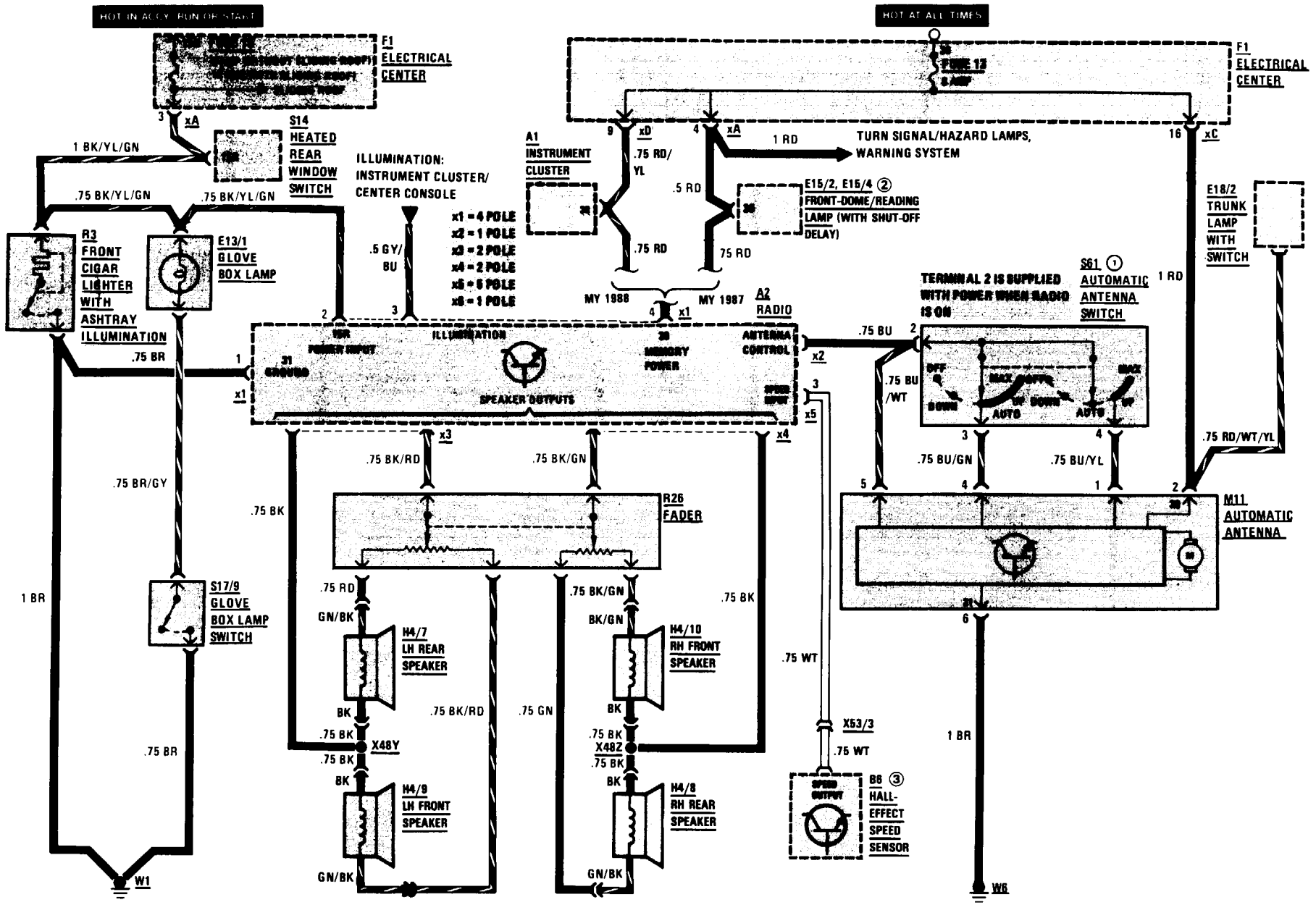
201.0/.1

GLOVE BOX LAMP/CIGAR LIGHTER/RADIO/AUTOMATIC ANTENNA



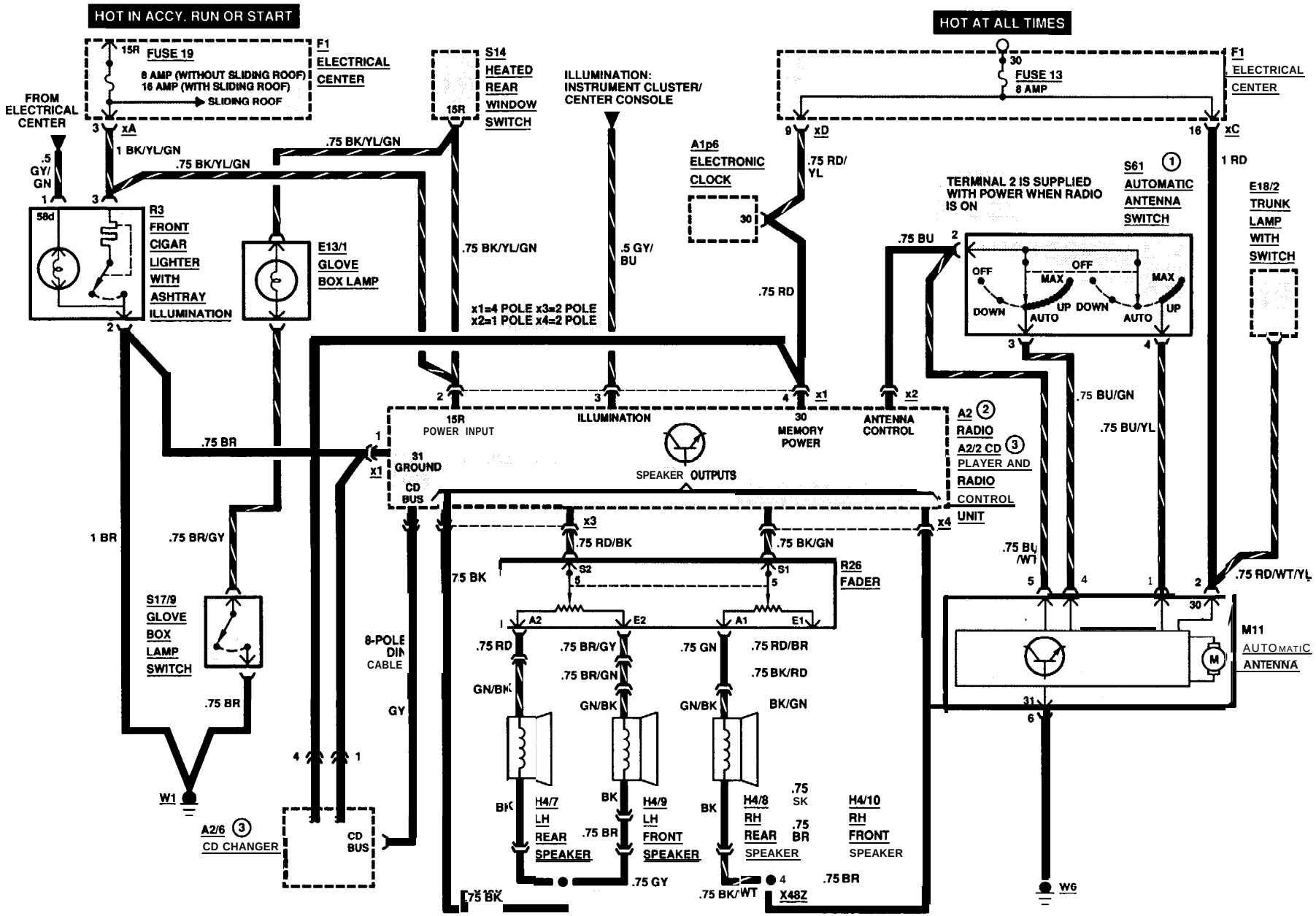
REVISIONS:

GLOVE BOX LAMP/CIGAR LIGHTER/RADIO/AUTOMATIC ANTENNA MY 1987-1989



REVISIONS:
① THE AUTOMATIC ANTENNA SWITCH IS ILLUMINATED FROM THE INSTRUMENT CLUSTER BY MEANS OF A FIBER OPTIC CABLE.
② AS OF MY 1988
③ AS OF MY 1989

GLOVE BOX LAMP/CIGAR LIGHTER/RADIO/AUTOMATIC ANTENNA



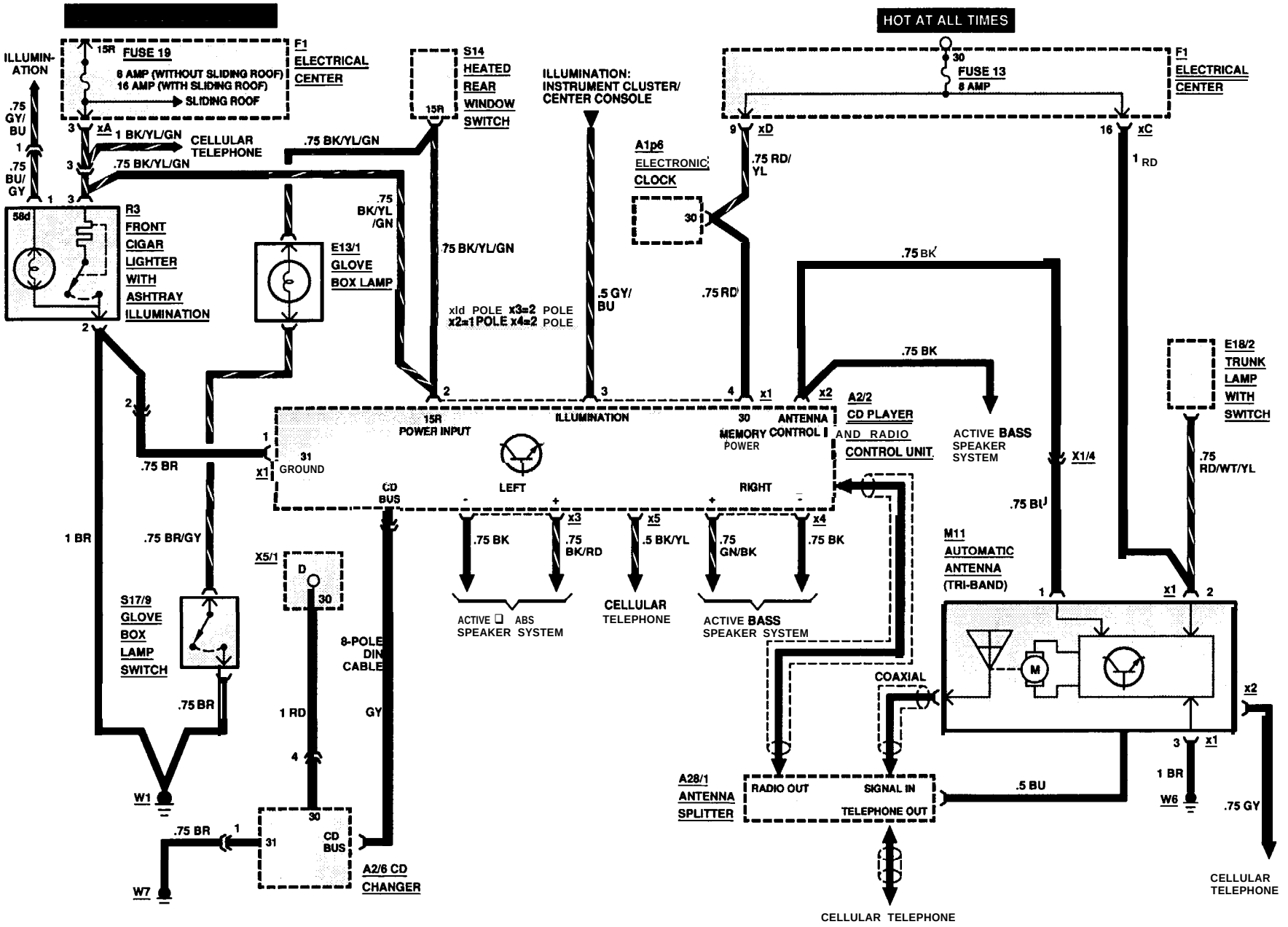
REVISIONS: (1) THE AUTOMATIC ANTENNA SWITCH IS ILLUMINATED FROM THE INSTRUMENT CLUSTER BY MEANS OF A FIBER OPTIC CABLE.

(2) AS OF CHASSIS END NR.F 796944 THE RADIO CONNECTIONS ARE NO LONGER PIG-TAILED

(3) OPTIONAL, MY 1991 PHASE-IN

GLOVE BOX LAMP/CIGAR LIGHTER/RADIO/AUTOMATIC ANTENNA

AS OF MY 1992

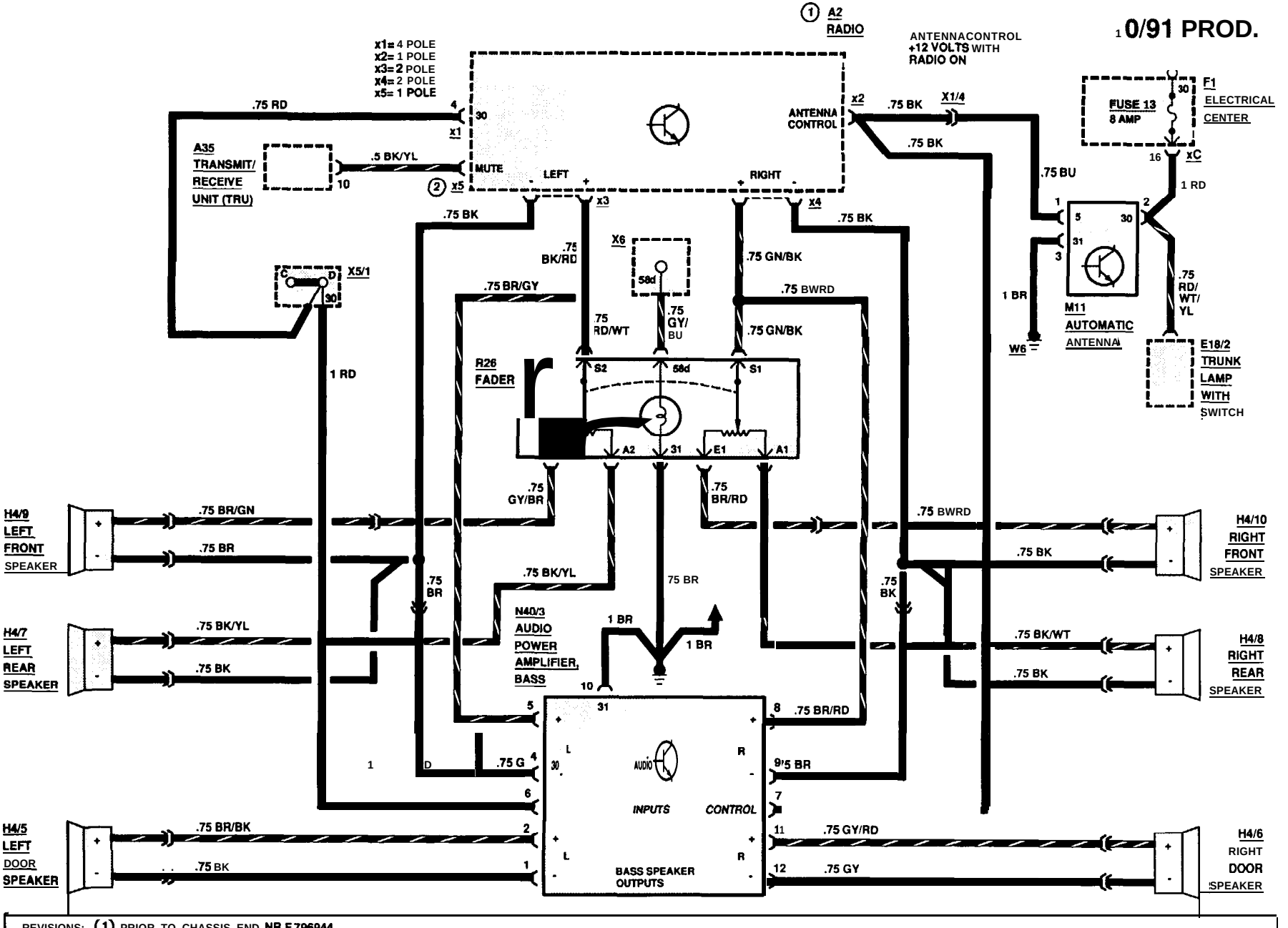


REVISIONS:

ACTIVE BASS SPEAKER SYSTEM

AS OF MY 1991

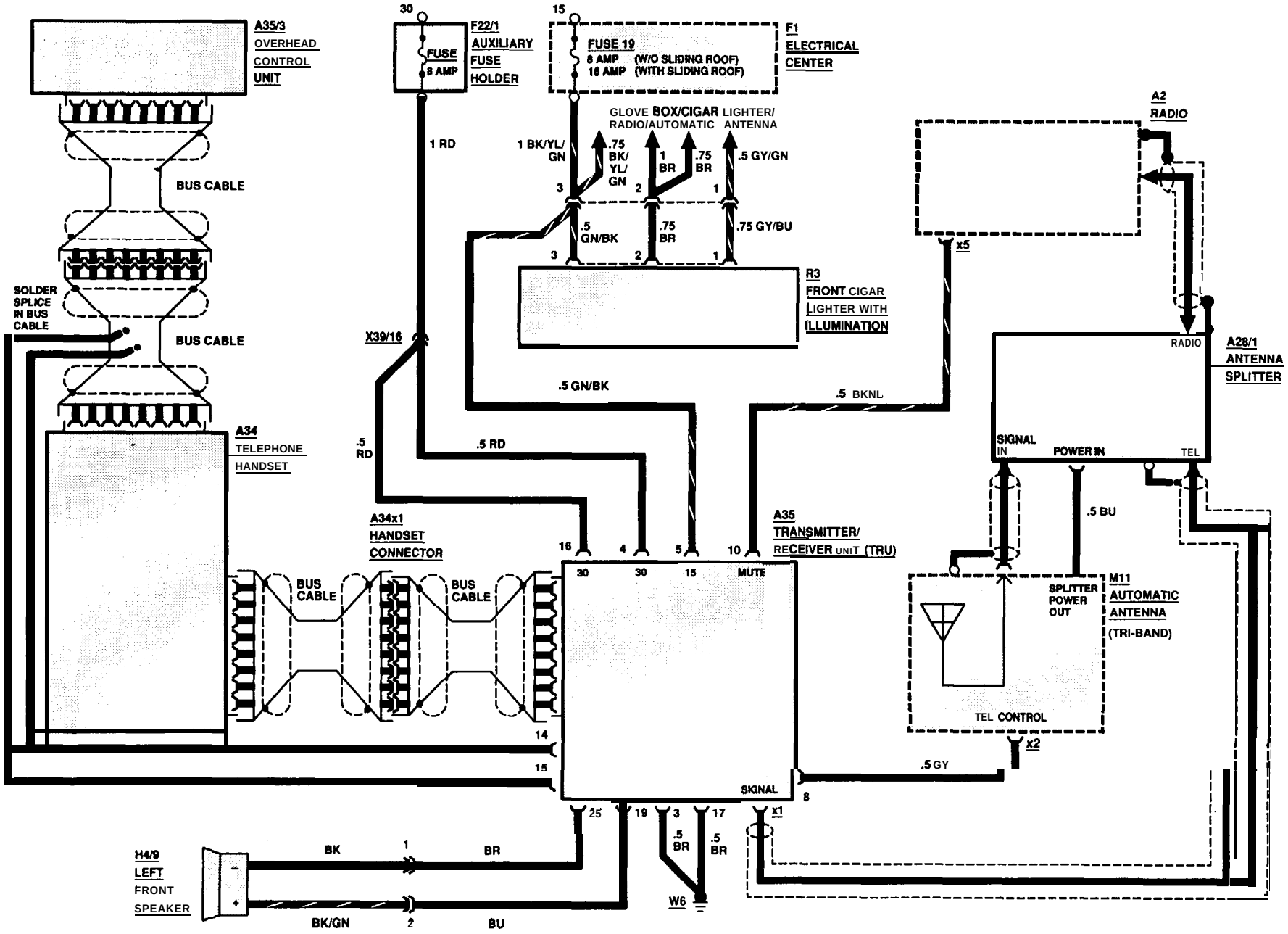
10/91 PROD.



REVISIONS: (1) PRIOR TO CHASSIS END NR.F796944 RADIO CONNECTIONS ARE PIG-TAILED

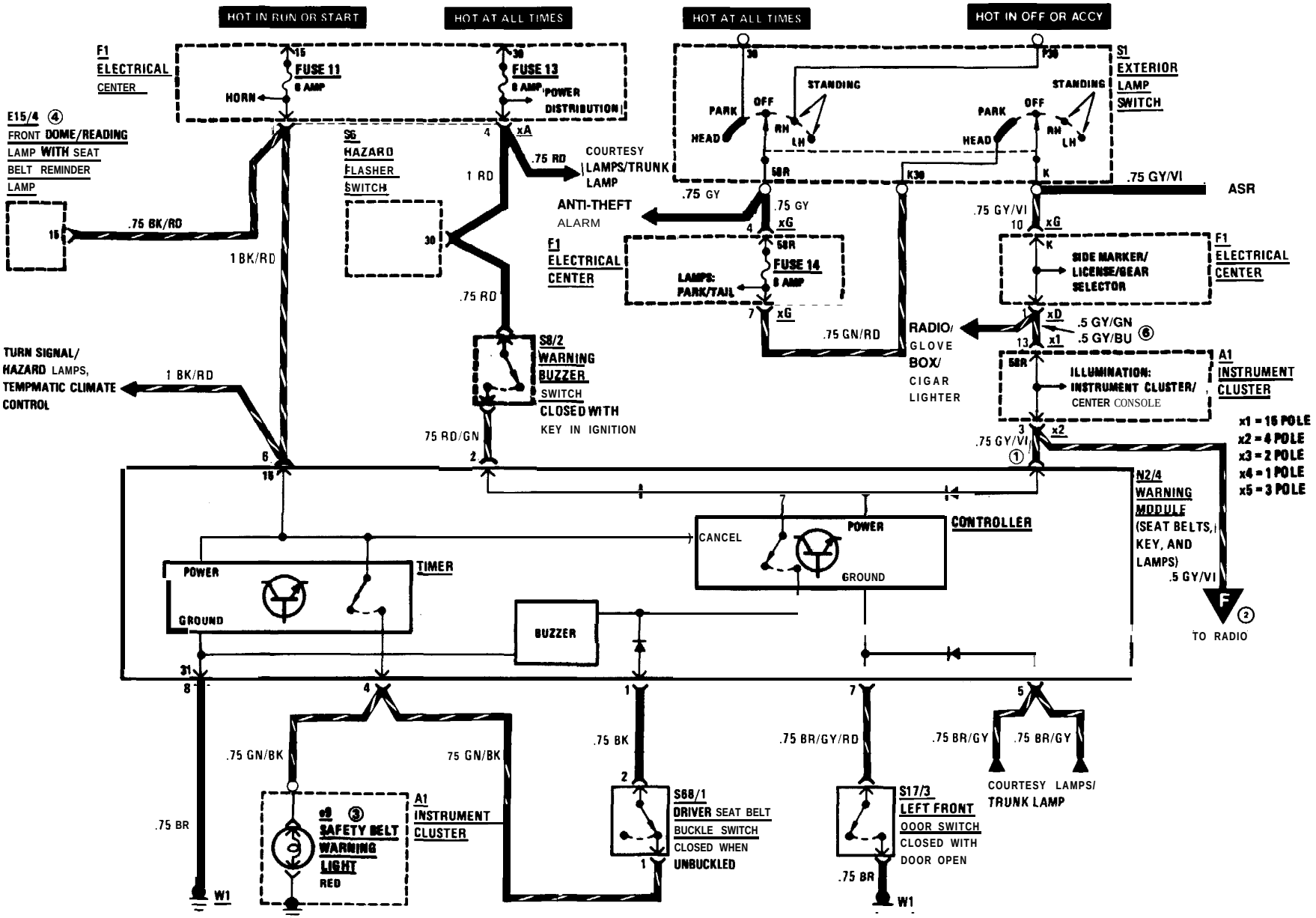
(8) AS OF MY 1992

CELLULAR TELEPHONE



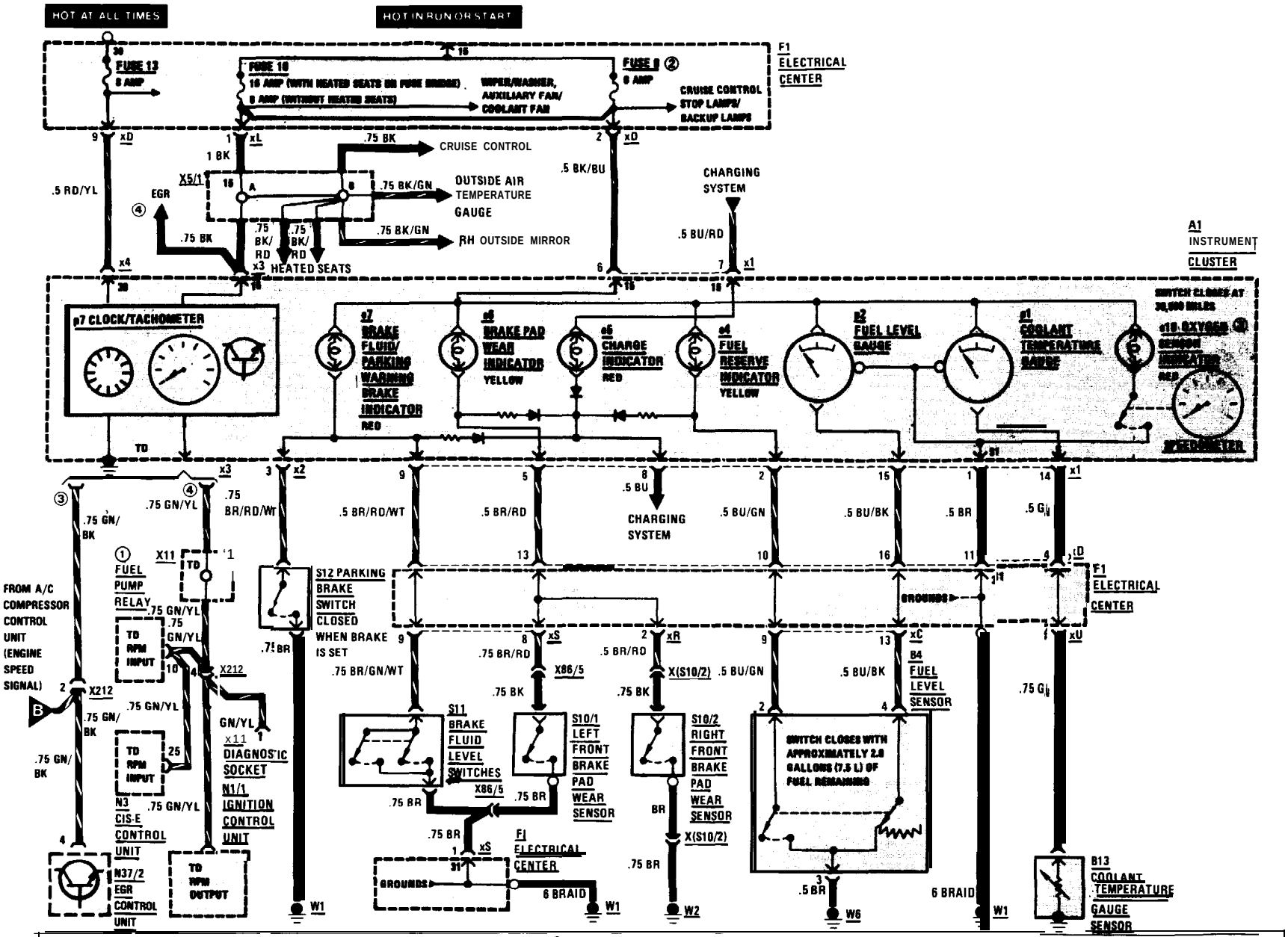
REVISIONS:

WARNING SYSTEM



REVISIONS: ① UP TO MODEL YEAR 1986 PIN 4
AS OF MODEL YEAR 1987 PIN 3
② MODEL 1986 ONLY
③ MODEL YEARS 1989 AND 1987
④ AS OF MY 1988
@AS OF MY 1986
⑥ AS OF MY 1990

WARNING INDICATORS/GAUGES/CLOCK/TACHOMETER



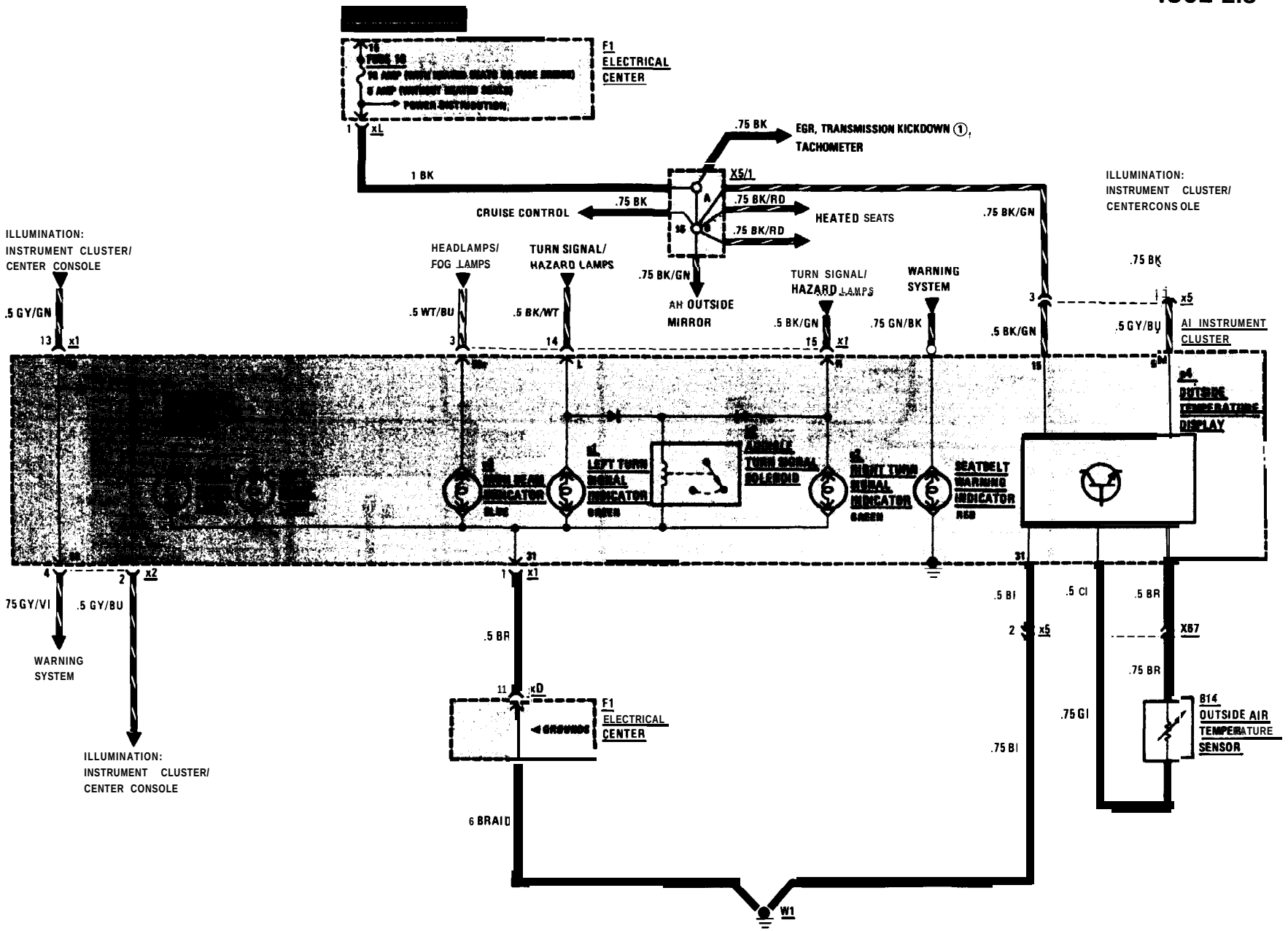
REVISIONS: ① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)

② UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

③ GASOLINE

④ DIESEL

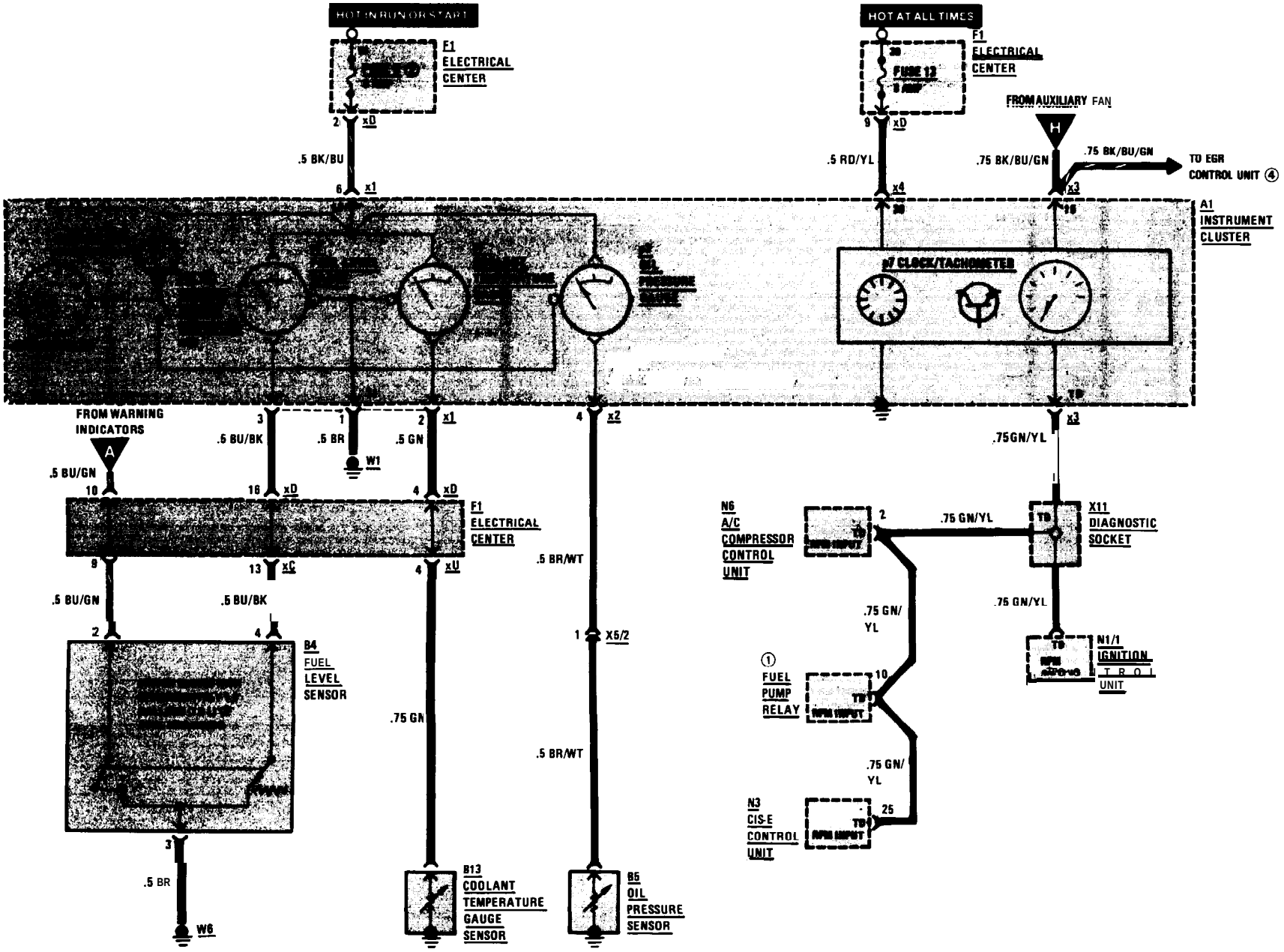
WARNING INDICATORS/GAUGES



201.0/.1

127/1

REVISIONS: ①DIESEL

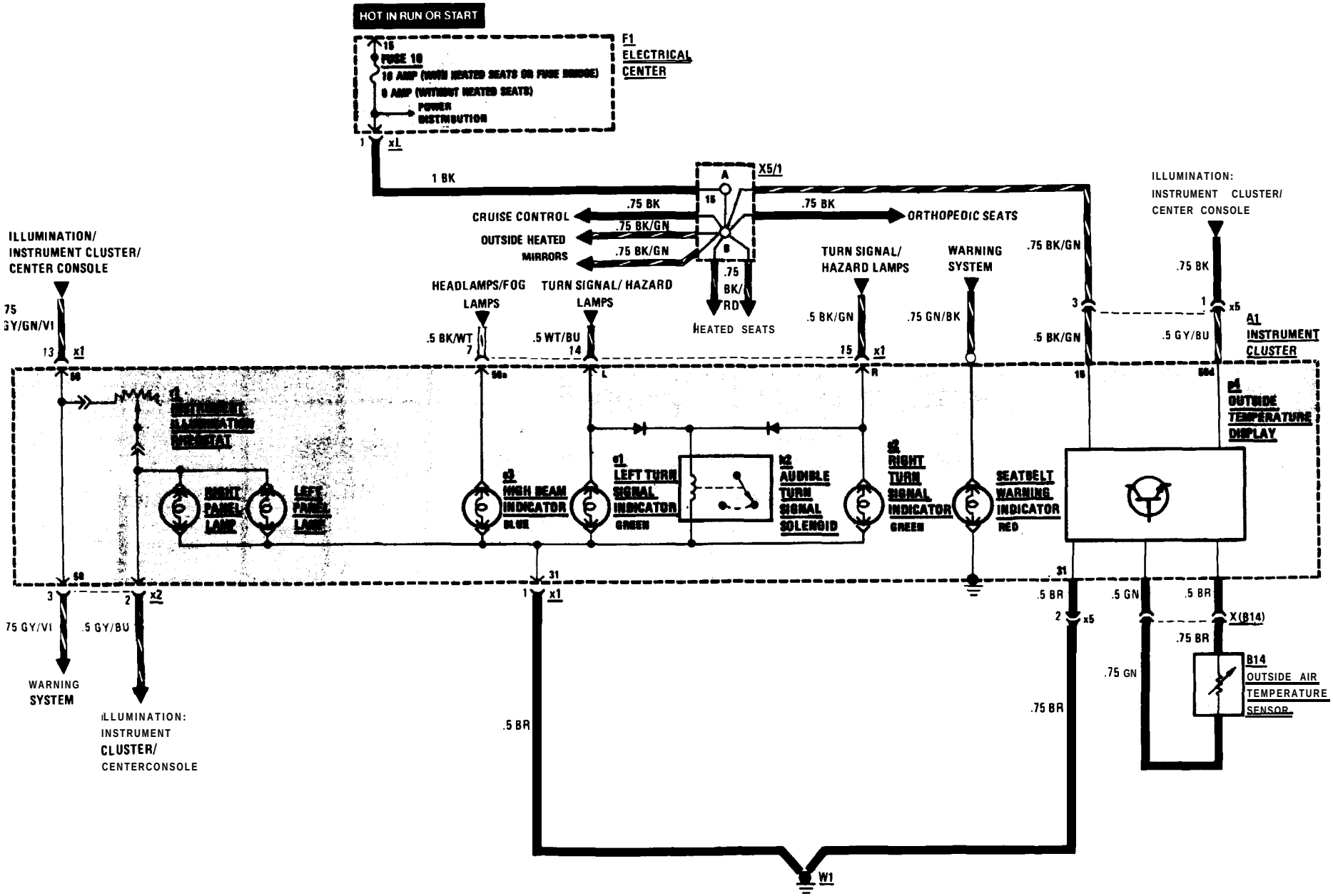


REVISIONS: ① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION1

② UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

③ GASOLINE

④ DIESEL

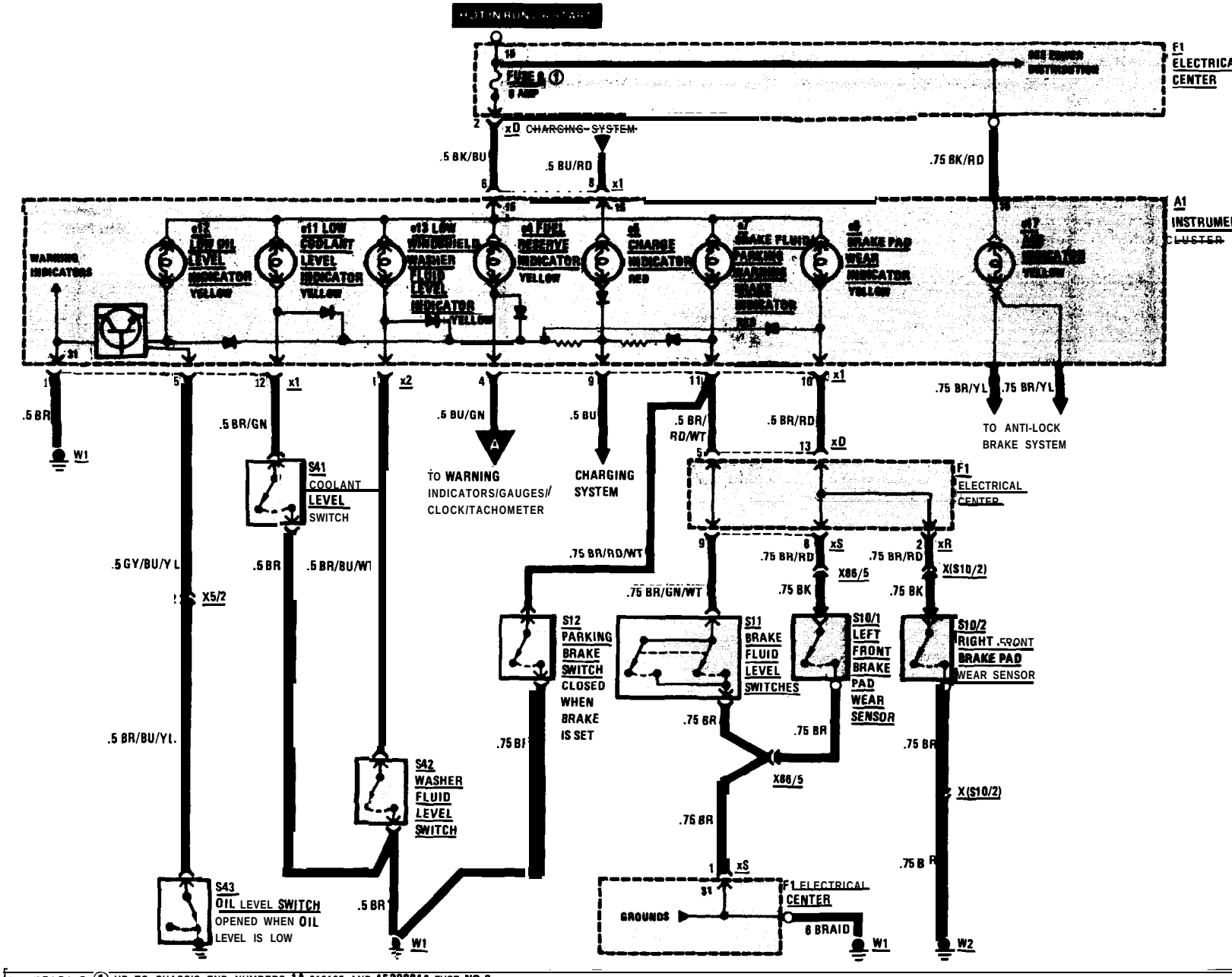


201.0/.1

127/3

REVISIONS:

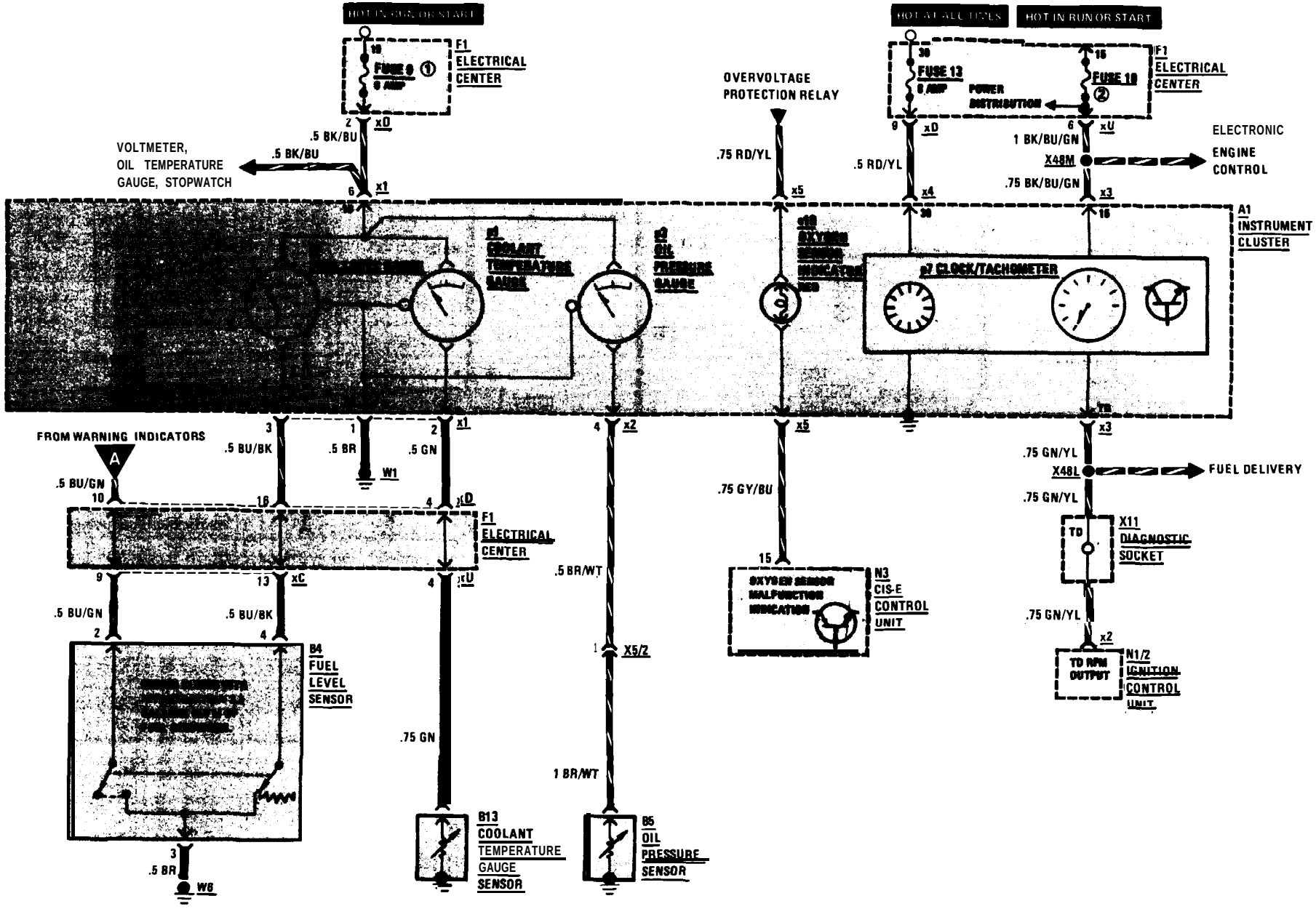
WARNING INDICATORS



REVISIONS: ① UP TO CHASSIS END NUMBERS 1A 313125 AND 1F229814 FUSE NO.9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO.9 AND 10

WARNING INDICATORS/GAUGES/CLOCK/TACHOMETER

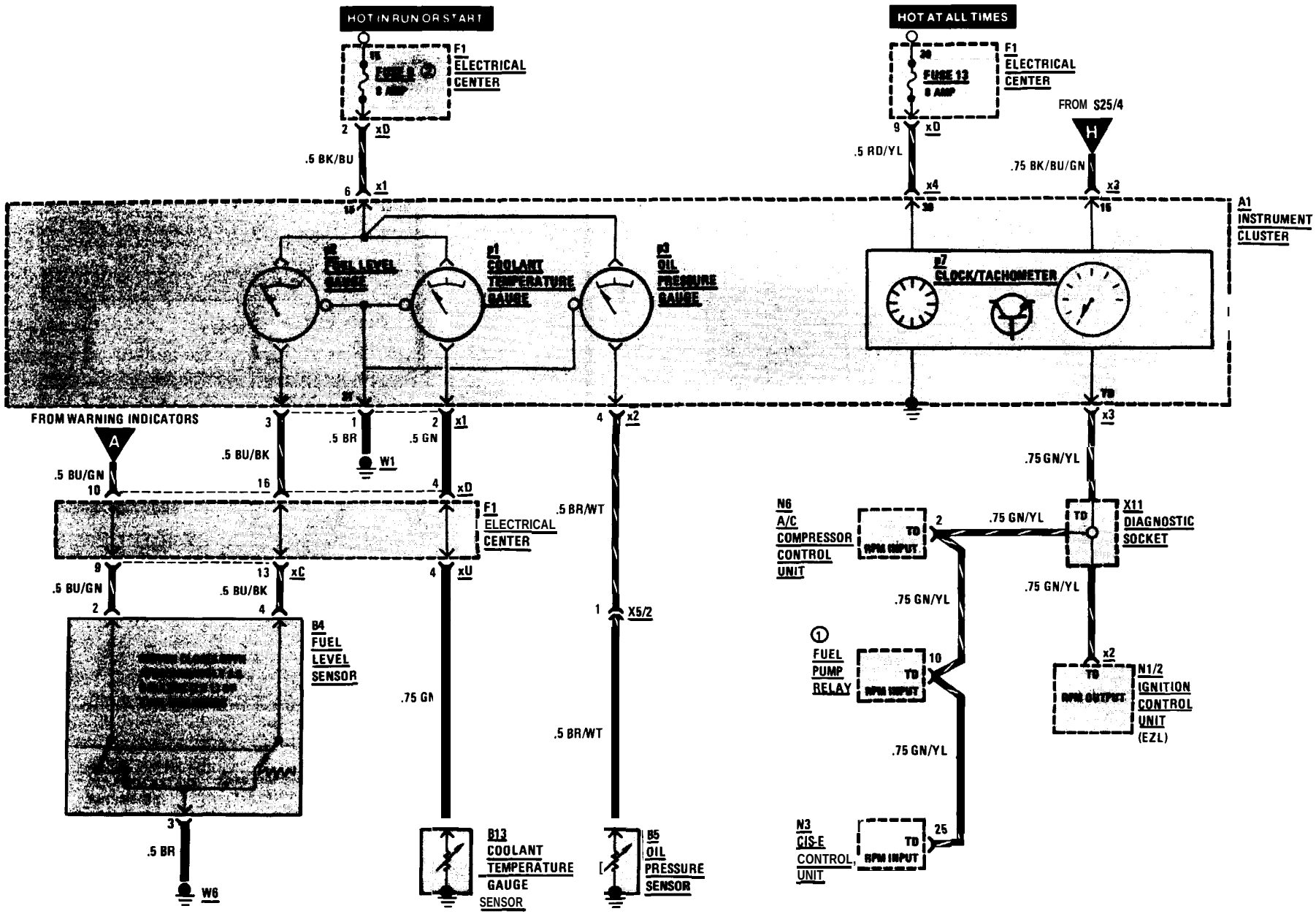
MY 1986
190E 2.3-16



REVISIONS: ① UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 228814 FUSE NO. 8 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

② 16 AMP (WITH HEATED SEATS OR FUSE BRIDGE)
8 AMP (WITHOUT HEATED SEATS)

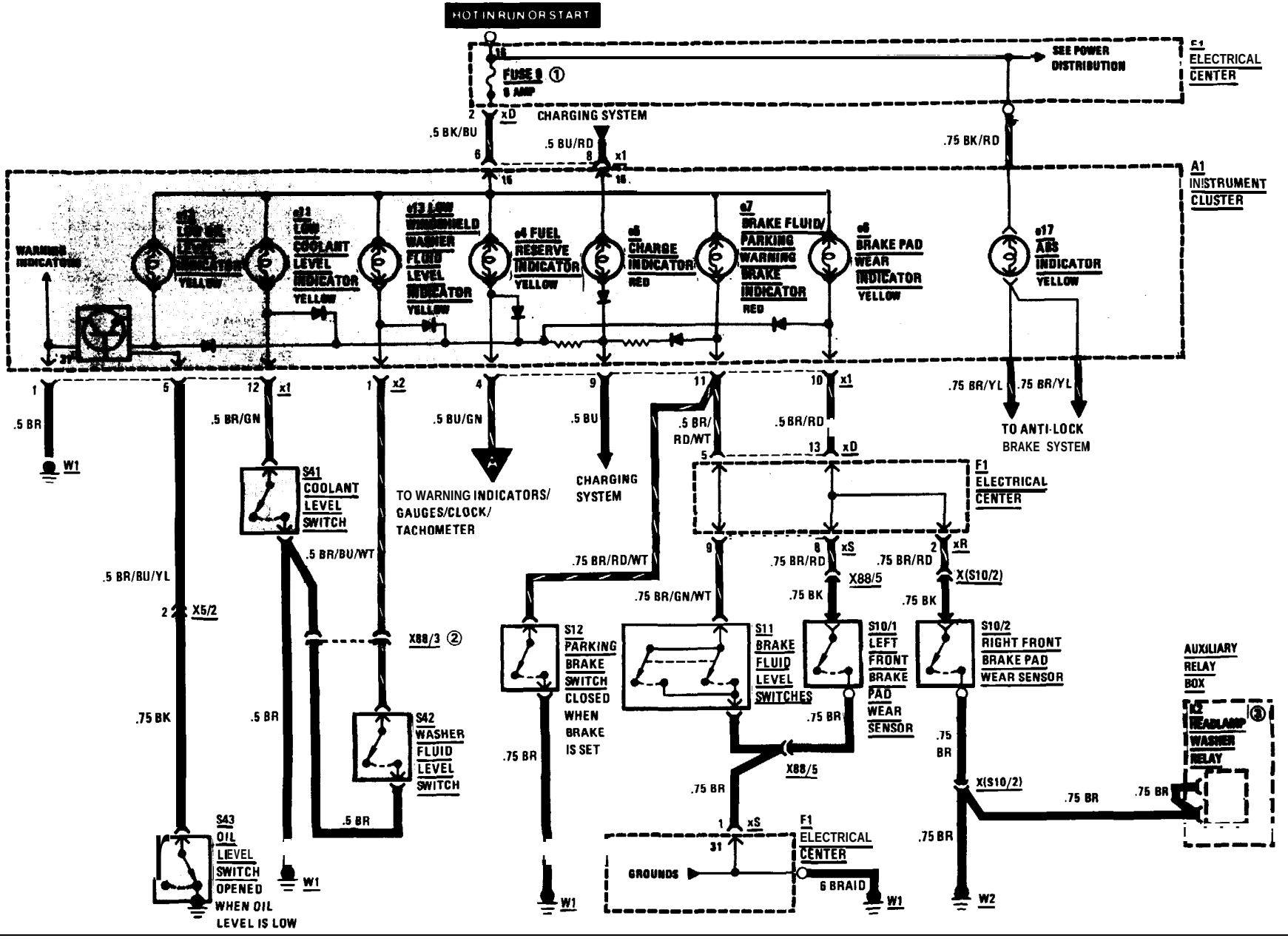
WARNING INDICATORS/GAUGES/CLOCK/TACHOMETER



REVISIONS: ① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)

② UP TO CHASSIS END NUMBERS 1A 313825 AN0 IF 229914 FUSE NO. 9 IS REMOVED AND A **BRIDGE** IS **INSTALLED** BETWEEN FUSE NO. 9 AN 10

WARNING INDICATORS



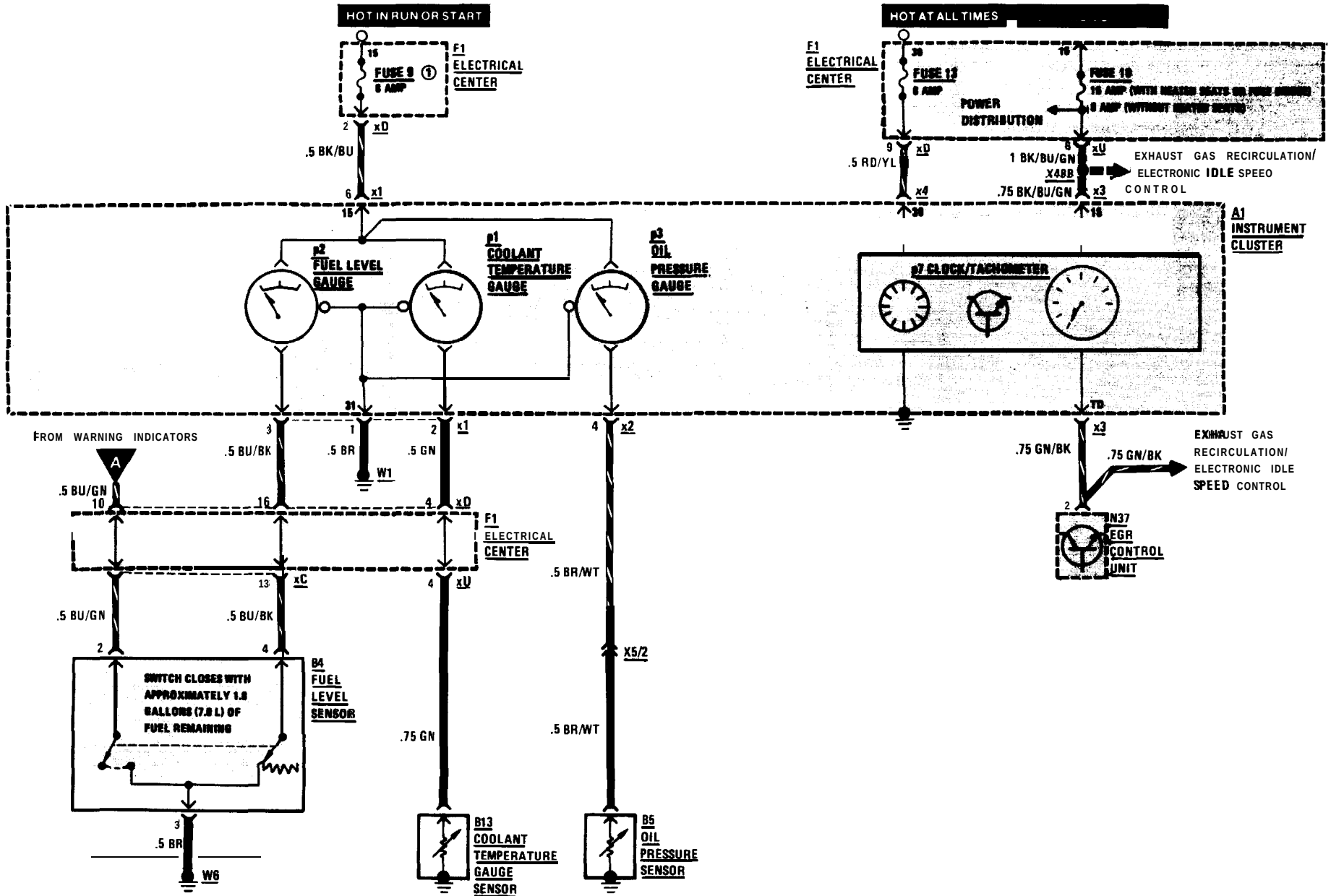
REVISIONS: ① UP TO CHASSIS **END** NUMBERS **1A** 313925 AND **1F 229814** FUSE NO. 9 IS REMOVED AND A **BRIDGE** IS **INSTALLED** BETWEEN FUSE NO. 9 AN0 IO

② MODEL 201.129 **ONLY**

③ AS OF **MY** 1997, MODEL 201.034

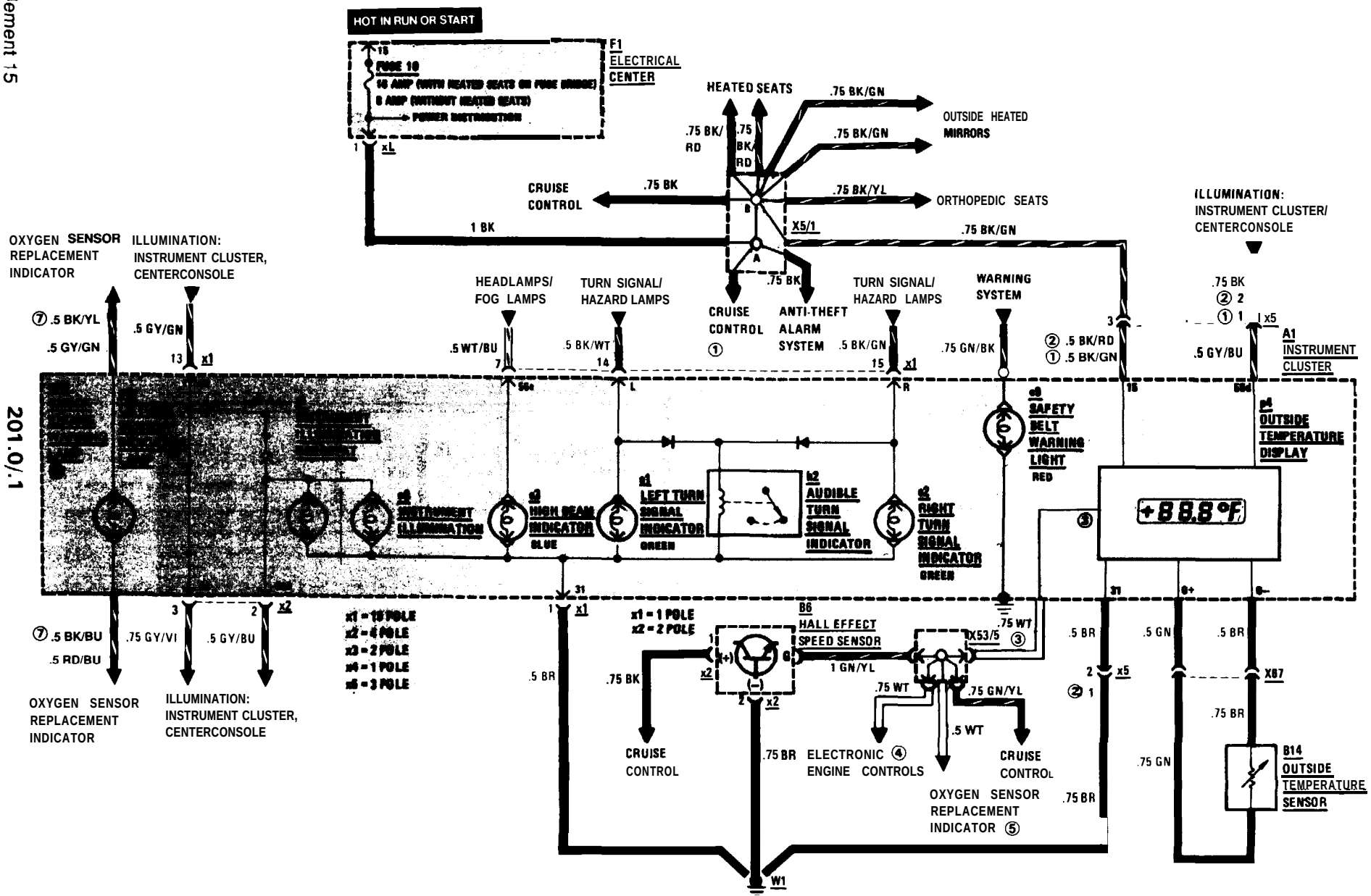
WARNING INDICATORS/GAUGES/CLOCK/TACHOMETER

MY 1986
190D 2.5

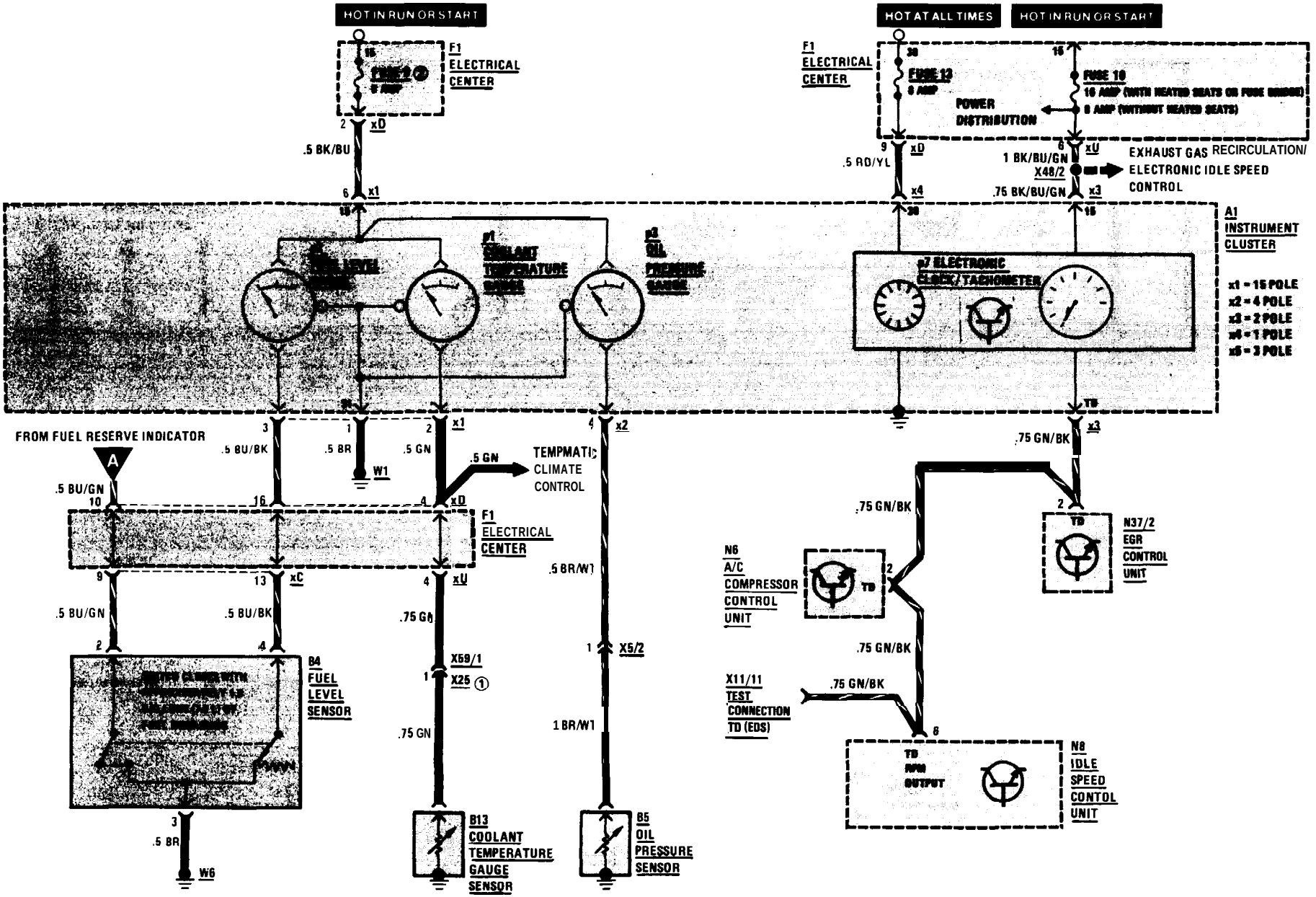


REVISIONS: ① UP TO CHASSIS END NUMBERS **1A313825** AND **1F** 229814 FUSE NO. 9 IS REMOVED AND A **BRIDGE** IS INSTALLEO BETWEEN FUSE NO. 9 AN0 10

WARNING INDICATORS/GAUGES



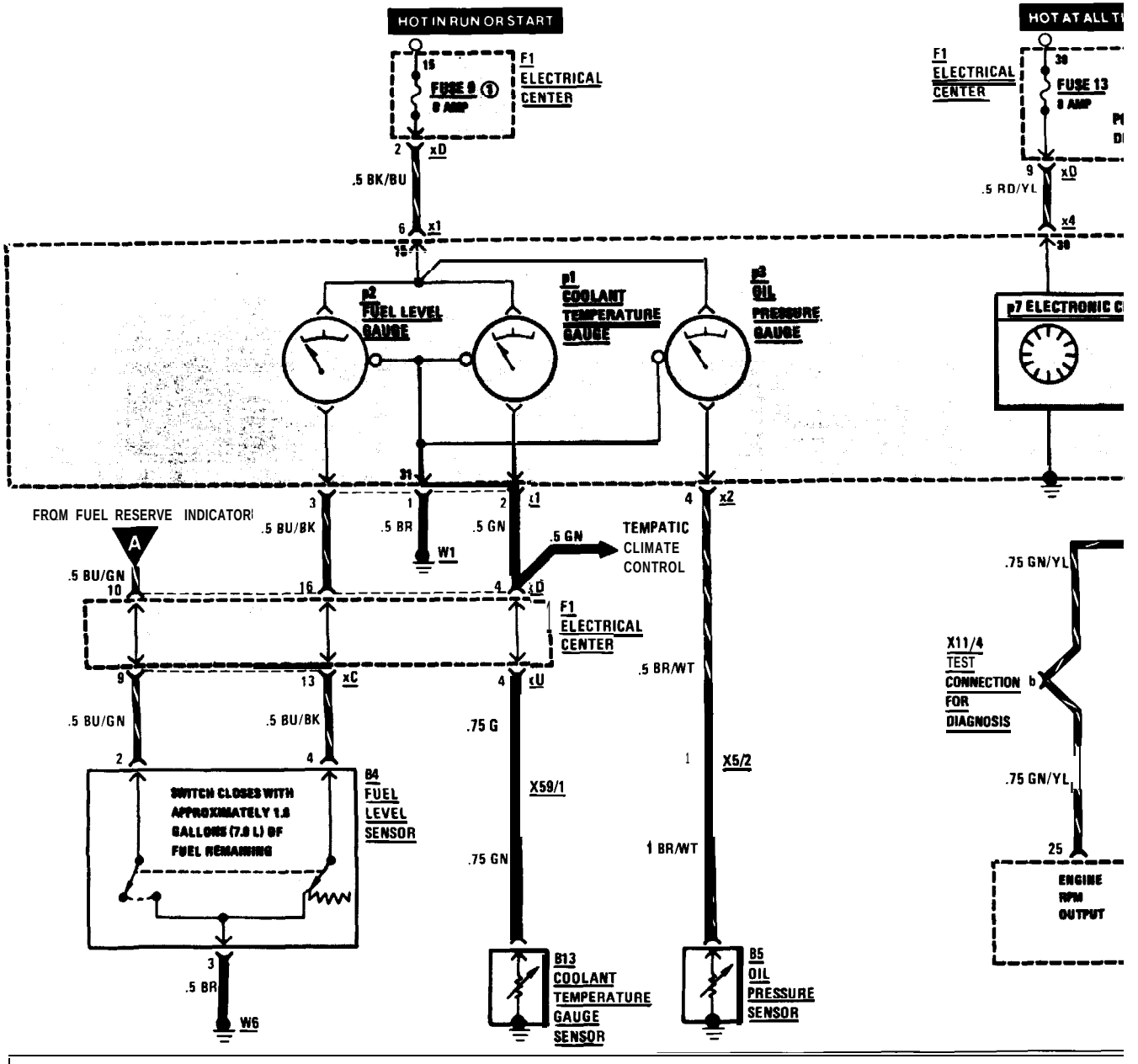
REVISIONS: ① MODEL YEAR 1986
② MODEL YEAR 1987
@ OUTSIDE TEMPERATURE DISPLAY WITH SPEED DEPENDENT READOUT; 201.029 ONLY
④ GASOLINE
⑤ AS OF MY 1992, 201.028 CALIFORNIA
⑥ AS OF MY 1992, EXCEPT MY 1992 FEDERAL
⑦ UP TO MY 1992



REVISIONS: ① AS OF **MY 1988**

② UP To CHASSIS **END** NUMBERS **1A** 313925 AND **1F 229814** FUSE NO. 9 IS REMOVED **AND** A BRIDGE IS **INSTALLED BETWEEN** FUSE No. 9 AND 10

WARNING INDICATORS/GAUGES/CLOCK/TACHOMETER

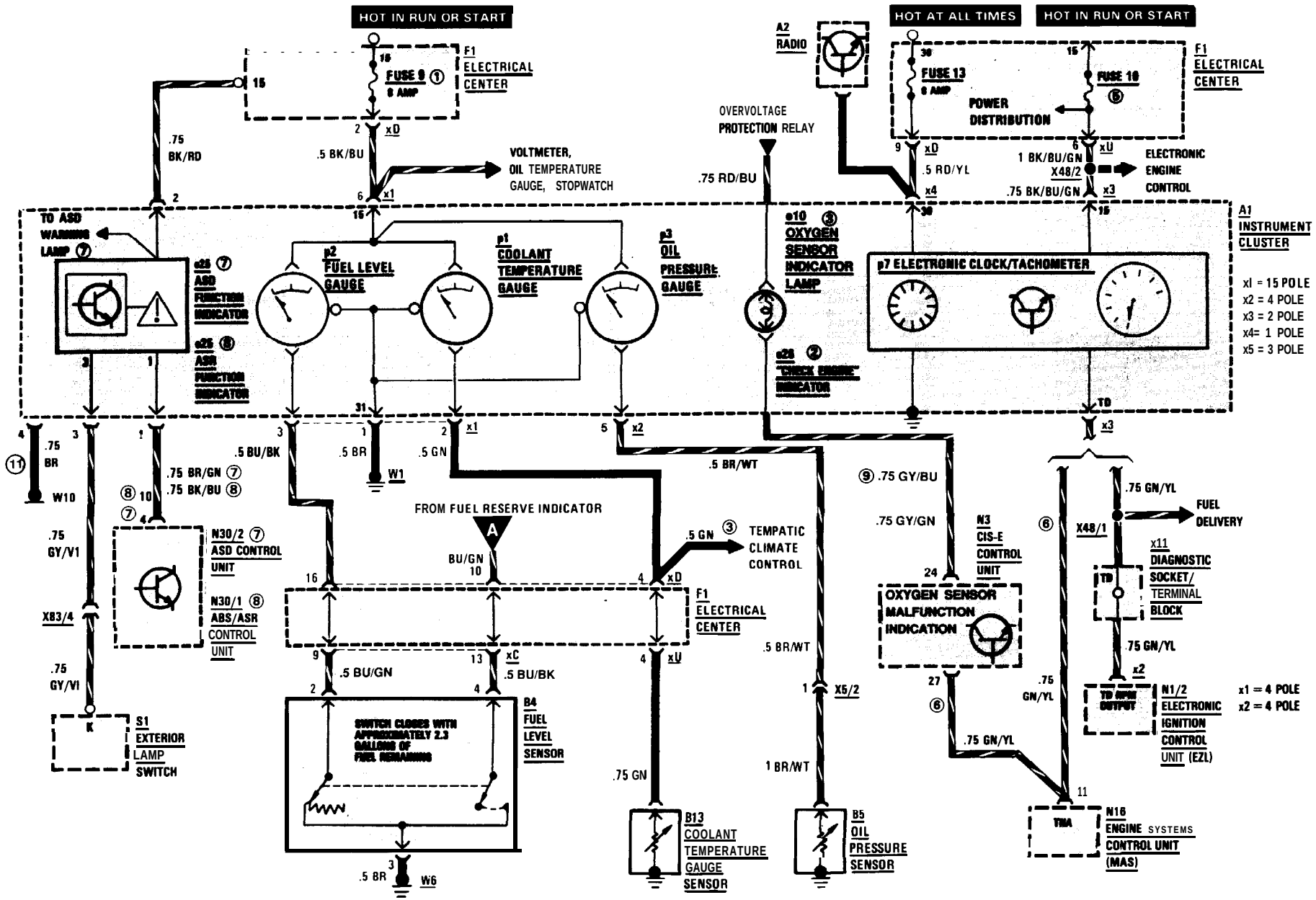


REVISIONS: ① UP TO CHASSIS END NUMBERS 1A 313125 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. B AND 10

WARNING INDICATORS/GAUGES/CLOCK/TACHOMETER

AS OF MY 1987

GASOLINE



REVISIONS:

① UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

② AS OF 1988

③ MY 1987

④ 201.034 ONLY

⑤ 16 AMP (WITH HEATED SEATS OR FUSE BRIDGE) 8 AMP (WITHOUT HEATED SEATS)

⑥ AS OF MY 1990

⑦ WITH ASD

⑧ WITH ASR

⑨ UP TO MY 1992

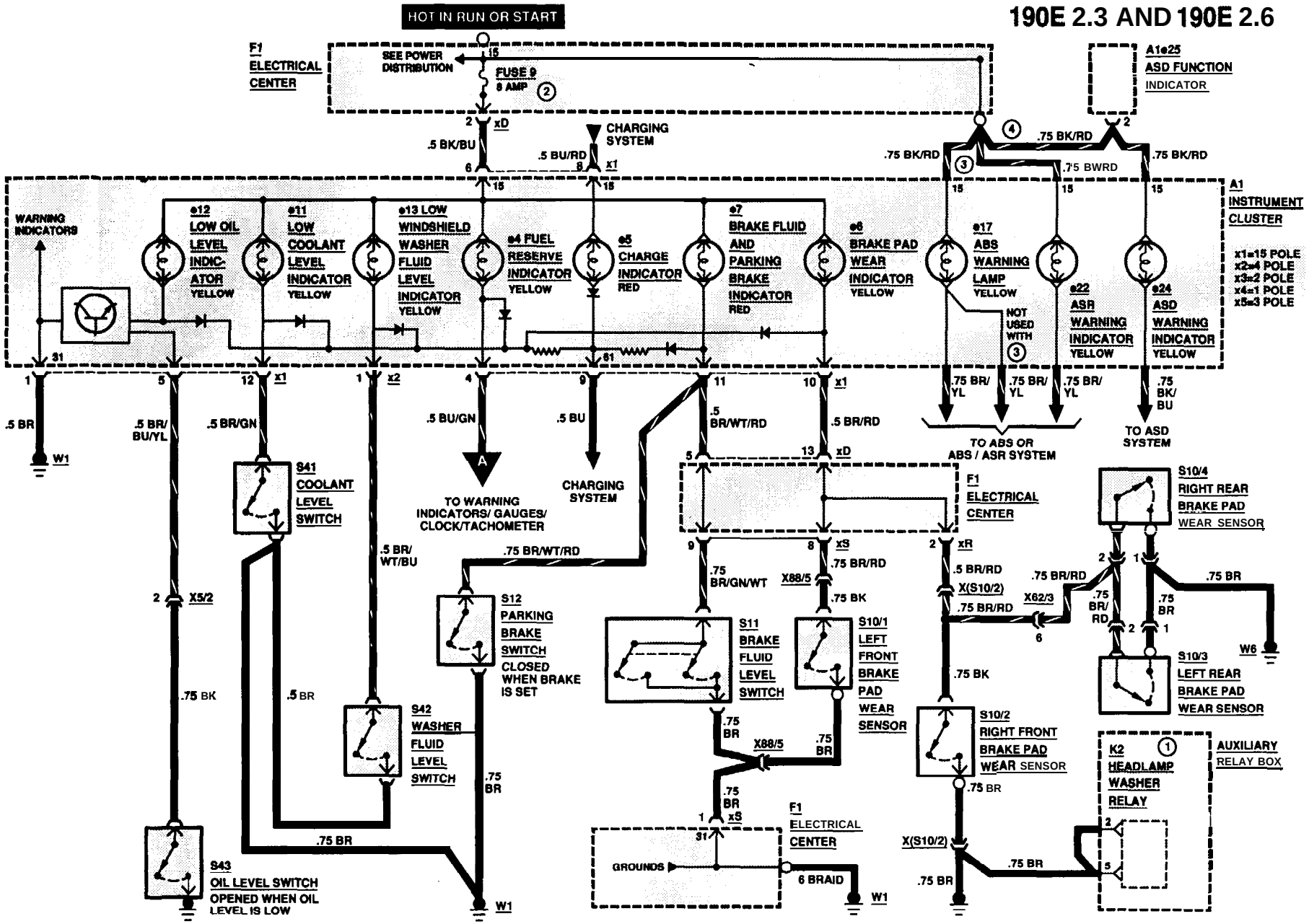
⑩ UP TO MY 1989

⑪ WIRE AND FEMALE CONNECTOR EXIST IN HARNESS, BUT SERVE NO FUNCTION

WARNING INDICATORS

AS OF MY 1987

190E 2.3 AND 190E 2.6



REVISIONS: (1) MODEL 201.028 ONLY

(2) UP TO CHASSIS END NUMBERS **1A** 313325 AND IF 223514 FUSE NO.0 IS REMOVED AND A **BRIDGE** IS INSTALLED BETWEEN FUSE NO.9 AND 10

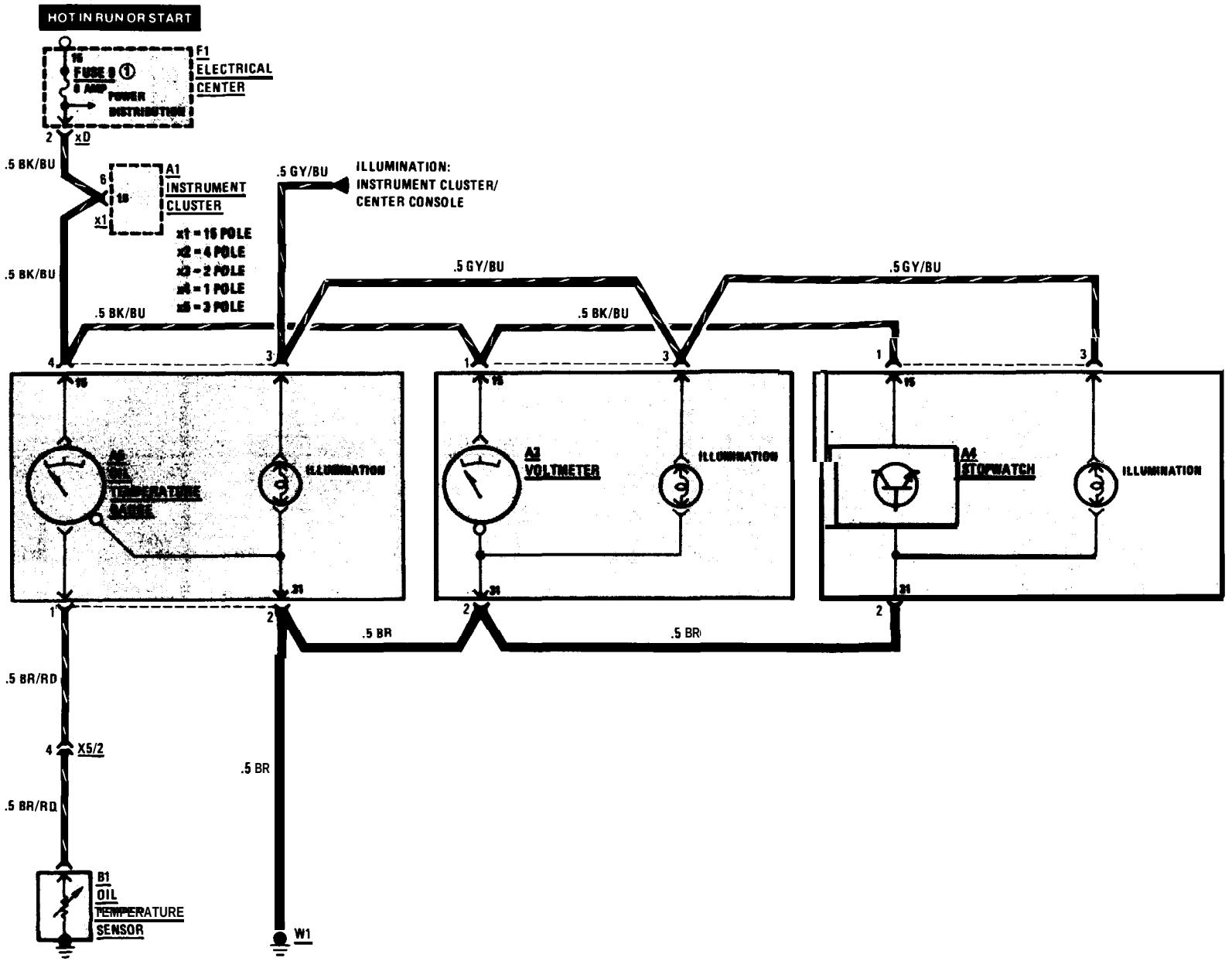
(3) VEHICLES WITH ASR

(4) VEHICLES WITH ASD

CENTER CONSOLE: OIL TEMPERATURE GAUGE/STOPWATCH/VOLTMETER AS OF MY 1986

190E 2.3-16

128

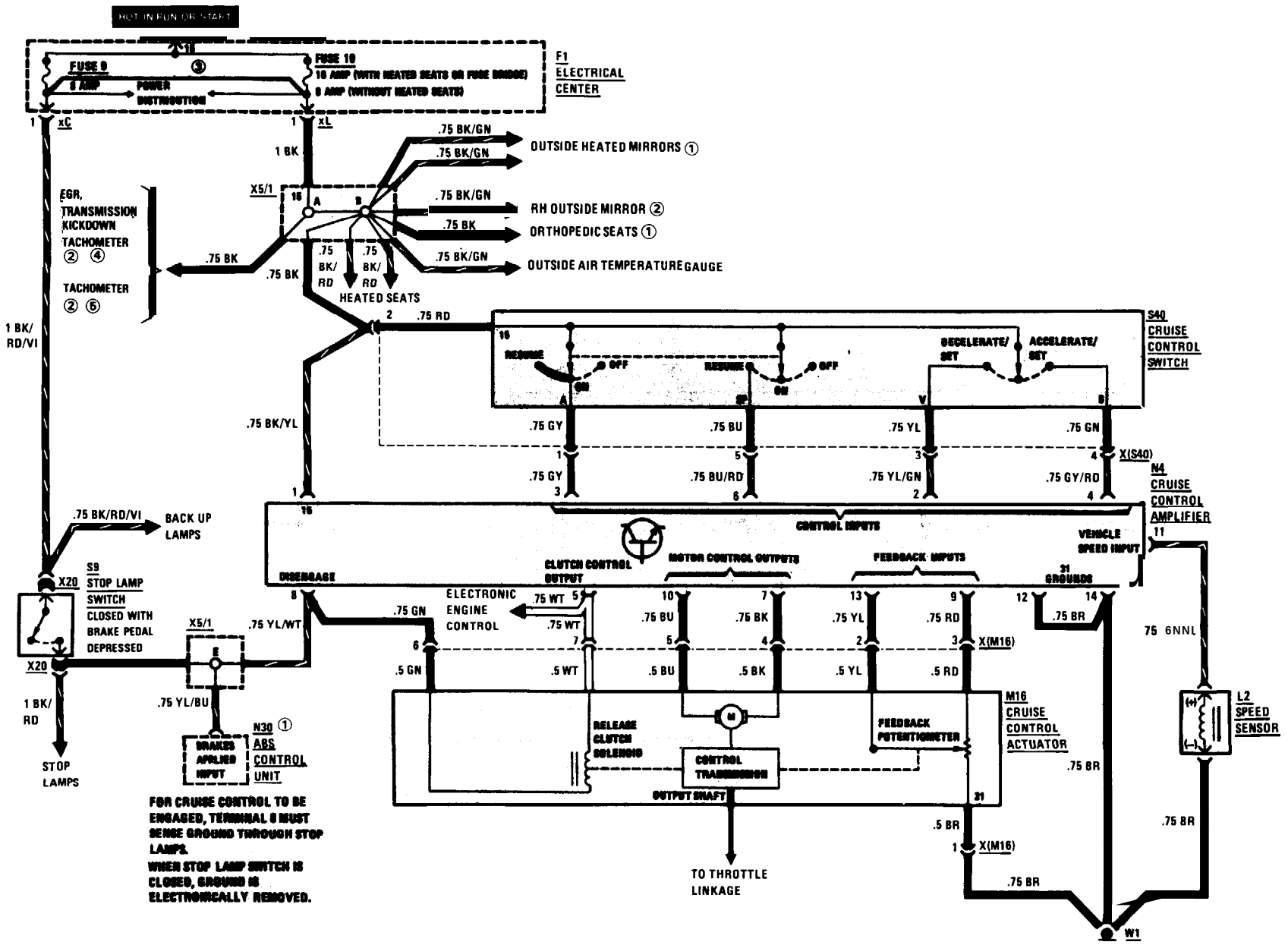


REVISIONS: ① UP TO CHASSIS END NUMBERS **1A** 313925 **AND 1F** 229814 FUSE NO. 9 IS REMOVED **AND A BRIDGE** IS INSTALLED BETWEEN FUSE NO. 9 AND 10

201.034

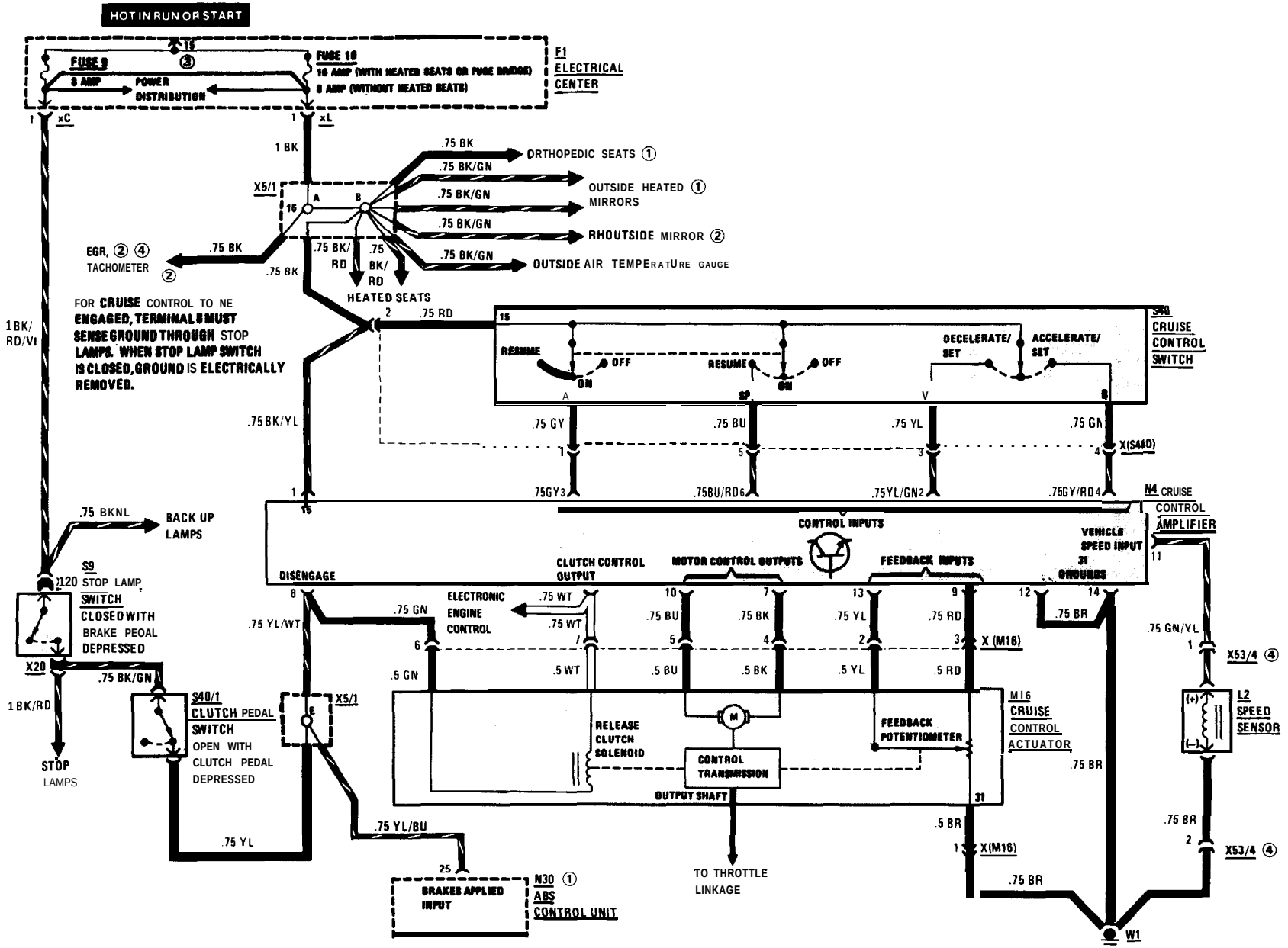
12/87

CRUISE CONTROL (WITH AUTOMATIC TRANSMISSION)



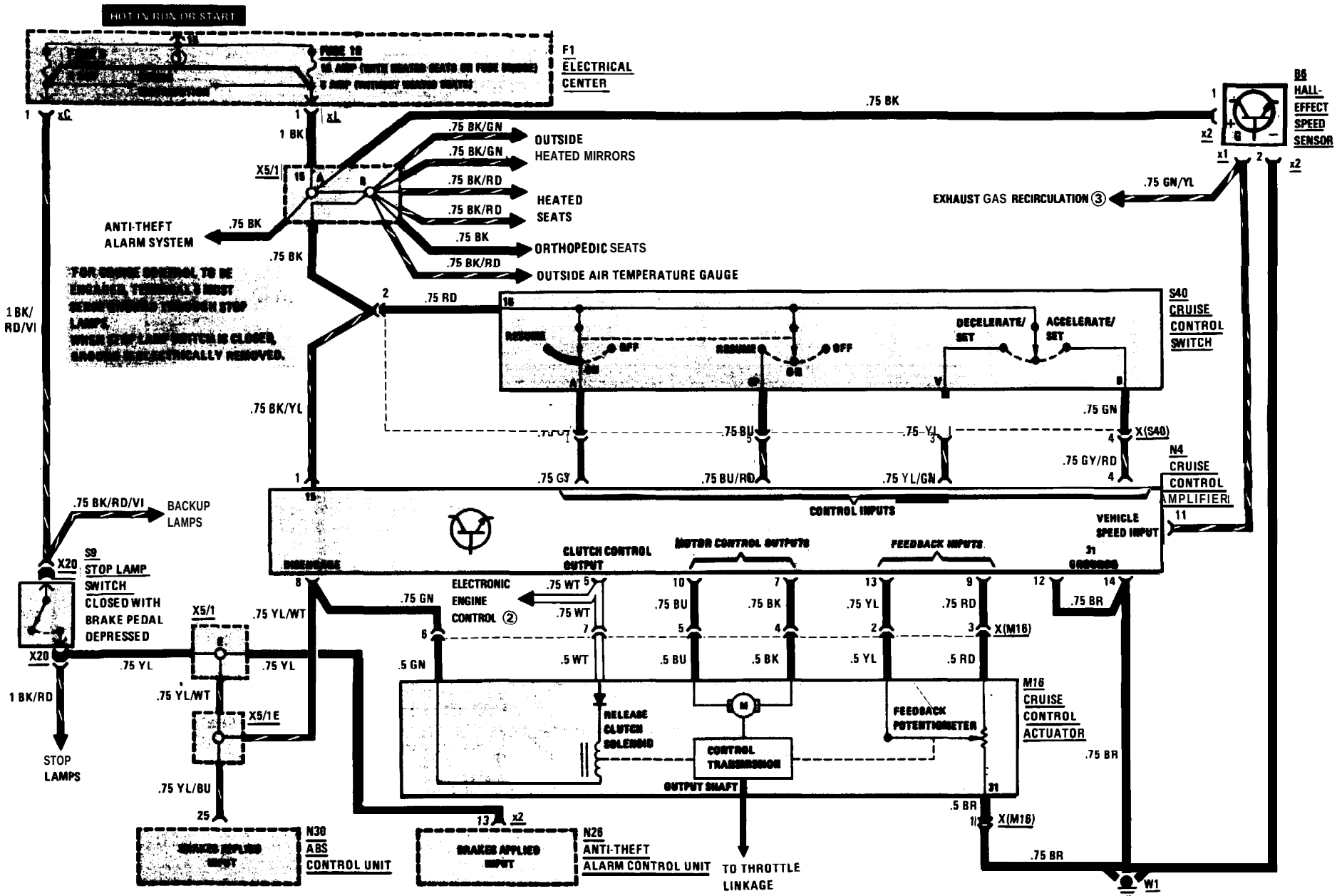
REVISIONS: ① AS OF MODEL YEAR 1985
② MODEL YEAR 1984 ONLY
③ UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10
④ DIESEL
⑤ GASOLINE

CRUISE CONTROL (WITH MANUAL TRANSMISSION)



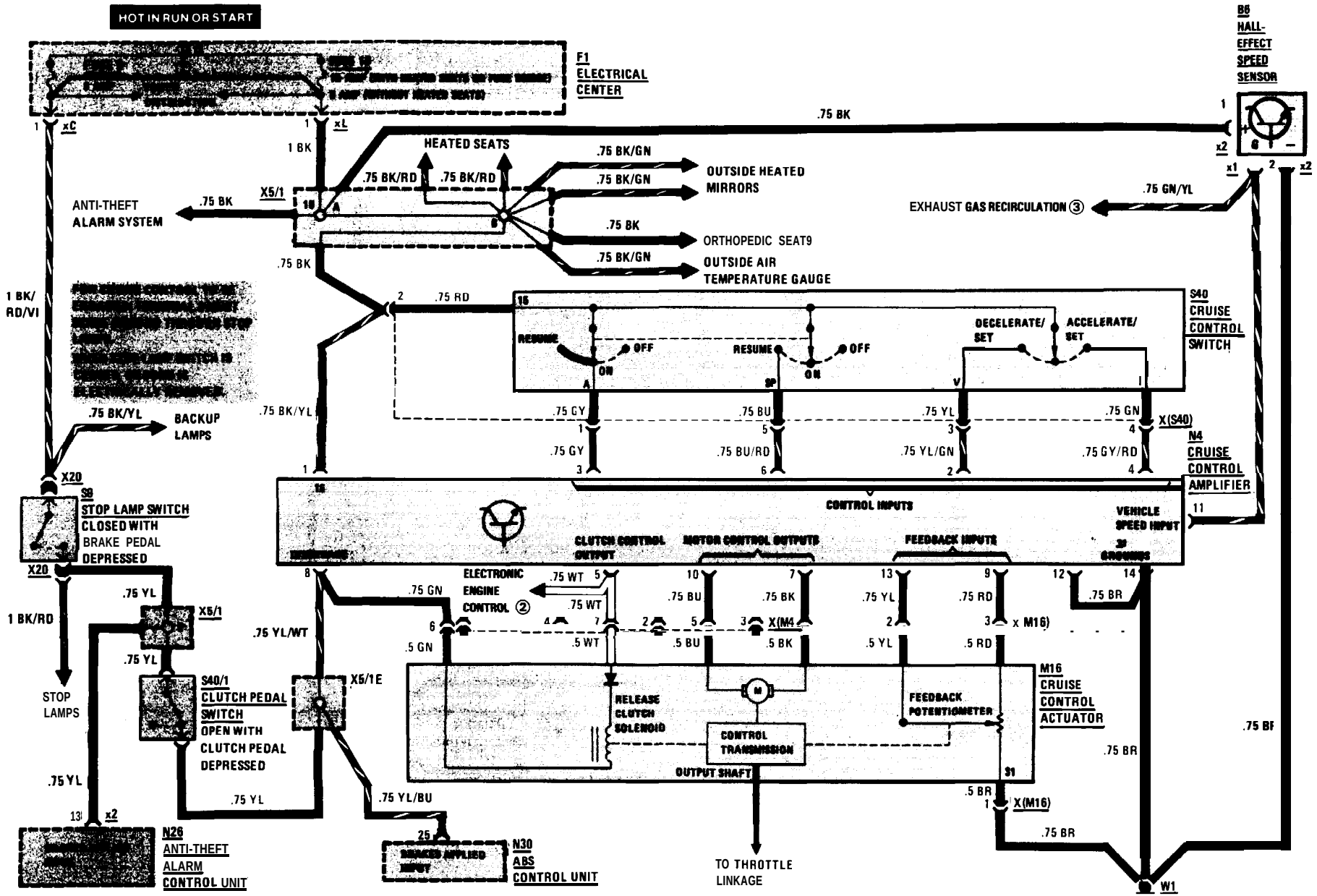
REVISIONS: ① AS OF MODEL YEAR 1985
② MODEL YEAR 1994 ONLY
③ UP TO CHASSIS END NUMBERS 1A 313825 AND1F 229914 FUSE NO. 9 IS REMOVED AN0 A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10
④ DIESEL

CRUISE CONTROL (WITH AUTOMATIC TRANSMISSION) MY 1986



REVISIONS: ① UP To CRASS13 END NUMBERS **1A** 313125 AN0 **1F** 228814 FUSE **NO.** 8 IS **REMOVED** AND A BRIDGE IS INSTALLED BETWEEN FUSE No. 8 AND **10**
② **GASOLINE**
③ **DIESEL**

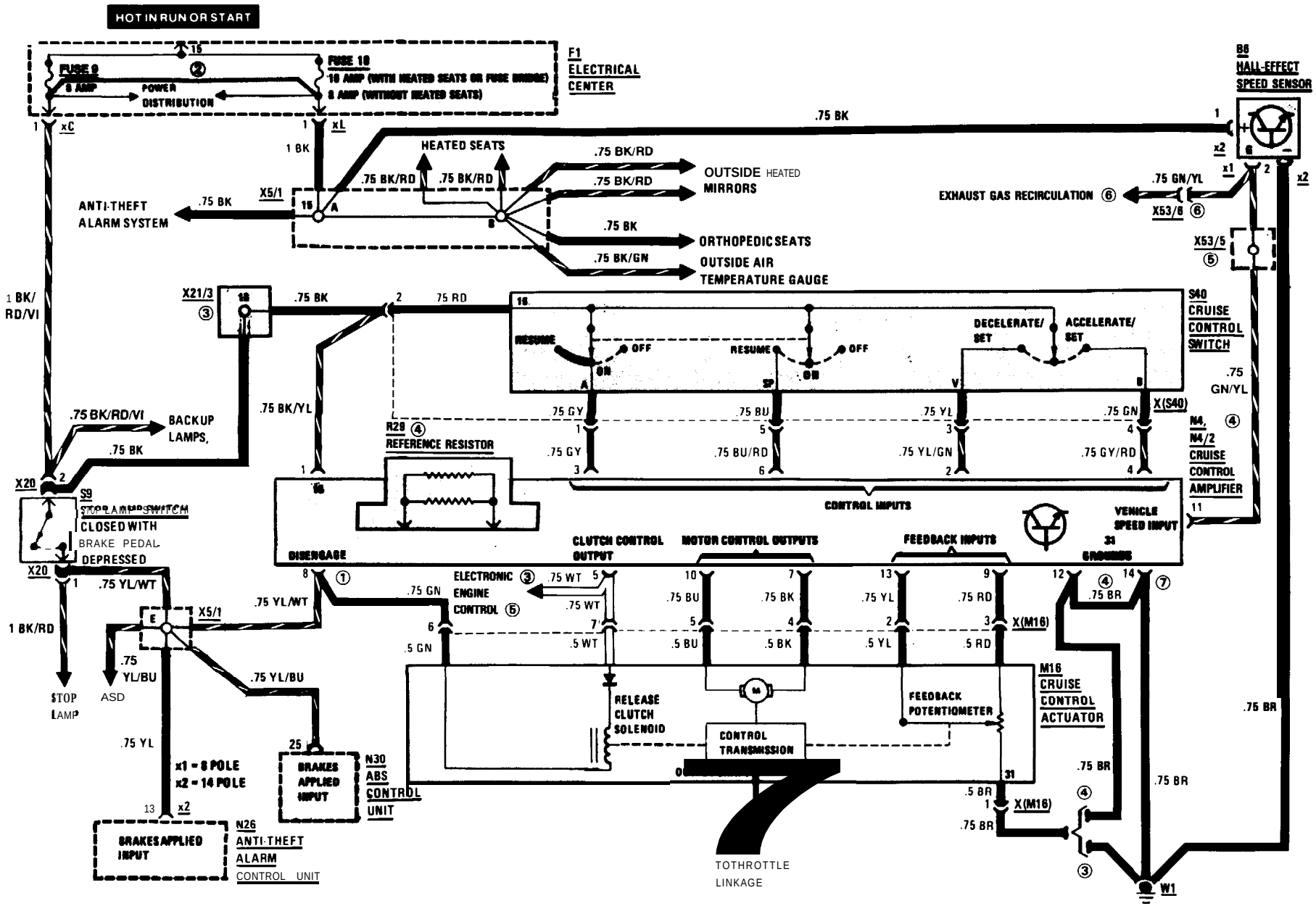
CRUISE CONTROL (WITH MANUAL TRANSMISSION)



REVISIONS: ① UP TO **CHASSIS** END NUMBERS **1A** 313925 AND **1F** 229914 FUSE NO. 9 IS REMOVED **AND** A BRIDGE IS **INSTALLED BETWEEN** FUSE NO. 9 AND 10
② GASOLINE
③ **DIESEL**

CRUISE CONTROL (WITH AUTOMATIC TRANSMISSION)

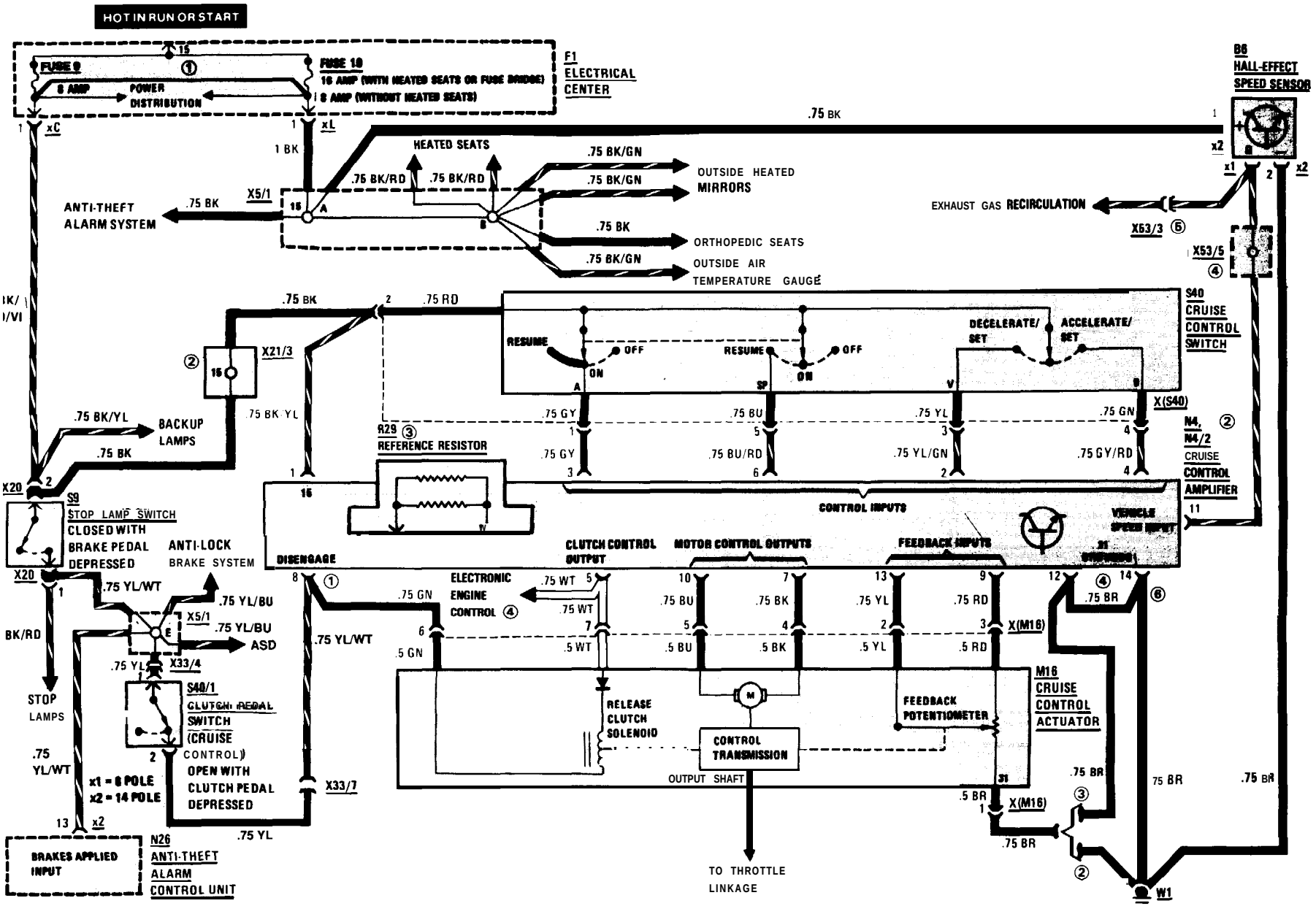
AS OF MY 1987



REVISIONS:
① FOR CRUISE CONTROL TO BE ENGAGED, TERMINAL 8 MUST SENSE GROUND THROUGH STOP LAMPS. WHEN STOP LAMP SWITCH IS CLOSED, GROUND IS ELECTRICALLY REMOVED.
② UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 229814
FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10
③ MY 1987 ONLY
④ AS OF MY 1988
⑤ GASOLINE
⑥ DIESEL
⑦ AS OF MY 1989, PIN 12 IS WIRED DIRECTLY TO W1 (PIN 14 NOT USED)

CRUISE CONTROL (WITH MANUAL TRANSMISSION)

AS OF MY 1987



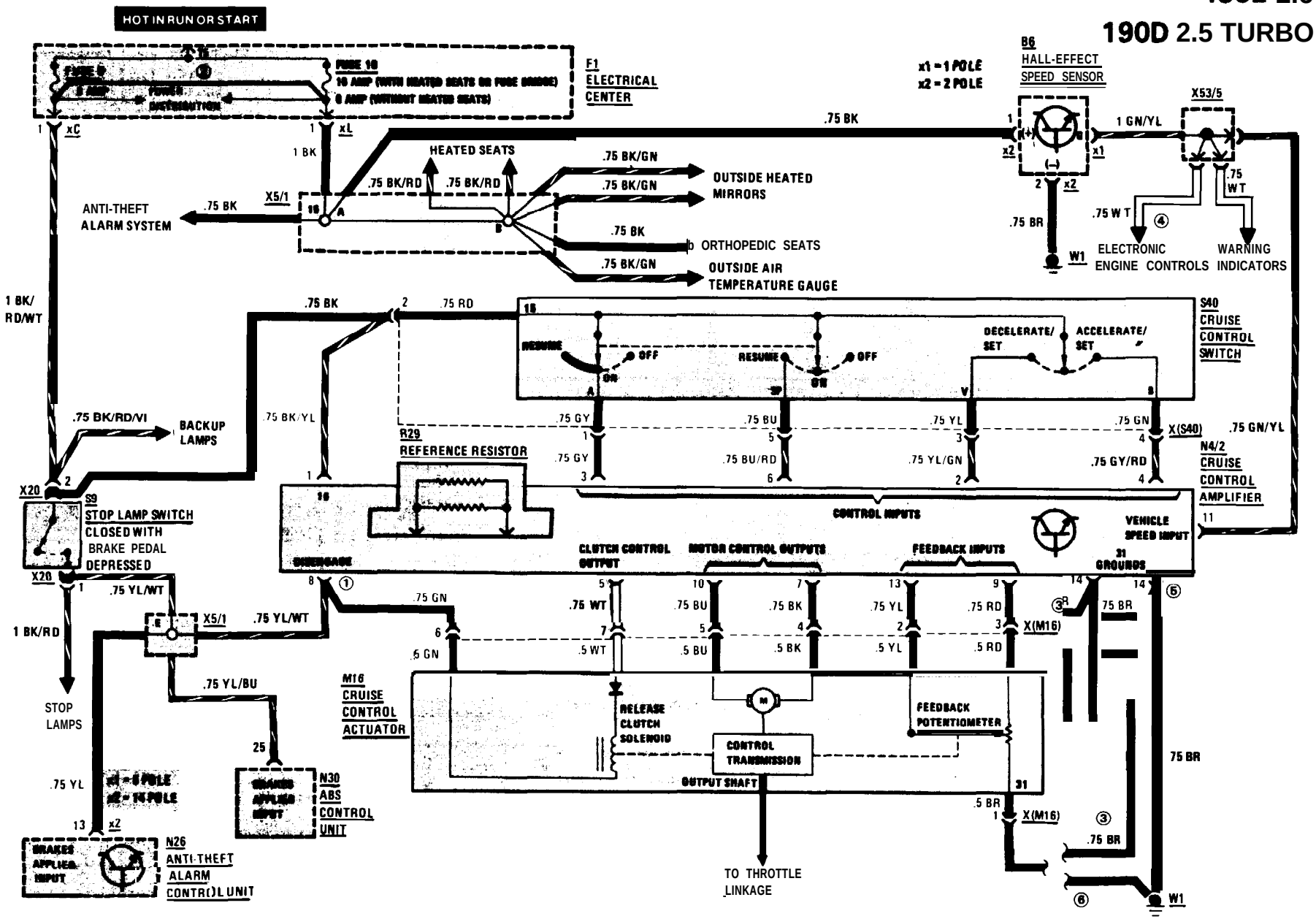
REVISIONS:
① UP TO CHASSIS END NUMBERS 1A 313825 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10
② MY 1987 ONLY
③ AS OF MY 1988
④ GASOLINE
⑤ DIESEL
⑥ AS OF MY 1989, PIN 12 IS WIRED DIRECTLY TO W1 (PIN 14 NOT USED)

CRUISE CONTROL (WITH AUTOMATIC TRANSMISSION)

AS OF MY 1987

190E 2.6

190D 2.5 TURBO



REVISIONS: ① FOR CRUISE CONTROL TO BE ENGAGED, TERMINAL 8 MUST SENSE GROUND THROUGH STOP LAMPS. WHEN STOP LAMP SWITCH IS CLOSED, GROUND IS ELECTRICALLY REMOVED.

② UP TO CHASSIS END NUMBERS **1A** 313825 AND 1 F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10

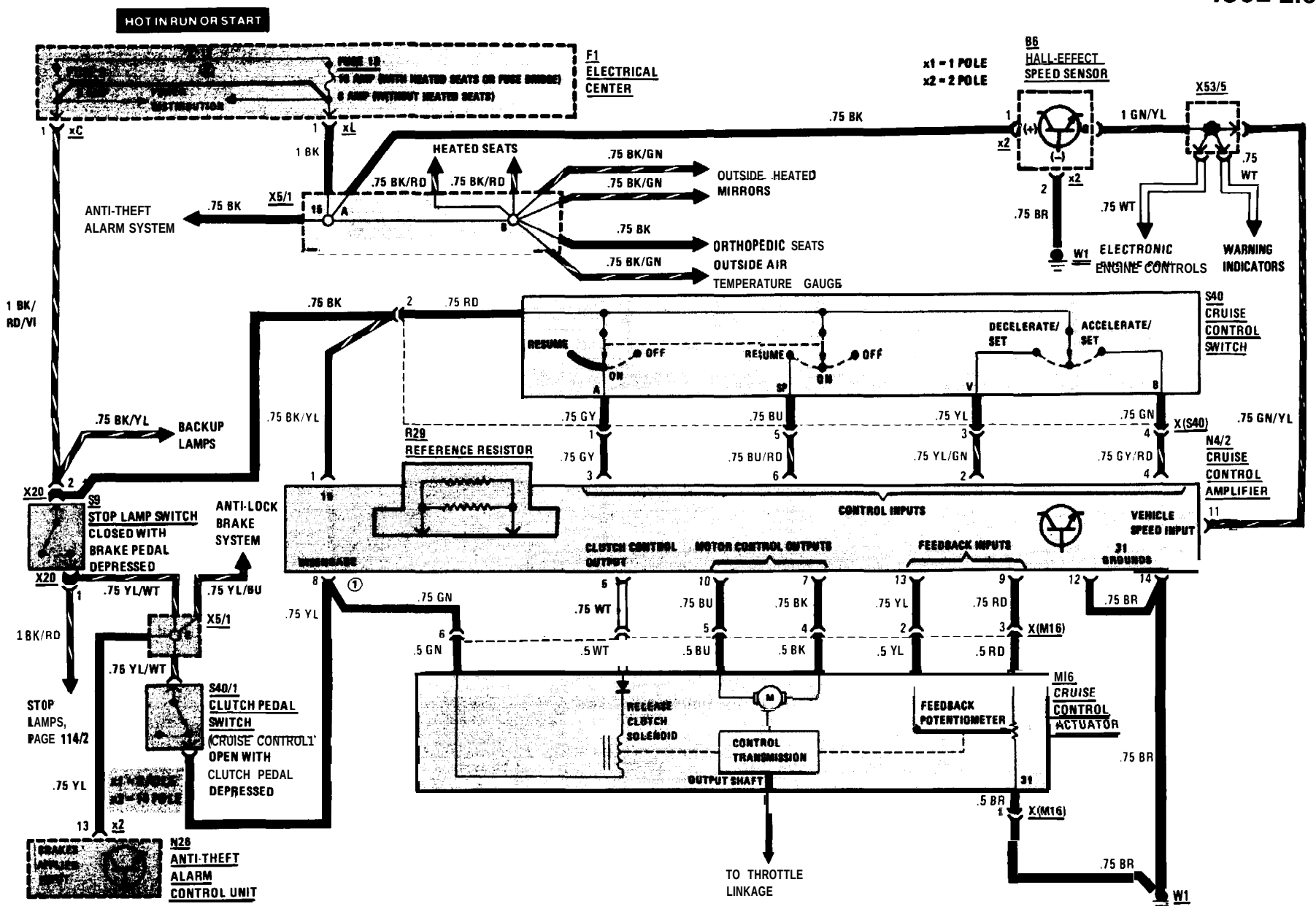
③ AS OF MY 1988

④ GASOLINE

⑤ AS OF MY 1989, PIN 12 IS WIRED DIRECTLY TO **W1** (PIN 14 NOT USED)

⑥ MY 1987

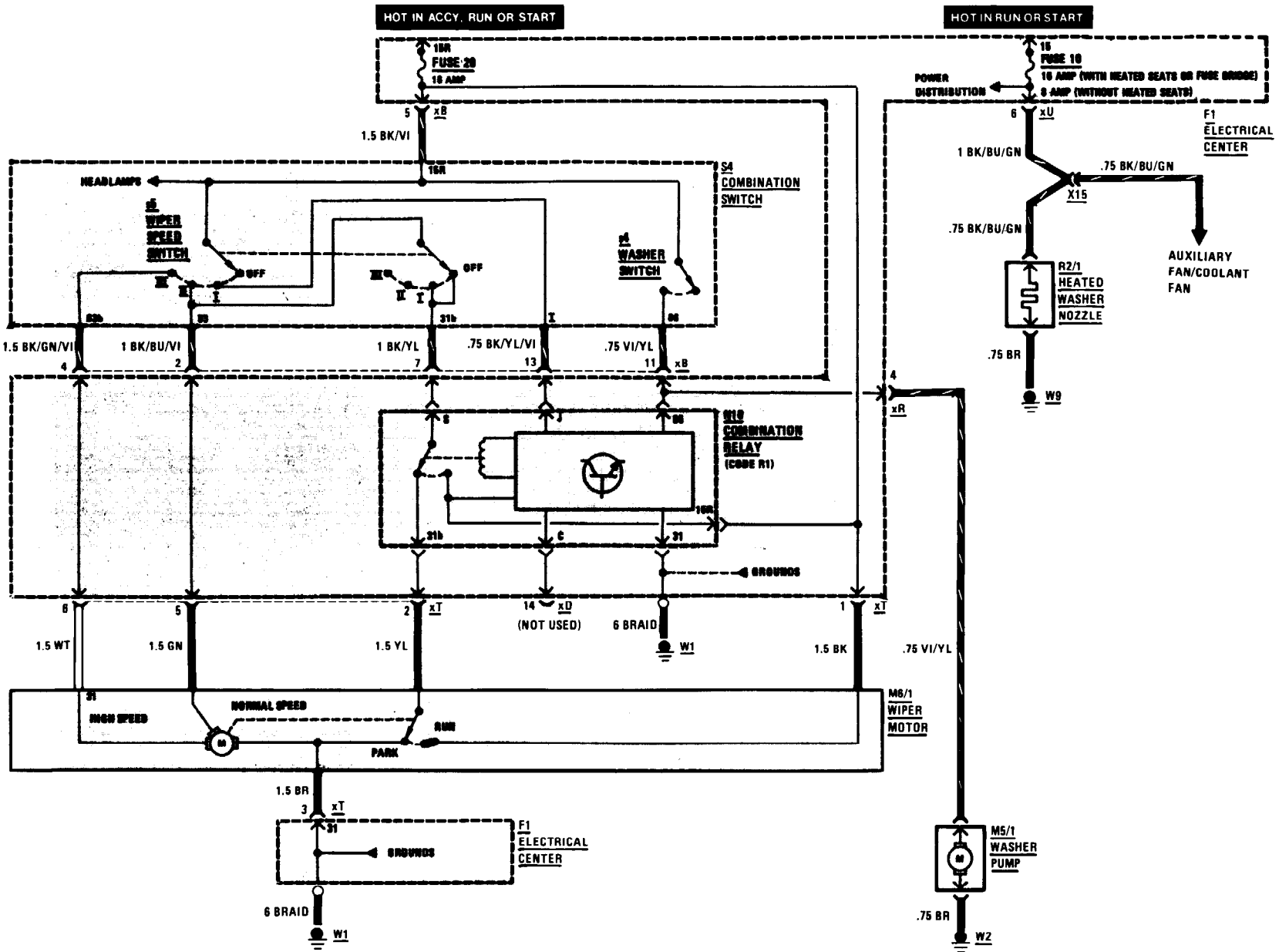
CRUISE CONTROL (WITH MANUAL TRANSMISSION)



REVISIONS: ① FOR CRUISE CONTROL TO BE **ENGAGED, TERMINAL 8** MUST SENSE GROUND THROUGH STOP LAMPS. WHEN STOP LAMP SWITCH IS CLOSEO, GROUND IS ELECTRICALLY REMOVED.

② UP TO CHASSIS **END** NUMBERS **1A** 313825 AND **1F 229814** FUSE NO. S IS REMOVED AN0 A BRIDGE IS **INSTALLED** BETWEEN FUSE NO. 9 AND 10

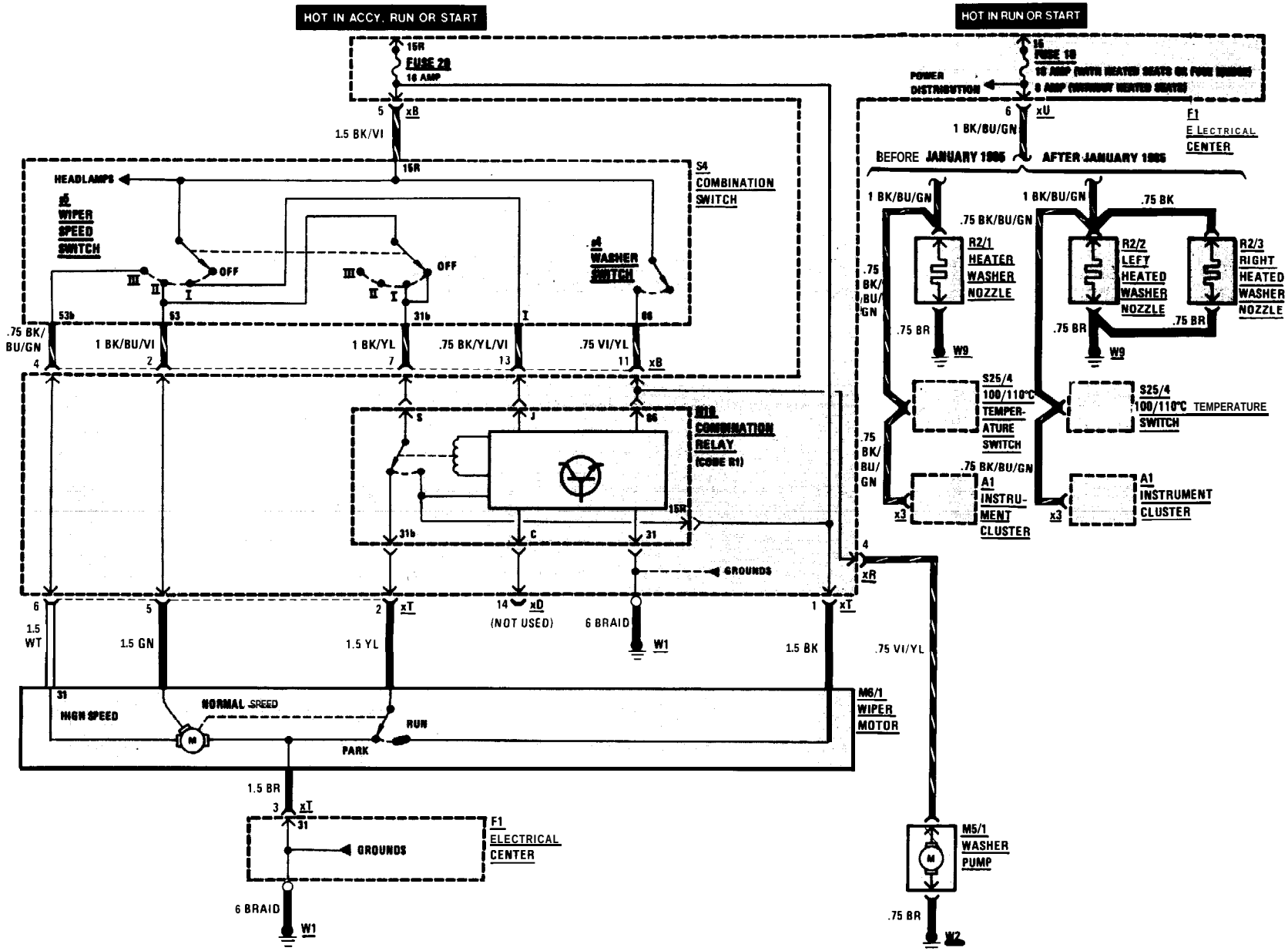
WIPER/WASHER



REVISIONS:

WIPER/WASHER

MY 1985-1986 190E 2.3
MY 1985 190D 2.2

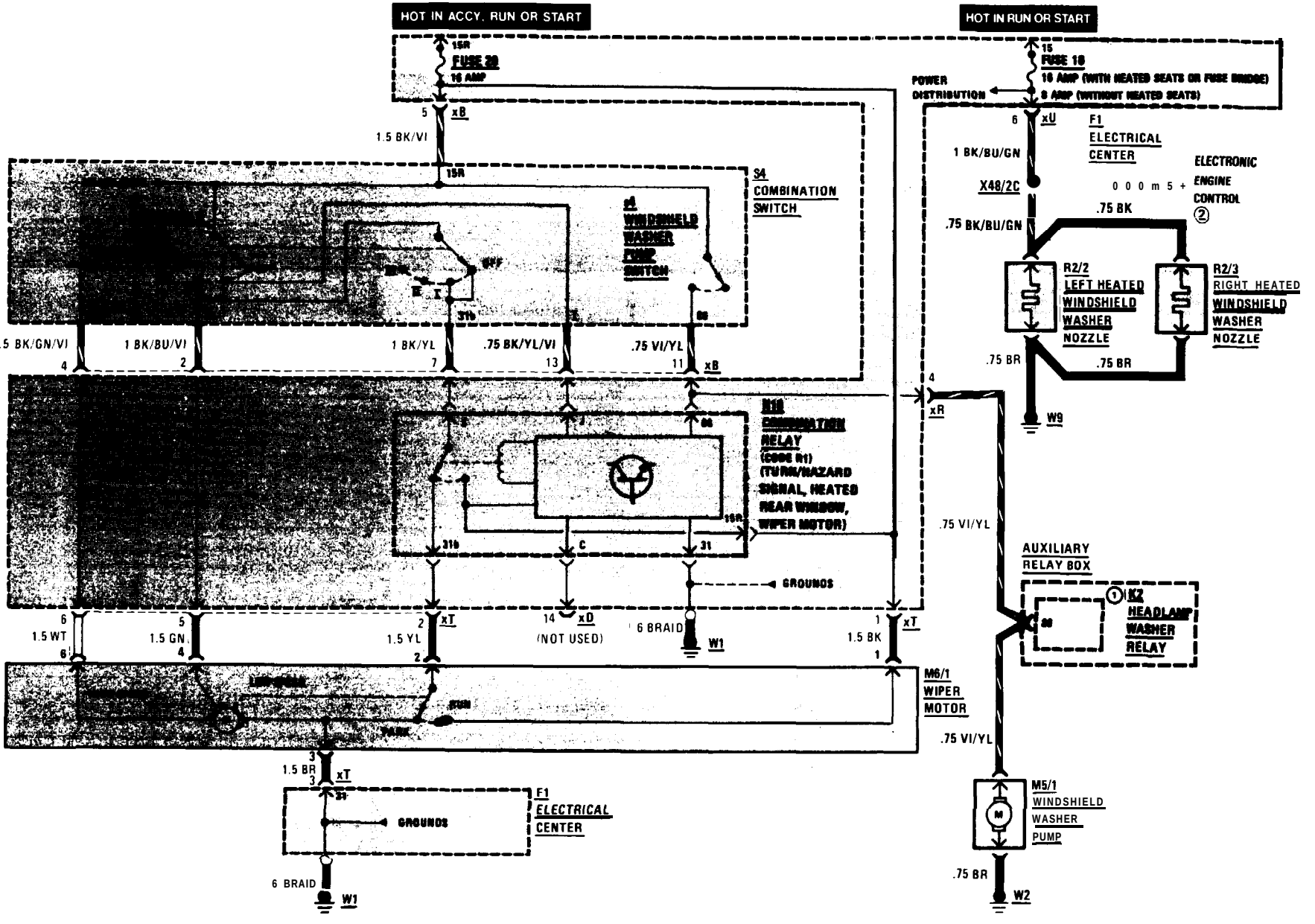


REVISIONS:

WIPER/WASHER

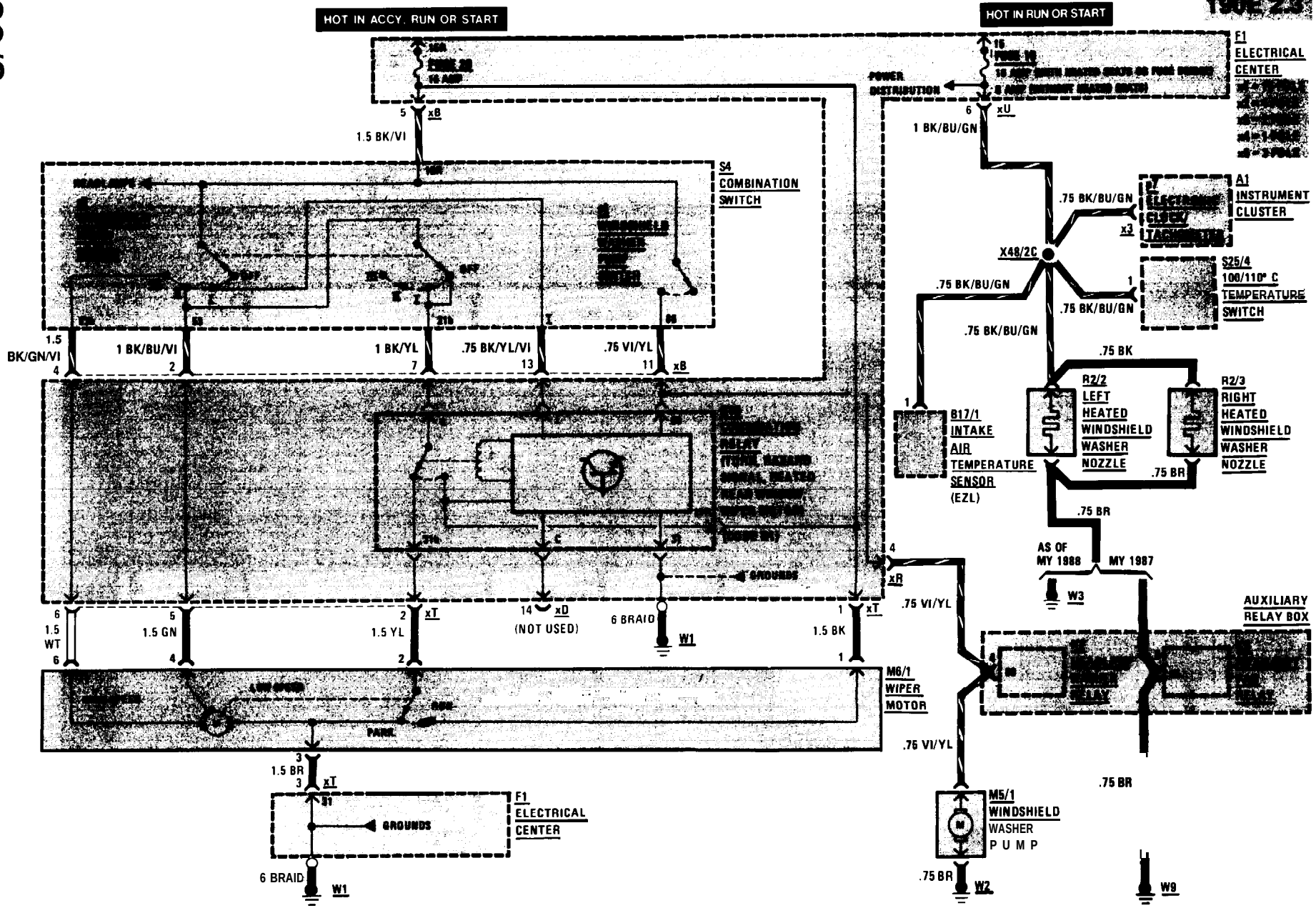
AS OF MY 1987 AS OF MY 1986

190E 2.3-16



REVISIONS: ① AS OF MODEL YEAR 1987
② GASOLINE

WIPER/WASHER

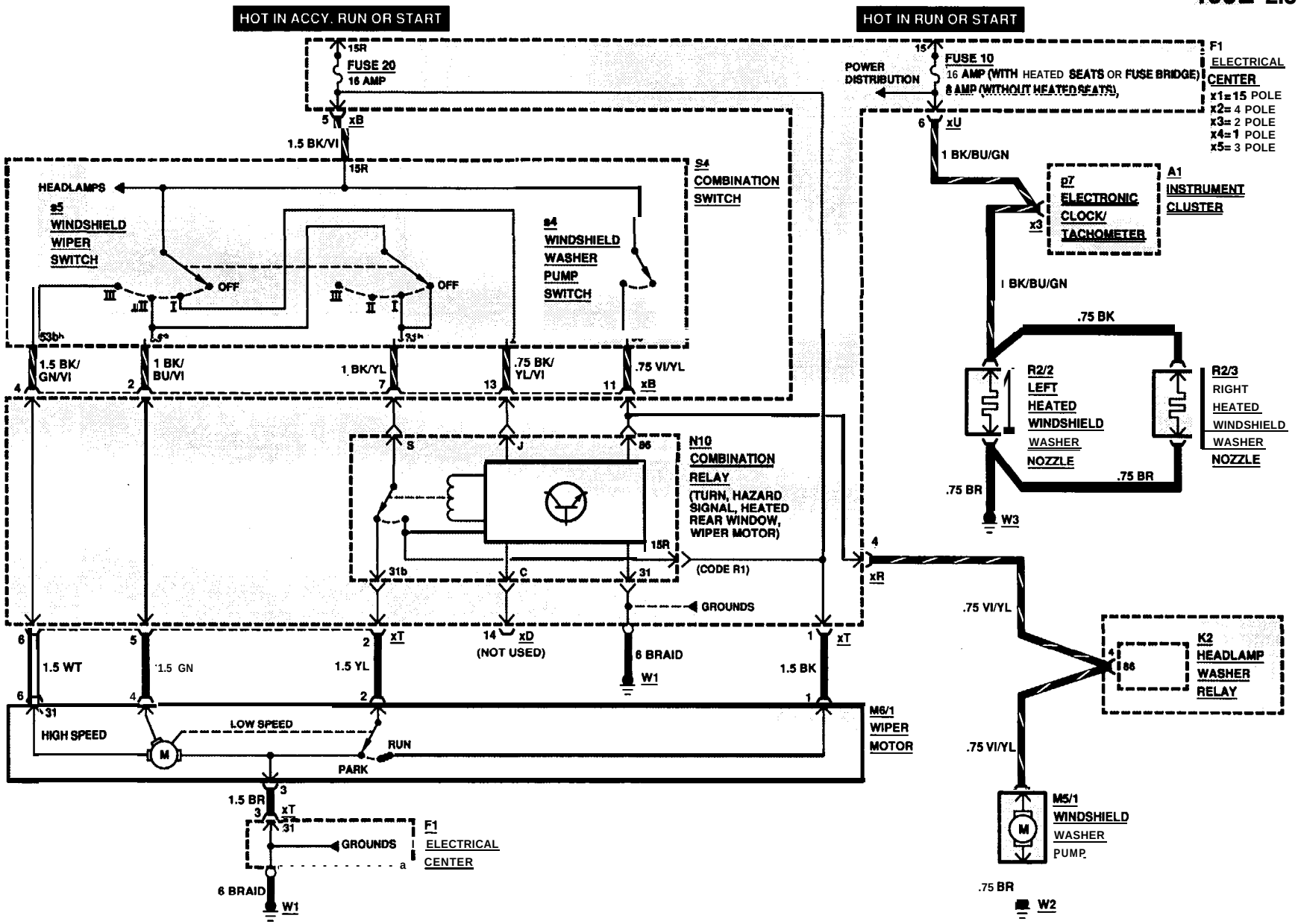


REVISIONS:

WIPER/WASHER

AS OF MY 1989

190E 2.3



REVISIONS:

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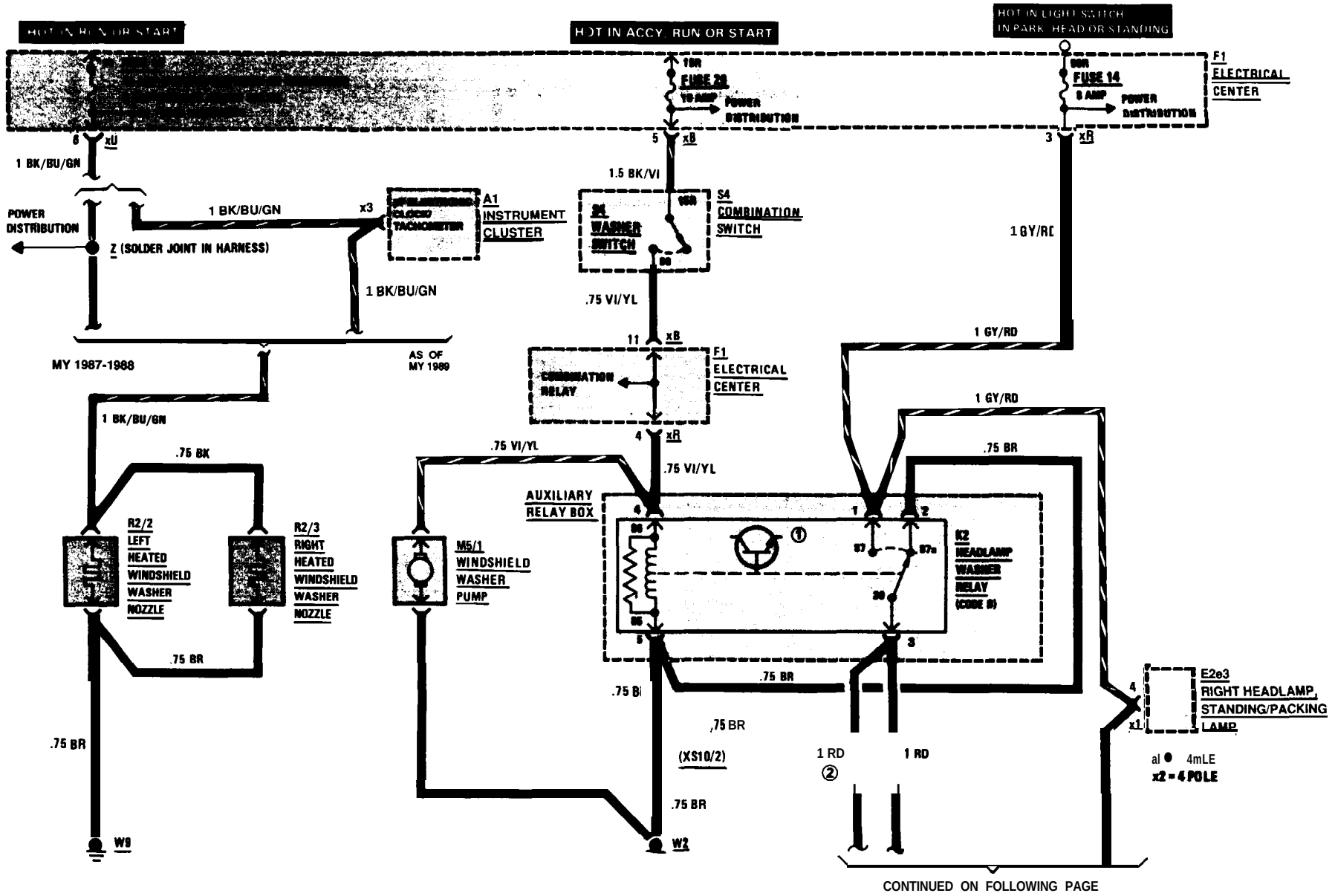
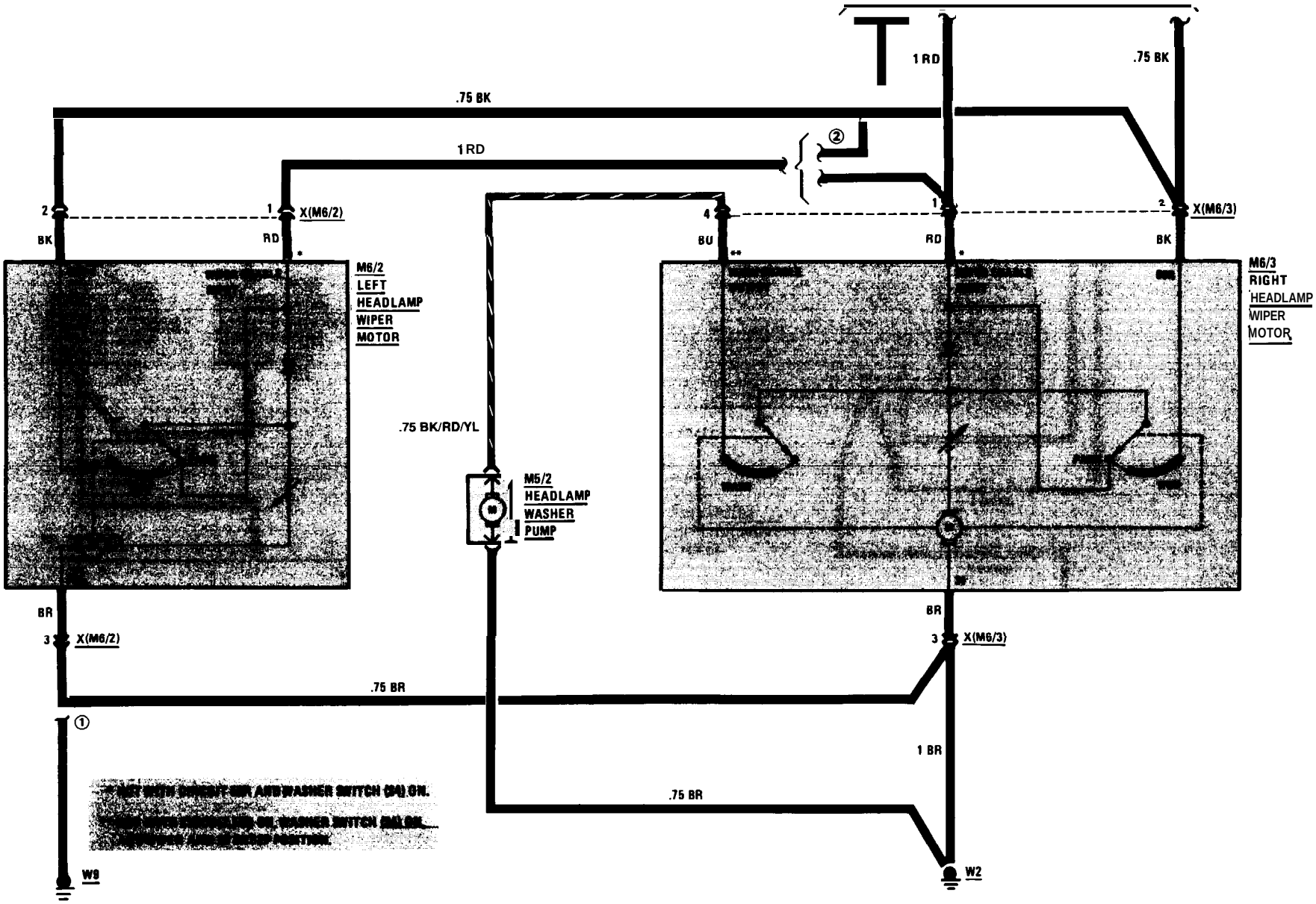
HEADLAMP WIPER/WASHER



REVISIONS: ① ELECTRONIC AS OF CHASSIS NO. F606844
② AS OF MY 1992

HEADLAMP WIPER/WASHER

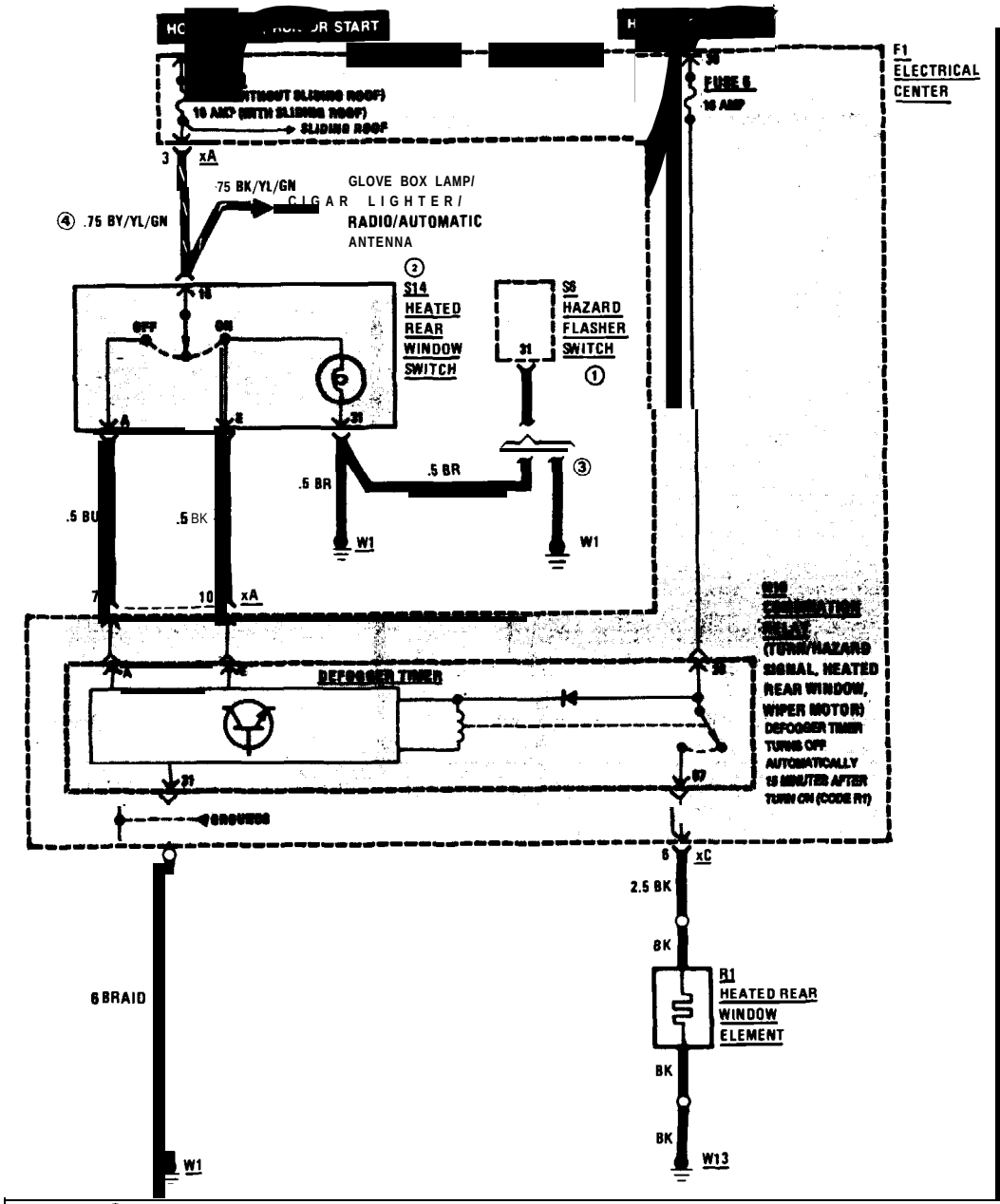
CONTINUED FROM PRECEDING PAGE

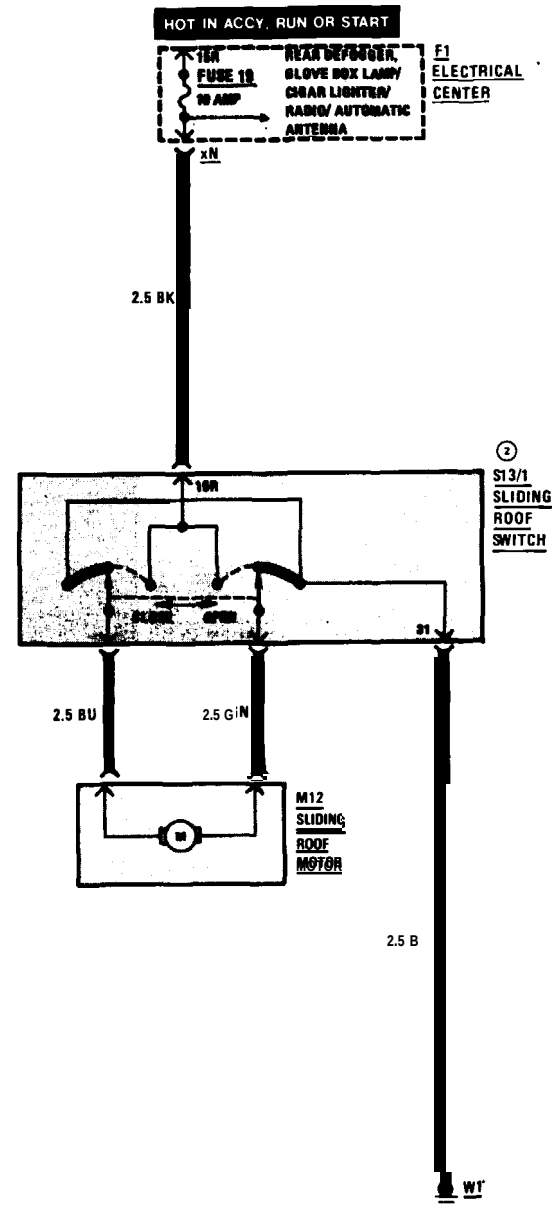


REVISIONS: ① MODEL 201.029
② AS OF MY 1992

REAR DEFOGGER/SLIDING ROOF

AS OF MY **1984**





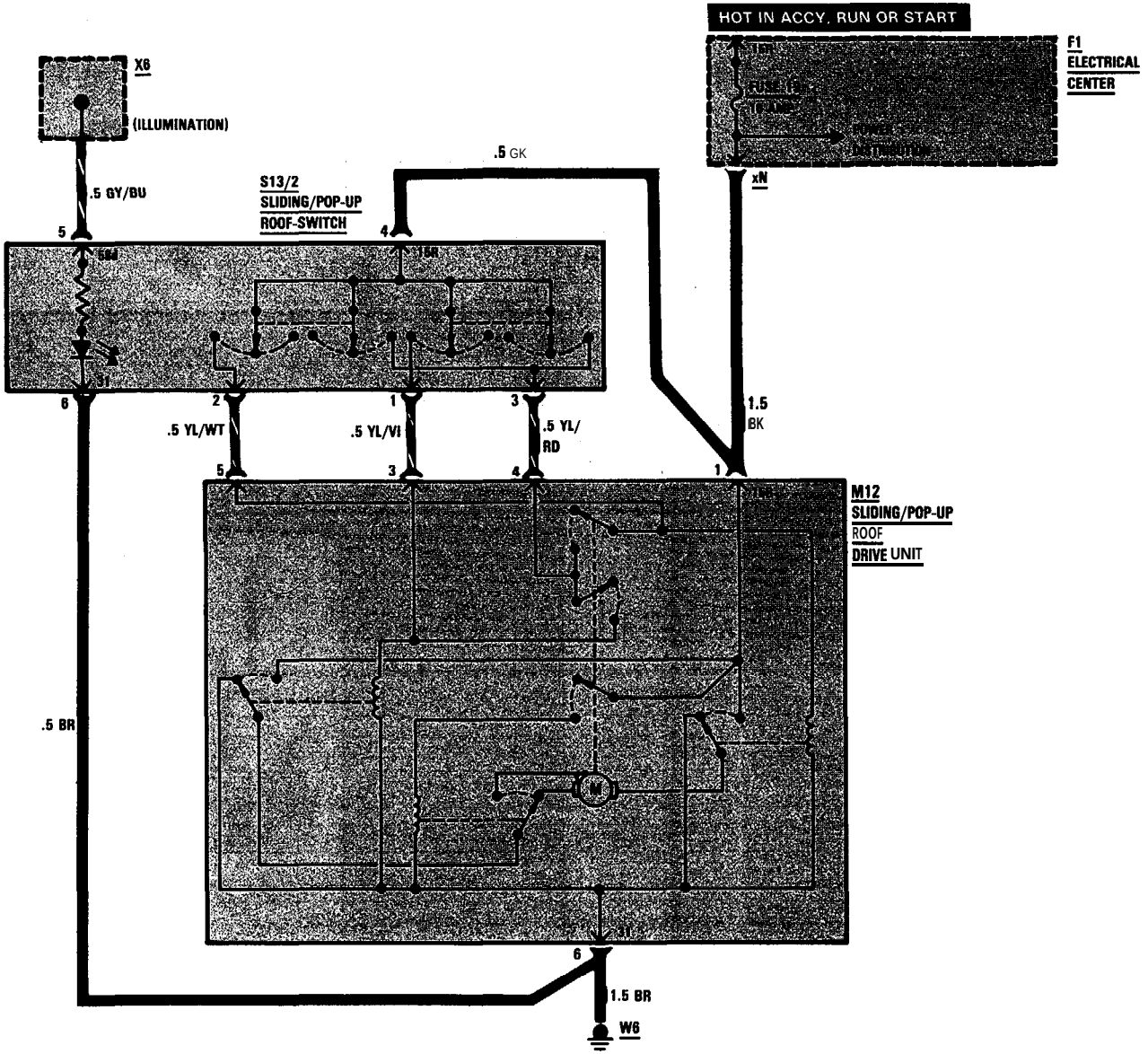
REVISIONS: ① AS OF MODEL YEAR 1985

② 9WITCHESARE ILLUMINATED FROM THE INSTRUMENT CLUSTER BV MEANS OF A FIBER OPTIC CABLE.

③ ASOFMV1990

SLIDING/POP-UP ROOF

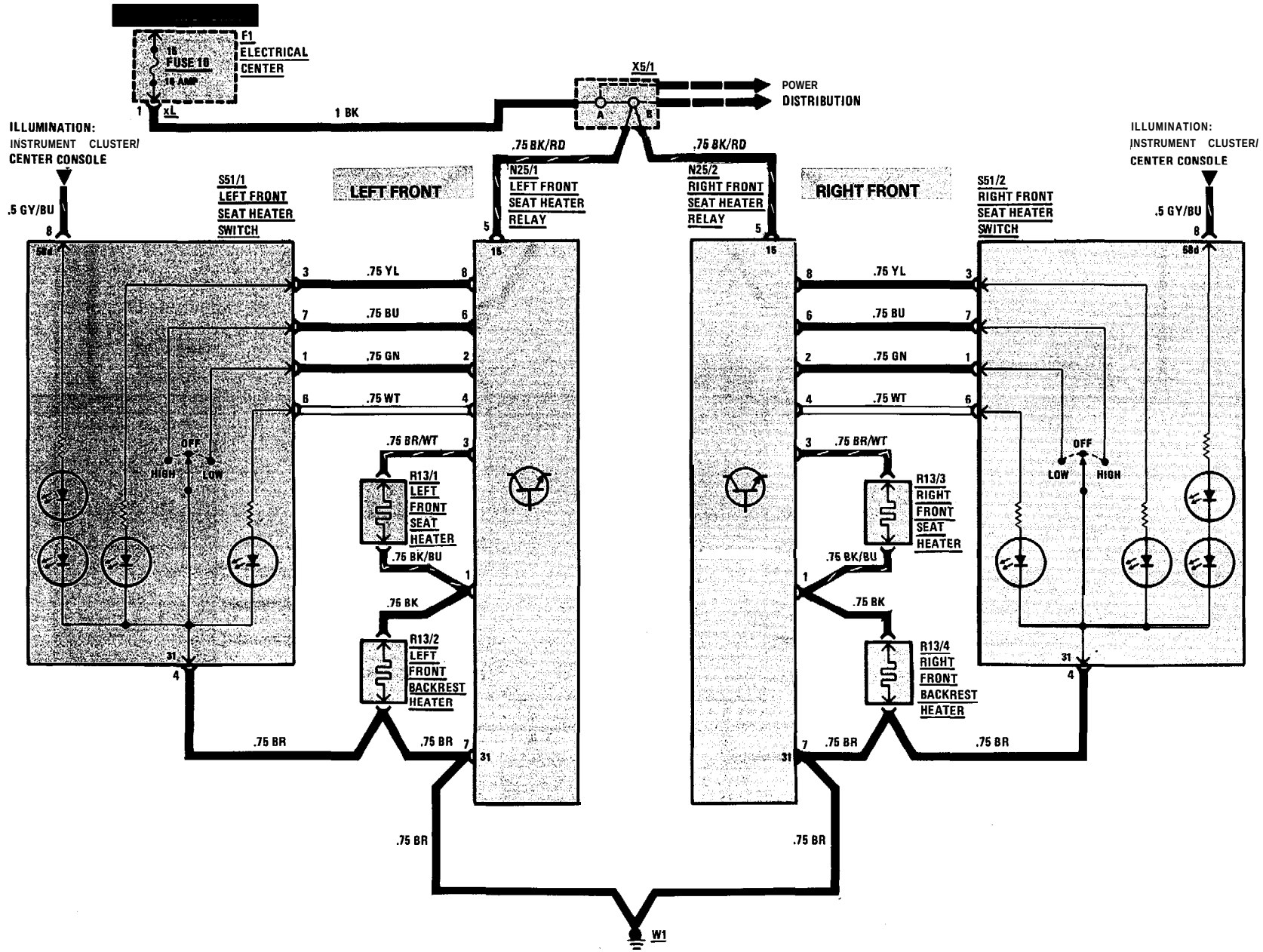
AS OF MY 1988



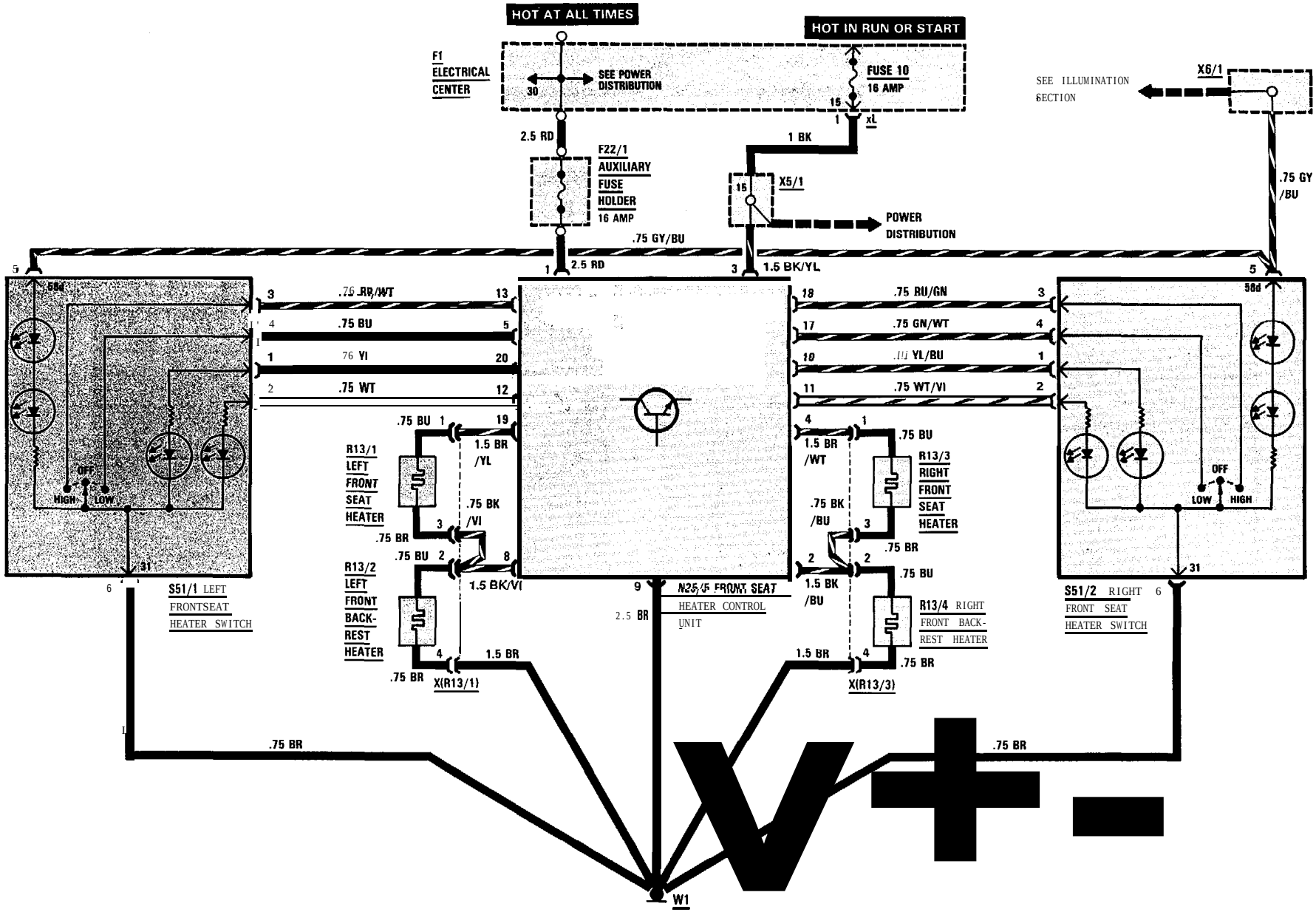
REVISIONS:

HEATED SEATS

MY: 1.984 THROUGH MY.. 1988



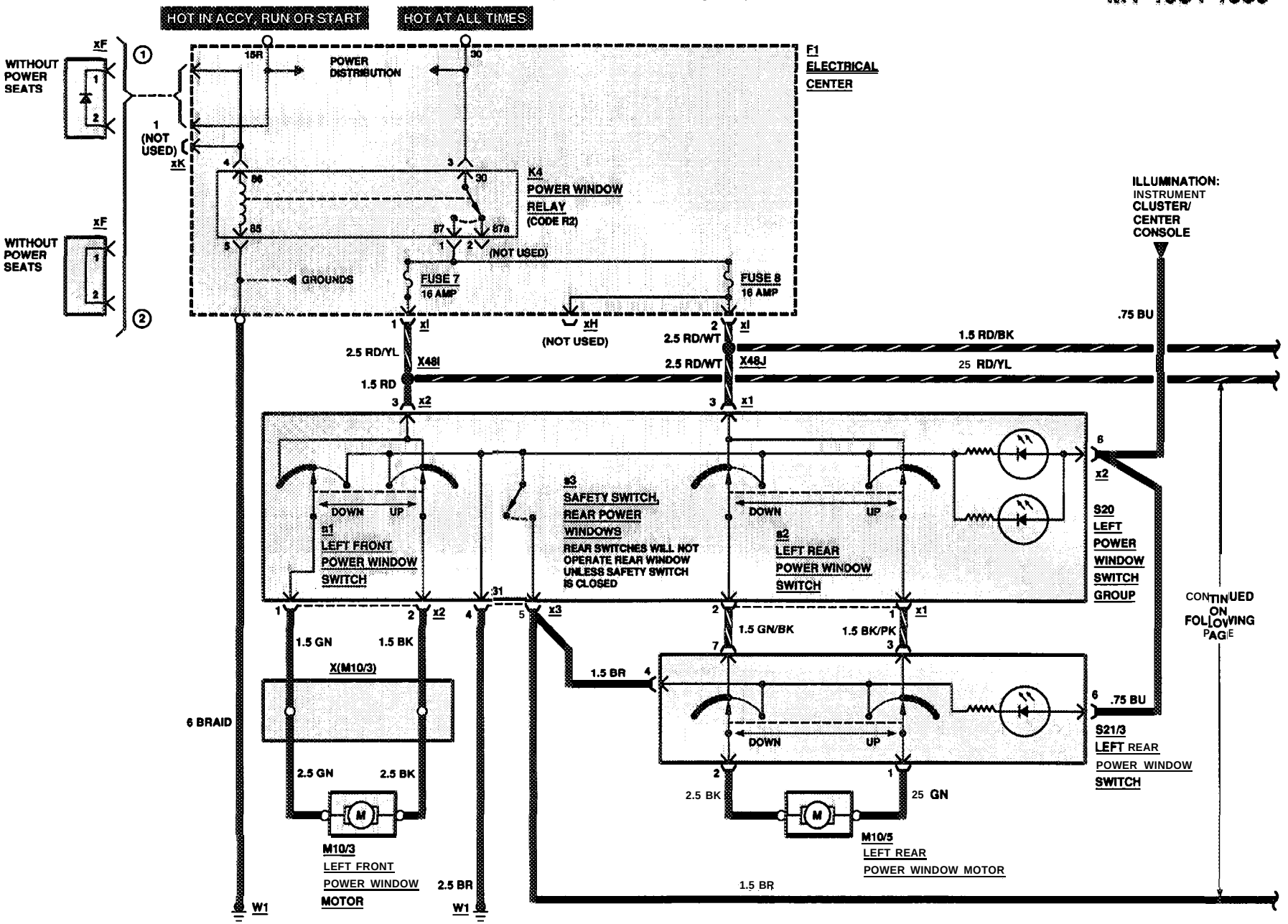
REVISIONS:


HOT AT ALL TIMES
HOT IN RUN OR START
F1 ELECTRICAL CENTER
SEE POWER DISTRIBUTION
30
FUSE 10 16 AMP
15
1 xL
SEE ILLUMINATION SECTION
X6/1
2.5 RD
F22/1 AUXILIARY FUSE HOLDER 16 AMP
1 BK
X5/1
POWER DISTRIBUTION
.75 GY/BU
.75 GY /BU
1 2.5 RD
3 1.5 BK/YL
5
56d
3 .75 RD/WT 13
4 .75 BU 5
1 .76 YI 20
2 .75 WT 12
18 .75 RU/GN 3
17 .75 GN/WT 4
18 .75 YL/BU 1
11 .75 WT/VI 2
OFF
HIGH
LOW
31
6
S51/1 LEFT FRONTSEAT HEATER SWITCH
.75 BU 1 19
1.5 BR /YL
R13/1 LEFT FRONT SEAT HEATER
.75 BK /VI
.75 BR
3
.75 BU 2 8
1.5 BK/VI
R13/2 LEFT FRONT BACK-REST HEATER
.75 BR
4
1.5 BR
X(R13/1)
9
N25/5 FRONT SEAT HEATER CONTROL UNIT
2.5 BR
4 1 .75 BU
1.5 BR /WT
R13/3 RIGHT FRONT SEAT HEATER
.75 BK /BU
.75 BR
3
2 2 .75 BU
1.5 BK /BU
R13/4 RIGHT FRONT BACK-REST HEATER
1.5 BR
4
.75 BR
X(R13/3)
S51/2 RIGHT FRONT SEAT HEATER SWITCH
.75 BR
.75 BR
W1

REVISIONS:

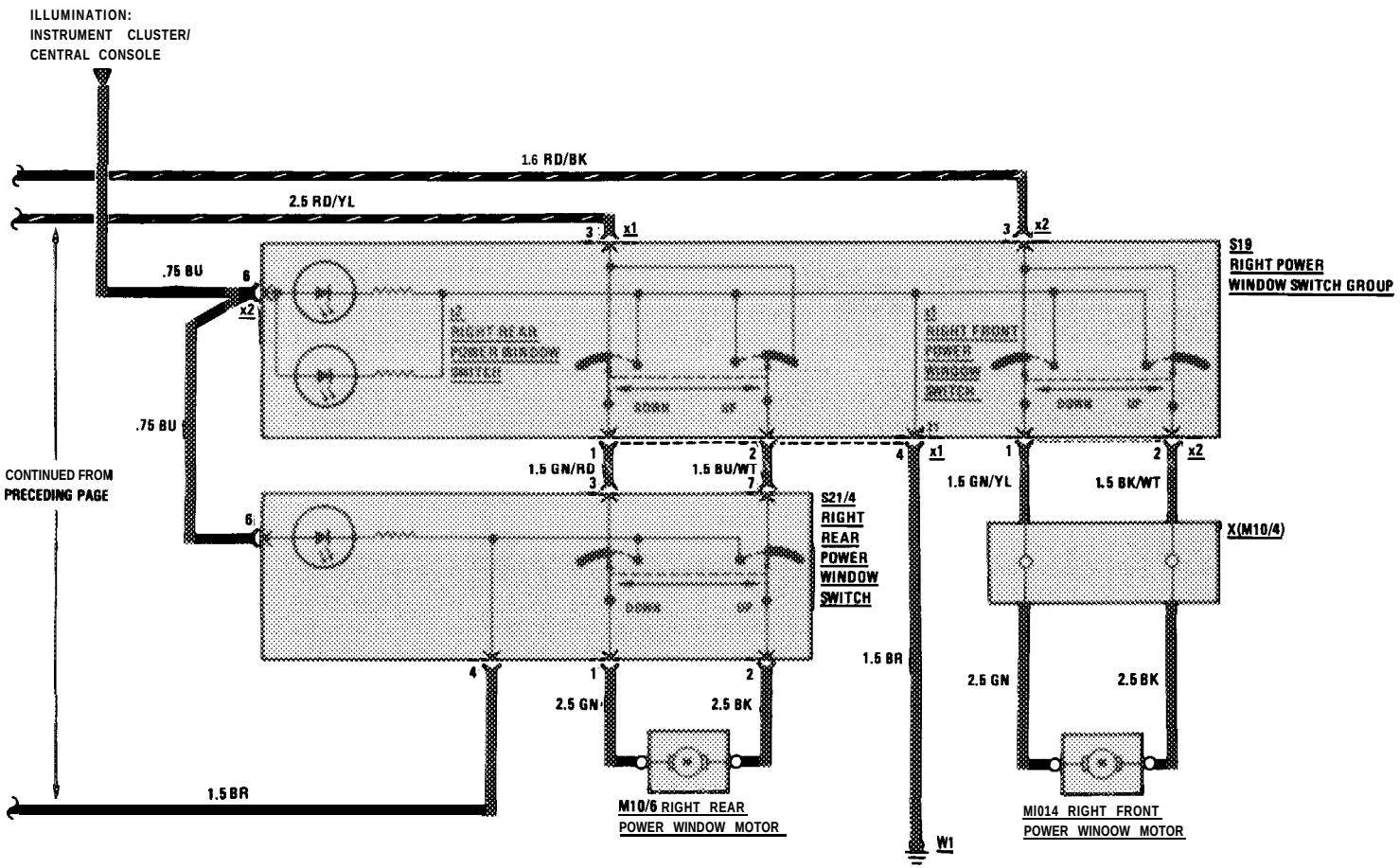
POWER WINDOWS

MY 1984-1989



REVISIONS: (1) MODEL YEAR 1984

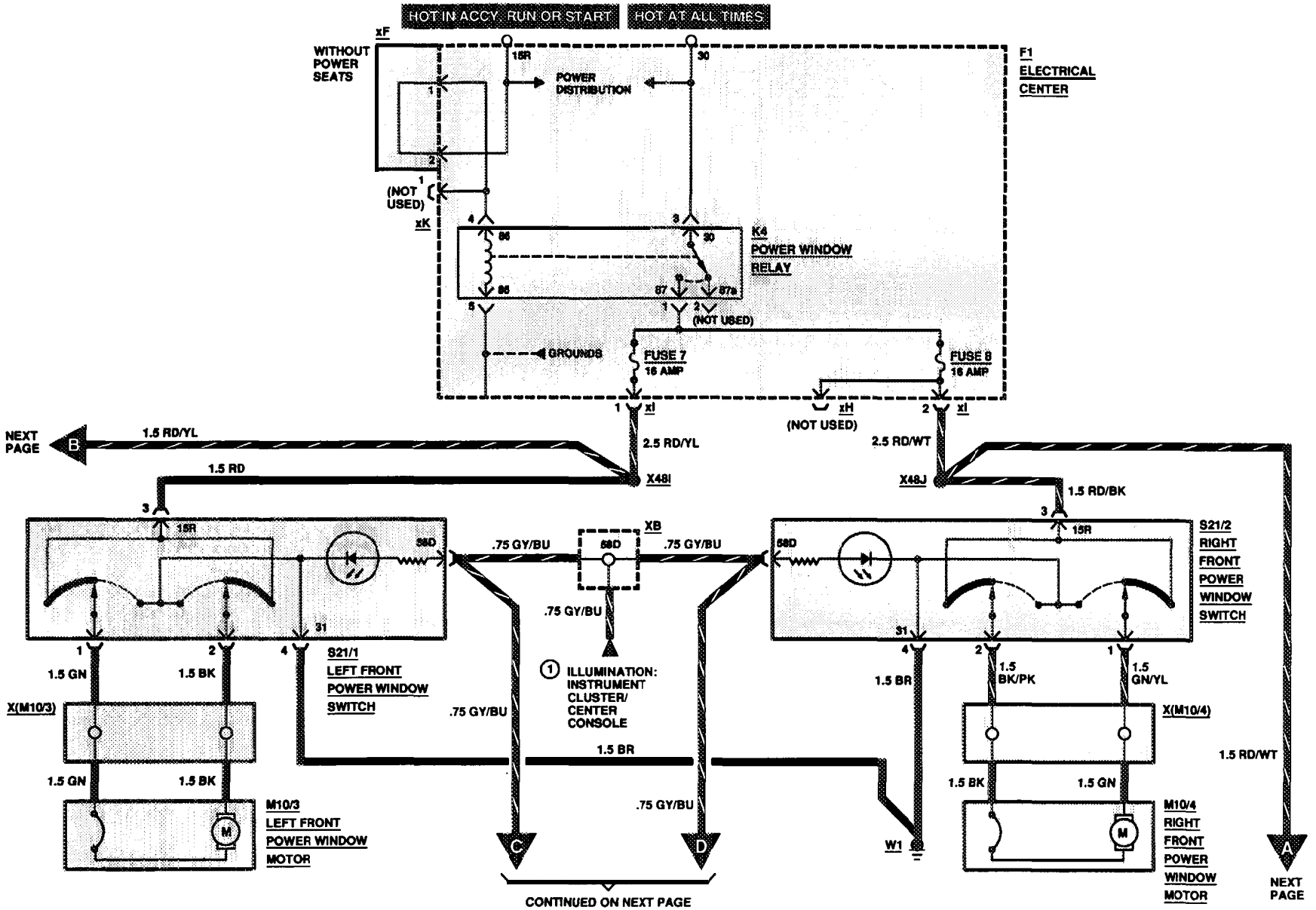
(6) AS OF MODEL YEAR 1985


ILLUMINATION:
INSTRUMENT CLUSTER/
CENTRAL CONSOLE
1.6 RD/BK
2.5 RD/YL
.75 BU
.75 BU
CONTINUED FROM
PRECEDING PAGE
1.5 GN/RD
1.5 BU/WT
1.5 GN/YL
1.5 BK/WT
1.5 BR
2.5 GN
2.5 BK
2.5 GN
2.5 BK
1.5 BR
S19
RIGHT POWER
WINDOW SWITCH GROUP
S21/4
RIGHT
REAR
POWER
WINDOW
SWITCH
X(M10/4)
M10/6 RIGHT REAR
POWER WINDOW MOTOR
MI014 RIGHT FRONT
POWER WINOOW MOTOR
W1

REVISIONS:

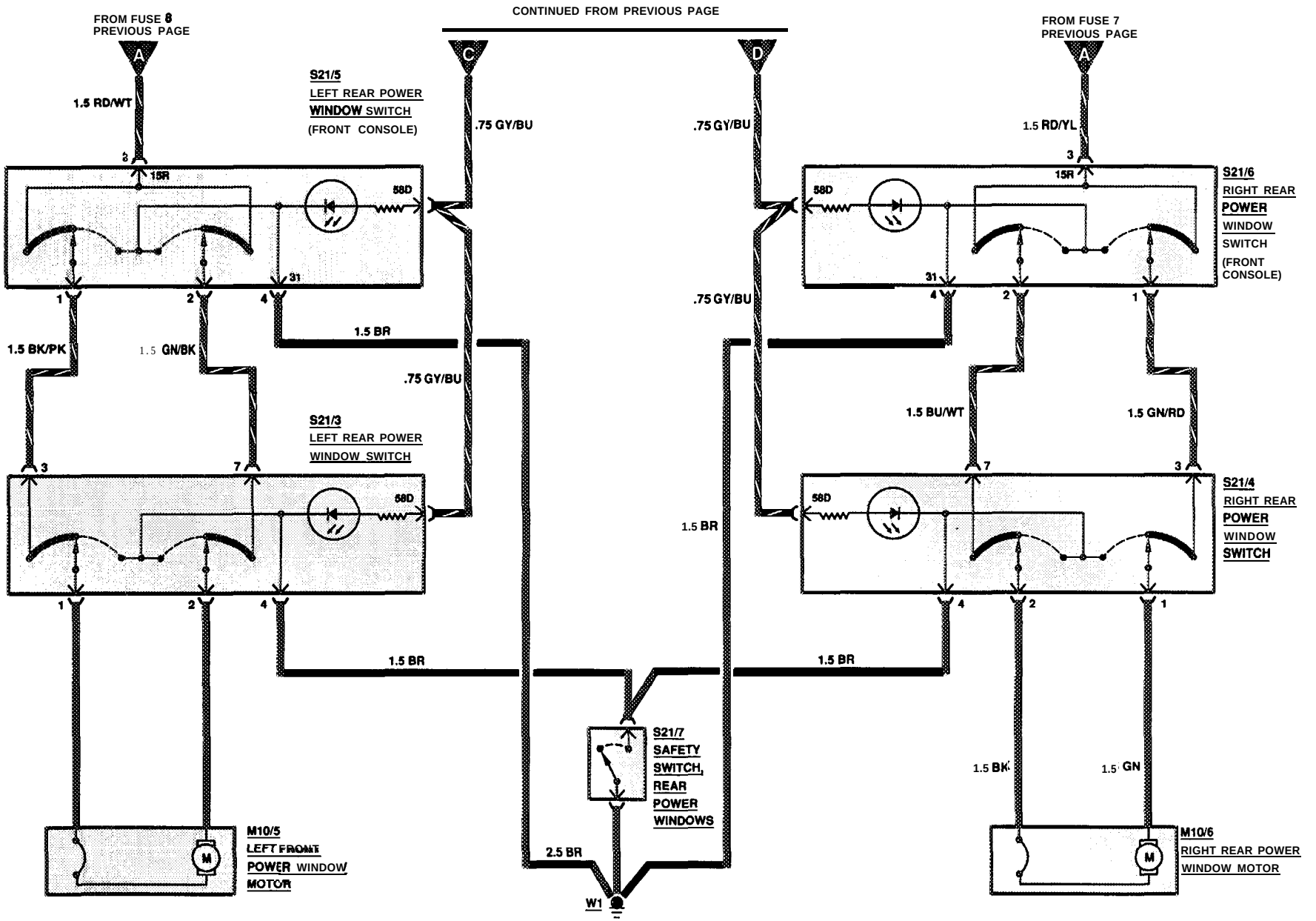
POWER WINDOWS

AS OF MY 1990



REVISIONS:

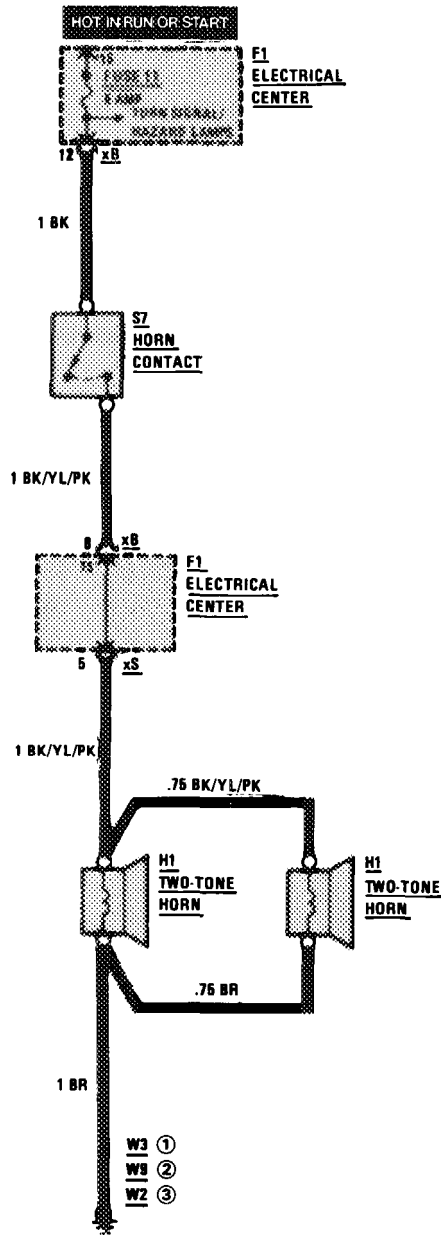
POWER WINDOWS



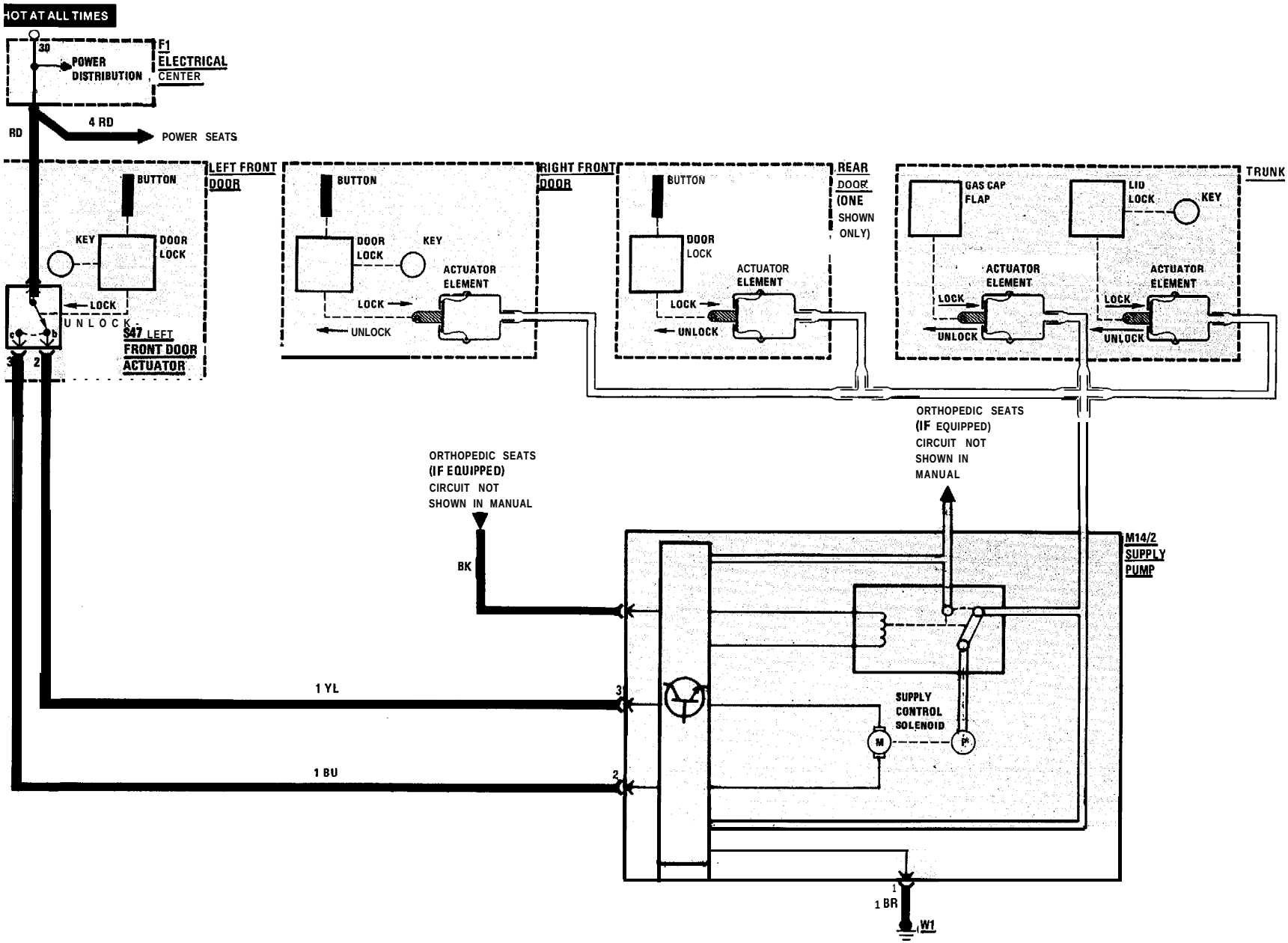
REVISIONS:

HORN

AS OF MY 1984



REVISIONS:
① MODEL VEAA 1984 TO 1986 (ALL MODELS)
② AS OF MODEL YEAR 1987 (201.0211 ANO201.034~
③ AS OF MODEL YEAR 1987 (201.028)

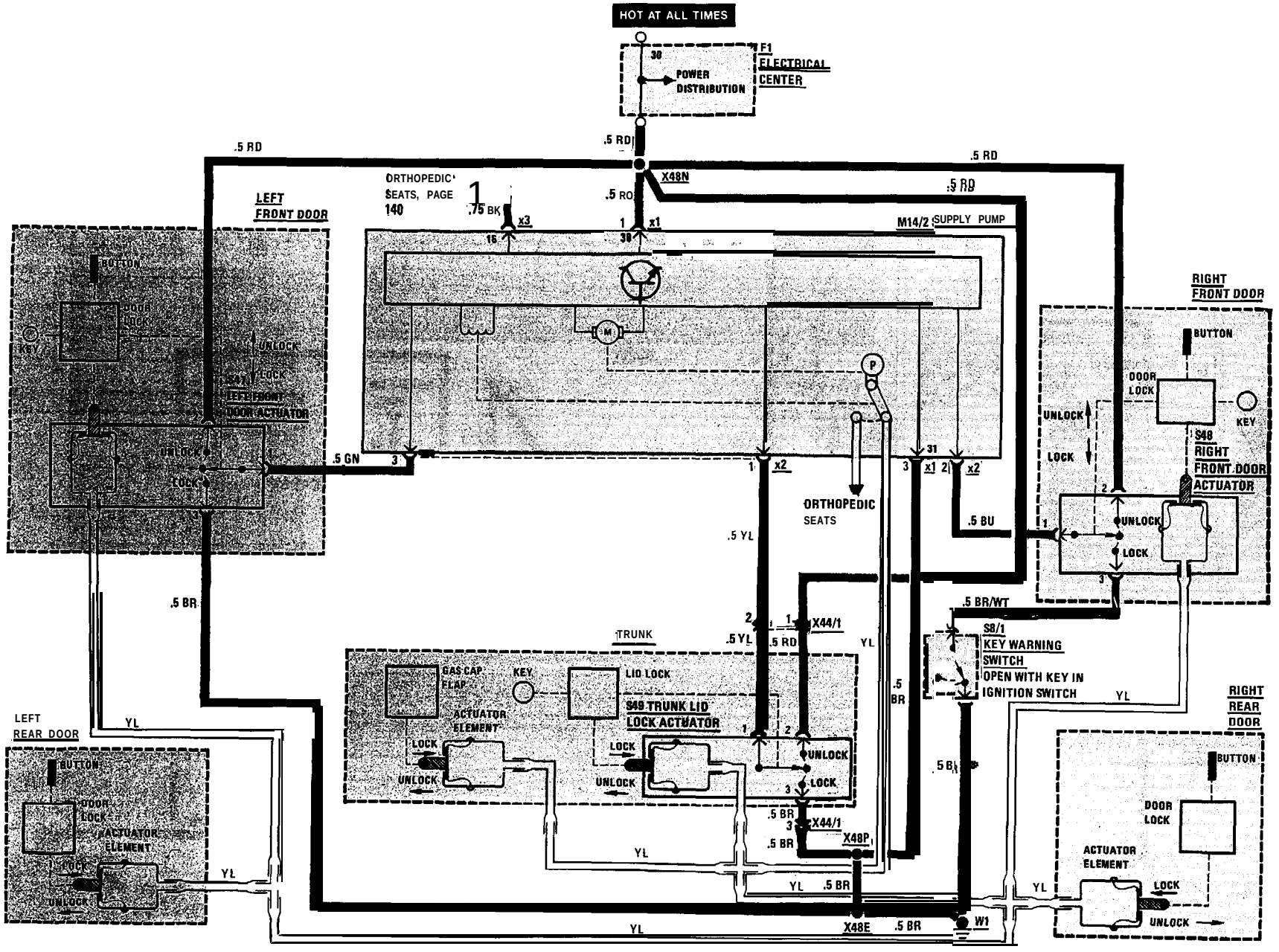


201.0/.1

REVISIONS:

1/87

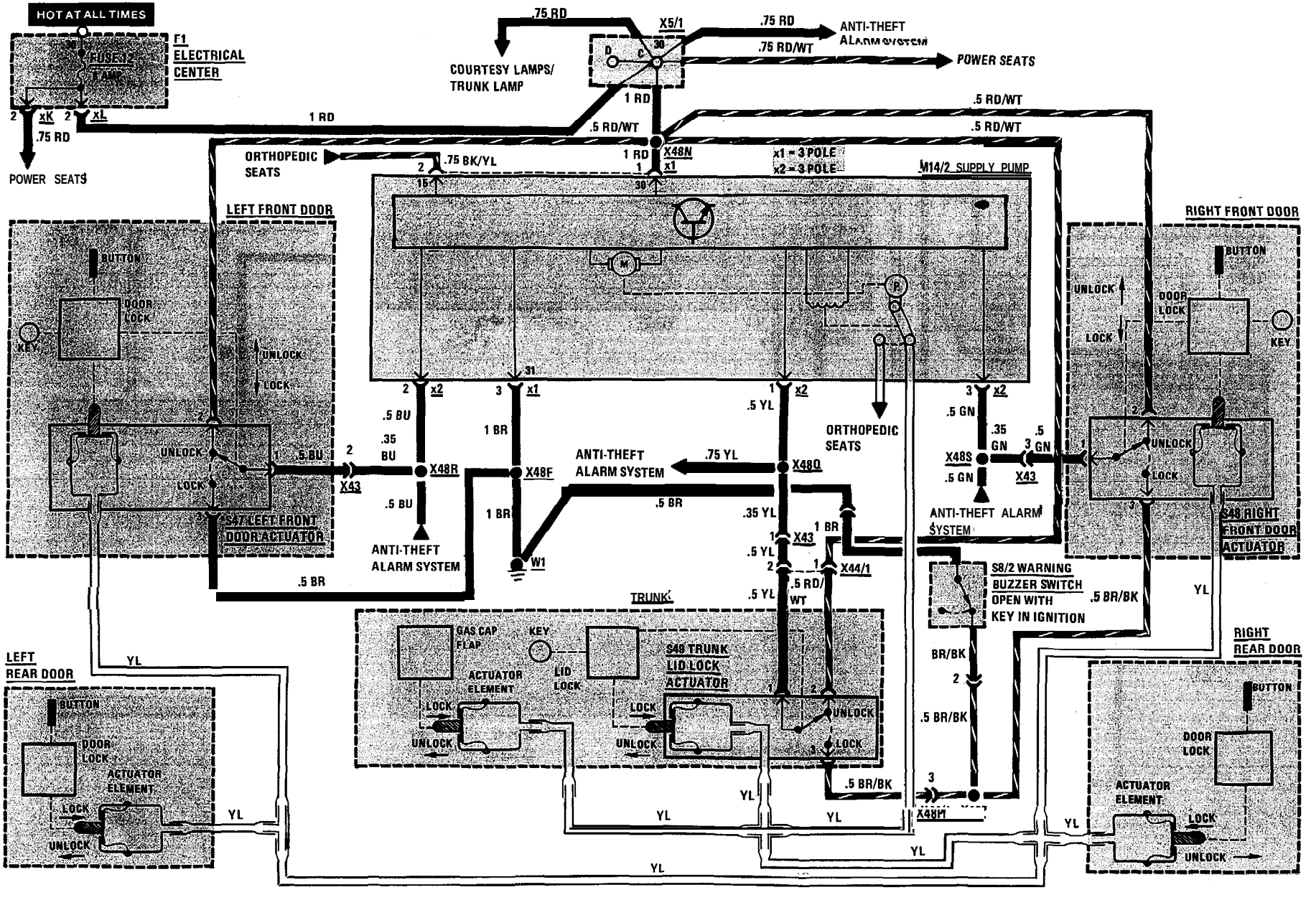
CENTRAL LOCKING SYSTEM



REVISIONS:

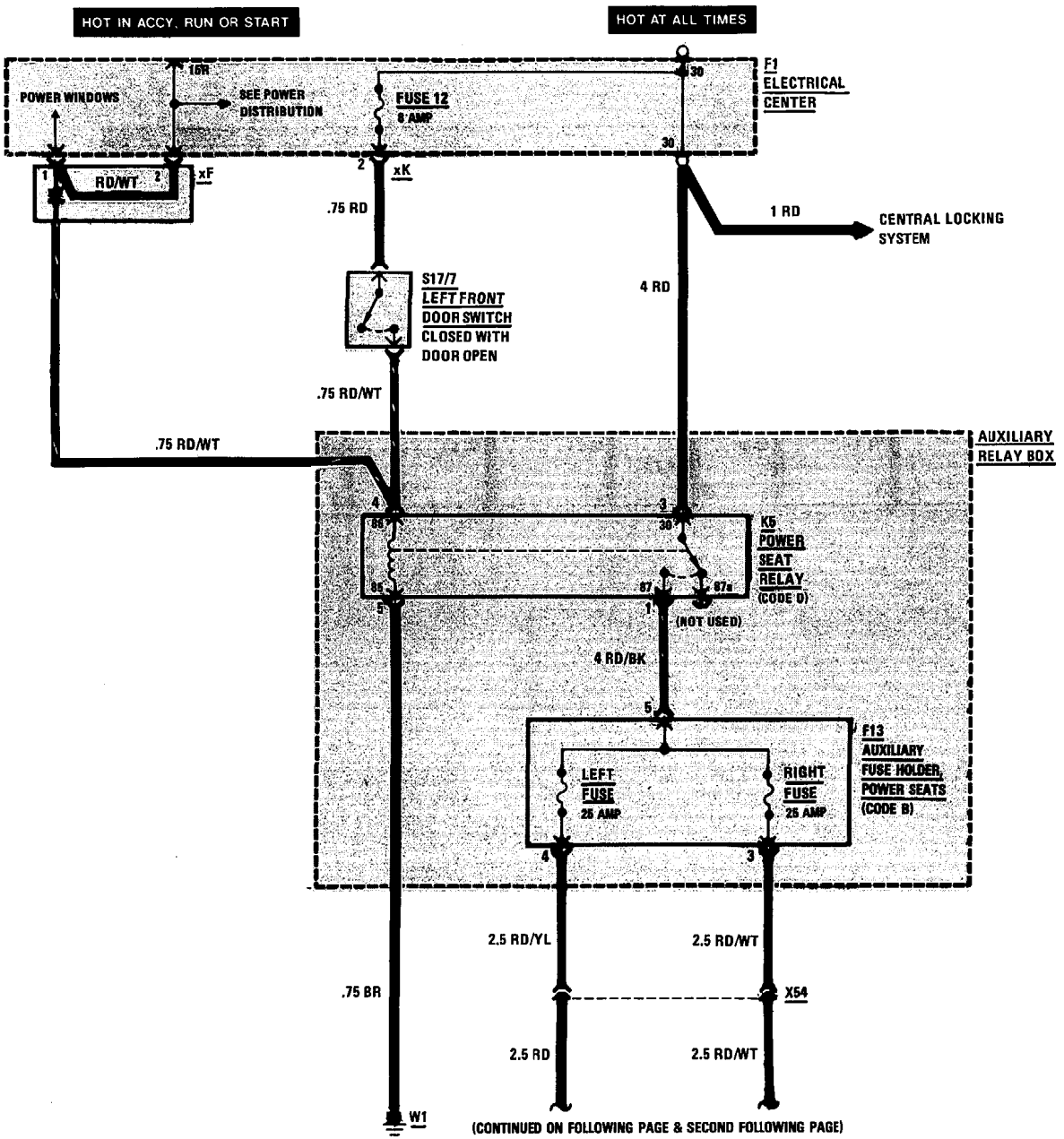
CENTRAL LOCKING SYSTEM

AS OF MY 1986



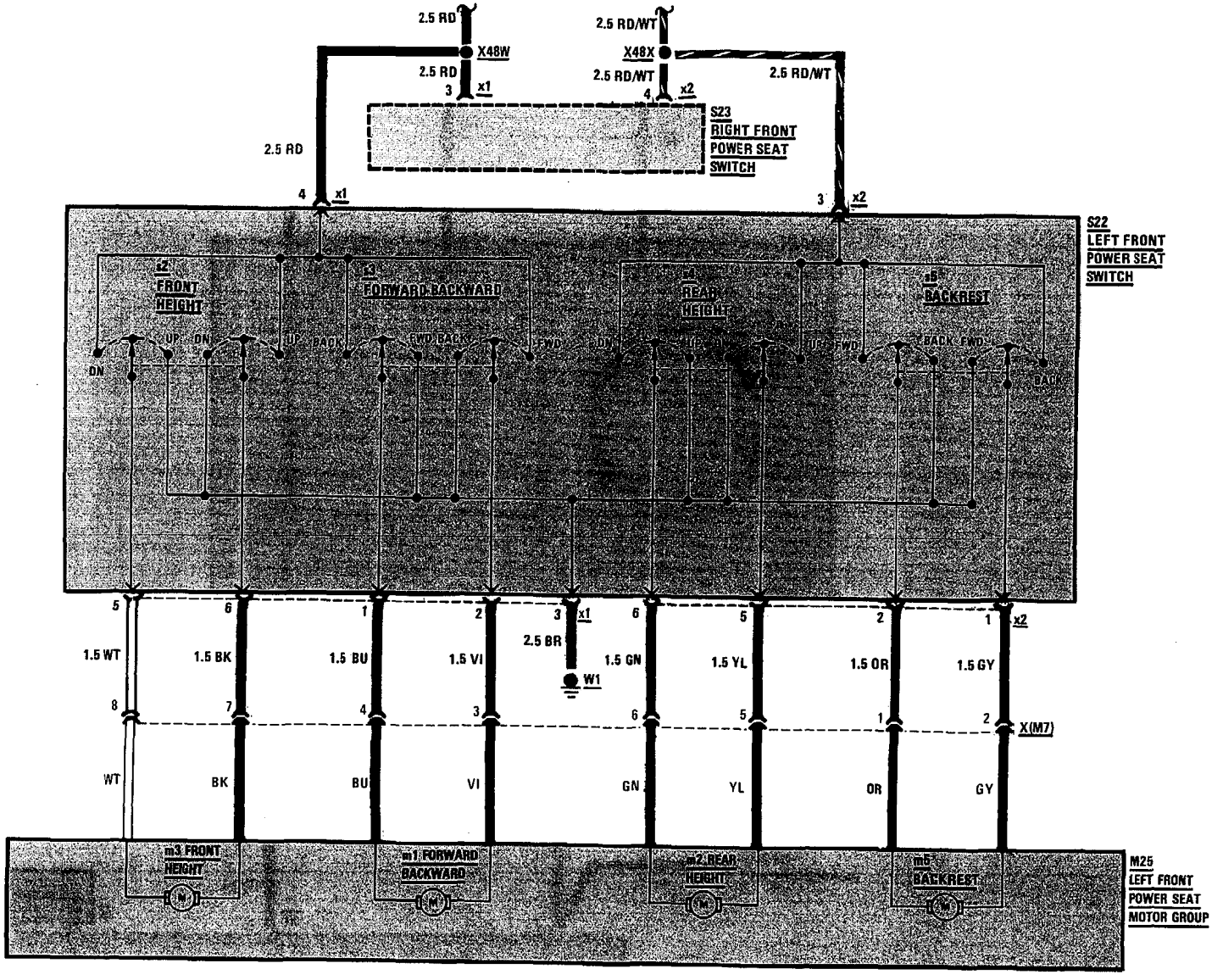
REVISIONS:

POWER SEATS

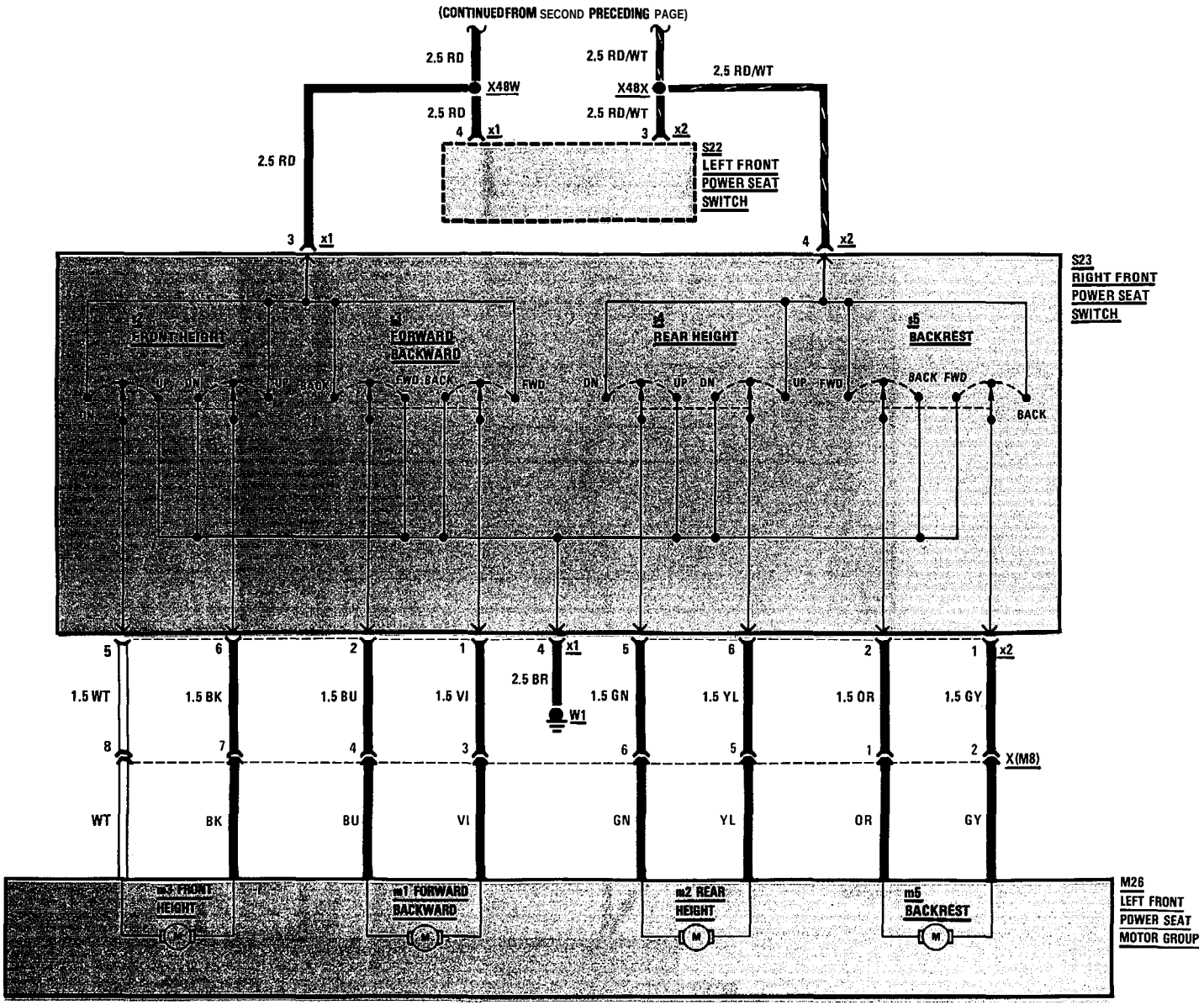


REVISIONS:

POWER SEATS

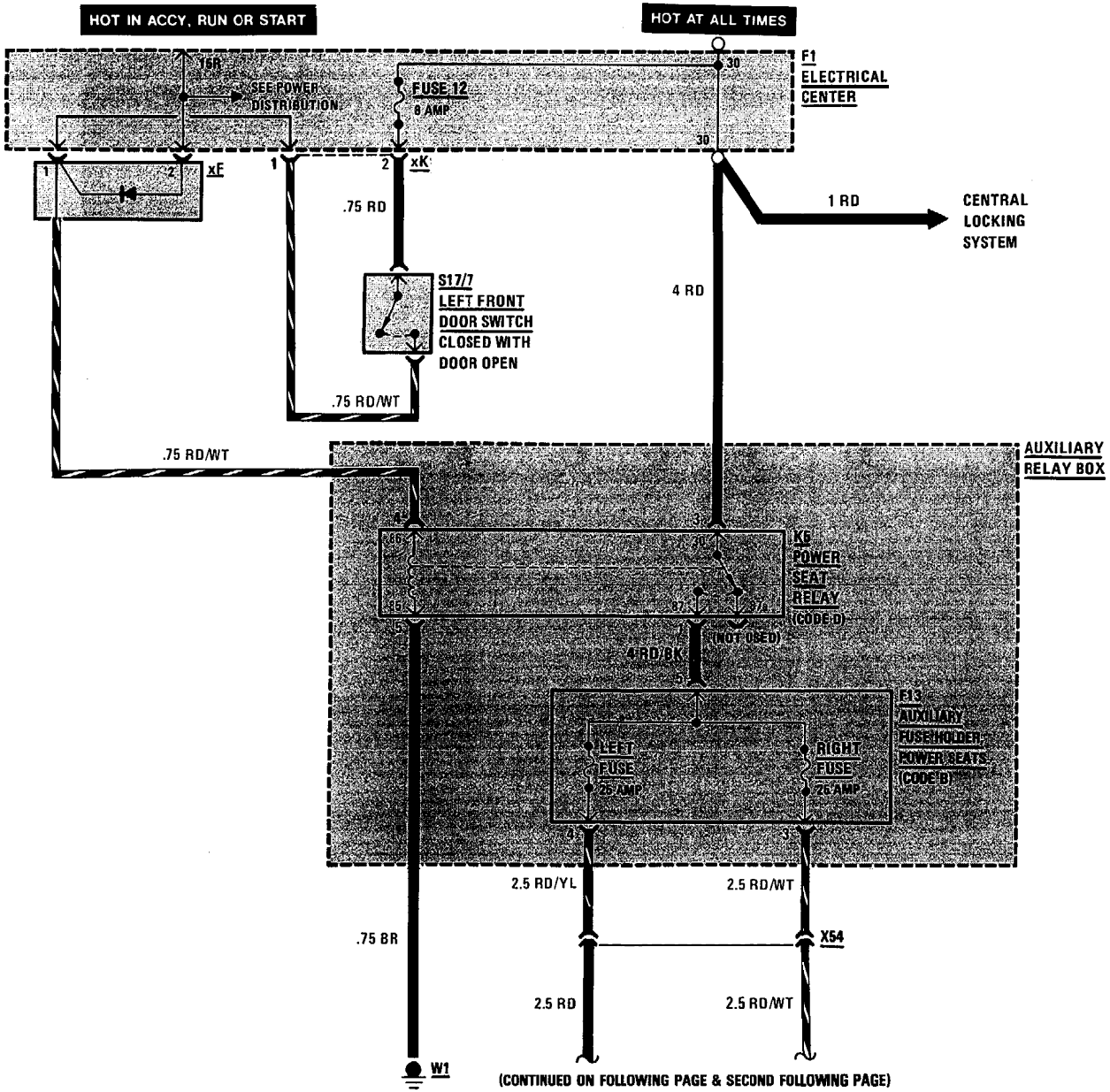

2.5 RD
X48W
2.5 RD
3
x1
2.5 RD/WT
X48X
2.5 RD/WT
4
x2
2.5 RD/WT
S23
RIGHT FRONT
POWER SEAT
SWITCH
2.5 RD
4
x1
3
x2
S22
LEFT FRONT
POWER SEAT
SWITCH
s2
FRONT
HEIGHT
UP
DN
DN
UP
s3
FORWARD-BACKWARD
BACK
FWD
BACK
FWD
s4
REAR
HEIGHT
UP
DN
UP
DN
s5
BACKREST
BACK
FWD
BACK
FWD
5
6
1
2
3
x1
6
5
2
1
x2
1.5 WT
1.5 BK
1.5 BU
1.5 VI
2.5 BR
1.5 GN
1.5 YL
1.5 OR
1.5 GY
W1
8
7
4
3
6
5
1
2
X(M7)
WT
BK
BU
VI
GN
YL
OR
GY
m3 FRONT
HEIGHT
m1 FORWARD
BACKWARD
m2 REAR
HEIGHT
m5
BACKREST
M25
LEFT FRONT
POWER SEAT
MOTOR GROUP

POWER SEATS



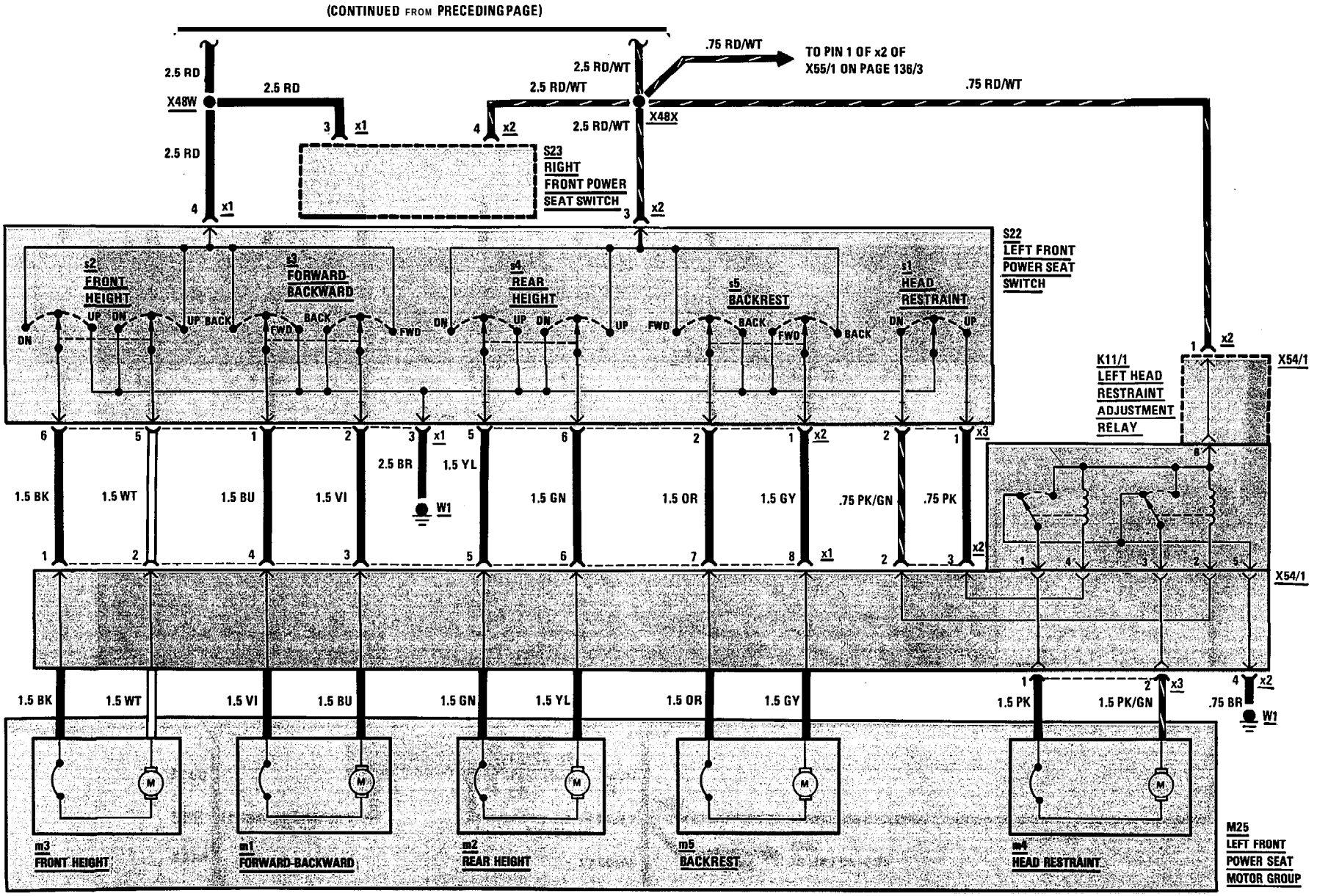
REVISIONS:

POWER SEATS



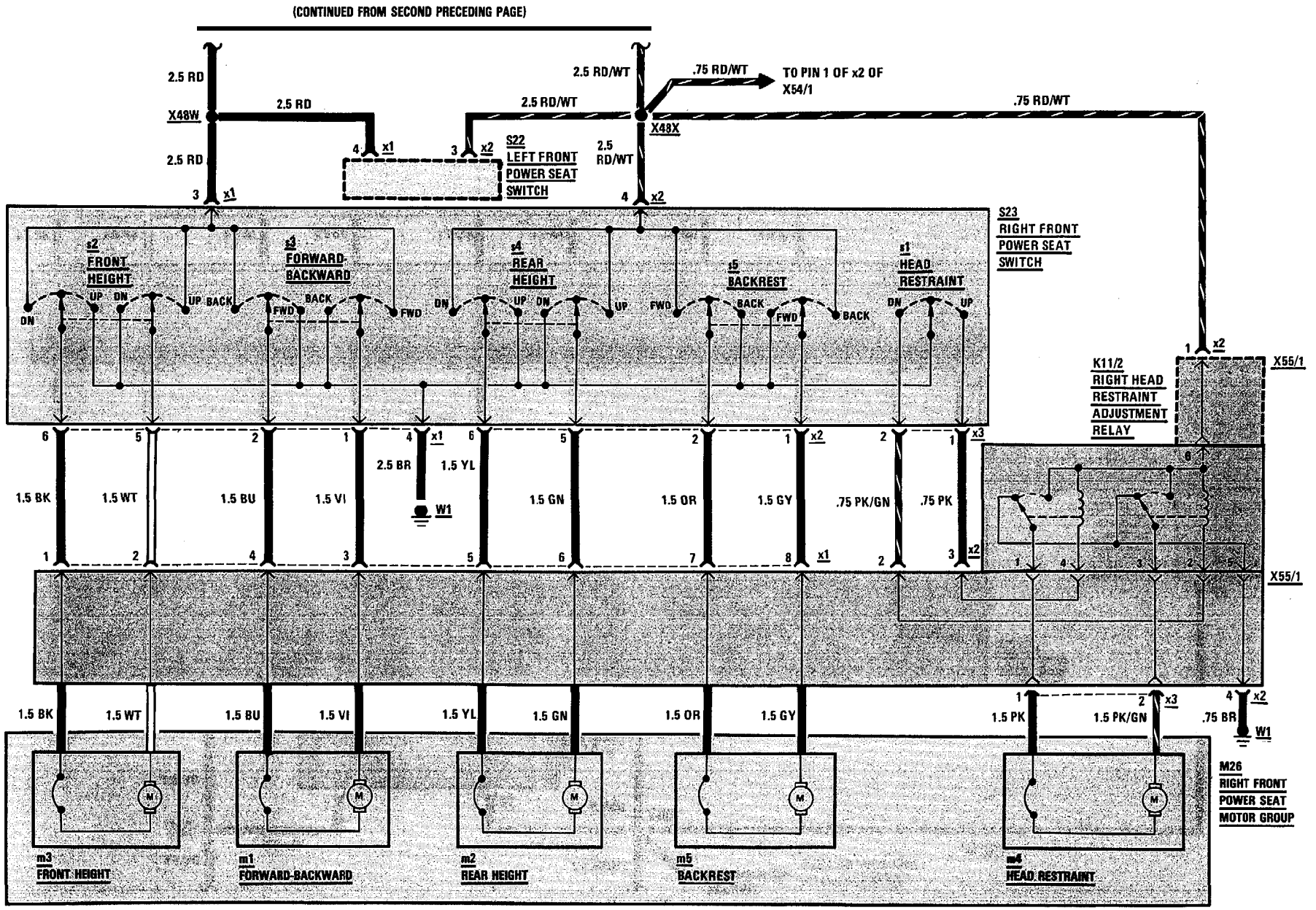
REVISIONS:

LH POWER SEAT



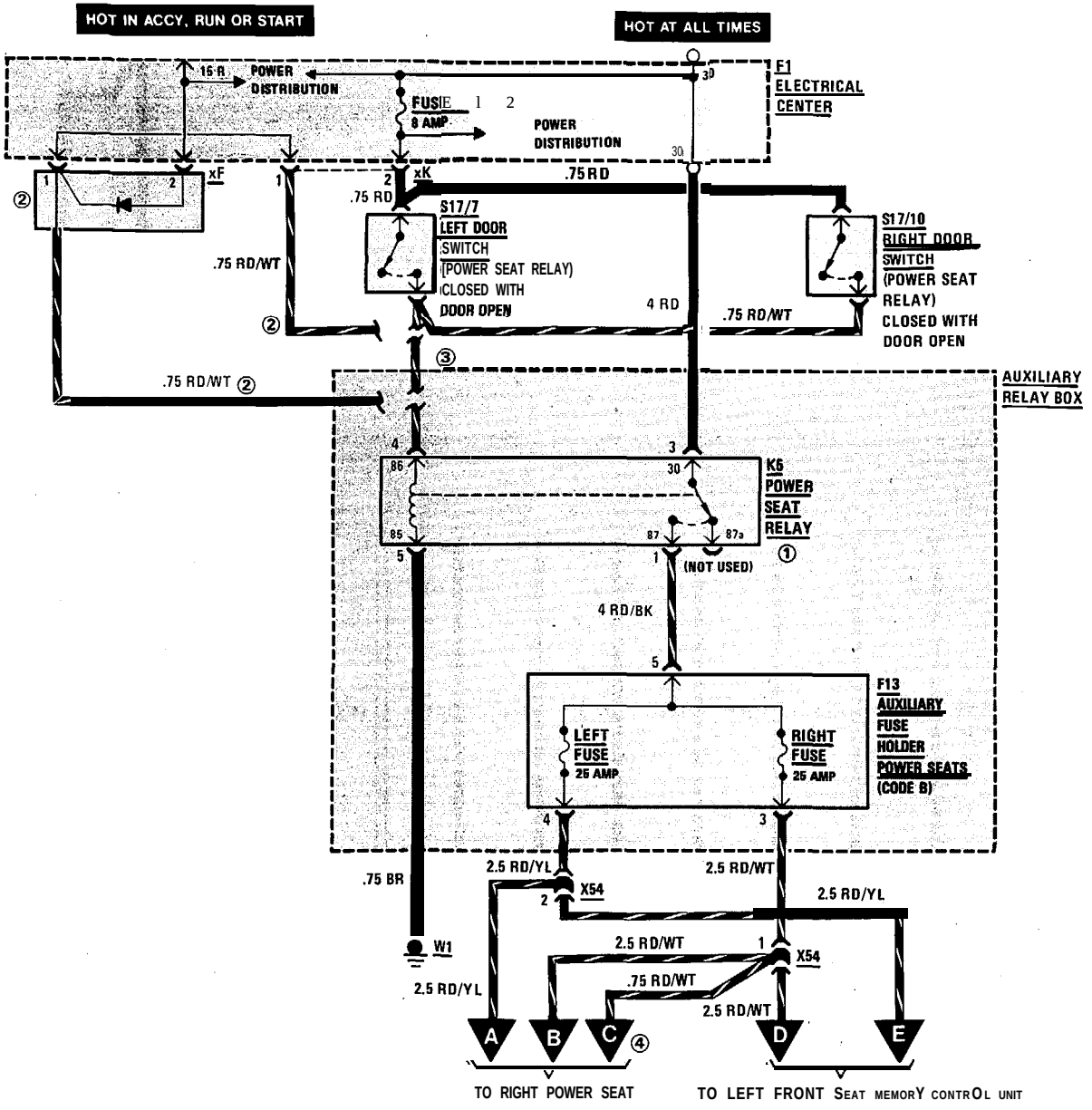
REVISIONS:

RH POWER SEAT



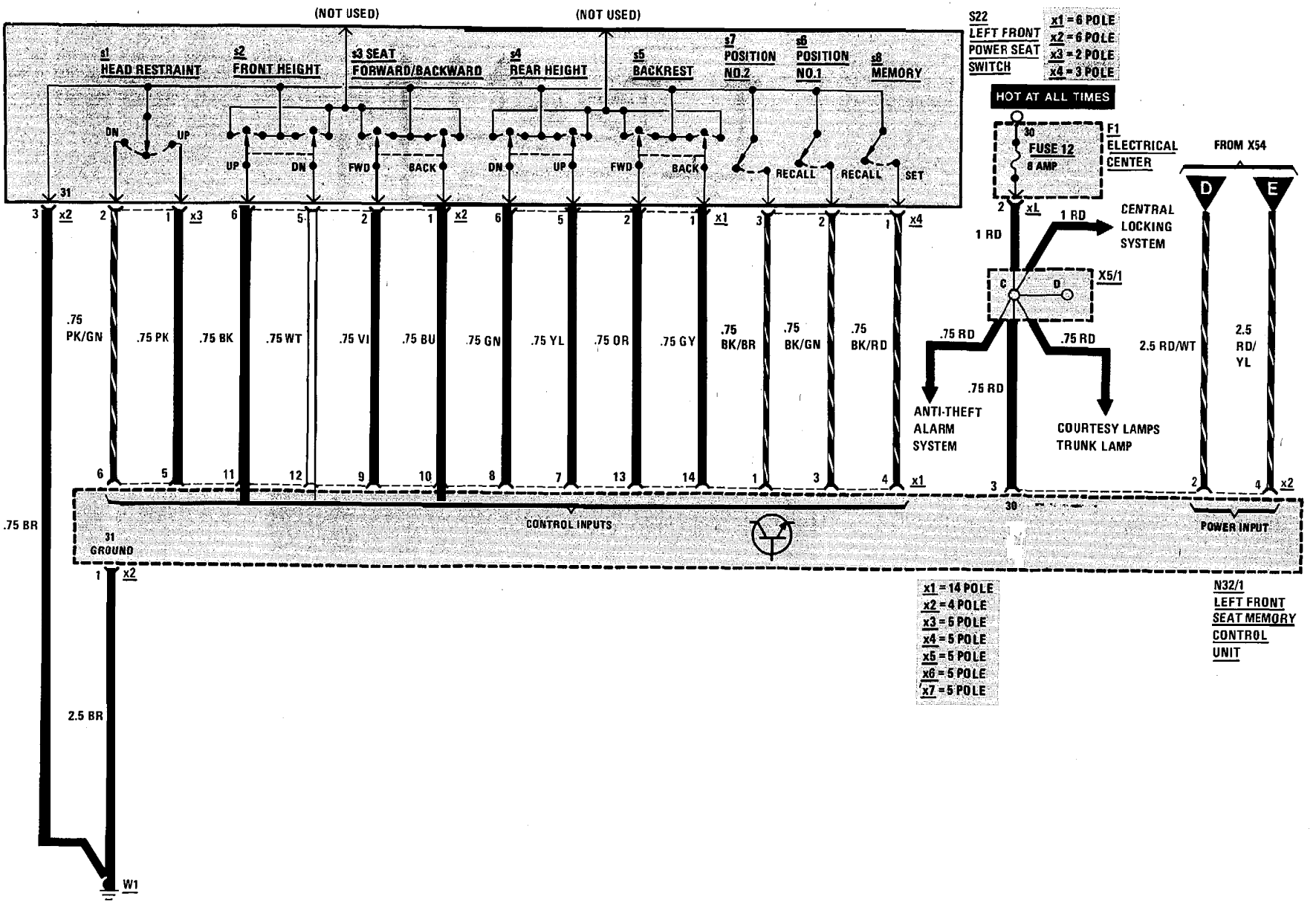
REVISIONS

POWER SEATS (WITH MEMORY)



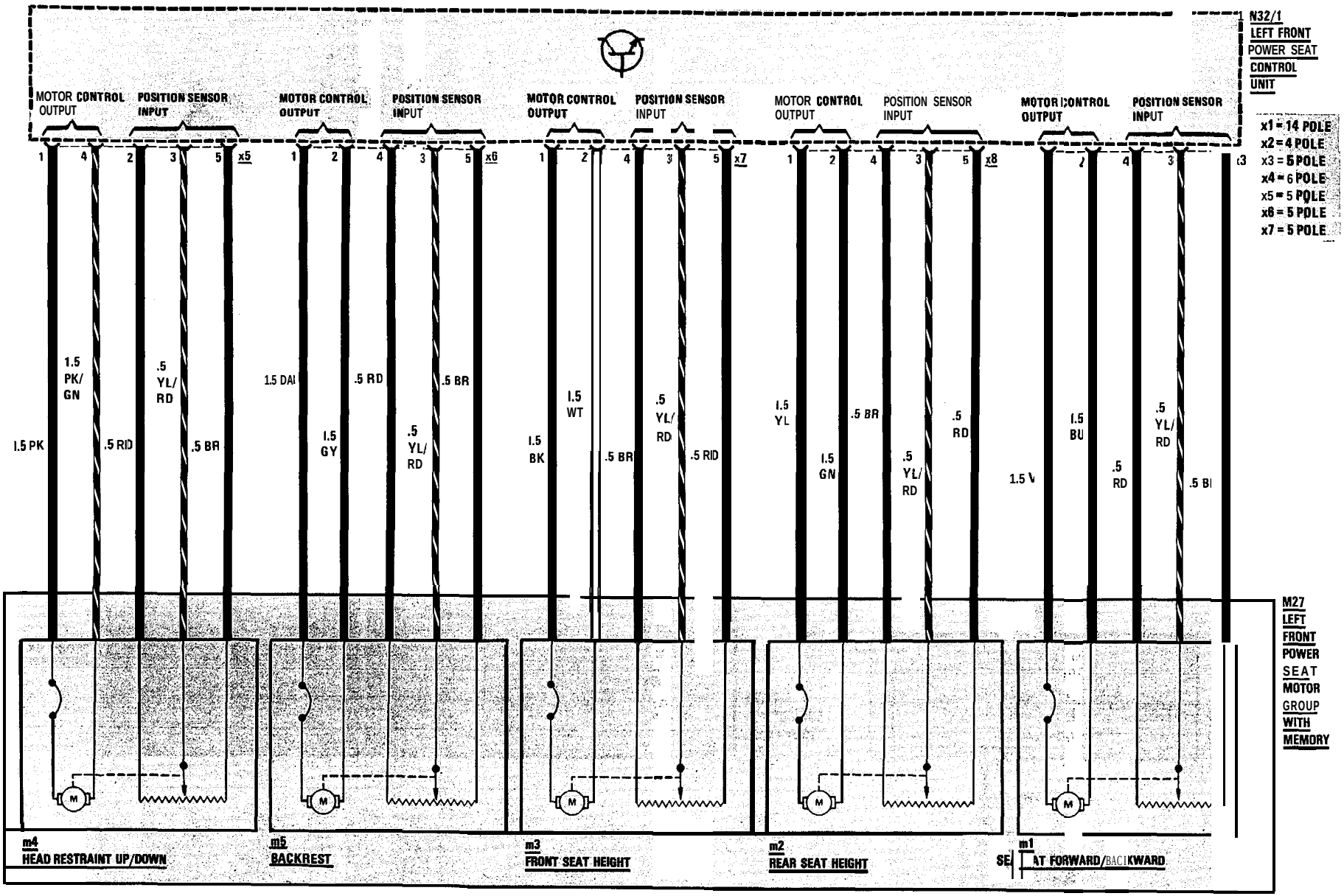
REVISIONS: ① MODEL YEAR 1986 (CODE D)
AS OF MODEL YEAR 1987 (CODE A)
② UP TO MY 1989
③ AS OF MY 1990
④ UP TO MY 1990

LEFT POWER SEAT (WITH MEMORY)



LEFT POWER SEAT (WITH MEMORY)

AS OF MY 1986

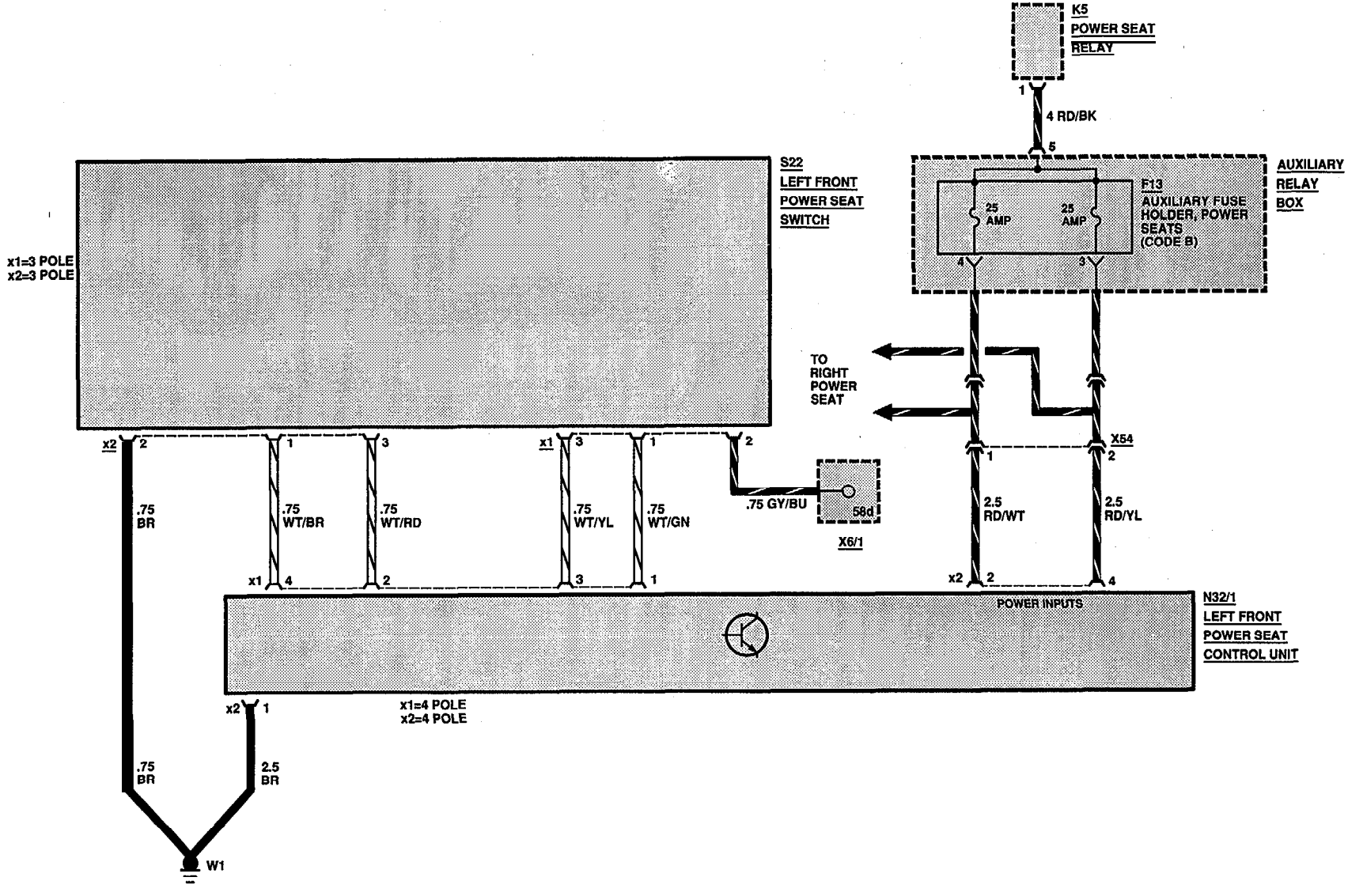


REVISIONS:

LEFT POWER SEAT (WITH MEMORY)

AS OF MY 1991

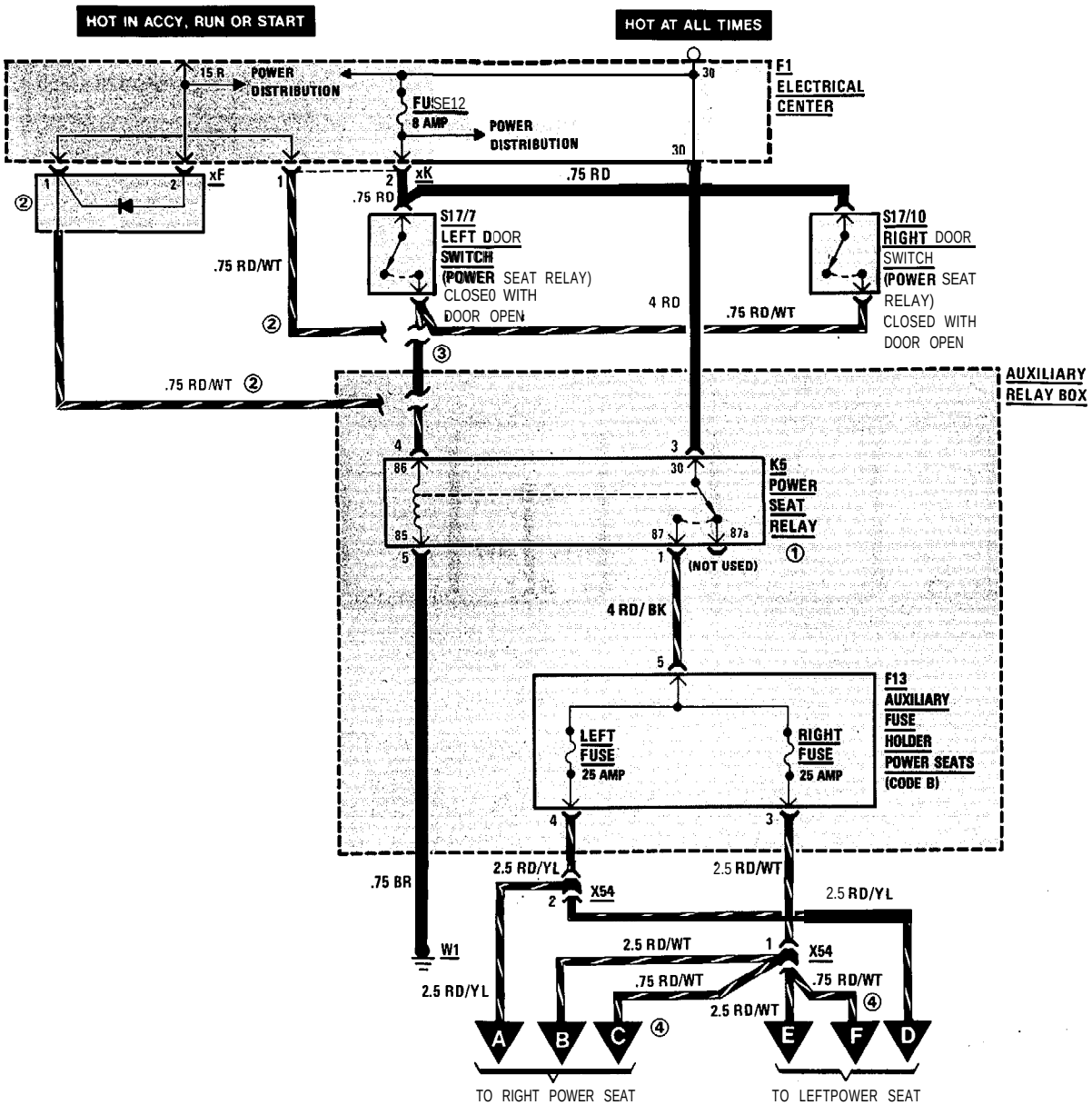
190E 2.3, 190E 2.6



REVISIONS:

POWER SEATS (WITHOUT MEMORY)

AS OF MY 1986



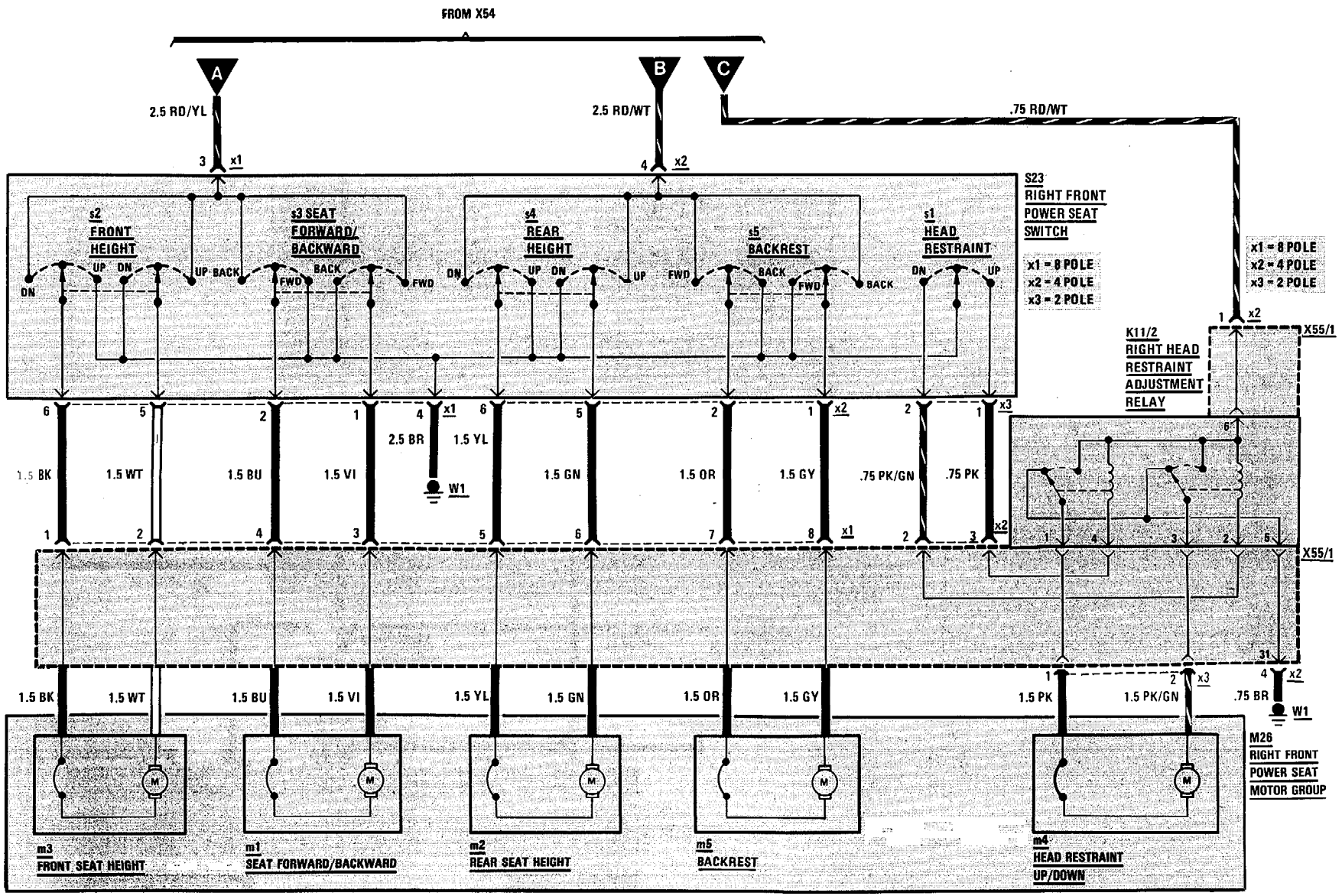
REVISIONS: ① MODEL YEAR 1986 (CODE D)
AS OF MODEL YEAR 1987 (CODE A)
② UP TO MY 1999
③ ASOFMY 1990
④ UP TO MY 1990

RIGHT POWER SEAT

MY 1986-1990

138/11

201.0/.1



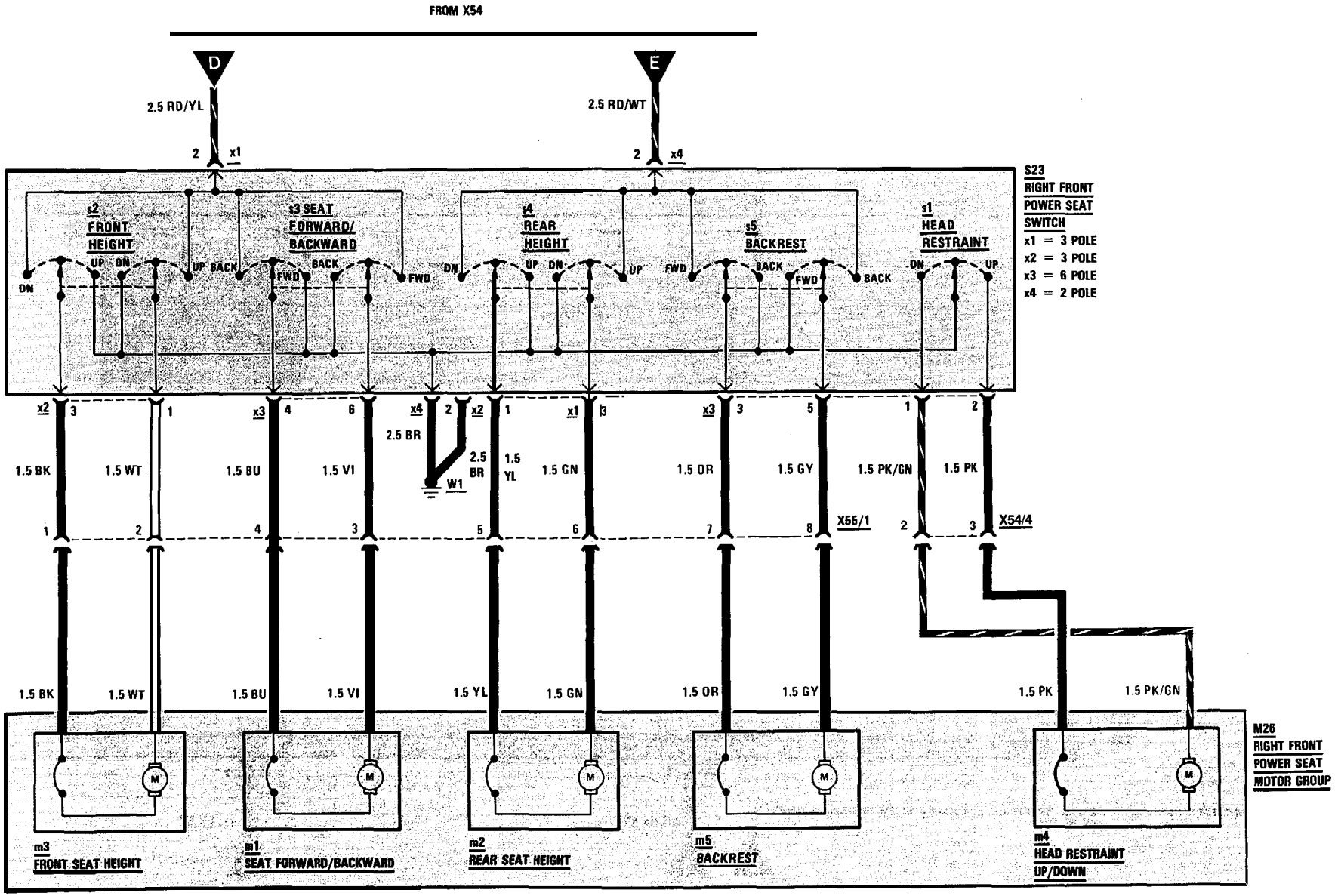
REVISIONS:

Supplement 9

RIGHT POWER SEAT

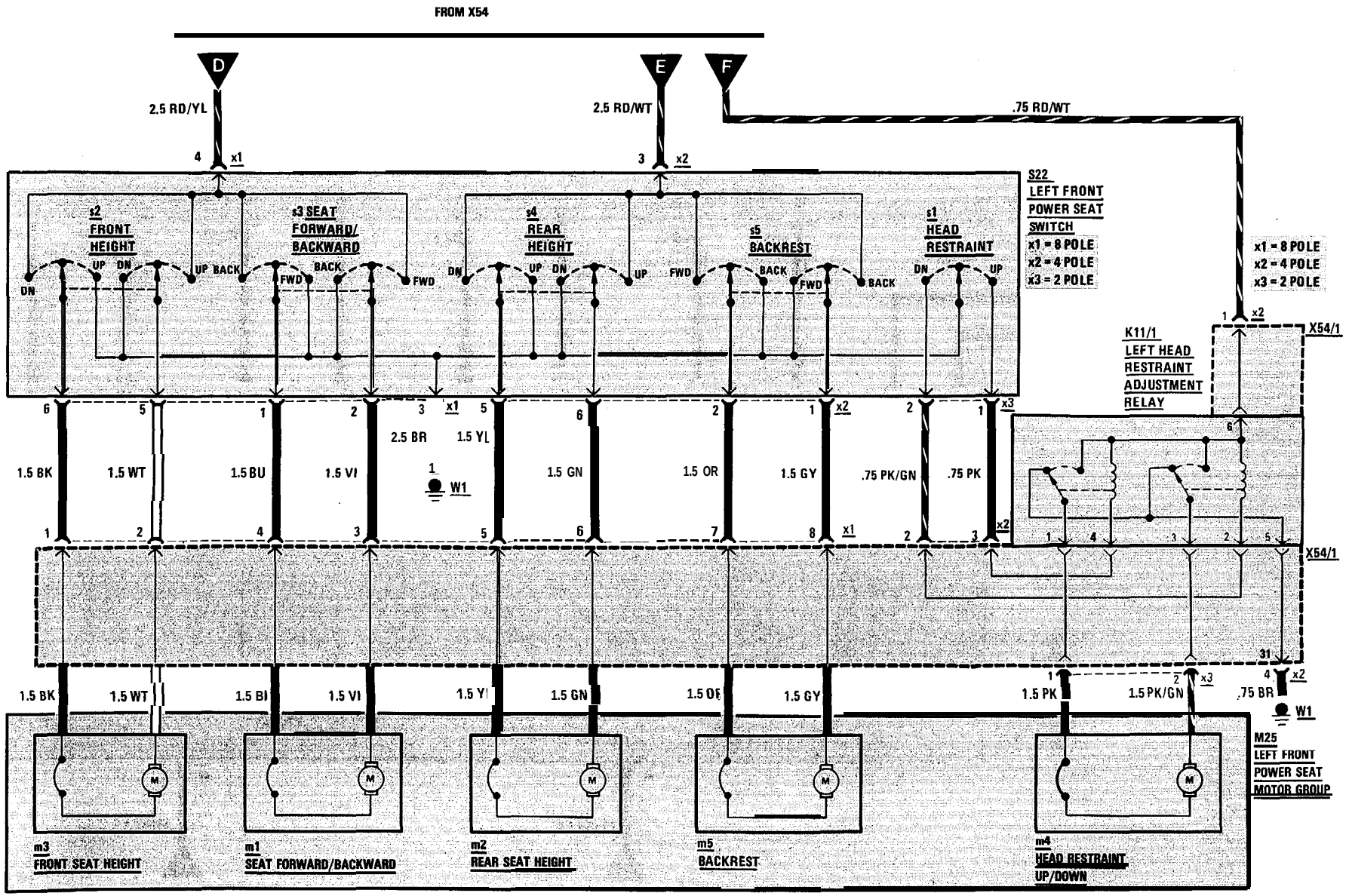
AS OF MY 1991

190E 2.3, 190E 2.6



REVISIONS:

LEFT POWER SEAT (WITHOUT MEMORY)

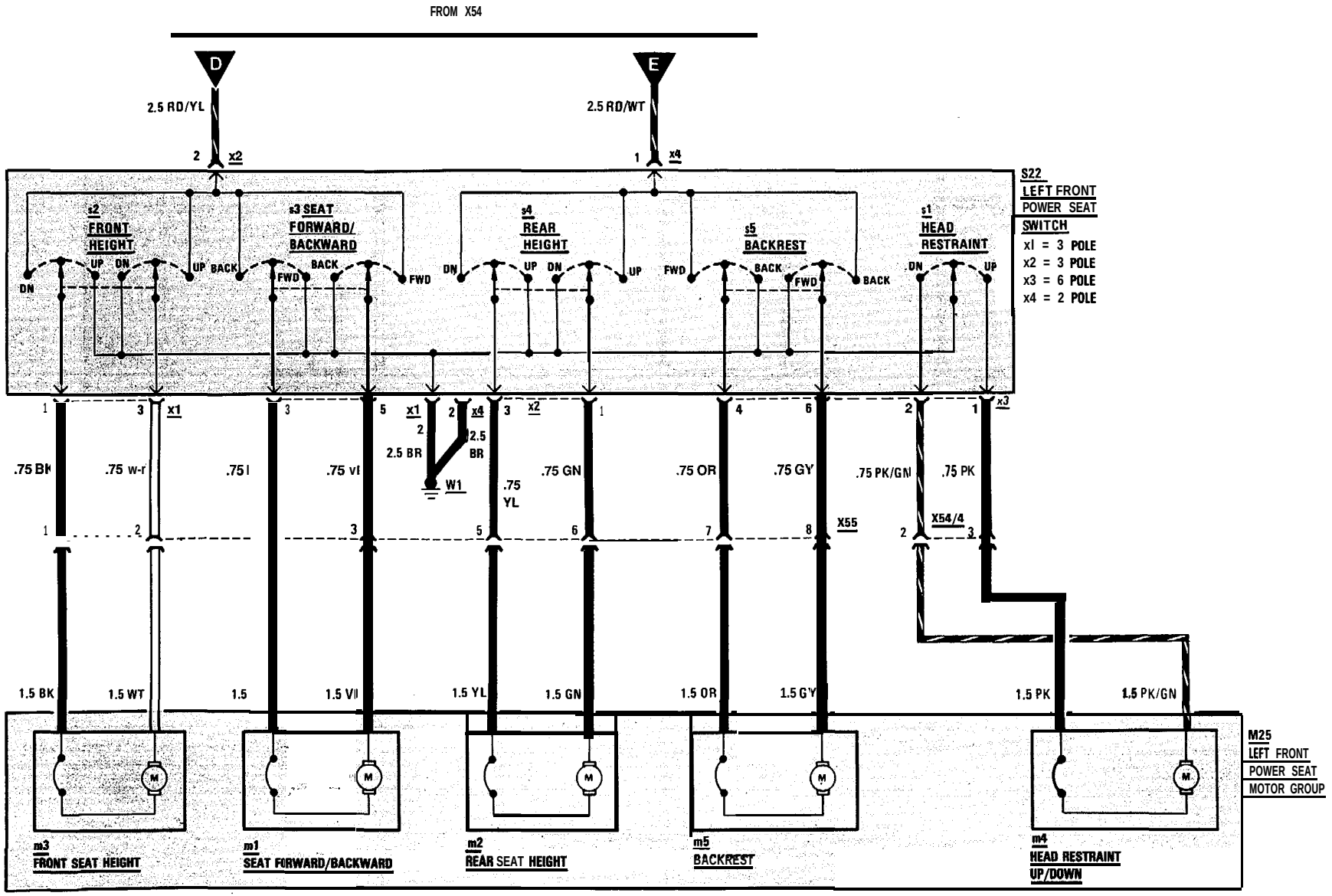


REVISIONS:

LEFT POWER SEAT (WITHOUT MEMORY)

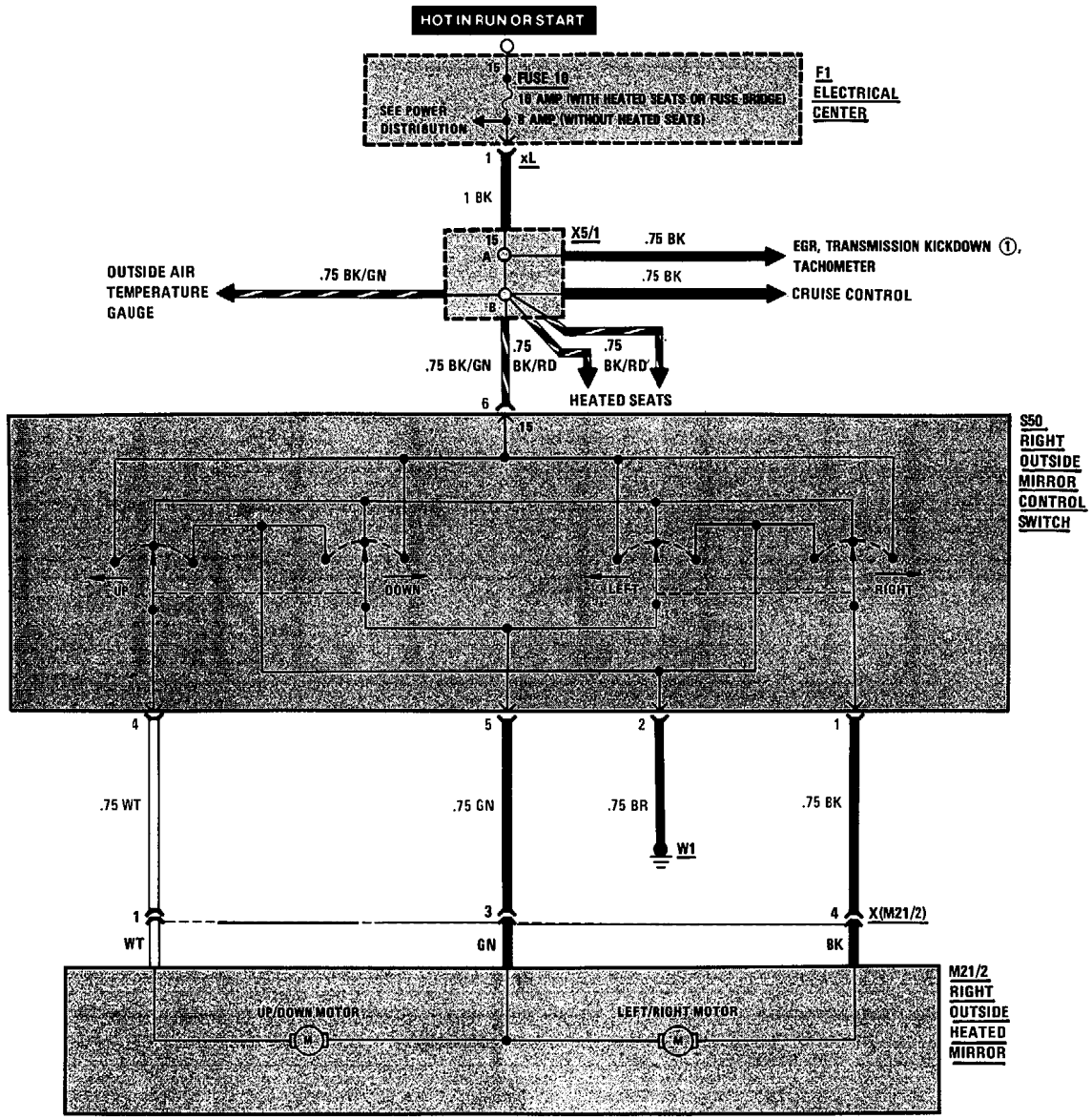
AS OF MY 1991

190E 2.3, 190E 2.6



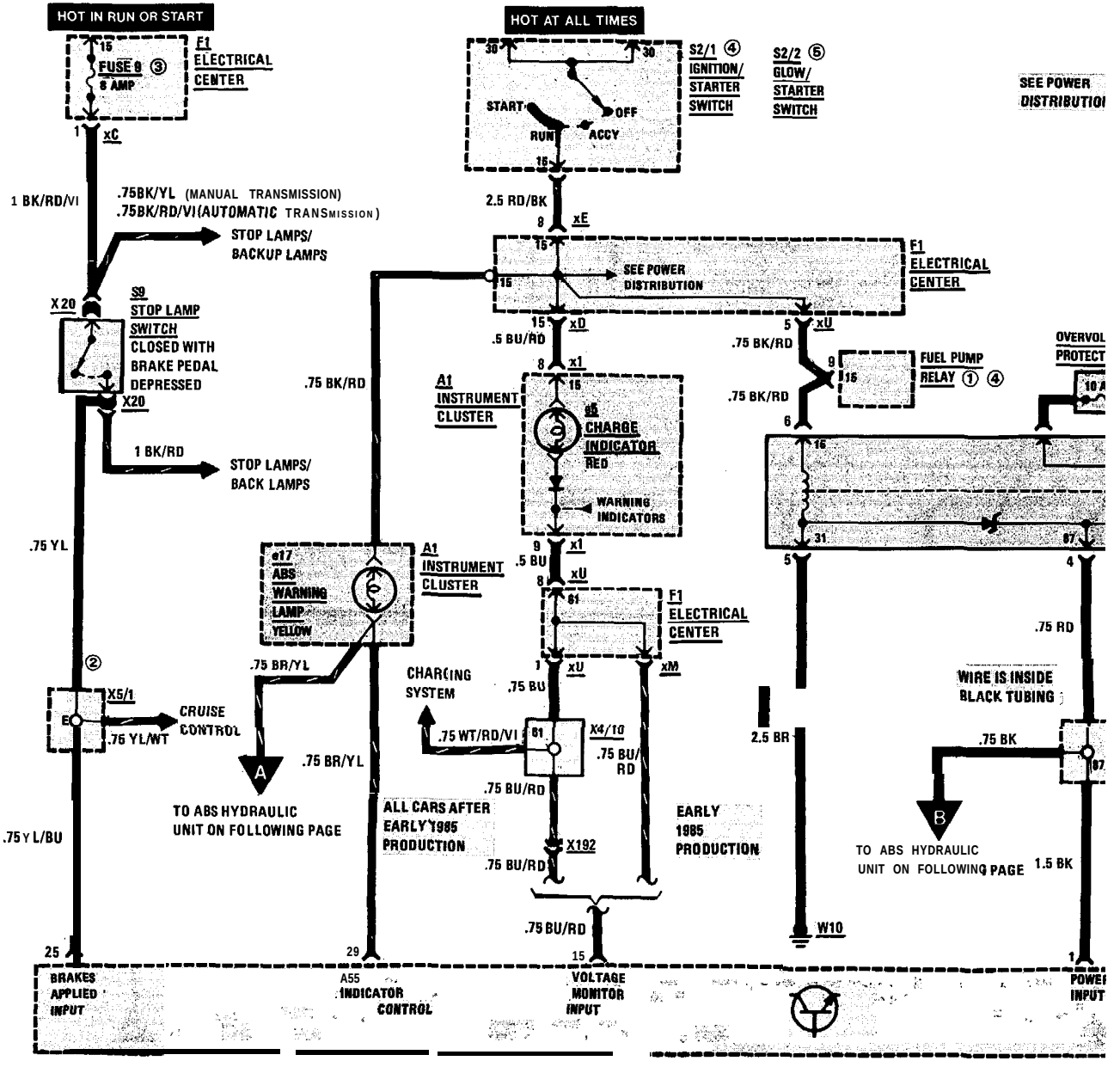
REVISIONS:

RH OUTSIDE MIRROR



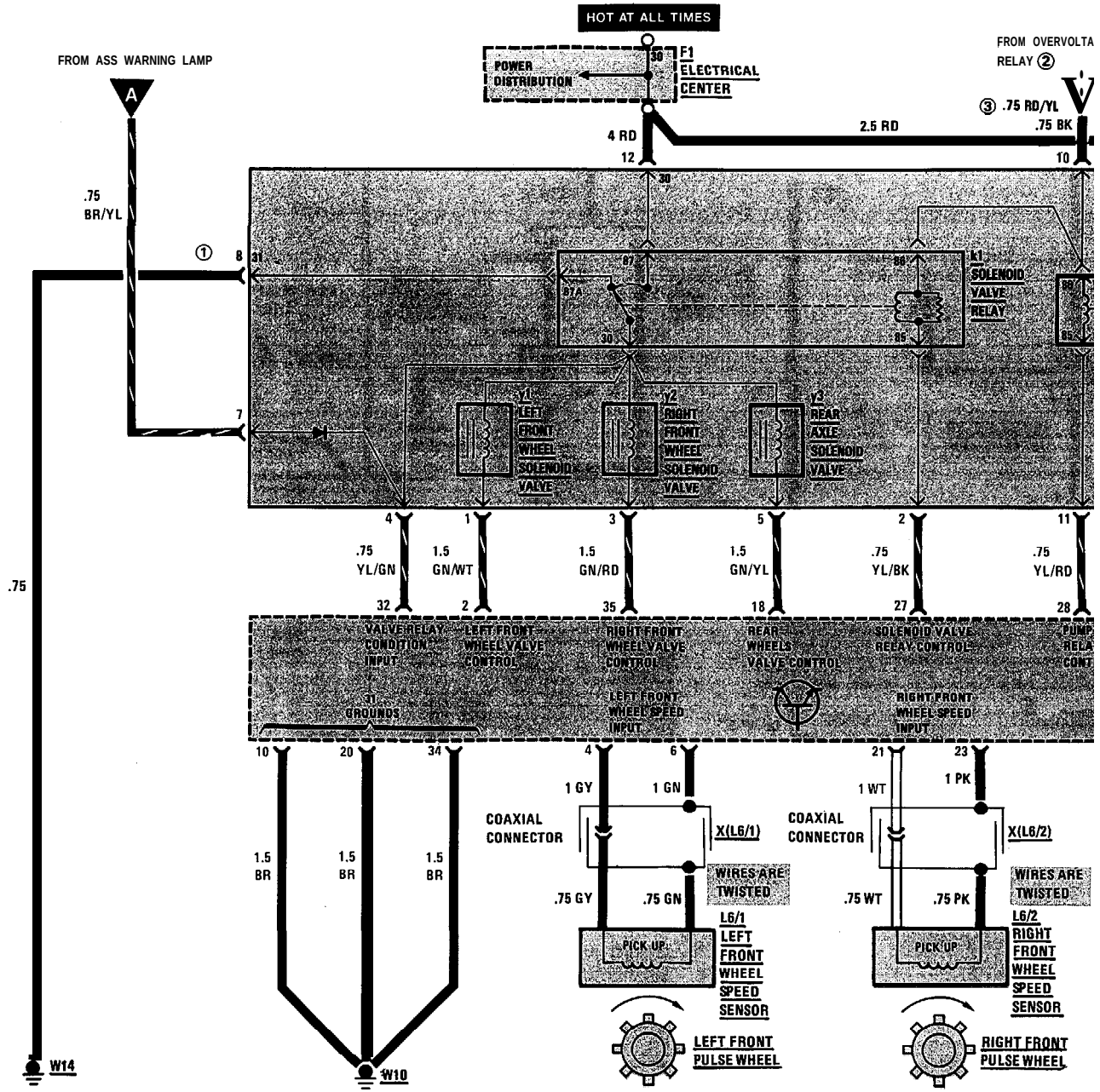
REVISIONS: (1) DIESEL

ANTI-LOCK BRAKE SYSTEM



REVISIONS: ① N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)
② AUTOMATIC TRANSMISSION ONLY (MANUAL TRANSMISSION, SEE CRUISE CONTROL (WITH M/T)
③ UP TO CHASSIS END NUMBERS 1A 313925 AND 1F 229914 FUSE NO. 9 IS REMOVED AN0 A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10
④ GASOLINE
⑤ DIESEL

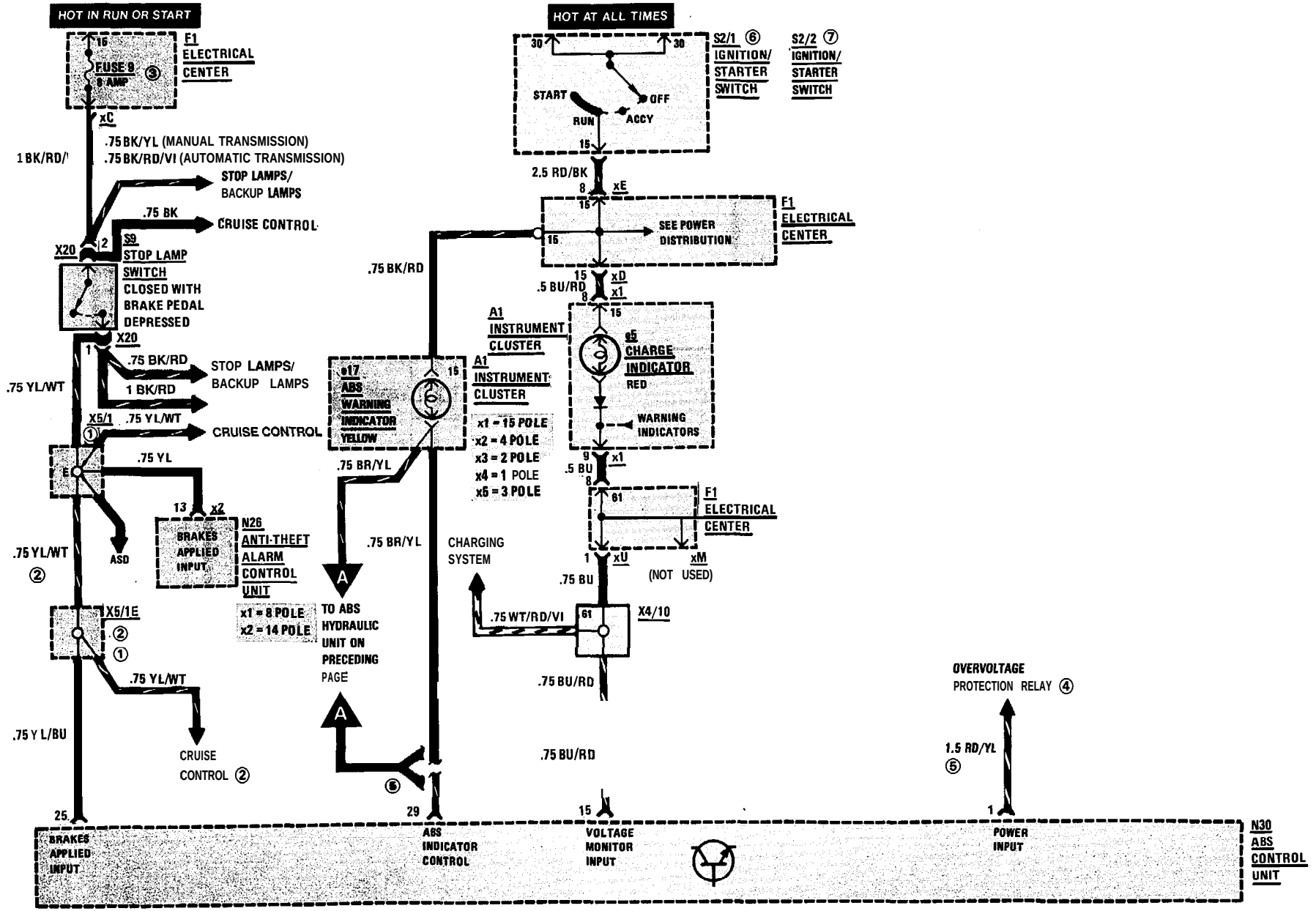
ANTI-LOCK BRAKE SYSTEM



REVISIONS: ① NOT USED AS OF MY 1999 ③ WITH AS0
② MY 1985-1989 PIN 4
AS OF MY 1990 PIN 7

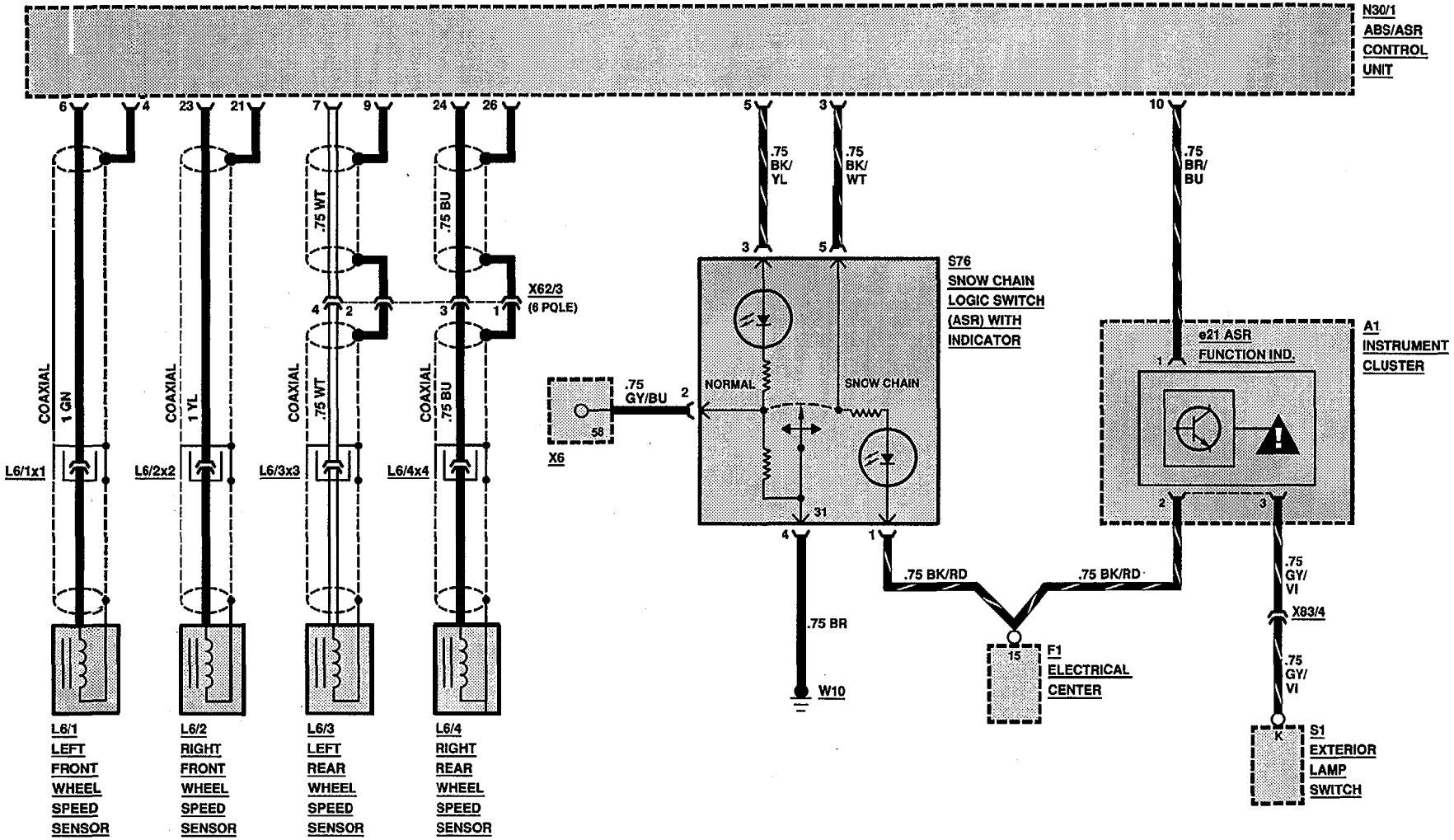
ANTI-LOCK BRAKE SYSTEM (ABS)

AS OF MY 1986



REVISIONS: ① AUTOMATIC TRANSMISSION **ONLY** (MANUAL TRANSMISSION WIRING, SEE CRUISE CONTROL (WITH M/T)
② **X5/1E** USED IN MODEL YEAR 1996 ONLY.
AS OF **MY** 1987 THE **.75 YL/BU** WIRE CONNECTS PIN 25 ON **N30** TO **X5/1** DIRECTLY
③ UP TO CHASSIS **END** NUMBERS **1A** 313825 AND **1F** 229914 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10
④ **MY 1986-1989** PIN 4, AS OF MY 1990 PIN 7
⑤ WITH **ASD**
⑥ GASOLINE
⑦ **DIESEL**

ANTI-LOCK BRAKE SYSTEM/ACCELERATION SLIP CONTROL (ABS/ASR)

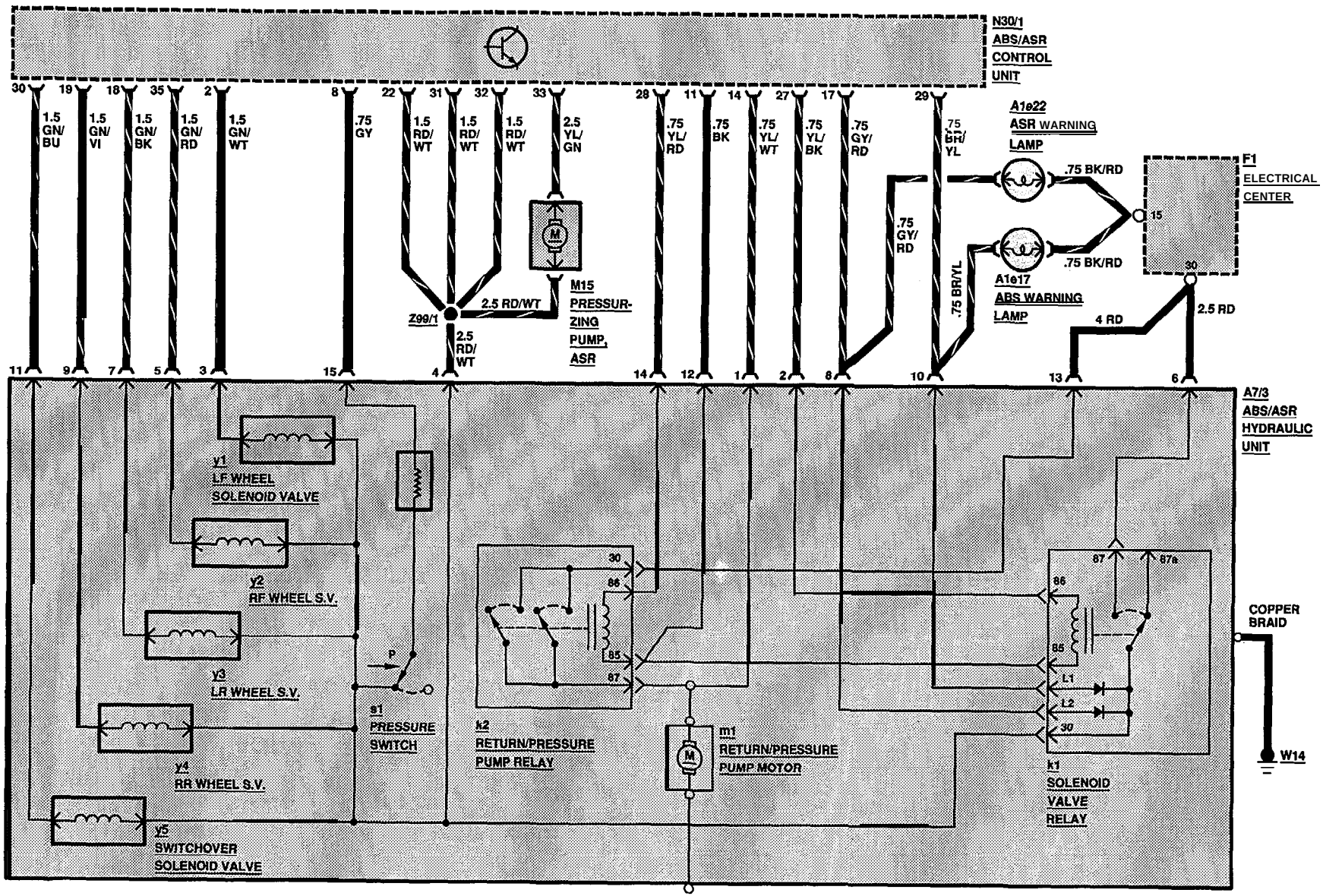


REVISIONS:

ANTI-LOCK BRAKE SYSTEM/ACCELERATION SLIP CONTROL (ABS/ASR) (HYDRAULIC UNIT)

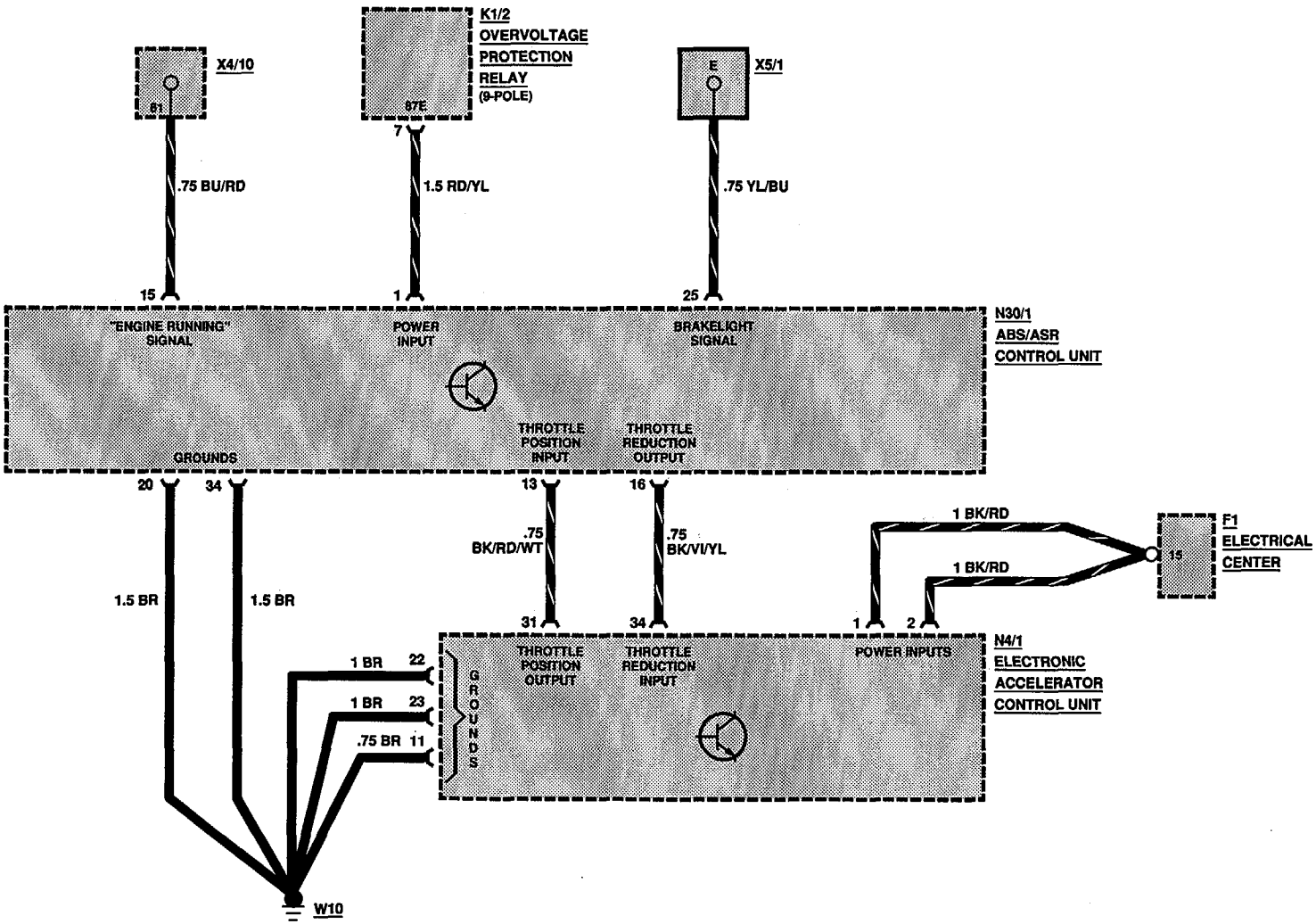
AS OF MY 1991

190E 2.6



REVISIONS:

ANTI-LOCK BRAKE SYSTEM/ ACCELERATION SLIP CONTROL/ELECTRONIC ACCELERATION SYSTEM

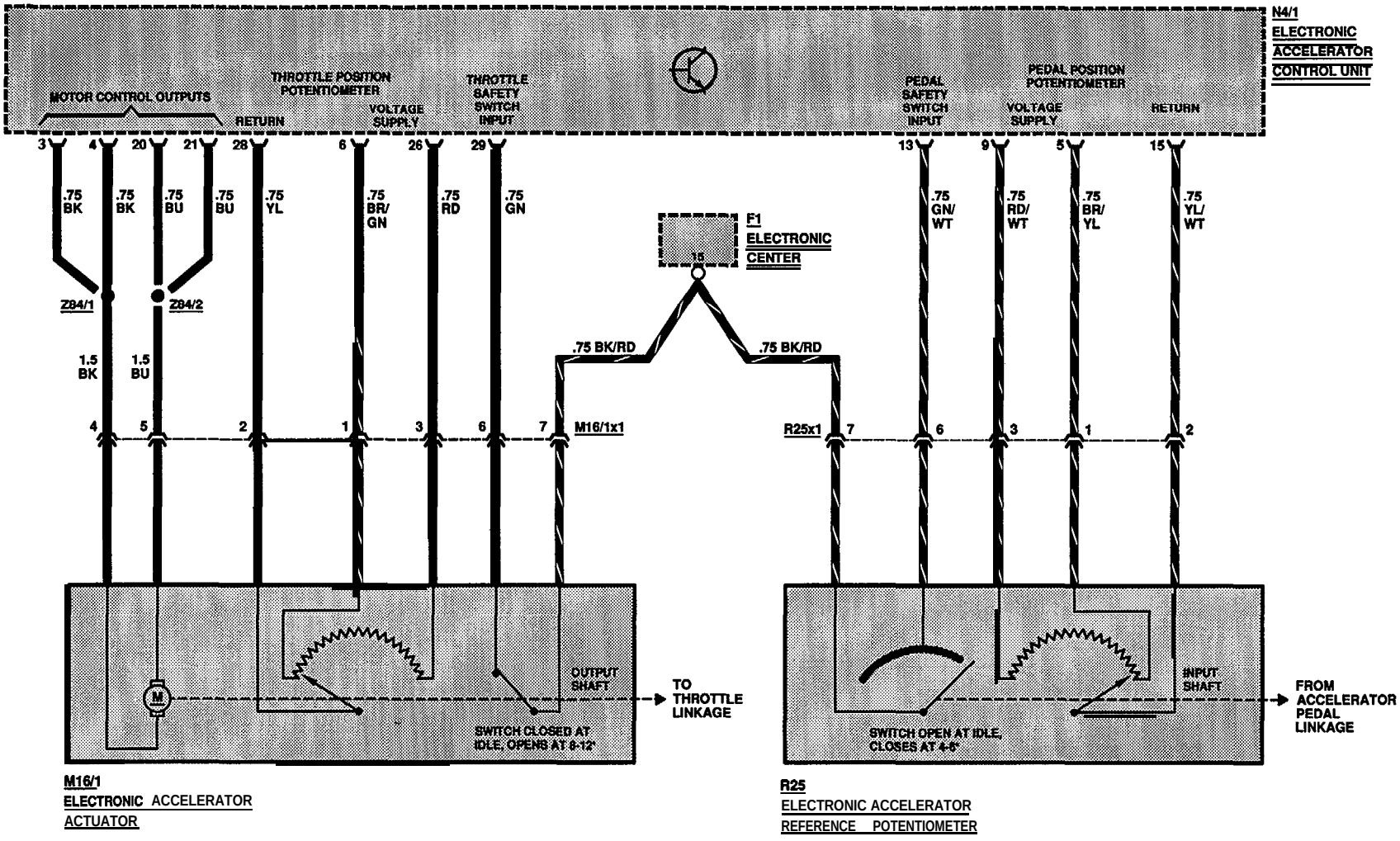


REVISIONS:

ELECTRONIC ACCELERATOR SYSTEM

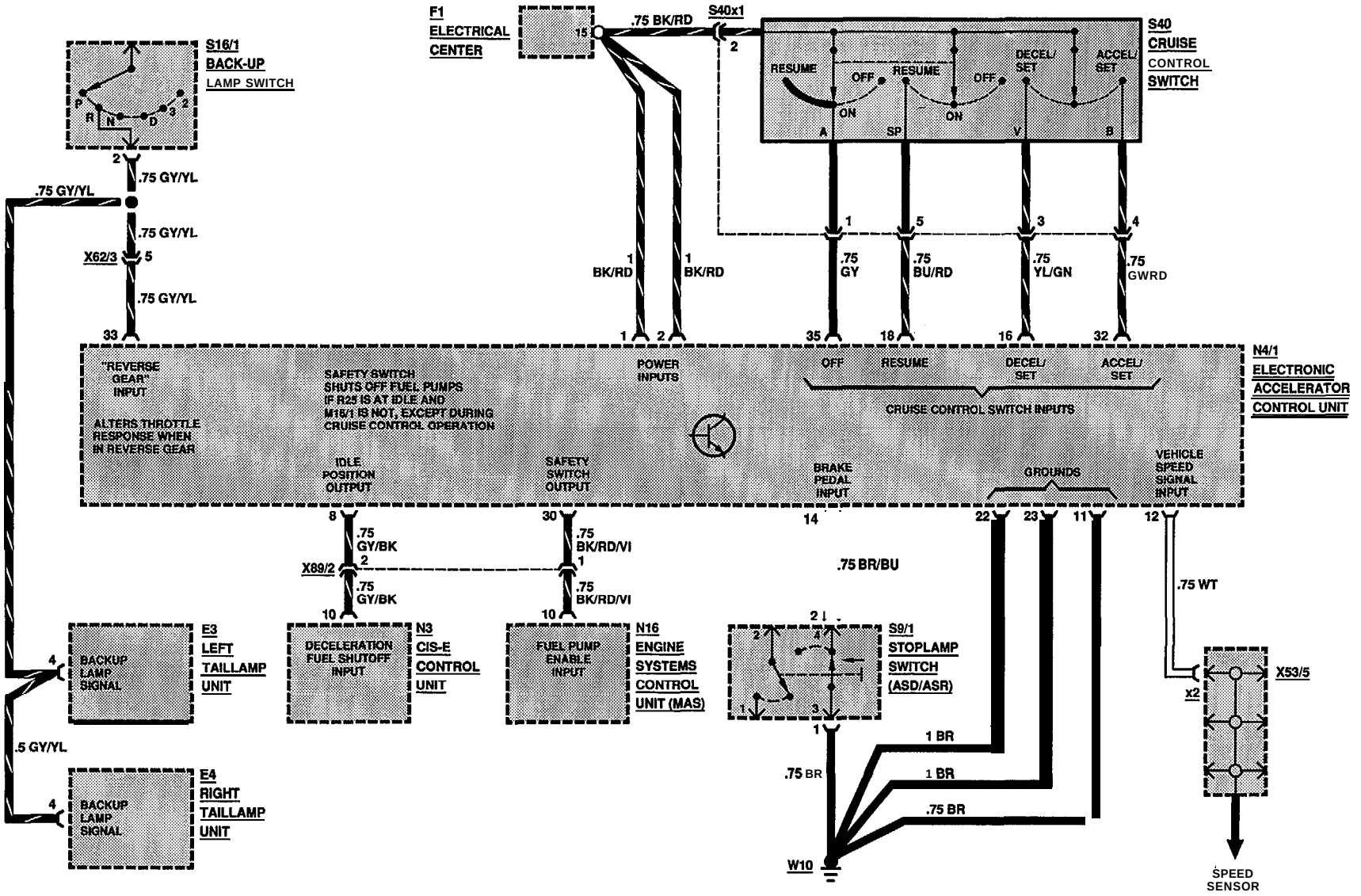
AS OF MY 1991

190E 2.6



REVISIONS:

ELECTRONIC ACCELERATOR SYSTEM/CRUISE CONTROL

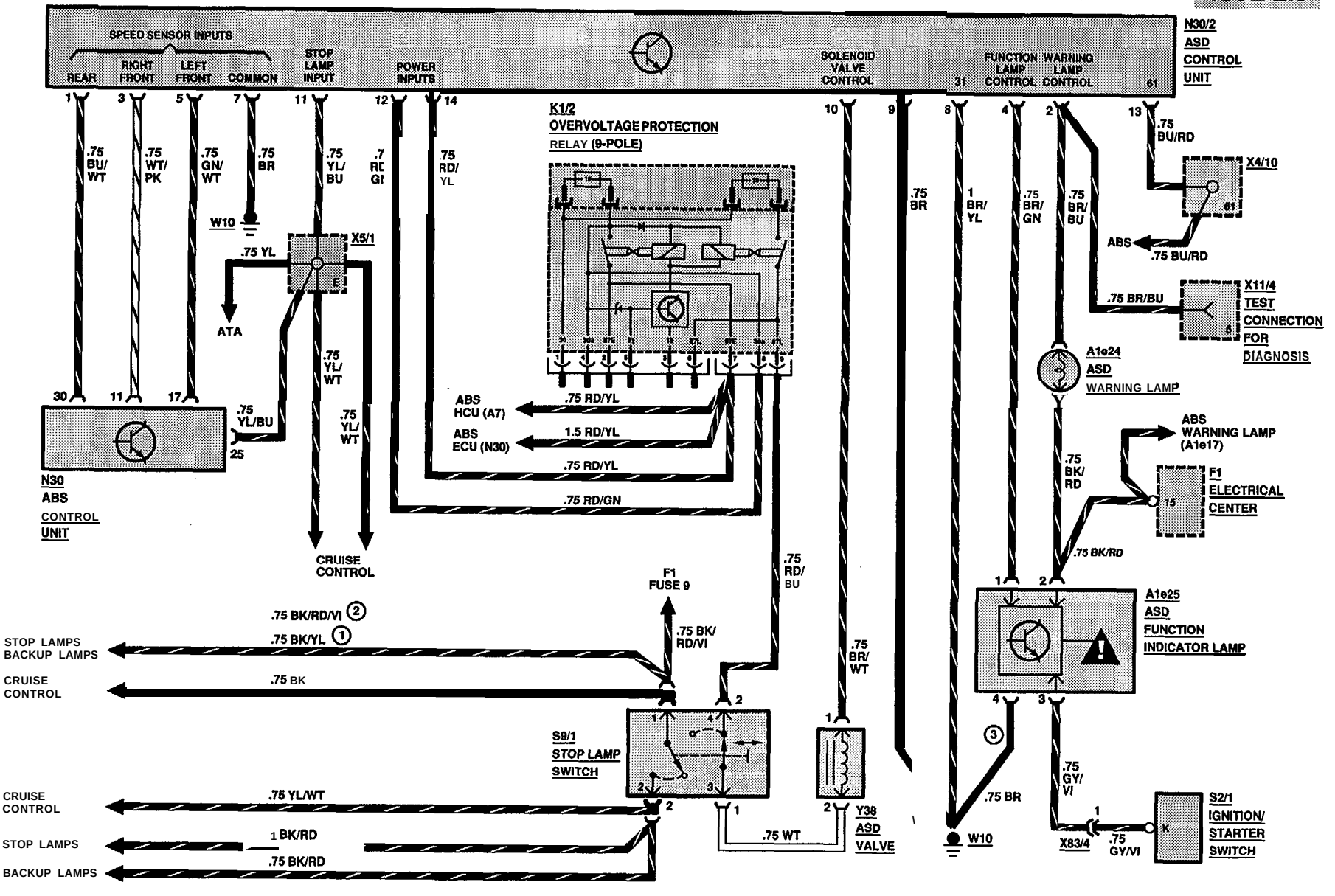


REVISIONS:

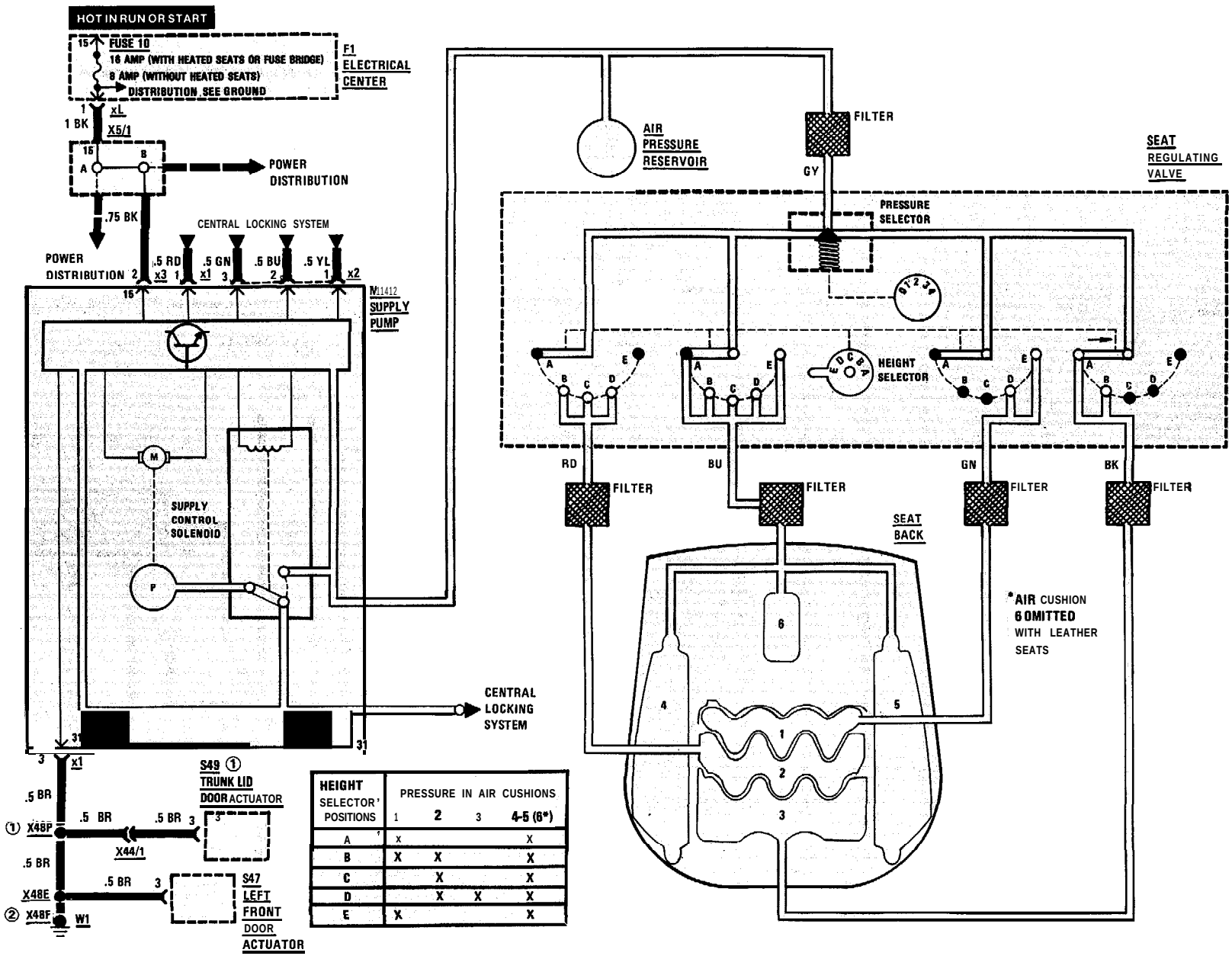
AUTOMATIC LOCKING DIFFERENTIAL (ASD)

AS OF MY 1991

190E 2.3



REVISIONS: (1) MANUAL TRANSMISSION
(θ) AUTOMATIC TRANSMISSION
(3) WIRE AND FEMALE CONNECTOR EXIST IN HARNESS BUT SERVE NO FUNCTION

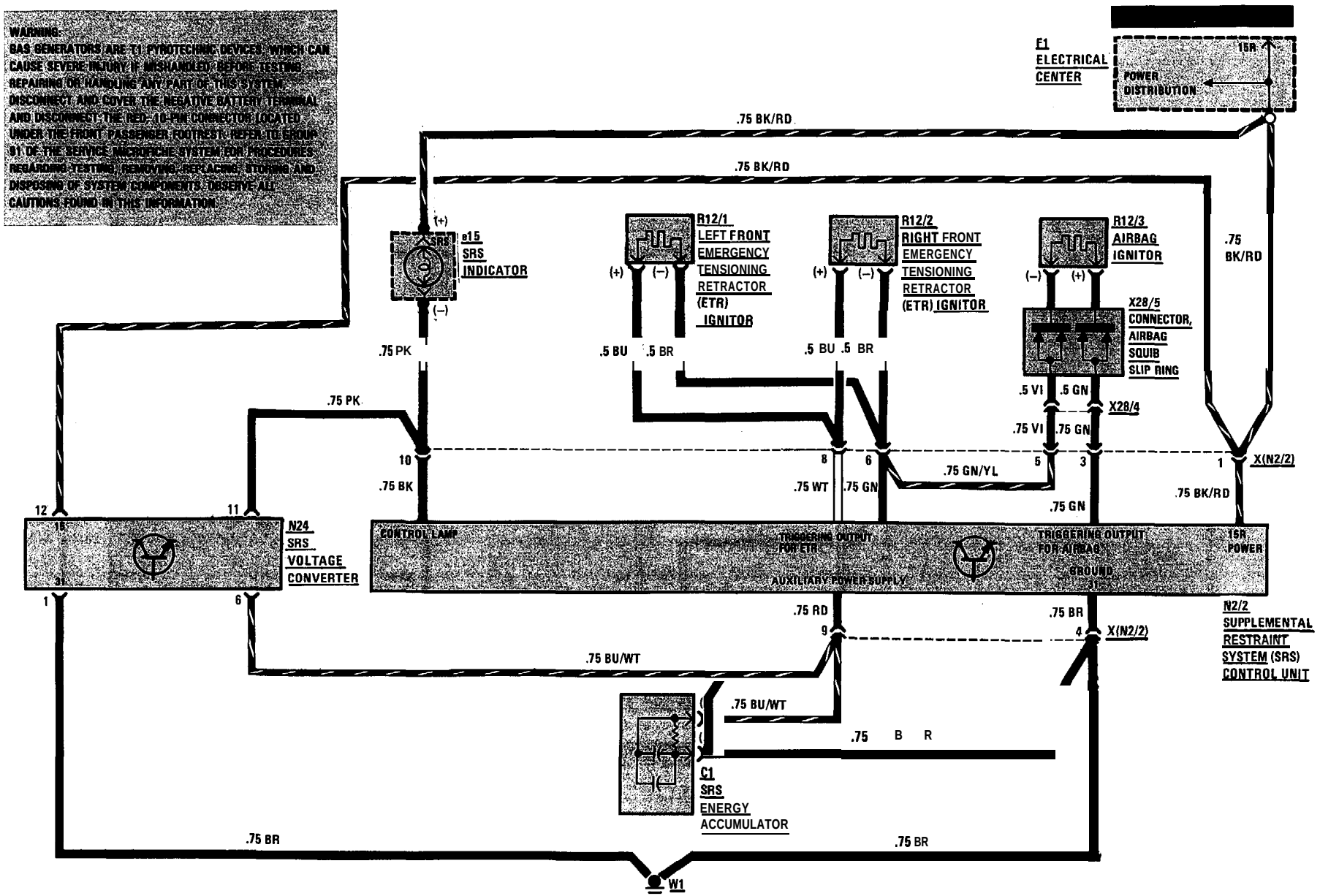


HEIGHT SELECTOR POSITIONS	PRESSURE IN AIR CUSHIONS 1	2	3	4-5 (6*)
A	X			X
B	X	X		X
C		X		X
D		X	X	X
E	X			X

REVISIONS: ① MY 1985 ONLY
② AS OF MY 1986

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) (WITH AIR BAG)

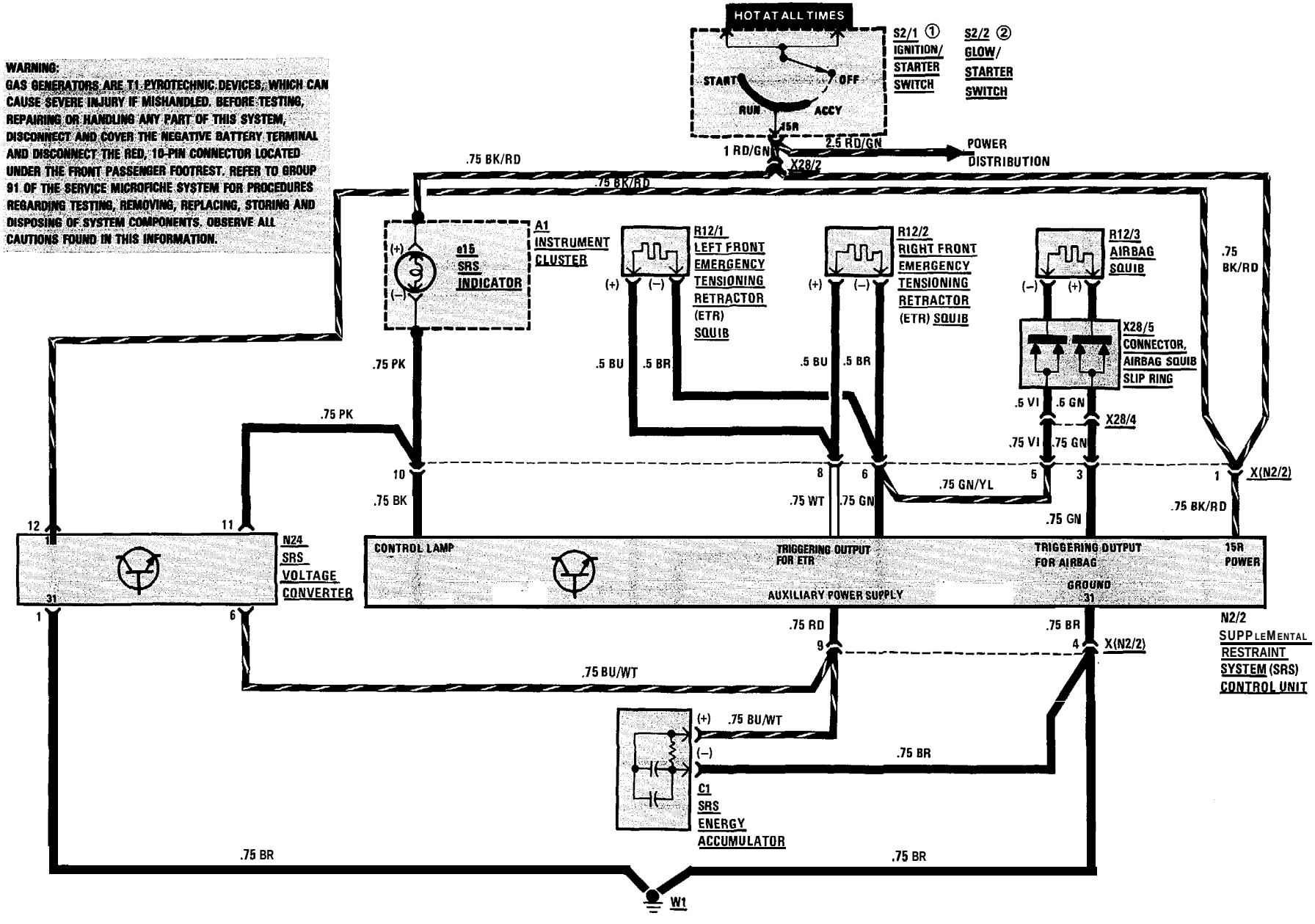
MY 1986



REVISIONS:

SUPPLEMENTAL RESTRAINT SYSTEM (SRS) (WITH AIR BAG)

WARNING:
GAS GENERATORS ARE TI PYROTECHNIC DEVICES, WHICH CAN CAUSE SEVERE INJURY IF MISHANDLED. BEFORE TESTING, REPAIRING OR HANDLING ANY PART OF THIS SYSTEM, DISCONNECT AND COVER THE NEGATIVE BATTERY TERMINAL AND DISCONNECT THE RED, 10-PIN CONNECTOR LOCATED UNDER THE FRONT PASSENGER FOOTREST. REFER TO GROUP 91 OF THE SERVICE MICROFICHE SYSTEM FOR PROCEDURES REGARDING TESTING, REMOVING, REPLACING, STORING AND DISPOSING OF SYSTEM COMPONENTS. OBSERVE ALL CAUTIONS FOUND IN THIS INFORMATION.

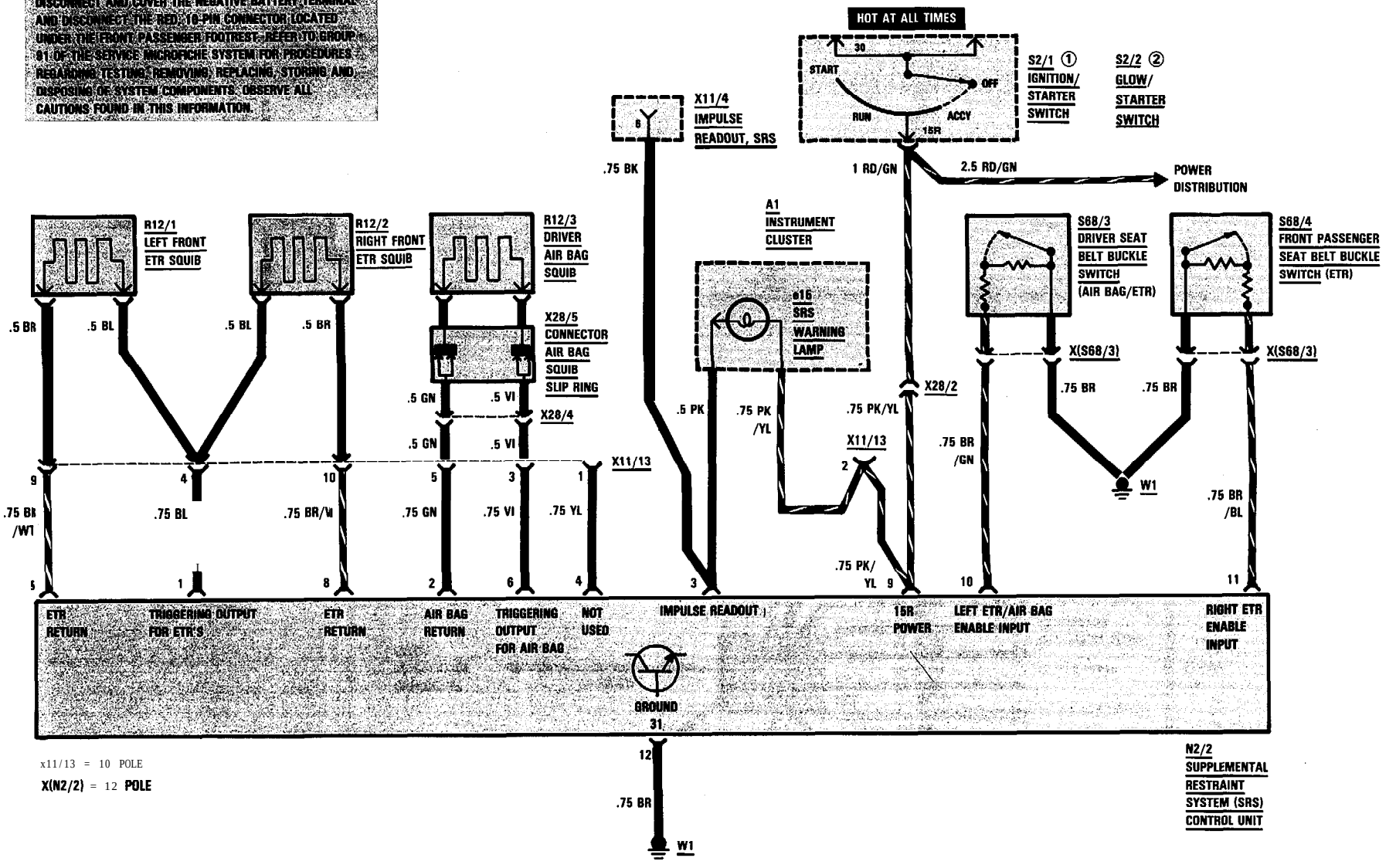


REVISIONS: ① GASOLINE
② DIESEL

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

AS OF MY 1988

WARNING:
GAS GENERATORS ARE PYROTECHNIC DEVICES, WHICH CAN CAUSE SEVERE INJURY IF MISHANDLED. BEFORE TESTING, REPAIRING OR HANDLING ANY PART OF THIS SYSTEM, DISCONNECT AND COVER THE NEGATIVE BATTERY TERMINAL AND DISCONNECT THE RED, 10-PIN CONNECTOR LOCATED UNDER THE FRONT PASSENGER FOOTREST. REFER TO GROUP 01 OF THE SERVICE MICROFICHE SYSTEM FOR PROCEDURES REGARDING TESTING, REMOVING, REPLACING, STORING AND DISPOSING OF SYSTEM COMPONENTS. OBSERVE ALL CAUTIONS FOUND IN THIS INFORMATION.

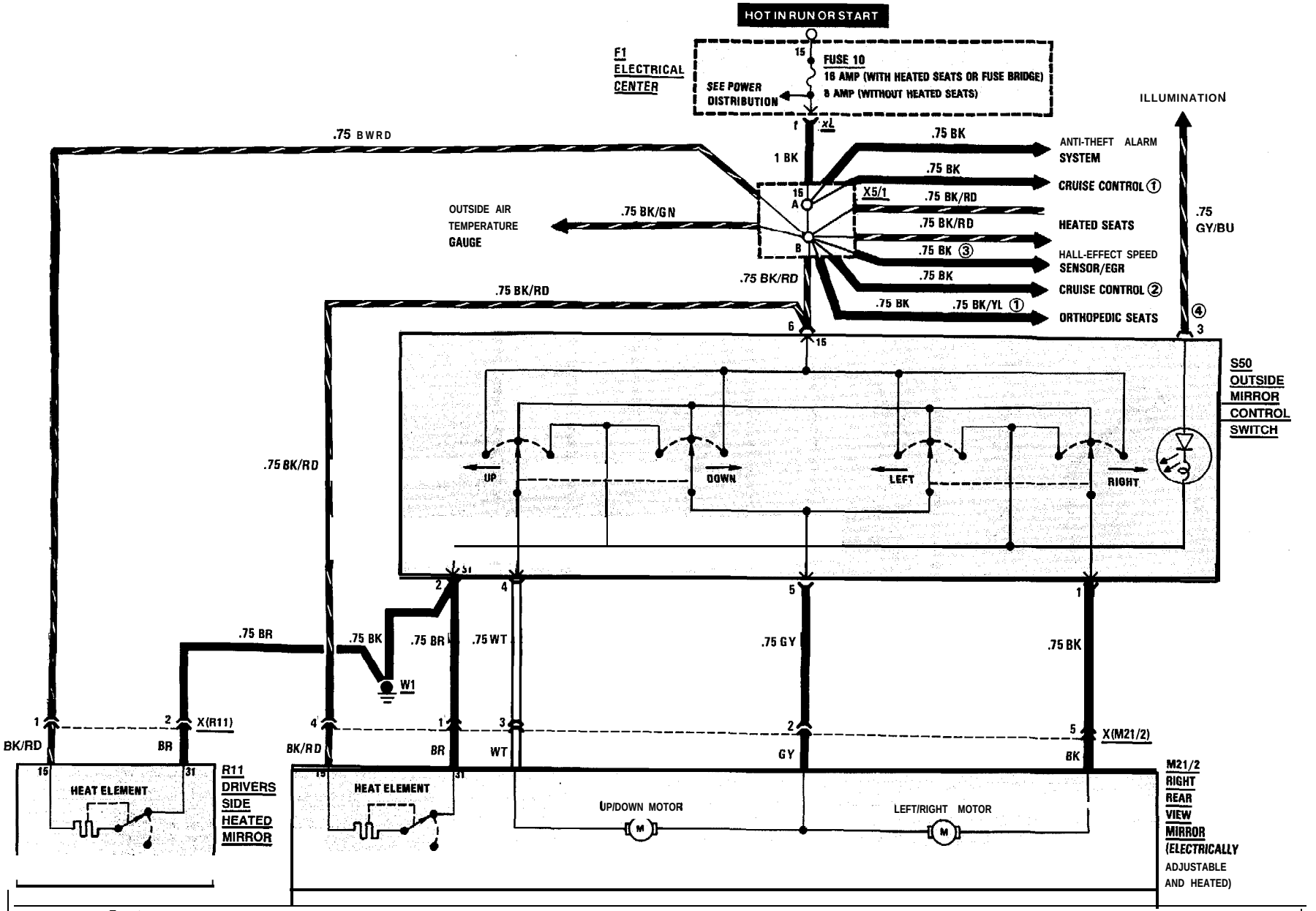


x11/13 = 10 POLE

X(N2/2) = 12 POLE

REVISIONS: ① GASOLINE
② DIESEL

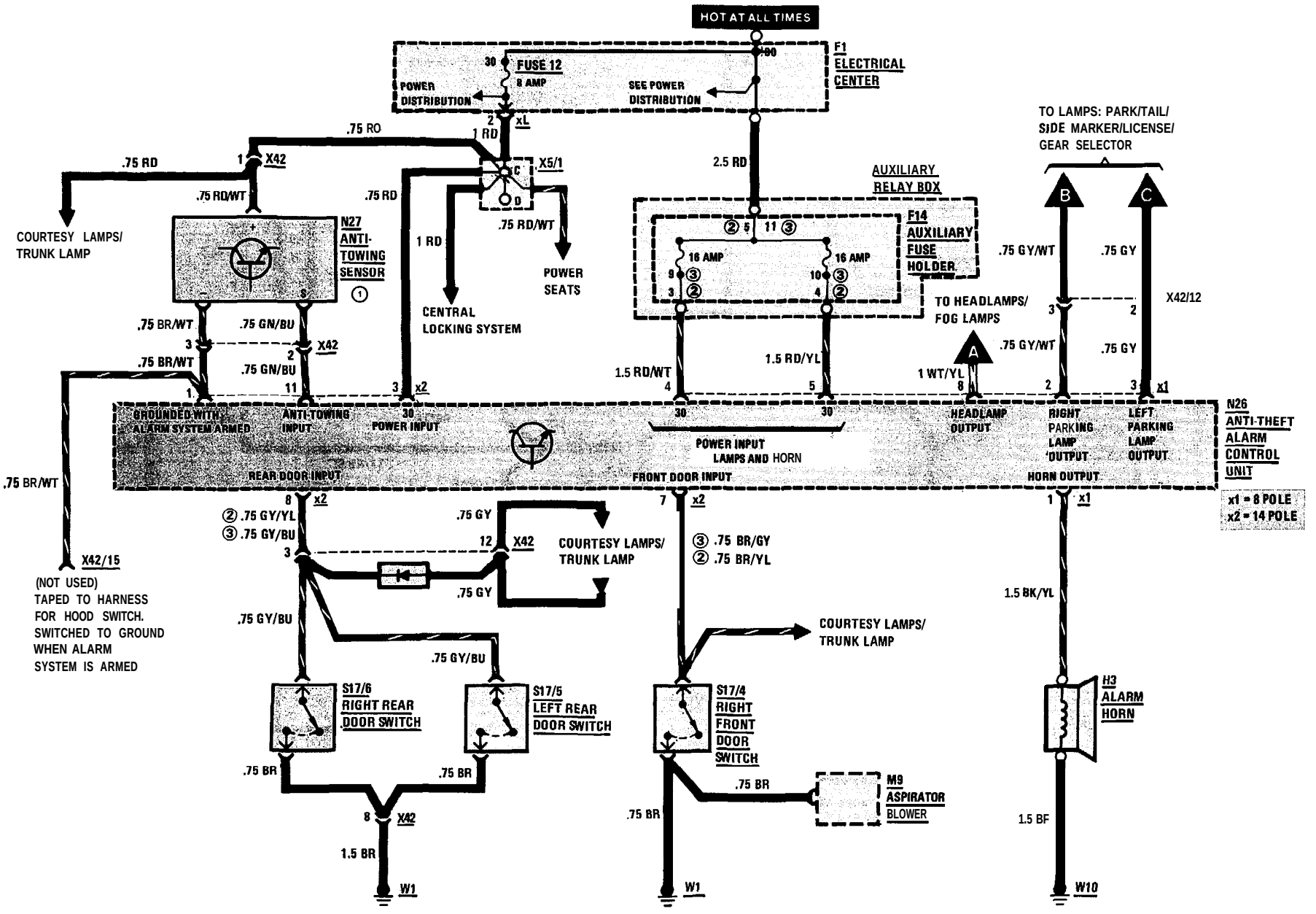
OUTSIDE HEATED MIRRORS



REVISIONS: ① AS OF MODEL YEAR 1988
@MODEL YEAR 1985 AND 1988 ONLY
@MODEL 201.126 ONLY, SEE EGR/ELECTRONIC IDLE SPEED CONTROL
④ AS OF MY 1988

ANTI-THEFT ALARM SYSTEM

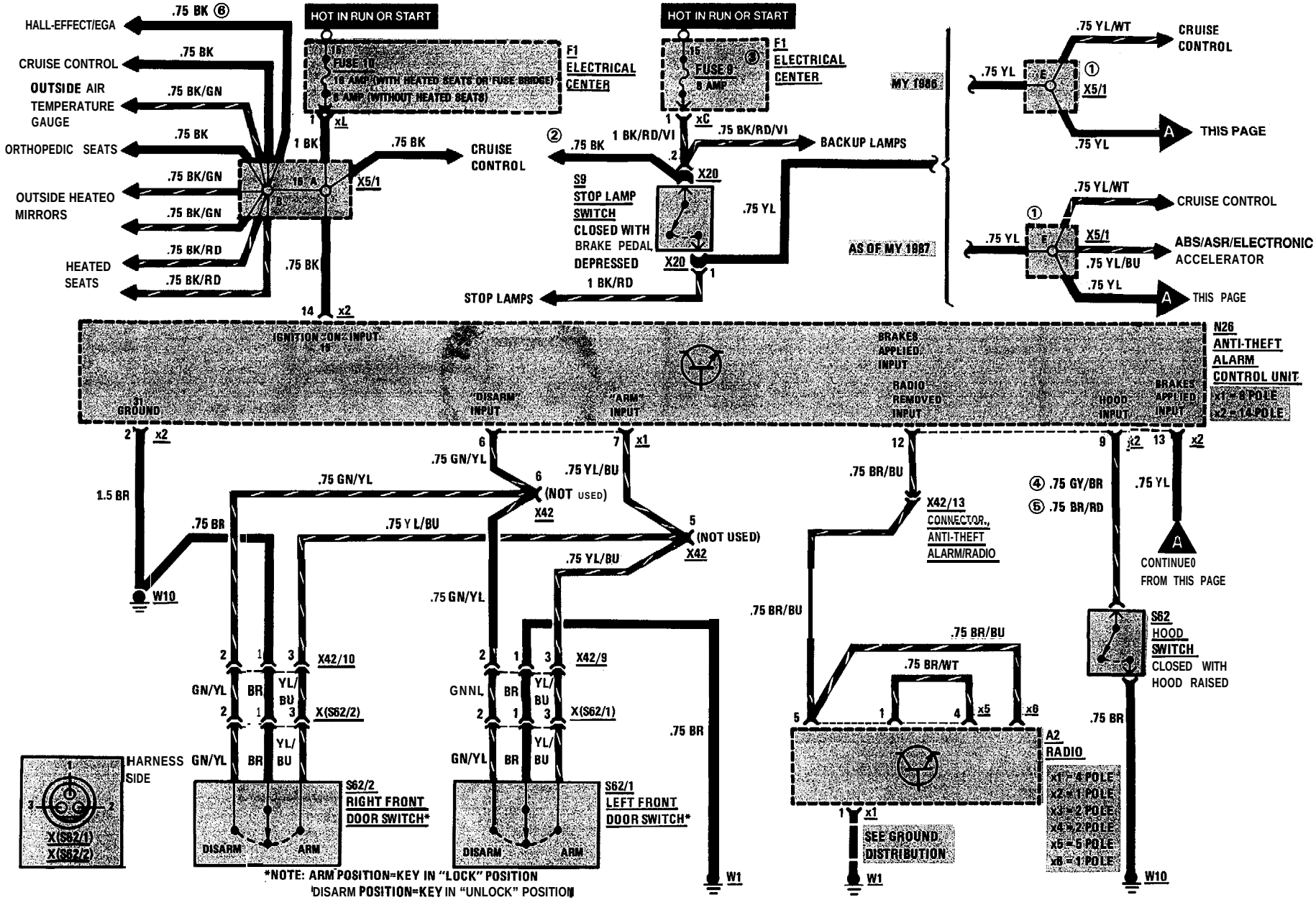
AS OF MY 1986



REVISIONS: ① ELIMINATED AS OF CHASSIS END NUMBER F256525
② MODEL YEARS 1986/1987/1988
③ AS OF MY 1989

ANTI-THEFT ALARM SYSTEM

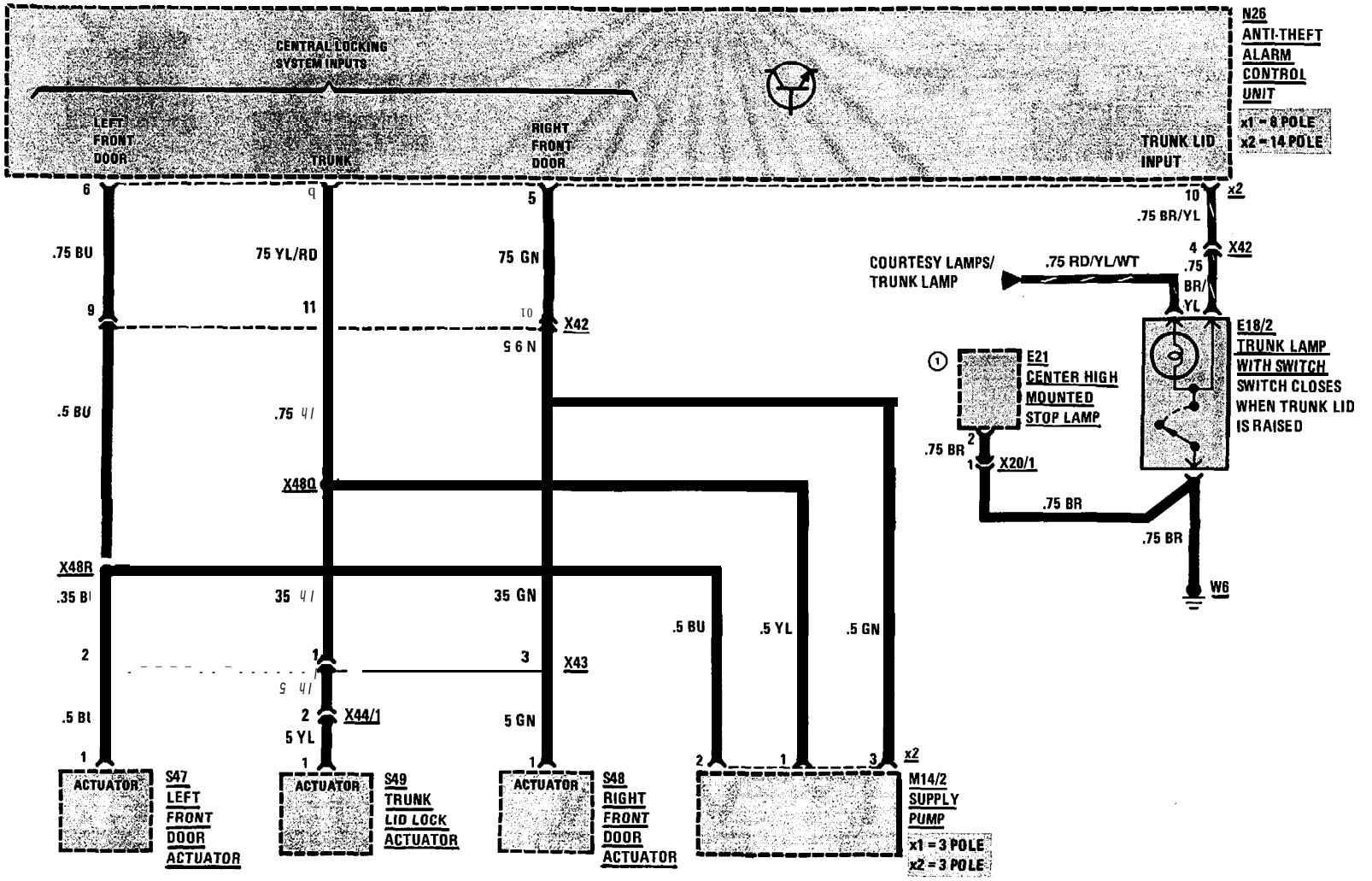
AS OF MY 1986



REVISIONS: @AUTOMATIC TRANSMISSION ONLY (MANUAL TRANSMISSION WIRING, SEE CRUISE CONTROL (WITH M/T)
@AS OF MODEL YEAR 1987
@UP TO CHASSIS END NUMBERS IA 313825 AND 1F 229814 FUSE NO. 9 IS REMOVED AND A BRIDGE IS INSTALLED BETWEEN FUSE NO. 9 AND 10
④ MODEL YEARS 1986-1988
⑤ AS OF MY 1989
⑥ MODEL 201.126 ONLY, SEE EGR/ELECTRONIC IDLE SPEED CONTROL

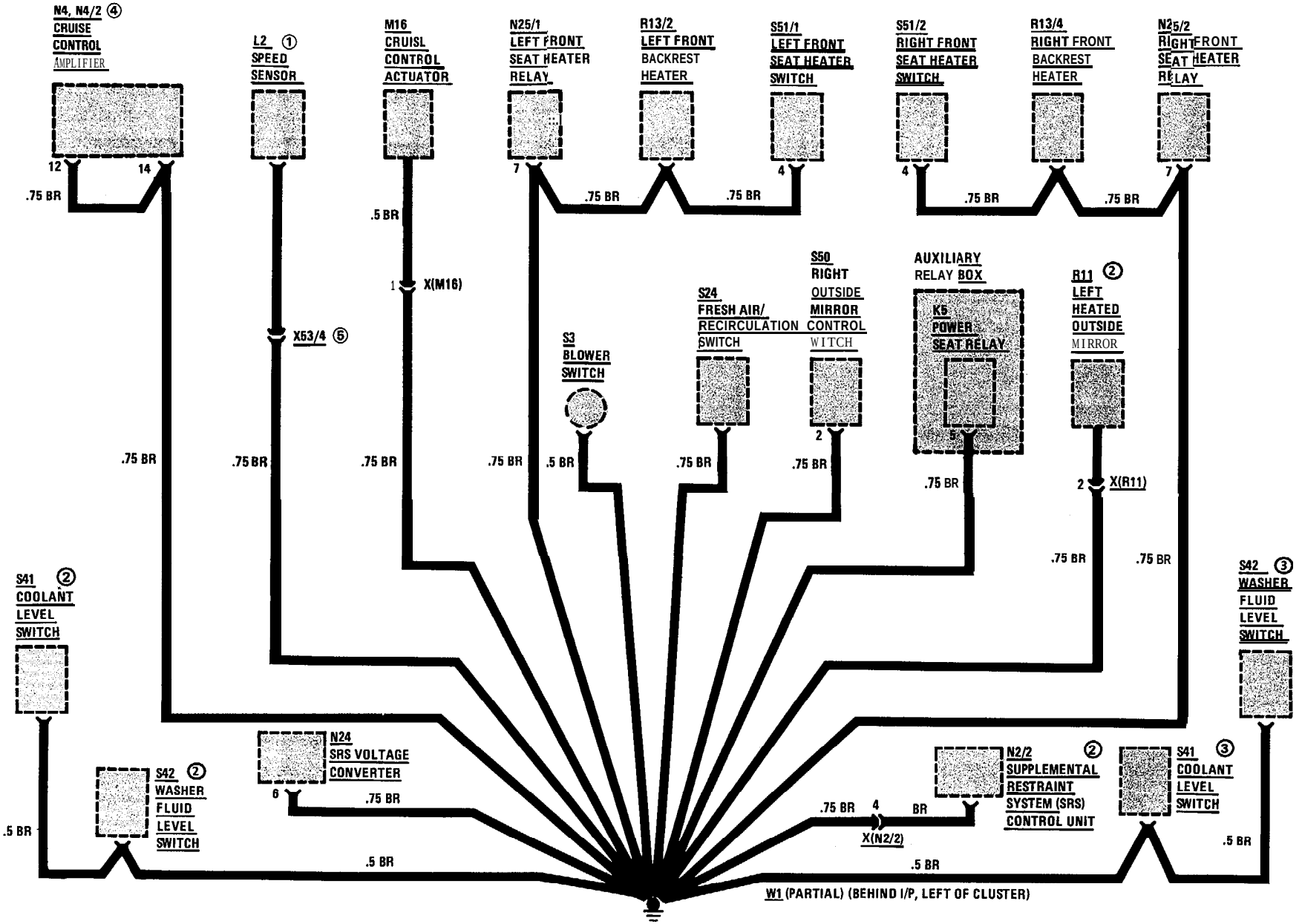
ANTI-THEFT ALARM SYSTEM

AS OF MY 1986



REVISIONS: ① AS OF MODEL YEAR 1986, MODEL 201.034

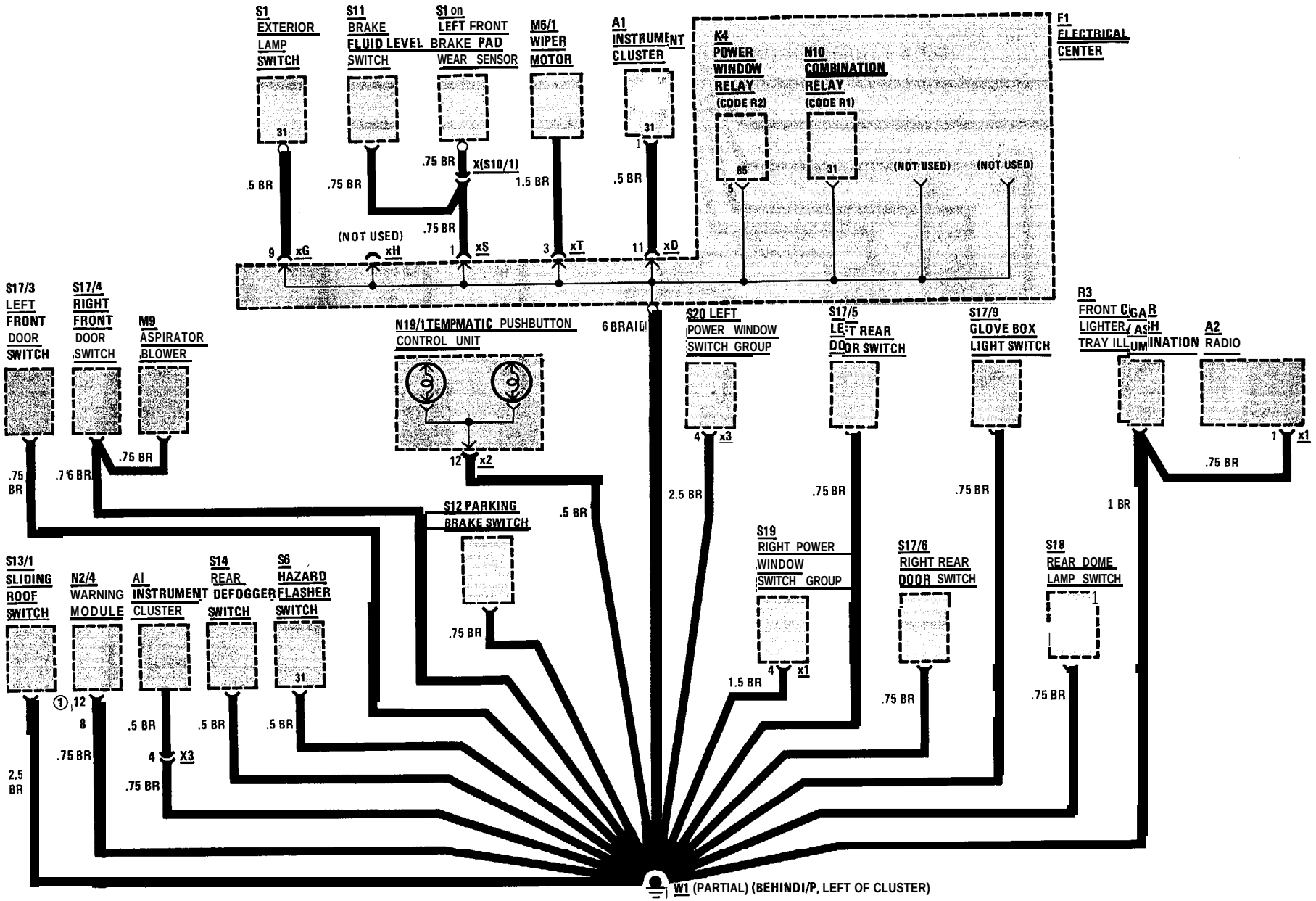
GROUND DISTRIBUTION (WI)



REVISIONS:
① MODEL YEAR 1994
② MODEL YEAR 1985
③ AS OF MODEL YEAR 1986
④ AS OF MY 1988
⑥ MY 1994 CAL. VERSION DIESEL WITH MANUAL TRANSMISSION ONLY

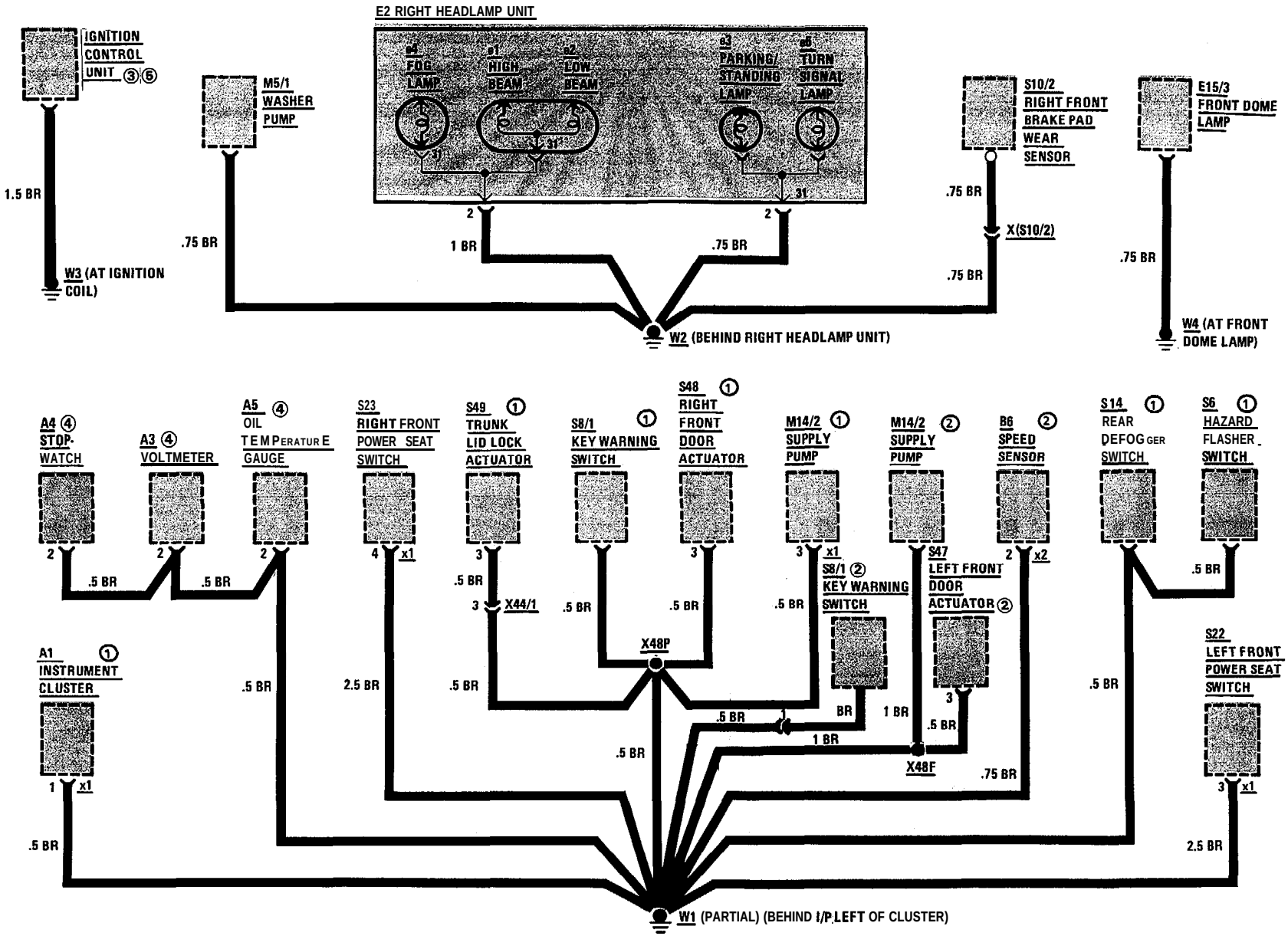
GROUND DISTRIBUTION (WI)

MY 1984-1986



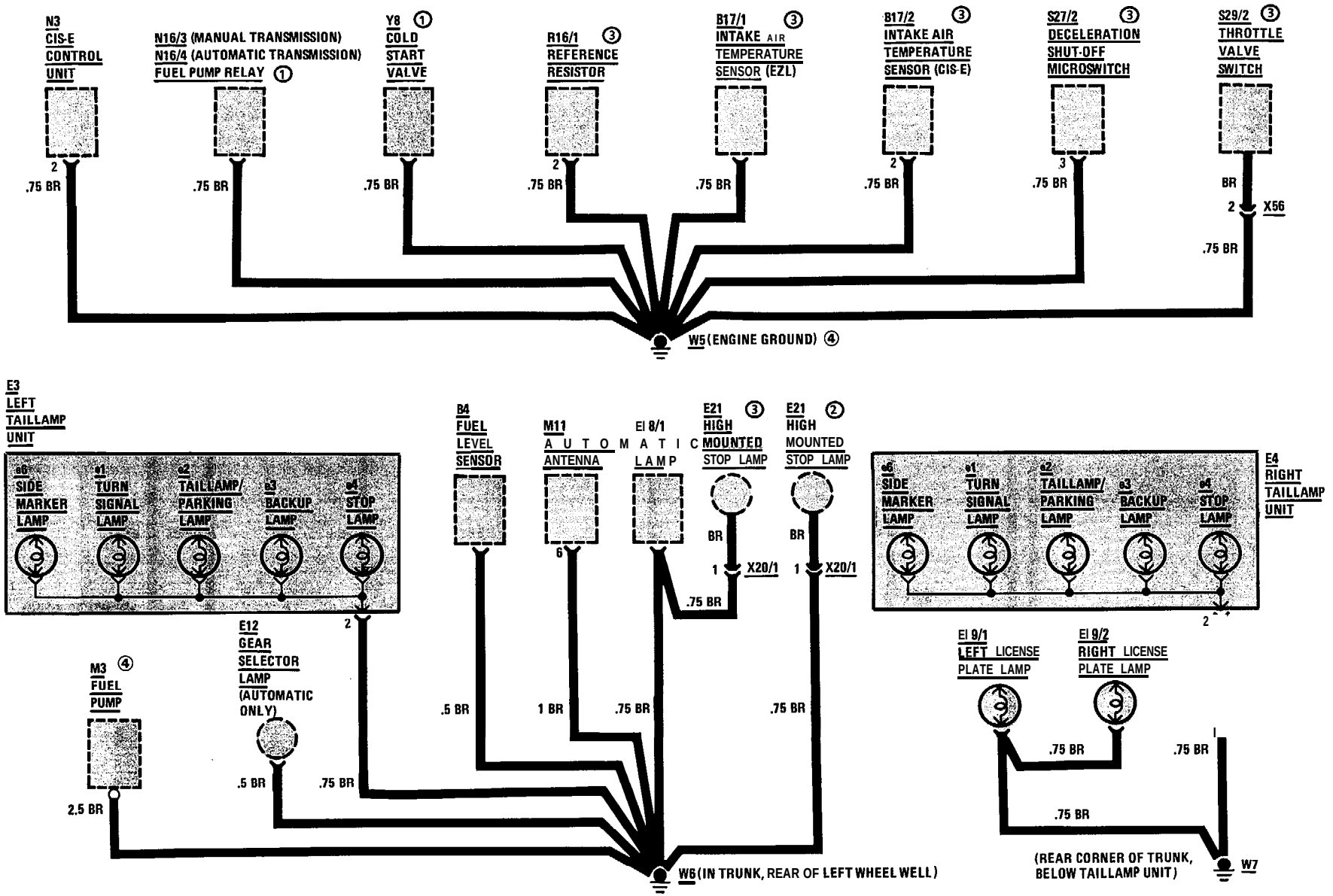
REVISIONS: ① AS OF MODEL YEAR 1986

GROUND DISTRIBUTION (W1, W2, W3, W4)



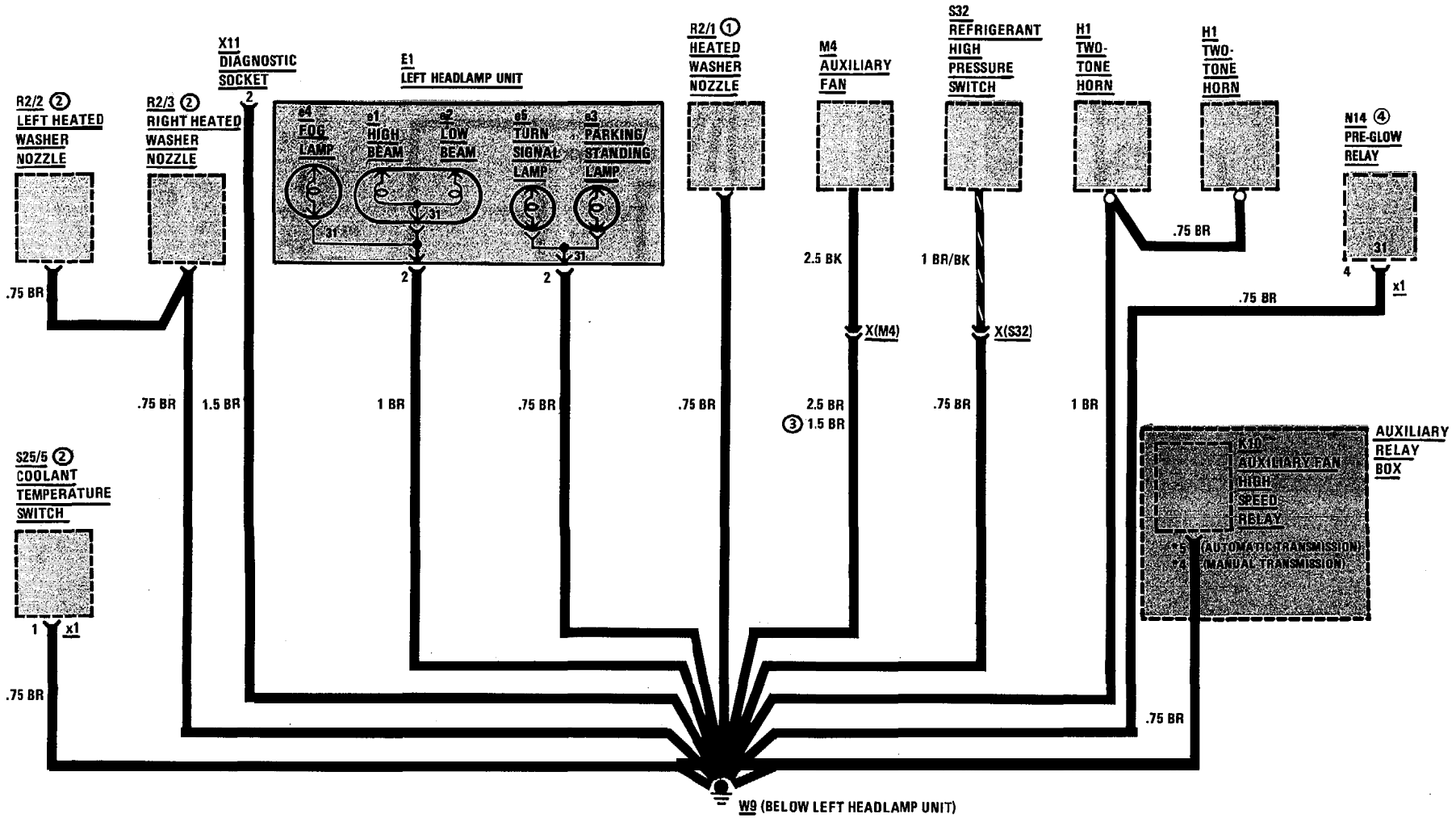
REVISIONS:
① MODEL MAR 1965
② AS OF MODEL YEAR 1986
③ N1/1 (190E 2.3), N1/2 (190E 2.3-16)
④ MODEL 201.034 ONLY
⑤ GASOLINE

GROUND DISTRIBUTION (W5, W6, W7)



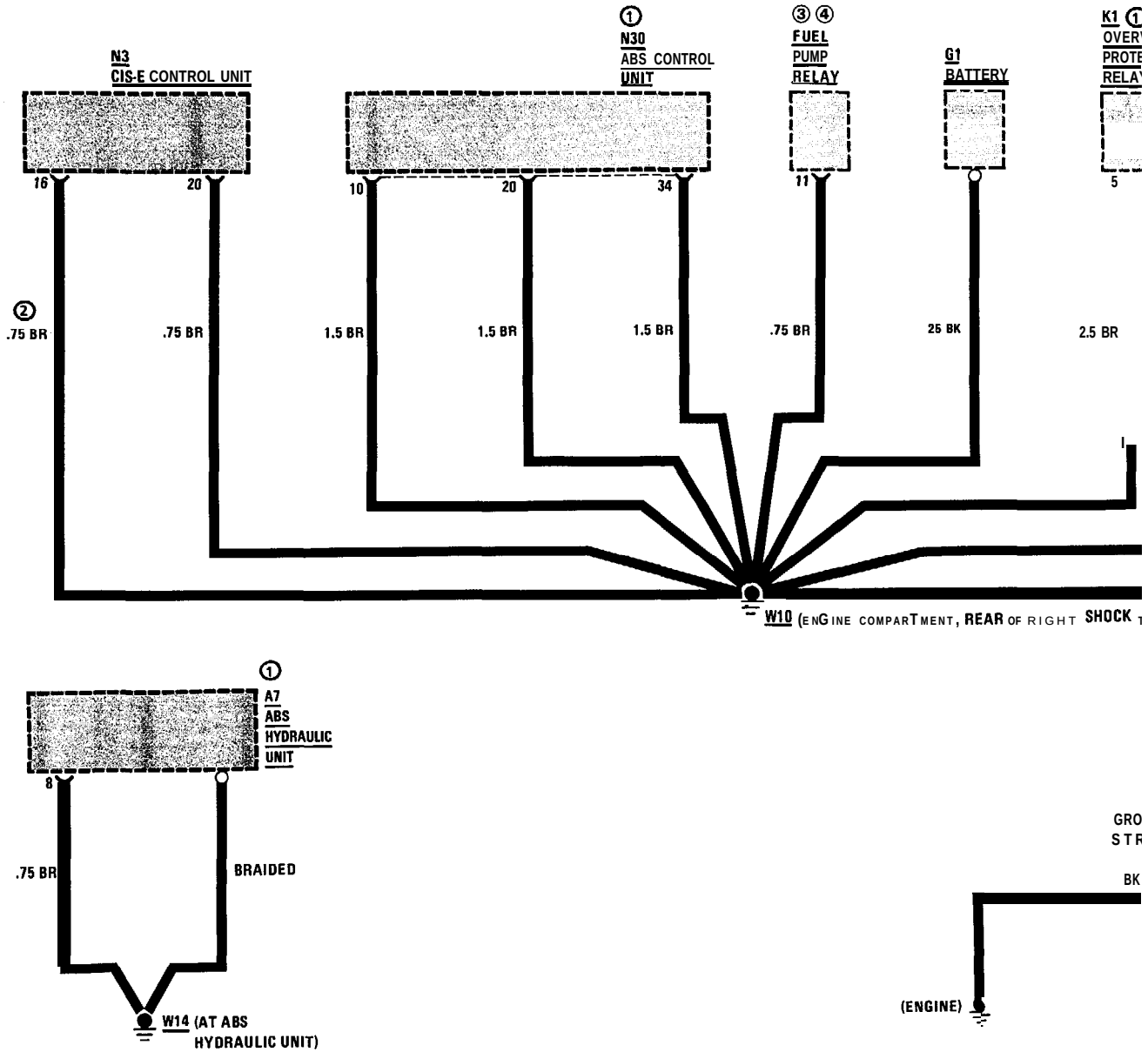
REVISIONS: ① MODEL YEAR 1995
② AS OF MODEL YEAR 1096
③ AS OF MODEL YEAR 1996, **190E** 2.3-16 ONLY (201.034)
④ GASOLINE

GROUND DISTRIBUTION (W9)



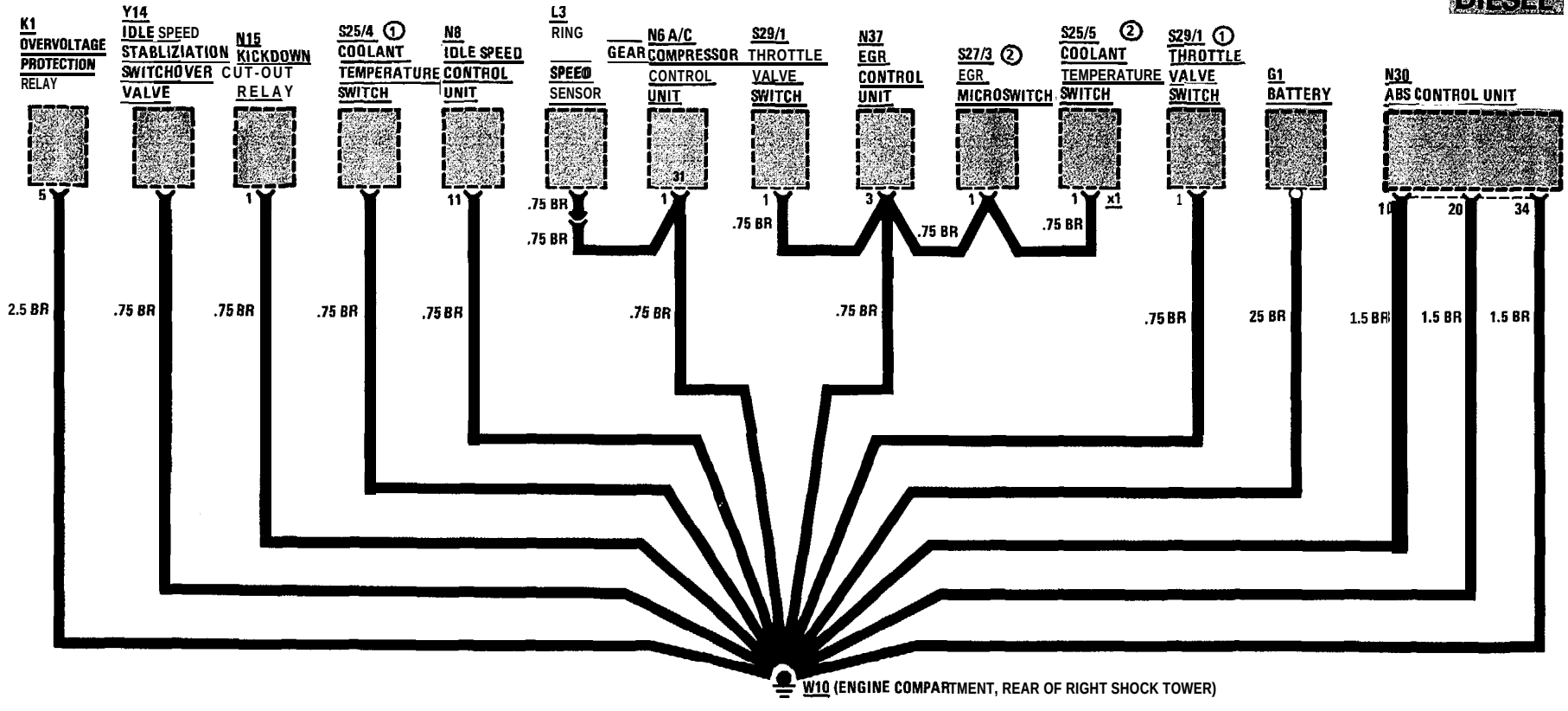
REVISIONS: ① MODELS 201.024/.122
② AS OF 1/85 PRODUCTION (IN CONJUNCTION WITH EXTENDED REACH WIPER SYSTEM)
③ AS OF MODEL YEAR 1985
④ DIESEL

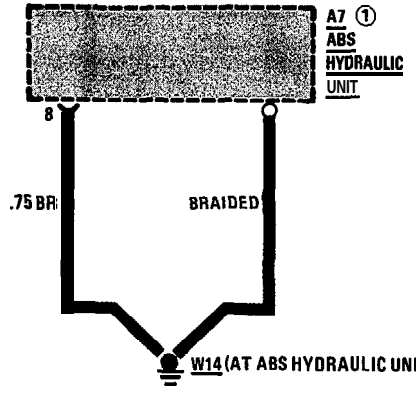
GROUND DISTRIBUTION (W 10, WI 1, W14)

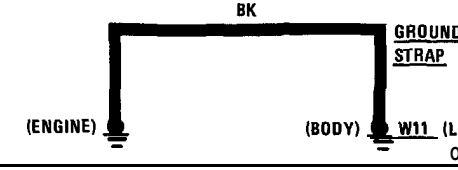


REVISIONS: ① As OF MODEL YEAR 1985
② ONLY WITH MANUAL TRANSMISSION MODEL YEAR 1985 AN0 LATER
③ N16/3 (MANUAL TRANSMISSION), N16/4 (AUTOMATIC TRANSMISSION)
④ UP TO MY 1990

GROUND DISTRIBUTION (W10, W11, W14)



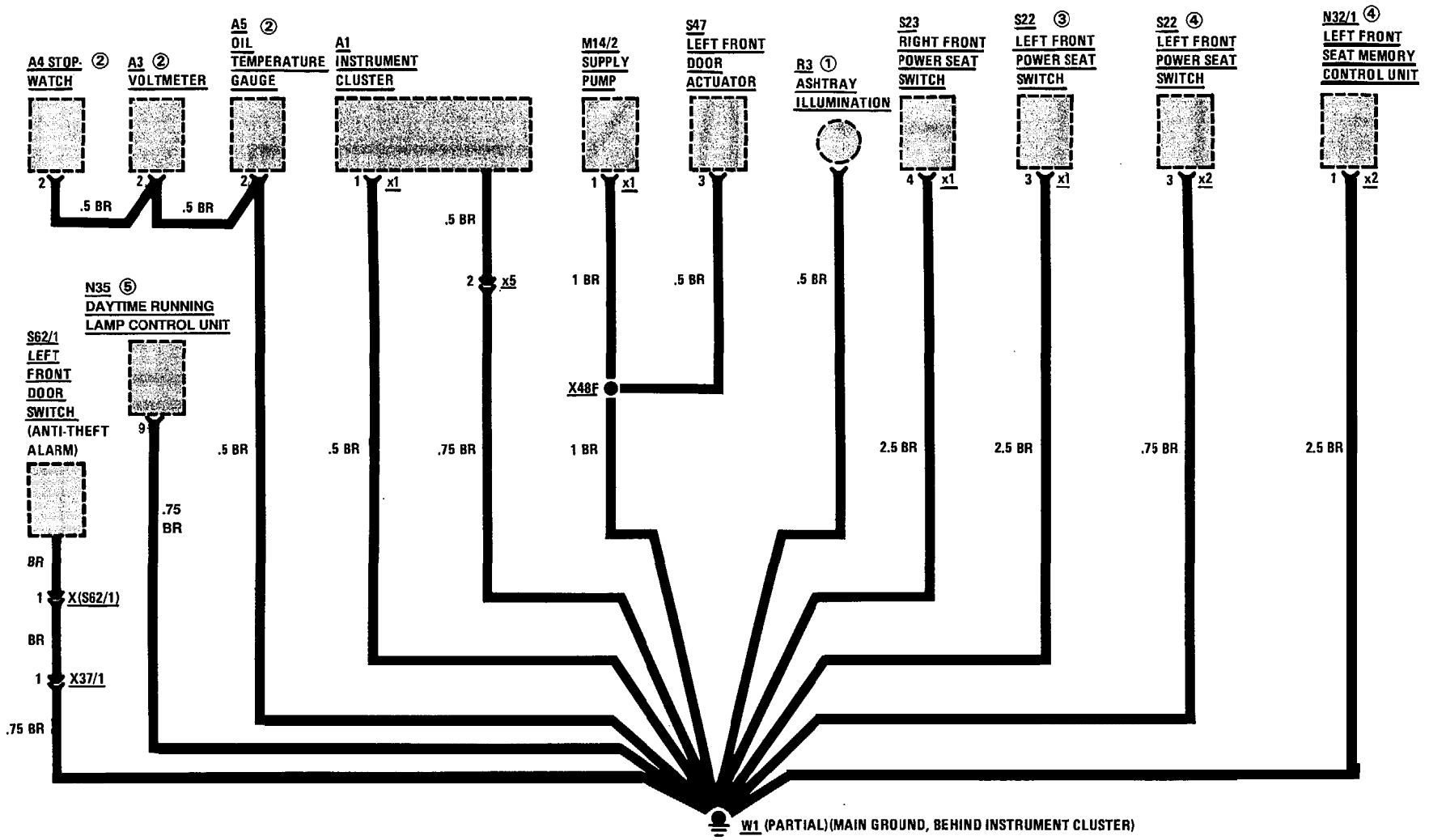




REVISIONS: ① AS OF MODEL YEAR 1995
② AS OF MODEL YEAR 1986

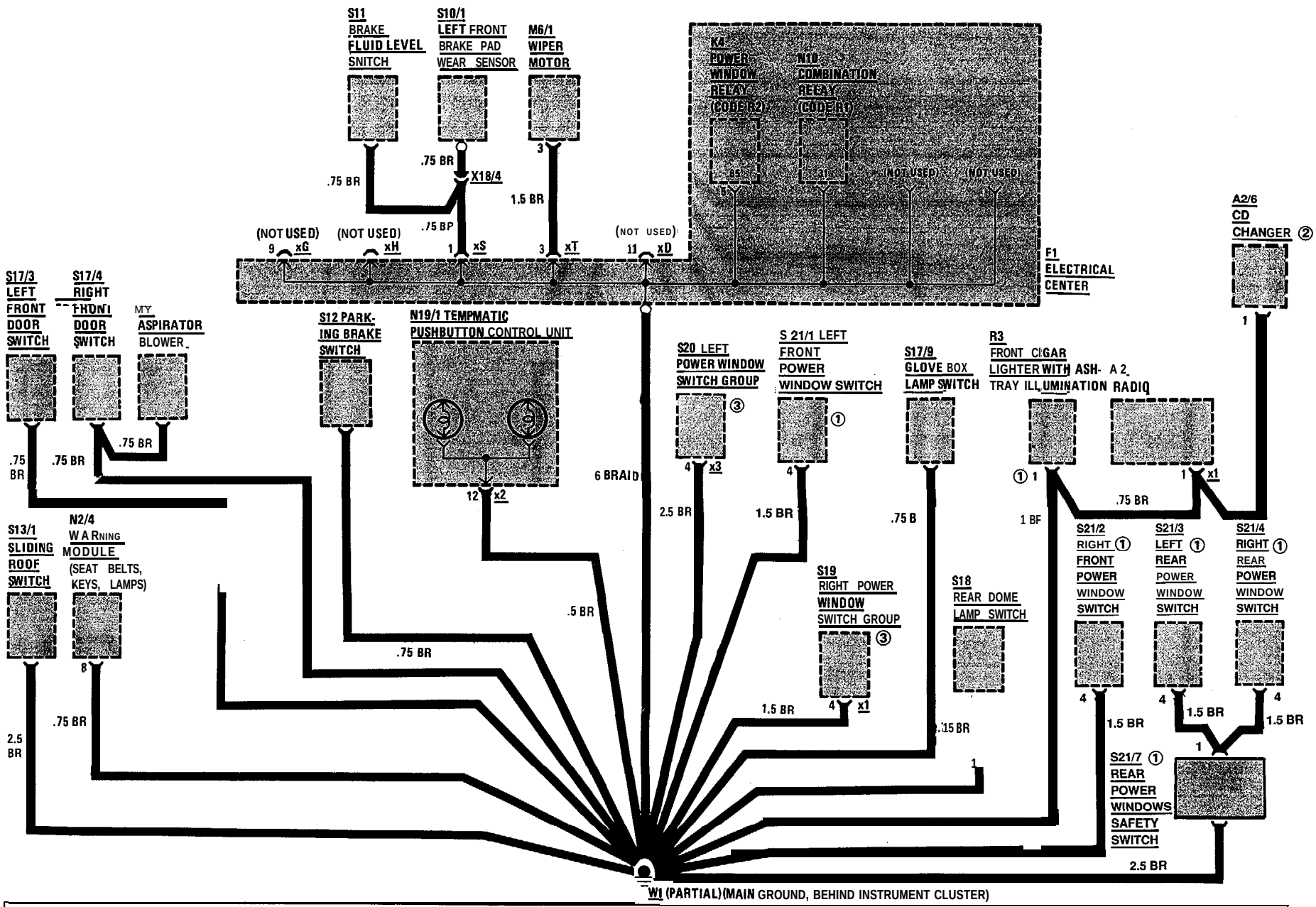
GROUND DISTRIBUTION (W

AS OF MY 1987



REVISIONS: ① NOT USED AS OF MY 1990
② MODEL 201.034 ONLY
③ WITHOUT MEMORY
④ WITH MEMORY
⑤ CANADA ONLY

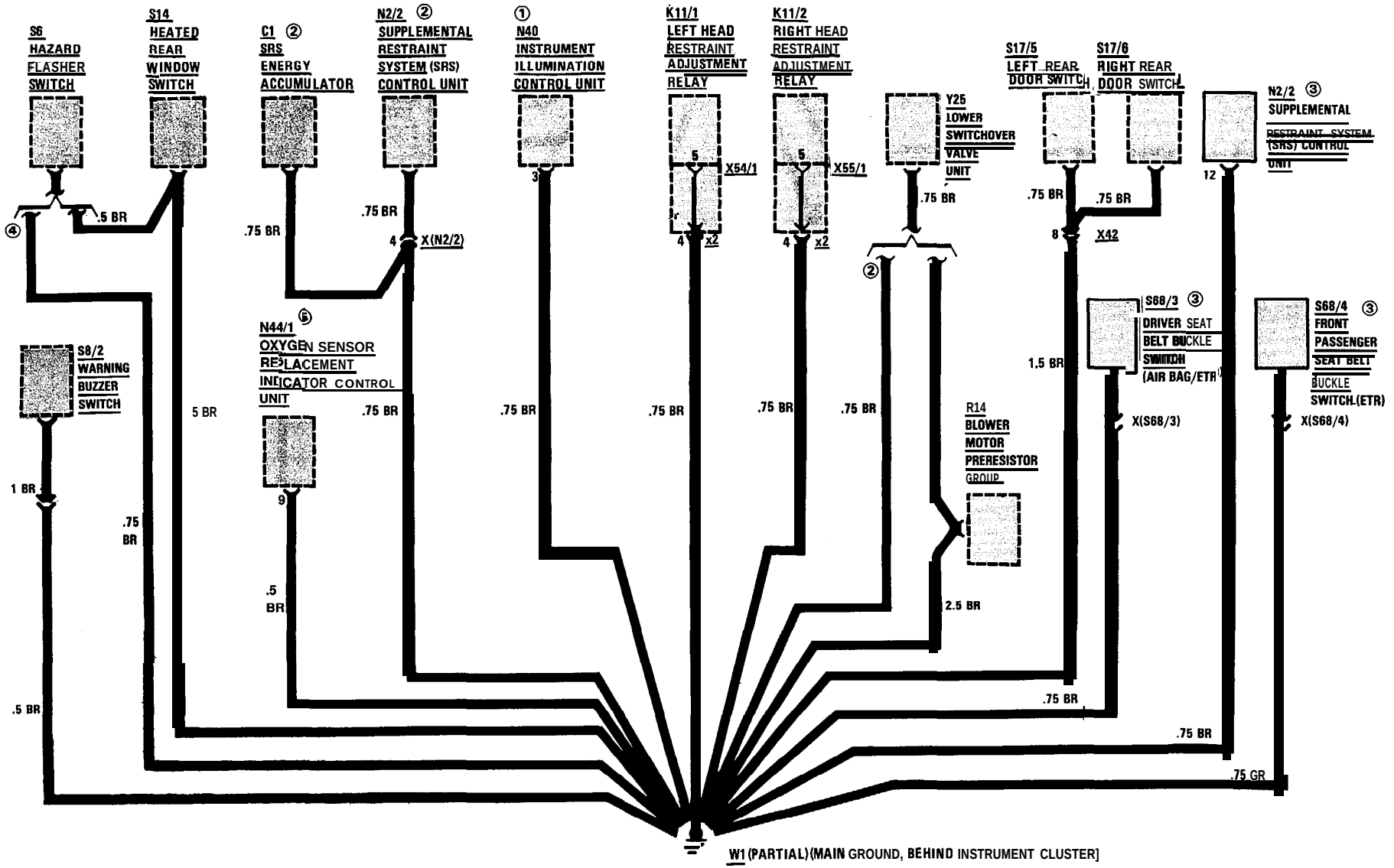
GROUND DISTRIBUTION (WI)



REVISIONS: @AS OF MY 1990
② AS OF MY 1991
③ UP TO MY 1989

GROUND DISTRIBUTION (WI)

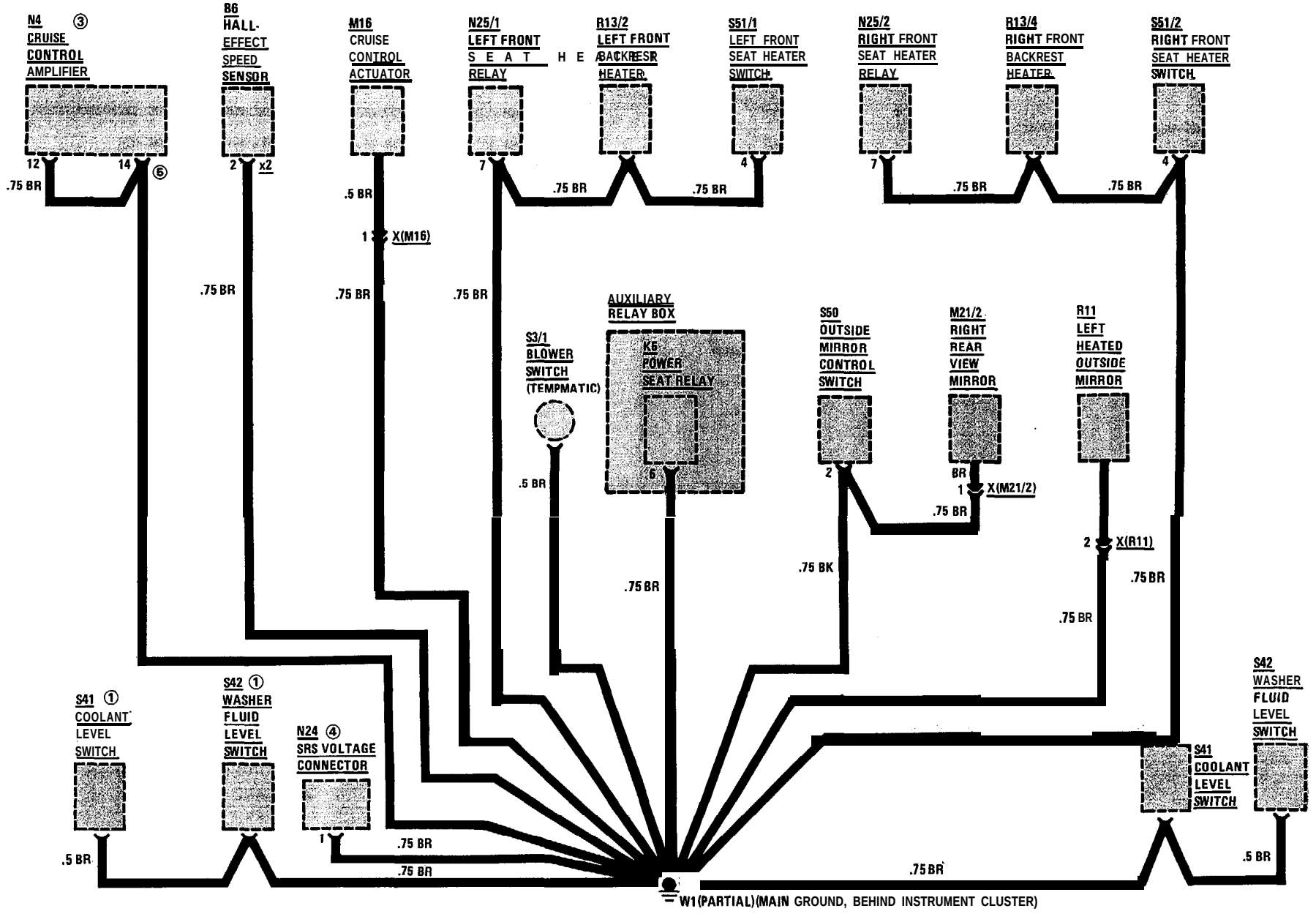
AS OF MY 1987



REVISIONS: ① MODEL 201.034 ONLY
② MY 1987
③ AS OF MY 1988
④ AS OF MY 1990
⑤ AS OF MY 1992, MODEL 190E 2.3

GROUND DISTRIBUTION (WI)

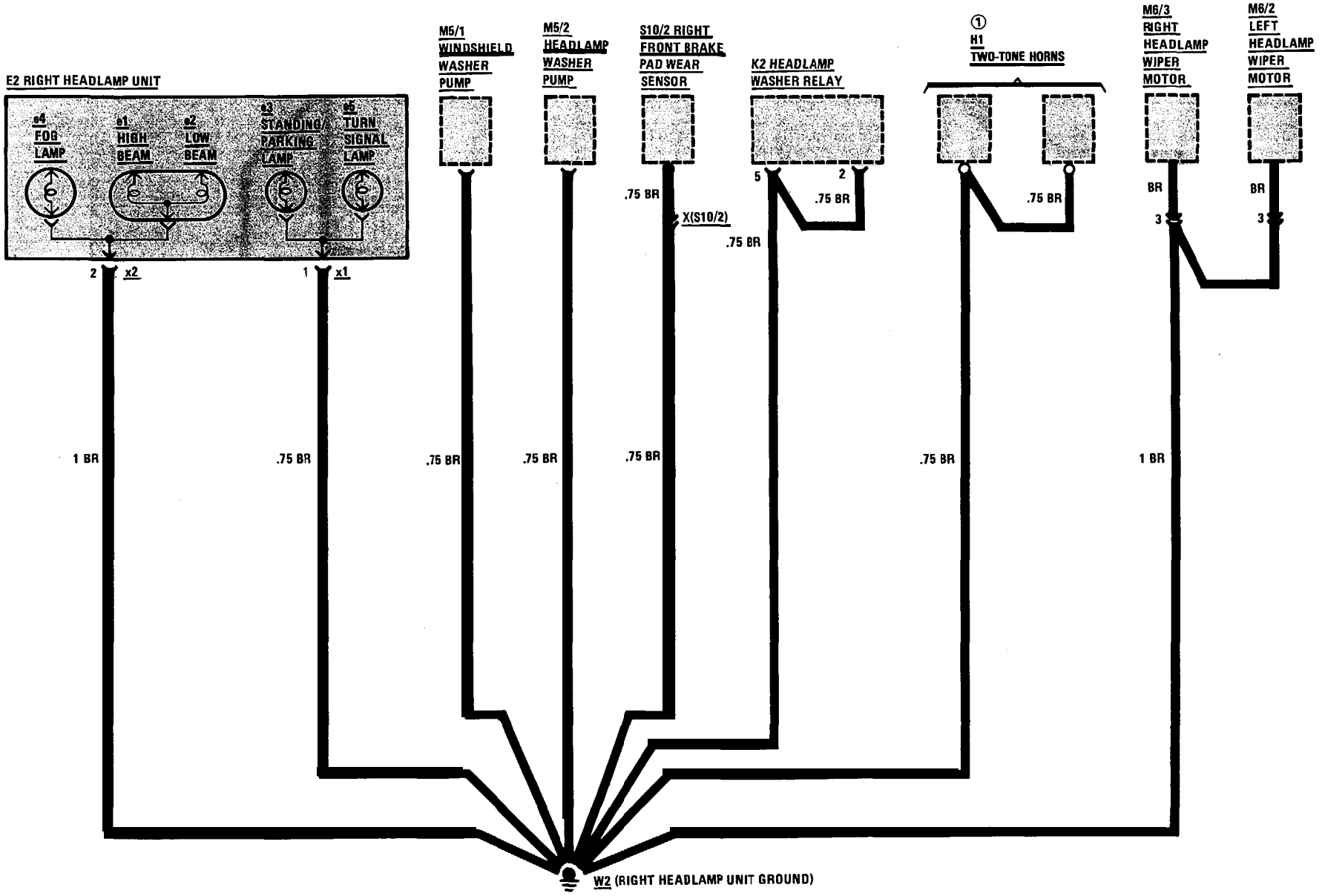
AS OF MY 1987



REVISIONS:
① **MODELS** 201.028 AND 201.029 **ONLY**
② MODEL 201.034 ONLY
③ **N4-MODELS 201.028/.034/.126** MY 1987
N4/2-MODEL 201.029 AS OF MY 1987
N4/2-MODEL 201.028 AS OF MY 1999
④ MODEL YEAR 1987
⑤ AS OF MY **1989,** PIN 14 NOT USED.
N4/2 GROUNDED VIA PIN 12

GROUND DISTRIBUTION (W2)

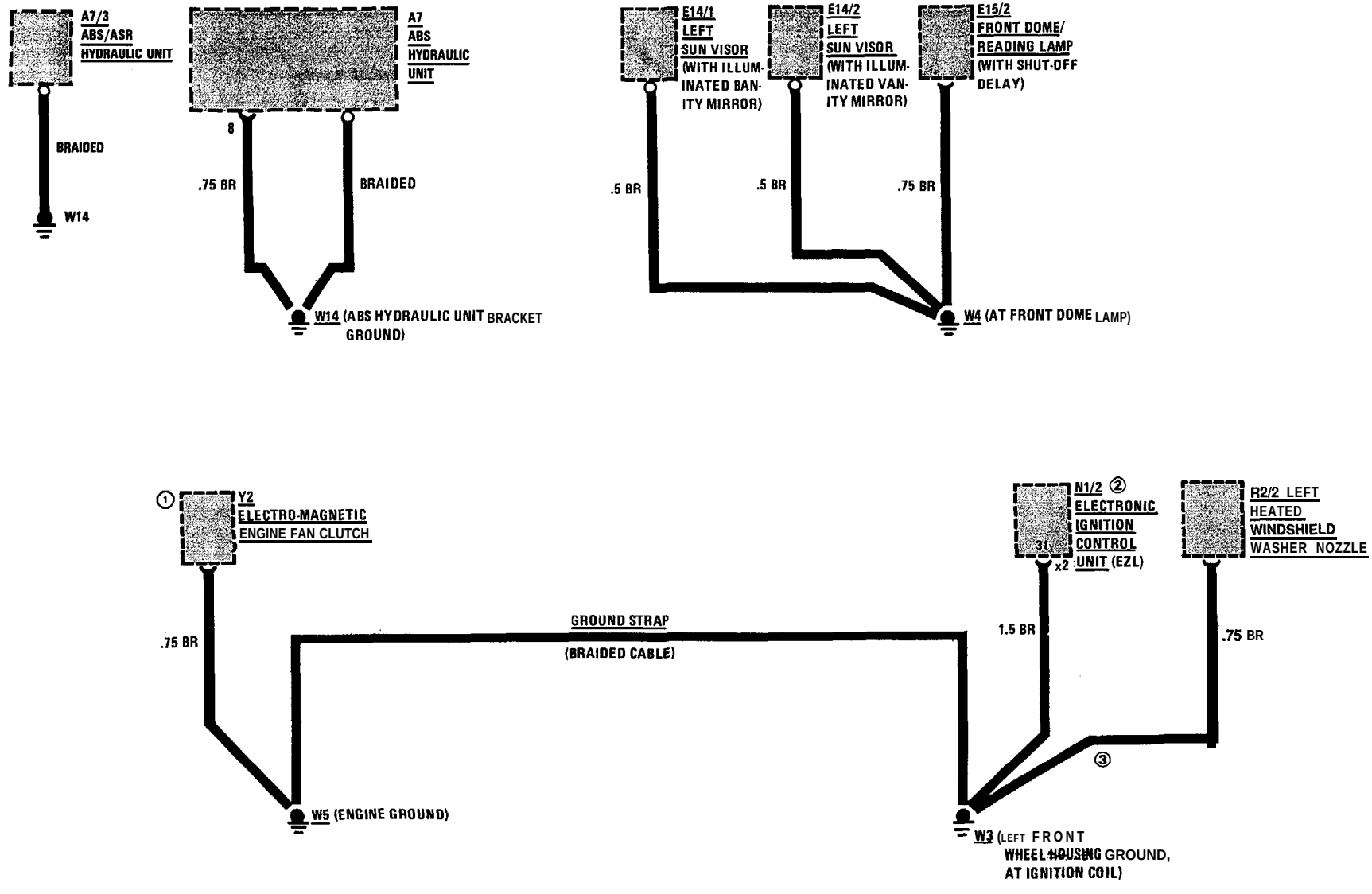
AS OF MY 1987



REVISIONS: ① MODEL 201.029 (190E 2.6) ONLY

GROUND DISTRIBUTION (W3, W4, W5, W14)

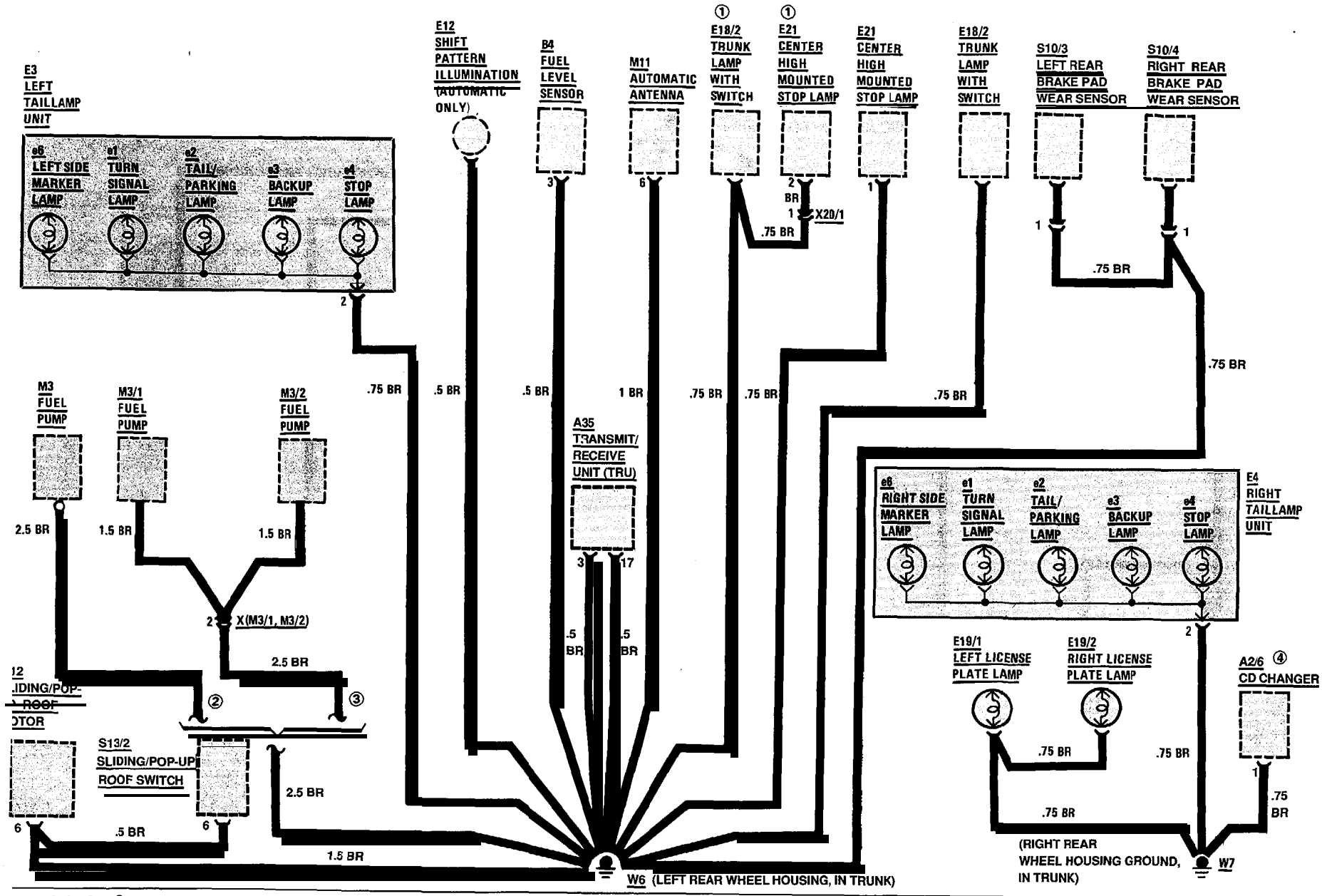
AS OF MY 1987



REVISIONS: ① MODEL 201.034 ONLY
② GASOLINE
③ AS OF MY 1988

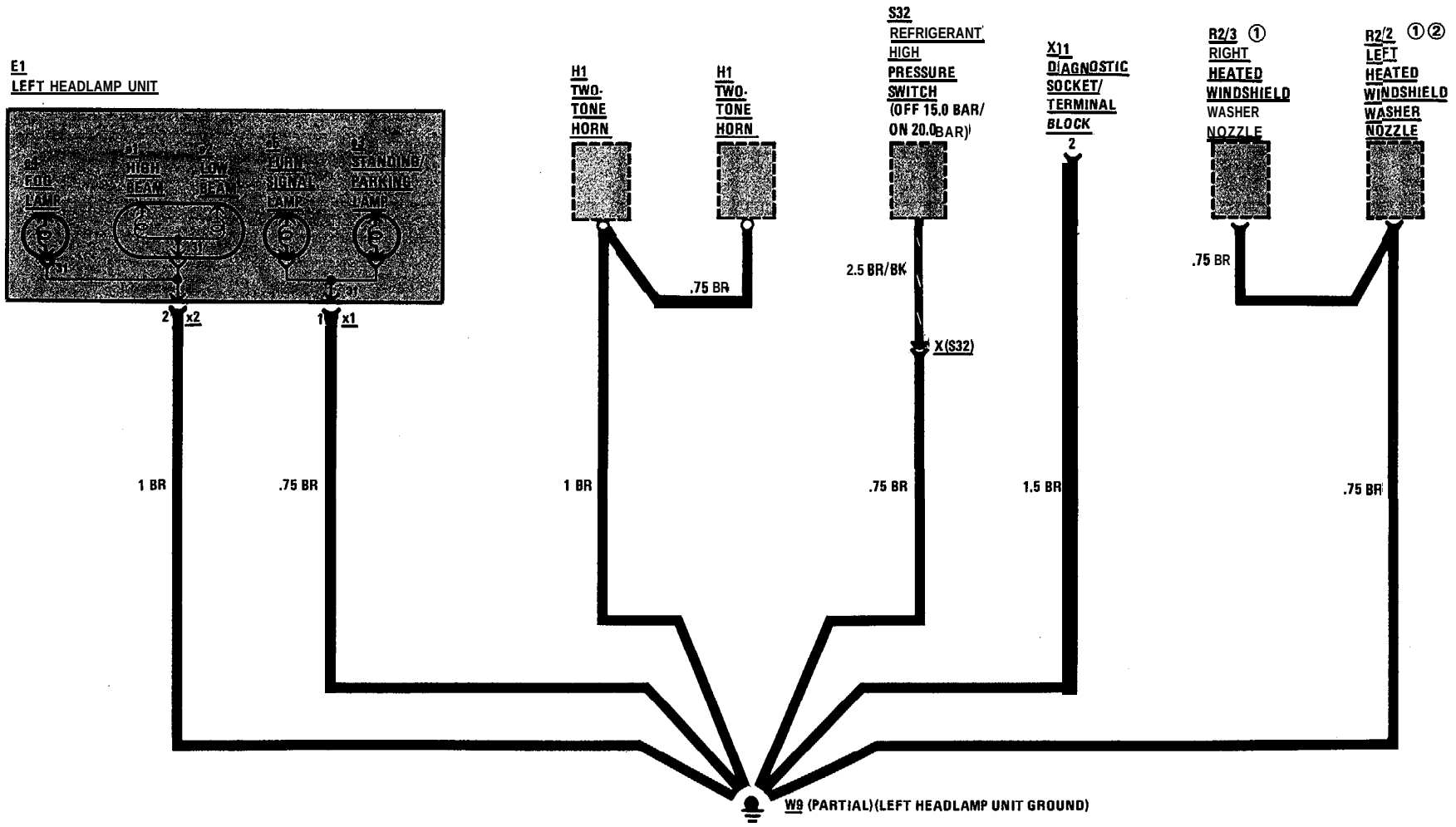
GROUND DISTRIBUTION (W6, W7

AS OF MY 1987



REVISIONS: ① *MODEL 201.034 (190E 2.3-16) ONLY*
② MODEL 201.028

GROUND DISTRIBUTION (W9)



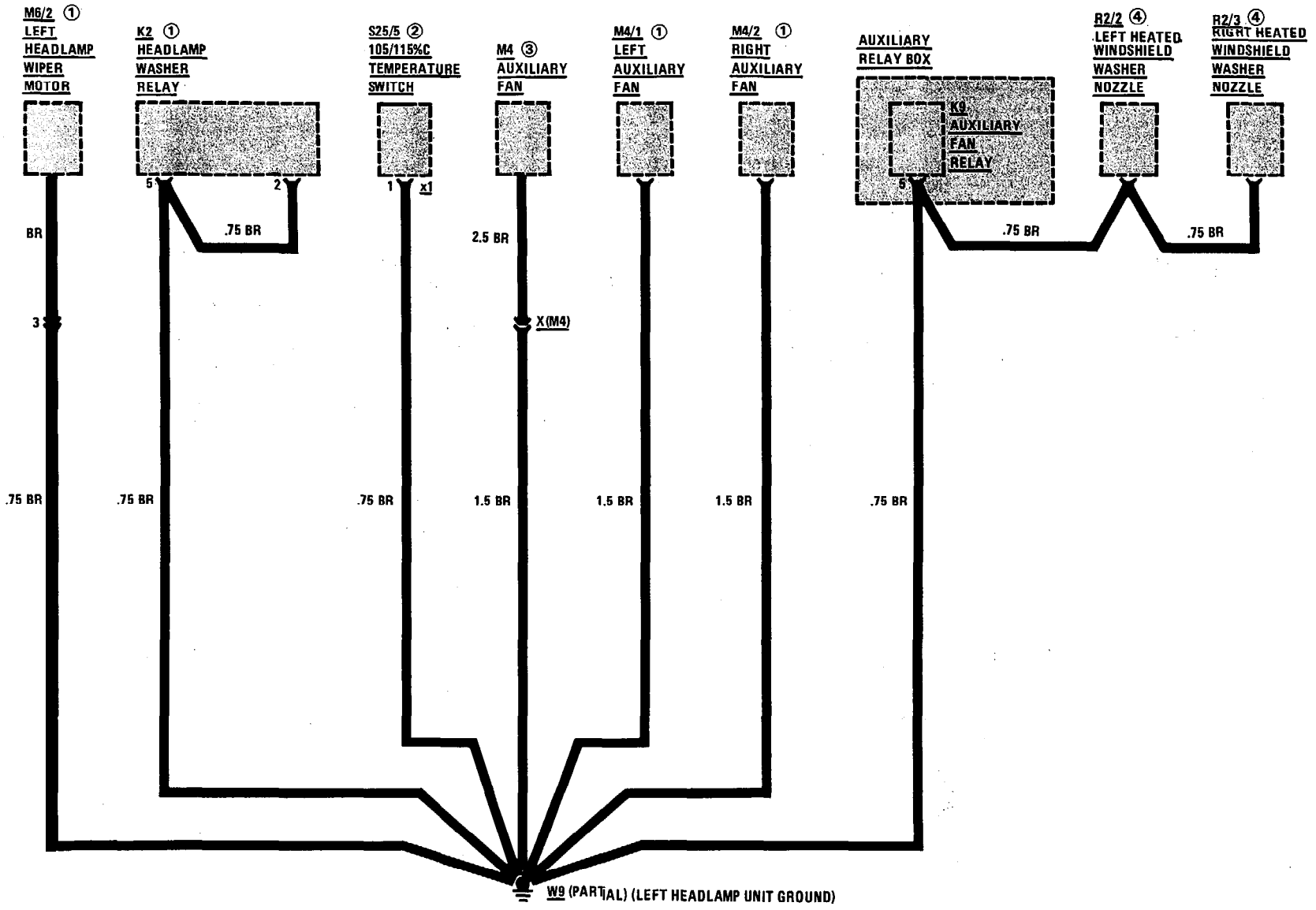
201.0/.1

Supplement 15

REVISIONS: ① ALL MODELS EXCEPT 201.028
② AS OF MY 1988, CONNECTED TO W3

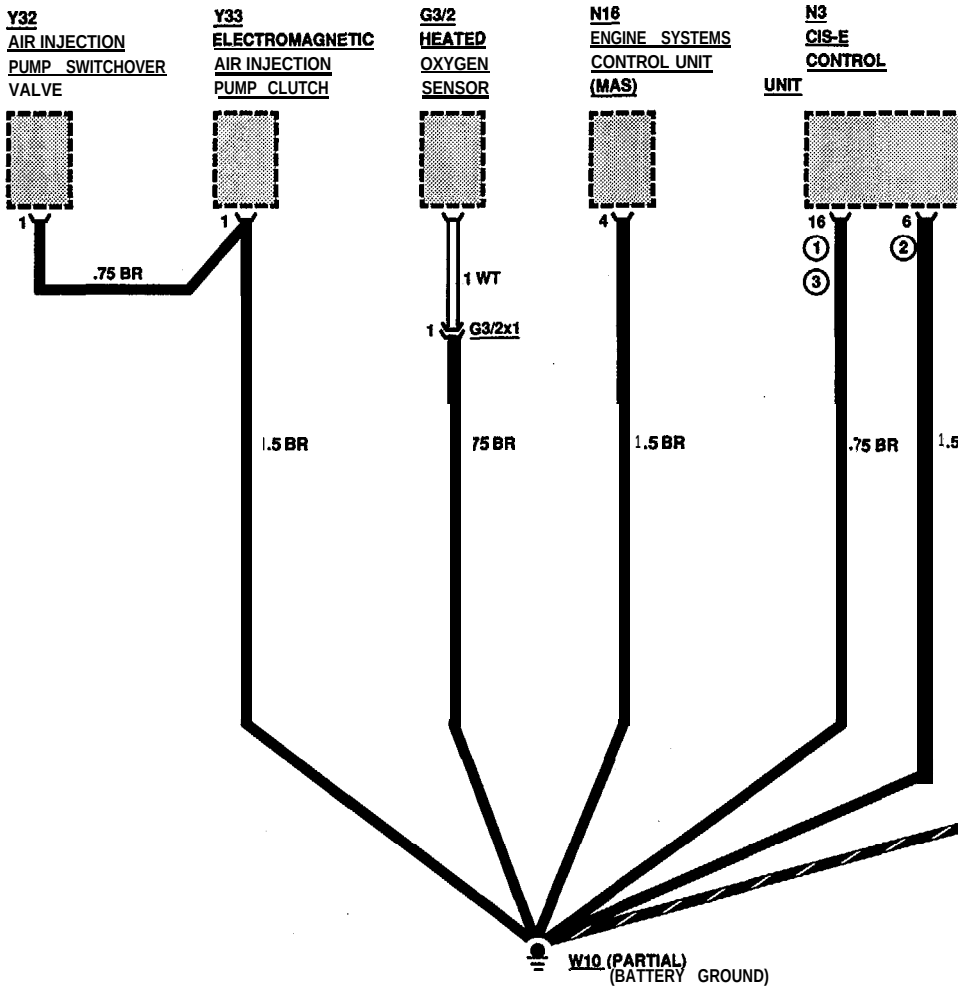
GROUND DISTRIBUTION (W9)

AS OF MY 1987



REVISIONS: ① MOOELS **201.029/.128**
② MODEL 201.034 ONLY
③ MODELS **201.028/.034/.126**
④ **MODEL 201.028** ONLY

GROUND DISTRIBUTION (W10)



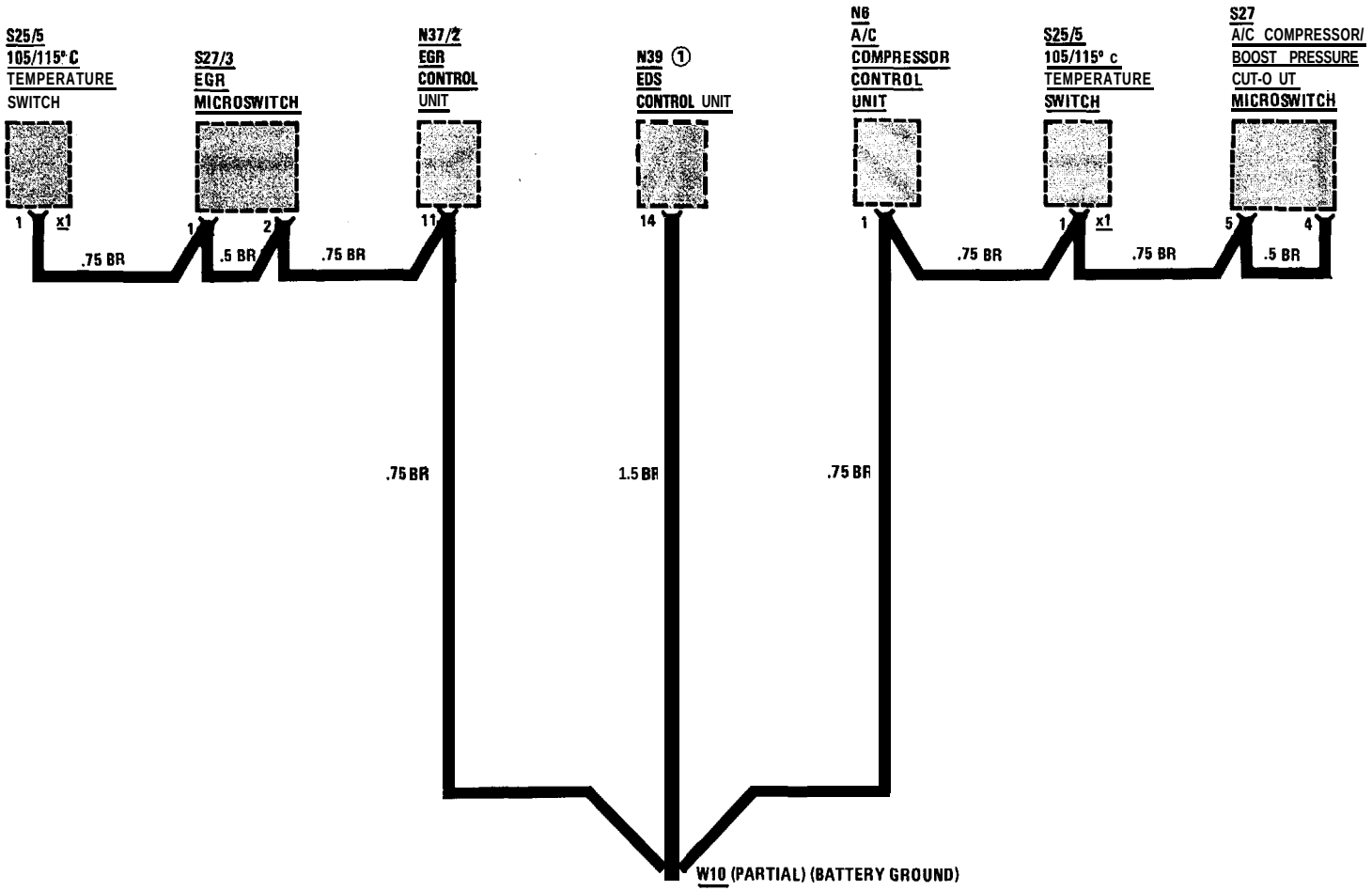
REVISIONS: (1) UP TO MY 1990 (3) VEHICLES WITH MANUAL TRANSMISSION

0 AS OF MY 1990

GROUND DISTRIBUTION (W IO)

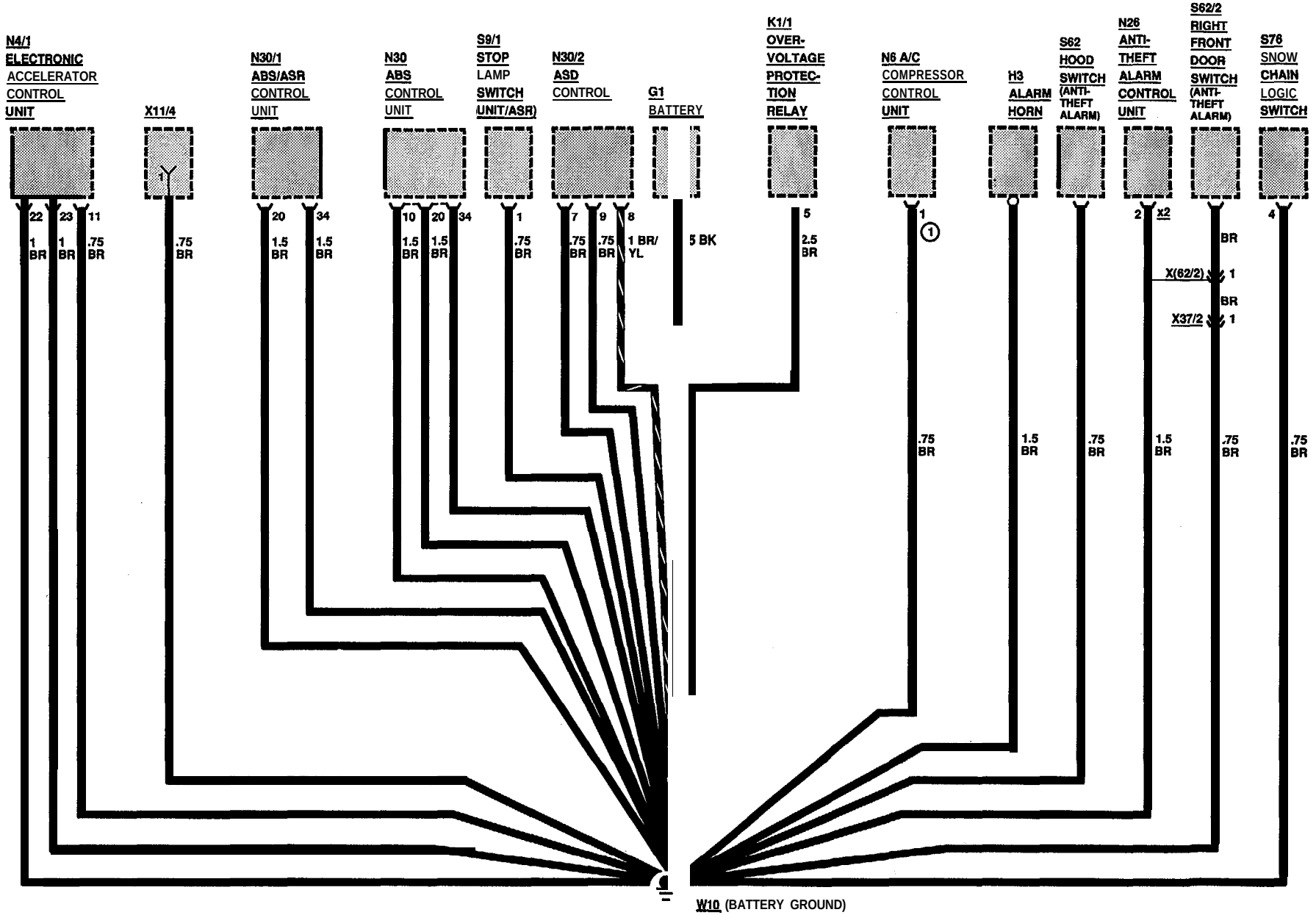
AS OF MY 1987

DIESEL



REVISIONS: ① MODEL 201.128 ONLY

GROUND DISTRIBUTION (W10)

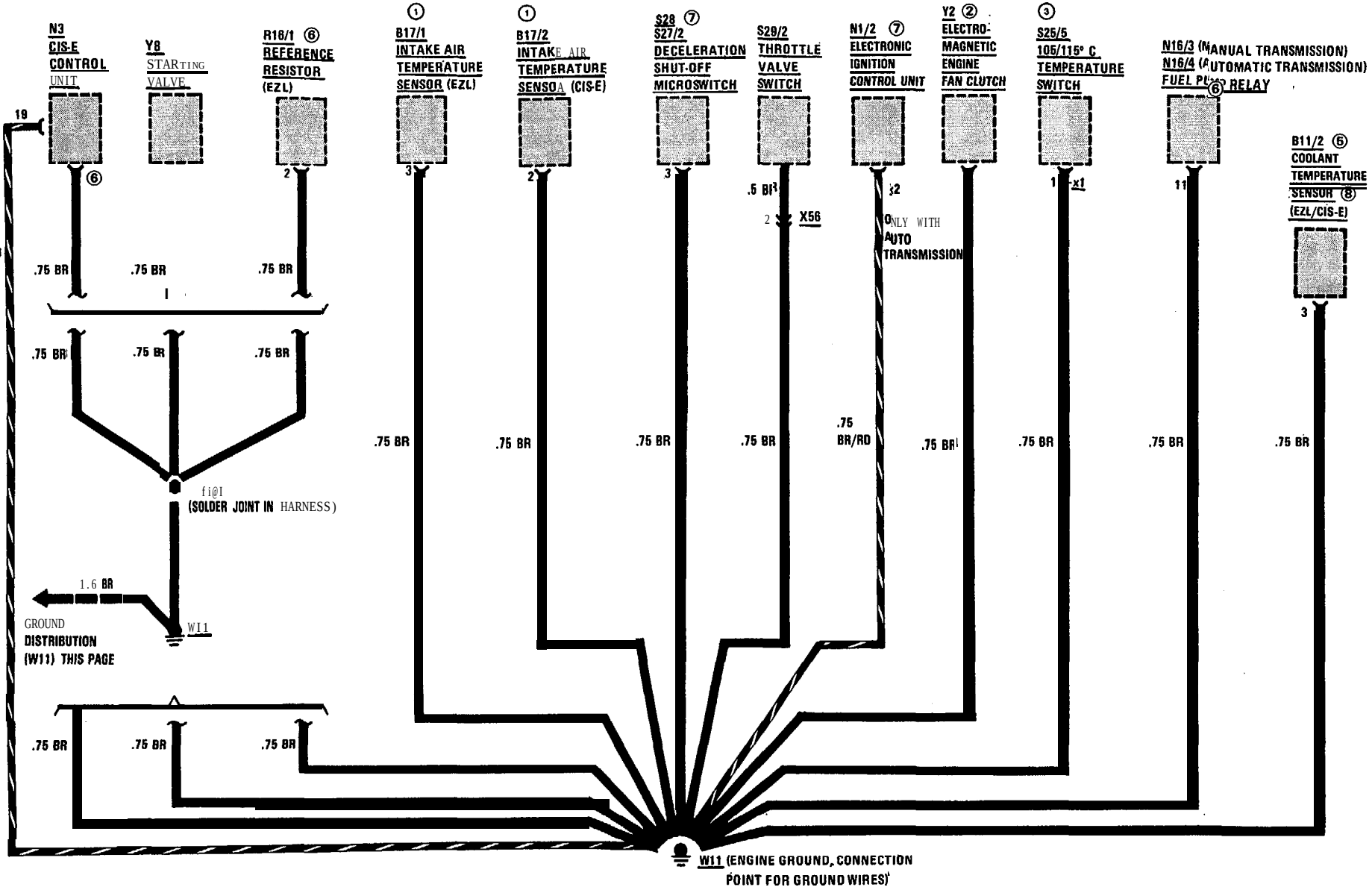


REVISIONS: (1) UP TO MY 1990

GROUND DISTRIBUTION (W11)

AS OF MY 1987

GASOLINE



REVISIONS:
① MODEL 201.034 ONLY
② MODEL 201.028 ONLY
③ MODEL 201.029 ONLY
④ AS OF MY 1968 MODEL 201.029
⑤ CALIFORNIA AS OF MY 1988
⑥ UP TO MY 1990
⑦ AS OF MY 1990, MODEL 201.028 ONLY
⑧ AS OF MY 1990, GROUNDED AT W3

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COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
A1	Instrument cluster		
A2	Radio	Center console	238-1
A2/2	CD-player and radio control unit	Center console	
A2/6	CD changer	Right wheel well	
A3	Voltmeter	Center console, below radio	
A4	Stopwatch	Center console, below radio	
A5	Oil temperature gauge	Center console, below radio	
A7	ABS hydraulic unit	Left front corner of engine compartment	225-5
A7/3	ABS/ASR hydraulic unit	Left front corner of engine compartment	240-5
A28/1	Antenna splitter	On antenna mast	241-4
A34	Telephone handset	Center console	
A35	Transmit/receive unit (TRU)	Left trunk well	241-3
A3513	Overhead control unit (OHCU)	Front of dome lamp (E15/2)	241-2
B1	Oil temperature sensor	Lower left rear of engine	227-4
B2	Air flow sensor position indicator	Top center of engine, beneath air filter housing	226-3
B2/1	Air flow sensor with intake air temperature sensor (EDS)	Air filter housing cover	
B4	Fuel level sensor	Top of fuel tank	222-3
B5	Oil pressure sensor	On oil filter housing	231-6
B6	Hall-effect speed sensor	Rear of instrument cluster	234-2

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
B10/8	Coolant temperature sensor (climate control)	Top center of engine (4 cylinder) Top front of engine (6 cylinder) Top front of engine (Diesel)	236-1 236-2
B11/1	Coolant temperature sensor (ELR)	Top front of engine	237-6
B11/2	Coolant temperature sensor (EZL/CIS-E)	Top front of engine (4 cylinder, 16V) Top front of engine (4 cylinder) Top front of engine (4 cyl. M.Y. 91 →) Top rear of engine (6 cylinder)	226-5 231-5 239-2 238-2
B11/4	Coolant temperature sensor (EDS)	On engine coolant outlet	
B11/7	Preglow system temperature sensor	Top right side of engine	235-6
B13	Coolant temperature gauge sensor	Front of engine, behind thermostat housing	230-3
B14	Outside temperature sensor (outside temperature indicator)	Front of car, below bumper	232-2
B14x1	Connector, outside temperature indicator	Right side of component compartment	235-5
B17/1	Intake air temperature sensor (EZL)	Top rear of engine compartment	227-I
		On air filter housing (as of MY. 94)	239-2
B17/2	Intake air temperature sensor (CIS-E)	Top rear of engine compartment	227-I
B18	Altitude correction capsule	Right side of component compartment, behind battery	231-4
B21	EGR temperature sensor	In exhaust gas recirculation (EGR) pipe	239-5
C1	SRS energy accumulator	Below footrest, right front footwell area	228-2
E12	Shift pattern illumination	Beneath transmission shift lever	
E13/1	Glove box lamp	Inside of glove box	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
E14/1	Left sun visor with illuminated vanity mirror		
E14/2	Right sun visor with illuminated vanity mirror		
E15/2	Front dome lamp with shut-off delay and reading lamp	In windshield header	
E15/3	Rear dome lamp	In headliner above rear window	
E15/4	Dome/reading lamp with seat belt reminder lamp	In windshield header	
E18/2	Trunk lamp with switch	Inside of trunk lid	229-1
E19/1	Left license plate lamp	Rear panel	
E19/2	Right license plate lamp	Rear panel	
E21	Center high mounted stop lamp	Center of hat shelf	
F1	Electrical center	Left side of component compartment	230-2
F13	Auxiliary fuse holder, power seats	Left side of component compartment, inside auxiliary relay box	103
F14	Auxiliary fuse holder,' anti-theft alarm	Left side of component compartment, inside auxiliary fuse box	103/2
F22/1	Auxiliary fuse holder	Left side of component compartment	236-3
G1	Battery	Right side of component compartment	
G2	Alternator	Right front of engine	
G3/2	Heated oxygen sensor	In exhaust system, rear of transmission In exhaust manifold (M.Y. 91 →)	223-4 239-3
G3/2x1	Connector, oxygen sensor heater coil	Below front passenger seat in right front footwell area Near X11/4 (M.Y. 91 →)	232-6 239-4

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
G3/2x2	Connector, oxygen sensor signal	Below front passenger seat in right front footwell area	232-6
		Near X11/4 (M.Y. 91 →)	239-4
H1	Two-tone horn	Front of vehicle, behind grille	232-2
H3	Alarm horn	Left front of engine compartment	232-1
H4/5	Left door speaker	Left front door	
H4/6	Right door speaker	Right front door	
H4/7	Left rear speaker	Left side of hat shelf	
H4/8	Right rear speaker	Right side of hat shelf	
H4/9	Left front speaker	Left side of dash panel	
H4/10	Right front speaker	Right side of dash panel	
K1	Overvoltage protection relay (5-pole)	same as K1/1	
K1/1	Overvoltage protection relay, 87E (7-pole)	Right side of component compartment, behind battery	238-4
K1/2	Overvoltage protection relay, 87E/87L/30a (9-pole)	same as K1/1	
K2	Headlamp washer relay	Left side of component compartment, in auxiliary relay box	103/2
K3/1	Intake manifold preheater relay (PSV)	Left side of component compartment, in front of fuse box	240-1
K4	Power window relay	Left side of component compartment, in electrical center	103/2
K5	Power seat relay	Left side of component compartment, inside auxiliary relay box	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
K8	Double contact relay for auxiliary fan, magnetic clutch for engine fan	Left side of component compartment, in auxiliary relay box	103/2
K8/1	Dual auxiliary fan relay	Left side of component compartment, in auxiliary relay box	103/2
K9	Auxiliary fan relay	Left side 0% component compartment, in electrical center	103/2
K10	Auxiliary fan preresistor relay	Left side of component compartment, in auxiliary relay box	103/2
K11/1	Left head restraint adjustment relay	Beneath driver's seat	
K11/2	Right head restraint adjustment relay	Beneath front passenger seat	
K29	Transmission upshift delay relay	Right side of engine, next to coolant reservoir	238-3
L1	TDC sensor	Front of engine	
L2	Vehicle speed sensor	Rear of instrument cluster	234-2
L3	Starter ring gear speed sensor	Upper left side of Bell Housing	230-5
L3x1	Connector, starter ring gear speed sensor	Right side of component compartment	237-1
L4	A/C compressor speed sensor	Back side of A/C compressor	
L5	Crankshaft position sensor	Upper left side of Bell Housing	
L6	Rear axle speed sensor	In rear axle center piece housing	225-6
L6/1	Left front wheel speed sensor	In left steering knuckle	
L6/2	Right front wheel speed sensor	In right steering knuckle	228-6
L6/3	Left rear wheel speed sensor	Left side of rear axle center piece	
L6/4	Right rear wheel speed sensor	Right side of rear axle center piece	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
L7	Fuel rack position sensor	Left side of engine, top of injection pump	
M1	Starter	Cower left rear of engine	
M3	Fuel pump	Left rear underside of car, forward of rear axle	233-3
M3/1	Fuel pump 1	Left rear underside of car, forward of rear axle	233-3
M3/2	Fuel pump 2	Left rear underside of car, forward of rear axle	233-3
M4	Auxiliary fan	Front of vehicle, behind grille	232-2
M4m1	Left auxiliary fan	Front of vehicle, behind grille	232-2
M4m2	Right auxiliary fan	Front of vehicle, behind grille	232-2
M5/1	Windshield washer pump	Right front of engine compartment, front of windshield washer fluid reservoir	231-2
M5/2	Headlamp washer pump	Right front of engine compartment, front of windshield washer fluid reservoir	231-2
M6/1	Wiper motor	Left side of component compartment, under fresh air grille	232-3
M6/2	Left headlamp wiper motor	Beneath left headlamp unit	
M6/3	Right headlamp wiper motor	Beneath right headlamp unit	
M9	Aspirator blower, in-car temperature sensor	Part of El 5/2	
M10/3	Left front power window motor	In left front door	
M10/4	Right front power window motor	In right front door	
M10/5	Left rear power window motor	In left rear door	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
M10/6	Right rear power window motor	In right rear door	
M11	Automatic antenna	Left front corner of trunk	222-I
M12	Sliding/pop-up roof drive unit	Left front corner of trunk	222-1
M14/1	Supply pump, central locking system	Beneath right side of rear seat bench	
M14/2	Supply pump, central locking system and orthopedic backrest	Beneath right side of rear seat bench	229-3
M15	ASR charging pump	On brake booster, below master cylinder	240-4
M16	Cruise control actuator	Right side of engine, connected to throttle linkage	224-6
M16/1	Electronic accelerator/cruise control/idle speed control actuator	Left side of engine	
M16/1x1	Connector, electronic accelerator/cruise control/idle speed control actuator	Left side of component compartment, on shock tower	
M21/2	Electrically adjustable front passenger rearview mirror		
M25	Left front power seat motor group	Under lower seat cushion of left front seat	
M26	Right front power seat motor group	Under lower seat cushion of right front seat	
M27	Left front power seat motor group with memory	Under lower seat cushion of left front seat	
N1/1	Transistorized ignition control unit	Left side of engine compartment, on inner fender	235-3
N1/2	Electronic ignition control unit (EZL)	Left side of engine compartment, on inner fender	227-2

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
N2/2	SRS control unit	Beneath radio, mounted to transmission tunnel	
N2/4	Warning module (seat belts, keys, lights)	Left front footwell area, behind left kickpanel	228-3
N3	CIS-E control unit	Right side of component compartment, behind battery	238-4
N4	Cruise control amplifier	Under right front footrest	
N4/1	Electronic accelerator control unit	Right side of component compartment, next to battery	
N4/2	Cruise control amplifier with reference resistor	Under right front footrest	229-4
N6	A/C compressor control unit	Right side of component compartment, behind battery	226-1
N8	Idle speed control unit	Behind N6	226-1
N10	Combination relay (turn/hazard signal, heated rear window, wiper motor)	Left side of component compartment, inside electrical center	103
N14	Preglow time relay	Left side of engine compartment, on inner fender	225-1
N16	Engine systems control unit (MAS)	Right side of component compartment, behind battery	238-4
N16/3	Fuel pump relay	Right side of component compartment, behind battery	231-3
N16/4	Fuel pump relay with kickdown cut-out	same as N16/3	231-3
N19/1	Tempmatic pushbutton control unit	Center of dashboard	238-1
N24	SRS voltage converter	Right front footwell area, behind right kickpanel	229-4
N25/1	Left front seat heater relay	Under left front footrest	225-2

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
N25/2	Right front seat heater relay	Under right front footrest	
N25/5	Front seat heater control unit	Under left side of rear bench seat	237-2
N26	Anti-theft alarm control unit	Under right front footrest	228-2
N27	Anti-towing sensor	Under left side of rear bench seat	228-5
N30	ABS control unit	Right side of component compartment, behind battery	226-I
N30/1	ABS/ASR control unit	same as N30	
N30/2	ASD control unit	Right side of component compartment, behind shock tower	240-2
N32/1	Left front power seat control unit (with memory)	Under driver's seat	
N35	Daytime running lamp control unit (CDN)	Under left side of dash panel	
N37/2	EGR control unit (11-pole)	Right side of component compartment, behind battery	236-4
N39	EDS control unit	Right side of component compartment, behind battery	
N40	Instrument illumination control unit (circuit 58d)	Left front footwell area, under lower dashboard	235-I
N40/3	Audio power amplifier, bass	In trunk, on right rear wheelwell	243-1
N44/1	Oxygen sensor replacement indicator control unit	Passenger side footwell	
R1	Heated rear window element	On rear windshield	
R2/1	Heated windshield washer nozzle	Rear underside of engine hood	223-5
R2/2	Left heated windshield washer nozzle	Left rear underside of engine hood	232-4
R2/3	Right heated windshield washer nozzle	Right rear underside of engine hood	232-4

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
R3	Front cigar lighter with ashtray illumination	In front of ashtray	
R8/2	Intake manifold preheater (PSV)	Between intake manifold and cylinder head	
R11	Driver-side heated mirror		
R12/1	Left front emergency tensioning retractor (ETR) squib	Base of left "B" pillar, in ETR	
R12/2	Right front emergency tensioning retractor (ETR) squib	Base of right "B" pillar, in ETR	229-5
R12/3	Driver airbag squib	Rear of airbag, in steering wheel	
R13/1	Left front seat cushion heater	In driver's seat cushion	
R13/2	Left front backrest heater	In driver's seat backrest	
R13/3	Right front seat cushion heater	In front passenger seat cushion	
R13/4	Right front backrest heater	In front passenger seat backrest	
R14	Blower motor preresistor group	Right side of component compartment, behind battery	238-4
R15	Auxiliary fan preresistor	Lower left corner of engine compartment	223-1
R16/1	Reference resistor (EZL)	Top center of engine	226-6
R17/1	Reference resistor (CIS-E)	Right side of component compartment	226-4
R18/1	Resistance trimming plug, electronic idle speed control (ELR)	Right side of component compartment, behind battery	
R18/2	Reference resistor (EGR)	Right side of component compartment, behind battery	
R25	Accelerator pedal position sensor	Top rear of engine	
R25x1	Connector, accelerator pedal position sensor	Left front of engine compartment, near T1	
R26	Fader switch	In center console	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
R29	Cruise control reference resistor	Under right front footrest, part of N4/2	
S1	Exterior lamp switch	Left side of dash panel	
S2/1	Ignition/starter switch	Dash panel, right of steering wheel	238-1
S2/2	Glow/starter switch	Dash panel, right of steering wheel	238-1
S3/1	Blower switch, Tempmatic	Center of dash panel	238-1
S4	Combination switch	Left side of steering column	
S4s1	Turn signal switch	Part of S4	
S4s2	Headlamp flasher switch	Part of S4	
S4s3	Low beam switch	Part of S4	
S4s4	Windshield washer pump switch	Part of S4	
S4s5	Windshield wiper switch	Part of S4	
S4s6	Horn contact	Beneath airbag	
S5/3	High-voltage distributor	Top left front of engine	227-3
S6	Hazard flasher switch	In center console	
S8/1	Warning buzzer contact, exterior lamps	Part of S2/1 or S2/2	
S8/2	Warning buzzer contact, exterior lamps/central locking system	Part of S2/1 or S2/2	
S9	Stop lamp switch	Above brake pedal, on bracket	224-5
S9/1	Stop lamp switch (ASD)	Above brake pedal, on bracket	
S10/1	Left front brake pad wear sensor	In left front brake pad	
S10/2	Right front brake pad wear sensor	In right front brake pad	
S11	Brake fluid level switch	Top of brake fluid reservoir	230-6

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
S12	Parking brake switch	Under parking brake lever	
S13/1	Sliding roof switch	In center of dash	
S13/2	Sliding/pop-up roof switch	Center of windshield header	
S14	Heated rear window switch	Center of dash panel	238-1
S16/1	Starter lock-out/backup lamp switch	Lower left side of transmission	233-4
S16/2	Backup lamp switch	Part of gearshift assembly	233-4
S16/6	Kickdown switch	Under accelerator pedal	224-2
S17/3	Left front door switch	In left front door jamb	
S17/4	Right front door switch	In right front door jamb	232-5
S17/5	Left rear door switch	In left rear door jamb	
S17/6	Right rear door switch	In right rear door jamb	
S17/7	Left door switch (power seat relay)	In left front door jamb	
S17/9	Glove box lamp switch	In glove box	
S17/10	Right door switch (power seat relay)	In right front door jamb	232-5
S18	Rear dome lamp switch	Left side of dash panel	
S18/1	Rear dome lamp switch with illumination	Left side of dash panel	
S19	Right power window switch group	Center console	
S20	Left power window switch group	Center console	
S21/3	Left rear power window switch	Left rear door panel	
S21/4	Right rear power window switch	Right rear door panel	
S22	Left front power seat switch	Left front door panel	
S23	Right front power seat switch	Right front door panel	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
S25/1	100 °C Temperature switch	Tog front of engine	226-5
S25/4	100/110 °C Temperature switch auxiliary fan high speed/emergency cut-out	Top front of engine	231-5
S25/5	105/115 °C Temperature switch auxiliary fan high speed/emergency cut-out	Top front of engine	231-5
S25/6	50 °C Temperature switch	Lower right front of engine	228-1
S25/7	25 °C Temperature switch (EGR)	Lower right front of engine	228-1
S25/9	97 °C Temperature switch (EGR)	Top front of engine, rear of coolant outlet	227-6
S25/13	60 °C Temperature switch	front of engine, below coolant pump	239-6
S27	A/C compressor/boost cut-out microswitch	Top left of engine, on throttle linkage	
S27/2	Deceleration shut-off microswitch	Left side of engine, on side of throttle body	223-6
S27/3	Microswitch (EGR)	Top rear of engine	227-5
S27/4	Microswitch pressure control flap	Tog, fear of engine	227-5
S29/1	Throttle valve switch, full load	Top rear of engine	
S29/2	Throttle valve switch, full load/idle	Left side of engine, below throttle body	223-6
S31	Refrigerant low pressure switch, A/C compressor (off 2.0 bar/on 2.6 bar)	Left front of engine compartment, near receiver/drier	
S31/1	Refrigerant pressure switch, 2 function (off 2.0/30.0 bar, on 2.6/22.0 bar)	Left front of engine compartment, near receiver/drier	223-2
S32	Refrigerant high pressure switch, auxiliary fan (off 15.0 bar/on 20.0 bar) (green)	same as S31/1	223-2

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
S40	Cruise control switch V Decelerate/set B Accelerate/set SP Resume A Off	Left side of steering column	
S40/1	Clutch pedal switch (cruise control)	Top of clutch pedal bracket	224-5
S41	Coolant Bevel switch	Right front of engine compartment, on side of coolant reservoir	225-4
s42	Washer fluid level switch	Right front of engine compartment, tog of windshield washer fluid reservoir	225-4
S43	Oil level switch	Left side of oil pan	233-5
S47	Left front door actuator	In left front door	
S48	Right front door actuator	In right front door	
S49	Trunk lid lock actuator	In rear center of trunk lid	233-d
S50	Outside mirror control switch	Center console	
S51/1	Left front seat heater switch	Center console	
S51/2	Right front seat heater switch	Center console	
S61	Automatic antenna switch	Center of dash panel	238-1
S62	Hood switch (ATA)	Right side of component compartment	231-3
S62/1	Left front door switch (ATA)	In left front door, part of lock	
S62/2	Right front door switch (ATA)	In right front door, part of lock	
S66	Engine overload protection switch	On intake manifold	
S68/1	Driver seat belt buckle switch (warning buzzer)	In driver's seat belt buckle	
S68/3	Driver seat belt buckle switch (airbag/ETR)	In driver's seat belt buckle	
S68/4	Front passenger seat belt buckle switch (ETR)	In front passenger seat belt buckle	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
S76	Snow chain logic switch (ASR) with indicator	On center console	
T1	Ignition coil	Left front side of engine compartment	234-5
W1	Main ground (behind instrument cluster)	Behind left side of instrument cluster	222-6
W2	Ground, at right headlamp unit	Lower right front of engine compartment	222-4
W3	Ground, left front wheelhousing (at ignition coil)	Left side of engine compartment, on inner fender panel	
W4	Ground, front dome lamp	Behind front dome lamp (E15)	235-2
W5	Ground, engine	Top front of engine	228-4
W6	Ground, left rear wheelhousing in trunk	Left side of trunk, below hinge	222-1
W7	Ground, right rear wheelhousing in trunk	Right rear corner of trunk, behind panel	222-2
W9	Ground, at left headlamp unit	Lower left front of engine compartment	222-4
W10	Ground, battery	Right side of component compartment	222-5
W11	Ground, engine (connection point for ground wires)	Left front corner of engine compartment	225-5
W13	Ground, heated rear ωndoω	At right rear pillar	225-3
W14	Ground, ABS hydraulic unit bracket	Left front corner of engine compartment	225-5
X4	Terminal block, terminal 30, electrical center	Part of F1	
X4/10	Terminal block, terminal 30/terminal 61 (battery)	On rear of right shock tower	222-5
X4/13	Terminal block, terminal 87	Right side of component compartment, behind battery	
X5/1	Terminal block, interior, terminal 15/30	Left front footwell, behind left kick panel	228-3

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
X512	Connector, interior/starter (4-pole)	Right side of component compartment, behind battery	235-5
X6	Terminal Mock, terminal 58d (l-pole)	Behind instrument cluster	223-3
X6/1	Terminal block, terminal 580 (1-pole)	Behind center console	
X6/4	Connector sleeve, terminal 58d (solder joint in harness)	In main vehicle harness, behind instrument cluster	
X11	Diagnostic socket/terminal block (circuit TD)	Left side of engine compartment, on inner fender	232-1
X11/4	Test connection for diagnosis, (impulse readout, 8-pole)	Right side of component compartment	238-6
X11/4s1	Pushbutton switch with LED (California)	Part of X11/4	238-6
X11/11	Test connection, TD (EDS, 1-pole)	Right side of component compartment, front of battery	
X11/13	Test connection, SRS plug connection (IO-pole)	Right front footwell, under footrest, red connector	229-4
X14	Connector, terminal 50	Left side of engine compartment, right side of brake booster	
x15	Connector, engine fan/l 00 °C temperature switch	Top of engine	234-3
X18	Connector, interior/taillamp harness	Behind left side of dash panel	
X20	Connector, stop lamp switch (2-pole)	Above brake pedal	224-5
X20/1	Connector, center high-mounted stop lamp	Underside of trunk lid	229-I
X21/3	Terminal block, stop lamp switch/cruise control (1-pole)	Left front footwell, behind left kick panel	233-6
X22/7	Connector, upshift delay solenoid valve (1-pole)	Rear of engine, next to lifting eye	238-2
X24	Connector, headlamp harness (6-pole)	Below front of throttle body	231-1
X25	Connector, preglow harness	Left side of engine compartment, on inner fender	236-5

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
X26	Connector, interior/engine	Rear of engine, on intake manifold	
X26/4	Connector, engine/headlamp harness (1-pole, diagnostic socket)	Top center of engine	234-3
X26/3	Connector, engine/taillamp harness (2-pole)	Behind left side of dash panel	
X26/5	Connector, engine/taillamp harness (1-pole)	Behind left side of dash panel	
X26/6	Connector, engine harness/Tempmatic (3-pole)	Right side of component compartment	235-5
X27	Connector, starter harness	Left rear 0% engine compartment, next to power brake booster	230-6
X28/2	Connector, SRS voltage supply (2-pole)	Behind left side of instrument duster	
X28/4	Connector, driver airbag squib	Behind left side of dash panel	229-6
X28/5	Airbag squib slip ring (2-pole)	Behind airbag in steering wheel	
x33	Connector, CIS-E/cruise control (1-pole)	Right front footwell, behind right kick panel	233-2
X33/7	Connector, cruise control voltage supply, terminal 15 (1-pole)	Below ignition switch (S2/1 or S2/2)	
x34	Connector, right front door contact switch	In right front "A" pillar	
X39/16	Connector, telephone voltage suply (1-pole)	Behind left front kick panel, near X5/1	
X42	Connector, anti-theft alarm, front/rear	Under left front footrest	237-5
X42/9	Connector, left front door ATA harness	On left "A" pillar, near footwell	
X42/10	Connector, right front door ATA harness	In right "A" pillar, near footwell	233-2
X42/12	Connector, ATA/exterior lamps switch	Behind instrument cluster	
X42/13	Connector, ATA/radio (1-pole)	Behind radio	234-6
X42/15	Connector, ATA/switched ground	Right side of component compartment	
x43	Connector, central locking system (ATA)	Below right side of rear bench seat	229-2

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
X44/1	Connector, central locking system (trunk lock)	Below right side of rear bench seat	229-2
x47	Connector, rear speed sensor harness (2-pole)	Below right side of rear bench seat	229-3
X48A	Solder joint in harness	Taillamp harness, below front 0% center console	
X48%	Solder joint in harness	Engine harness, top right rear of engine	
X48C	Solder joint in harness	Engine harness, top right rear of engine	
X48D	Solder joint in harness	Engine harness, left side of engine compartment	
X48E	Solder joint in harness	Central locking harness	
X48F	Solder joint in harness	Central locking harness	
X48G	Solder joint in harness	Taillamp harness, below front of center console	
X48H	Solder joint in harness	Taillamp harness, left front corner of trunk	
X4811	Solder joint in harness	Power window harness	
X484	Solder joint in harness	Power window harness	
X48K	Solder joint in harness	In connector to N3	
X48L	Solder joint in harness	Engine harness, left side of component compartment	
X48M	Solder joint in harness	Engine harness, left side of component compartment	
X48N	Solder joint in harness	Central locking harness	
X48P	Solder joint in harness	Central locking harness	
X48Q	Solder joint in harness	Central locking harness	
X48R	Solder joint in harness	Central locking harness	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
X48S	Solder joint in harness	Central locking harness	
X48W	Solder joint in harness	Power sea? harness	
X48X	Solder joint in harness	Power seat harness	
X48Y	Solder joint in harness	Speaker harness	
X48Z	Solder joint in harness	Speaker harness	
X48/1	Solder joint in harness	Engine harness, right side of component compartment	
X48/2C	Solder joint in harness	Engine harness, right side of component compartment	
x53/3	Connector, Hall-effect sensor/EGR (1-pole)	Behind instrument cluster	
X53/4	Connector, inductive sensor/EGR (2-pole)	Behind instrument cluster	
x53/5	Multipoint connector, Hall-effect sensor	Behind right side of instrument cluster	239-1
X53/6	Connector, Hall-effect sensor/CIS-E (I -pole)	Behind right side of instrument cluster	
x54	Connector, power seat voltage supply (2-pole)	Behind left side of dash panel	
X54/1	Connector, power seat	Beneath driver's seast	
X55/1	Connection board, right front power seat	Beneath front passenger seat	
X56	Connector, throttle valve switch	Lower left front of engine	227-3
X62/3	Connector, rear axle speed sensor, ASR (6-pole)	front passenger footwell	240-3
X62/8	Connector, rear axle distributor	Left rear underside of car near fuel pump (M3)	240-6
X67	Connector, outside temperature indicator (2-pole)	Back of instrument cluster	234-2
X80/1	Connector, electromagentic actuator, electronic idle speed control (ELR)/extension	Top left rear of engine, atop intake manifold	230-4

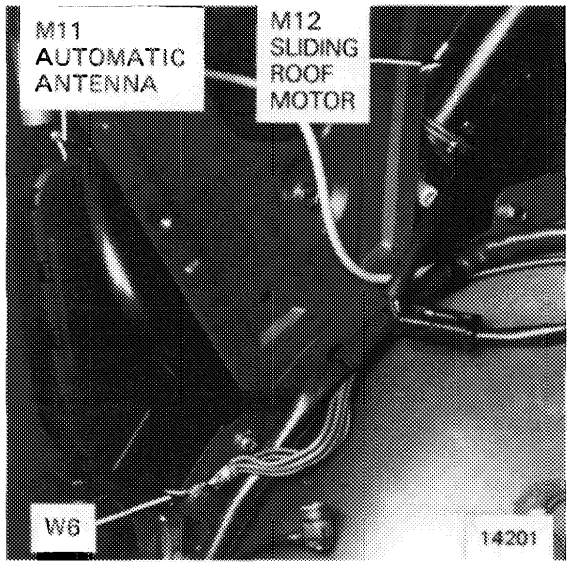
COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
X83/4	Connector, instrument cluster/exterior lamps switch (terminal K/ASD) (2-pole)	Behind exterior lamp switch (S1)	
X88/3	Connector, windshield washer fluid level control (2-pole)	Top of windshield washer fluid reservoir	
X88/5	Connector, left front brake pad wear sensor	Left side of component compartment, near shock tower	226-2
X89/2	Connector, electronic accelerator control unit/engine harness (2-pole)	Behind K1/2	
X91	Terminal block, clutch pedal/cruise control (1-pole)	Left front footwell, behind left kick panel	233-6
X95	Connector, CHECK ENGINE	Right side of component compartment	238-6
X207	Connector	Left side of engine compartment, on inner fender	225-1
X212	Connector, interior/engine harness (4-pole)	Right side of component compartment, behind battery	224-4
Y1	Electrohydraulic actuator (EHA)	Top of engine, rear of air flow sensor housing	224-1
Y2	Electromagnetic engine fan clutch	On center of engine fan	
Y3	Kickdown valve (automatic transmission)	Right rear corner of transmission	224-3
Y3/2	Upshift delay solenoid valve	Front left of transmission	
Y3/3	Upshift delay switchover valve	Rear of engine compartment, right of brake fluid reservoir	241-5
Y5/1	Electromagnetic A/C compressor clutch	On front of A/C compressor	
Y6	Idle speed air valve	Left side of engine, behind air flow sensor housing	234-4
Y8	Start valve	Top of engine, right side of air flow sensor housing	224-1

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
Y22	Electromagnetic actuator, electronic idle speed control (ELR)	Left side of engine, on injection pump	230-4
Y27	EGR switchover valve	Left side of component compartment, on compartment wall	
		Gasoline	238-5
		Diesel	236-6
Y28	Vacuum control flap switchover valve	Top of engine	227-5
Y29	Vacuum amplifier switchover valve (Diesel with automatic transmission)	Right rear of engine compartment	236-6
Y30	Engine overload protection switchover valve	Left side of engine compartment, on shock tower	
Y31	Air recirculation valve vacuum transducer	Left side of engine compartment, on shock tower	
Y31/1	EGR valve vacuum transducer	Right side of engine compartment, on shock tower	
Y32	Air injection pump switchover valve	Left side of component compartment, on compartment wall	238-5
Y33	Electromagnetic air injection pump clutch	Right side of engine, above alternator, on air pump	
Y38	ASD valve	Underside of car, rearward of right front wheelwell	
Z	Connector sleeve (solder joint in harness)		
Z6	Connector sleeve, ground (solder joint in harness)		
Z7	Connector sleeve, terminal 87L (solder joint in harness)		

COMPONENT LOCATION



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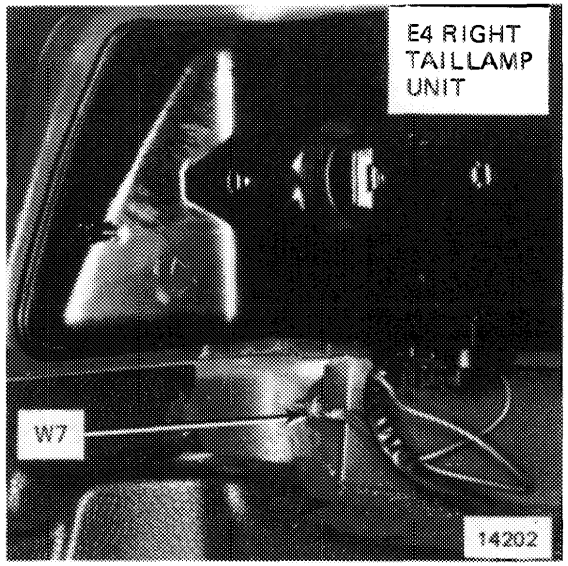

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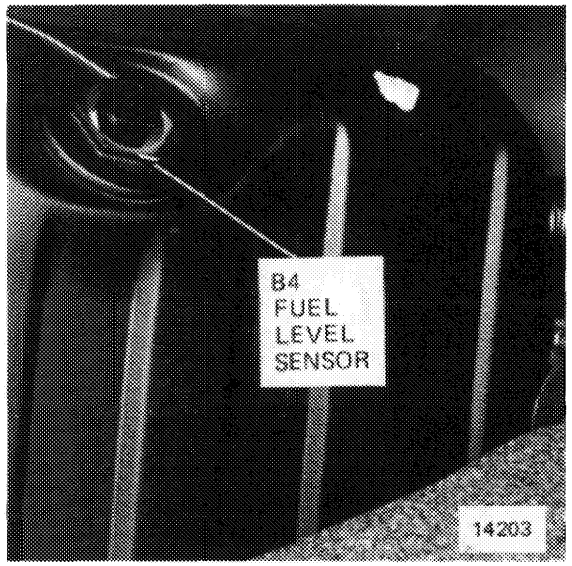

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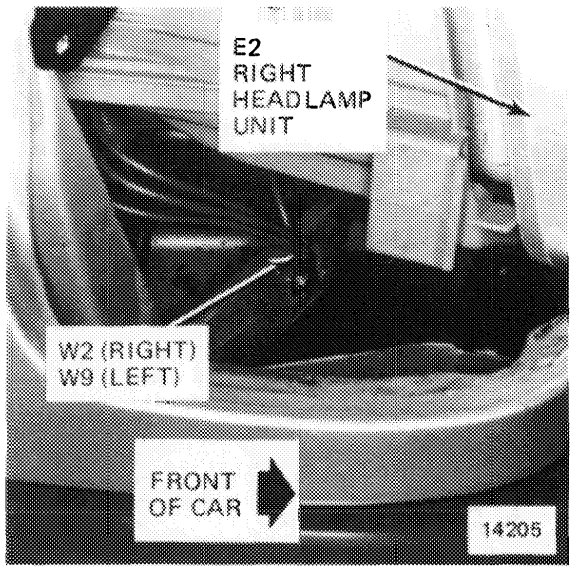

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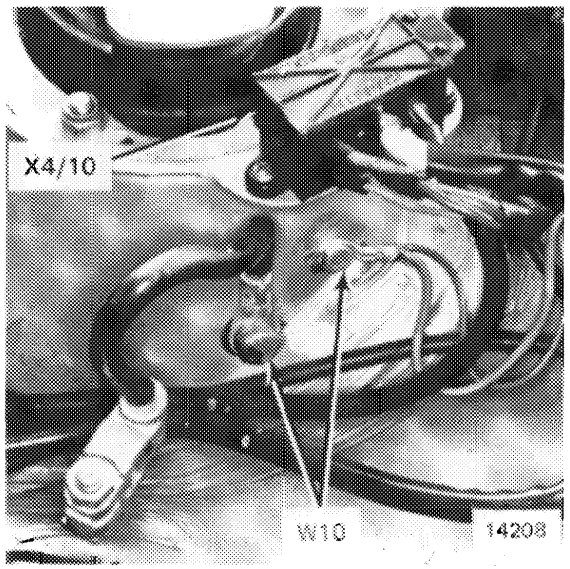

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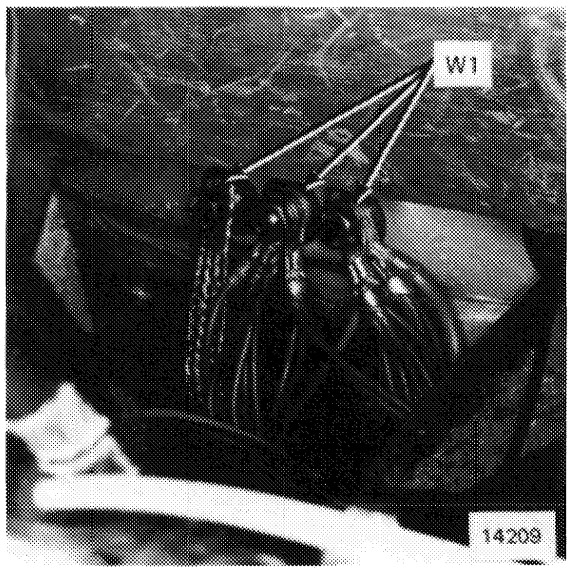
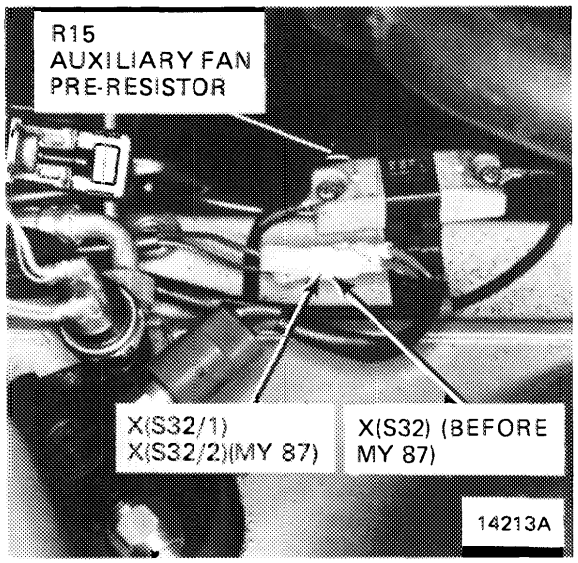


Figure 6

COMPONENT LOCATION



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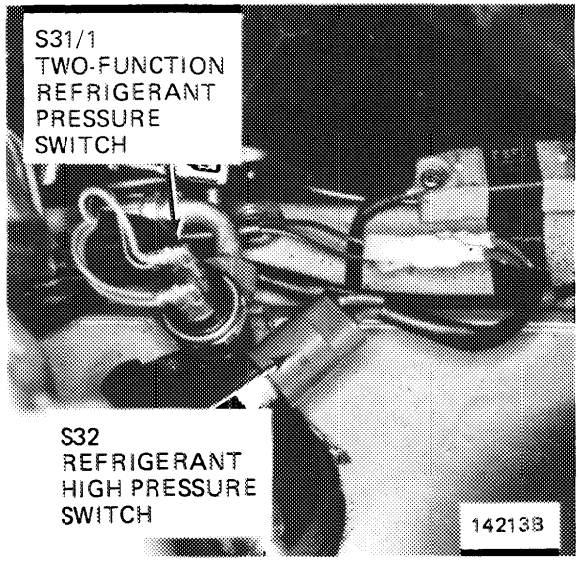

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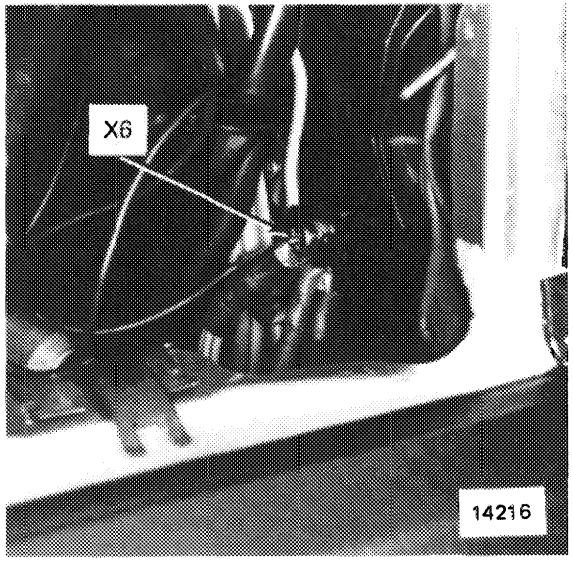

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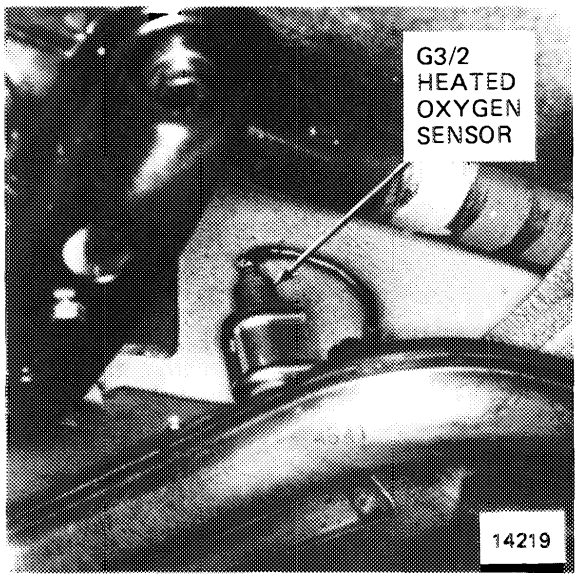

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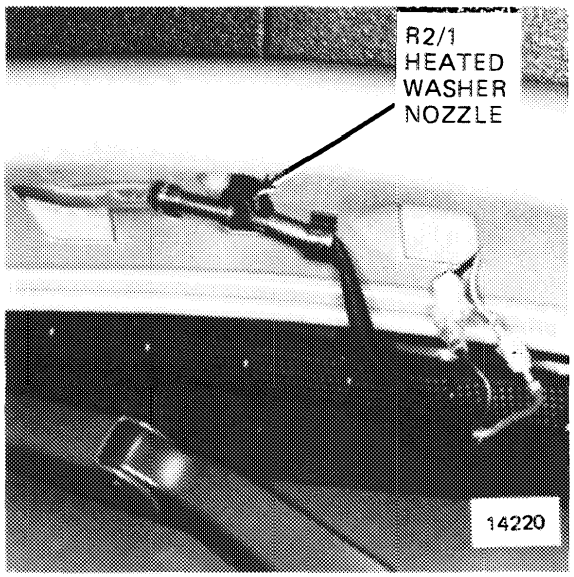

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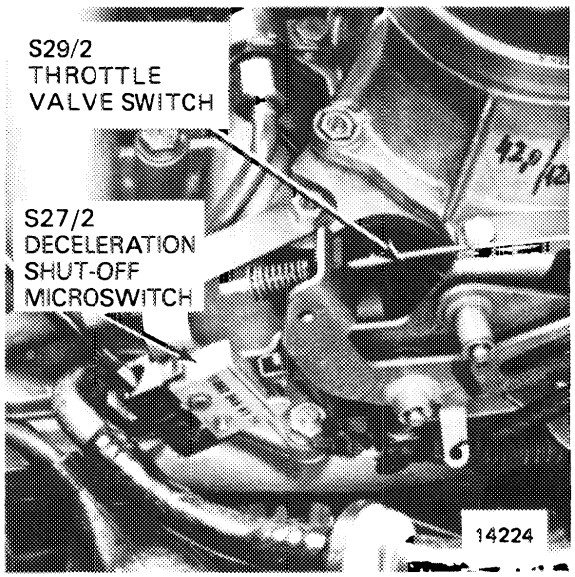

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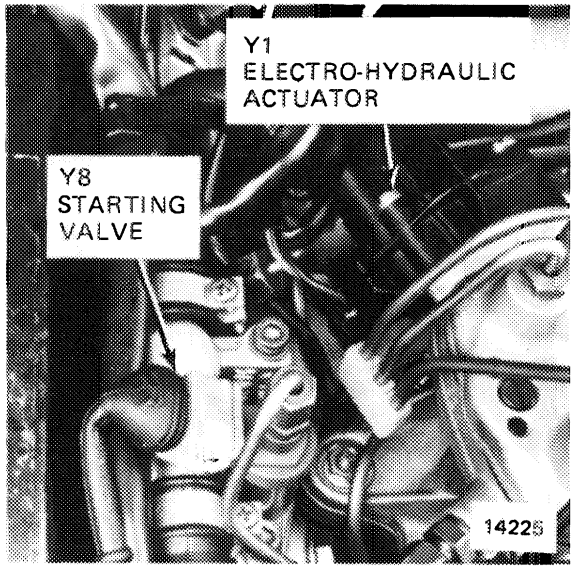

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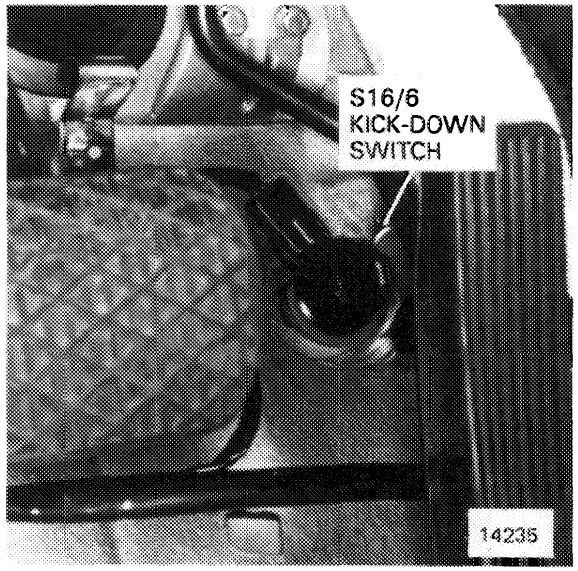

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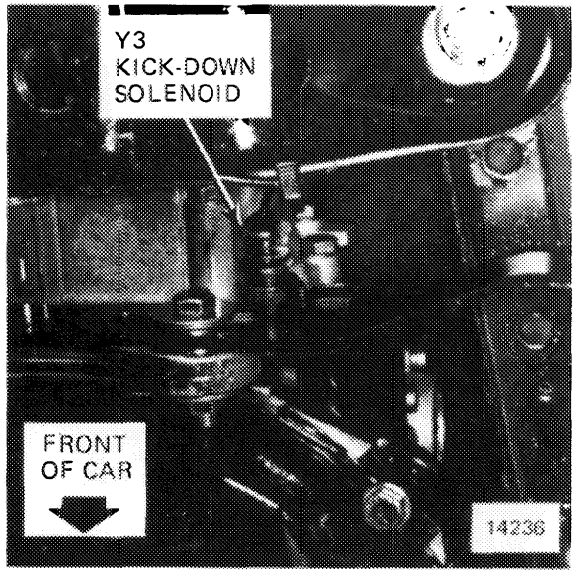

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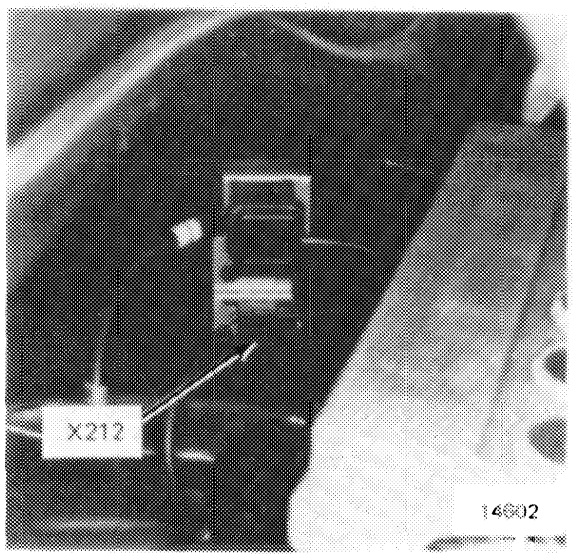

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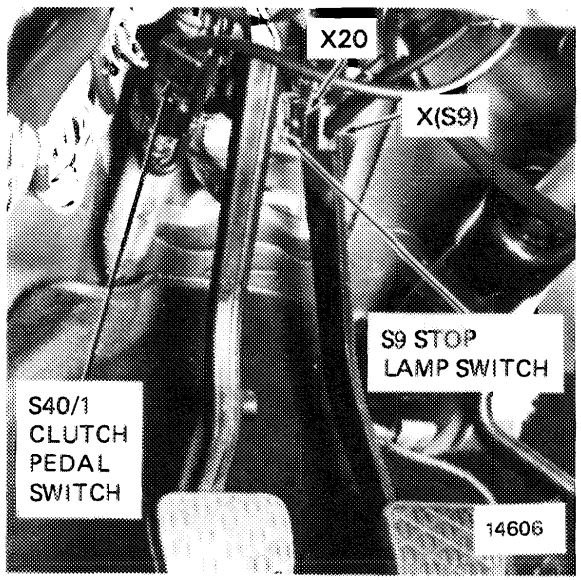

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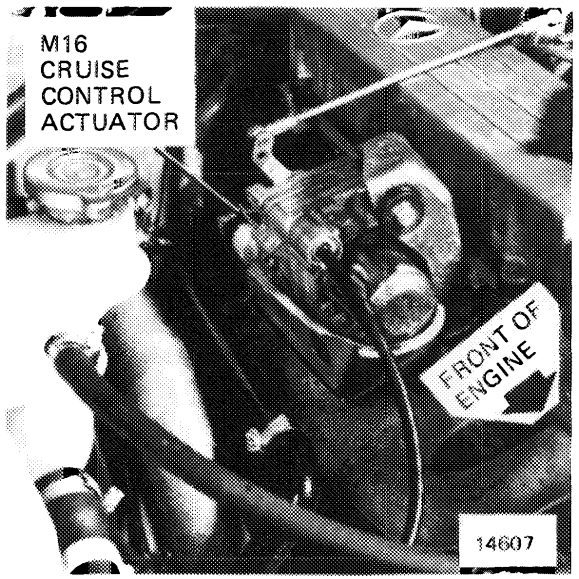

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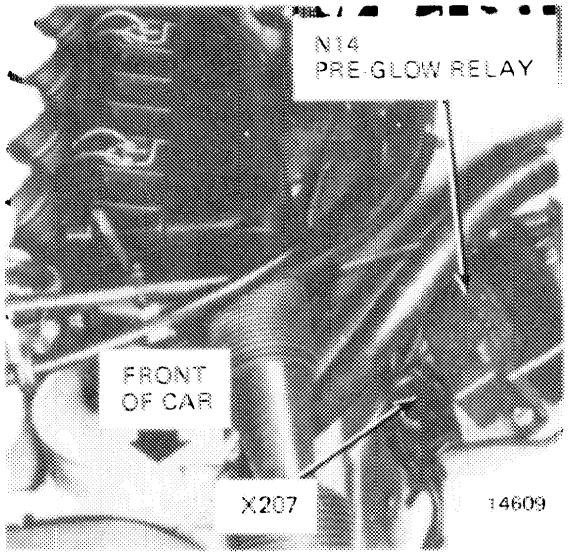

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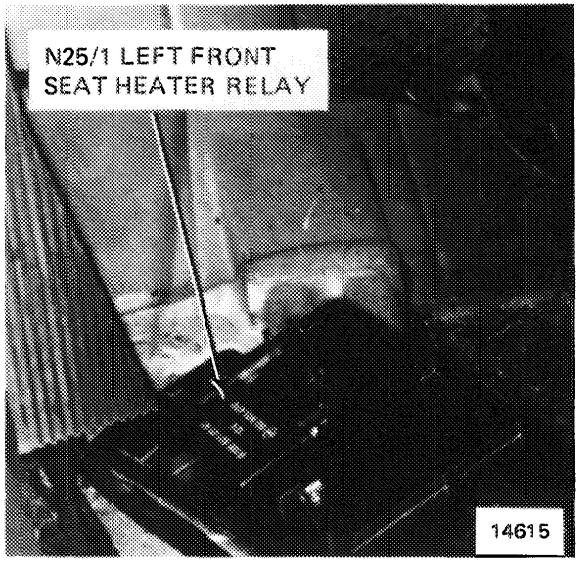

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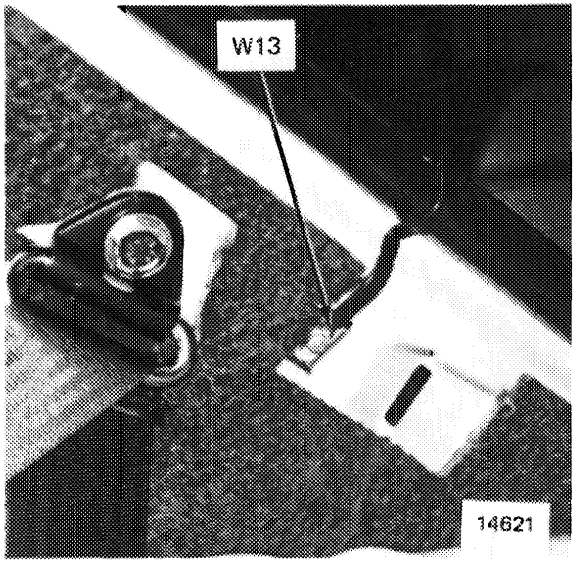

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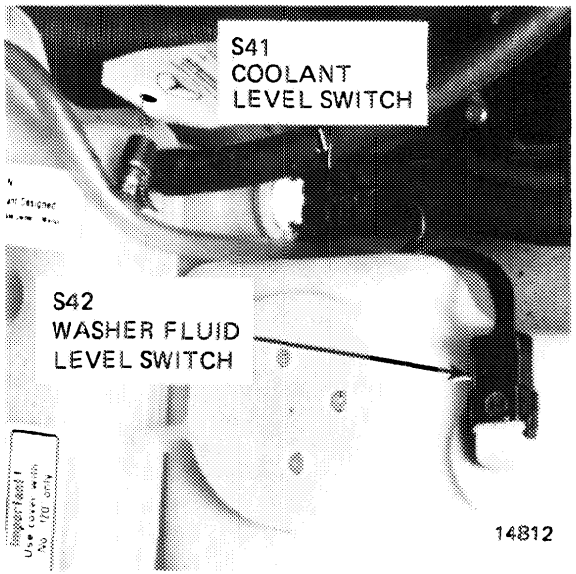

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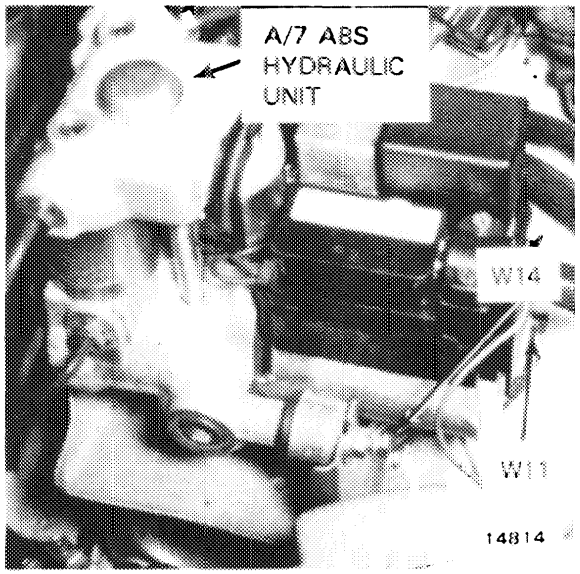

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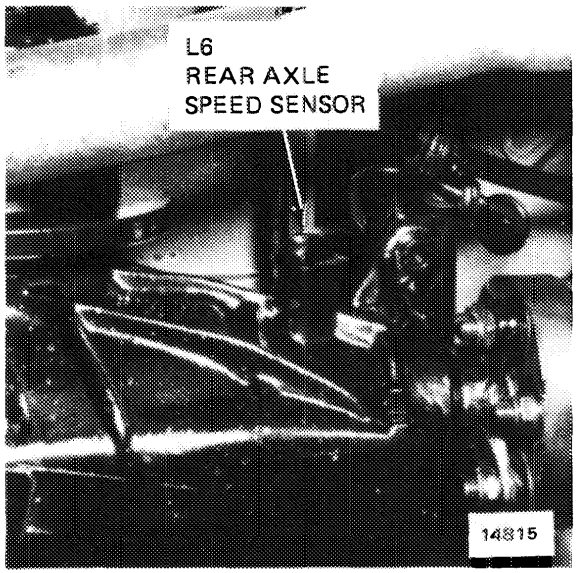

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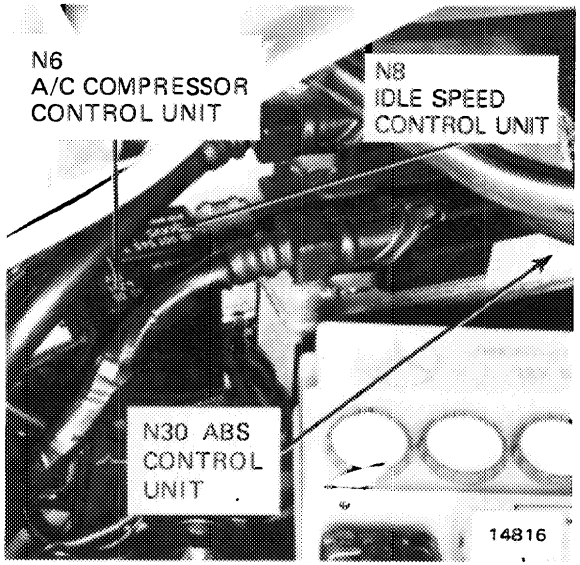

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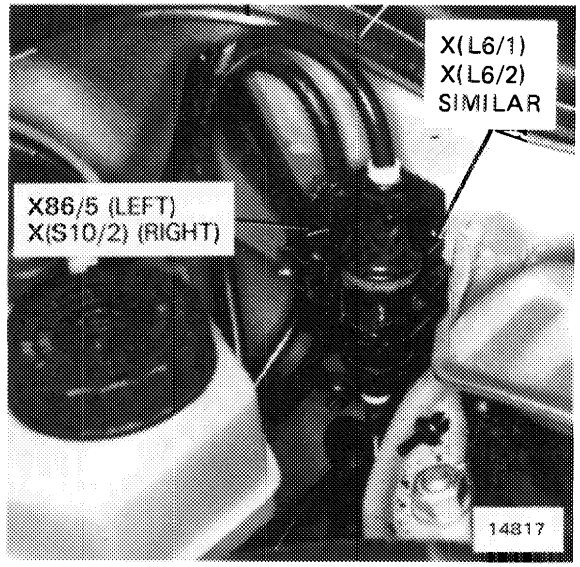

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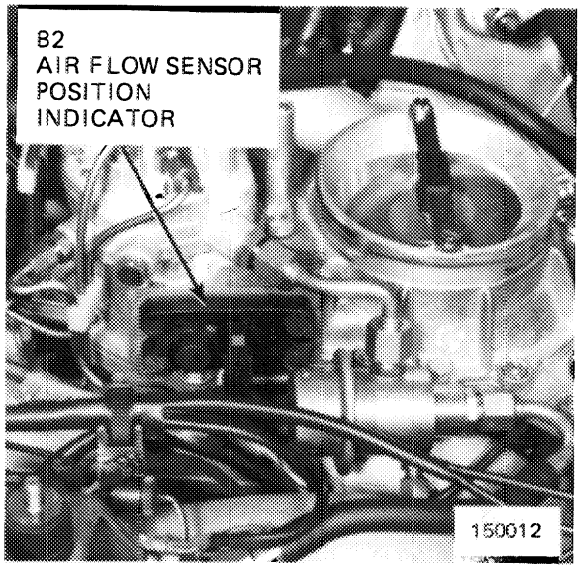

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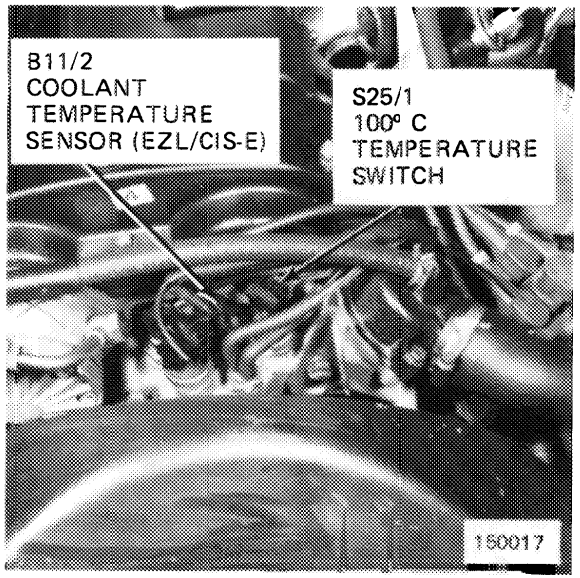

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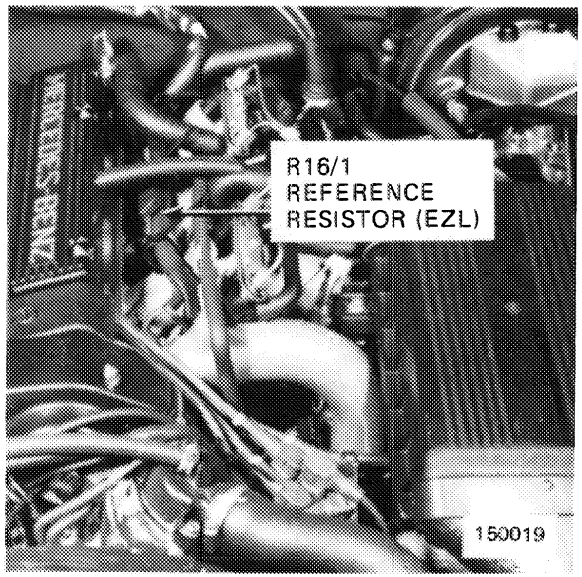

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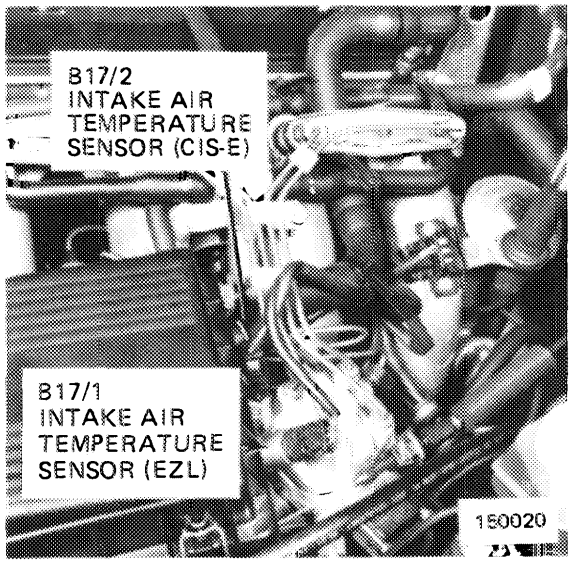

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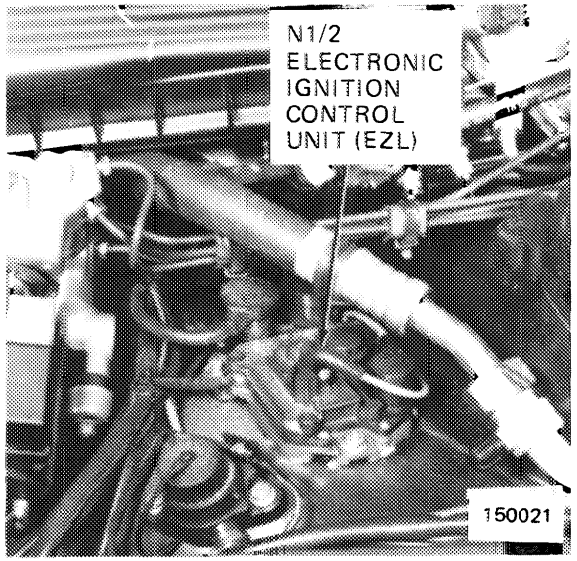

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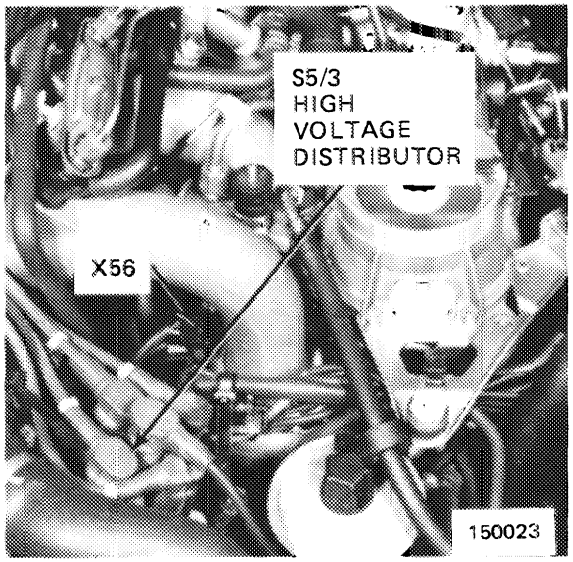

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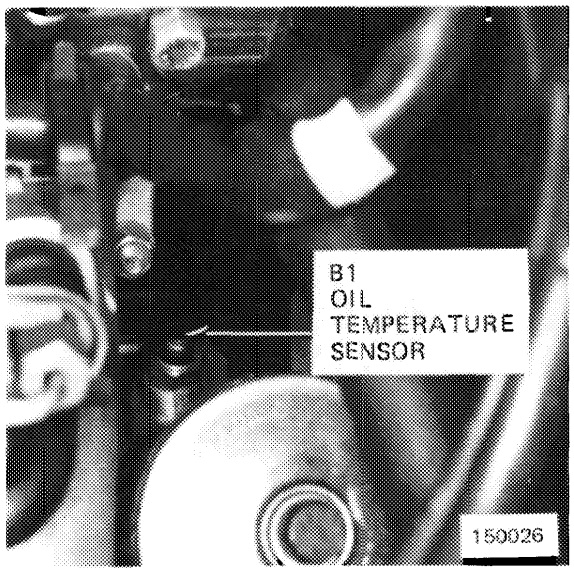

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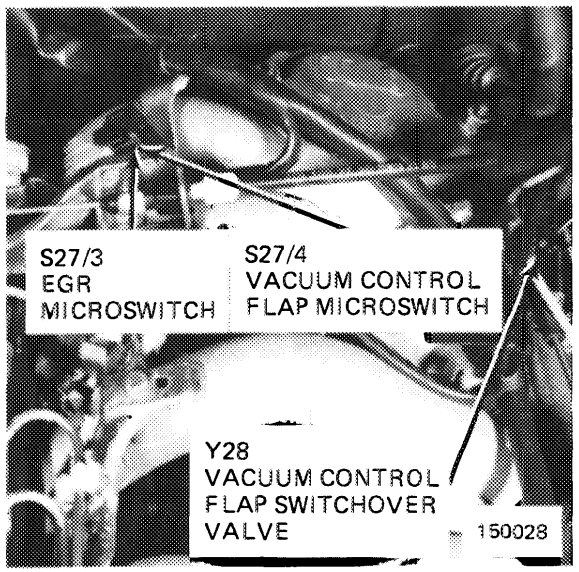

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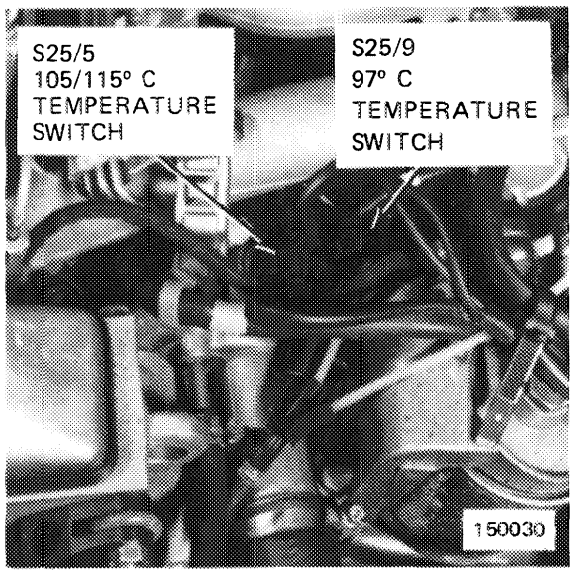

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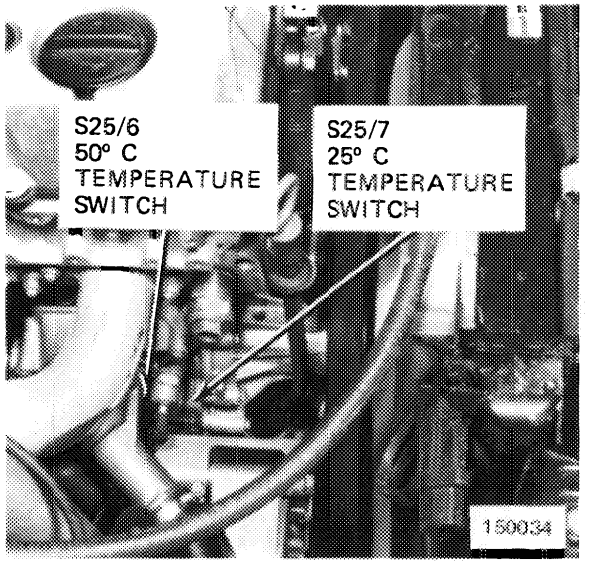

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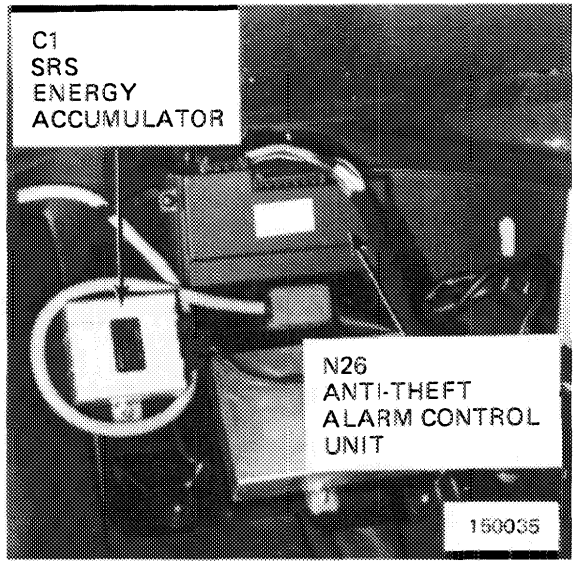

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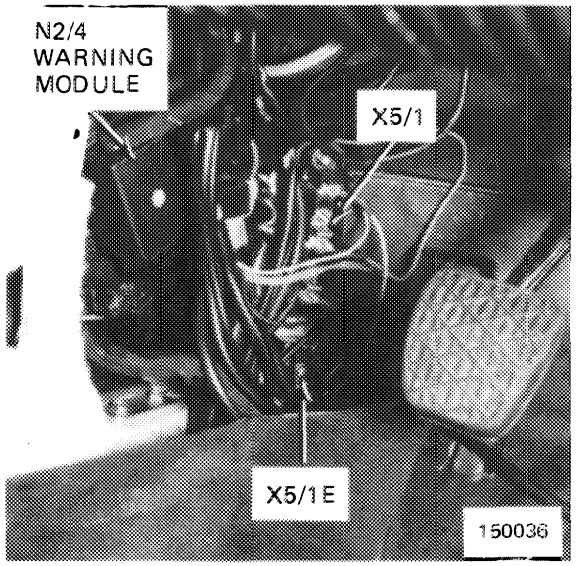

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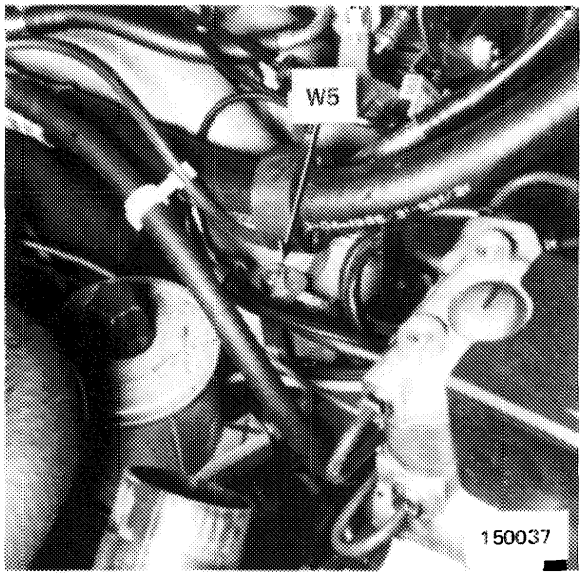

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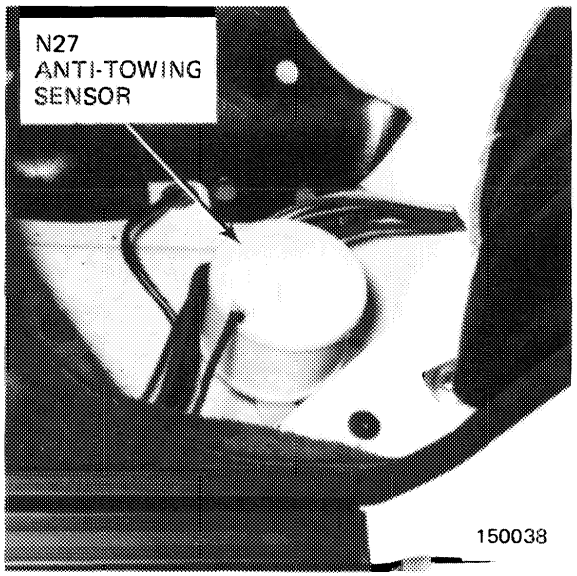

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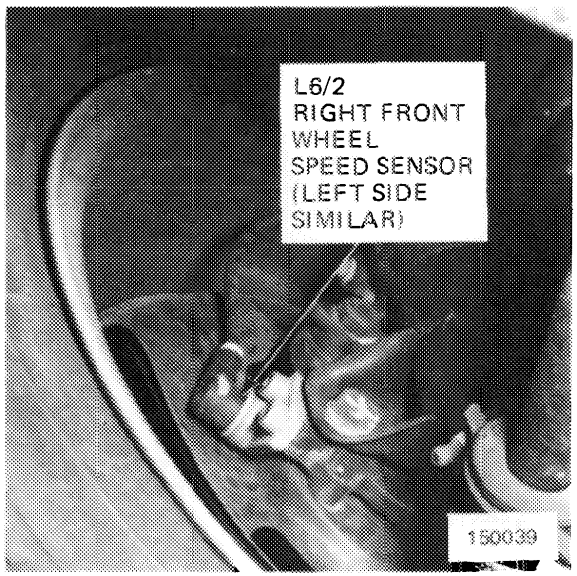
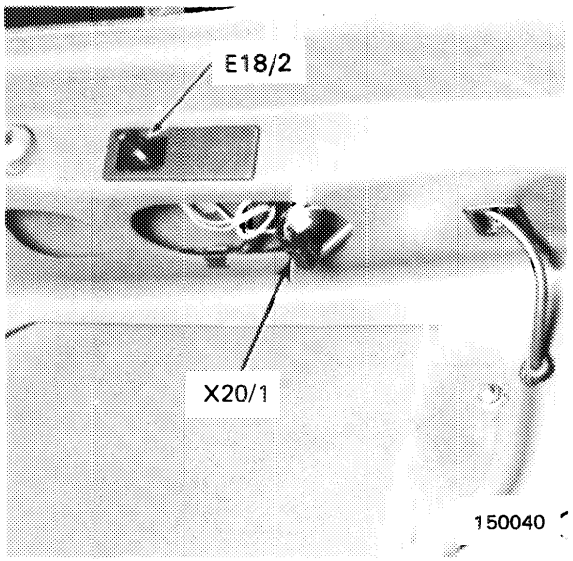


Figure 6

COMPONENT LOCATION



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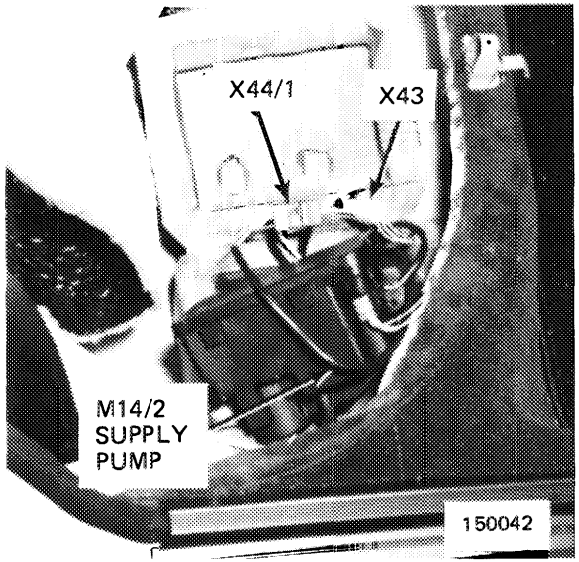

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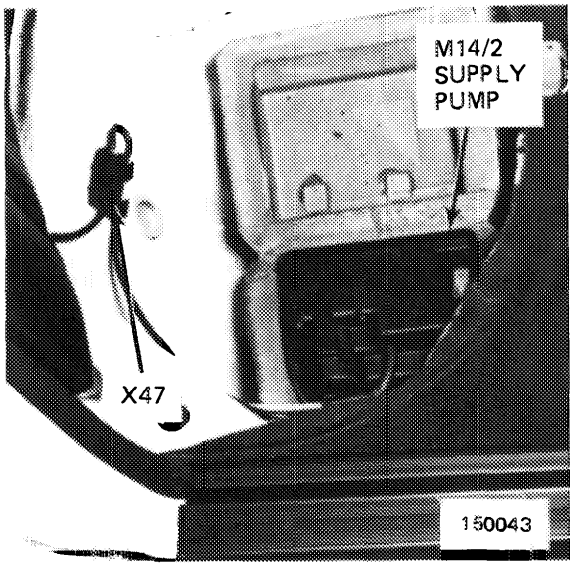

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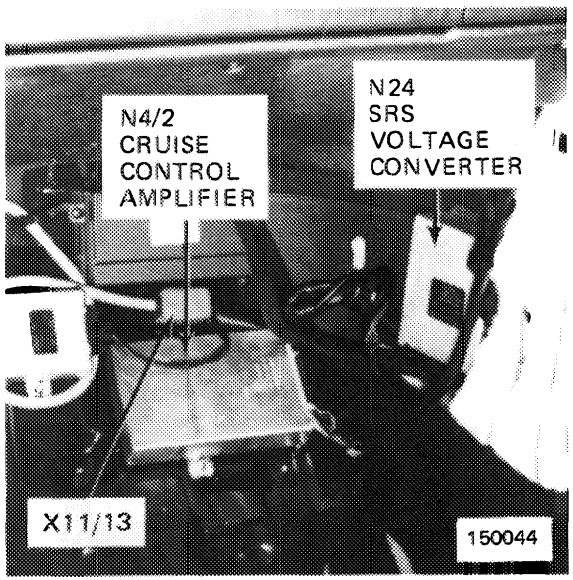

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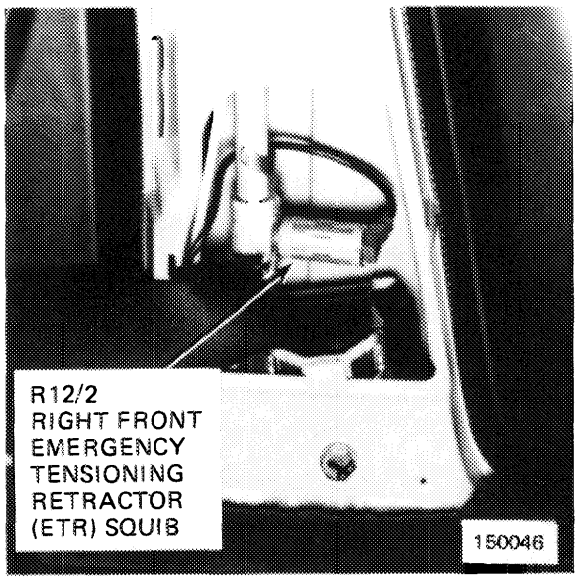

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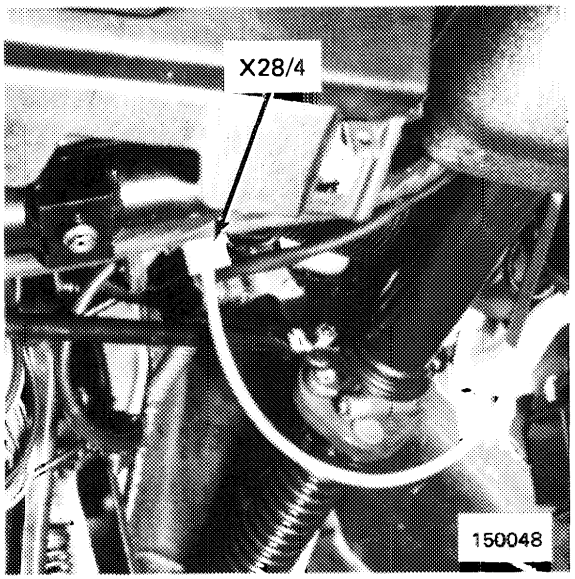

Figure 6

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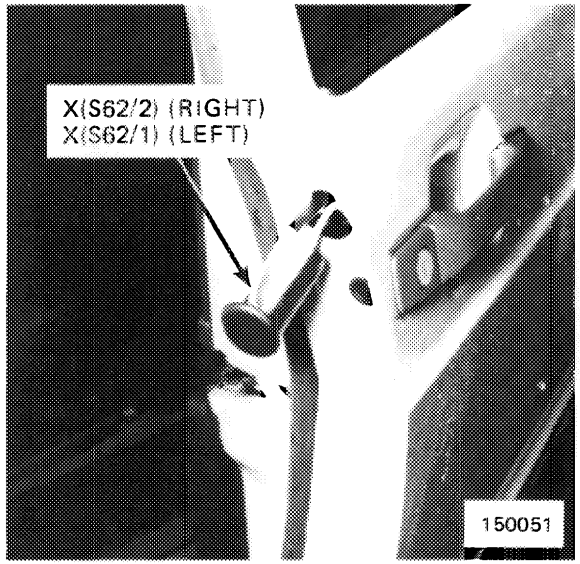

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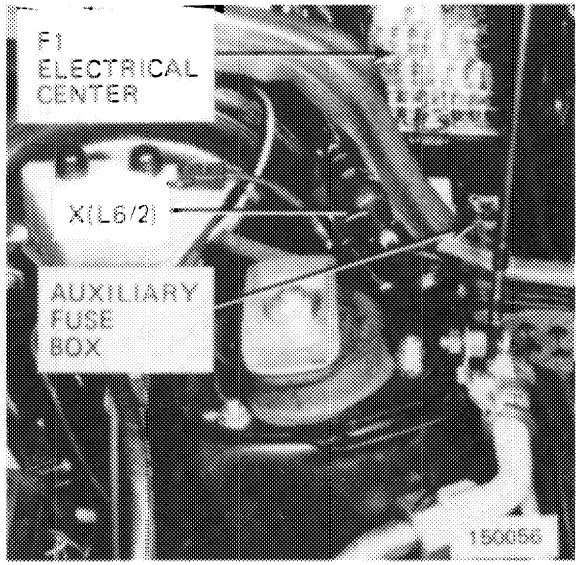

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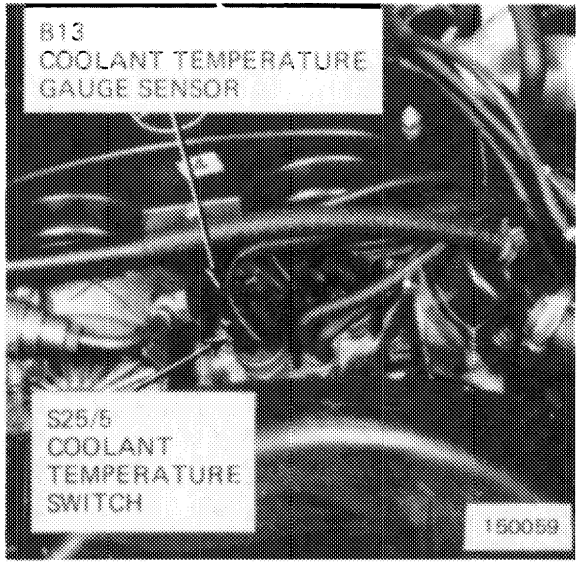

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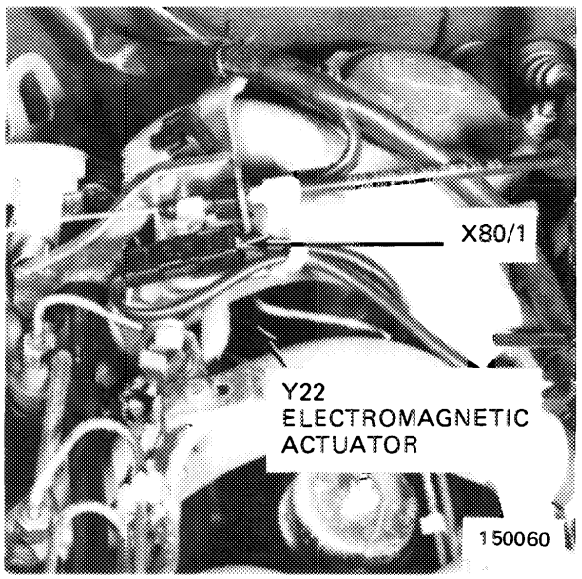

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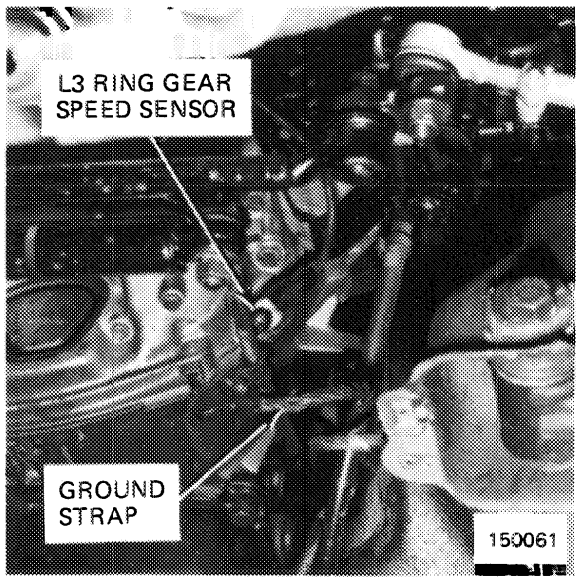

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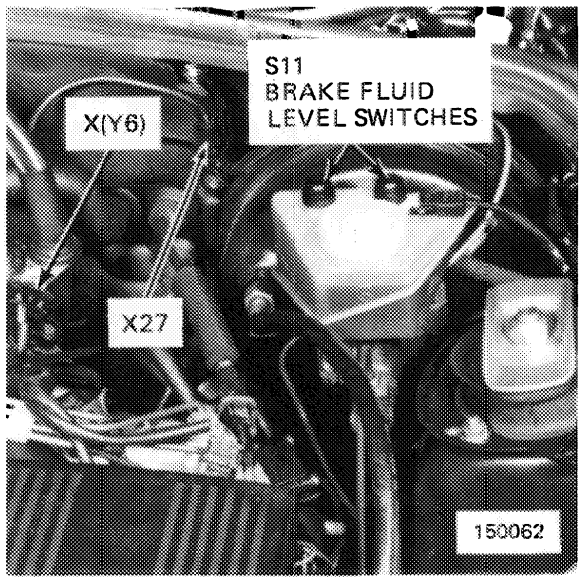

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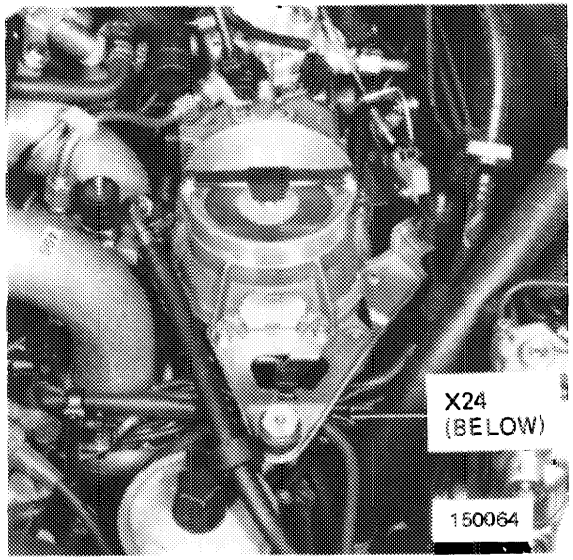

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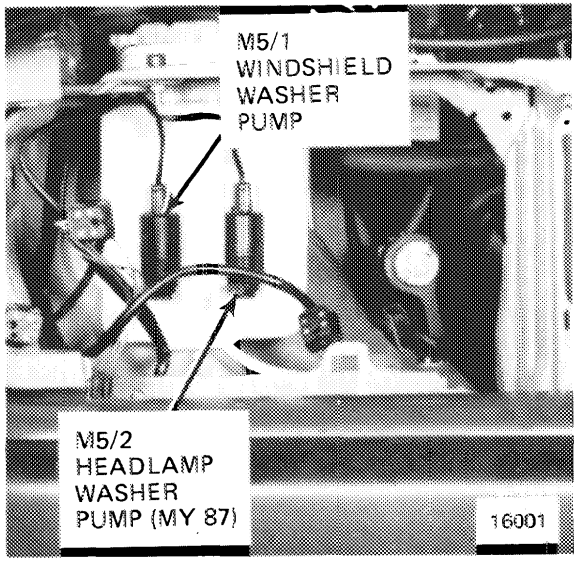

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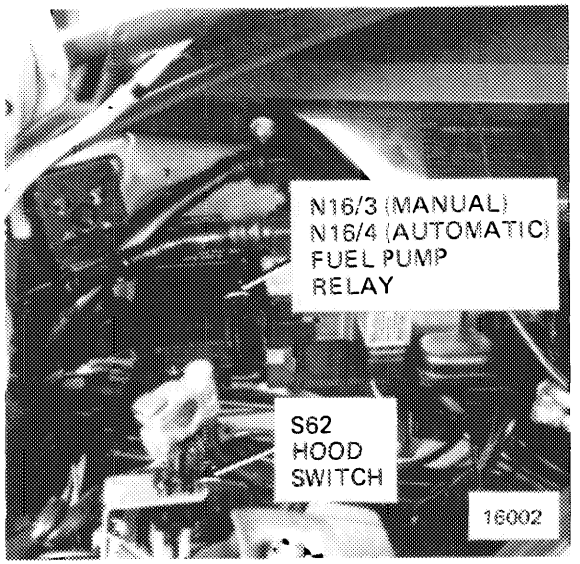

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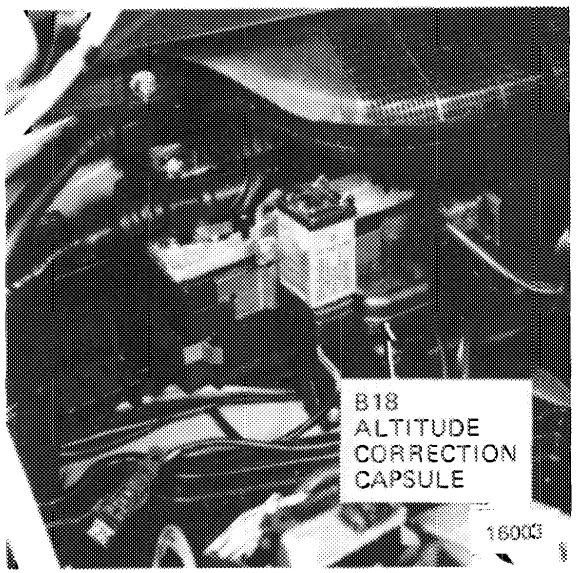

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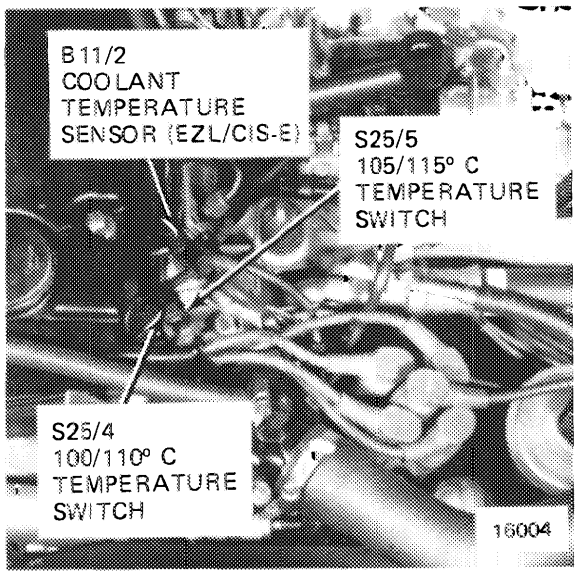

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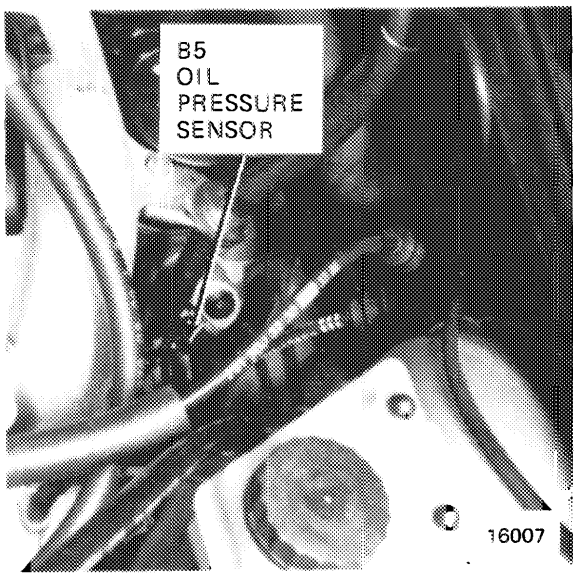

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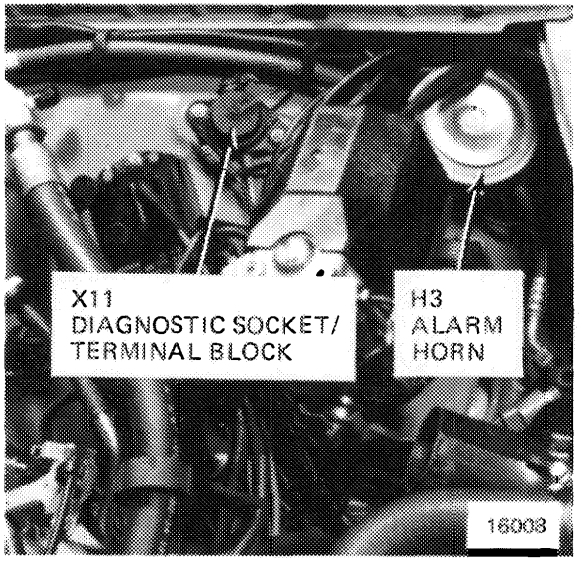

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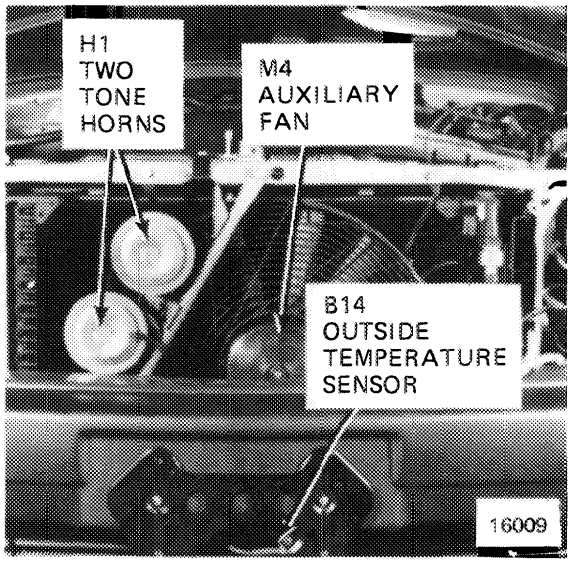

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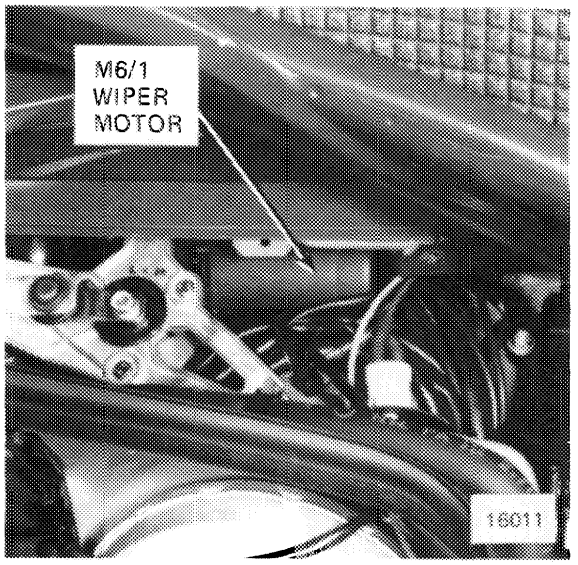

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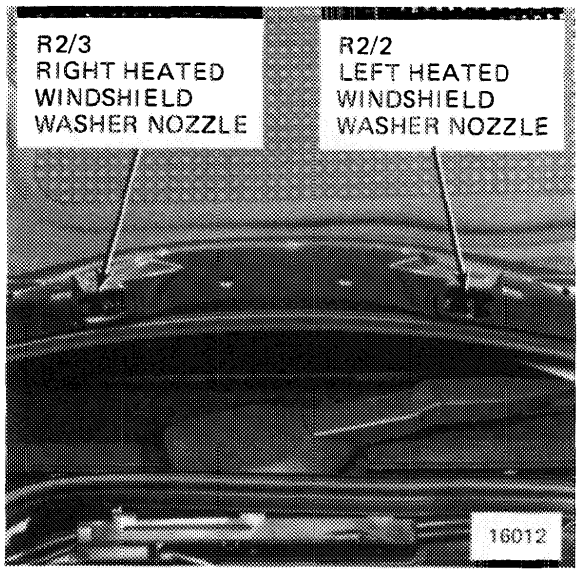

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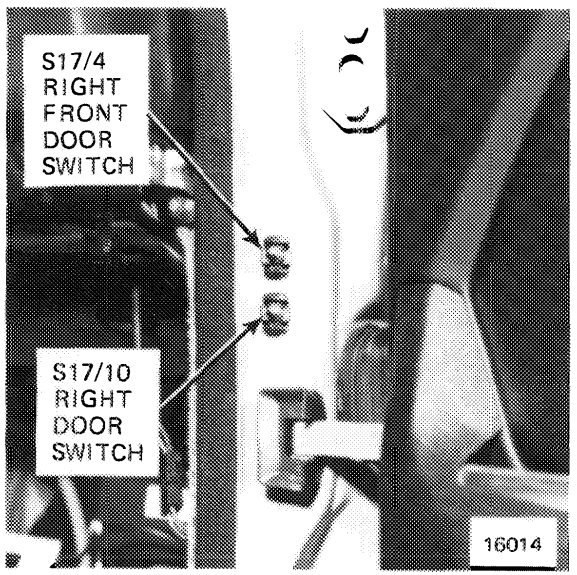

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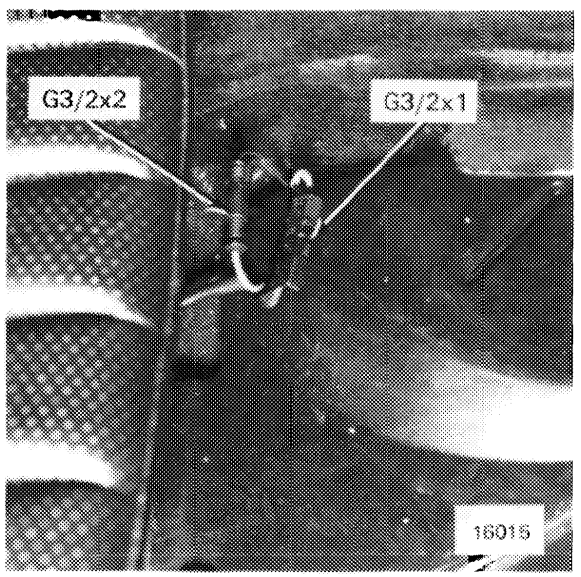

Figure 6

COMPONENT LOCATION

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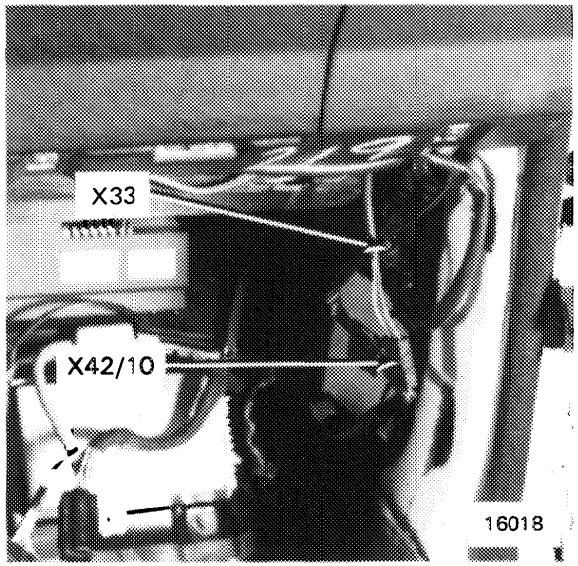

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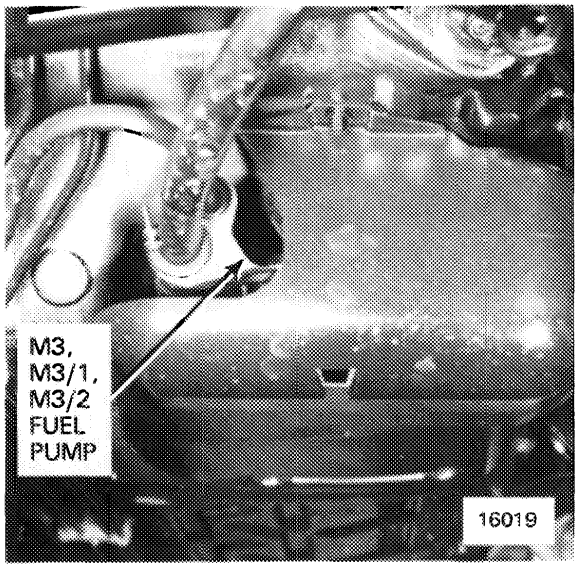

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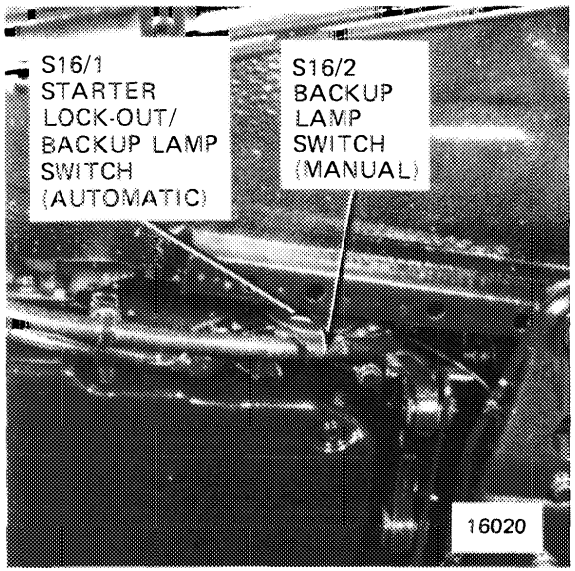

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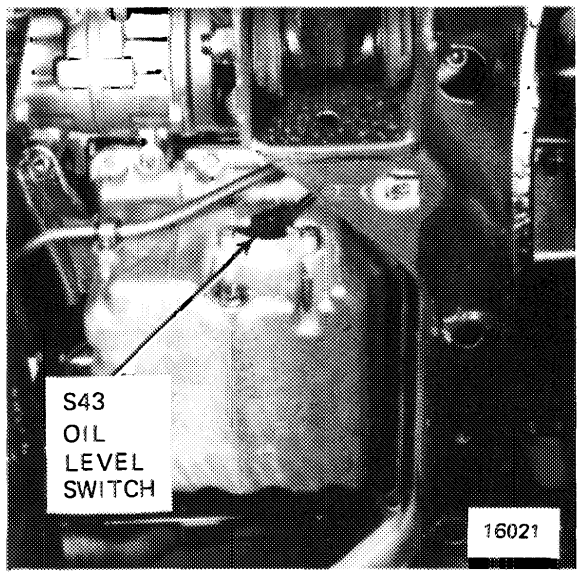

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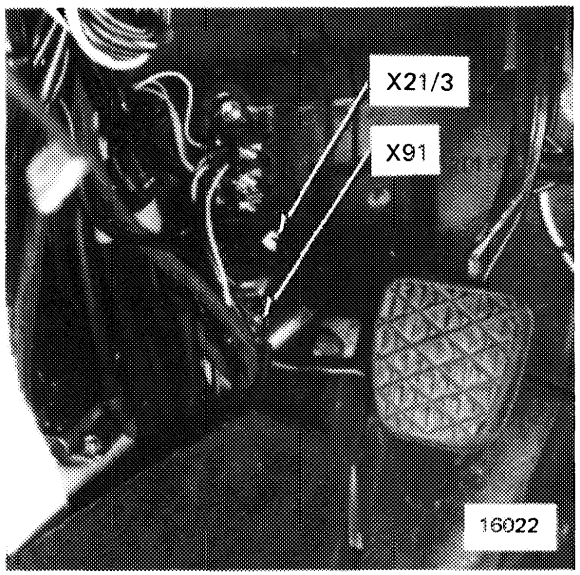

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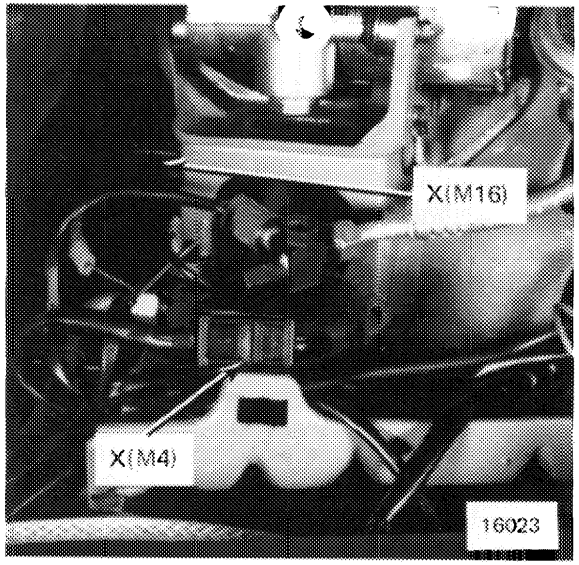

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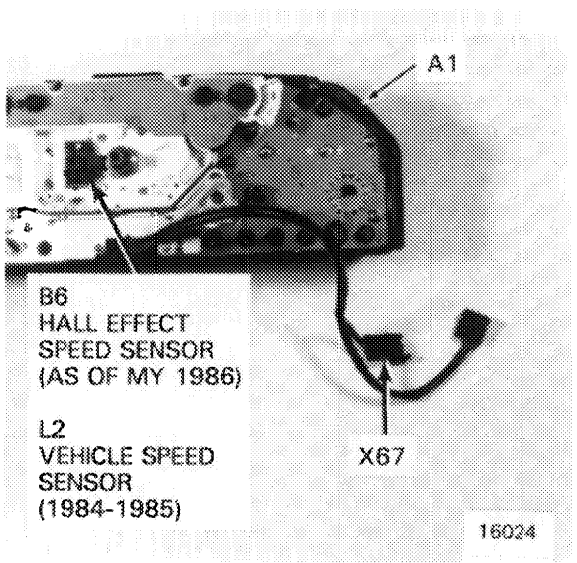

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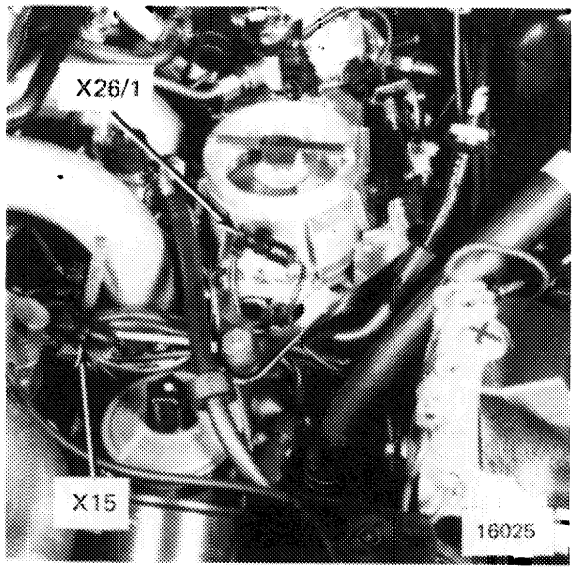

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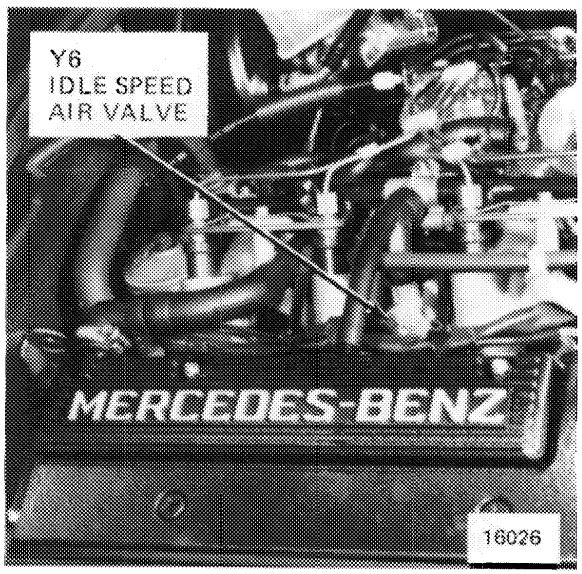

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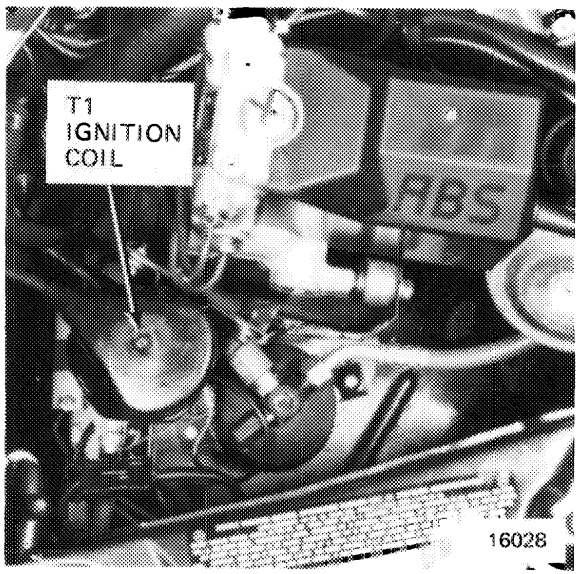

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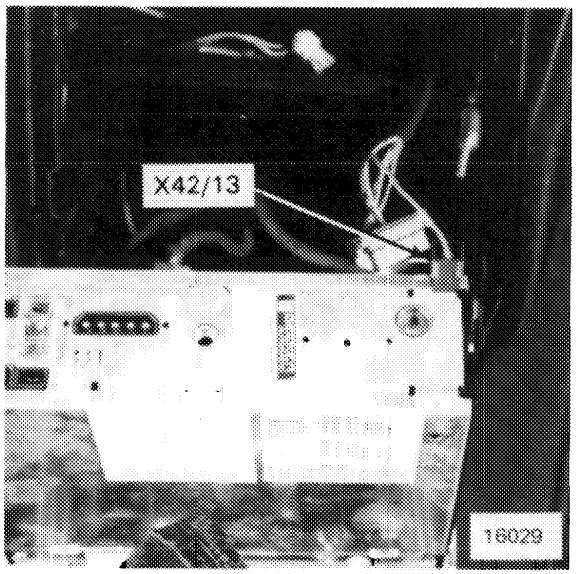

Figure 6

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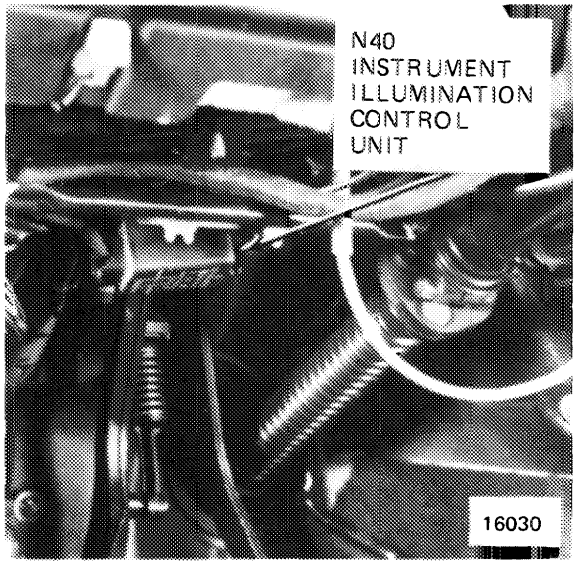

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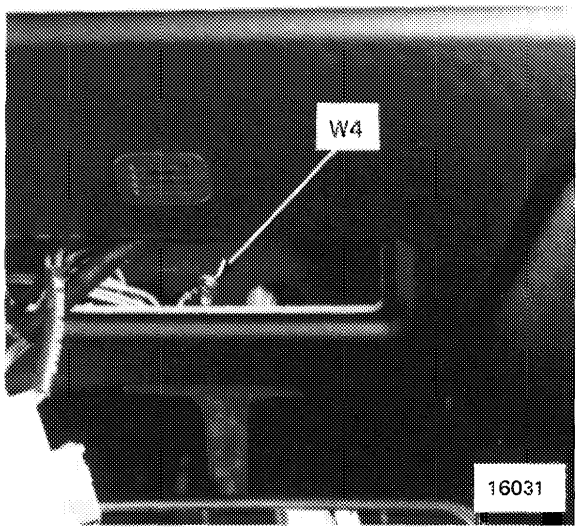

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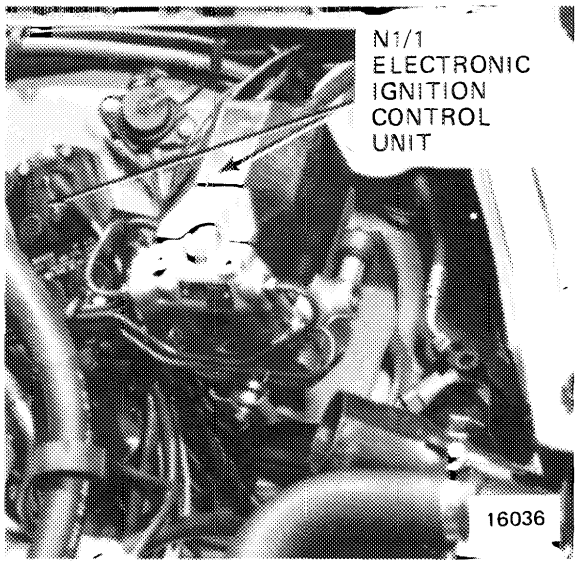

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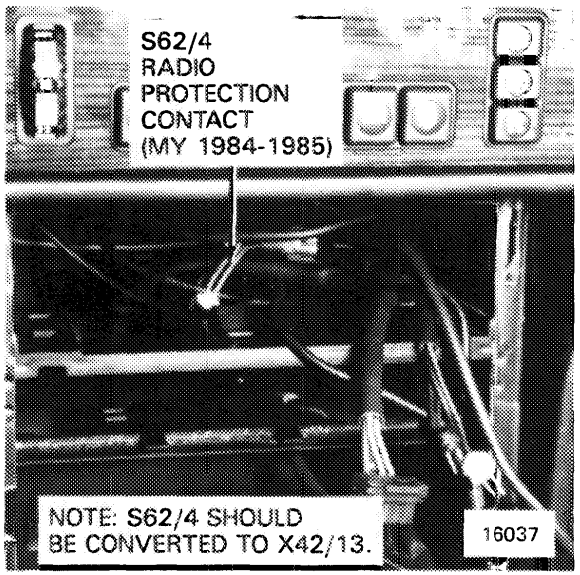

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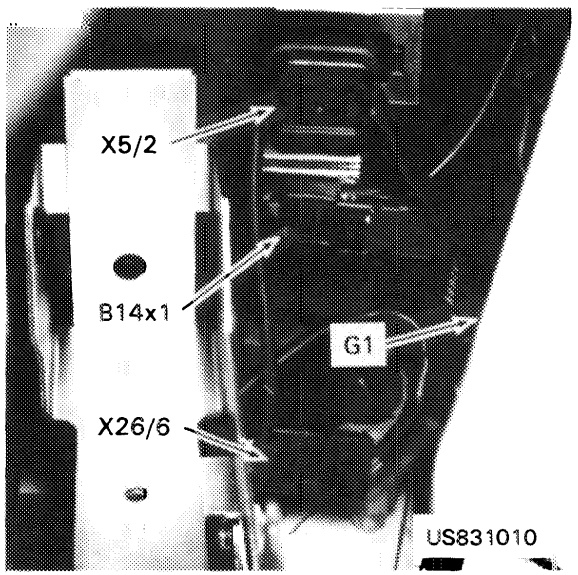

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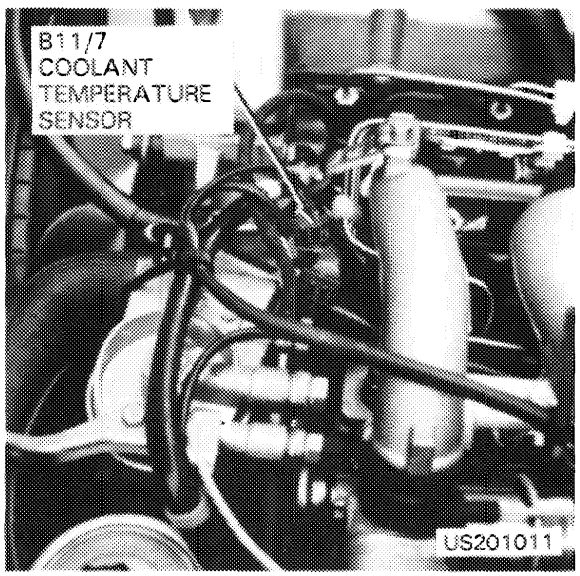

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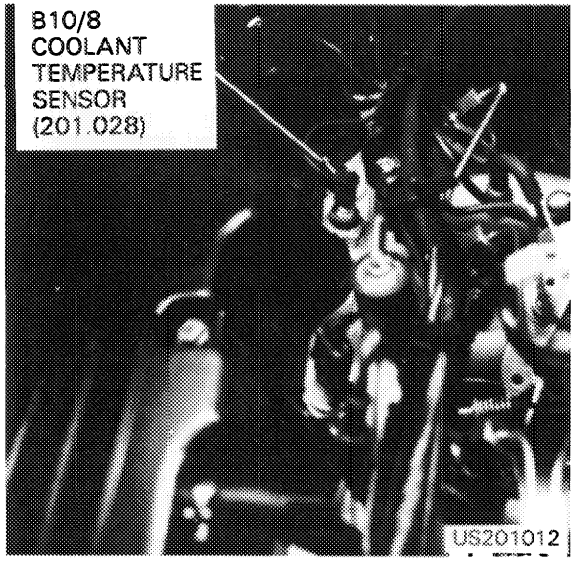

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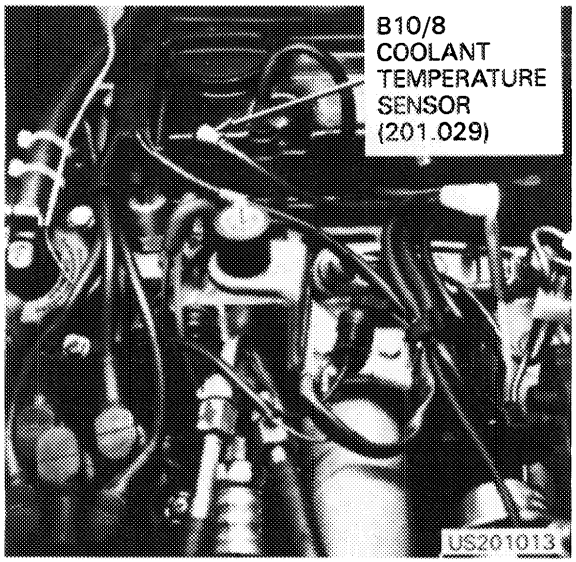

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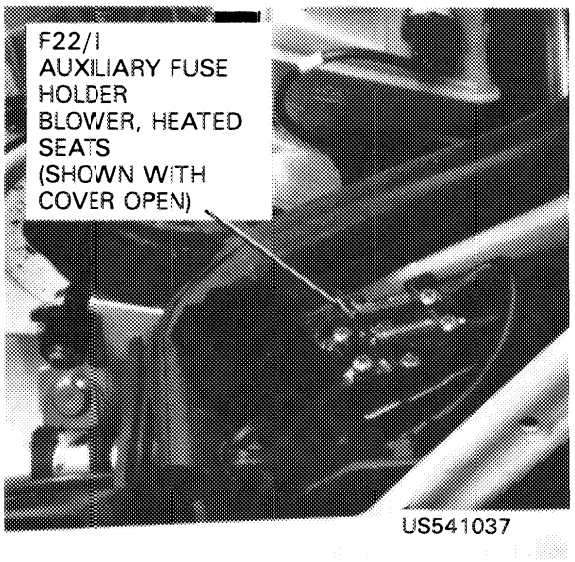

Figure 3

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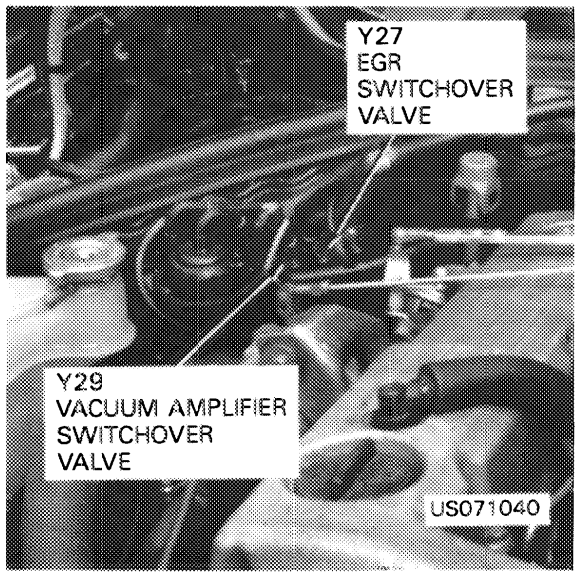
Figure 5



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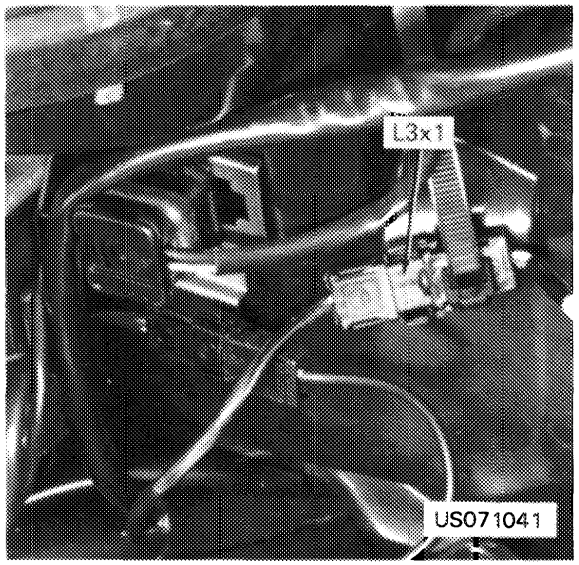

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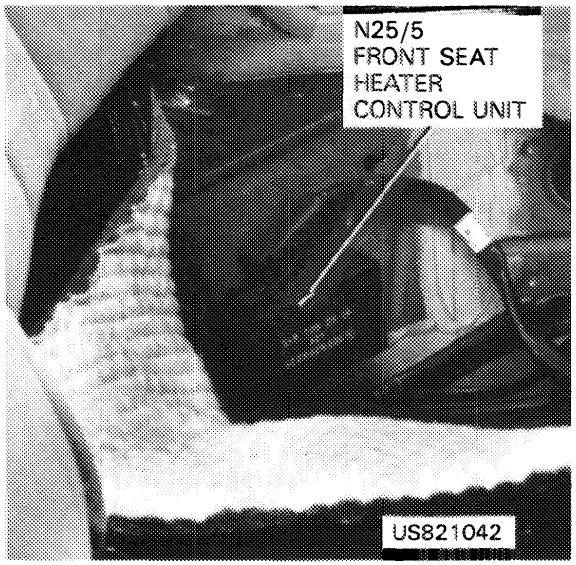

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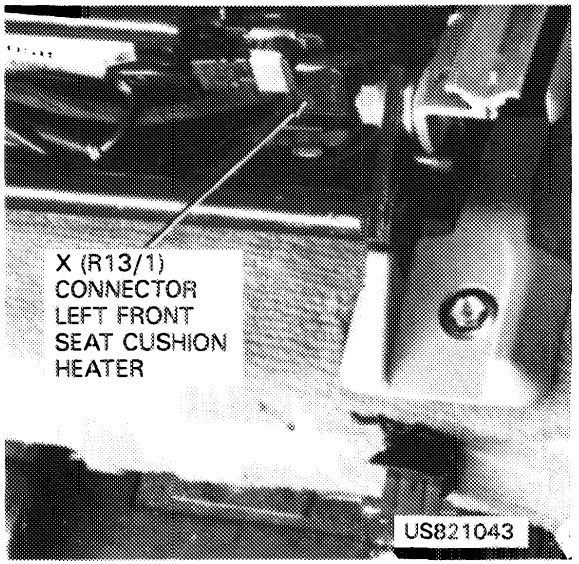

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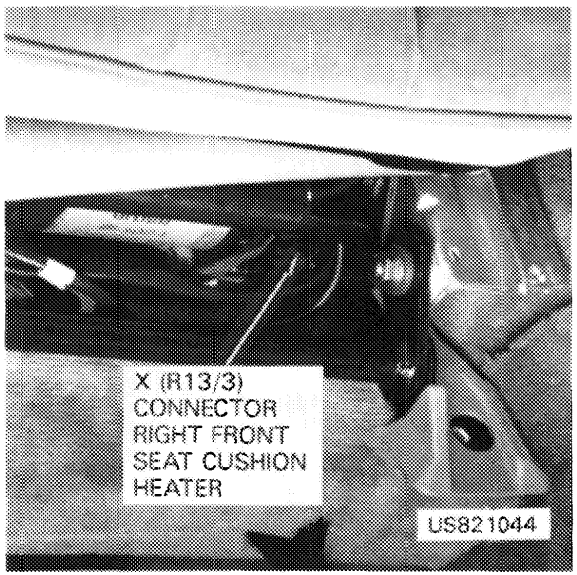

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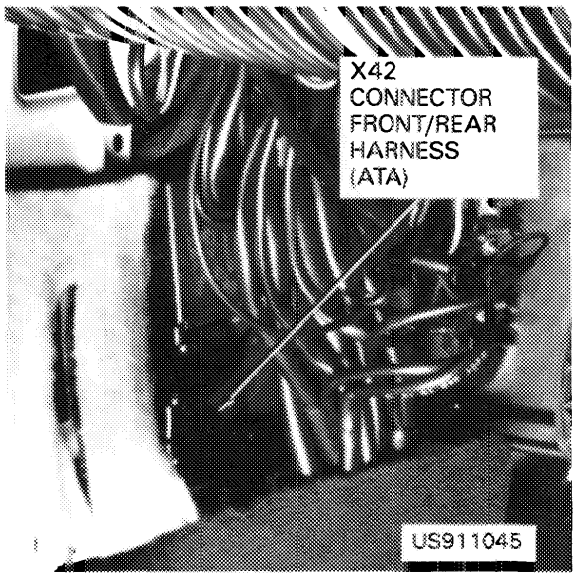

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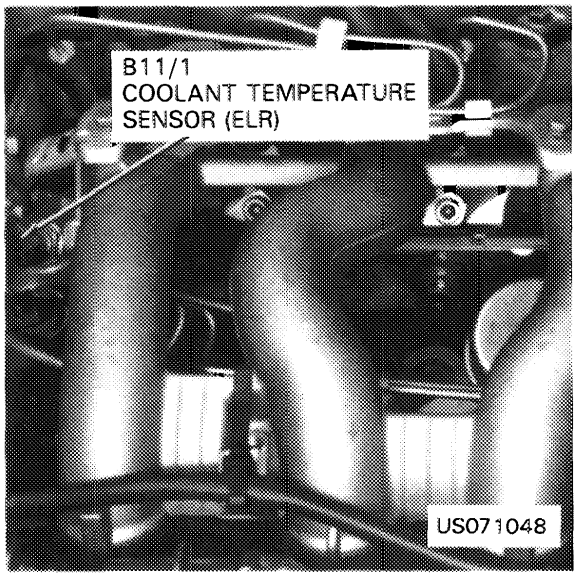

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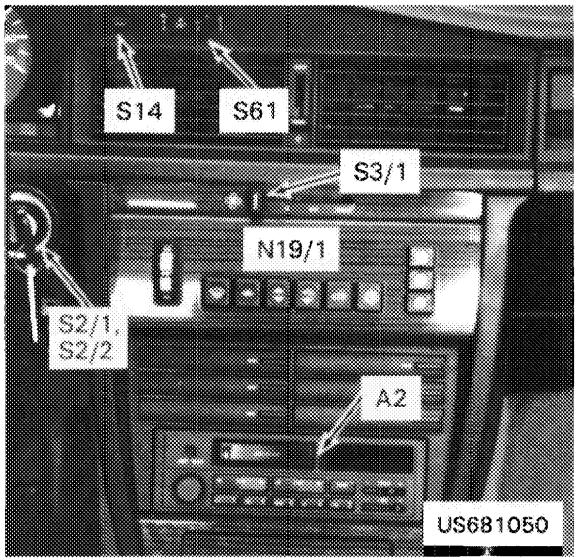

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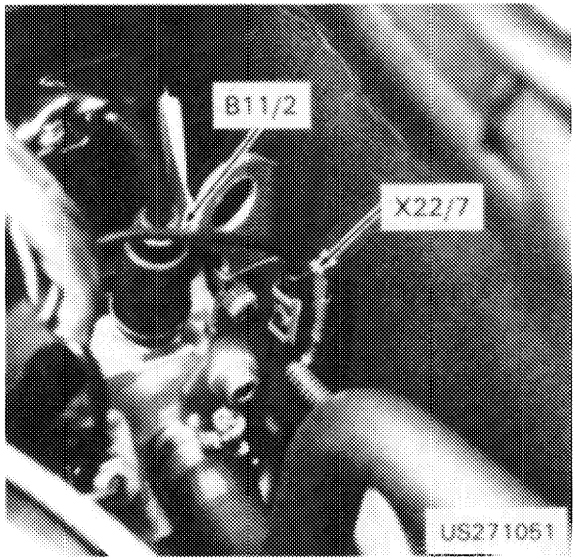

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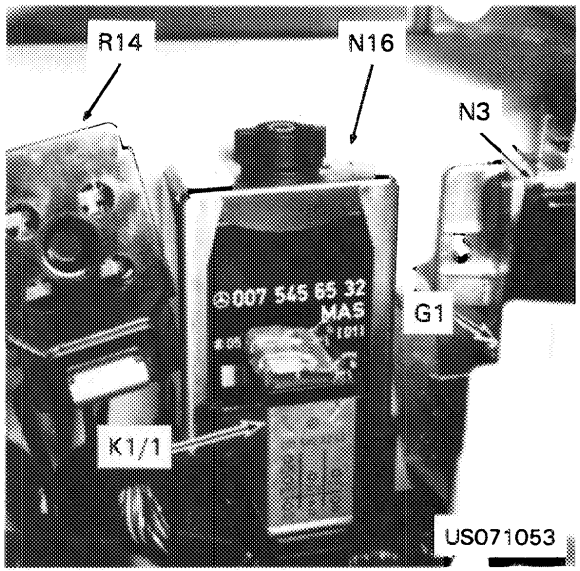

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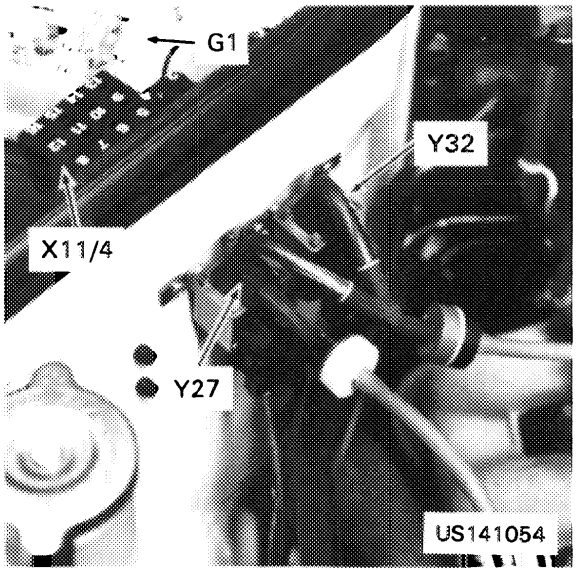


Figure 5

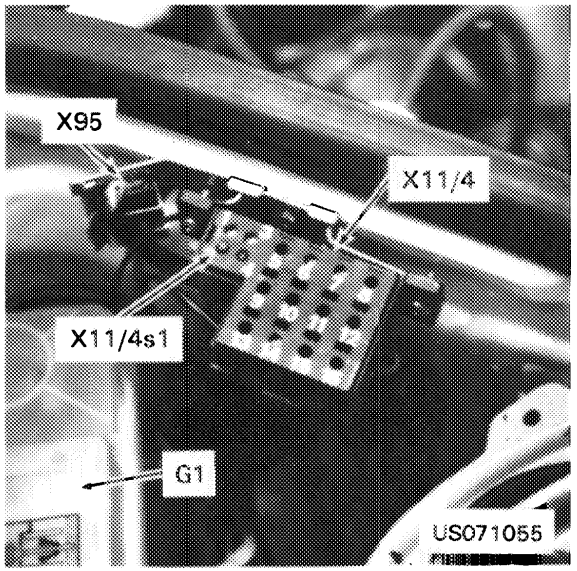


Figure 6

COMPONENT LOCATION

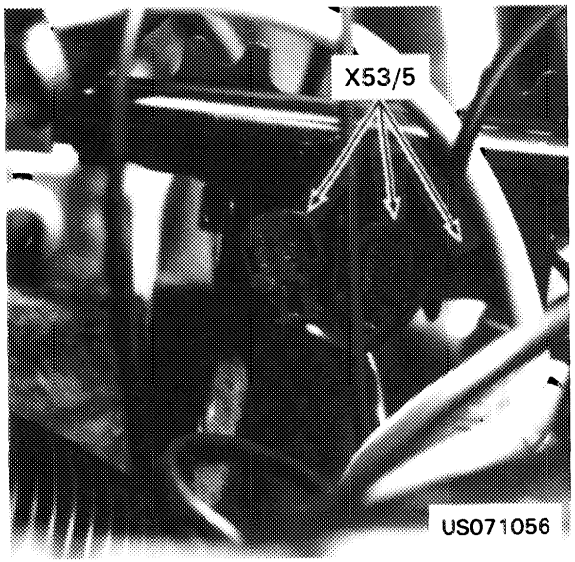


Figure 1

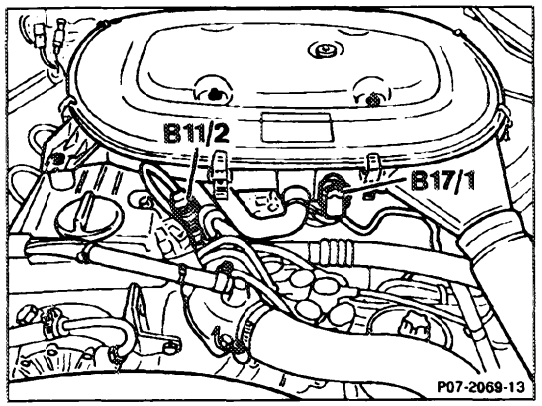


Figure 2

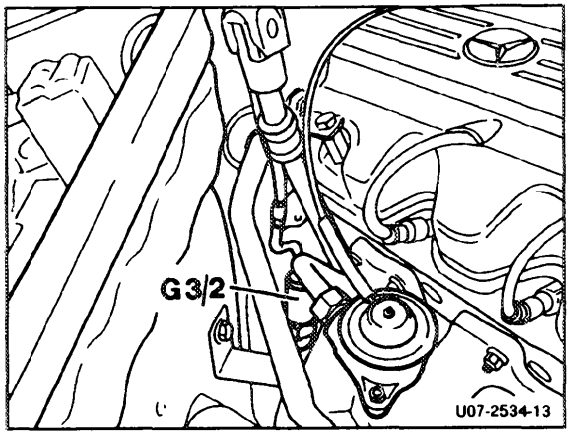
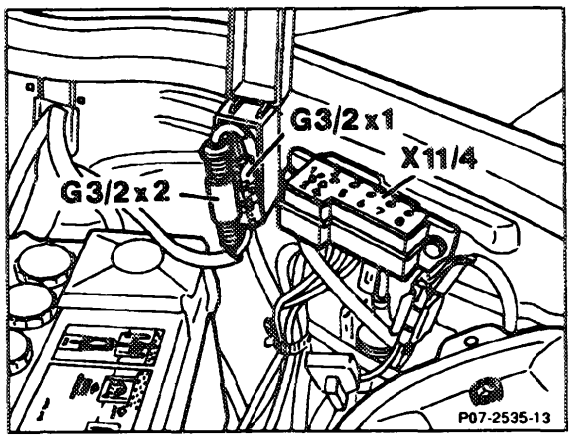


Figure 3



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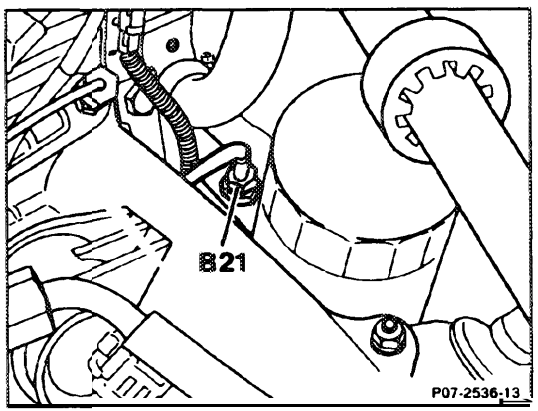

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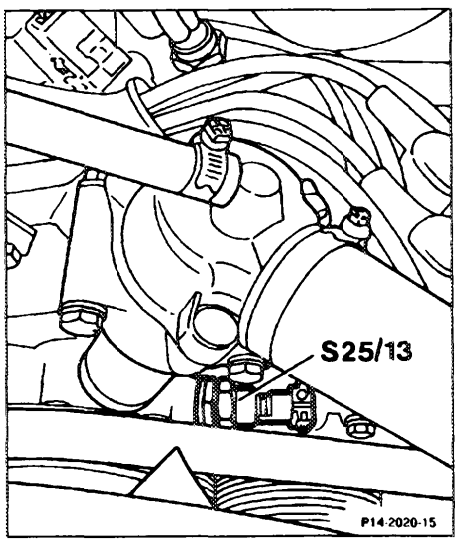


Figure 6

COMPONENT LOCATION

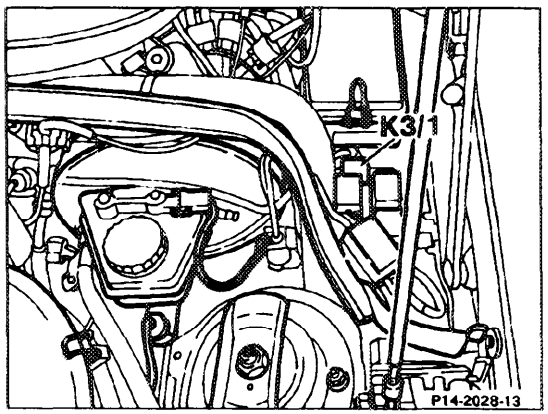


Figure 1

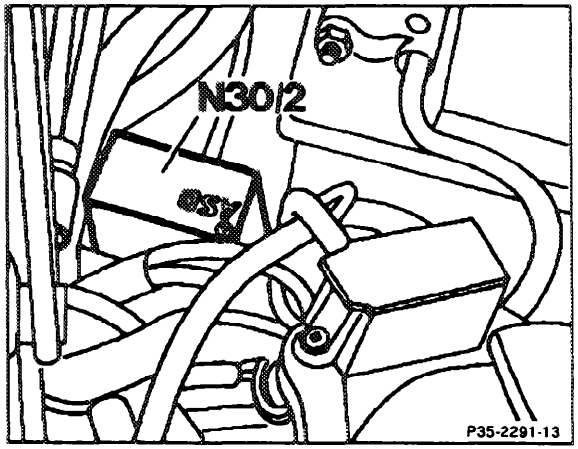
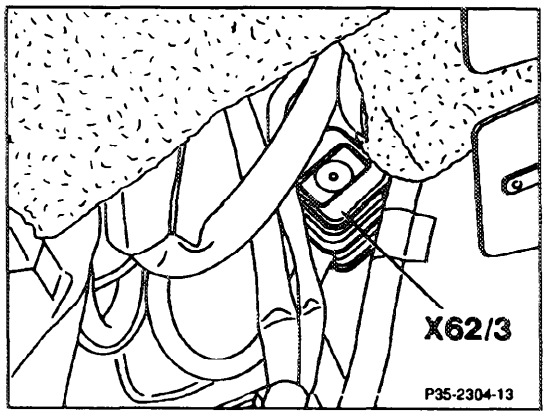


Figure 2



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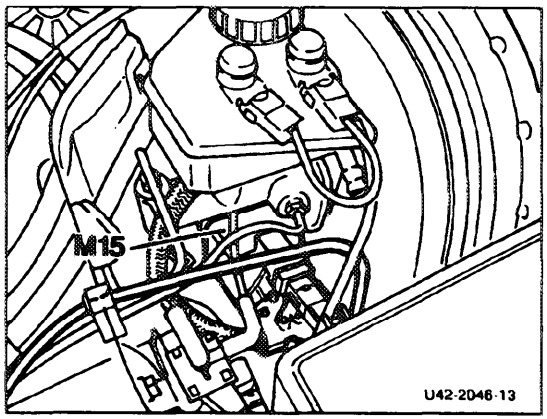

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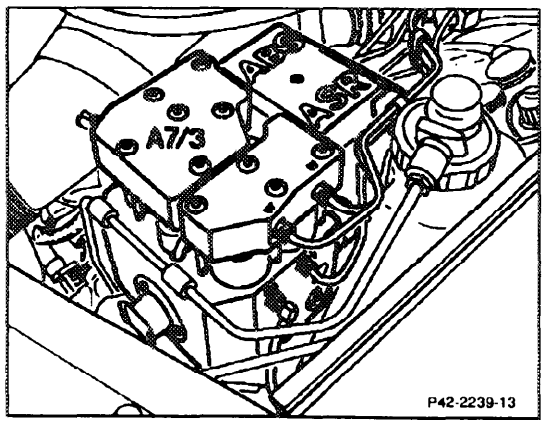


Figure 5

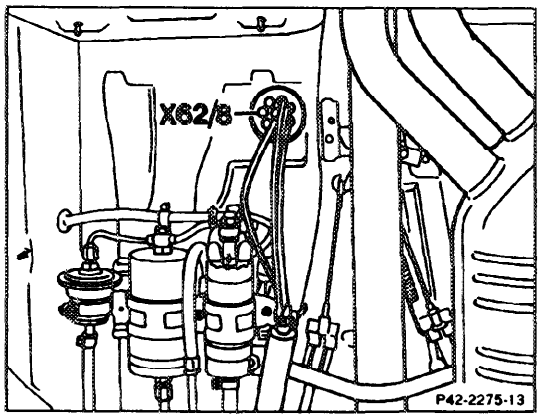


Figure 6

COMPONENT LOCATION

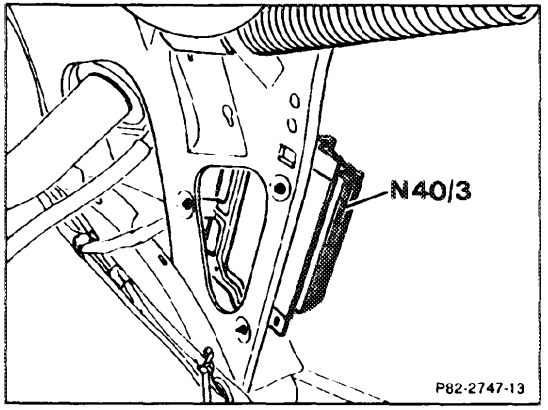
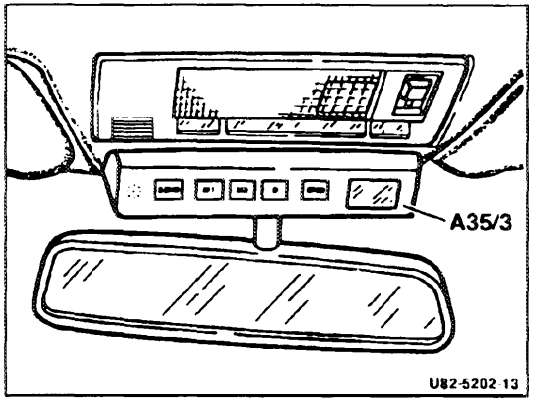


Figure 1



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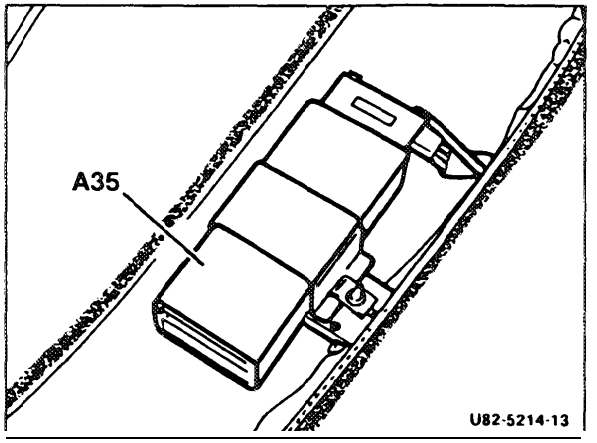


Figure 3

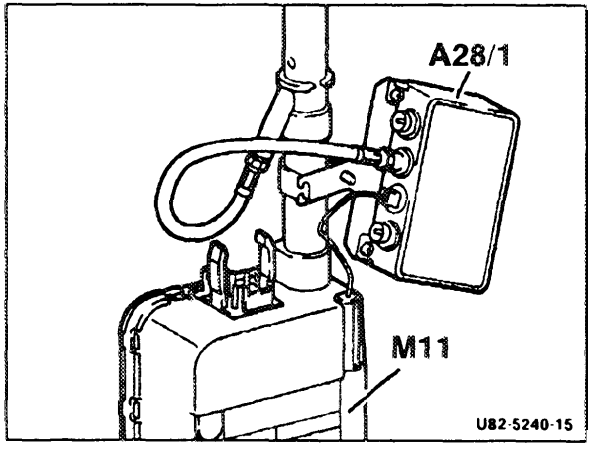


Figure 4

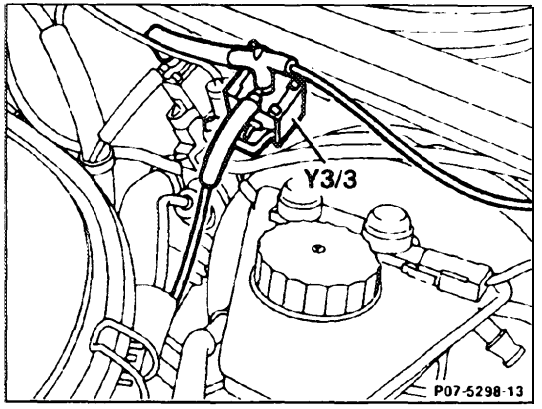


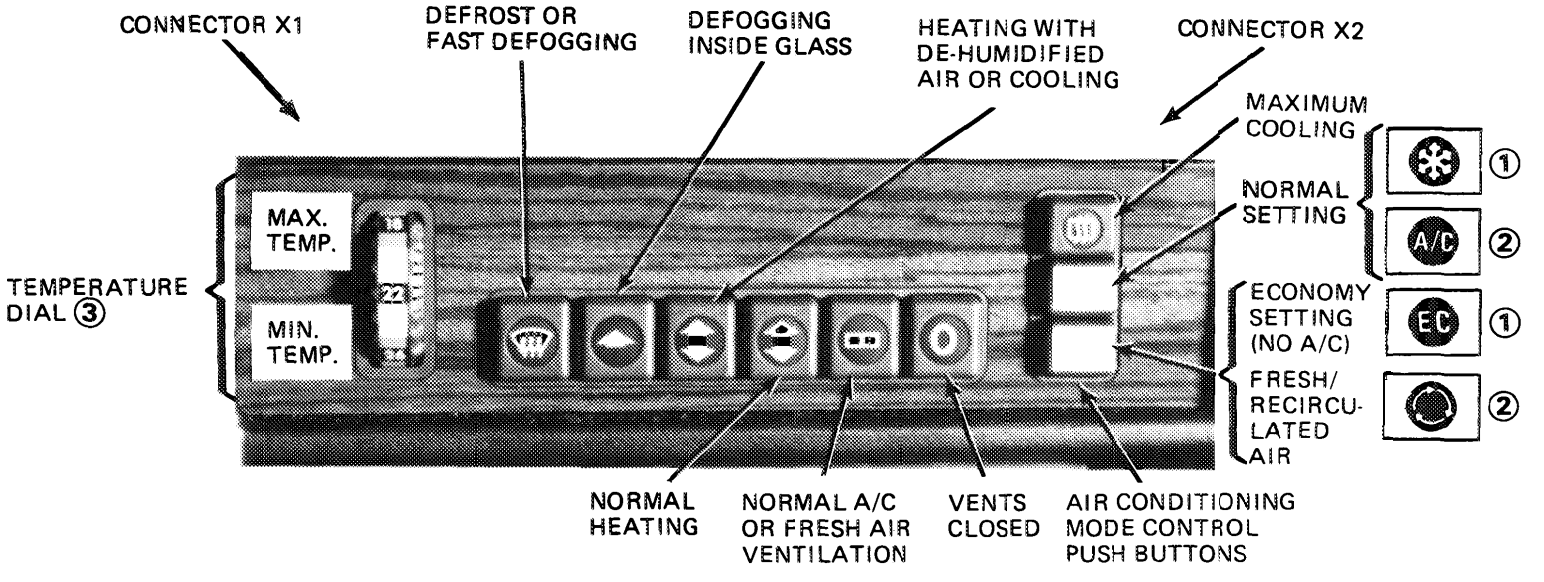
Figure 5

TEMPMATIC CLIMATE CONTROL

INDEX

Air Delivery 305
Blower Control 302
Component Location Table 401
Compressor Clutch Control 308
Power and Ground Distribution . 320

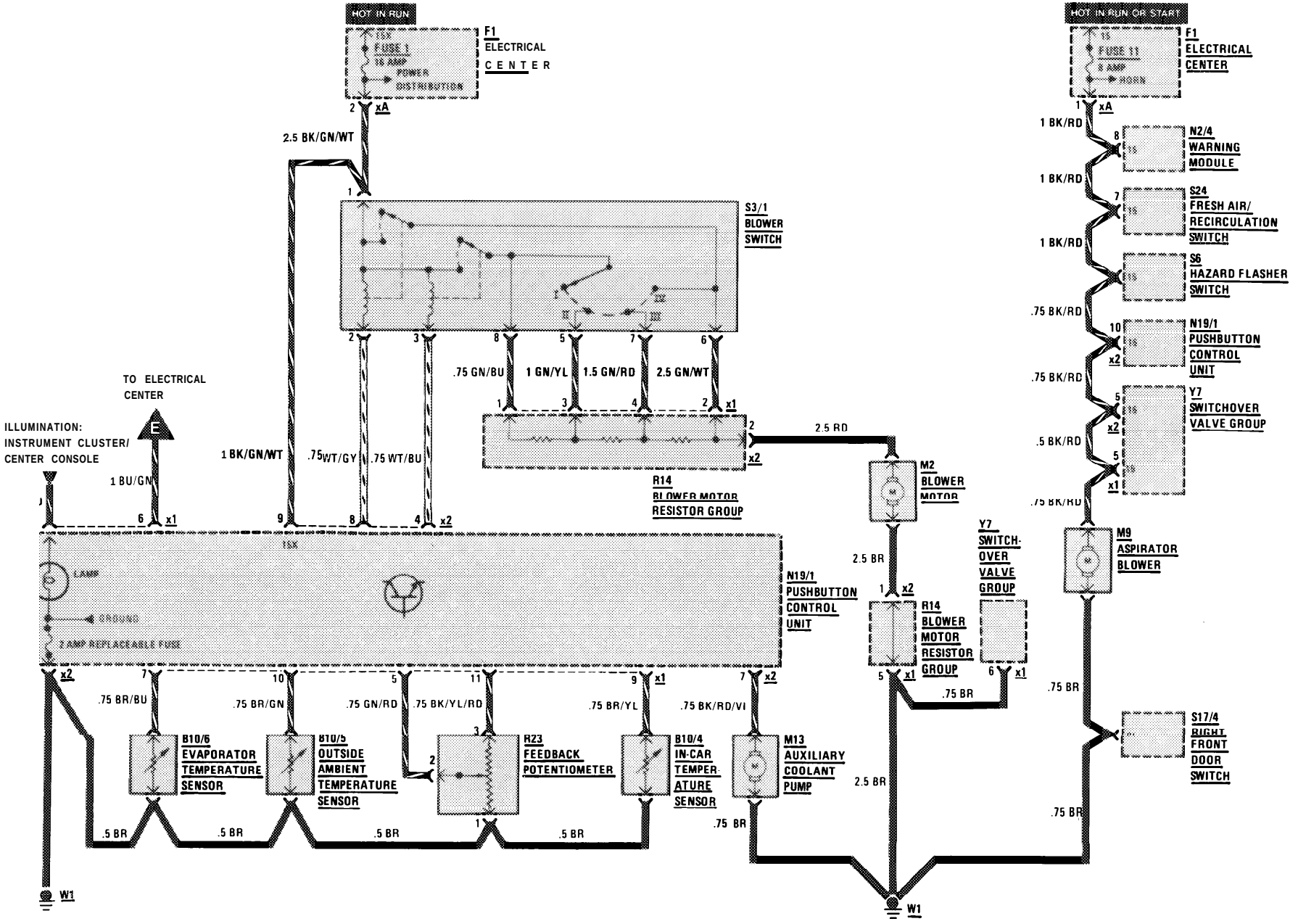
PUSHBUTTON CONTROL UNIT



REVISIONS: ① MODEL YEARS 1984 TO 1986
② AS OF MODEL YEAR 1987
③ AS OF MY 1990. TEMPERATURE DIAL CALIBRATED IN °F

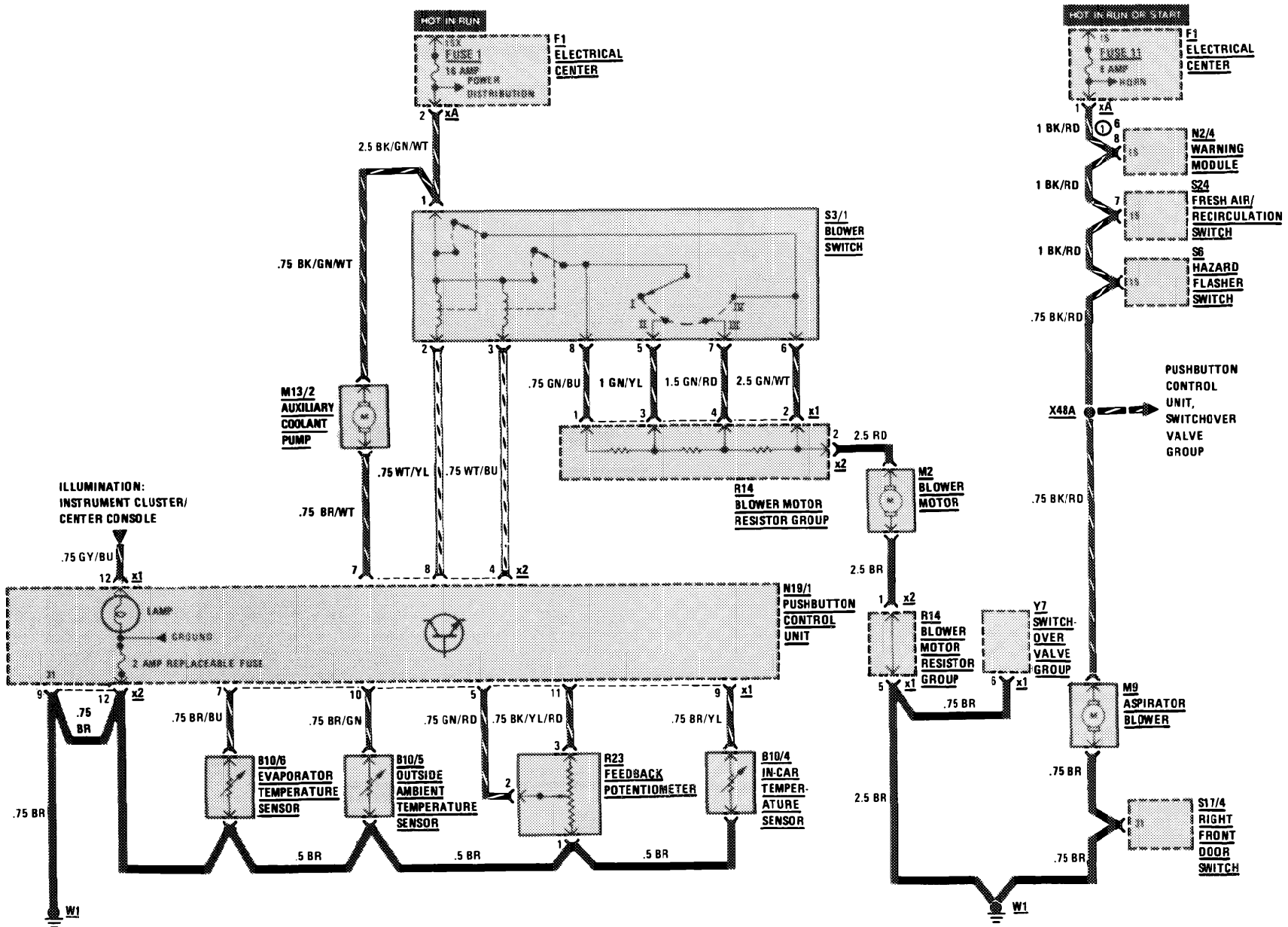
TEMPMATIC CLIMATE CONTROL BLOWER CONTROL

MY 1984



REVISIONS:

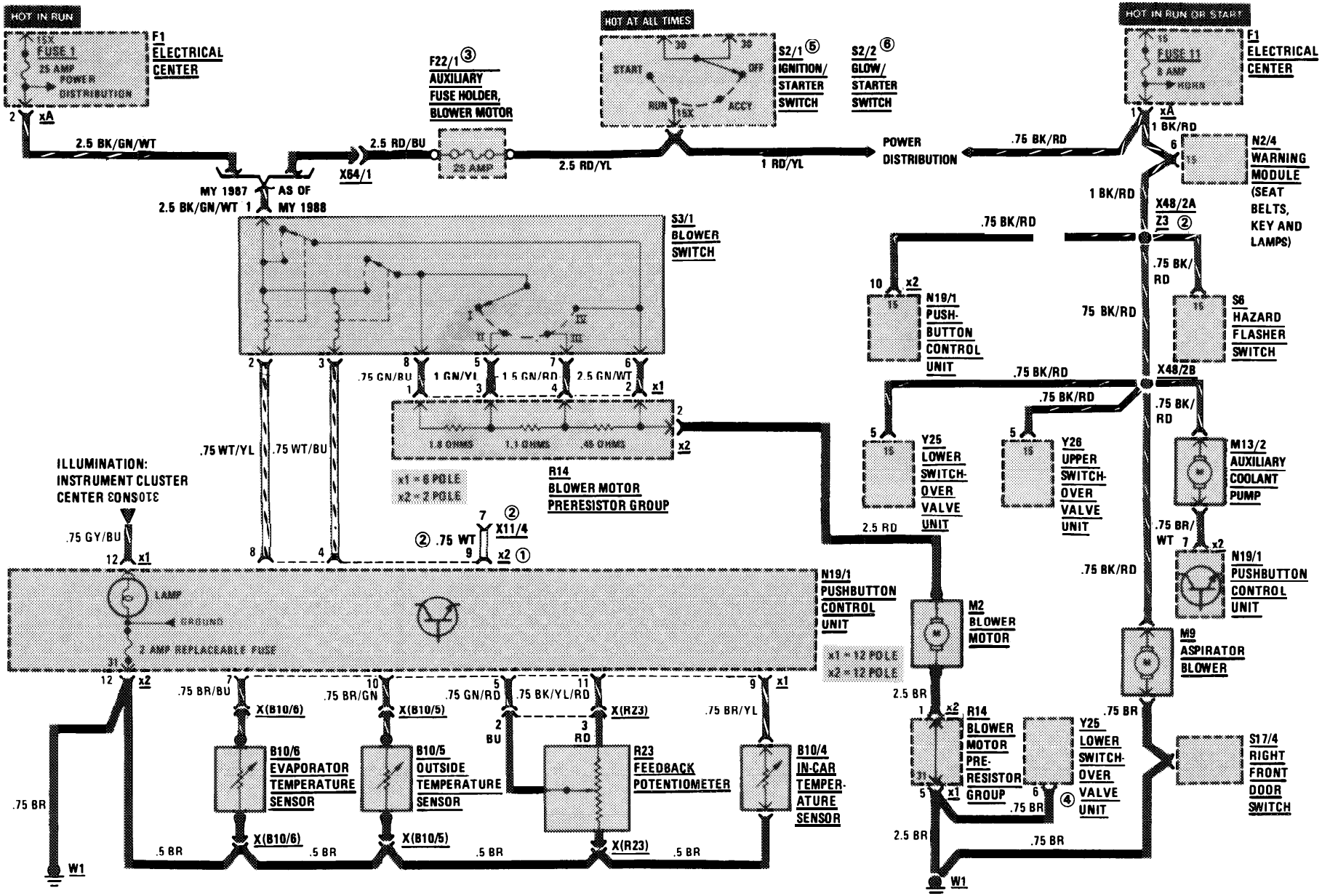
TEMPMATIC CLIMATE CONTROL BLOWER CONTROL MY 1985 AND MY 1986



REVISIONS: ① AS OF MODEL YEAR 1986

TEMPMATIC CLIMATE CONTROL BLOWER CONTROL

AS OF MY 1987



REVISIONS: ① ISSI CONNECTION USED TO INDICATE A MALFUNCTION IN THE TEMPMATIC CLIMATE CONTROL (TCC) SYSTEM BY MEANS OF A LIGHT-EMITTING DIODE (LED) BLINK CODE.

② AS OF MY 1988

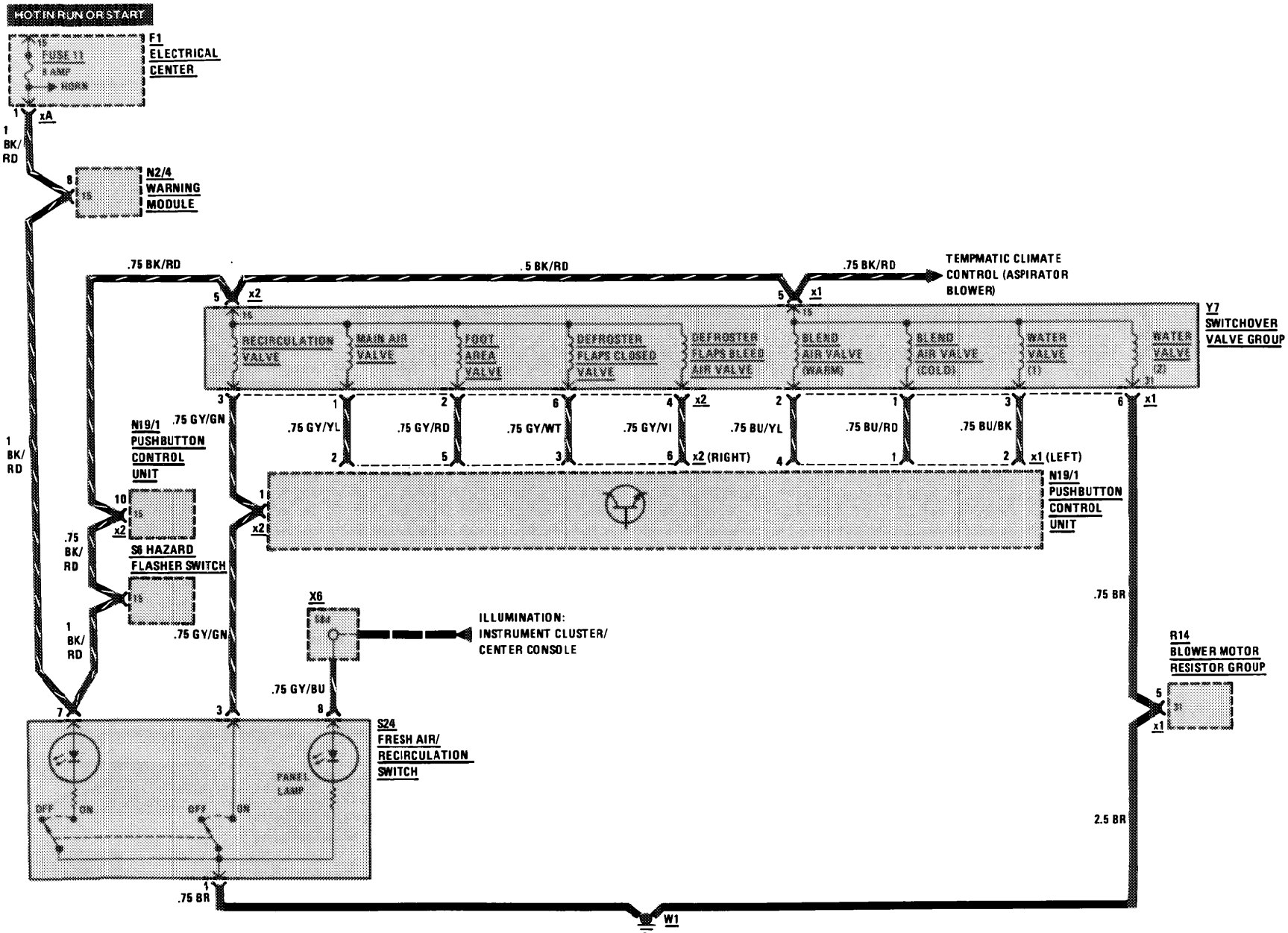
③ AS OF MY 1989

④ AS OF MY 1990, Y25 IS GROUNDED DIRECTLY TO W1.

⑤ GASOLINE MODELS

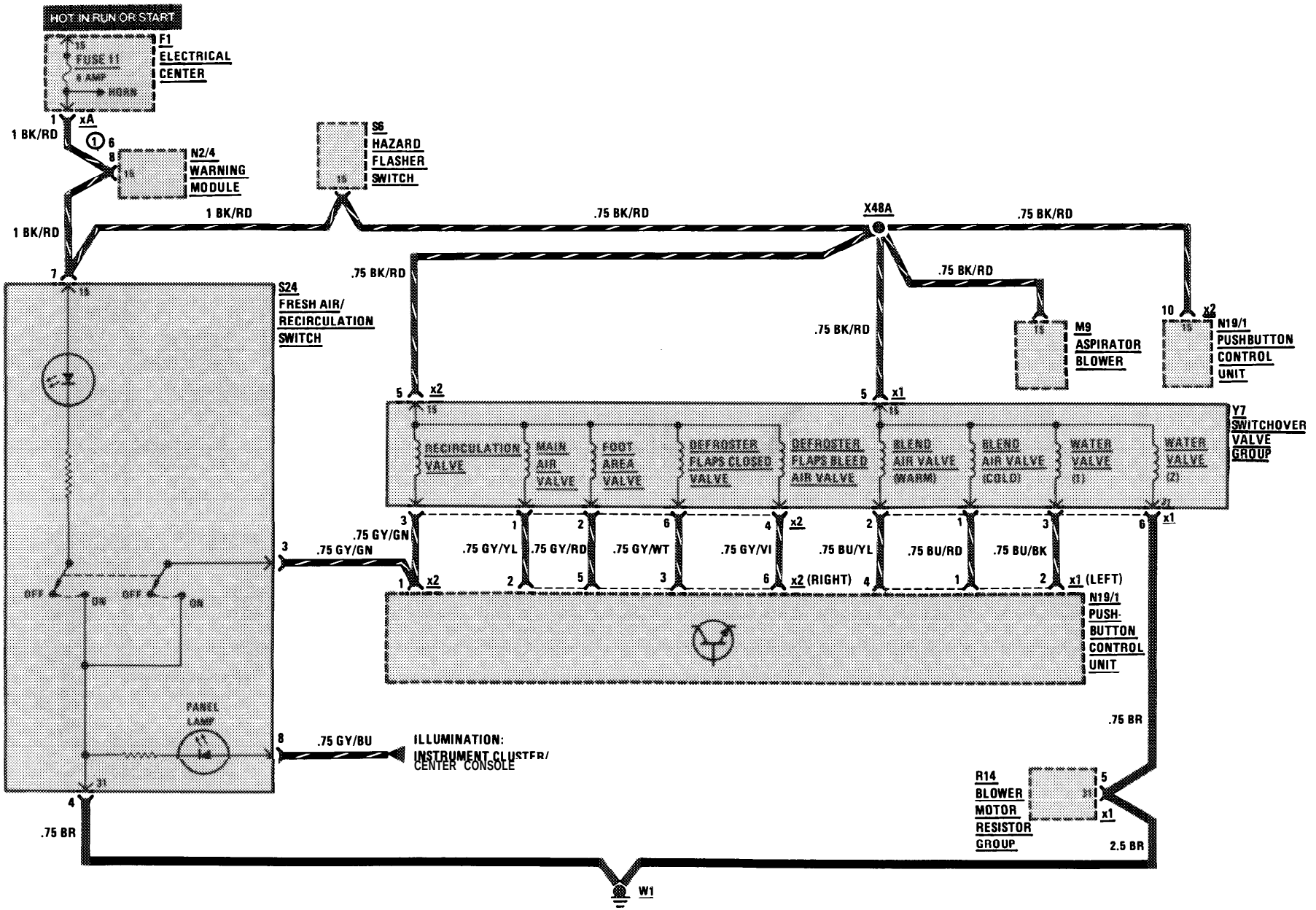
⑥ DIESEL MODELS

TEMPMATIC CLIMATE CONTROL AIR DELIVERY



REVISIONS:

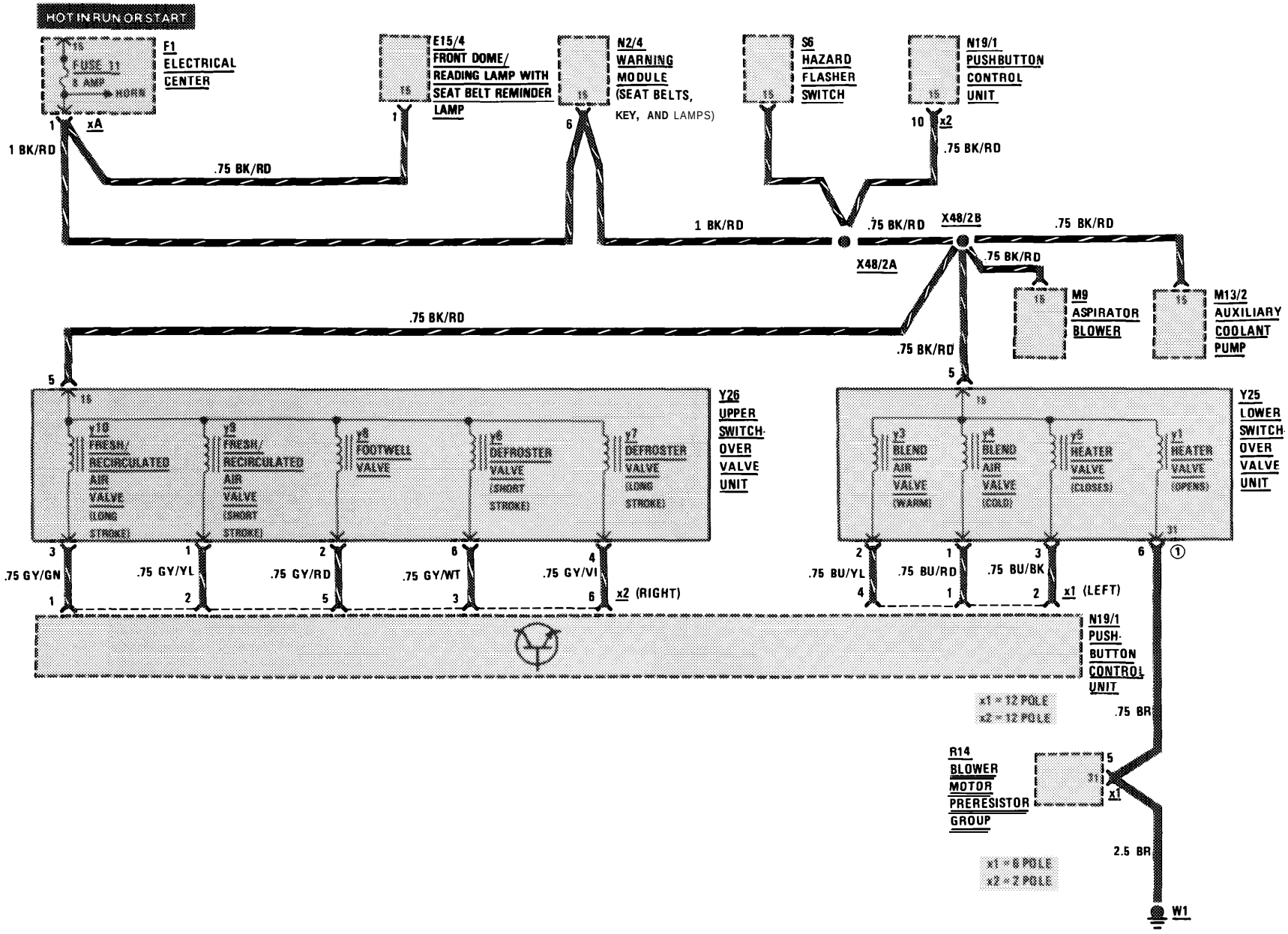
TEMPMATIC CLIMATE CONTROL AIR DELIVERY



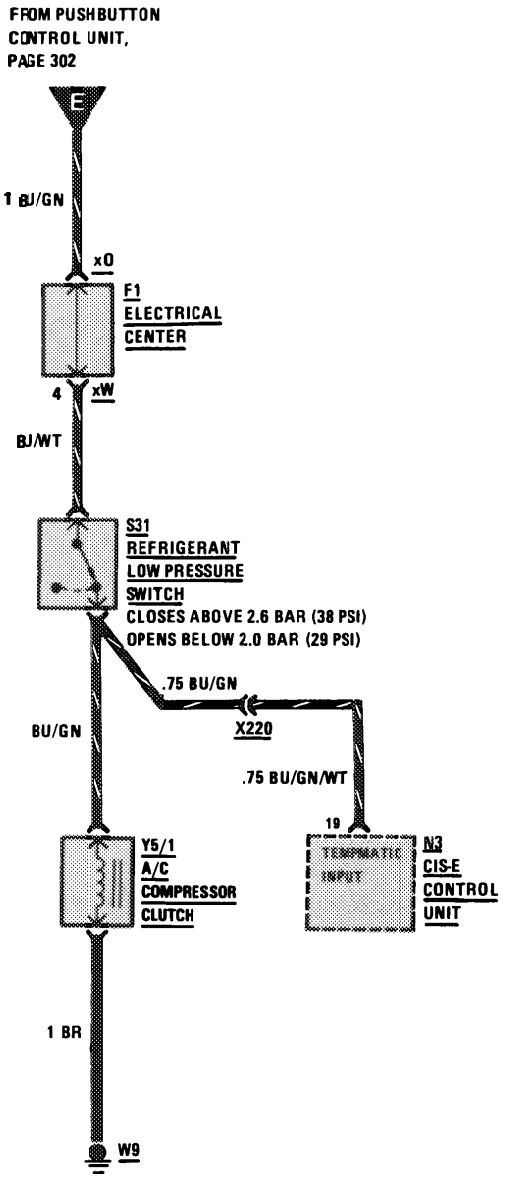
REVISIONS: ① AS OF MODEL YEAR 1986

TEMPMATIC CLIMATE CONTROL AIR DELIVERY

AS OF MY 1987

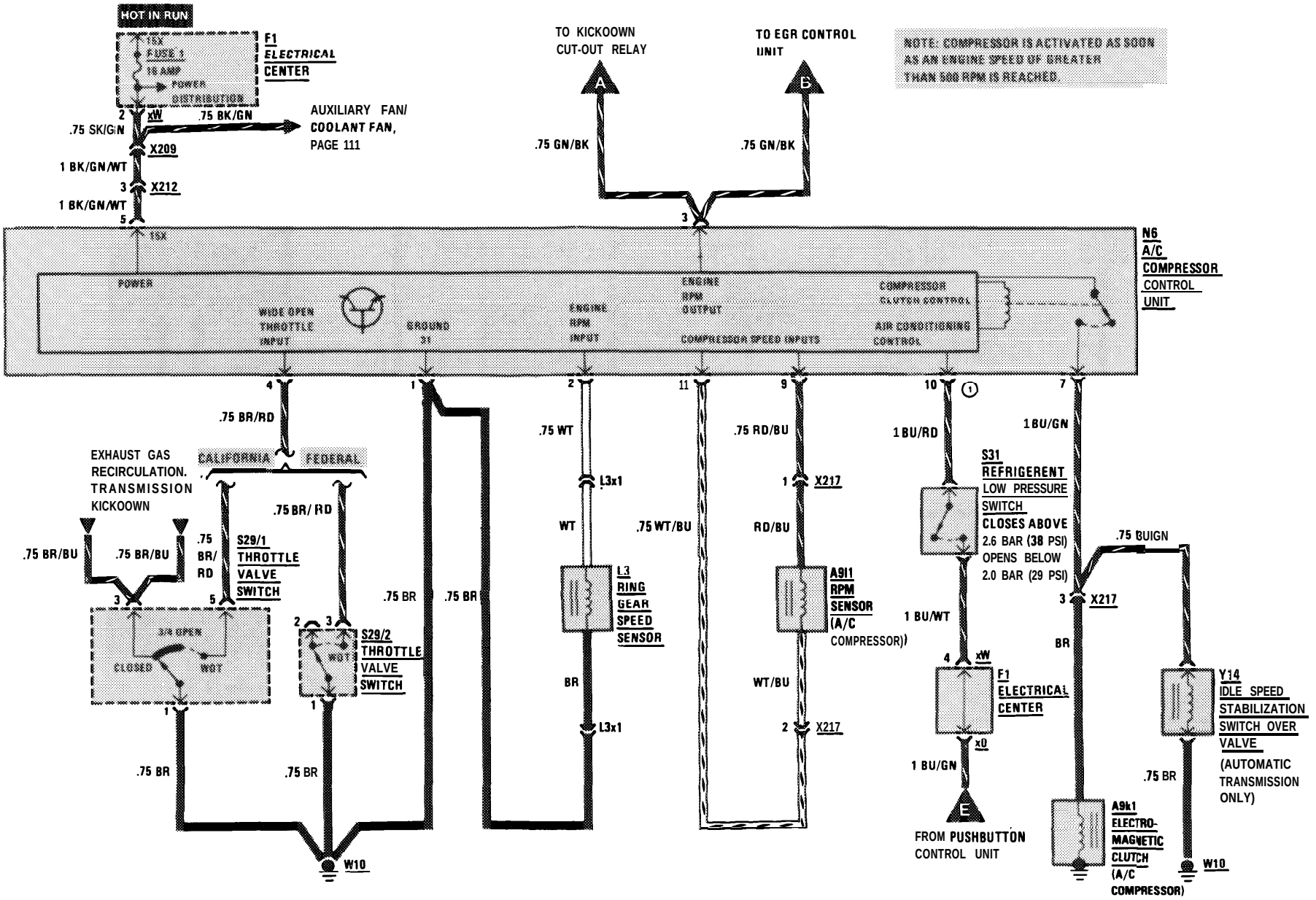


REVISIONS: ① AS OF MY 1990, Y25 IS GROUNDED DIRECTLY TO **W1**.


FROM PUSHBUTTON CONTROL UNIT, PAGE 302
E
1 BU/GN
x0
F1
ELECTRICAL CENTER
4
xW
BU/WT
S31
REFRIGERANT LOW PRESSURE SWITCH
CLOSES ABOVE 2.6 BAR (38 PSI)
OPENS BELOW 2.0 BAR (29 PSI)
.75 BU/GN
BU/GN
X220
.75 BU/GN/WT
19
TEMPMATIC INPUT
Y5/1
A/C COMPRESSOR CLUTCH
N3
CIS-E CONTROL UNIT
1 BR
W9

REVISIONS:

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL

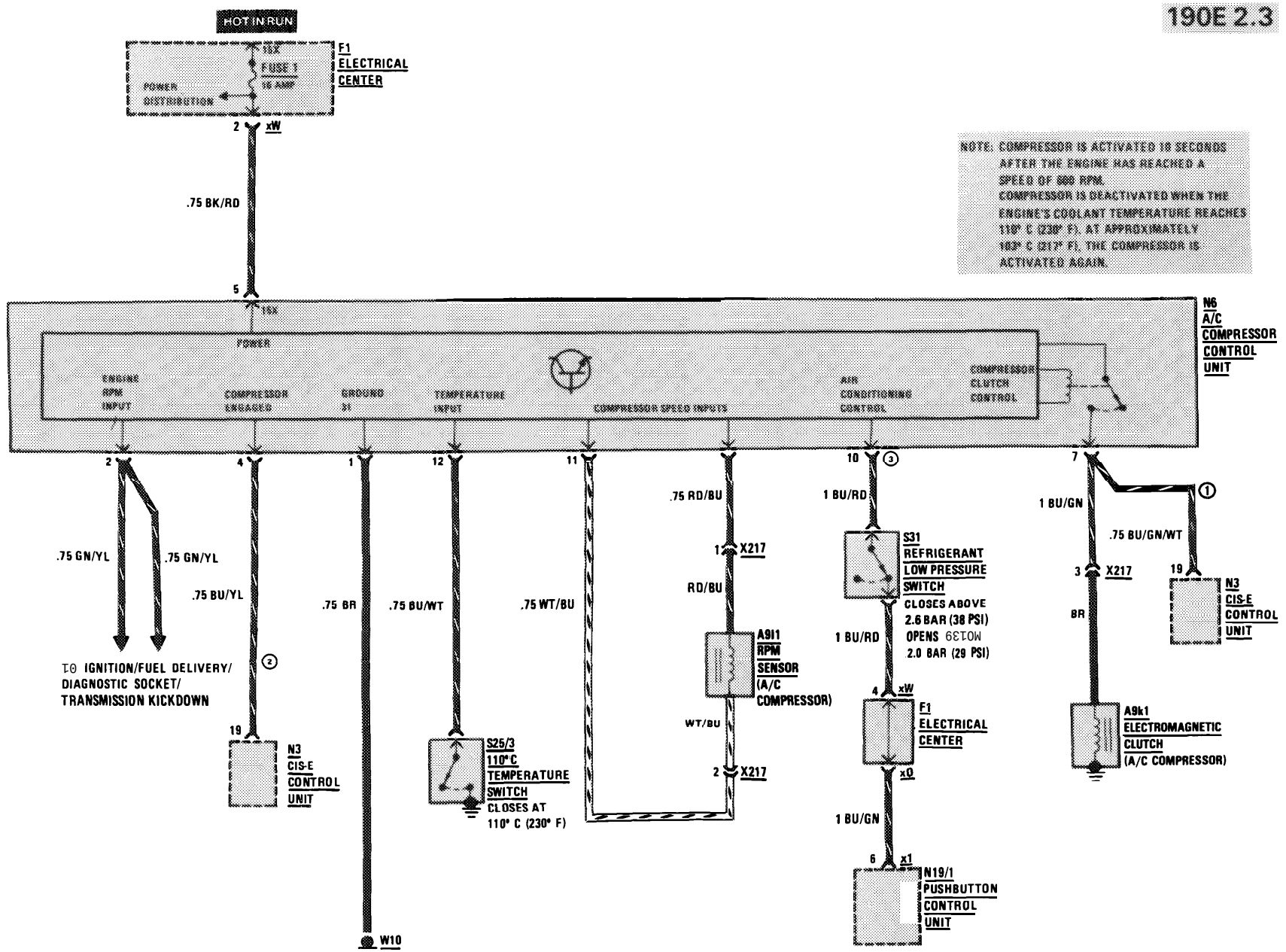


REVISIONS: ① POWER IS APPLIED AT PIN 10 WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL

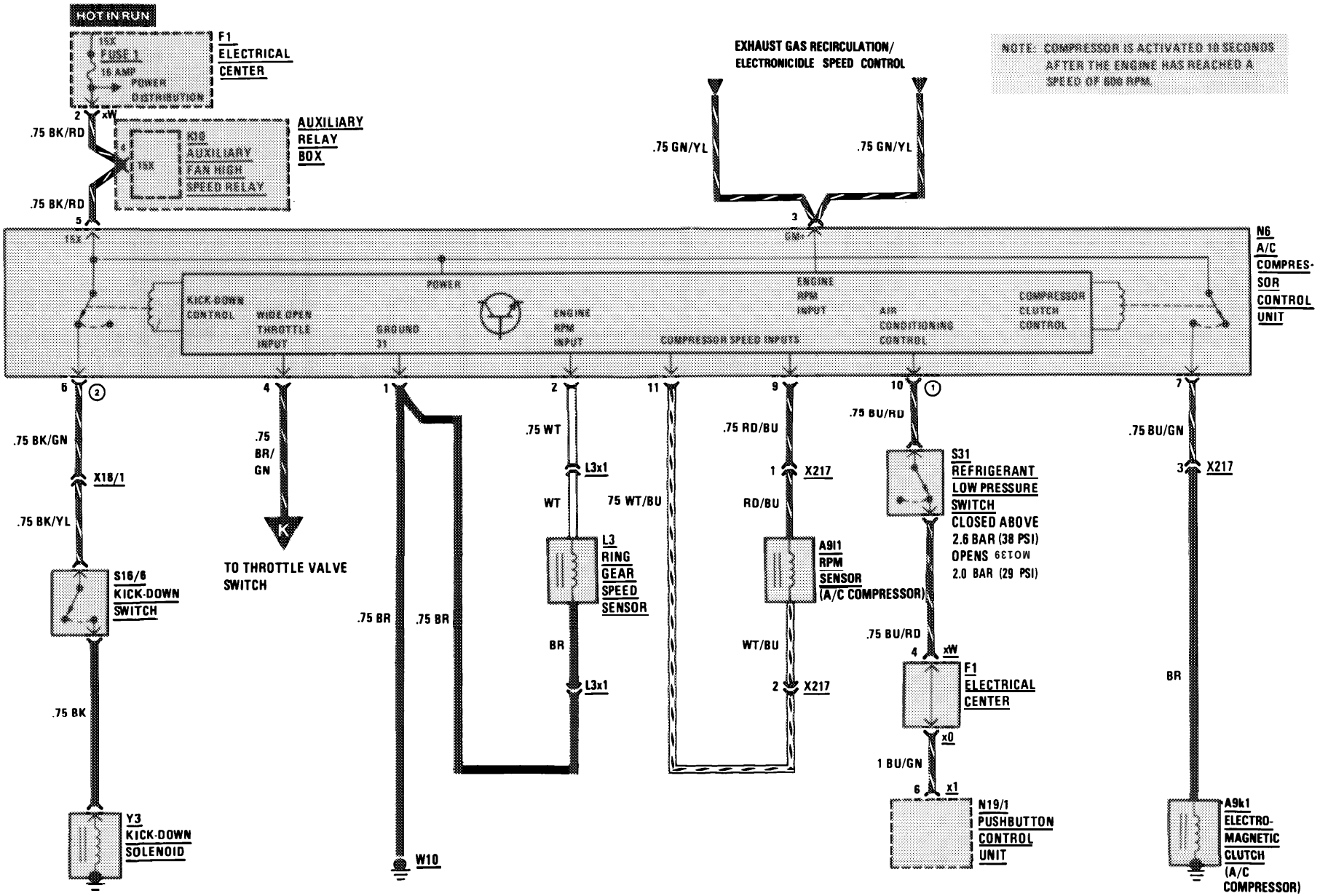
MY 1985 AND MY 1986

190E 2.3



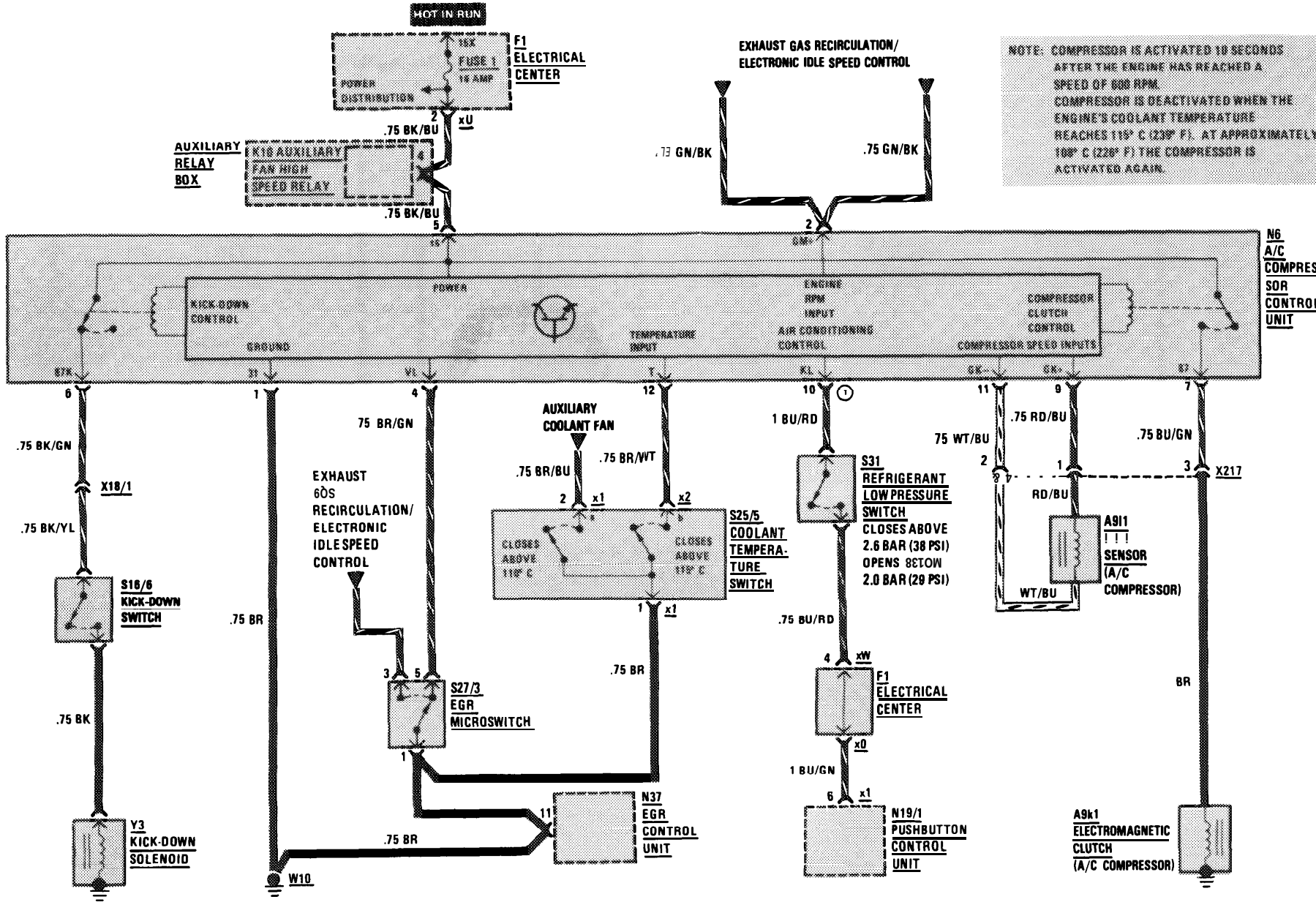
REVISIONS: ① MODEL YEAR 1985 ONLY
② AS OF MODEL YEAR 1966
③ PIN 10 GROUNDS WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL



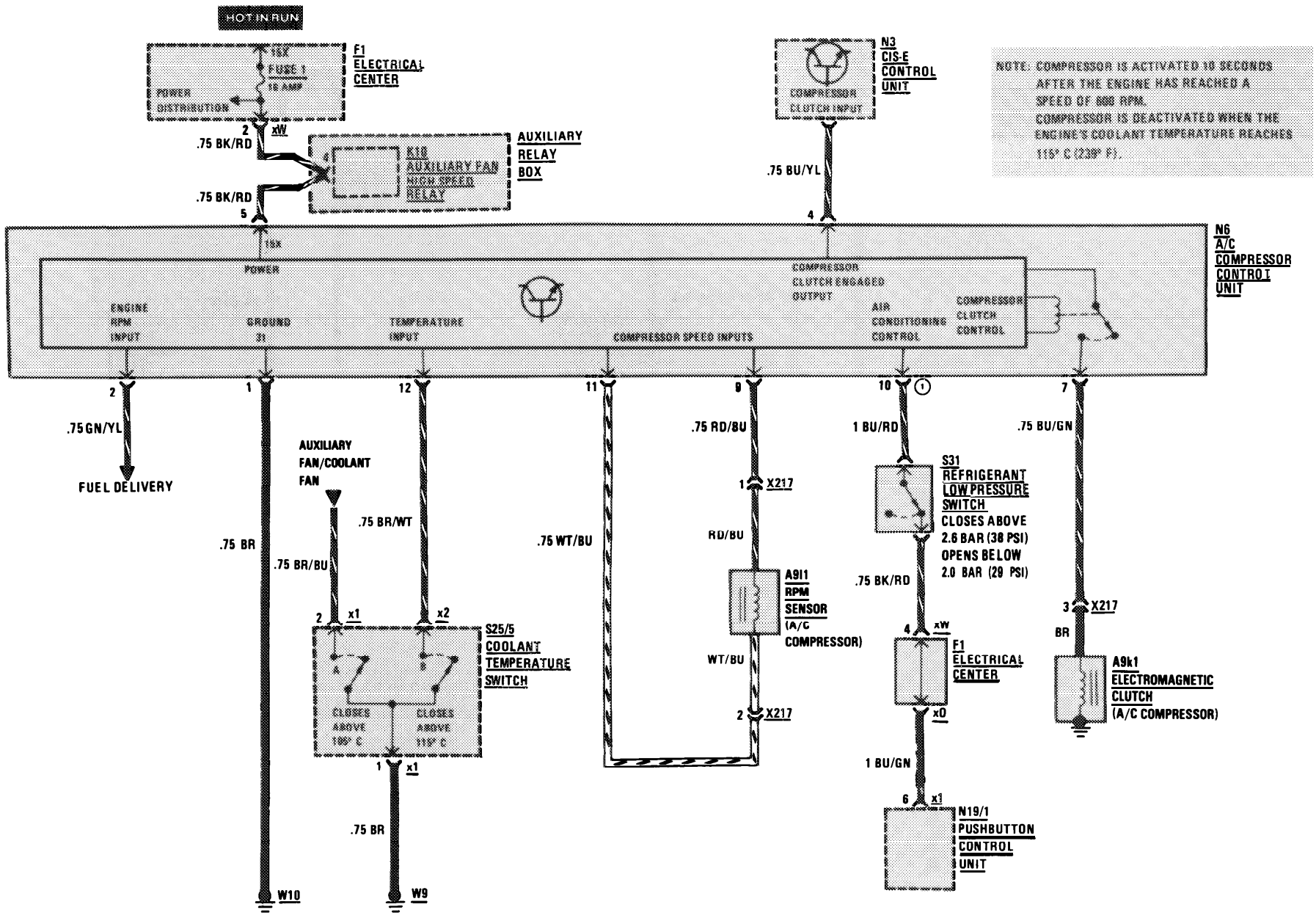
REVISIONS: ① PIN 10 GROUNDS WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON ② AUTOMATIC TRANSMISSION ONLY

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL



REVISIONS: ① PIN 10 GROUNDS WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL

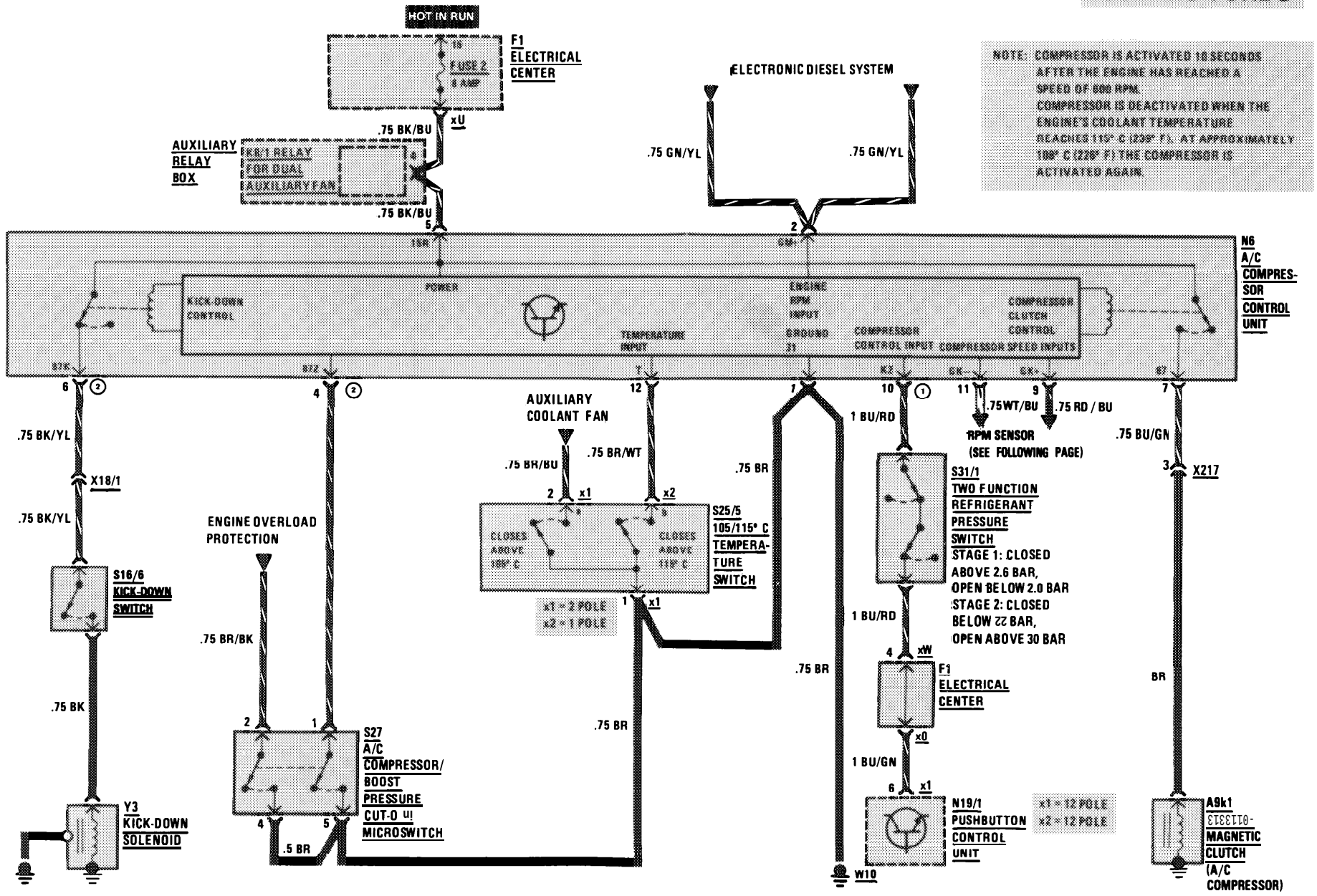


REVISIONS: ① PIN 10 GROUNDS WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL

MY 1987

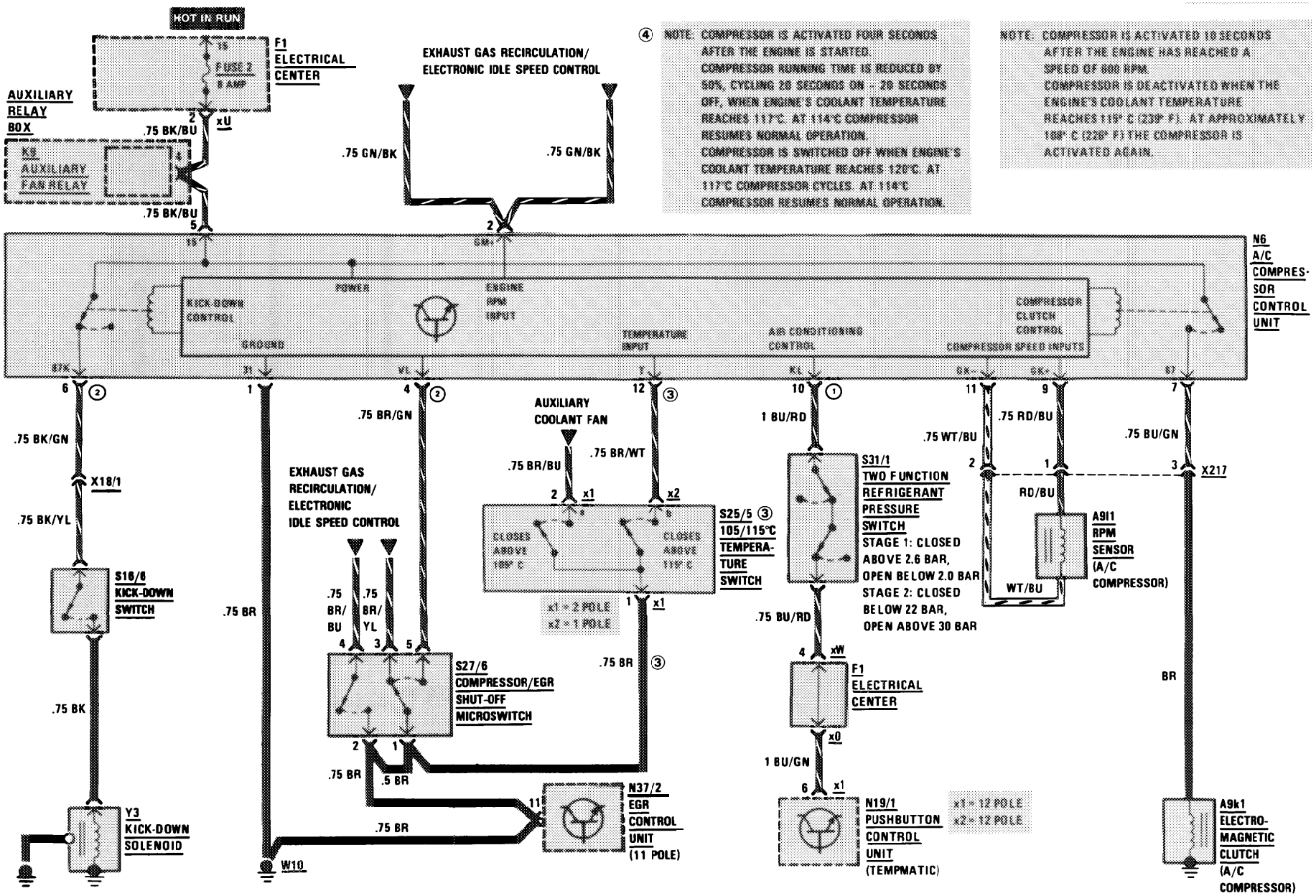
190D 2.5 TURBO



REVISIONS: ① PIN 10 GROUNDS WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON ② AUTOMATIC TRANSMISSION ONLY

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL MY 1987/MY 1988

190D 2.5

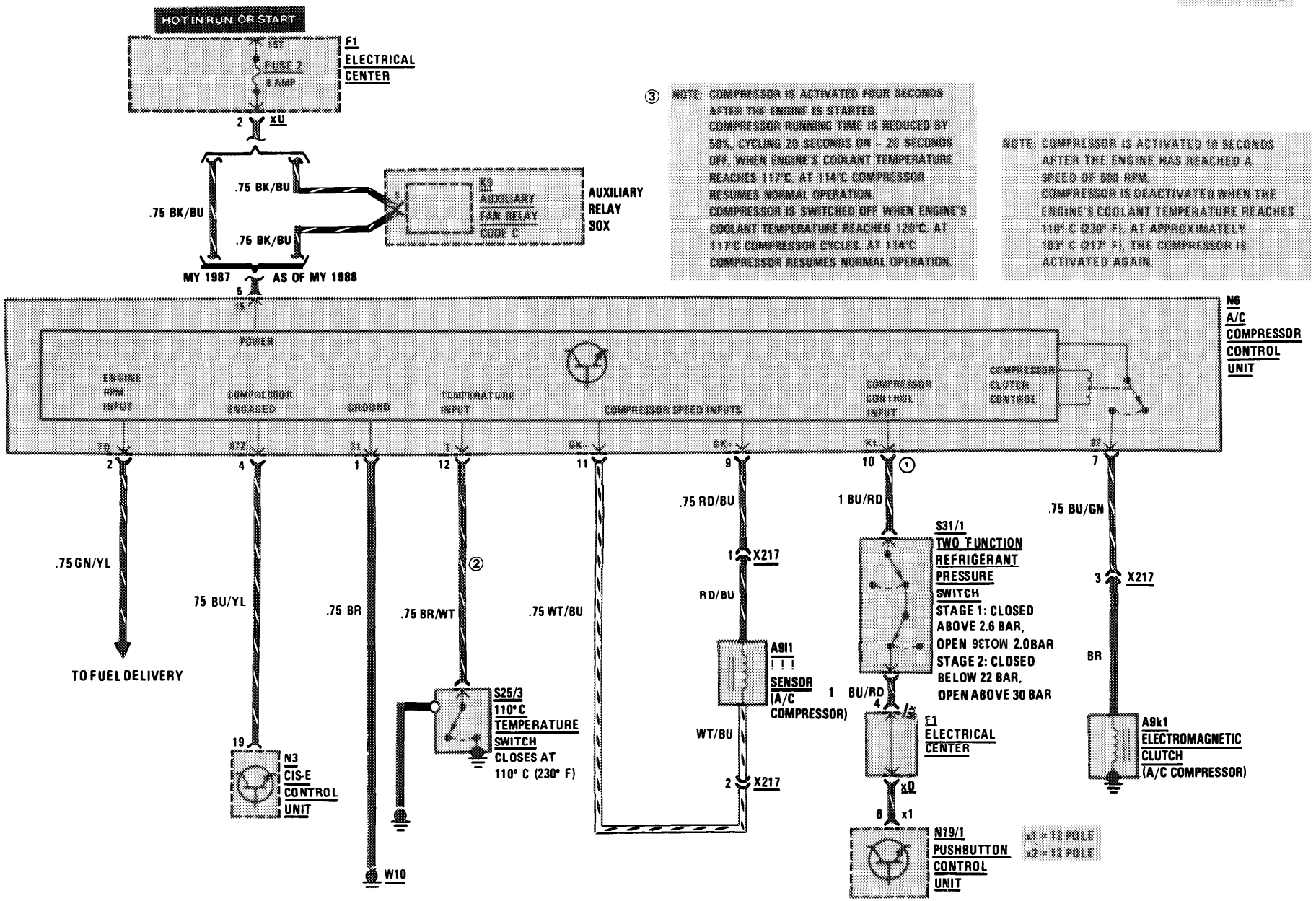


REVISIONS: ① PIN 10 GROUNDS WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON
② AUTOMATIC TRANSMISSION ONLY
③ TEMPERATURE INPUT NOT USED AS OF MY 1988
④ MODEL YEAR 1988 PRODUCTION PHASE-IN

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL

MY 1987/MY 1988

190E 2.3



③ NOTE: COMPRESSOR IS ACTIVATED FOUR SECONDS AFTER THE ENGINE IS STARTED. COMPRESSOR RUNNING TIME IS REDUCED BY 50%, CYCLING 20 SECONDS ON – 20 SECONDS OFF, WHEN ENGINE'S COOLANT TEMPERATURE REACHES 117°C. AT 114°C COMPRESSOR RESUMES NORMAL OPERATION. COMPRESSOR IS SWITCHED OFF WHEN ENGINE'S COOLANT TEMPERATURE REACHES 120°C. AT 117°C COMPRESSOR CYCLES. AT 114°C COMPRESSOR RESUMES NORMAL OPERATION.

NOTE: COMPRESSOR IS ACTIVATED 18 SECONDS AFTER THE ENGINE HAS REACHED A SPEED OF 600 RPM. COMPRESSOR IS DEACTIVATED WHEN THE ENGINE'S COOLANT TEMPERATURE REACHES 110° C (230° F). AT APPROXIMATELY 103° C (217° F), THE COMPRESSOR IS ACTIVATED AGAIN.

REVISIONS:

① WN TO GROUNDS WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON

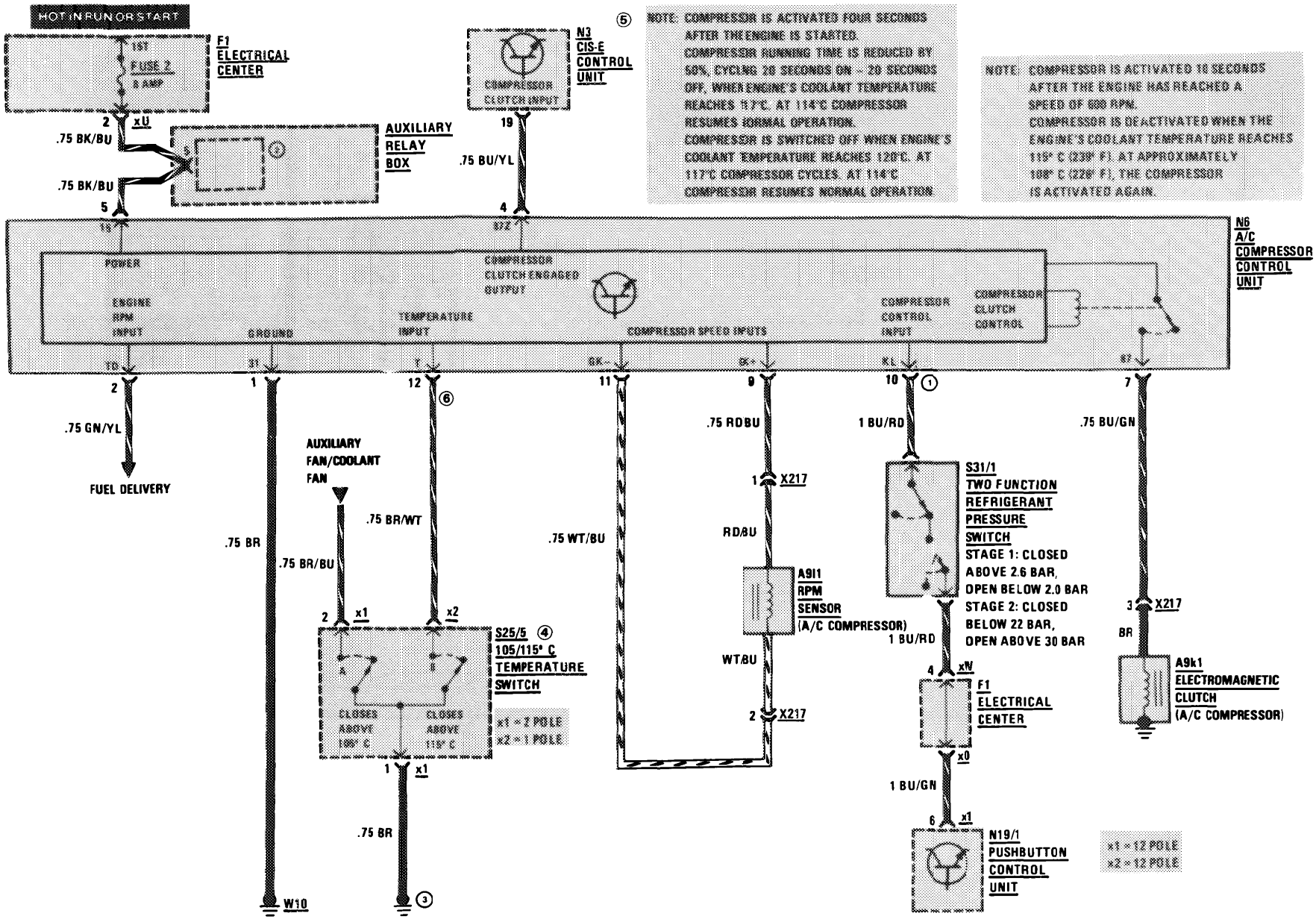
② TEMPERATURE INPUT NOI USED AS OF MY T999

③ MODEL YEAR T999 PRODUCTION PHASE-IN

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL

MY 1987 TO MY 1989

190E 2.6 AND 190E 2.3-16



REVISIONS:

① PIN 10 GROUNDS WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON

② K8/1, RELAY FOR DUAL AUXILIARY FAN (201.029)
K9, AUXILIARY FAN RELAY (201.034)

③ W11 FOR MODEL 201.029
W9 FOR MODEL 201.034

④ MY 1987 ONLY

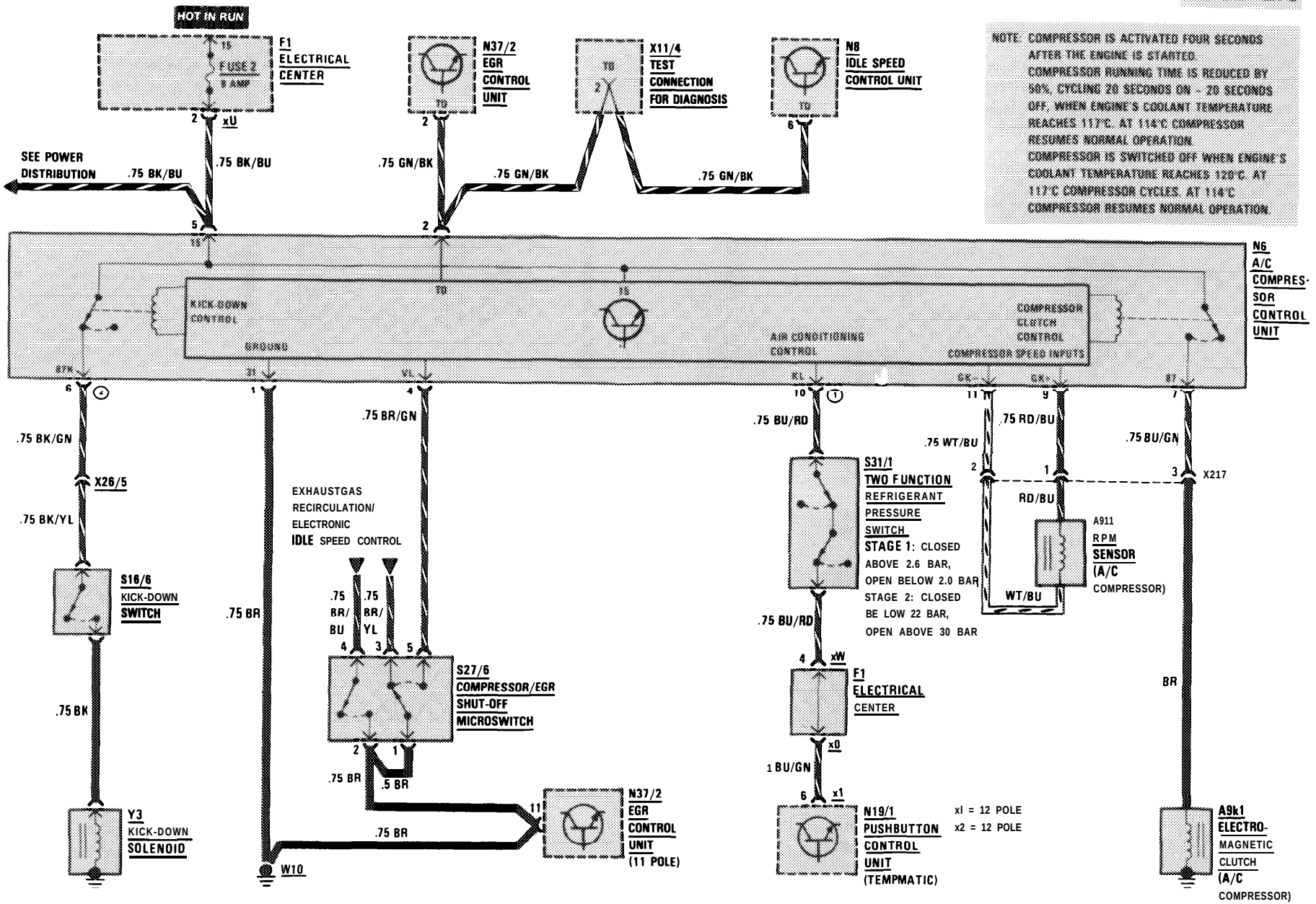
⑤ MODEL YEAR 1988 PRODUCTION PHASE-IN

⑥ TEMPERATURE INPUT NOT USED AS OF MY 1988

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL

AS OF MY 1989

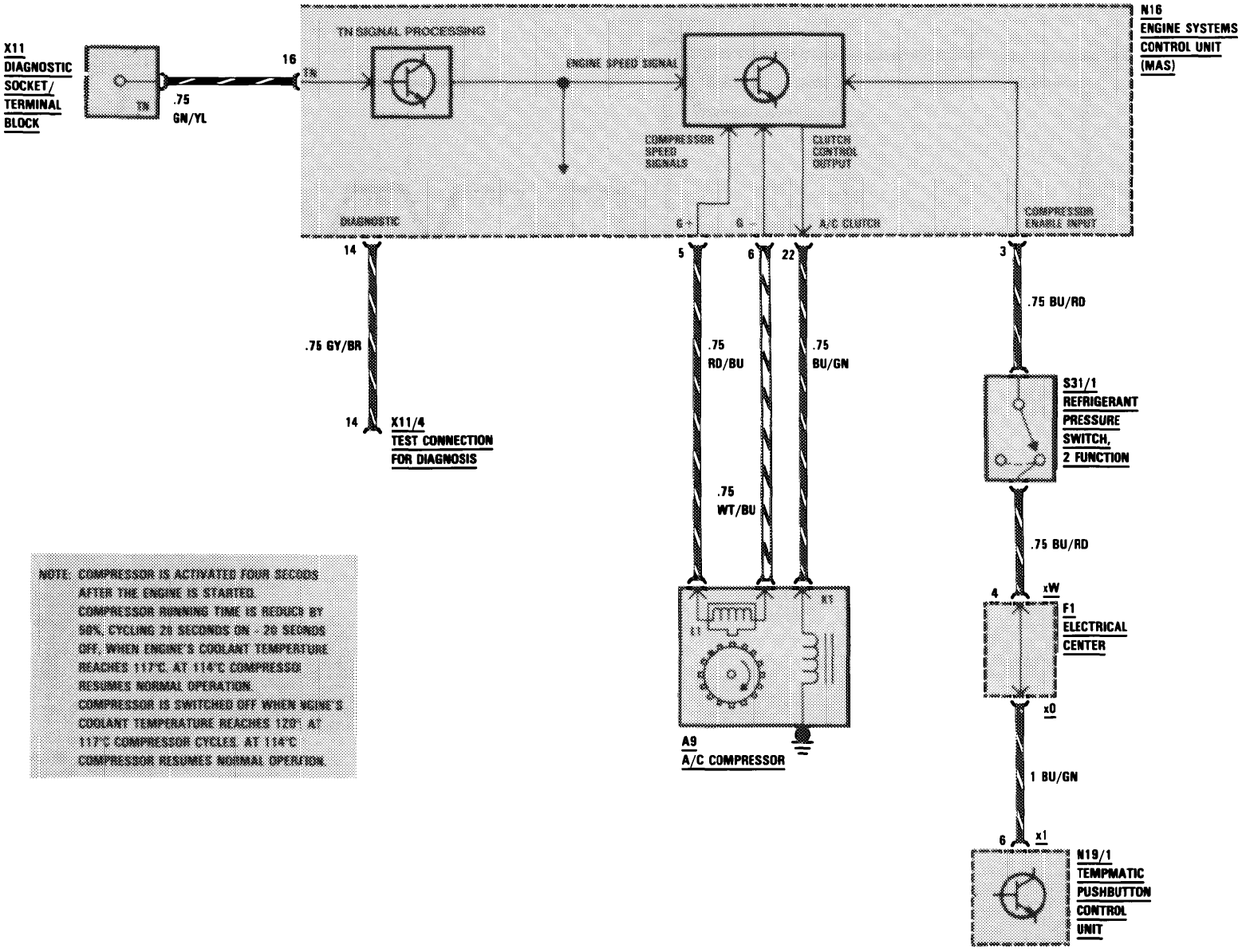
190D 2.5



REVISIONS: ① PIN 10 GROUNDS WHEN PUSHBUTTON CONTROL UNIT COMMANDS COMPRESSOR ON

TEMPMATIC CLIMATE CONTROL COMPRESSOR CLUTCH CONTROL

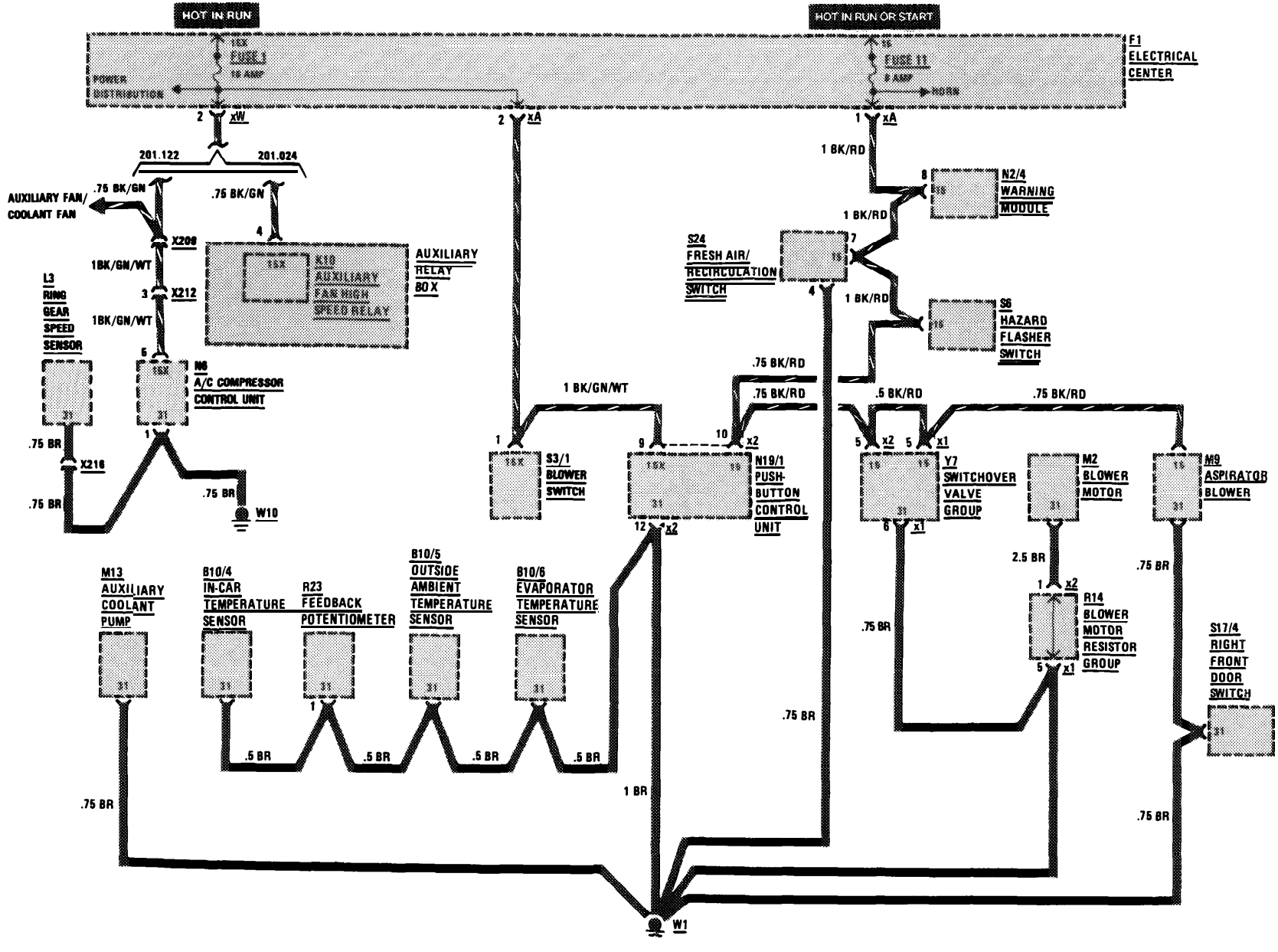
AS OF MY 1990
190E 2.6



NOTE: COMPRESSOR IS ACTIVATED FOUR SECONDS AFTER THE ENGINE IS STARTED.
COMPRESSOR RUNNING TIME IS REDUCED BY 50%, CYCLING 20 SECONDS ON - 20 SECONDS OFF, WHEN ENGINE'S COOLANT TEMPERATURE REACHES 117°C. AT 114°C COMPRESSOR RESUMES NORMAL OPERATION.
COMPRESSOR IS SWITCHED OFF WHEN ENGINE'S COOLANT TEMPERATURE REACHES 120°. AT 117°C COMPRESSOR CYCLES. AT 114°C COMPRESSOR RESUMES NORMAL OPERATION.

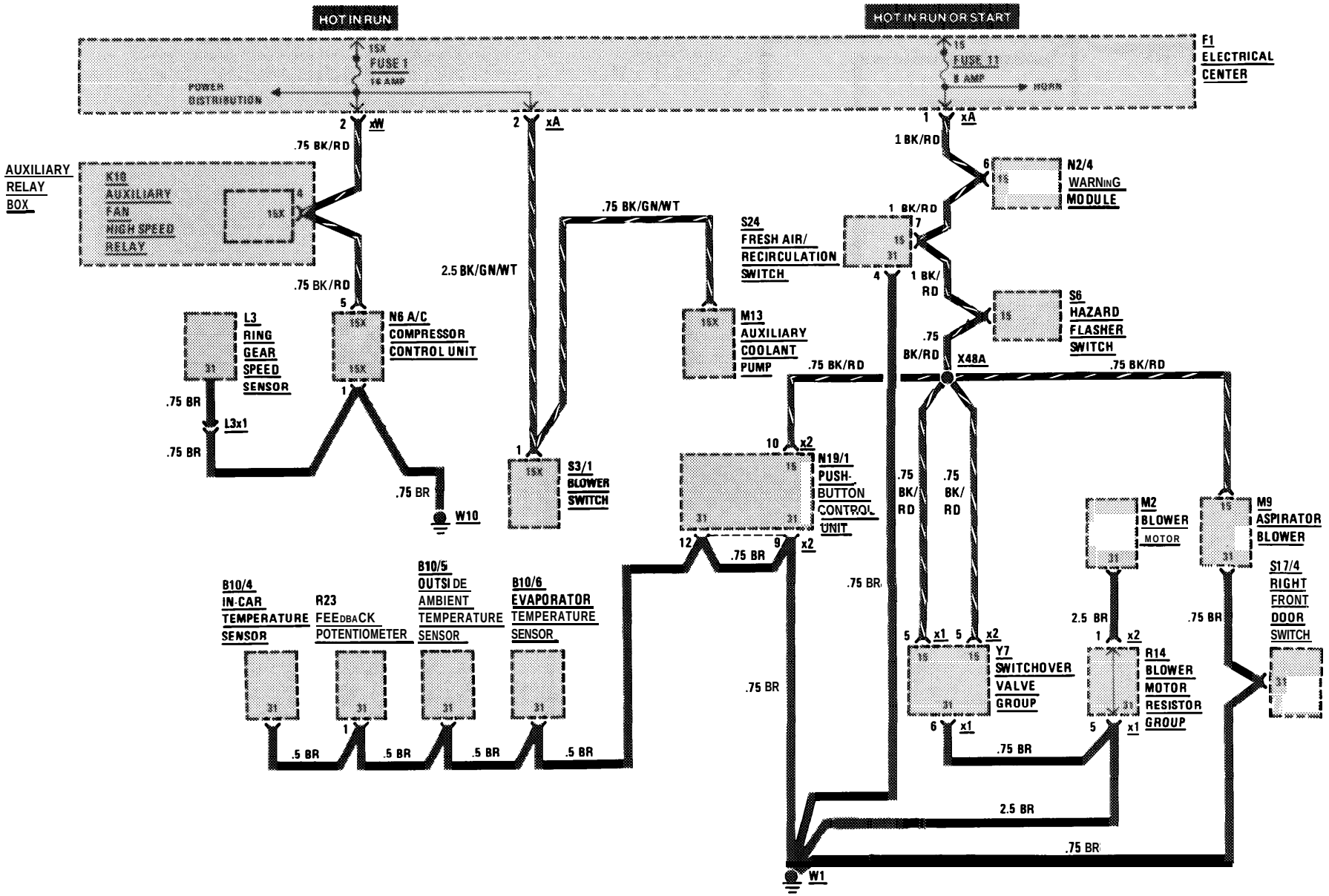
REVISIONS:

TEMPMATIC CLIMATE CONTROL POWER AND GROUND DISTRIBUTION



REVISIONS:

TEMPMATIC CLIMATE CONTROL POWER AND GROUND DISTRIBUTION

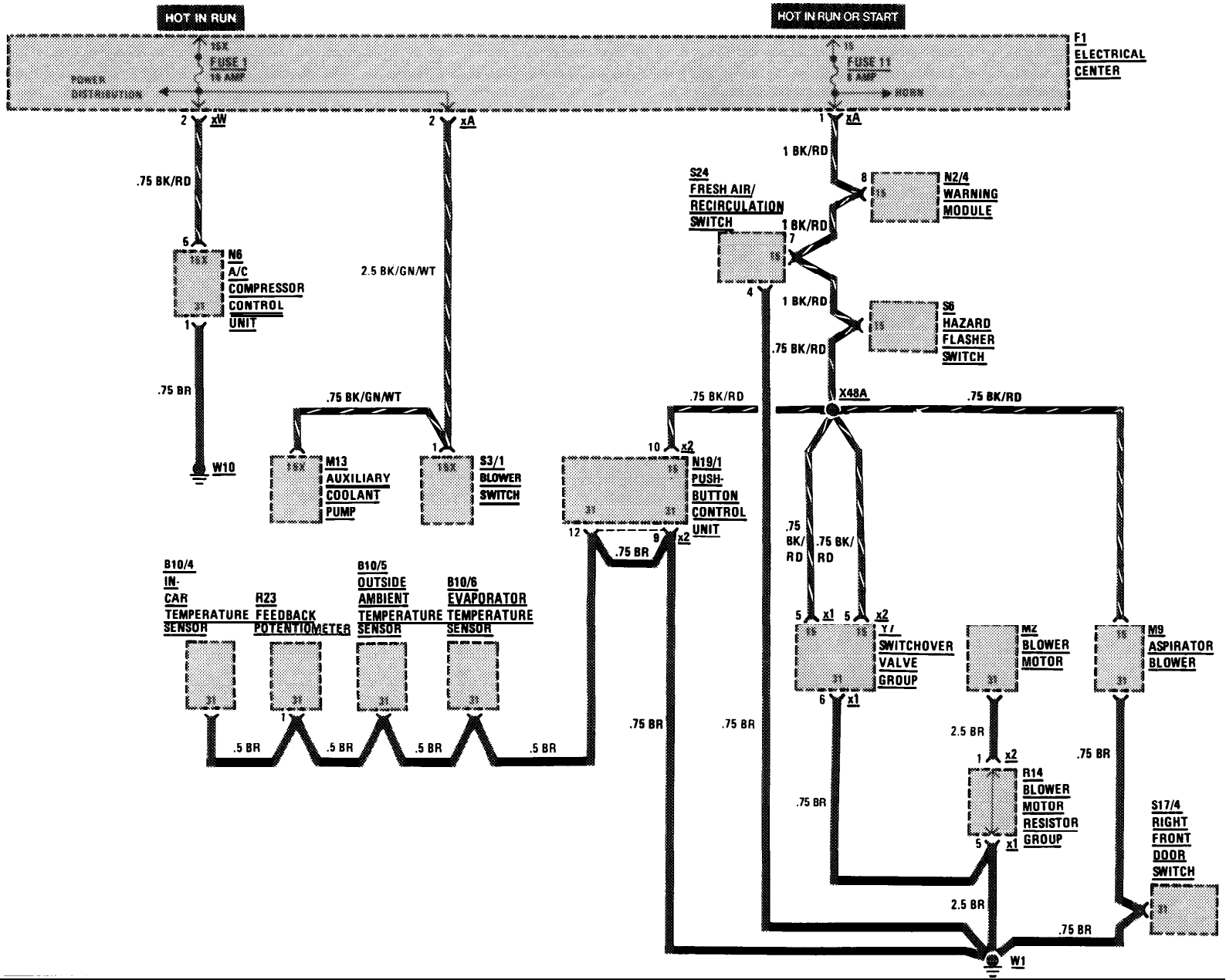


REVISIONS:

TEMPMATIC CLIMATE CONTROL POWER AND GROUND DISTRIBUTION

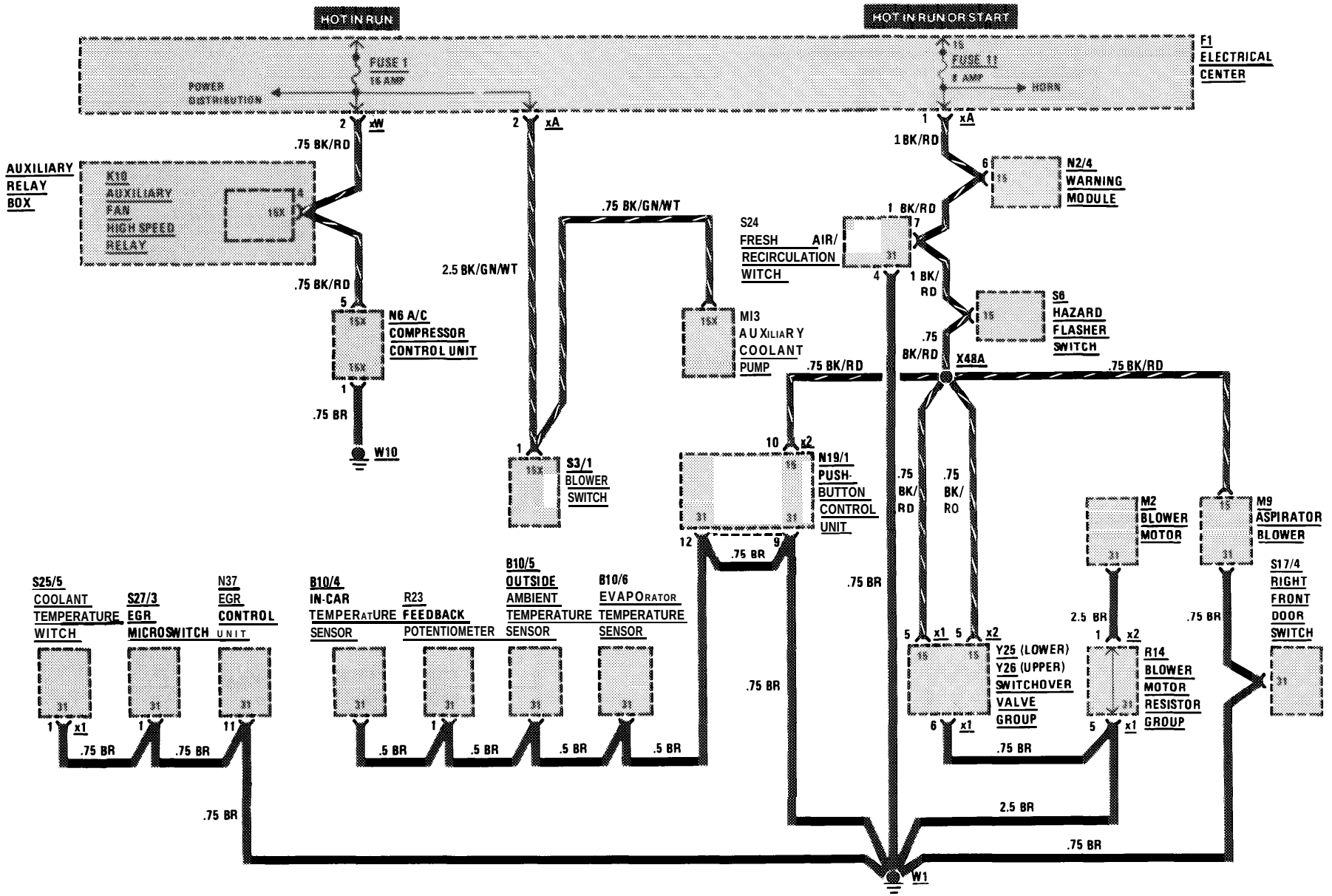
MY 1985 AND MY 1986

190E 2.3



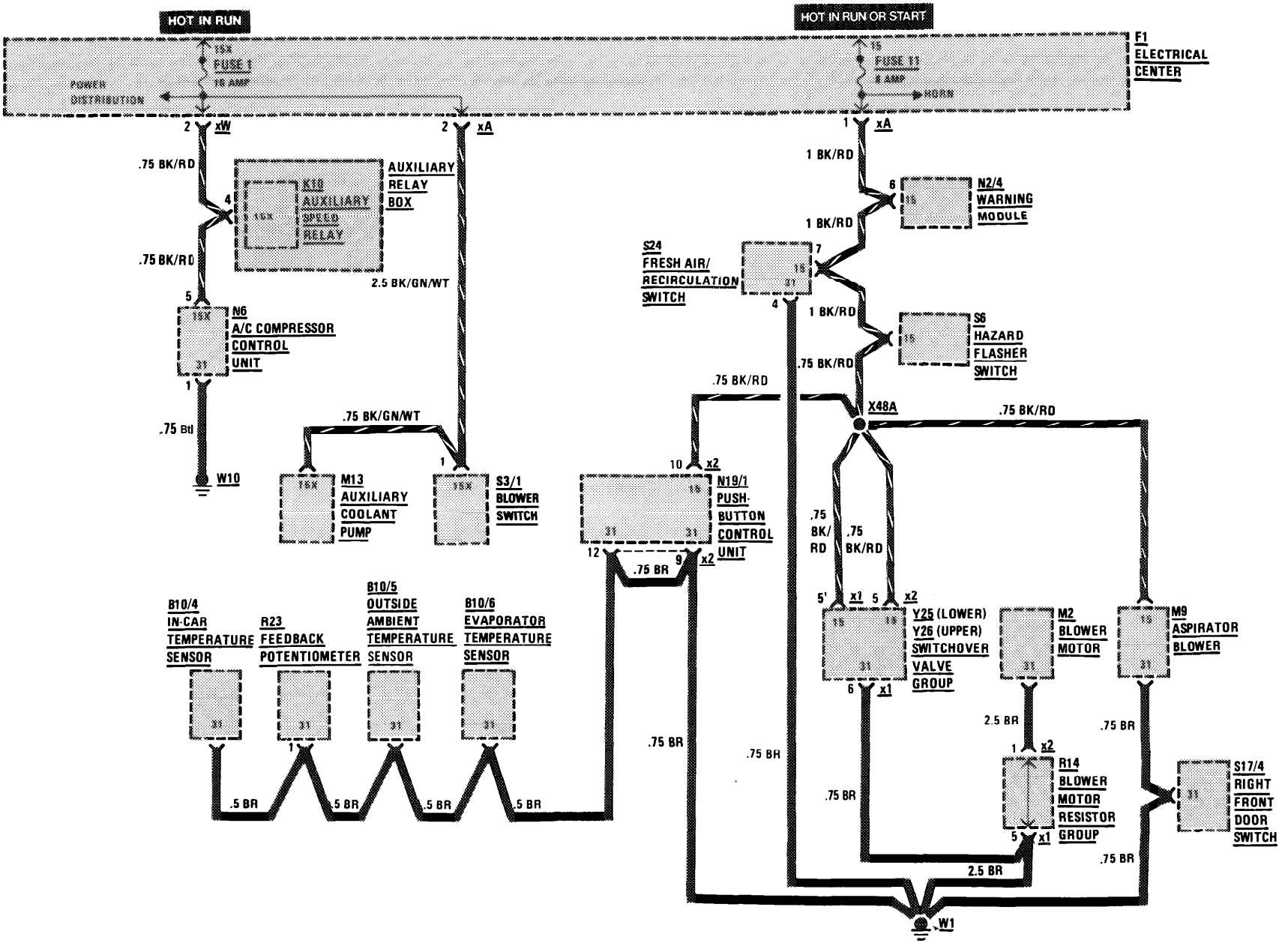
REVISIONS:

TEMPMATIC CLIMATE CONTROL POWER AND GROUND DISTRIBUTION



REVISIONS:

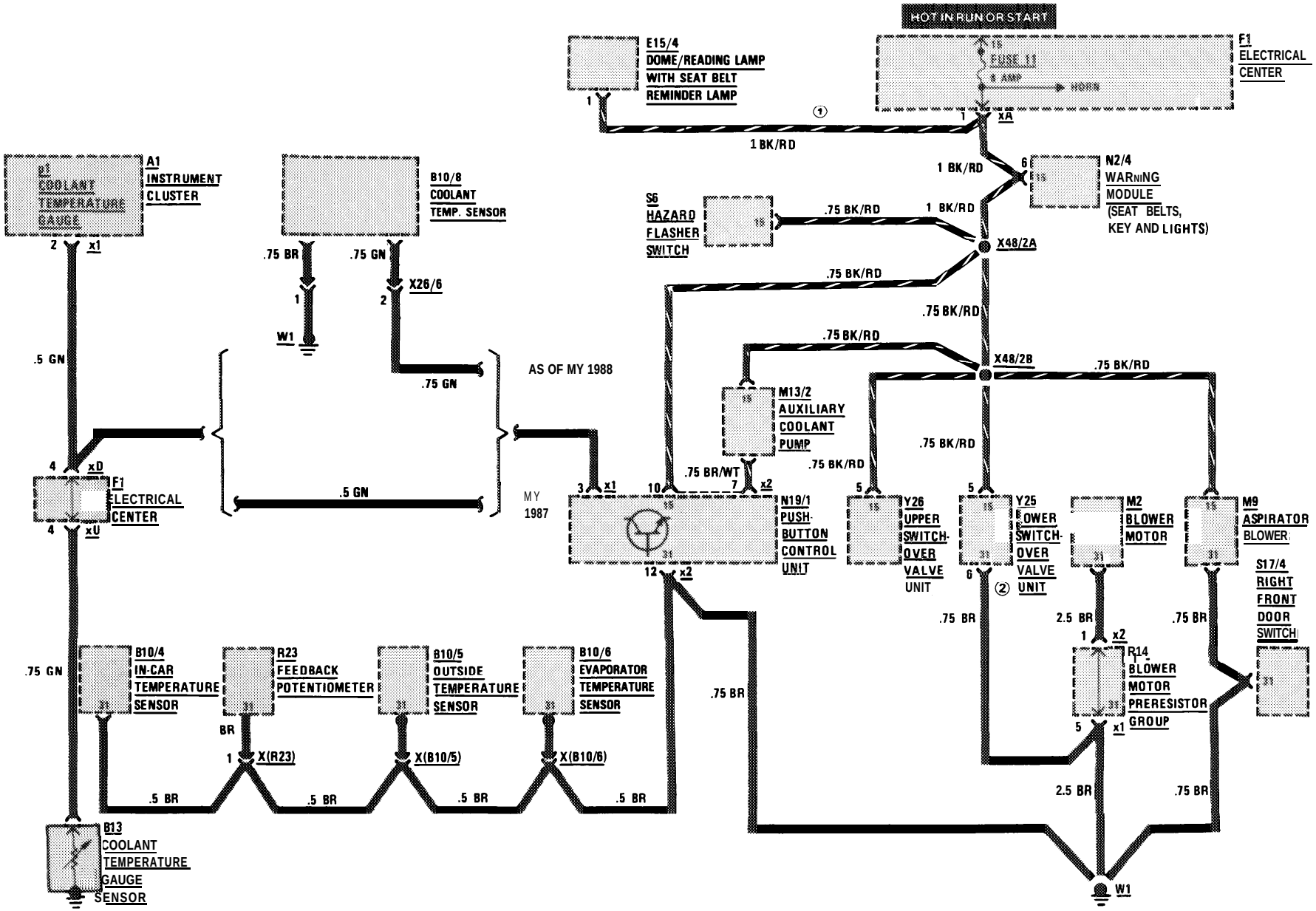
TEMPMATIC CLIMATE CONTROL POWER AND GROUND DISTRIBUTION



REVISIONS:

TEMPMATIC CLIMATE CONTROL POWER AND GROUND DISTRIBUTION

AS OF MY 1987



REVISIONS: ① AS OF MY 1988

② AS OF MY 1990, Y25 IS GROUNDED DIRECTLY TO W1.

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
A9	A/C compressor	Front left of engine	
A9k1	Electromagnetic clutch	Front of A/C compressor	408-4
A9i1	RPM sensor	In rear of A/C compressor	
B10/4	In-car temperature sensor	Center of windshield header *or* in E15/4	
B10/5	Outside temperature sensor	Under air inlet, forward of windshield	408-5
B10/6	Evaporator temperature sensor	Under air inlet, forward of windshield	408-5
B10/8	Coolant temperature sensor (climate control)	Top of engine	
B13	Coolant temperature gauge sensor	Front of engine, behind thermostat housing	408-2
E15/4	Dome/reading lamp with seat belt reminder lamp	In windshield header	
F1	Electrical center	Left side of component compartment	408-1
F15	Auxiliary fuse holder, blower motor/automatic climate control/ Tempmatic	Left side of component compartment, near auxiliary relay box	409-4
F22/1	Auxiliary fuse holder, blower, trailer hitch, heated seats	Left side of component compartment, near auxiliary relay box	409-5
K8/1	Dual auxiliary fan relay	In electrical center/auxiliary relay box	103
K9	Auxiliary fan relay	In electrical center/auxiliary relay box	103
K10	Auxiliary fan preresistor relay	In electrical center/auxiliary relay box	103

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
L3	Starter ring gear speed sensor	Lower left rear of engine	
L3x1	Connector, flywheel ring gear speed sensor		
M2	Blower motor	Center front of cowl, below wiper motor	
M9	Aspirator blower, in-car temperature sensor	Under right side of dash panel	
M13	Auxiliary coolant pump	Behind right headlamp unit	409-1
M13/2	Auxiliary coolant pump	Behind right headlamp unit	409-1
N2/4	Warning module (seat belts, keys, lights)	Left front footwell, behind left kick panel	407-6
N3	CIS-E control unit	Right side of component compartment, behind battery	409-2
N6	A/C compressor control unit	Right side of component compartment, behind battery	407-4
N8	Idle speed control unit	Behind N6	407-2
N16	Engine systems control unit (MAS)	Right side of component compartment, behind battery	410-4
N19/1	Tempmatic pushbutton control unit	Center of dashboard	410-1
N37	EGR control unit	Right side of component compartment, behind battery	409-6
N37/2	EGR control unit (11-pole)	same as N37	409-6

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
R14	Blower motor preresistor group	Right side of component compartment, behind battery	408-3
R23	Feedback potentiometer (Tempmatic)	Behind dash panel, top center of plenum	
S2/1	Ignition/starter switch	In dash panel, right of steering column	410-1
S2/2	Glow/starter switch	In dash panel, right of steering column	410-1
S3/1	Blower switch, Tempmatic	In center of dash panel	410-1
S6	Hazard flasher switch	In center console	
S16/6	Kickdown switch	Under accelerator pedal	406-6
S17/4	Right front door switch	In right front door jamb	408-6
S24	Fresh/recirculated air switch	Center of dash panel	
S25/3	110 °C Temperature switch	Top front of engine	409-3
S25/5	105/115 °C Temperature switch auxiliary fan high speed/emergency cut-out	Top front of engine	408-2
S27	A/C compressor/boost pressure cut-out microswitch		
S27/3	Microswitch (EGR)	Top left rear of engine	407-5
S27/6	A/C compressor cut-out/EGR microswitch		
S29/1	Throttle valve switch, full load	Left side of engine, below throttle body	
S29/2	Throttle valve switch, full load/idle	Left side of engine, below throttle body	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
S31	Refrigerant low pressure switch, A/C compressor (off 2.0 bar/on 2.6 bar)	Left front of engine compartment, near receiver/drier	406-4
S31/1	Refrigerant pressure switch, 2 function (off 2.0/30.0 bar, on 2.6/22.0 bar)	same as S31	406-4
W1	Main ground (behind instrument cluster)	Behind left side of instrument cluster	406-3
W3	Ground, left front wheelhousing (at ignition cod)	Left side of engine compartment, on inner fender	
W9	Ground, at left headlamp unit	Lower left front of engine compartment	406-I
W10	Ground, battery	Right side of component compartment, near battery	406-2
W11	Ground, engine (connection point for ground wires)	Left front corner of engine compartment	407-3
X6	Terminal block, terminal 58d (l-pole)	Below right side of instrument cluster	406-5
X11	Diagnostic terminal block, circuit TD	Left side of engine compartment, on inner fender	410-3
X11/4	Test connection for diagnosis (impulse readout)	Right side of component compartment	41 o-2
X18/1	Connector, taillamp harness/NC compressor harness		
X26/5	Connector, engine/taillamp harness (1-pole)		
X26/6	Connector, engine harness/Tempmatic (3-pole)	Right side of component compartment, behind battery	
X48A	Solder joint in harness	Taillamp harness, below front of console	
X48/2A	Solder joint in harness	Interior harness, behind dashboard	

COMPONENT LOCATION

Component	Component Designation	Location	Page - Figure
X48/2B	Solder joint in harness	Interior harness, behind dashboard	
X64/1	Connector, blower fuse (1-pole)	Inside car, below electrical center	
X209	Connector		
X212	Connector, interior/engine harness (4-pole)	Right side of component compartment, behind battery	
X217	Connector, A/C compressor (3-pole)	Right side of A/C compressor	408-4
X220	Connector, pressure switch (1-pole)		
Y3	Kickdown valve (automatic transmission)	Right rear corner of transmission	407-1
Y5/1	Electromagnetic A/C compressor clutch	Front of A/C compressor	
Y7	Switchover valve unit (7 connections)	Behind right side of dash panel	
Y14	Idle speed stabilization switchover valve		
Y25	Lower switchover valve unit, 4 connections (Tempmatic)	Behind right side of dash panel	
Y26	Upper switchover valve unit, 5 connections (Tempmatic)	Behind right side of dash panel	

COMPONENT LOCATION

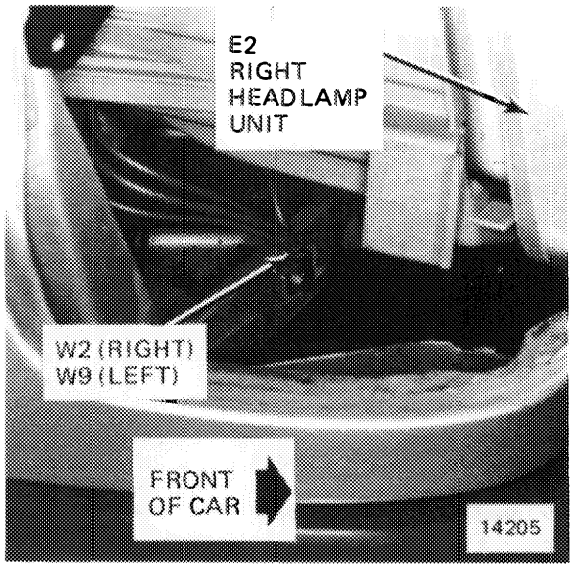
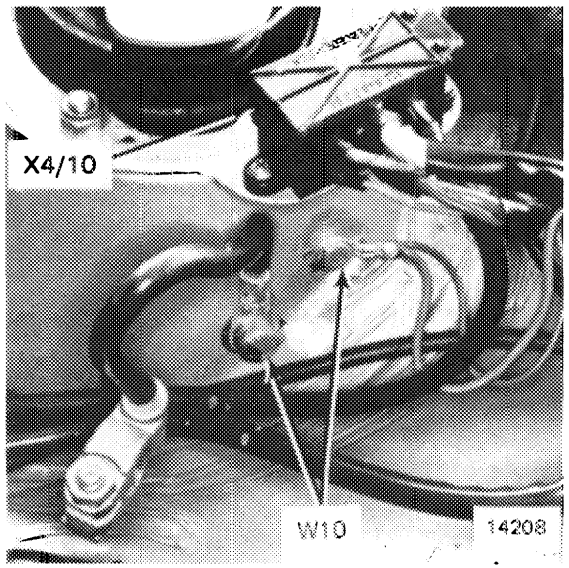


Figure 1



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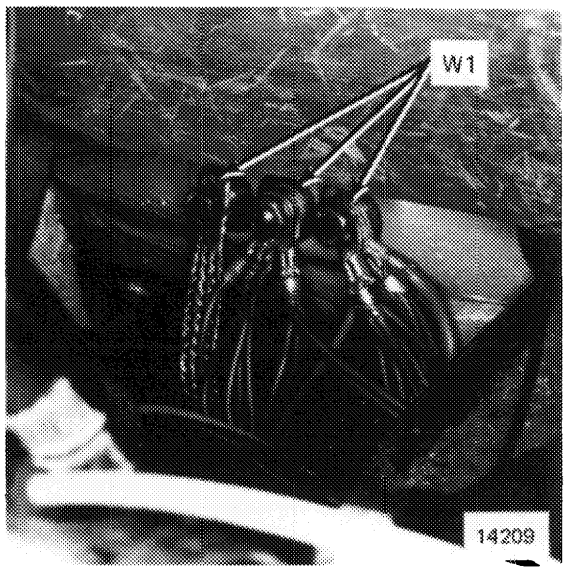

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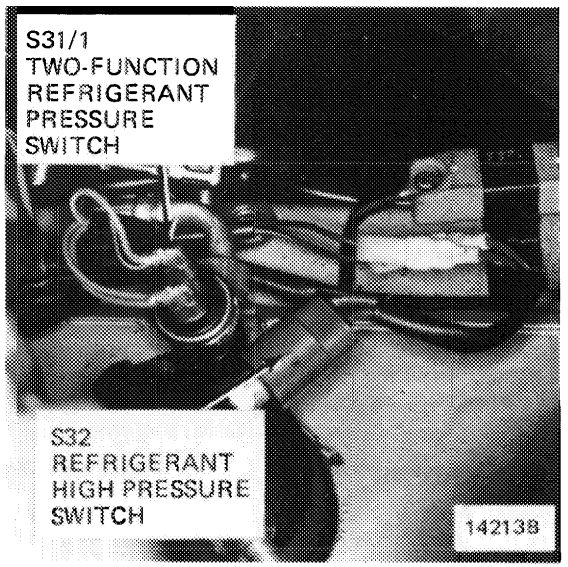
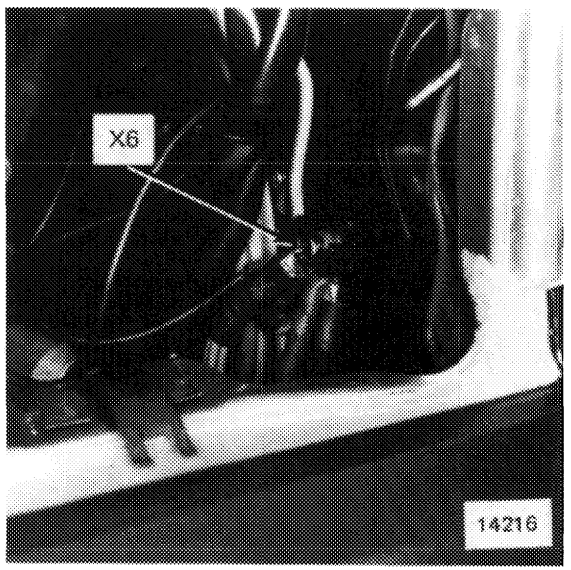


Figure 4



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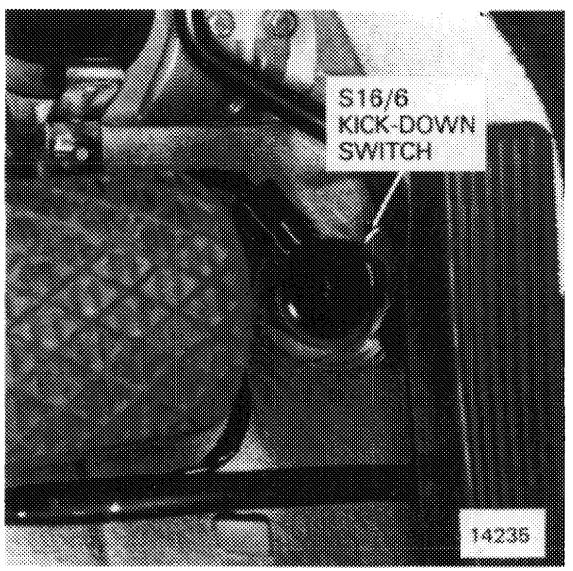
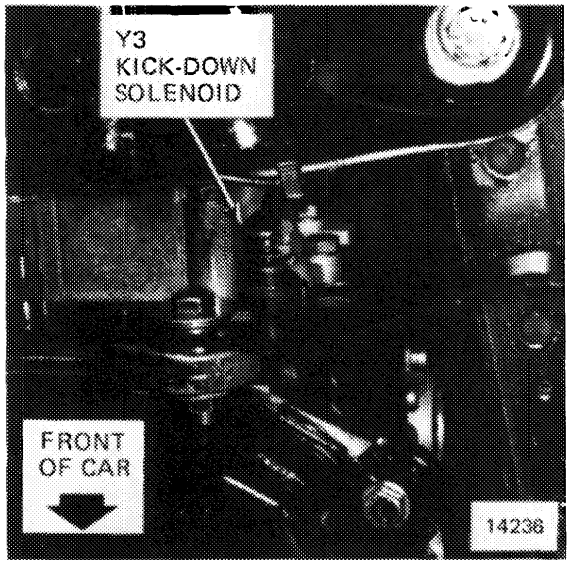


Figure 6

COMPONENT LOCATION



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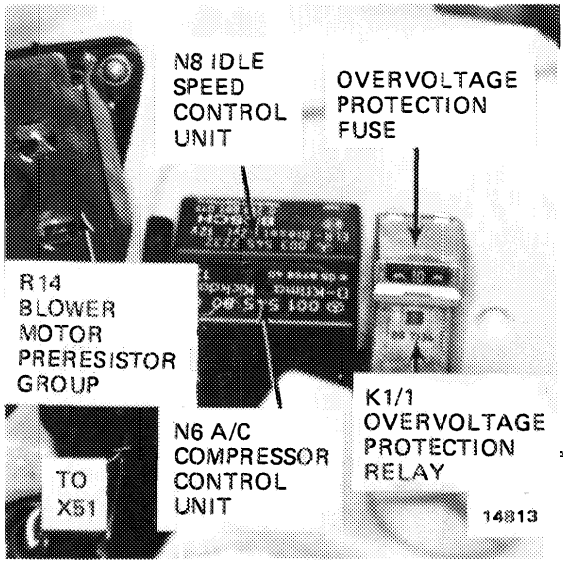

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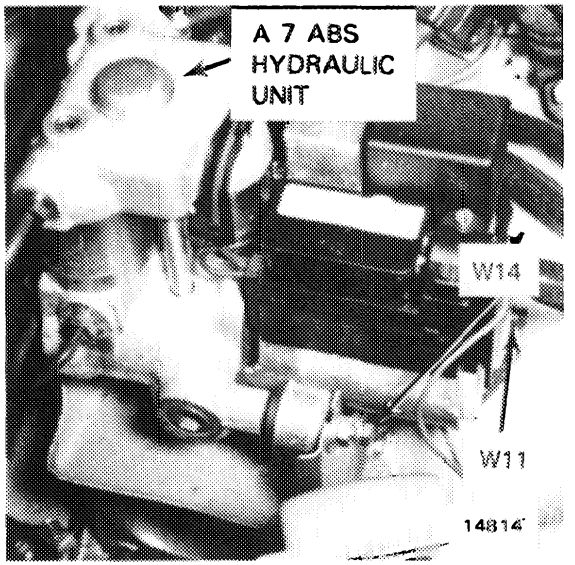

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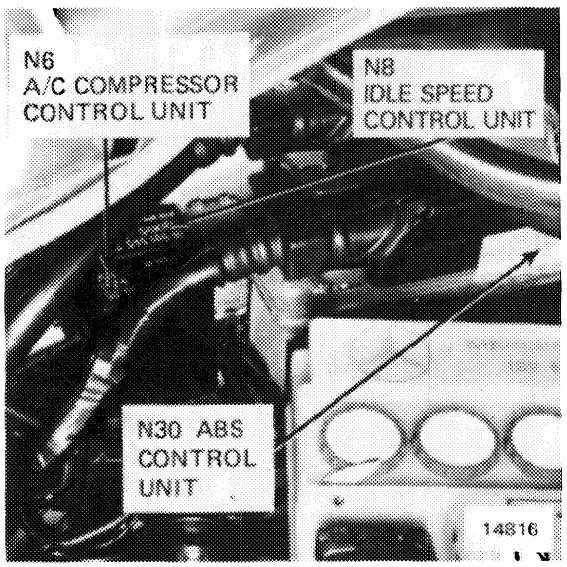

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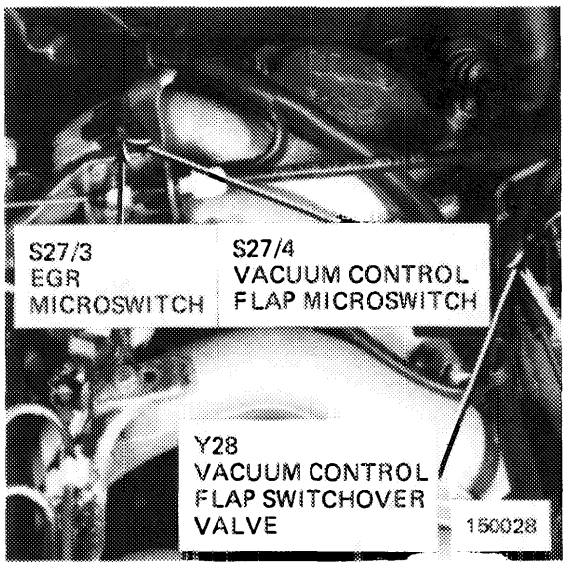

Figure 5

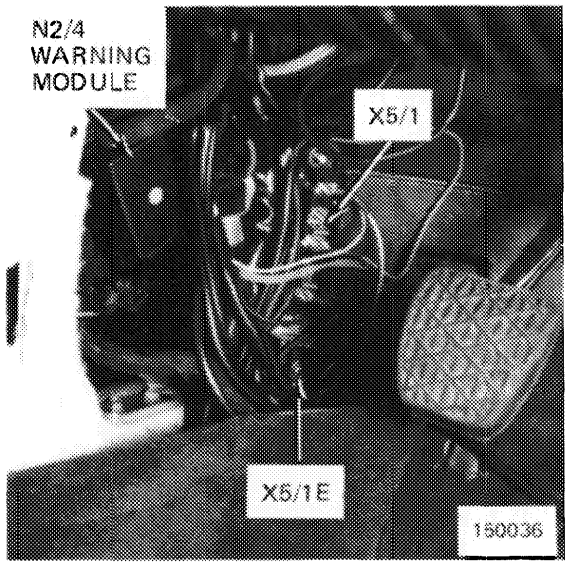

Figure 6

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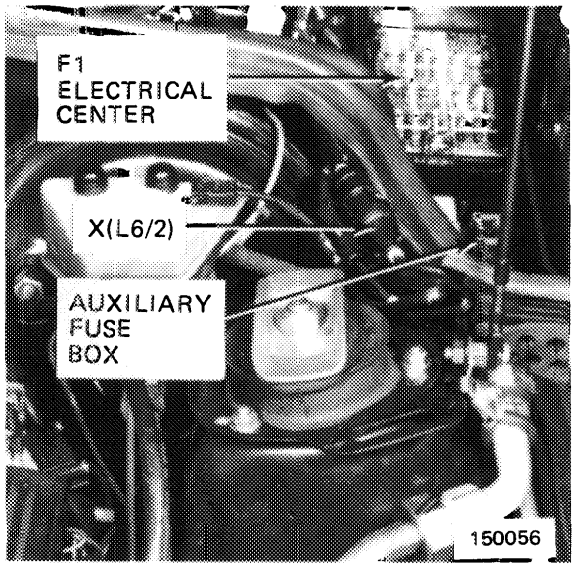

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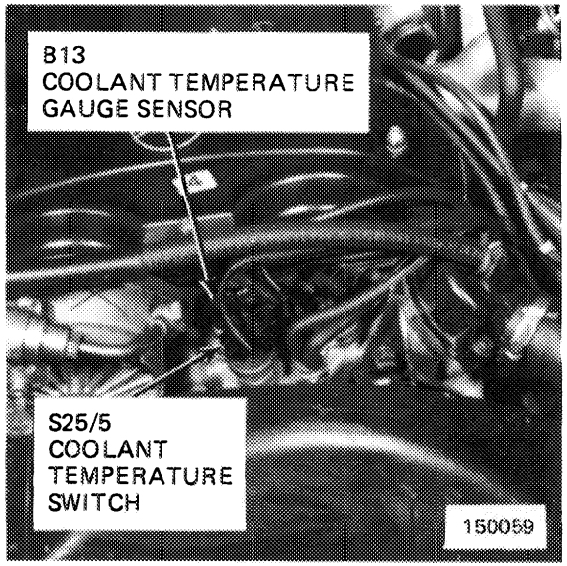

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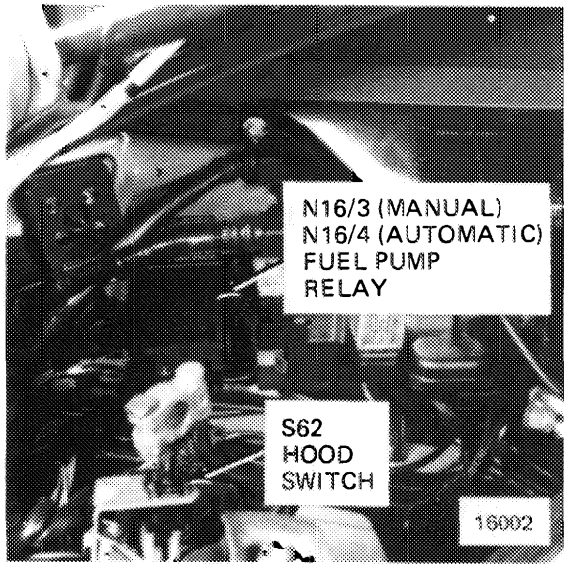

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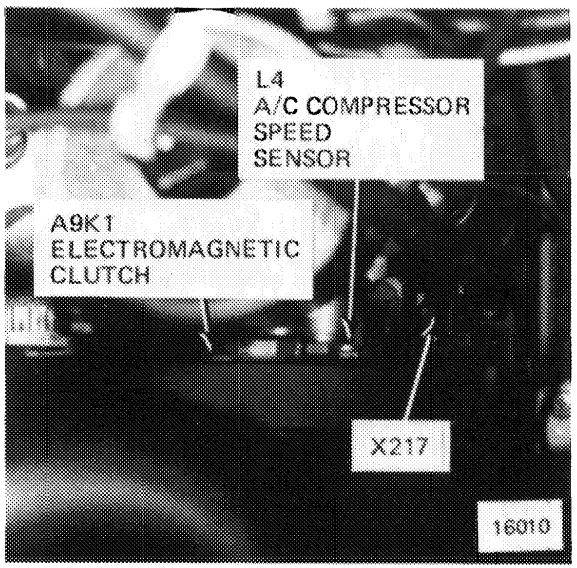

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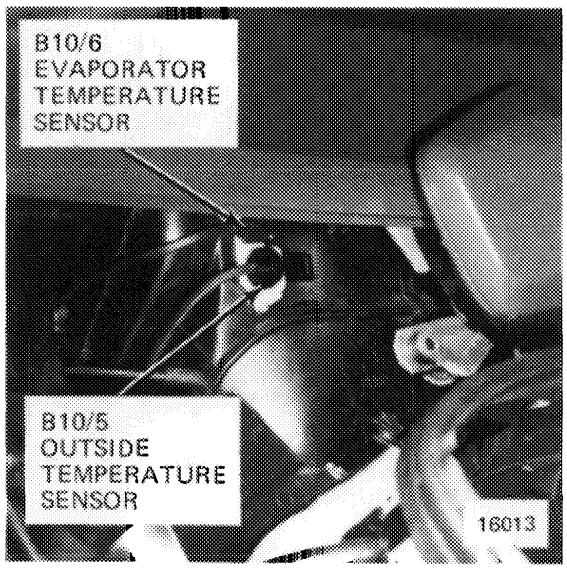

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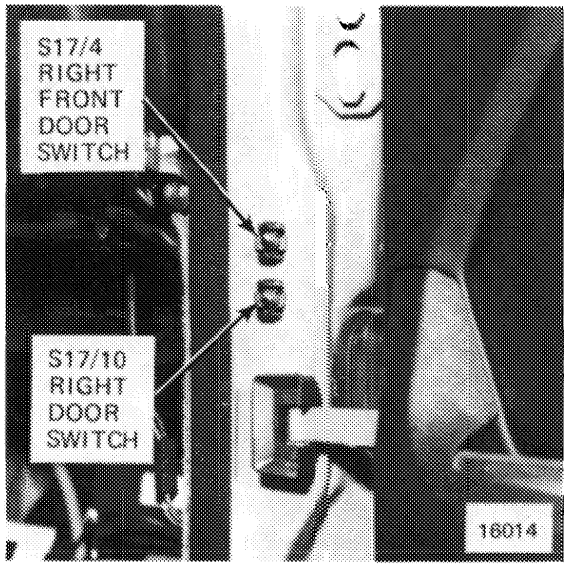

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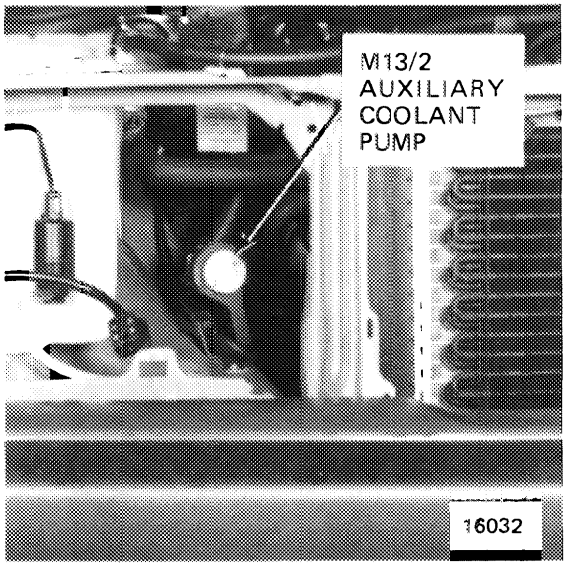

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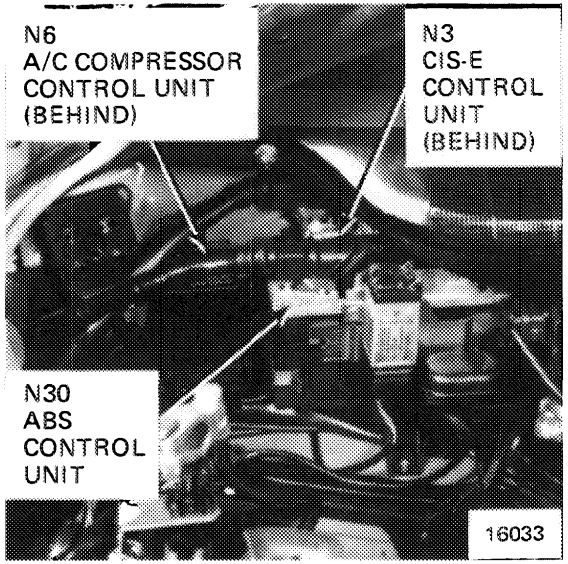

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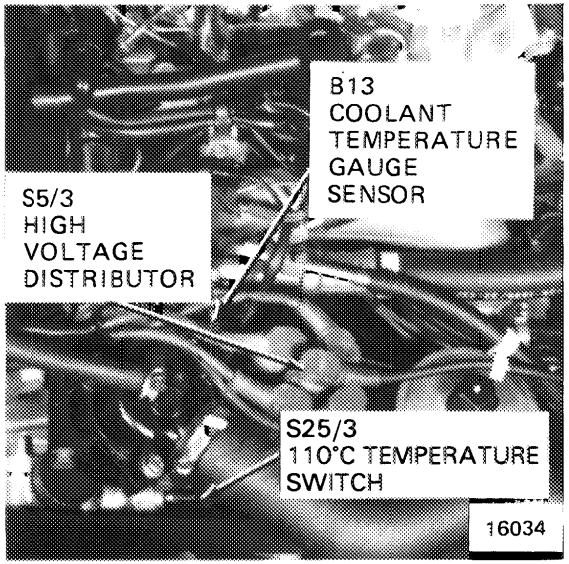

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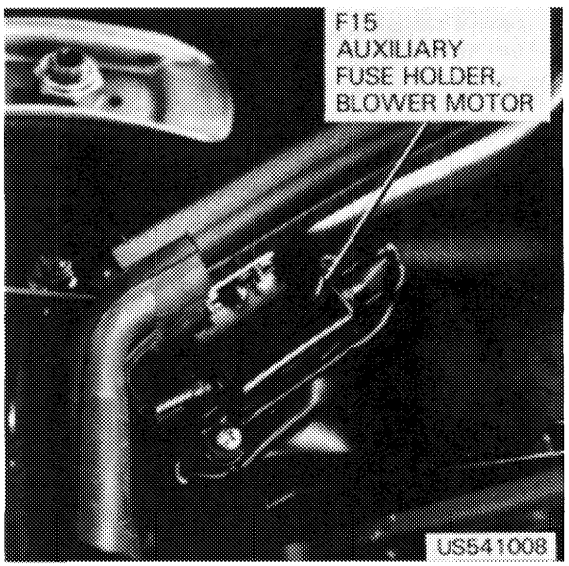

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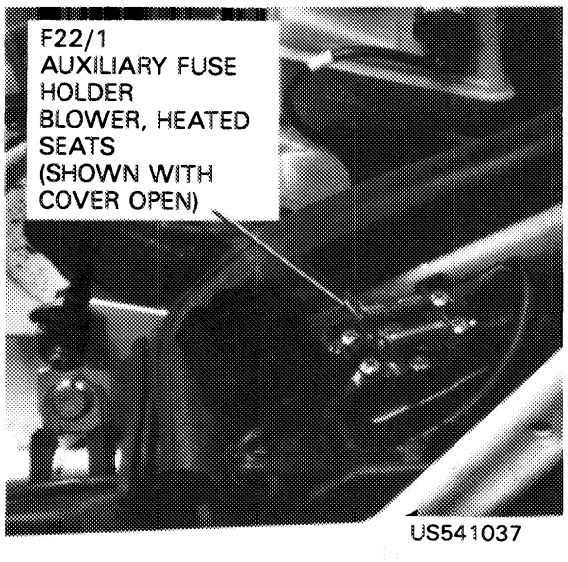

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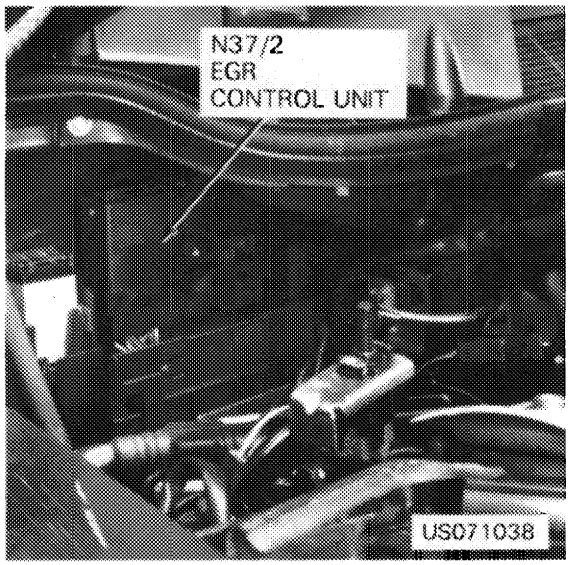

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COMPONENT LOCATION

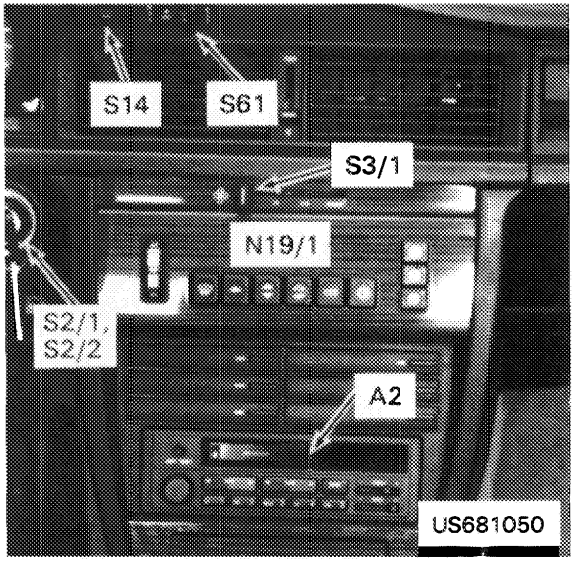
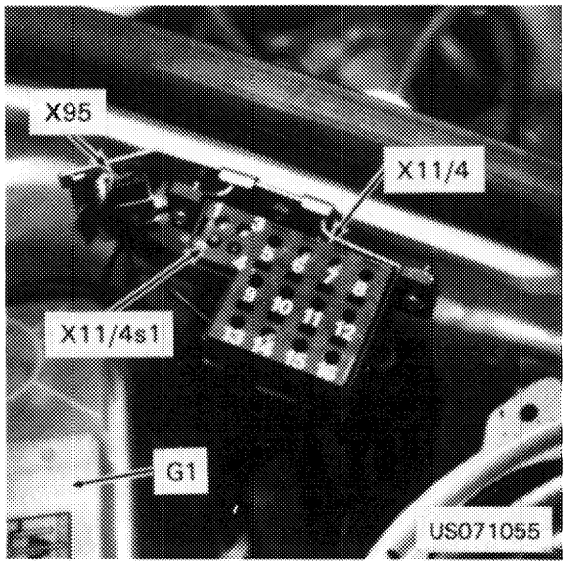


Figure 1



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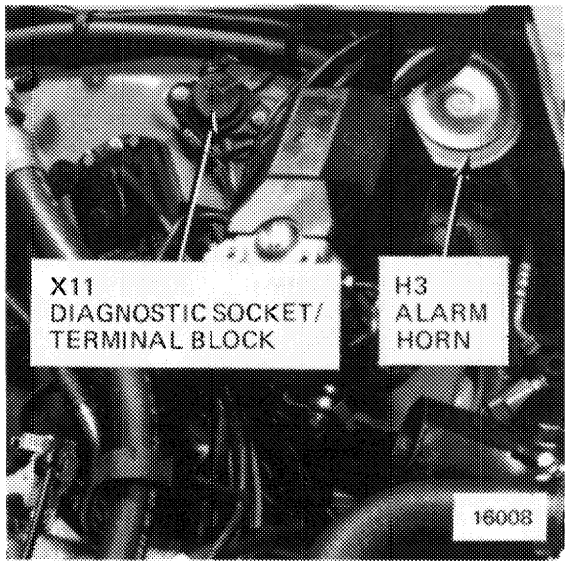

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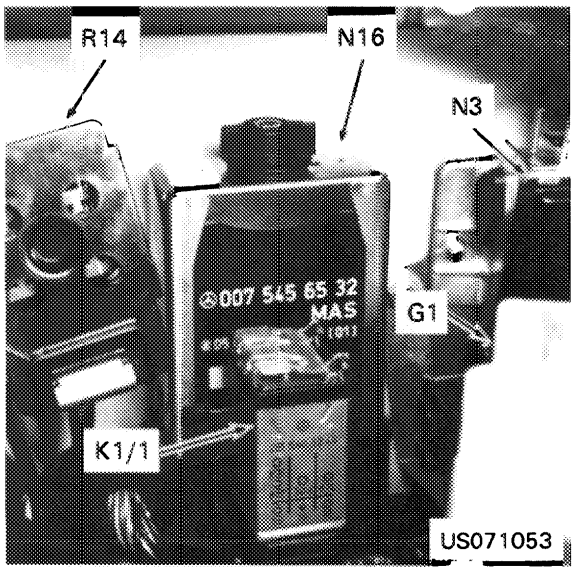

Figure 4

MERCEDES-BENZ

Service

Service Manual
Chassis and Body
Series 201

Mercedes-Benz of North America, Inc.
One Mercedes Drive
Montvale, NJ 07645

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MBNA/MBC 2348

Introduction

This service manual is the product of existing technical publications. Special care has been taken to provide accurate information on removal, disassembly, inspection, installation, and adjustment procedures, together with the necessary technical data for the particular job.

The material in this manual is divided according to the Mercedes-Benz Component Group System as outlined on the GROUP INDEX page. This page will quickly direct the reader to the Major Component Group. Each Major Component Group begins with a JOB INDEX listing all jobs within that group.

Mercedes-Benz of North America, Inc. recommends that repairs to, and maintenance of Mercedes-Benz automobiles be performed by trained Mercedes-Benz personnel at authorized Mercedes-Benz dealerships.

The information contained in this special publication is ordinarily issued by Mercedes-Benz of North America, Inc., in conjunction with supplementary service literature and special tools supplied only to its authorized dealers. The repair and maintenance procedures outlined herein are intended for use by **trained** Mercedes-Benz **service and dealership personnel.** This manual can also be useful for Mercedes-Benz owners in diagnosing vehicle systems and performing repairs. Supplementary service literature will not be provided with this publication, but may be contained in reprints of this service manual.

Please note that this manual has been compiled from various sources, some of which cover models other than the subject of this book. Always refer to the engine and vehicle Identification table for model and component information.

Special tools required in performing certain service jobs are identified in the manual and are recommended for use. Any part numbers given are only used for identification and easier differentiation between individual components, and are not intended for ordering purposes.

If your Mercedes-Benz model differs from the specifications contained in the manual you select, consult your authorized Mercedes-Benz dealer.

All procedures, illustrations and specifications contained in this manual were based on the latest information available at the time of publication. All rights are reserved to make production, design and specification changes at any time, without notice and without obligation to give notice. Any such changes will not be contained in this manual.

Caution!

The proper performance of service and repair procedures is essential for both the safety of the mechanic and the safe and efficient operation of the vehicle. The use of Incorrect service procedures and tools may greatly increase the risk of personal injury and render the vehicle unsafe. The procedures in this manual are described in such a manner that the service may be performed safely and accurately.

However, it is a general assumption that the reader is familiar with basic automotive repair procedures and Mercedes-Benz vehicles. You should not attempt to use this manual if this is not the case.

Mercedes-Benz of North America, Inc. assumes no liability for any damage to person or property caused by the utilization of this publication to effect maintenance or repair work on Mercedes-Benz automobiles.

MERCEDES-BENZ OF NORTH AMERICA, INC.
Technical Publications

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Instructions for use of service manual	00-005
Engine and vehicle identification	010
Vehicle identification number location	015
Technical data	020

Complete Service Manual coverage for late model year Mercedes-Benz vehicles requires four individual manuals:

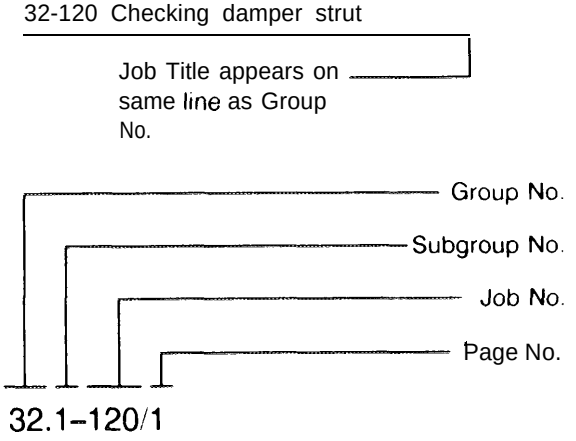
Service Manual, Engine
Service Manual, Transmission
Service Manual, Chassis and body
Service Manual, Heating and air conditioning

Throughout these manuals, the vehicles are identified by their chassis and engine numbers. These numbers are made up of the first six digits of the respective serial number. For the actual location of chassis and engine numbers, see page 00–015/1 In case where the repair instructions apply to all versions, only the first three digits of the respective number are referenced.

For example, chassis 201 applies to all 201 models. However, chassis 201.024 would only apply to model 190 E-2.3.

Location of specific repair instructions

First locate the Group No. in the Group Index. Individual groups are separated by an easily visible dividing page, which is followed by the job index page. Then check the job index for the exact job required. The first page of a typical job description looks like this:



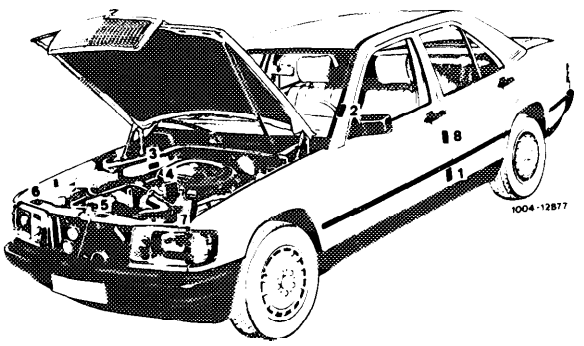
Technical data, tightening torques and tools are listed at the beginning of each job.

All dimensions are in metric units, unless otherwise Indicated. Any part numbers given are only used for identification and easier differentiation between individual components, and are not intended for ordering purposes,

This manual applies to the following passenger cars, starting model year 1984:

Model	Engine	USA Model Year From	To	Chassis
190 E 2.3	102.961/985	1984	1986	201.024
190 E 2.3	102.985	1987	1988	201.028
190 E 2.3-16	102.983	1986	1987	201.034
190 E 2.6	103.942	1987		201.029
190 D 2.2	601.921	1984	1985	201.122
190 D 2.5	602.911	1986		201.126
190 D 2.5 TURBO	602.961	1987	1987	201.128

00-015 Vehicle identification number locations



1. Certification Tag (left door pillar)
2. Identification Tag (left window post)
3. Chassis No.
4. Engine No.
5. Body No. and Paint work No.
6. Informatton Tag
   California version
   Vacuum line routing for emission control system
7. Emission Control Tag
8. Emission Control Tag Catalyst Information

Otto engines

Model	201.024	201.024	201.034	201.028	201.029
Sales designation	190 E 2.3	190 E 2.3	190 E 2.3-16V	190 E 2.3	190 E 2.6
Engine	102.961	102.985	102.983	102.985	103.942
Operation	4-cycle,electronic/mechanical gasoline injection system with airflow sensor (CIS-E)				
Number of cylinders	4				6
Cylinder arrangement	In-line, 15° inclination				
Bore/stroke mm	95.5/80.25				82.9/80.25
Total effective piston displacement cc	2299				2599
Compression ratio	8.0		9.7	9.0	9.2
Firing order	1-3-4-2				1-5-3-6-2-4
Maximum speed rpm	5700 ± 50	6200 ± 50	6800 ± 50	6200 ± 50	6550 ± 50
Engine output					
(SAE)kW/rpm	84/5000	90/5000	125/5800	97/5100	118/5800
net bhp/rpm	113/5000	120/5000	167/5800	130/5100	158/5800
Maximum torque					
Nm/rpm	181/3500	184/3500	220/4750	198/3500	220/4600
net lb-ft./rpm	133/3500	136/3500	162/4750	146/3500	162/4650
Crankshaft bearings	5 (multi-component friction bearings)				7
Valve arrangement	Overhead				
Camshaft arrangment	SOHC		DOHC	SOHC	
Oil cooling,			Oil to air cooler		
Cooling	Coolant circulating pump, thermostat with bypass line, fan with electromagnetic clutch, finned lube radiator		Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with electromagnetic clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator
Lubrication	Forced feed lubrication via gear-type pump				
Oil filter	Main flow filter				
Air cleaner	Dry air cleaner with paper cartridge				

Diesel engines

Model	201.122	201.126	201.128
Sales designation	190 D 2.2	190 D 2.5	190 D 2.5 Turbo
Engine	601.921	602.911	602.961
Operation	4 cycle diesel, MB prechamber design		
Number of cylinders	4	5	
Cylinder arrangement	In-line, 15° inclination		
Bore/stroke mm	87.0/92.4	87.0/84.0	
Total effective piston displacement cc	2197	2497	
Compression ratio	22.0:1	22.0:1	
Firing order	1-3-4-2	1-2-4-5-3	
Maximum speed rpm	4900-5100	5000-5300	
Engine output kW/rpm SAE net bhp/rpm	 54/4200 72/4200	 69/4600 93/4600	 92/4600 123/4600
Maximum torque Nm/rpm SAE net lbf-ft/rpm	 130/2800 96/2800	 165/2800 122/2800	 228/2400 168/2400
Crankshaft bearings	5	6	
Valve arrangement	Overhead	Overhead	
Camshaft arrangement	1 overhead camshaft	1 overhead camshaft	
Oil cooler	-	-	Oil-to-air cooler
Cooling	Coolant circulating pump, thermostat with bypass line, finned tube radiator, fan with electromagnetic clutch	Coolant circulating pump, thermostat with bypass line, finned tube radiator, fan with viscofan clutch	
Lubrication	Pressure lubrication via gear type pump		
Oil filter	Combined full flow and bypass filter	Full flow filter	Combined full flow and bypass filter
Air cleaner	Dry air cleaner with paper cartridrige		

Model	201.024	201.028	201.029	201.034	201.122	201.126	201.128
Sales designation	190 E 2.3	190 E 2.3	190 E 2.6	190 E 2.3-16	190 D 2.2	190 D 2.5	190 D 2.5 Turbo
Engine	102.961 /985	102.985	103 942	102.983	601.921	602.911	602.961

Dimensions

Vehicle length mm	4445	4445	4448	4430	4445	4445	4448
Vehicle width mm	1678	1678	1678	1706	1678	1678	1678
Vehicle height curb weight condition mm	1350	1390	1390	1361	1390	1390	1390
Wheelbase mm	2665						
Front track mm	1428	1437	1437	1446	1428	1437	1437
Rear track mm	1415	1418	1418	1429	1415	1418	1418
Turning circle min. diameter m	10.6	10.7	10.7	10.6	10.6	10.6	10.7
Vehicle weight, empty kg	1205 (MY 1984) 1210 (MY 1985)	1260	1285	1375	1200 (MY 1984) 1225 (MY1985)	1295	1365
Permissable total weight kg	1685 (MY1984) 1705 (MY1985)	1750	1765	1765	1680 (MY1984) 1725 (MY 1985)	1785	1850
Permissable axle load, front kg	790 (MY 1984) 805 (MY1985)	825	835	835	785 (MY 1984) 815 (MY 1985)	860	915
Permissable axle load, rear kg	895 (MY1984) 900 (MY1985)	925	930	930	895 (MY1984) 910 (MY 1985)	925	935

Model	201.024	20 1.028	201.029	20 1.034	201.122	201.126	201.128
Sales designation	190 E 2.3	190 E 2.3	190 E 2.6	190 E 2.3-16	190 D 2.2	190 D 2.5	190 D 2.5 Turbo
Engine	102.96 1 102.985	102.985	103 942	102.983	601.921	602.91 !	602.961
Electrical system							
Battery							
Voltage	12v	12 v	12 V	12v	12v	12 v	12v
Capacity	55 Ah	62 Ah	62 Ah	62 Ah	72 Ah	62 Ah	92 Ah
Starter Bosch	GF 12V 1.5 kW	12v 1.4 kW	12 V 1.7 kW	DW 12 V 1.5 kW	EV 12V 2.2 kW	EV 12 V 2.2 kW	DW 12 V 2.2 kW
Alternator	14 V 70 A'	14 V 70A	14 v 80A	14 V 70A	14 V.70A*	14 V.70A	14 V.70A
Filling capacities							
Fuel tank/reserve approx. l	551-7.5	5517.0	55/7.0	70/8.5	55/7.5	55/7.0	55/7.0
Engine oil initial filling approx. l	5.0	5.0	6.5	5.5	7.3	8.0	8.2
During oil and filter change approx. l	4.5	4.5	6.0	5.0	6.5	7.0	7.5
Marks on dipstick max./min. approx. l	4.3/2.8	*4.3i2.8*	5.7/3.7	4.8/2.8	5.0/3.0	5.5/3.5	6.0/4.0
Oil cooler approx. l				02		-	0.7
Cooling system with heater approx. l	8.5	8.5	9.0	80	8.5	8.0	9.0
Brake system approx. l	0.35						
Manual transmission ATF approx. l	1.5			1.6	1.5		-
Automatic transmission approx. l Initial filling/oil change approx l	6.6/5.9	7.1/6 0	7 1 6.0	7.1/6 0	6 615 9	6.6/5.5	7.1/6.0
Rear axle hypoid gear oil SAE 90 approx. l	0.7	1 1			0.7		1.1
Limited slip oil 00 589 0904 approx. l	-	-	-	1.2	-	-	-
Power steering	1.0						

	Job No.
Alternator	
Testrng alternator with regulator invehicle	15-600
Renewing fan assembly	642
Starter	
Removal and installation of starter	700
A. Engine 102 with GF starter (without countershaft)	
B. Engine 102 with countershaft starter	
C. Engine 601	

Test values

Regulating voltage — regulator

Regulating voltage (on battery) Volts (nominal value)	Engine speed 1/min	Battery load	Battery acid density kg/dm^3 [1])	Regulating voltage measured after
13.0-14.5	3000	Compulsory consumers only (e.g. ignition)	normal min. 1.24 tropics min. 1.19	approx. 2 minutes

1) If battery state of charge is less than 1.24 kg/dm^3 or 1.19 kg/dm^3, the regulator will not operate in regulation range during test, but will fully excite alternator, that ist, a defective regulator with continuous full excitation will not be recognized.

Charging current of alternator

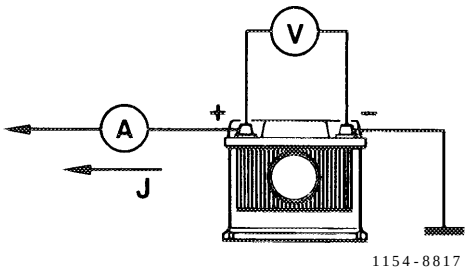
Engine	Alternator designation 14 volts/..... amps	Engine speed[4]) 1/min	Charging current amps	Ratio Engine/Generator
102	55	2680	55	2.35
102 (USA)	65	2680	65	2.35
102[1])	55	2830	55	2.23
102[1])[2])	55	2480	55	2.54
102[1])[2])[3]) (USA)	70	2480	70	2.54
601	55	2830	55	2.23
601[2])	55	2480	55	2.54
601[2])[3])	70	2480	70	2.54
602[2])	55	2480	55	2.54

1) Single-belt drive
2) With power steering
3) With air conditioning and Tempmatic climate control
4) Engine speed = alternator speed of 6300/min

Note: When checking charging current at 6000/min of alternator the voltage should not drop below 12.7 volts.

With engine stopped

1 Check battery and alternator connections, as well as grounding strap between engine and body for tight seat and perfect condition. In addition, check V-belt tension and pay attention to charge indicator lamp (Nom.: Key position 2 = check lamp on; Key position 0 and 1 = check lamp off).



1154-8817

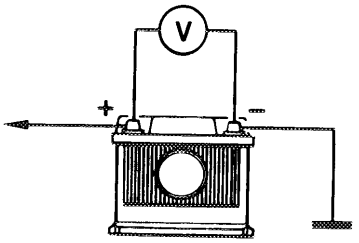
2 As a prerequisite for measuring regulating voltage, check acid density of battery in all cells.

Required values: normal min. 1.24 kg/dm³
tropics min. 1.19 kg/dm³

3 If discharge is supected, test battery discharge current (all consumers switched off, pay attention to time clock and consumers with rest potential input).

With engine running

4 Pay attention to charge indicator lamp at idle and at increasing engine speed (up to approx. 3000/min) – light should go out.



1154 – 8818

5 Check regulating voltage. Acid density of battery should amount to at least 1.24 kg/dm³ or tropics 1.19 kg/dm³. Run engine at 3000/min. Load battery with compulsory consumers only (e.g. ignition). Read regulating voltage after approx. 2 minutes of operation.

Nominal value 13.0-14.5 volts.

6 Testing charging current

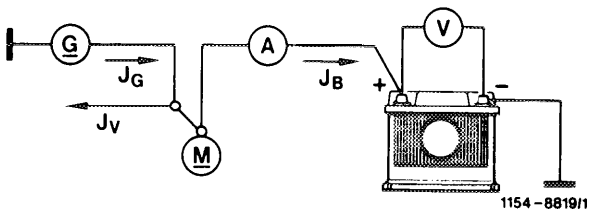
a) with ammeter

Run engine at idle to respective alternator speeds (refer to Table).

Load battery with installed consumers or with load resistance until max. charging current is attained. Regulating voltage should not drop below 12.7 volts.

Note: If measuring proceeds according to connection diagram on battery, the previously supplied current for compulsory consumers, e.g. ignition, fuel pump, must be added to the battery current measured.

When using DC clip-on, the entire charging current can be measured on alternator.

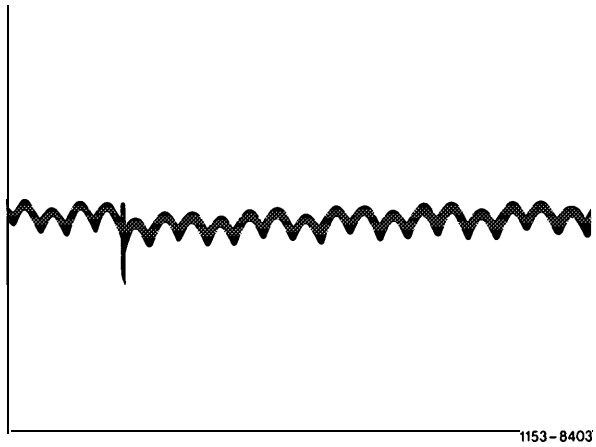


1154 – 8819/1

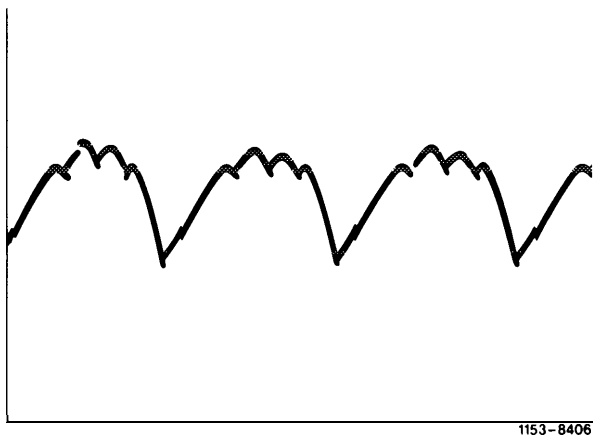
J_B Battery current
J_G Alternator current
J_V Consumer current

b) Diode test (harmony)

Evaluate harmony of regulating voltage (voltage flow) (measuring value or good/poor evaluation with oscilloscope). For this purpose, load battery with high beam at engine speed of 3000/min.



Alternator in order (voltage peaks possible — but without significance).



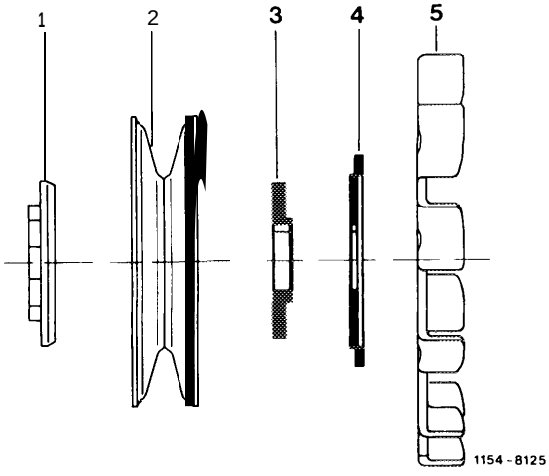
Alternator defective (example)

Tightening torques	Nm
Fastening nuts of fan assembly with divided pulley	**35-45**
Fastening nut of fan assembly with taper rib pulley	65 ± 5

Note

The fan disk is subject to considerably varying stresses. The extent of these stresses depends mainly on driving conditions. This is why, when reconditioning or exchanging alternators after driving for more than 100000 km, the fan assembly will also be replaced.

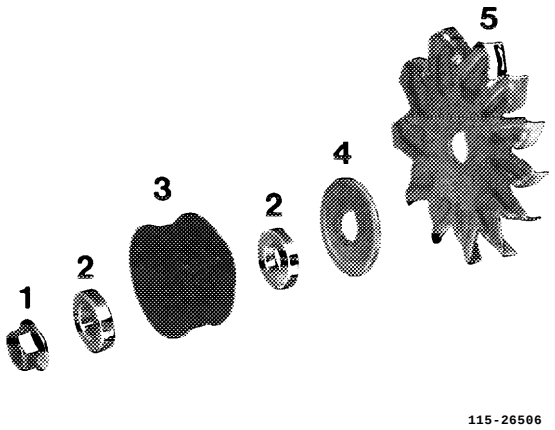
With divided pulley



1 Front groove disk
2 2-piece pulley
3 Rear groove disk
4 Supporting disk
5 Fan disk

With taper rib pulley

Holder, part no. 126 589 00 40 00 can be used for holding pulley, if fitted with a segment from taper rib pulley.



1 Flange nut
2 Spacing washer
3 Taper rib pulley
4 Supporting disk
5 Fan disk

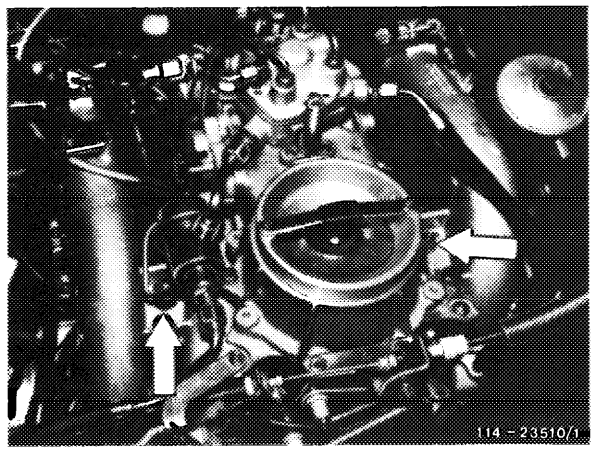
A. Engine 102 with GF starter (without countershaft)

Removal

1 Disconnect negative terminal of battery.

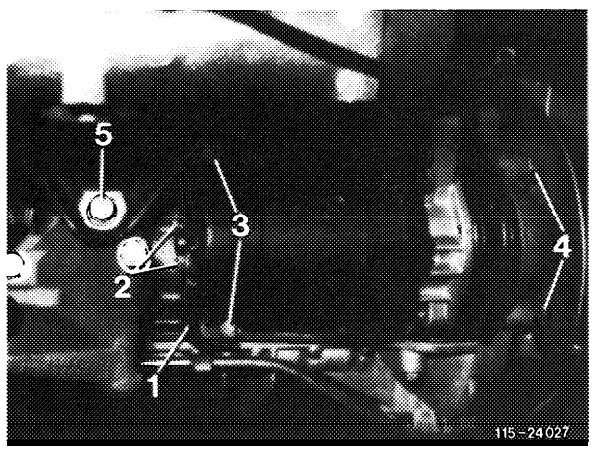
2 Remove air cleaner.

3 Remove intake manifold support.



Fastening of intake manifold support, top (arrows)

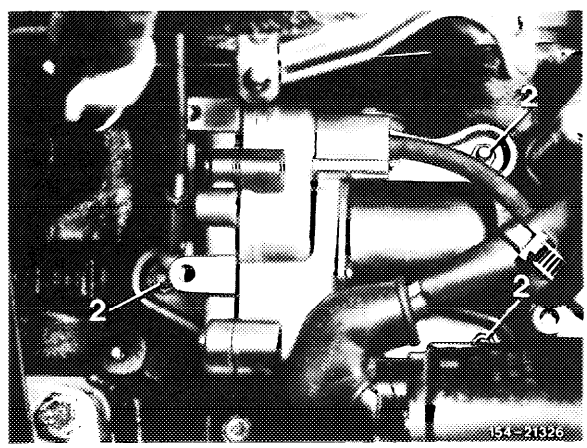
4 Disconnect return spring between throttle valve housing and intake manifold support.



Fastening (5) of intake manifold support, below

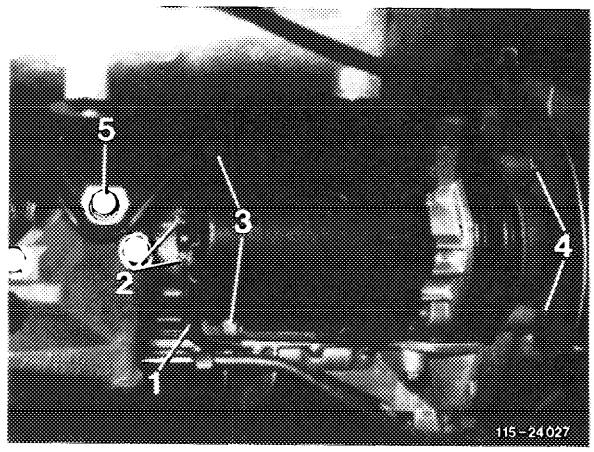
5 On vehicles with E-cruise control/tempomat, unscrew three fastening nuts of actuator, remove actuator from stud.

Note: The partial removal of actuator (E-cruise control/ tempomat) is required because the starter must be turned as much as possible in direction of engine block during removal.

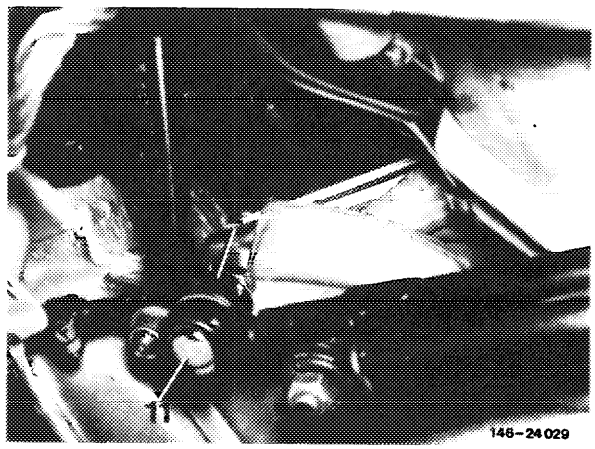


6 Unscrew support (1) on starter (2) and engine block (3).

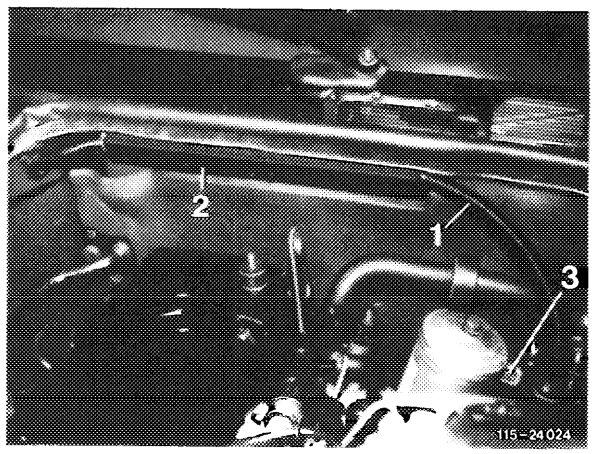
7 Unscrew starter from transmission (4).



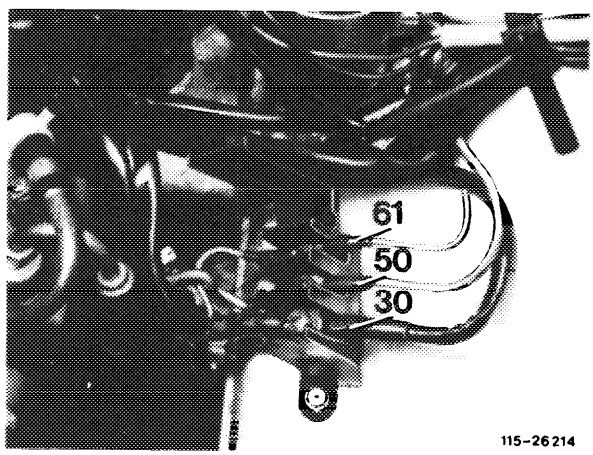
8 Pull drag link (11) from pitman arm (2).



9 Remove battery positive line (1), loosen fastening rail (2) and holder (3).

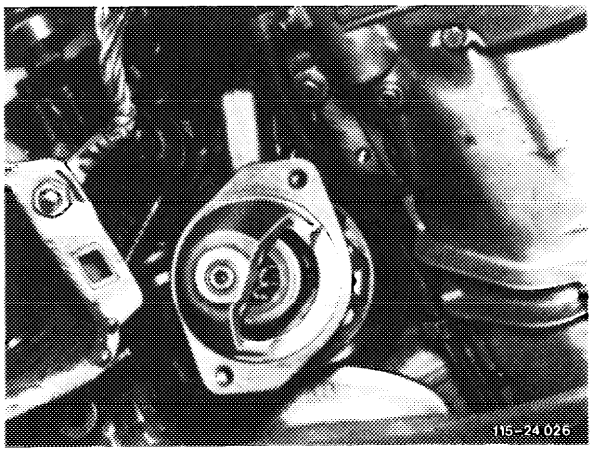


10 Unscrew lines, terminal 30 (color, red) and 50 (color, purple) on cable connector.

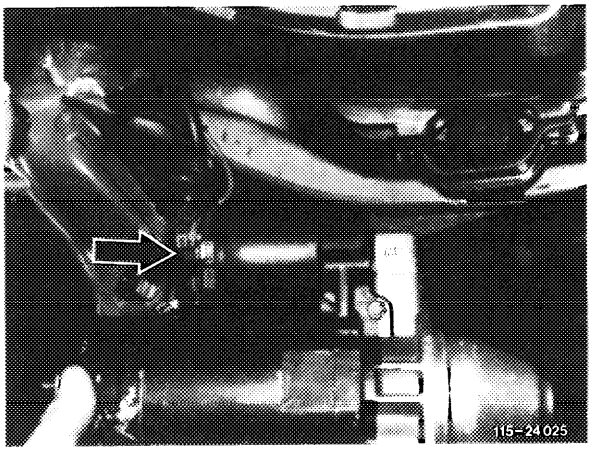


11 Turn steering wheel completely to the right.

12 Remove starter.



13 Disconnect electric lines on starter.



Installation

14 Connect electric lines to starter.

15 Introduce starter between steering and engine and screw to transmission.

16 Install support for starter.

17 Mount actuator for E-cruise control/tempomat.

18 Mount intake manifold support and engage return spring on intake manifold support and throttle valve housing.

19 Connect line, terminal 30 and terminal 50 to engine cable connector.

20 Install battery positive line (1), screw holder (3) to oil filter and mount fastening rail (2).

21 Mount drag link (11) on pitman arm (2).

22 Mount engine compartment lining.

23 Install air cleaner and connect negative terminal of battery.

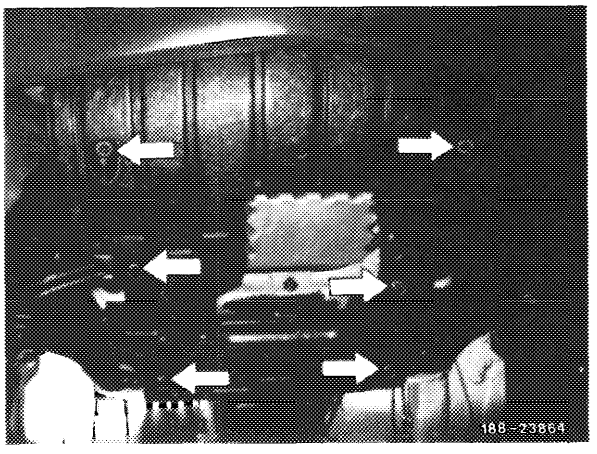
3. Engine 102 with countershaft starter

Removal

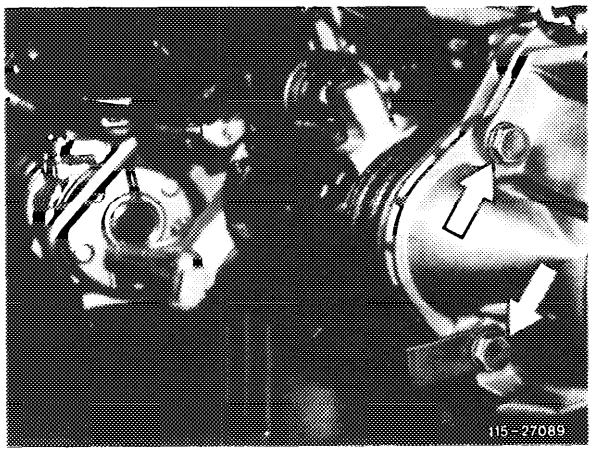
1 Disconnect negative terminal of battery.

2 Remove engine compartment lining below (if existing).

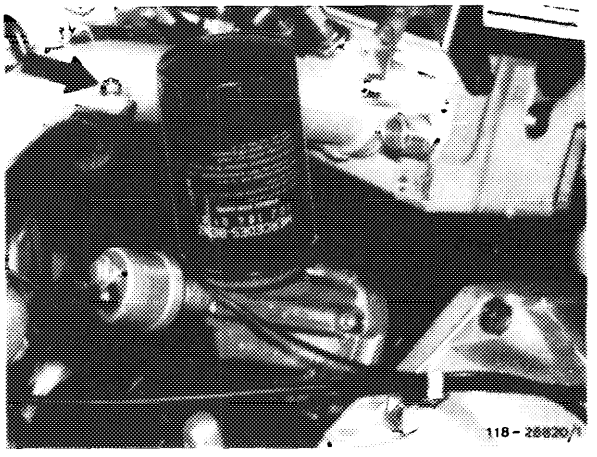
3 Remove air cleaner (model 201.024).



4 Unscrew starter from transmission.

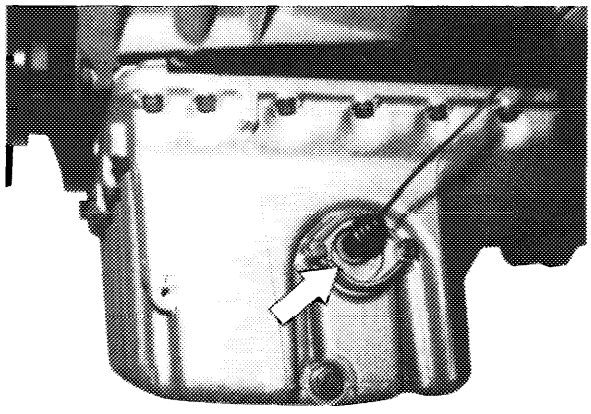


5 Loosen holder on intake manifold.



6 Pull plug from oil level indicator (arrow).

7 Turn steering wheel to the right,

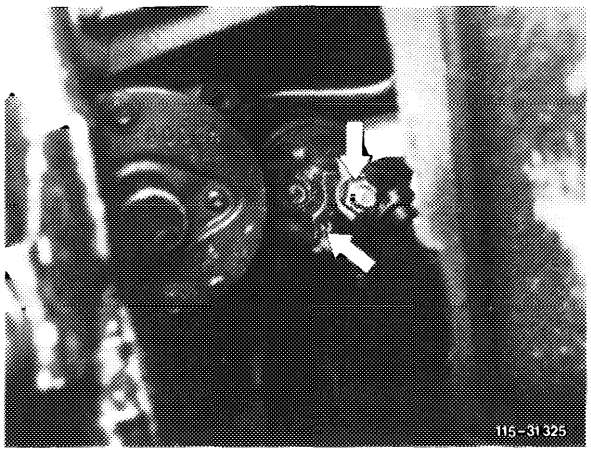


101 • 28890/1

8 Slightly pull out starter.

9 Disconnect electric lines on starter.

10 Remove starter.



Installation

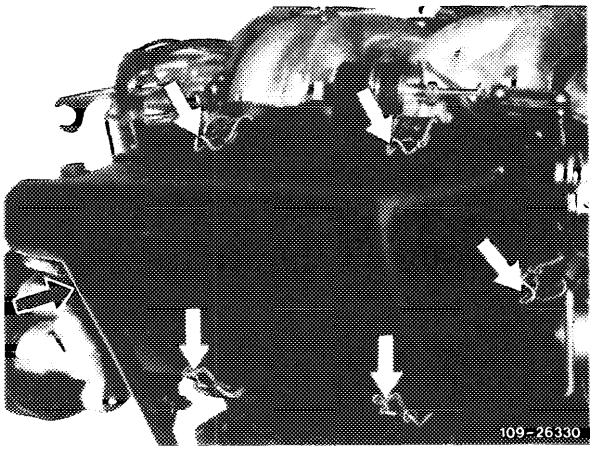
For installation proceed vice versa.

C. Engine 601

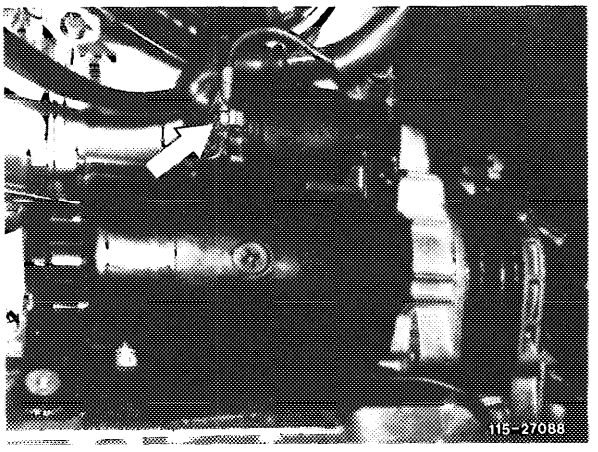
Removal

1 Disconnect negative terminal of battery.

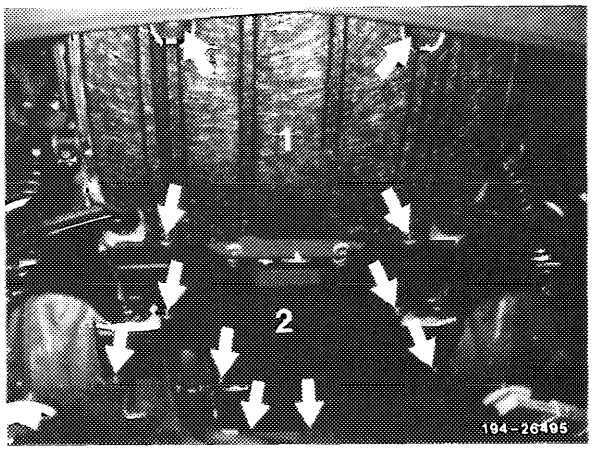
2 Completely remove air cleaner (09–400).



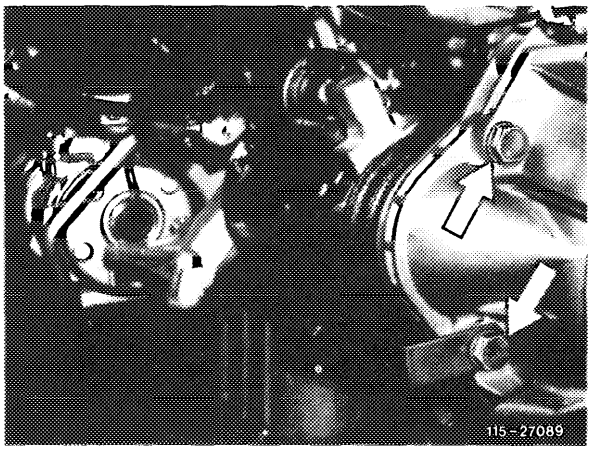
3 Disconnect electric lines terminal 30 and terminal 50 on starter.



4 Remove noise capsule rear (2).



5 Unscrew fastening screws of starter on transmission and remove starter in upward direction.



Installation

For installation proceed vice versa.

Job No.

Damper struts - shock absorbers

Removal and rnstallatron of damper strut 32-l 00
Removal and rnstallatron of rear shock absorber 110
Checking damper strut (front axle) 120
Checking shock absorber (rear axle) 121

Springs

Removal and rnstallatron of front spring 200

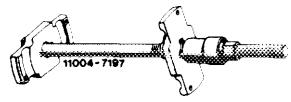
Torsion bars

Removal and rnstallatron of torsion bar on front axle 300
Removal and Installation of torsion bar on rear axle 310

32-100 Removal and installation of damper strut

Tightening torque	Nm
Hex. nut (self-locking) of upper damper strut suspension	60
Hex. screw for lower fastening of damper strut to steering knuckle	100
Hex. screw of clamp connection of damper strut on steering knuckle	75

Special tools

Spring tensioner for front spring		201 589 00 31 00
Hex. socket wrench element 32 mm 1/2'' square 284 mm long for spring tensioner		201 589 01 09 00

Note

Damper struts are simultaneously serving as deflection stop for front wheels. For this reason, loosen damper strut suspension only when the vehicle is resting on its wheels or when the control arm is supported or the spring tensioner is applied.

Always renew self-locking screws and nuts on principle!

In the event of repairs, damper struts can be individually replaced, independent of make. Only the version of damper struts according to color code e.g. 1 lengthwise line red or 2 lengthwise lines red must be in agreement.

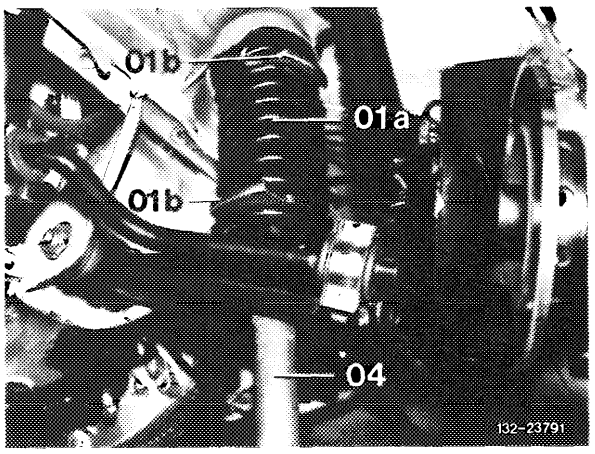
Removal

1 Jack up vehicle at the front, remove front wheel.

2 Insert spring tensioner (01) for front spring and tension spring until control arm is free of load (32-200).

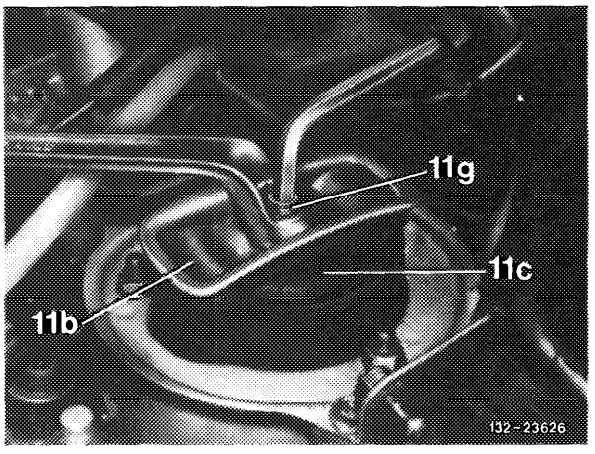
Note: Insert tensioning plates of spring tensioner offset by 90" into front spring in such a manner that 7 1/2 coils are engaged.

Attention!
Webs of tensioning screw and guide sleeve must be correctly seated in grooves of the two tensioning plates. Danger!



01 a Tensioning screw
01 b Tensioning plates
04 Tubular socket wrench

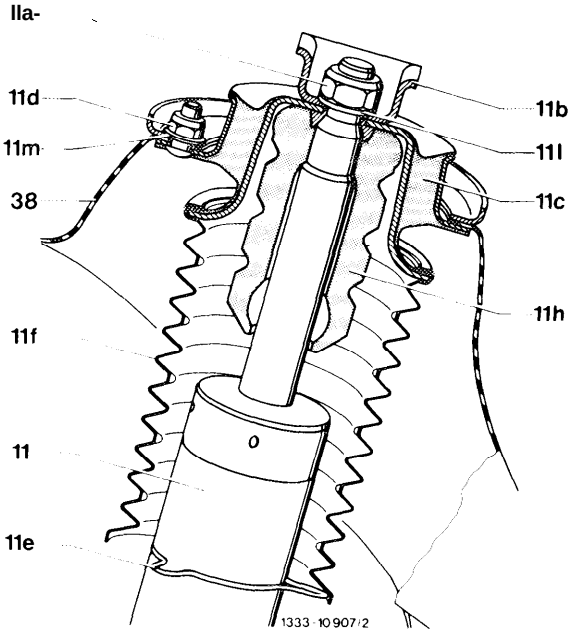
3 Loosen upper suspension of damper strut while supporting control arm.



11 b Spring release limit
1 lc Rubber mount
1 lg Piston **rod**

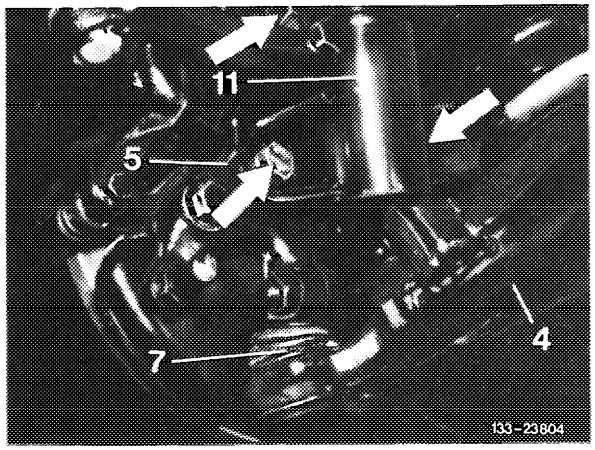
Attention!
When loosening upper damper strut suspension, pay attention to the following items:

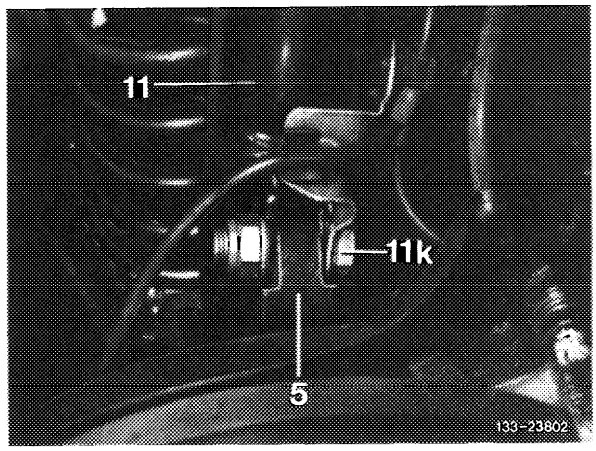
- Apply counterhold to piston rod (hex. socket wrench 8 mm)
- Do not use percussion wrench
- Do not unscrew hex. nut with axle half fully unsprung
- Control arm must be supported.



11 Damper strut
1 la Hex. nut
11b Spring **release stop**
1 lc Rubber mount
11d Hex. nuts
11e Stop ring
11f Sleeve
11 h PU auxiliary spring
11 l Washer B 15
11 m Washer
38 Front end

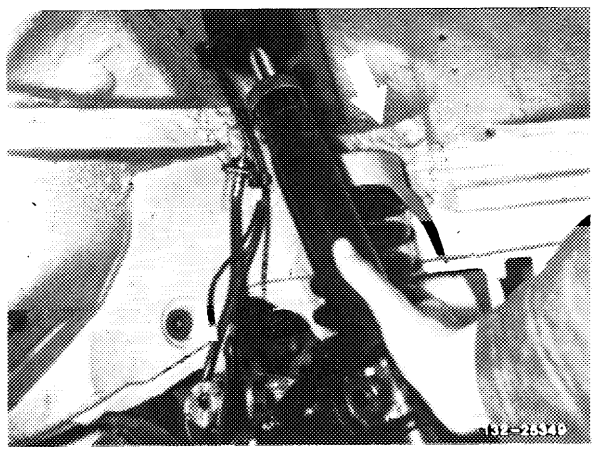
4 Unscrew hex. screws (arrows) and hex. nut (11k) of lower damper strut (11) suspension on steering knuckle (5).





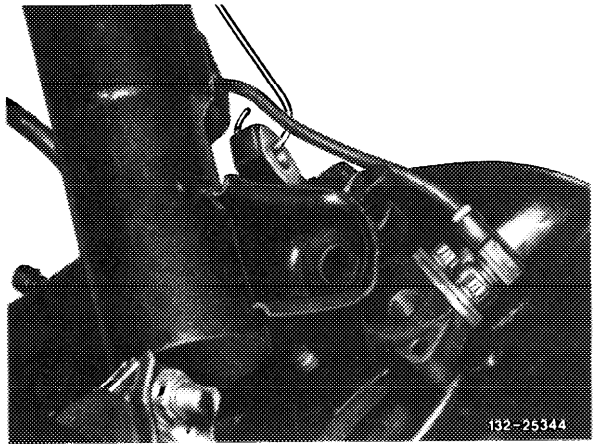
5 Steering knuckle
11 Damper strut
11 k Hex. screw with washers and self-locking hex. nut

5 Remove damper strut downwards in driving direction.



6 Protect steering knuckle with a hook against tilting.

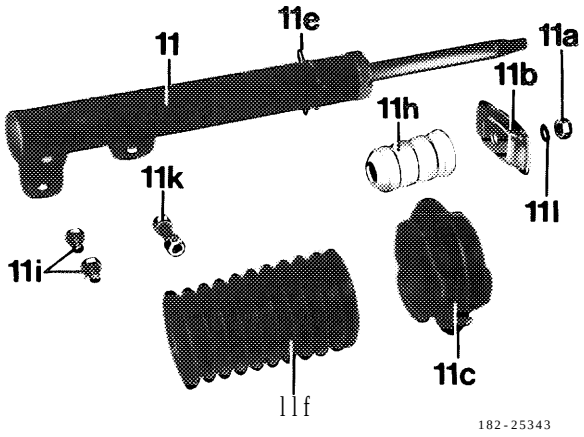
Do not expose brake hose, brake lining wear indicator and cable of rpm sensor for ABS to tensile stress.



7 Remove suspension members: PU auxiliary spring (11h) and stop ring (11e).

Note: The auxiliary spring (1 lh) is made of polyethane foam (PU) and is located between damper strut tube and rubber mount (1 lc) on piston rod.

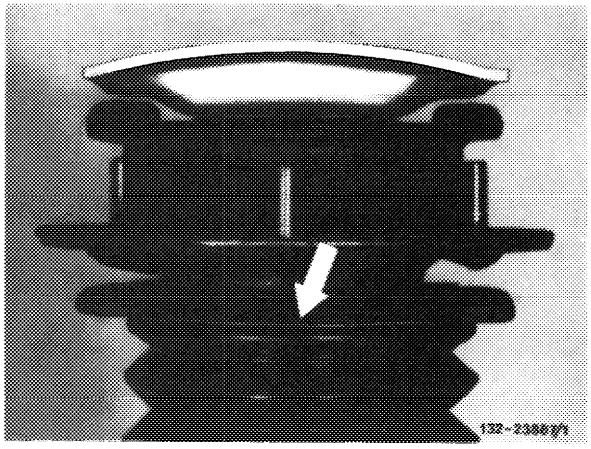
11 Damper strut
11 a Hex. nut
11 b Spring release stop
1 lc Rubber mount
11 e Stop ring
11f Sleeve
11 h PU auxiliary spring
11 i Hex. screw
11 k Hex. screw with washers and self-locking hex. nut
11l Washer



Installation

Note: If the rubber mount (1 lc) has been removed, mount with new self-locking hex. nuts (tightening torque 20 Nm).

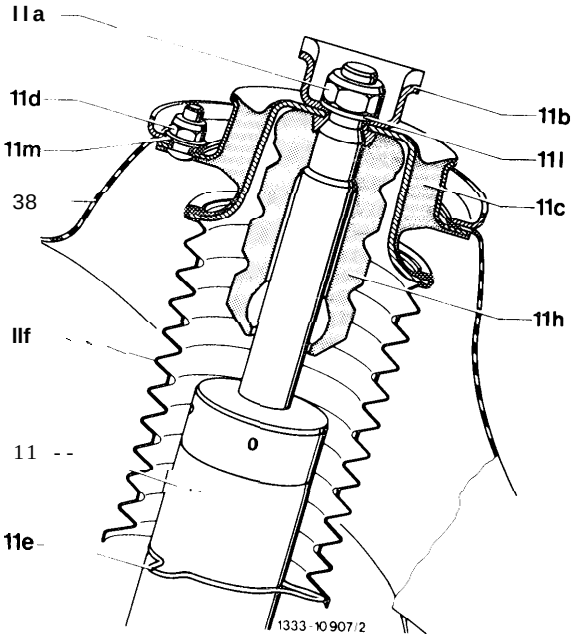
Prior to installing damper strut, connect sleeve on the two shorter collars to rubber mount (arrows).



8 Check suspension members. Clean steering knuckle on contact surface of lower damper strut suspension.

9 Mount suspension members: Place stop ring (1 le) over damper strut tube, hook to each other and slide up to thicker section or into ring bead. Slide polyethane foam PU auxiliary spring (11 h) onto piston rod.

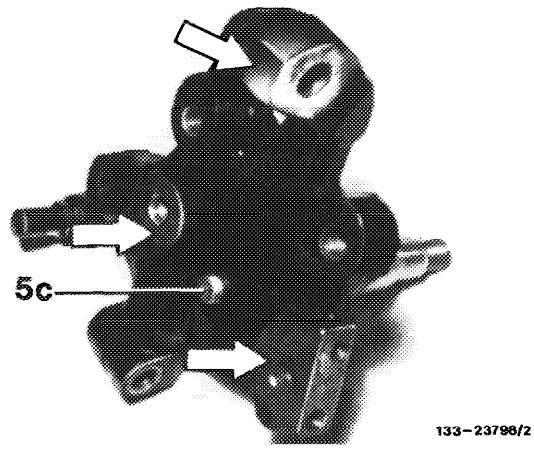
Note: The PU auxiliary spring is the same on vehicles with harder suspension for countries with poor road conditions.



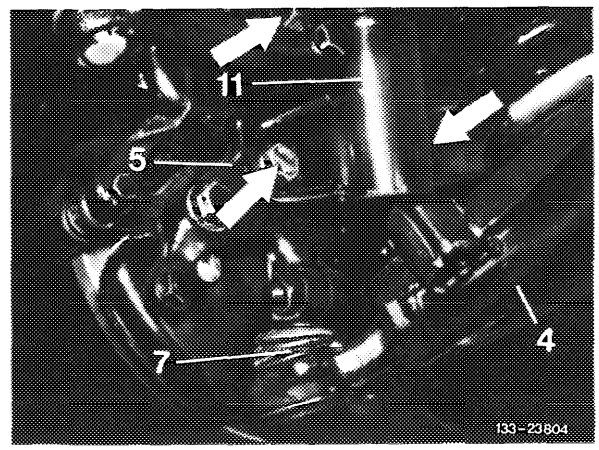
11 Damper strut
1 la Hex. nut
11 b Spring release stop
1 lc Rubber mount
11 d Hex. nuts
11 e Stop ring
11 f Sleeve
11 h PU auxiliary spring
11 l Washer B 15
11 m Washer
38 Front end

10 Introduce damper strut into rubber mount in front end.

Attention!
Locate steering knuckle and damper strut in relation to each other in longitudinal direction (caster) via centering bolt (5c) and in transverse direction (camber) via flats (arrows).

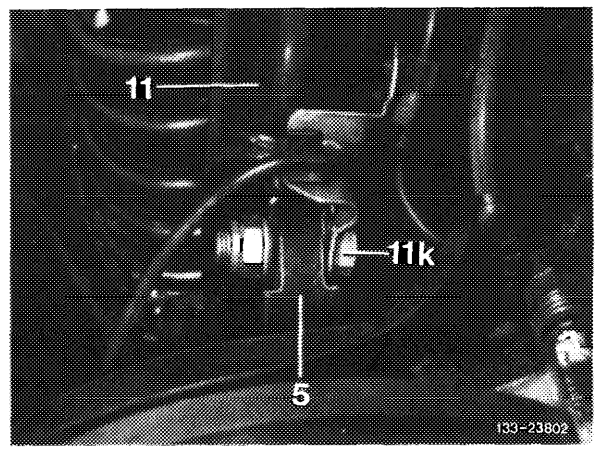


11 Mount lower damper strut suspension, inserting the two lower new self-locking hex. screws (arrows) and abut.



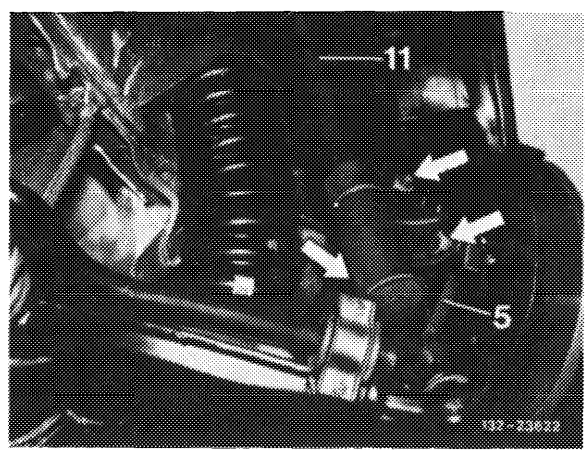
4 Control arm
5 Steering knuckle
7 Supporting joint
11 Damper strut

12 Push damper strut (11) at top to abut against steering knuckle (5), mount upper hex. screw with washers and new self-locking hex. nut (11 k) and tighten slightly, with face of steering knuckle resting inside against damper strut.



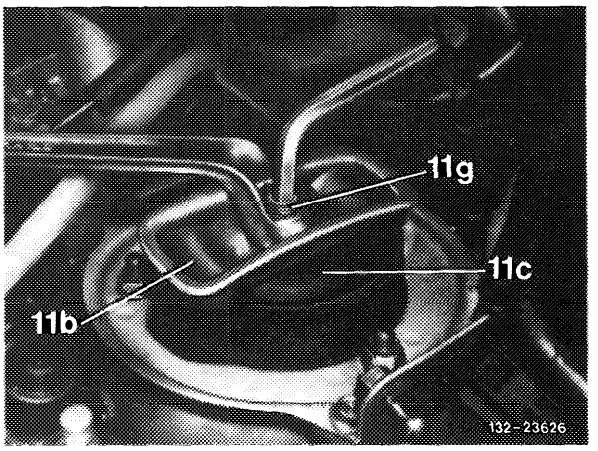
13 After inserting screws, tighten the two lower hex. screws first to 100 Nm and only then the hex. screw of upper clamping connection to 75 Nm (arrows).

Attention!
When assembling damper strut to steering knuckle, maintain specified sequence when tightening screws, since correct location in relation to steering knuckle by way of the three contact surfaces and thereby maintenance of camber tolerances depends on that sequence.



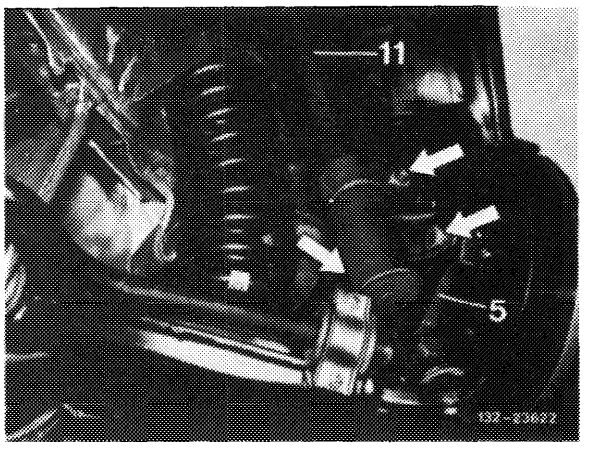
14 Lift front axle half with vehicle jack and mount upper damper strut suspension. Use new self-locking hex. nuts and washers and tighten to 60 Nm.

Do not use percussion wrench!

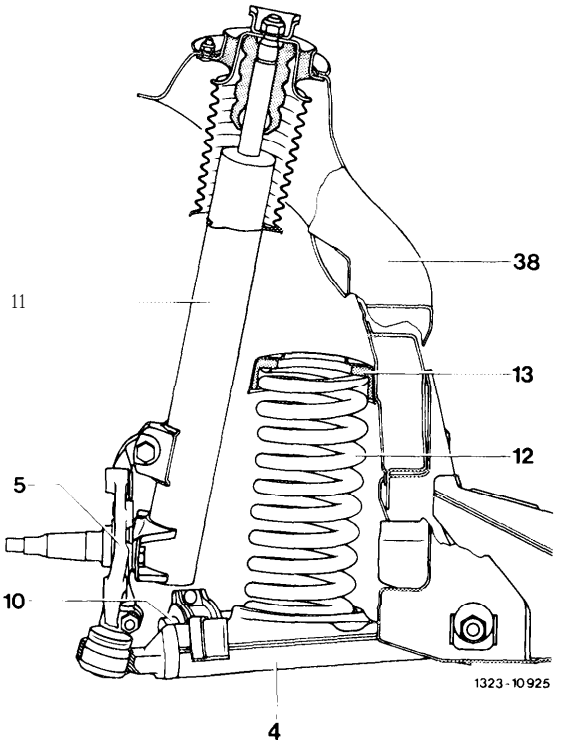


11 b Spring release limit
11 c Rubber mount
11 g Piston rod

15 Slacken front spring, while paying attention to correct seat of rubber mount in frame floor and to coil runout of spring in control arm (arrows) (32-200)



16 Mount front wheel (40-l 10), lower vehicle.



4 Control arm
5 Steering knuckle
10 Torsion bar
11 Damper strut
12 Front spring
13 Spring-rubber mount
38 Front end

32–110 Removal and installation of rear shock absorber

Tightening torques	Nm
Hex. nut of lower shock absorber suspension	65
Hex. nuts of upper shock absorber suspension	tighten up to thread runout

Note

The rear shock absorbers are simultaneously serving as a spring release stop for rear wheels. For this reason, loosen shock absorber suspension only when the vehicle rests on its wheels or when the spring link is supported. In the event of repairs and independent of make, the shock absorbers can be **individually** exchanged. Only the shock absorber version identified by color code e.g. 1 lengthwise line red or 2 lengthwise lines red must be in agreement.

Renew self-locking hex. nuts.

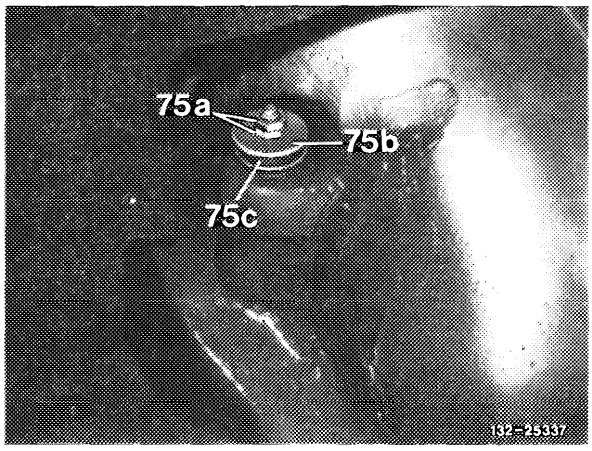
Attention!
When removing shock absorbers on jacked-up vehicle with axle half relieved, make sure that the shock absorber tube is not turning along while loosening the upper suspension, Since in this condition the spring release stop in shock absorber rests against power piston, the fastening of the power piston to piston rod might become loose. The gas pressure would then result in a sudden extension of piston rod and a loss of the oil in shock absorber (danger).

Removal

1 Remove trunk lining,

2 Unscrew hex. nuts (75a) of upper suspension, remove washer (75b) and rubber ring (75c).

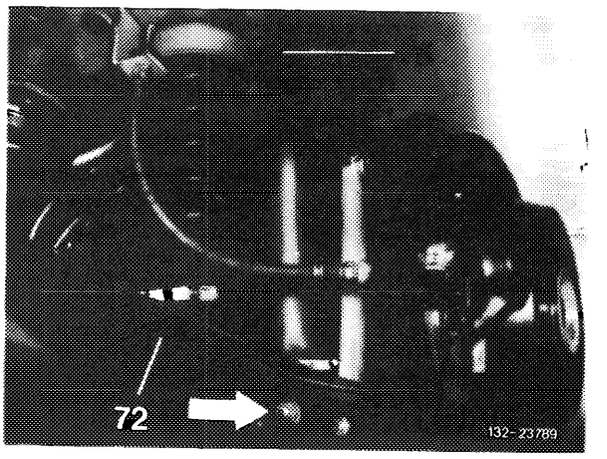
Note: If the shock absorber tube is turning along when the hex. nuts are unscrewed, hold tube manually in wheelhouse. Loosening of counternut requires a flat open-end wrench **(17** mm width between flats) and grind to thickness of 5 mm, if required.

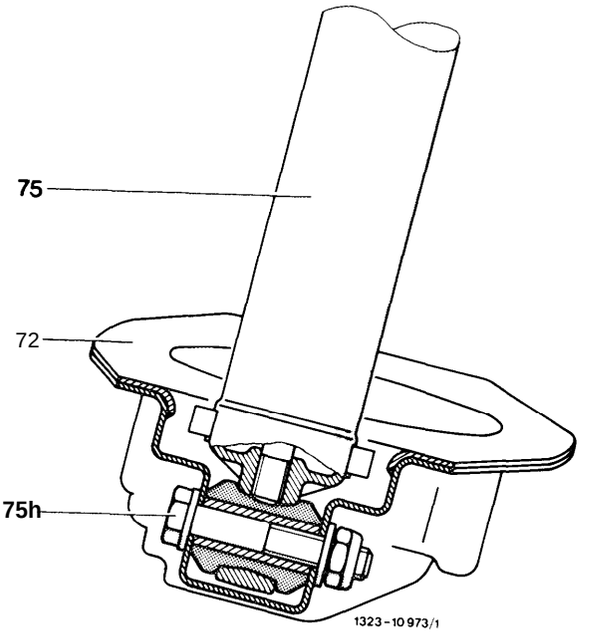


3 Jack up vehicle on rear axle.

4 Remove holding clamps of spring link cover and remove cover.

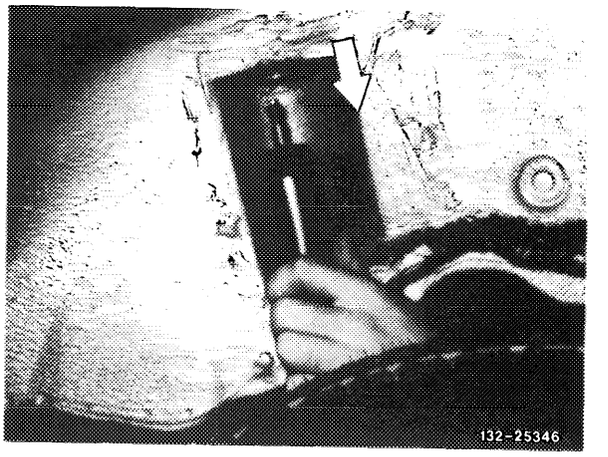
5 Loosen hex. nut of lower suspension on spring link (72) and remove hex. screw (arrow).

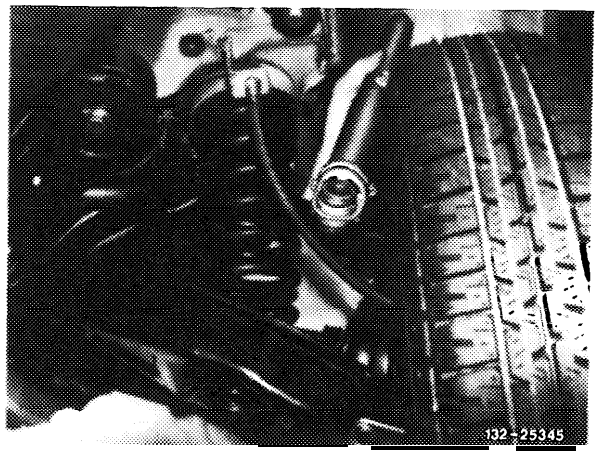




72 Spring link
75 Shock absorber
75h Hex. screw with washers and self-locking nut

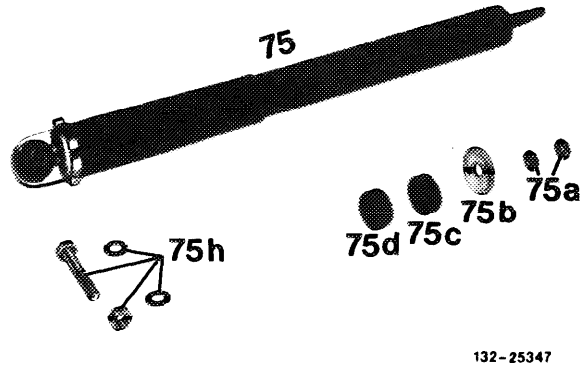
6 Push shock absorber in downward direction out of mounting bore in frame floor, remove shock absorber from spring link and take off in rearward direction.





Installation

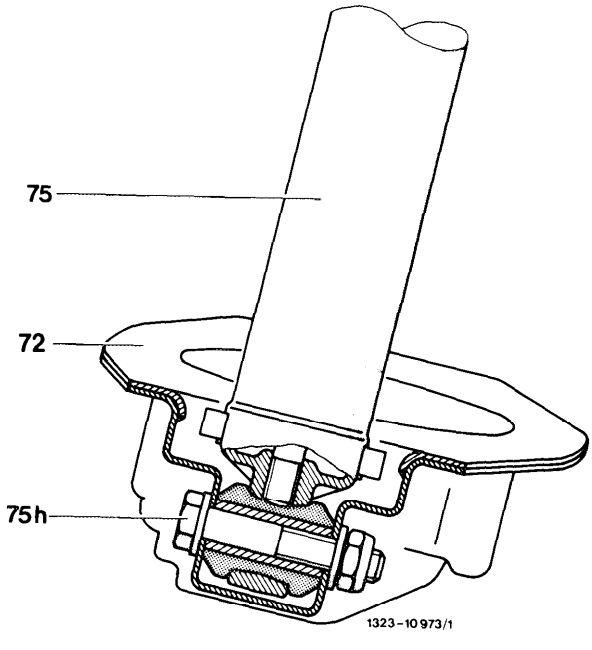
7 Check suspension members.



75 Shock absorber
75a Hex. nuts
75b Washer
75c Rubber ring, upper
75d Rubber ring, lower
75h Hex. screw with washers and self-locking nut

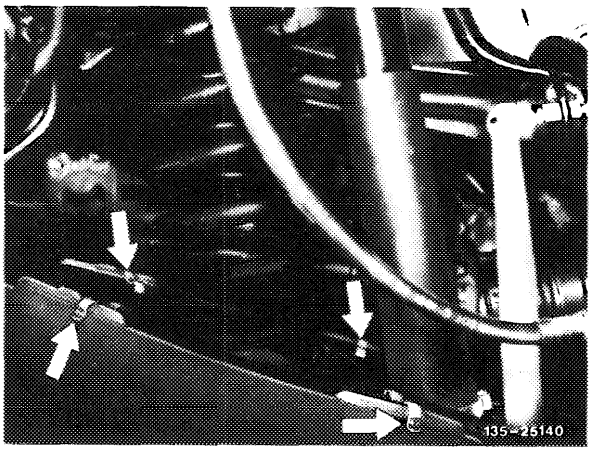
8 Place rubber ring (75d) on shock absorber.

9 Insert shock absorber and mount lower suspension. Tightening torque of self-locking hex. nut 65 Nm.



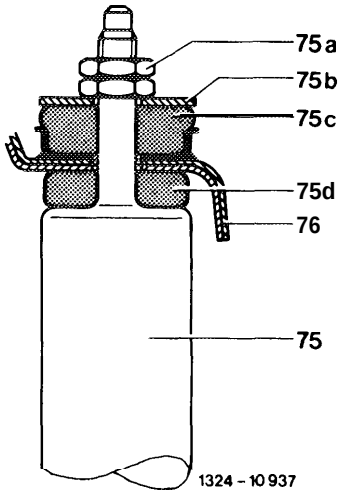
72 Spring link
75 Shock absorber
75h Hex. screw with washers and self-locking nut

10 Fasten spring link cover with 4 spring clamps (arrows).



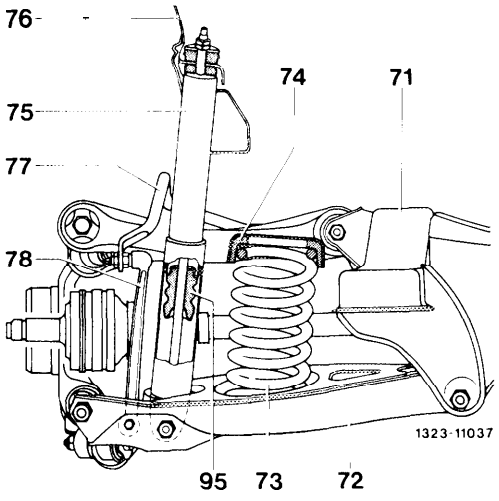
11 Lower vehicle.

12 Mount upper suspension, making sure that parts are correctly seated. Tighten lower of the two hex. nuts up to end of threads, then counterlock with upper nut.



75 Shock absorber
75a Hex. nuts
75b Washer
75c Rubber mount, upper
75d Rubber mount, lower
76 Frame floor

13 Install trunk lining.

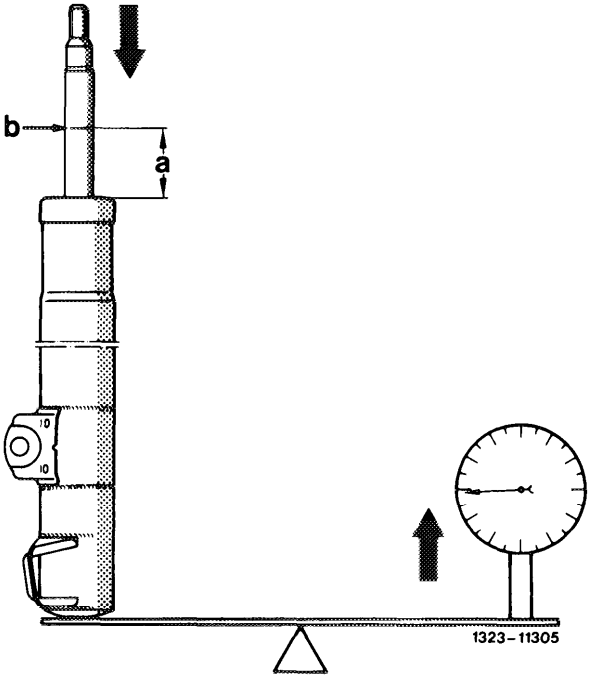


71 Rear axle carrier
72 Spring link
73 Rear spring
74 Rubber mount – rear spring
75 Shock absorber
76 Mandrel on frame floor
77 Torsion bar
78 Connecting rod for torsion bar
95 PU auxiliary spring

Test values of damper struts

Designation	Part No.	Color code on damper strut tube	Adjustment reference values in N at 100/min and 50 mm stroke for new damper struts		Checkup of oil reserve in damper strut[1] Gas extension force on piston rod including weight of damper strut (piston rod pushed in to test dimension a = 84)	
			Pull	Push	Value when new	Minimum value
Bilstein F & S	201 320 02 30	1 lengthwise line red	740	320	280 ± 30 N	170 N
	201 320 05 30	2 lengthwise lines red	1150	450		

[1]) For measuring oil reserve, temperature of damper strut should amount to approx. 20 °C.



a Distance for test mark
b Test mark on piston rod (apply prior to test to piston rod with a felt pencil or the like)

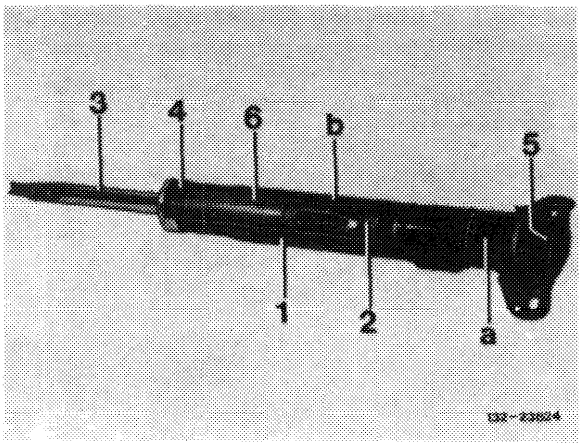
Attention! Do not damage piston rod.

Note

When testing and evaluating damper struts, always proceed on basis of design.

The damper strut is designed as a double tube gas pressure shock absorber without separating piston (installation position with piston rod in upward direction).

With shock absorber on rear axle, the oil and gas chamber is separated by a separating piston.



1 Damper strut tube
2 Power piston
3 Piston rod
4 Closing assembly with piston rod seal and piston rod guide
5 Floor valve
6 Power cylinder
a Working chamber
b Compensating chamber

Visual checkup

Carefully inspect piston rod for surface damage.

Check piston rod for distortion. A distorted piston rod shows up by binding during insertion into guide bushing.

Note: For lubrication of piston rod guide outside piston rod seal the design provides for a slight oil film on piston rod.

Checking oil reserve

The oil reserve is checked by means of extending force of piston rod in installation position of damper strut. During checkup, temperature of damper strut should amount to approx. 20 °C.

Checking requires a scale (for weighing material or persons) with a weighing range of O-40 kg.

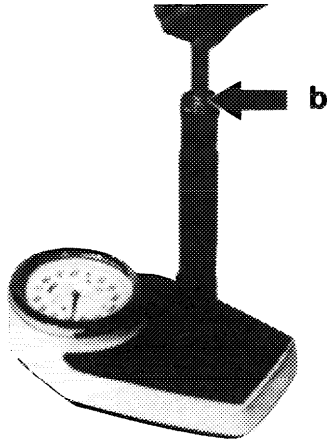
Test procedure

Prior to evaluation, push down piston rod in installation position (piston rod pointing upwards) several times for at least 100 mm. Damper strut can be evaluated when hissing sound is no longer heard while pushing down piston rod.

Write distance “a” = 84 mm onto piston rod by means of a felt pencil or the like.

Place damper strut on scale and push in piston rod up to test mark “b”.

Following a short stabilization period, read value on scale and compare with value in table. (The dead weight of the damper strut is taken into consideration in table values.)



132 - 25312

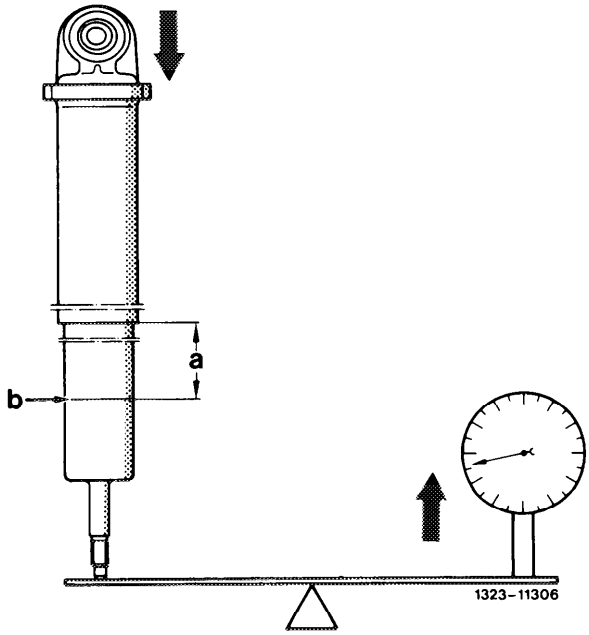
In the event of a gas or oil leak, the extension force of piston rod will be reduced. If the minimum value is exceeded, the damping force effect will be impaired and replacement is required.

Attention!
In the event of repairs, damper struts can be individually exchanged, independent of make. Only those damper strut versions which are identified according to color code e.g. 1 lengthwise line red or 2 lengthwise lines red must be in agreement.

Test values of shock absorbers

Designation	Part No.	Color code (mount shock absorber so that color code on tube can be seen from outside)	Adjustment reference values in N at 100/min and 50 mm stroke for new shock absorbers		Checkup of oil reserve in shock absorber[1] Gas extension force on piston rod including weight of shock absorber (piston rod pushed in to test dimension a = 84)	
			Pull	Push	Value when new	Minimum value
Bilstein F & S	201 326 05 00	1 lengthwise line red	930	360	260 ± 25 N	150 N
	201 326 06 00	2 lengthwise lines red	1150	450		

[1]) For measuring oil reserve, temperature of shock absorber should amount to approx. 20 °C.



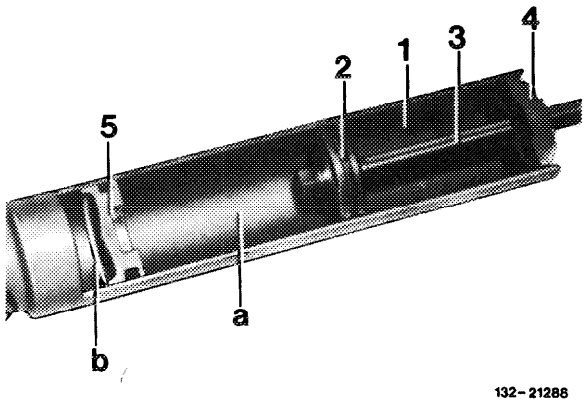
a Distance for test mark
b Test mark on shock absorber tube (apply prior to test to tube with a felt pencil or the like)

Note

Owing to the auxiliary spring made of polyethane foam (PU) integrated on piston rod between shock absorber tube and suspension rod, the conventional method for checking the oil reserve of single-tube gas pressure shock absorbers with separating piston by measuring piston rod extension is not possible.

For this reason, oil reserve is checked similar to front damper struts by way of piston rod extension force.

The difference with regard to damper strut is the spatial separation of oil and gas chamber by separating piston.



132-21288

1 Cylinder
2 Power piston with spring washers
3 Piston rod
4 Closing assembly with piston rod seal and piston rod guide
5 Separating piston
a Oil chamber
b Gas chamber

Visual checkup

Carefully inspect piston rod for surface damage.

Check piston rod for distortion. A distorted piston rod shows up by binding during insertion into guide bushing.

Note: For lubrication of piston rod guide outside piston rod seal the design provides for a slight oil film on piston rod.

Checking oil reserve

The oil reserve is checked by means of extending force of piston rod.

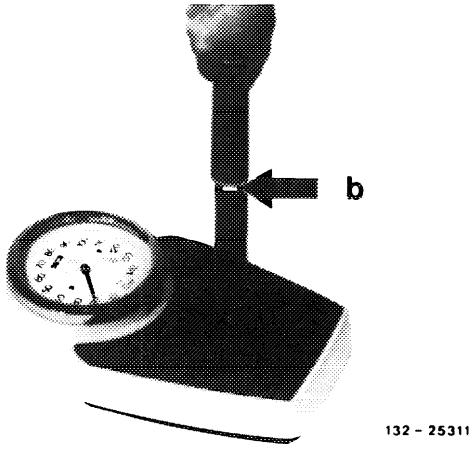
During checkup, temperature of shock absorber should amount to approx. 20 °C.

Checking requires a scale (for weighing material or persons) with a weighing range of O-40 kg.

Test procedure

Measure distance for test mark “a” = 84 mm (refer to table) on shock absorber tube starting from edge of rubber sleeve and write down with a felt pencil or the like.

Place shock absorber with piston rod in upward direction (i.e. fastening eye pointing upwards) on scale and push in up to test mark “b”. Compare indicated value with that in table. (The dead weight of the shock absorber is taken into consideration in table values.)



132-25311

In the event of a gas or oil leak, the extension force of piston rod will be reduced. If the minimum value is exceeded, the damping force effect will be impaired and replacement is required.

Attention!

In the event of repairs, shock absorbers can be individually exchanged, independent of make. Only those shock absorber versions which are identified according to color code e.g. 1 lengthwise line red or 2 lengthwise lines red must be in agreement.

Rumbling and knocking noises

Check upper suspension for correct assembly, lower suspension for tight seat of rubber mount in housing lug.

Determine oil reserve. If oil losses are high, shock absorbers with separating piston will develop a trend for knocking, since the piston rod may knock against separating piston during deflection.

A loose power piston may also be responsible for knocking noises.

To check, push in piston rod in installation position of shock absorber, release and push in again. A loose power piston will be noticed by a knocking noise during interchange of push and pull.

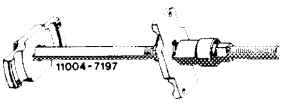
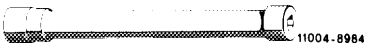
Hissing noises

In a leaking separating piston, shock absorbers with separating piston are showing a tendency toward hissing noises, whenever gas is entering the oil system and foaming will result. Such shock absorbers may very well be still functioning, but should nevertheless be replaced.

32-200 Removal and installation of front spring

Tightening torque	Nm
Hex. nut (self-locking) of upper damper strut fastening	60

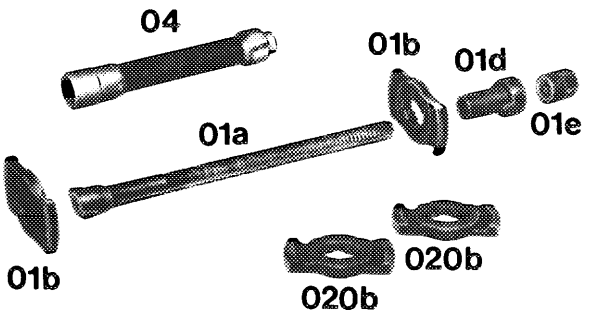
Special tools

Spring tensioner for front spring		201 589 00 31 00
Socket wrench element 32 mm 1/2" square 284 mm long for spring tensioner		201 589 01 09 00

Note

Damper struts are simultaneously serving as defelction stop for front wheels. For this reason, loosen damper strut suspension only when the vehicle is resting on its wheels or when the control arm is supported or the spring tensioner is applied.

Always renew self-locking screws and nuts on principle!



132 23616

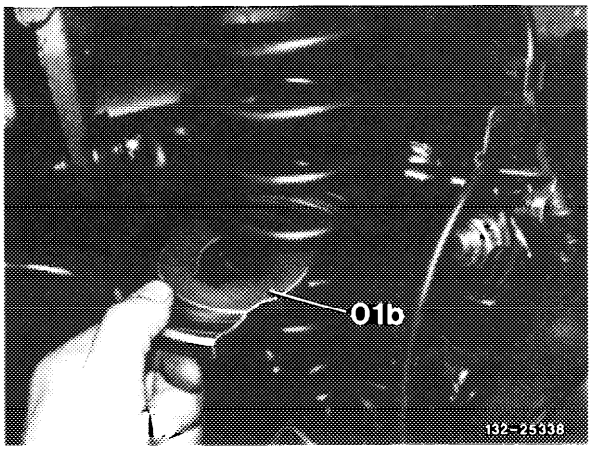
01a Tensioning screw
01 b Tensioning plates for front springs
01 d Guide sleeve
01e Nut
04 Tubular socket wrench
020b Tensioning plates for rear springs

Removal

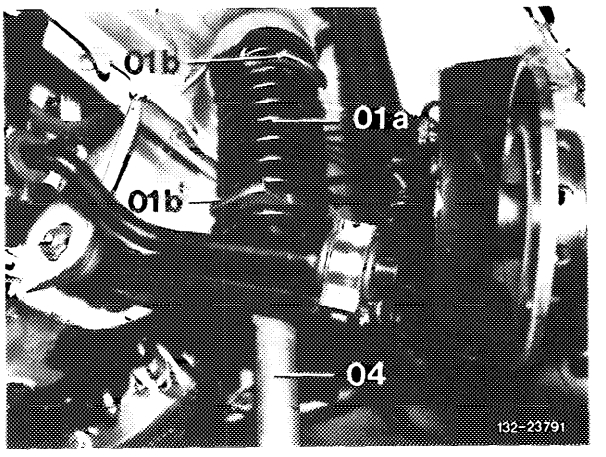
1 Jack up vehicle at the front, remove front wheel.

2 Remove engine compartment lining below, if installed.

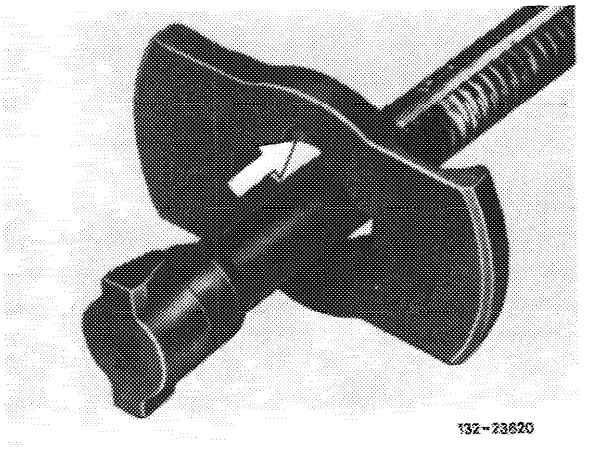
3 Insert tensioning plates of spring tensioner offset by 90" into front spring in such a manner that 7 1/2 coils are engaged.

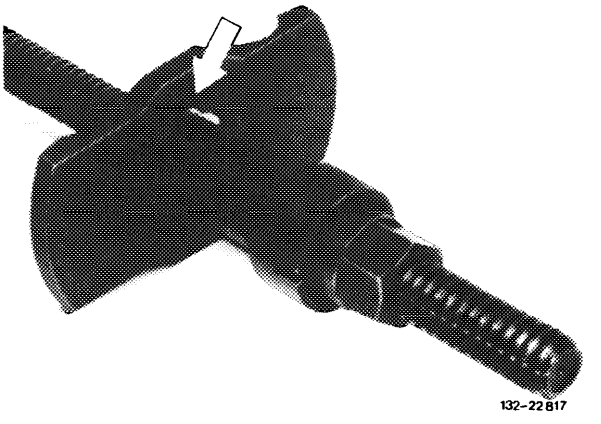


4 Insert tensioning screw (Ola) through opening in control arm.

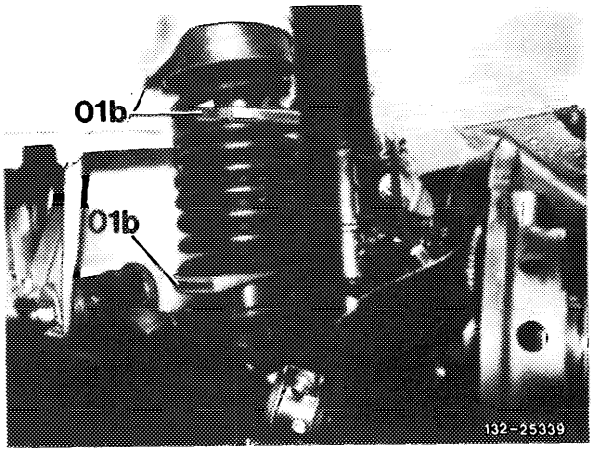


Attention!
Webs of tensioning screw and guide sleeve must be correctly seated in grooves of the two tensioning plates. Danger!





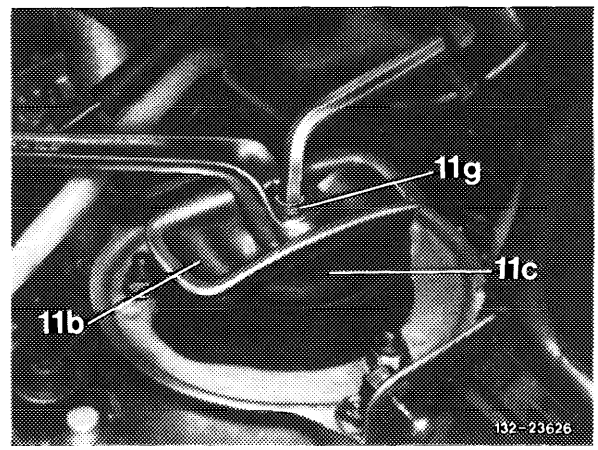
5 Tension front spring.



6 Loosen upper suspension damper strut while supporting control arm.

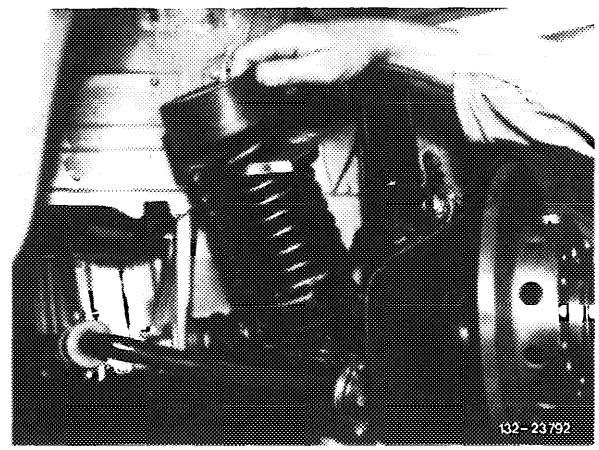
Attention!
When loosening upper damper strut suspension, pay attention to the following items:

- Apply counterhold to piston rod (hex. socket wrench 8 mm)
- Do not use percussion wrench
- Do not unscrew hex. nut with axle half fully unsprung
- Control arm must be supported.

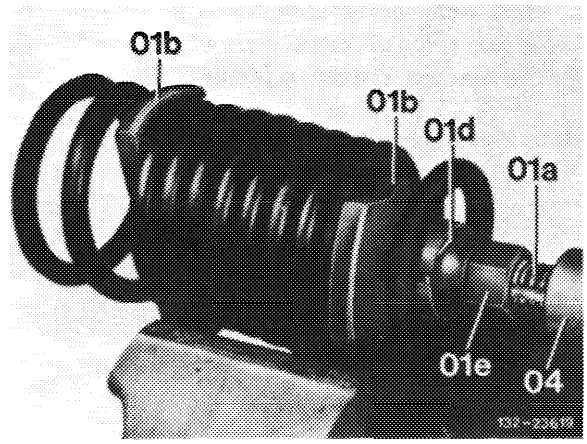


11b Spring release limit
11c Rubber mount
11g Piston rod

7 Slightly lower front axle half and remove front spring with rubber mount in forward direction.



8 Slacken front spring in vise.



01a Tensioning screw
01b Tensioning plates
Old Guide sleeve
01e Nut
04 Tubular socket wrench

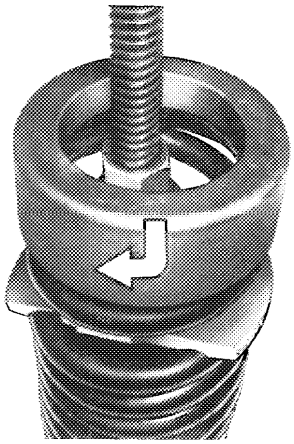
Installation

Note: Prior to installing front spring, make sure that the control arm in range of spring contact surface is free of dirt.

9 Tension front spring along 7 1/2 coils, while positioning tensioning plates offset by 90°.

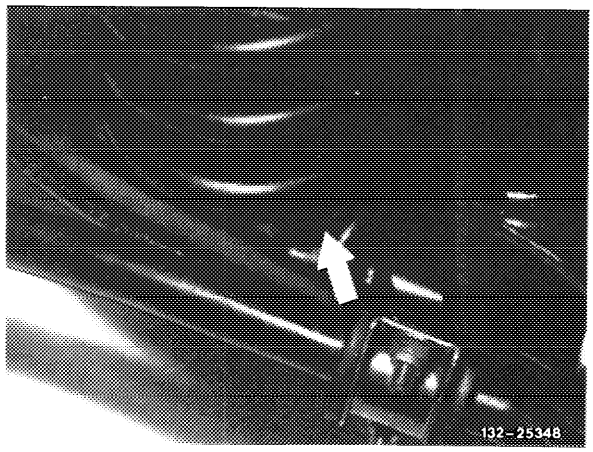
Attention!
Webs of tensioning screw and guide sleeve must be correctly seated in grooves of the two tensioning plates. Danger!

10 Place rubber mount with a screwing motion to front spring.



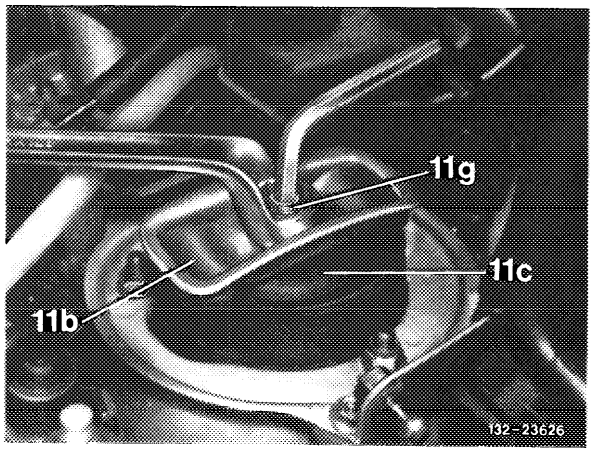
132-21283

11 Introduce front spring so that the coil runout is located in impression of control arm.

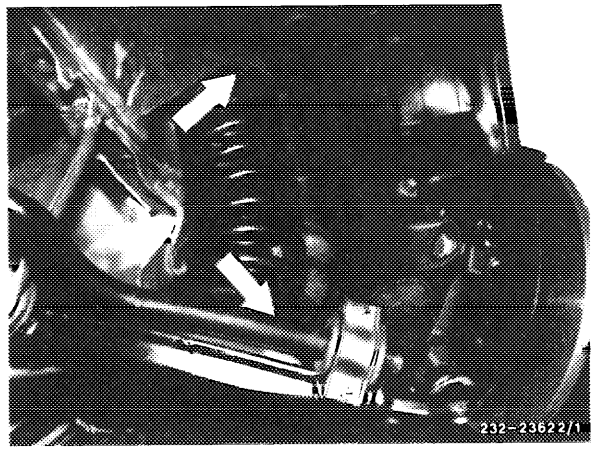


12 Lift front axle half with vehicle jack and mount upper suspension of damper strut with new self-locking hex. nut. Tightening torque 60 Nm.

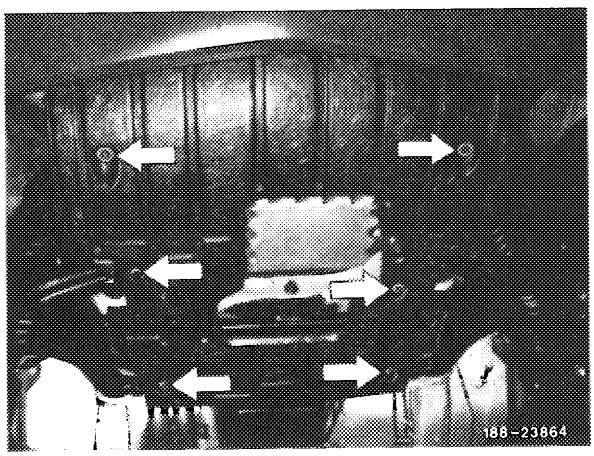
Note: Do not use percussion wrench!



13 Slacken front spring while paying attention to correct seat of rubber mount in frame floor and of spring coils in control arm (arrows).



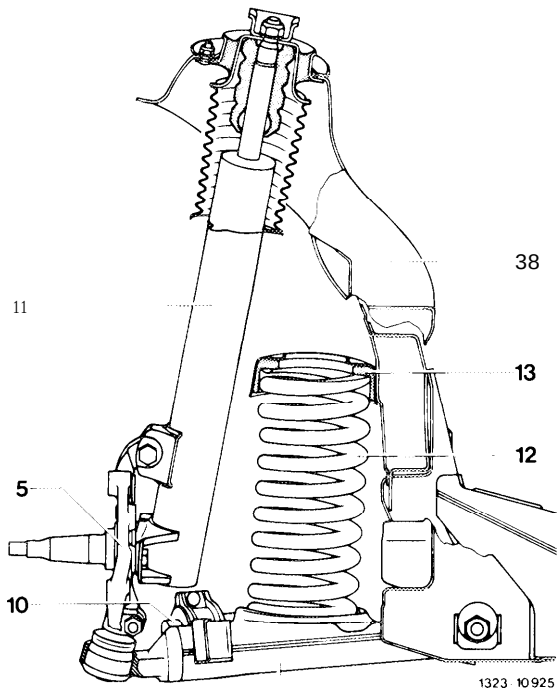
14 Mount engine compartment lining below.



15 Mount front wheel, lower vehicle.

16 Check vehicle level at front axle (40-300).

17 Check adjustment of headlamps.



4 **Control** arm
5 Steering knuckle
10 Torsion bar
11 Damper strut
12 Front spring
13 **Spring rubber mount**
38 Front end

4

32-300 Removal and installation of torsion bar on front axle

Data

Torsion bar Part No.	Dia.	Rubber mount of torsion bar bearing Part No.	Bore dia.
201 323 47 65 201 323 52 65[1)]	22	201 323 48 85	22

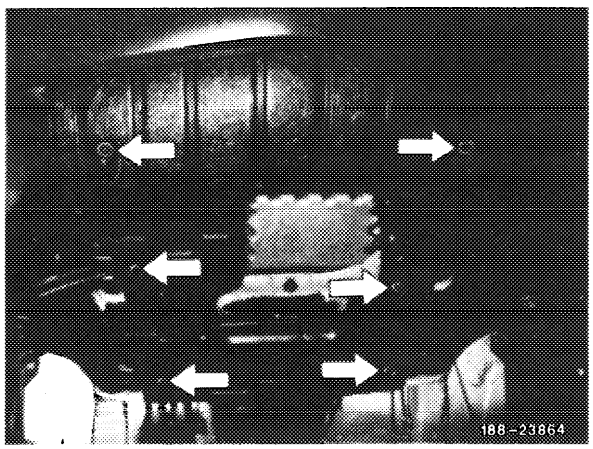
1) Vehicles with air conditioning

Tightening torques	Nm
Hex. nuts of torsion bar bearing on control arm	20
Hex. bolts and nuts of torsion bar bearing on spring leaf rocker	20
Hex. bolts of spring leaf rocker for torsion bar on frame	60

Note

Mount and tighten torsion bar bearing on control arm and on spring leaf rocker only in the position corresponding to a condition ready for driving.

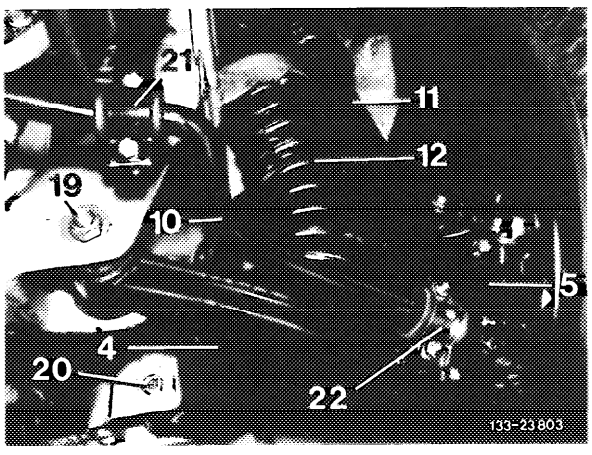
Always replace self-locking screws and nuts on principle!



Removal

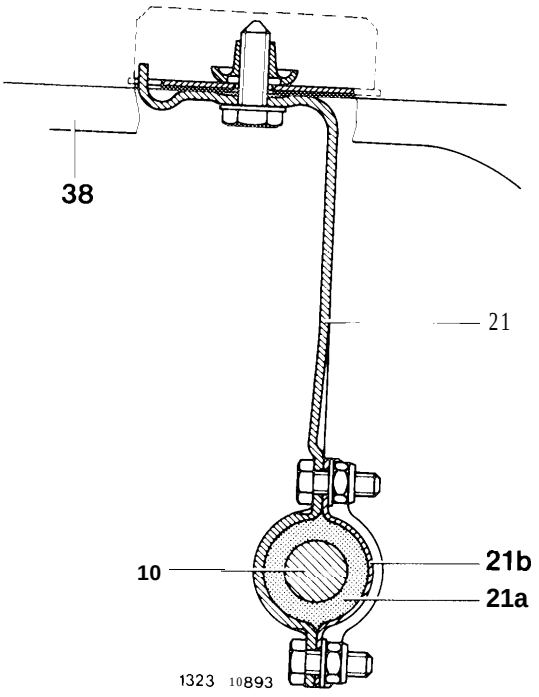
1 Remove engine compartment lining below, if installed.

2 Loosen and remove holding clamp of torsion bar bearing (22) at left and right on control arm (4).



3 Loosen bearing on spring leaf rockers and remove torsion bar.

Note: Rubber mounts of torsion bar have no slot, for this reason use a rubber lubricant (e.g. sliding paste A 000 989 01 60) for removal and installation.



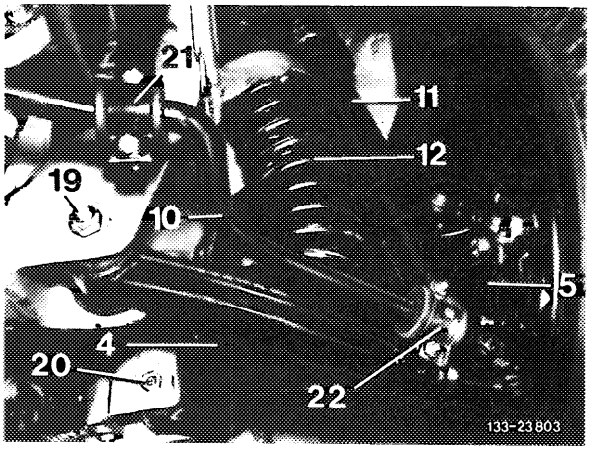
10 Torsion bar
21 Spring leaf rocker
21a Rubber mount
21 b Holding clamp
38 Front end

Installation

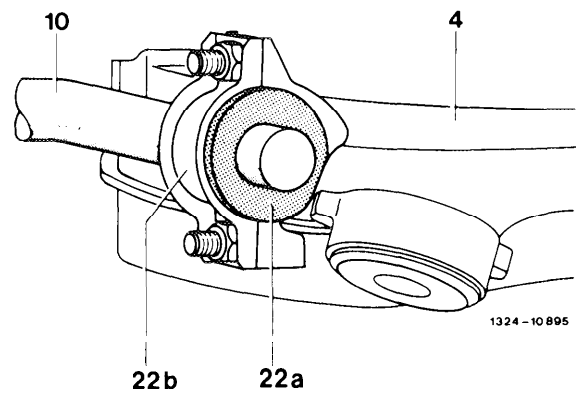
4 Check rubber mount of torsion bar bearing as well as suspension members.

5 Mount rubber mount on torsion bar while coating inside of rubber mounts with rubber lubricant.

6 Mount torsion bar (10) on both spring leaf rockers (21). Tightening torque of new self-locking hex. nuts 20 Nm.



7 Fasten torsion bar suspension on control arm left and right. Tightening torque of new self-locking hex. screws is 20 Nm.



4 Control arm
10 Torsion bar
22a Rubber mount
22b Holding clamp

8 Mount engine compartment lining, below.

32-310 Removal and installation of torsion bar on rear axle

Data

Model	Torsion bar Part No.	Dia	Rubber mount of torsion bar bearing Part No.	Bore dia
201.022	201 3262265	13	201 3261081	13
201.024	201 3261765			

Tightening torques		Nm
Hex. bolts of torsion bar bearing on frame floor		20
Ball joints of connecting rod between torsion bar and spring link of rear axle	on torsion bar	30
	on spring link	20
Hex. screws (self-locking) for fastening front rubber mount to frame floor		70
Hex. screws for fastening propeller shaft intermediate bearing to frame floor		25
Self-locking hex. nuts for fastening companion plate		45
Self-locking hex. socket screw for fastening ABS rpm sensor to rear axle center piece		8

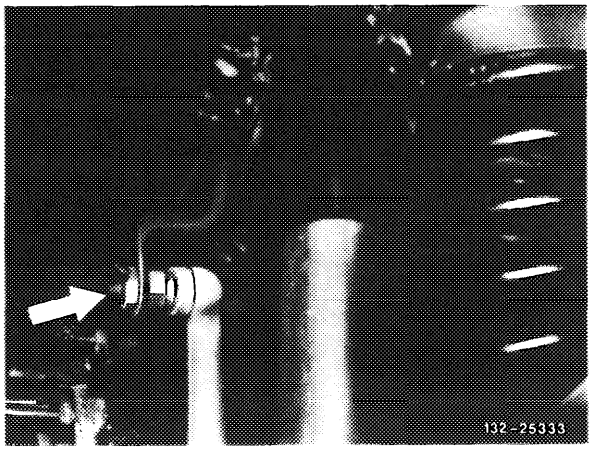
Note

Always renew self-locking screws and nuts on principle!

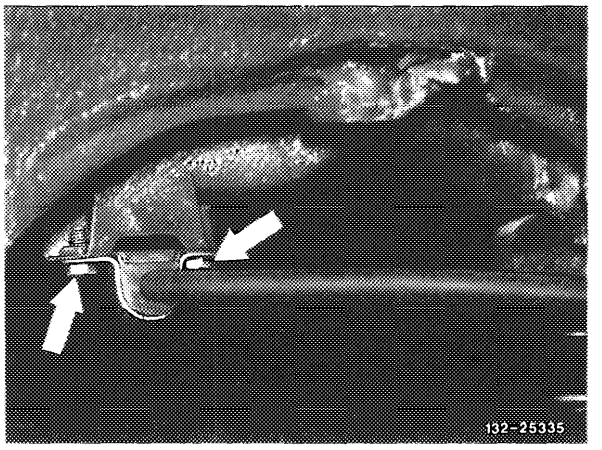
Removal

1 Jack up vehicle at rear, remove rear wheels.

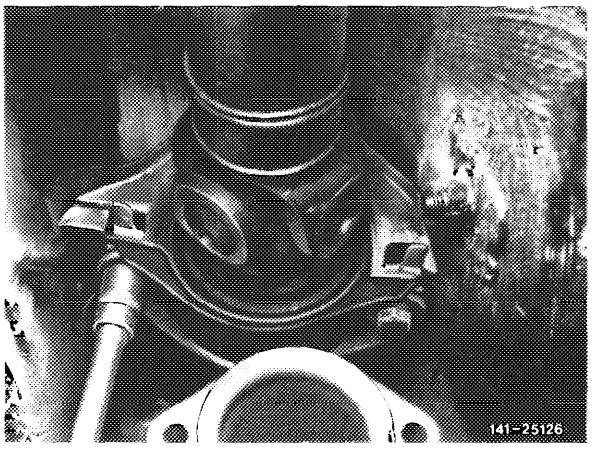
2 Unscrew both hex. nuts (arrow) of connecting rod left and right.



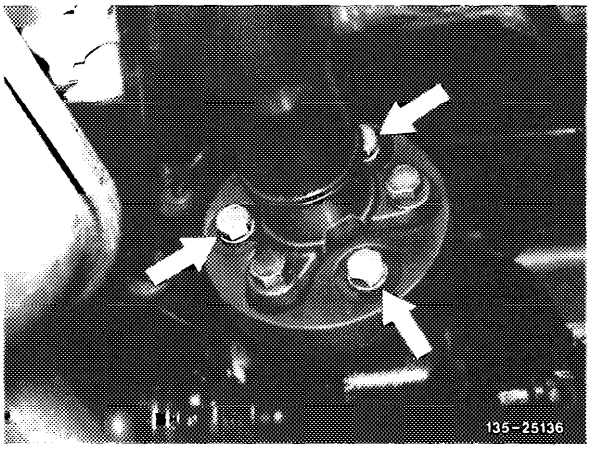
3 Unscrew hex. screws of torsion bar bearing on frame floor, remove rubber mounts.



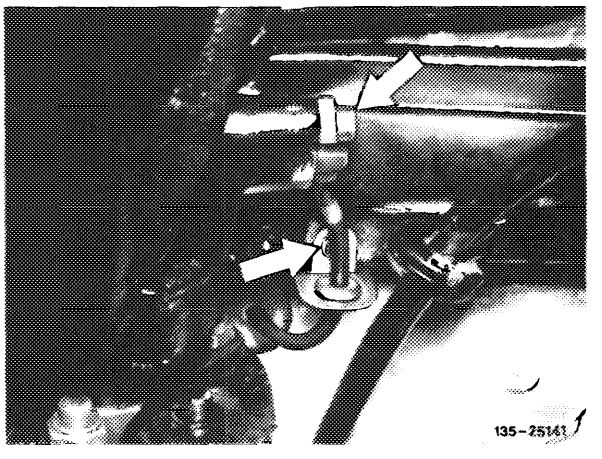
4 Loosen propeller shaft intermediate bearing.



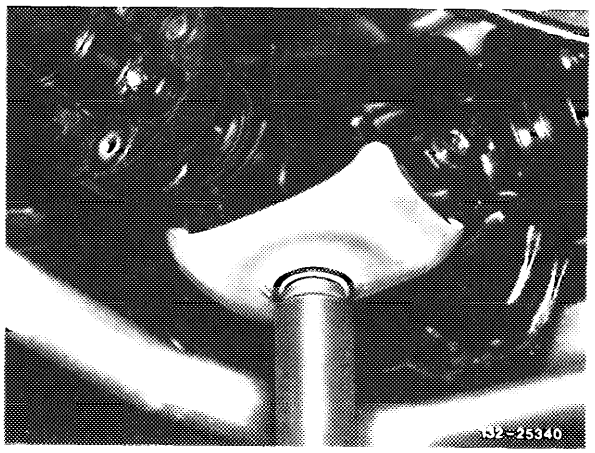
5 Separate propeller shaft at rear axle center piece.

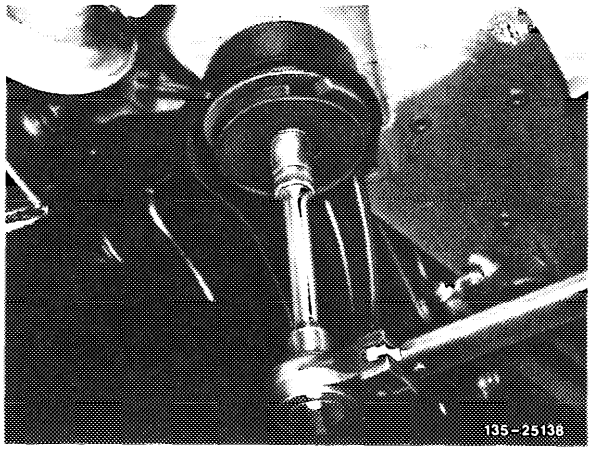


6 On vehicles with ABS, remove rpm sensor after loosening hex. socket screw with cable (arrows) (42-714).

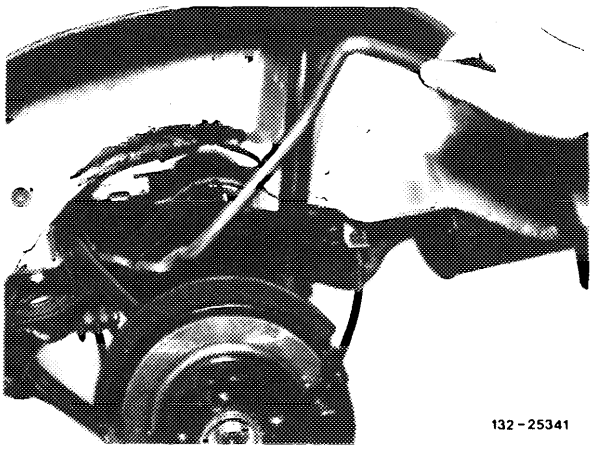


7 Unscrew both hex. screws of front rear axle bearing on frame floor, while supporting rear axle center piece with vehicle jack.

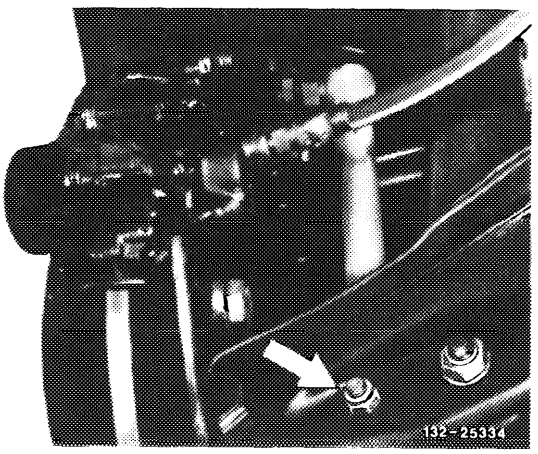




8 Slightly lower rear axle and remove torsion bar after turning pertinently to the left.



9 If the connecting rod is additionally removed, remove rod after unscrewing hex. screw with nut (arrow) (spring link cover removed).

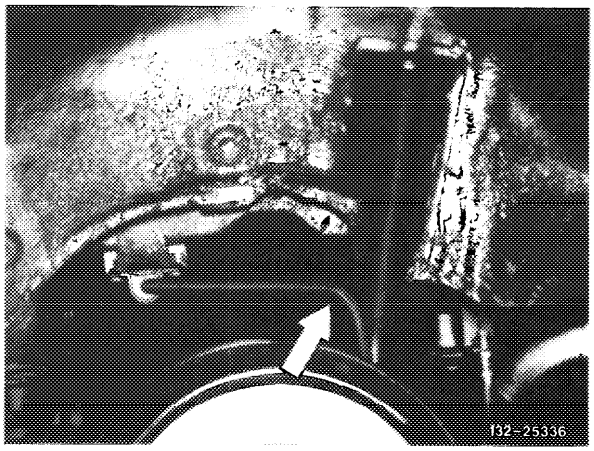


Installation

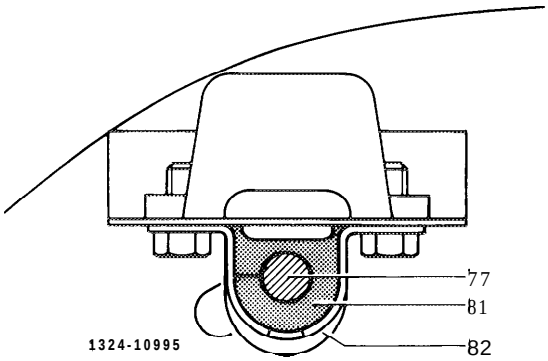
10 Check rubber mounts of torsion bar bearings and connecting rods and renew, if required.

11 Introduce torsion bar in such a manner that the offset of torsion bar arms points in downward direction and in driving direction toward the rear (arrow).

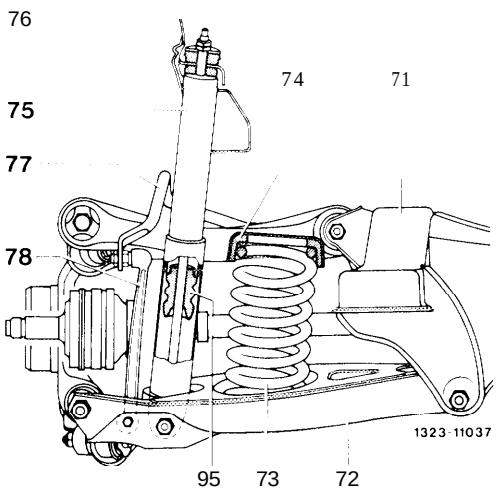
Slip on rubber mounts at left and right (slot in forward direction).



12 Fasten torsion bar with holding clamps left and right to frame floor. Tightening torque of new self-locking hex. screws 20 Nm.

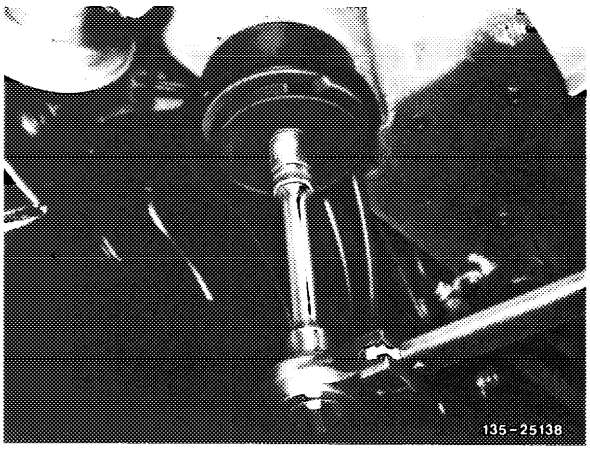


77 Torsion bar
81 Rubber mount
82 Holding clamp



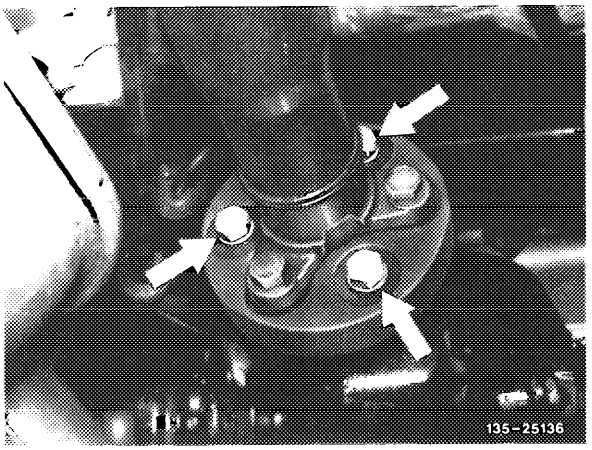
71 Rear axle carrier
72 Spring link
73 Rear spring
74 Rubber mount – rear spring
75 Shock absorber
76 Mandrel on frame floor
77 Torsion bar
78 Connecting rod for torsion bar
95 PU auxiliary spring

13 Fasten front bearing of rear axle with new self-locking hex. screws and tighten to 70 Nm.



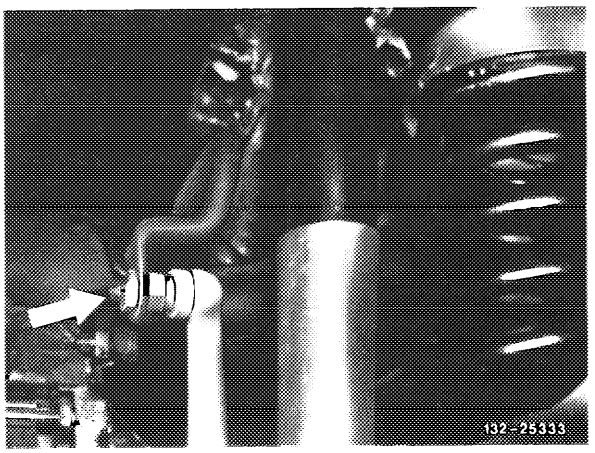
14 Mount companion plate with new self-locking hex. nuts on rear axle shaft flange. Tightening torque 45 Nm.

15 Tighten joint intermediate bearing to 25 Nm.



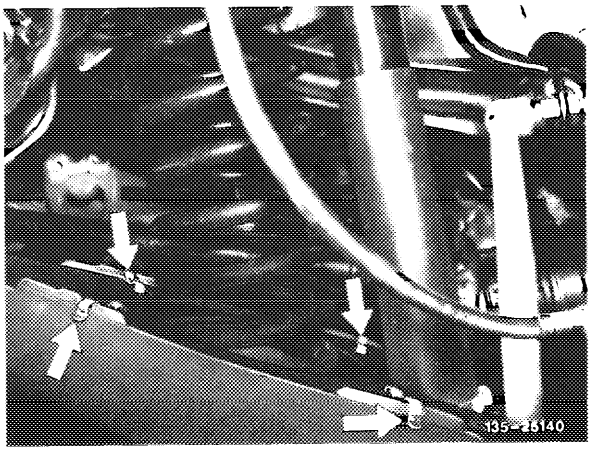
16 On vehicles with ABS fasten rpm sensor with new self-locking hex. socket screw to rear axle center piece (tightening torque 8Nm).

17 Fasten connecting rod left and right to torsion bar (arrow), tighten to 30 Nm.



Note: If connecting rods on spring link have been released, use new micro-encapsulated hex. nut (tightening torque 20 Nm) for installation. Then fasten spring link cover with 4 spring clamps (arrows).

18 Mount rear wheel (40-l 10), lower vehicle.

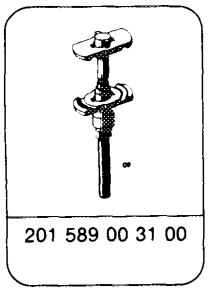


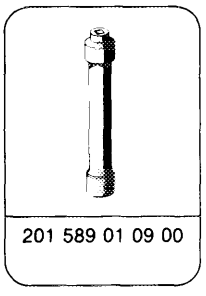
	Job No.
Front axle halves	
Removing and installing front axle half	33-200
Front wheel hub	
Adjusting end play of wheel bearings	**300**
Removing and installing front wheel hub	310
Disassembling, checking, reconditioning and assembling front wheel hub	320
Steering knuckle	
Removing and installing steering knuckle	400
Checking steering knuckle	410
Removing and Installing steering knuckle arm	420
Steering knuckle bearing	
Checking supporting Joint of the steering knuckle bearing	425
Renewing sleeve supporting joint of steering knuckle bearing	430
Renewing supporting joint of the steering knuckle bearing	440
Wishbone	
Removal and installation of wishbone	510
Checking beanng of wishbone	525
Renewing beanng of wishbone	526
A. Front bearing model 201; and rear beanng model 201.034	
B. Rear bearing model 201.01/201.1	
Checking wishbone (on vehicles involved in an accident)	530

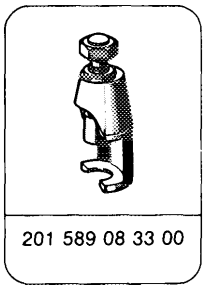
33-200 Removal and installation of front axle half

Tightening torques	Nm
Hexagon nuts of the eccentric pins at the wishbone bearing	120
Hexagon nut of the ball joint of the tie rod	35
Hexagon nut at upper suspension point of the shock absorber strut	60
Hexagon nuts of the torsion bar mounting at the wishbone	20

Special tools







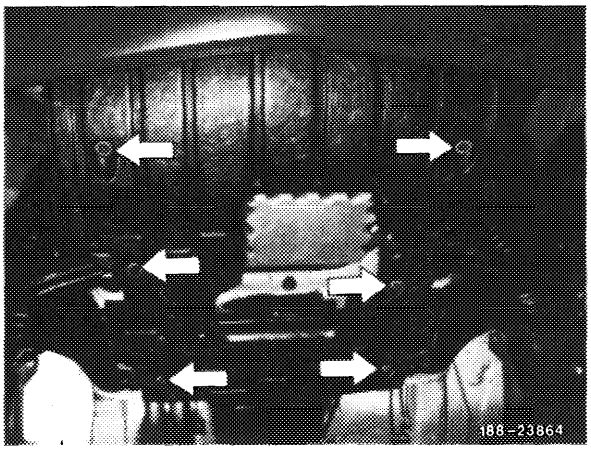
Note

The bearings of the wishbone at the front may be tightened only when the vehicle is ready for the road. If these bearings were tightened without any weight on the wheels, incorrect values would be obtained for the wishbone positioning. The shock absorber strut serves also as a rebound stop for the front wheel. Therefore release shock absorber strut mounting only when the vehicle is standing on its wheels or the wishbone is supported. To assemble the upper suspension either place vehicle on the wheels or raise axle half at the wishbone.

Renew self-locking bolts and nuts!

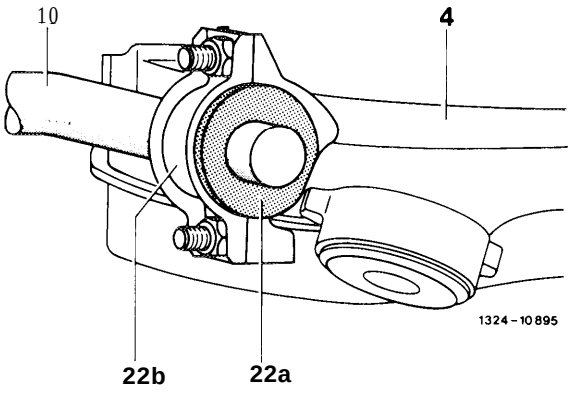
Removal

1 Remove engine compartment lining at bottom on vehicles equipped thus.



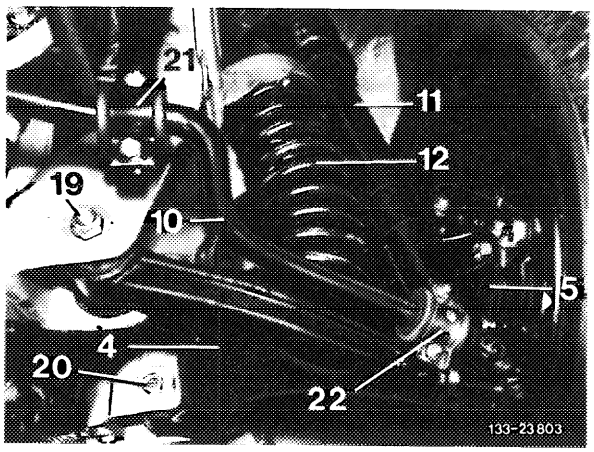
2 Jack up vehicle at front, remove front wheel.

3 Release bearing of the torsion bar at the wishbone.

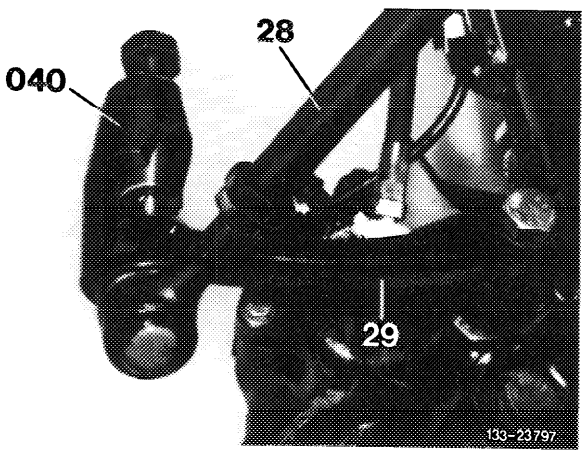


4 Wishbone
10 Torsion bar
22a Rubber mount
22b Retainer

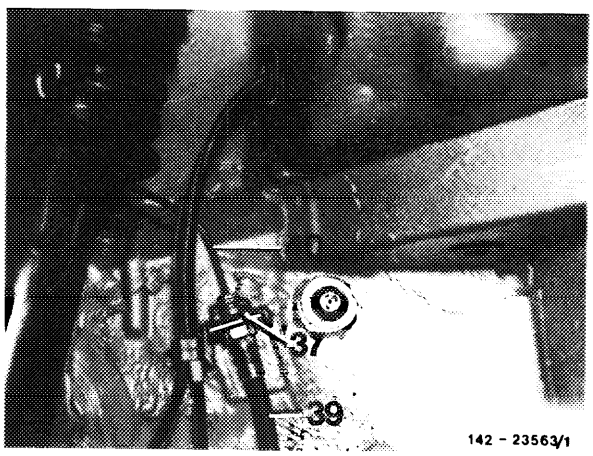
4 Remove front spring (12) (32-200).



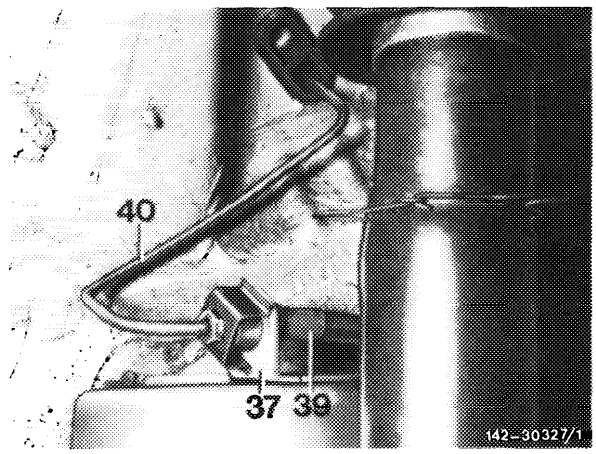
5 Unscrew hexagon nut of the tie rod ball joint at the steering knuckle arm (29) and press off joint with the extractor (040).



6 Separate brake line (40) and brake hose (39) from one another at the front. Plug lines against penetrating dirt.

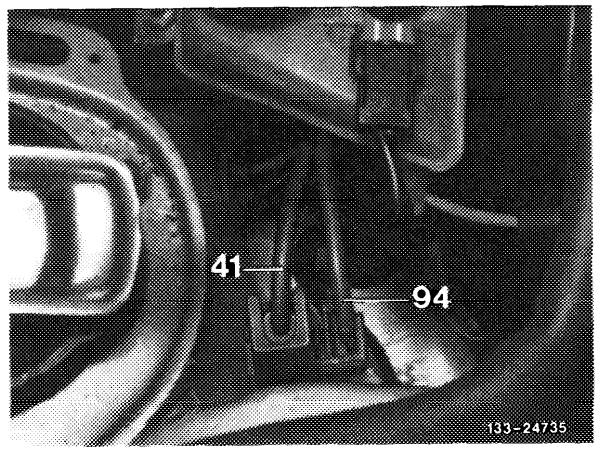


1 st version
Models 124, 201 brake hose layout

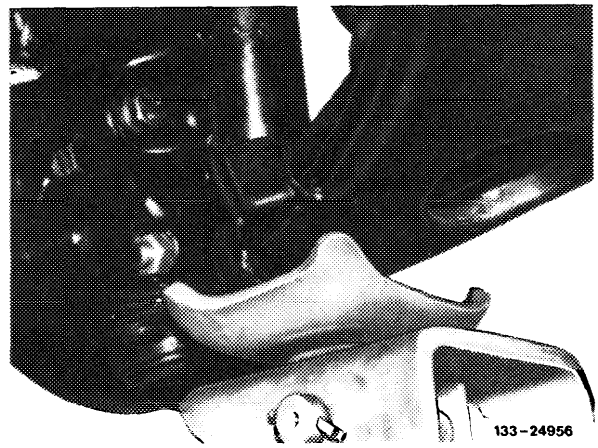


2nd version
Models 124, 201 brake hose layout

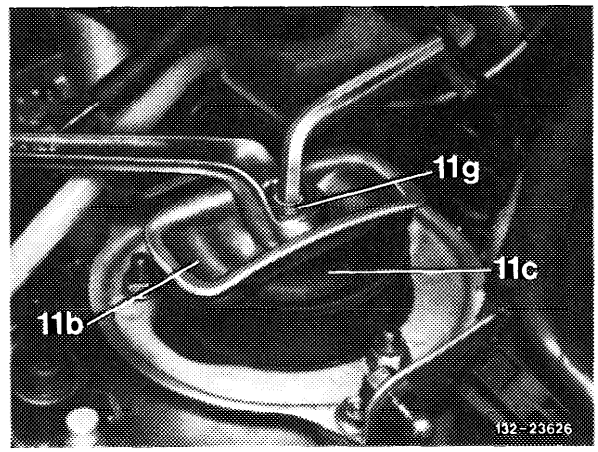
7 Separate plug-and-socket connection for the brake lining wear indicator (94) and, if fitted, for the speed sensor of the ABS (41) in the engine compartment and pull through the wheel housing.



8 Support front axle half at the wishbone.



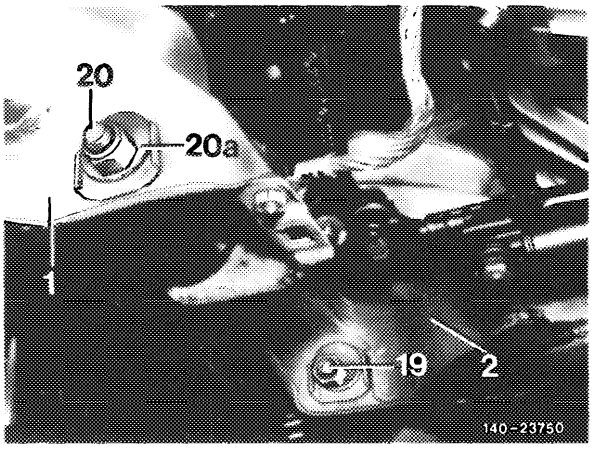
9 Release suspension of the shock absorber strut at the piston rod (wishbone supported).



11 b Rebound limit
1 lc Rubber mount
1 lg Piston rod

10 Mark position of the eccentric pins relative to frame on the bearing of the wishbone.

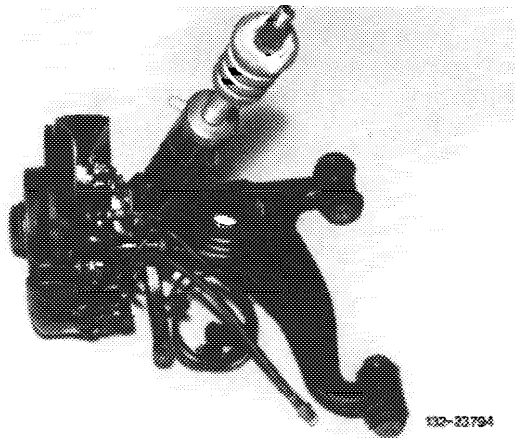
11 Unscrew hexagon nuts of the eccentric pins and remove eccentric pins.



1 Side member
2 Cross member
19 Eccentric pin (camber)
20 Eccentric pin (caster)
20a Eccentric disk

12 Remove front axle half.

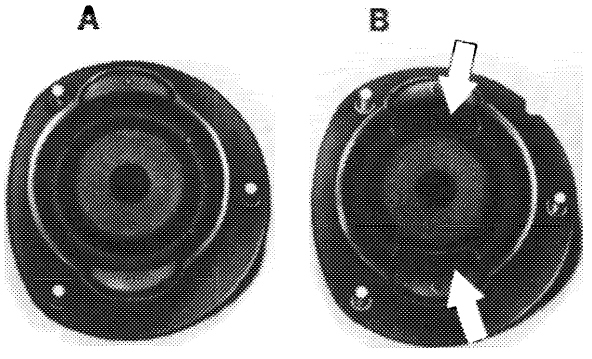
13 Check rubber mounts on the wishbone and torsion bar and, if necessary, renew.



Installation

Repair note

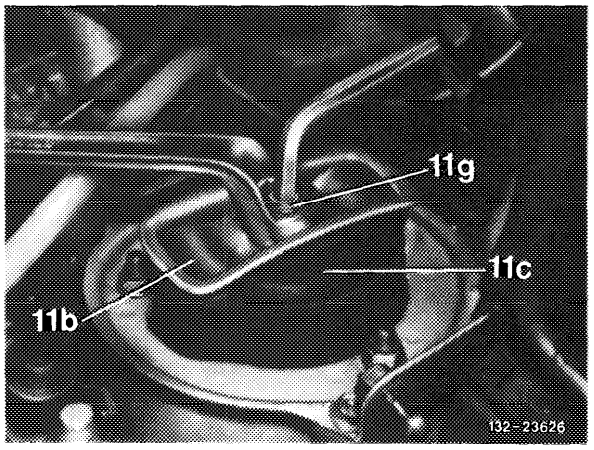
From April 1983 onwards, modified rubber mounts have been installed on the upper shock absorber strut mounting at the front end. In case of repair, install the second version (with kidney-shaped recesses — arrow). Tightening torque of hexagon nuts on front end 20 Nm.



A Rubber mount 1st version
B Rubber mount 2nd version

14 Fasten front axle half and shock absorber strut at the upper suspension.

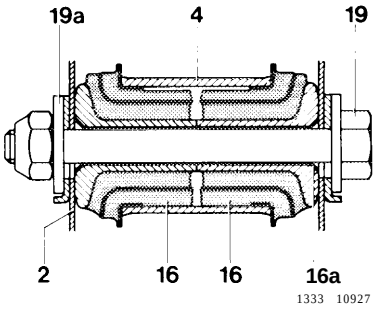
Tightening torque of the hexagon nut 60 Nm.



1 lb Rebound limit
1 1c Rubber mount
1 lg Piston rod

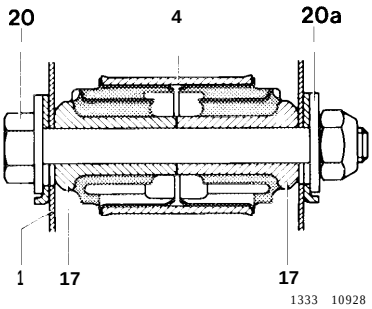
15 Install bearing of the wishbone at the frame cross member.

Tightening torque of the hexagon nuts 180 Nm.



Front bearing model 124/201 and rear bearing model 201.034

2 Frame cross member
4 Wishbone
16 Torsion rubber mount
16a Clamping sleeve
19 Eccentric pin (camber setting)
19a Eccentric disk

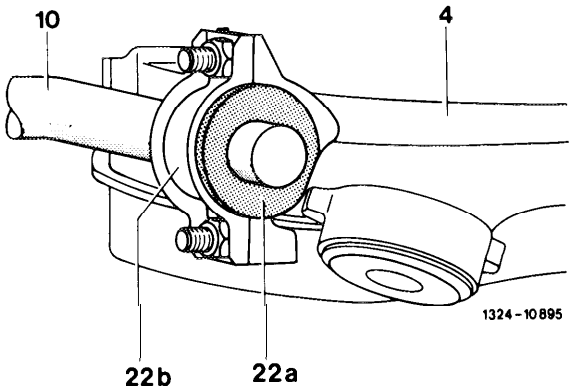


Rear bearing model 201.02/1

1 Frame side member
4 Wishbone
17 Torsion rubber mount
20 Eccentric pin (caster setting)
20a Eccentric disk

16 Fasten bearing of the torsion bar at the wishbone. Tightening torque of the hexagon nuts 20 Nm.

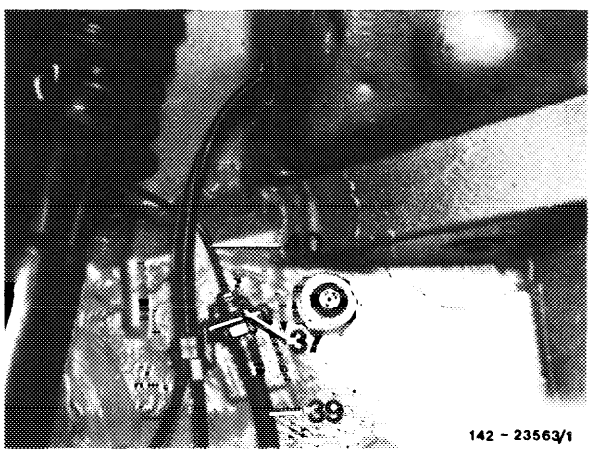
Note: To facilitate torsion bar installation, raise wishbone at oppsite side using jack,



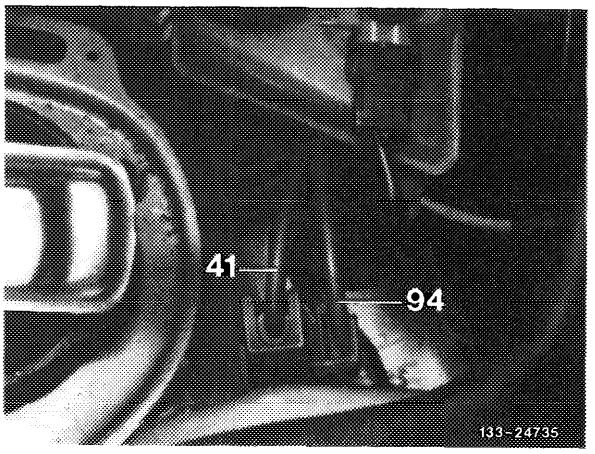
4 Wishbone
10 Torsion bar
22a Rubber mount
22b Retainer

17 Connect brake line (40) and brake hose (39) together at the front,

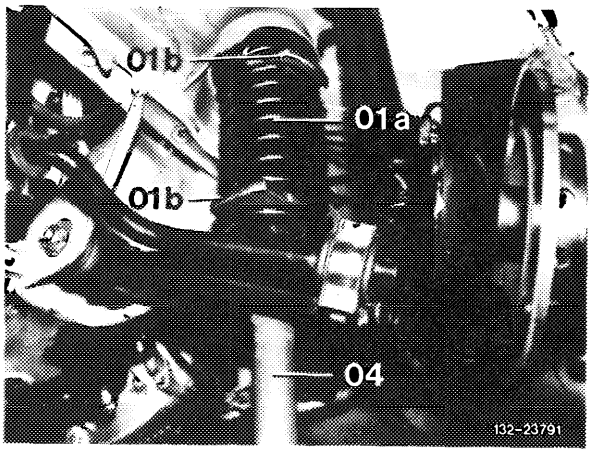
Important!
Do not turn brake hose and do not expose to tensile stress.



18 Pass plug-and-socket connection for the brake lining wear indicator (94), and if fitted, for the speed sensor of the ABS (41) through the wheelhousing and fit together in the engine compartment.



19 Install front spring (32-200).



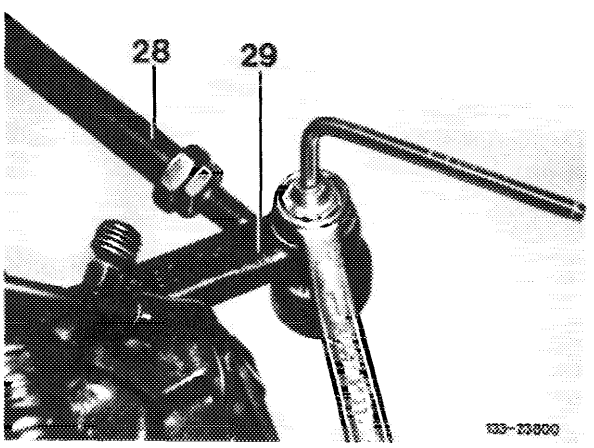
20 Check rubber sleeve on the ball joint of the tie rod. If the rubber sleeve is damaged, check the ball joint for wear and renew (46-540) if necessary.

Note: If the rubber sleeve was damaged upon removal, it will suffice to renew the rubber sleeve.

21 Fasten ball joint of the tie rod (28) at the steering knuckle arm (29), while holding knuckle pin in place with a hexagon socket wrench. Tightening torque 35 Nm.

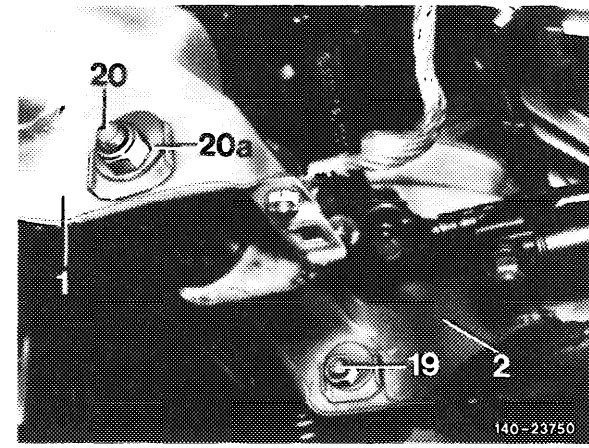
22 Bleed brake system and check for leaks (visual check) (42-010).

23 Mount front wheel (40-110), lower vehicle.



24 Set the eccentric pin for camber and caster adjustment to the previously applied markings and tighten hexagon nuts to 180 Nm.

Important!
If the position of the eccentric pin was not marked upon removal, move the eccentric pin to centre positron for preliminary adjustment.



1 Side member
2 Cross member
19 Eccentric pin (camber)
20 Eccentric pin (caster)
20a Eccentric disk

25 Check vehicle level at the front axle (40-300)

26 Check wheel alignment at the front axle (40-320).

27 Check setting of the headlamps.

33-300 Adjusting end play of wheel bearings

Dates

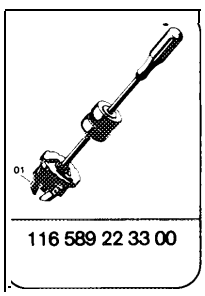
End play of wheel bearings	0.01-0.02

Lubricant

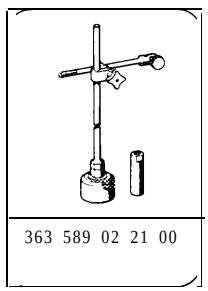
Grease grade:	High-temperature anti-friction bearing grease (refer to service product specifications page 265.1) part No. 000 989 49 51 (150 g – can with screw top)
Grease packing:	In hub cap: Grease quantity approx. 15 g

Tightening torque	Nm
Hex, head socket screw of clamping nut	12

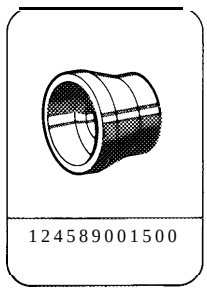
Special tools



116 589 22 33 00



363 589 02 21 00



124589001500

Commercially available tool

Dial gauge A 1 DIN 878	eg. Mahr, D-7300 Essl i ngen order No. 810

Note

In case of repairs at the front wheel hub adjust end play of wheel bearings before assembly of the brake disk.

Adjustment is described below for brake disk in situ.

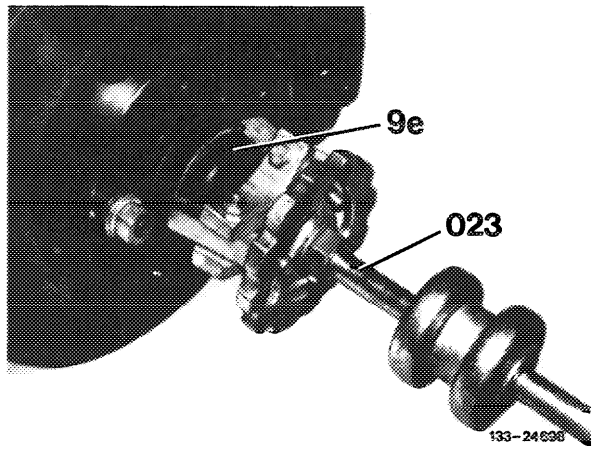
1 Jack up vehicle, remove front wheel.

2 Secure brake disk to the wheel hub using two wheel bolts.

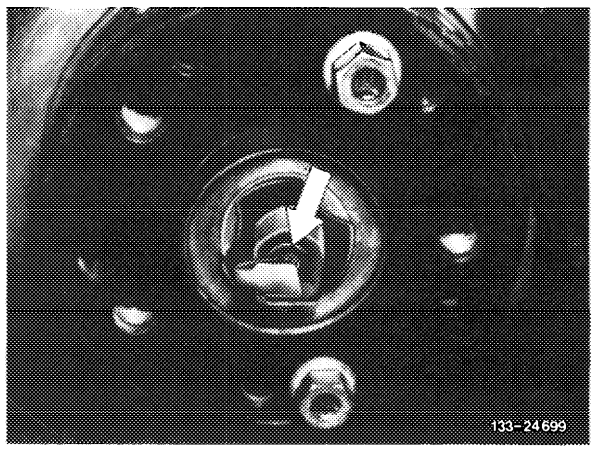
Note: Wheel hub version with locking screw requires one wheel bolt only.

3 Force brake pads away from the brake disk, and if necessary. swing away (42-160) cylinder body of the floating caliper after releasing upper mounting.

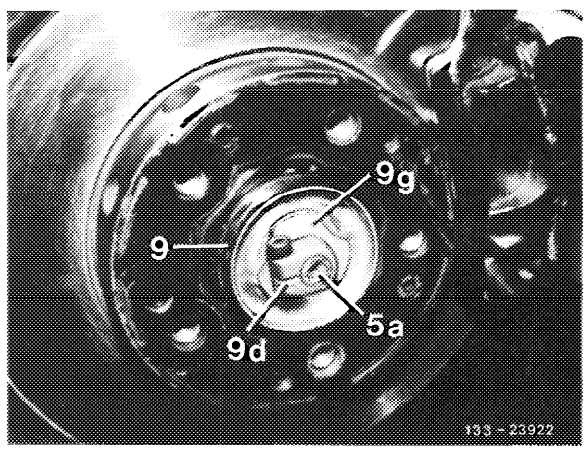
4 Remove hub cap (9e) with device (023).



5 Remove contact spring for radio Interference suppression (arrow).

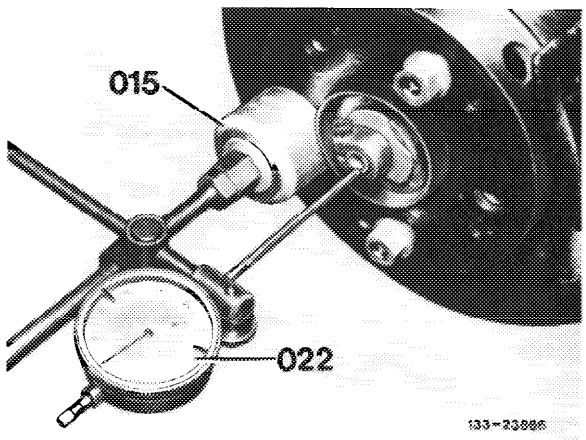


6 Release hex. head socket screw of clamping nut (9d), and tighten clamping nut while simultaneously turning the hub (9) so that the hub can only just be turned. Then slacken clamping nut again by approx. 1/3 revolution and relieve tension by striking the stub axle (5a) with a plastic-headed hammer.



7 Mount tester (15) on front wheel hub and adjust dial gauge (022) to approx. 2 mm preloading.

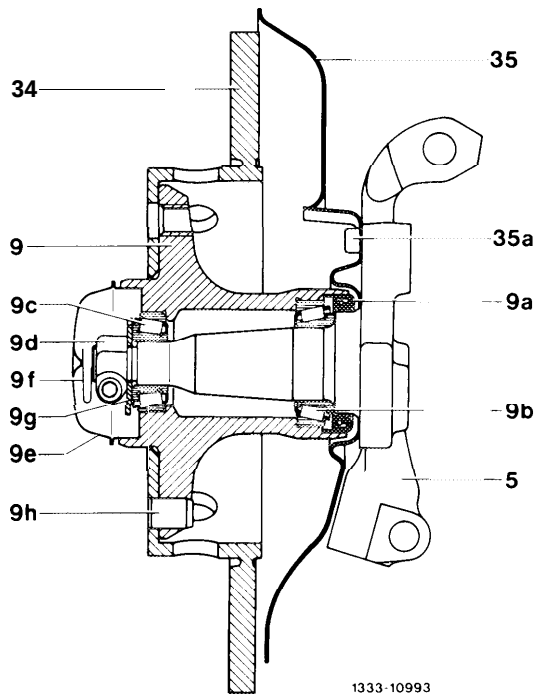
Note: To adjust the wheel bearing play in conjunction with the dial gauge holder 363 589 02 21 00 the contact pin of the dial gauge must be lengthened.



8 Check end play of the wheel hub by pulling and pushing hard at the flange.

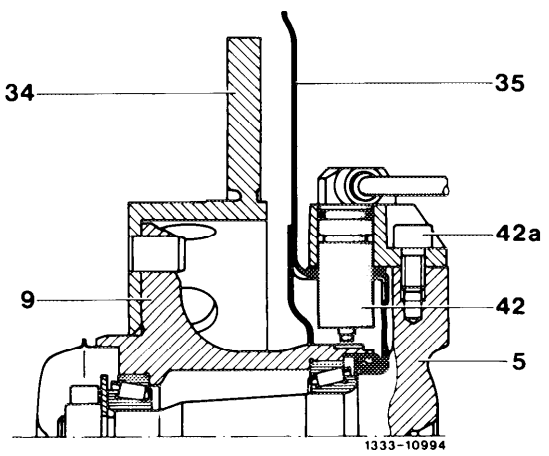
Turn wheel hub several times before each measurement.

Important!
During the measurement the wheel hub must not turn. Every rotary movement of the wheel hub is indicated on the dial gauge so that an exact reading of the actual end play is not possible in this case.



Front wheel hub without ABS

5 Steering knuckle
9 Front wheel hub
9a Radial seal
9b Tapered roller bearing inside
9c Tapered roller bearing outside
9d Clamping nut
9e Hub cap
9f Contact spring
9g Washer
9h Clamping sleeve
34 Brake disk
35 Brake cover plate
35a Hex. head socket screws



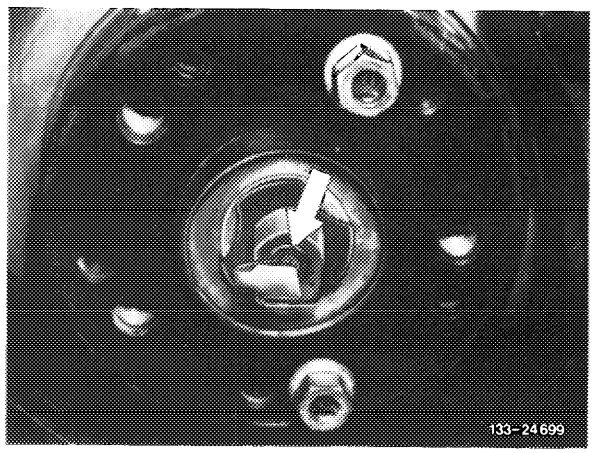
Front wheel hub with ABS

5 Steering knuckle
9 Front wheel hub
34 Brake disk
35 Brake cover plate
42 Speed sensor
42a Fastening bolt

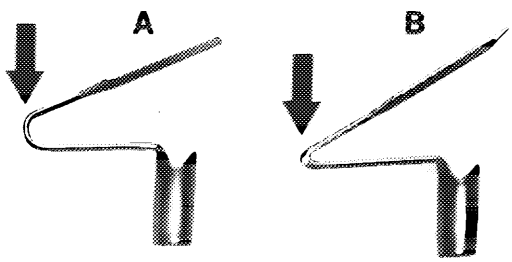
9 Tighten hex, head socket screw of clamping nut to 12 Nm and once again check end play.

Note: When end play of wheel bearings is correctly adjusted, the washer placed between outer tapered roller bearing and clamping nut must just still turn under the pressure of your finger. Always adjust end play of wheel bearings using dial gauge.

10 Insert contact spring for radio Interference suppression.



Note: Only use contact spring of the 2nd version (installed from the end of December 192) with 0.5 mm radius.

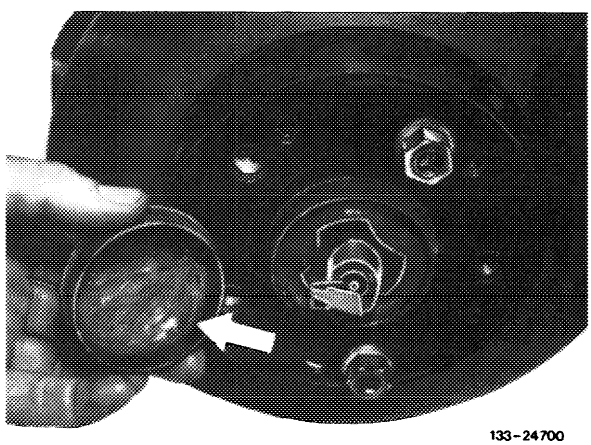


A Contact spring, first version with 2 mm radius (arrow) part No. 1085470085

B Contact spring, second version with 0.5 mm radius (arrow) part No. 201 5470085

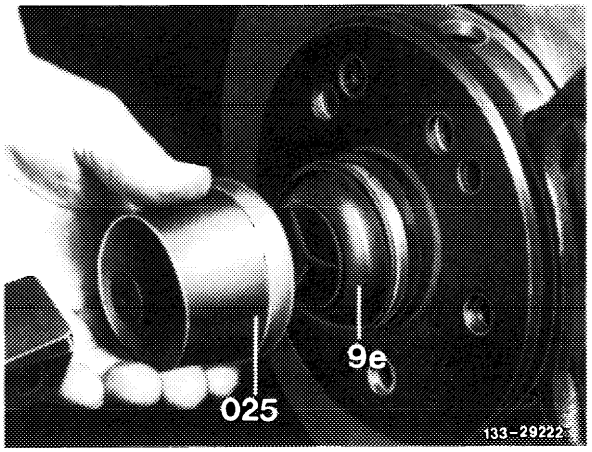
133-25504

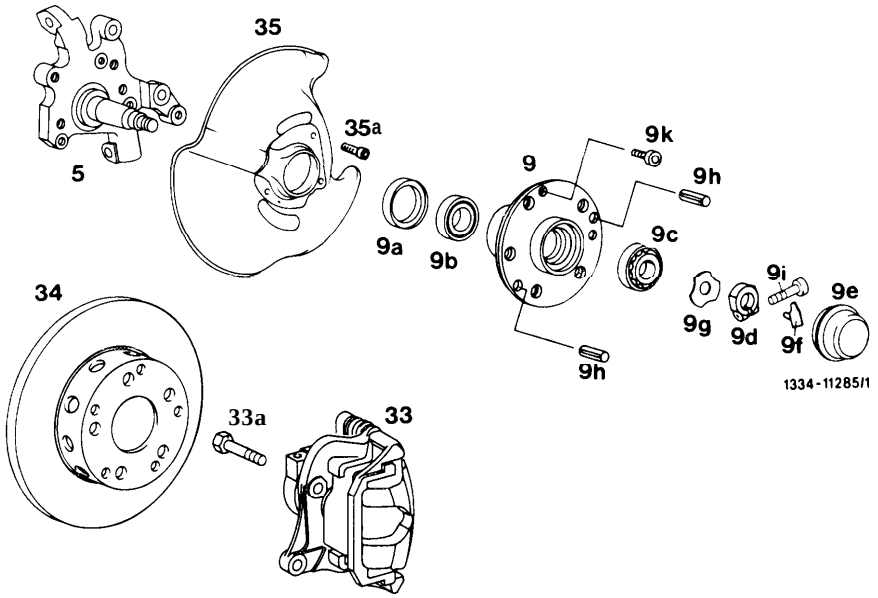
11 Fill hub cap to the flanged edge (arrow) with high-temperature anti-friction bearing grease.



12 Knock on hub cap with mandrel (025). Remove wheel bolts.

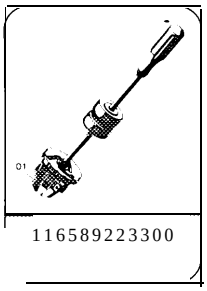
13 install front wheel (40-l 10), lower vehicle.





5 Steering knuckle	Check stub axle for damage and running surface for radial seal for wear.
9 Front wheel hub	Check for damage. Additionally check the teeth on ABS front wheels hubs.
9a Radial seal	Check, renew if necessary
9b Tapered roller bearing inside	Check for damage, ease of movement and wear.
9c Tapered roller bearing outside	Check for damage, ease of movement and wear.
9d Clamping nut	
9e Hubcap	**Check for leaks and damage. Hub** cap must be located **firmly on the front wheel hub. Grease quantity** up to **the flanged edge approx.** 15 g. High-temperature anti-friction bearing grease (refer to specifications for service products page 265.1) part No. 000 989 49 51 (150 g -- **can** with screw cap)
9f Contact spring	
9g Washer.	Additional possibility of checking the end play of wheel bearings.
9h Clamping sleeve	
9i Hex. head socket screw	Tightening torque 12 Nm.
9k Locking screw	Renew, tightening torque 10 Nm.
33 Floating caliper	
33a Hexagon bolt	Always renew microencapsulated bolts. Tightening torque 115 Nm.
34 Brake disk	Check for wear and condition.
35 Brake cover plate	
35a Hex. head socket screws	Renew, tightening torque 10 Nm.

Special tools



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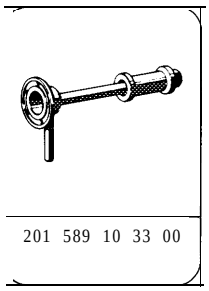
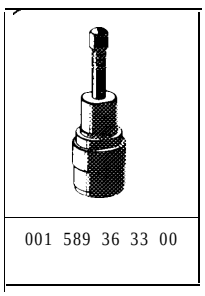
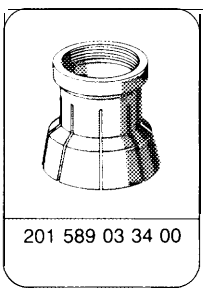


201 589 10 33 00



001 589 36 33 00



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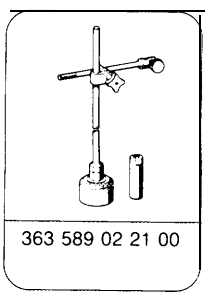

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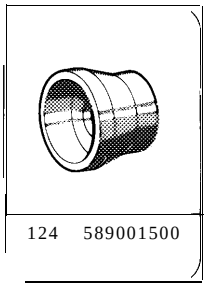


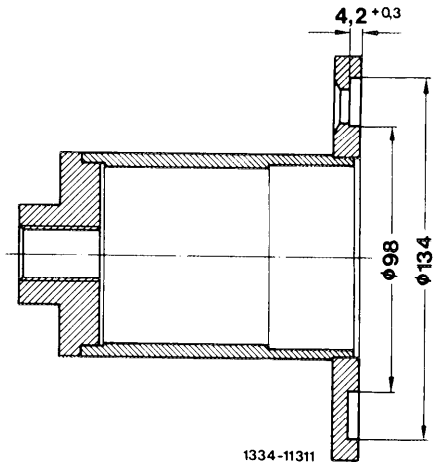
124 589001500

Commercially available tool

Dial gauge A 1 DIN 878	e.g. Mahr, D-7300 Esslingen Order No. 810

Note

The puller for front wheel hub part No. 116 589 17 33 00 used up to now can also be used for models 124 and 201, if changes are made according to drawing.



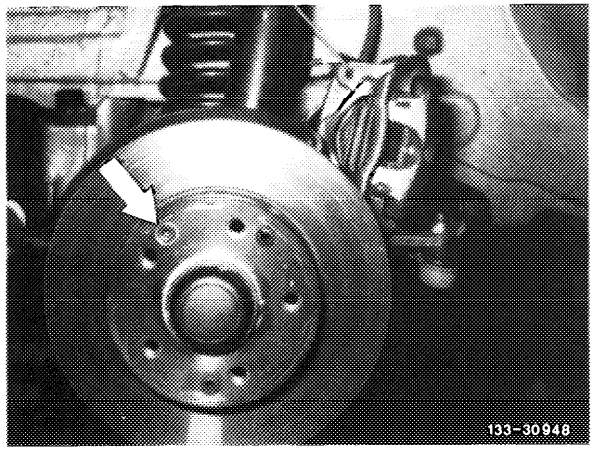
Removal

1 Jack up vehicle, remove front wheel.

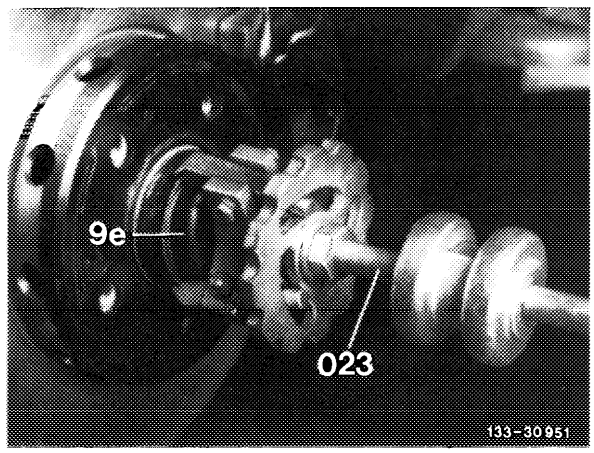
2 Unscrew floating caliper from steering knuckle and attach in wheelhouse by means of a suitable hook (42-l 10).

Attention!
Do not expose brake hose to tensile stress!

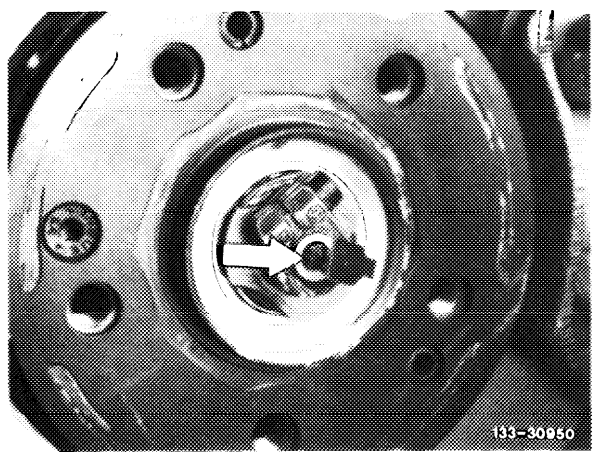
3 Unscrew locking screw (arrow) and remove brake disk.



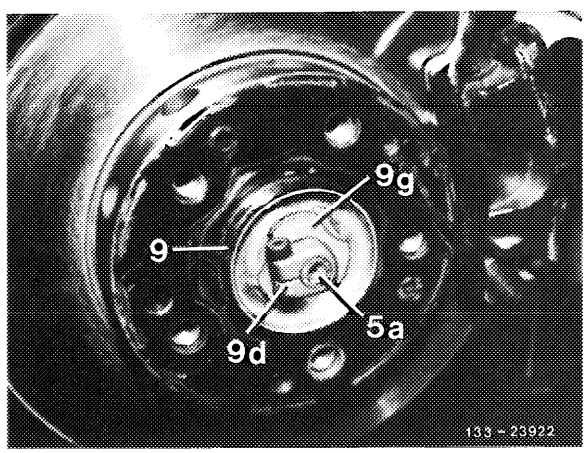
4 Remove hub cap (9e) with device (023).



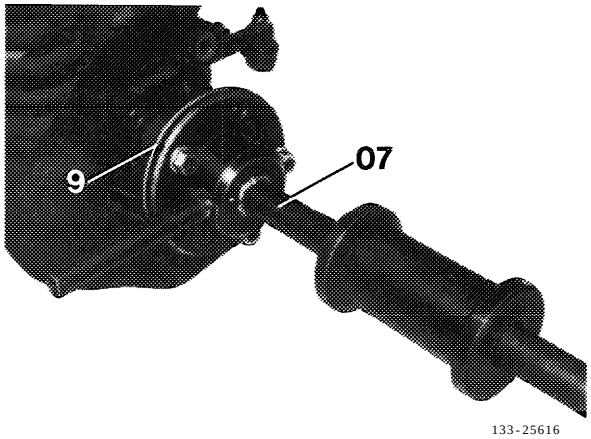
5 Remove contact spring (arrow) for radio interference suppression.



6 Release hex. head socket screw of clamping nut (9d) on the stub axle (5a) and unscrew clamping nut.



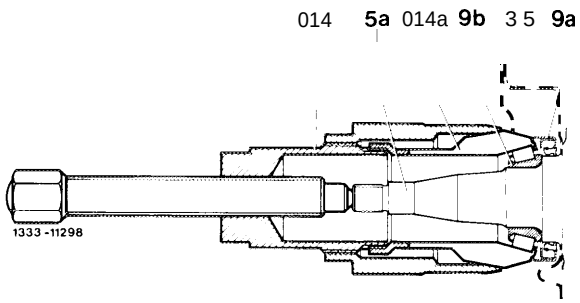
7 Remove front wheel hub (9), if necessary with puller (07).



8 Additional work if inner ring of tapered roller bearing is jammed on the steering knuckle:

a) Remove inner ring of tapered roller bearing from the steering knuckle with device (014).

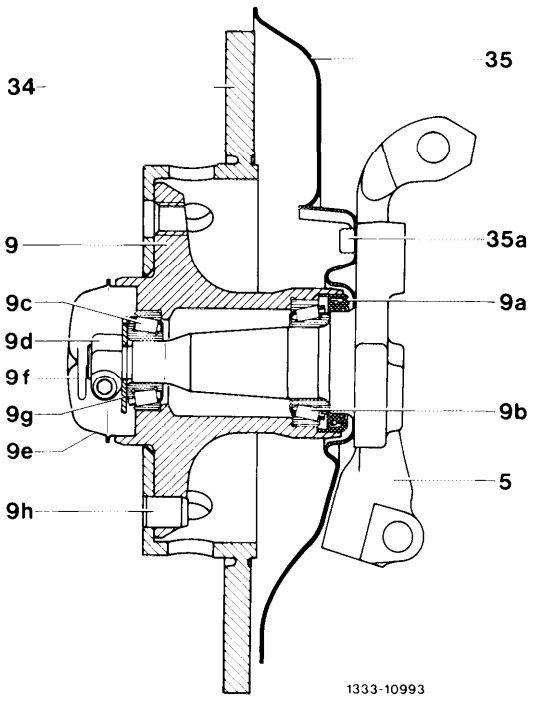
b) Remove radial seal (9a) from the steering knuckle.



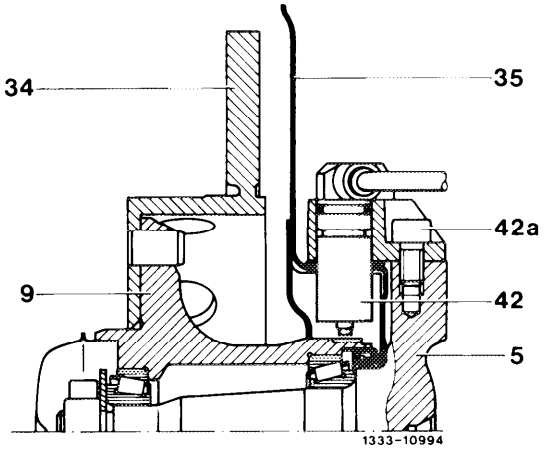
5a Stub axle
9a Radial seal
9b Tapered roller bearing inside
014 Inner ring of tapered roller bearing (basic unit)
014a Collet chuck
35 Brake cover plate

9 Check front wheel hub, tapered roller bearing and radial seal, renew if necessary (33-320).

10 Check king pin, paying particular attention to the bearing seats and the contact surface of the radial seal.



Front wheel hub without ABS
5 Steering knuckle
9 Front wheel hub
9a Radial seal
9b Tapered roller bearing inside
9c Tapered roller bearing outside
9d Clamping nut
9e Hub cap
9f Contact spring
9g Washer
9h Clamping sleeve
34 Brake disk
35 Brake cover plate
35a Hexagon socket-head bolts



Front wheel hub with ABS
5 Steering knuckle
9 Front wheel hub
34 Brake disk
35 Brake cover plate
42 Speed sensor
42a Fastening bolt

Installation

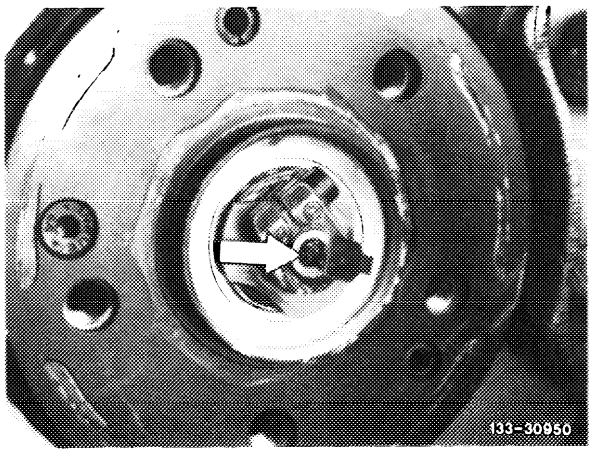
11 If required, install inner ring of inside tapered roller bearing and radial seal in front wheel hub (33-320).

12 Coat running surface for the radial seal at the stub axle sparingly with high-temperature anti-friction bearing grease.

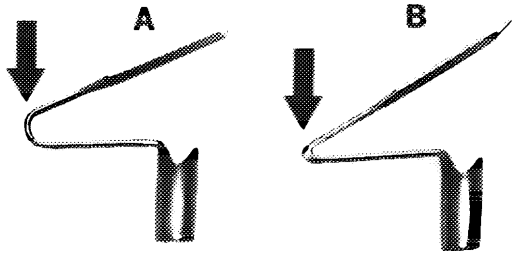
13 Press front wheel hub on to king pin, install inner ring with roller cage of outer tapered roller bearing. Place washer in position, screw on clamping nut and tighten hexagon socket head bolt.

14 Adjust end play of wheel bearings (33-300)

15 Insert contact spring (arrow) for radio interference suppression,



Note: Only use contact spring of the 2nd version (installed from end of December 1982) with 0.5 mm radius.

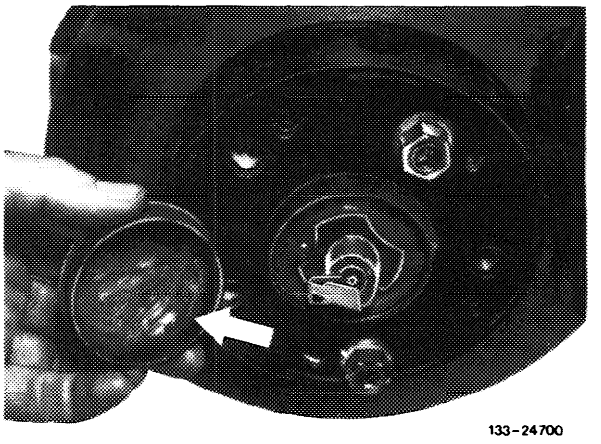


A Contact spring, first version with 2 mm radius (arrow) part No. 108 547 00 85

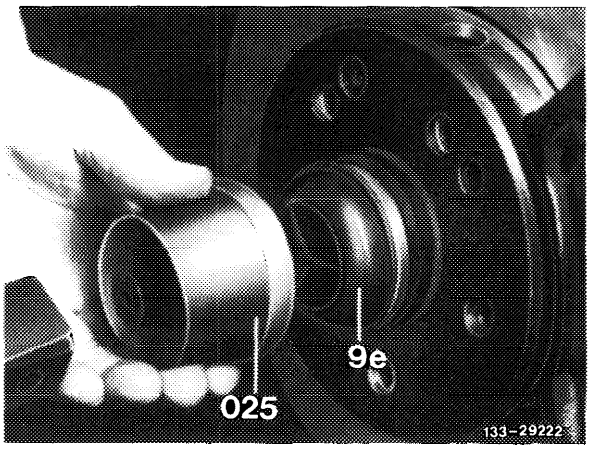
B Contact spring, second version with 0.5 mm radius (arrow) part No. 201 547 00 85

133-25504

17 Fill hub cap to the flanged edge (arrow) with high-temperature anti-friction bearing grease.



18 Knock on hub cap (9e) with mandrel (025).



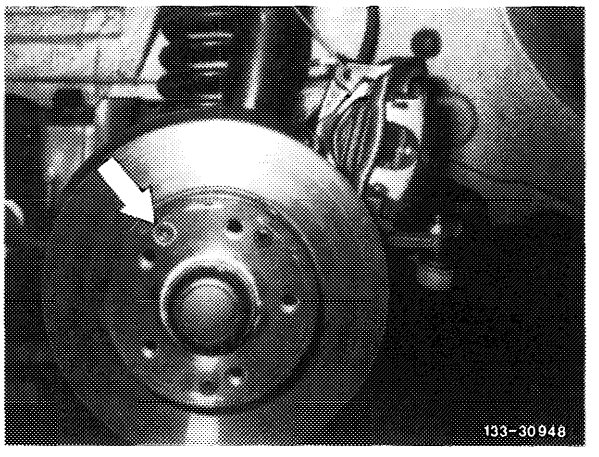
19 Place brake disk on front wheel hub and fasten with new micro-encapsulated locking screw (arrow) — 10 Nm.

20 Fasten floating caliper to steering knuckle with new self-locking hex. head screws (42-100).

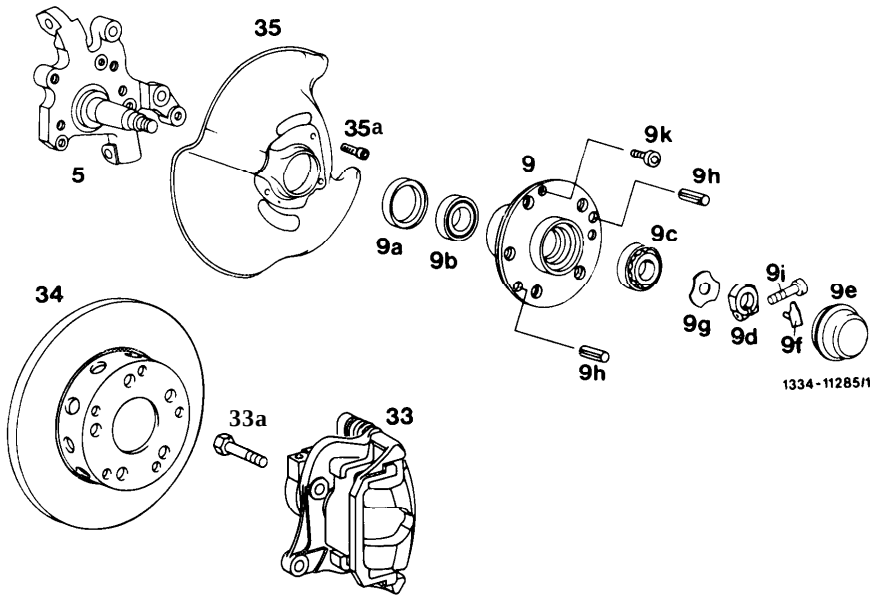
Tightening torque of hex. head screws 115 Nm.

Attention!
Do not twist brake hose and do not expose to tensile stress!

21 Install front wheel (40-l 10), lower vehicle.



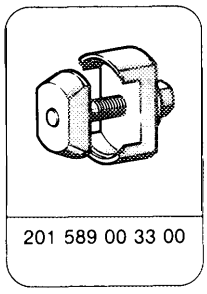
Front wheel hub removed



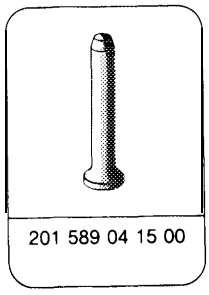
5	Steering knuckle.	Check stub axle for damage and running surface for radial seal for wear.
9	Front wheel hub	Check for damage. Additionally check teeth on ABS front wheel hub. Be sure to use specified fill-in quantity! Therefore, prior to assembling front wheel hub, weigh entire fill-in quantity, while also filling roller cage of tapered roller bearings well with grease. Also provide roller faces with grease. For quantity of grease refer to table.
9a	Radial seal	Check, renew if necessary. Radial seal with sealing lip and additional dust lip. Fill the space between sealing lip and dust lip with high-temperature anti-friction bearing grease upon assembly.
9b	Tapered roller bearing inside . . .	Check for damage, ease of movement and wear.
9c	Tapered roller bearing outside ...	Check for damage, ease of movement and wear.
9d	Clamping nut	
9e	Hubcap	Check for leaks and damage. Hub cap must be located firmly on the front wheel hub. Grease quantity refer to table.
9f	Contact spring	
9g	Washer	Additional possibility of checking the end play of wheel bearings.
9i	Hex. head socket screw	Tightening torque 12 Nm.
9k	Locking screw	Renew, tightening torque 10 Nm.

33	Floating caliper	
33a	Hex. head screw	Always renew micro-encapsulated bolts Tightening torque 115 Nm.
34	Brake disk	Check for wear and condition.
35	Brake cover plate	
35a	Hex. head socket screw.	Renew, tightening torque 10 Nm.

Special tools



201 589 00 33 00



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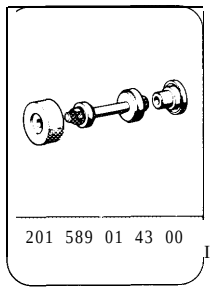

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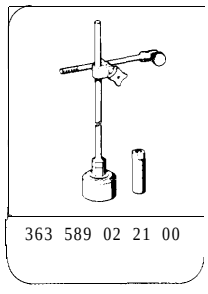


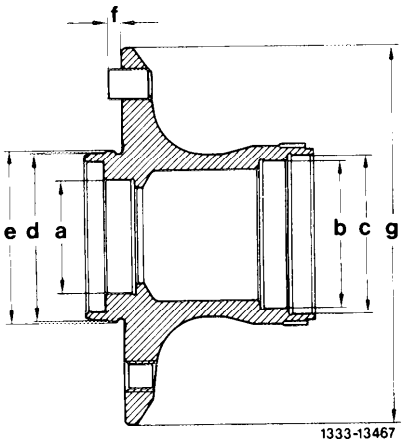
363 589 02 21 00

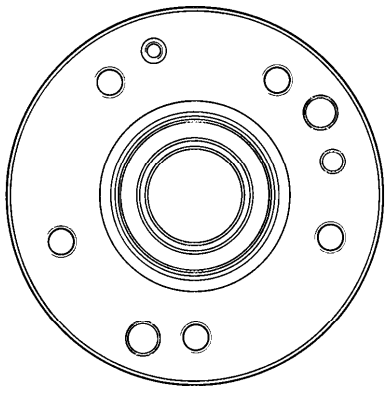
Conventional tools

Dial gauge A 1 DIN 878	e.g. Mahr, D-7300 Esslingen Order No. 810

Front wheel hub

Model	124 201.034 from start of series	201.02 201.1 1 st version (up to Jan. 1983)	2nd version (start. Febr. 19831
Bore ,,a" for inner tapered roller bearing	59.117 59.098	50.258 50.228	59.117 59.098
Bore ,,b'' for outer tapered roller bearing	45.220 45.195	39.857 39.84 1	39.857 39.84 1
Bore ,,c'' for radial sealing ring	64.046 64.000	54.046 54.000	64.046 64.000
Pilot ,,d" for centering rim		66.400 66.354	
Pilot ,,e'' for centering brake disk		66.990 66.97 1	
Installation dimension ,,f'' for dowel pin		3.8 — 0.2	
Flange dia. ,,g''	150		14.1
Permissible lateral runout on flange		0.03	
Permissible vertical runout on rim centering point ,,d"		0.05	





Tapered roller bearings, radial sealing rings, lubricants

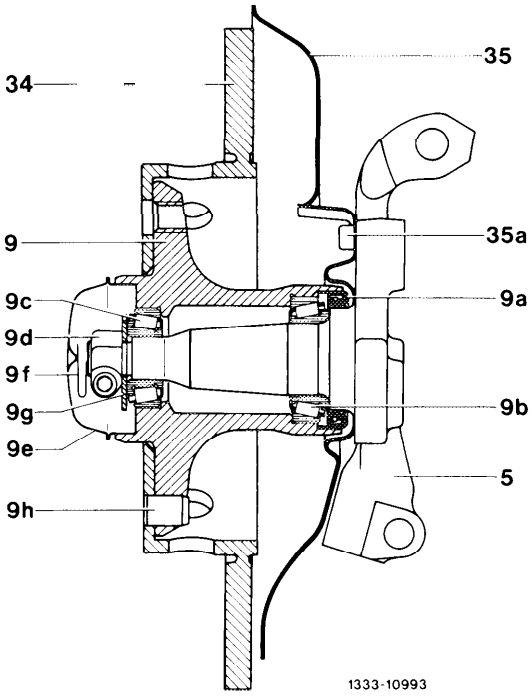
Model			124 201.034 from start of series	201.02 201.1 1 st version (up to Jan. 1983)	 2nd version (start. Febr. 1983)
Tapered roller bearings')	Inside	Dimensions (OD, ID, width)	59.131 x 31.75 x 16.75	50.292 x 29 x 14.7	59.131 x 31.75 x 16.76
		Part No.	000981 5805	0059817105	000981 58 05
	Outside	Dimensions (OD, ID, width)	45.237 x 19.05 x 16.64	39,878 x 17.462 x 14.6	
		Part No.	000981 5905	006981 1605	
Radial sealing ring		Dimensions (OD, ID, width)	64 x 45 x 12	54 x 41 x 12	64 x 45 x 12
		Part No.	011 997 51 47	009997 1847	011 997 51 47
Lubri-cant	Grease charge in grams approx.	Total filling capacity	65	50	
		Hub with bearing	50	35	
		Hub cap	15	15	
		Grease type	High-temperature anti-friction bearing grease (refer to specifications for service products sheet 265.1) part No. 000 989 49 5 1 (150 g — can with screw cap)		

[1]) The bearing inner races are mounted on steering knuckle pin at a sliding fit or a light press fit. In the event of repairs, a radial play of 0.03 mm on inner bearing and of 0.025 mm on outer bearing between bearing inner race and steering knuckle pin is still permitted. If the play is higher, there is the possibility to eliminate that play during assembly by applying ,,Omnifit type 80 red M or H" with activator (combination pack part No. 002 989 69 71) or Loctite code No. 640, part No. 002 989 20 7 1. For details, refer to respective operating instructions.

Disassembly

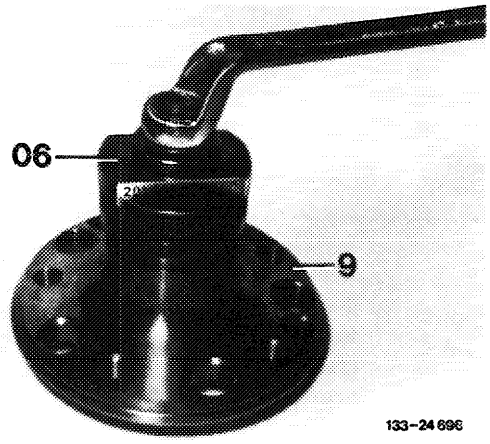
1 Remove inner race with roller cage of the outer tapered roller bearing (9c) from the hub.

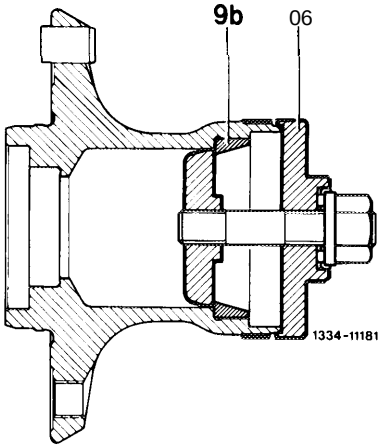
2 Press off radial sealing ring and remove inner race of tapered roller bearing with roller cage from the front wheel hub.



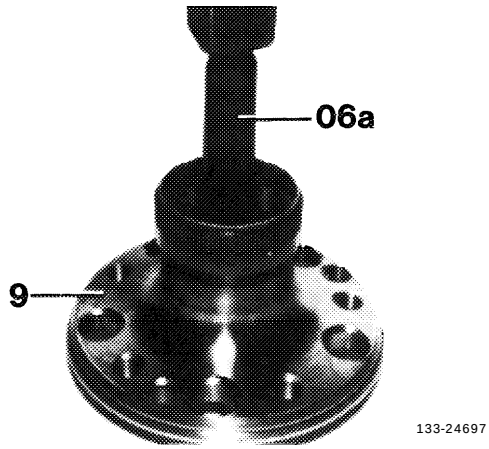
5 **Steering knuckle**
9 **Front wheel hub**
9a **Radial sealing ring**
9b **Tapered roller bearing inside**
9c **Tapered roller bearing outside**
9d **Clamping nut**
9e **Hub cap**
9f **Contact spring**
9g **Washer**
9h **Dowel pin**
34 **Brake disk**
35 **Brake cover plate**
35a **Hex. head socket screws**

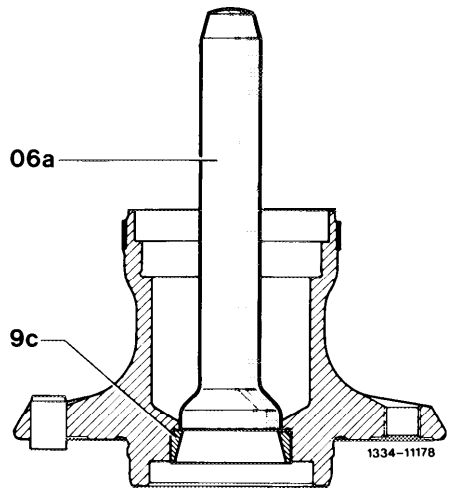
3 Withdraw outer race (9b) of the inside tapered roller bearing using device **(06).**





4 Knock out outer race (9c) of the outer tapered roller bearing on wheel hubs of model 201.02/1 with mandrel (06a). On wheel hubs of models 124 and 201.03 knock out outer race (9c) with a suitable mandrel (self-made).





Checking and reconditioning

5 Check flange of the front wheel hub for runout.

6 Check screw holes for wheel mounting.

7 Check condition of running surface for radial sealing ring on steering knuckle pin.

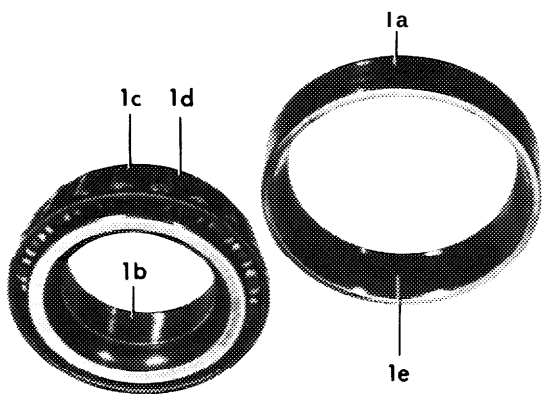
8 Thoroughly wash out tapered roller bearing and hub inside. Use clean detergent only.

9 Check tapered roller bearing and bearing seats in the hub.

The condition of the track of the inner and outer bearing rings as well as the faces of the tapered rollers are decisive for the assessment of tapered roller bearings.

Tapered roller bearings are still usable if:

the outer race has a smooth, grey line from the tapered rollers.



1a Outer race
1b Inner race
1c Tapered rollers
1d Roller cage
1e Ring track

Tapered roller bearings are no longer usable if:

1. The line of the tapered rollers in the outer bearing shows indentations (caused by peeling on the bearing inner race);

2. Rust has formed on the tapered roller bearings (occurs when water enters the front wheel bearing through a defective radial seal);

3. The outer bearing has turned light brown to blue as a result of an excessive temperature rise.

Note: If one tapered roller bearing is defective, always renew the other bearing of the hub concerned.

Install wheel bearings of identical make. If used bearings are put back, do not mix up related inner bearing races with roller cage and outer races.

Assembly

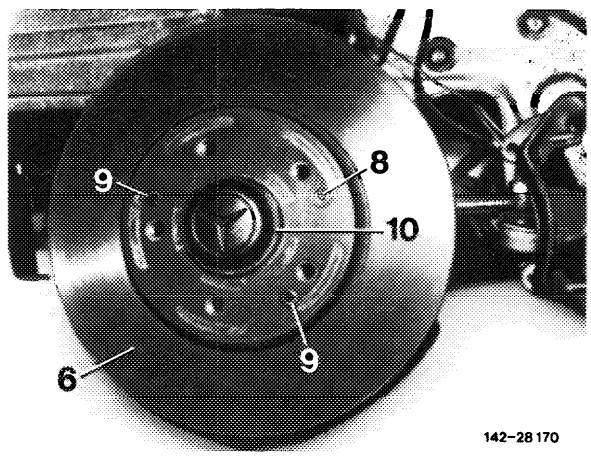
On model 201.02/1 with 15" wheels the front wheel hubs have wider contact surfaces than the front wheel hubs with 14" wheels.

In addition, the brake disk is attached to the front wheel hub by means of a locking screw.

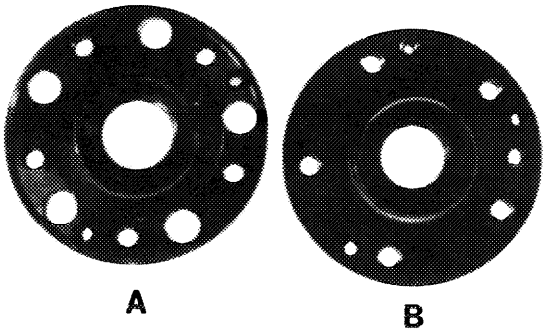
Conversion

Principally, a conversion of formerly made vehicles with 14" to 15" steel rims is permissible **only following reconstruction** to the present series version of the front wheel hubs and the brake disks (contact surface of steel rim in combination with former hubs is too narrow).

When using 15" light-alloy rims, reconstruction is not required. In the Federal Republic of Germany, the usual procedure requires that the new tire size is entered into the vehicle documents by a technical inspection society for motor vehicles.



Identifying characteristic of modified brake disks:
8 Locking screw



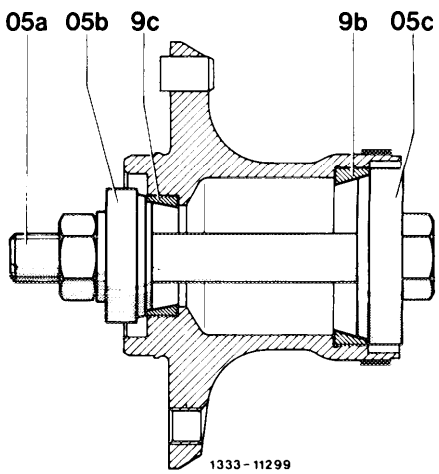
A Version for 14" rims (up to 1.1985)
B Version for 15" rims (as of 2.1985)

133-30 949

Production breakpoint of the new front wheel hubs on models 201.02/1

As of chassis end No. A 168985
F 062643

10 Press outer races of the tapered roller bearings together with the device into the front wheel hub. Always ensure that the thrust washers (05b and 05c) are seated correctly.

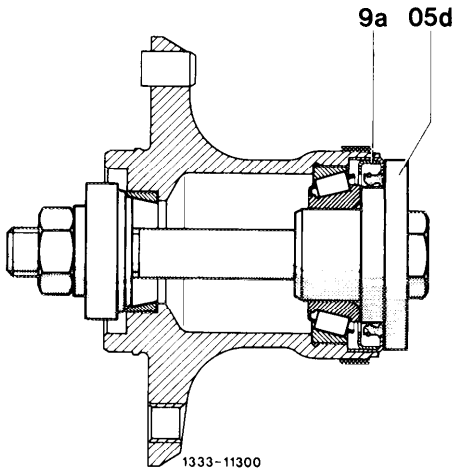


9b Outer race for inside tapered roller bearing
9c Outer race for outer tapered roller bearing
05a Bolt with hexagon nut and washer
05b Thrust washer for outer race of the outer tapered roller bearing
05c Thrust washer for outer race of the inside tapered roller bearing

11 Weigh specified grease quantity for hub with bearing, depending on version (refer to table).

12 Pack roller cage of inside tapered roller bearing well with anti-friction bearing grease, then insert inner race with roller cage into the hub and grease end faces of the rollers.

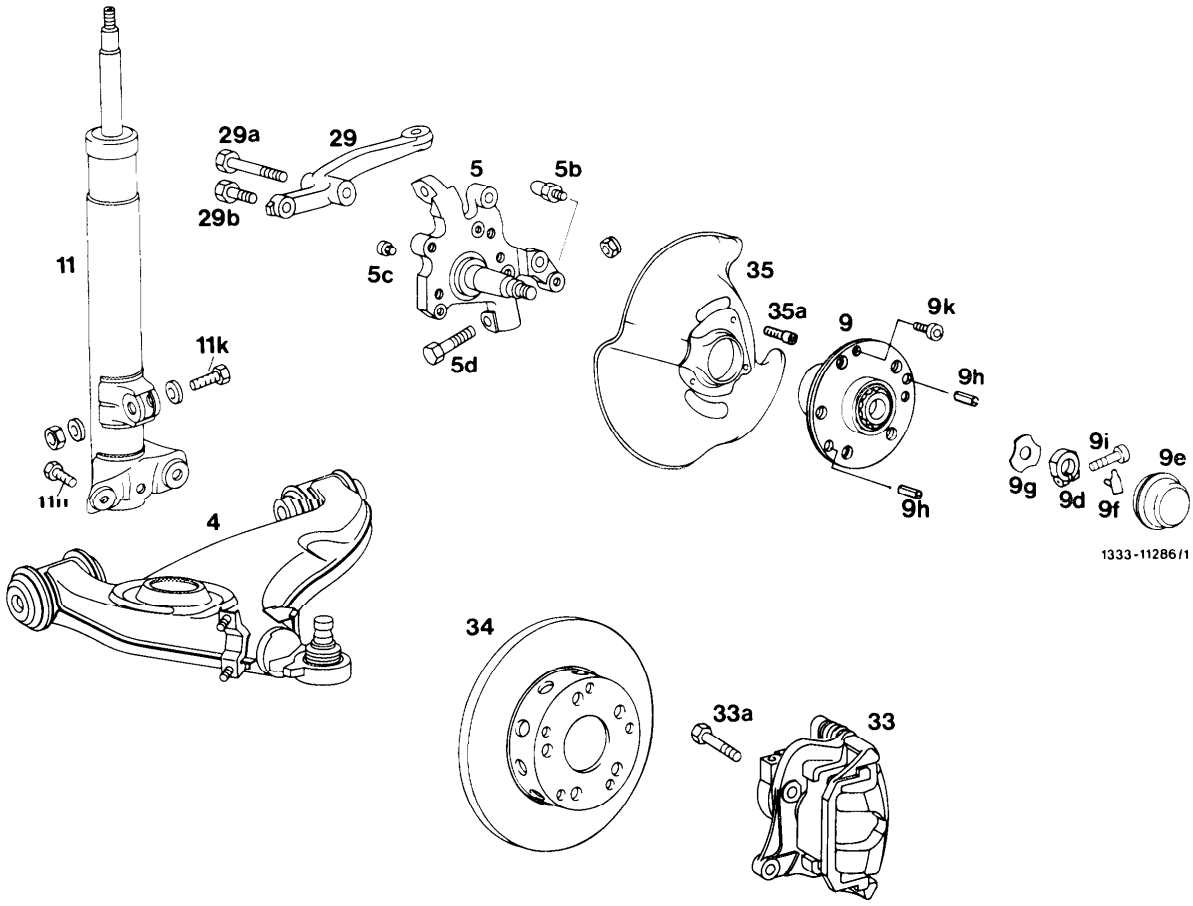
13 Fill radial sealing ring between sealing lip and dust lip with the specified grease and press in with device.



9a Radial sealing ring
05d Thrust washer for radial sealing ring

14 Fill front wheel hub with remaining grease.

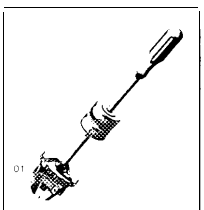
Note: If too much grease is added it will overheat on account of the flexing (fulling) effect and may then lose its lubricating properties. However, an inadequate amount of grease is also wrong because the tapered roller bearings will not be lubricated correctly in this case.



4	Wishbone	Check rubber mount for firm seat. Check condition of the sleeve at the supporting joint.
5	Steering knuckle	Check steering knuckle pin for damage and running surface for radial seal for wear. Survey of versions, refer to 33–410.
5b	Stop pin	Remove and install. Tightening torque 45 Nm.
5c	Centering pin	
5d	Hexagon bolt with self-locking nut	Tightening torque 125 Nm.
9	Front wheel hub	Adjust end play of wheel bearings (0.01-0.02). Survey of wheel hub versions, refer to 33-320.
9d	Clamping nut	
9e	Hub cap.	Fill up to the flanged edge with high-temperature anti-friction bearing grease (approx. 15 g).
9f	Contact spring	
9g	Washer	
9i	Hex. head socket screw	Tightening torque 12 Nm.
9k	Locking screw.	Renew, tightening torque 10 Nm.
11	Shock absorber strut	
11n	Hex. head screw with washer	Tightening torque 1 st version 10.9 100 Nm 2nd version 12.9 1 10 Nm
11k	Hex. head screw with washers and self-locking nut	Tightening torque 1st version with hex. head screw 10.9 was 75 Nm 2nd version with hex. head screw 12.9 (as of 1.1985) = 110 Nm
29	Steering knuckle arm	Survey of versions, refer to 33-420
29a	Hex. head screw.	Tightening torque 80 Nm.
29b	Hex. head screw.	Tightening torque 80 Nm.

33	Floating caliper		
33a	Hex. head screw	.....	Always renew micro-encapsulated bolts. Tightening torque 115 Nm.
34	Brake disk	.....	Check for wear and condition.
35	Brake cover plate		
35a	Hex. head socket screws	.....	Tightening torque 10 Nm.

Special tools



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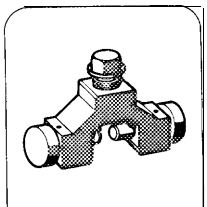

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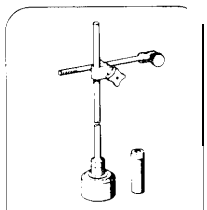

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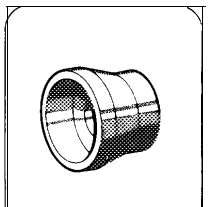
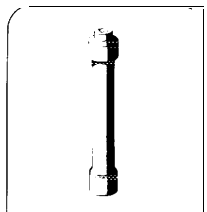


124 589 00 15 00



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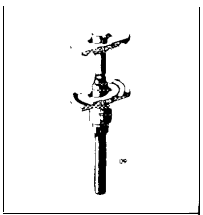


201 589 00 31 00

Commercially available tools

Dial gauge A 1 DIN 878	e.g. Mahr, D-7300 Esslingen Order No. 810

Sealing compound

Sealing material **(200 g** can)	0019897920

Note

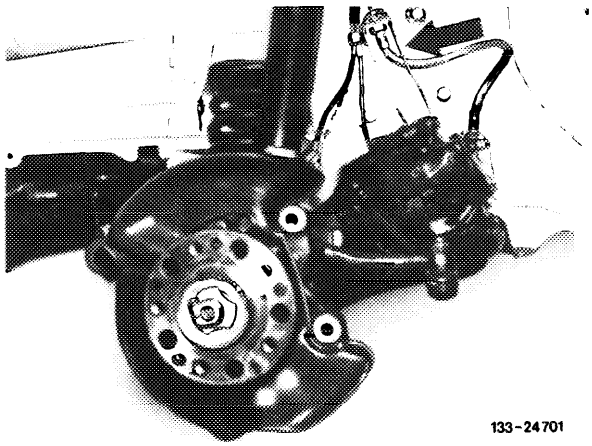
With front spring installed, only release hexagon nuts at supporting joint if the trestles are placed beneath the lower wishbones at front, not beneath frame floor; otherwise clamp or remove front spring.

Damaged or leaking sleeves on used joints must not be replaced. In such a case always exchange supporting joint. Always renew self-locking nuts and bolts!

Removal

1 Jack up vehicle at front. Remove front wheel.

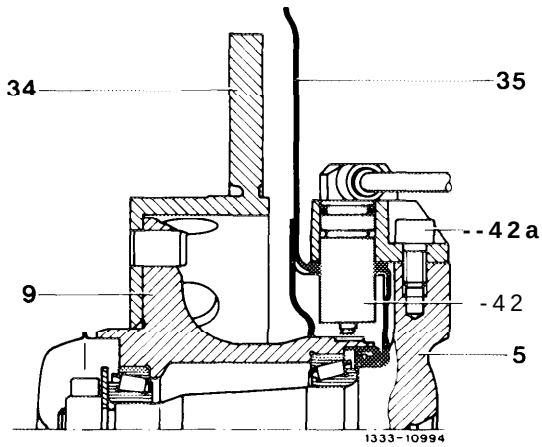
2 Unscrew floating caliper from the steering knuckle and position at the front with a suitable hook (arrow). Remove brake disk.



Important!
Do not tension brake hose.

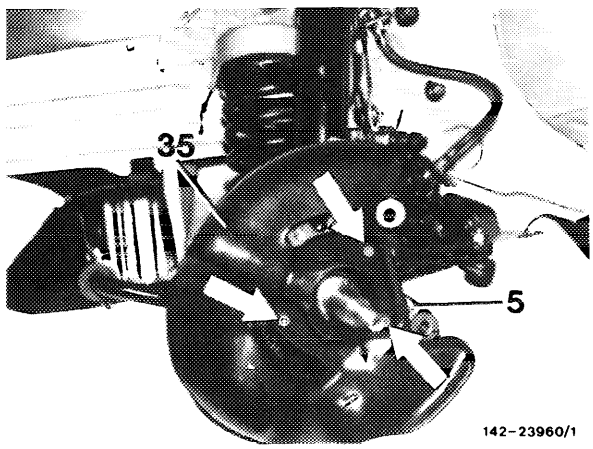
3 Remove front wheel hub (33-310).

Note: On vehicles with ABS, remove speed sensor after loosening the hexagon socket head bolt (42a) from steering knuckle.

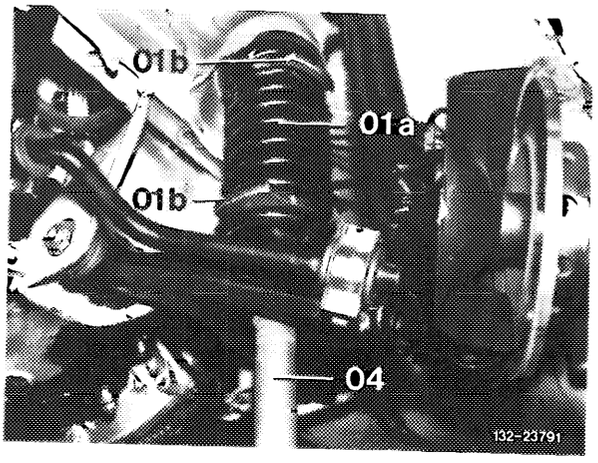


5 Steering knuckle
9 Front wheel hub
34 Brake disk
35 Brake cover plate
42 Speed sensor
42a Hex. head socket screw

4 Remove brake cover plate (35) after unscrewing the 3 hex. head screws (arrow) from the steering knuckle (5).

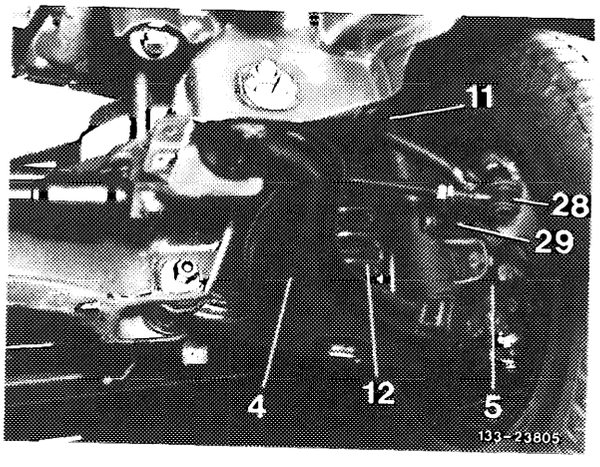


5 Insert spring compressor (01) for front spring and compress spring until the wishbone is relieved (32-200).

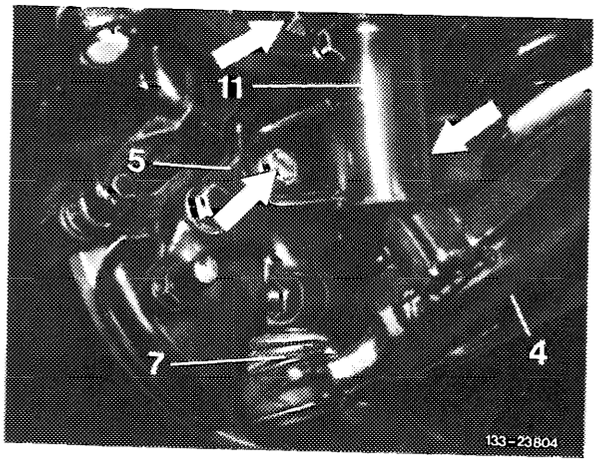


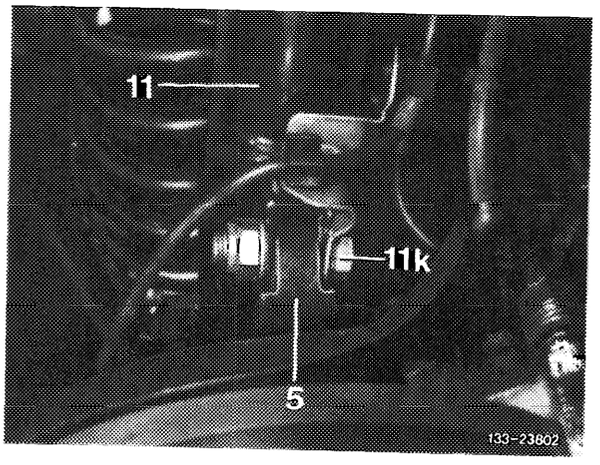
01a **Clamping bolt**
01b **Clamping plates**
04 Box wrench

6 Unscrew hex. head screws holding the steering knuckle arm (29) at the steering knuckle (5).



7 Remove hex. head screws (arrows) holding the shock absorber strut (11) at the steering knuckle (5).

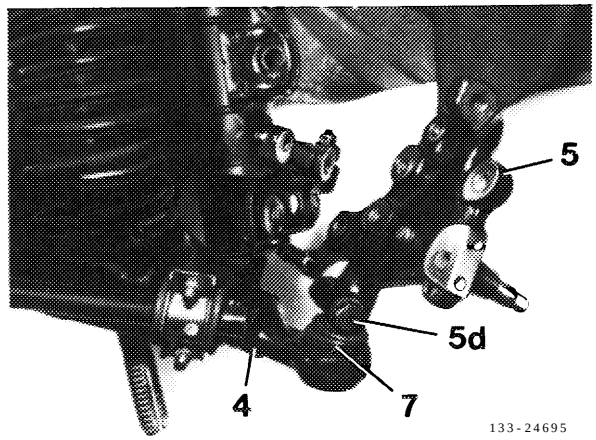




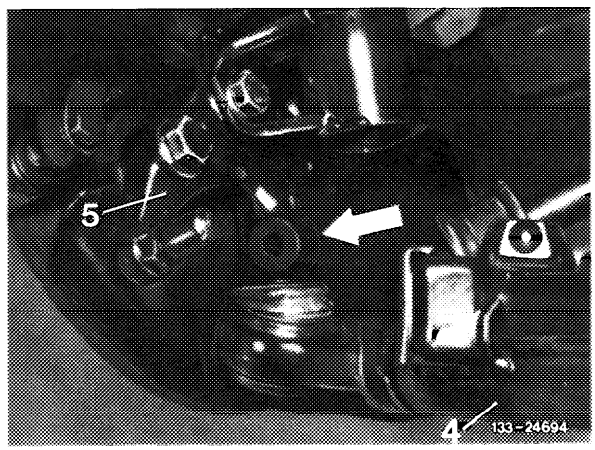
5 Steering knuckle
11 Shock absorber strut
11k Hex. head screw

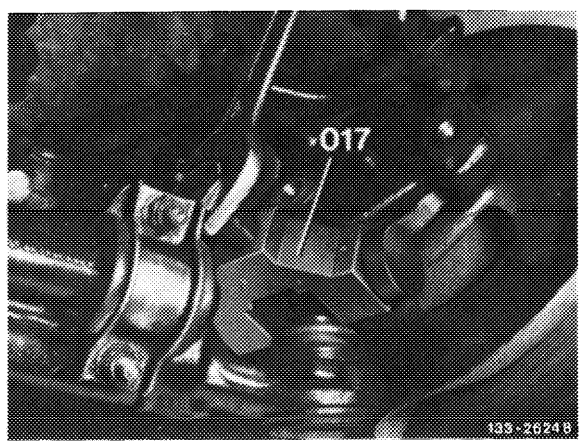
8 Remove hex. head screw (5d) of the clamping joint between steering knuckle (5) and supporting joint (7).

9 Remove steering knuckle from the supporting joint.



Note: If the steering knuckle cannot be removed from the supporting joint because of corrosion, the clamping joint will have to be released by widening the slot in the steering knuckle (arrow) with the spreader.



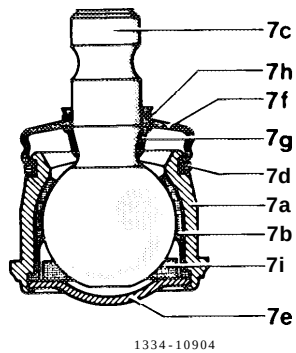


017 Spreader

Installation

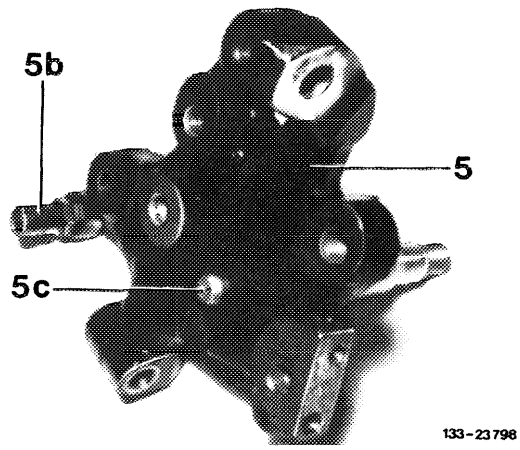
10 Check supporting joint in wishbone (33-425).

Note: The sleeve (7f) should be renewed if damaged during removal (33-430). However, if the sleeve is found to be damaged in a used joint, the supporting joint must be renewed (33-440).



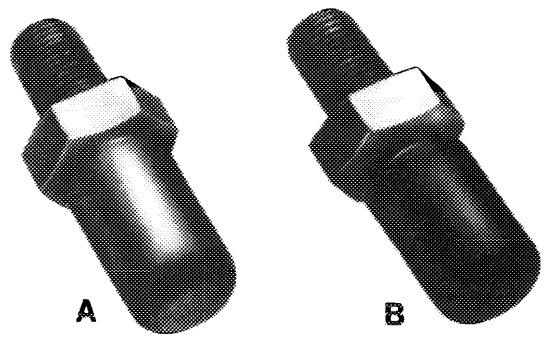
7a Housing
7b Ball shell
7c Knuckle pin
7d Wire retainer
7e Cover
7f Sleeve
7g Supporting ring
7h Wire retainer
7i Ball shell

11 Check steering knuckle (33-410).



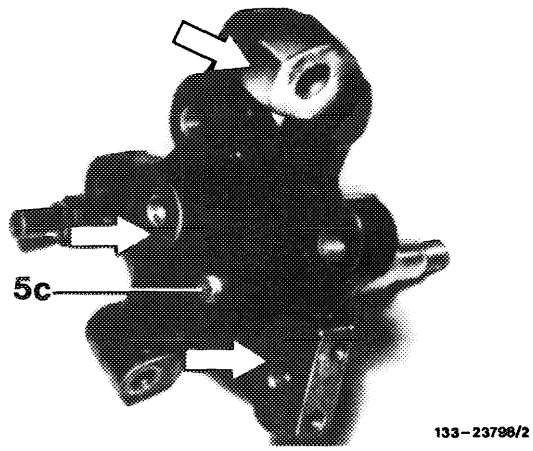
5 Steering knuckle
5b Stop pin
5c Centering bolt

Note: As of the middle of September 1985 the stop pins with plastic cap are installed as standard equipment. On vehicles made at an earlier date, this version can be installed in the event of repairs.



A = Stop pin without plastic cap
Version up to 8. 1985
B = Stop pin with plastic cap
Version starting 9. 1985

Important!
Steering knuckle and shock absorber strut are fixed lengthwise (caster) via the centering pin (5c) and crosswise (camber) via surfaces (arrows). Therefore always observe the correct sequence (Nos. 14-16) for installation.

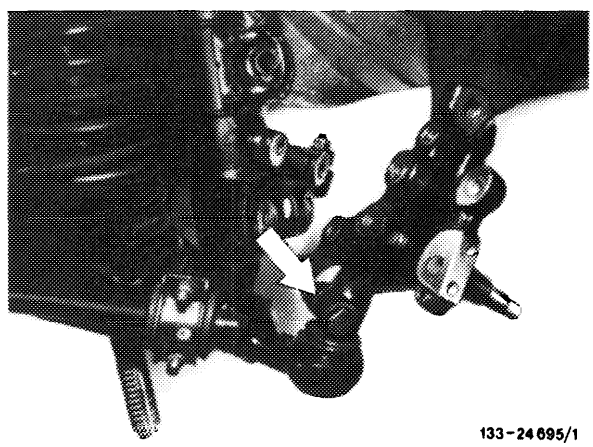


12 Insert steering knuckle into the supporting joint, Install and tighten hex. head screw with new self-locking nut.

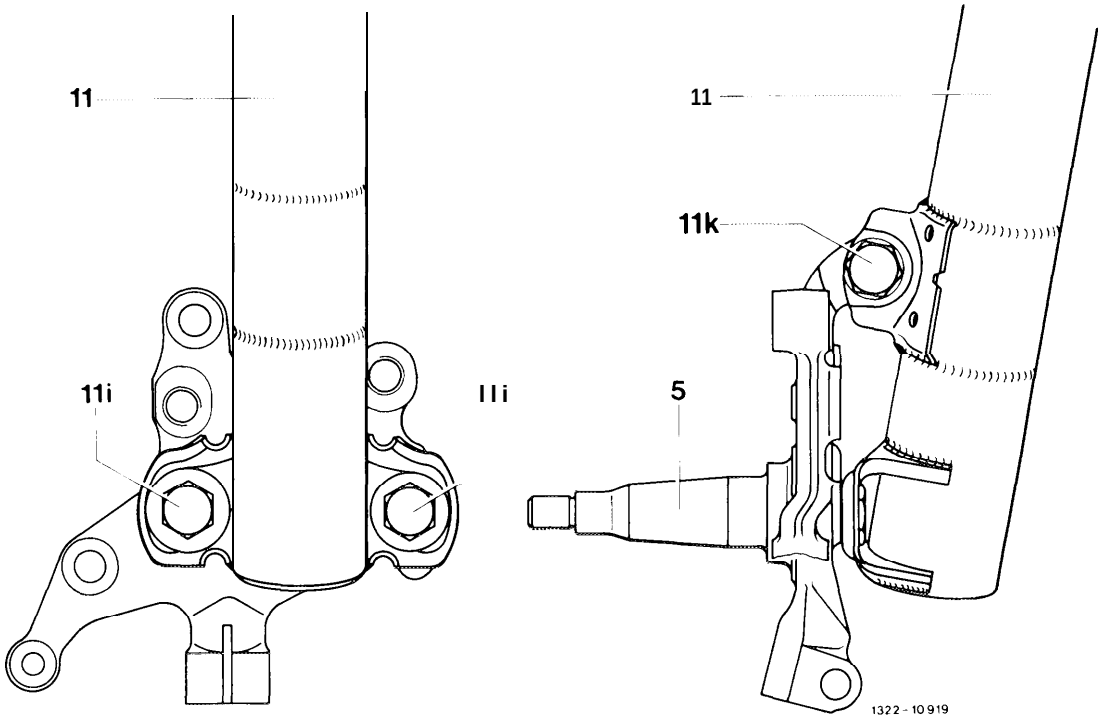
Tightening torque 125 Nm.

13 Fill separating slot (arrow) for the prevention of corrosion completely with sealing compound (refer to table).

14 Install steering knuckle arm with new micro encapsulated hex. head screws and tighten to 80 Nm



15 Join shock absorber strut (11) to the steering knuckle (5). Only apply, do not tighten, the two new micro-encapsulated bolts (11 i).



16 Press steering knuckle (5) up and home against the shock absorber strut, install and slightly tighten upper bolt with washers and self-locking nut (11 k); ensure that the surface of the steering knuckle contacts the shock absorber strut at the inside.

Note: Always renew self-locking bolts and nuts

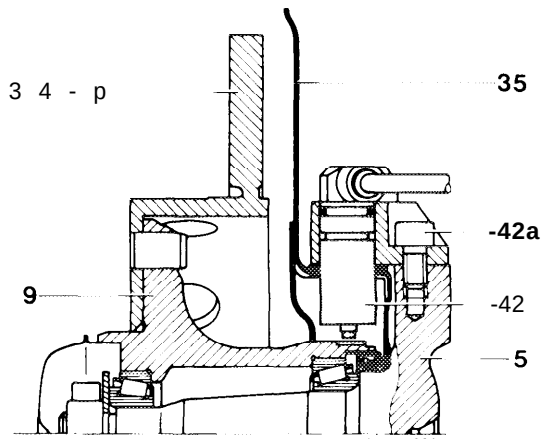
17 First tighten the two lower hexagon bolts (11 i) to 100 Nm and then the hexagon bolt of upper clamping joint (11 k) to 75 Nm.

18 Release front spring and remove spring compressor

19 Install brake cover plate (35) with new self-locking hexagon socket-head bolts and tighten to 10 Nm.

Note: On models with ABS install the speed sensor (42) in the steering knuckle (5) with new self-locking hexagon socket-head bolts (42a)

Tightening torque 22 Nm



20 Install front wheel hub (33-310).

21 Adjust end play of wheel bearings (33-100).

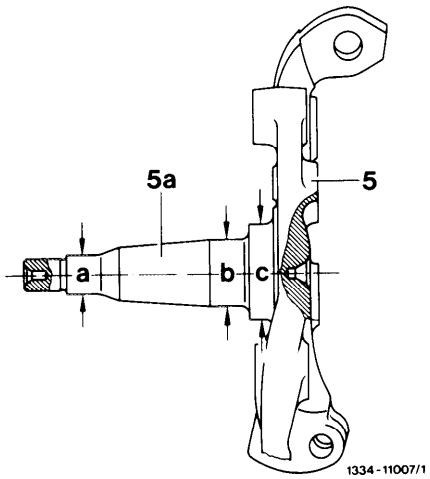
22 Install floating caliper (42-100).

Important!
Do not twist brake hose and do not tension.

23 Install front wheel (40-110), lower vehicle.

24Check wheel alignment at front axle (40-320).

25 Check setting of the headlamps.

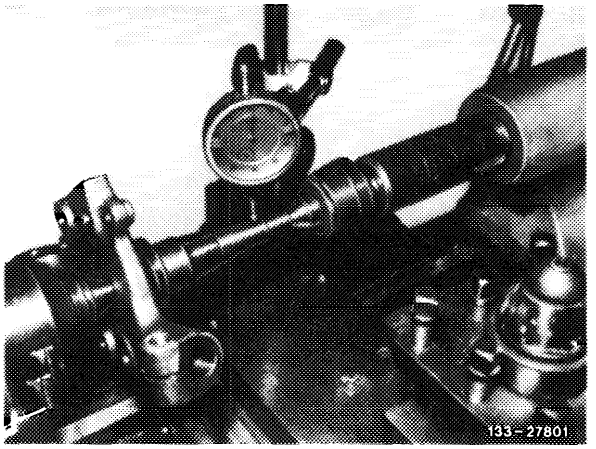


5	Steering knuckle	Check for outer damage
5a	King pin	Check contact surface for radial seal and bearing seat. Permissible deviation from concentricity at the bearing seats max. 0.05 mm.
a	Bearing seat	Min. diameter for repair Model 124, 201.034 = 19.04 mm Model 201.02/1 = 17.45 mm
b	Bearing seat	Min. diameter for repair Model 124, 201.034 = 31.74 mm Model 201.02/1 : 1 st version up to January 1983 = 29.00 mm 2nd version as of February 1983 = 31.74 mm
c	Contact surface for radial seal	Min. diameter for repair Model 124, 201.034 = 44.40 mm Model 201.02/1: 1st version up to January 1983 = 41.00 mm 2nd version as of February 1983 = 44.40 mm

Commercially Available Tools

Measuring stand	e.g. Messrs. Bosch, D-7000 Stuttgart-Feuerbach Order No. 0 601 980 001
Dial gauge A 1 DIN 878	e.g. Messrs. Mahr, D-7300 Esslingen Order No. 810 St

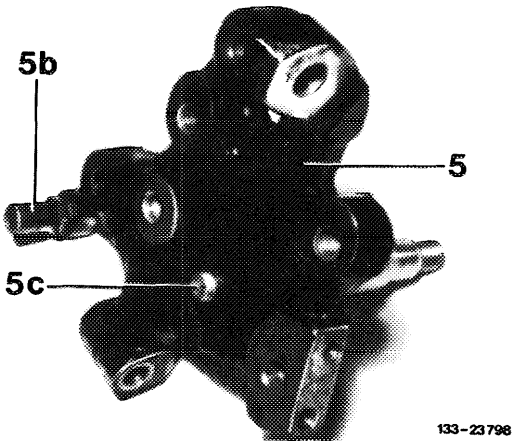
For checking the steering knuckle, mount between centers on the lathe at both centering holes.



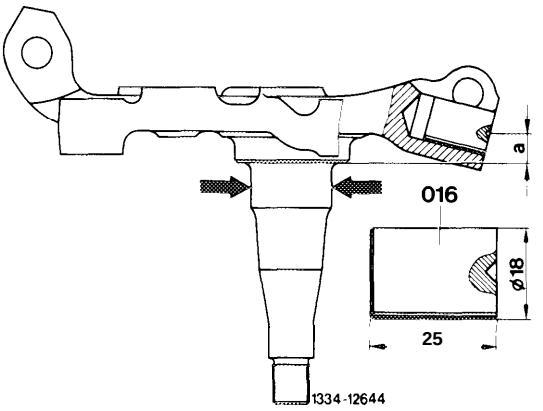
Firstly remove the centering pin (5c) from the steering knuckle (5).

Note: New steering knuckles are supplied with the center ing pin.

As from approx. September 1985 only stop pins (5b) with plastic flap will be installed.



When repairing accidents, the steering knuckle can be additionally checked for bends via the lower bearing point in direction of camber after checking the kingpin by means of a measuring bolt. In such a case, the steering knuckle is mounted on inner bearing seat of pin (arrows) in a three-jaw chuck.



016 Measuring bolt with center bore (self-made)

For evaluation, the different dimension (a) between the contact surface for the inner tapered roller bearing and the mounting bore for the ball pin of the supporting joint is measured by means of a height-measuring instrument. The measuring bolt must be seated flush with face in mounting bore.

The reference dimension „a" should be 12.5 ± 0.5 mm.

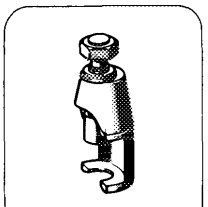
Data

Model	Part No.	Code number	Layout of steering knuckle arm
124	124332 1020	24 10	left
	1243321120	24 11	right
201[1])	2013320820	01 08	left
	2013320920	01 09	right
201[2]) 201.034	201 332 1020	01 10	left
	201 332 1120	01 11	right

[1]) 1st version up to 8. 1984
[2]) 2nd version as of 9. 1984

Tightening torques	Nm
Self-locking hex. head screws for mounting the steering knuckle arm on the steering knuckle	80
Self-locking hexagon nut for the ball joint of the tie rod	35

Special tool

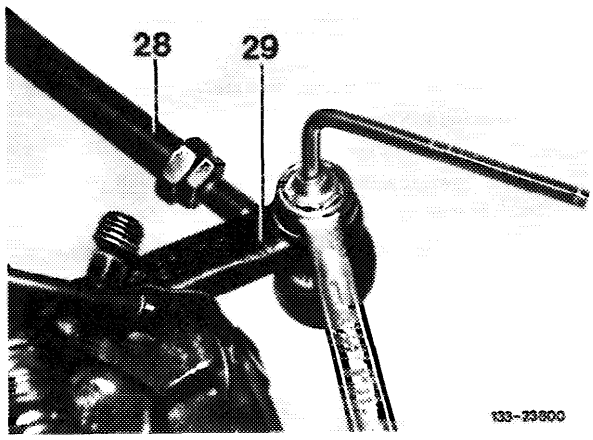


201 589 08 33 00

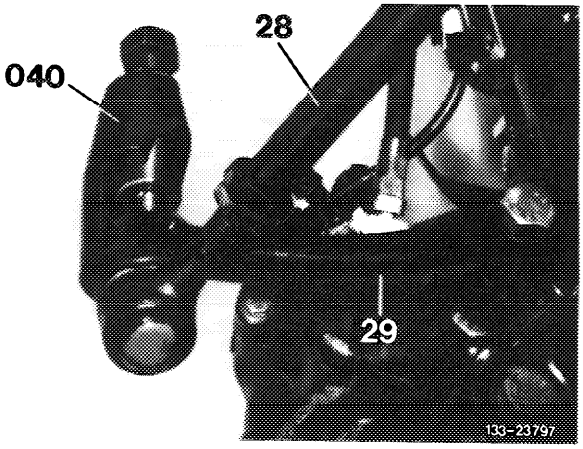
Removal

1 Jack up vehicle at front, remove front wheel.

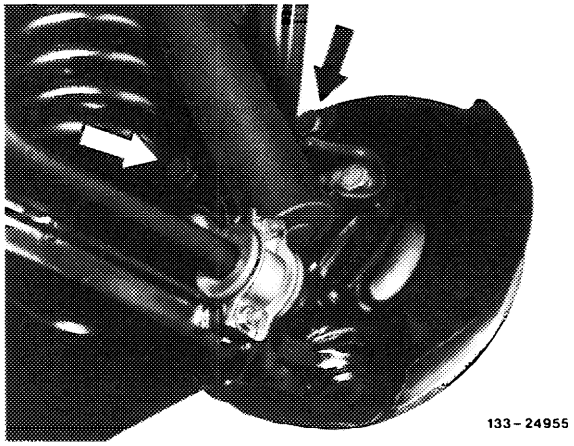
2 Unscrew hexagon nut of the tie rod (28) at the steering knuckle arm (29).



3 Press off ball joint of the tie rod (28) at the steering knuckle arm (29) using device (040).

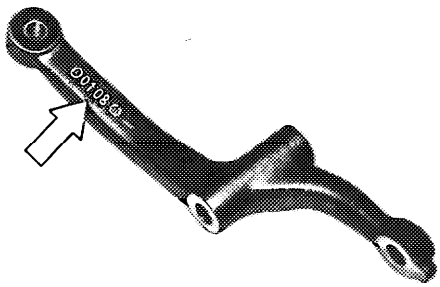


4 Unscrew hex. head screws (arrows) and remove steering knuckle arm to the rear.



Checking

5 The steering knuckle arm cannot be checked with usual workshop means. **If in doubt,** especially after accidents, install **a new steering knuckle arm.** Note the correct code number (arrow) of the steering knuckle arm. (For survey of versions, refer to Table).



Installation

6 Clean contact surface for the steering knuckle arm at the steering knuckle.

Note: If a new steering knuckle arm is installed, ensure that the contact surfaces for the steering knuckle, the hex. head screws and the hexagon nut are free of paint.

7 Fasten steering knuckle arm to the steering knuckle with two new self-locking hex. head screws. Tighten hex. head screws to the specified torque of 80 Nm.

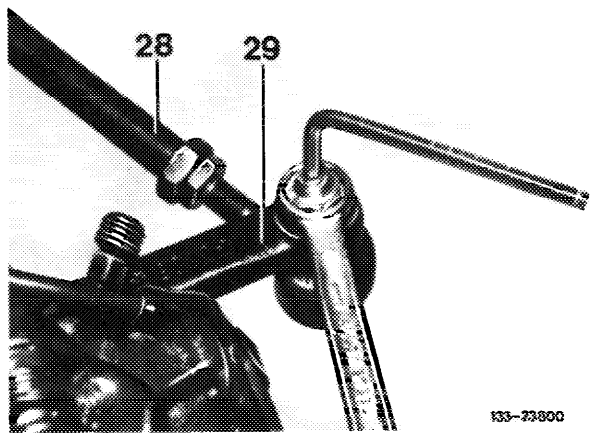
Important!
Always renew self-locking hex. head screws.

8 Check rubber sleeve on the ball joint of the tie rod. If the rubber sleeve is damaged, check the ball joint for wear and renew (46-540) if necessary.

Note: If the rubber sleeve was damaged upon removal, it will suffice to renew the rubber sleeve.

9 Fasten tie rod (28) to the steering knuckle arm (29) with new self-locking hexagon nut, while holding the knuckle pin in place with a hex. head socket wrench.

Tightening torque 35 Nm.



10 Install front wheel (40-l 10), lower vehicle.

11 Check wheel alignment at the front axle (40-320).

33–425 Checking supporting joint of the steering knuckle bearing

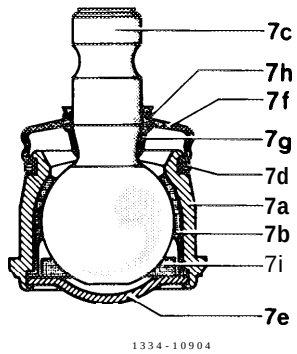
Ball joint

Ball dia.	Ball shells	Checking instruction
35	Plastic	Knuckle pins must move backward and forward without play, without jamming and without grating noises.

Note

The supporting joint of the steering knuckle bearing is a ball joint mounted in plastic shells.

The housing of the supporting joint is pressed into the transverse link.

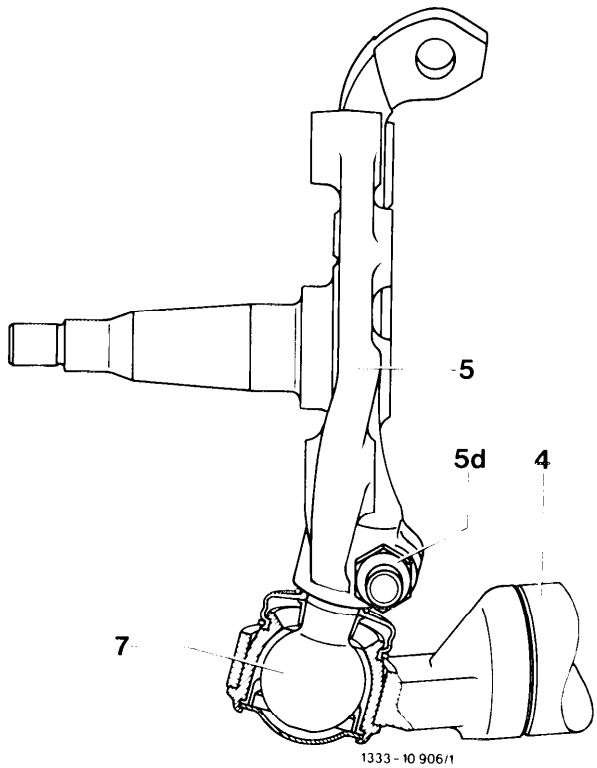


1334-10904

7a Housing
7b Ball shell
7c Knuckle arm
7d Wire retainer
7e Cover
7f Sleeve
7g Supporting ring
7h Wire retainer
7i Ball shell

The ball joints are maintenance-free, i.e. they are greased for life. In a maintenance-free joint, seal protection against penetrating dirt and sand is of decisive importance for the life of the joint. For this reason it is necessary to check the joints carefully from time to time. If dirt passes through a leaking sleeve it will certainly lead to premature joint wear.

A rubber sleeve damaged during assembly must be renewed immediately (33-430). **Always renew a joint already used with a leaking sleeve.**



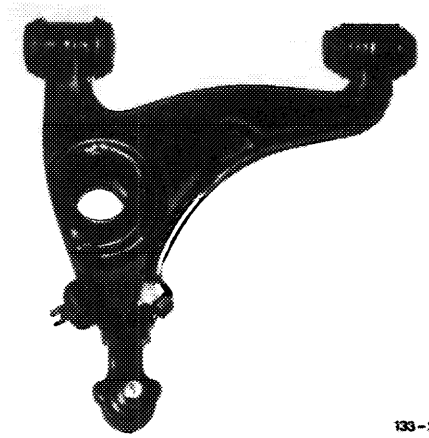
1333-10 906/1

4 Wishbone
5 Steering knuckle
5d Hex. head screw with nut
7 Supporting joint

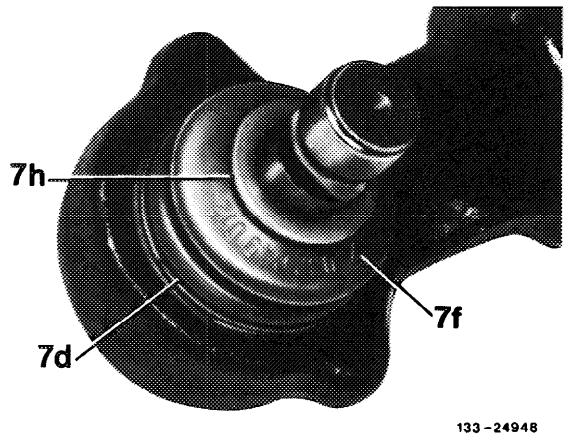
Checking

1 Check ball joint. For this purpose slip an approx. 150 mm long tube onto the knuckle pin, see checking instruction.

2 Check supporting joint for firm seat in the wishbone.

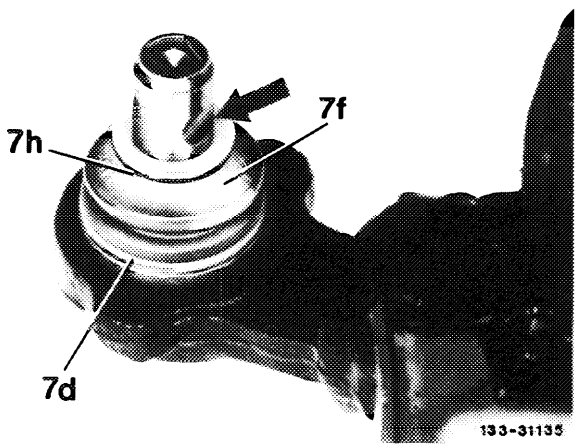


3 Check sleeve (7f) for cracks and damage, check wire retainer (7d) and wire retainer (7h) for correct seating.



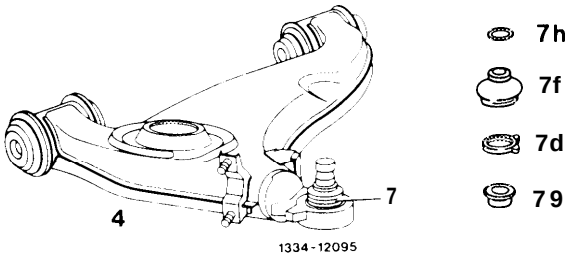
Note: On model 201 the supporting joint pin has been changed as of the end of 1984 from the ring groove version to a flat: groove version (arrow).

On model 124 the flat groove version applies already as from start of series.



7d Wire retainer
7f Sleeve
7h Wire retainer

33-430 Renewing the sleeve for the supporting joint of the steering knuckle bearing mount



4 Transverse link

7 Supporting joint . . . . . **Amount of grease** between housing and sleeve 5-6 g.
Type of grease: Longlife grease, refer to Service Product Specification Sheet 266.2

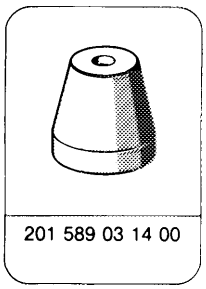
7d Wire retainer

7f Sleeve. . . . . Immediately renew sleeves damaged during assembly. Damaged or leaking sleeves on already used joints must under no circumstances be replaced. In such a case, always exchange the complete supporting joint (33–440). Do not wash ball joint.

7g Supporting ring . . . . . Renew according to condition.

7h Wire retainer, ... Mount with special tool 201 589 03 14 00.

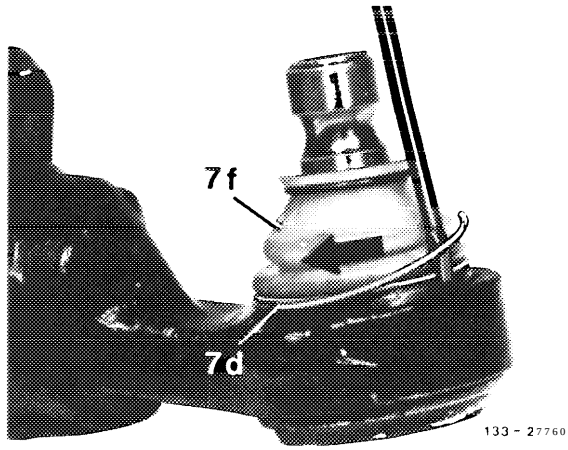
Special tool



Removal and installation

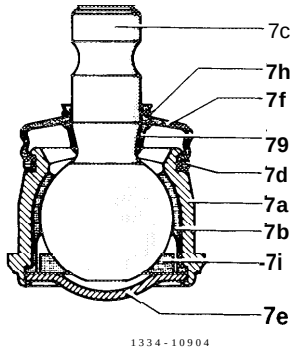
1 Remove wire retainer (7d).

2 Remove sleeve (7f) and remove old grease from ball joint (do not wash).



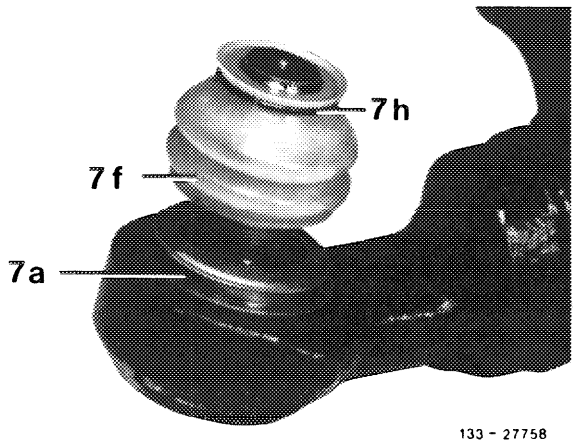
3 Renew supporting ring (7g).

4:Pack space between housing and ball pin with fresh grease. Take care to ensure that the seat of the sleeve on the housing remains free of grease.



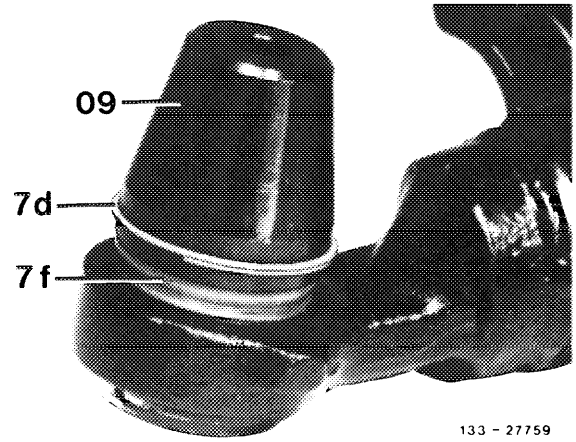
7a Housing	7e Cover
7b Ball shell	7f Sleeve
7c Ball pm	7g Supporting ring
7d Wire retainer	7h Wire retainer

5 With wire retainer (7h) fitted in position, slide new sleeve (7f) on the housing (7a).

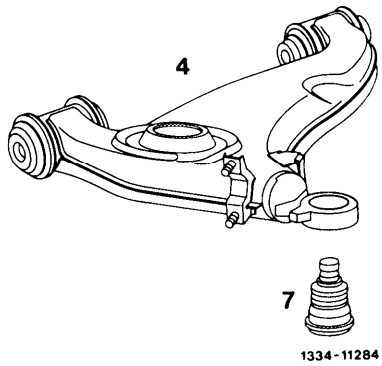


6 Slide wire retainer (7d) on the mounting sleeve (09) until the cylindrical section of the sleeve is reached.

7 Place the mounting sleeve (09) on the supporting joint and slide the wire retainer (7d) on to the sleeve (7f).



33–440 Renewing supporting joint of steering knuckle bearing

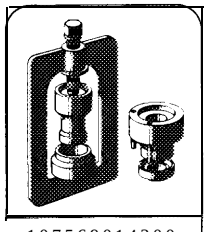


4	Wishbone	Check rubber mount of the front and rear wishbone bearings. Mend paint defects on the wishbone.
7	Supporting joint	Check sleeve for damage, ball joint for wear.

The ball joints are maintenance-free, i. e. they are greased for life. In a maintenance-free joint, seal protection against penetrating dirt and sand is of decisive importance for the life of the joint. For this reason it is necessary to check the joints carefully from time to time. If dirt passes through a leaking sleeve it will certainly lead to premature joint wear.

A rubber sleeve damaged during assembly must be renewed immediately (33-430). **Always renew a joint already used with a leaking sleeve.**

Special tools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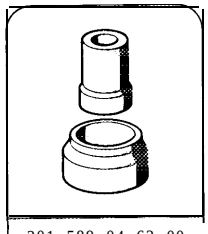
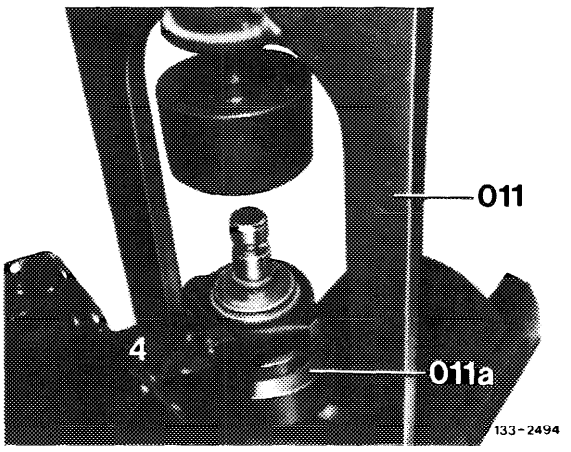

201 589 04 63 00

Removal

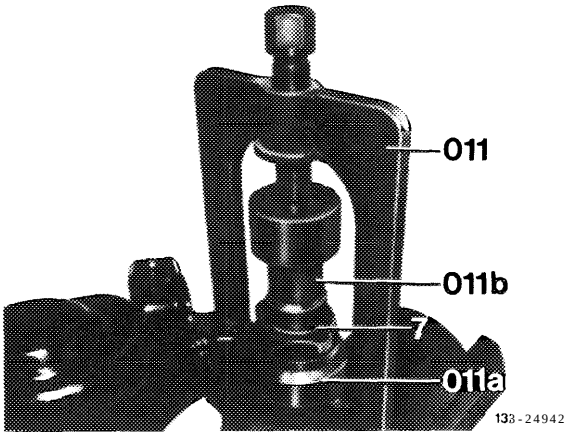
1 Remove wishbone (33-5 10).

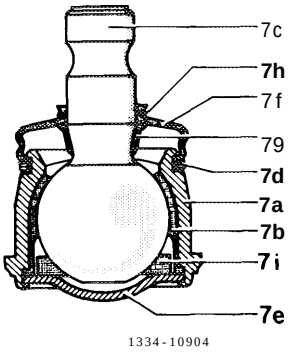
2 Remove sleeve of the supporting joint,

3 Clamp special tool (01 1) in vise and attach sleeve (01 la). Mount wishbone.



4 Place sleeve (01 lb) on the supporting joint (7) and press out joint.





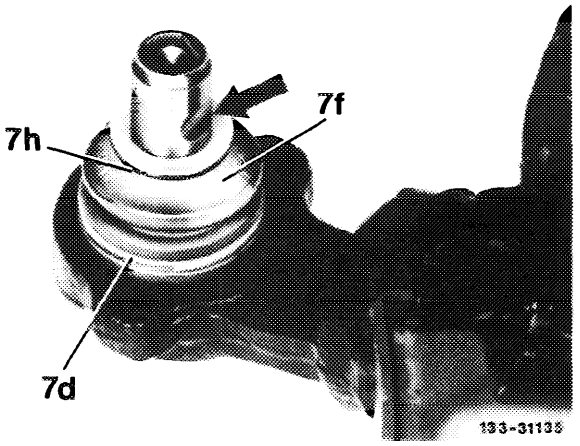
Supporting joint

7a Housing
7b Ball shell
7c Knuckle pin
7d Wire retainer
7e Cover
7f Sleeve
7g Supporting ring
7h Wire retainer
7i Ball shell

Installation

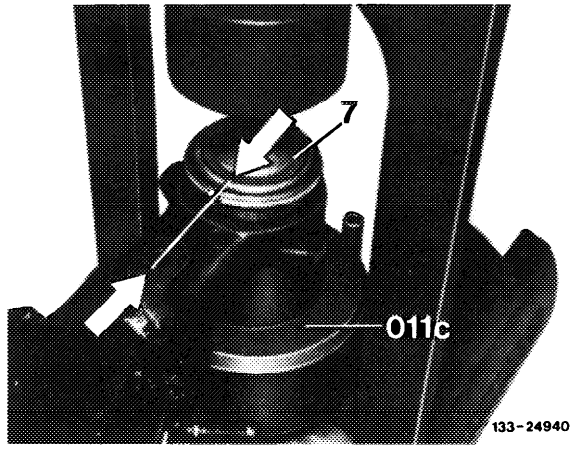
Note: The supporting joint pin on model 201 has been changed as from the end of 1984 from a ring groove version to a flat groove version (arrow).

On model 124, the flat groove version is valid already as from start of series.



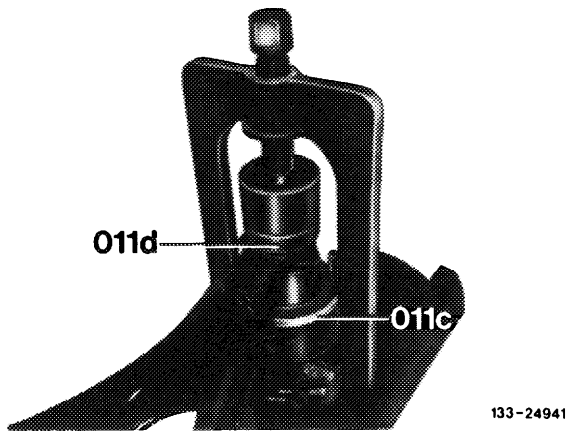
7d Wire retainer
7f Sleeve
7h Wire retainer

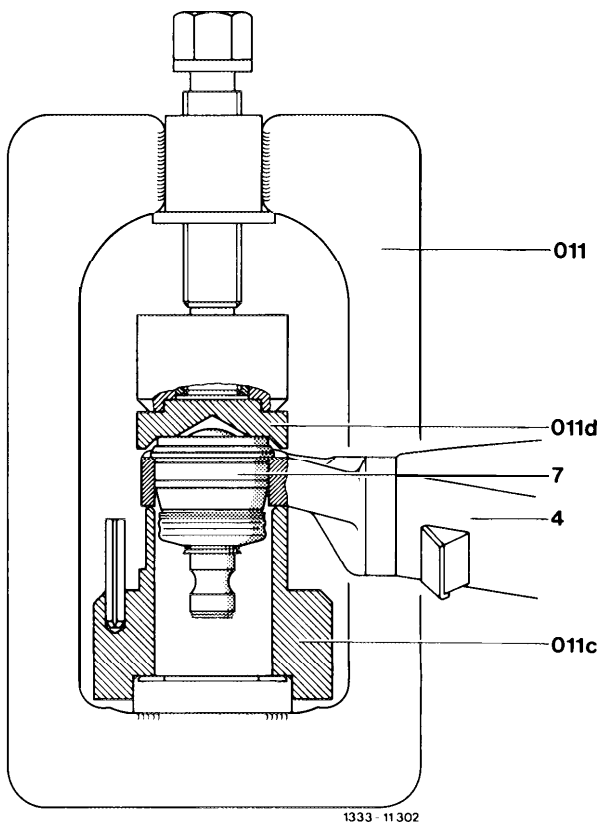
5 Place support (01 lc) on installer. Insert supporting joint (7) in the boss of wishbone so that the marking on the supporting joint (arrow) agrees with the center of the wishbone boss (arrow).



6 Place thrust piece (01 1d) on the supporting joint and press in with the spindle. Check supporting joint for correct seat in wishbone.

7 Install wishbone (33-510).



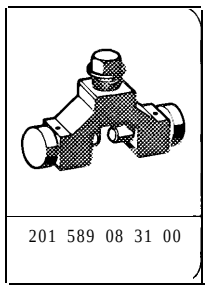


4 Wishbone
7 Supporting joint
011 Remover and installer
011d Support for wishbone
01 lc Thrust piece for installation

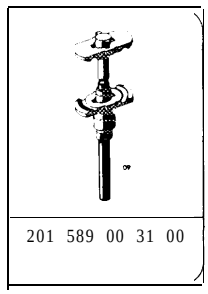
33-510 Removal and installation of wishbone

Tightening torques	Nm
Hex. head screw of clamping joint of the supporting joint at the steering knuckle	125
Hex. head nuts of the eccentric pins at the wishbone bearing	120
Hex. head nuts of the torsion bar bearing at the wishbone	20

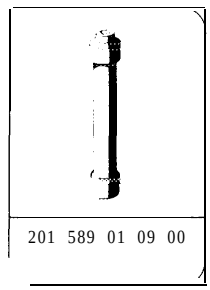
Special tools



201 589 08 31 00



201 589 00 31 00



201 589 01 09 00

Sealing compound

Sealing compound (200 g can)	0019897920

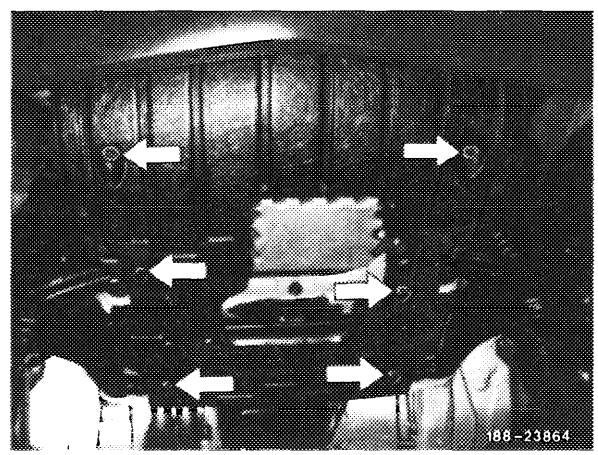
Note

The eccentric pin of the wishbone bearing may only be tightened when the vehicle is standing on its wheels ready for the road. If this bearing is tightened while the wheels are relieved, incorrect values will be obtained for the wishbone positioning.

Always renew self-locking bolts and nuts!

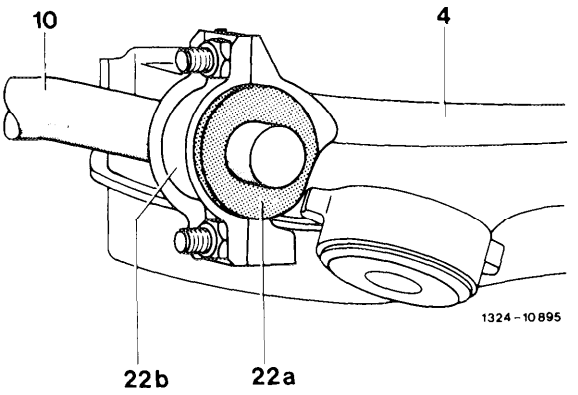
Removal

1 Remove engine compartment lining at bottom on vehicles equipped thus.



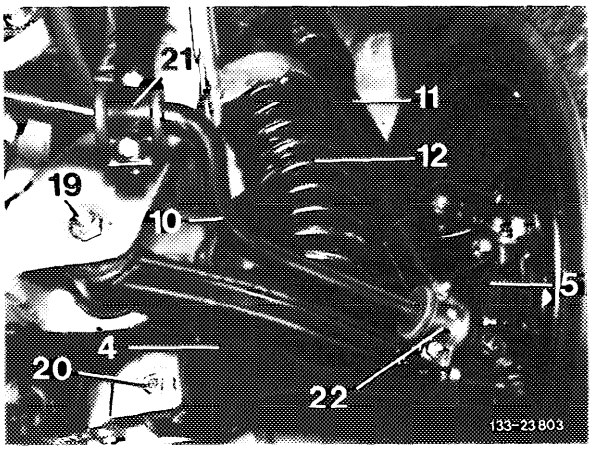
2 Jack up vehicle at front, remove front wheel.

3 Release bearing of the torsion bar at wishbone.

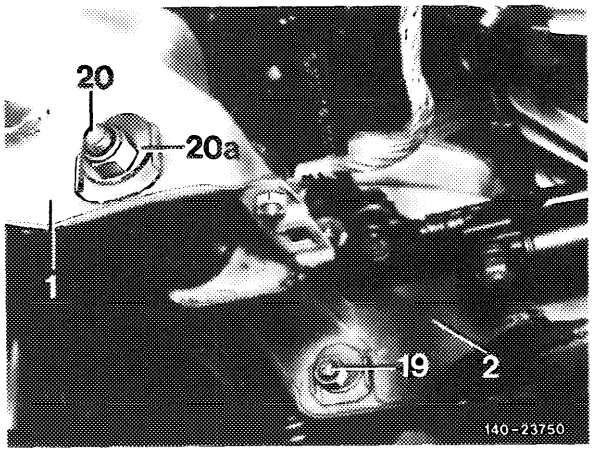


4 Wishbone
10 Torsion bar
22a Rubber mount
22b Retainer

4 Remove front spring (12) (33-200).

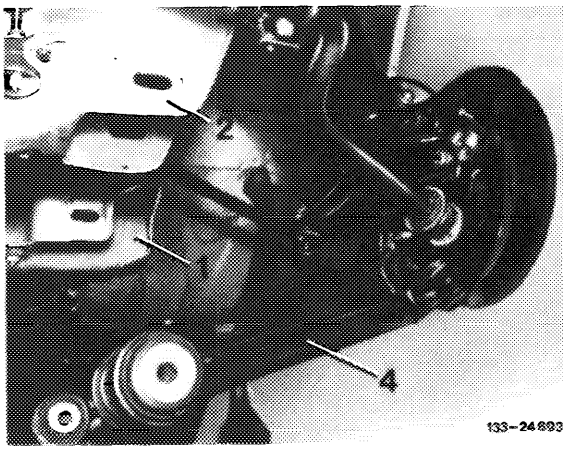


5 Mark position of the eccentric pins relative to frame on the wishbone bearing.



Side member
2 Cross member
19 Eccentric pin (camber)
20 Eccentric pin (caster)
20a Eccentric disk

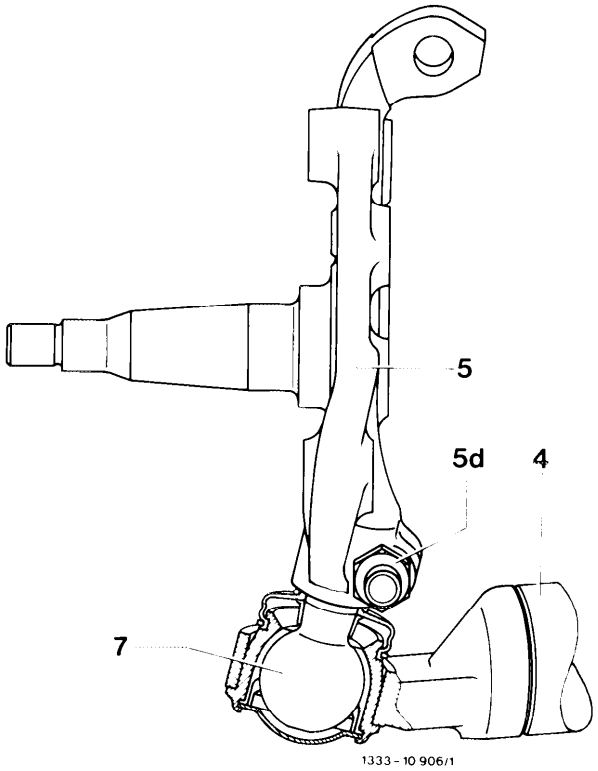
6 Unscrew hex, head nuts of the eccentric pins and remove eccentric pins. Lower wishbone.



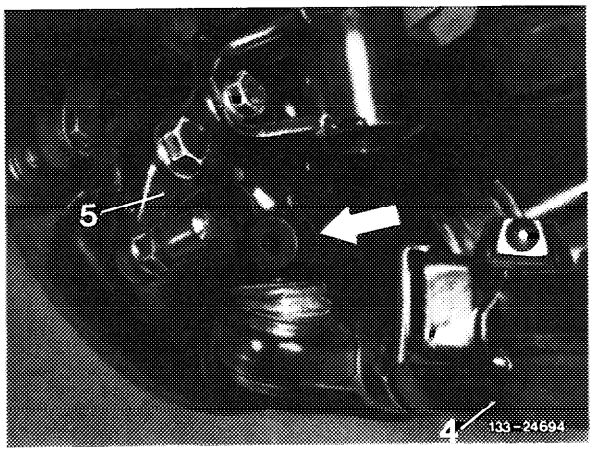
1 Side member
2 Cross member
4 Wishbone

7 Remove hex, head screw (5d) from the clamping joint between steering knuckle (5) and supporting joint (7).

8 Remove wishbone (4) from the steering knuckle (5).



Note: If the supporting joint cannot be removed from the steering knuckle because of corrosion, release the clamping joint by widening the slot in the steering knuckle (arrow) with the spreader 201 589 08 31 00.

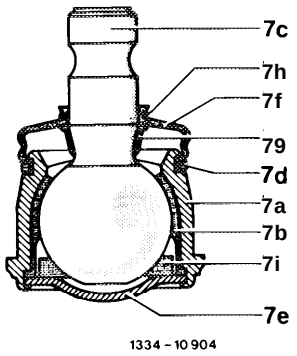


Installation

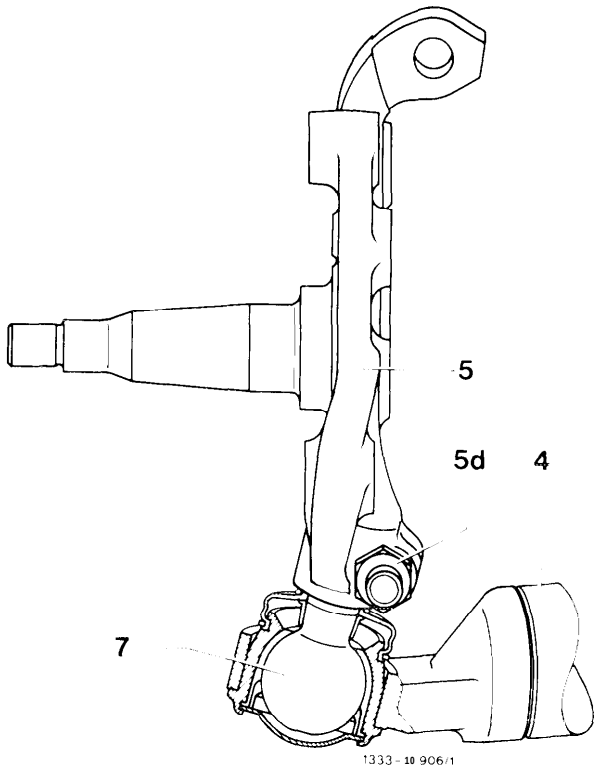
9 Check supporting joint in wishbone (33-425).

Note: The sleeve (7f) should be renewed if damaged during removal (33-430). However, if a sleeve is found to be damaged in a used joint, then the supporting joint must be renewed (33-440).

10 Check bearing of wishbone (33-525).

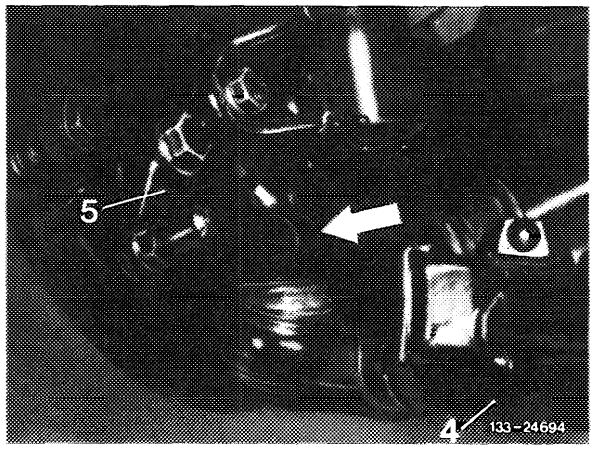


11 Fasten wishbone at the clamping joint between supporting joint and steering knuckle. Insert hex. head screw and tighten new self-locking hex, head nut to 125 Nm.

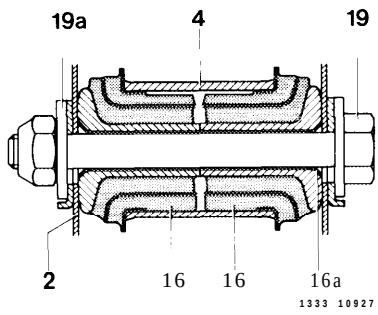


4 Wishbone
5 Steering knuckle
5d Hex. head screw with self-locking nut
7 Supporting joint

12 Completely fill separating slot (arrow) with sealing compound (refer to Table) to prevent corrosion.

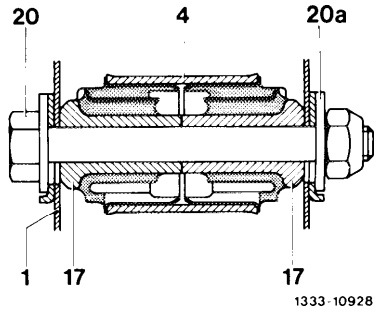


13 Insert eccentric pin of wishbone bearing at front end. Do not yet tighten self-locking hex. nuts.



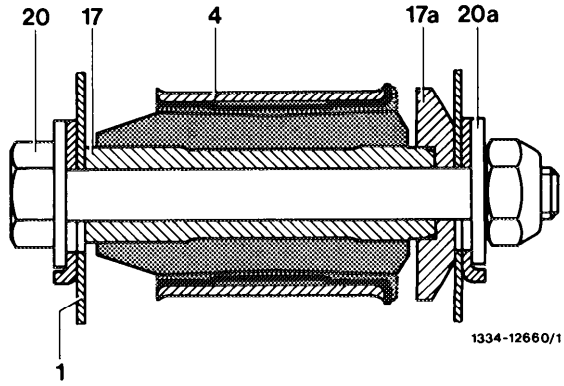
Front bearing model 124/201 and rear bearing model 201.03

2 Frame cross member
4 Wishbone
16 Rubber torsion mount
16a Clamping sleeve
19 Eccentric pin (camber setting)
19a Eccentric disk



Rear bearing
Model 201.02/1

1 Frame side member
4 Wishbone
17 Rubber torsion mount
20 Eccentric pin (camber setting)
20a Eccentric disk

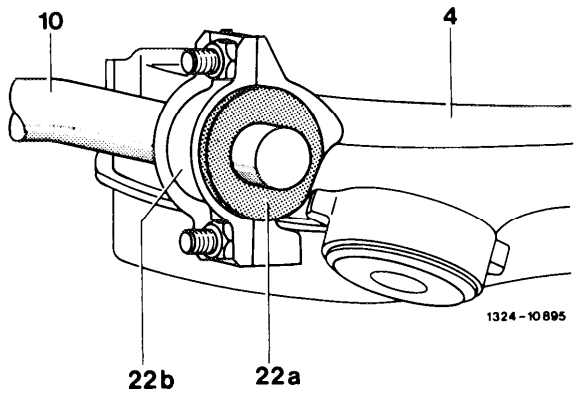


Rear bearing
Model 124

1 Frame side member
4 Wishbone
17 Rubber torsion mount
17a Washer
20 Eccentric pin (camber setting)
20a Eccentric disk

14 Fasten torsion bar bearing at wishbone. Tightening torque of the self-locking hex. nuts = 20 Nm.

Note: To facilitate installation of the torsion bar, raise wishbone on the opposite side with jack.



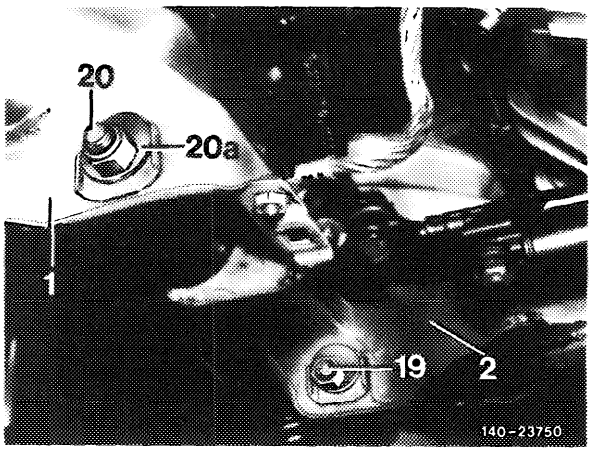
4 Wishbone
10 Torsion bar
22a Rubber mount
22b Retainer

15 Install front spring (32–200).

16 Install front wheel (40-I 10), lower vehicle.

17 Place the eccentric pin for camber and caster adjustment in the position marked beforehand and tighten hexagon nuts to 120 Nm.

Important!
If the position of the eccentric pin was marked upon removal, move the eccentric pin to centre position for preliminary adjustment.

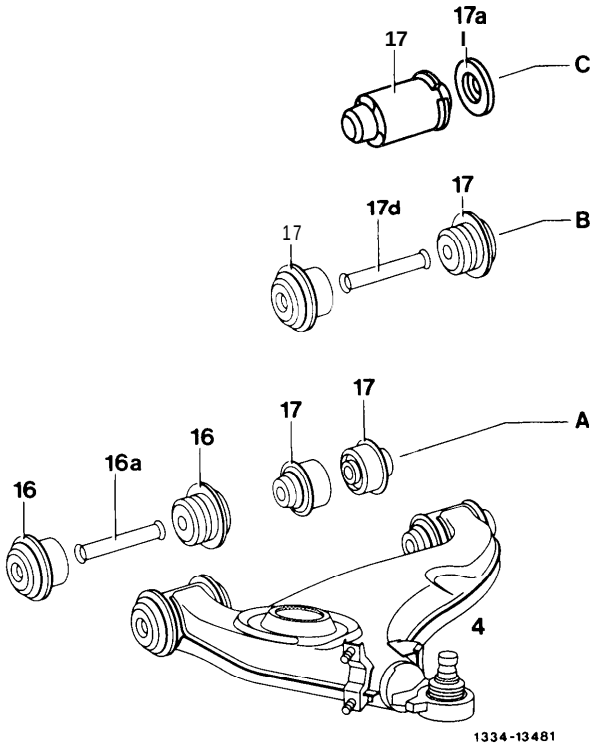


1 Sidemember
2 Cross member
19 Eccentric pin (caster)
20 Eccentric pin (camber)
20a Eccentric disk

18 Check vehical level at the front axle (40-300).

19 Check wheel alignment at the front axle (40-320).

20 Check setting of the headlamps.



4	Wishbone.	Removed
16	Rubber mount, front	Check for tight seat in wishbone as well as rubber mount for tight connection with rubber jacket
16a	Clamping sleeve	
17	Rubber mount, rear	
17a	Disk	
17d	Clamping sleeve	

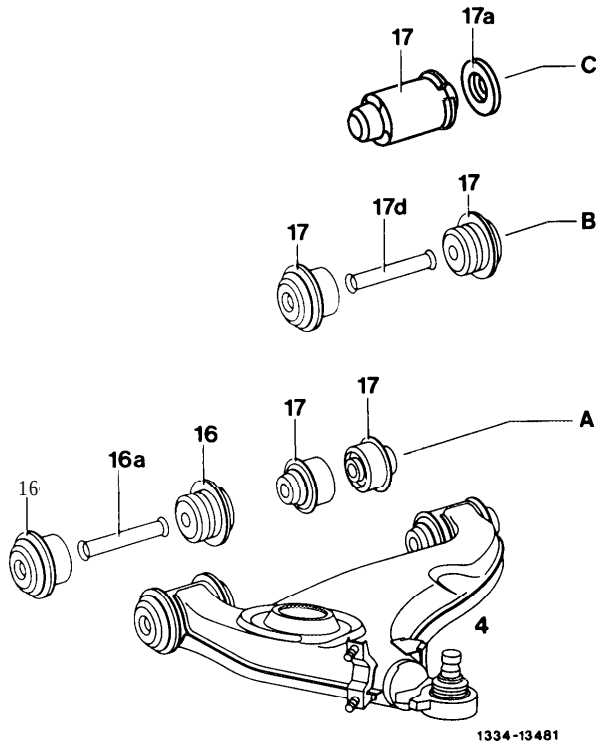
Wishbone bearing — cross reference

A = Model 201.02/1

B = Model 201.034

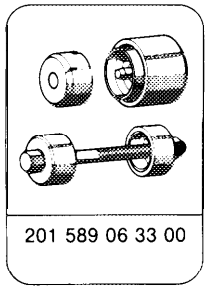
C = Model 124

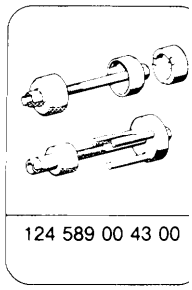
Wishbone removed



4	Wishbone	
16	Rubber mount, front	Use slide fluid for mounting. Slide fluid Naphtolen part No. 000 989 04 60 optionally also slide fluid Paladinol part No. 0009890860
16a	Clamping sleeve.	For removal, drill 90" with countersink 25 mm dia. For installing rubber mounts and clamping sleeve Special tool: Pulling device 201 589 06 33 00
17	Rubber mount, rear	A = Model 201.02/1 for installation use special tool 201 589 06 33 00
17	Rubber mount, rear	B = Model 201.034 for mounting refer to remarks under item 16 and 16a
17d	Clamping sleeve	
17	Rubber mount, rear	C = Model 124 for removal and installation special tool remover and installer 124589004300
17a	Washer	

Special tools


201 589 06 33 00


124 589 00 43 00

Cross reference torsion rubber mounts on wishbone

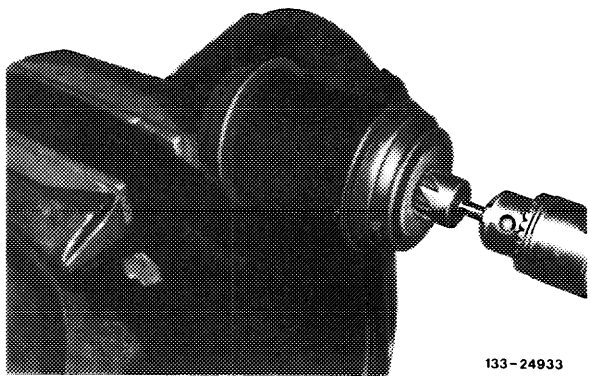
Model	Front mount Part No.	Rear mount Part No.	Part
124	12433337 14	12433338 14	A + C
201.02/1	201 33351 14	201 3334514	A + B
201.034	**201 3335214**	**20133352 14**	A

A. Front mount model 124, 201 front and rear mounts model 201.034

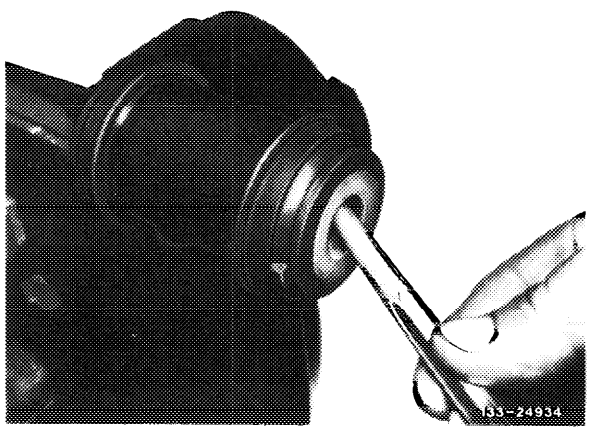
Removal

1 Clamp wishbone in a vise with light-alloy jaws.

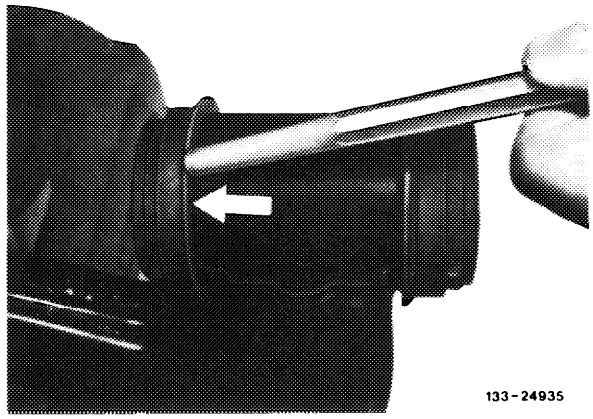
2 Sink the flange of the clamping sleeve by 90^{o} with a countersink 25 dia.


133-24933

3 Knock out clamping sleeve; if it is jammed, drill out by half.


133-24934

4 Knock rubber mount out of wishbone with suitable drift.



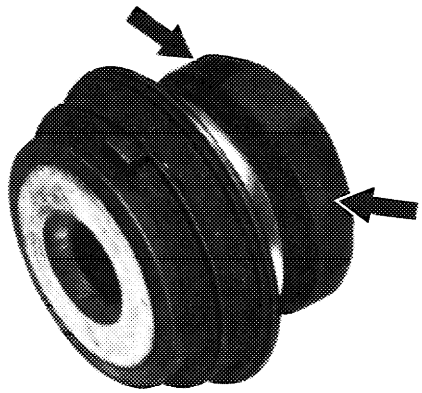
133-24935

Installation

5 Thoroughly clean mounting bore for bearing in wishbone; if necessary, treat with fine emery cloth.

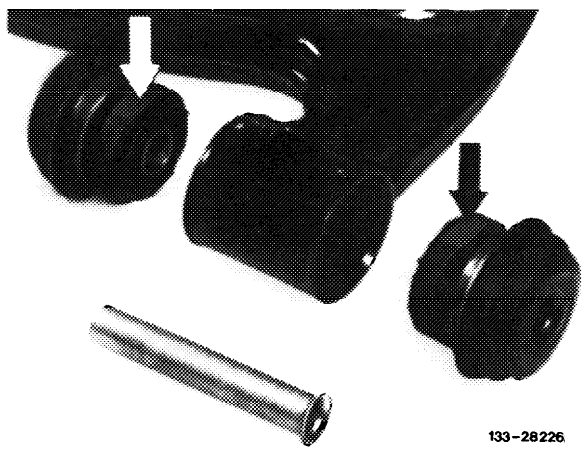
6 Coat the circumference (arrows) of the rubber mount and the locating bore in wishbone with special lubricant (see table).

Important!
Do not use oil or grease.



133-24949

7a Install torsion rubber mounts in such a manner that the flats (arrows) are horizontally resting against front mount.



Front mount

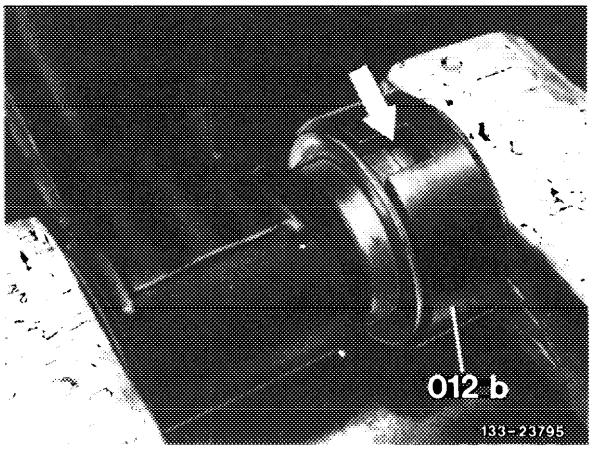
133-28226

7b On **model 201.034** install rubber mounts at the rear in such a manner that the flats (arrows) are vertical.

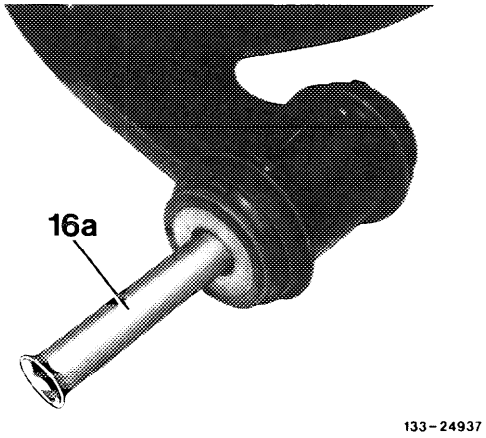
Rear mount

133-28227

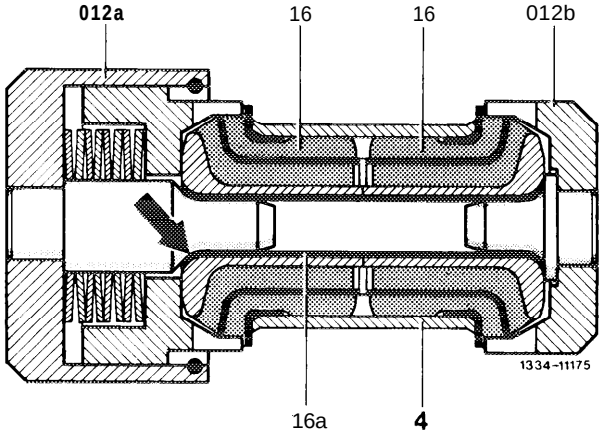
8 Press rubber mounts singly in the vise into the wishbone, ensuring that the knobs of the rubber mount (arrow) are located in the cut-out of the thrust piece (012b).



9 Insert clamping sleeve (16a).



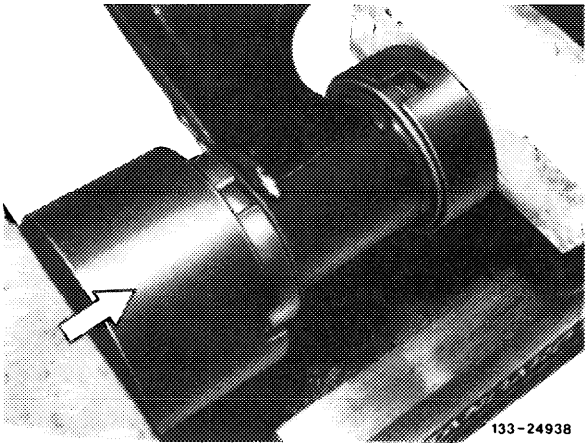
10 Position installer so that the unflanged side of the clamping sleeve points toward housing (012a) (arrow). Clamp in vise and press home.



4 Wishbone
16 Rubber mount
16a Clamping sleeve
012a Housing
012b Thrust piece

Note: The clamping sleeve is flanged simultaneously during the screwing action.

11 Check rubber mount (16) and clamping sleeve (16a) for satisfactory seat at the contact surfaces.

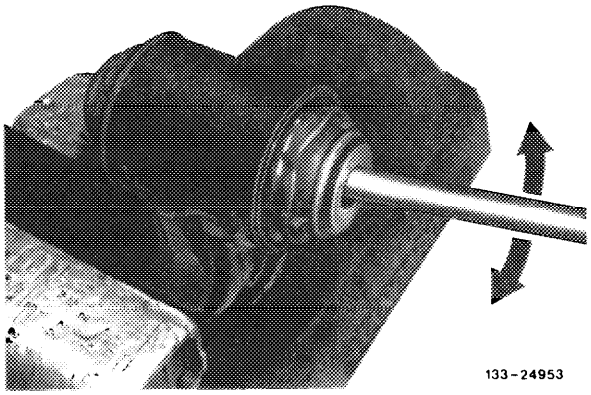


B. Rear mounts model 201.0/201.1

Removal

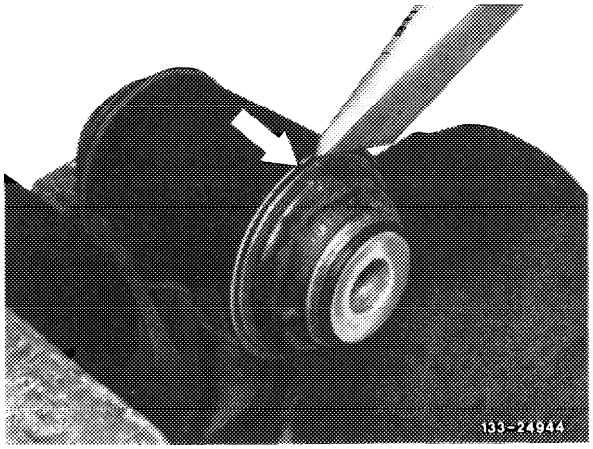
1 Clamp wishbone in a vise with light-alloy jaws.

2 Slacken rubber mount by pushing and pulling in the wishbone and then remove.



Note: If rubber mounts are jammed, first release one rubber mount at the metal jacket (arrow) with a flat chisel.

Then knock out second rubber mount on inner bushing from other side by means of a mandrel.

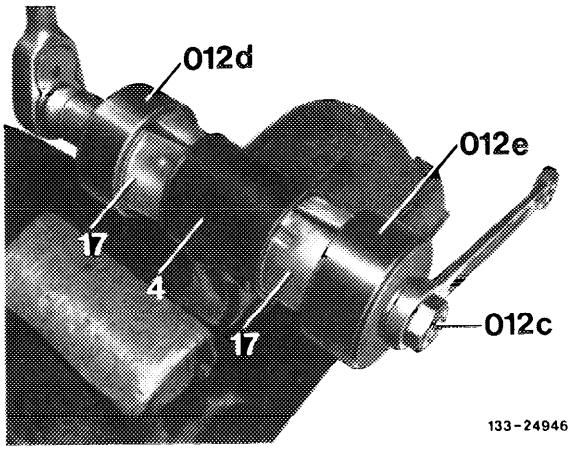


Installation

3 Thoroughly clean the mounting bore for rear bearing in wishbone; if necessary, ream with emery cloth.

4 Insert installer (012) together with both rubber mounts into the mounting bore in the wishbone.

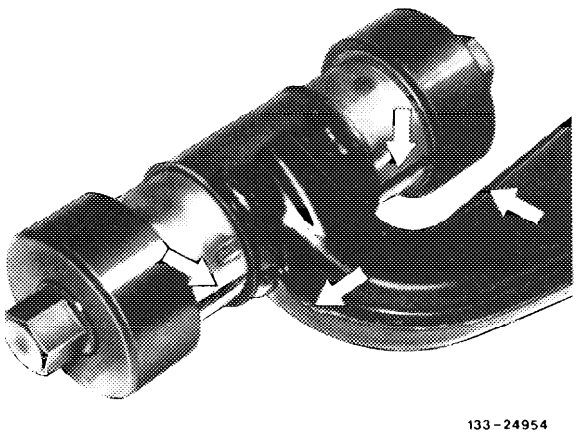
4 Wishbone
012c Clamping bolt with nut
012d Thrust piece
012e Counter support
17 Rubber mount



Note: Align rubber mount so that the parting slit in the metal jacket (arrows) points toward the weld of the housing half of the wishbone (arrows).

5 Press rubber mount fully home with device (012).

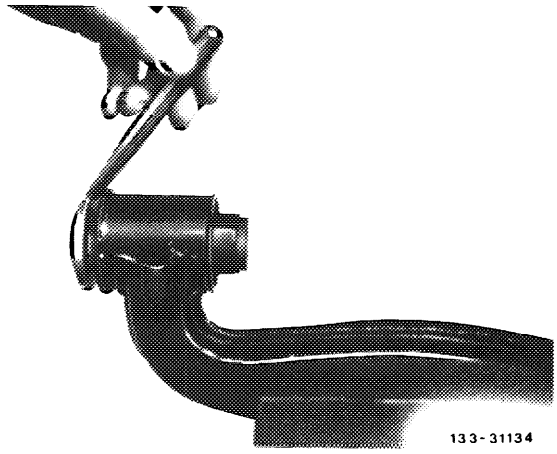
6 Remove installer and rubber mount (17) for correct seat in wishbone (4).



C. Rear mounts model 124

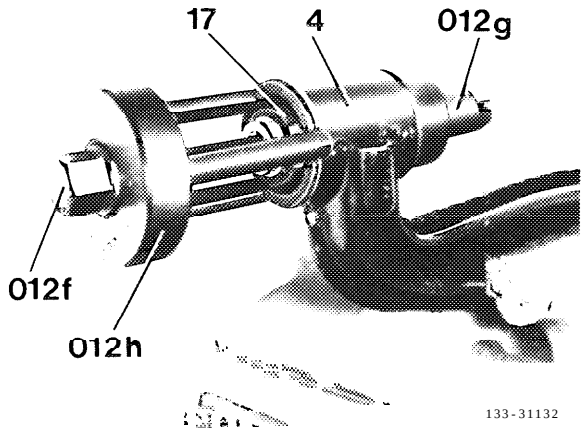
1 Clamp wishbone into vise.

2 Knock off washer.



3 Mount puller (012).

The 3 studs should rest in recesses of rubber mount on wishbone.



4 Wishbone
17 Torsion rubber mount
012f Tensioning screw
012g Thrust piece with nut
012h Thrust piece

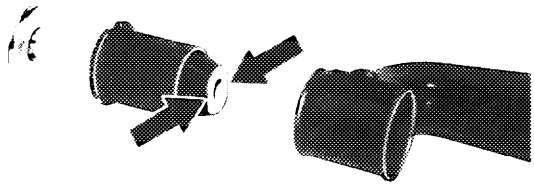
4 Pull out rubber mount and remove tool.

Installation

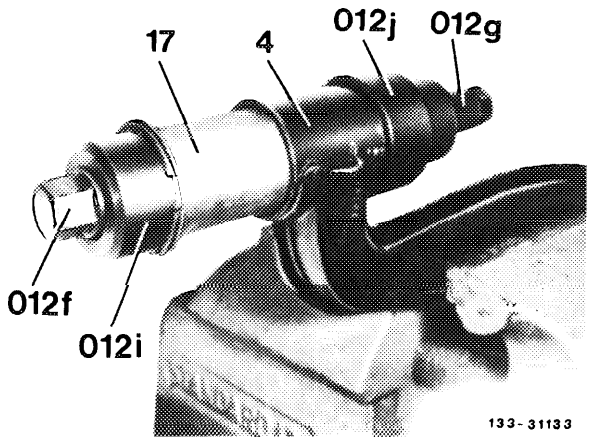
5 Thoroughly clean mounting bore for rear rubber mount on wishbone, rub out with emery cloth, if required.

6 Insert rubber mount into wishbone.

Note: The two surfaces of the aluminum core (arrows) must be **vertically** located with wishbone installed.

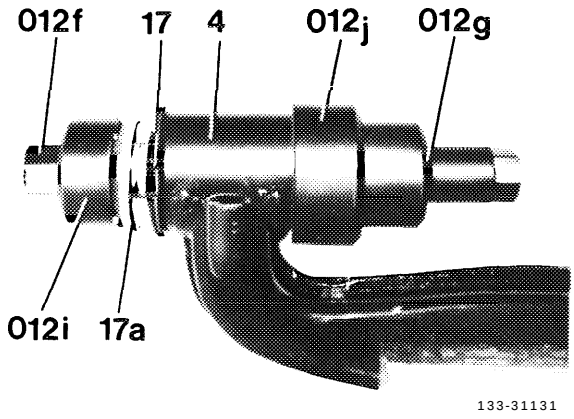


7 Position installer (012), pull thrust piece (012i) in recesses on flange and rubber mount up to stop on wishbone.



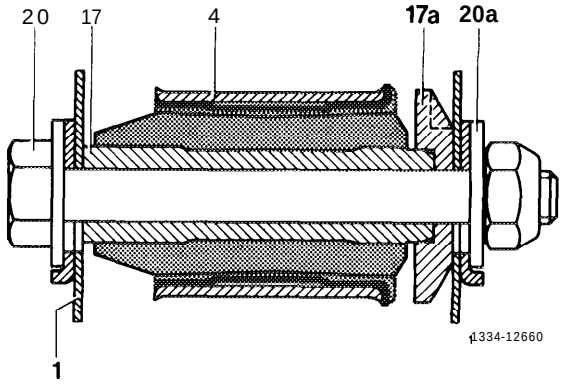
4 Wishbone
17 Torsion rubber mount
12f Tensioning screw
12g Thrust piece with nut
12i Thrust piece (with 3 lugs)
12j Thrust piece

8 Position washer (17a) on aluminum core of rubber mount (17) and pull in with installer up to stop.



4 Wishbone
17 Torsion rubber mount
12f Tensioning screw
12g Thrust piece with nut
12i Thrust piece (with 3 lugs)
12j Thrust piece

9 Remove installer, check rubber mount and washer for correct seat in wishbone.



1 Frame side member
4 Wishbone
17 Torsion rubber mount
17a Washer
20 Eccentric pin (camber setting)
20a Eccentric disk

33-530 Checking wishbone (for vehicles following accident)

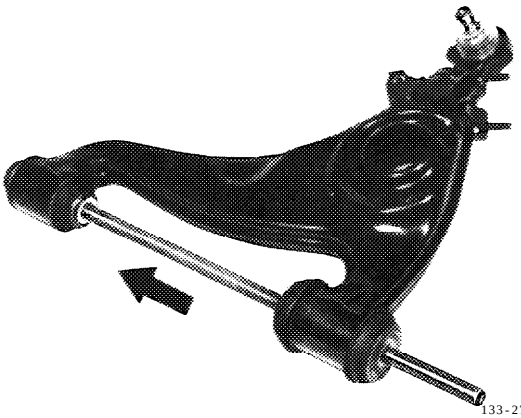
1 **Visual checkup:** Pay attention to damage (e.g. dents).

2 Insert drift with a diameter of 14 mm and length of approx. 430 mm from the front (arrow) through the wishbone bore.

The wishbone is in correct working order when the drift can be pushed through the rear bore with a sucking effect.

As soon as the drift is not flush to the rubber mount, renew wishbone.

3 Check bearings of wishbone (33-525).


133-27761

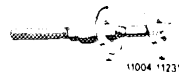
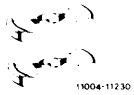
	Job No.
Rear axle	
Removal and installation of complete rear axle	35-010
Removal and installation of front and rear rubber mounts of rear axle suspension	040
Wheel alignment	
Removal and Installatlon of camber strut	110
Removal and Installatlon of pulling strut	111
Removal and installation of track rod, renewing rubber mounts	112
Removal and Installatlon of pushing strut	113
Removal and Installatlon of spring link, renewing rubber mounts and supporting joint.	114
Removal and installation of wheel carrier	115
Removal and installation of rear axle shaft flange with angular ball bearing	130
Rear axle center piece	
Removal and Installatlon of rear axle center piece	520
Renewing radial sealing ring on drive pinion (rear axle center piece Installed)	530
Renewing radial sealing ring on connecting flange of rear axle shaft (rear axle center piece removed)	540
Disassembly and assembly of rear center piece, adjustment of wheel set	550
Reconditioning of differential	560
Removal and Installatlon or rear axle shaft	620
Renewing rubber sleeve on rear axle shaft	660
Removal and Installatlon of connecting flange or rear axle shaft (rear axle center piece removed)	670

35-010 Removal and installation of complete rear axle

Oil type and filling capacity		
Hypoid gear oil SAE 90	refer to Specifications for service products page 235	
Filling capacity	0.7 liter	

Tightening torques	Nm
Hex. head screws (self-locking) for fastening front and rear rubber mount to frame floor	70
Clamping nut of propeller shaft	30-40
Hex. head screws for fastening propeller shaft intermediate bearing to frame floor	25

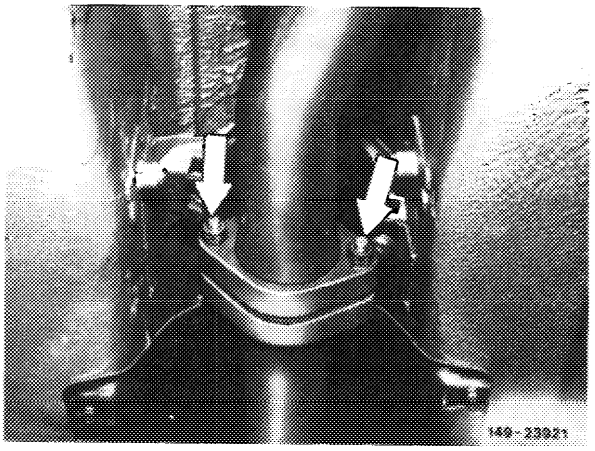
Special tools

Torque wrench 25 — 130 Nm with plug-in ratchet 1/2" square	11004-10056	001 589 66 21 00
Open-end wrench 41 mm for torque wrench for clamping nut of propeller shaft	11004-9974	201 589 00 01 00
Spring tensioner (complete)	 11004-11231	201 589 00 31 00
Socket wrench element 32 mm 1/2" square for spring tensioner	11004-11048	201 589 01 09 00
Tensioning plates for spring tensioner for removal and installation of rear spring	 11004-11230	201 589 00 63 00

Removal

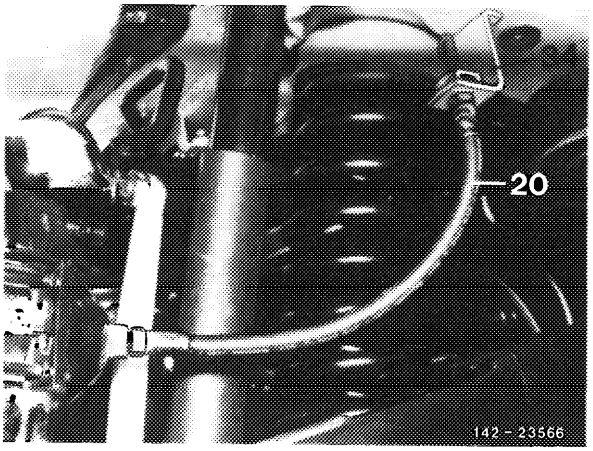
1 Remove exhaust system starting at flange connection.

2 Unscrew exhaust shielding plate.

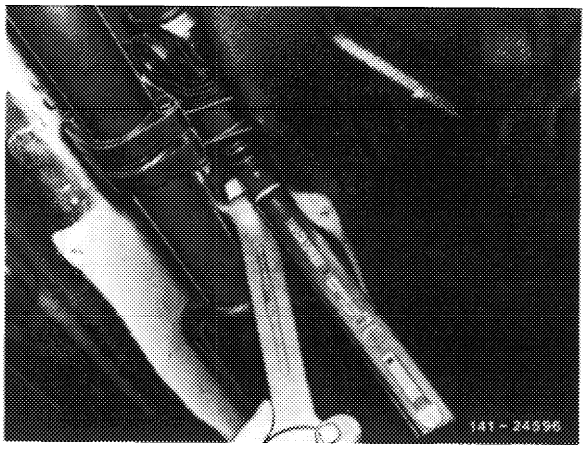


3 Remove intermediate lever of parking brake and disconnect cable controls (42–525).

4 Unscrew both brake hoses and close brake lines against penetration of dirt.



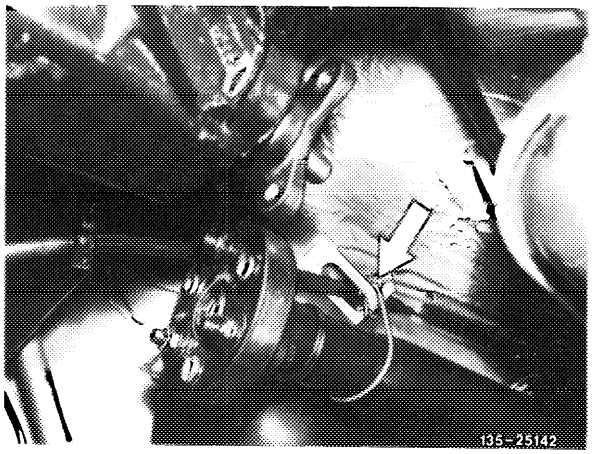
5 Loosen clamping nut of propeller shaft, also loosen hex. head screws of propeller shaft intermediate bearing on frame floor and remove.



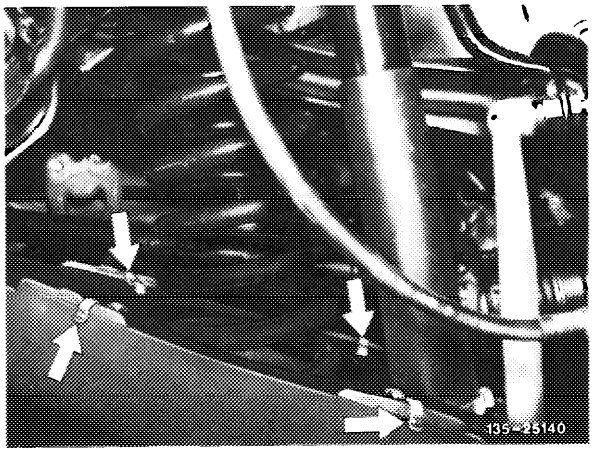
6 Unflange propeller shaft at the rear.

7 Slide propeller shaft out of center in forward direction.

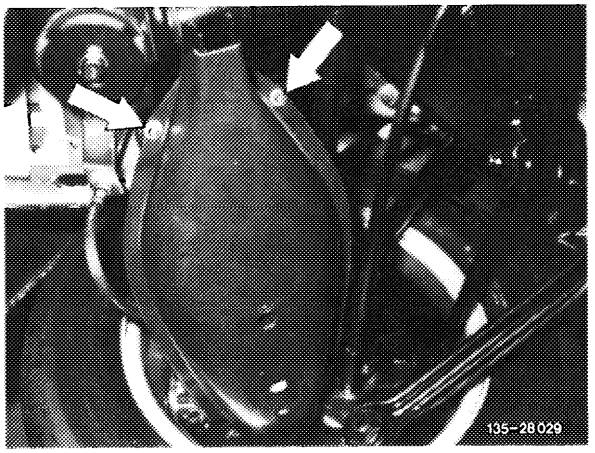
Note.: Tie propeller shaft with a wire to holder of brake cable control, so that shaft will not fall down.



8 Remove holding clamps on 1st version or unscrew sheet metal screw on 2nd version and remove spring link covering.



1st version up to December 1983

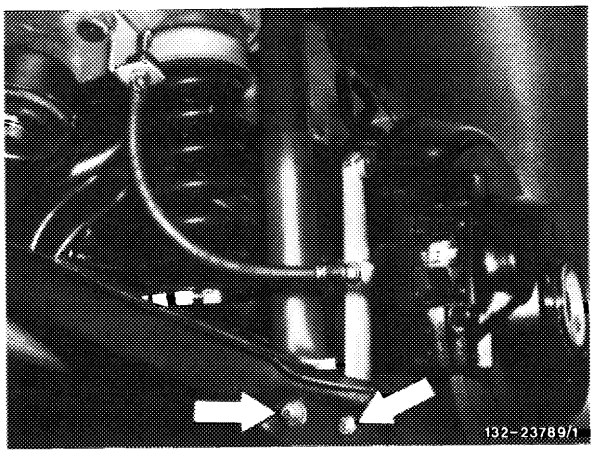


2nd version starting January 1984

9 Remove shock absorbers or spring struts (32-l 10 or 32-6 10).

10 Remove rear springs (32–230).

11 Loosen torsion bar connection toward rear axle and remove (32-310 or 32-320).

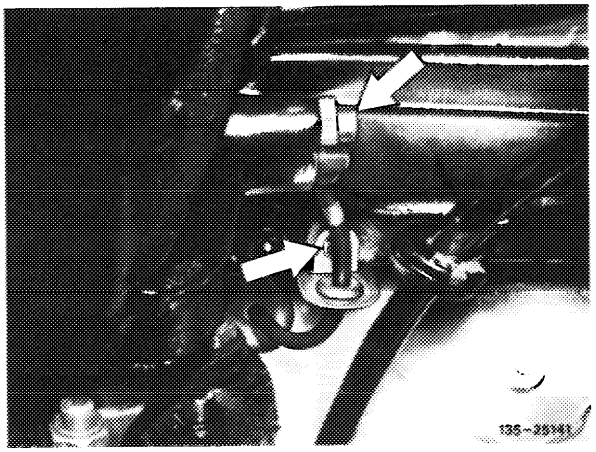


12 On vehicles with ABS

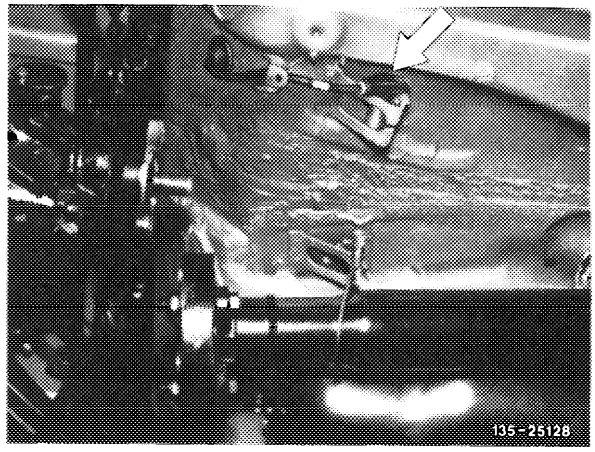
a) Drain rear axle oil.

b) Unscrew hex. socket screw and take rpm sensor out of rear axle housing (arrow).

c) Unscrew sheet metal screw for holder on rear axle carrier and **remove (arrow).**

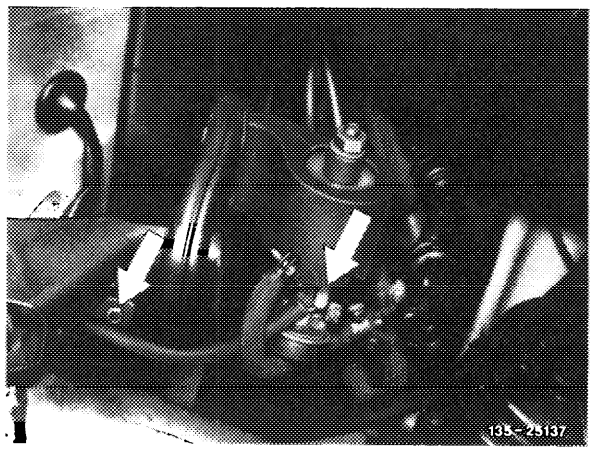


d) Cover magnetic edge of rpm sensor and introduce into holder of brake cable (arrow).



13 **On vehicles with auxiliary heater**

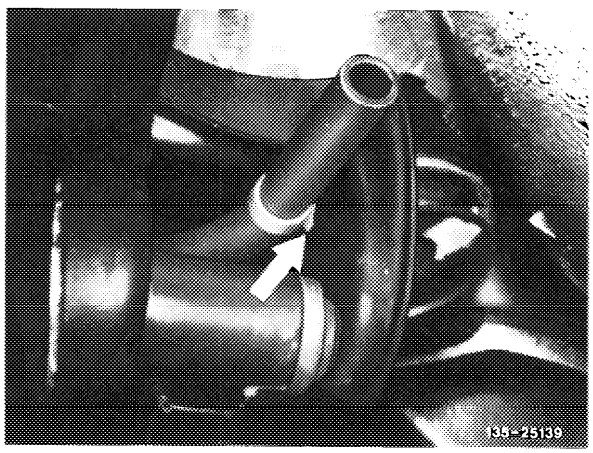
Loosen hex. head screws for fastening holder of electric gasoline pump and suspension plate of exhaust suspension and remove. Also remove cable connector and unscrew sheet metal screw from rear axle cross member (arrows).



14 Slip vehicle jack or pit lift under rear axle and lift up to stop.

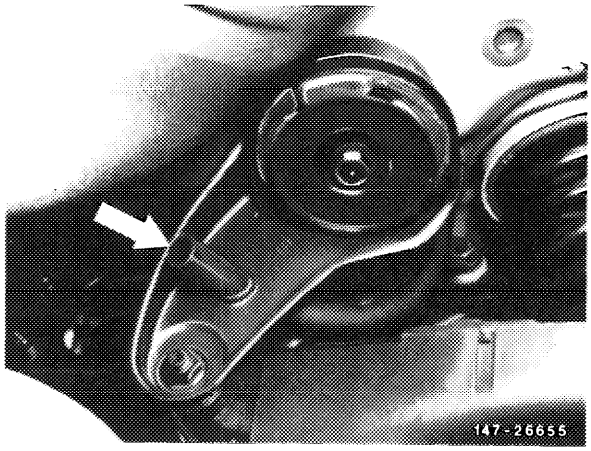
15 On 1st version, force fastening clamp of water drain hose out of rear axle carrier and remove (arrow).

1 st version up to April 1983



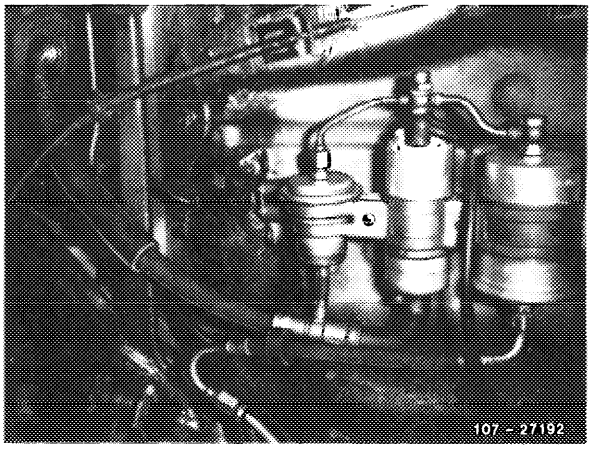
16 On 2nd version, force water drain hose out of rear axle carrier (arrow).

2nd version starting May 1983

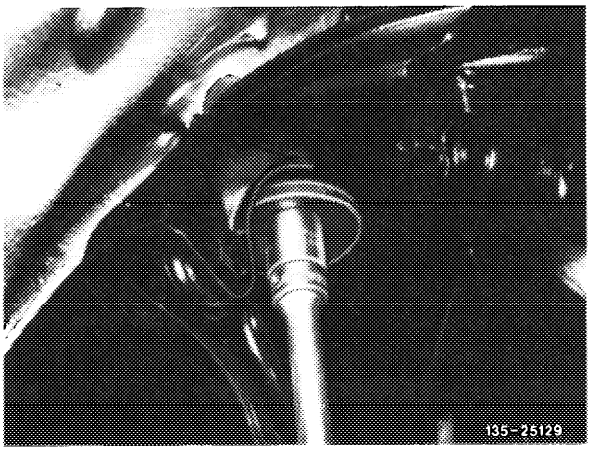


17 On vehicles with CIS-E injection system starting September 1983

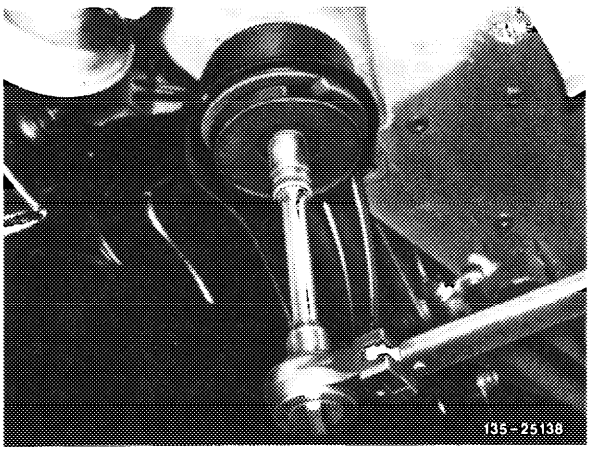
Pinch fuel suction hose between fuel tank and fuel pump with a clip. Loosen clamp on fuel hose to accumulator and to pump and pull off.



18 Unscrew self-locking hex. head screws of front rubber mounts on frame floor and remove with stop plate.



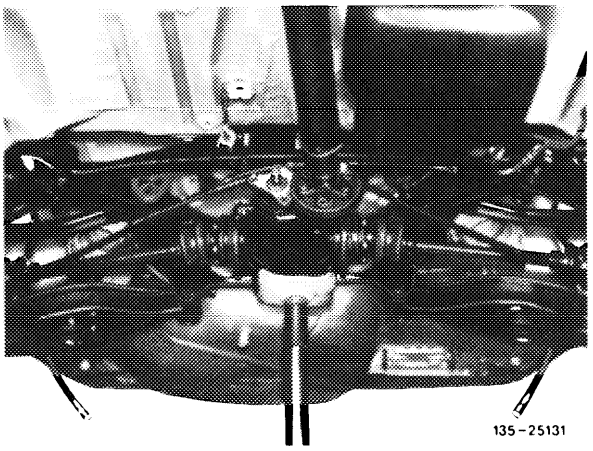
19 Unscrew self-locking hex. head screws of rear rubber mounts on frame floor and remove with stop plate.



20 Carefully lower rear axle.

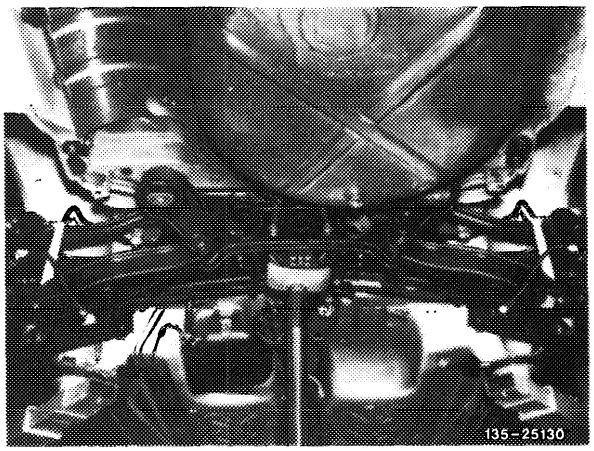
Attention!
When lowering and transporting rear axle, do not damage cover plates of brake disks.

21 Check front and rear rubber mounts and renew, if required.



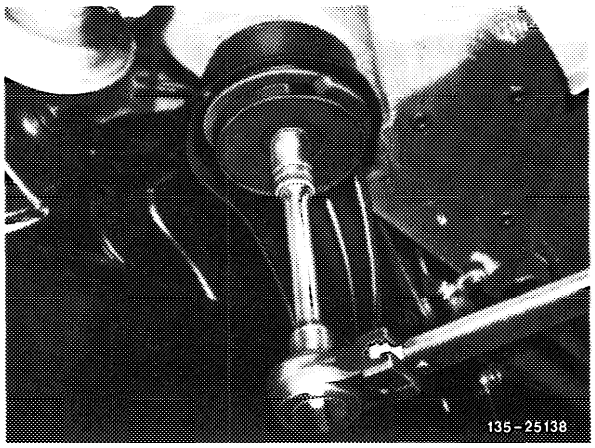
Installation

22 Lift rear axle with vehicle jack or pit lift up to guide bolts.



23 Mount self-locking hex. head screws with stop plate of front and rear suspension on frame floor. Tightening torque of self-locking hex, head screws 70 Nm.

Attention!
Use self-locking hex. screws with plastic coating (micro-encapsulated) only once. Refinish threads with tap prior to screwing in self-locking hex. screws.

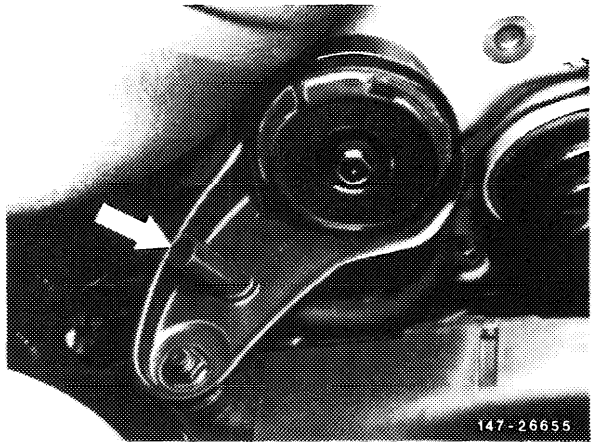


24 Remove vehicle jack top.

25 On 1st version, mount water drain hose with fastening clamp.

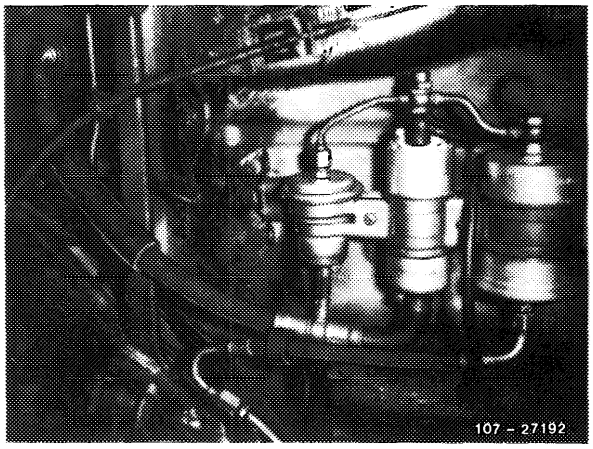
26 On 2nd version, insert water drain hose through bore on rear axle carrier (arrow).

2nd version
starting May 1983



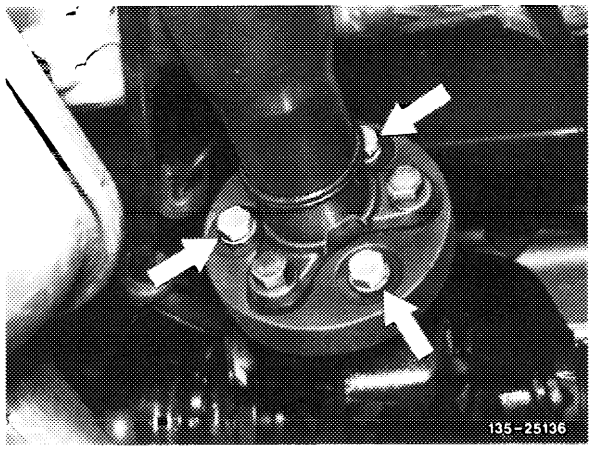
27 **On vehicle with CIS-E injection system starting September 1983**

Mount fuel suction hose for fuel pump and accumulator. Remove clamp from fuel suction hose,



28 Flange propeller shaft to rear axle (arrows).

NOte: Renew self-locking hex. nuts on principle.

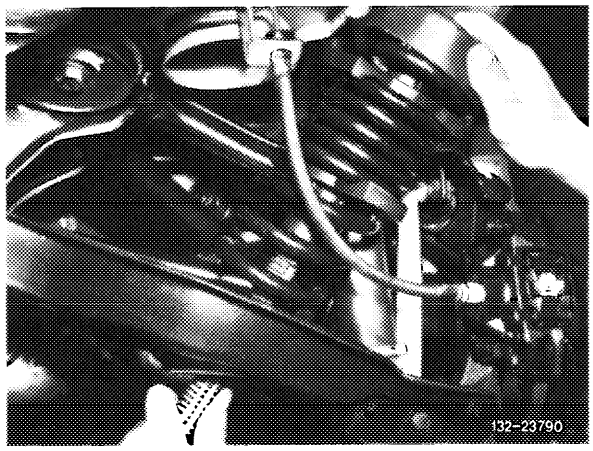


29 Mount torsion bar connection for rear axle (32–310).

30 Install rear springs (32–230).

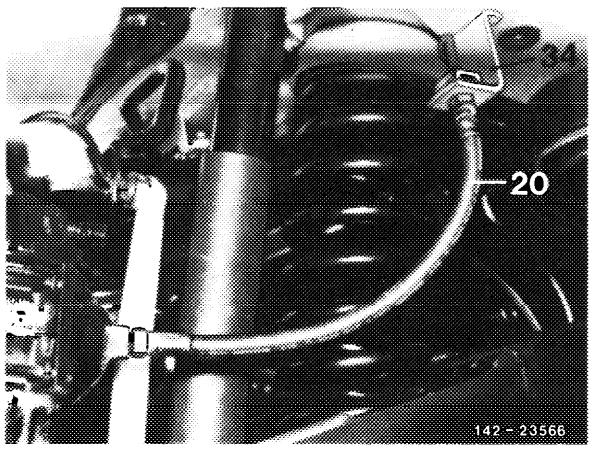
31 Install shock absorbers or spring struts (32-I 10 or 32–610).

32 Mount spring link lining.



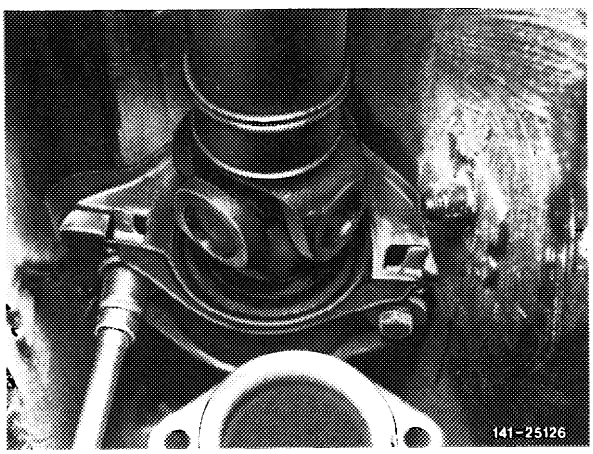
33 Connect both brake hoses (20) and bleed brake system (42–010).

34 Connect cable controls of parking brake and mount holder. Adjust parking brake (42-525).



35 Tighten clamping nut on propeller shaft to 30-40 Nm.

36 Tighten propeller shaft intermediate bearing to 25 Nm.

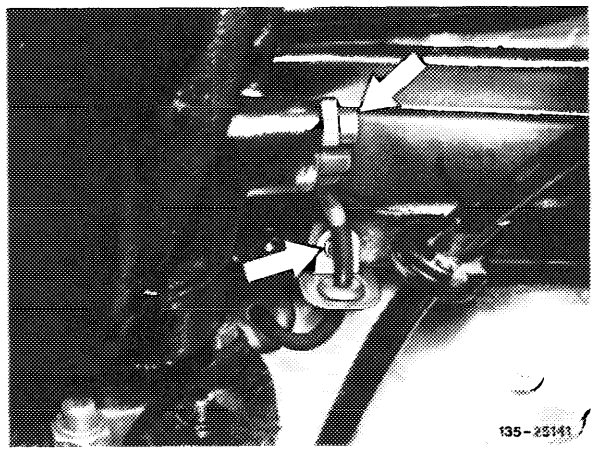


37 **On vehicles with ABS**

a) Introduce rpm sensor into axle housing. Make sure that there is no metallic residue on magnetic edge.

b) Use new self-locking hex. socket screw (arrow).

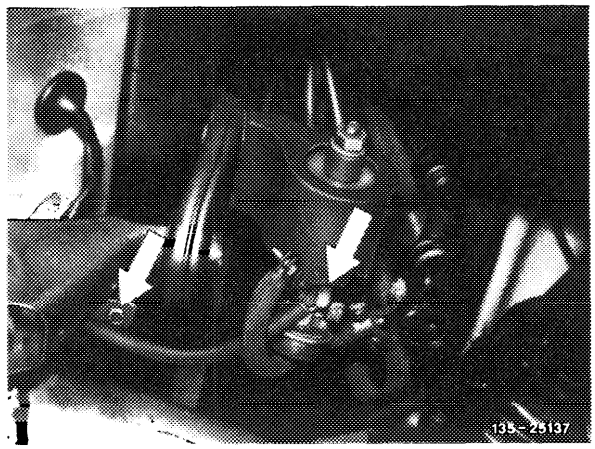
c) Fasten holder for cable to rear axle cross member with sheet metal screw (arrow).



38 **On vehicles with auxiliary heater**

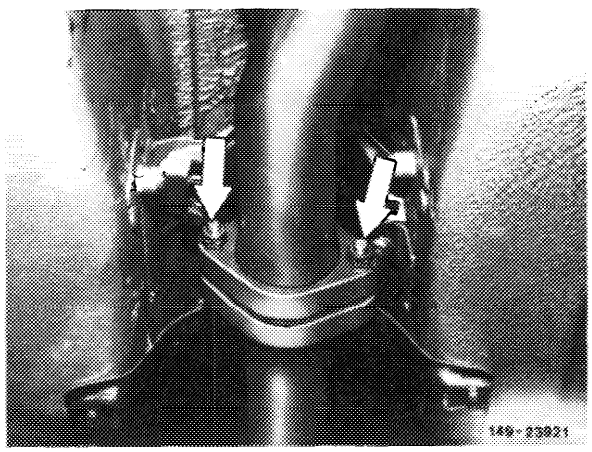
a) Mount electric gasoline pump with suspension plate of exhaust suspension (arrow).

b) Fasten holder for cable on rear axle cross member with sheet metal screw and connect cable (arrow).

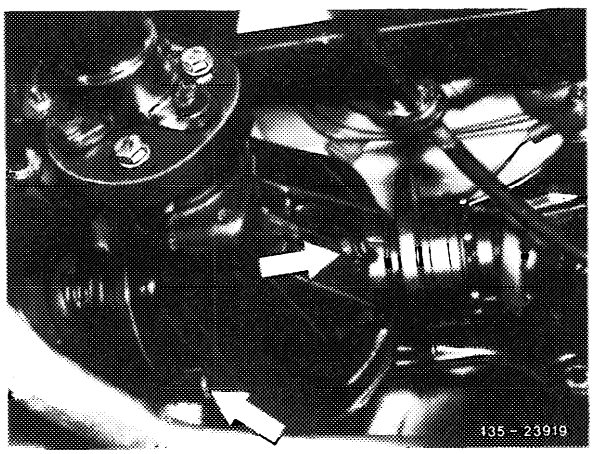


39 Mount shielding plate.

40 Install exhaust system (49-100).

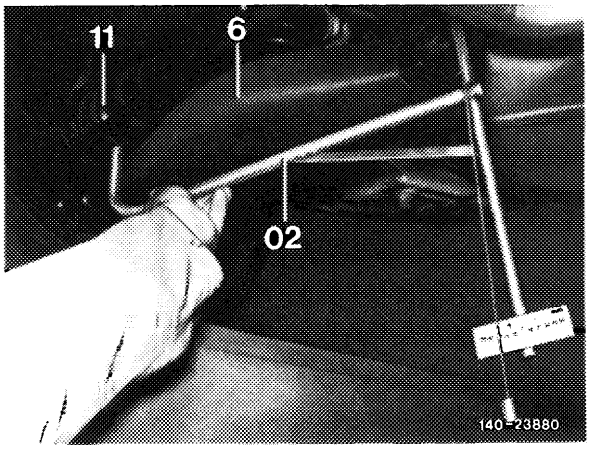


41 Check oil level in rear axle, if required, fill-in up to level of filler hole.

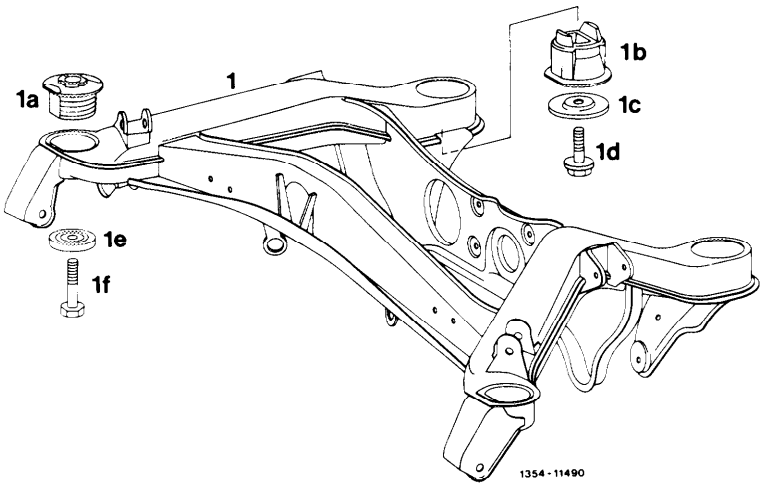


42 Check vehicle level on rear axle (40-300).

43 Check headlamp adjustment.

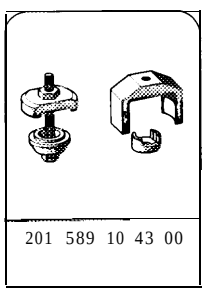


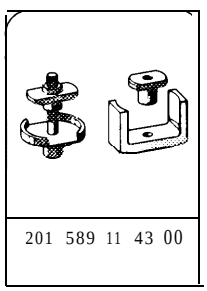
35-040 Removal and installation of front and rear rubber mounts of rear axle suspension



1	Rear axle carrier	
1a	Front rubber mount	Check for damage and wear, prior to pressing in, rub with slide fluid Naphtolen H or coat with Fahr slide paste 0009890860 Special tool: Remover and installer 201 589 10 43 00
1b	Rear rubber mount	Check for damage and wear, prior to pressing in, rub with slide fluid Naphtolen H or coat with Fahr slide paste 0009890860 Special tool: Remover and installer 201 589 11 43 00
1c	Stop plate rear	
1d	Locking screw	Renew, tightening torque 70 Nm
1e	Stop plate front	
1f	Locking screw	Renew, tightening torque 70 Nm

Special tools


201 589 10 43 00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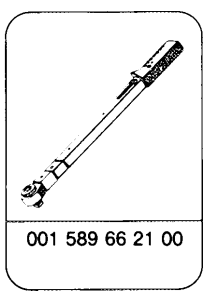

001 589 66 21 00

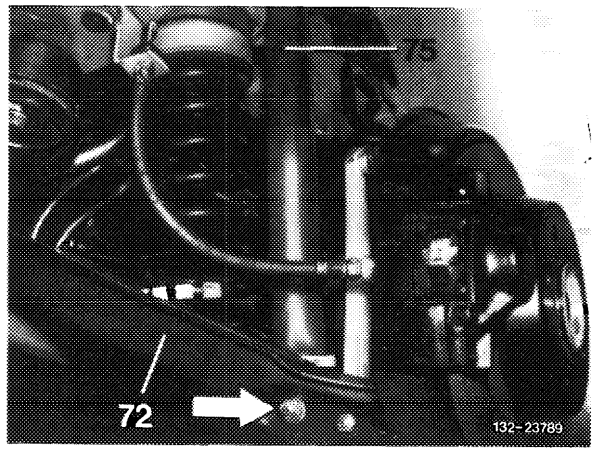
Note

Removal and installation of rubber mounts is possible also with rear axle installed. Exchange rubber mount in sets only. Renew penetrated or damaged rubber mounts.

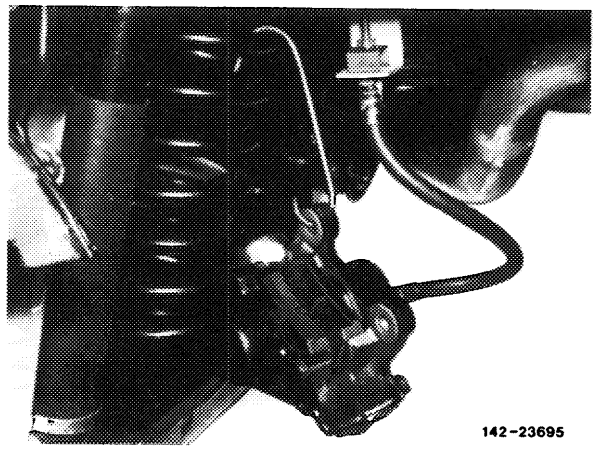
Removal

1 Remove holding clamps or sheet metal screws for spring link covering and remove together with spring link covering.

2 Loosen lower shock absorber fastening and remove, while supporting spring link (arrow).

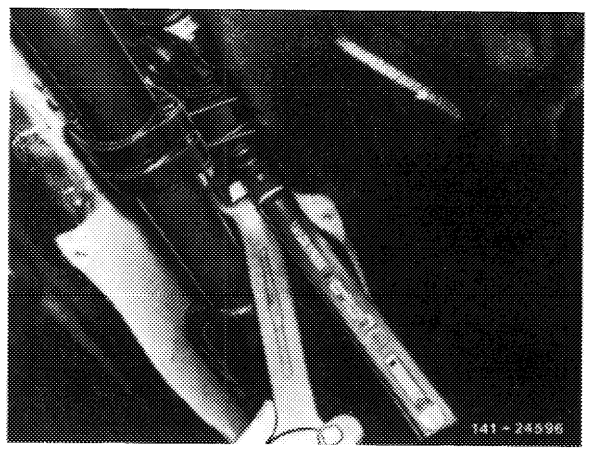


3 Remove brake caliper and suspend with a hook.

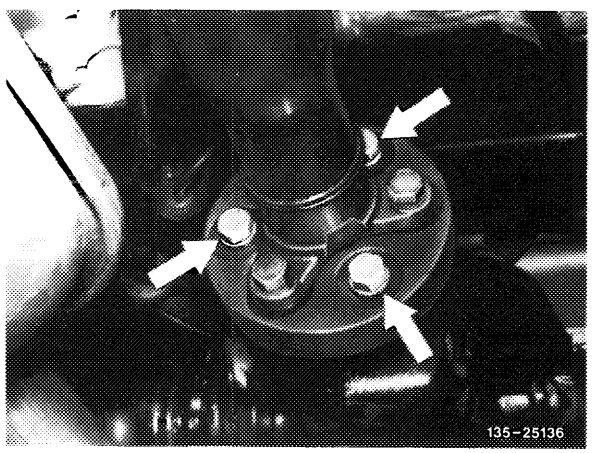


4 Remove exhaust shielding plate.

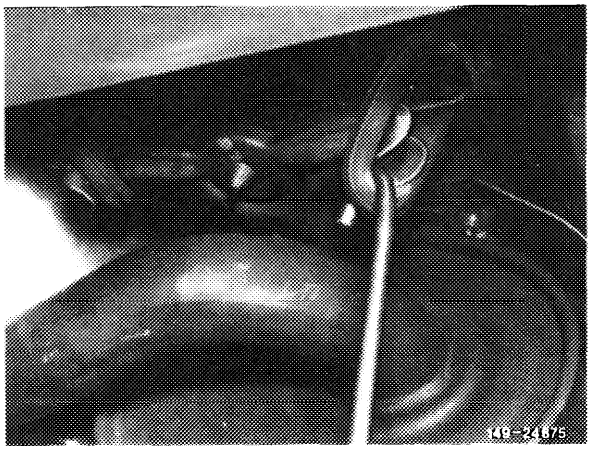
5 Loosen clamping nut on propeller shaft, unscrew hex. head screws of propeller shaft intermediate bearing on frame floor and remove.



6 Remove propeller shaft on universal flange of drive pinion and slide forward (arrows).

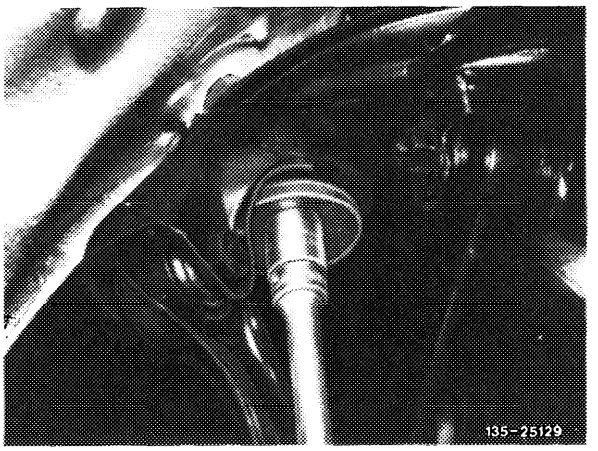


7 Unhook rubber rings on end muffler and support exhaust system.

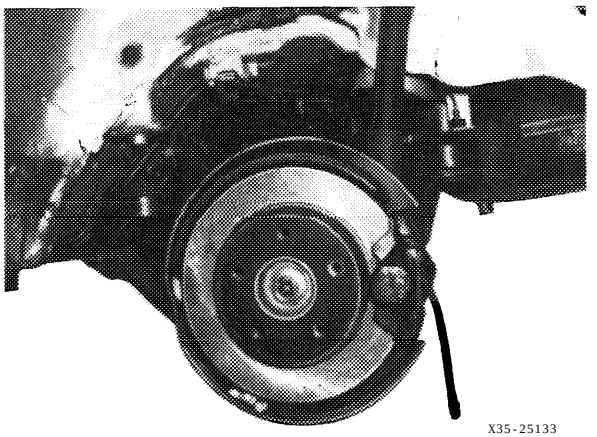


8 Support rear axle center piece with a vehicle jack or pit lift.

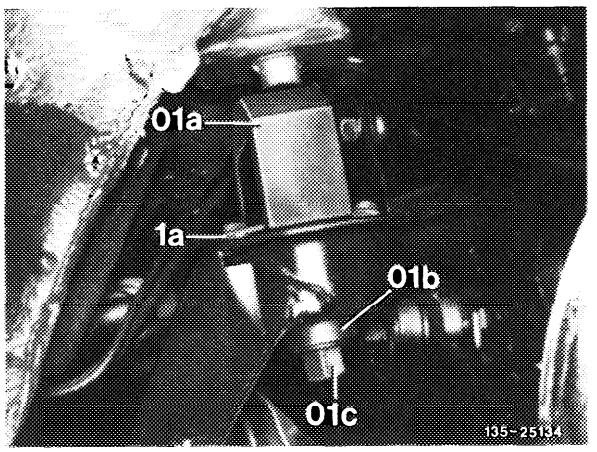
9 Unscrew self-locking hex. head screws of front and rear suspension on one side of rear axle carrier on frame floor, and remove with stop plates.



10 Lower rear axle on one side (left or right) until the puller can be positioned.

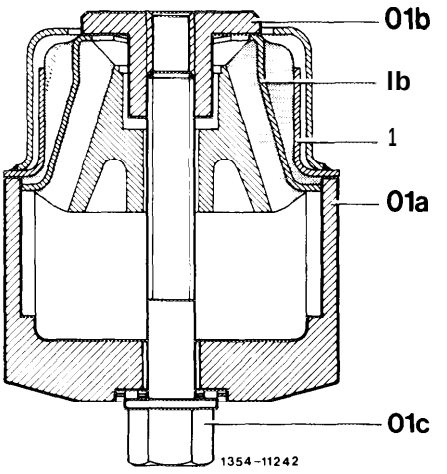


11 Force front rubber mount out of rear axle carrier. Remove rubber mount with puller.



1a Rubber mount
01a Clamp
01b Thrust ring
01c Hex, head screw

12 Pull rear rubber mount out of rear axle carrier. Remove rubber mount with puller.



1 Rear axle carrier
Ib Rubber mount
Ola Clamp
01b Thrust piece
Olc Hex. head screw

Checking

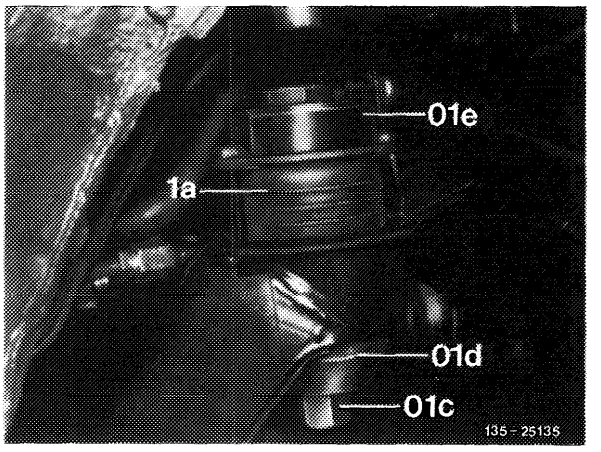
13 Check rubber mounts. Renew cracked, depressed or damaged rubber mounts.

Installation

14 Rub rubber mounts with slide fluid.

Attention!
Prior to inserting rubber mounts into rear axle carrier, refinish threads for fastening rear axle carrier to frame floor with a tap.

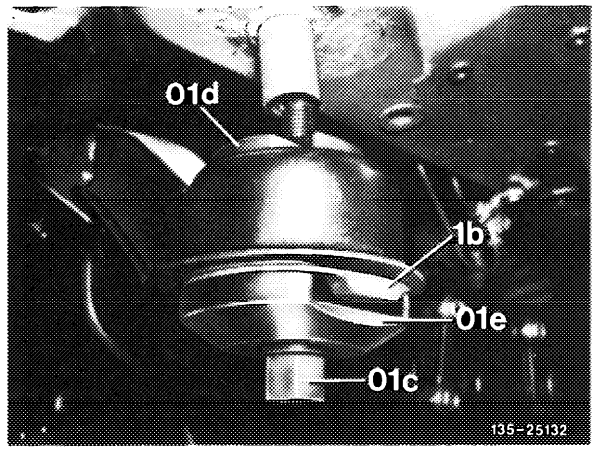
15 Insert front rubber mounts into rear axle carrier. Remove insertion tool.



1a Rubber mount
01c Head head screw
Old Thrust piece
01e Clamp

16 Insert rear rubber mounts into rear axle carrier. Remove insertion tool.

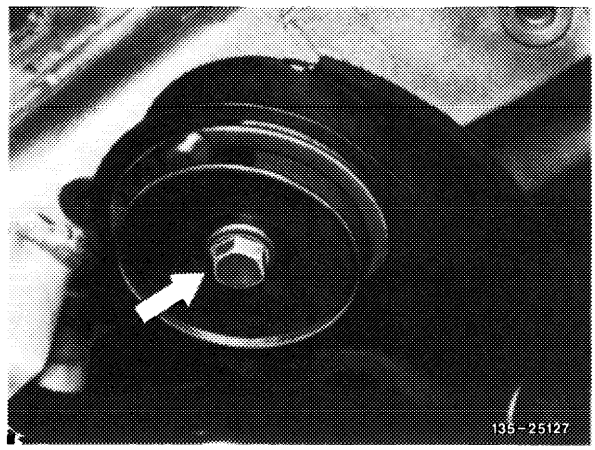
Note: Position clamp (Ole) on rubber mount (1 b) in such a manner that the projections are not damaged during insertion.



1 b Rubber mount
01c Hex. head screw
Old Thrust piece
01e Clamp

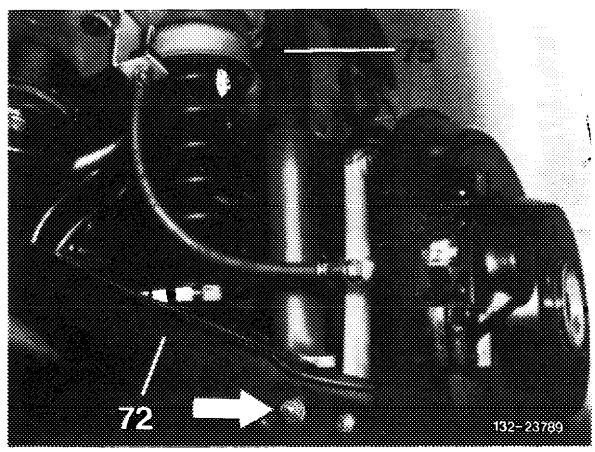
17 Lift rear axle. Mount self-locking hex. head screws with stop plate of front and rear rear-axle suspension and tighten to 70 Nm.

Atention!
Renew self-locking hex. head screws on principle.



18 Mount lower shock absorber suspension and tighten to 65 Nm.

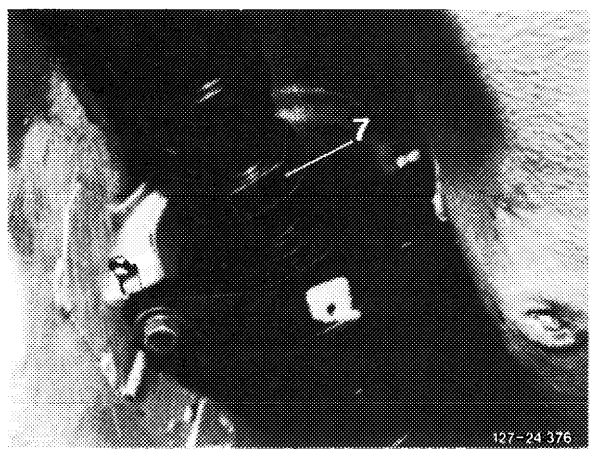
19 Mount brake caliper to wheel carrier (42-120).



20 Plug propeller shaft on centering at drive pinion and mount on propeller flange.

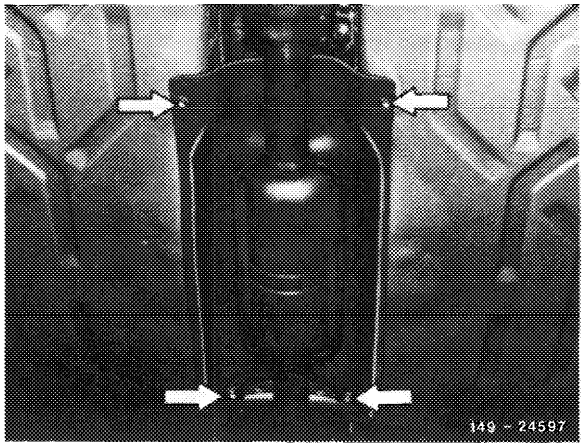
21 Tighten clamping nut on universal shaft to 30-40 Nm. Special tool: Open end wrench 41 mm 201 589 00 01 00.

22 Tighten propeller shaft intermediate bearing to 25 Nm.

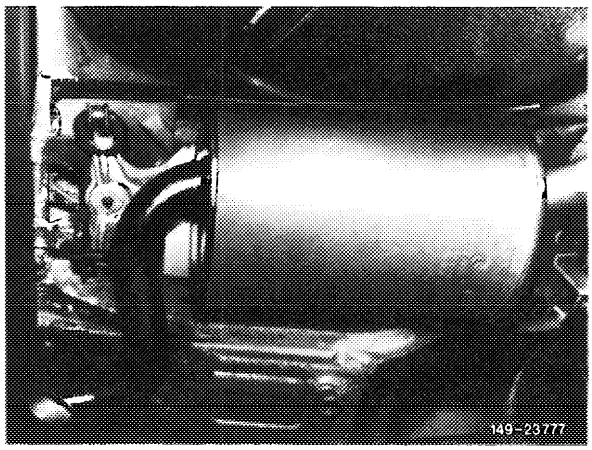


23 Apply spring link cover ing and fasten with holding clips.

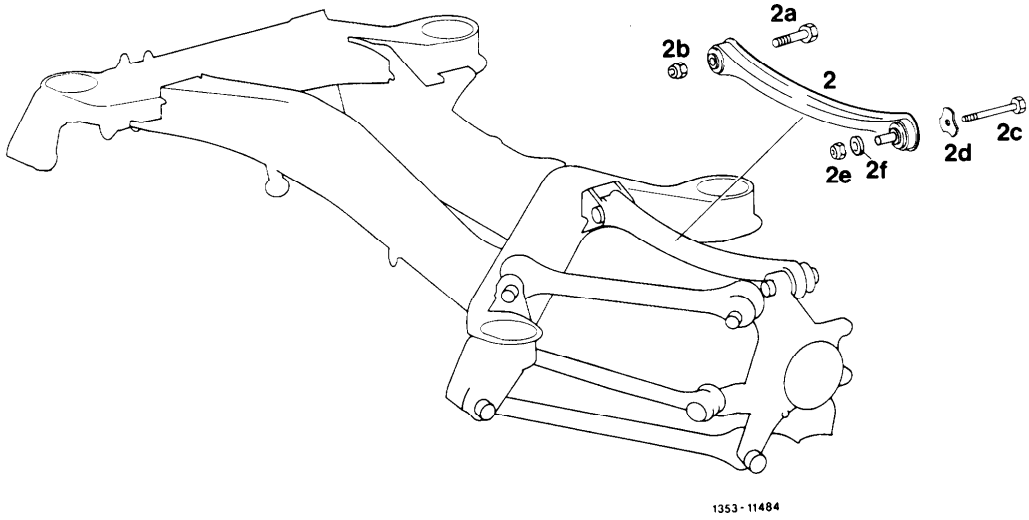
24 Mount exhaust shielding plate.



25 Hang up rubber rings on end muffler.

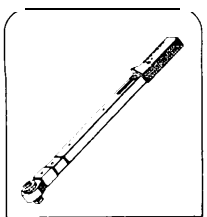


35-I 10 Removal and installation of camber strut



2	Camber strut	Check camber strut and rubber mount for damage
2a	Hex. head screw	
2b	Self-locking hex. nut	Renew, tightening torque 70 Nm
2c	Hex. head screw	
2d	Contour disk	
2e	Self-locking hex. nut	Renew, tightening torque 40 Nm
2f	Washer	

Special tool



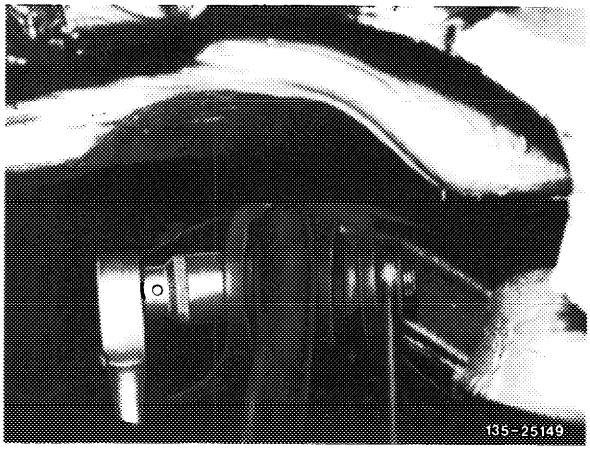
001 589 66 21 00

Note

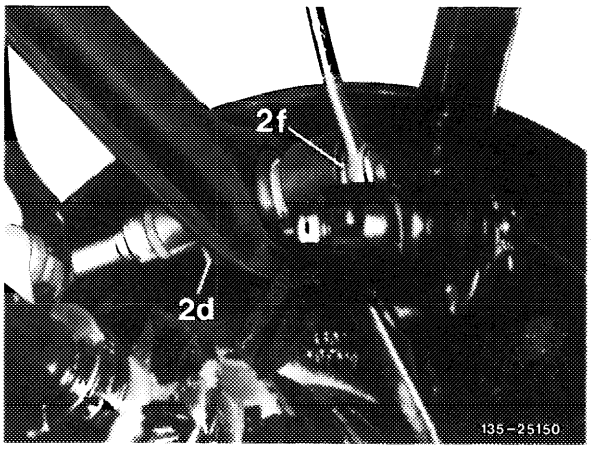
Rubber mounts of camber strut cannot be individually exchanged. Camber strut is available only with rubber mount as a spare part. Removal and installation with rear axle installed is possible.

Removal

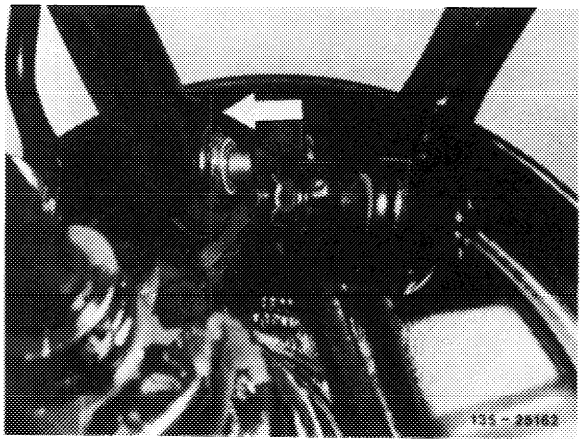
1 Unscrew self-locking hex. nut of camber strut on rear axle carrier and remove together with hex. head screw.



2 Unscrew self-locking hex. nut of camber strut on wheel carrier and remove together with contour disk (2d), washer (2f) and hex. head screw.

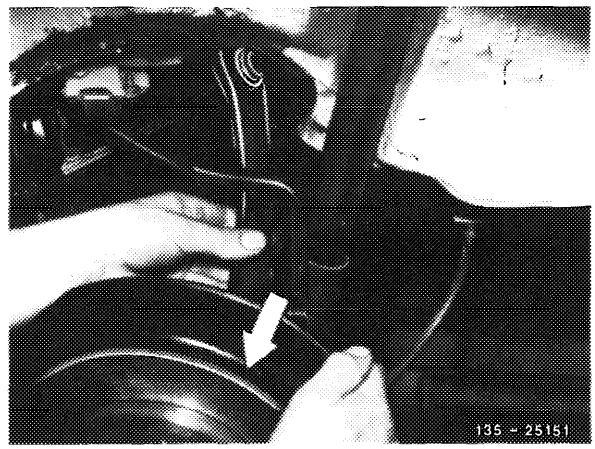


3 Force clamping sleeve of camber strut out of wheel carrier.



4 Force camber strut at rear axle carrier bearing out in upward direction while pulling wheel carrier slightly in outward direction and remove camber strut in downward direction.

Note.: If rubber mounts are damaged, renew complete camber strut.

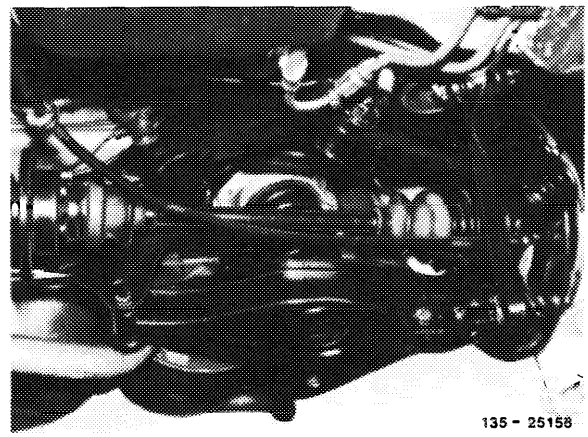


Installation

5 Install in vice versa sequence. Pay attention to the following items:

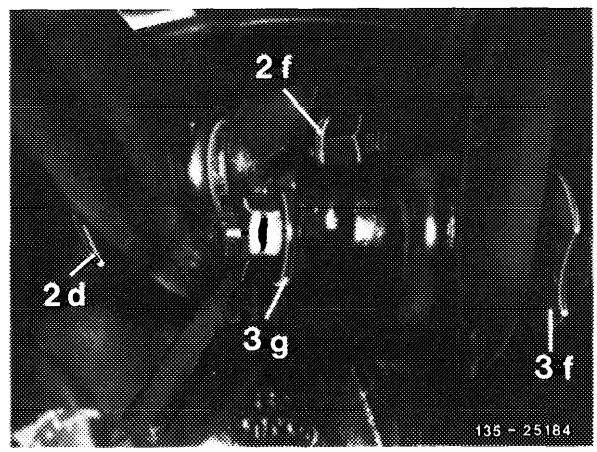
a) The tightening torque of self-locking hex. nut is 70 Nm on rear axle carrier and 45 Nm on wheel carrier.

b) Rear axle shaft must be horizontal prior to tightening self-locking hex. nut.

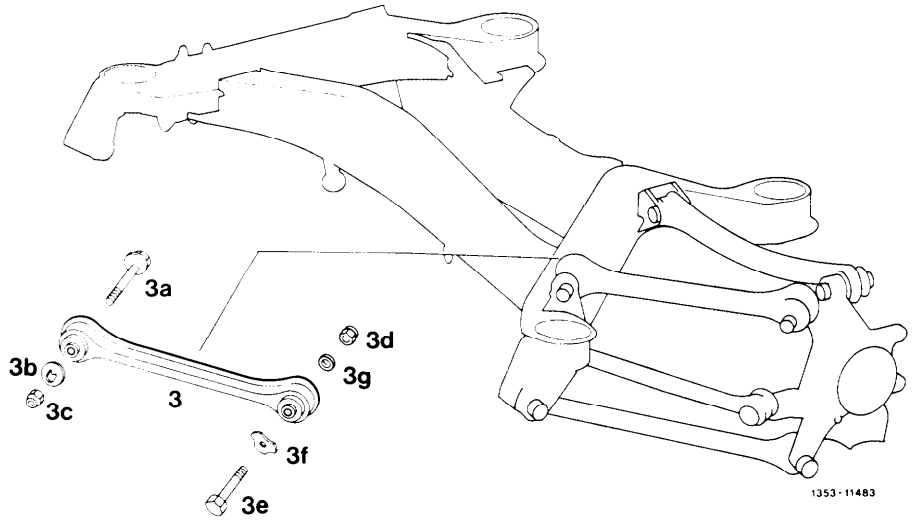


c) Remove self-locking hex. nut on principle.

d) Mount contour disk (2d) at rubber mount end and washer (2f) at wheel carrier end.

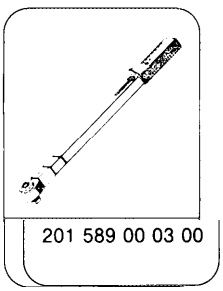


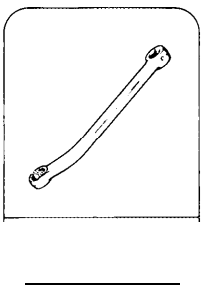
35-I 11 Removal and installation of pulling strut



3	Pulling strut	Check pulling strut and rubber mount for damage
3a	Eccentric screw	
3b	Eccentric disk	
3c	Self-locking hex. nut	Renew, tightening torque 70 Nm with rear axle removed or 50 Nm with rear axle installed and use of special tool: Special box end wrench 201 589 00 03 00
3d	Self-locking hex. nut	Renew, tightening torque 40 Nm
3e	Hex. head screw	
3f	Contour disk	
3g	Washer	

Special tools



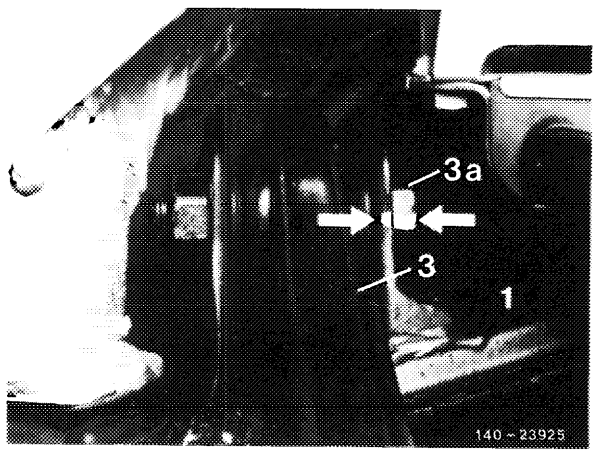


Note

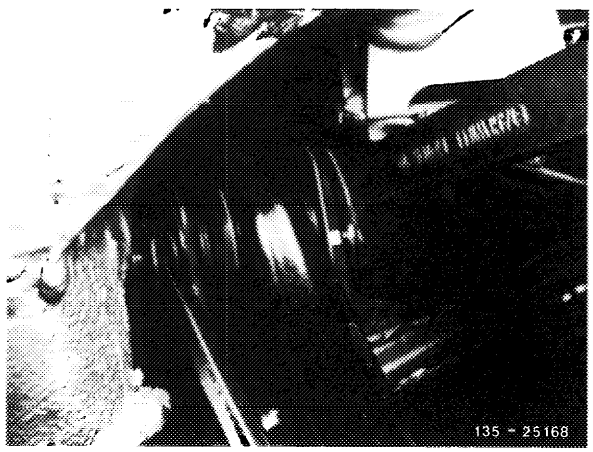
Rubber mounts of pulling strut cannot be individually exchanged. Pulling strut is available only with rubber mount as spare part. Removal and installation with rear axle installed is possible.

Removal

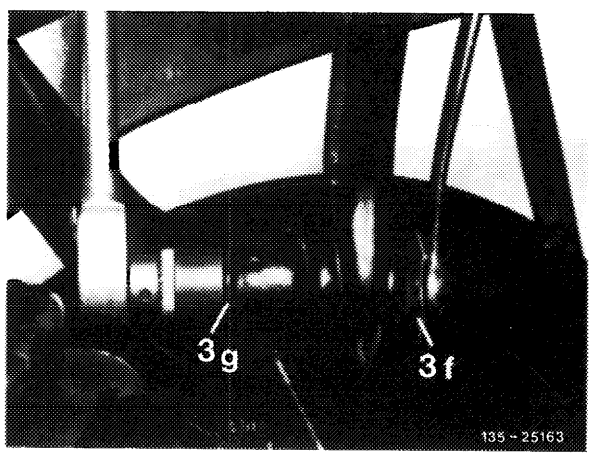
1 Mark position of eccentric screw in relation to rear axle carrier (arrows).



2 Unscrew self-locking hex. nut and remove together with cam disk and eccentric screw. Prior to pulling out eccentric screw, push wheel carrier in forward direction — slacken.

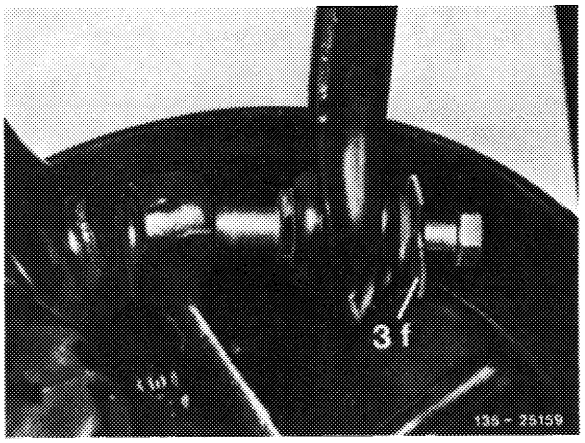


3 Unscrew self-locking hex. nut and remove with washer (3g).



4 Force clamping sleeve of pulling strut out of wheel carrier and remove together with contour disk (3f) and hex. head screw.

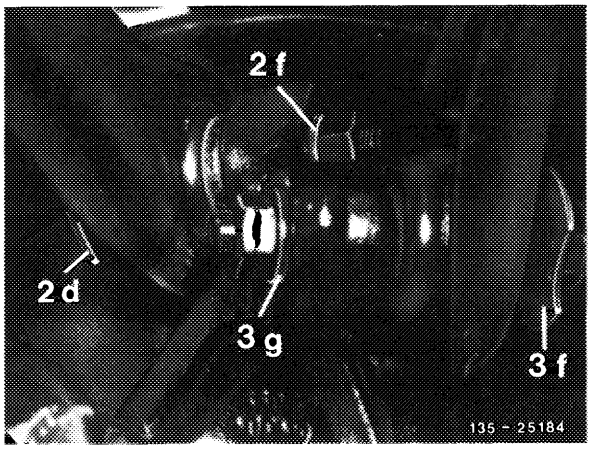
Note.: If rubber mounts are damaged, renew complete pulling strut.



Installation

5 Install in vice versa sequence. Pay attention to the following items:

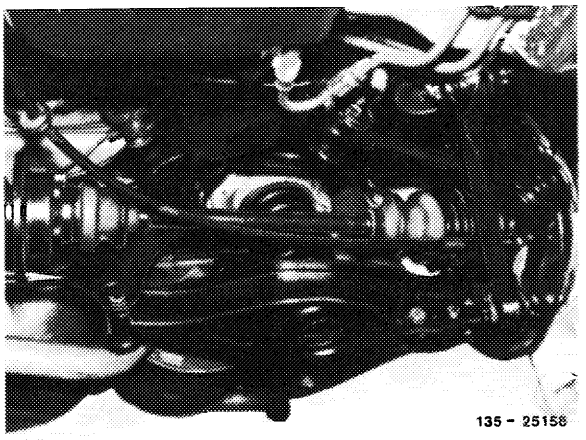
a) Mount contour disk (3f) on rubber mount end and washer (3g) on wheel carrier end.



b) Mount eccentric screw in position as marked.

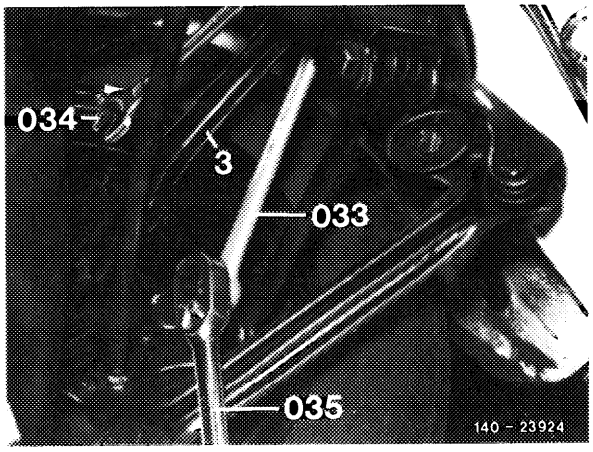
c) Rear axle shaft must be horizontal prior to tightening self-locking hex. nut.

d) Renew self-locking hex. nuts on principle.

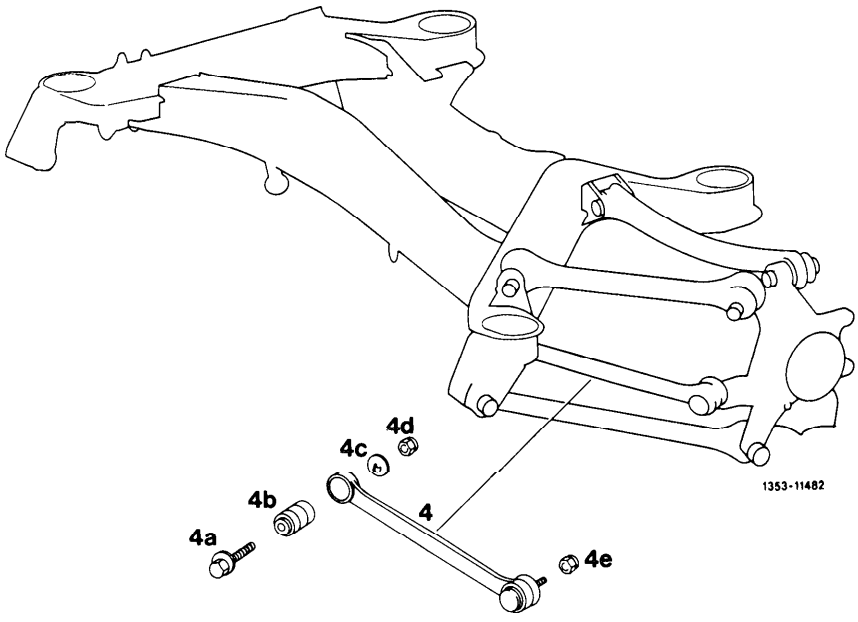


e) Tightening torque of self-locking hex. nut is 70 Nm on rear axle carrier with rear axle removed or 50 Nm with rear axle installed by means of special box-end wrench (033) offset by 19 mm, and 45 Nm on wheel carrier.

f) Check tilt of wheel carrier and toe-in of rear axle and adjust, if required (40-330).

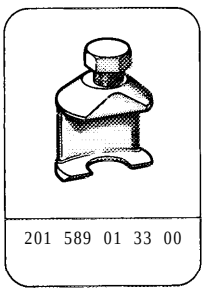


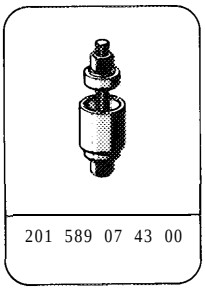
35-I 12 Removal and installation of track rod, renewing rubber mounts

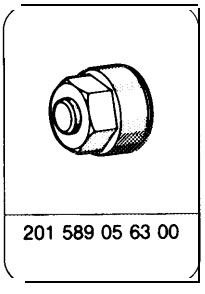


4	Track rod	Check ball head for play. Special tool: Puller 201 589 01 33 00 with thrust piece 201 589 05 63 00
4a	Eccentric screw.	
4b	Rubber mount	Check for damage. Special tool: Remover and installer 201 589 07 43 00
4c	Eccentric disk	
4d	Self-locking hex. nut	Renew, tightening torque 70 Nm
4e	Self-locking hex, nut	Renew, tightening torque 35 Nm

Special tools


201 589 01 33 00


201 589 07 43 00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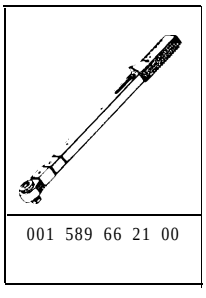
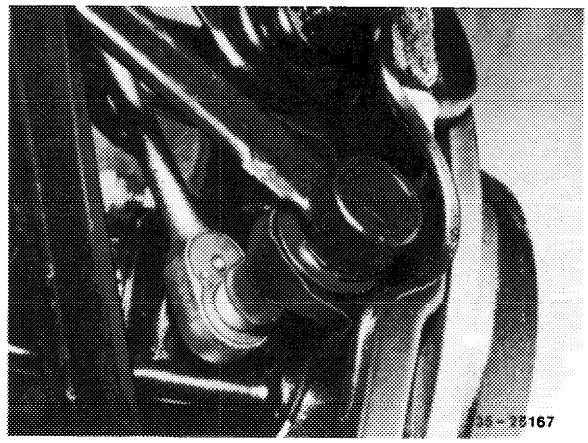

001 589 66 21 00

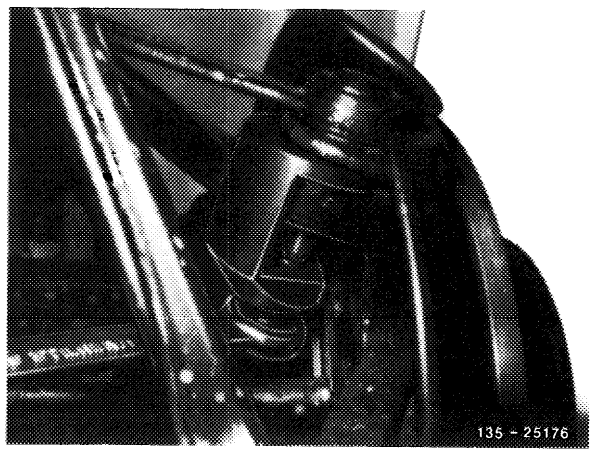
Removal

1 Unscrew self-locking hex. nut of track rod on wheel carrier and remove.

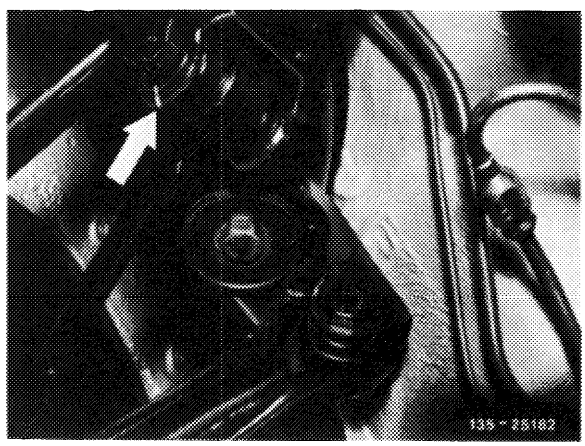


2 Force track rod from wheel carrier by means of puller, using thrust piece, so that the threads on ball pin are not damaged.

3 Remove puller.

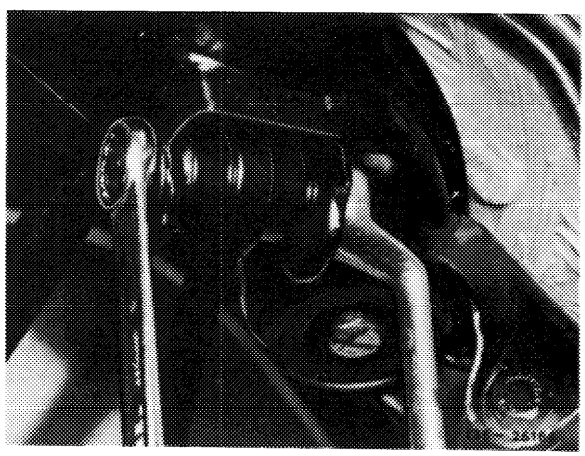


4 Mark position of eccentric screw in relation to rear axle carrier (arrow).



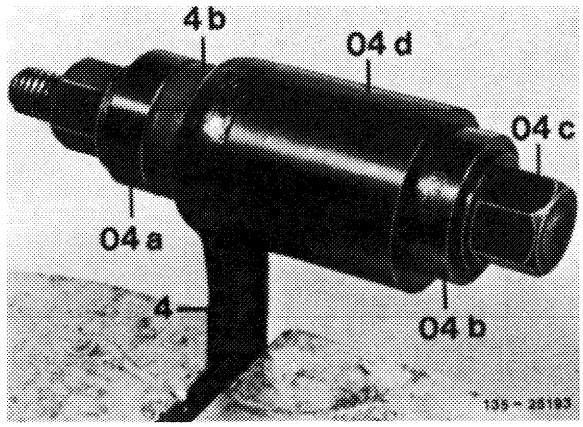
5 Unscrew self-locking hex. nut and remove complete with cam disk, eccentric screw and track rod.

Note: Renew damaged rubber mounts and renew track rod if rubber sleeve is damaged or ball joint is worn out.



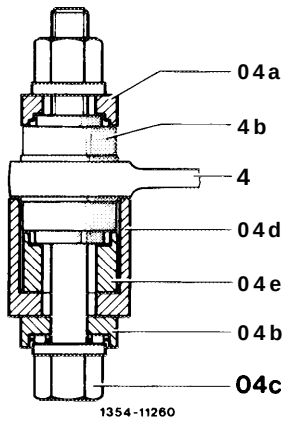
Renewing rubber mounts

6 Pull rubber mount (4b) out of track rod (4) with puller (04a–04d).



4 Track rod
4b Rubber mount
04a Thrust ring
04b Thrust washer with axial needle bearing
04c Hex. head screw with hex. nut
04d Sleeve

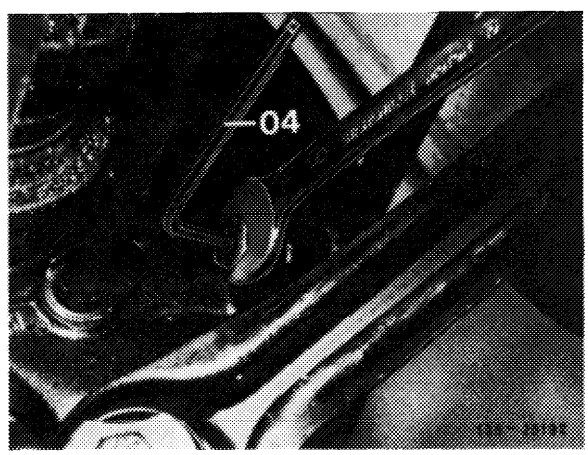
7 Insert rubber mount with installer into track rod until it rests against spacing member (04e).



4 Track rod
4b Rubber mount
04a Thrust ring
04c Hex. head screw with hex. nut
04d Sleeve
04e Spacing member

Installation

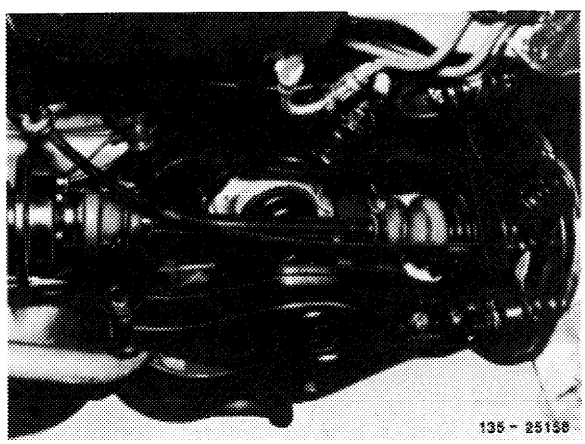
8 Install in vice versa sequence. Pay attention to the following items:



a) Mount eccentric screw in position as marked.

b) Clean ball pin as well as conical seat in wheel carrier from grease. Push ball pin tightly into cone of wheel carrier, screw on self-locking hex. nut while applying counterhold to ball pin with hex. socket wrench (04). Tightening torque 35 Nm.

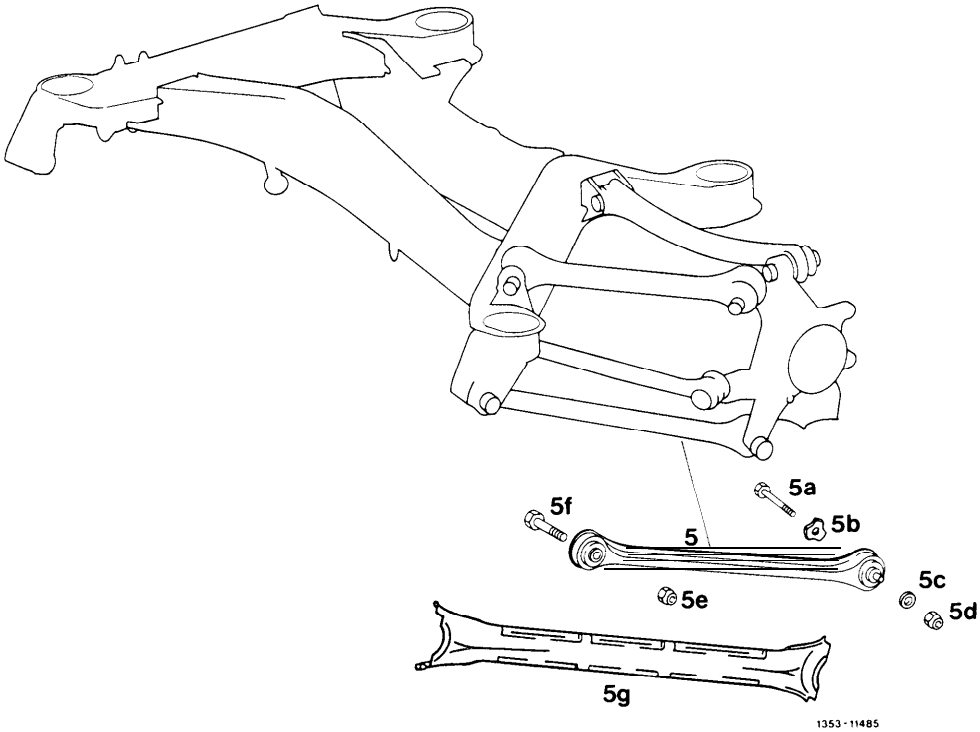
c) Prior to tightening self-locking hex. nut on rear axle carrier, the rear axle shaft should be in horizontal position. Tightening torque is 70 Nm.



d) Renew self-locking hex. nuts on principle,

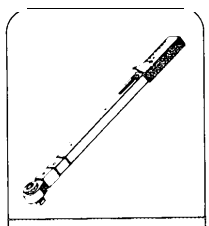
e) Check toe-in of rear axle and adjust, if required (40-330).

35-I 13 Removal and installation of pushing strut



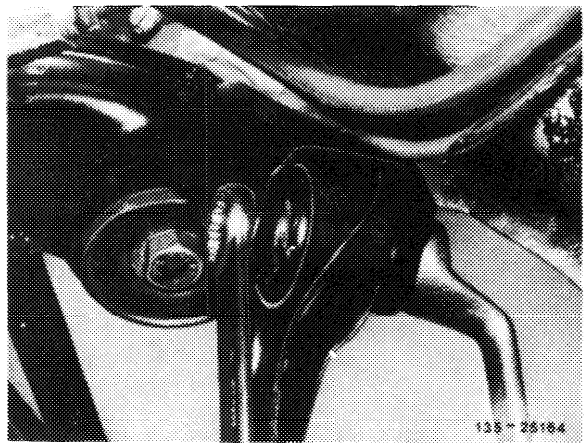
5	Pushing strut.	Check pushing strut and rubber mount for damage
5a	Hex. head screw	
5b	Contour disk	
5c	Washer	
5d	Self-locking hex. nut	Renew, tightening torque 45 Nm
5e	Self-locking hex. nut	Renew, tightening torque 70 Nm
5f	Hex. head screw	
5g	Pushing strut covering.	Check for damage

Special tool



Note

Rubber mounts of pushing strut cannot be individually exchanged. Pushing strut is available only with rubber mount as a spare part. Removal and installation with rear axle installed is possible.



Removal

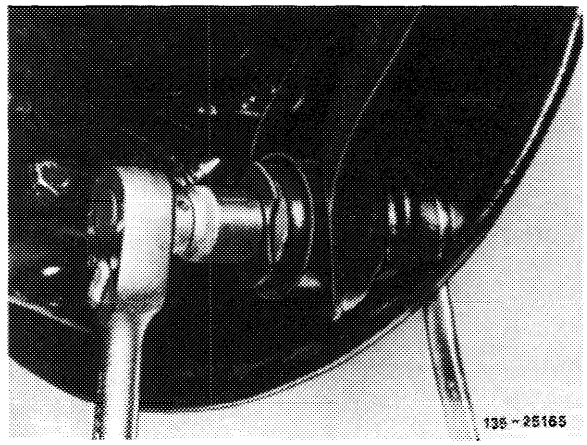
1 Remove pushing strut cover.

2 Loosen self-locking hex. nut of pushing strut on rear axle carrier and remove with hex. head screw.

3 Unscrew self-locking hex. nut on wheel carrier and remove with washer, hex. head screw and contour disk.

4 Turn pushing strut on rear axle carrier in downward direction, then force clamping sleeve out of wheel carrier and remove.

Note.: Renew pushing strut if rubber mounts are damaged.



Installation

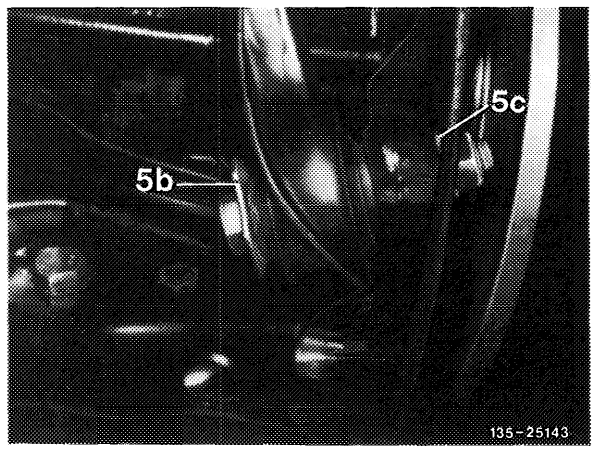
5 Install in vice versa sequence, pay attention to the following items:

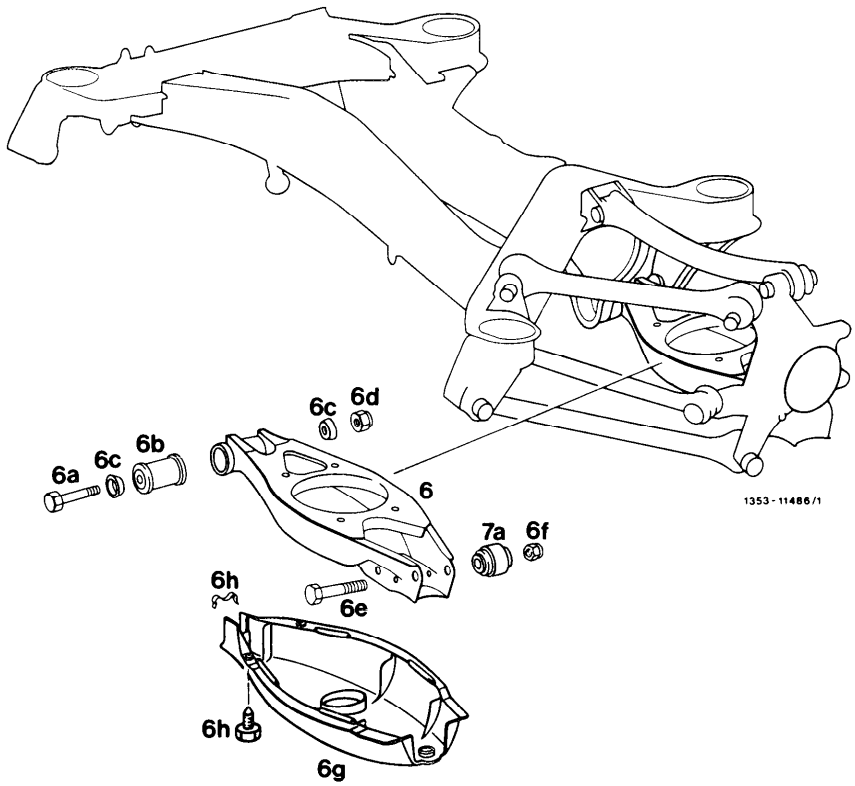
a) Mount contour disk (5b) on rubber mount end and washer (5c) at wheel carrier end.

b) Rear axle shaft must be horizontal prior to tightening self-locking hex. nuts.

c) 'Renew self-locking hex. nuts on principle,

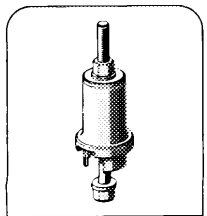
d) The tightening torque of self-locking hex. nuts on rear axle carrier amounts to 70 Nm and on wheel carrier to 45 Nm.



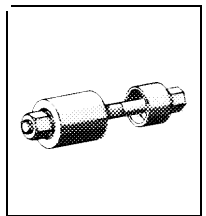


6	Spring link	.....	Check for damage
6a	Hex. head screw		
6b	Rubber mount	.....	Check for damage, prior to pressing-in, coat with slide fuid (Naphtolen H or Fahr slide paste 000 989 08 60), special tool: Remover and installer 201 589 03 43 00
6c	Washer		
6d	Self-locking hex. nut	.....	Renew, tightening torque 70 Nm
6e	Hex. head screw		
6f	Self-locking hex. nut	.....	Renew, tightening torque 120 Nm
6g	Spring link covering	.....	Check for damage
6h	Holding clip or sheet metal screw		
7a	Supporting joint	.....	Check for damage, special tool: Remover and installer 201 589 05 43 00

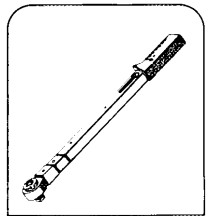
Special tools



201 589 03 43 00



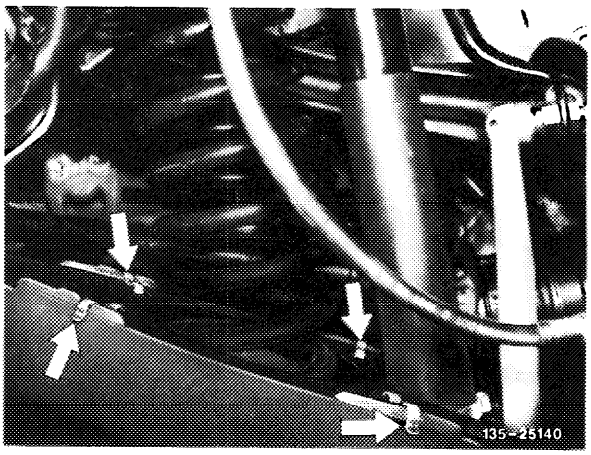
201 589 05 43 00



001 589 66 21 00

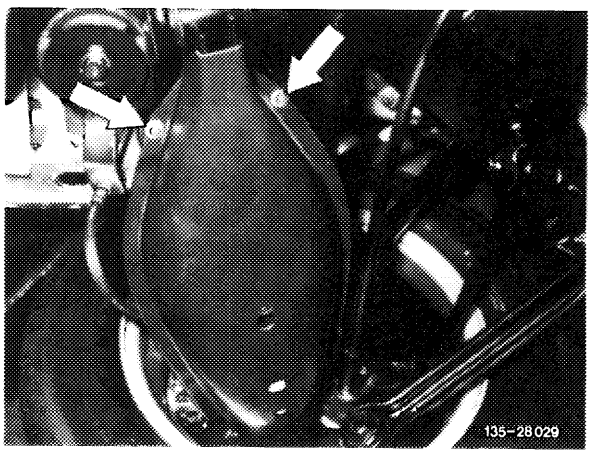
Removal

1 On 1 st version, remove holding clips and remove spring link covering (arrows).



1 st version

2 On 2nd version, unscrew sheet metal screws and remove spring link covering (arrows).



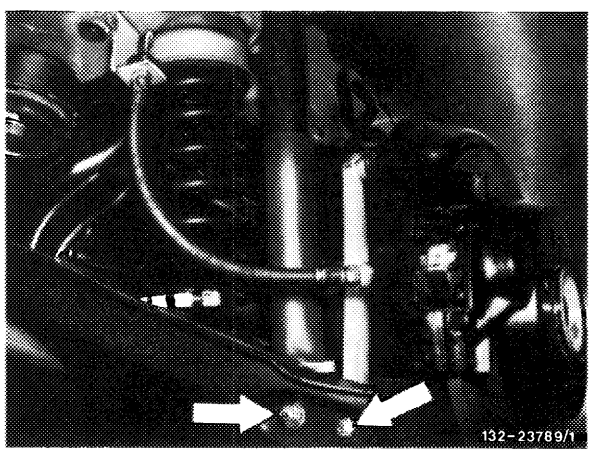
2nd version

3 Unscrew self-locking hex. nut of shock absorber fastening and remove with washer (arrow).

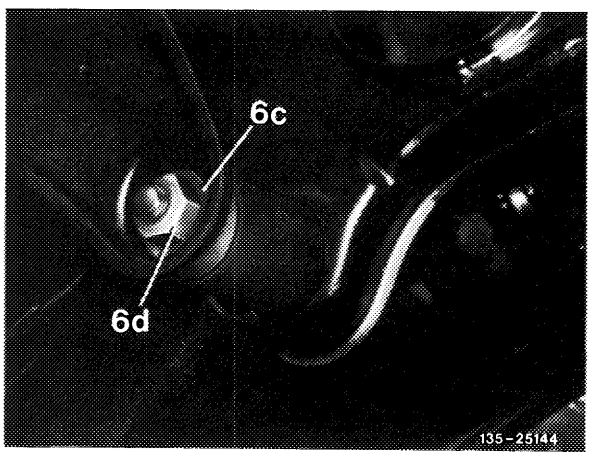
4 Slightly lift spring link and pull out hex. head screw.

5 Unscrew lower torsion bar fastening on spring link and remove (arrow).

6 Remove rear spring (32–230).

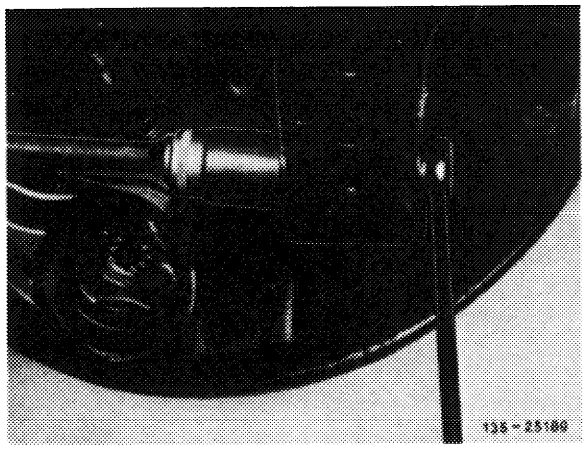


7 Unscrew self-locking hex. nut (6d) of spring link on rear axle carrier and remove with washers (6c) and hex. head screw.



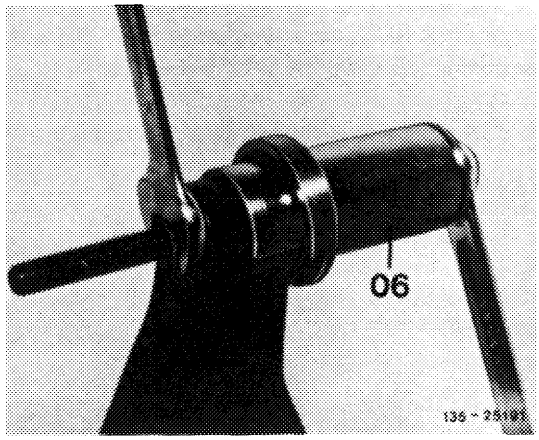
8 Unscrew self-locking hex. not of spring link on wheel carrier and remove with hex. head screw.

9 Remove spring link.



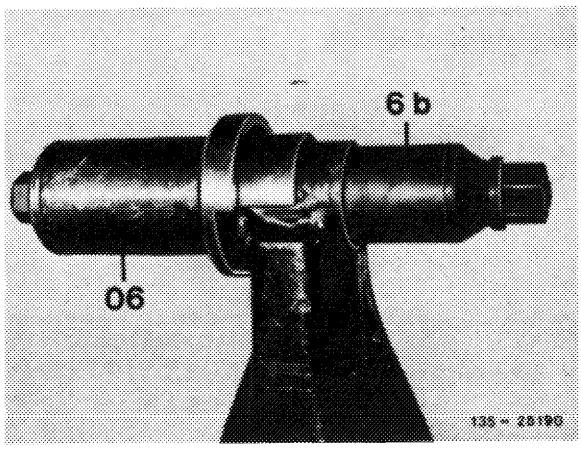
Renewing rubber mount

10 Pull rubber mount out of spring link by means of puller (06).



11 Rub rubber mount with slide fluid.

12 Install rubber mount(6b) by means of installer (06) into spring link until both ends are at the same distance from spring link bushing.

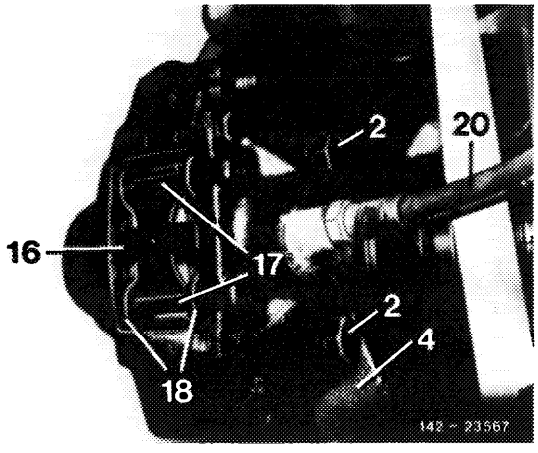


Removing and installing supporting joint on wheel carrier

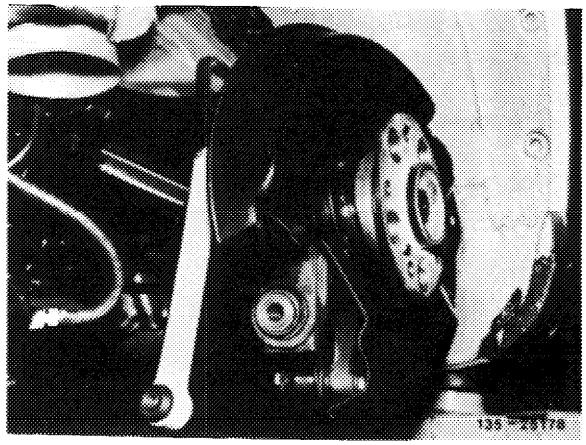
13 Remove brake caliper on wheel carrier and suspend by means of a hook.

14 Remove brake disk.

15 Remove brake shoes of parking brake(42–530).

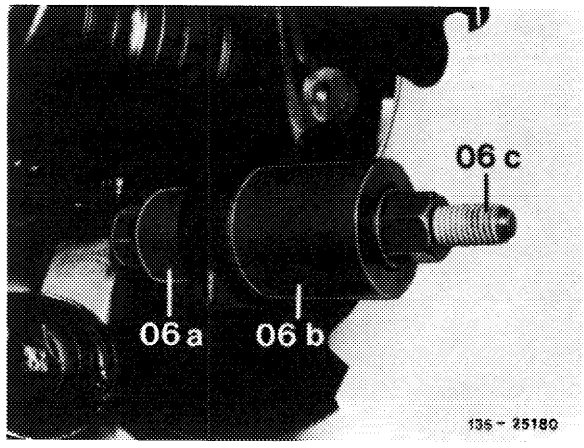


16 Unscrew hex. head screws for fastening cover plate and turn cover plate in such a manner that the cutout rests against supporting joint.

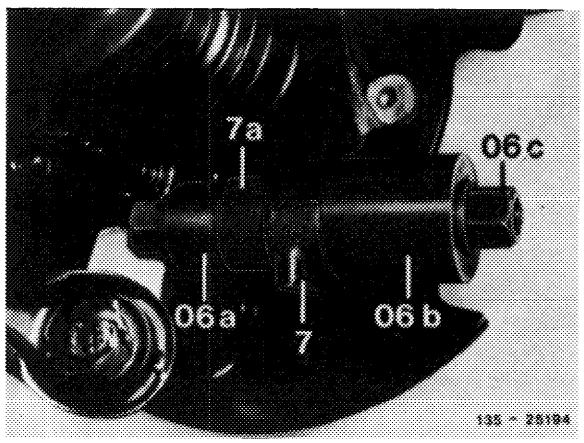


17 Pull supporting joint wiht remover, comprising thrust piece (06a), counterhold bushing (06b) and tensioning screw (06c) from wheel carrier.

18 Take away remover with supporting joint.

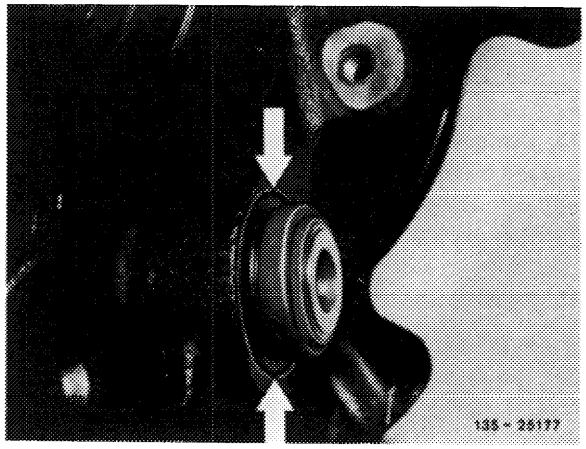


19 Insert supporting joint (7a) with installer (06a–06c) into wheel carrier.

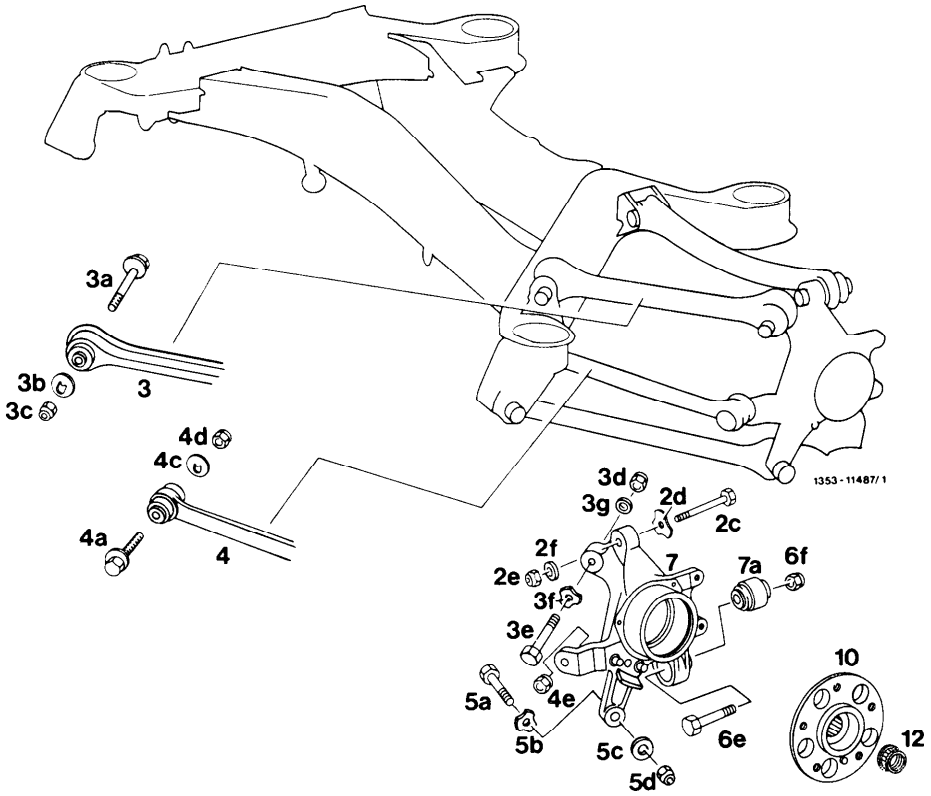


06a Thrust piece
06b Counterholding bushing
06c Tensioning screw with hex. nut
7 Wheel carrier
7a Supporting joint

Attention!
The supporting joint is correctly seated in wheel carrier when the supporting joint is flush with chamfer on wheel carrier (arrows).



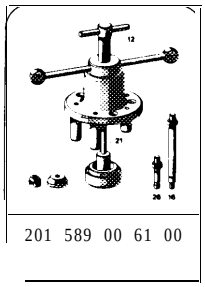
20 Fasten cover plate to wheel carrier by means of hex. head screws.



2c	Hex. head screw — fastening of camber strut	
2d	Contour disk	
2e	Self-locking hex. nut	Renew, tightening torque 40 Nm
2f	Washer	
3	Pulling strut	
3a	Eccentric screw	
3b	Eccentric disk	
3c	Self-locking hex. nut	Renew, tightening torque with rear axle removed 70 Nm or 50 Nm with rear axle installed and use of special tool: Special box end wrench 201 589 00 03 00
3d	Self-locking hex. nut	Renew, tightening torque 40 Nm
3e	Hex. head screw-fastening of pulling strut	
3f	Contour disk	
3g	Washer	
4	Track rod	Check ball head for play. Special tool: Puller 201 589 01 33 00 and thrust piece 201 589 05 63 00
4a	Eccentric screw	
4c	Eccentric disk	
4d	Self-locking hex, nut	Renew, tightening torque 70 Nm
4e	Self-locking hex. nut — fastening of track rod	Renew, tightening torque 35 Nm
5a	Hex. head screw — fastening of pushing strut	
5b	Contour disk	
5c	Washer	
5d	Self-locking hex. nut	Renew, tiqhtening torque 40 Nm

6e	Hex. head screw	
6f	Self-locking hex. nut	Renew, tightening torque 120 Nm
7	Wheel carrier.	Check for damage
7a	Supporting joint	Check for damage, insert supporting joint flush with wheel carrier
12	Double hex. collar nut	Renew, tightening torque 280-320 Nm, special tool: Socket wrench element 30 mm 126 589 02 09 00 and remover and installer 201 589 00 61 00

Special tools



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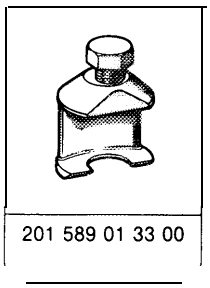

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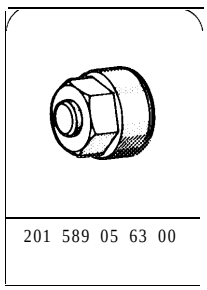

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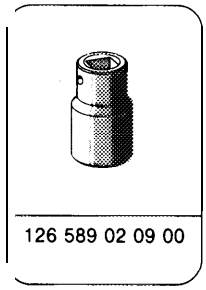
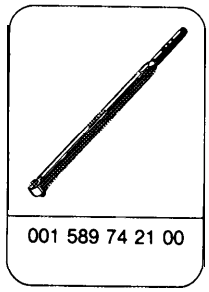
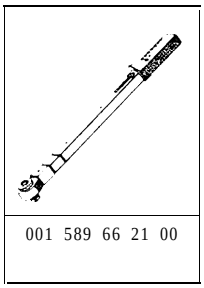


126 589 02 09 00



001 589 74 21 00



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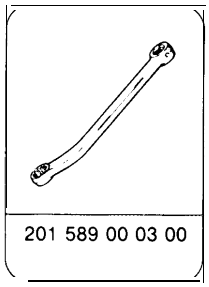


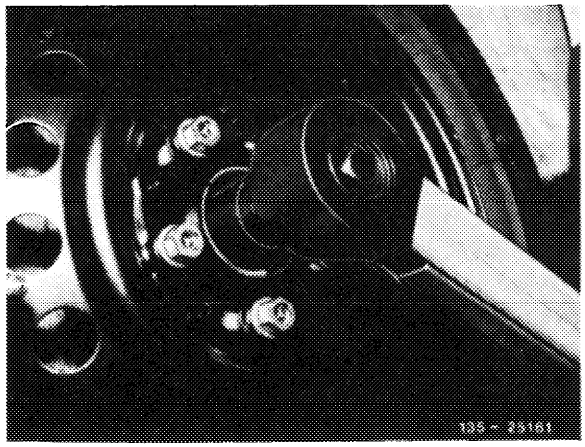
201 589 00 03 00

Note

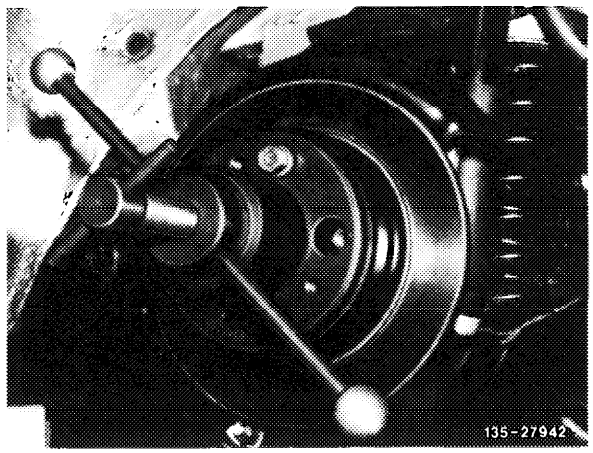
Removal and installation of complete **wheel carrier with rear axle installed is possible.**

Removal

1 Unscrew double hex. collar nut for fastening real axle shaft prior to lifting vehicle and removing whee!l.

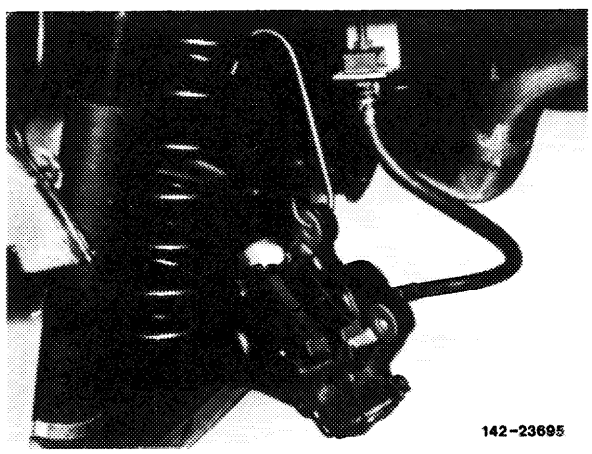


2 Force stuck rear axle shafts out of rear axle shaf t flange by means of remover.



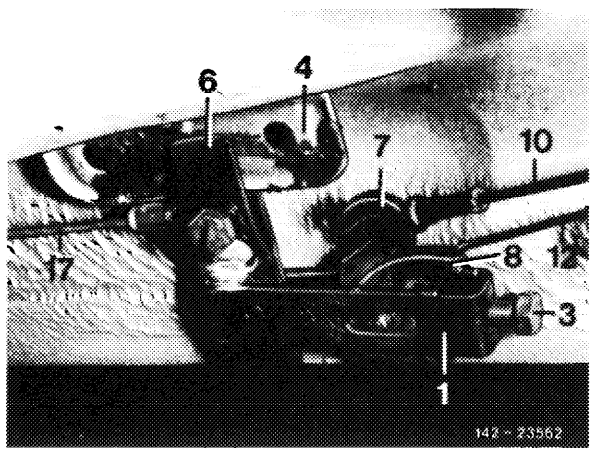
3 Remove brake caliper and suspend by means of a hook.

4 Remove brake disk.



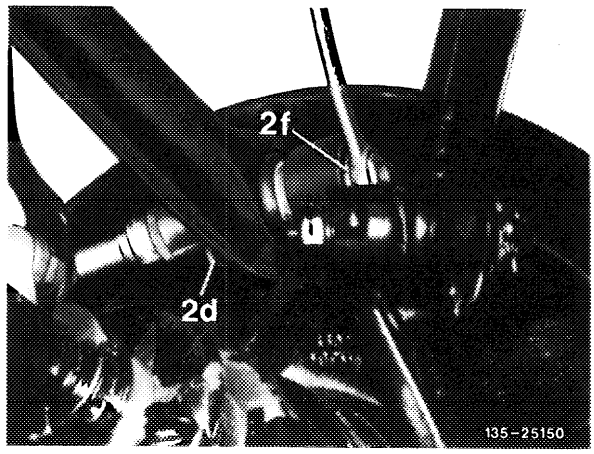
5 Remove intermediate lever of parking brake and disengage cable control (10) (42-525).

6 Pull out lock on hand brake cable.



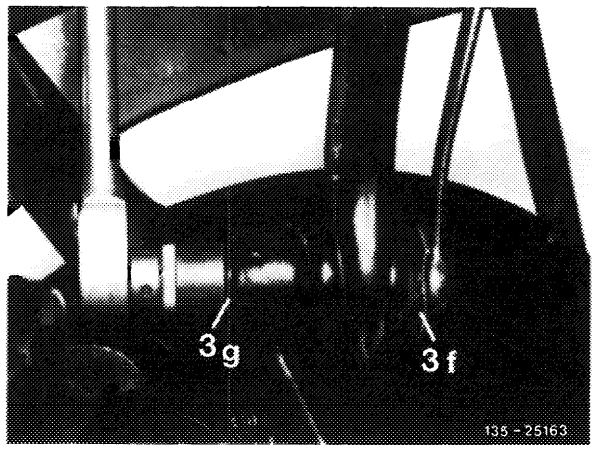
7 Unscrew self-locking hex. nut of camber strut on wheel carrier. Remove washer **(2f),** contour disk **(2d)** and hex. head screw.

8 Force clamping sleeve of rubber mount out of wheel carrier.



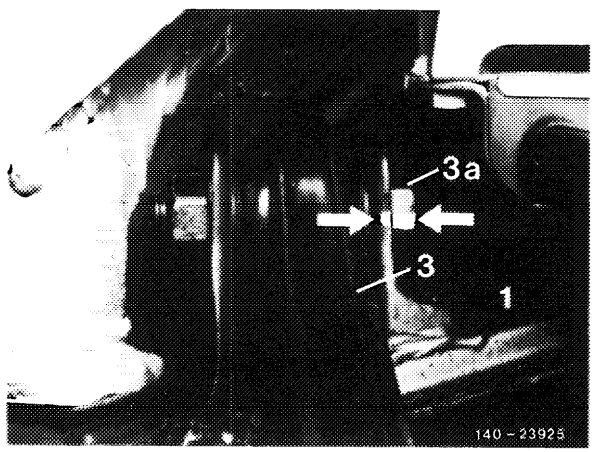
9 Unscrew self-locking hex. nut of pulling strut on wheel carrier and remove washer **(3g),** contour disk **(3f)** and hex. head screw.

10 Force clamping sleeve of rubber mount out of wheel carrier.



11 Mark position of eccentirc screw of pulling strut in relation to rear axle carrier (arrows).

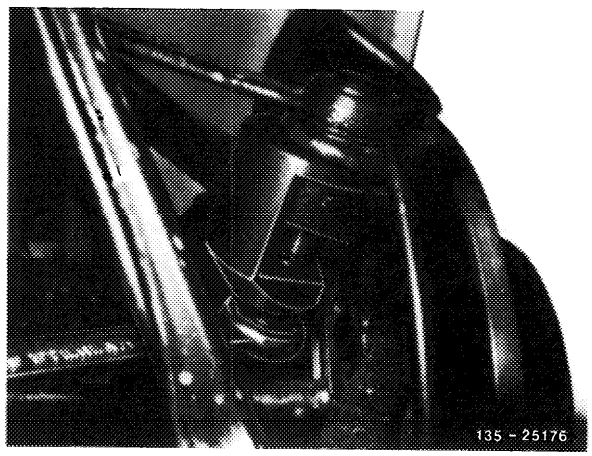
12 Unscrew self-locking hex. nut of pulling strut on rear **axle** carrier and remove together with cam disk and eccentric screw.



13 Unscrew self-locking hex. nut of track rod on wheel carrier and remove.

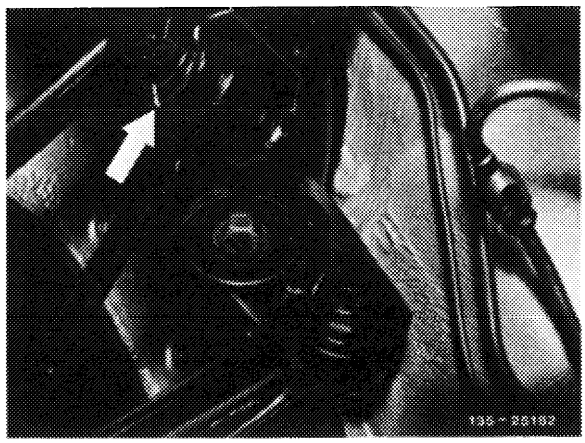
14 Force track rod from wheel carrier by means of puller, while using thrust piece, so that threads on ball pin are not damaged.

15 Remove puller and thrust piece.



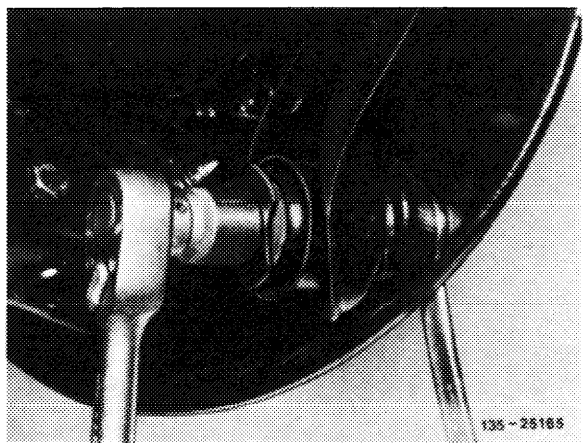
16 Mark position of eccentric screw of track rod in relation to rear axle carrier (arrow).

17 Unscrew self-locking hex. nut and completely remove.

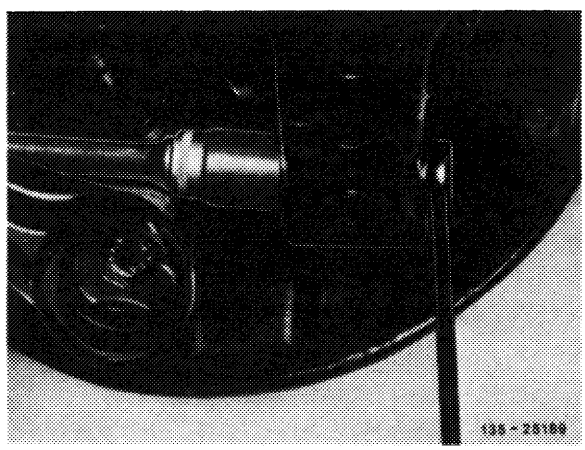


18 Unscrew self-locking hex. nut of pushing strut on wheel carrier and remove together with washer, contour disk and hex. screw.

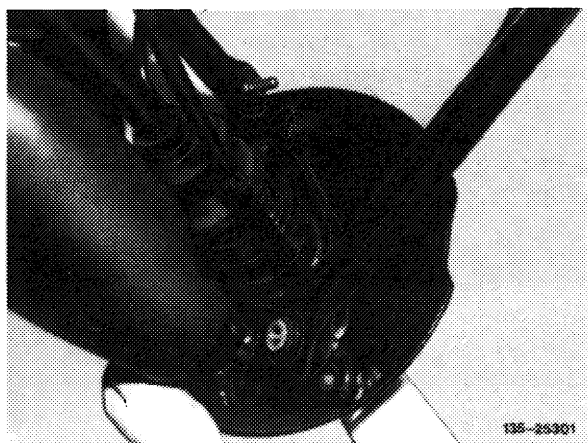
19 Force clamping sleeve out of wheel carrier.



20 Unscrew self-locking hex. nut on spring link and remove together with hex. screw.



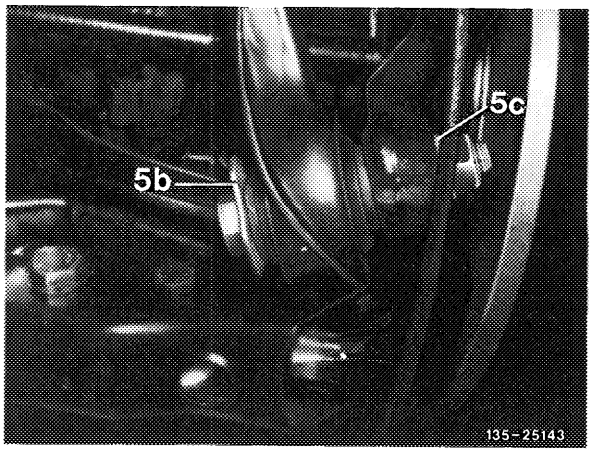
21 Pull complete wheel carrier from rear axle shaft and remove.



Installation

22 For installation proceed vice versa. Pay attention to the following items:

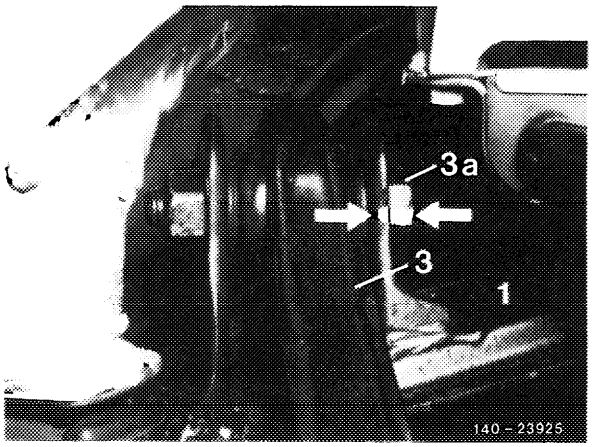
a) Mount contour disk (5b) on rubber mount end and washer (5c) on wheel carrier end.



Fastening pushing strut to wheel carrier

b) Pay attention to position of eccentric screw of pulling strut and of track rod.

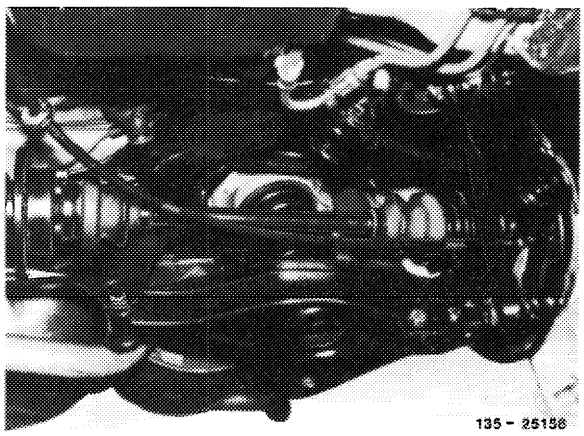
Note: If position of eccentric screw of pulling strut is not marked, mount eccentric screw in center position.



c) Prior to tightening self-locking hex. nuts on wheel carrier or rear axle carrier, rear axle shaft should be in horizontal position.

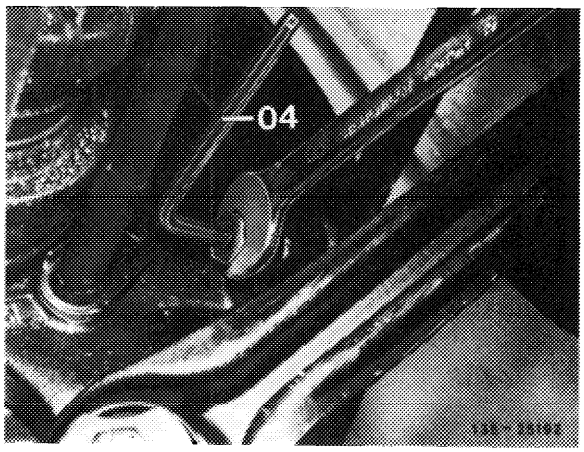
d) Renew self-locking hex. nuts on principle.

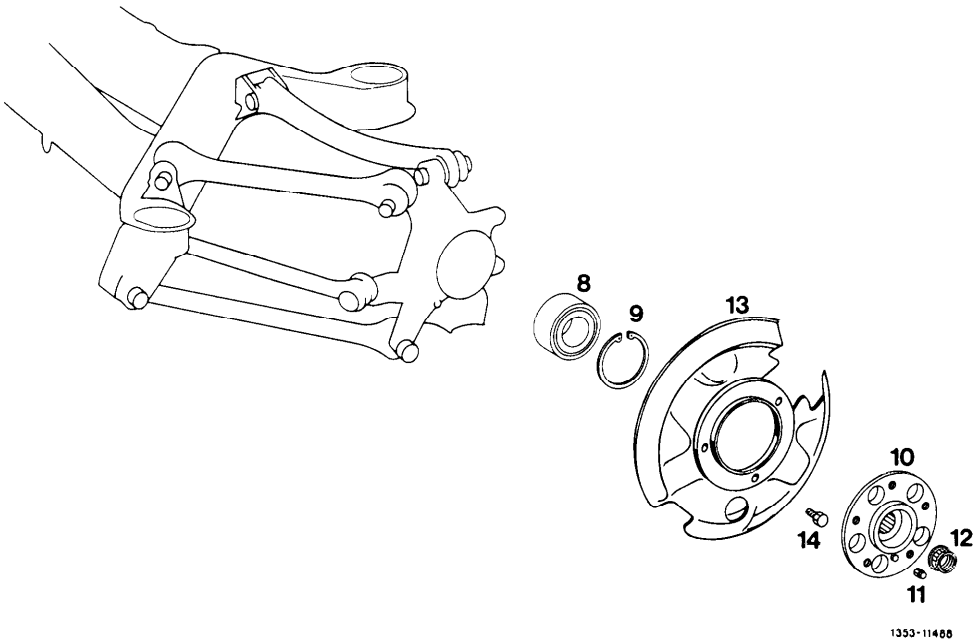
e) Pay attention to tightening torque of self-locking hex. nuts and hex. head screws, as well as double hex. collar nut.



f) Clean ball pin of track rod, as well as conical seat in wheel carrier from grease. Push ball pin tightly into cone of wheel carrier, screw on self-locking hex. nut while applying counterhold to ball pin by means of hex. socket wrench (04).

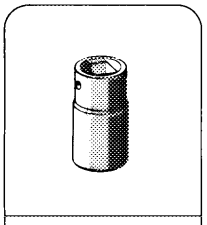
g) Check toe-in and track angle change of rear wheels, adjust, if required (40-330).





8	Angular ball bearing	Renew, special tool: Remover and installer 201 589 04 43 00
9	Locking ring	Pay attention to perfect seat, special tool: Pliers 1 2 6 5 8 9 0 0 3 7 0 0
10	Rear axle shaft flange	Check for damage, radial runout installed: 0.12 mm, removed: 0.02 mm, axial runout installed: 0.12 mm, pilot bore (dia.) for brake disk 67.00 mm — 66.97 mm, double row angular ball bearing dia 45.020 mm — 45.011 mm Special tool: Remover and installer 201 589 04 43 00, remover and installer 201 589 00 61 00, puller 001 589 36 33 00, collet, 201 589 00 34 00, thrust piece 0 0 0 5 8 9 0 3 3 4 0 0
11	Cyl. pin.	Check for correct seat
12	Double hex. collar nut.	Renew, tightening torque 280-320 Nm, special tool: Socket wrench element 30 mm 126 589 02 09 00
13	Cover plate	
14	Hex. head screw	

Special tools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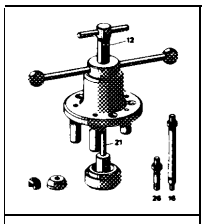
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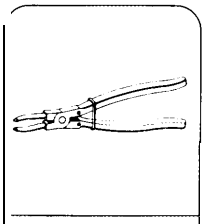
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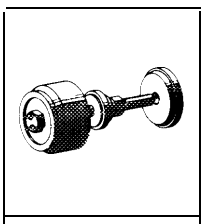
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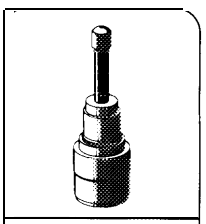
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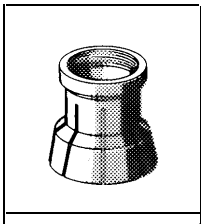
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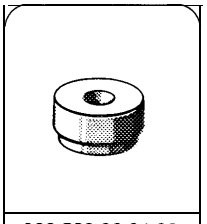
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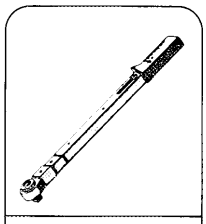
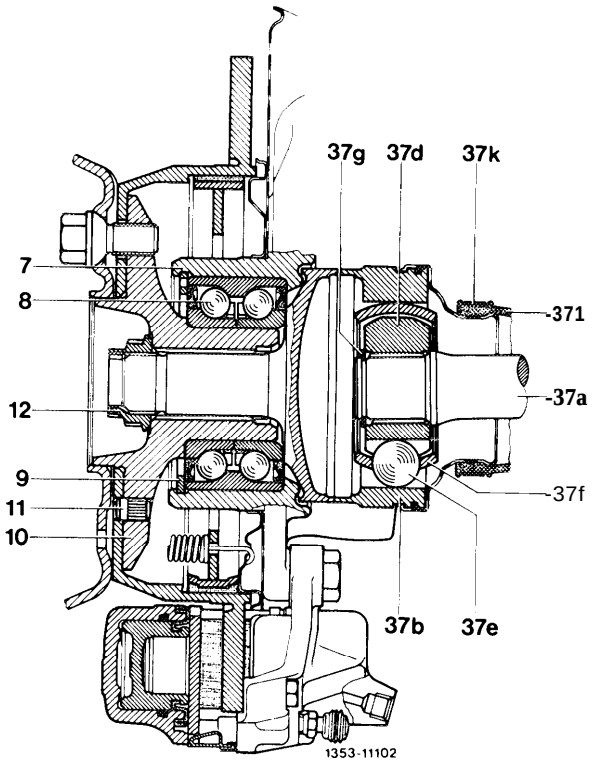

001 589 66 21 00

001 589 74 21 00

Note

Jobs on bearing of rear axle shaft flange can also be performed with rear axle installed.



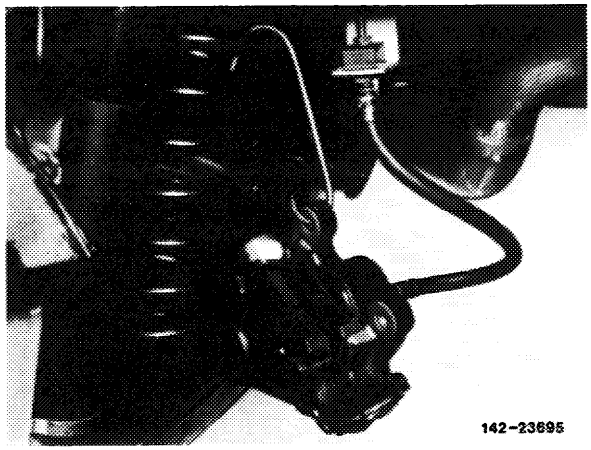
7 Wheel carrier
8 Double-row angular ball bearing
9 Locking ring
10 Rear axle shaft flange
11 Cyl. pin
12 Double hex. collar nut
37a Rear axle shaft
37b Universal joint ring, outer
37d Joint hub
37e Ball
37f Ball cage
37g Locking ring
37k Hose clamp
371 Rubber sleeve

Removal

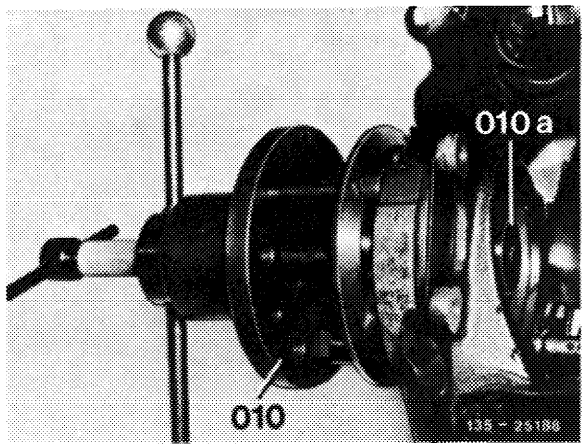
1 Remove rear axle shaft (35-620).

2 Remove brake caliper and suspend with a hook.

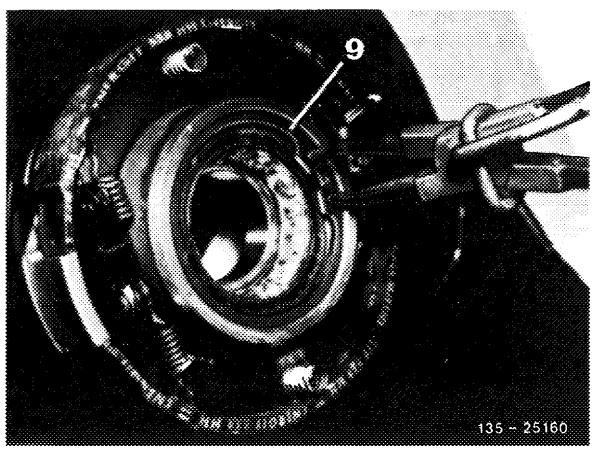
3 Remove brake disk.



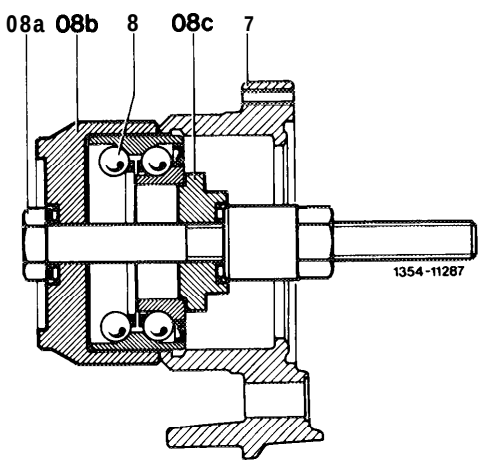
4 Mount remover (010) with thrust piece (010a, 201 589 00 61 29) on rear axle shaft flange. Pull remover out of angular ball bearing and remove.



5 Remove locking ring (9) with pliers from wheel carrier.

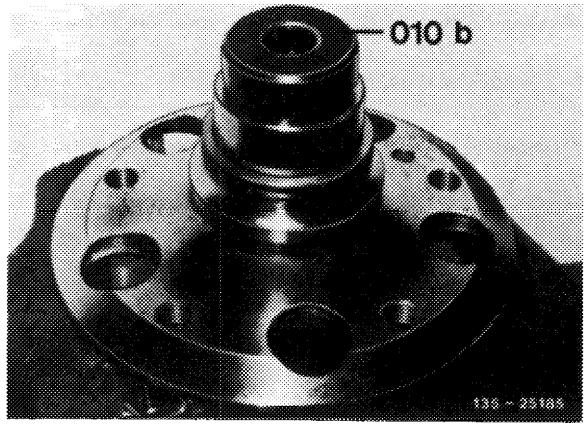


6 Pull double-row angular ball bearing (8) with puller (08a–08c) out of wheel carrier and remove.

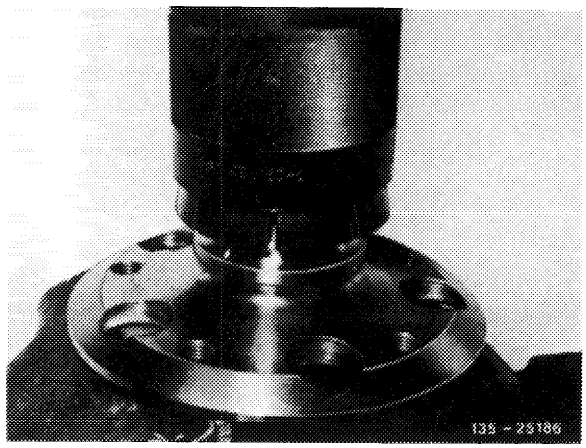


7 Wheel carrier
8 Double-row angular ball bearing
08a Hex.head screw with collar nut
08b Removing and installing sleeve
08c Thrust washer (small)

7 Clamp rear axle shaft flange with aluminum jaws into vise. Mount thrust piece (010b).



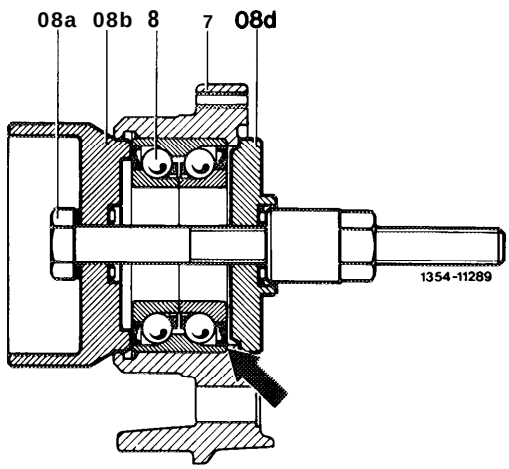
8 Pull bearing inner race with puller from rear axle shaft flange and remove.



9 Check parts for re-use. Check radial and axial run-out of rear axle shaft flange. Renew double-row angular ball bearing on principle after one-time installation.

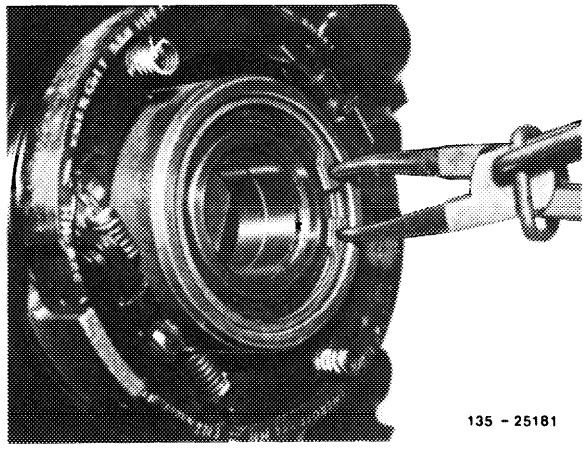
Installation

10 Install double-row angular ball bearing (8) with installer (08a, 08b and 08d) in wheel carrier up to stop (arrow).

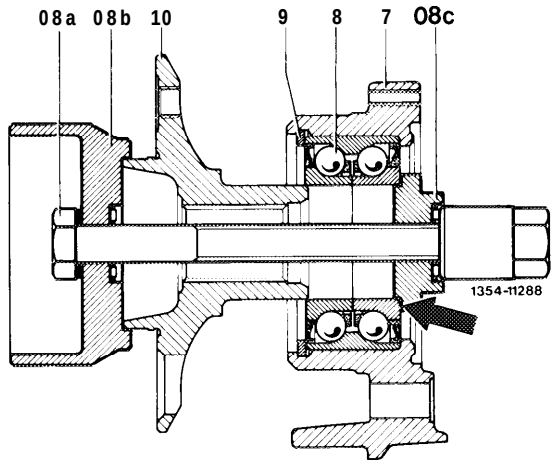


7 Wheel carrier
8 Double-row angular ball bearing
08a Hex. head screw with collar nut
08b Removing and installing sleeve
08d Pulling disk (large)

11 insert locking ring with pliers into wheel carrier, paying attention to correct seat.



12 Install rear axle shaft flange (10) with installer (08a, 08b and 08c) into double-row angular ball bearing (8). Make sure that the thrust washer (small 08c) rests well against bearing inner race during insertion (arrow).

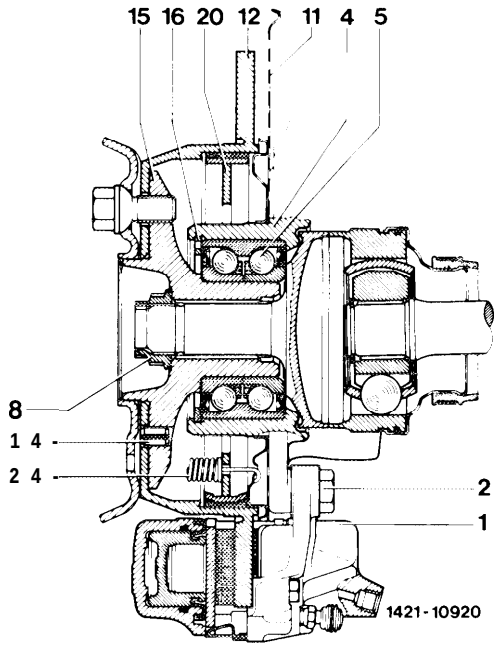


7 Wheel carrier
8 Double-row angular ball bearing
9 Locking ring
10 Rear axle shaft flange
08a Hex. head screw with collar nut
08b Removing and installing sleeve
08c Thrust washer (small)

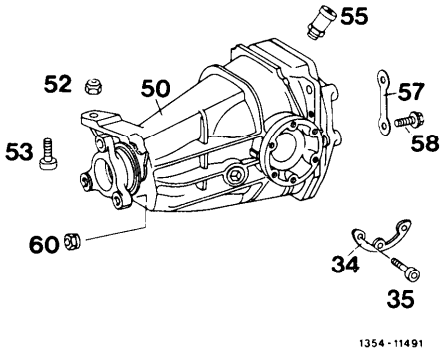
13 Place brake disk (12) on rear axle shaft flange.

14 Mount brake caliper (1) on wheel carrier (4) (42–120).

15 Install rear axle shaft (35–620).

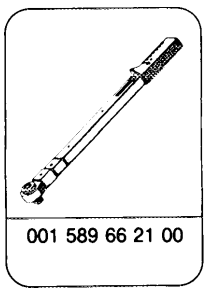


1 Brake caliper
2 Self-locking hex. head screw
4 Wheel carrier
5 Double-row angular ball bearing
8 Double hex. collar nut
11 Cover plate
12 Brake disk
14 Cyl. pin
15 Rear axle shaft flange
16 Locking ring
20 Brake shoes
24 Spring



34	Washer	
35	Locking screw	Renew, thightening torque 70 Nm, threads and screw head contact surface lubricated
50	Rear axle center piece, complete	Oil type hypoid gear oil SAE 90, filling capacity 0.7 liter
52	Self-locking hex. nut, front.	Renew
53	Hex. socket screw, front,	Tightening torque 45 Nm
55	Vent	Renew dirty vent
57	Locking plate.	Renew
58	Locking screw, rear	Renew, tightening torque 50 Nm
60	Self-locking hex. nut for propeller shaft	Renew, tightening torque 40-50 Nm

Special tools



Conventional tools

Screw driver element for muti-tooth screws M 10 (XZN) 1/2" square	e.g. Hazet D-5630 Remscheid Order No. 990 lg-10

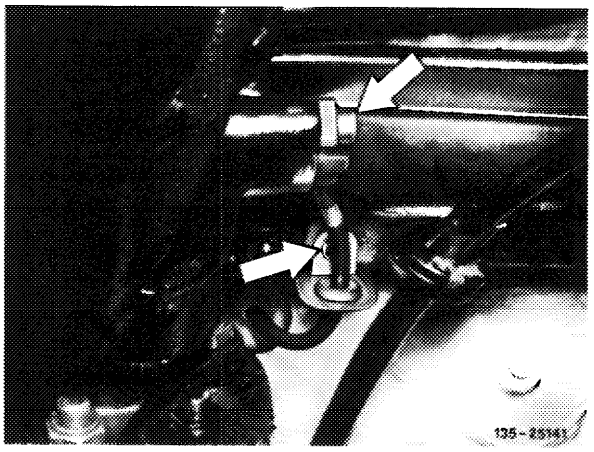
Removal

1 **Only on vehicles with ABS**

a) Drain oil from rear axle.

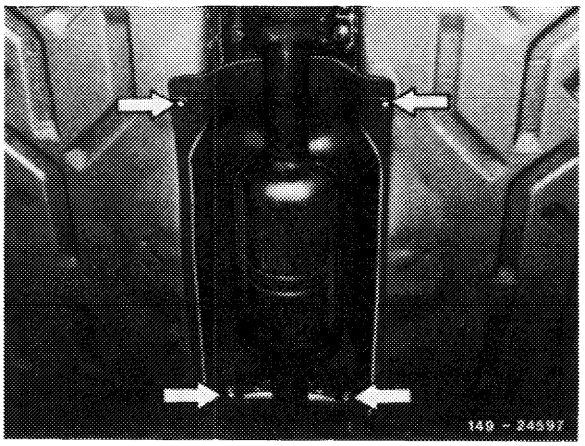
b) Loosen hex. socket screw and remove rpm sensor from rear axle housing (arrow).

c) Cover magnetic edge of rpm sensor and protect against damage.



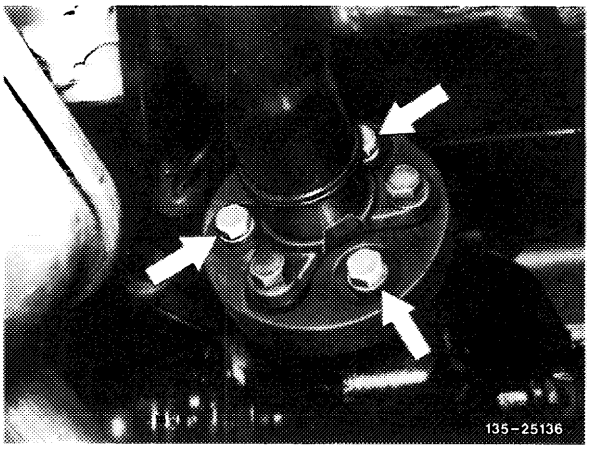
2 Unscrew exhaust shielding plate and remove.

3 Loosen clamping nut on propeller shaft.

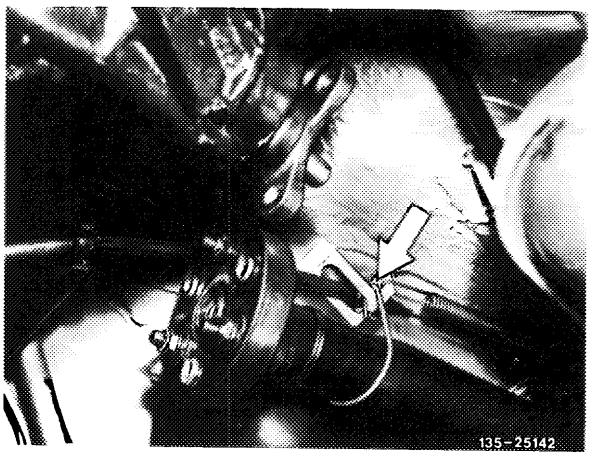


4 Unscrew hex. head screws of propeller shaft intermediate bearing on frame floor and remove (arrows).

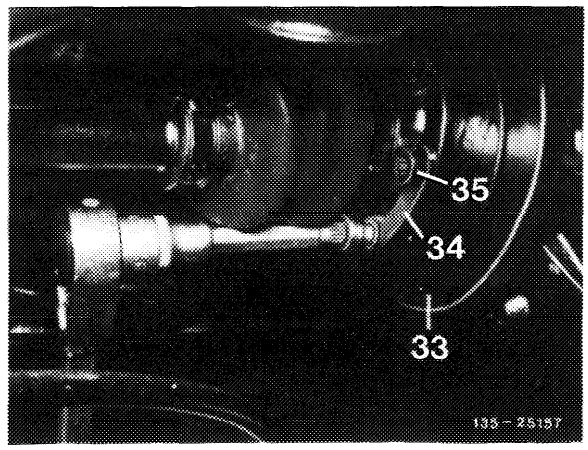
5 Remove propeller shaft on universal flange of drive pinion and push in forward direction.



6 Tie propeller shaft with a wire to holder of brake cable control to protect shaft against falling down.

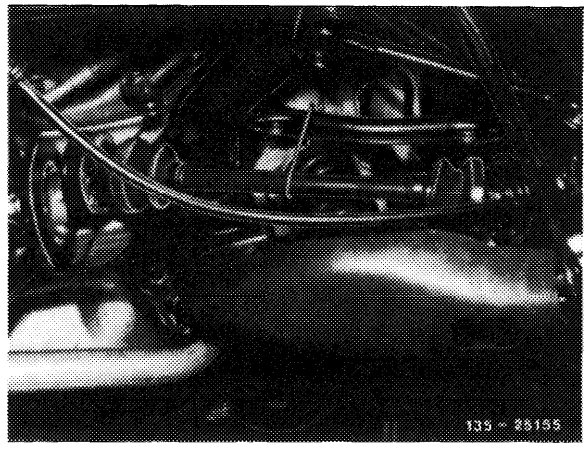


7 Remove rear axle shafts on connecting flange (33) and remove together with locking screws (35) and washers (34).



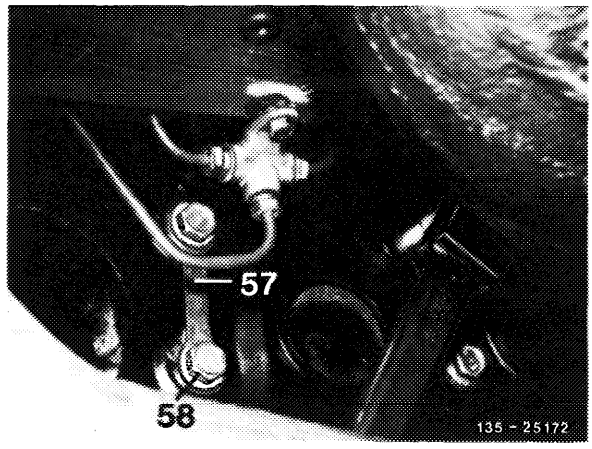
Attention!
Make sure that the screw driver element is **completely inserted in multi-tooth profile** when loosening locking screws – clean screw head, if required.

8 Compress rear axle shafts and fasten with a wire to camber strut.

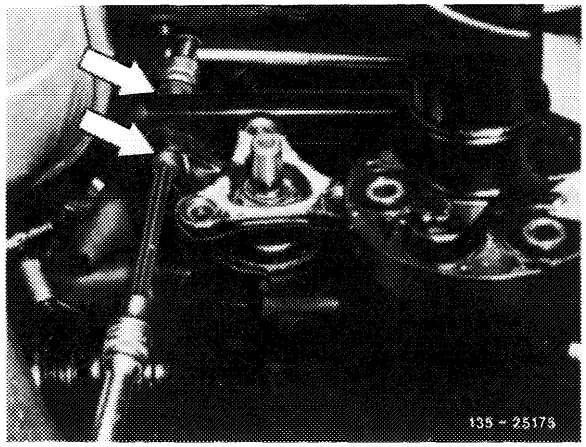


9 Support rear axle center piece.

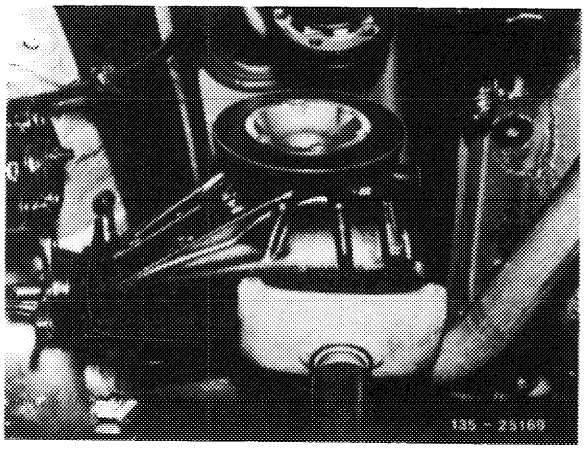
10 Unscrew locking screws (58) on rear axle carrier for end cover and remove together with locking plate (57).



11 Loosen front hex. socket screw for fastening rear axle center piece to rear axle carrier and remove (arrows).



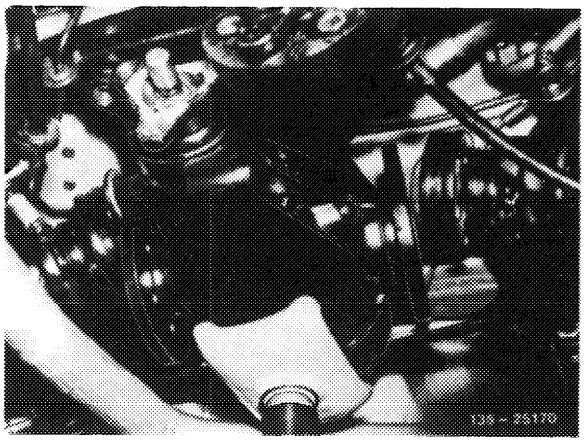
12 Lower rear axle center piece and remove.



Installation

13 Place rear axle center piece on vehicle jack top and move into installation position.

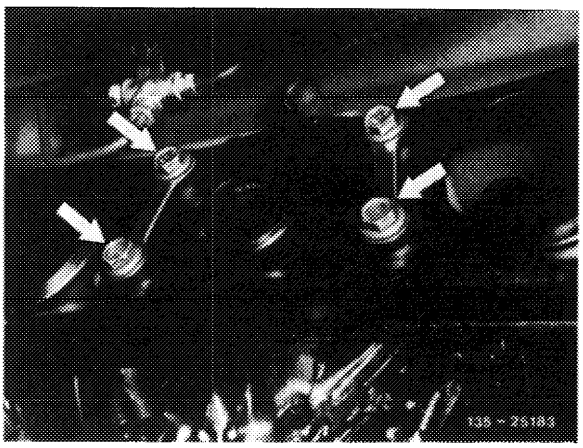
14 Position front hex. socket screw with self-locking hex. nut, but do not yet tighten.



15 Mount locking screws with locking plate and tighten to 50 Nm (arrow).

16 Tighten front hex. socket screw to 45 Nm.

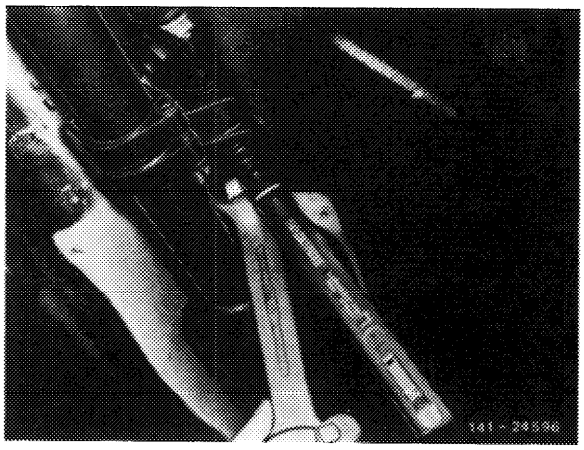
Attention!
Renew self-locking hex. nut, locking screws and locking plates on principle.



17 Mount propeller shaft on universal flange of drive pinion,

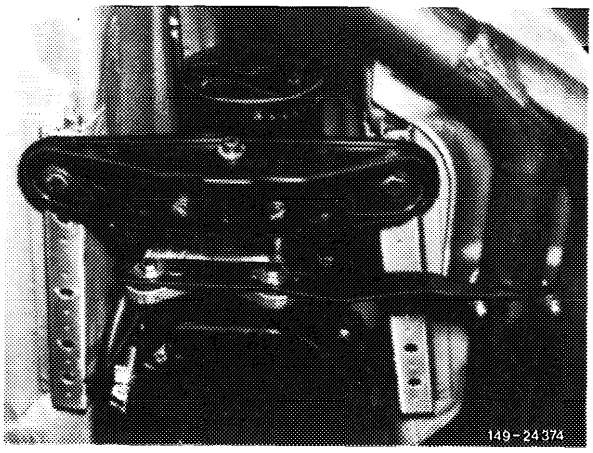
18 Fasten propeller shaft intermediate bearing on frame floor, but do not yet tighten.

19 Tighten clamping nut of propeller shaft to 30-40 Nm. Special tool: Open end wrench 41 mm, 201 589 00 01 00.



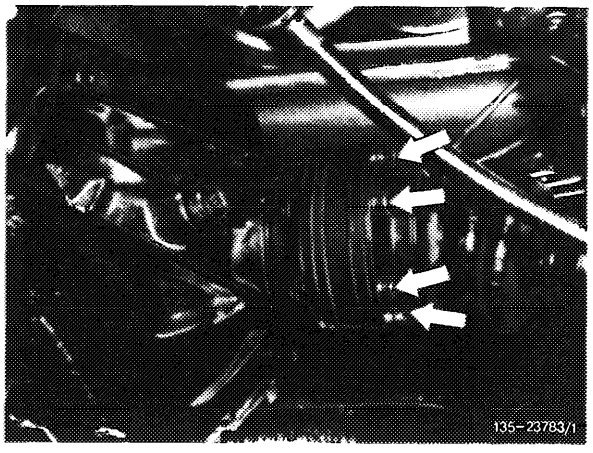
20 Tighten hex. screws for fastening propeller shaft intermediate bearing to 25 Nm.

21 Mount exhaust shielding plate.



22 Mount rear axle shafts with washers and locking screws (arrows). Tightening torque 70 **Nm, moisten threads and screw head contact surface with oil.**

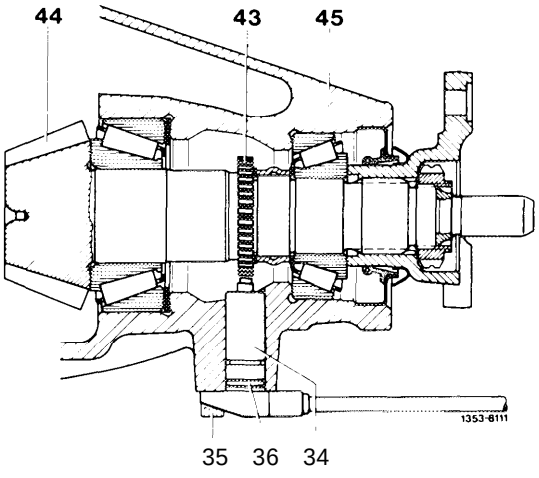
Attention!
Renew locking screws on principle.



23 **Vehicles with ABS**

Note: Prior to installation make sure that no metallic foreign bodies remain on magnetic edge of rpm sensor.

a) Insert new O-ring (36) for rpm sensor (34)

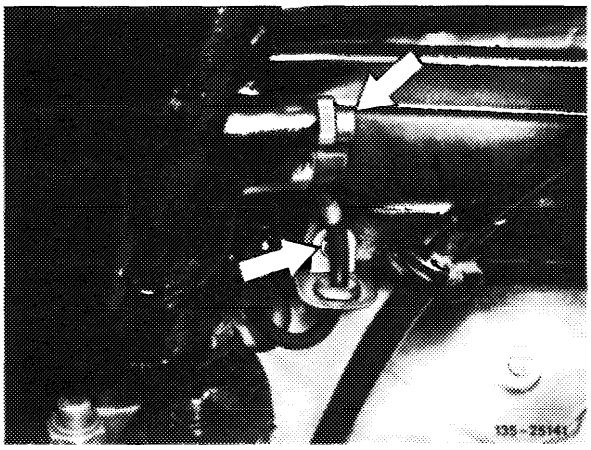


34 Rpm sensor
35 Hex. socket screw
36 O-ring
43 Gear wheel (rotor)
44 Drive pinion
45 Rear axle housing

b) Insert rpm sensor (34) into rear axle housing (45) making sure that O-ring (36) is not damaged.

Note: Use self-locking hex. head screw only once.

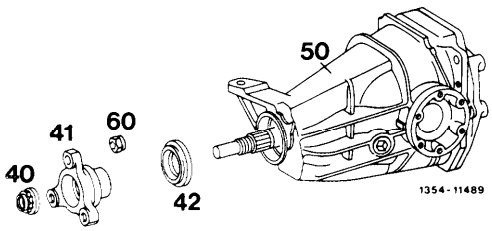
c) Fasten rpm sensor with new. hex. socket screw to rear axle housing (arrow).



24 Check oil in rear axle and fill up to filler hole, if required.

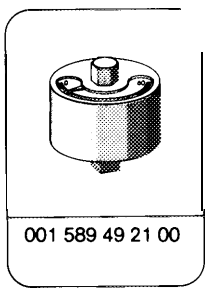
35-530 Renewing radial sealing ring on drive pinion

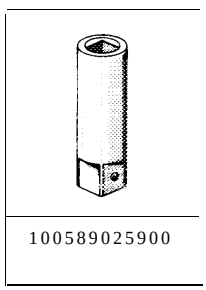
Rear axle center piece installed



40 Double hex. collar nut..	Renew, refer to item 5 and 11, secure by knocking in collar, special tools: Torque measuring instrument 001 589 49 21 00, socket wrench element 27 mm 201 589 00 09 00 and connection 3/4'' 10058902 5900
41 Universal flange	Renew, if score marks of radial sealing ring are showing up, special tool: Holding wrench 116 589 10 07 00, puller 116 589 19 33 00
42 Radial sealing ring	Renew, special tool: Knocking-in punch 201 589 00 15 00
50 Rear axle center piece	Oil type hypoid gear oil SAE 90, correct oil level, filling capacity 0.7 liter
60 Self-locking hex. nut for porpeller shaft	Renew, tightening torque 40-50 Nm

Special tools


001 589 49 21 00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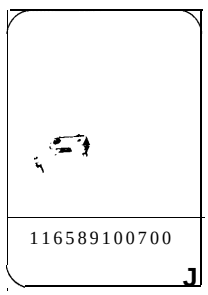
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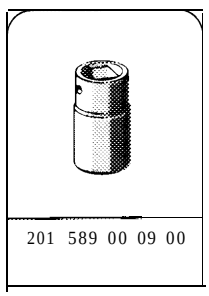
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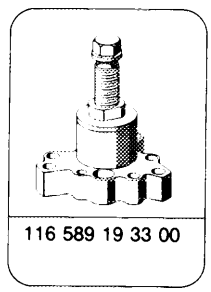
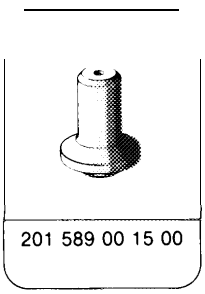
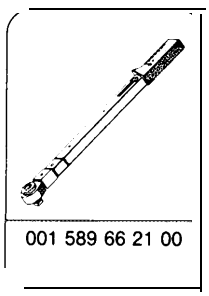

116 589 19 33 00

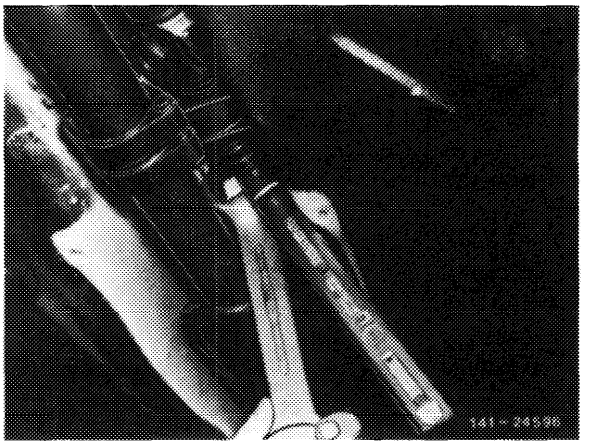

201 589 00 15 00


001 589 66 21 00

Removal

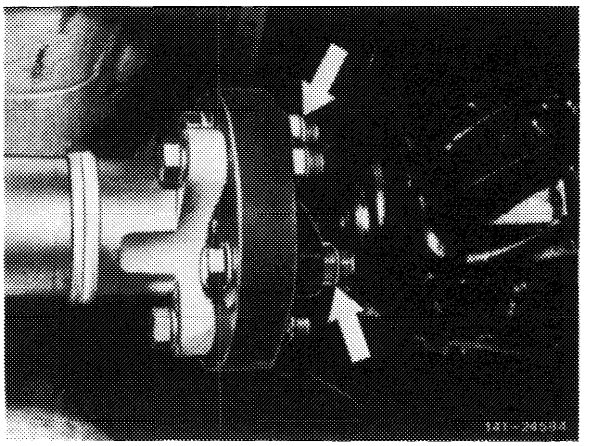
1 Remove exhaust shielding plate.

2 Loosen clamping nut and unscrew propeller shaft intermediate bearing on frame floor.



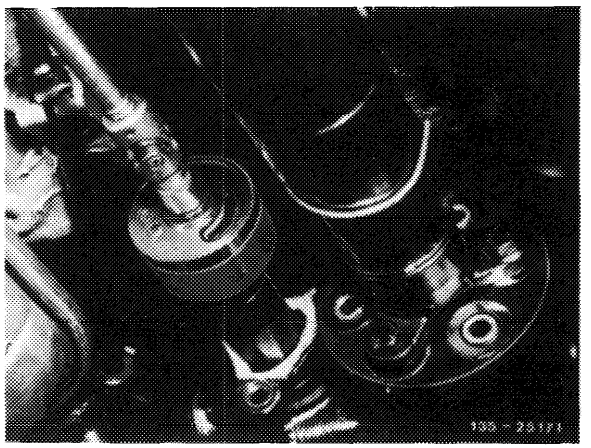
3 Unflange propeller shaft on rear axle and push forward from centering (arrows).

4 Tie propeller shaft with a wire to frame floor.



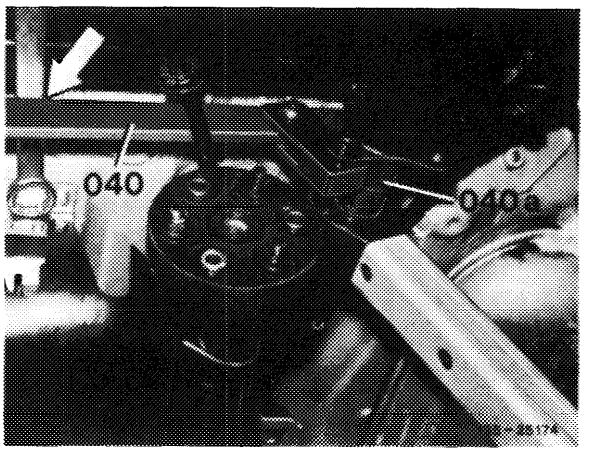
5 Measure friction torque of entire rear axle drive and note.

Attention!
When measuring friction torque, make sure that the rear axle shafts are approximately horizontal, and that neither the brake pads are wiping against brake disks nor the brake shoes of the parking brake against drum.

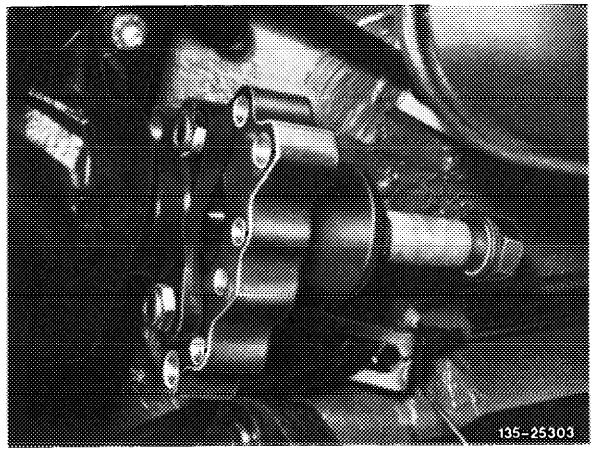


6 Position holding wrench (040) on universal flange and loosen double hex. collar nut with double hex. socket wrench element (040a). Use suitable box-end wrench for supporting holding wrench (arrow).

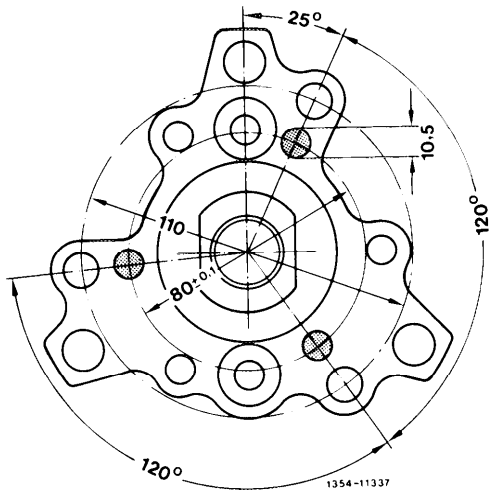
Note: Do not unlock double hex. collar nut with crush lock, but just loosen.



7 Pull universal flange from drive pinion, with puller if required, and remove.

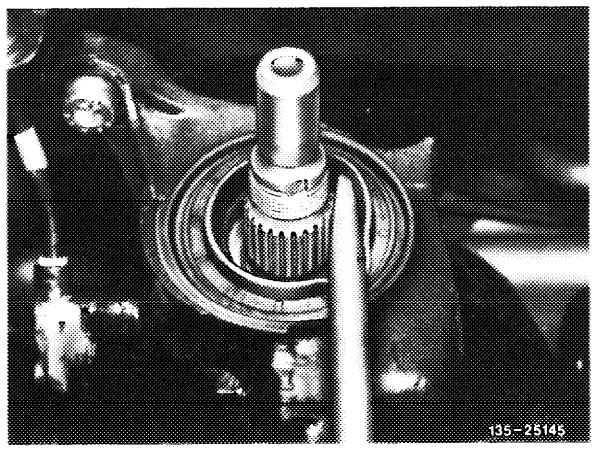


Note: Modify formerly supplied puller 116 589 19 33 00 according to drawing, that ist, drill an additional 3 holes of 10.5 mm in a bolt hole circle dia. of 80 mm (hatched holes).



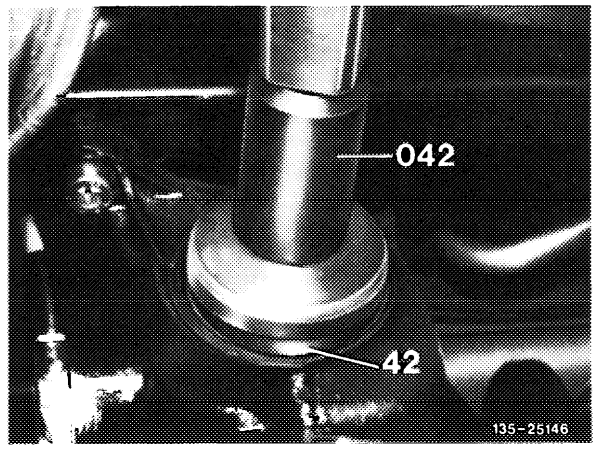
8 Force radial sealing ring out of rear axle housing by means of a screwdriver.

9 Check running surface for radial sealing ring on universal flange. Renew universal flange if running surface is worn out.

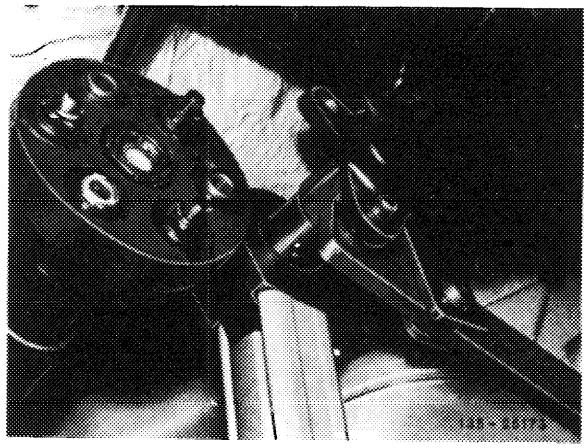


Installation

10 Knock radial sealing ring (42) up to stop into rear axle housing by means of a punch (042).

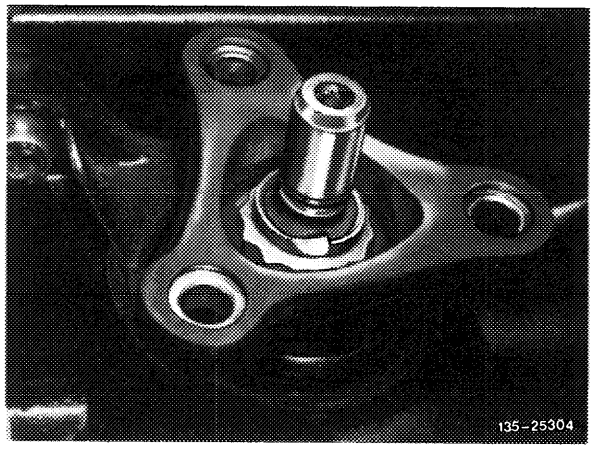


11 Mount universal flange and carefully tighten with a new double hex. collar nut until the measured or noted friction torque is attained. Tightening torque of double hex. collar nut should be at least 180 Nm. If this minimum tightening torque is not attained, renew elastic spacing sleeve.



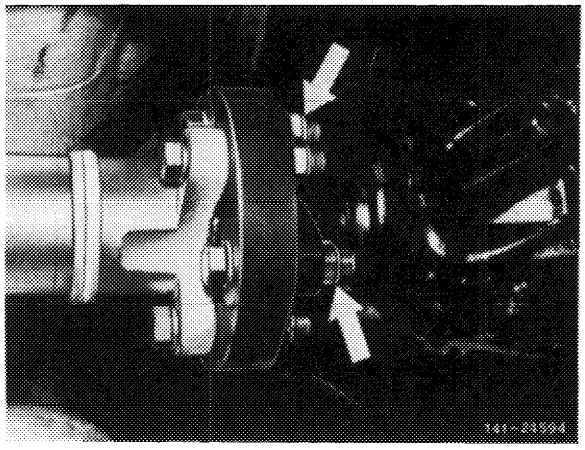
12 Peen double hex. collar nut with a peening tool into one of the two grooves of the drive pinion in such a manner that there is no gap between groove and locking tab.

Attention!
No hard blows in axial direction.



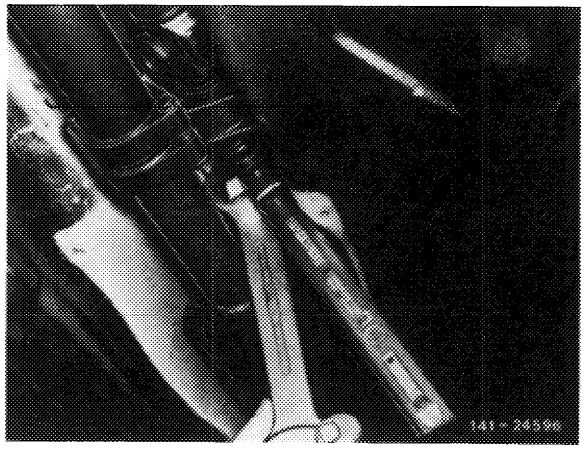
13 Mount propeller shaft to universal flange of drive pinion.

14 Fasten propeller shaft intermediate bearing, but do not yet tighten.



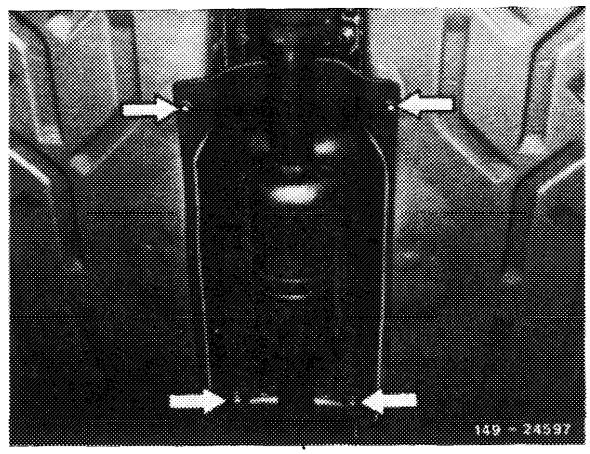
15 Tighten clamping nut on propeller shaft to 30-40 Nm. Special tool: Open end wrench 41 mm, 201 589 00 01 00.

16 Tighten hex. head screw for fastening propeller shaft intermediate bearing to 25 Nm.



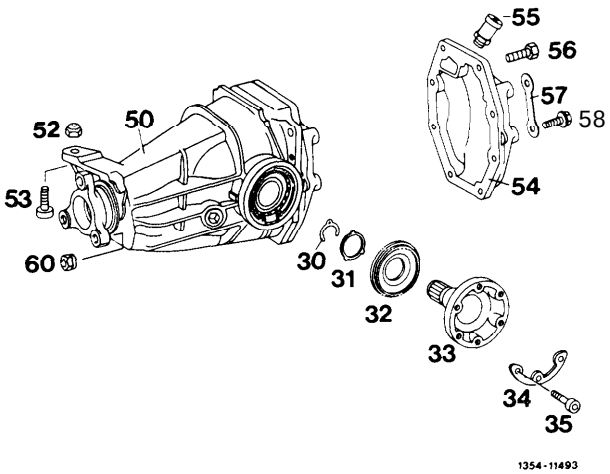
17 **Install exhaust shielding plate.**

18 Fill rear axle housing up to level of filler hole with hypoid gear oil.



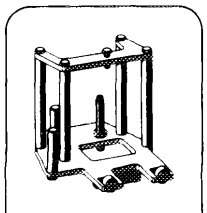
35-540 Renewing radial sealing ring on connecting flange of rear axle shaft

Rear axle center piece removed



30	Locking ring..	Renew, thickness from 1.2 to 1.8 mm — steps: 0.05 to 0.05
31	Compensating washer	
32	Radial sealing ring	Renew, coat OD with rubber sliding compound, special tool: Punch 201 589 03 15 00
33	Connecting flange without ring-shaped weight,	Renew, when heavy score marks of radial sealing are showing up
34	Washer	Renew
35	Locking screw.	Renew, tightening torque 70 Nm, threads and screw head contact surface lubricated
50	Rear axle center piece.	Clean sealing surface, oil type hypoid gear oil SAE 90, filling capacity 0.7 liter, special tool: Clamping device 201 589 03 31 00
52	Self-locking hex. nut, front	Renew
53	Hex. socket screw, front	Tightening torque 45 Nm
54	Rear axle end cover	Sealing surface clean and coat with sealing compound
55	Vent	Renew contaminated vent, tightening torque 25 Nm
56	Hex. screw	Tightening torque 45 Nm
57	Locking plate	Renew
58	Locking screw, rear	Renew tightening torque 50 Nm
60	Self-locking hex. nut, propeller shaft	Renew, tightening torque 40-50 Nm

Special tools



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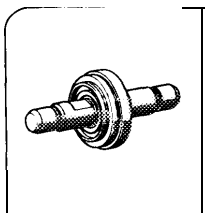

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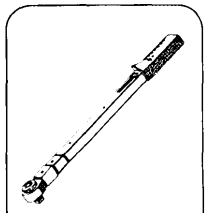

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Conventional tool	
Screw driver element for multi-tooth screws M 10 (XZN)1/2'' square	e.g. Hazet D-5630 Remscheid Order No. 990 lg-10

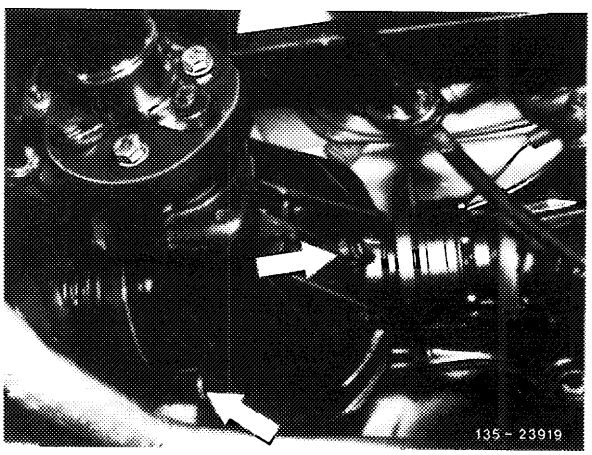
Note

Replacement of a leaking radial sealing ring can be performed only with rear axle center piece removed. Thoroughly clean rear axle center housing in range of bearing cap so that no dirt can enter rear axle housing.

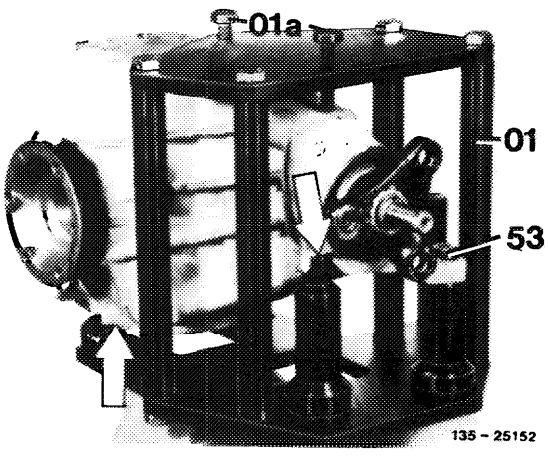
Removal

Drain rear axle oil.

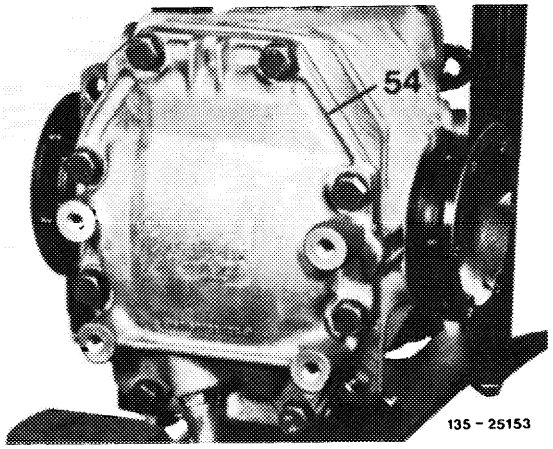
2 Remove rear axle center piece (35-520).



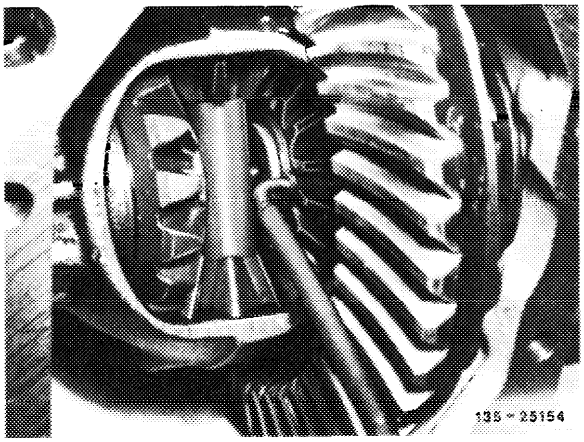
3 Place rear axle center piece into clamping fixture (01) and tighten with hex. socket screw (53) and hex. head screws (01 a). Pay attention to good seat of center piece in clamping fixture (arrows).



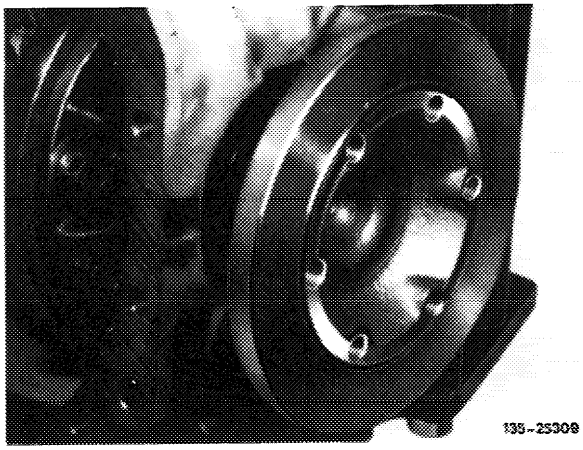
4 Unscrew rear axle end cover (54) and remove.



5 Pull locking ring from connecting flange with pliers or suitable hook and take from housing.

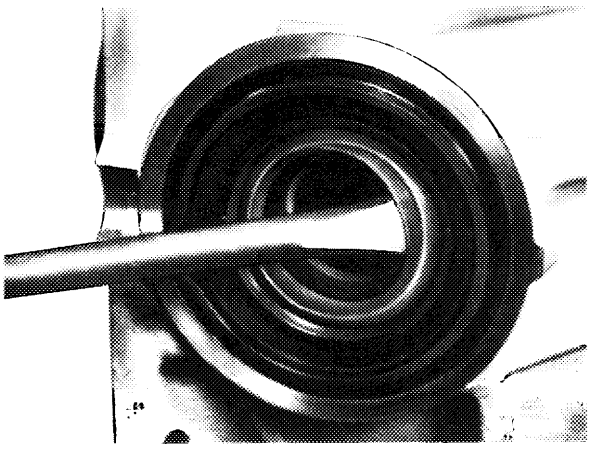


6 Pull connecting flange from rear axle side gear and remove.



Connecting flange with annular weight

7 Force radial sealing ring out of housing by means of a screwdriver.

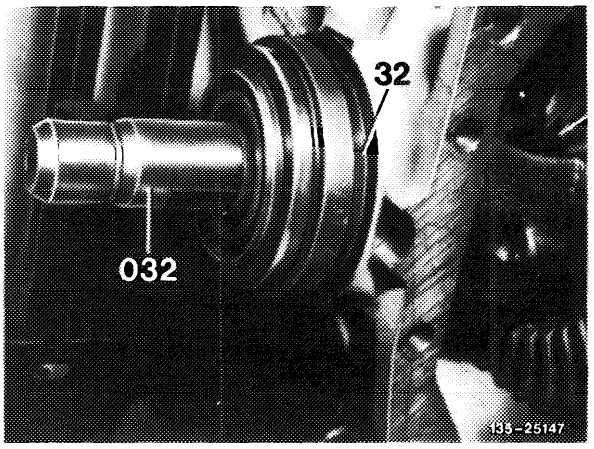


8 Check running surface for radial sealing ring on connecting flange and renew connecting flange, if required, if running surface is badly worn out.

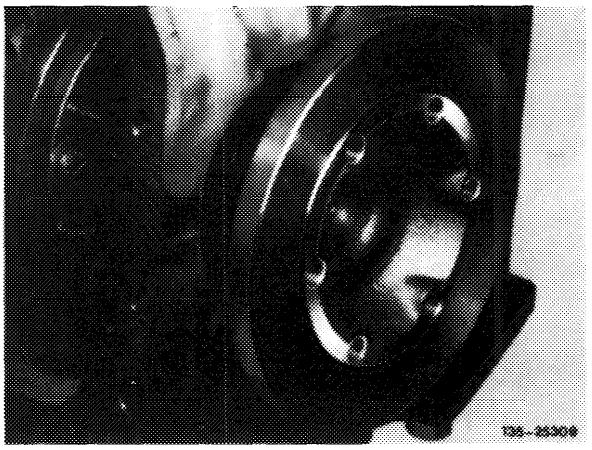
Installation

9 Knock in radial sealing ring (32) with mandrel (032) until mandrel rests against rear axle housing.

Note: Coat radial sealing ring with rubber-coated sheet metal jacket on OD with rubber sliding compound „Naphtolen or hypoid gear oil".



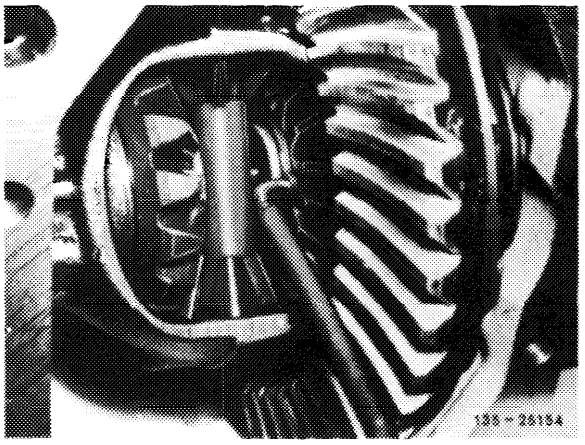
10 Install connecting flange. For this purpose, use a new locking ring of similar thickness between connecting flange and rear axle side gear.



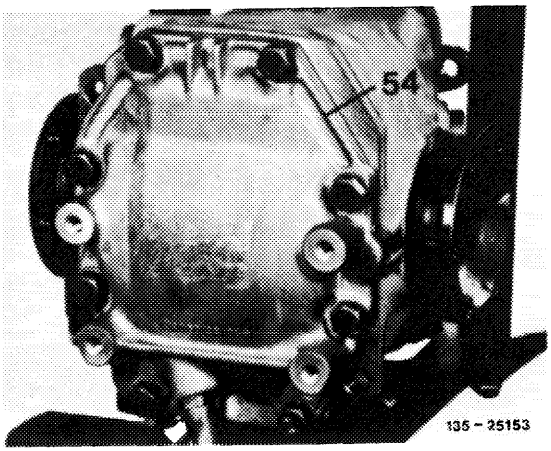
Connecting flange with annular weight

11 Check end play between connecting flange and rear axle side gear.

There should be no noticeable end play; rotation of locking ring in groove should be just barely possible. If required, mount a thicker or a thimmer locking ring.



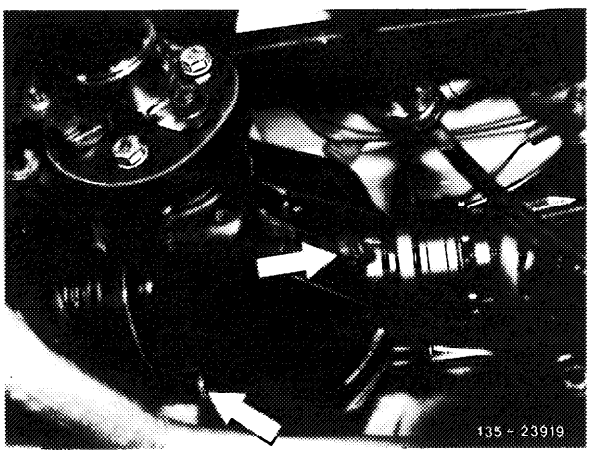
12 Clean sealing surface on rear axle end cover and on rear axle housing and coat with sealing compound. Mount rear axle end cover (54) end tighten hex. head screws to 45 Nm.

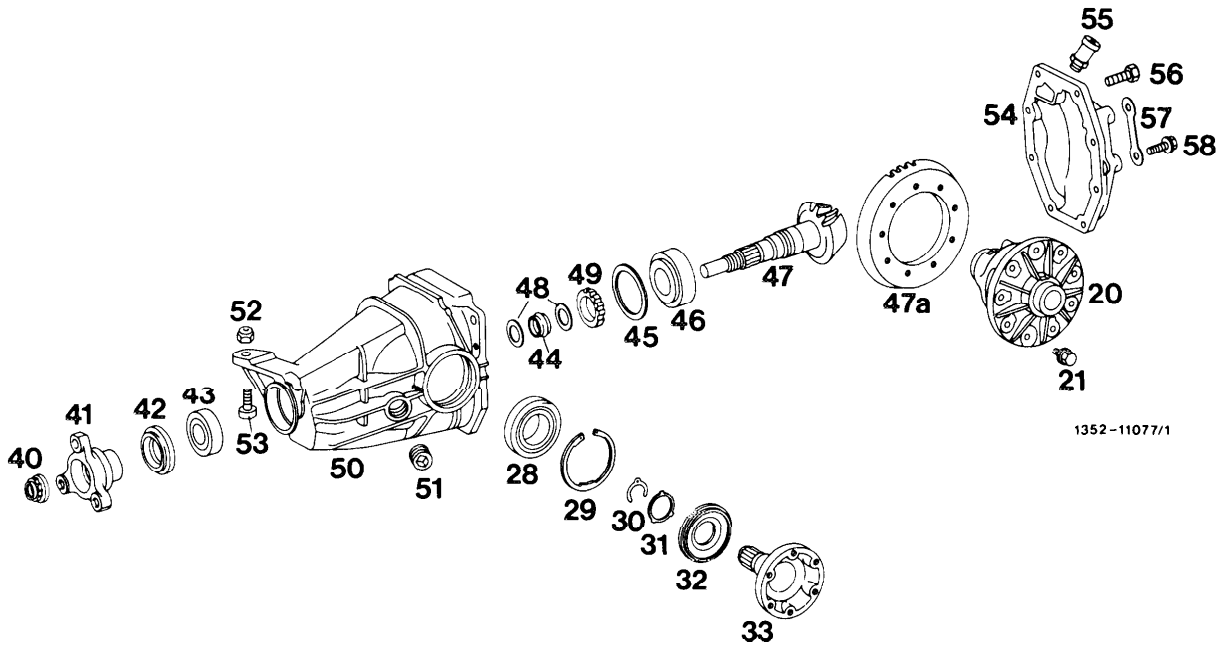


13 Remove rear axle center piece from clamping fixture.

14 Install rear axle center piece(35–520).

15 Fill-in hypoid gear oil up to bottom edge of oil filler hole.





20	Differential cage	Check for damage
21	Hex. screw, self locking	Renew, tightening torque 105 Nm, length 18 mm
28	Tapered roller bearing (differential)	Check for damage and wear
29	Locking ring	Pay attention to perfect seat, thickness from 3.3 to 4.1 mm steps 0.05 to 0.05 mm
30	Locking ring	Renew, pay attention to perfect seat, determine thickness in such a manner that no end play shows up on connecting flange, thickness from 1.20 to 1.80 mm, steps 0.05 to 0.05 mm
31	Compensating washer	Thickness 1.5 mm
32	Radial sealing ring	Renew
33	Connecting flange without ring-shaped weight	Renew, if heavy score marks of radial sealing ring are showing up
40	Double hex. collar nut	Renew, secure by knocking in collar
41	Universal flange	Check, renew, if radial runout exceeds 0.06 mm after several displacements
42	Radial sealing ring	Renew
43	Small tapered roller bearing (drive pinion)	Check for damage and wear
44	Spacing sleeve	Renew
45	Compensating washer	Thickness from 1 ,10 to 1.7 mm, Steps 0.05 to 0.05, grind to a required thickness, if required
46	Large tapered roller bearing (drive pinion)	Check for damage and wear
47	Drive pinion	Pay attention to mating number, check for damage and wear. Refer to Note: At item 39
47a	Ring gear	Check for damage and wear, heat to 60–70 °C and mount
48	Thrust washer	Renew
49	ABS gear wheel (rotor)	Check for damage and pay attention to number of teeth

50	Rear axle housing	Check for damage, clean sealing surface. Oil type: Hypoid gear oil SAE 90, filling capacity 0.7 liter Specs, for Service Products sheet no. 235
51	Closing plug	Tightening torque 50 Nm
54	End cover	Check for damage, clean parting surface and coat with sealing compound
55	Vent	Renew, tightening torque 25 Nm
56	Hex.screw	Tightening torque 45 Nm
57	Locking plate	Renew
58	Locking screw	Renew, tightening torque 50 Nm

Installation survey – rear axle ratio

Model	Vehicle version	Ratio	Number of teeth
201.022 201.024 201.122	Standard	3.23	42:13
201.122 (USA)		3.42	41:12

Gear wheel (rotor) for rpm sensor on vehicles with ABS

Part number	Ratio	Number of teeth
1243530585	3.23	30
1243530285	3.42	28

Adjusting data of wheel set

Backlash of wheel set		0.08-O. 14 mm
Adjustment of tapered roller bearings for differential: The tapered roller bearings are provided with the required pre-load by widening (spreading dimension) rear axle housing by		0.10-0.15 mm
Permissible tolerance of adjusting dimension "A" of drive pinion		+ 0.01 -0.02
Adjustment of tapered roller bearing for drive pinion by measuring friction torque when rotating drive pinion with friction torque wrench [1]	new tapered roller bearings	120– 140 Ncm
	used tapered roller bearings	50-100 Ncm

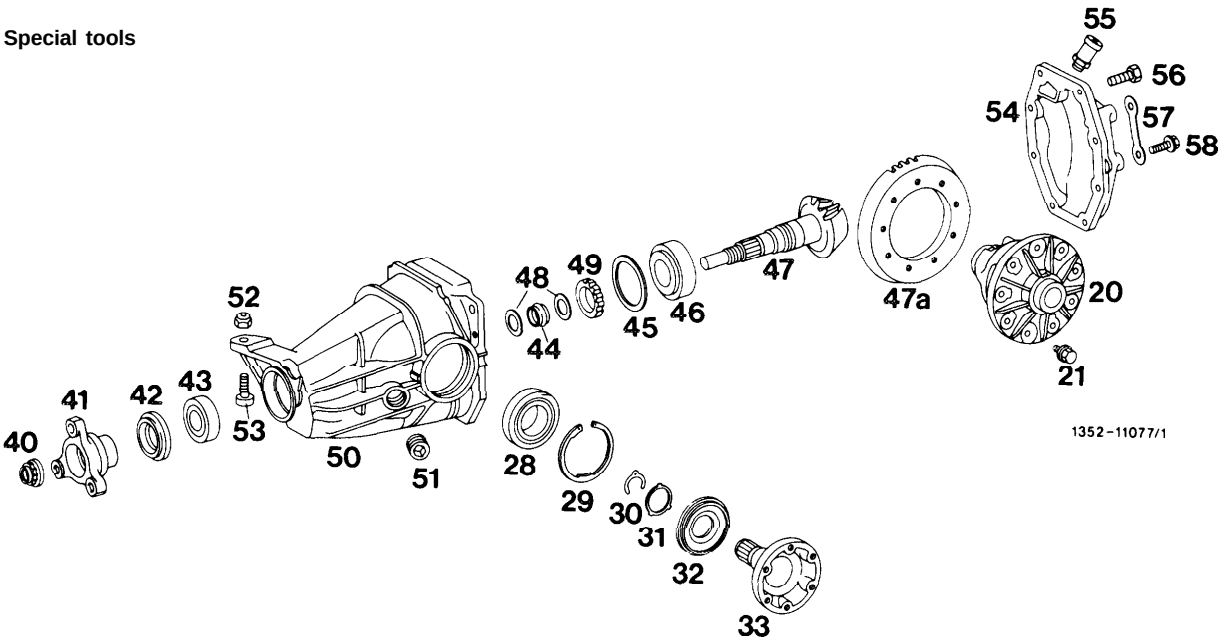
[1] For corrected adjustment of tapered roller bearings tighten double hex. (twelve-point) collar nut on flexible coupling in such a manner that the specified friction torque when rotating drive pinion is attained. To check friction torque while rotating drive pinion, make sure that the differential with ring gear is not installed.

Flexible coupling on drive pinion

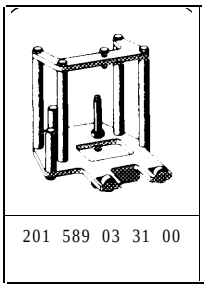
Diameter of running surface for radial sealing ring on flexible coupling	new	37.00-o. 16
	minimum dia. in the event of repairs[1]	36.6
Running surface of flexible coupling		no thread
Permissible radial runout of sealing surface of flexible coupling		0.06

[1] Machine running surface for sealing in an emergency only.

Special tools



20	Differential cage	Assembly mandrel 201 589 01 15 00
28	Tapered roller bearing (differential)	Puller 001 589 36 33 00, collet 201 589 01 23 00, thrust piece 000 589 03 34 00, mandrel 201 589 03 15 00
29	Locking ring	Pliers 126 589 00 37 00, mandrel 201 589 03 15 00
32	Radial sealing ring	Mandrel 201 589 03 15 00
40	Double hex. collar nut	Socket element 27 mm 201 589 00 09 00
41	Flexible coupling	Holding wrench 116 589 10 07 00, puller 1 1 6 5 8 9 1 9 3 3 0 0
42	Radial sealing ring	Knocking-in punch 201 589 00 15 00
43	Small tapered roller bearing (drive pinion)	Remover 201 589 02 43 00, installer 201 589 00 43 00
46	Large tapered roller bearing (drive pinion)	Remover 201 589 02 43 00, installer 201 589 00 43 00, puller 001 589 36 33 00, extension 000 589 35 34 00, collet 201 589 02 34 00
47	Drive pinion	Remover and installer 201 589 02 43 00, measuring device 201 589 05 2 1 00,201 589 04 21 00, measuring plate 601 589 00 23 00, dial gauge holder 363 589 02 21 00, dial gauge 000 589 38 19 00, torque measuring instrument 001 589 49 21 00
47a	Ring gear	Backlash measuring instrument 201 589 03 21 00
49	ABS gear wheel (rotor)	Puller 000 589 88 33 00
50	Rear axle housing	Clamping fixture 201 589 03 31 00, spreader 201 589 01 31 00, measuring bracket 126 589 08 21 00, stop 201 589 01 63 00



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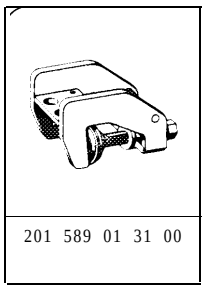

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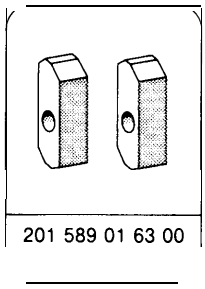

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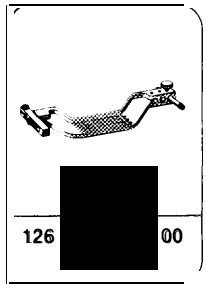

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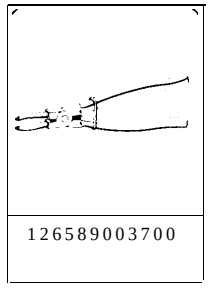

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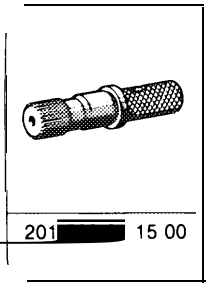

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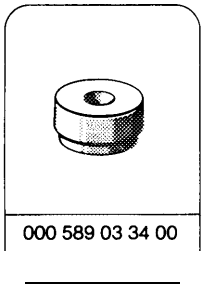

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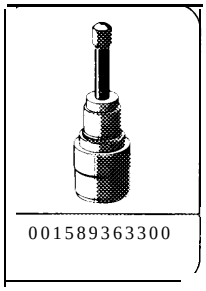

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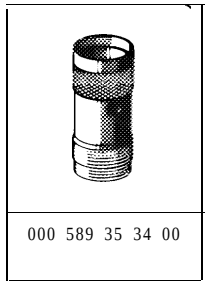

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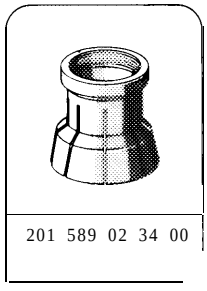

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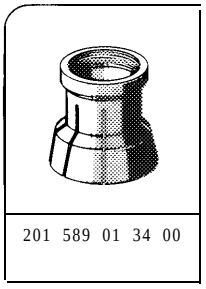

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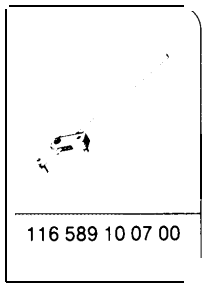

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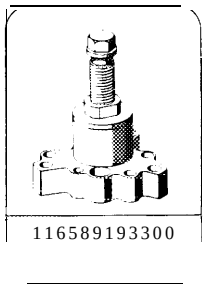

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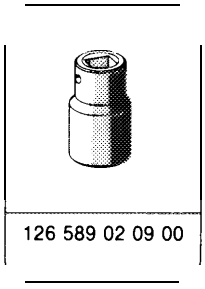

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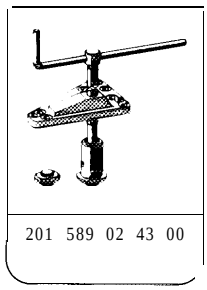

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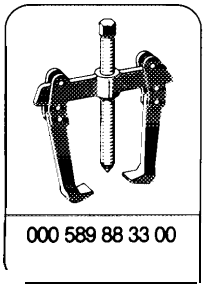

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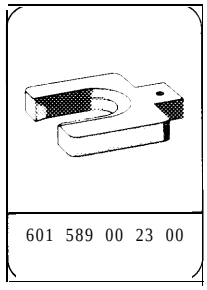

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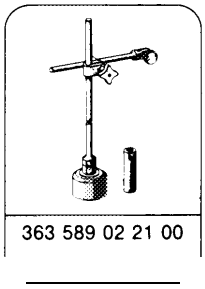

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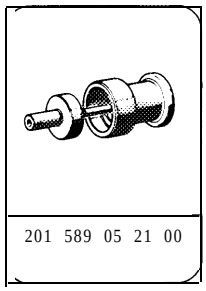

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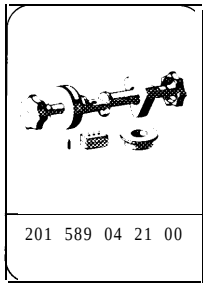

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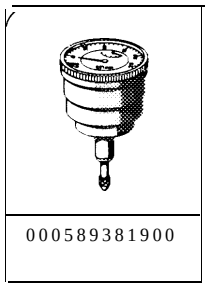

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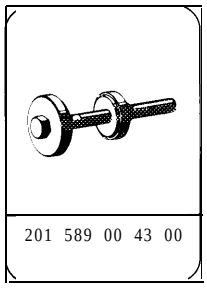

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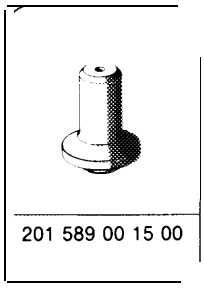

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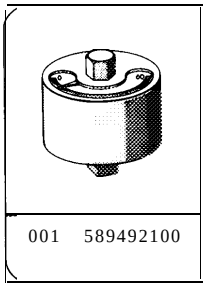

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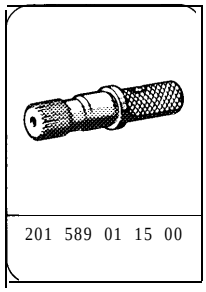

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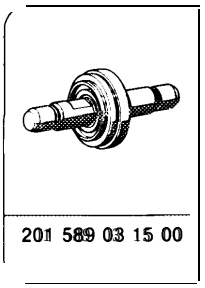

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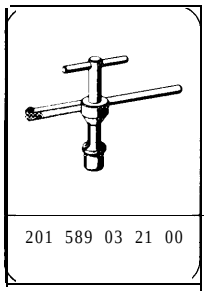

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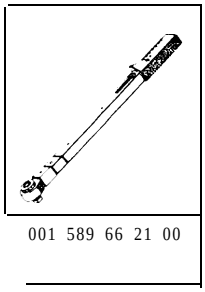


001 589 66 21 00

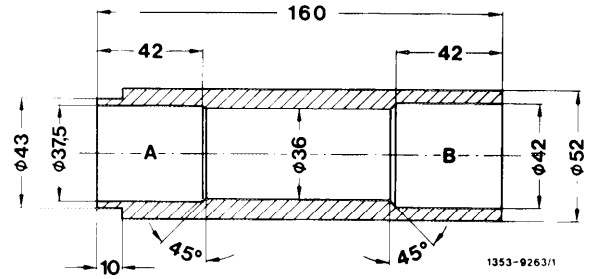
Conventional tools

Two-arm puller	e.g. Nexus, D-5630 Remscheid Order no. 100 Gr. 2

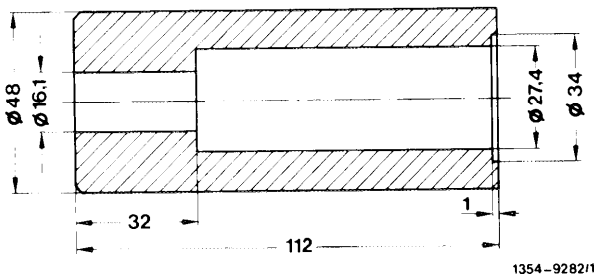
Self-made tools

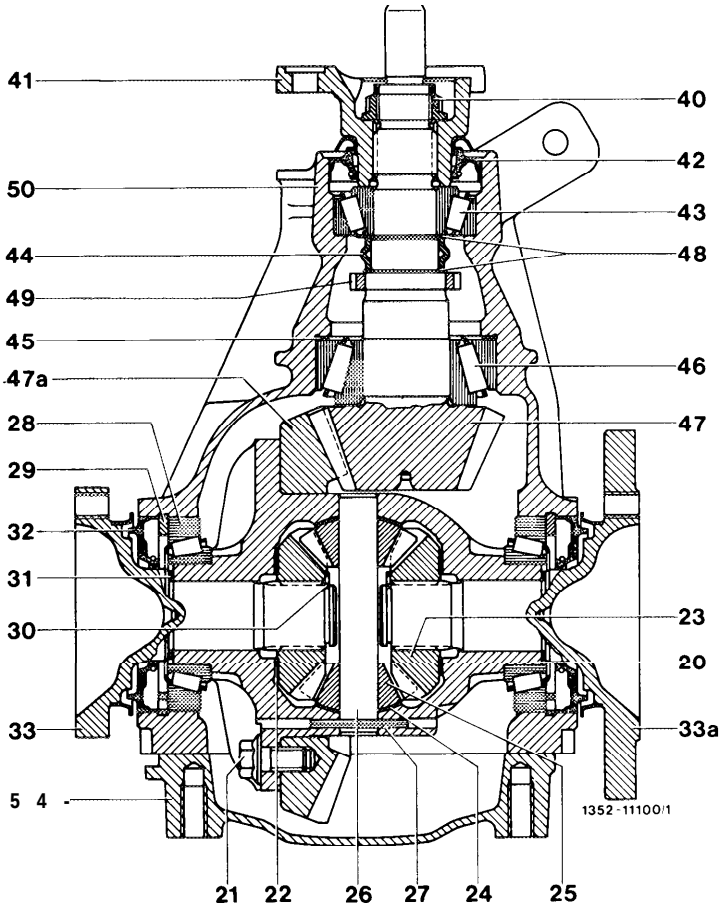
Pressinpon sleeve for tapered roller bearing on drive pinion.

A = Small drive pinion
B = Large drive pinion



Pressingon sleeve for gear wheel on drive pinion on vehicles with ABS



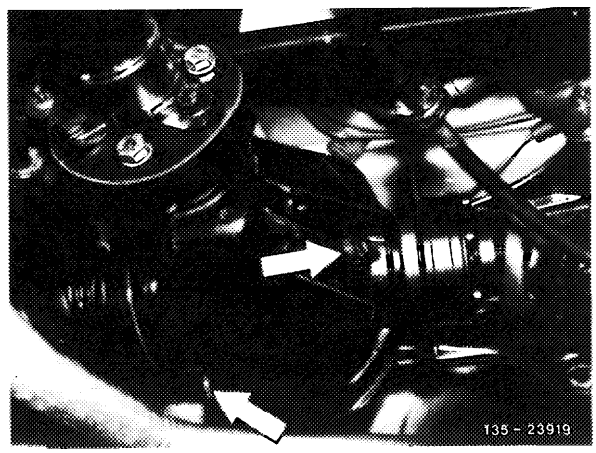


20 Differential cage
21 Hex. head screw, self-locking
22 Thrust washer
23 Differential side gear
24 Spherical washer
25 Differential pinion
26 Differential pinion shaft
27 Clamping sleeve
28 Tapered roller bearing
29 Locking ring for bearing outer race
30 Locking ring for connecting flange
31 Compensating washer
32 Radial sealing ring
33 Connecting flange without rinpshaped weight
33a Connecting flange with ring-shaped weight
40 Double hex. collar nut
41 Flexible coupling
42 Radial sealing ring
43 Tapered roller bearing, small
44 Spacing sleeve
45 Compensating washer
46 Tapered roller bearing, large
47 Drive pinion
47a Ring gear
48 Thrust washer
49 Gear wheel for ABS
50 Rear axle housing
54 End cover

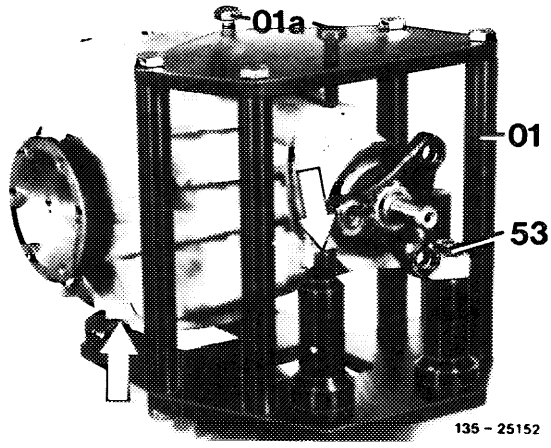
Removal

1 **Drain rear axle oil.**

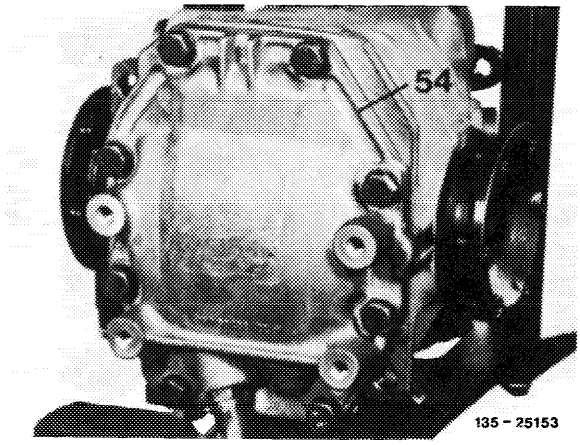
2 **Remove rear axle center piece (35-520).**



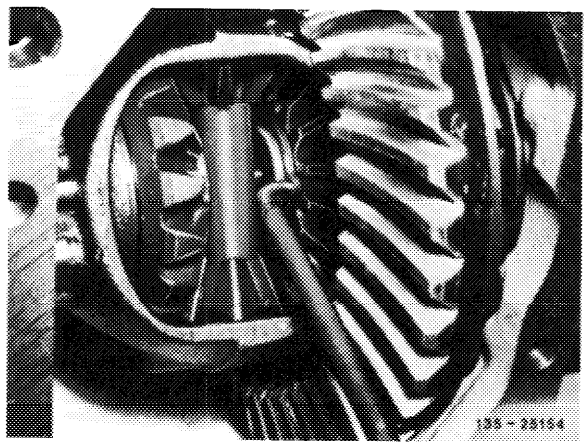
3 Insert rear axle center piece into clamping fixture (01) and tighten with hex. socket screw (53) and hex. head screws (01a). Pay attention to good seat of center piece in clamping fixture (arrows).



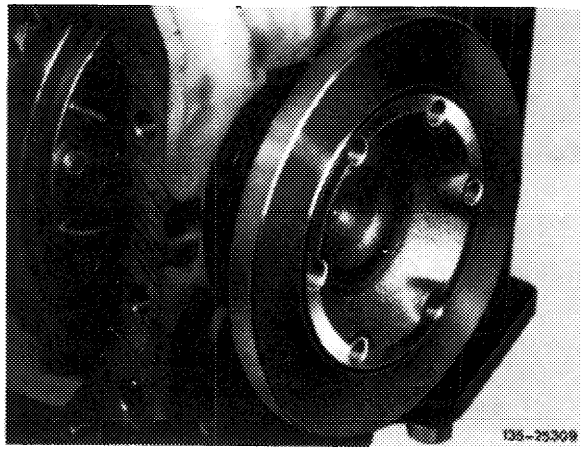
4 Unscrew rear axle end cover (54) and remove.



5 Pull locking ring from connecting flange with pliers or suitable hook and remove from housing.

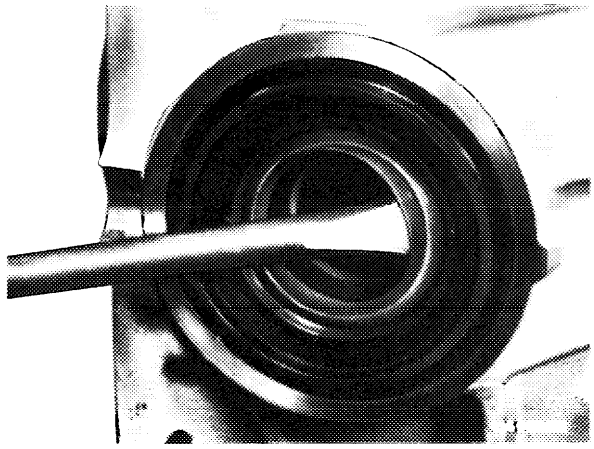


6 Pull connecting flange out of differential side wheel and remove.

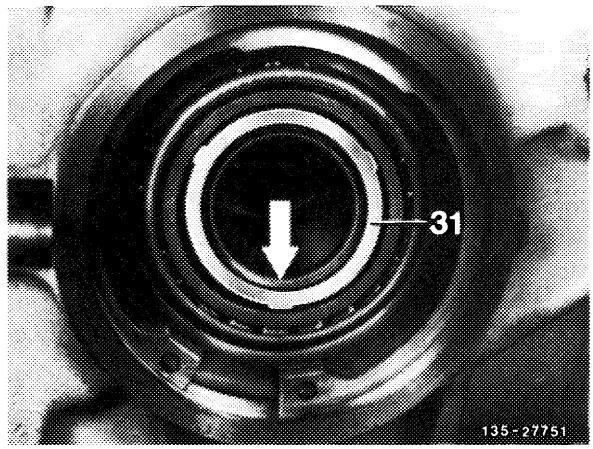


Connecting flange with ring-shaped weight

7 Force both radial sealing rings out of rear axle housing by means of a screw driver.

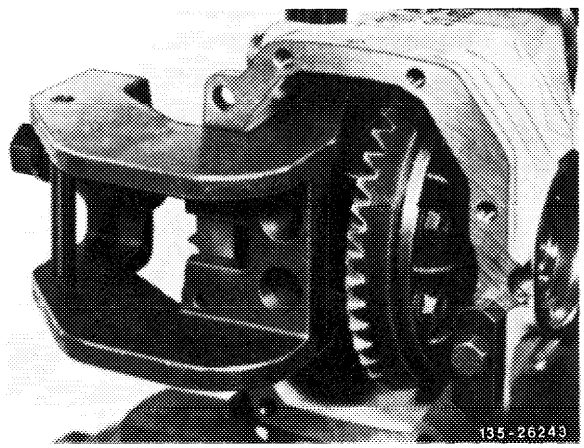


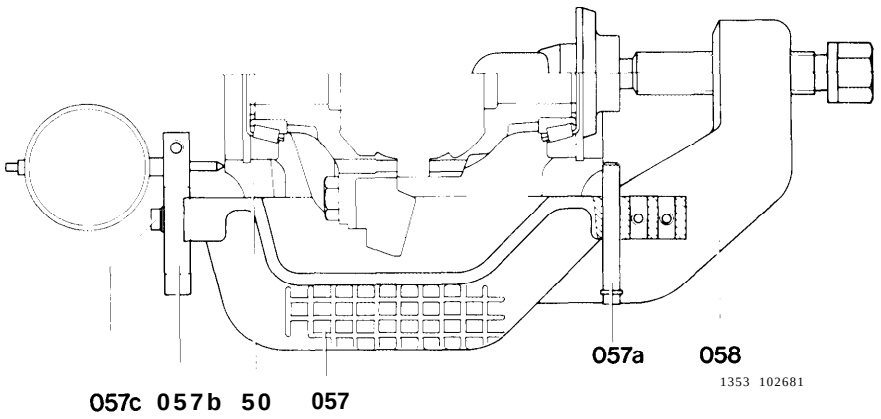
8 Remove compensating washer (31) on face of differential cage.



9 Fasten spreader to rear axle housing and manually move screw spindle up to contact surface on bearing outer race.

10 Fasten stop for supporting measuring bracket on rear axle housing.



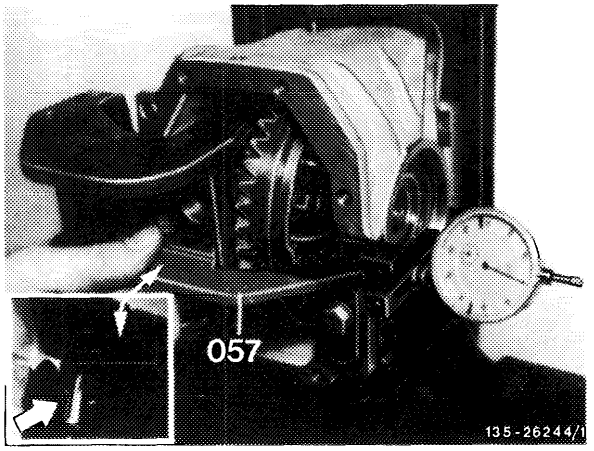


11 **Insert stop bolt (057a) into inside bore of measuring bracket (057) and clamp down with knurled screw.**

12 **Adjust dial gauge holder (057b) lengthwise in such a manner (front notch), that the dial gauge tip rests against rear axle housing (50). Clamp down dial gauge holder (057b) with hex, socket screw(057c).**

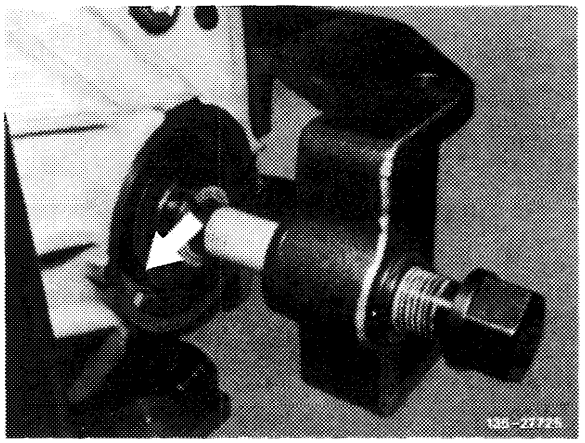
13 **Place spread measuring instrument on installation and set dial gauge to 0 at 3 mm preload.**

Attention!
Make sure that the stop bolt of the measuring instrument rests against contact surface on rear axle housing (refer to cutout, arrow).



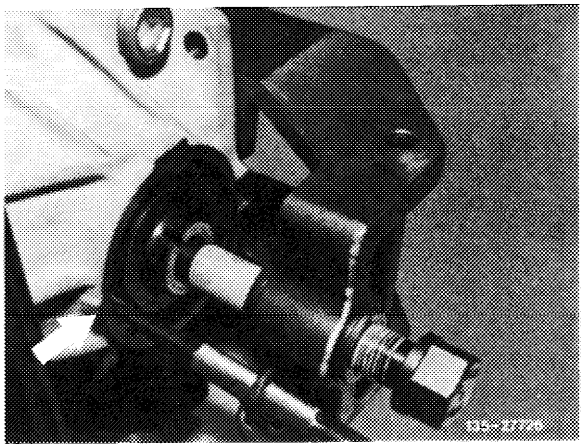
14 **Turn one surface of thrust piece toward opening of locking ring (arrow) and preload (spread) rear axle housing by screwing threaded spindle of spreader to 0.20 mm.**

Attention!
When spreading, do not exceed 0.20 mm.



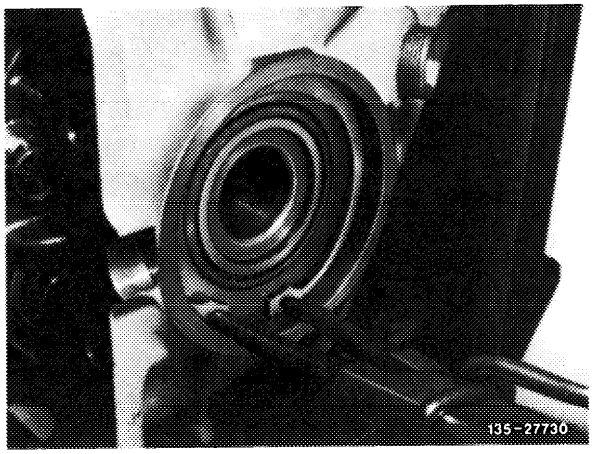
15 Remove spreader.

16 Take lefthand locking ring out of rear axle housing by means of pliers and mark.



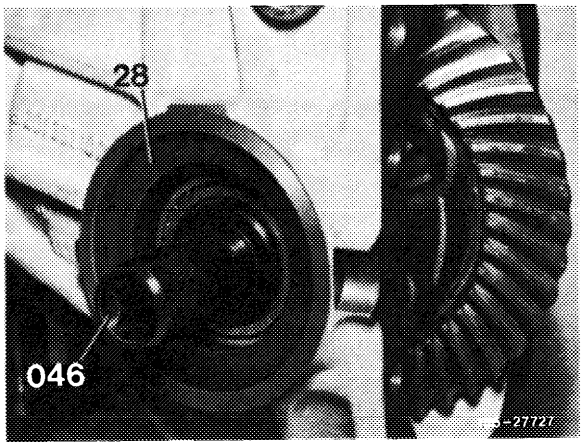
17 Unclamp rear axle housing and remove spreaders.

18 Remove righthand locking ring with pliers out of rear axle housing.

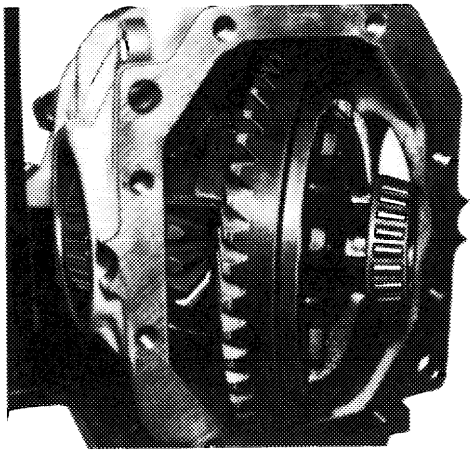


19 Remove both bearing outer races of tapered roller bearings (28) from rear axle housing and mark, to eliminate mistakes during reinstallation.

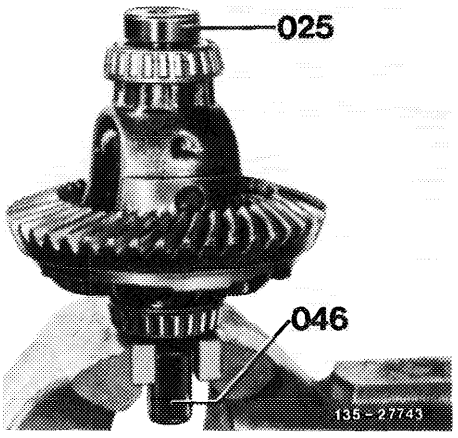
Note: For easier removal of bearing outer races, insert assembly mandrel for differential pinions (046) at the right and force complete differential to the left until it rests against rear axle housing. Remove lefthand and righthand bearing outer race.



20 Move differential into position shown and take out of rear axle housing,



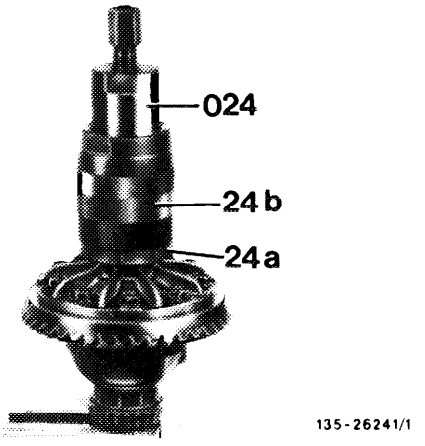
21 Place differential cage on assembly mandrel (046) and mount thrust piece (025).



22 Assemble pulling device (basic unit 024) with collet (24a).

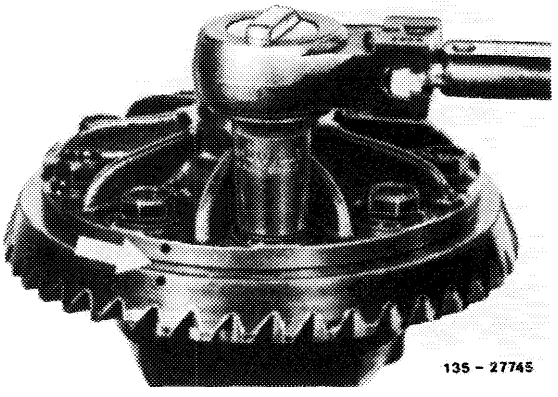
23 Slip pulling device with collet (24a) over tapered roller bearing and clamp collet behind rollers of tapered roller bearings by means of clamping sleeve (24b).

24 Pull both tapered roller bearings from differential cage and mark to eliminate mistakes during reinstallation.



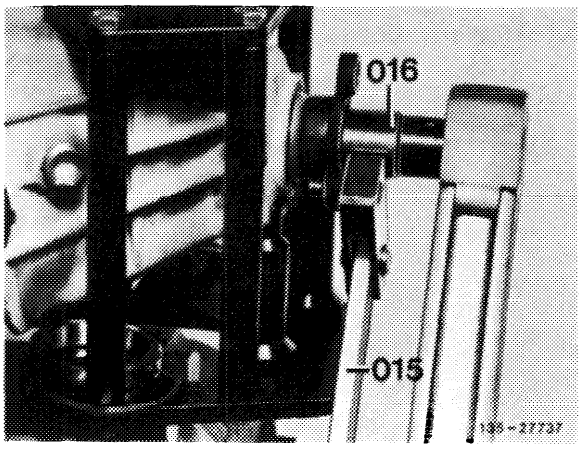
25 Unscrew ring gear from differential cage and carefully force off in direction of cage.

Note: If the wheel set is used again, mark position of ring gear in relation to differential cage (arrow).



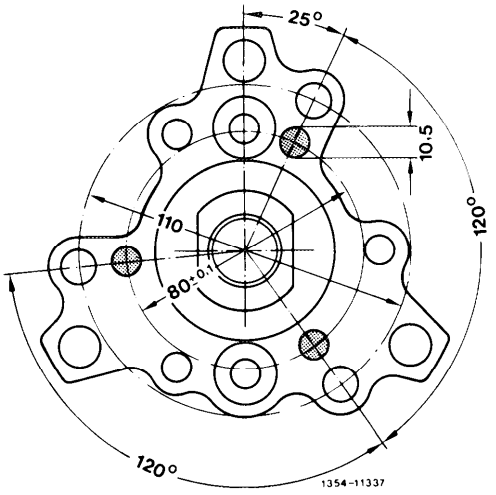
Removing and checking of drive pinion

26 Place holding wrench (015) on flexible coupling and loosen double hex. collar nut by means of double hex. socket wrench element (016).

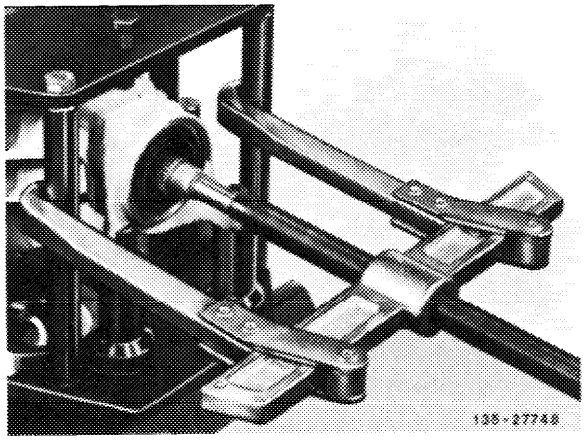


27 If required, pull flexible coupling from drive pinion by means of puller and remove.

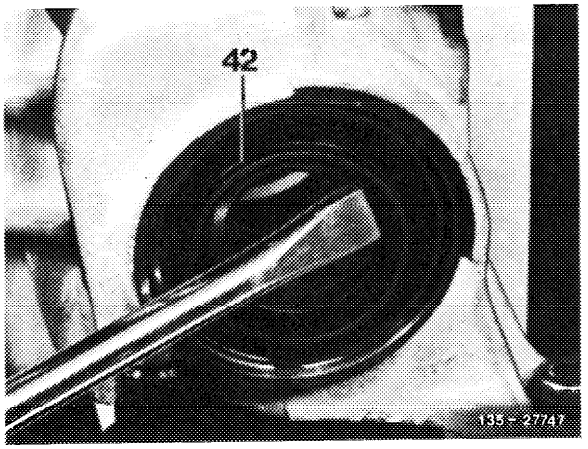
Note: Change puller 116 589 19 33 00 delivered up to now according to drawing, that is, drill 3 additional holes of 10.5 mm dia. in a hole circle dia. of 80 mm (hatched holes).



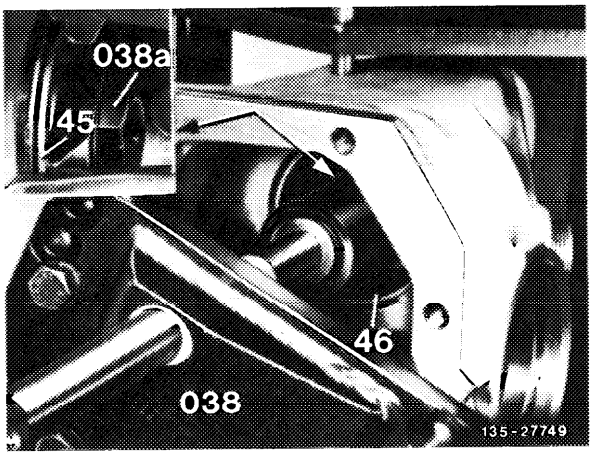
28 Force drive pinion out of rear axle housing by means of a conventional puller.



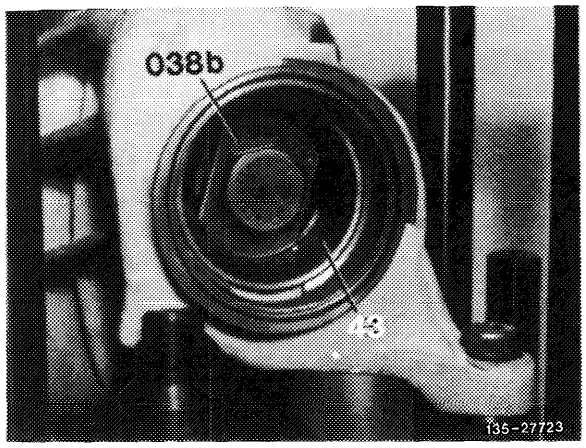
29 Force radial sealing ring (42) out of rear axle housing by means of a screw driver and remove tapered roller bearing inner race.



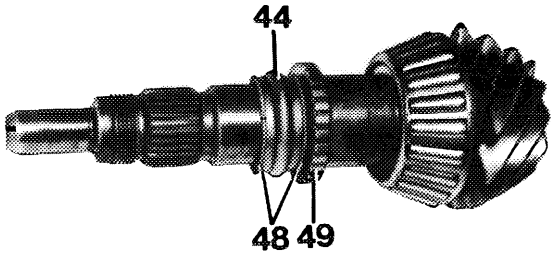
30 Screw installer and remover (038) to rear axle housing. Pull inner tapered roller bearing outer race (46) out of housing by means of pulling member (038a) and remove together with compensating washer (45).



31 Force outer tapered roller bearing outer race (43) out of the rear axle housing by means of pushing member (038b) and remove.



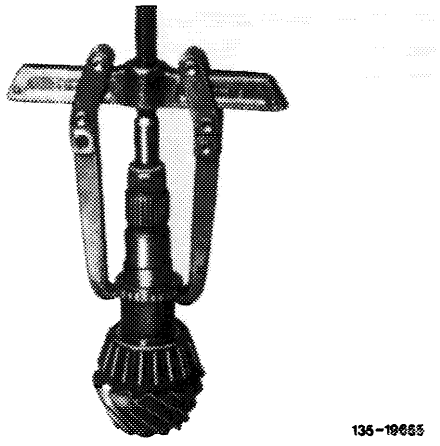
32 Remove spacing sleeve (44) together with thrust washers (48) from drive pinion.



44 Spacing sleeve
48 Thrust washer
49 Gear wheel (on vehicles with ABS only)

135-19634

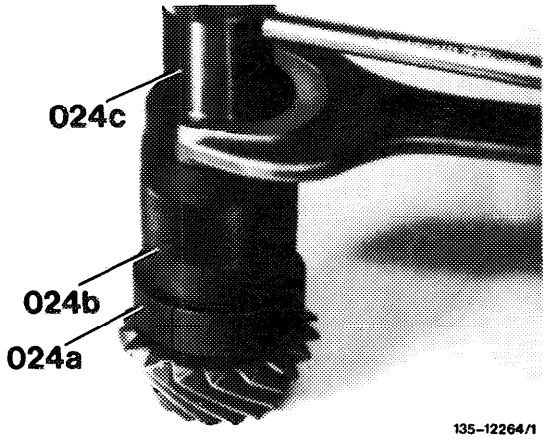
33 On vehicles with ABS, pull gear wheel (rotor) from drive pinion.



135-19635

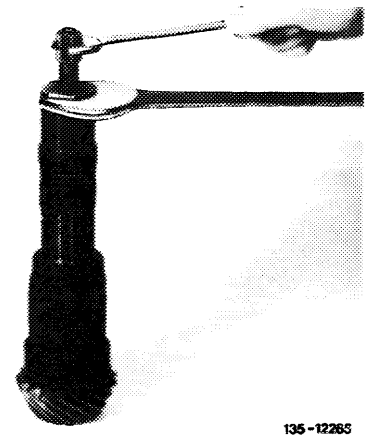
34 Assemble puller (basic unit) with extension (024c) and collet (024a).

35 Slip puller with collet (024a) over tapered roller bearing and clamp collet behind rollers of tapered roller bearing by means of clamping sleeve (024b).



135-12264/1

36 Pull tapered roller bearing inner race from drive pinion by means of puller,



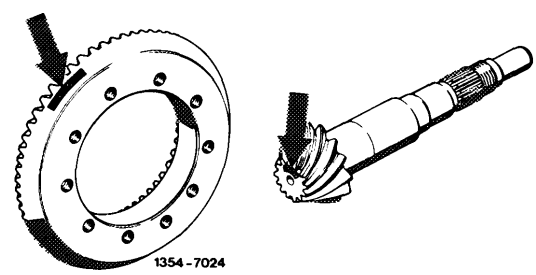
Checking

37 Check all parts for reuse. Check bearing seats on drive pinion for radial and axial runout.

38 Check running surface for radial sealing ring on flexible coupling. With score marks on running surface, renew flexible coupling.

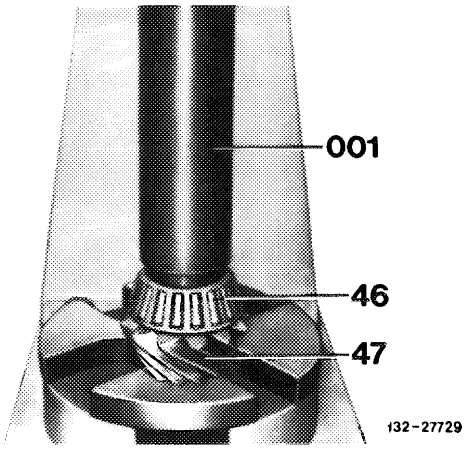
39 Place flexible coupling on drive pinion and check radial runout of flexible coupling on running surface of radial sealing ring. If, in spite of several displacements of flexible coupling, the radial runout on splining is higher than 0.06 mm, renew flexible coupling.

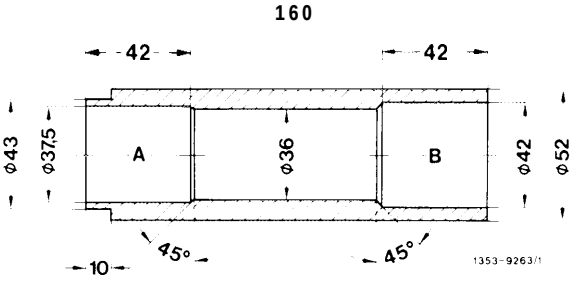
Note: Each drive pinion and ring gear belonging to a wheel set is identified by a consecutive number written on both parts, In addition, the wheel distance for the respective wheel set in relation to each other is named on drive pinion.



To calculate the thickness of the compensating washer required for adjustment of drive pinion, use a data sheet each time. A sample data sheet is shown at end of this job number. The measuring and calculating procedure of the example named there is described in detail in the following items.

40 Press rear tapered roller bearing (46) with self-made pressing-on sleeve (001) on drive pinion (47). For this purpose, use side of sleeve identified with an "A".

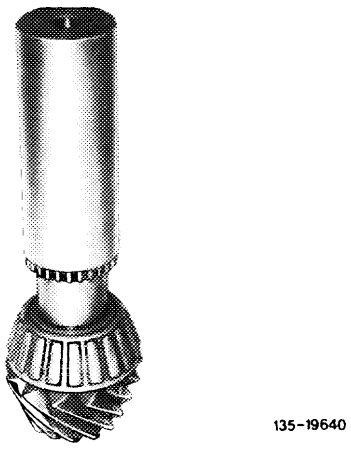




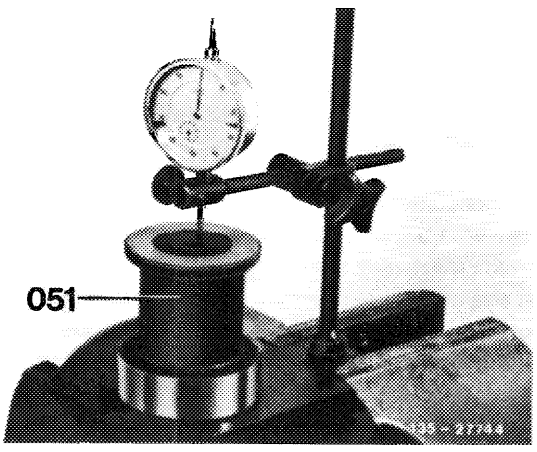
Pressing-on sleeve (self-made)

A = for vehicles with small and medium center piece
B = for vehicles with large center piece

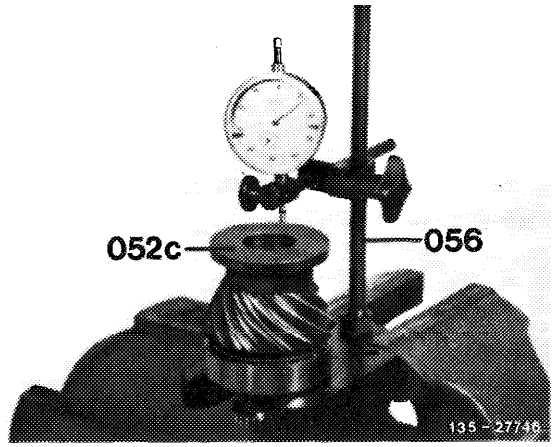
41 On vehicles with ABS gear wheel (rotor) press on by means of self-made pressing-on sleeve.



42 Adjust dial gauge at approx. 5 mm preload to 0 on measuring body (051) first.



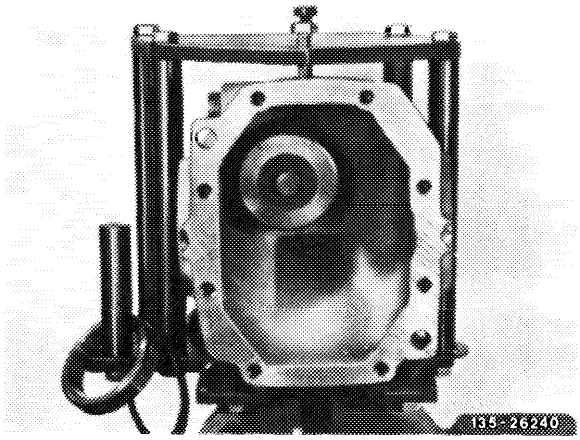
43 Place outer bearing race on roller cage of drive pinion. Insert drive pinion into measuring device (056) and measure height of drive pinion with bearing and magnetic plate (052c). Read dimension, which shows the difference between height of measuring body "B1" and height of drive pinion "B" and enter into data sheet item 1.



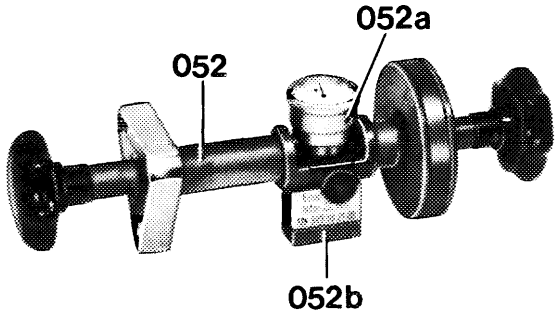
44 Enter basic deviation "a" of drive pinion (+ or —) under item 2 in data sheet.

45 Add data of item 1 and 2 depending on prefix of value on drive pinion (+) or deduct (-).

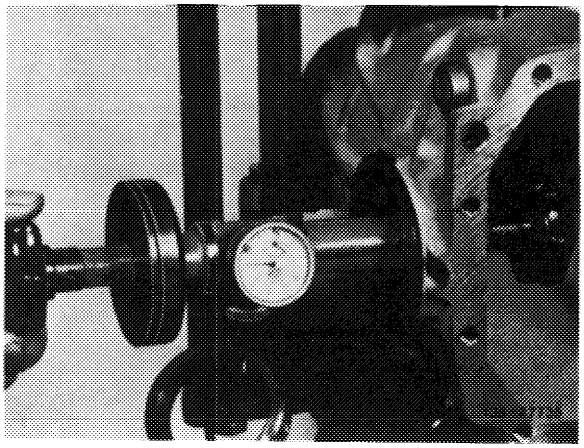
46 Insert measuring boby of measuring device into rear axle housing and screw on measuring body.



47 Inset-t dial gauge (052a) into measuring device (052). Push adjusting member (052b) against measuring device and adjust dial gauge to 0 at 2 mm preload. Tighten clamping screw while checking O-position of dial gauge and realign, if required.



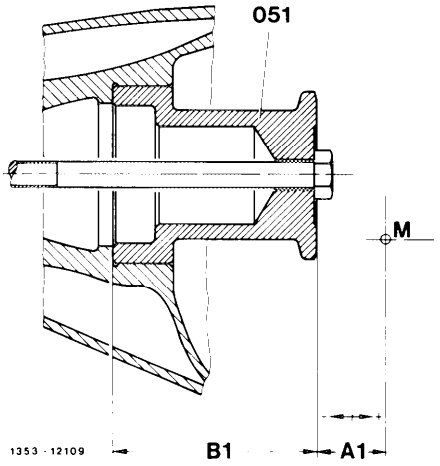
48 Insert measuring device from direction of right-hand bore into rear axle housing.



Attention!

When inserting measuring device into rear axle housing, make sure that the measuring pin of the dial gauge is not damaged on bore.

49 Read difference (Al) between preset gauge dimension and face of measuring body and enter into data sheet under item 3 in plus or minus direction.



Note: Naming the direction plus (+) or minus (-) is done with reference to turning direction of the dial gauge needle. A deviation from zero position in counterclockwise direction therefore means minus direction, in clockwise direction it means plus direction.

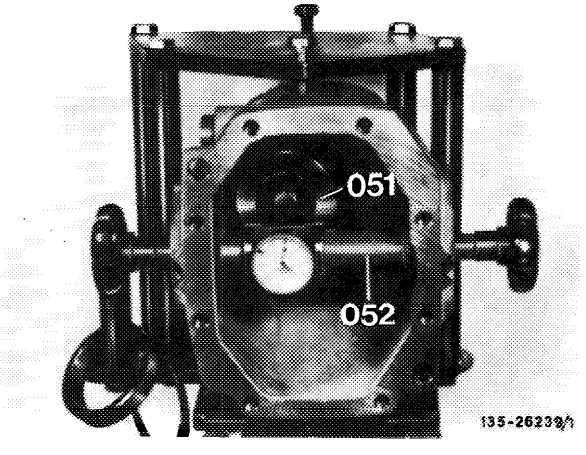
50 Add (+) or deduct (-) subtotal of values from item 1 and item 2, as well as value from item 3. This calculated value indicates the thickness of the compensating washer.

Example:

Item 1		= 0.88
Item 2		= +0.37
		= —
Subtotal		= 1.25
Item 3	Minus direction	= +0.28
	Plus direction	= —
Thickness of compensating washer "S"		= 1.53

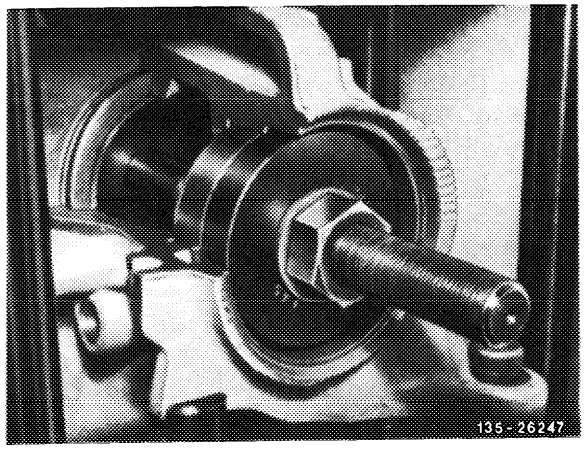
51 Remove measuring devices (051, 052) from rear axle housing.

52 Place compensating washer of calculated washer thickness "S" into rear axle housing (refer to example).

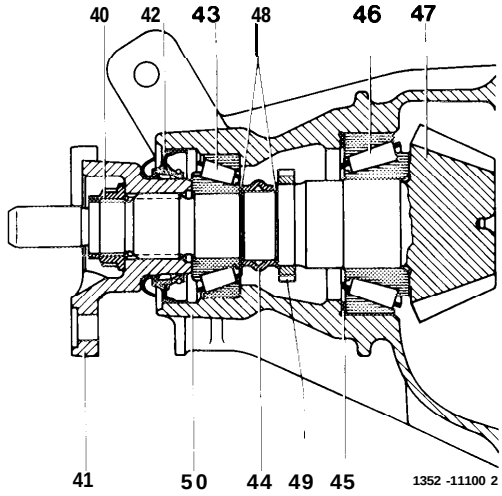


Note: Use hardened compensating washers only, they are available at varying thicknesses, If required, grind a compensating washer as required,

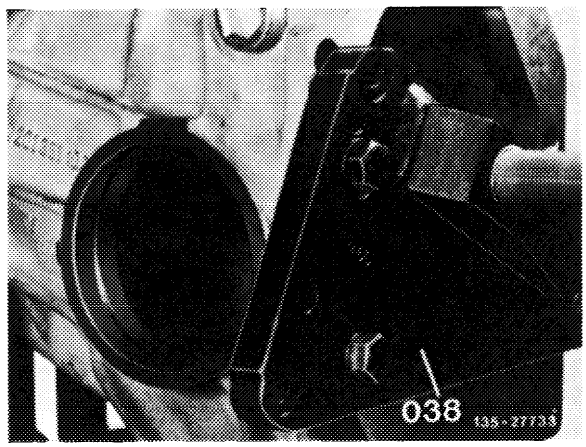
5 3 Insert outer races of front and rear tapered roller bearing into rear axle housing by means of inserting device.



5 4 Add one thrust washer (48) each on both sides of spacing sleeve (44) and place on drive pinion.



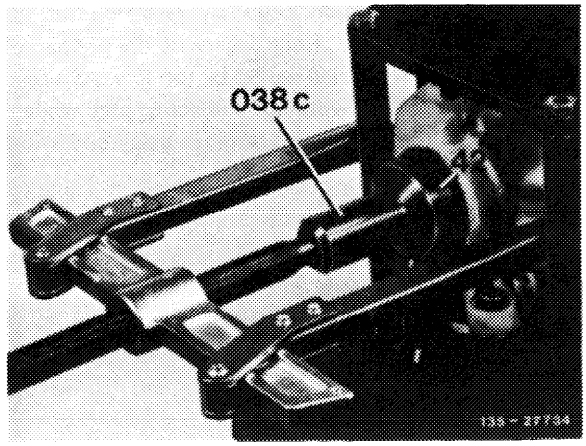
5 5 Insert drive pinion into rear axle housing and support with remover and installer (038).



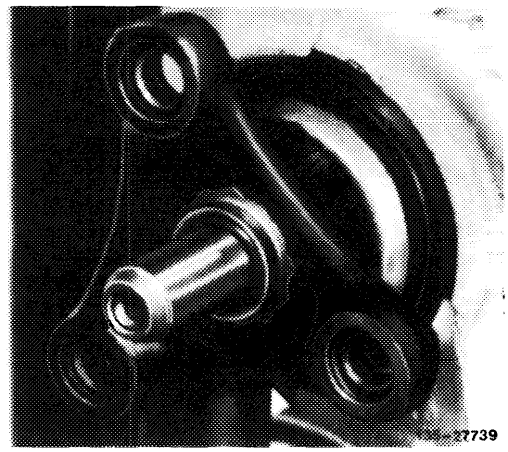
5 6 Insert inner race and sealing ring of front tapered roller bearing and force in with thrust piece (038c).

Note: Coat rubberized radial sealing ring (42) on circumference with hypoid gear oil or rubber sliding compound "Naphtolen H".

5 7 Take remover and installer from rear axle housing.

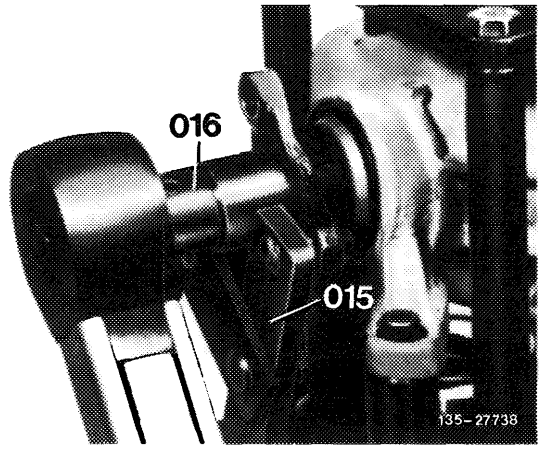


58 Coat running surface for radial sealing ring on flexible coupling with molybdenum disulfide paste and slip flexible coupling on drive pinion. Screw on new double hex. collar nut.



59 Place holding wrench (015) and double hex. socket (016) on flexible coupling and tighten nut carefully until a friction torque of 120-140 Ncm for new bearings and of 50-100 Ncm for used bearings is attained.

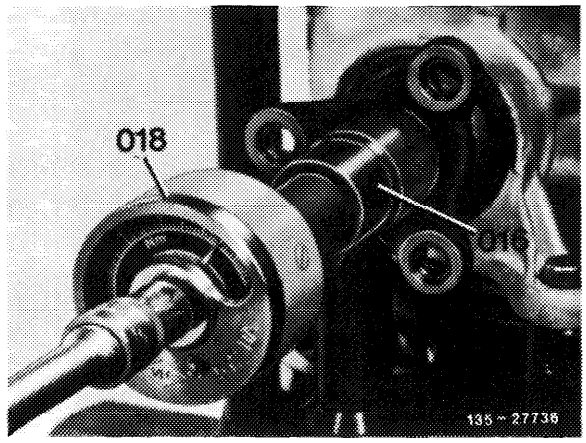
Attention!
When tightening double hex. collar nut rotate drive pinion several times and apply light blows against rear axle housing to make sure that the tapered rollers are easily rotating in races of ball bearings.



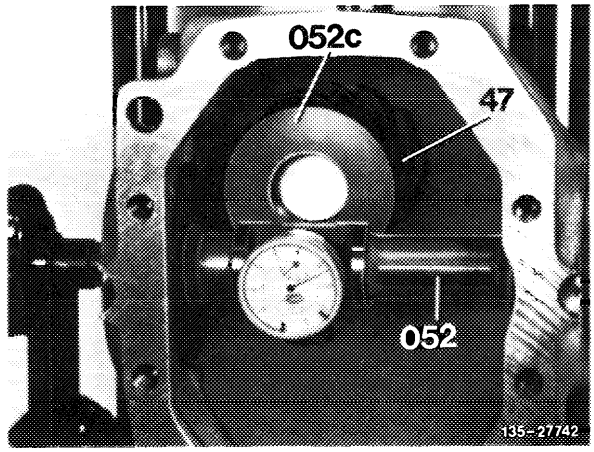
60 To check, mount torque measuring instrument (018) with extension on double hex. socket (016) and rotate drive pinion.

Note: The tapered roller bearings of the drive pinion must be installed with a given preload. This preload is attained by compressing the spacing sleeve located between the bearing-inner race of front tapered roller bearing and drive pinion when tightening the double hex, collar nut,

If the friction torque during rotation of drive pinion, that is, if the preload of the tapered roller bearing is too low, tighten double hex, collar nut again slightly. If the specified friction torque is exceeded, remove drive pinion once again and insert a new spacing sleeve. **Never reduce the friction torque by loosening the double hex. collar nut,** since otherwise the preload of the tapered roller bearing would be too low. As a result, the drive pinion would be subject to play while driving, which in turn would result in noisy operation of rear axle drive.



61 Place magnetic measuring plate (052c) on face of drive pinion (47) to measure adjusting dimension '' A".

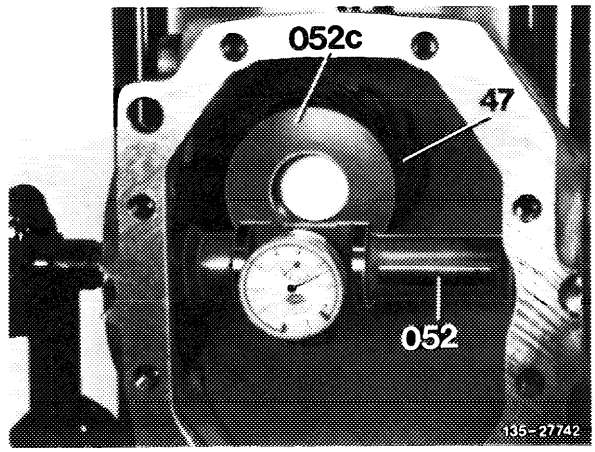


62 Insert measuring device (052) with dial gauge for checking adjustment once again into rear axle housing from direction of righthand bore.

On wheel set of the example named above, the dial gauge should indicate a deviation of 0.37 mm from basic dimension in plus direction; the same dimension which is written on face of drive pinion.

The permissible basic deviation of the adjusting dimension "A" may not exceed 0.01 mm in plus and 0.02 mm in minus,

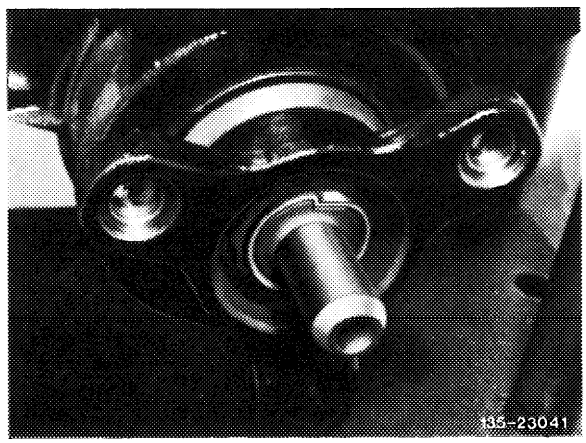
If the deviation is higher, grind down installed compensating washer or install a new compensating washer of the required thickness. In such a case, be sure to use a **new spacing sleeve** for tapered roller bearing.



47 Drive pinion
052 Measuring device
052c Magnetic measuring plate

63 Remove measuring device with dial gauge and magnetic measuring plate from rear axle housing.

64 Peen double hex, collar nut with a peening tool into one of the two grooves of the drive pinion in such a manner that there will be no gap between the groove and the tab.



Attention!
Do not apply heavy axial blows.

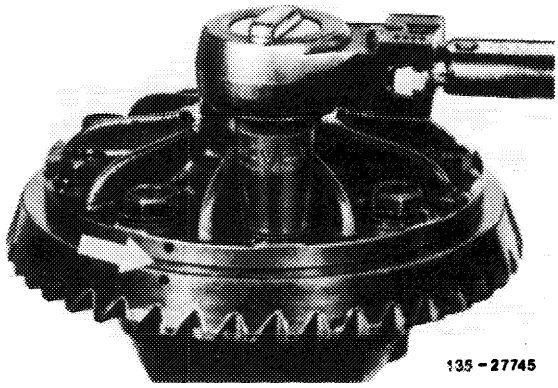
Adjustment of backlash

Note: The backlash of the wheel set and the required preload of the tapered roller bearings in relation to bearing of differential is obtained by means of the locking rings inserted **in rear axle housing. Locking rings of different thickness are available for this purpose. For assembly, the previously removed locking rings are most suitably installed again on respective side to obtain a basic adjustement.**

65 Disassemble and assemble differential (35-560).

66 Carefully clean bore of ring gear and seat on differential cage. Heat ring gear to approx. 60-70 °C and place on differential cage, If applicable, pay attention to identification of ring gear and differential cage, if applied (arrow).

If the ring gear cannot be placed on differential cage, assist by means of light hammer blows (rubber hammer).

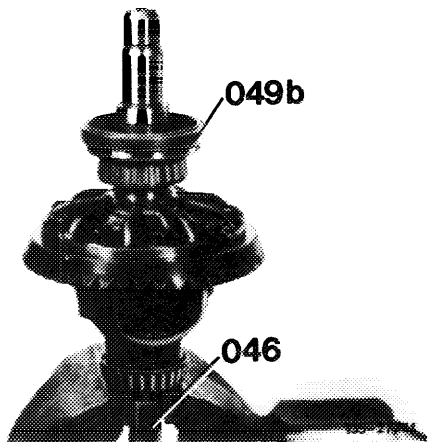


67 Tighten self-locking hex. screws for fastening ring gear uniformly and crosswise to 105 Nm.

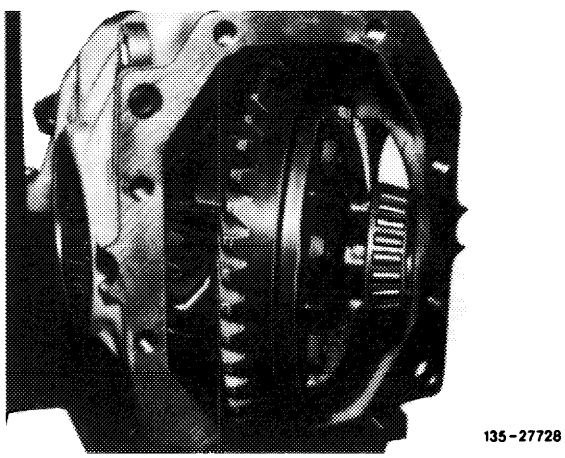
Attention!
Renew ring gear screws on principle after one-time use.

68 Press inner races of tapered roller bearings on differential cage by means of assembly mandrel (049b).

Attention!
Use assembly mandrel (046) to prevent damage to roller cage when pressing on second inner race.



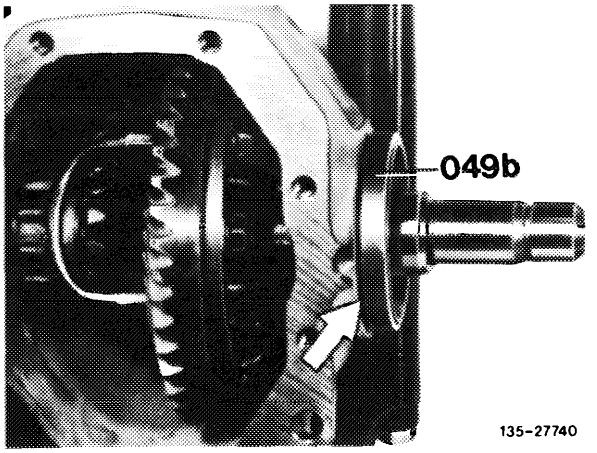
69 Insert differential with lefthand end first into bore of rear axle housing, until the differential can be introduced at the right.



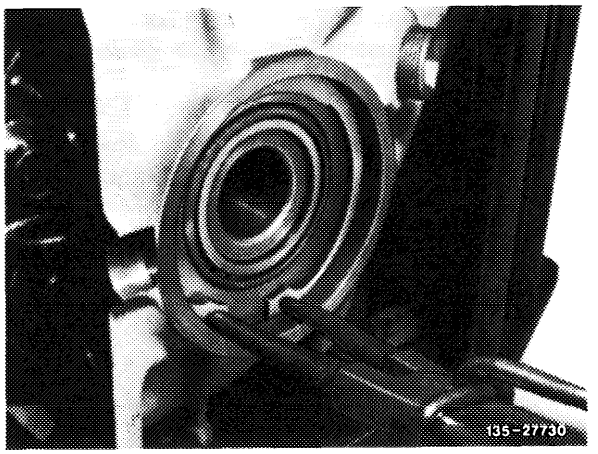
Note: Use two assembly mandrels for better assembly of outer bearing races,

70 Locate differential with assembly mandrel (049b) in relation to rear axle housing.

71 Remove righthand assembly mandrel and again introduce with bearing outer race into rear axle housing until the assembly mandrel rests against housing (arrow).

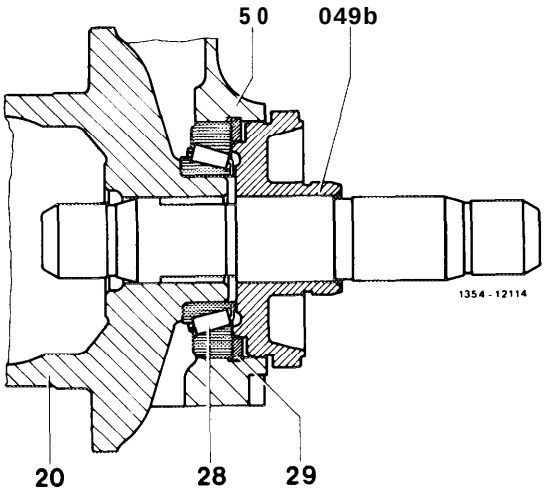


72 Remove assembly mandrel at the right. Insert previously removed locking ring into groove,



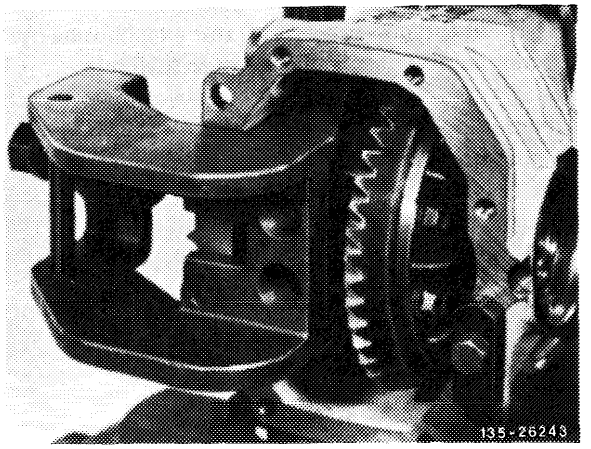
73 Check locking ring (29) for correct seat by means of assembly mandrel (049b).

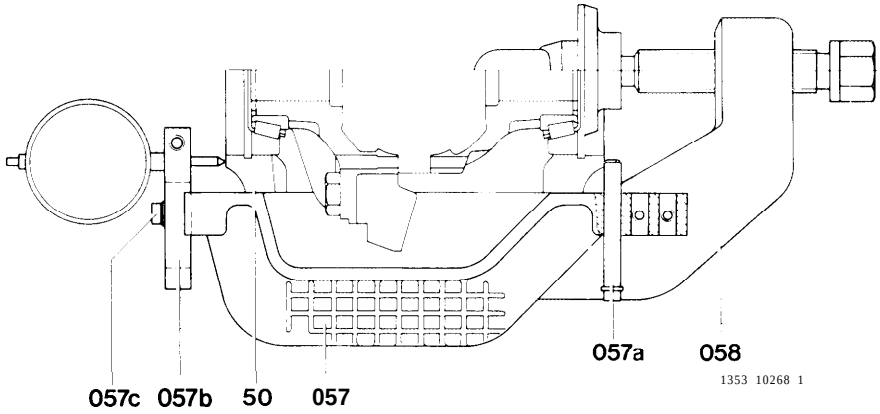
74 Introduce lefthand outer race into rear axle housing until it rests against tapered roller bearing inner race (28).



75 Fasten spreader to rear axle housing and manually position screw spindle up to contact surface on bearing outer race,

76 Fasten stop for supporting measuring bracket on rear axle housing.



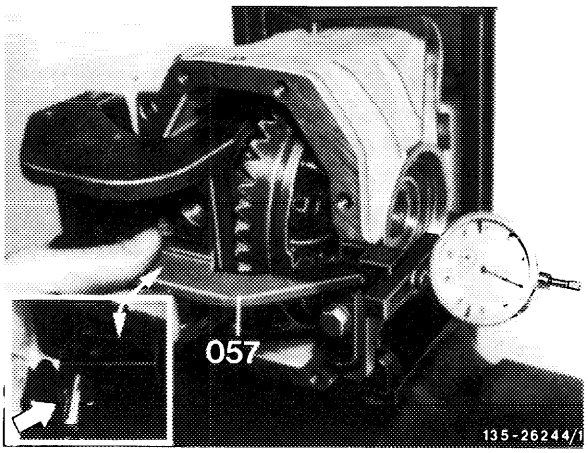


77 Insert stop bolt (057a) into inner bore of measuring bracket (057) and clamp down with knurled screw,

78 Adjust dial gauge holder (057b) lengthwise in such a manner (front notch), that the dial gauge tip comes to rest against rear axle housing (50). Clamp down dial gauge holder (057b) with hex. socket screw (057c).

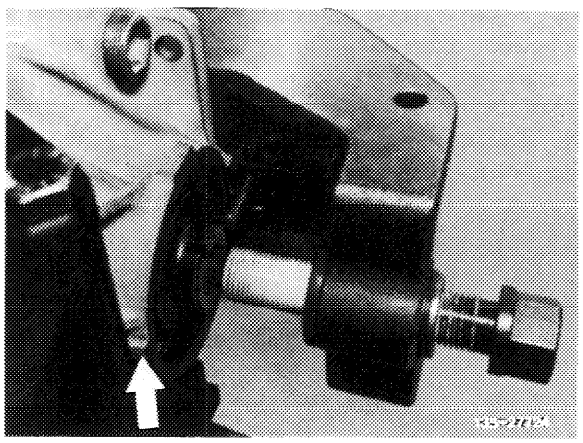
79 Position spreader (057) and adjust dial gauge to 0 under 3 mm preload.

Attention!
Make sure that the stop pin of the measuring instrument rests well against contact surface on rear axle housing (refer to cutout, arrow).



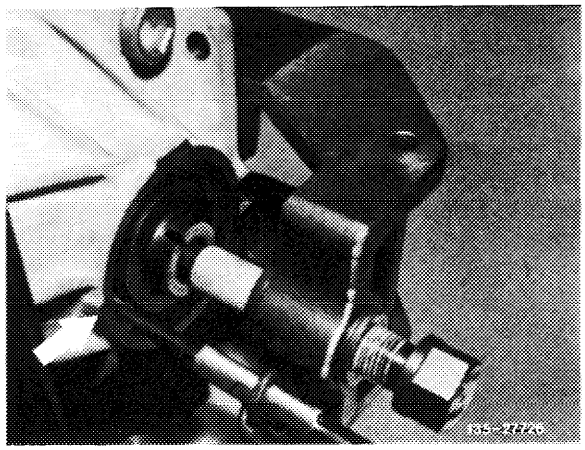
80 Turn one surface of thrust piece toward front rib (arrow) and preload (spread) rear axle housing by screwing spindle of spreader down to 0.25 mm.

Attention!
Do not exceed 0.25 mm while spreading.



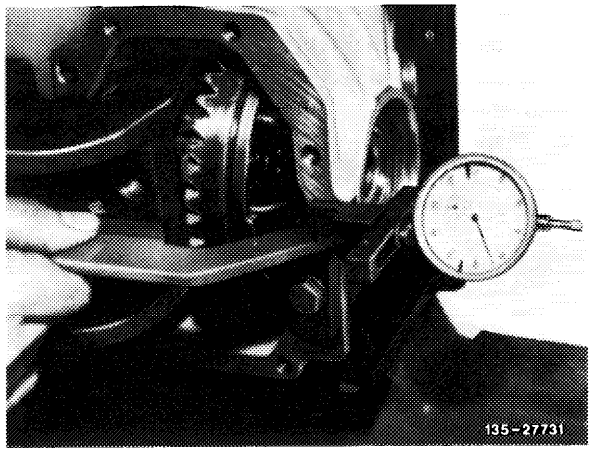
81 Insert locking ring installed up to now within range of front rib (arrow),

82 Slacken rear axle housing.



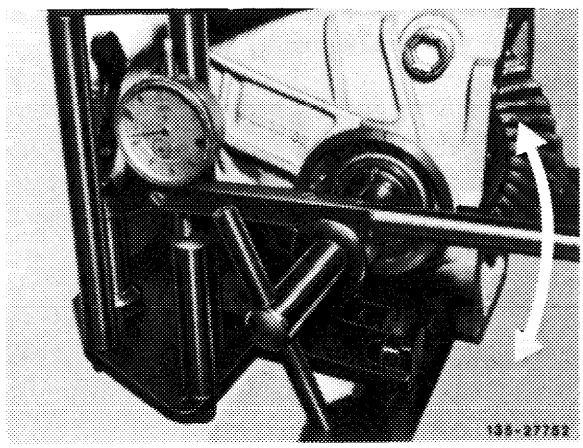
83 Measure spread dimension (widening) of rear axle housing with spreader. The required spread of rear axle housing and thereby the correct preload of tapered roller bearing on differential is attained when the spread is in range between 0.10 — 0.15 mm.

84 Remove spread measuring instrument.

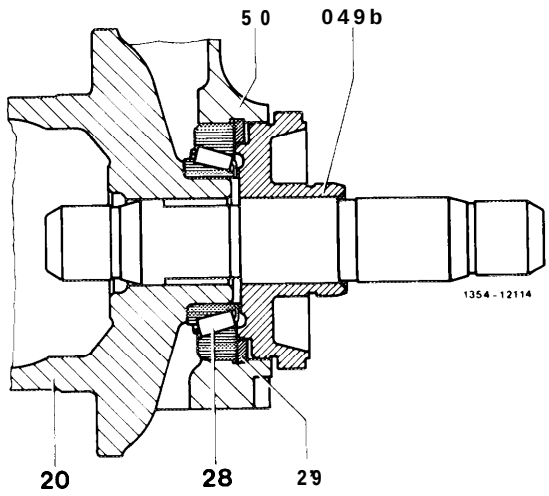


85 Insert backlash measuring instrument into left-hand bore of differential cage and clamp down.

86 By moving dial gauge holder, measure backlash at four points, with reference to circumference of ring gear. The minimum play is decisive. Backlash should amount to 0.08 — 0.14 mm, When measuring, always hold drive pinion in place at flexible coupling.

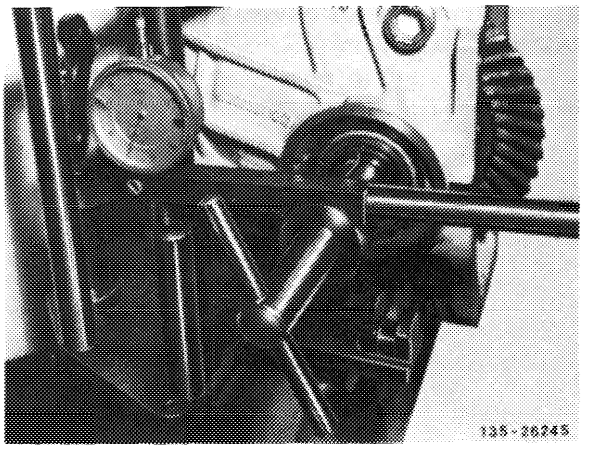


Note: Adjustment of tapered roller bearings and of wheel set is in order when the spread (widening) of the rear axle housing and the backlash are in range of nominal values. If these values are not attained, repeat adjustment by using locking rings (29) which are pertinently thicker or thinner.



Example 1: if the backlash is in order, but the spread of the rear axle housing is too low, mount thicker locking rings for the two locking rings which are each thicker by the same amount.

If the measured value is e.g. 0.05 mm, also increase the thickness of the locking ring at left and right by 0.05 mm. This may lead to a change of backlash!

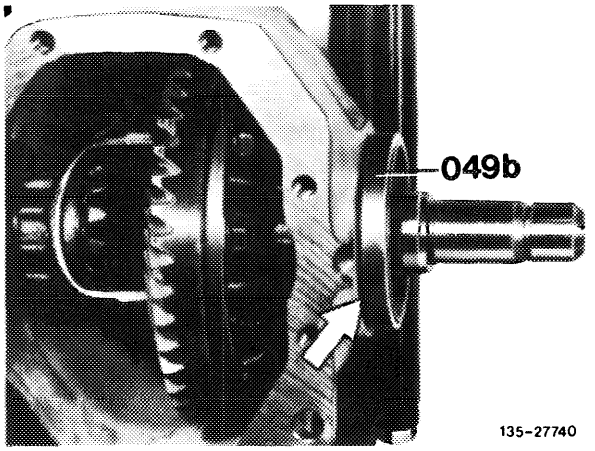


Example 2: If the spread is in order, but the backlash is too high, reduce the thickness of the locking ring from left assembly side by the lesser amount, and add the same amount at righthand assembly side (ring gear side). If the backlash is too low, proceed vice versa.

87 Remove backlash measuring instrument and spreader,

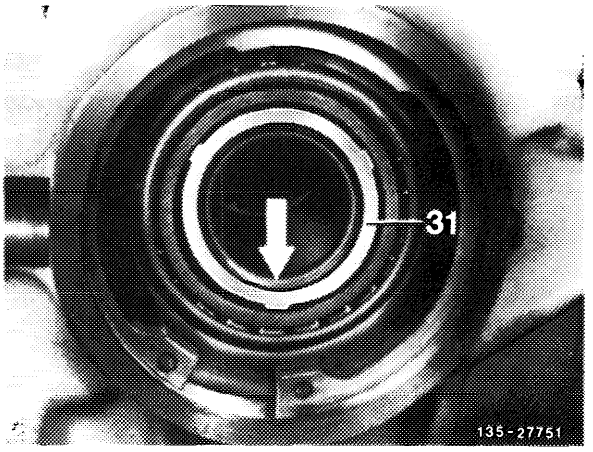
88 Check locking ring for correct seat by means of assembly mandrel (049b).

Note: If correctly seated, a gap of approx. 1 mm must show up between the rear axle housing and the assembly mandrel (arrow).

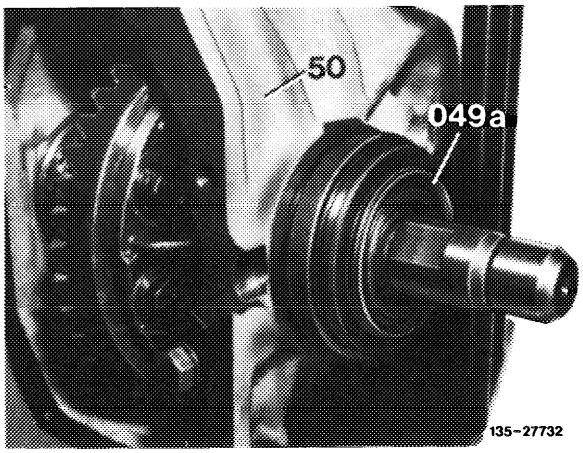


89 Insert compensation washer in differential cage (31).

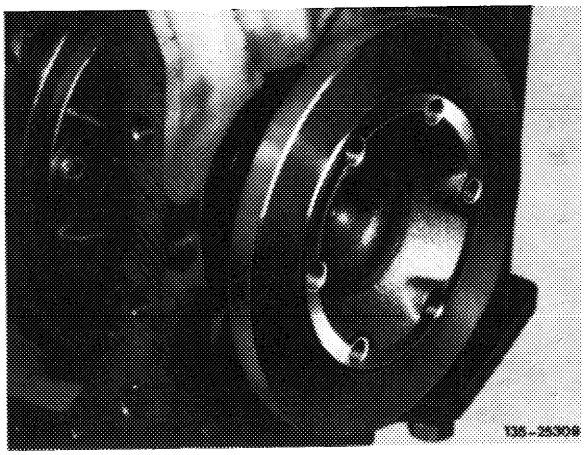
Note: Compensating washer should rest tightly against face of differential cage (arrow).



90 Coat rubberized radial sealing ring on **OD** with hypoid gear oil or rubber sliding compound "Naphtolen H" and force into rear axle housing (50) with assembly mandrel (049a).

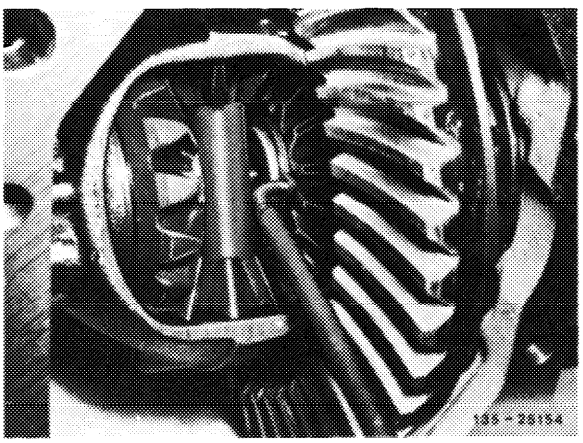


91 Slip lefthand and righthand connecting flange into differential side gear,



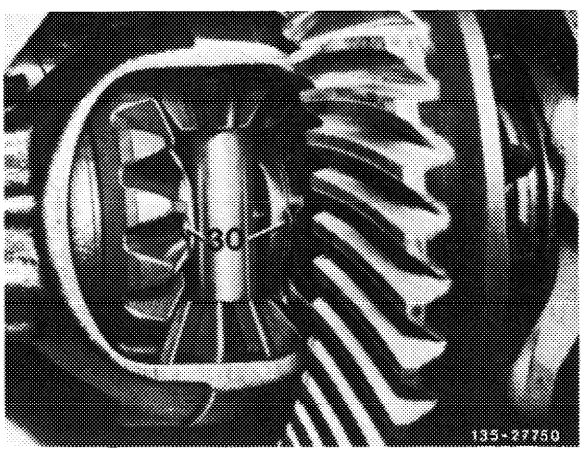
Connecting flange with ring-shaped weight

92 **Use** new locking ring of similar thickness between connecting flange and differential side gear and force in.



93 Check end play between connecting flange and differential side gear. There should be no noticeable end play; the locking ring (30) in groove should still be able to rotate. If required, mount locking ring thicker or thinner as required

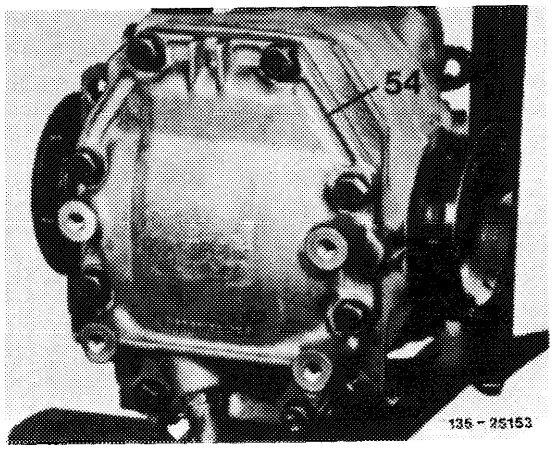
Attention!
Renew locking ring after one-time use.



94 Clean sealing surface on end cover and on rear axle housing and coat with sealing compound, Mount rear axle end cover (54). Tightening torque of hex. head screws 45 Nm.

95 Fill in hypoid gear oil up to lower edge of oil filler bore. Tightening torque of closing plug 50 Nm.

96 Renew vent on rear axle end cover.



Data sheet
Adjustment of rear axle gears

Type 124, 201

Mercedes-Benz service

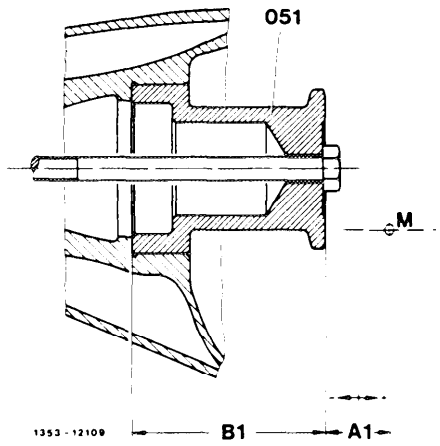
Branch/Agency

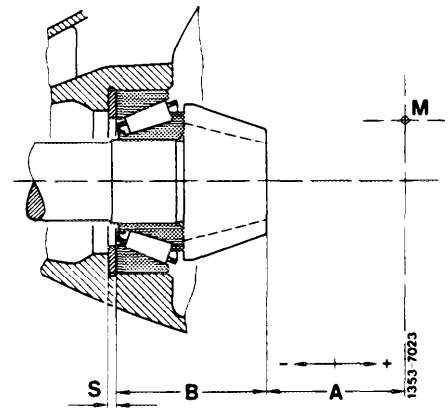
Customer

Chassis No. | Repair Order No

Measurement carried out: Date/Name | Date

License Plate No | Original Registration Date | Type | Odometer Reading km/miles





A = Basic adjusting dimension
B = Pinion height plus height of tapered roller bearing
Al = Distance from face of measuring body to center of ring gear
B1 = Height of measuring body
s = Thickness of compensating washer
M = Center of ring gear
051 = Measuring body

Computation of washer thickness "S"

1. Difference between measuring body height "B1" and pinion height with bearing "B". =

2. Basic deviation "a" read on pinion (+ or -) = +
= −

Subtotal =

3. Difference between adjusting gauge and depth of rear axle housing "Al " minus direction = +
plus direction = −

Thickness of compensating washer „S" =

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Explanations and instructions

a) Each drive pinion and ring gear of a gear assembly is identified by a consecutive number written on both components.

b) Measure difference between measuring body height "B1" and height of pinion plus height of tapered roller bearing "B" and enter into table under item 1.

c) Read basic deviation "a" on drive pinion and enter into column of table with respective prefix (+ or -) under item 2.

d) Add (+) or subtract (-) data of item 1 and item 2.

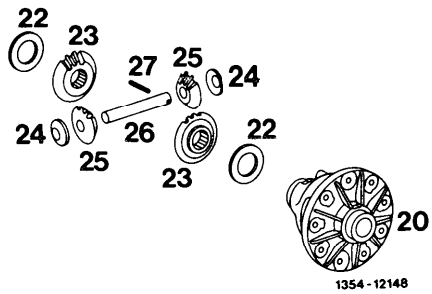
e) Measure difference between adjusting gauge dimension and depth of rear axle housing "Al " and enter into respective column of table (plus or minus direction) under item 3.

The directional data plus (+) or minus (-) refer to direction of rotation of dial gauge needle. A deviation from zero position in anti-clockwise direction means minus direction, in clockwise direction plus direction.

f) Only the basic adjustment dimension "A" is decisive for adjustment of the drive pinion. When checking the basic adjusting dimension "A" the drive pinion must be completely installed together with the spacing sleeve and the friction torque should amount to 120-140 Ncm for new tapered roller bearings and to 50-100 Ncm for used roller bearings. If the limit of 0.01 mm in plus direction and of 0.02 mm in minus direction from basic adjusting dimension "A" is exceeded, grind down compensating washer or install another compensating washer of appropriate thickness. In doing this it is imperative that a **new spacing sleeve** is used.

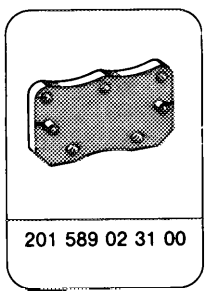
Example
Computation of washer thickness "S" with small center piece.

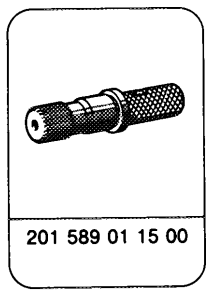
1. Difference between measuring body height "B1" and pinion height with bearing "B" (measured valve only).		= 0.88
2. Basic deviation "a" read on pinion (+ or -)		= + 0.37 = —
Subtotal		1.25
3. Difference between adjusting gauge dimension and depth of rear axle housing "Al "	minus direction plus direction	= + 0.28 = —
Thickness of compensating washer "S"		**= 1.53**



20 Differential cage	Check radial and axial runout at pilot bore for ring gear max. 0.02 mm, special tool: Clamping plate 201 589 02 31 00
22 Thrust washer	Renew, selecting thickness in such a menner that a friction torque of 40-90 Nm is attained, thickness from 1.25 to 1.65 mm, steps 0.1 to 0.1 mm
23 Differential side gear	Check for damage, special tool: Assembly mandrel 201 589 01 15 00
24 Spherical washer	Renew
25 Differetial pinion	Check for damage, special tool: Assembly mandrel 201 589 02 15 00
26 Pinion shaft	Check for wear
27 Clamping sleeve	Renew

Special tools


201 589 02 31 00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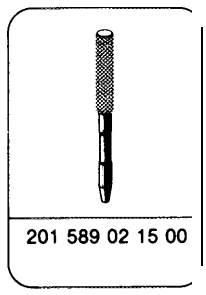
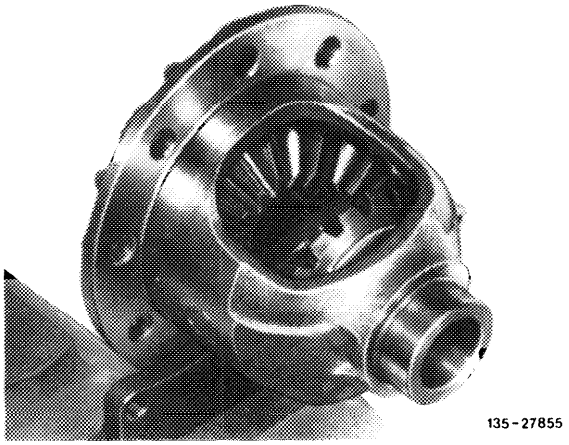
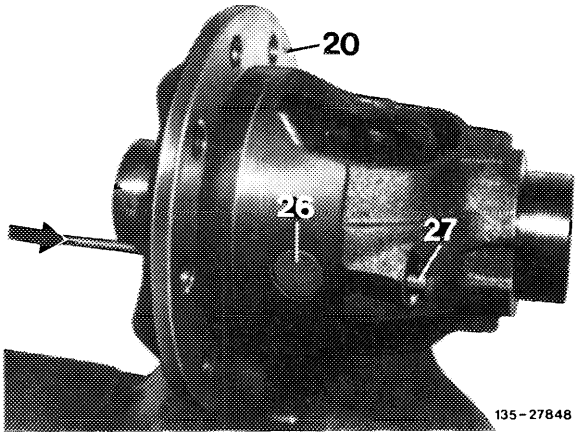

201 589 02 15 00

Disassembly

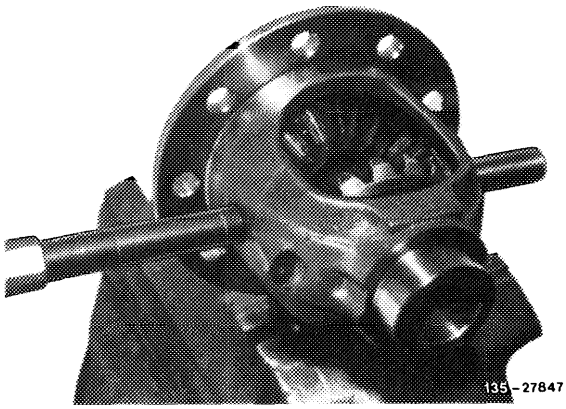
1 Fasten differential on clamping plate and clamp into vise.



2 Knock clamping sleeve (27) for pinion shaft (26) out of differential cage (20) (arrow) by means of a suitable mandrel.



3 Push out pinion shaft and remove differential pinions, differential side gears, thrust washers and spherical washers.



4 Check individual parts for reuse. Renew all differential pinions, thrust washers and spherical washers, running hot or seizing, on principle,

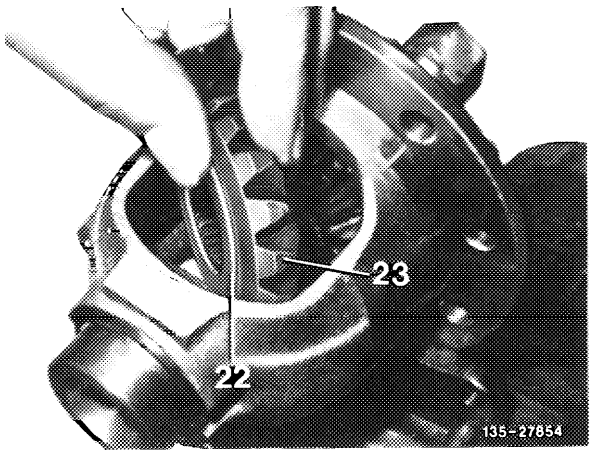
5 Check bores in differential cage, Check pilot bore and contact surface for ring gear for radial and axial runout.

Assembly

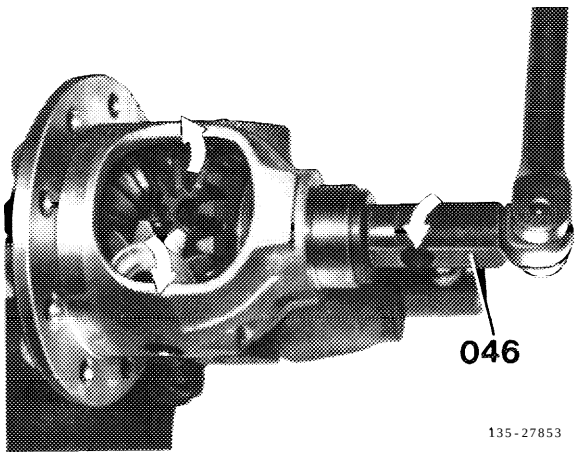
6 Insert both assembly mandrels into bores of differential cage,

7 Place thrust washer (22) on differential side gears (23).

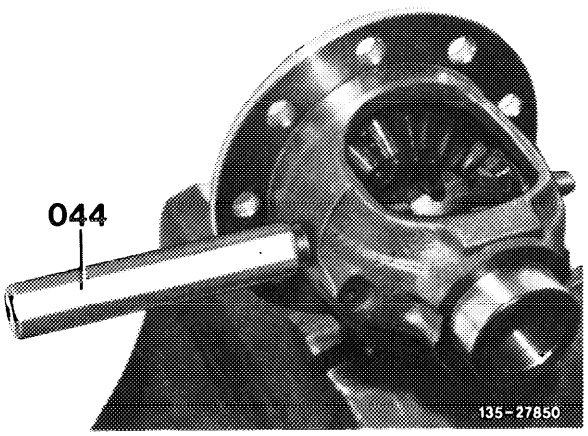
8 Place both differential side gears (23) with thrust washers (22) on assembly mandrels in differential cage.



9 Rotate and insert both differential pinions and spherical washers together into differential cage by means of assembly mandrel (046).

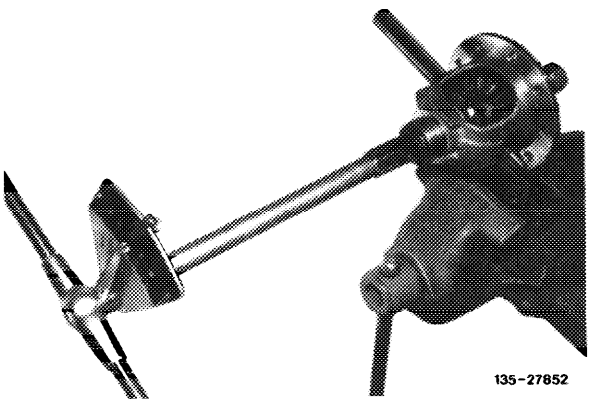


10 Slip assembly mandrel (044) into differential cage instead of pinion shaft to locate differential pinions and spherical washers.

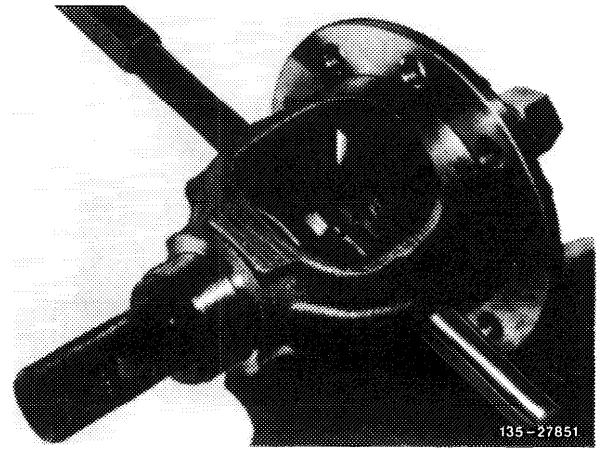


11 Check friction torque. Friction torque should amount to 40-90 Nm; up to 100 Nm are permitted when retarded.

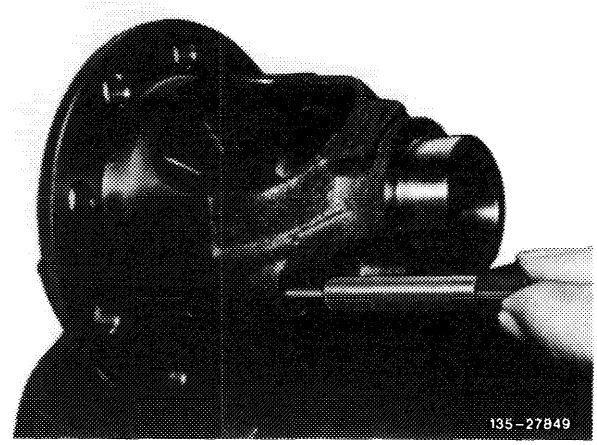
Note: Select thrust washers for differential side gears in such a manner that a given friction torque is available during assembly.

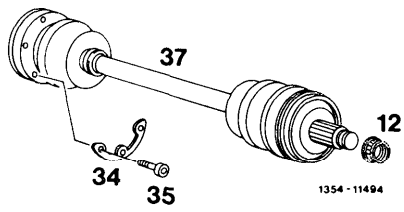


12 **Knock in pinion shaft while paying attention to bore for clamping sleeve.**



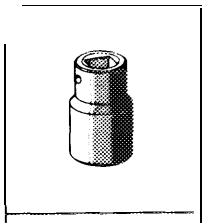
13 **Knock in new clamping sleeve with a suitable mandrel.**

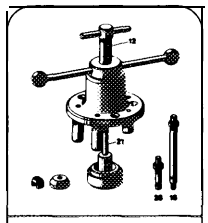




12	Double hex. collar nut	Renew, tightrning torque 280-320 Nm, secure by knocking in collar, special tool: socket 30 mm 126589020900
34	Washer	Renew
35	Locking screw	Renew, tightening torque 70 Nm, threads and screw head contact surface lubricated
37	Rear axle shaft, complete	Check rubber sleeves for damage, special tool: Remover and installer 201 589 00 61 00

Special tools


126 589 02 09 00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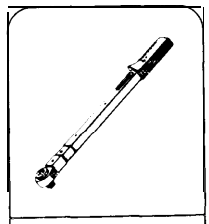

001 589 66 21 00

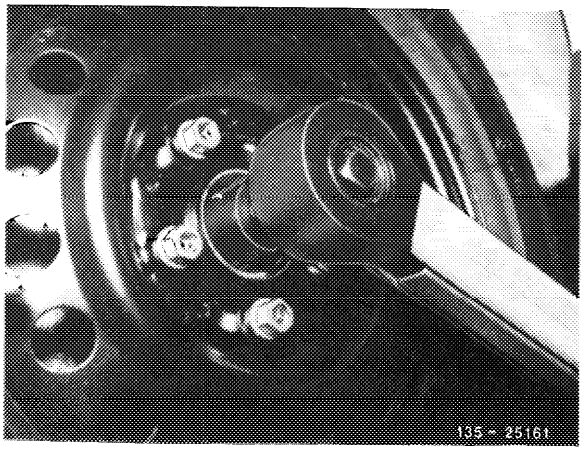
001 589 74 21 00

Conventional tools

Screwdriver element for inside multi-tooth screws (XZN)1/2" square	e.g. Hatet D-5630 Remscheid Order No. 999 lg–10

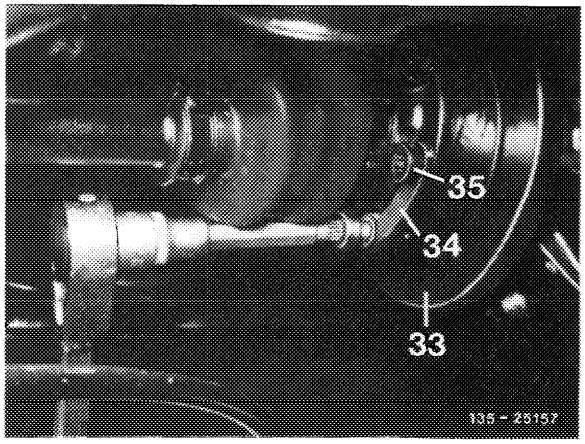
Removal

1 Loosen double hex. collar nut for fastening rear axle shaft prior to lifting vehicle and remove.

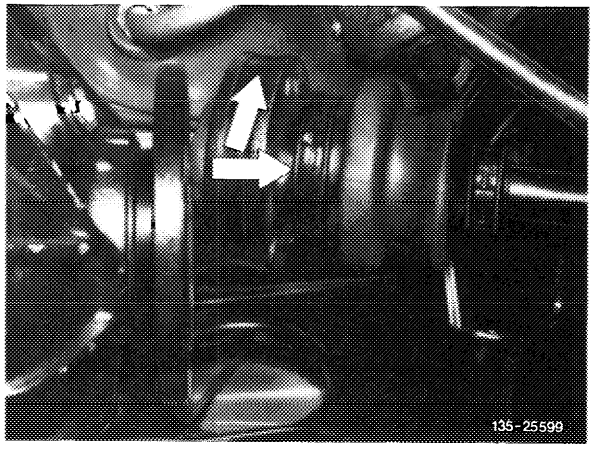


2 Remove rear axle shaft on connecting flange (33) and remove together with locking screws (35) and washers (34).

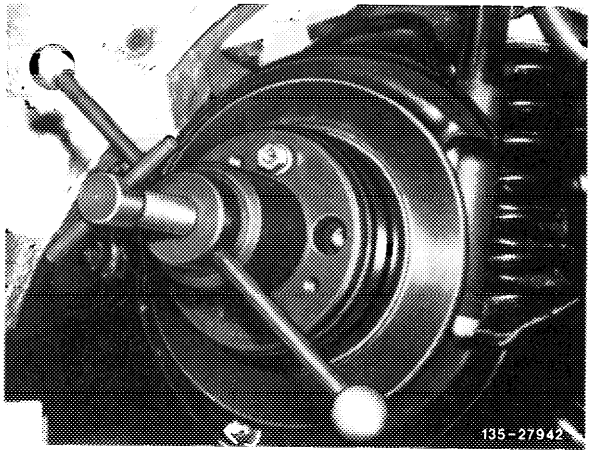
Attention!
Make sure that while loosening locking screws the screw-driver element is well-inserted in multi-tooth profile. Clean, if required.



3 Separate rear axle shaft from connecting flange. Telescope rear axle shaft in axial direction (arrow) and swivel upwards (arrow).

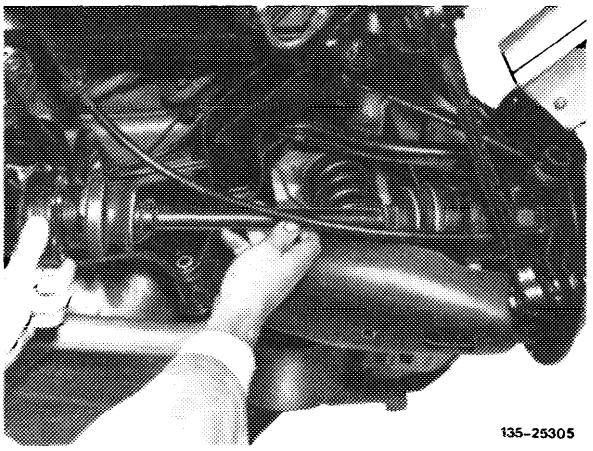


4 At fixed seat of rear axle shaft in rear axle shaft flange, push out rear axle shaft by means of remover.



5 Push rear axle shaft down at front end and remove.

Note: Make sure that end cover of universal joint ring is not loosening when removing rear axle shaft.



6 Check synchromesh joints as well as rubber sleeves and end cover for leaks and damage.

Installation

7 Install in vice versa sequence, Pay attention to the following items:

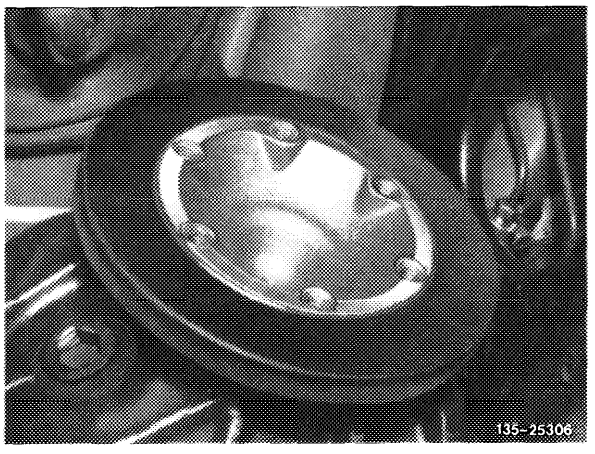
a) Renew locking screws and double hex. collar nut on principle.

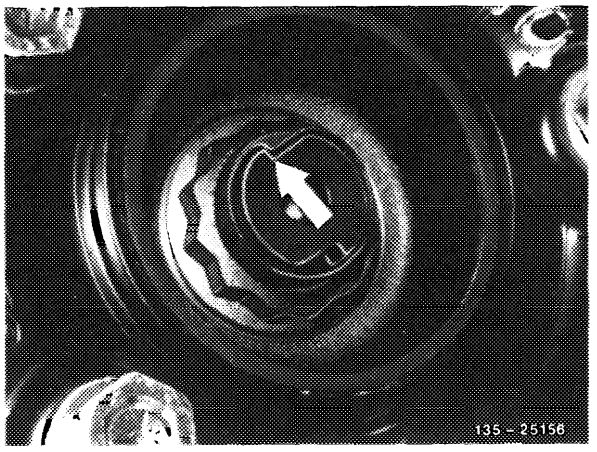
b) Protect flange-on surface between connecting flange and end cover of rear axle shaft against contaminations.

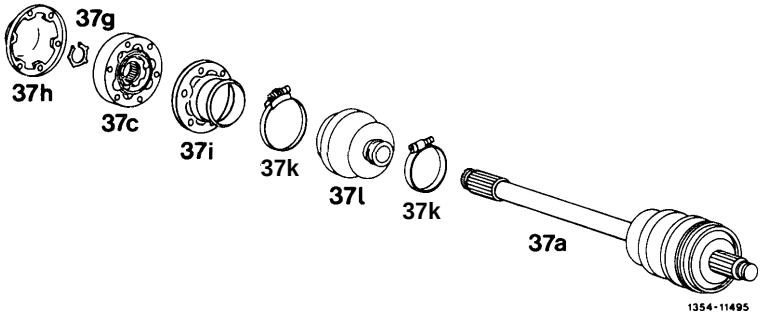
c) Prior to screwing-in locking screws, **moisten threads and screw head contact surface with oil.**

d) Tightening torque of locking screws 70 Nm and of double hex. collar nut 280-320 Nm.

e) Lock double hex. collar nut at crush flange (arrow).

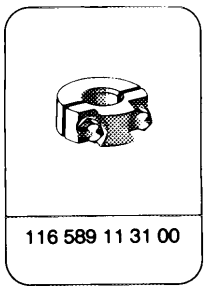


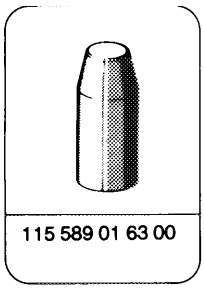




37a Rear axle shaft	Check for damage, special tool: Clamping jaws 116589 11 31 00
37c Ring joint inside complete	Check for wear, use MB-longterm grease only, filling capacity model 201.02/01 100 grams per joint
37g Locking ring	Renew
37h End cover	Check for damage, coat sealing surface with sealing compound
37i Sleeve cap	Check for damage, coat sealing surface with sealing compound
37k Hose clamp	Renew
371 Rubber sleeve	Renew, special tools: Assembly sleeve 11558901 6300

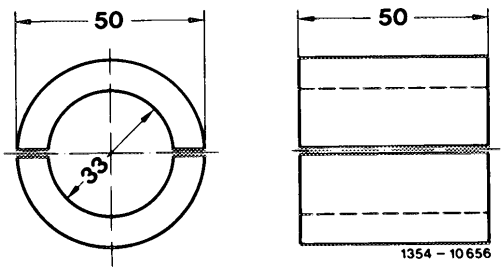
Special tools

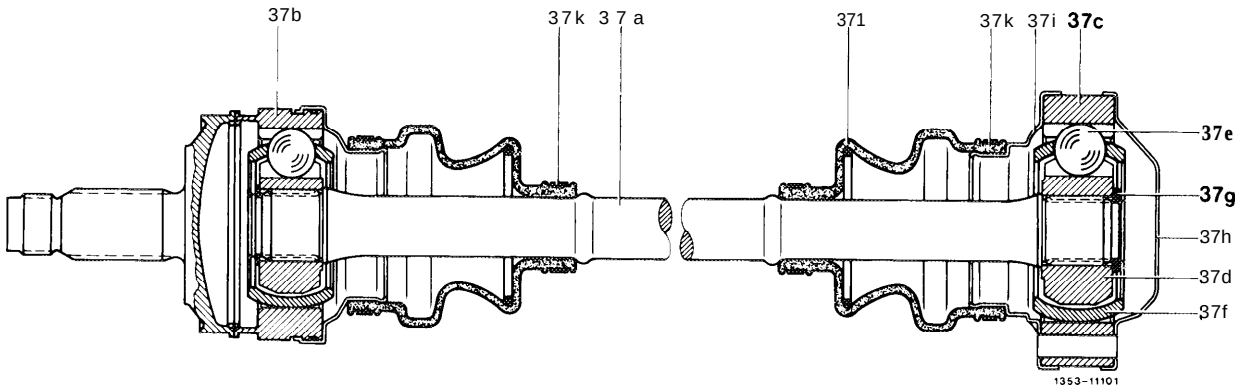




Self-made tool

Half shells for pressing off synchromesh joint





37a Rear axle shaft
37b Universal joint ring, outer
37c Universal joint ring, inner
37d Universal joint hub
37e Ball
37f Ball cage
37g Locking ring
37h End cover
37i Sleeve cap
37k Hose clamp
371 Rubber sleeve

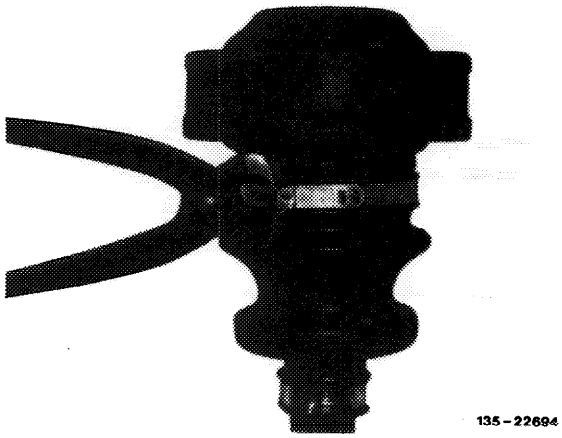
Note

Rubber sleeve of rear axle shaft on outer joint can be renewed only after disassembly of inner joint, since disassembly of outer joint is not possible.

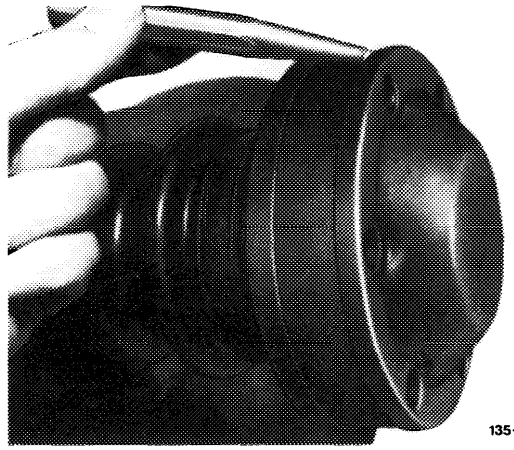
Disassembly

1 Remove rear axle shaft (35–620).

2 Loosen hose clamps and remove. Open hose clamps without clamping screw by means of cutting pliers on clamping tube.



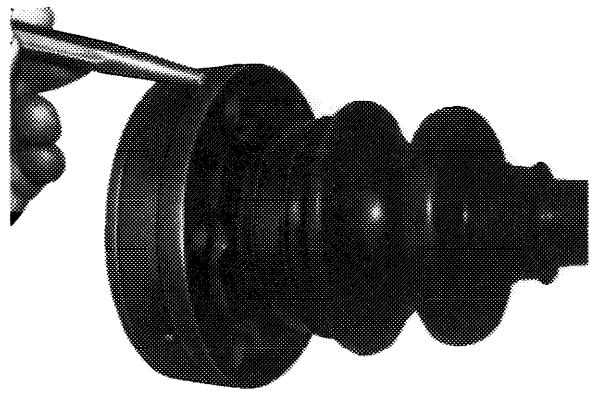
3 **Force end cover from universal joint ring.**



135-22695

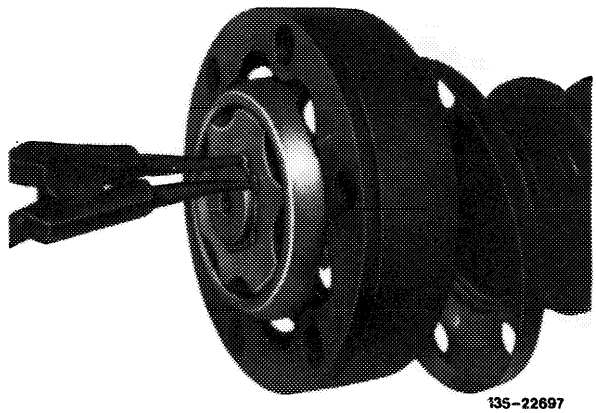
4 Force sleeve cap from universal joint ring.

5 Slip rubber sleeve with sleeve cap back on rear axle shaft. Clean joint from grease.



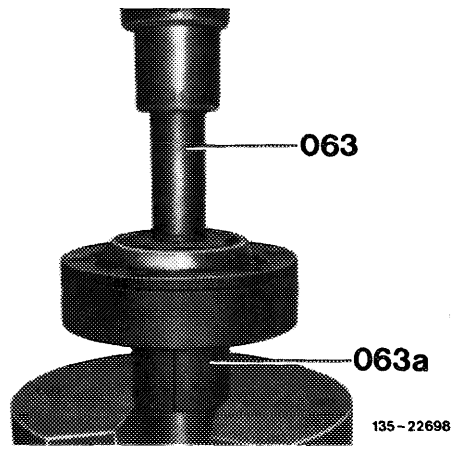
135-22696

6 **Remove locking ring.**

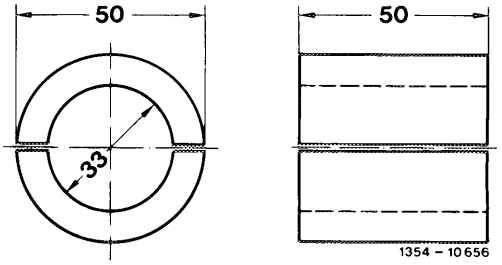


135-22697

7 **Press synchromesh joint from rear axle shaft, while using the two self-made shells (063a) as well as a suitable mandrel (24 mm dia. and approx. 80 mm long 063).**

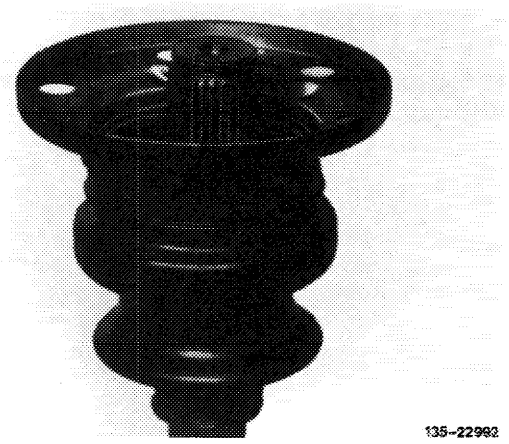


135-22698

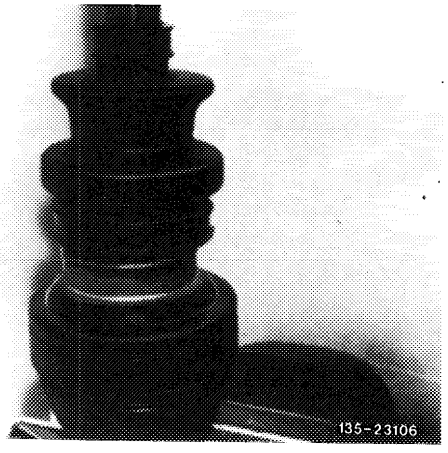


Self-made half shells

8 Pull sleeve cap and rubber sleeve from rear axle shaft.



Note: The second rubber sleeve can now be pulled off after loosening hose clamps via disassembled end of rear axle shaft, if required. Make sure that nothing of grease charge is getting lost and that no dirt can enter inside joint. Wipe off the grease still inside rubber sleeve and fill into synchromesh joint.

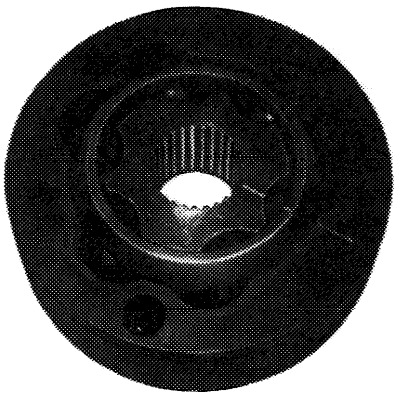


9 Clean synchromesh joint.

Checking synchromesh joint for wear

Note: Disassemble joint for checking synchromesh joint for wear.

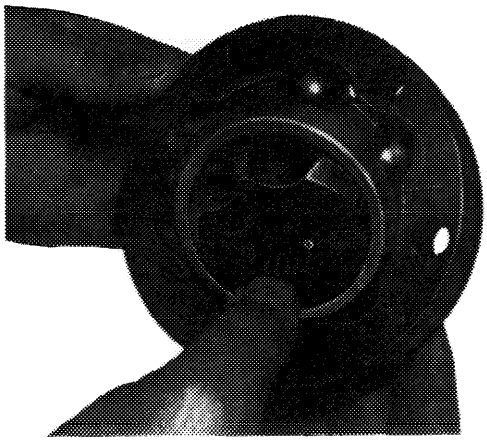
10 Mark location of universal joint ring, joint hub and ball cage prior to disassembly with electric pen or dressing stone.



135 - 22693

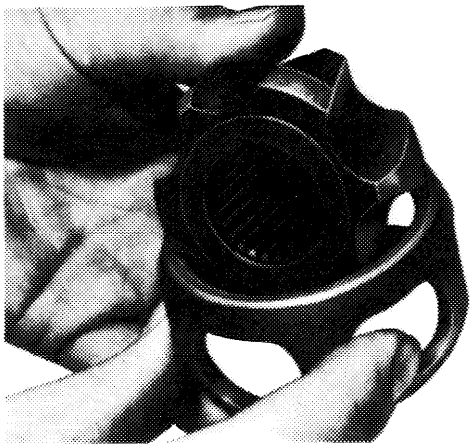
11 Swivel joint hub with ball cage and remove balls individually one after the other.

12 Remove joint hub with ball cage from universal joint ring.



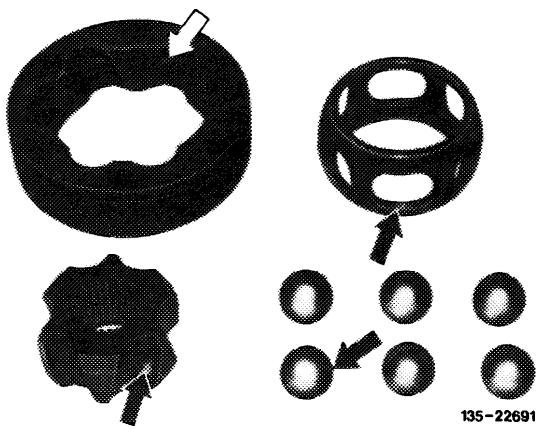
135-22692

13 Swivel joint hub by 90^{o} in relation to ball cage and remove.



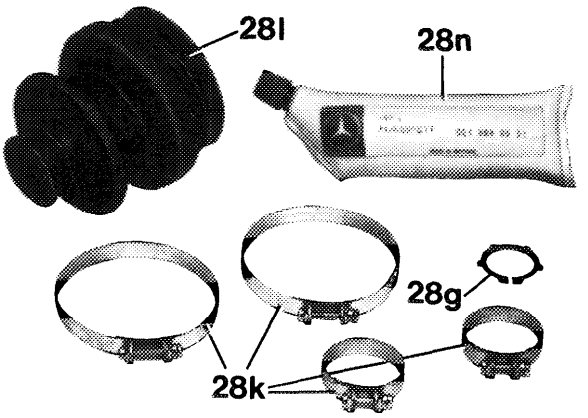
135-22699

14 Check ball races of joint ring, joint hub, ball cage and balls for pitting marks and evidence of wear (arrows). If these parts are showing considerable wear, renew complete synchromesh joint. Smooth spots and running traces caused by the balls are no reason for exchanging synchromesh joint.



135-22691

Note: A repair kit with all required parts is available for changing sleeve. If a second sleeve is required for the same rear axle shaft, use an additional rubber sleeve for this purpose.



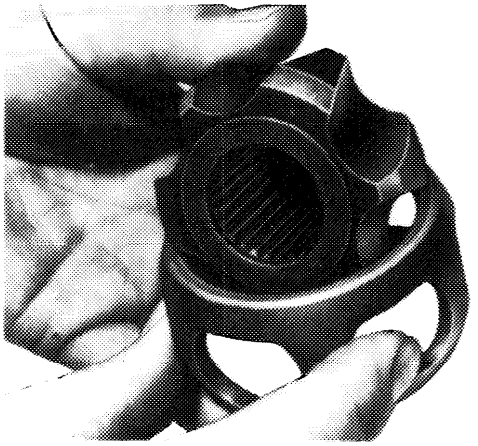
135-22669

281 Rubber sleeve
28k Hose clamps
28s Locking ring
28n MB longterm grease

Assembly

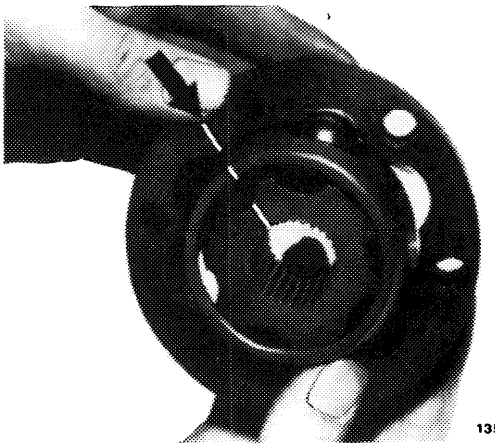
15 Set joint hub vertically in relation to ball cage an insert.

16 Introduce one ball while paying attention to applied mark of joint hub and ball cage.



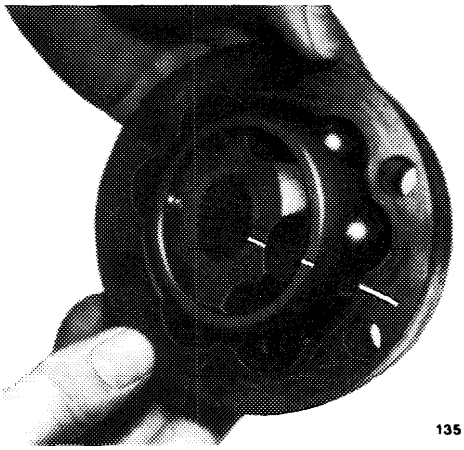
135-22699

17 Insert joint hub with ball cage and ball into joint ring. Also pay attention to applied marks (arrow).



135 - 22707

18 Swivel joint hub with ball cage to the extent that one ball after the other can be inserted.

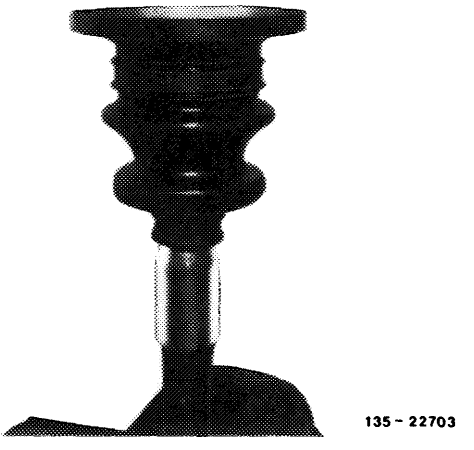


Sixth ball inserted

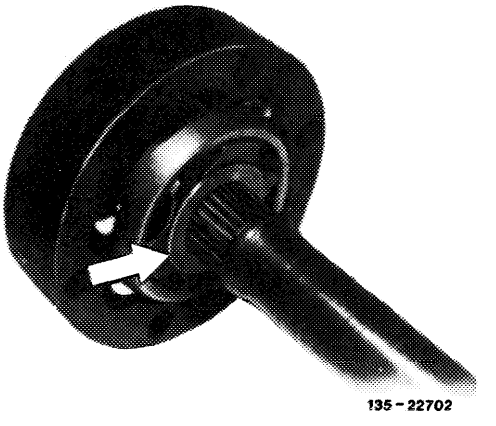
135 - 22705

19 Slip assembly sleeve (029) on splining of rear axle shaft.

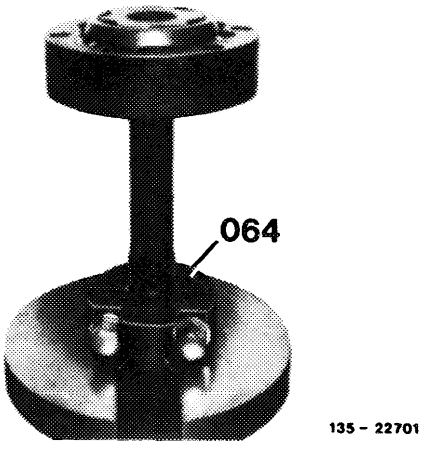
20 Slip rubber sleeve and sleeve cap on rear axle shaft.



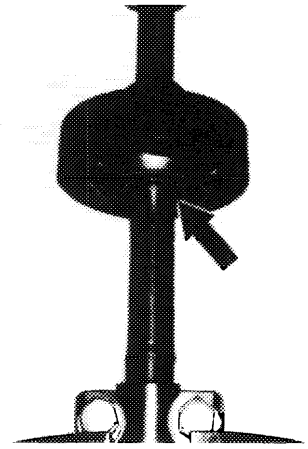
21 Slip synchromesh joint on rear axle shaft (arrow).



22 Position clamping device (064) against sleeve flange of rear axle shaft.

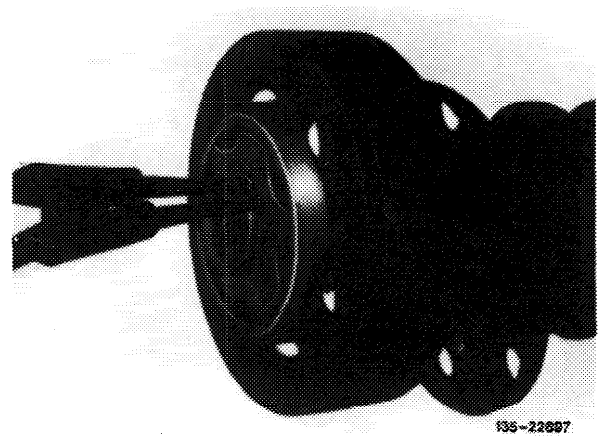


23 Press on synchromesh joint by means of a suitable mandrel up to contact surface of rear axle shaft (arrow).

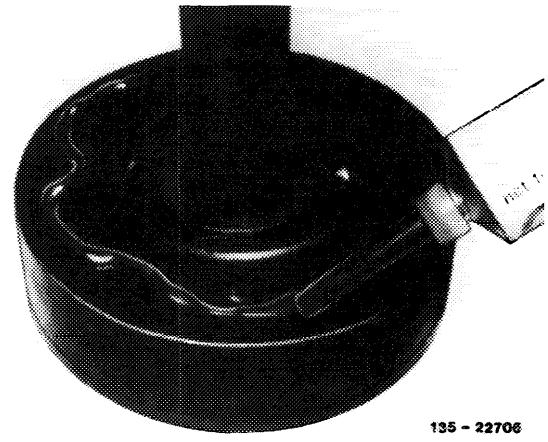


24 Remove clamping device and pressing-on mandrel.

25 Mount locking ring.



26 Coat sealing surface on synchromesh joint of end cover and sleeve cap with sealing compound (e.g. Curil, Loctite 574 or Hylomar) and mount. But mount end cover only after the grease has been filled in.

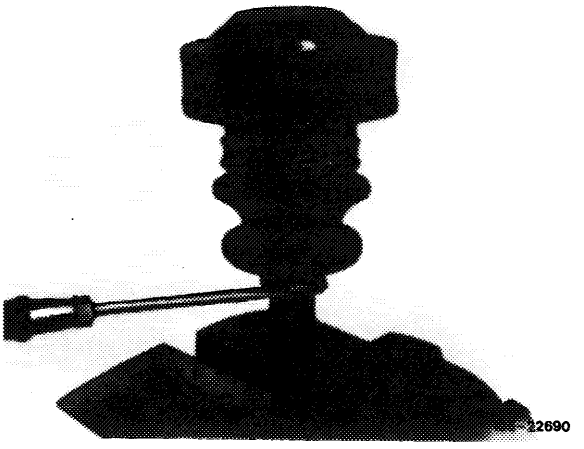


27 Fill synchromesh joint and rubber sleeve with grease.

Attention!
Use specified type of grease and quantity only.

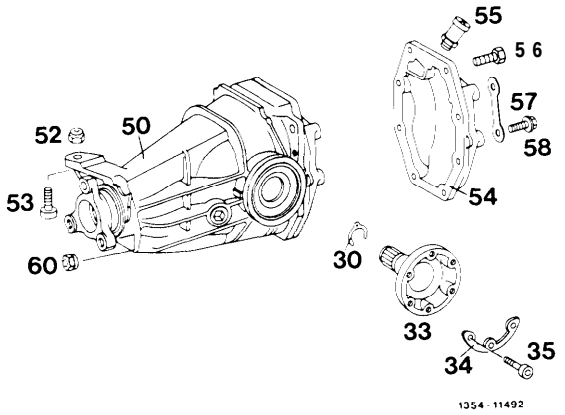
28 Fasten rubber sleeve on sleeve cap and on rear axle shaft with new hose clamp, while pushing sleeve up to bead on rear axle shaft.

Note: The screws of the two hose clamps on one sleeve should point in one and the same direction. On second sleeve, mount clamps in such a manner that the screws are rotated by 180° in relation to first sleeve.



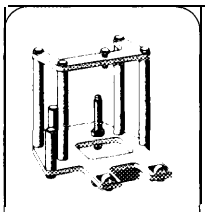
35-670 Removal and installation of connecting flange of rear axle shaft

Rear axle center piece removed

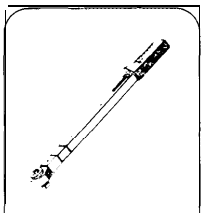


30 Locking ring	Renew, thickness from 1.20 to 1.80 mm for adjusting end play, steps: 0.05 to 0.05 mm
33 Connecting flange without ring-shaped weight	Renew, if heavy score marks of radial sealing ring are showing up
34 Washer	Renew
35 Locking screw	Renew, tightening torque 70 Nm, threads and screw head contact surface lubricated
50 Rear axle center piece	Clean sealing surface, oil type hypoid gear oil SAE 90, filling capacity 0.7 liter (Specs. for Service Products, sheet 235), special tool: Clamping device 201 589 03 31 00
52 Self-locking hex. nut, front	Renew
53 Hex. socket screw, front	Tightening torque 45 Nm
54 Rear axle end cover	Clean sealing surfaces and coat with sealing compound
55 Vent	Renew dirty vent
56 Hex, head screw	Tightening torque 45 Nm
57 Locking plate	Renew
58 Locking screw, rear	Renew, tightening torque 50 Nm
60 Self-locking hex. nut for propeller shaft	Renew, tightening torque 40-50 Nm

Special tools



201 589 03 31 00



001 589 66 21 00

Conventional tool	
Screw driver element for multitooth socket screws M 10 (XZN) 1/2'' square	e.g. Hazet D–5630 Remscheid Order-No. 990 lg–10

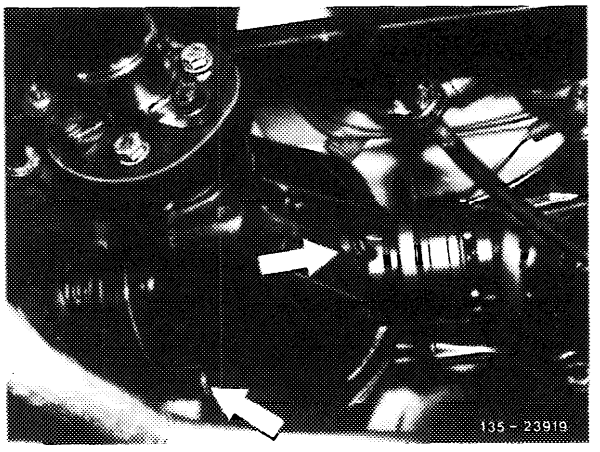
Note

A connecting flange can be replaced only with rear axle center piece removed. Thoroughly clean rear axle housing in range of bearing cap so that no dirt can enter rear axle housing.

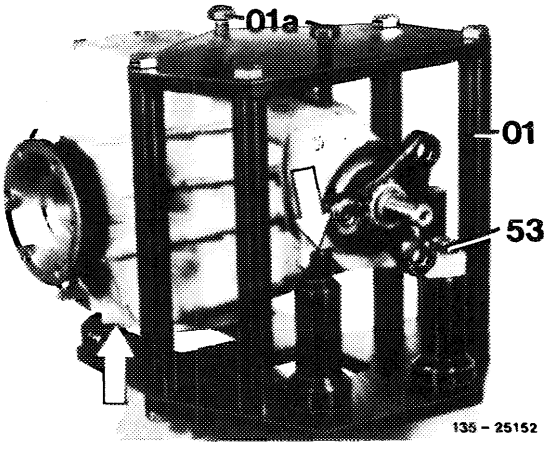
Removal

1 Drain rear axle oil.

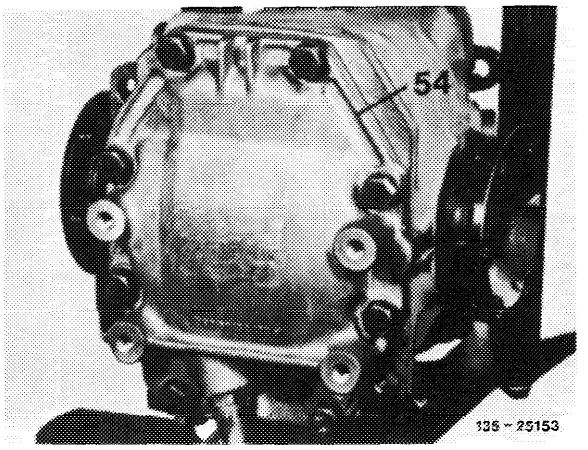
2 Remove rear axle center piece (35-520).



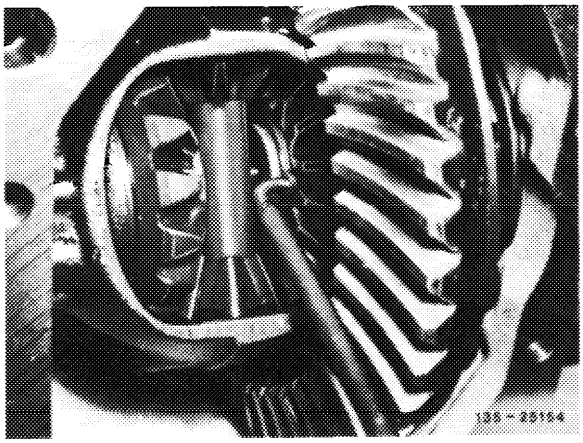
3 Place rear axle center piece into clamping fixture (01) and tighten with hex. socket screw (53) and hex. head screws (01 a). Pay attention to good seat of center piece in clamping fixture (arrows).



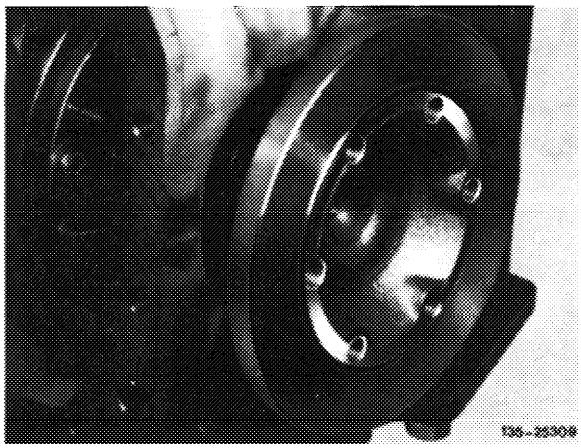
4 Unscrew rear axle end cover (54) and remove.



5 Pull locking ring from connecting flange with pliers or suitable hook and remove from housing.



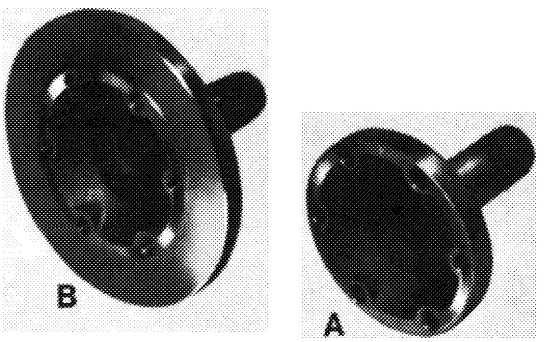
6 Pull connecting flange out of rear axle side gear and remove.



Connecting flange with ring-shaped

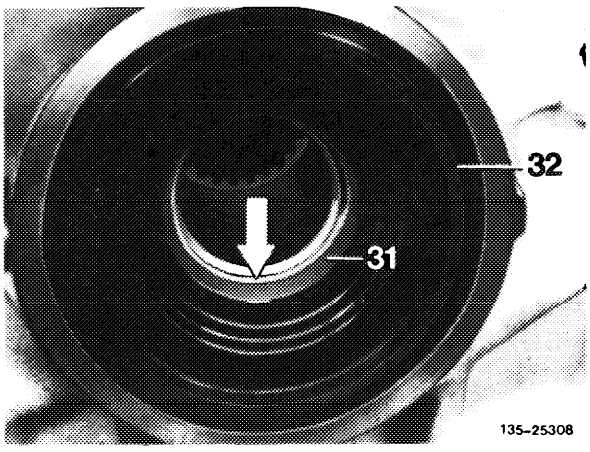
7 Check running surface for radial sealing ring on connecting flange and renew connecting flange if required, if running surface is badly worn out.

Note: As from start of series, models 201.02 are provided with one ring-shaped weight each on connecting flanges. Different installation is not permitted, but exchange like for like. Model 201.1 has no ring-shaped weight,



A Connecting flange without weight
B Connecting flange with weight

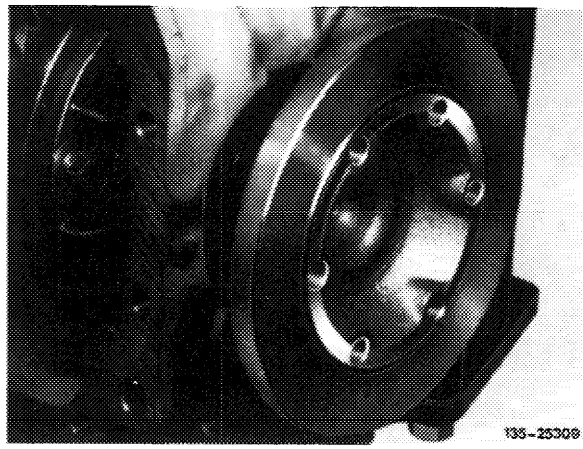
8 Prior to inserting connecting flange, check whether compensating washer (31) is still firmly seated in differential cage (arrow).



31 Compensating washer
32 Radial sealing ring

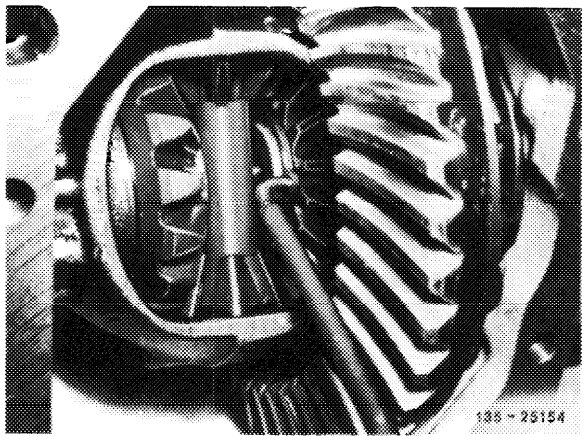
Installation

9 Install connecting flange. For this purpose, use a new locking ring of the same thickness between connecting flange and rear axle side gear.

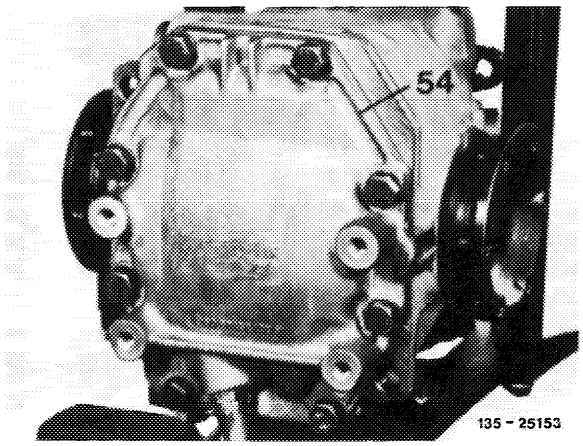


10 Check end play between connecting flange and rear axle side gear.

There should be no noticeable end play; rotation of locking ring in groove should still be possible. If required, mount a thicker or a thinner locking ring.



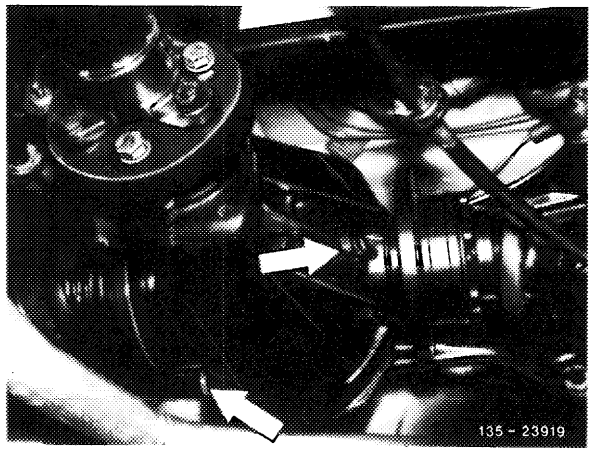
11 Clean sealing surface on end cover and on rear axle housing and coat with sealing compound. Mount rear axle end cover (54) and tighten hex. head screws to 45 Nm.



12 Remove rear axle center piece from clamping fixture.

13 Install rear axle center piece (35-520).

14 Fill-in hypoid gear oil up to bottom edge of oil filler hole.

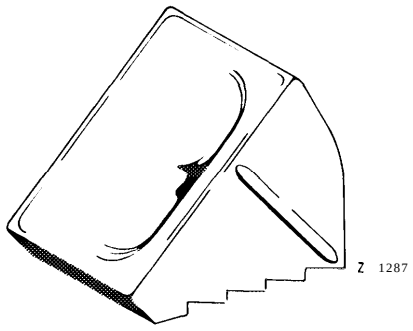


	Job No.
Lifting vehicle with jack	40-010
Positioning of jacking up shoes and jacks	013
Survey rims and tires	100
Rims	102
Tires	104
Tire inflation pressure	106
Snow chains	106
Removing and mounting of wheels	110
Removing and mounting hub cap for torged light alloy rims	113

Note

Carefully lift vehicle to avoid accidents and damage to vehicle. Prior to lifting vehicle with a vehicle jack, be sure to protect vehicle by means of chocks (part No. 110 583 01 75) or the like against moving off.

For safety reasons (risk of tilting) T-sedans model 123 and special vehicles (special body) models 114, 115 and 123 should be lifted in empty condition only.



On level ground, protect one wheel of opposite vehicle end against moving off.

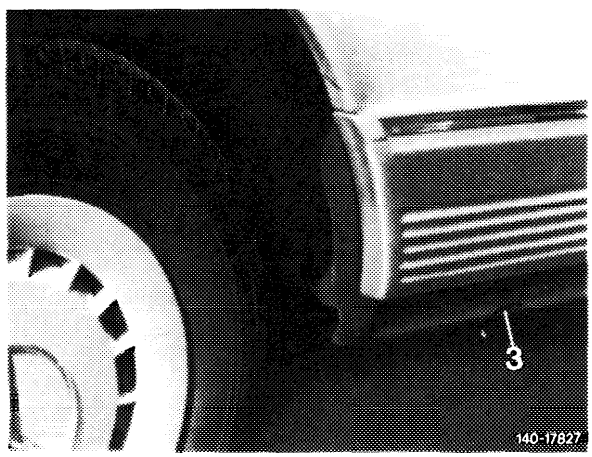
On a gradient, protect both wheels of opposite vehicle end against moving off.

On vehicles with manual transmission, engage first gear step. On vehicles with automatic transmission, place selector lever into position **''P''.**

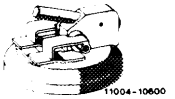
Step down energetically on parking brake pedal.

Push mounting pin of vehicle jack completely into respective plug-in tube **(3)** in outer longitudinal member of frame.

Position vehicle jack vertically — also on a gradient.

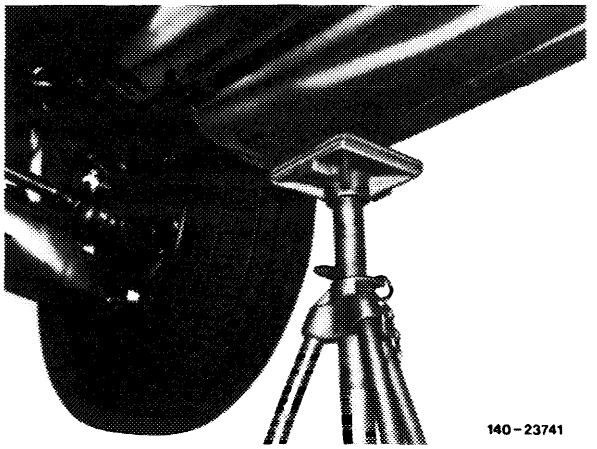


Special tools

Jacking-up shoe required 4 each		123589 11 6300

C. Model 201

Position jacks directly at mounting points (hard rubber plates) at front and rear similar to lifting with lifting platforms at outer frame side members. However, only jacks with a flat supporting surface are suitable for this purpose.



Model	Year	Rim	Off set	Summer tires Radial tires (Tubeless) Tires Size	Winter tires Radial tires (Tubeless) Tires Size
201.024	1984-1985	5J x 14 H2	50 mm	175/70 R 14 82T or 84T	175/70 R 14 82Q or 840 M + S or 175/70 R 14 82T or 84T M + S
201.122	1984-1985	5J x 14 H2	50 mm	175/70 R 14 82S or 84S	175/70 R 14 82Q or 84Q M + S or 175/70 R 14 82T or 84T M + S
20 1.024	1986	6J x 15 H2	49 mm	185/65 R 15 87H	185/65 R 1587T M+S
201.126	1986-	6J x 15 H2	49 mm	185/65 R 15 87T or 87S	185/65 R 15 87T M + S
201.034	1986-1987	7J x 15 H2	44 mm	205/55 VR 15	205/55 R 15 87T M + S
201.028	1987-1988	6J x 15 H2	49 mm	185/65 R 15 87H	185/65 R 15 87T M + S
201.029	1987-	6J x 15 H2	49 mm	185/65 VR 15	185/65 R 15 87T M + S
201.128	1987	6J x 15 H2	49 mm	185/65 R 15 87H	185/65 R 15 87T M + S

Note

Each vehicle should be provided with rims of the same version on principle.

Mount only rims approved by us. When in doubt, the MB part no. adjacent to general designation will be decisive.

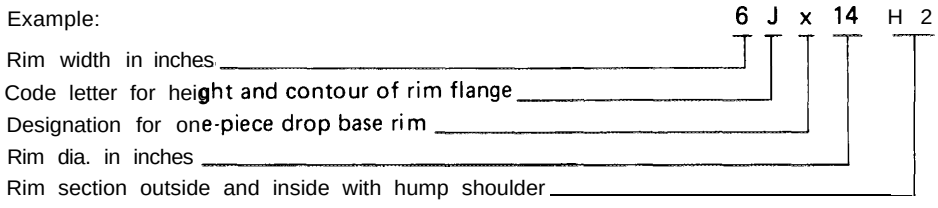
Designation and part no. are located on wheel disk (on steel plate and light alloy rims outside, on forged light alloy rims inside). As an additional identification a Mercedes star is impressed on steel plate rims starting July 1973, on light alloy rims from start of production.

The additional identification A for symmetrical rim section, B for asymmetric rim section is no longer used on present passenger car rims, since only wheels with asymmetric rims are mounted. Mercedes-Benz wheels have an asymmetric rim and are provided outside and inside with a normal hump.

Rims with a hump at outside only are carrying the designation “H”. At high air loss of tire, the hump prevents sliding of tire bead into well-base rim, that is, a sudden venting of tire. For tubeless tires at least one hump on rim outer side is specified.

If, in connection with a change of tire size, vehicles are converted to another rim size, approved by the company, attention must be paid to national laws and regulations prior to conversion.

Rim designations



a Rim width in inches

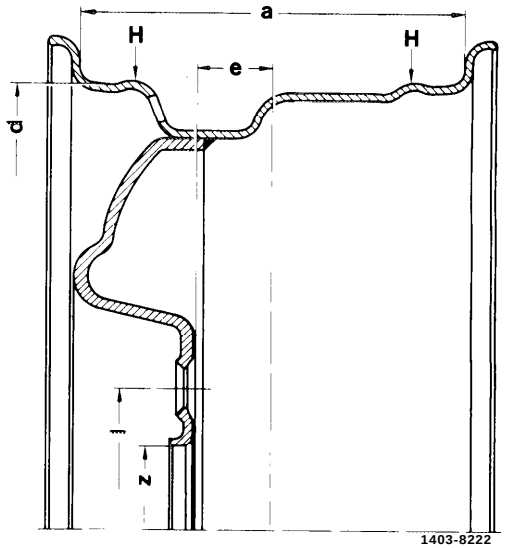
d Rim dia. in inches (measuring points dia.)

e Rim offset – ET
(distance from rim center to contact surface of wheel disk, measured in mm)

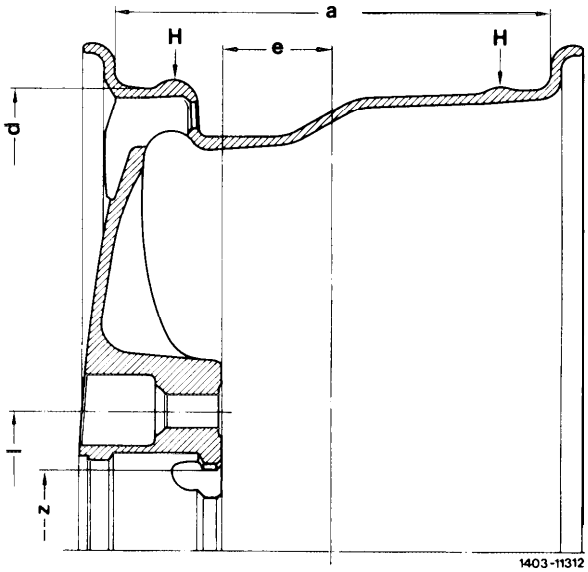
I Hole circle dia. = 112mm

z Centering bore dia. = 66.5 ± 0.1 mm

H Hump (rim with safety shoulder)



Steel plate and light alloy rim



Forged light alloy rim

Rim designation

1 Rim designation e.g. 6 J x 14 H 2

2 Part no. e.g. 108 400 14 02

3 Identification as original Mercedes-Benz part.

4 Production code number or production date

a) Identification of production plate including month/year up to February 1978, e.g. = January 1978

b) Identification of production date including week/year starting March 1978, e.g. 13 78 = 13th week 1978

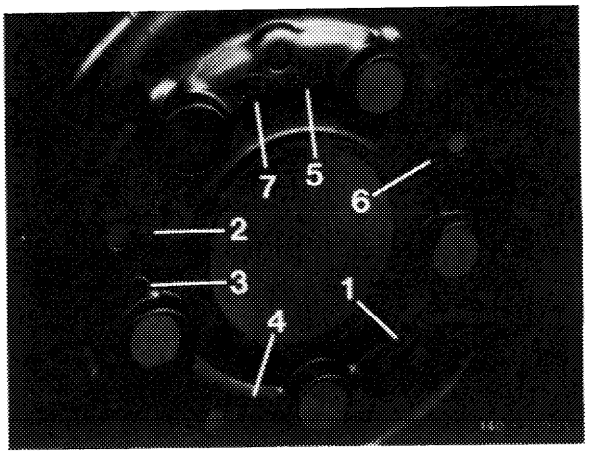
5 Trademark of manufacturer

6 Part number of manufacturer

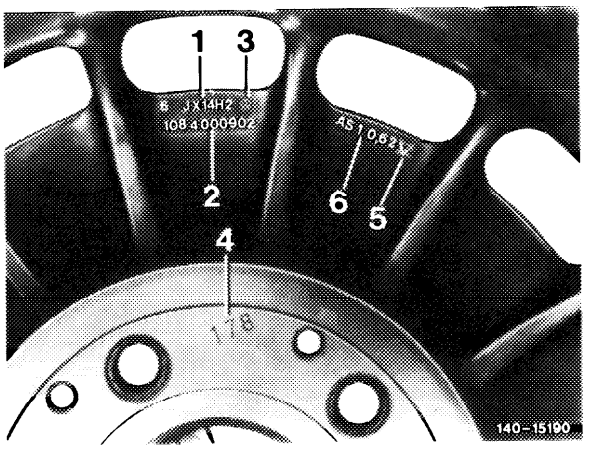
7 Rim offset – ET
Designation of rim offset:

a) On steel plate rims for the first time with ET 50 (rim 5 J x 14 H2 only) starting with production code number 41 81.

b) On forged light alloy rims starting with production code number 32 81.

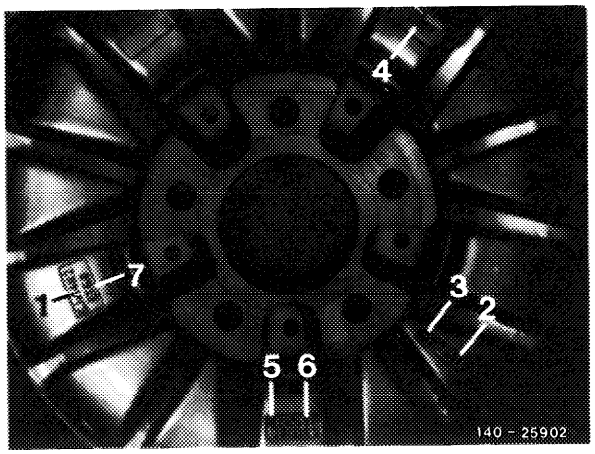


Identification on steel plate and light alloy rims outside



Identification on forged light-alloy ri ms inside

Version for models 107, 114, 115, 116, 123 and 126



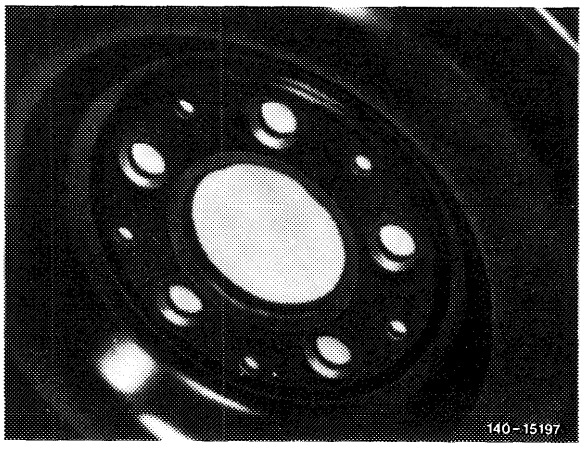
Version for model 201

Steel plate rims

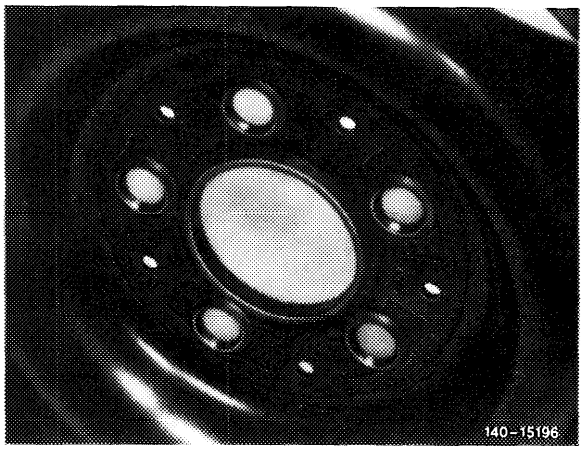
On steel plate rims the seat of the tire bead on radius toward rim flange and on rim flange itself, as well as the outer surfaces, particularly on inside of wheel, should not show any rust marks. Prior to fitting a new rubber valve, clean contact surfaces on rim. If required, derust surfaces and apply fresh paint.

Particularly during the six winter months, check rims inside for contamination and clean, if required.

For steel plate rims the design of the fastening eyes is decisive for accurate fastening of wheels. Wheels with raised fastening eyes provide a very high degree of safety against excessive tightening of spherical collar bolts as compared with recessed fastening eyes used on former types of wheels.



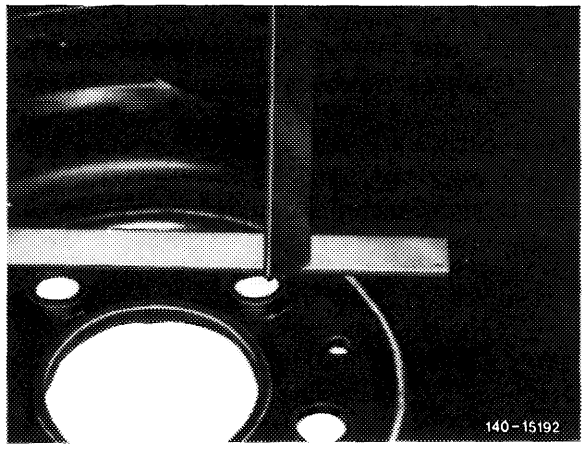
1st version
Wheel with recessed fastening eyes

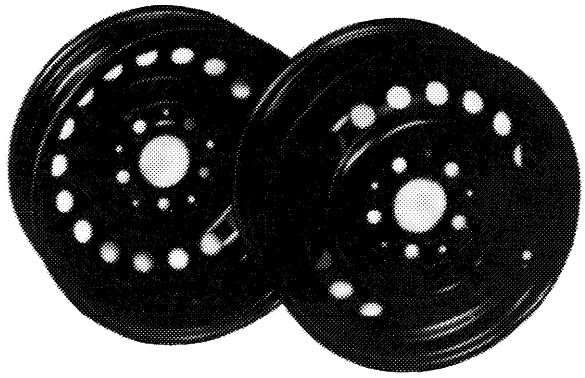


2nd version
Wheel with raised fastening eyes

Wheels with reduced inside spacing in relation to contact surface caused by often, excessive tightening of spherical collar bolts should no longer be mounted.

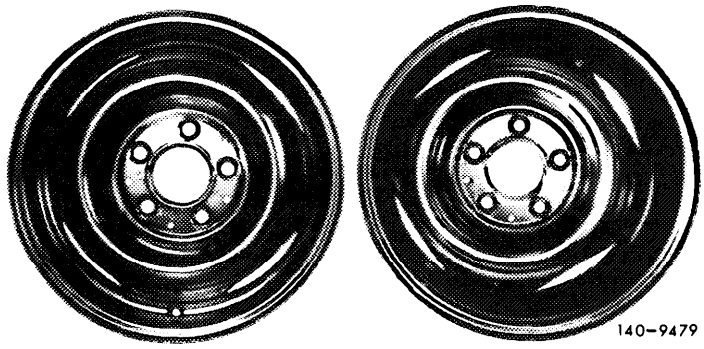
On a removed wheel, the distance between the contact surface and the range of the fastening eyes should amount to at least 0.7 mm. For measuring, use a straightedge and a sliding caliper with depth gage.



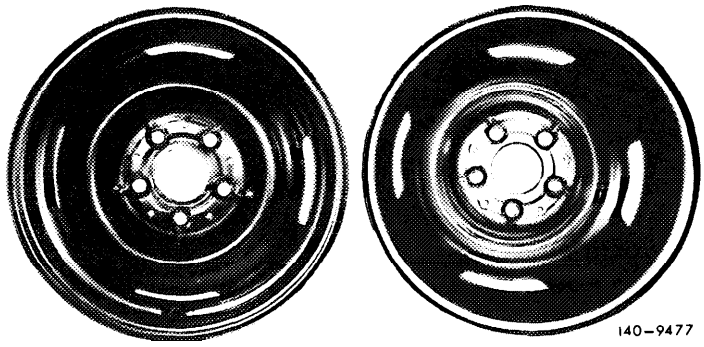


Steel plate rim
5 J x 14 H 2
without inner venting ring
wheel disk with 18 vent holes
of 20 mm dia.

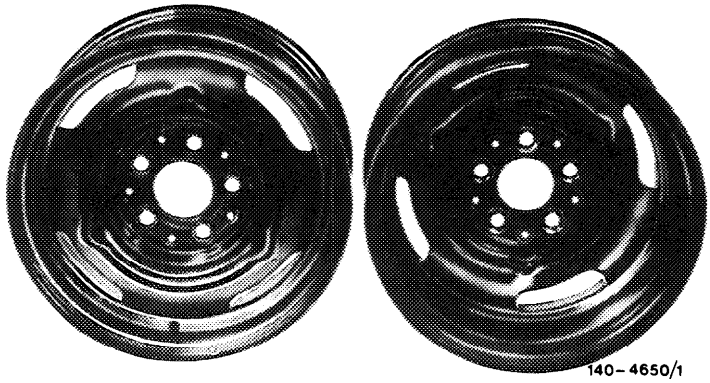
140-23735



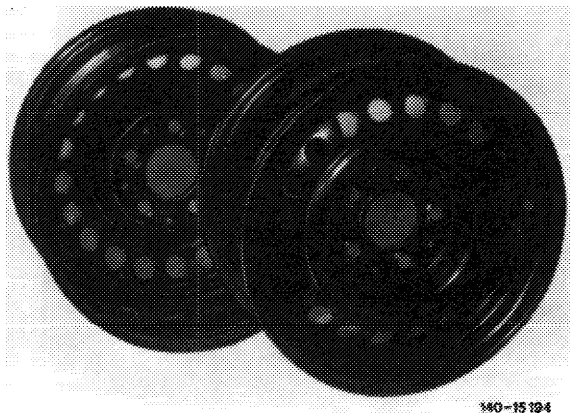
Steel plate rim
5 1/2 J x 14 H 2
(version up to September 1977)



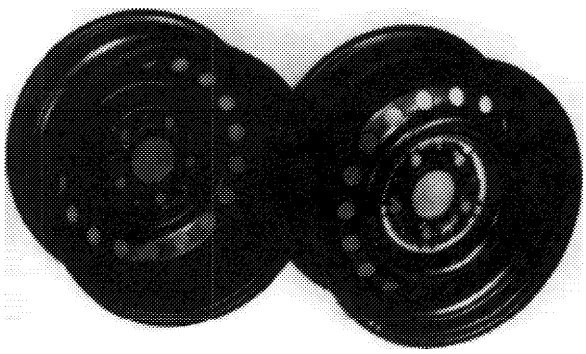
Steel plate rim
5 1/2 J x 14 H 2
(version starting October 1977)



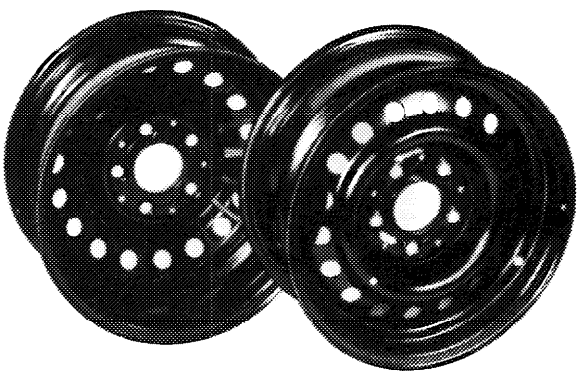
Steel plate rim
6 J x 14 H 2
(version up to December 1969)



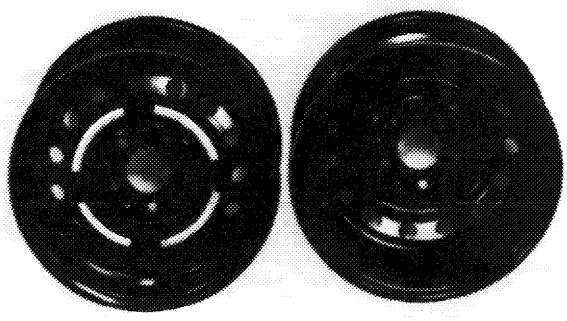
Steel plate rim
6 J x 14 H 2
without inner venting ring
Wheel disk with 20 vent holes of 28 mm dia.
(version starting January 1970 up to October 1981)



Steel plate rim
6 J x 14 H 2
without inner venting ring
Wheel disk with 18 vent holes of 25 mm dia.
(version starting November 1981)

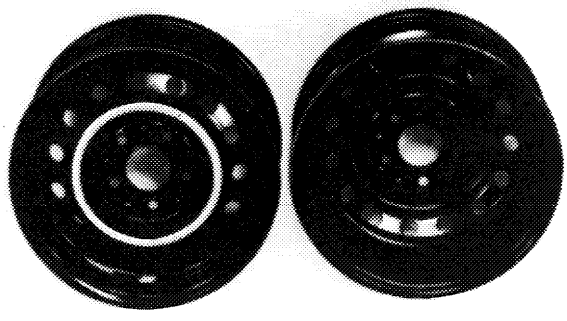


Steel plate rim
6 J x 14 H 2
with inner venting ring
Wheel disk with 18 vent holes of 25 mm dia.



Light alloy rim
5 1/2 J x 14 H 2

140-17054/1



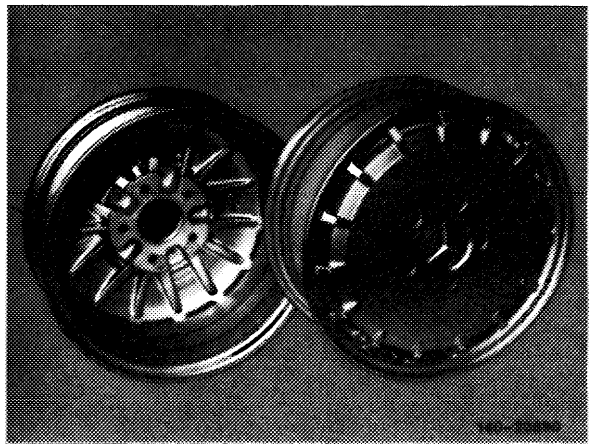
Light alloy rim
6 J x 14 H 2

140-17054

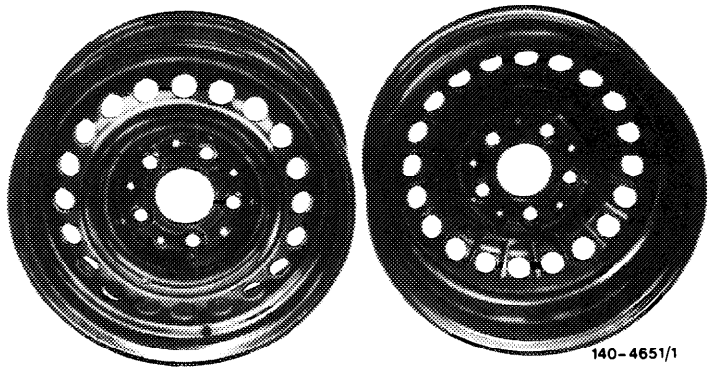
Forged light alloy rims

The rim flanges of light alloy rims may show increased wear under the following operating conditions: high load, trailer operation, not enough tire inflation pressure, use of unrecommended tire makes or tire versions, accumulation of dirt, sand and road salt (particularly during winter months). Prior to mounting a new tire, check rim flanges for wear. Remove burr, if any. Replace rim as soon as wear limit is attained (40-120).

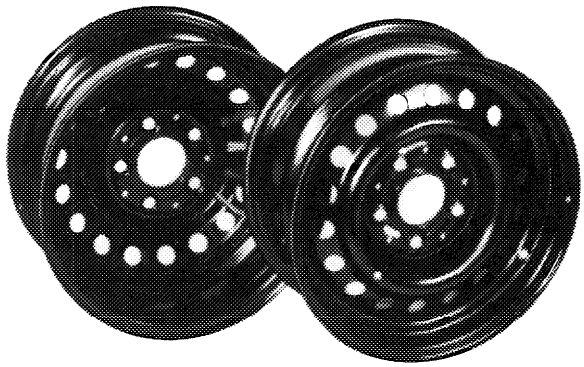
Particularly during the six winter months, check rims inside for contamination and clean, if required.



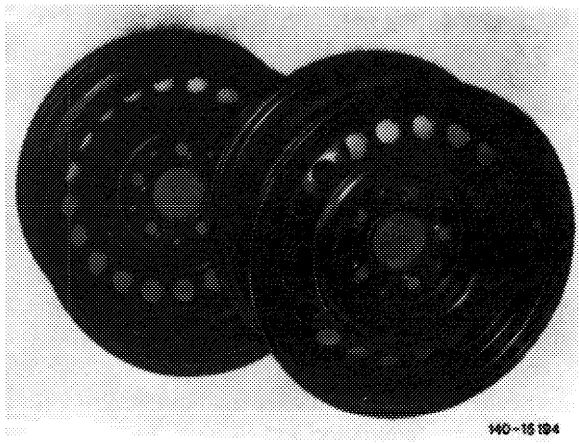
Forged light alloy rim
5 J x 14 H 2



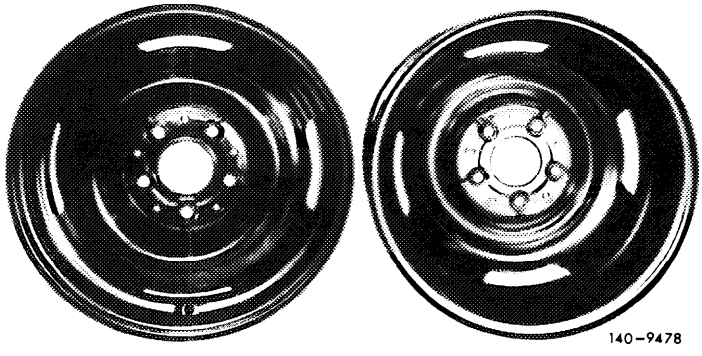
Steel plate rim
6 1/2 J x 14 H 2
with inner venting ring
Wheel disk with 20 vent holes of 28 mm dia.
(version up to December 1979)



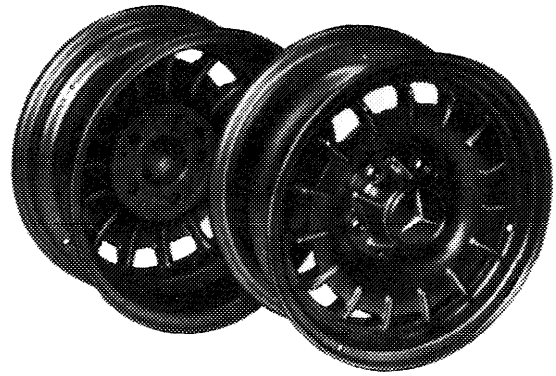
Steel plate rim
6 1/2 J x 14 H 2
with inner venting ring
Wheel disk with 18 vent holes of 25 mm dia.
(version starting January 1980)



Steel plate rim
6 1/2 J x 14 H 2
without inner venting ring
Wheel disk with 18 vent holes of 25 mm dia.

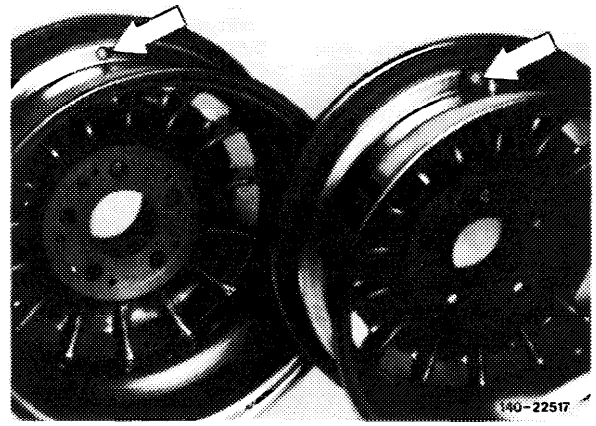


Steel plate rim
5 1/2 J x 15 H 2



140-15195

Forged light alloy rim
5 1/2 J x 14 H 2, 6 J x 14 H 2, 6 1/2 J x 14 H 2,
7 J x 15 H 2



140-22517

Version up to September 1981
(**wihtout** cavity on valve seat –
for special metal valve)

Version starting October 1981
(**with** cavity on valve seat –
for rubber valve)

Upkeep and cleaning of forged light alloy rims

Light alloy rims are coated with a special metallic paint. For this reason, they must be serviced and cleaned with paint-protecting compounds only, just like the vehicle body. Any damage to clear paint surface may lead to peeling.

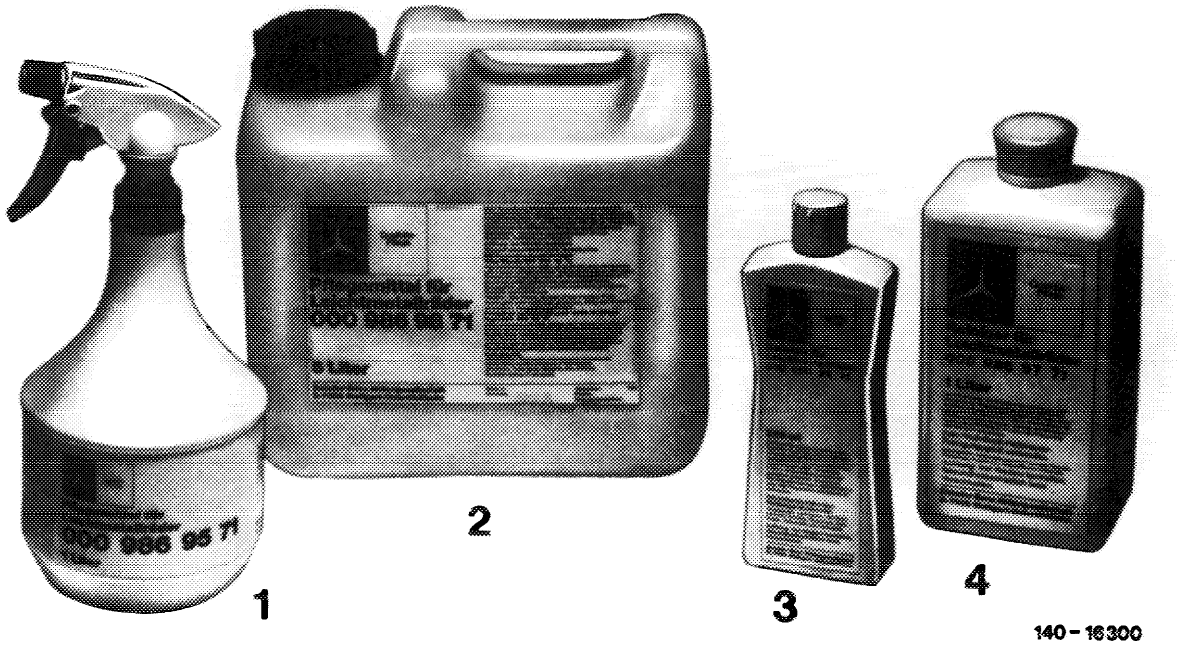
For this reason, the following instructions should be observed and maintained for upkeep and cleaning.

1. Never treat light alloy rims with abrasive compounds, compounds or sponges which are containing acids or are heavily alkaline. High-pressure hot-water cleaning units should also not be used.

2. Depending on accumulated dirt, clean wheels once a week, whenever possible. Normal dirt including abrasive dust from brake linings can be removed with lukewarm water, a mild solvent for removing dirt (of the type used for cleaning vehicle body) and a sponge. Also use lots of water.

If the wheel cleaning job in combination with a normal vehicle wash is not enough, special preserving and cleaning compounds for light alloy rims are now available (used after precleaning with water).

If repainting of light alloy rims is required, refer to paintwork repair instructions.



Service compounds and cleaners for light alloy rims

1 Spray bottle (1 liter)
2 Canister — refill pack (5 liters)
3 Bottle (1/4 liter)
4 Bottle – refill pack (1 liter)

Materials

Designation	Container size	Part No
Service compound for light alloy rims	1-liter spray bottle	000 986 95 71
	5-liter canister	000 986 98 71

For regular treatment of rims, also if heavily contaminated, but not for tightly sticking residual dirt. Compound has preserving effect.

Cleaner for light alloy rims	1/4 liter bottle for approx. 5 treatments	000 986 94 71
	1-liter bottle	000 986 97 71

For removing tightly sticking dirt which cannot be removed with our service compounds for light alloy rims. After a cleaning job with this compound a subsequent preservation with gloss preservation 000 986 06 74 or service compound for light alloy rims 000 986 95 71 must be performed.

Rims

Model year	Material	Dimensions	Part No
1984	Alloy	5 x 14	201 400.07 02
1985	Alloy	5 x 14	201 400 07 02
	Steel	5 x 14	201 40005 02
1986	Alloy	6 x 15	201 400 12 02 201 400 1402
1987	Alloy	6 x 15	201 400 15 02 201 400 16 02

Note

Use only tires recommended by us. Pay attention to our tire recommendations particularly with regard to light alloy rims.

As replacements or for a conversion, use tires of similar construction, similar make and similar version for all rims. We do not approve combination of belted tires (radial) with conventional tires (diagonal), steel belted tires with textile belted tires, as well as winter tires (M+S) with summer tires.

In the event of replacements, tires approved for higher speeds may of course be used instead of the tires specified for the respective model (example: belted tires 195/70R 14 90 H instead of 195/70R 14 90 S).

When replacing tires, include spare wheel as a road wheel, but only if depth of tire treads and tire version are similar. Avoid excessive ageing of tires!

New tires should be run in prior to demanding full efficiency. About 100 km driven at moderate speed are enough. Avoid sharp acceleration and braking.

Storage areas for keeping tires in stock should be dark, cool and dry. Avoid drafts as much as possible, since oxygen accelerates ageing of rubber compound.

Place tubes upright in shelf (min. 10 cm ground clearance) or in sets one upon the other on wooden gratings.

On removed tires, put tubes into tires lightly inflated and dusted with talcum, make sure that tires are not coming into contact with gasoline, oil or technical greases.

Apply safety rules as a protection against fire!

If vehicles are converted to a different tire size than the one ex factory, pay attention to national laws and regulations prior to conversion.

For tube type tires use only new tubes of the same make and specified designation.

For tubeless tires, insert valves of specified version into rims (refer to 40-l 20).
When renewing a tire, also exchange rubber valve as a safety measure. Prior to inserting the new rubber valve, clean contact surfaces on rim. If required, de-rust surfaces and re-paint.

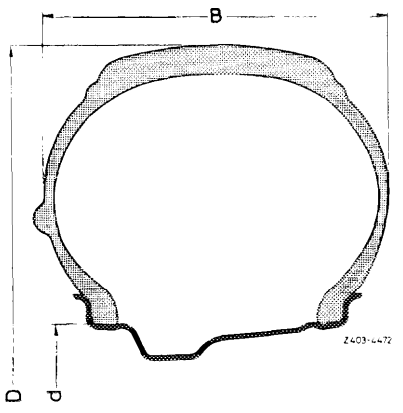
Screw only metal or rigid plastic valve caps with rubber sealing rings, part no. 007757 008600, on valves.

1 Tire designation

Example: 195/70 R 14 90 H[1])

Identification for nominal width of tire in mm
Designation for tires of series 70
(cross section ratio height: width 70 %)
Code letter for belted tires in radial type
Rim dia. in inches
Code number for load carrying capacity of tire
Code letter for max. speed up to 210 km/h

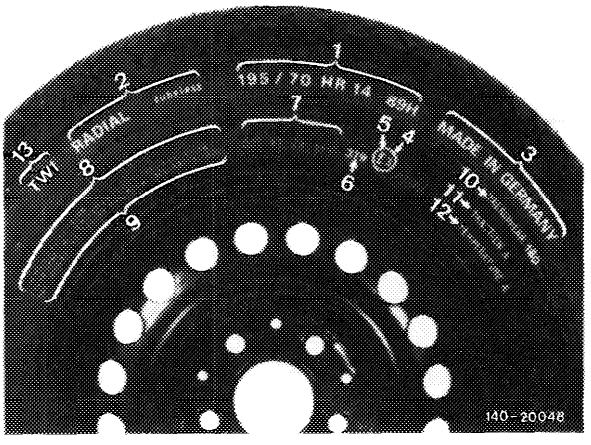
[1]) **For designation of tires according to ECE-regulation no. 30 (starting 1978), with the exception of VR-version tires, the operational identification, that is, the code letter for the permissible max. speed and the code number for load carrying capacity is named following the tire designation. The former designation of tire was 195/70 HR 14 or as a temporary designation 195/70 HR 14 90 H.**



B = Nominal width of tire in mm
D = Tire OD
d = Rim dia. in inches

2 Additional tire designations

Radial	= designation for belted tires
tube-type	= tube-type tires or assembly with tube
tubeless	= tubeless version tires
M + S	= mud and snow tires



3 Indication of manufacturing country

4 Country code number for licence number

Example:
3 = Italy, 1 = Germany, 2 = France.
0132239 = registration number for type or model test

5 Europe licence number

E = Europe

6 Production date code number

The 3-digit code or production code number is at end of letter and number sequence beginning with DOT and located in bead range of outer tire flanc.

Number 1 and 2 = production week
Number 3 = last digit of production year

7 (USA) licence number

DOT = Certificate of Department of Transportation

XT = Manufacturer's code

J9 = Size code

XKNC = Type or version code

8 (USA) **identification for tire understructure**

Example:
SIDEWALL 2 PLIES RAYON = Sidewall of carcass comprises 2 layers rayon cord.

TREAD AREA 2 PLIES RAYON + 2 PLIES STEEL + 1 PLY NYLON = Tread zone has 2 layers rayon cord of carcass and 2 layers steel cord + 1 layer Nylon of belt.

9 (USA) identifications for max. wheel **load and max. air pressure**

Example:
MAX. LOAD RATING 1340 LBS =
max. permissible wheel load 1340 pounds
MAX. PERM. INFL. PRESS 36 PSI =
Max. permissible air pressure 36 pounds per square inch

10 (USA) **identification for tread wear**

TREAD WEAR 160 = Wear code number in % as compared with an average US comparison tire.

11 (USA) identification for anti-skid properties

TRACTION A = Identification for deceleration on wet asphalt and concrete.

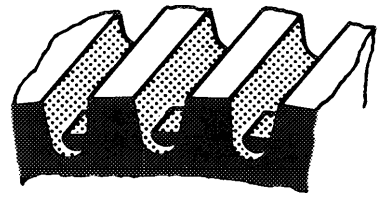
12 (USA) identification for temperature stress

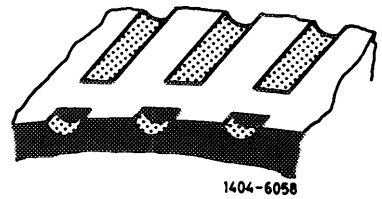
TEMPERATURE A = Identification for temperature behavior during fast dynamometer run

13 Tire wear limit

The wear limit of 1.6 mm for tire tread specified for USA and lately for other countries has already been indicated for a number of years by the ''TWI'' tread wear indicator on tire.

These humps are 1.6 mm high and embedded in base of tread at 6 points of circumference and will show up as cross stripes on tread when the wear limit is attained.





1404-6058

Permissible max. speed for passenger car belted tires (radial)

Code letter Q up to 160 km/h
Code letter R up to 170 km/h
Code letter S up to 180 km/h
Code letter T up to 190 km/h
Code letter H up to 210, km/h
Code letter V above 210 km/h

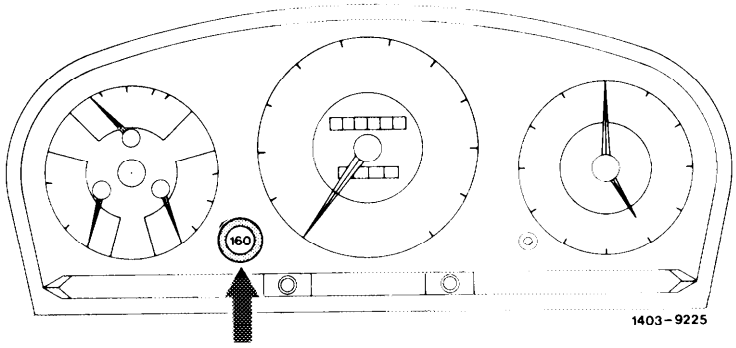
Sticker for M + S tires

Regulations in the Federal Republic of Germany are specifying that the legally permitted maximum speed for M + S tires "should be clearly displayed within view of driver", if the max. speed permitted for M + S tires is below the max. speed of the vehicle (refer to vehicle documents).

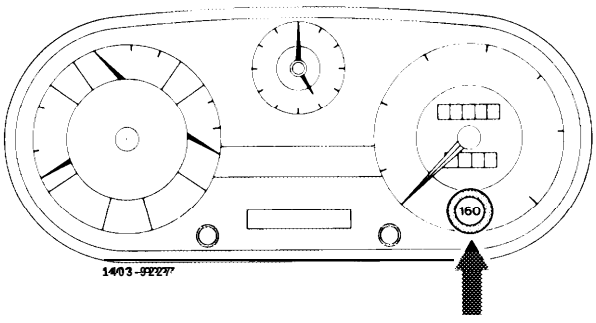
This sticker may be attached to the spot specified for this purpose only. On models 123 and 126 do not place this sticker on glass of instrument cluster, since this glass may be damaged when the residual glue is removed (plexiglass).

Sticker for M + S tire version
Q = up to 160 km/h

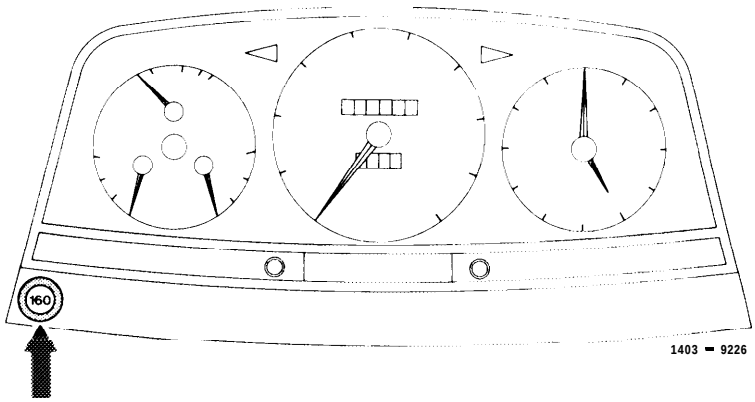
Sticker for M + S tire version
T = up to 190 km/h



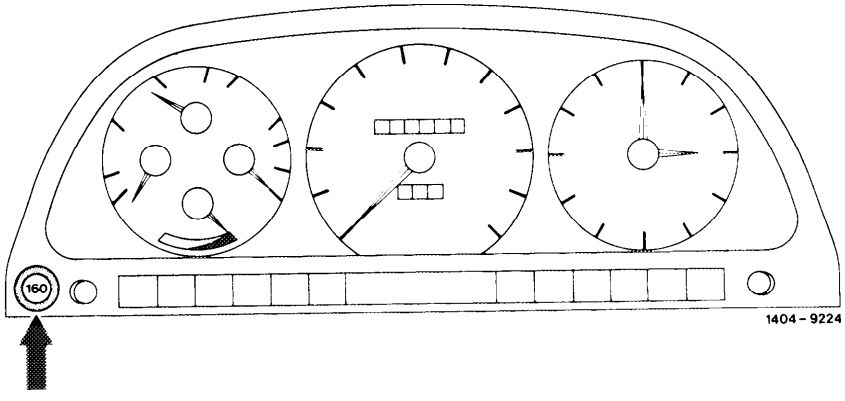
Models 107, 116



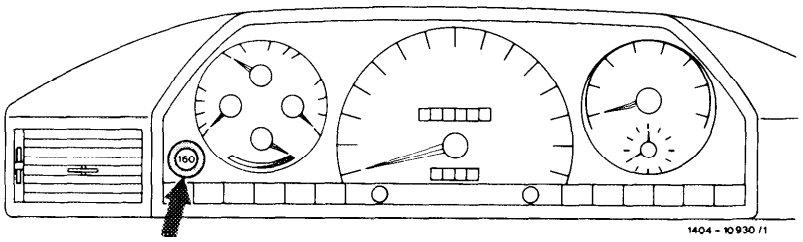
Models 114, 115



Model 123

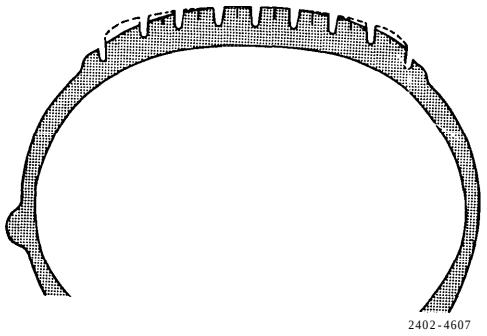


Model 126



Model 201

Tire wear



When evaluating tire wear patterns proceed as follows:

Front axle

On front wheels, a slightly higher wear of tire shoulders as compared with center of thread is normal, while the wear on tire shoulder facing the road center (e.g. with righthand traffic on outside of lefthand wheel, on inside of righthand wheel) may be more distinctive.

Causes of increased tire wear

1. Not enough inflation pressure, influencing both outer and inner shoulder to the same extent.

2. Predominantly city or highway driving, as well as sports style driving. The habit of driving around sharp bends while decelerating may lead to increased shoulder wear. Wear occurs mostly on outer shoulders, with righthand traffic particularly more clearly at lefthand front wheel.

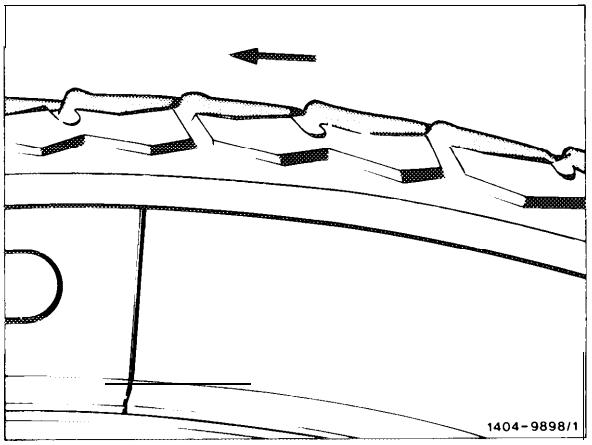
3. Deviations of toe-in. Even minor deviations beyond normal tolerance range may lead to increased wear on tire shoulders, particularly on white tires (starting with series 70) each time on both wheels. At insufficient toe-in, increased wear will show up on inner shoulders or at increased toe-in on outer shoulders. In the event of toe-in deviations, which are clearly exceeding the tolerance limits, the wear may extend from tire shoulder almost to center of tread, in which case the tread may be slightly roughened.

If deviations of pivot point position from nominal value are too high, increased shoulder wear may occur on both wheels as well as on one wheel only, since changes of toe-in during deflection will be too high. A pivot point which, for example, is substantially too low will lead to an increased change of track in minus direction during downstroke, while a pivot point which is substantially too high will lead too early to a change of track in minus direction during upstroke.

If the track difference angle deviates too much, an unfavorable wheel position may result in influences which lead to increased shoulder wear.

4. In dependence of tire version and tire tread, the wear on shoulders, predominantly outside, may have a saw-toothed shape. This wear pattern is particularly distinctive on tires with a shoulder zone open in outward direction, e. g. sports style summer tires and M + S tires.

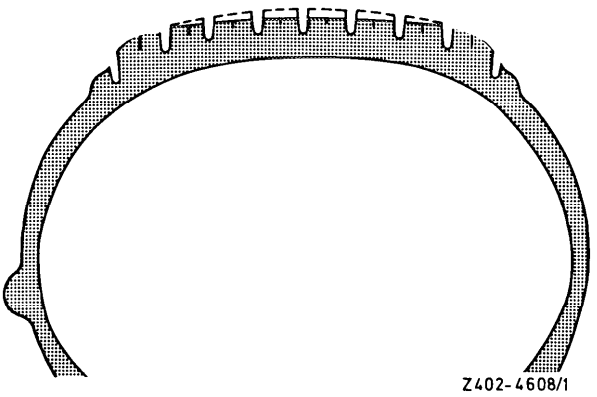
Saw tooth-shaped wear occurs predominantly on front axle, but to a lesser degree also on rear axle.



Saw tooth-shaped wear on front wheel tires

Rear axle

On rear wheels, wear is normally distributed across entire tire tread surface, but may be slightly higher in tread center than at the shoulders.



Causes of increased wear

1. Depending on load of vehicle rear end (on vehicles without level compensation increased minus camber at high load) wear on inner side of tread is higher than on outer side.

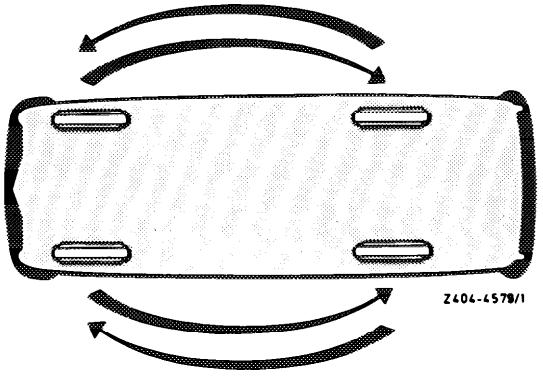
2. If toe-in is wrong, the same applies as explained in section “front axle”.

Rotation (switching) of wheels

Summer tires and winter tires (M + S):

For max. mileage while simultaneously maintaining good driving characteristics.

Rotate (switch) wheels depending on tire wear (that is, between 5000 and 10,000 km as shown by experience) while keeping driving direction of wheels the same.



However, the wheels should be rotated (switched) prior to attaining a distinctive, characteristic wear pattern, since otherwise driving characteristics will turn to the worse. Optimal driving characteristics, in turn, can be obtained only if the wheels are left in their position or are rotated (switched) at very short intervals (mileage).

Rebalancing of wheels may be required depending on driving style, wear pattern and condition of tires.

Upon rotation (switching) of wheels, make sure of correct tire inflation pressure.

Note

The tire inflation pressure specified by vehicle manufacturer is determined in accordance with the following criteria:

1. Consideration of axle loads on vehicle under influence of full load.

2. Consideration of attainable max. speed of respective vehicle.

3. Good driving characteristics, also for sports-style driving.

4. Satisfactory driving comfort.

5. Favorable tire wear pattern.

A wrong tire inflation pressure, particularly when the air pressure is too low, will influence the driving characteristics and the life of the tires depending on extent of deviation from specified value, and will also lead to an additional, higher fuel consumption.

If the tire inflation pressure is too low, flexing and thereby excessive heating will increase. The understructure of such a tire will lose its compactness. The results: tread and belt will come loose. Depending on size of reduced inflation pressure and driven speeds, the life of the tire will become shorter, while even short-term "inflation pressure sins" may lead to permanent damage.

On the other hand, a tire inflation pressure which is essentially too high (higher than the values named for fast driving or for max. loads) incorporates the disadvantages of a high loss in comfort, while the smaller tire road contact area results in a worsening of driving characteristics and on a wet road also in a higher trend toward aquaplaning.

Notes concerning tire inflation pressure checkup

1. Check inflation pressure of tubeless tires every two weeks.

On tube-type tires, checking inflation pressure once a week will be of advantage.

2. Measure inflation pressure as much as possible when tires are cold, while taking the respective outside temperature into account. Here, approx. 10 °C are equal to an air pressure change by 0.1 bar.

Example 1

The specified air pressure is valid if the temperature of the tires is in accordance with outside temperature.

Example 2

If the temperature of the tires is equal to room temperature (ambient temperature) e. g. + 20 °C, and the outside temperature amounts to approx. 0 °C, the tire inflation pressure must be set 0.2 bar higher than the specified air pressure.

3. if the inflation pressure is measured on warm tire, an increase up to 0.5 bar must be taken into consideration depending on extent of heating up caused **for example by fast driving on a highway, by hot weather or by exposure to sunshine. Following normal driving, the increase in air pressure will amount** to approx. 02. bar.

Never deflate warm tire.

4. If an inflation pressure checkup on a single wheel will always show a higher drop in inflation pressure than on the other tires, the respective wheel should be checked.

The following causes may be responsible:

a) Penetration of foreign bodies.

b) Damaged tread or side wall.

c) Leaking valve bodies or valve elements (refer to item 4).

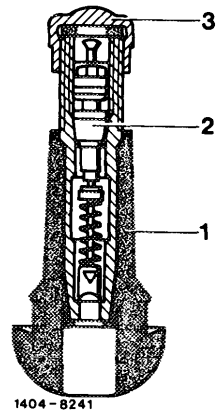
d) On tubeless tires leak between tire bead and rim.

e) On tube-type tires, leaking innter tube.

f) On tubeless tires leaking rim e. g. crack in welding seam or faulty welding on steel plate rims or porous spot on cast light alloy rims (products from other manufacturers).

5. If the valve cap is not screwed on again following a tire inflation pressure checkup, penetrating dirt may settle at edge of valve element during next inflation pressure checkup and will subsequently result in a creeping inflation pressure loss.

6. Use only metal valve caps or valve caps made of hard (rigid) plastic material with rubber sealing ring recommended by us. In contrast to caps made of soft plastic material, these caps guarantee additional sealing in the event of a leaking valve element.



1 Valve body
2 Valve element
3 Valve cap with rubber sealing ring

Cold tire inflation pressures

Model	Load	Front pressure bar/psi	Rear pressure bar/psi
201.024	Partial	2.0/29	2 2 32
	Max	2.2/32	2.5136
201.034	Partial	2.2/32	2.4'35
	Max	2.4/35	2.8 41
201.028	Partial	1.8/26	2.0/29
	Max	2.0/29	2.3/33
201.029	Partial	1.8/26	2.01'29
(MY1987)	Max	2.0/29	2.3/33
201.029	Partial	1.9/27	2.0/29
(MY1988)	Max	2.0/29	23/33
201.122	Partial	1.8/26	2.0129
	Max	2.0/29	2.31'33
201.126	Partial	1.8/26	2.01'29
	Max	2.0/29	2.3133
201.128	Partial	1.8/26	2.0/29
	Max	2.0/29	2.3133

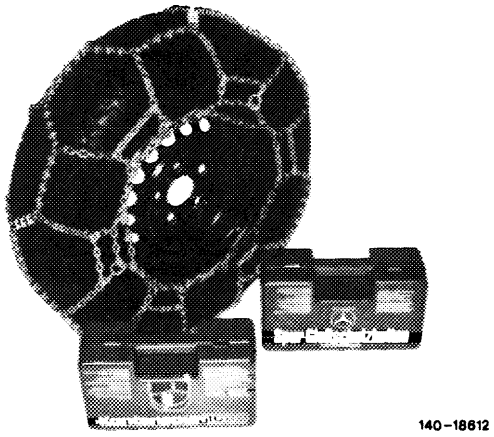
Tire inflation pressure labels

Model	Part Number	Color Base/Letters
20 1.024	201 584 05 39	red/silver
20 1.034	201 584 13 39	silver/red
201.028	201 584 05 39	red/silver
201.029 (MY 1987)	201 584 05 39	red/silver
201 029 (MY1988)	201 584 22 39	silver/red
201.122	201 584 05 39	red/silver
201 126	201 584 05 39	red/silver
201.128	201 584 05 39	red/silver

Remove wheel caps.
Retension snow chains after driving for a short distance!
When driving with snow chains, do not exceed max. speed of 50 km/h!
On roads free of snow, drive with restraint for safety reasons and to protect chains.

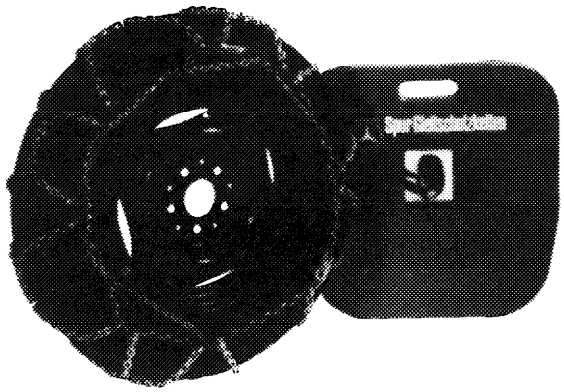
Mercedes-Benz non-skid chains with gripping studs
(up to 1982)

Tire size	Part no.	Code no.[1])
175 R 14	000 583 66 16	07 325
185 R 14	000 583 68 16	17 328
195/70 R 14	000 583 89 16	16 327
205/70 R 14	000 583 81 16	16 329
215/70 R 14 185 R 15	000 583 88 16	16 331


140-18612

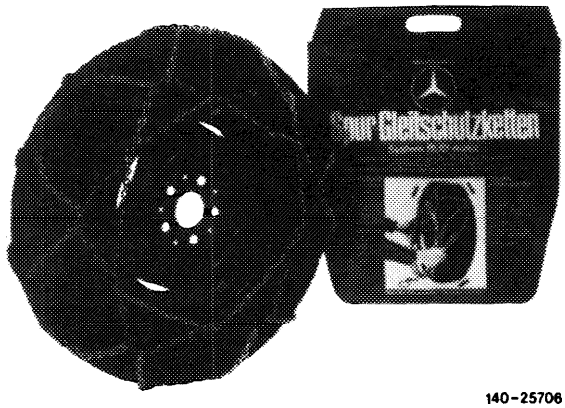
Mercedes-Benz nonskid chains with gripping studs
RUD-matic system (starting 1983)

Tire size	Part no.	Code no.[1])
175/70 R 14	201 583 00 16	46 320
175 R 14	123 583 00 16	46 325
185 R 14 195/70 R 14	1075830016	46 328
205/70 R 14	1265830016	46 329
215/70 R 14 185 R 15	1165830016	46 331
205/65 R 15	107 583 01 16	46 384


140-25705

Mercedes-Benz non-skid chains without gripping studs
RUD-matic system (starting 1983)

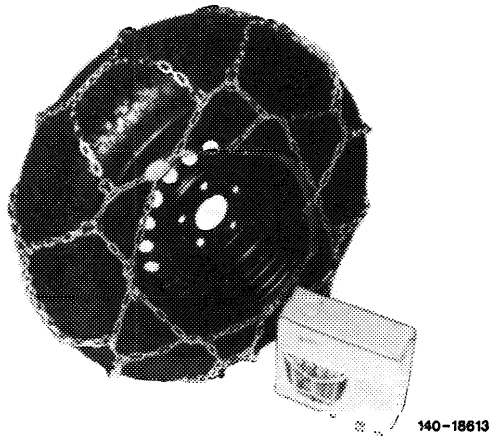
Tire size	HW-part no.	Code no.[1])
175/70 R 14	758 0265	44 320
175 R 14	758 0266	44 325
185 R 14 195/70 R 14	758 0267	44 328



140-25706

Additionally recommended non-skid chains
Erlau-Quadrat-m (up to 1982)

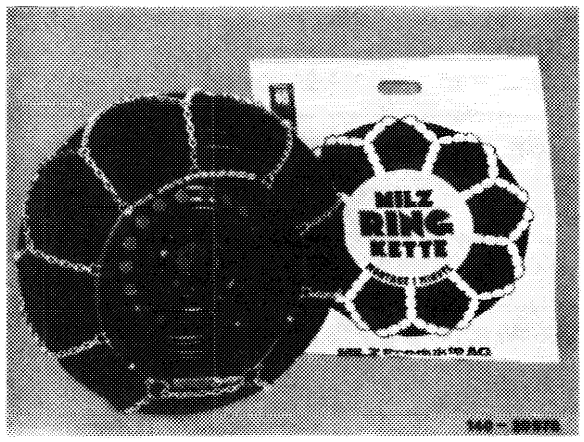
Tire size	Part no./code no.[1])
175 R 14	417-048
185 R 14	417-056
195/70 R 14	417-059
205/70 R 14	417-057
215/70 R 14	417-054
185 R 15	417-061



140-18613

Milz ring chain

Tire size	Without gripping studs Y-grip pattern code no.[1])	With gripping studs Y-super grip pattern code no.[1])
175/70 R 14	60 or 20 060	–
175 R 14	70 or 20 070	23 070
185 R 14 195/70 R 14	80 or 20 080	23 080
205/70 R 14	90 or 20 090	23 090
215/70 R 14	100 or 20 100	23 100
165 R 15	90 or 20 090	23 090
205/65 R 15	90 or 20 090	23 090



RUD-"non skid" (up to 1982)

Tire size	Part no.[1])
175 R 14	07125
185 R14	17 128
195/70 R14	16 127
205/70 R 14	16 129
215/70 R 14	16 131
185 R 15	

140-22908

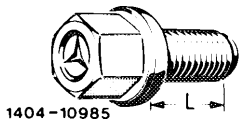
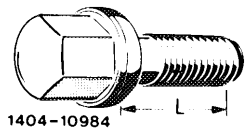
RUD-matic
type "non-skid" (starting 1983)

Tire size	Part no.[1])
175/70 R 14	46 120
175 R 14	46 125
185 R 14 195/70 R 14	46128
205/70 R 14	46 129
215/70 R 14	46 131
185 R 15	46 131
205/65 R 15	46 184

[1]) **Code numbers or part numbers are each stamped-in at closing hook of tensioning chain or at outer (red) steel rope ring.**

140-25707

Wheel bolts for fastening wheel

Part no.	Threads	Length "L"	Type	
For steel plate and light alloy rims[1]				
110 401 01 70	M 12 x 1.5	21	107 114 115 116 123 126 201	
For forged light alloy rim[2]				
108 401 00 70	M 12 x 1.5	29.5	107 114 115 116 123 126 201	

[1] A Mercedes star is stamped into face of screw head for identification as an MB original part.
[2] A Mercedes star is stamped into face of threaded part for identification as an MB original part.

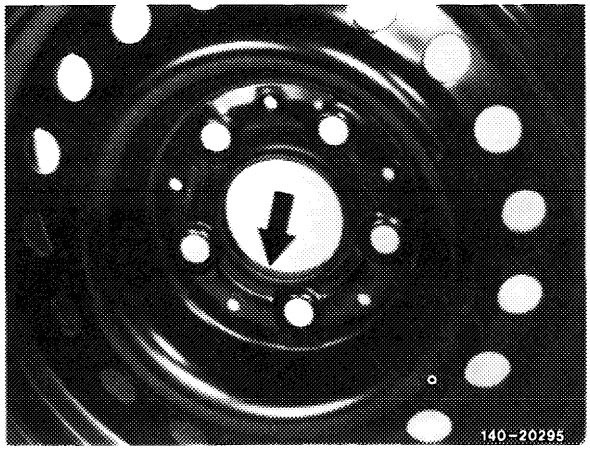
Centering of rims

Centering on rim dia.	Centering on front wheel hub or on rear axle shaft flange	Radial play between rim and front wheel hub or rear axle shaft flange[1]
66.50	66.40	0.10
66.57	66.35	0.22

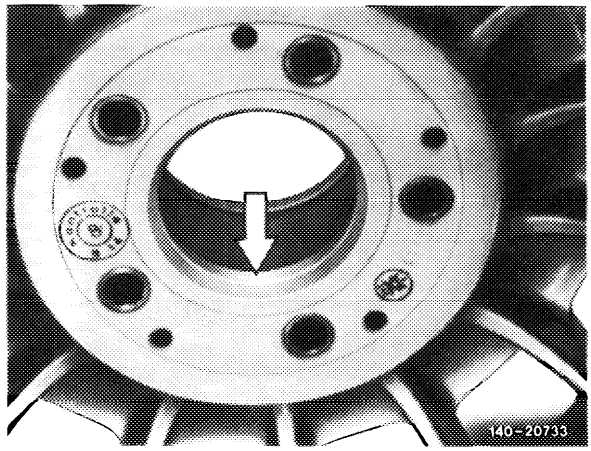
[1] Checking wheel centering play.

Check centering bore of rim for burr, if any.

The wheel play between rim and front wheel hub or rear axle shaft flange should not exceed 0.2 mm. Reduce higher play by spraying quick-drying paint from a spray can against wheel center (refer to arrow), covering wheel contact surface for this purpose (refer to 40-I 30).



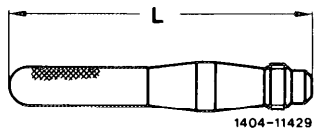
Steel plate rim



Forged light alloy rim

Tightening torque	Nm
Wheel bolts for fastening wheel	110

Assembly bolt for forged light alloy rim[1])

Model	Part no.	Threads	Length "L"	
201	201 400 00 74[1])	M 12 x 1.5	80	

[1]) On light alloy rims, prior to mounting wheel, screw assembly bolt available with spare wheel into screw hole located at the top.
[2]) Spare parts scope of delivery includes: Assembly bolt and rubber sleeve (rubber sleeve serves for fastening bolt in spare wheel).

Conventional tools

Electric or pneumatic impact wrench with limited tightening torque of 100 Nm	e.g. Atlas-Copco D-7250 Leonberg order no. LMS 26 HR 01
Hex. socket for impact wrench, OD max. 26.5 mm	e.g. Hazet D-5630 Remscheid order no. 900 S
Torque wrench, automatically releasing	e.g. Rahsol D-5650 Sol i ngen order no. 7562-l

Never mix up spherical collar bolts for steel plate and light alloy rims with spherical collar bolts for forged light alloy rims.

Check spherical collar bolts. Clean dirty bolts. Replace screws with damaged threads, worn zinc layer on spherical collar and with corroded spherical collar. Check threads in front wheel hub and rear axle shaft flange for easy operation and refinish, if required.

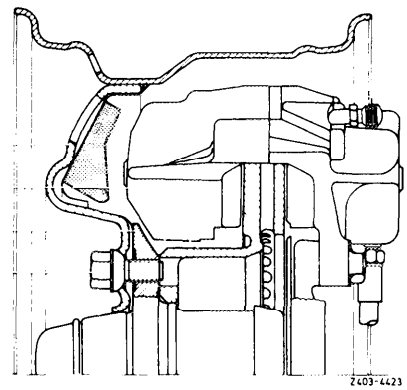
There should be no dirt or grease on spherical collar of bolts as well as on spherical segments of rims, since otherwise the threads of the spherical collar bolts and of front wheel hub or rear axle shaft flange will be excessively strained.

Contact surfaces on rim and front wheel hub or on brake disk bowl must be clean. Clean corroded surfaces with wire brush or emery cloth.
Always tighten spherical collar bolts with torque wrench on principle.

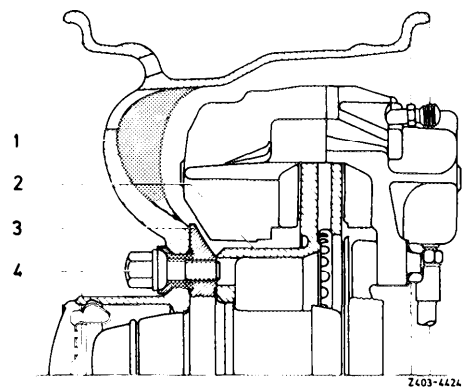
Check torque wrench regularly.

Re-tighten new rims after a mileage between 100 and 500 km. The reason for this requirement is the setting of the spherical sections for wheel fastening.

Steel plate and light alloy rim

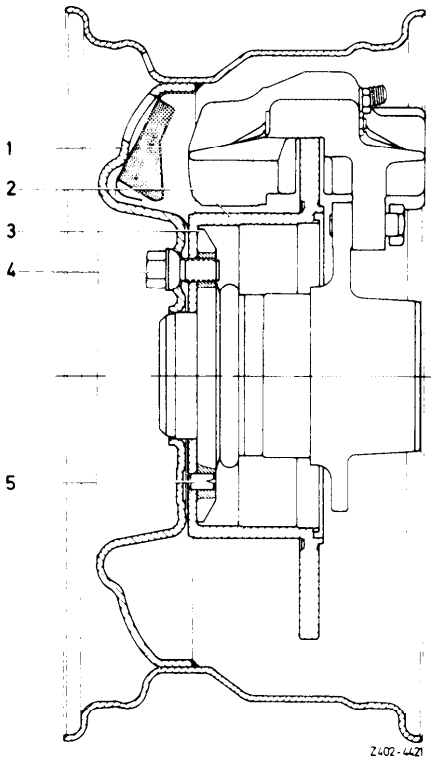


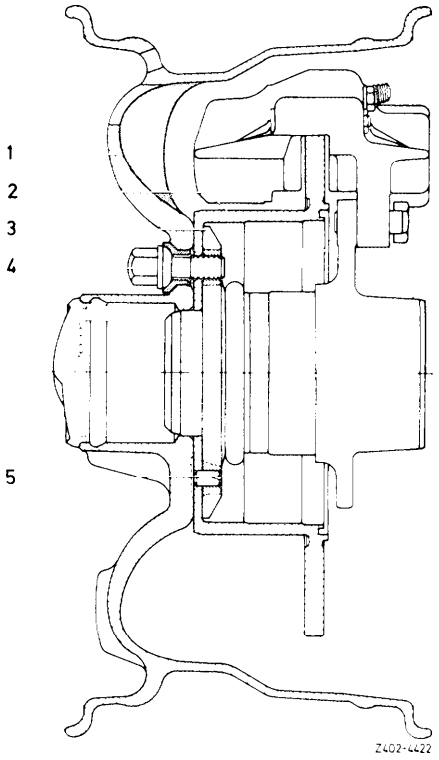
Forged light alloy rim



Wheel attachment front axle

1 Rim
2 Brake disk
3 Front wheel hub
4 Spherical collar bolt



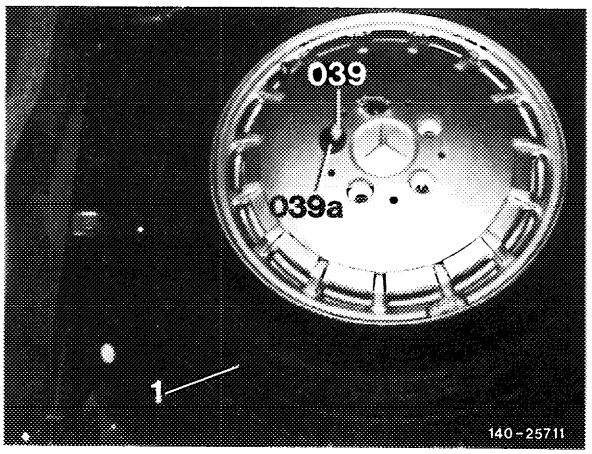


Wheel attachment rear axle

1 Rim
2 Brake disk
3 Rear axle shaft flange
4 Spherical collar bolt
5 Fitted pin for locating brake disk

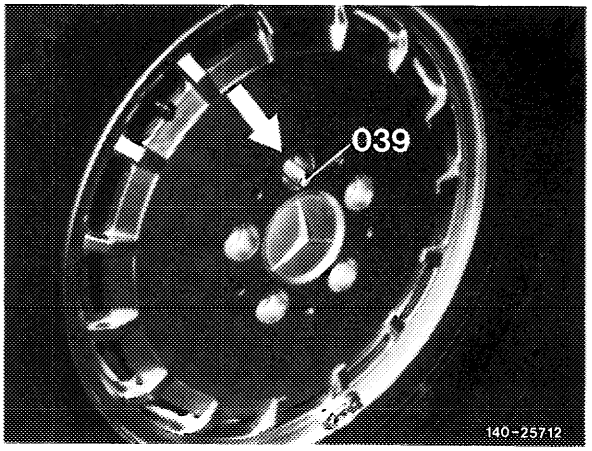
Note

On model 201 with forged light alloy rims use assembly bolt available with spare wheel for mounting wheel.



1 **Spare wheel**
039 **Assembly bolt**
039a Rubber sleeve

Prior to mounting wheel, screw assembly bolt into tapped hole located at top (arrow).

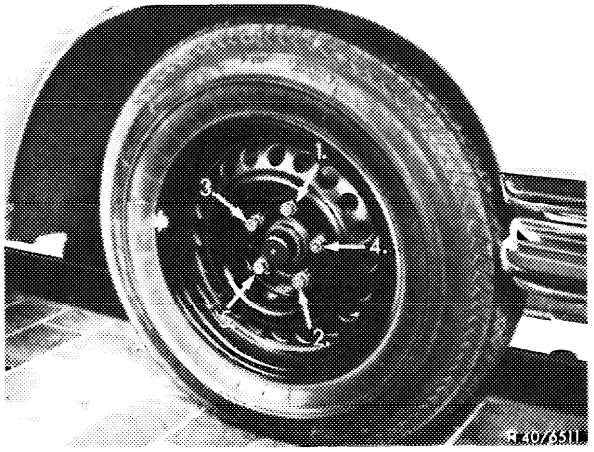


039 Assembly bolt

Make sure that the wheels are not distorted by one-sided tightening of spherical collar bolts.

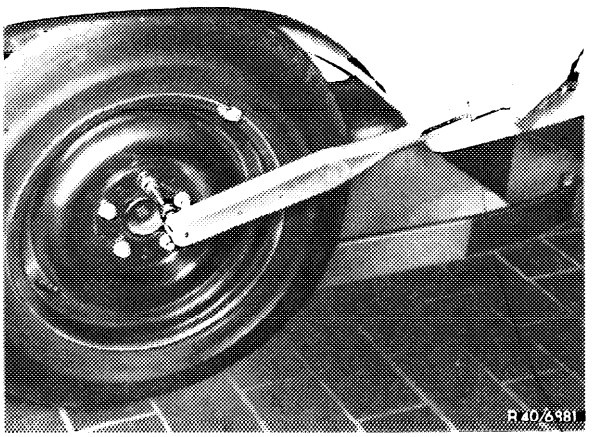
Tighten spherical collar bolts crosswise in several steps.

Make particularly sure that the first wheel bolt is not already tightened to its full tightening torque prior to at least screwing-on the others.



When using impact wrenches, tighten only up to appr. 3/4 of the required torque, then tighten with torque wrench while not exceeding specified value.

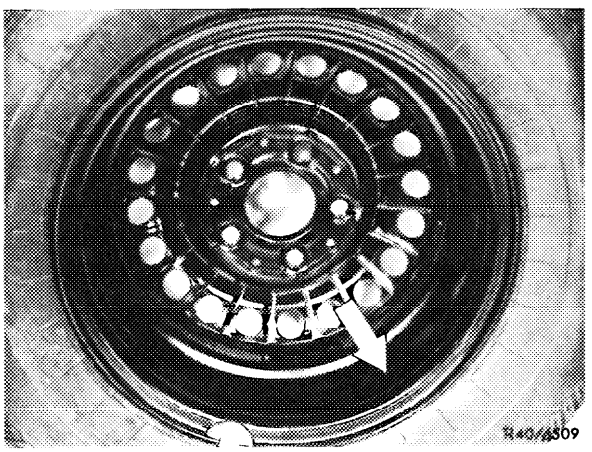
Experience has shown that impact wrenches will already obtain a tightening torque of 60 to 70 Nm under a single impact. When impacts continue, some impact wrenches may already have established an essentially excessive tightening torque, which may lead to a deformation of rim, damage to threads or fracture of spherical collar bolts.



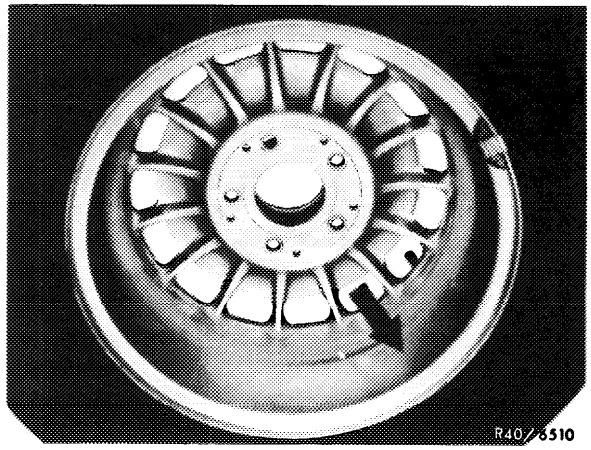
On forged light alloy rims, the OD of the wheel wrench or socket wrench element for impact wrench may amount to max. 26.5 mm, since otherwise hub of wheel may be damaged. When unscrewing last spherical collar bolt, make sure that the wheel is not tilting, since otherwise the paint on wheel hub may suffer damage.

For tightening spherical collar bolts, use a torque wrench with automatic release (click wrench).

Ventilated rims are subject to a high air flow. Prior to mounting rim, check wheel disk for contamination and clean, if required.



Steel plate rim

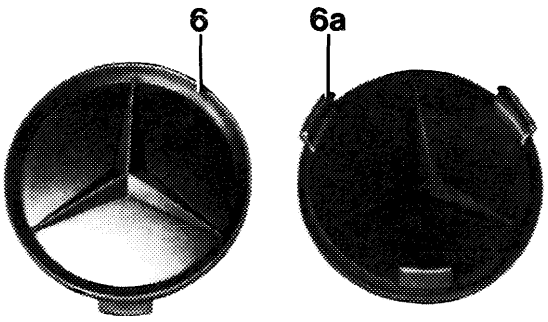


Forged
light alloy rim

The hub cap serves for covering rim hub.

B. Model 201

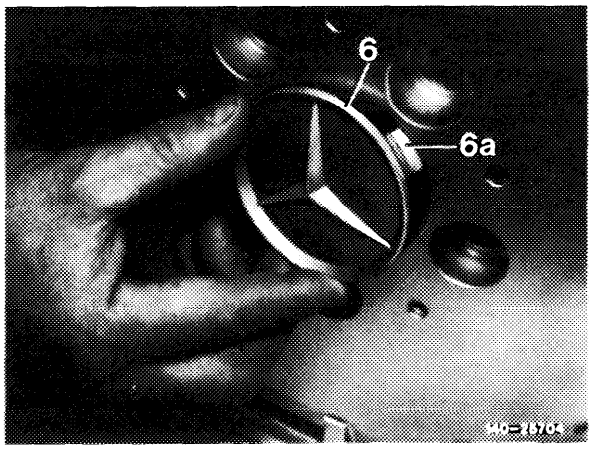
The plastic hub cap (6) is fastened in rim hub by means of three holding cams (6a).



6 Plastic hub cap
6a Holding cam

140-23738

For removal, carefully push out hub cap from inner side of wheel, for insertion, push-on hub cap with ball of thumb.



6 Plastic hub cap
6a Holding cam

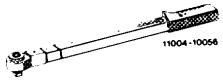
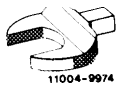
41 Propeller shaft

	Job No.
Propeller shaft	
Removal and installation of propeller shaft	41-050
Reconditioning of propeller shaft	
Removal and installation of propeller shaft Intermediate bearing, replacement of radial ball bearing	100
Replacement of centering sleeve	200

E. Model 201

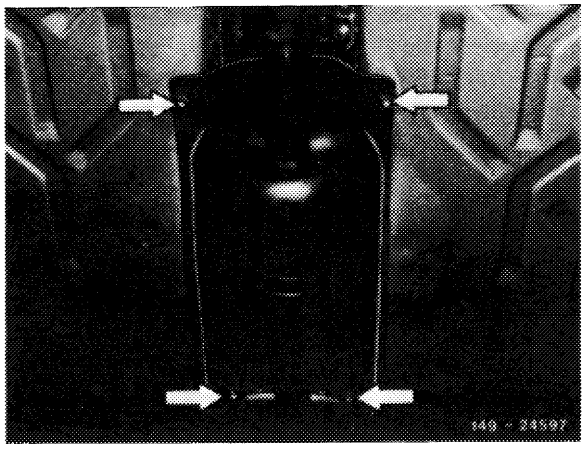
Lubricants	
Centering sleeve, per sleeve approx. 6 g	refer to Specifications for service products page 266.2
Clamp connection	

Tightening torques	Nm
Self-locking hex. nuts for fastening companion plates	45
Hex. screws on propeller shaft intermediate bearing	25
Clamping nut on propeller shaft	30-40
Hex. screws for fastening rear engine carrier on frame floor	45

Special tools		
Torque wrench 25-130 Nm with plug-in ratchet 1/2" square		001 589662100
Open-end wrench element 41 mm for plugging into torque wrench		201 589 00 01 00

Removal

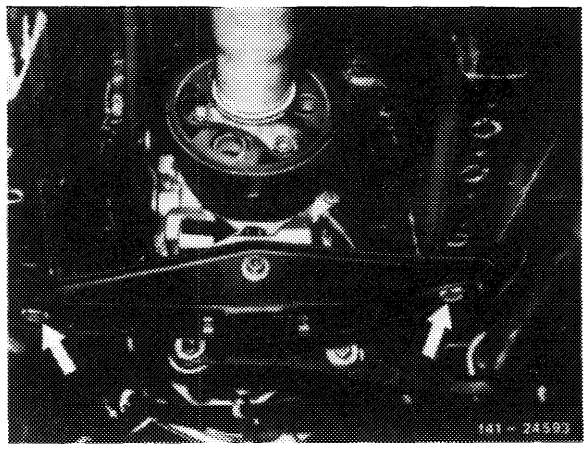
1 Unscrew exhaust shield.



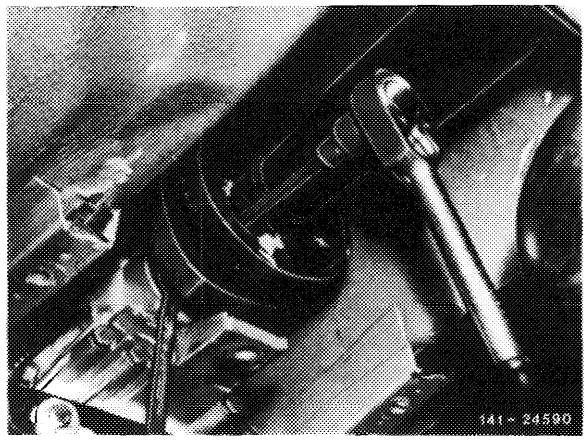
2 Lift transmission and place jack underneath.

3 Unscrew hex. head screws of rear engine carrier on frame floor and remove (arrows).

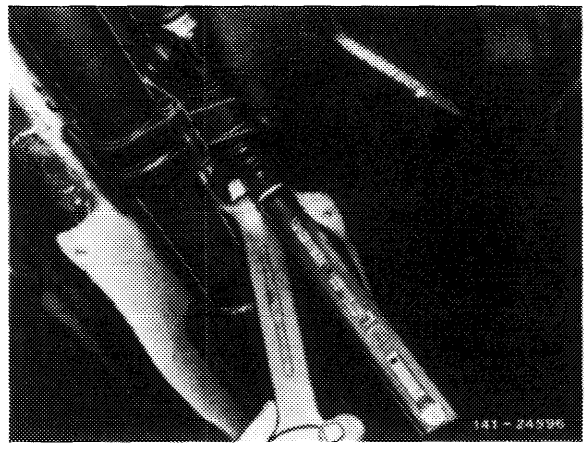
4 Loosen hex. nut from engine mounting and remove complete with engine carrier (arrow).



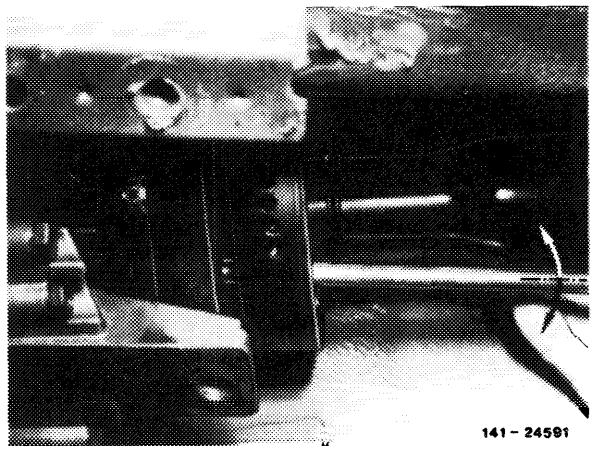
5 Unflange propeller shaft on transmission.



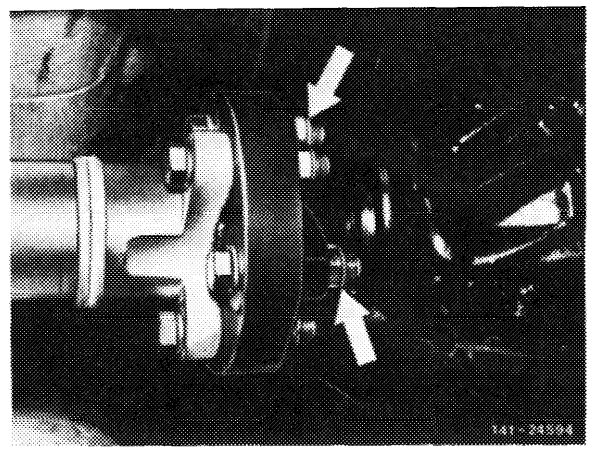
6 Loosen clamping nut of propeller shaft for approx. 2 turns without sliding back rubber sleeve (slides along).



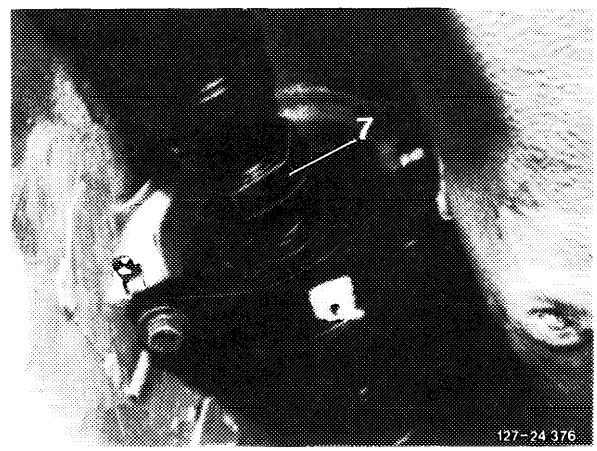
7 On tangentially soft companion plate installed at transmission end, loosen vulcanized fitted sleeves in universal flange by means of a mandrel prior to sliding back propeller shaft. For this purpose, use a cylindrical mandrel of 10 mm dia. and approx. 150 mm in length.



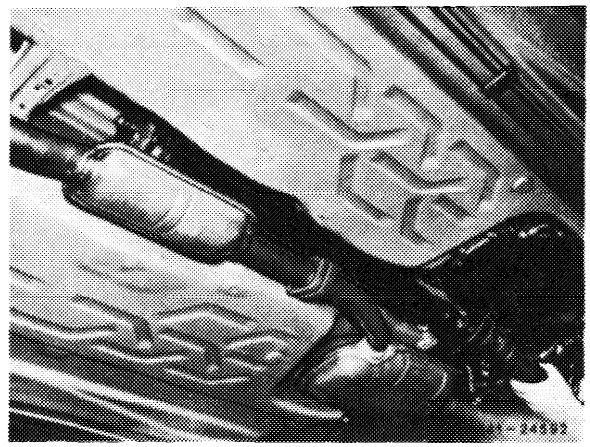
8 Unflange propeller shaft from rear axle.



9 Unscrew hex. head screws for fastening propeller shaft intermediate bearing on frame floor.

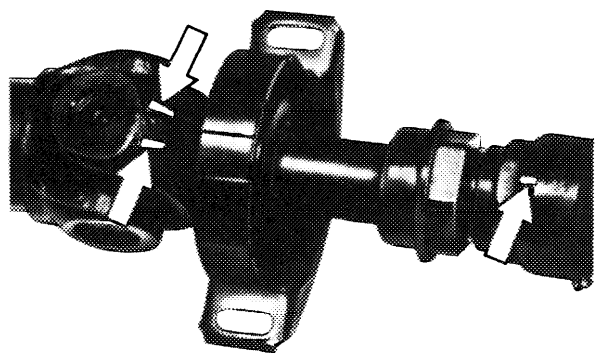


10 Force propeller shaft from centering pin of rear axle drive pinion and remove toward the rear.



Attention!

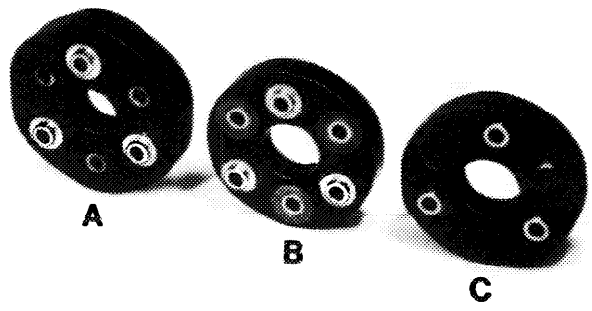
If separation of propeller shaft is required, reassemble parts again as drawn. The front shaft is provided with a hump and the yoke of the rear shaft with two arrow-like humps. The hump of the front shaft should be located between the two arrows on yoke (arrows).



141-23660

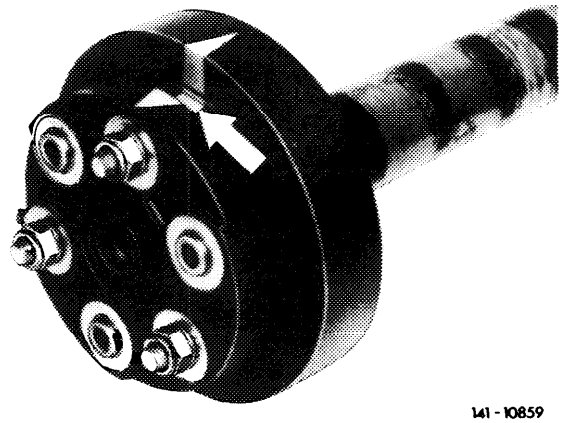
11 Check companion plates, centering sleeves, vibration eliminator and propeller shaft intermediate bearing for damage, if any. Renew damaged parts.

Note: Model 201.024 is provided with an accel-decel (tangentially) softer companion plate (A) at transmission end. On this version, special attention must be paid to damage, if any, particularly in range of vulcanized centering bushings.



A Soft accel-decel companion plate at front, model 201.024
B Front companion plate model 201.022
C Rear companion plate model 201.022/024

12 If during renewal of companion plate the vibration eliminator is separated from propeller shaft, mark vibration eliminator and three-arm flange in relation to each other.

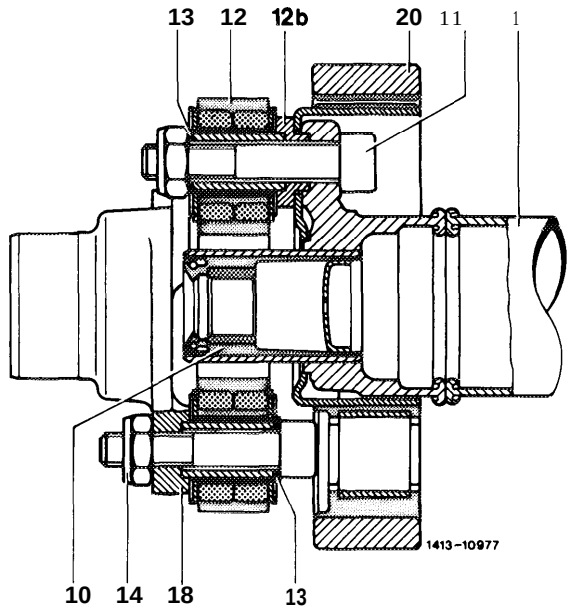


Installation

13 Grease cavities of the two centering sleeves with specified grease (approx. 6 g per sleeve).

14 Slip propeller shaft with companion plates on centering pins on transmission and on rear axle.

15 Fasten propeller shaft intermediate bearing to frame floor, but do not yet tighten.

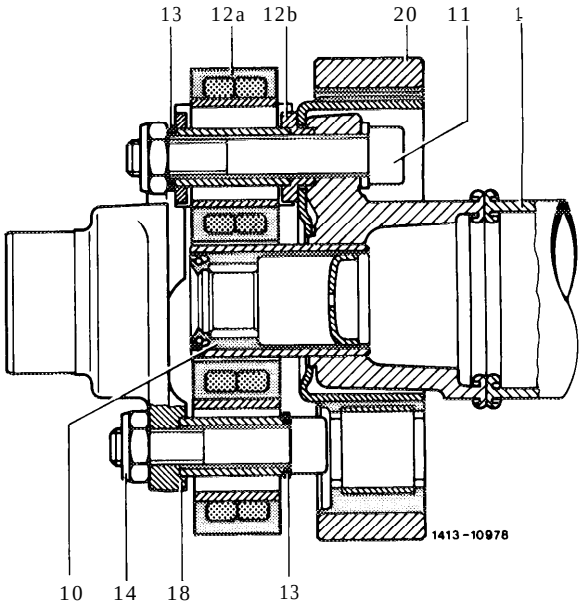


Model 20 1.022

1 Front propeller shaft
10 Centering sleeve
11 Hex. socket screw
12 Companion plate
12b Centering bushing
13 Washer
14 Self-locking hex. nut
18 Universal flange
20 Vibration eliminator

16 Fasten propeller shaft to transmission and rear axle. Tightening torques of self-locking hex. nuts 45 Nm.

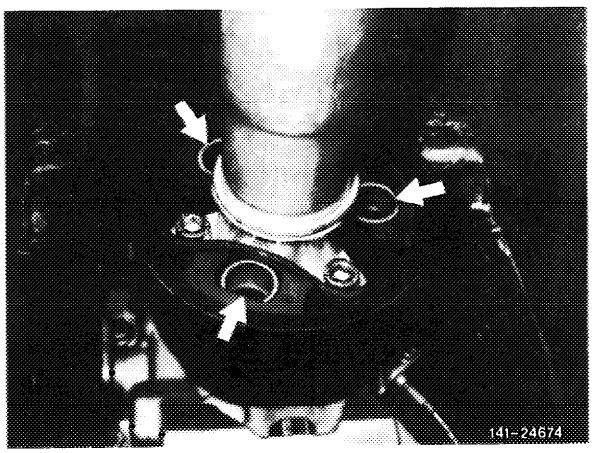
Attention!
Renew self-locking hex. nuts on principle after one-time use.



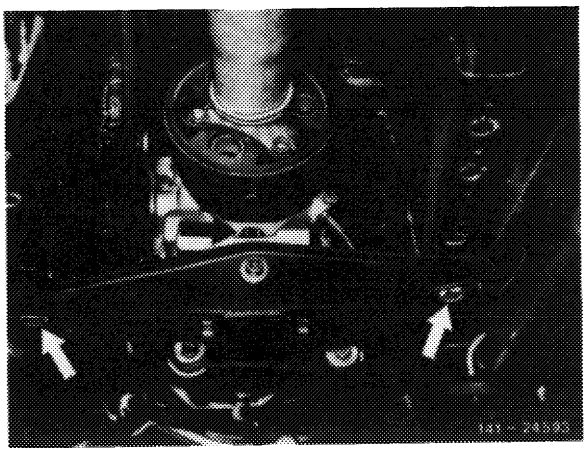
Model 201.024

1 **Front propeller shaft**
10 Centering sleeve
11 Hex. socket screw
12a Soft acceldecel companion plate
12b Centering bushing
13 Washer
14 Self-locking hex. nut
18 Universal flange
20 Vibration eliminator

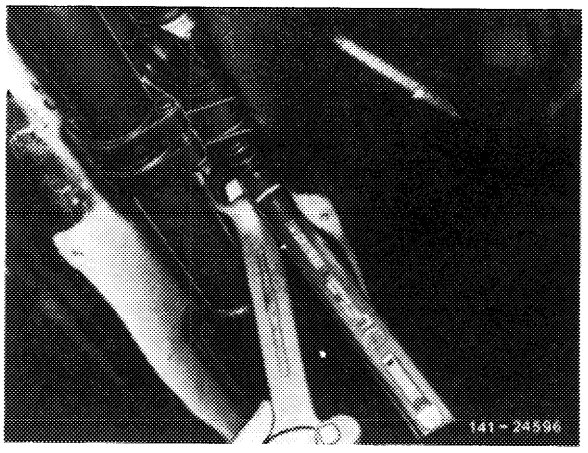
17 On vehicles with manual transmission pay attention to correct seat of rollers in vibration eliminator after tightening transmission-propeller shaft connection and push in rollers, if required (arrows).



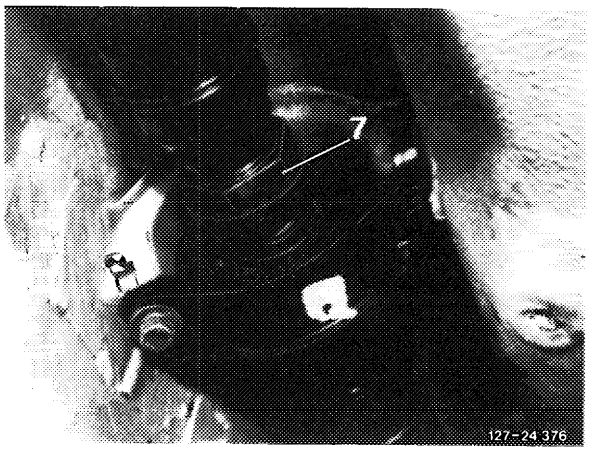
18 Mount rear engine carrier on frame floor, tightening torque of hex. head screws 45 Nm.



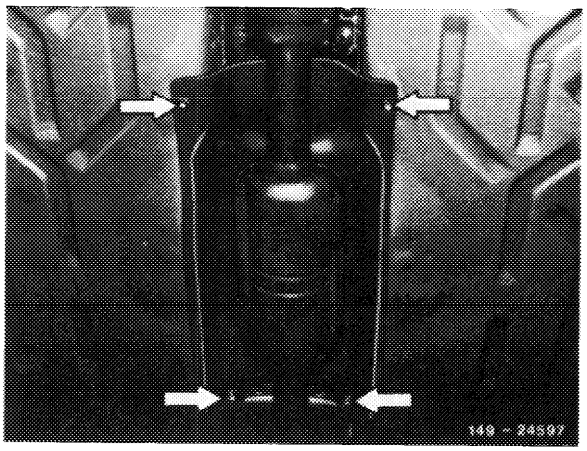
19 Tighten clamping nut on propeller shaft to 30-40 Nm while paying attention to good seat of sleeve.



20 Tighten hex. head screws for fastening propeller shaft intermediate bearing to frame floor to 25 Nm.



21 Mount exhaust shielding plate.



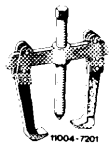
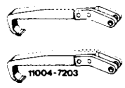
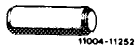
41-100 Removal and installation of propeller shaft intermediate bearing, replacement of radial ball bearing

B. Model 201

Lubricant

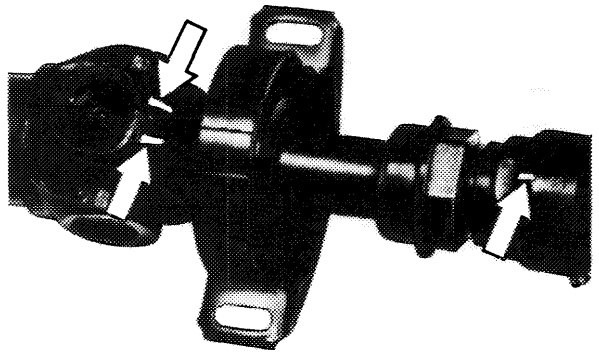
Clamp connection	refer to Specifications for service products page 266.2

Special tools

Two-arm puller		**000589883300**
Pulling arms (2 each)		116589033300
Remover and installer for radial ball bearing		201 589 09 43 00
Mandrel for assembly of propeller shaft intermediate bearing and of protective cap		201 58907 1500

Note

The front and the rear propeller shaft are provided with a mark ex factory. Separation will therefore make the identification ineffective.

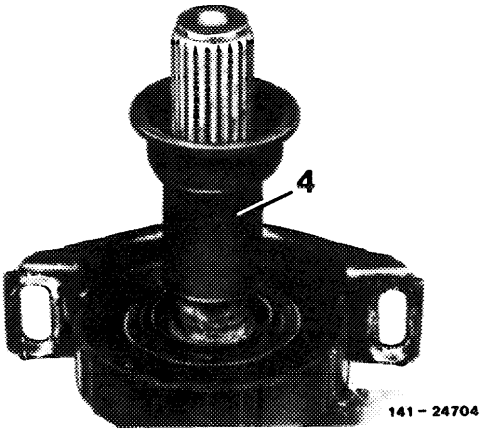


141-23660

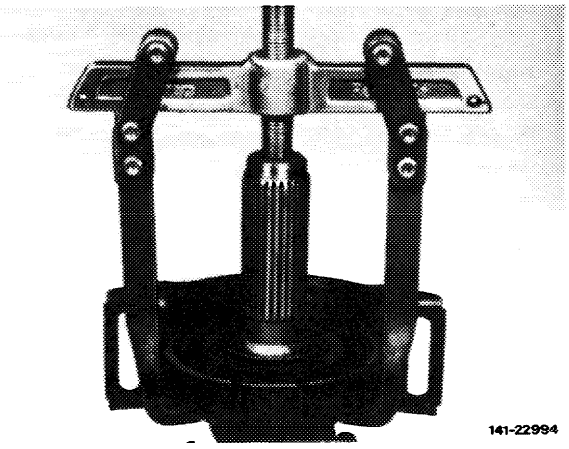
Removing propeller shaft intermediate bearing

1 Separate front and rear propeller shaft at clamp connection.

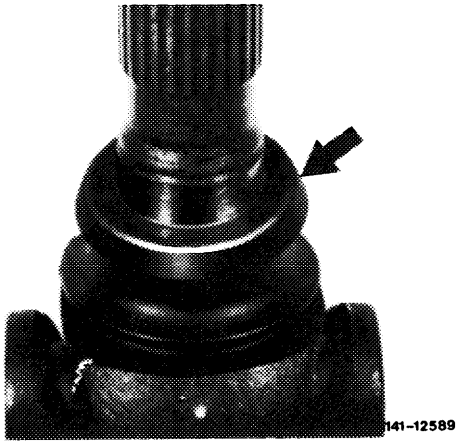
2 Pull off rubber sleeve (4) over splining.



3 Pull rubber mount with radial ball bearing and protective cap together from yoke by means of two-arm puller.



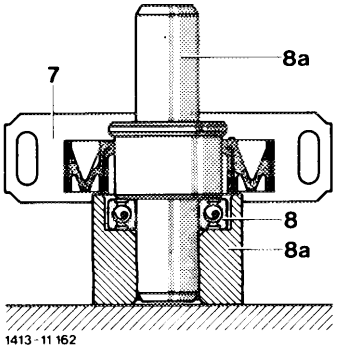
4 Remove rear protective cap from yoke (arrow).



Renewing radial ball bearing

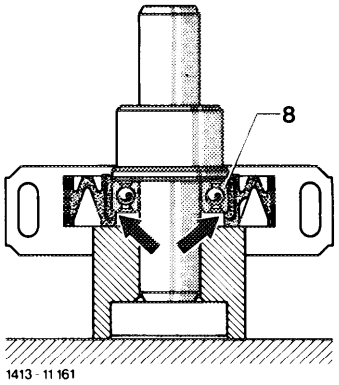
5 Press radial ball bearing (8) out of rubber mount (7) by means of remover and installer (8a).

6 Check rubber mount and radial ball bearing for damage and renew, if required.



7 Slowly press radial ball bearing (8) into rubber-coated bearing seat to contact surface (arrows).

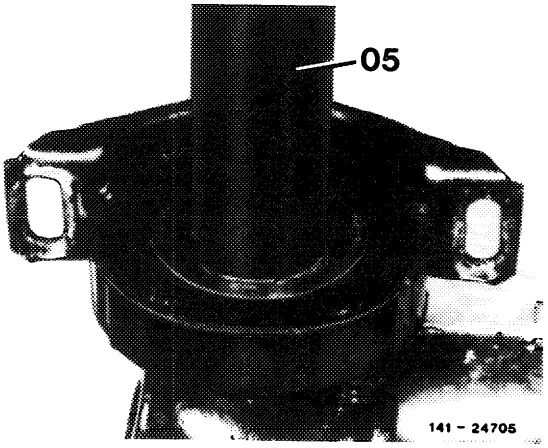
Attention!
Pay attention to good seat of radial ball bearing.



Installing propeller shaft intermediate bearing

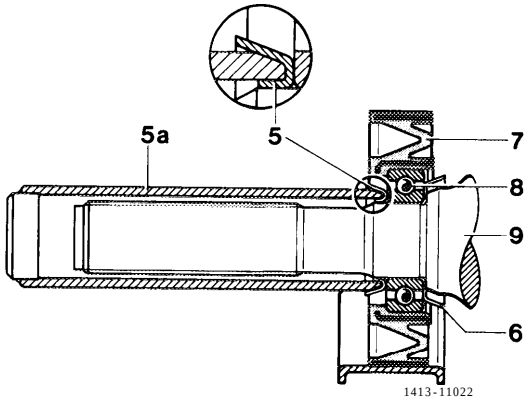
8 Insert protective cap.

9 Press rubber mount with pressing-on sleeve (05) on yoke while paying attention to correct location of V-fold.

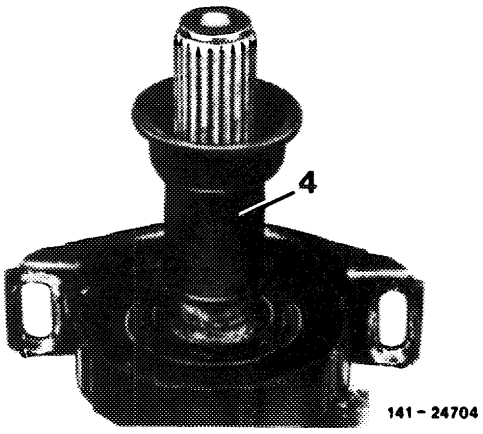


10 Mount self-locking protective cap (5) with pressing-on sleeve while making sure that the protective cap rests well against radial ball bearing.

Attention!
Use pressed-on protective cap only once.



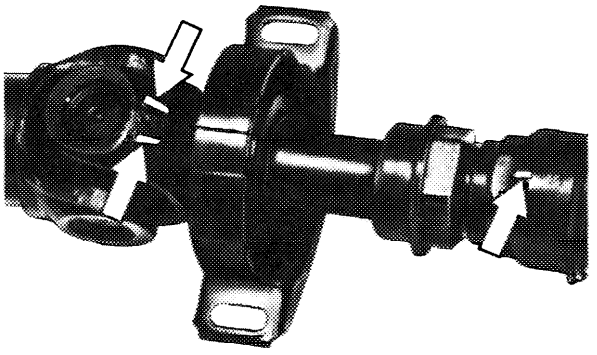
11 Pull rubber sleeve (4) over splining of yoke. Pay attention to correct seat of sleeve at small diameter.



12 Coat splining with specified grease.

13 Plug front and rear propeller shaft together as shown on drawing.

Attention!
The front and the rear propeller shaft are correctly plugged together if the hump of the front shaft is located between the two arrows of the rear humps (arrow).



141-23660

Pressing-in dimension for centering sleeve from upper edge to contact surface of three-arm flange

Model	At front "a"	At rear "b"
201.022	31 mm	24 mm
20 1.024	33 mm	

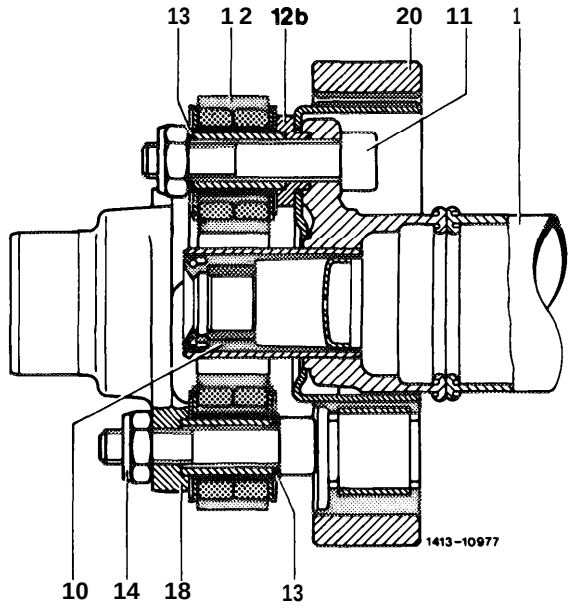
Lubricant

Centering sleeve, approx. 6 g per sleeve	refer to Specifications for service products page 266.2

Tightening torques		Nm
Self-locking hex. nuts for fastening companion plates	M 10	45

Note

In the event of wear or damage of sealing lip in centering sleeve (10) on front or rear propeller shaft, exchange of complete propeller shaft is not necessary. The centering sleeve can be individually replaced.

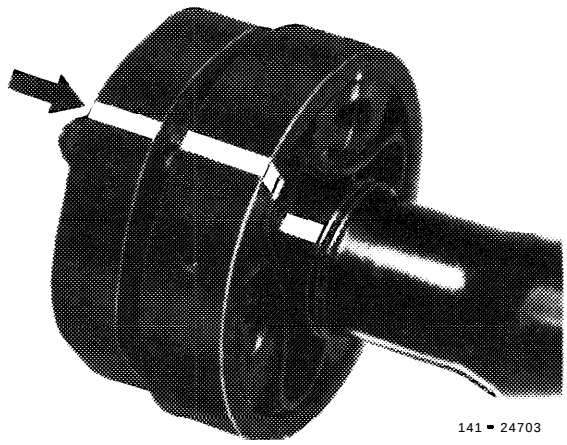


Layout of model 201.022
with manual 4-speed transmission

1 Front propeller shaft
10 Centering sleeve
11 Hex. socket screw
12 Companion plate normal version
12b Centering bushing
13 Washer
14 Self-locking hex. nut
18 Transmission-universal flange
20 Vibration eliminator

Removal

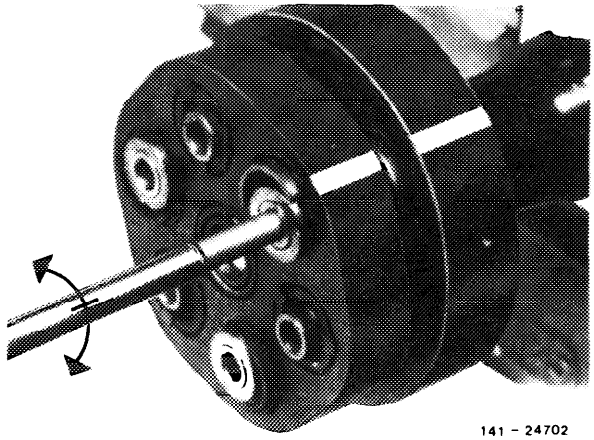
1 Unscrew hex. socket screws with self-locking hex. nuts and remove.



141 - 24703

Attention!
Prior to removing vibration eliminator, mark vibration eliminator in relation to front propeller shaft and companion plate.

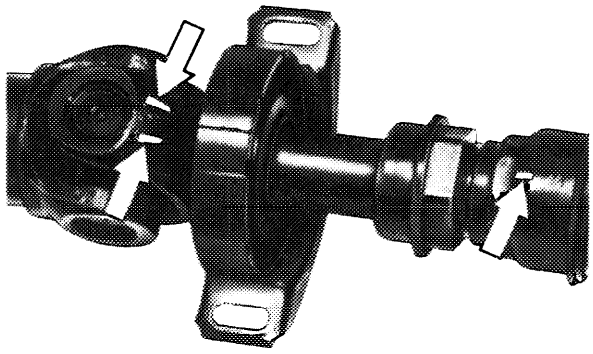
2 On vehicles with tangentially soft companion plates, loosen the vulcanized fitted sleeves of companion plate in three-arm flange of propeller shaft. For this purpose, use a cylindrical mandrel of 10 mm dia. and approx. 150 mm in length.



141 - 24702

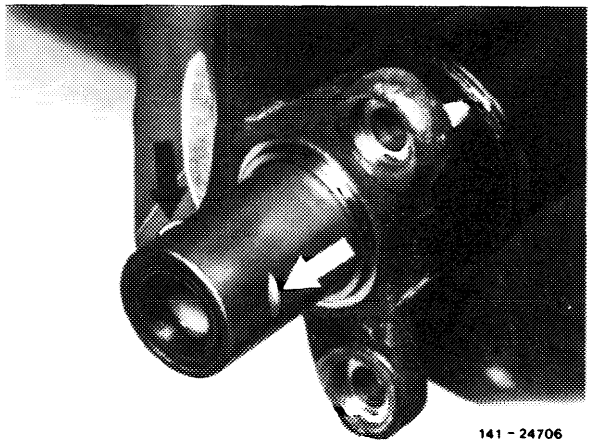
3 Remove companion plate and vibration eliminator.

4 For separating front and rear propeller shaft, components are marked in relation to each other.



141-23660

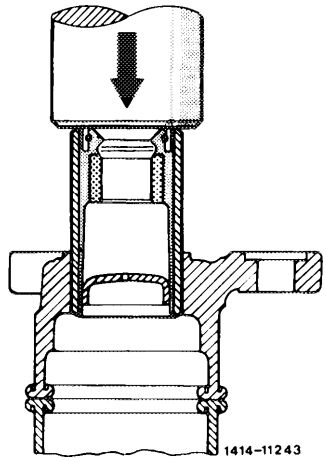
5 Knock centering sleeve uniformly out of propeller shaft by means of a flat chisel (arrows).



141 - 24706

Installation

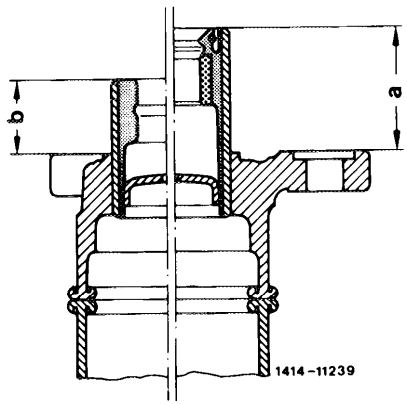
6 Force in new centering sleeve by means of a suitable mandrel.



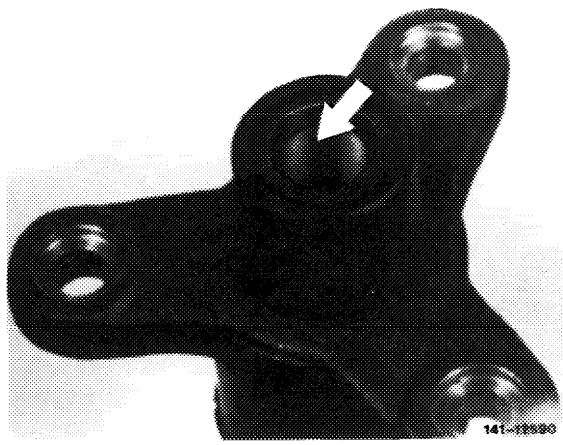
Centering sleeve front

7 Pay attention to pressing-in dimension for centering sleeve.

Model	At front "a"	At rear "b"
201.022	31 mm	24 mm
201.024	33 mm	

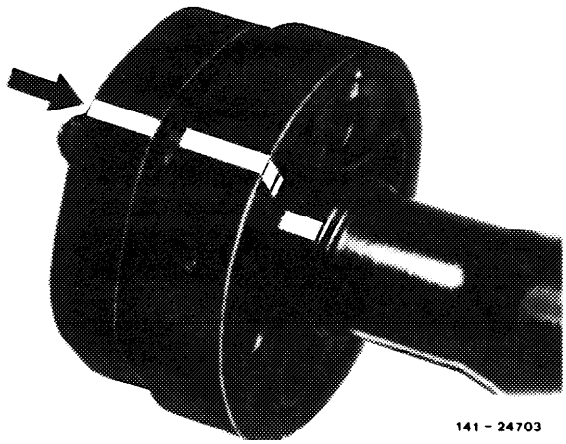


8 Coat cavity of centering sleeve with specified grease (quantity per sleeve approx. 6 g).

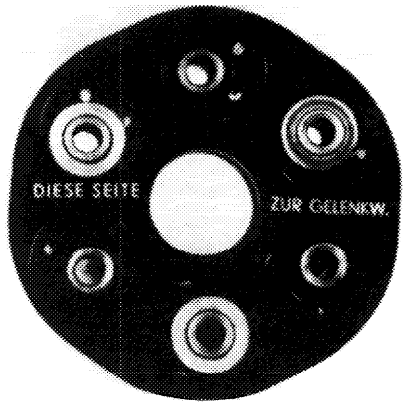


9 Mount vibration eliminator and companion plate with hex. socket screws. Tightening torque of self-locking hex. nuts 45 Nm.

Attention!
Pay attention to identification applied prior to disassembly (arrow). Renew self-locking hex. nuts on principle.



10 Mount tangentially soft companion plates (on vehicles with 5-speed transmission) according to lettering “DIESE SEITE ZUR GELENKWELLE” (“This side toward propeller shaft”).



141-21695

Lettering on companion plate:
DIESESEITE ZUR GELENKWELLE
(This side toward propeller shaft)

Job No.

Brake system

Bleeding the brake system or renewing the brake fluid ... 42-010
Checking the brake lines and brake hoses ... 012
Checking the brake system for leaks ... 015
Checking warning device in expansion tank ... 035
Checking and adjusting or removal and installation of mechanical stop lamp switch ... **040**
A. Stop lamp switch 1 st version
B. Stop lamp switch 2nd version

Brake caliper

Removal and Installation of floating caliper on front axle ... 110
Removal and Installation of fixed caliper on rear axle ... 120
Replacing brake pads ... 160
A. Fixed caliper
B. Floating caliper

Brake disk

Removal and installation of brake disk on front axle ... **220**
Removal and installation of brake disk on rear axle ... **228**
Cleaning of brake disks ... **260**

Stepped tandem master cylinder

Removal and rnstallatron of stepped tandem main cylinder ... 310
Disassembly, checkup and assembly of stepped tandem main cylinder ... 315

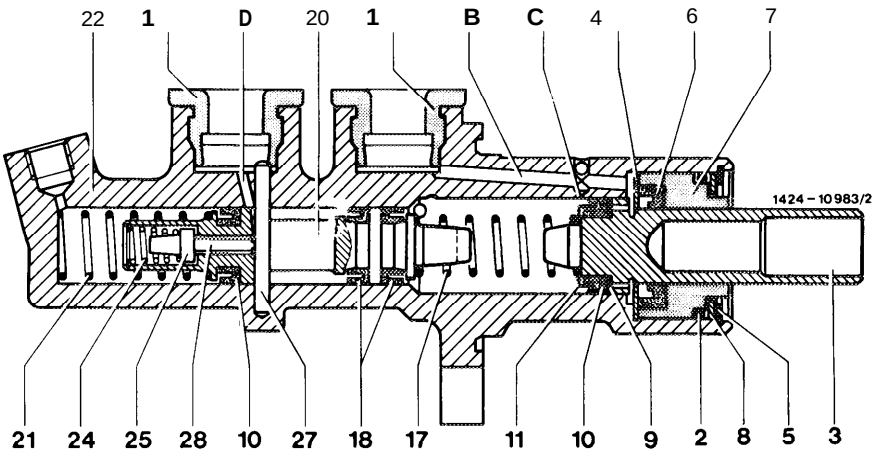
Parking brake

Removal and rnstallatron of parking brake lever ... 510
Removal and rnstallatron of front brake cable control ... 520
Removal and rnstallatron of rear brake cable control ... 525
Removal and rnstallatron of brake shoes of parking brake ... 530
Readjustment of brake shoes of parking brake ... 540

The tandem main cylinder with central valve is made of light alloy and has no stop screw.

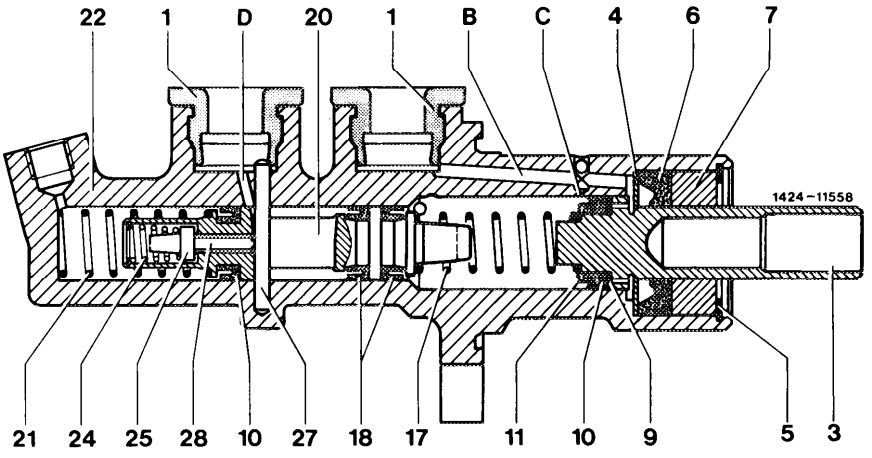
Girling tandem main cylinder

1 Tank plug
2 O-ring
3 Piston (pushrod circuit)
4 Stop washer
5 Locking ring
6 Secondary sleeve
7 Bushing
8 Stop washer
9 Filling disk
10 Primary sleeve
11 Supporting ring
17 Compression spring
18 Separating sleeve
20 Piston (floating circuit)
21 Compression spring
22 Housing
24 Valve spring
25 Valve seal
27 Cyl. pin
28 Valve pin
B Filling bore
C Compensating bore
D Filling and compensating bore



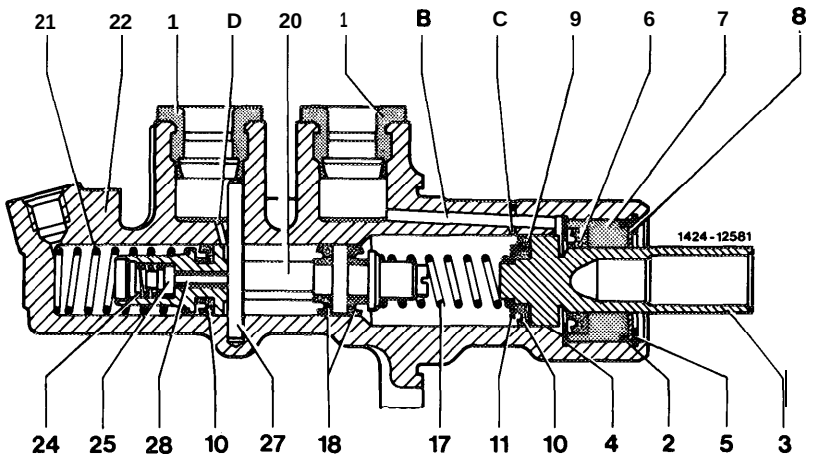
Bendix tandem main cylinder

1 Tank plug
3 Piston (pushrod circuit)
4 Stop washer
5 Locking ring
6 Secondary sleeve
7 Bushing
9 Filling disk
10 Primary sleeve
11 Supporting ring
17 Compression spring
18 Separating sleeve
20 Piston (floating circuit)
21 Compression spring
22 Housing
24 Valve spring
25 Valve seal
27 Cyl. pin
28 Valve pin
B Filling bore
C Compensating bore
D Filling and compensating bore



Teves tandem main cylinder

1 Tank plug
2 O-ring
3 Piston (pushrod circuit)
4 Stop washer
5 Locking ring
6 Secondary sleeve
7 Bushing
8 Stop washer
9 Filling disk
10 Primary sleeve
11 Supporting ring
17 Compression spring
18 Separating sleeve
20 Piston (floating circuit)
21 Compression spring
22 Housing
24 Valve spring
25 Valve seal
27 Cyl. pin
28 Valve pin
B Filling bore
C Compensating bore
D Filling and compensating bore



42-010 Bleeding the brake system or renewing the brake fluid

Brake fluid

Use specified brake fluid only	refer to Specifications for service products, page 331 .O

Important note

Handle brake fluid with care

a) Fill brake fluid only into container from which the fluid cannot be consumed by mistake. **(Fatal dose 100 cc).**

b) Even slight traces of mineral oil will lead to failure of brake system. When brake fluid looks from colorless up to yellow, particular attention is required since in such a case the risk of making a mistake is the highest. If mineral oil is found in brake system or if the presence of mineral oil is suspected, thoroughly flush entire brake system with brake fluid. Also renew main cylinder.

c) Brake fluid is highly **hygroscopic,** that is, it will absorb moisture out of the air, which in turn will lower the boiling point. For this reason, store brake fluid in well sealed storage tanks only.

Note: During its service life, the boiling point of the brake fluid will go down as a result of constant absorption of moisture from the atmosphere. When the brakes are very sharply applied, there is a possibility of vapor lock in brake system.**For this reason, change the brake fluid once a year, if possible, in spring.**

To facilitate inspections, a new sticker naming the year and month of the next fluid change must be glued to brake unit during each change of fluid.

Bleeding

1 When using a bleeding unit, observe operating instructions of pertinent manufacturer.

To remove all air bubbles from tandem main cylinder, be sure to step down fully on brake pedal at least three times while bleeding, with bleed screws of brake pedal opened.

2 When bleeding by "pumping" the brake pedal, close the respective bleeder plug each time prior to releasing the brake pedal, so that no air will enter through the threads of the bleeder plug.

Note: Slowly retract brake pedal, so that enough brake fluid is drawn from expansion tank during piston return stroke.

3 Stop bleeding when clear brake fluid, free of bubbles, emerges from bleed hose.

Attention!
Do not use the pumped out brake fluid again, since it may contain foreign bodies which will then again enter the brake system.

4 Fill expansion tank with brake fluid up to "maximum" mark.

Renewing

5 Pump empty or draw fluid out of expansion tank down to a fluid level of approx. 10 mm.

Attention!
Do not empty expansion tank completely, so that no air can enter the brake system.

a) Renewing the brake fluid with bleeding unit:

Permit approx. 80 cc of brake fluid to flow out at each brake caliper, so that the lines and the pressure cylinders of the brake calipers will also be filled with fresh brake fluid.

b) Renewing the brake fluid without bleeding unit:

Fill expansion tank with fresh brake fluid up to "maximum" mark. Pump old brake fluid of each brake caliper with approx. 10 pump strokes. Top up brake fluid.

Note: For both methods of renewing brake fluid, the brake fluid flowing out through vent hose must be free of bubbles.

42-012 Checking brake lines and brake hoses

Check **brake hoses and brake lines for chafing marks** or other damage e.g. caused by corrosion or road metal. Do not use steel brush, emery cloth, scrapers or similar sharp-edged tools, since otherwise the plastic layer will be damaged. Clean dirty brake lines only within scope of an underfloor wash. Do not clean brake hoses with cleaning compounds containing mineral oil. Remove outside dirt with water. To prevent spraying or preservating compounds containing mineral oil from coming into contact with brake hoses, cover brake hoses prior to repeating preservation.

When installing a new brake hose, observe the following:

1. Install approved brake hoses only.

2. Do not install brake hose in twisted condition. Twisted brake hoses can be straightened by adjusting the hexagon head on the brake hose within the double hexagon of the safety plate.

3. Also install brake hose in such a manner that any possibility of chafing is eliminated. To check, turn steering gear each time completely to righthand and lefthand lock, making sure that each front axle half completes a full up and down stroke. Also check layout of brake hose on rear wheel brake in uppermost and lowermost position of spring link.

Attention!

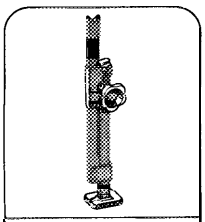
Upon completion of repairs following an accident be sure to check installation of brake hose, since even a minor change of location of holder on frame floor may change the brake hose layout in such a manner that chafing of hose will result.

42-015 Checking the brake system for leaks

Data

	High-pressure test	Low-pressure test
Line test pressure in bar gauge pressure	50-90	3
Duration of test in min.	5	2
Pressure drop of preset value in %	5	0

Special tool



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Conventional tool

Pressure tester	e.g. Teves, D-6000 Frankfurt/M. Order No. 3.9305–1020.4/01

Note

The leak test required for both brake circuits includes a high-pressure test and a low-pressure test.

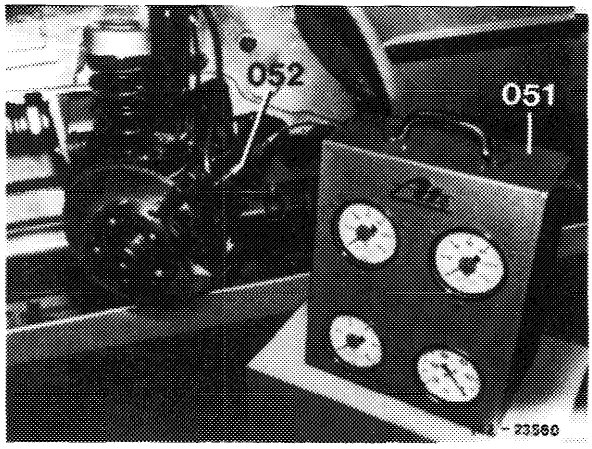
Attention!
In the event of a loss of brake fluid, which cannot be observed visually, check whether brake fluid has entered the brake booster through a leaking secondary seal in tandem main cylinder. If so, proceed as follows:

1. **Do not** remove brake booster.
2. Draw off brake fluid.
3. Change brake booster if there are more than 100 cc of brake fluid in unit.

Note: The flexible diaphragm is resistant to brake fluid, while the reaction disk and the plate valve in control member are not. For this reason, draw off brake fluid only with the brake booster installed. With the brake booster installed, no brake fluid can reach the reaction disk or the plate valve up to 100 cc.

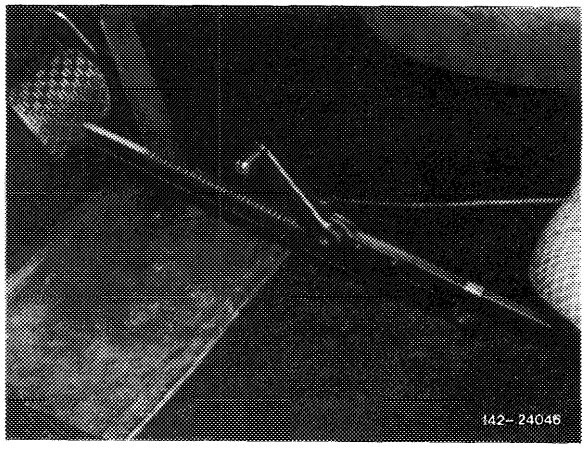
High-pressure test

1 Connect pressure tester (051) to a brake caliper. For this purpose, screw bleeder plug out and screw connection (052) in. Then bleed pressure tester.



2 Run engine at medium speed and establish highest possible vacuum by suddenly releasing accelerator pedal.

3 Depress brake pedal with brake pedal winch until the highest possible line pressure between 50 and 90 bar gauge pressure is obtained, then hold brake pedal in this position.



4 During the 5 minutes test period, the pressure loss should not exceed 5 % of the value set. If the pressure drop is higher, look for leaks and seal.

Low-pressure test

5 Stop engine. Actuate brake pedal until vacuum is exhausted.

6 Set brake pedal winch to a line pressure of approx. 3 bar gauge pressure.

7 The pressure should not drop during a test period of 2 minutes. If a pressure loss is indicated, look for leak and seal.

42-035 Checking warning device in expansion tank

Note

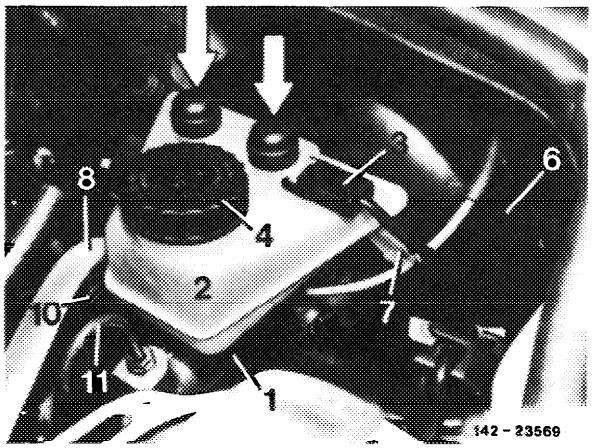
The warning lamp in instrument cluster is a combination lamp, that is, it will light up when:

a) the parking brake is actuated,

b) the brake fluid in one of the chambers in expansion tank is too low.

Checking

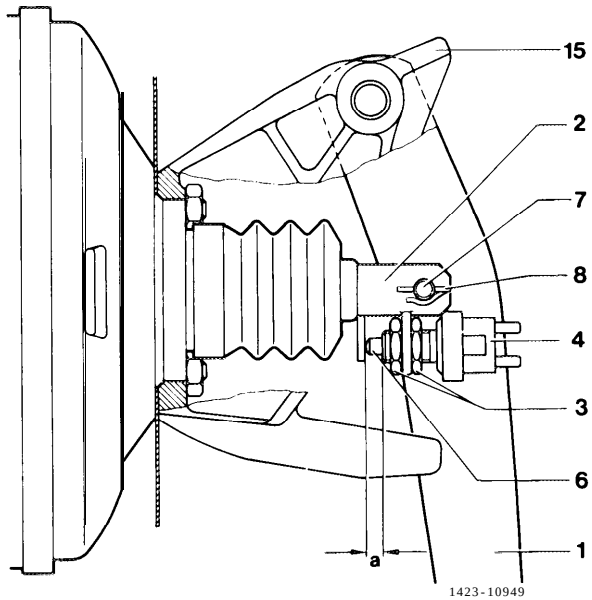
Push both contacts (refer to arrow) down one after the other. This will close the contact and the warning lamp should light up. The contact elements cannot be removed.



A. Stop lamp switch 1st version

Checking

1 **The stop lamp should light up at a pedal travel between 3-20 mm, measured to center of pedal plate.**

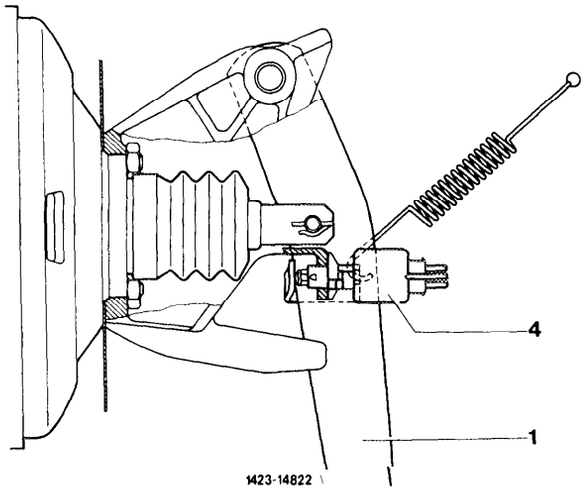


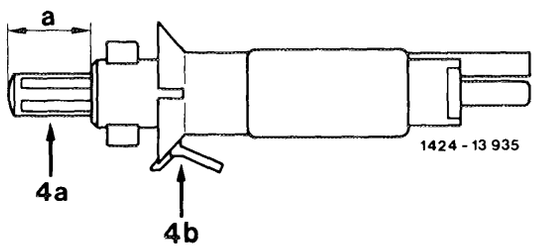
1 Brake pedal
2 Fork head
3 Hex. nut
4 Stop lamp switch
6 Contact button
7 Holder with flange bolt
8 Lock
15 Carrier for brake pedal

Adjusting

2 Adjust stop lamp switch with the two hex. nuts (3), which are simultaneously serving to attach switch (4).

B. Stop lamp switch 2nd version



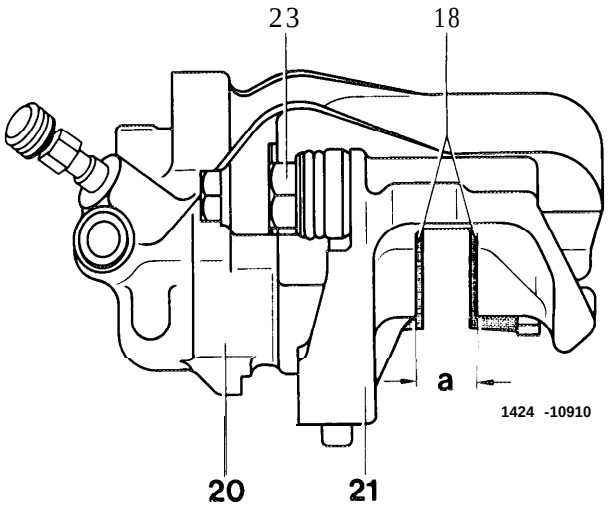


Lock (4b) of stop lamp switch	Push
Stop lamp switch (4)	Rotate and pull out
Actuating pin (4a)	Pull out up to stop. This will provide max. distance ,,a''
Brake pedal(1)	Step down on pedal. Insert switch and turn until lock (4b) engages. Then release brake pedal. Note: The actuating distance is set automatically.

42-I 10 Removal and installation of floating caliper on front axle

Data

Model	201.028/029/ 128	201.022/023/024/ 122/126	201.03
Floating caliper make	Girling	Girling, Teves	Girling
Floating caliper piston dia.	54		
Shaft width for brake pads	95, 15 + 0.15		110 + 0.2
Disk contact width „a"	25.0	15.5	25.0



a Disk contact width
18 Brake pad
20 Cylinder housing
21 Brake carrier
23 Sliding bolt

Tightening torque	Nm
Self-locking hex. head screw for attaching floating caliper to steering knuckle	115

Conventional tool

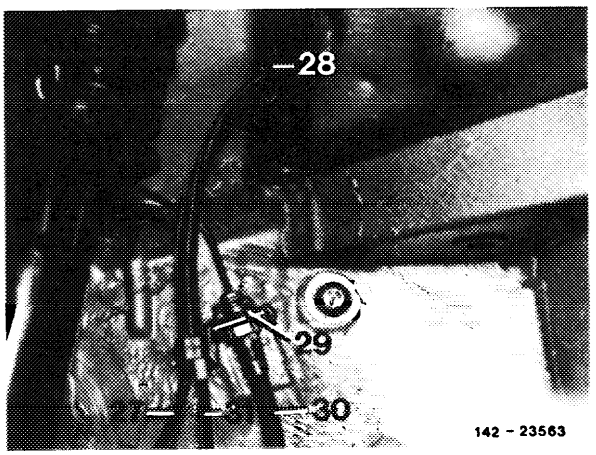
Open double-box wrench 9 x 11	e.g. Hazet, D-5630 Remscheid order no. 612

Note

For loosening and tightening brake lines use conventional double-box wrench only.

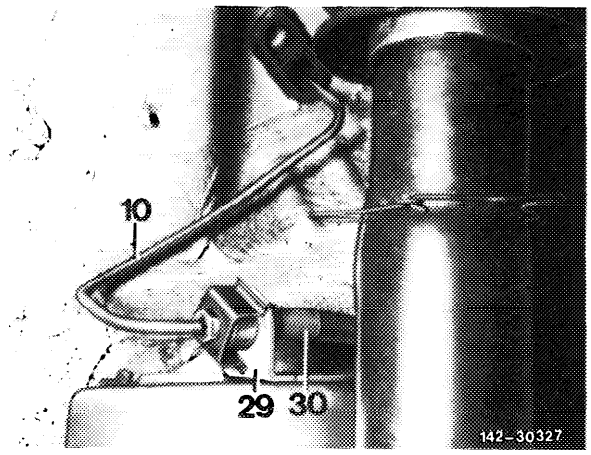
Removal

1 **Pump brake fluid out of front brake circuit through an opened vent screw.**



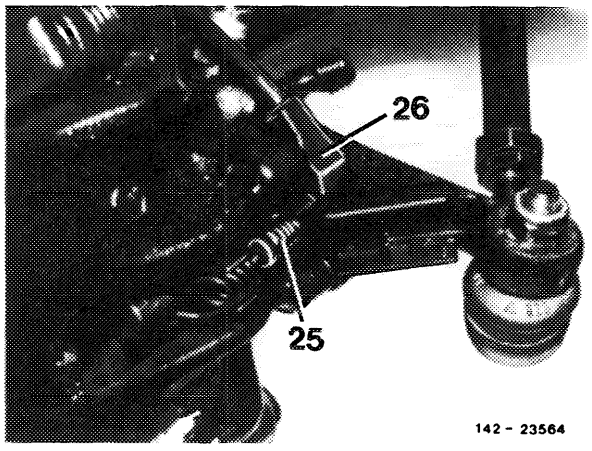
Brake hose layout 1st version

2 L.oosen brake hose (30) on brake line, then close brak e hose and brake line immediately with rubber plug



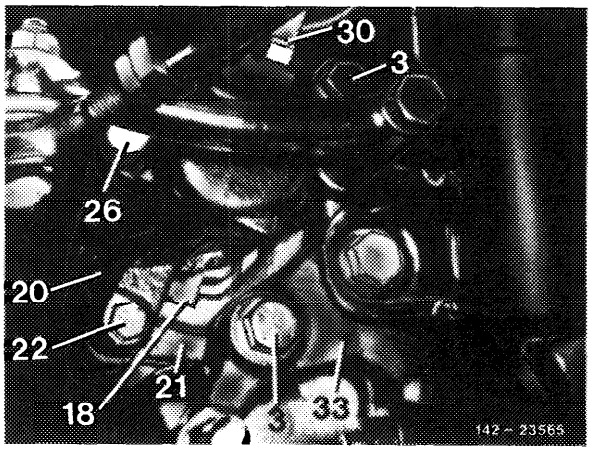
Brake hose layout 2nd version

3 Lift the two holding lugs located laterally on cover of plug connection by means of a screw driver and open cover. Do not use force. Remove cable of clip sensor (25) from plug connection (26) on floating caliper. Do not pull on cable.



4 Loosen plug connection (26) of brake lining wear indicator and brake hose (30) from cylinder housing (20). Close connection of brake hose and on cylinder housing with rubber plug.

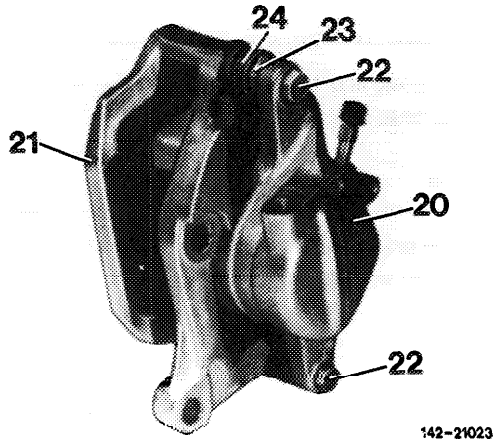
5 Unscrew hex. head screws (3) on brake carrier (21 Then remove floating caliper from steering knuckle (33).

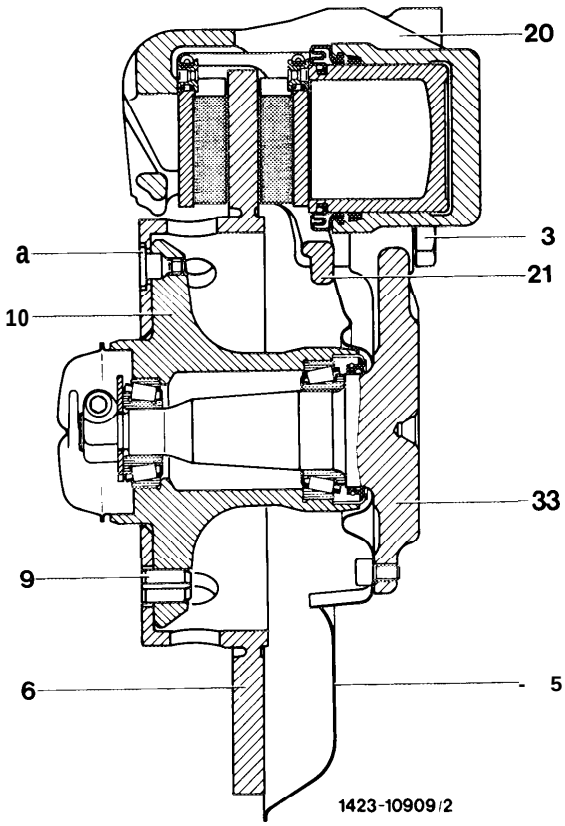


Installation

Attention!
When installing a new floating caliper, note the following: different disk contact width for solid and vented brake disks.

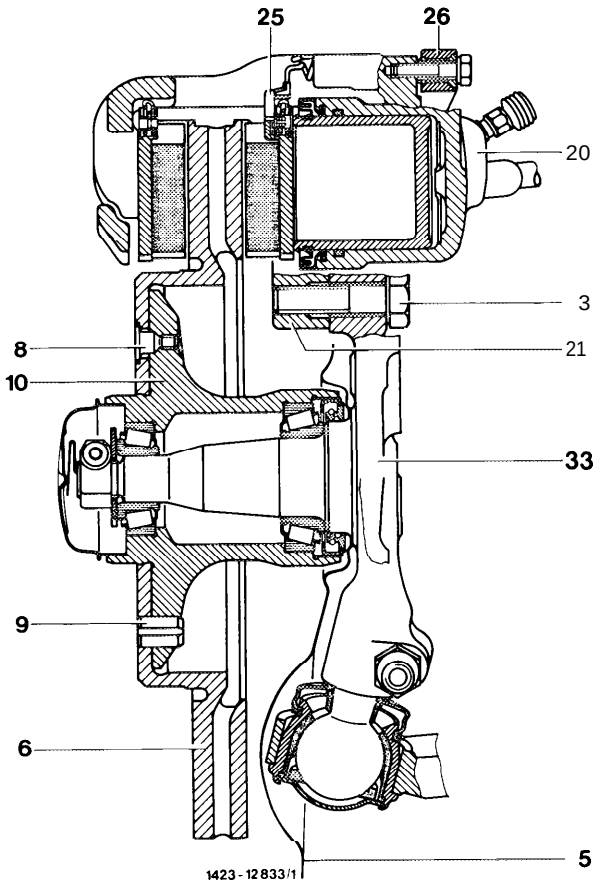
The piston dia. of the floating calipers **of one axle must be the same.** Floating calipers of different manufacturers may be installed on one and the same axle.





Layout with solid brake disk

3 Self-locking hex. head screw
5 Cover plate
6 Brake disk
8 Lock screw
9 Dowel sleeve
10 Front wheel hub
20 Cyl. housing
21 Brake carrier
33 Steering knuckle



Layout with vented brake disk

3 Self-locking hex. head screw
5 Cover plate
6 Brake disk
8 Lock screw
9 Dowel sleeve
10 Front wheel hub
20 Cyl. housing
21 Brake carrier
25 Clip sensor
26 Plug connection
33 Steering knuckle

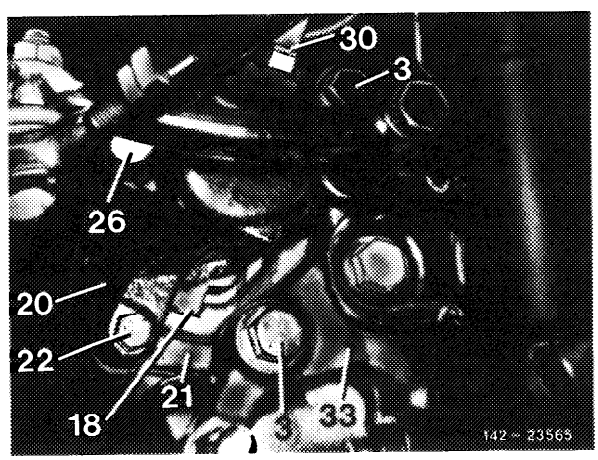
6 Attach floating caliper with new self-locking hex. head screws (3) to steering knuckle (6). Pay attention to perfect installation of brake hose.

Tighten hex. head screws to 115 Nm.

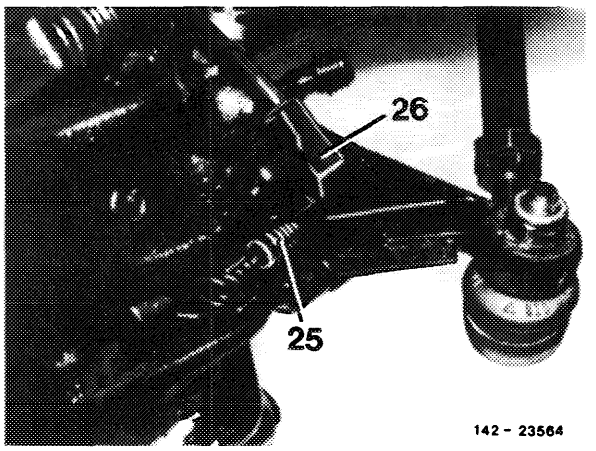
Note: Use self-locking hex. head screws only once.

If the screw-in torque of the new self-locking hex. head screws is very high, clean threads in floating caliper by means of a tap M 12 x 1.5 from residual glue of micro-encapsulated screws.

7 Attach brake hose (30) to cylinder housing (20).

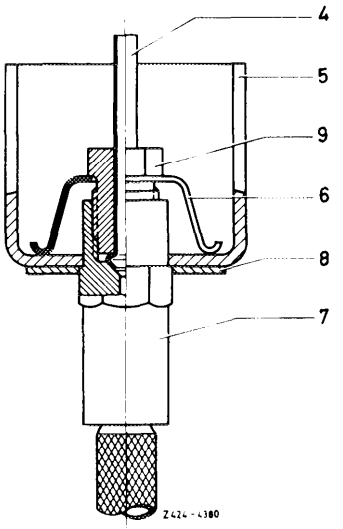


8 Fasten plug connection (26) to cylinder housing (20). Insert cable of slip sensor (25) into plug connection (26).



9 Connect brake line (4) to brake hose (7), making sure that the brake hose is not twisted.

Attention!
Holder (5) has a double hex. locking plate (8). Insert brake hose (7) into locking plate in such a manner that hose will not wipe against any obstacles at the left or right at full steering lock.



4 Brake line
5 Holder on frame floor
6 Brake hose holder
7 Brake hose
8 Locking plate
9 Coupling nut

10 Bleed front wheel brake circuit (42-010).

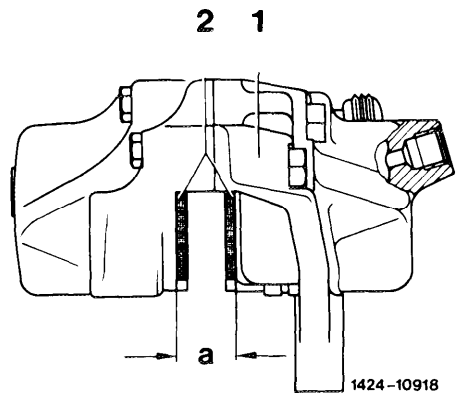
Attention!
Check brake system for leaks!

Upon bleeding, actuate brake pedal energetically several times to obtain the correct clearance between brake disk and brake pad. Then, with the engine running, perform leak test by actuating brake pedal at approx. 200-300 N. The established pressure should be maintained for some time, brake pedal should not permit additional depression. Check all connections for leaks. Top up brake fluid in expansion tank of tandem main cylinder, if required.

42–120 Removal and installation of fixed caliper on rear axle

Data

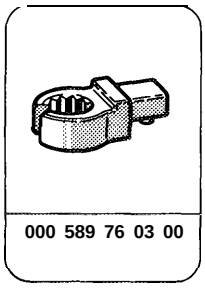
Fixed caliper make	Bend ix, Teves
Fixed caliper piston dia.	35
Shaft width for brake pads	62 + 0.2
Disk contact width “a”	approx. 12



a Disk contact width
1 Fixed caliper
2 Brake pad

Tightening torques	Nm
Self-locking hex. head screw for fastening fixed caliper to wheel carrier of rear axle	50
Brake hose to fixed caliper	15

Special tools



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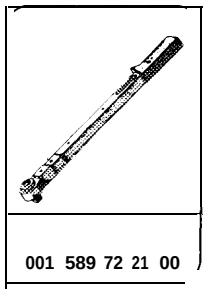

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Conventional tool

Open double box wrench 9 x 11	e.g. Hazet, D-5630 Remscheid order no. 612

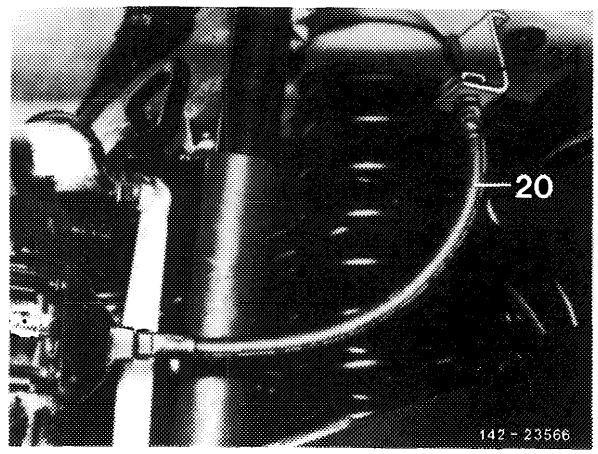
Note

For loosening and tightening brake lines, use conventional open double box wrench or open box wrench element only.

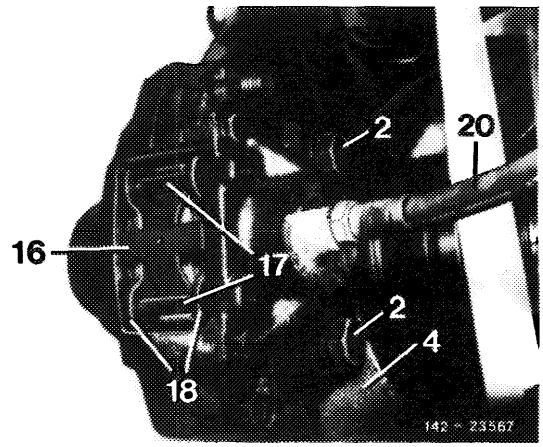
Removal

1 Pump brake fluid out of rear brake circuit through an opened vent screw.

2 Loosen brake hose (20) on holder (34) of frame floor and unscrew from fixed caliper. Close all connections immediately with rubber plugs.



3 Unscrew hex. head screws (2) and remove fixed caliper.

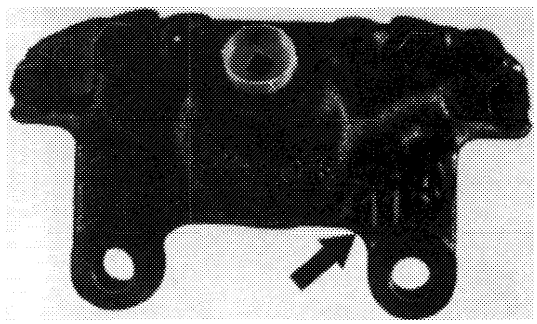


Installation

Attention!
When Installing a new fixed caliper, proceed as follows:

Calipers from different manufacturers may be installed on rear axle. However, the fixed calipers should have the same piston dia.

When replacing a fixed caliper, make sure to install only a fixed caliper approved for the respective model. The fixed caliper for model 201.034 has code number 11 (refer to arrow).



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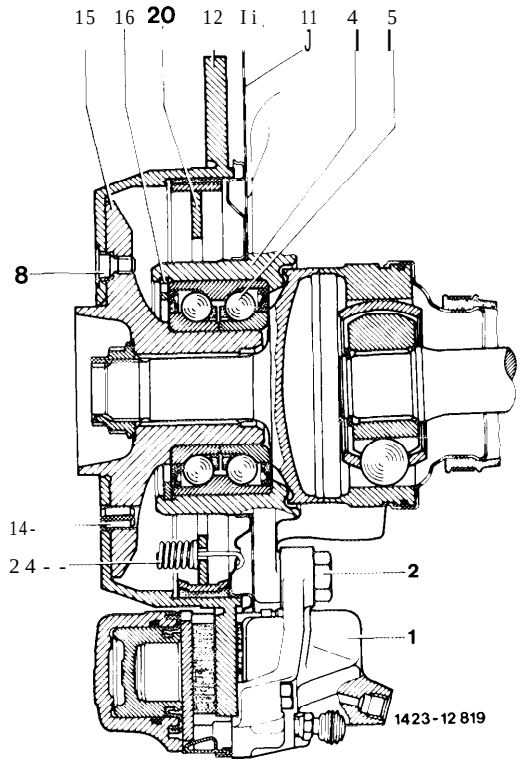
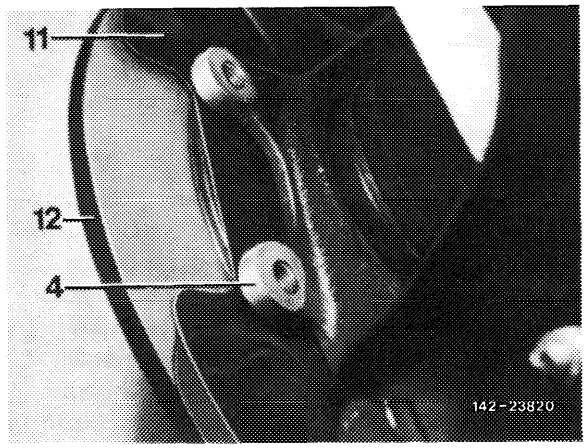


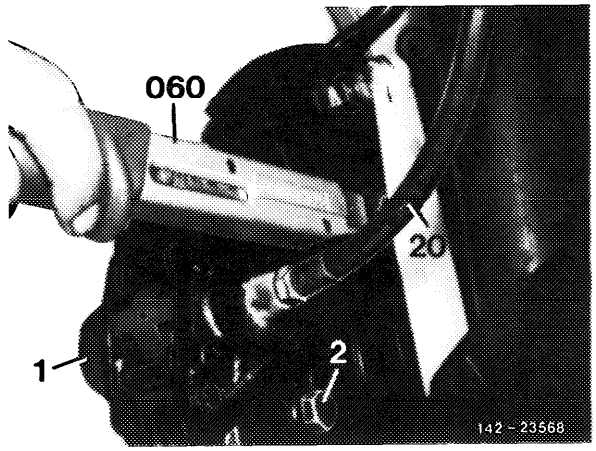
1 **Fixed caliper**
2 Hex. head screw
4 Wheel carrier
5 Double-row angular ball bearing
8 Lock screw
11 Cover plate
12 Brake disk
14 Fitted pin
15 Rear axle shaft flange
16 Locking ring
20 Brake shoes
24 Pressure spring

4 **Position fixed caliper against wheel carrier** (4). **Screw-in new self-locking hex. head screws (2) and tighten to 50 Nm by means of a torque wrench** (060).

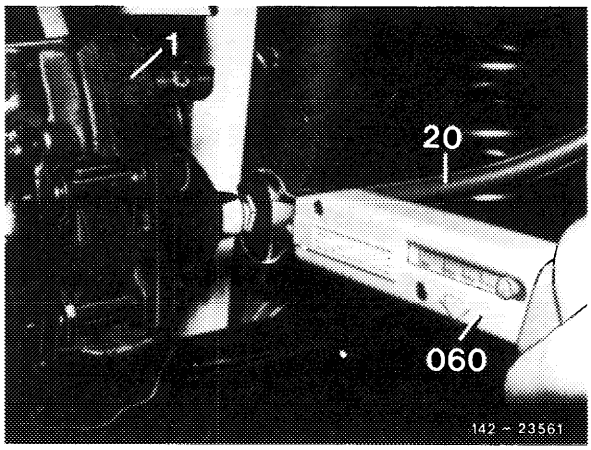
Note: Use self-locking hex. head screws M 10 x 22 only once.

If the screw-in torque of the new self-locking hex. head bolts is too high, clean threads in wheel carrier by means of a tap M 10 from residual glue of micro-encapsulated screws.

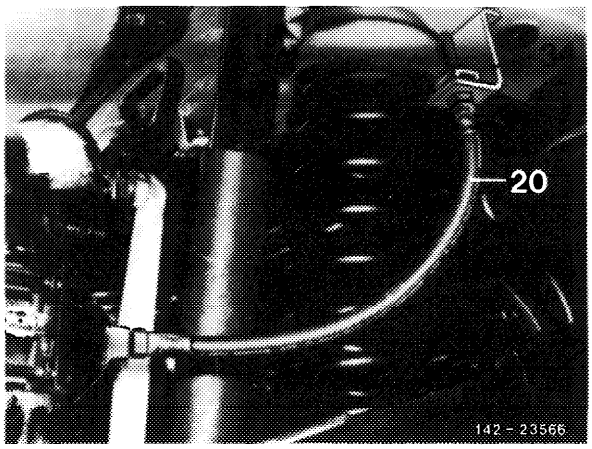




5 Tighten brake hose (20) with special tools torque wrench 001 589 72 21 00 (060) and box wrench element 000 589 76 03 00 to 15 Nm.



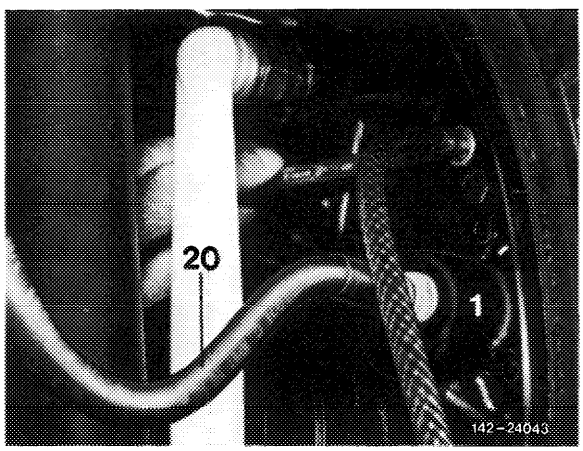
6 Connect brake hose to brake line on holder of frame floor. Pay attention to perfect installation of hose.



7 Bleed rear axle brake circuit (42-010). Use a straight double-box wrench 9 mm for this purpose.

Attention!
Check brake system for leaks!

Upon bleeding, actuate brake pedal energetically several times to obtain the correct clearance betweer brake disk and brake pad. Then, with the engine running, perform leak test by actuating brake pedal at approx. 200-300 N. The established pressure should be maintained for some time, brake pedal should not permit additional depression. Check all connections for leaks. Top up brake fluid in expansion tank of tandem main cylinder, if required.



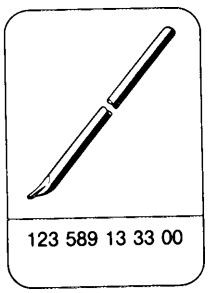
A. Fixed caliper

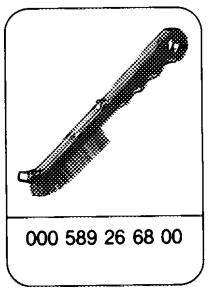
Data

Model	201.02, 201.12	201.03
Fixed caliper dia.	35	
Thickness of brake pad with backing plate for lining	13.5	15.5
Thickness of backing pad for lining	4.5	
Permissible wear of brake lining up to a remaining lining thickness of		2
Width of brake pad max.		61.75
Effective brake surface per axle (cm^2)		88
Thickness of brake disk		9
Wear limit		7.3
Limit dimension during maintenance')		7.6

[1]) **Refer to Maintenance Manual Volume 2.**

Special tools


123 589 13 33 00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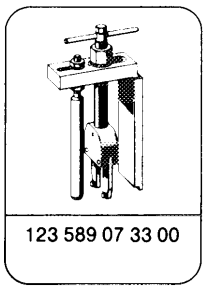
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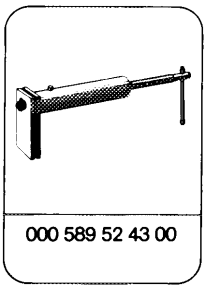
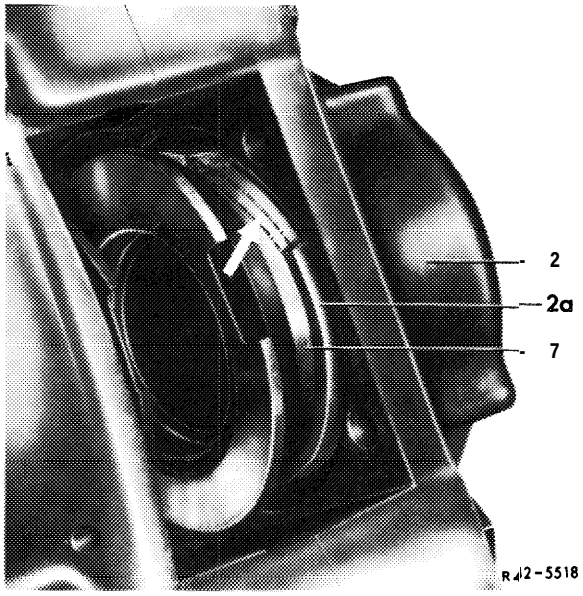

000 589 52 43 00

Note

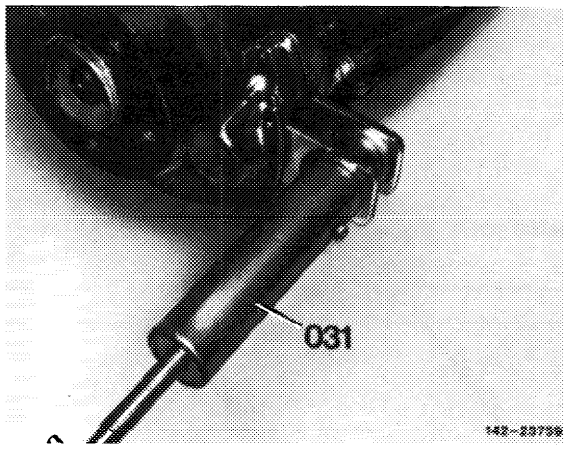
Replace brake pads when the lining is down to 2 mm or when greasy. Use only approved lining grades in sets.

When the brake pads are worn down to the lining backing plate beyond the permissible lining thickness, the fixed caliper may suffer damage since the web (arrow) between the sealing ring groove and the dust cap will fracture and the caliper will then leak.



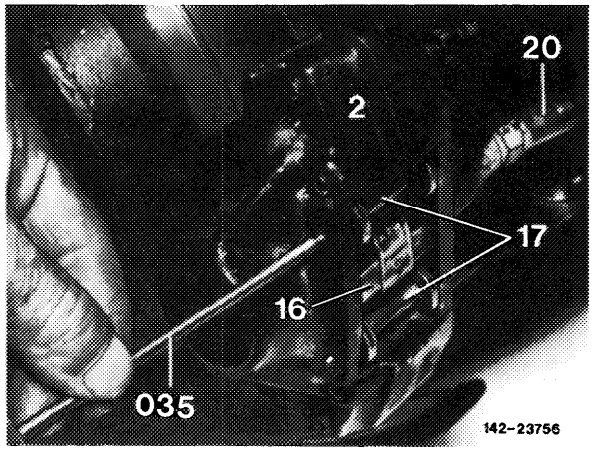
Perform a high and a low-pressure test (42–015) **if brake pads** are excessively worn out.

To prevent canting of piston, pistons may be pushed back to their end position by means of piston resetting device (031) only.

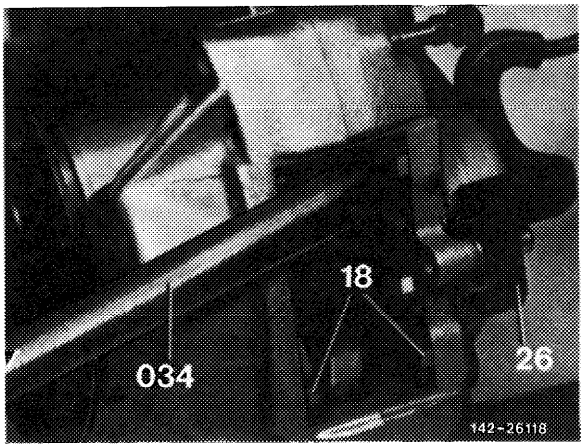


Removal

1 Knock holding pins (17) out of fixed caliper by means of a punch (035). Remove cross spring.



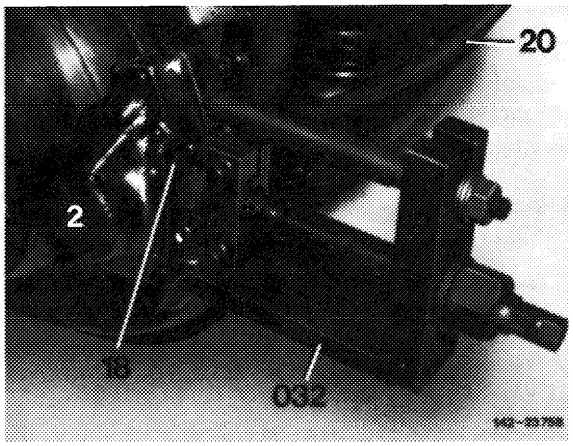
2 Push brake pads (18) out of fixed caliper by means of pushing lever (034).



Note: If brake pad is rusted down, use puller (032) for removal of stuck brake pads.

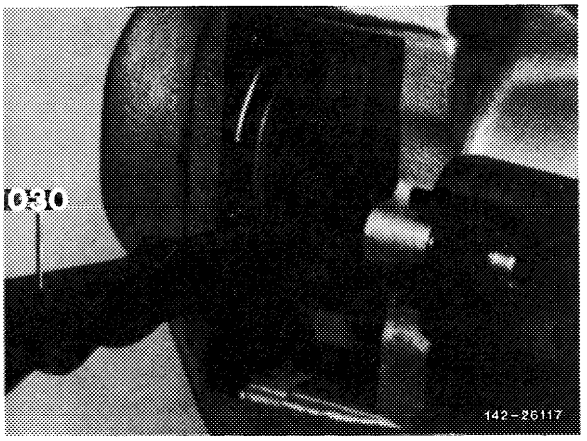
If brake pad wear is high, check pistons for easy operation. If pistons are hard to move, recondition fixed caliper.

Brake disks which are badly contaminated at braking surfaces by deposits from lining (indicated by gray or blue discoloration of brake surfaces) must be cleaned prior to installing new brake pads (42-260).



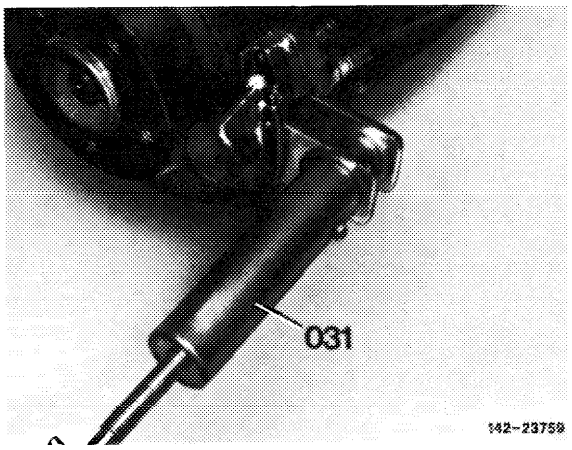
3 Clean guide surface for brake pad in fixed caliper (2) with brake caliper brush (030).

4 Check dust cap for cracks. If dust cap is damaged, remove and disassemble fixed caliper, since penetrating dirt will quickly lead to leaks in fixed caliper.



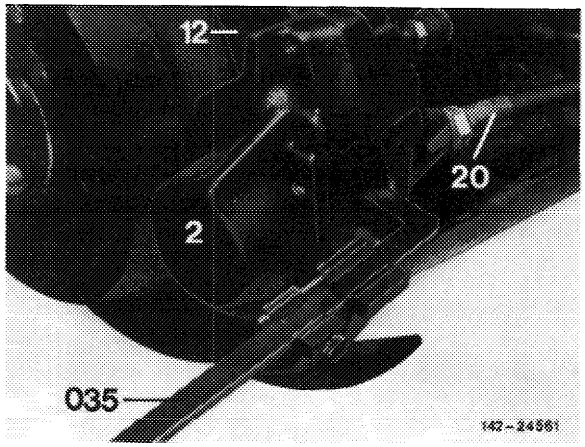
5 To prevent overflowing of expansion tank when the piston is pushed back, draw some brake fluid from expansion tank.

6 Push both pistons back with resetting device (031).



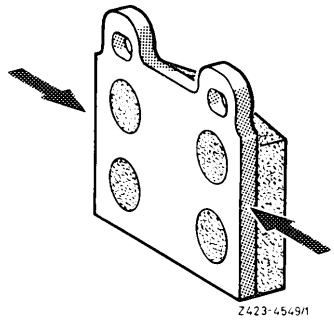
7 Measure thickness of brake disk. To make sure that the wear limit is not below specifications up to next change of brake lining, the dimension should be 0.3 mm above permissible wear limit of 7.3 mm.

8 If dimensions are below permitted test dimension of 7.6 mm, renew brake disk (42-220).



Installation

9 Lightly coat brake pads at spots indicated by arrows in illustration with specified lubricant (refer to table) and insert brake pad into caliper.

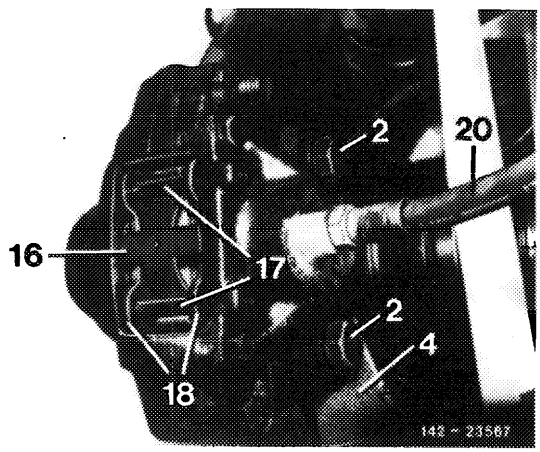


10 Position cross spring (16) and knock holding pin (17) into fixed caliper.

11 Actuate brake pedal several times energetically until firm resistance is felt. Then check level of brake fluid in expansion tank and top up, if required.

Note: New brake pads must be braked-in carefully, that is, the vehicle should be braked several times from 80 to 40 km/h at slight pedal pressure.

Prior to each deceleration, permit brake to cool slightly. Braking to a stop under deceleration should be attempted only with run-in linings.



B. Floating caliper

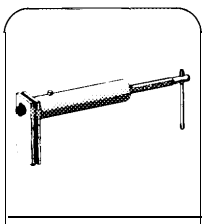
Data

Model	201.028/029 128	201.022/023/024/ 122/126	201.03
Floating caliper piston dia.	**54**		
Thickness of brake pad with backing plate for lining	17.5		19.3
Thickness of backing plate for lining	5.5		6.2
Permissible wear of brake lining up to a remaining lining thickness of	3.5		
Width of brake pad max.	95		110
Effective brake surface per axle (cm^2)	144		176
Thickness of brake disk	22	11	22
Wear limit	19.4	9	19.4
Limit dimension during maintenance[1])	20	9.5	20

[1]) **Refer to Maintenance Manual Volume 2.**

Tightening torque	**Nm**
Self-locking hex. head screw for fastening cylinder housing to brake carrier	35

Special tool



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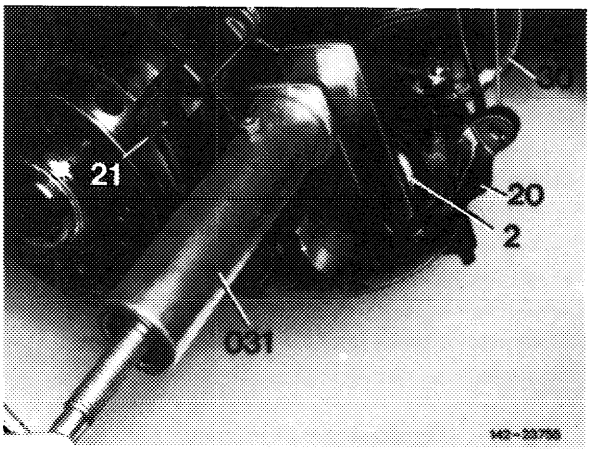
Note

Attention!
On vehicles with modified brake hose layout (brake hose holder on spring dome), 2nd version, **start of 1985, swing cylinder housing upward** for changing brake pad.

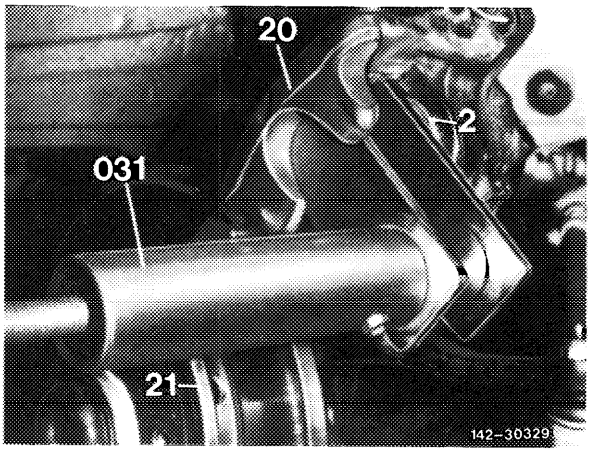
Replace brake pads when the lining is down to 3.5 mm or when greasy. Install only approved lining grades in sets.

Perform a high and a low-pressure test (40-015) if brake pads are excessively worn out.

To prevent canting of piston, piston may be pushed back to their end position by means of piston resetting device (031) only.



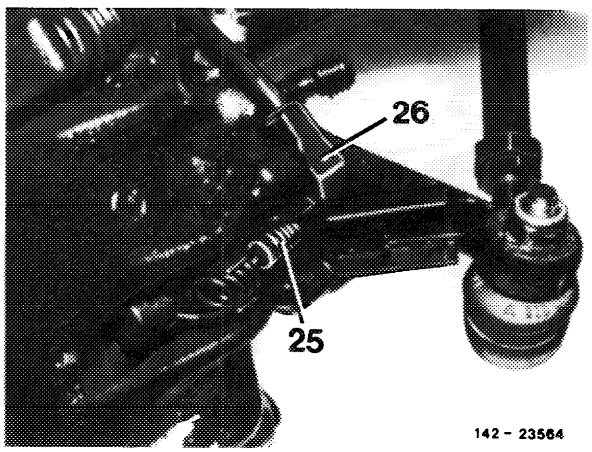
Brake hose layout 1st version



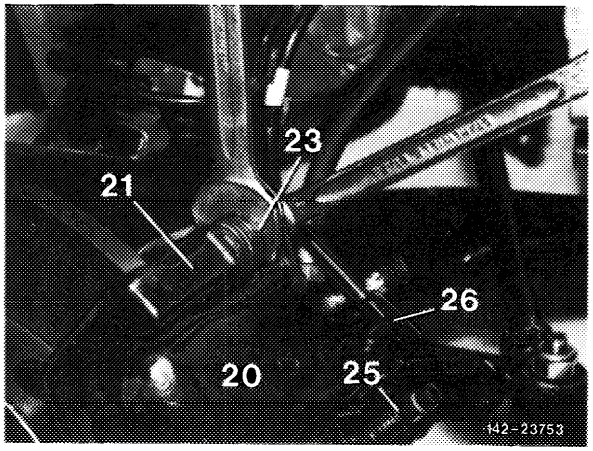
Brake hose layout 2nd version

Removal

1 Lift the two holding lugs attached laterally on cover of plug connection by means of a screw driver and open cover. Do not use force. Remove cable of clip sensor (25) from plug connection (26) on floating caliper and do not pull on cable.

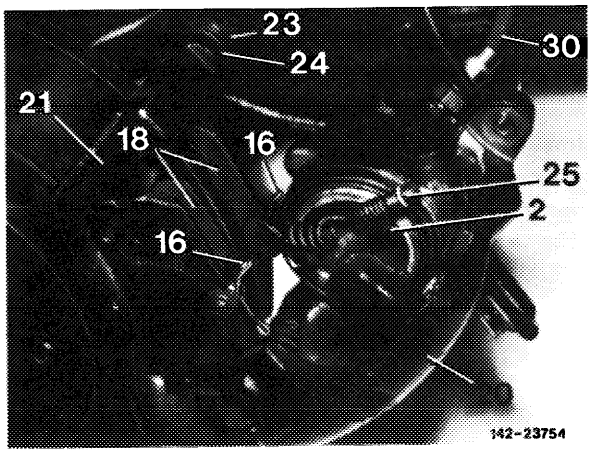


2 Unscrew upper hex. head screw while applying counterhold to sliding bolt (23).



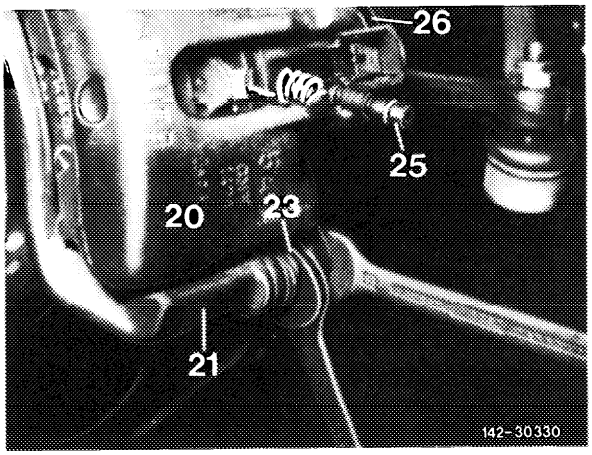
Brake hose layout 1st version

3 Swing cylinder housing (20) in downward direction and connect to torsion bar by means of a suitable hook. Remove both brake pads (18) from brake carrier (21).



Brake hose layout 1st version

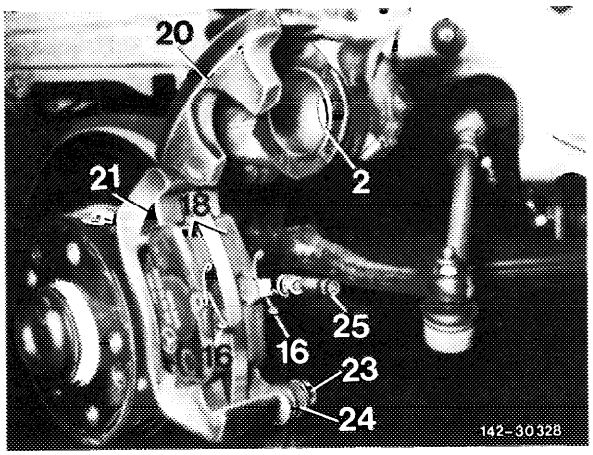
4 Unscrew lower hex. head screw while applying counterhold to sliding bolt (23).



Brake hose layout 2nd version

5 Swing cylinder housing (20) upward and hang up on wheelhouse with a suitable hook. Remove both brake pads (18) from brake carrier (21).

Attention!
After swinging cylinder housing in upward direction, make sure that the sliding bolts are not distorted. Never use cylinder housing for the purpose of changing the steering lock.

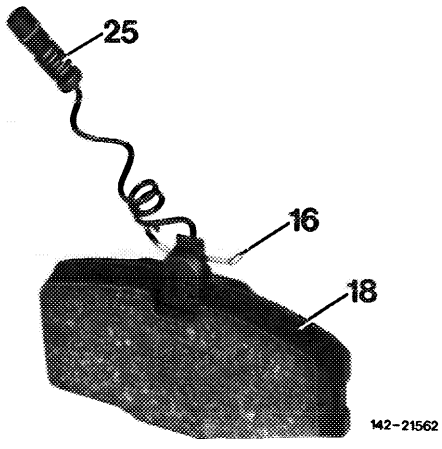


Brake hose layout 2nd version

6 Pull clip sensor (25) out of lining backup plate.

Note: On floating caliper wear limit indicator is on inner brake pad only.

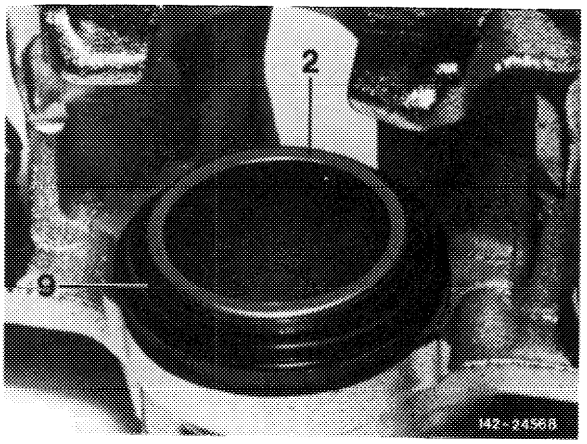
Attention!
Renew clip sensor on which the insulating layer of contact plate has been rubbed through or where damage on a part of sensor including line insulation shows up.



Note: If high brake pad wear shows up, check piston and slide bolt for easy operation. If piston is hard to move, recondition floating caliper.

Brake disks which are badly contaminated at braking surfaces by deposits from lining (indicated by gray or blue discoloration of brake surfaces), must be cleaned prior to installing new brake pads (42-260).

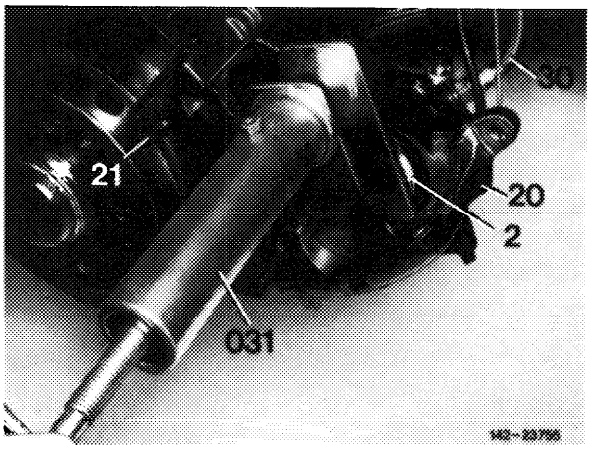
7 Clean contact surface of brake pads in brake carrier.



8 Check dust cap (9) for cracks. If dust cap is damaged, remove and disassemble floating caliper, since penetrating dirt will quickly lead to leaks in floating caliper.

9 To prevent overflowing of expansion tank when the piston is pushed back, draw some brake fluid from expansion tank.

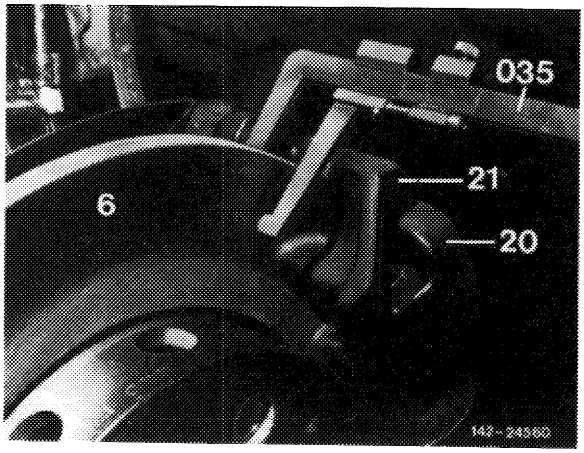
10 Push piston (2) back with resetting device (031).



11 Check air shafts of vented brake disks for contamination and clean air shafts, if required.

12 Measure thickness of brake disks. To make sure that up to next change of brake lining the wear limit is not less than specified, pay attention to limit dimension (refer to Data).

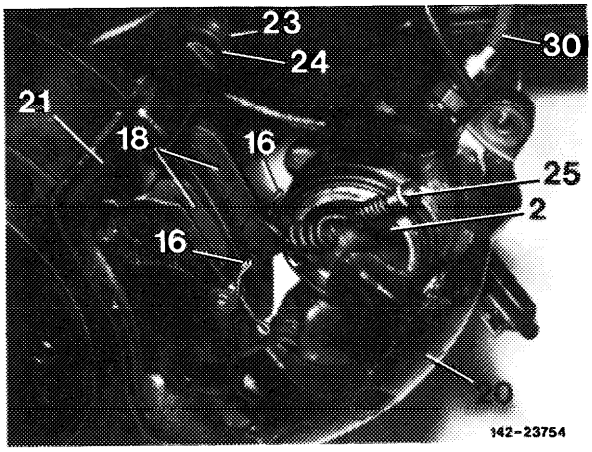
13 If the limit dimension is less than specified, renew brake disk (42–220).



Installation

14 Insert both brake pads (18) into brake carrier (21) making sure that the spring clamp (16) is in parallel with upper edge of lining.

15 Insert clip sensor (25) into inner brake pad.

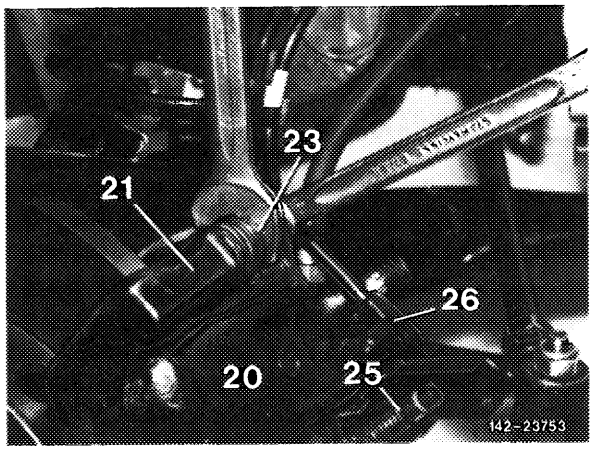


16 Fasten cylinder housing (20) with a new self-locking hex. head screw to brake carrier (21), while applying counterhold to sliding bolt (23). Tightening torque 35 Nm. Check bellows (24) for damage.

Note: Use self-locking hex. head screws only once.

17 Wind up cable of clip sensor (25) in spiral-shape and insert into plug connection (26) on floating caliper. Close cover of plug connection.

18 Operate brake pedal several times energetically until firm resistance is felt. Then check level of brake fluid in expansion tank and top up, if required.



Note: The new brake pads must be braked-in carefully, that is, brake vehicle several times from 80 to 40 km/h at low pedal pressure.

Prior to each deceleration, permit brake to cool slightly. Braking to a stop at high deceleration should be attempted only with run-in linings.

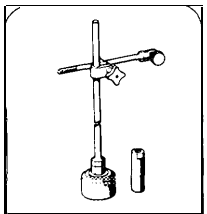
Data

Model	201.022/023/024 122/126	201.028/029 128	201.03
Thickness of brake disk	11	22	
Limit dimension during maintenance')	9.5	20	
Wear limit	9	19.4	
Brake disk dia.	262 ± 0.2		284 ± 0.2
Fitted bore dia.	67.07 67.00		
Lateral runout	max. 0.12		

[1]) Refer to Maintenance Manual Volume 2.

Tightening torque	Nm
Hex. head screw for fastening floating caliper to steering knuckle	115
Lock screw for fastening brake disk to front wheel hub	10

Special tools



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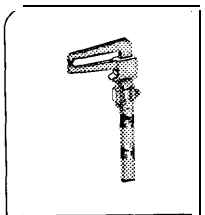

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Conventional tool

Dial gauge A 1 DIN 878	e.g. Mahr, D-7300 Esslingen order no. 810

Note

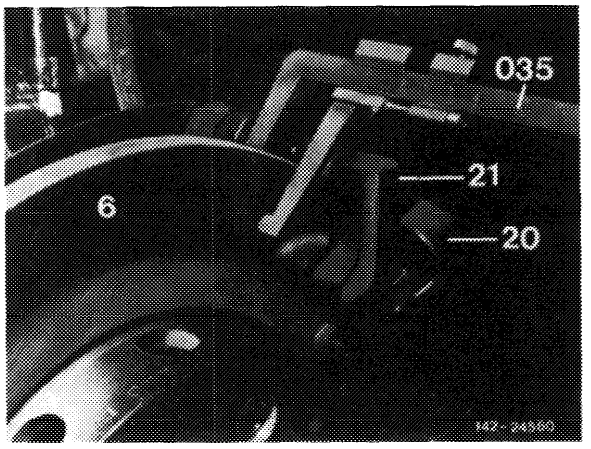
When checking brake disk, proceed as follows:

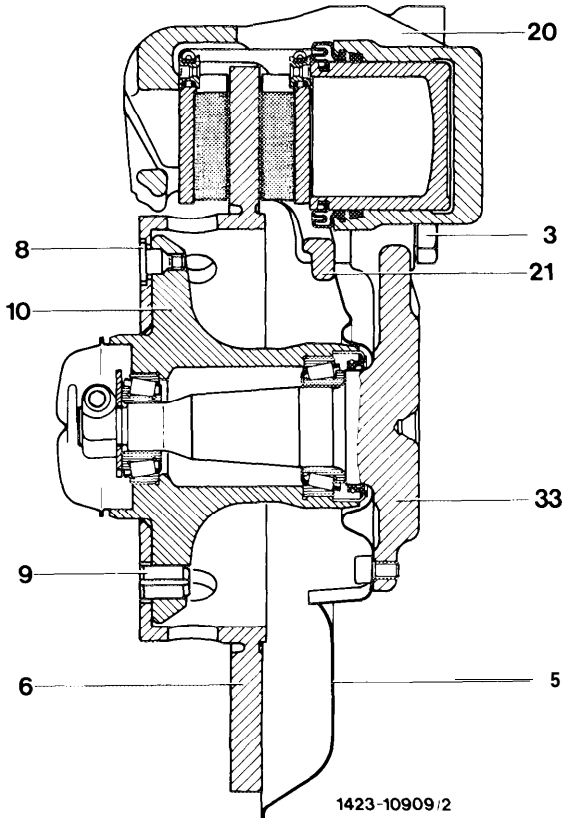
a) Measure thickness of brake disk between cover plate and floating caliper, or with brake pads removed, in shaft by means of slide gauge.

b) **Check visually.**

Vented brake disks with hairline cracks up to 25 mm length, caused by excessive stress, need not be renewed,

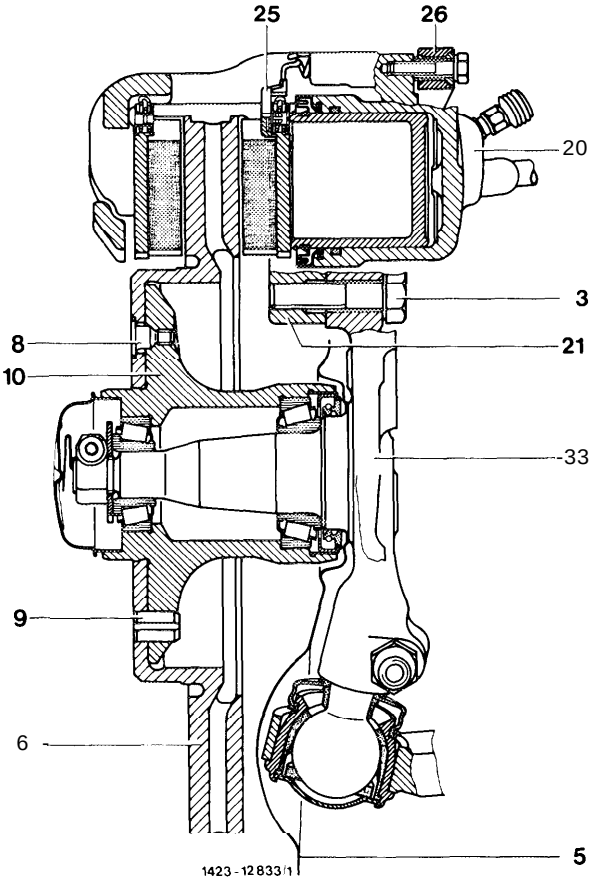
Brake disks with ruptured cracks, with score marks deeper than 0.15 mm and at end of wear limit, must be renewed.





Layout with solid brake disk

3 Self-locking hex. head screw
5 Cover plate
6 Brake disk
8 Lock screw
9 Clamping sleeve
10 Front wheel hub
20 Cylinder housing
21 Brake carrier
33 Steering knuckle



Layout with vented brake disk

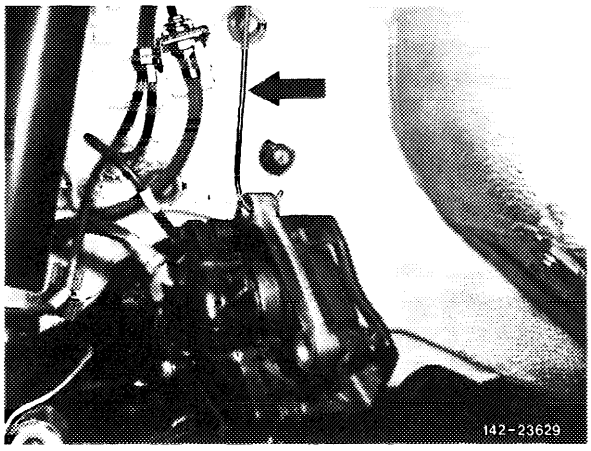
3 Self-locking hex. head screw
5 Cover plate
6 Brake disk
8 Lock screw
9 Clamping sleeve
10 Front wheel hub
20 Cylinder housing
21 Brake carrier
25 Clip sensor
26 Plug connection
33 Steering knuckle

Removal

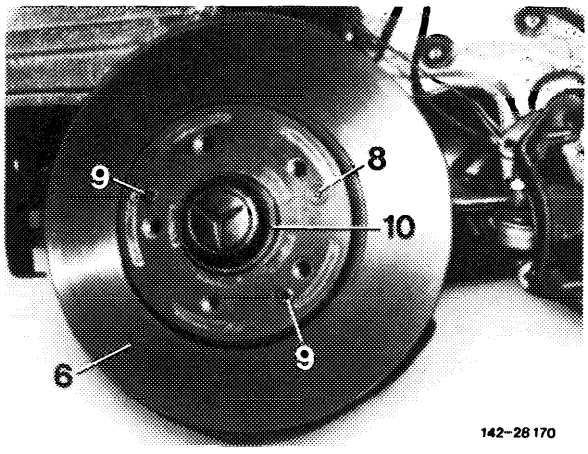
1 **Unscrew hex. head screws (3) and remove floating caliper from steering knuckle (33).**

2 Hang up floating caliper including brake hose in wheelhouse by means of a suitable hook.

Note: The hook is self-made. Brake hose should not undergo tensile stress.



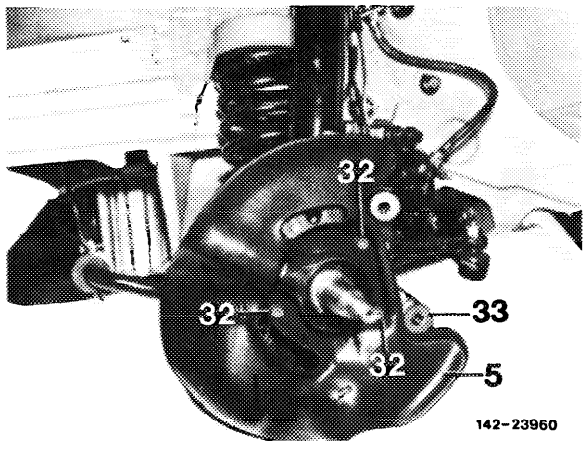
3 On vented brake disk and starting September 1984 on solid brake disk, unscrew lock screw (8) first, then remove brake disk (6) from wheel hub (10).



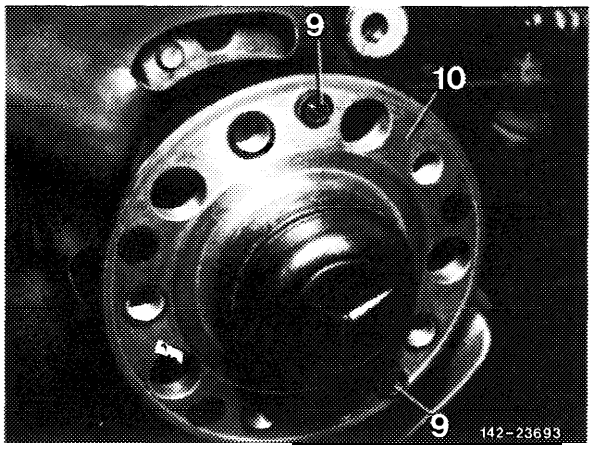
Installation

Note: Prior to installation of brake disk, remove rust, if any, on flange of brake disk and front wheel hub. Make sure that there is no burr at fitting point of brake disk. Check attachment of cover plate.

Replacement brake disks are protected against corrosion by means of nitro cellulose paint. Prior to installation, these brake disks must be cleaned with a solvent. Make sure that safety rules are observed.



4 Place brake disk on front wheel hub (10). Make sure that the two dowel sleeves (9) are perfectly seated in brake disk cup. Mount lock screw (8) and tighten to 10 Nm.



5 Fasten floating caliper with new self-locking hex. screws (3) to steering knuckle (33). Pay attention to perfect installation of brake hose (42–100).

Tighten hex. head screws to 115 Nm.

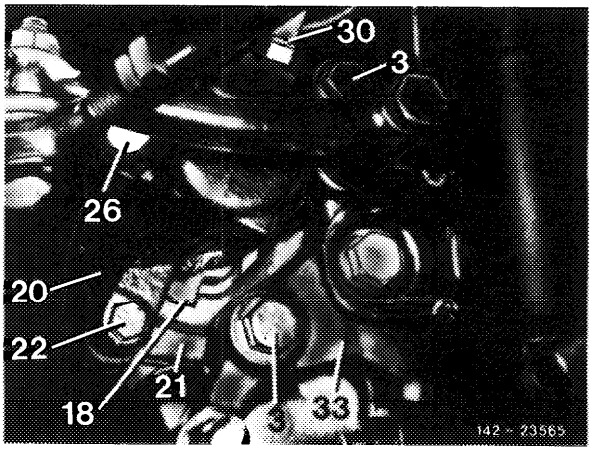
Note: Use self-locking hex. head screws only once.

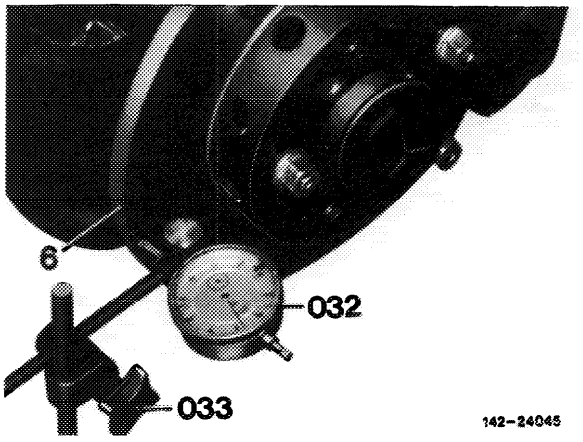
If the tightening torque of the new self-locking hex. head screws is very high, clean threads in floating caliper with a tap M 12 x 1.5 from residual glue of micro-encapsulated screws.

Prior to moving off, actuate brake pedal several times energetically to obtain the correct clearance between brake disk and brake pad. Then top up brake fluid supply in expansion tank of tandem main cylinder.

Note: If during the test drive (mainly after driving around a bend) a different pedal travel shows up, check wheel bearing end play of front wheel hubs and adjust, if applicable (33-300).
If required, measure lateral runout of brake disk at outer dia.

If lateral runout of brake disk is too high, displace brake disk on front wheel hub. Renew brake disk, if required.





42-228 Removal and installation of brake disk on rear axle

Data

Thickness of brake disk	9
Limit dimension during maintenance')	7.6
Wear limit	7.3
Disk dia.	258 ± 0.2
Fitted bore dia.	67.07 / 67 .OO
ID for parking brake	164 + 0.2
Lateral runout	max. 0.15

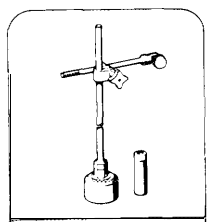
[1]) **Refer to Maintenance Manual Volume 2.**

Lubricants

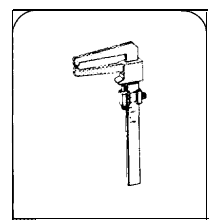
Molykote-Paste U	Molykote-Paste G Rapid	Liqui-Moly-Paste 36

Tightening torque	Nm
Hex. head screw for attaching fixed caliper to wheel carrier of rear axle	50
Lock screw for fastening brake disk to rear axle shaft flange	10

Special tools



363 589 02 21 00



126589001900

Conventional tool

Dial gauge A 1 DIN 878	e.g. Mahr, D-7300 Esslingen order no. 810

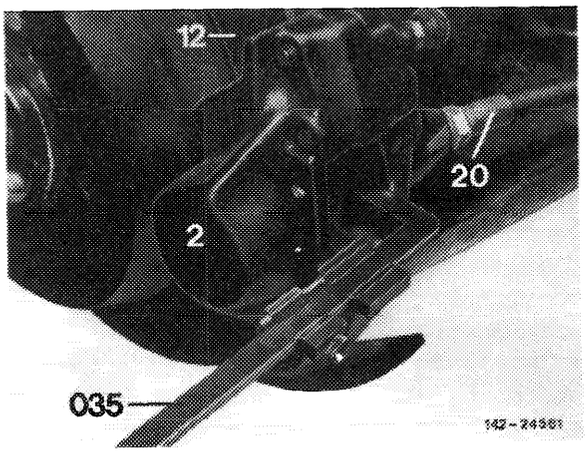
Note

When checking brake disk, proceed as follows:

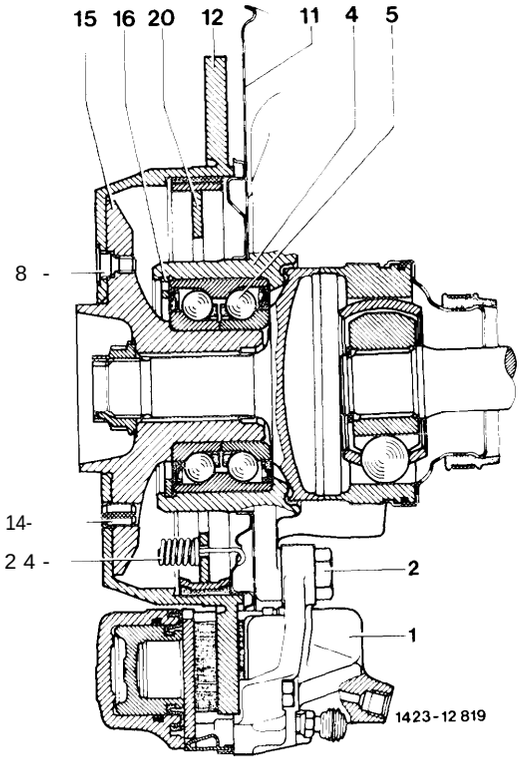
a) Measure thickness of brake disk between cover plate and caliper or with brake pads removed, in lining shaft with slide gauge.

b) Check visually.

If cracks are larger (not measurable), with score marks deeper than 0.5 mm and when attaining wear limit, renew brake disks.

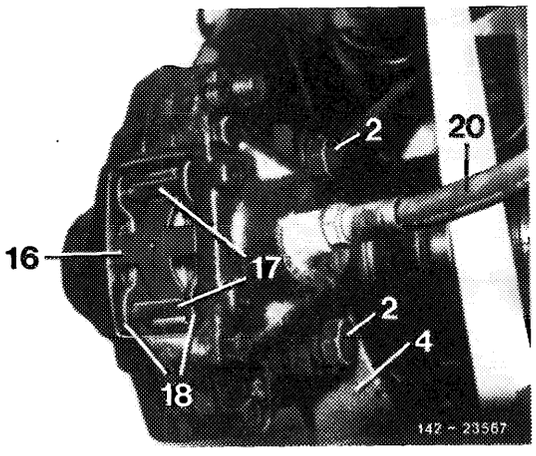


Removal



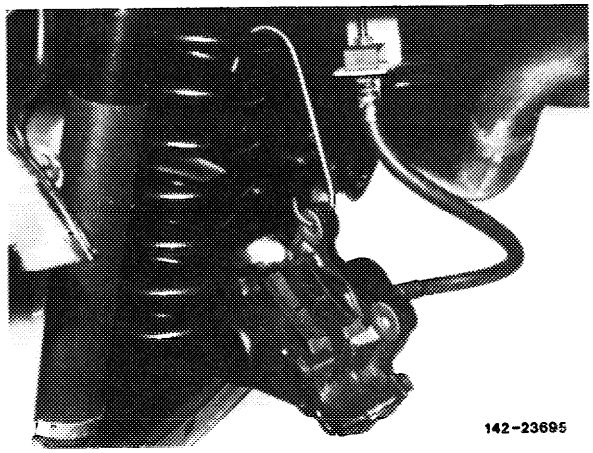
1 **Fixed caliper**
2 Self-locking hex. head screw
4 Wheel carrier
5 Two-row angular ball bearing
8 Lock screw
11 Cover plate
12 Brake disk
14 Fitted pin
15 Rear axle shaft flange
16 Locking ring
20 Brake shoes
24 Pressure spring

1 Unscrew hex. head screws (2) and remove fixed caliper from wheel carrier (4).



2 Hang up fixed caliper including brake hose with a suitable hook on spring.

Note: The hook is self-made. Do **not expose brake hose to tensile stress.**



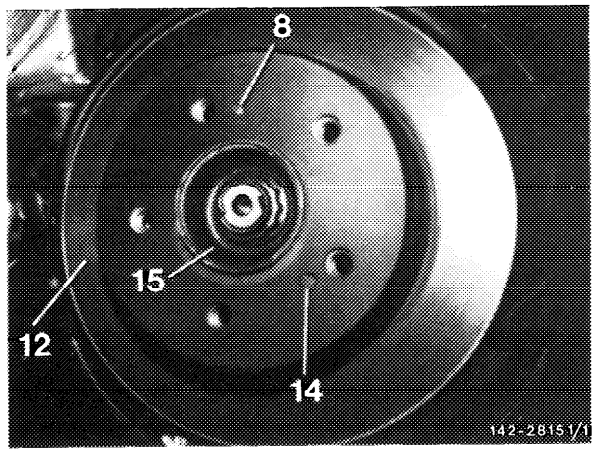
3 With lock screw (8) installed, unscrew this screw first, then remove brake disk (12) from rear axle shaft flange (15).

Loosen stuck brake disks by light blows with a plastic hammer from seat of rear axle shaft flange. Make sure that the parking brake is completely released.

Installation

4 Coat fitted seat of rear axle shaft flange with a heat-resistant long-term lubricant (Molykote-Paste "U", Molykote-Paste G Rapid, Liqui-Moly-Paste 36), so that the brake disk can be easily removed from rear axle shaft flange later on.

Note: Spare brake disks are protected against corrosion by means of nitro-cellulose paint. For this reason, these brake disks should be cleaned with a solvent prior to installation. Make sure that safety rules are observed.

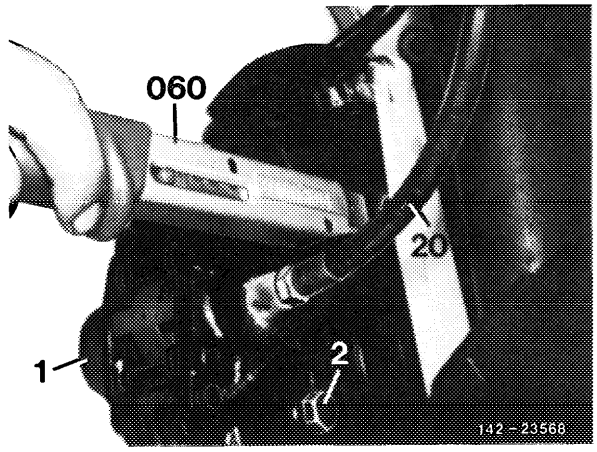


5 Place brake disk (12) on rear axle shaft flange. Make sure that the dowel pin (14) is correctly entering brake disk. Screw in lock screw (8) and tighten to 10 Nm.

6 Attach caliper with new self-locking hex. head screws to wheel carrier. Tighten hex. head screws to 50 Nm (42–120).

Note: Use self-locking hex. head screws M 10 x 22 only once.

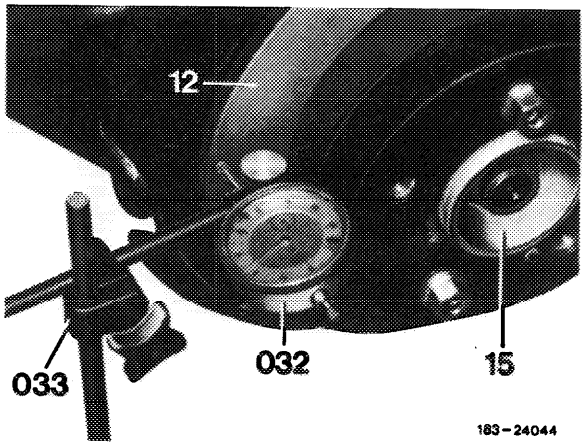
If the screw-in torque of the new self-locking hex. head screws is very high, clean threads in wheel carrier with a tap M 10 from residual glue of micro-encapsulated screws.

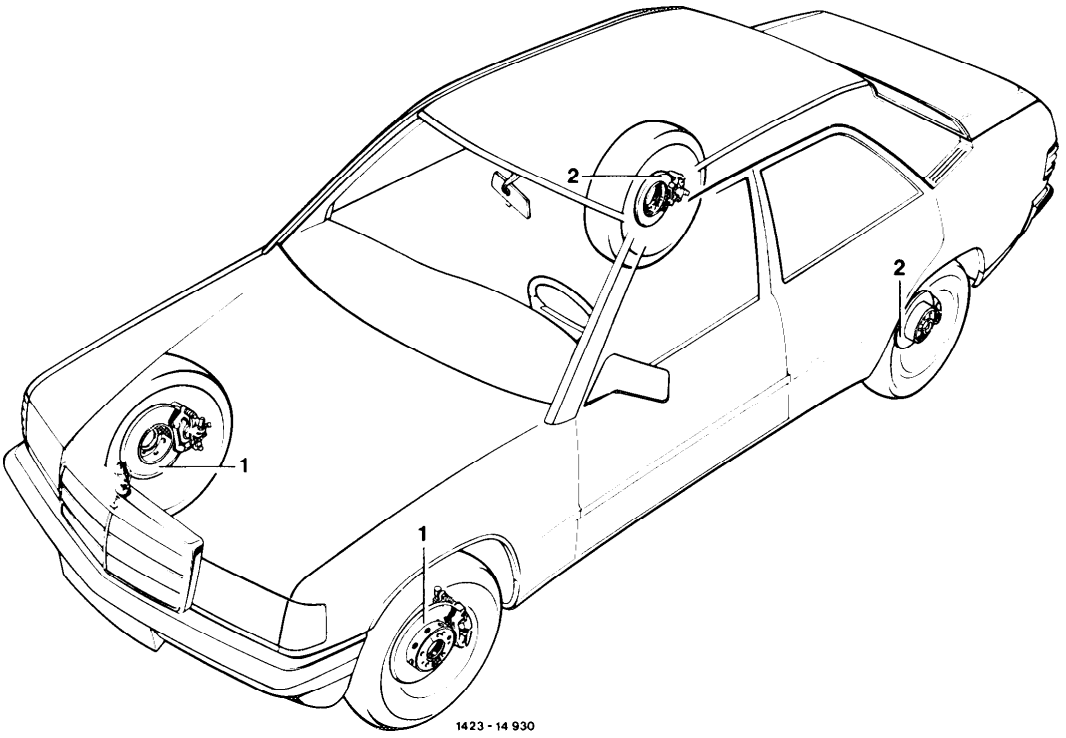


Attention!
Prior to moving off, actuate brake pedal several times energetically, to obtain the correct clearance between brake disk and brake pad. Then top up brake fluid supply in expansion tank of tandem main cylinder.

Note: If during a trial run (mainly after driving around bends) a different pedal travel is observed, measure lateral runout of brake disk at OD. Simultaneously, check rear axle shaft flanges for vertical and lateral runout (35-130).

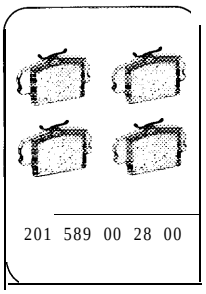
If lateral runout of brake disk is too high, renew brake disk.

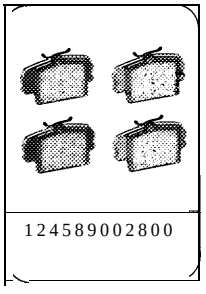




1 Brake disks of front axle . . . . . Cleaning pads 201 589 00 28 00 (95 mm wide)
Cleaning pads 124 589 00 28 00 (110 mm wide)
2 Brake disks of rear axle. . . . . Cleaning pads 201 589 01 28 00

Special tools


201 589 00 28 00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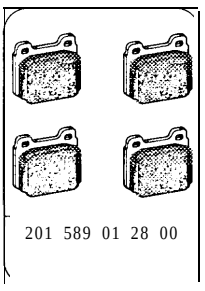

201 589 01 28 00

Note

When cleaning brake disks while driving, always provide only one axle with cleaning pads. Do not actuate brake in jerks, to make sure that the emery cloth cannot be pulled from cleaning pads.

Owing to their low speed and the resulting inadequate cleaning effect, drum-type and brake dynamometers are unsuitable for cleaning purposes.

Front axle

1 Remove brake pads (42—160).

2 Install cleaning pads 201 589 00 28 00 or 124 589 00 28 00 (050) on front axle only.

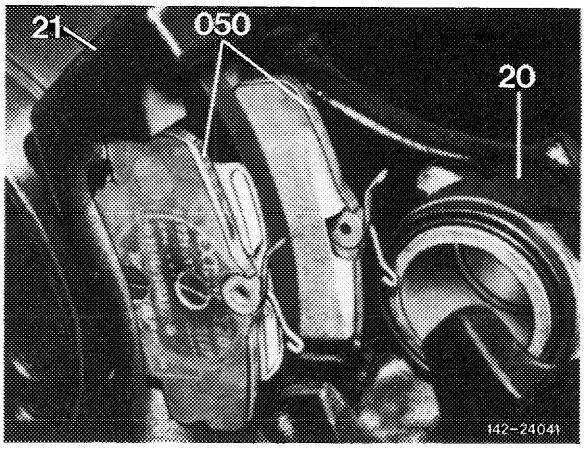
3 Clean brake disks,

a) Drive respective wheel with a suitable drive unit (e.g. finish balancer made by Hofmann) and press cleaning pads several times against brake disk under slight foot pressure against brake pedal.

b) **Drive vehicle at a speed of approx. 30 km/h for a distance of 300 m while pressing cleaning pads several times quickly against brake disks under a slight foot pressure of approx. 50 N.**

4 Remove cleaning pads.

5 Install brake pedals (42-160).

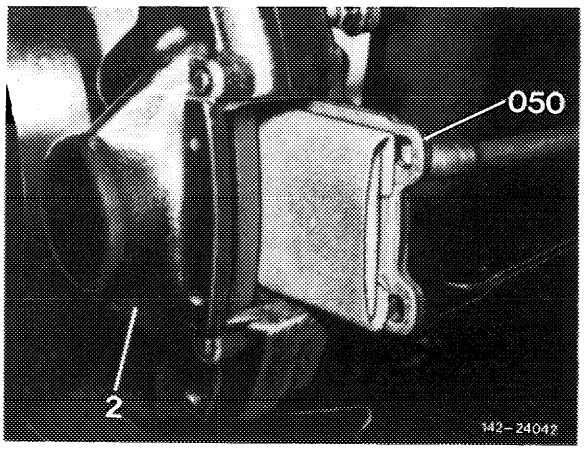


Rear axle

6 Remove brake pads (42-160).

7 Install cleaning pads 201 589 01 28 00 (050) at rear axle only.

Drive vehicle at a speed of approx. 30 km/h for a distance of 300 m while stepping against brake pedal at a low pedal pressure of approx. 50 N to force the cleaning pads for a short moment against the brake disks.



Attention!
With the vehicle jacked up, the rear wheels should never be driven by the engine or by means of another drive unit.

8 Remove cleaning pads.

9 Install brake pads (42—160).

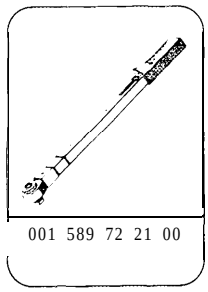
42-310 Removal and installation of stepped tandem main cylinder

Data

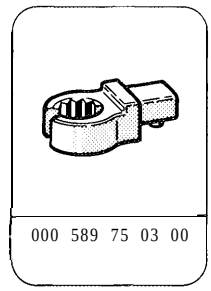
Model			201.023/024/028 122/126	201.029/034/128
Cylinder dia.	Pushrod circuit	Inch	7.8	15/16
		mm	22.20	23.81
	Floating circuit	Inch	11/16	3/4
		mm	17.46	19.05

Tightening torques	Nm
Hex. nuts for fastening main cylinder to brake unit	15
Coupling nut of brake line on main cylinder	10

Special tools



001 589 72 21 00



000 589 75 03 00

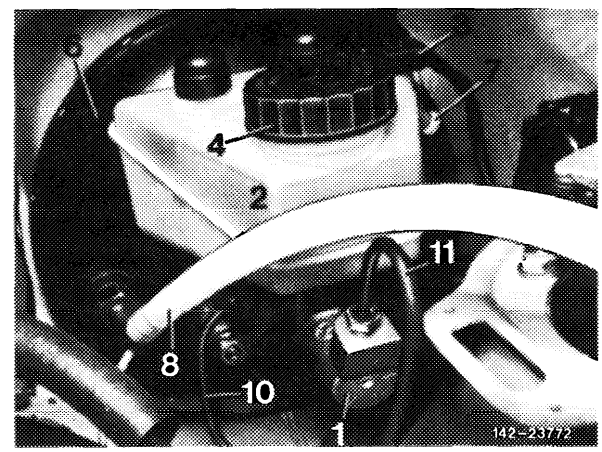
Conventional tool

Open double-box wrench 9 x 11 mm	e.g. Hazet, D-5630 Remscheid order no. 6 12

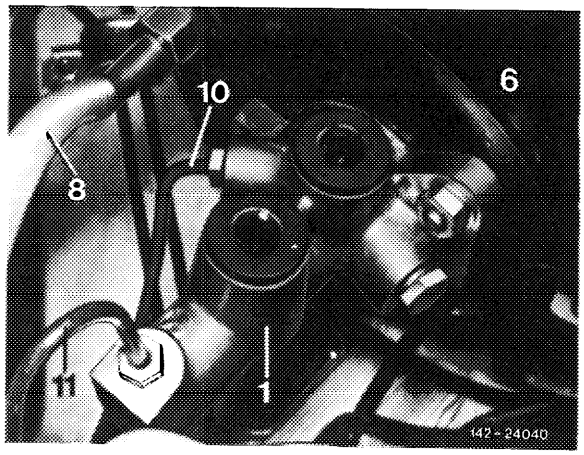
Note

During removal and installation of tandem main cylinder note the following:

Push brake line (11) slightly sideways. Remove and install tandem main cylinder in axial direction to push rod in brake carrier. Do not tilt tandem main cylinder, since-otherwise the push rod will be forced out of its axial position and may brake out of holding lugs on control member.



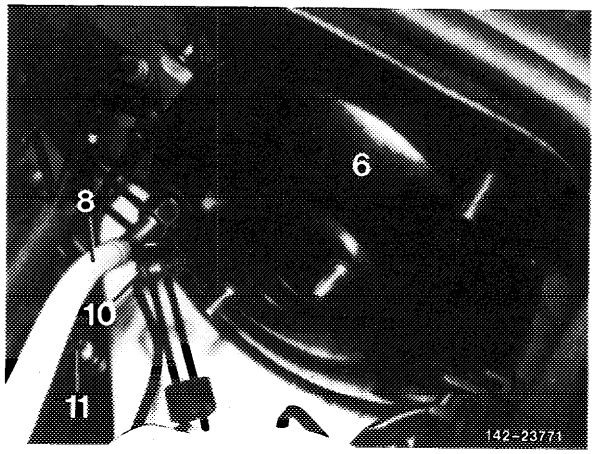
For loosening and tightening brake lines use conventional open double-box wrench or open box wrench element only.



Removal

1 Pump out brake fluid via an open bleeder plug of front axle and rear axle brake circuit. Make sure that all chambers of expansion tank are drained.

2 Loosen plug connection (3) on contact element of warning device, lifting holding lugs with a small screw driver for this purpose. On vehicles with manual transmission, remove connecting hose on connection (7) to master cylinder.



3 Remove expansion tank from tandem main cylinder.

4 Disconnect brake lines to front and rear wheel brake on tandem main cylinder.

Immediately close all brake lines with rubber caps and connections on tandem main cylinder with blind plugs.

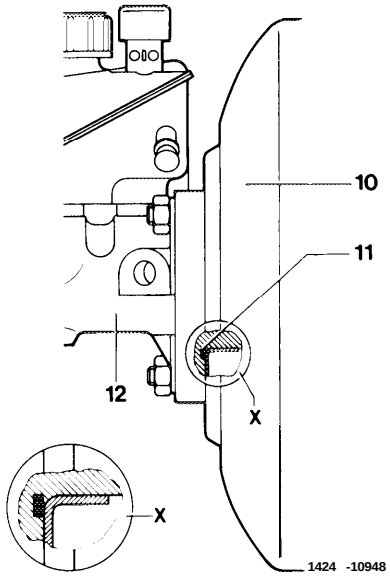
5 Loosen tandem main cylinder on brake unit and remove, paying attention to sealing ring located in groove in flange of tandem main cylinder.

Attention!

In the event of a loss of brake fluid, which cannot be observed visually, check whether brake fluid has entered the brake booster through a leaking secondary seal in tandem main cylinder. If so, proceed as follows:

1. Do not remove brake booster.
2. Draw off brake fluid.
3. Change brake booster if there are more than 100 cc of brake fluid in unit.

Note: The flexible diaphragm is resistant to brake fluid, while the reaction disk and the plate valve in control member are not. For this reason, draw off brake fluid only with the brake booster installed. With the brake booster installed, no brake fluid can reach the reaction disk or the plate valve up to 100 cc.



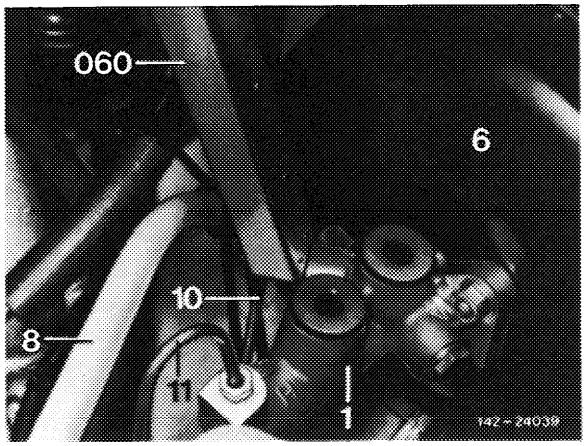
Installation

Attention!
Always renew sealing ring between tandem main cylinder and brake booster, since the connection must be **absolutely** sealtight.

6 Insert sealing ring (11) into groove of tandem main cylinder **(12)** and fasten main cylinder to brake unit (10). Tighten hex. nuts to 15 Nm.

7 Connect brake lines on tandem main cylinder. For this purpose, use torque wrench 001 589 72 21 00 with open box end element 000 589 75 03 00.

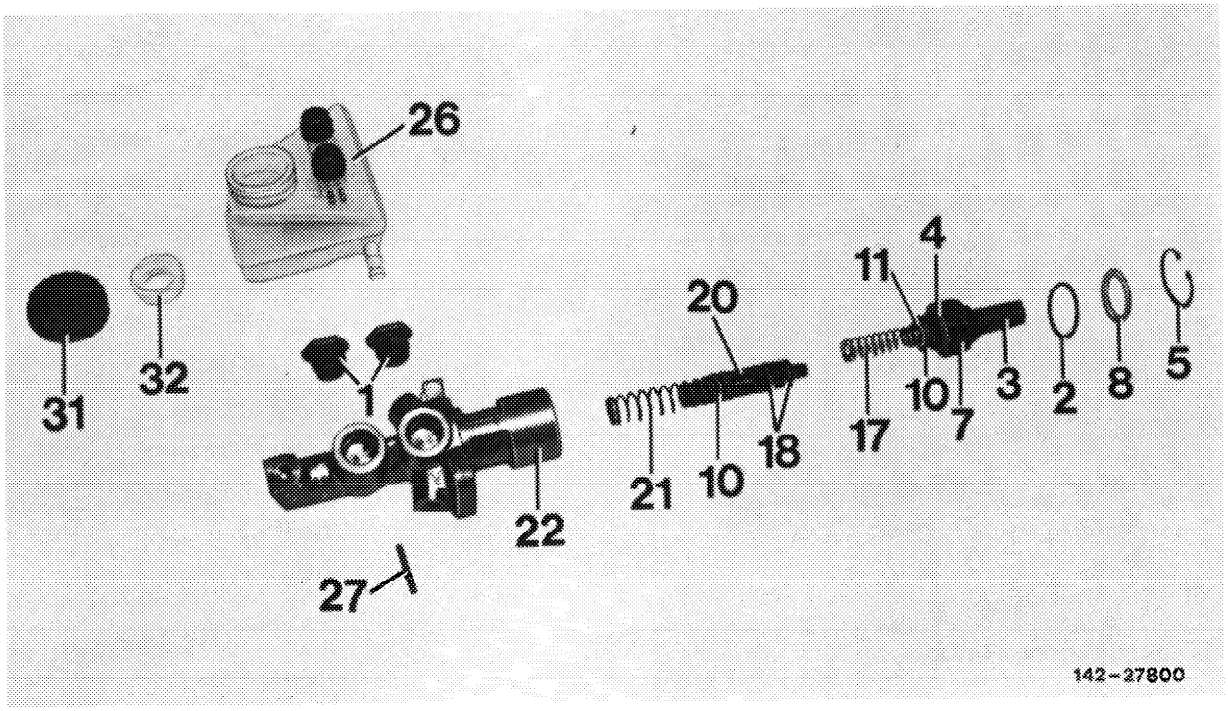
Tightening torque 10 Nm.



8 Install expansion tank and fill with brake fluid. Make sure that all chambers are completely filled with brake fluid.

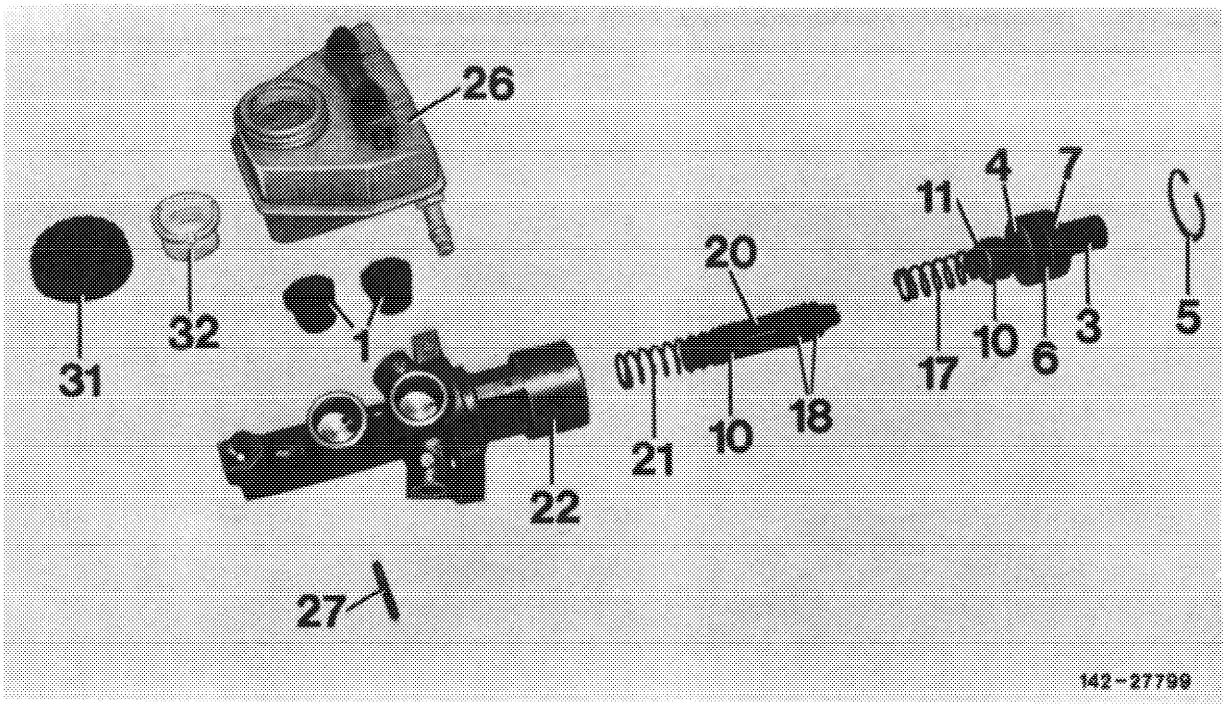
9 Connect plug connection on contact element of warning device.

10 Bleed brakes and check for leaks (42-010 and 42–015).



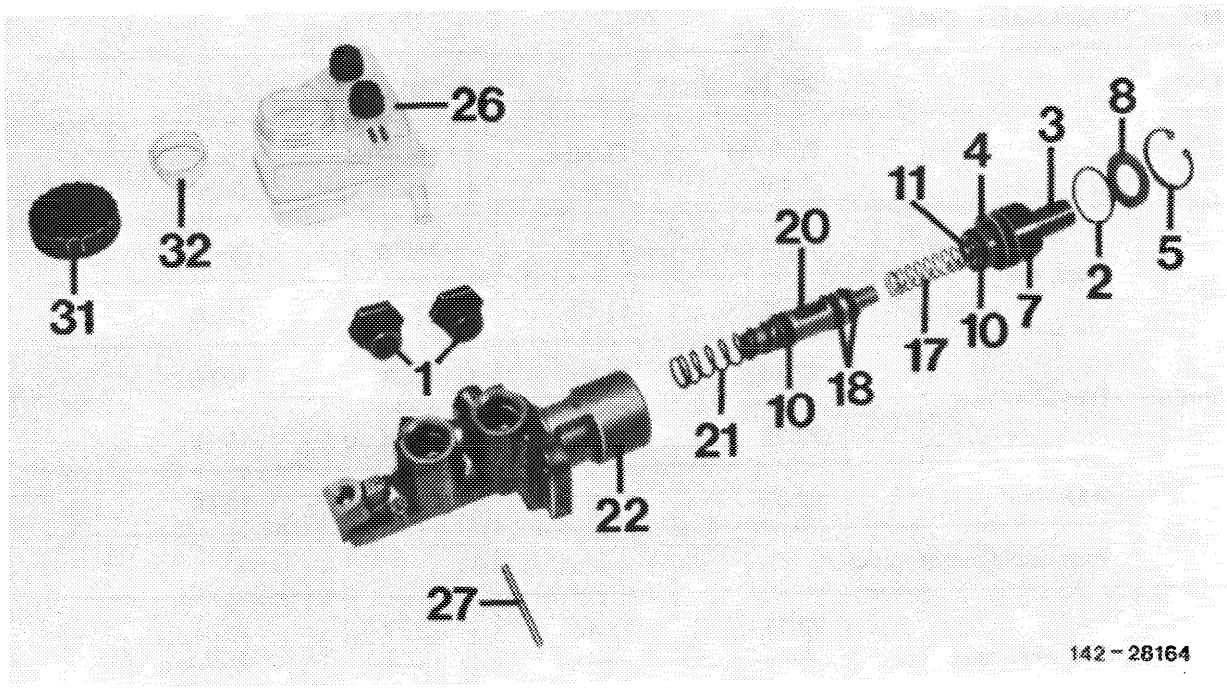
Girling tandem main cylinder

1	Tank plug	
2	O-ring.	Renew
3	Piston (push rod circuit)	Renew
4	Stop washer	
5	Locking ring	**Pay** attention to correct seat
7	Bushing	Renew
8	Stop washer	
10	Primary sleeve	Renew
11	Supporting ring	
17	Compression spring	**Renew**
18	Separating sleeve	Renew
20	Piston (floating circuit)	Renew
21	Compression spring	Renew
22	Housing	Pay attention to score marks
26	Expansion tank	Clean
27	Cyl. pin	
31	Cover	
32	Strainer	**Clean**



Bendix tandem main cylinder

1	Tank plug	
3	Piston (push rod circuit)	Renew
4	Stop washer	
5	Locking ring	Pay attention to correct seat
6	Secondary sleeve	Renew
7	Bushing	Renew
10	Primary sleeve	Renew
11	Supporting ring	
17	Compression spring	Renew
18	Separating sleeve	Renew
20	Piston (floating circuit)	Renew
21	Compression spring	Renew
22	Housing	Pay attention to score marks
26	Expansion tank	Clean
27	Cyl. pin	
31	Cover	
32	Strainer	Clean



Teves tandem main cylinder

1	Tank plug	
2	O-ring.	Renew
3	Piston (push rod circuit)	Renew
4	Stop washer	
5	Locking ring	Pay attention to correct seat
7	Bushing	Renew
8	Stop washer	
10	Primary sleeve	Renew
11	Supporting ring	
17	Compression spring	Renew
18	Separating sleeve	Renew
20	Piston (floating circuit)	Renew
21	Compression spring	Renew
22	Housing	Pay attention to score marks
26	Expansion tank	Clean
27	Cyl. pin	
31	Cover	
32	Strainer	Clean

Data Tandem main cylinder

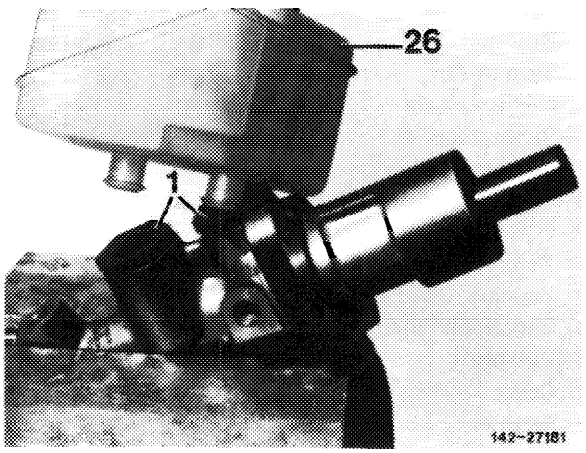
Model			201.02, 201.12		201.03	
			Push rod circuit	Floating circuit	Push rod circuit	Floating circuit
Housing	Nom. dia.	Inch	7/8	11/16	15/16	3/4
		mm	22.20	17.46	23.81	19.05
	Dia. when new		22.20 — 22.26	17.45 — 17.50	23.81 — 23.86	19.05 — 19.10
	Wear limit		22.30	17.56	23.92	19.16
	Permissible out-of-round		0.03			
Piston	Dia. when new		22.17 — 22.12	17.43 — 17.35	23.77 — 23.72	19.01 — 18.96
	Wear limit		22.05	17.33	23.66	18.90
	Clearance		0.02-O. 15			
	Stroke		17	15	16.8	16.2

Note

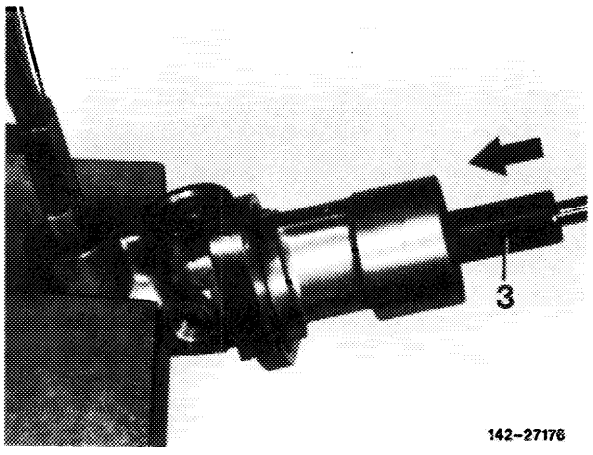
Repair sets and housings from different manufacturers can be optionally used.

Disassembly

1 Pull expansion tank and then tank plug out of tandem main cylinder.

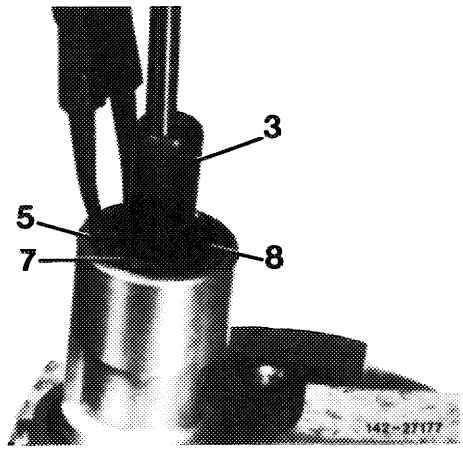


2 Slightly push in piston (3) by means of a mandrel and pull cyl. pin (27) out of housing with suitable pliers.



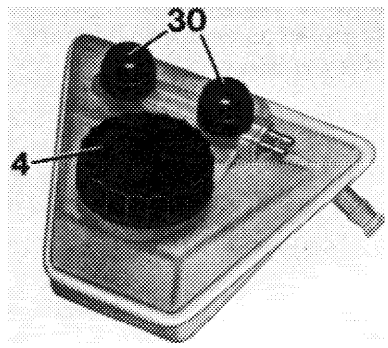
3 Take locking **ring** (5) out of housing, then remove piston (3) together with secondary sealing pack out of housing.

4 Knock out complete piston for floating circuit by means of light blows against housing.



5 Unscrew closing cover (4) and remove strainer.

Note: The contact element (30) cannot be removed.



142-23958

Checkup

6 Clean all parts thoroughly with new brake fluid, making sure that all residue is flushed out of housing and expansion tank.

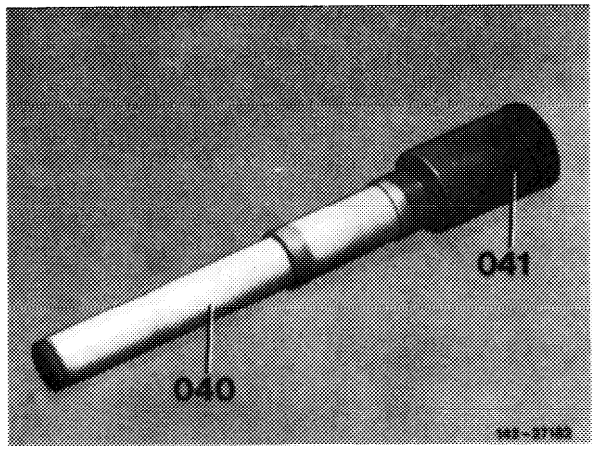
7 Check bore in housing for score marks and damage.

Do not refinish scored or damaged housings.

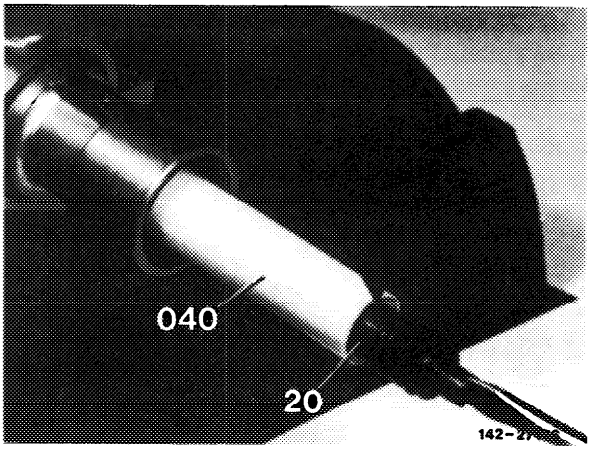
Assembly

8 Slightly rub bore of housing with brake cylinder paste.

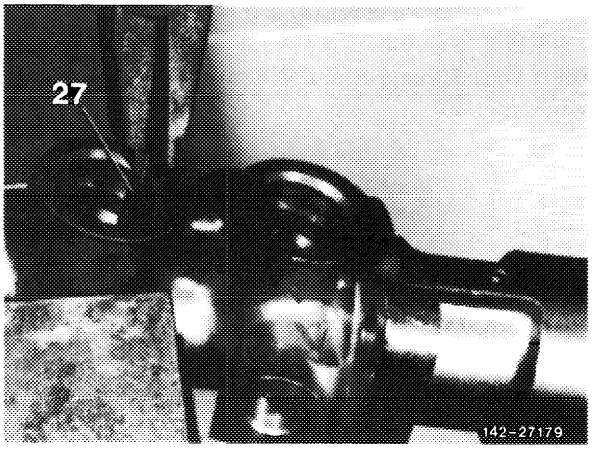
9 Separate packing sleeves. Remove sealing pack and piston for push rod circuit from sleeve (041).



10 Clamp housing slightly tilted with bore in downward direction. Slip sleeve (040) together with floating piston by means of a screwdriver up to stop into housing. Make sure that the guide slot in piston (refer to arrow) is vertical. Position of piston can be corrected as required with screwdriver.

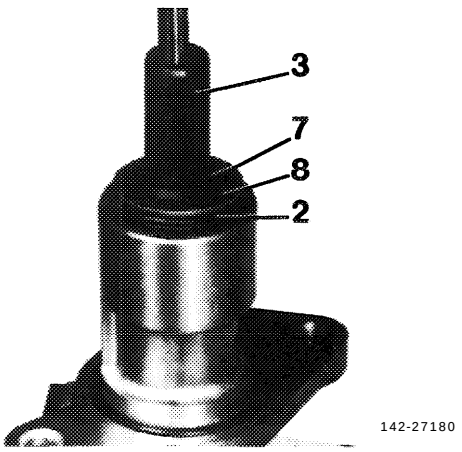


11 Hold piston in place with mandrel. Slip cyl. pin (27) with chamfer first into bore up to stop. The cyl. pin should project no more than 2-3 mm. Remove mandrel and sleeve.

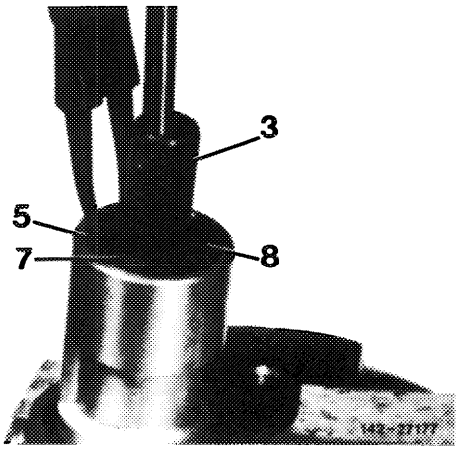


12 Clamp tandem main cylinder in such a manner that the cylinder bore is pointing upward.

13 Introduce secondary seal pack together with push rod piston into cylinder housing and push downward by means of mandrel.



14 Hold piston in place and mount locking ring (5). Make sure that the ring is correctly seated in groove of housing.

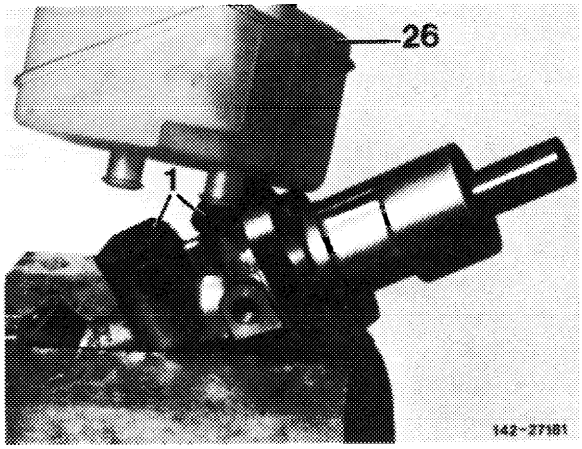


Mounting expansion tank

15 Clamp tandem main cylinder in horizontal position. Insert straliner into tank and screw on closing cover.

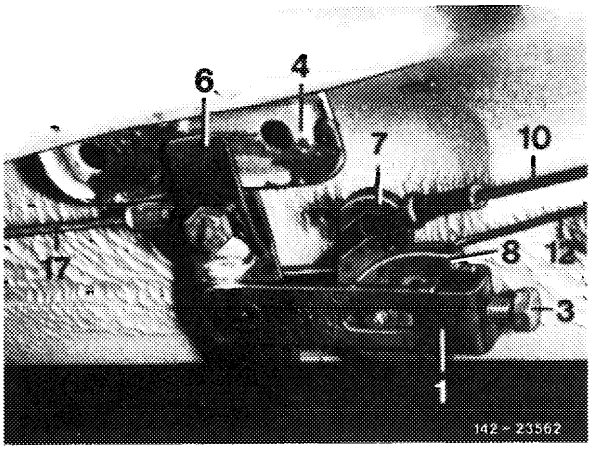
16 Rub tank plug (1) lightly with brake cylinder paste and push into housing.

17 Insert expansion tank (26) first with one pipe connection into housing, rotate by 180° and then push second pipe connection into housing. Make sure of perfect seat.



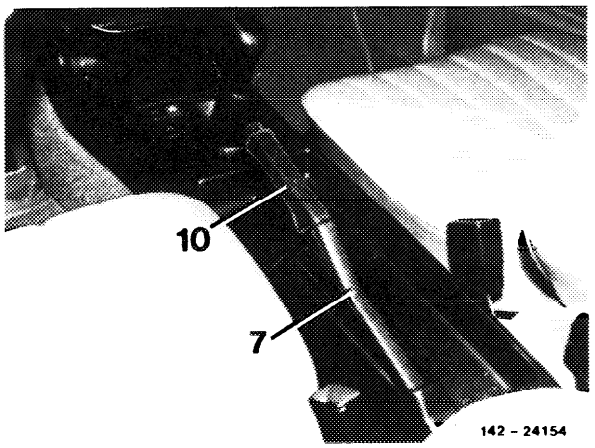
Removal

1 Disconnect return spring (12) on cable control compensation.



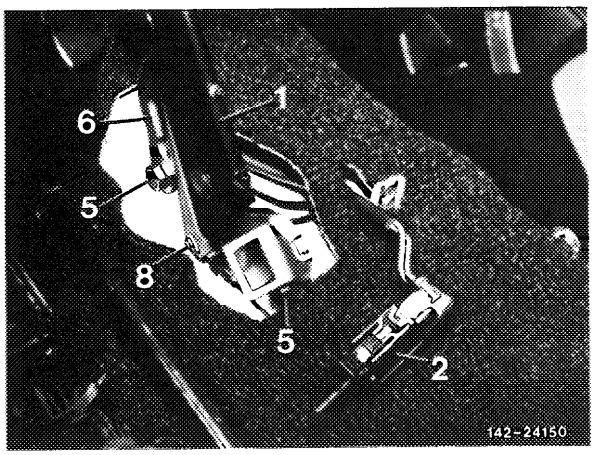
2 Pull-off handle (10) and remove lining (7) from lever.

3 Remove center console.

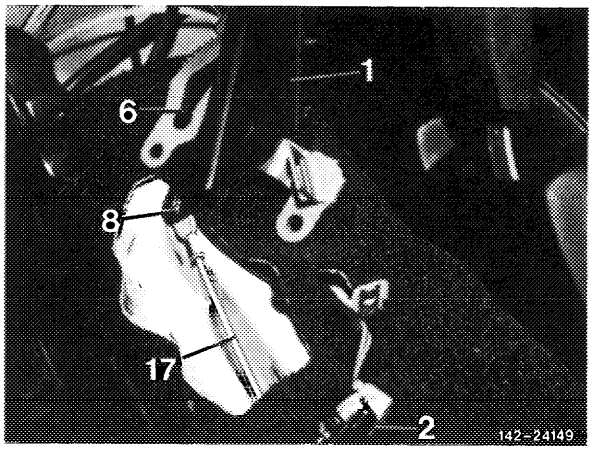


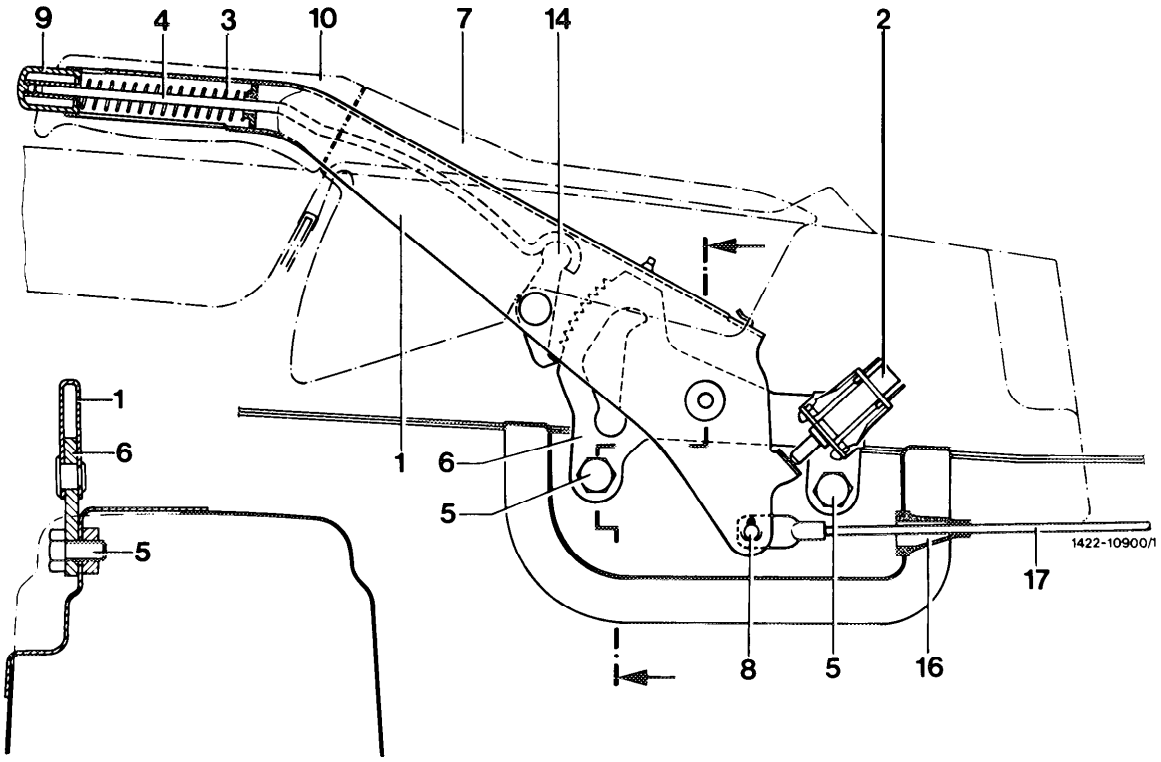
4 Remove switch for warning lamp (2).

5 Loosen hex. screws (5) and remove lever (1).



6 Remove flange bolt (8) and take off brake cable (17).





1 Lever
2 Switch
3 Spring
4 Pawl rod
5 Hex. head screw
6 Detent curve
7 Lining
8 Flange bolt
9 Push button
10 Handle
14 Locking pawl
16 Rubber grommet
17 Front brake cable

7 Attach brake cable (17) with flange bolt (8) to lever (1). Cotter flange bolt.

8 Fasten lever (1) with both hex. head screws (5) to propeller shaft tunnel.

9 Install switch for warning lamp (2).

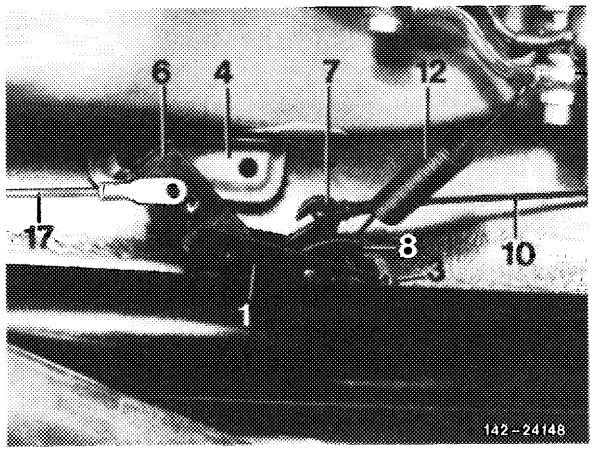
10 Install center console.

11 Install lining (7) and handle (10).

12 Attach return spring (12) to cable control compensation.

13 Adjust parking brake (42–540).

Removal



1 Disconnect return spring (12) on cable control compensation.

2 Unscrew hex. head screw by means of which the brake cable (17) is fastened to intermediate lever (6) and remove brake cable.

3 Remove lever of parking brake (42–510).

4 Loosen brake cable (17) on lever (1) and pull out toward the rear through frame floor.

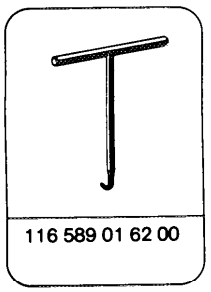
Installation

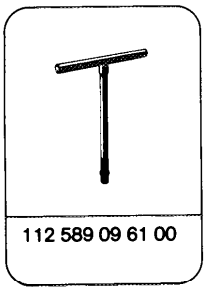
5 Guide brake cable (17) through frame floor and insert rubber grommet into frame floor.

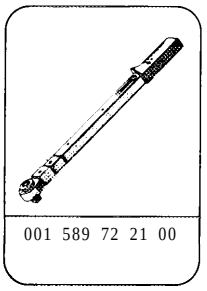
For further installation proceed vice versa.

6 Adjust parking brake (42–540).

Special tools







Removal

1 **Remove brake shoes of parking brake (42–530).**

2 Unscrew hex. head screw (25) from wheel carrier (4) and remove brake cable control (10).

3 Disconnect return spring (12) from holder (14).

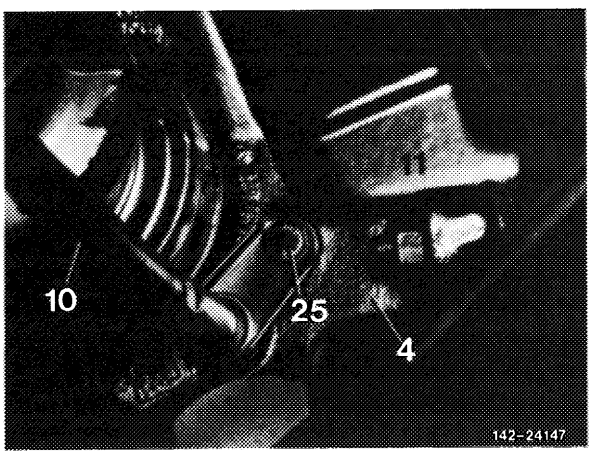
4 Screw back adjusting screw (3) of adjusting bracket (1).

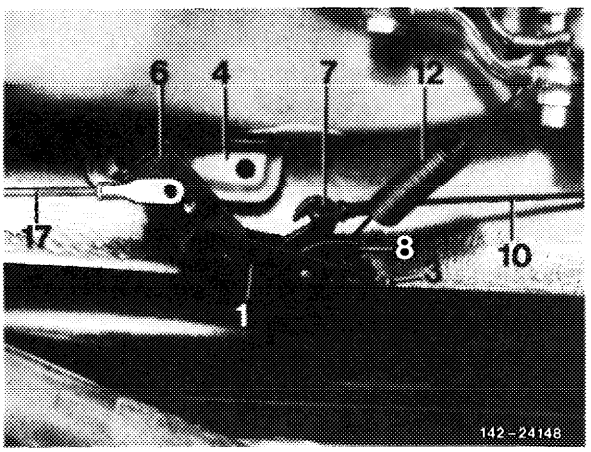
5 Remove front brake cable (17) from intermediate lever (6).

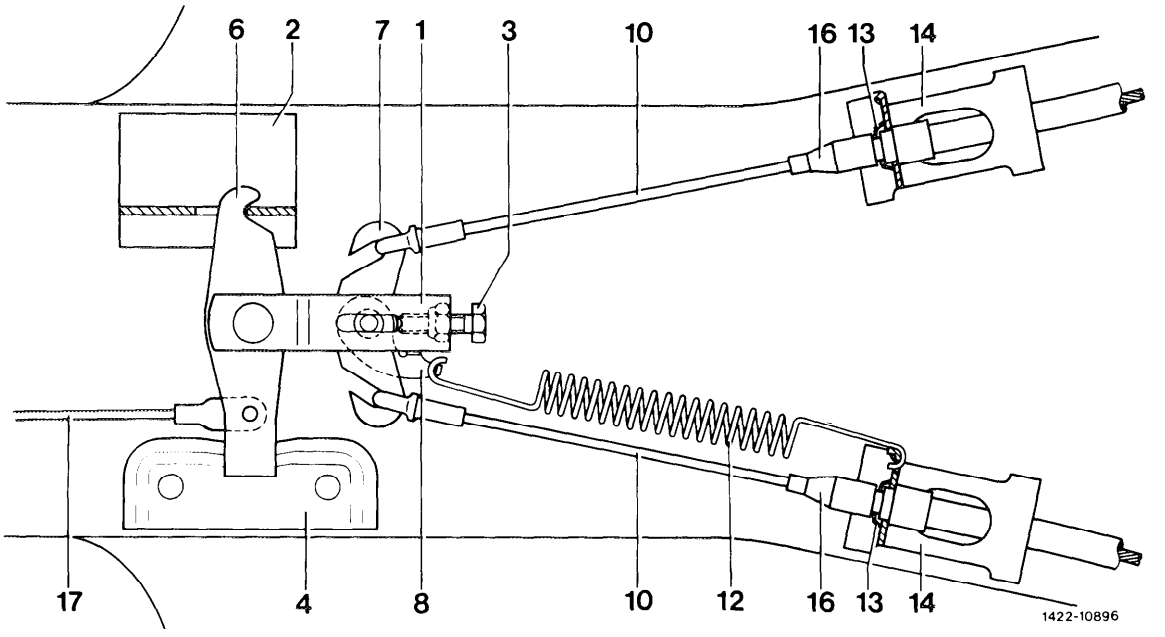
6 Disconnect intermediate lever (6) on bearing of frame floor (2).

7 Disconnect brake control (10) from compensating lever (7).

8 Remove spring clamp (13), remove cable control (10) from holder (14).







1 Adjusting bracket
2 Bearing on frame floor
3 Adjusting screw
4 Guide for intermediate lever
6 Intermediate lever
7 Compensating lever
8 Spring clip
10 Rear brake cable control
12 Draw spring
13 Spring clamp
14 Holder for rear brake cable control
16 Rubber grommet
17 Front brake cable control

Installation

Note: During reinstallation, make sure that the rubber grommets (16) are not damaged, so that no dirt can enter cable guide.

9 Pay attention to perfect installation of brake cable control in rubber grommet of holder on rear axle carrier.

10 Fasten brake cable control to wheel carrier (4).

11 Attach brake cable control to compensating lever (7). Secure brake cable control to holder (14) by means of spring clamp (13).

12 Connect intermediate lever (6) and install front brake cable (17). Attach return spring (12).

13 Install brake shoes (42–530).

14 Adjust parking brake (42–540).

42-530 Removal and installation of brake shoes of parking brake

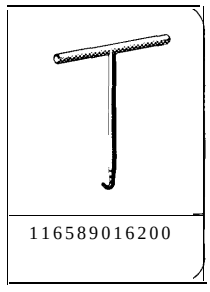
Data

Brake shoe dia.	164-0.2
ID of brake disk	164 + 0.2
Brake shoe width	20

Lubricants

Molykote-Paste U	Molykote-Paste G Rapid	Liqui-Moly-Paste 36

Special tools



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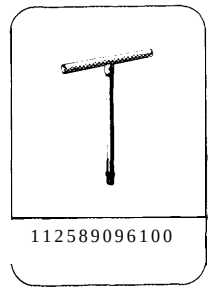

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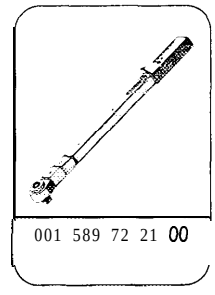

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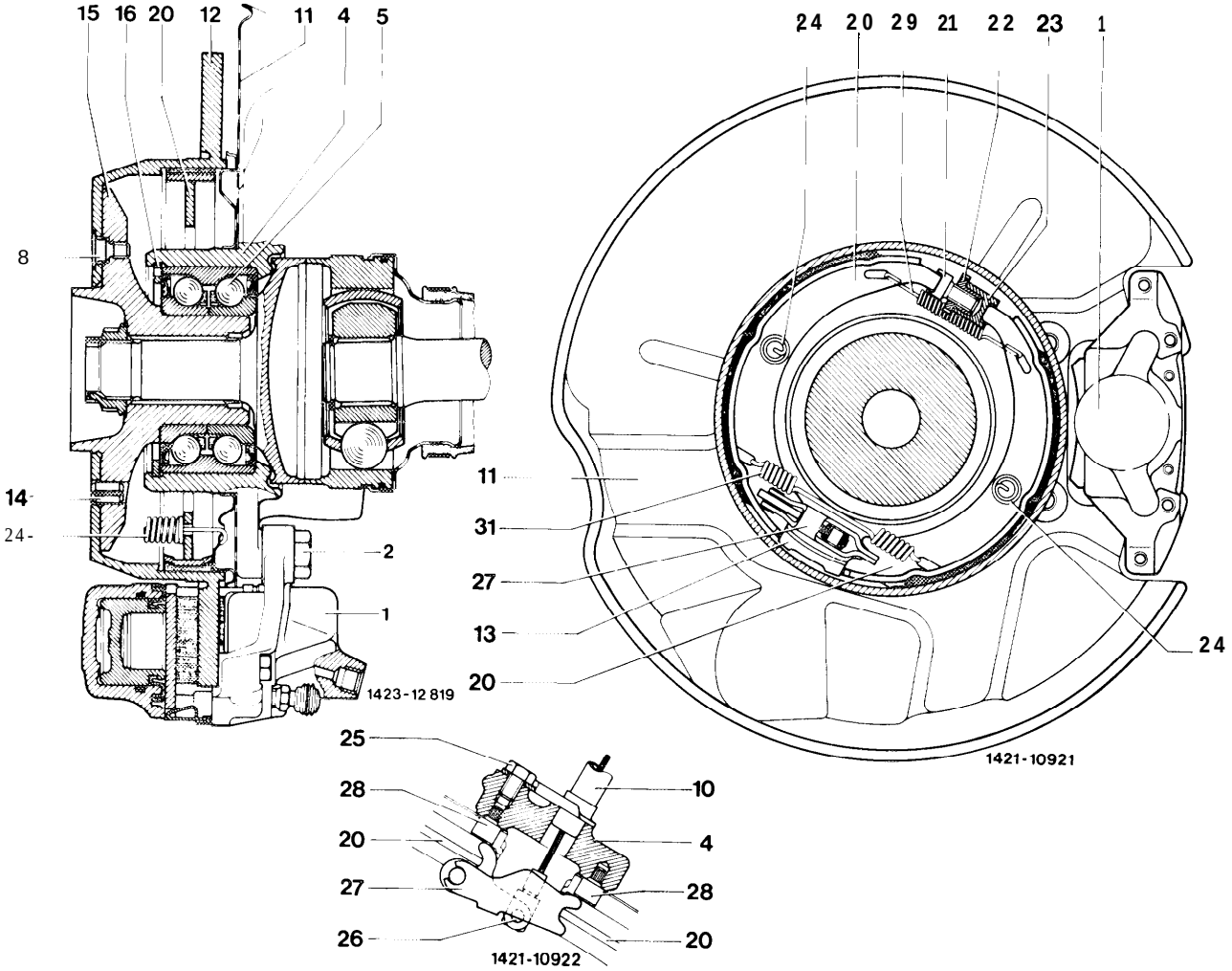


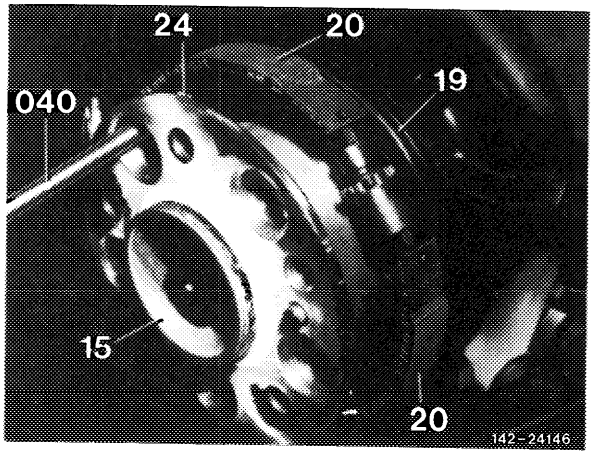
	Fixed caliper	11	Cover plate	22	Adjusting wheel
2	Hex. head screw	12	Brake disk	23	Pressure sleeve
4	Wheel carrier	13	Brake carrier	24	Pressure spring
5	Two-row angular ball bearing	14	Fitted pin	25	Hex. head screw
8	Locking screw	15	Rear axle shaft flange	26	Bolt
10	Brake cable control	16	Locking ring	27	Expanding lock
		20	Brake shoes	28	Supporting bolt
		21	Thrust piece	29	Upper return spring
				31	Lower return spring

Removal

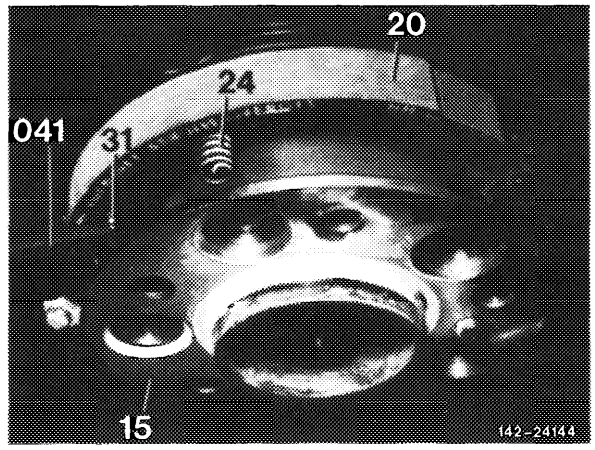
1 Remove brake disk (42–228).

2 Turn rear axle shaft flange (15) in such a manner that one hole faces spring (24). Then compress spring slightly with installer 112 589 09 61 00 (040), turn tool by approx. 90°, disconnect spring from cover ring (19) and remove,

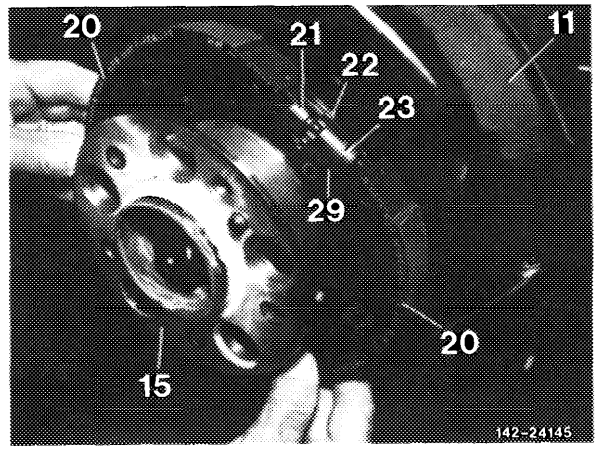
3 Also remove spring on other brake shoe.



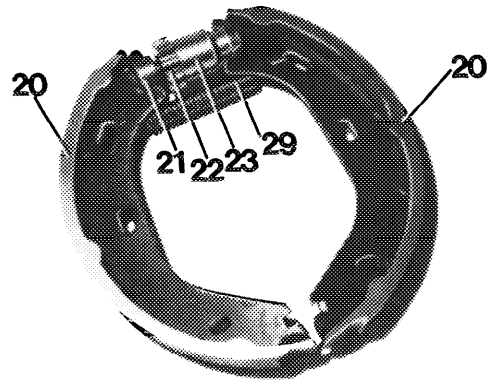
4 Disconnect return spring (31) with remover and installer 116 589 01 62 00 (041) from brake shoes (20).



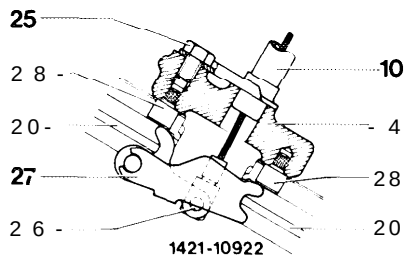
5 Pull both brake shoes (20) apart until they can be removed over rear axle flange (15).



6 Disconnect return spring (29) from brake shoes (20) and remove adjusting device (21 to 23).



7 Push bolt (26) out of expanding lock (27) and remove expanding lock from brake cable control (10).



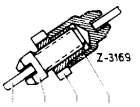
3 Wheel carrier
10 Brake cable control
20 Brake shoes
25 Hex. head screw
26 Bolt
27 Expanding lock
28 Hex. socket screw

Installation

8 Coat all bearing and sliding surfaces on expanding lock with specified lubricant (refer to table), fasten brake cable control (10) to expanding lock (27) with bolt (26). Then push expanding lock toward cover ring (19).

9 Coat threads of thrust piece (21) and cylindrical portion of adjusting wheel (22) with specified lubricant (refer to table). Assemble adjusting device and turn completely back.

20 Brake shoes
21 Thrust piece
22 Adjusting wheel
23 Pressure sleeve

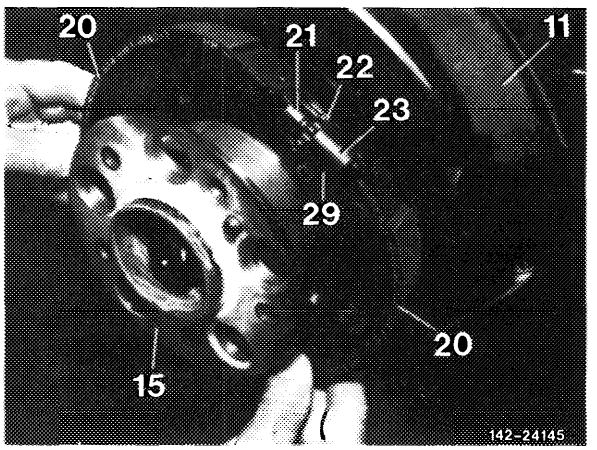


20 21 22 23

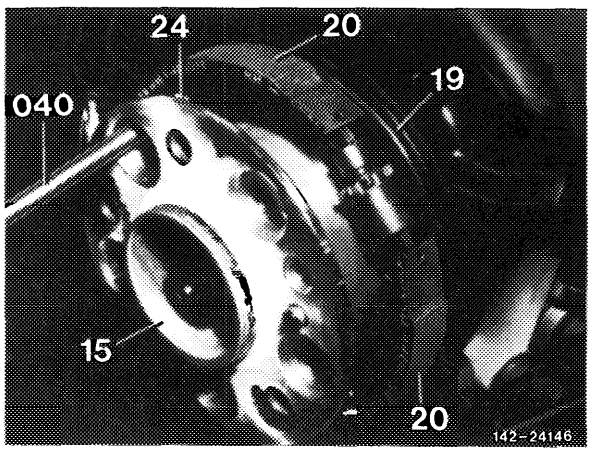
10 insert adjusting device (21 to 23) into both brake shoes in such a manner that the adjusting wheel (22) is pointing forward.

11 Connect return spring (29) to both brake shoes.

12 Pull brake shoes (20) apart, insert over rear axle shaft flange (15) and connect to expanding lock.



13 Insert spring (24) laterally into brake shoe (20). Introduce installer 112 589 09 61 00 (040) through a hole of rear axle shaft flange (15), then compress spring slightly, turn by 90" and connect to cover ring (19). Make sure that the spring is correctly connected.



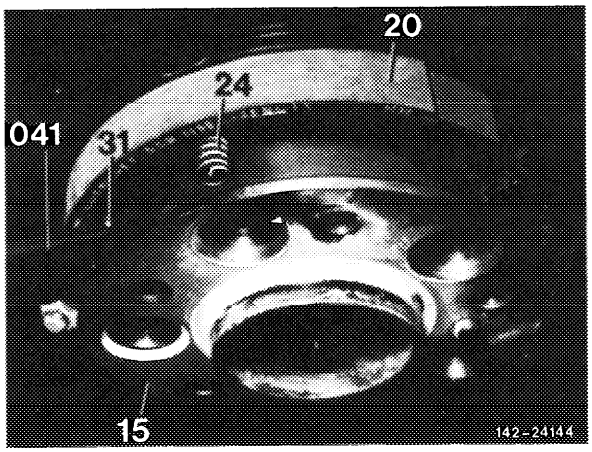
14 Connect spring (31) with small eye to brake shoes.

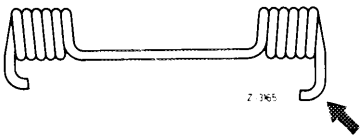
Note: The eyes of the return spring are of different size. For large eye refer to arrow.

15 Connect remover and installer 116 589 01 62 00 (041) to large eye of return spring (31), then connect return spring to other brake shoes (20).

16 Install brake disk (42-228).

17 Adjust parking brake (42-540).





42–540 Readjusting or adjusting brake shoes of parking brake

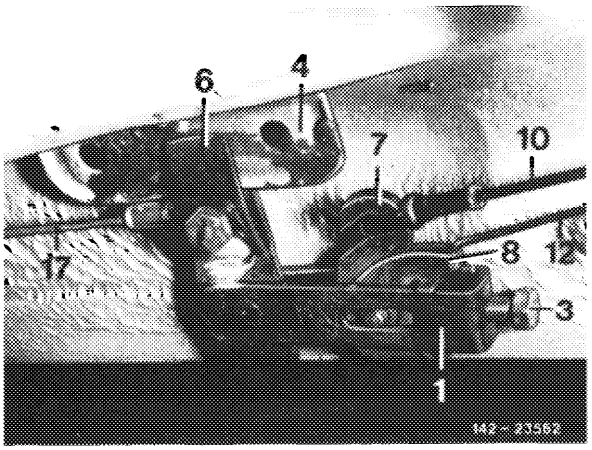
Data

	Up to April 1984	As of April 1984	As of February 1987
Total ratio of parking brake up to expanding lock outlet	1:25.2		
Number of detents on detent sector	8		12
Number of detents required for locking parking brake at medium energy of approx. 170 N	2 - 3		
Number of detents until effect of parking brake begins	1		
Number of teeth on adjusting wheel	8	15	

Note

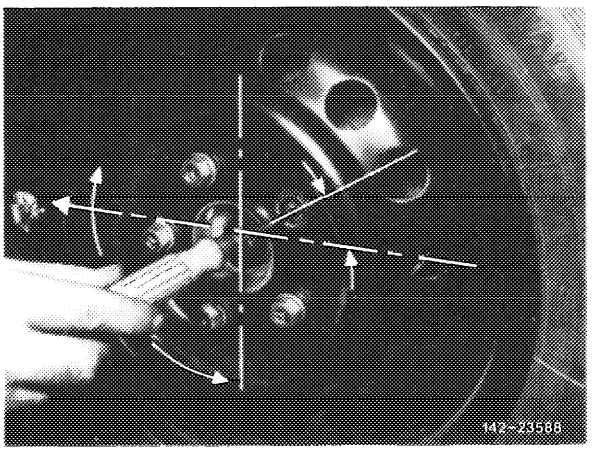
Readjust parking brake if the lever can be tightened by more than 2 detents (of a total of 8 or 12), without obtaining a braking effect.

1 Completely loosen adjusting screw (3) Make sure that expanding locks are not preloaded.

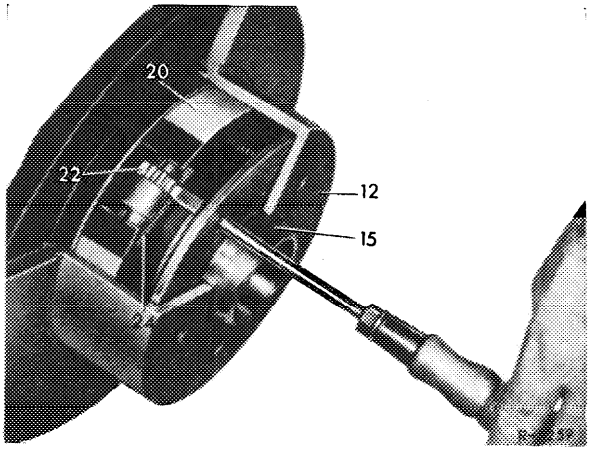


2 At rear axle left and right unscrew one spherical collar screw each.

3 Jack up vehicle and first turn one wheel in such a manner that the screw hole out of which the spherical collar screw has been screwed, points approx. 45" in rearward upper direction.



4 Insert screwdriver (size 4.5 mm) through hole of disk wheel, brake disk (12) and rear axle shaft flange (15) into adjusting wheel of readjusting device (22) and turn adjusting wheel by means of pertinent movements until wheel can no longer be turned. Then turn back adjusting wheel with 8 teeth for approx. 2-3 teeth, adjusting wheel with 15 teeth for approx. 5-6 teeth, i.e. enough until the wheel can be turned absolutely unrestricted.

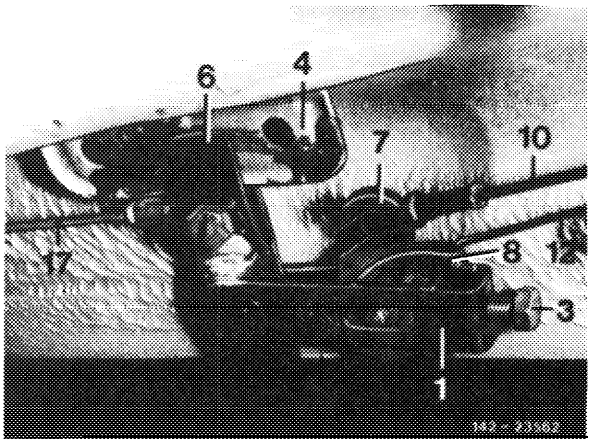


Attention!
Adjusting position of screwdriver for adjusting brake shoes:

Lefthand side: from below in upward direction.

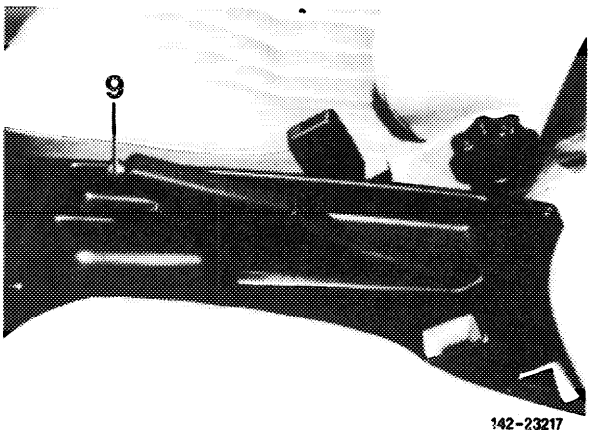
Righthand side: from top in downward direction.

5 Screw in adjusting screw (3) until the brake cables are no longer sagging.



6 Actuate parking brake several times energetically at approx. 400 N.

7 Rotate adjusting screw (3) in adjusting bracket (1) until the lever can be tightened for one tooth at an energy of approx. **90-l 20 N.**



43 Brakes, vacuum system

Job No

Brake unit

Testing check valve 43-023
Checking brake unit 325
Removal and installation of brake unit 350

Vacuum pump

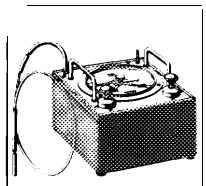
Removal and Installation of piston vacuum pump . . 618
Checking piston vacuum pump 660

43-023 Testing check valve

Data

Test vacuum in bar	0.75-0.8
Duration of test	30 s
Pressure loss in bar vacuum	0.2

Special tool



201 589 13 21 00

Self-made tool

Measuring connection	refer to fig. item 2, note

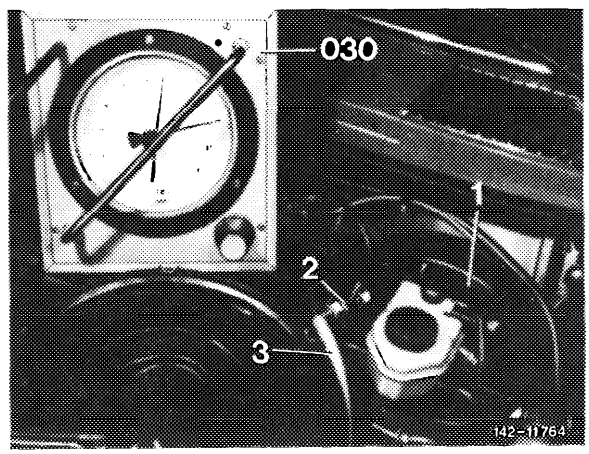
Note

Each time when renewing brake unit, test check valve in vacuum line for leaks.

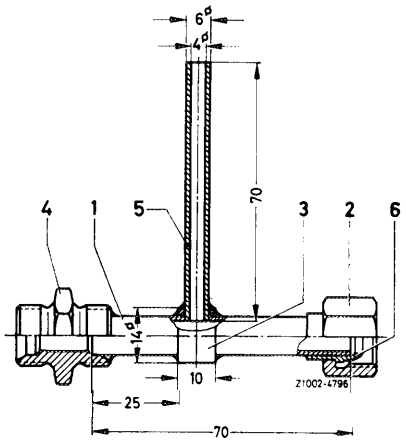
Testing

1 Loosen vacuum line (3) on brake unit (1) and connect measuring connection (2) between brake unit and line.

2 Connect tester for vacuum (030) to measuring connection (2).



Note: Make measuring connection yourself according to specified dimensions, part 1, 3, 4, 5 and 6 are brazed to each other. For connection to brake unit, the pipe member including coupling nut of an old vacuum line may be used. Connection to vacuum line is by way of a screw connection.



3 Run engine and generate a vacuum of 0.75-0.8 bar by accelerating and suddenly releasing accelerator pedal.

4 Test check valve for leaks. The available vacuum should not drop by more than 0.2 bar within 30 seconds, if the vacuum loss is higher, renew check valve including vacuum line.

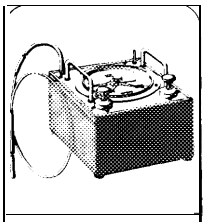
Note: Upon installation of a new vacuum line, repeat leak test. If the pressure loss is still too high, the leak may be caused by damaged screw connections or a leaking brake unit.

43-325 Checking brake unit

Data

Force at brake pedal N	bar vacuum	Line pressure bar gauge pressure Girling LSC 50 DBA Isovac 8" single	Teves 52/4A/225–210 8''/9'' double
50	0.75-0.8	5-11	10
100		20-31	25
150		35-50	42
200		54-65	59
250		70-76	75
300		80-82	90

Special tool



201 589 13 21 00

Conventional tools

Pressure tester	e.g. Teves, D-6000 Frankfurt/M. Order No. 3 9305-1020.4
Pedal force meter	e.g. Bosch Prüftechnik D-7000 Stuttgart Order No. 0681 148015 EFSV 57 B

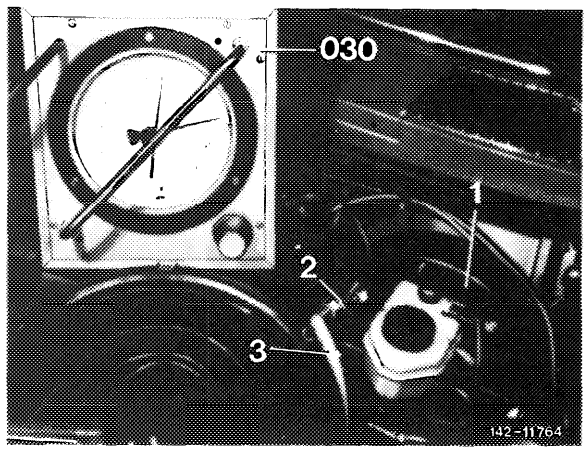
Self -made tool

Measuring connection	refer to Fig. item 2, Note

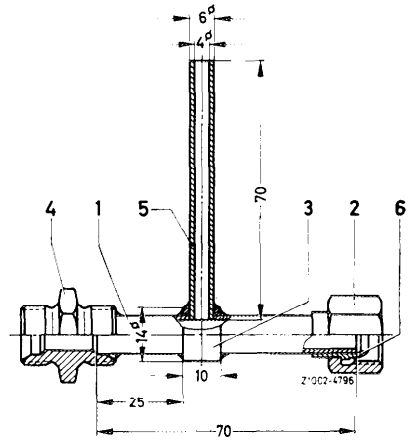
Testing

1 Loosen vacuum line (3) on brake unit (1) and connect measuring connection (2) between line and brake unit.

2 Connect tester for vacuum (030) to measuring connection (2).



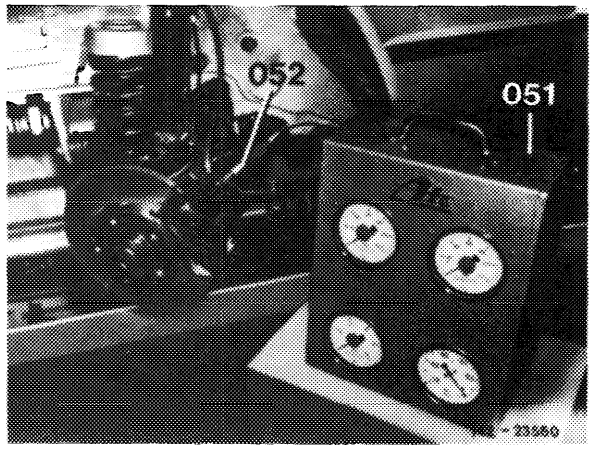
Note: The measuring connection is self-made according to specified dimensions, (parts 1, 3, 4, 5 and 6 are brazed to each other). For connection to brake unit, the pipe member including coupling nut of an old vacuum line may be used. Connection to vacuum line is by way of a screw connection.



3 Connect pressure tester (051) to a caliper. For this purpose, unscrew vent screw and screw in connection (052). Then bleed pressure tester.

4 Attach pedal force meter to brake pedal.

5 Run engine and generate a vacuum of 0.75-0.8 bar by accelerating and suddenly releasing accelerator pedal.



If only a substantially lower vacuum is obtained or if the vacuum is immediately again decreasing, the following cause may be responsible:

a) Leaking vacuum line or leaking connection points.

b) Test defective check valve (43-023).

c) Damaged sealing ring between brake booster and tandem main cylinder.

d) Damaged sealing ring on control housing of brake unit. The sealing ring cannot be renewed with shop equipment and the brake unit should therefore be renewed.

6 Run engine until a vacuum of 0.75-0.8 bar is attained, then measure respective line pressure with specified force on brake pedal.

Note: If the measured line pressures deviate by more than ± 10 bar gauge pressure, renew brake unit.

7 Remove pedal force meter and test equipment.

8 Bleed brake system only at caliper to which the pressure tester has been connected **(42–010).**

Data

Model		201.023/024/028/122/126	201.029/034/128
Brake unit		**Girling LSC 50 DBA Isovac**	**ATE 52/4A/225–2 10**
Dia.	Inch	8	8/9
	mm	203	203/228.6
Amplification factor		**3.4**	**4.5**

Tightening torques	**Nm**
Hex. nuts for fastening brake unit to front end	**15-25**
Coupling nut of vacuum line on brake unit	**30**

Attention!
In the event of a loss of brake fluid, which cannot be observed visually, check whether brake fluid has entered the brake booster through a leaking secondary seal in tandem main cylinder. If so, proceed as follows:

1. Do not remove brake booster.

2. Draw off brake fluid.

3. Change brake booster if there are more than 100 cc of brake fluid in unit.

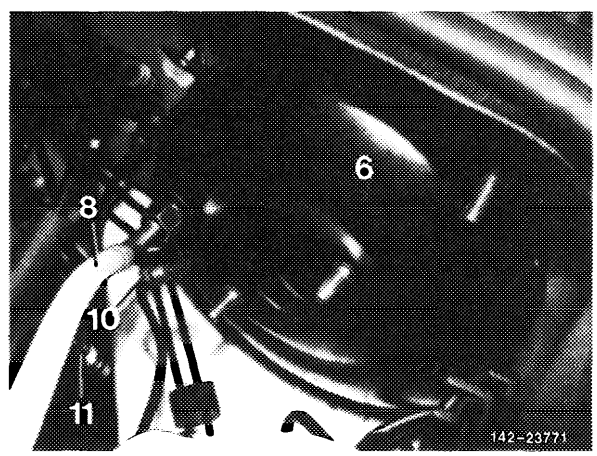
Note: The flexible diagphragm is resistant to brake fluid, while the reaction disk and the plate valve in control member are not. For this reason, draw off brake fluid only with the brake booster installed. With the brake booster installed, no brake fluid can reach the reaction disk or the plate valve up to 100 cc.

Removal

1 **On vehicles with manual transmission, remove connecting hose to master cylinder.**

2 Remove tandem main cylinder (42-310).

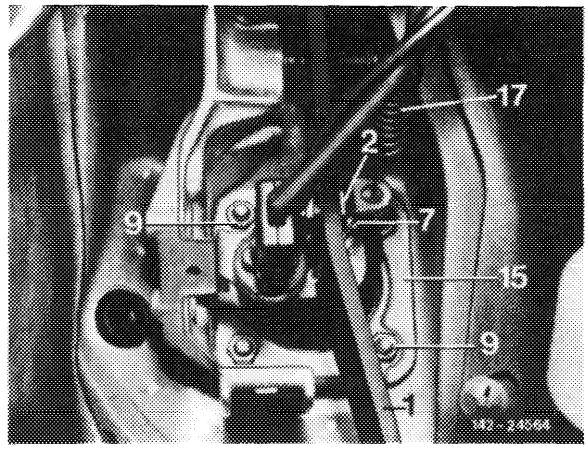
3 Loosen vacuum line (8) on brake unit (6).

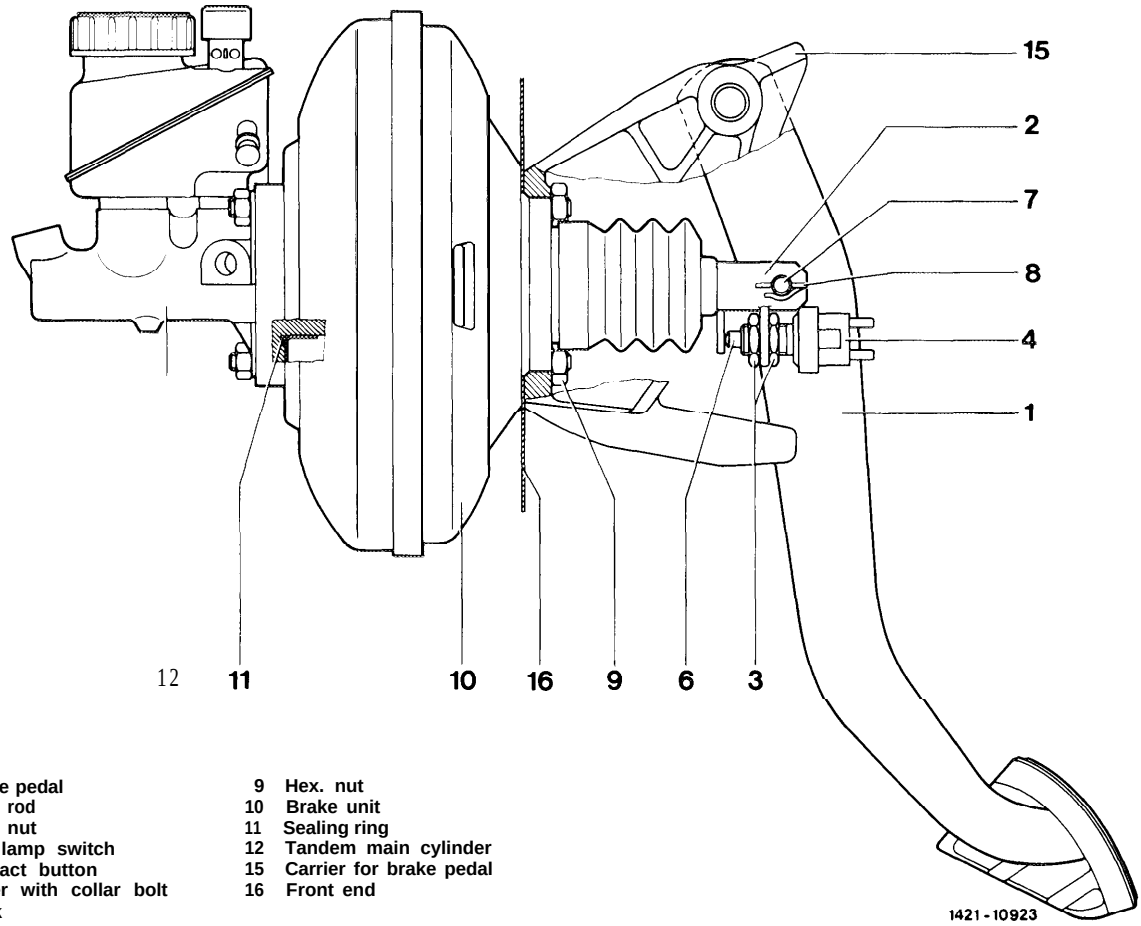


4 Remove cover below instrument panel in legroom.

5 Loosen pushrod (2) of brake unit on brake pedal (1), disconnecting return spring (17) for this purpose, pull out lock and remove holder to which the collar bolt (7) is attached.

6 Unscrew the two hex. nuts (9) from carrier (15).

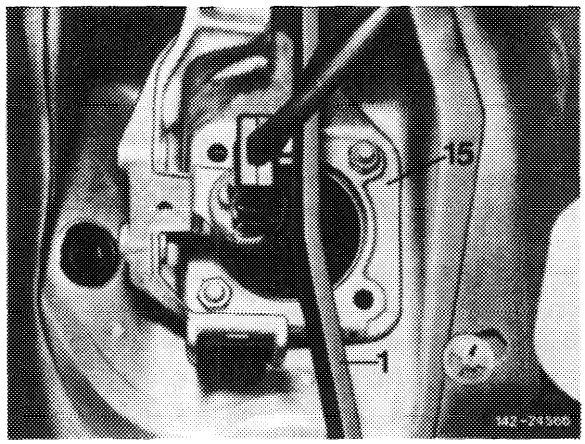




1 Brake pedal
2 Push rod
3 Hex. nut
4 Stop lamp switch
6 Contact button
7 Holder with collar bolt
8 Lock
9 Hex. nut
10 Brake unit
11 Sealing ring
12 Tandem main cylinder
15 Carrier for brake pedal
16 Front end

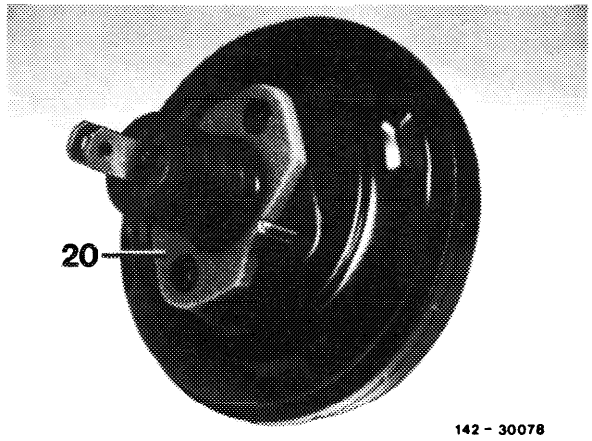
7 Remove brake unit.

Attention!
The control housing of brake unit is made of plastics and may break-off if improperly handled.



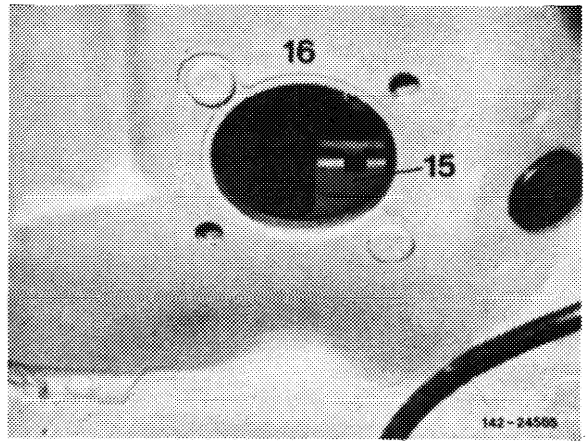
Installation

Note: Check glued-on gasket (20) on brake unit for damage and correct **seat,** renew gasket if required.



8 Prior to installation of a new brake unit, check whether separate check valve is in order. If in doubt, renew valve including plastic lines (43-023).

9 Fasten brake unit to front end (16) and carrier (15) of pedal assembly. Tighten hex. nuts to 15-25 Nm.

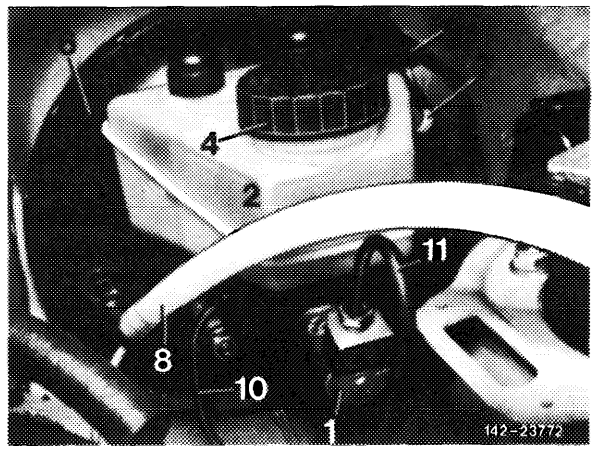


10 Fasten cover below instrument panel in legroom.

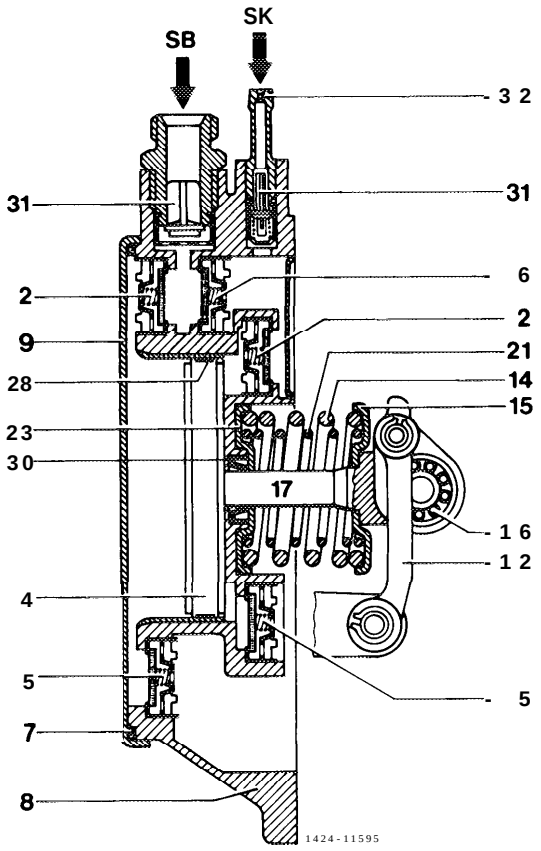
11 Connect vacuum line (8) to brake unit (6). Tighten coupling nut to 30 Nm.

12 Install tandem main cylinder (42-310).

13 On vehicles with manual transmission, plug connecting hose on connection (7) for master cylinder to expansion tank.



Model 201.1



2 Plate valve (suction end)
4 Piston
5 Plate valve (pressure end)
6 Separating valve
7 Gasket
8 Pump housing
9 Pump cover
12 Swivel arm
14 Outer compression spring
15 Lower spring plate
16 Race
17 Piston rod
21 Inner compression spring
23 Upper spring plate
28 Piston ring
30 Radial sealing ring
31 Oil retaining valve
32 Orifice

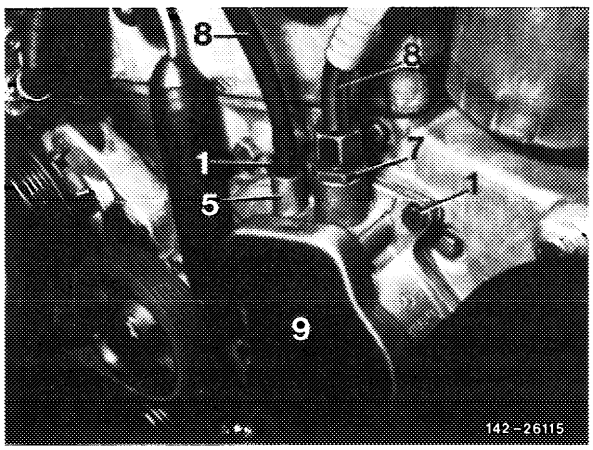
Removal

1 **Remove fan cover and fan. Take off V-belt (13–342).**

2 **Loosen vacuum line on screw connection (7), while applying counterhold to screw connection.**

Note: An oil retaining valve is located in screw connection (7). With the pump stopped and in the presence of a vacuum, the valve prevents the penetration of engine oil into brake booster.

3 Unscrew hex. head screws (1) from crankcase and remove vacuum pump including gasket.



4 Fasten vacuum pump with a new gasket to crankcase. Make sure that the lift curve of drive flange is at BDC.

Note: The thickness of the gasket between crankcase and vacuum pump is 0.5 mm.

5 Connect vacuum line to vacuum pump.

6 Install V-belt, fan and fan cover (13-342).

7 Check vacuum pump for function (42–660).

43-660 Testing piston vacuum pump

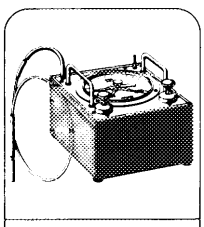
Data

The suction time is measured in seconds at 0.5 bar vacuum at an engine speed of 700/min.
The following value applies:

Brake booster and vacuum pump	
8" single-diaphragm brake booster and double-acting piston vacuum pump	3 seconds
8''/9'' double diaphragm brake booster and double acting piston vacuum pump	5 seconds

With engine stopped, a vacuum drop of 0.2 bar within 30 seconds is permitted.

Special tool



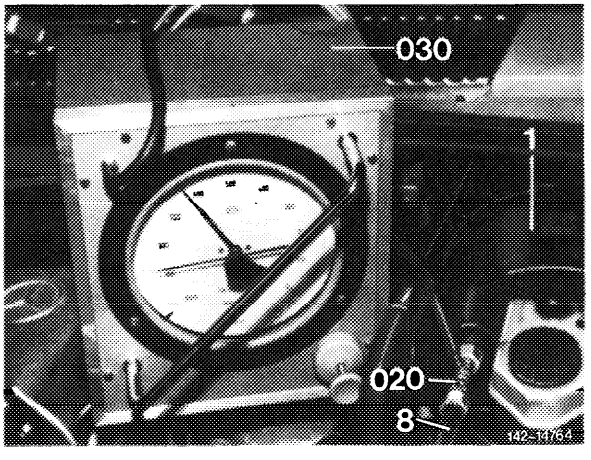
201 589 13 21 00

Self-made tool

Measuring connection	refer to Fig. item 1, Note

Testing

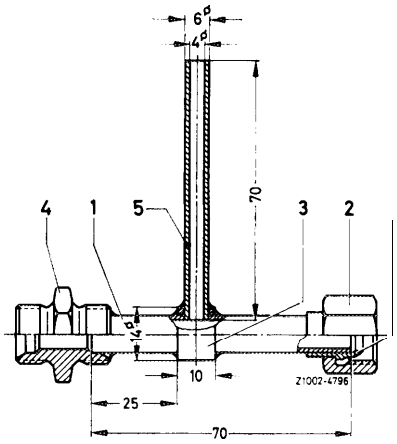
1 Connect tester (030) with measuring connection (020) to vacuum line (8) between check valve and brake booster (1).



Note: The measuring connection is self-made according to given dimensions (parts 1, 3, 4, 5 and 6 are brazed to each other). For connection to brake booster the pipe section including coupling nut of an old vacuum line may be used. Connection to vacuum line is made by means of a screw connection.

2 Run engine at 700/min and measure the time required to establish a vacuum of 0.5 bar.

Note: If the specified values are not attained and the vacuum drop is larger than 0.2 bar in 30 seconds, check vacuum system for leaks. If no fault shows up, recondition vacuum pump or renew.



Job No.

Checkup steering

Checking play of steering components 46-l 10
Checking start of manual restriction 120
Checking oil pressure of steering pump 130

Steering gear

Removal and rnstallatron of power steering 4 1 2

Steering linkage and pitman arm

Removal and installation of pitman arm 510
Removal and installation of intermediate steering arm 5 2 0
Removal and rnstallatron of track rod 540
Removal and Installation of drag link 550
Replacement of sleeves for ball joints of track rod and drag link 560

Steering wheel, jacket tube, steering spindle, steering lock

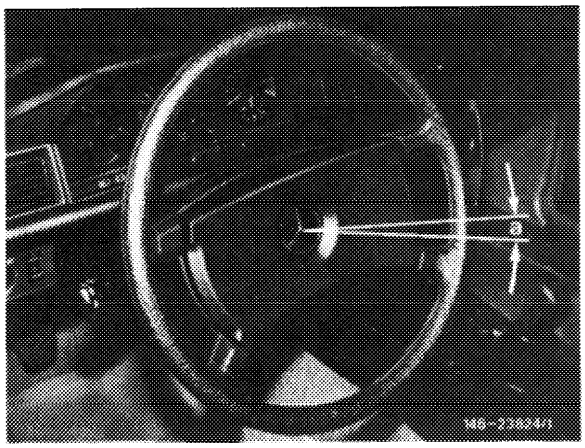
Removal and Installation of steering wheel 610
A. Steering wheel without airbag unit .....
B. Steering wheel with airbag unit .....
Removal and Installation of steering lock 640
A. Removal and rnstallatron of ignition starting switch .....
B. Removal and Installation of locking cylinder .....
C. Complete removal and installation of steering lock .....
Removal and rnstallatron of power steering pump 710
Istversion .....
2nd version (single belt drive)-diesel engines .....
2nd version(single belt drive)-gasoline engines .....

Power steering gear

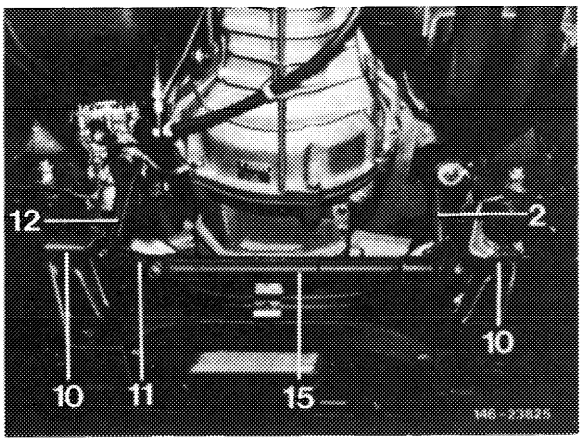
Differentiatingcharacteristics of steering gears 46-010

General checkup

1 Check play on steering wheel. On steering wheel circumference, a play of max. 25 mm is permitted in center position of steering.



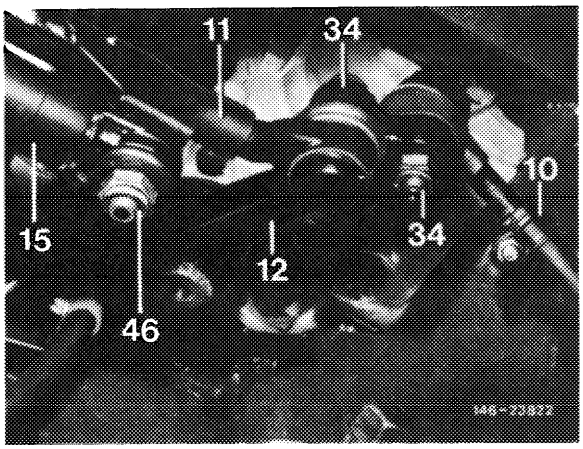
2 If the steering wheel play is rather high, check steering linkage, intermediate steering arm, steering gear and bearing play of front axle.



2 Intermediate steering arm
10 Track rod
11 Drag link
12 Pitman arm
15 Steering shock absorber

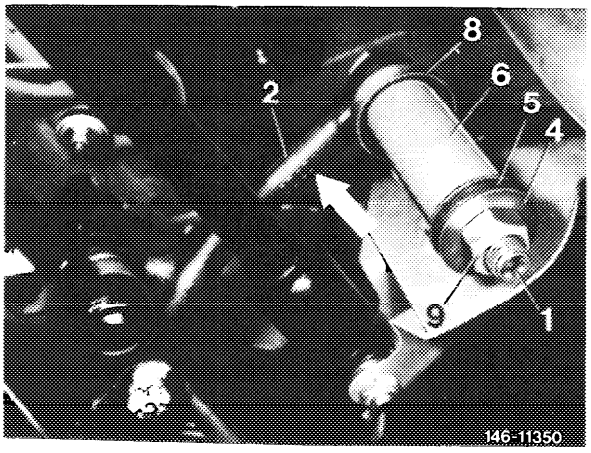
Steering linkage

3 Check play of steering linkage by energetically shaking track rods and drag link. If required, replace drag link or ball joints of track rods.



Intermediate steering arm

4 Check play of intermediate steering arm by energetically pushing arm up and down. If required, replace rubber slide bearing in journal bearing.



46–120 Checking start of manual restriction

Data

Start of manual support with a force at steering wheel circumference of		approx. 7 N
Start of manual restriction measured	on steering shaft	5-7 Nm
	on steering wheel circumference	23-33 N

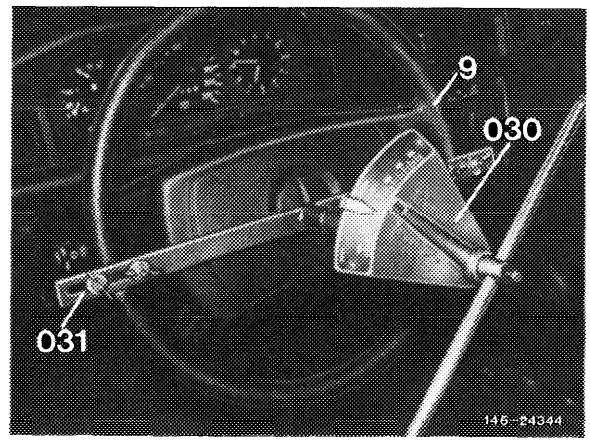
Special tool

Carrier for torque wrench 1/2'' square		126589136300

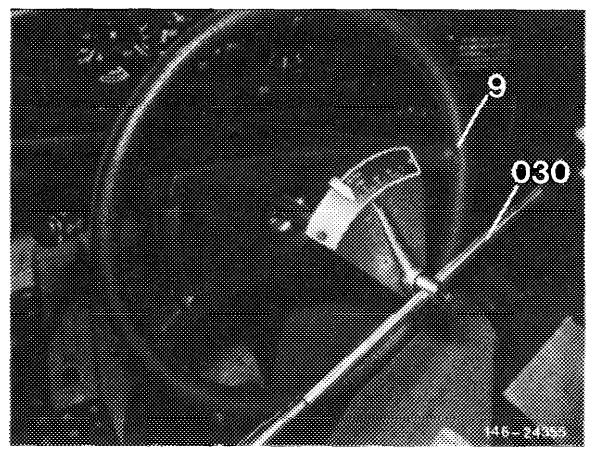
Checkup

1 Fasten carrier for torque wrench on steering wheel.

2 Run engine at idle speed,

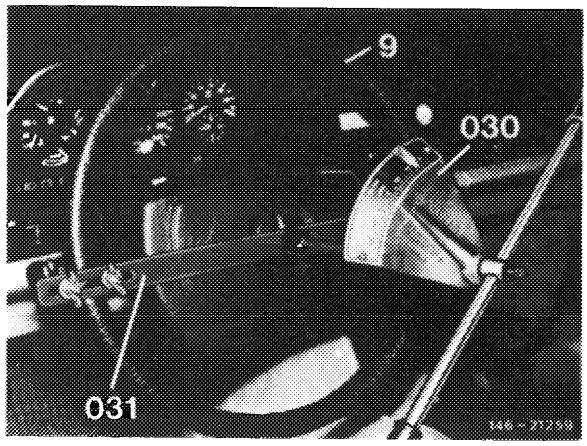


Note: On vehicles without restraining system, the start of manual restriction can well be measured without the carrier. For this purpose, remove company symbol from pad with a small screw driver and insert torque wrench by means of the 10 mm socket wrench (hexagonal recess) into countersunk screw for fastening steering wheel.



3 Insert torque wrench into carrier and measure the force required for turning steering shaft which should not exceed 5-7 Nm.

4 Remove carrier from steering wheel.



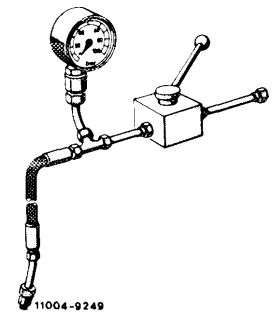
Data		
Model	201.03	201.02, 201 .12
Circulating pressure	max. 5 bar gauge pressure	
Pressure relief valve opens at	85 + 5	65 ± 5 bar gauge press.

Oil grades/Filling **capacity and oil level checkup**

Automatic transmission fluid (ATF) or transmission oil	refer to Specifications for service products page 236.2 refer to Specifications for service products page 237
Filling capacity	approx. 0.6 litre
Oil level checkup	When the oil is at operating temperature (approx. 80 °C), the oil level in supply tank should be at cast-in mark (approx. 20 mm below rim of tank). With the oil cold or at ambient temperature, oil level is at 6-8 mm below mark. For topping-up, use perfectly clean oil only, since even the smallest dirt particles may cause trouble in hydraulic system.

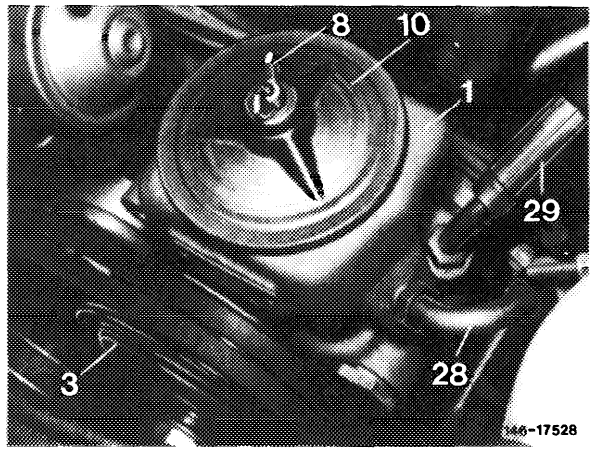
Tightening torque	Nm
Coupling screw on high-pressure expanding hose	25-30

Special tools

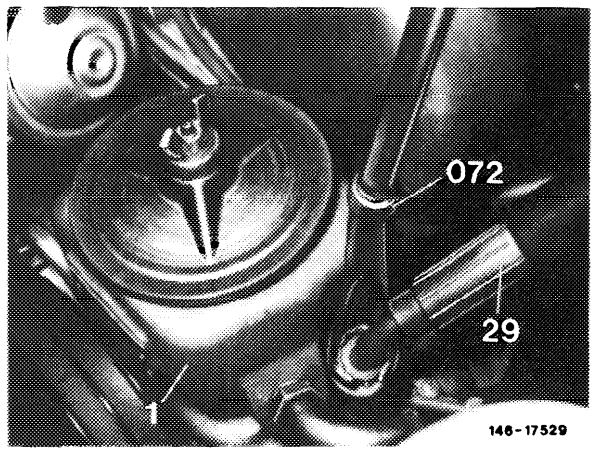
Tester		115589132100
Connecting socket to tester		201 589 02 63 00
Box wrench insert open 17 mm 1/2'' square		000589680300

Checkup

1 Remove closing cover and draw off oil with a syringe, since otherwise the oil will run out when unscrewing high-pressure expanding hose.



2 Unscrew high-pressure expanding hose (29) on power-steering pump with open double box wrench (072).

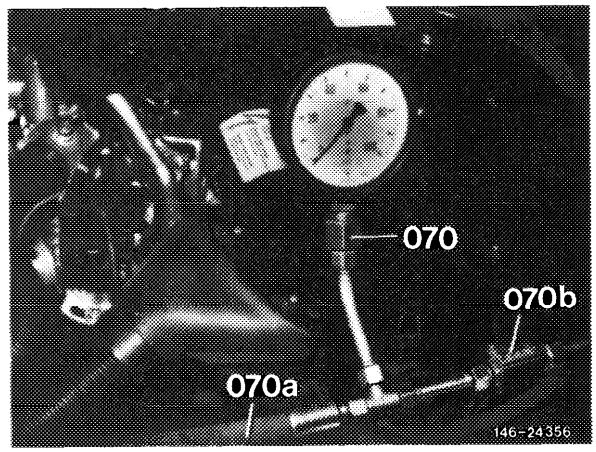


3 Connect high-pressure expanding hose (070a) of tester as well as high-pressure expanding hose (29) using the two connecting sockets on tester (070), fill supply tank with specified oil.

4 Run engine at idle speed and perform the following measurements:

a) **with throttle valve (070b) opened, measure circulating pressure which should not exceed 5 bar gauge pressure.** Do not move steering wheel when measuring, since this would activate the control valve and the pressure would increase.

b) **Close throttle valve** on tester **and measure max. pressure** of power steering pump, while accelerating engine to maintain a speed of approx. 1000/min.



The max. pressure can also be measured by turning the steering to left-hand and right-hand lock. **Caution, do not spend too much time for measuring,** since this would cause the oil temperature to rise to non-permissible limits, which in turn would result in damage to power steering pump.

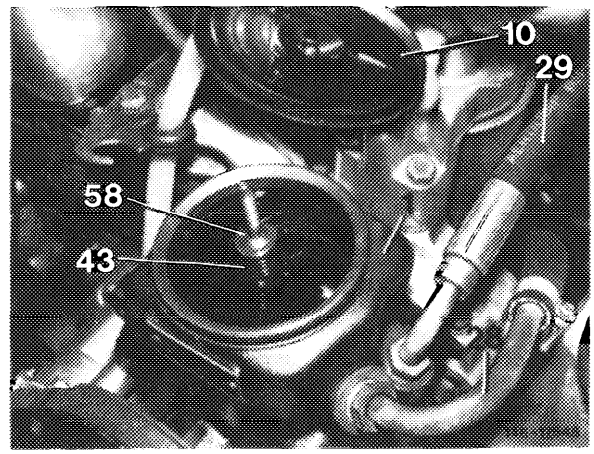
c) If the pump does not attain the specified pressure, check volume control valve and pressure relief valve and replace, if required.

5 Disconnect high-pressure expanding hose on tester, remove tester, connect high-pressure expanding hose to power steering pump. Tighten coupling screw to 25-30 Nm.

6 Fill servo system with specified oil, with engine running add oil up to mark.

7 Turn steering several times completely to left-hand and righthand lock to bleed the system.

8 Restore oil level and check servo system for leaks.



Data

Model	Steering gear	Part number	Steering version	Pitch of ball circuit	Ratio in center position i =	Total ratio in center position i =	Remarks
201.022 201.023 201.024 201 ,122 (option)	765.900	201 460 57 01 [1])	Lefthand steering[1])	10	14.61	16.66	Malleable iron
		201 460 58 01[1])	Righthand steering				
		201 460 43 01[1])	Lefthand steering				———
		201 460 49 01[1])	Righthand steering				Light alloy
		201 460 66 01 [2])	Lefthand steering				
		201 460 67 01 [2])	Righthand steering				
201.034	765.902	201 460 60 01	Lefthand steering	11	13.28	15.27	Light alloy

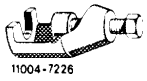
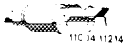
[1]) 1st version with clamping sleeve, without steering coupling
[2]) 2nd version without clamping sleeve, with steering coupling

Oil grades/Filling capacity and oil level checkup

Automatic transmission fluid (ATF)	refer to Specifications for service products page 236.2
or steering gear oil	refer to Specifications for service products page 237
Filling capacity	approx. 0.6 litre
Oil level checkup	With the oil at operating temperature (approx. 80 °C), the oil level in supply tank should reach up to cast-in mark (approx. 20 mm below edge of tank). With the oil cold and at ambient temperature, oil level is 6-8 mm below mark. For filling up, use perfectly clean oil, since even the smallest particles of dirt may cause trouble in hydraulic system.

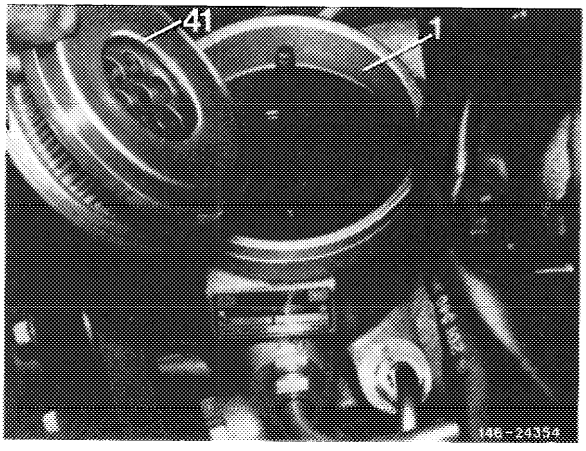
Tightening torques	Nm
Locking screws for fastening steering gear to longitudinal member of frame floor	70-80
Hex. socket screw to lower steering spindle or steering gear coupling	25
Self-locking hex. nut to track rod and drag ling	35
High-pressure expanding hose to steering gear	25-30
Return flow pipe to steering	35—40

Special tools

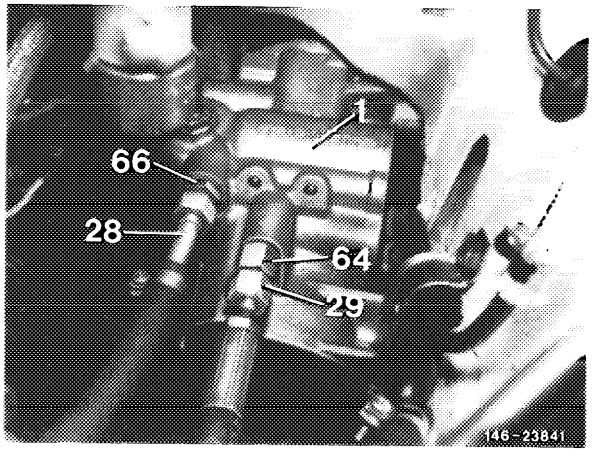
Puller for ball joints of track rod on pitman arm, intermediate steering arm and steering knuckle arm	 11004-7226	201 589 08 33 00
Puller for ball joints on drag link on pitman arm and intermediate steering arm	 11004 11214	201 589 07 33 00
Check screw for center position of steering gear	11004-11229	201 589 06 21 00
Socket wrench open 19 mm 1/2" square	11004-6359	314 589 01 03 00

Removal

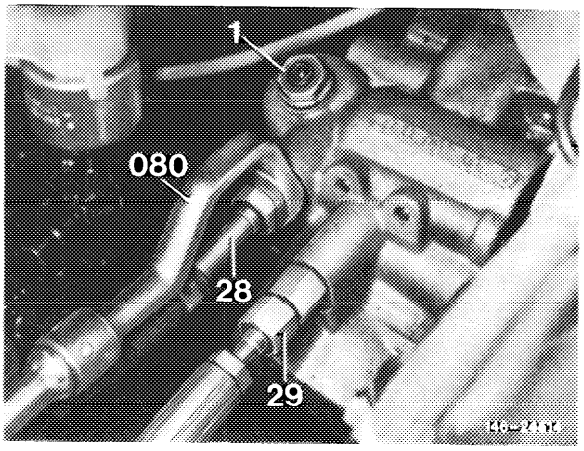
1 Remove cover from supply tank of power steering pump, take out filter element and draw off oil by means of a syringe.



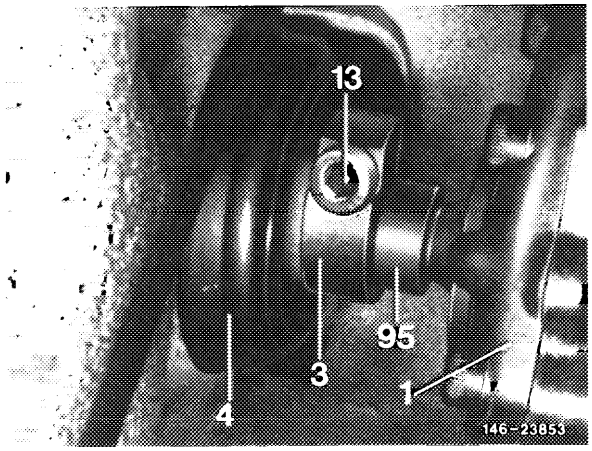
2 Loosen high-pressure expanding hose (29) and return flow line (28) on connecting socket while applying counterhold to connections. Close oil hoses and connections on steering with blind plugs.



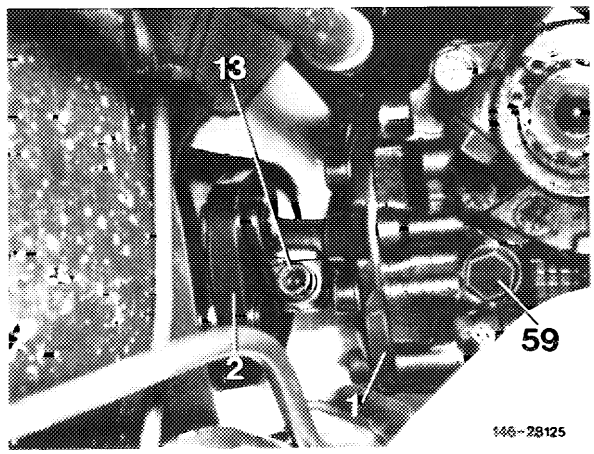
Note: For loosening return flow hose, use open socket wrench insert (080).



3 On steering gear 1st version (with clamping sleeve, without steering coupling) unscrew hex. socket screw (13) out of steering spindle (3).

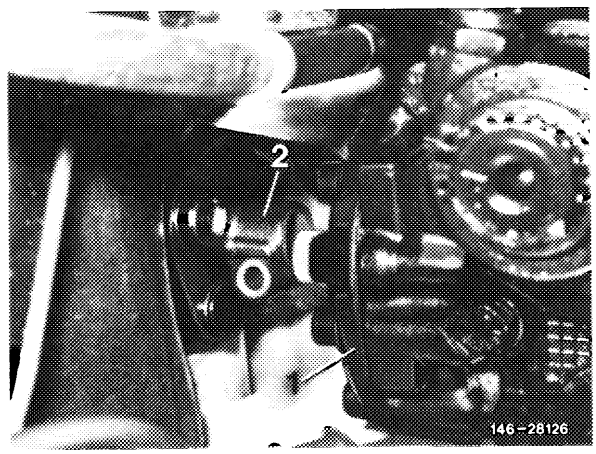


4 On steering gear 2nd version (without clamping sleeve, with steering coupling) unscrew both hex. socket screws (13) out of steering coupling (2).

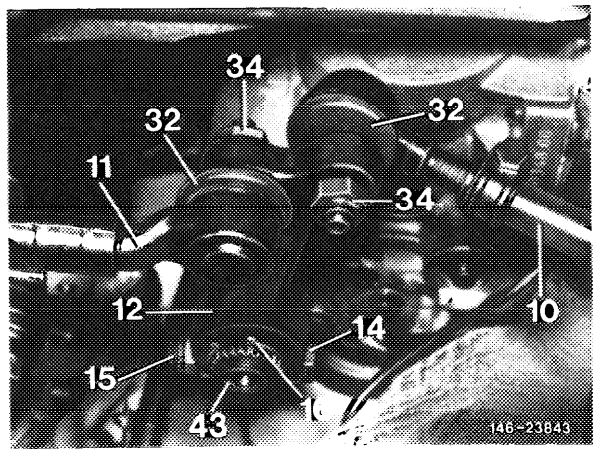


5 Slip steering coupling (2) on parallel flats of lower steering spindle (corrugated tube) in upward direction until it is no longer entering splining of steering worm.

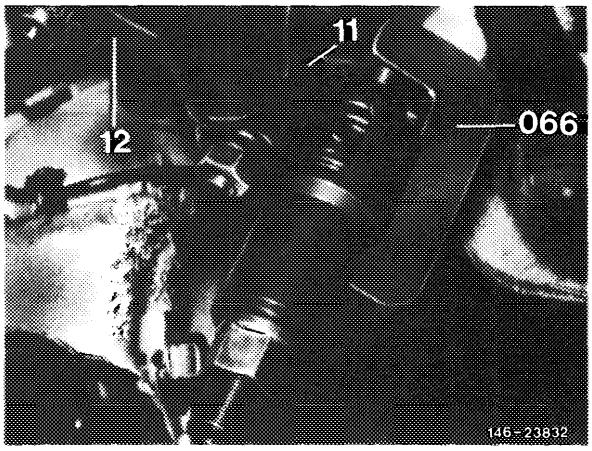
Note: Do not use force. If the steering coupling is hard to slide, slightly push parting joint apart by means of a screwdriver.



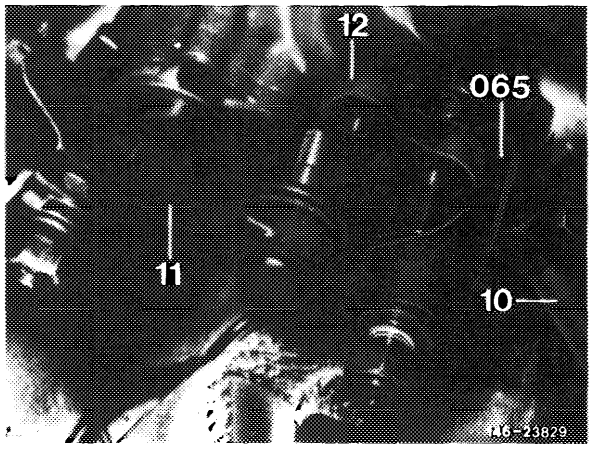
6 Unscrew self-locking hex. nut (34) from drag link and track rod.



7 Press off ball joint of drag link (11) with puller (066) from pitman arm,



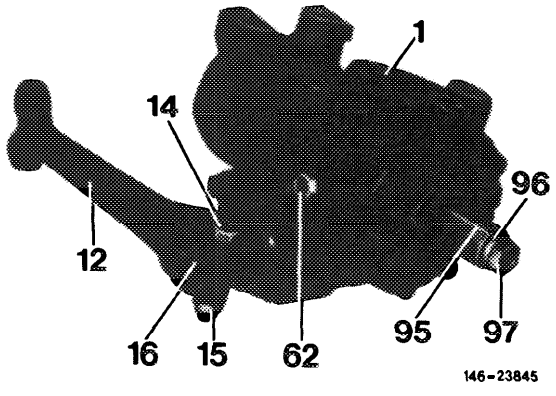
8 Press off ball joint of track rod (10) with puller (065) from pitman arm.



Attention!

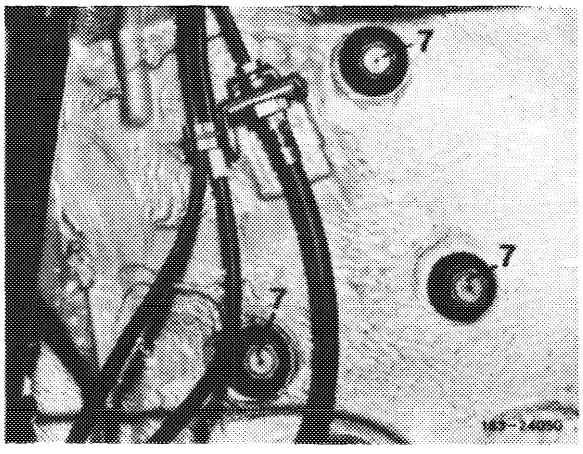
For releasing the compound pitman arm-pitman shaft, be absolutely sure to observe repair instructions (46–510).

A spare steering gear will be supplied including pitman arm.



1	Steering gear	16	Locking ring
12	Pitman arm	62	Locking screw
14	Hex. screw	95	Clamping sleeve
15	Self-locking hex. nut	96	Tapered ring
		97	Hex. nut

9 Screw out locking screws (7) for attaching steering gear to longitudinal member of frame floor.



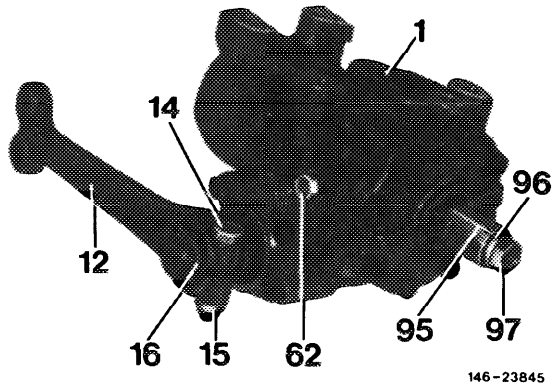
10 Remove steering gear 1st version in forward direction from lower steering spindle.

Remove steering gear 2nd version in downward direction.

Note: Release steering gear 2nd version only after the steering coupling is no longer entering the steering worm, since otherwise the lower steering spindle (corrugated tube) will be damaged.

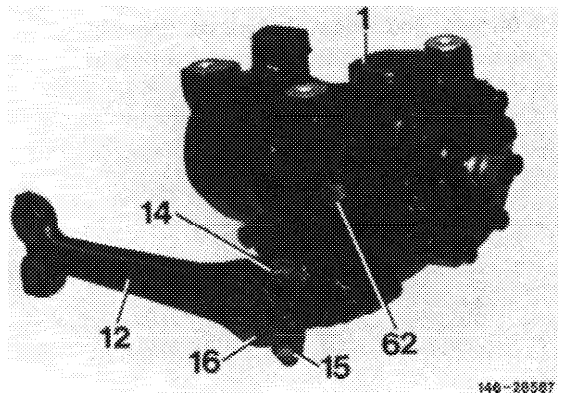
Installation

11 Unscrew closing plug (62) from steering gear.



Steering gear 1 st version

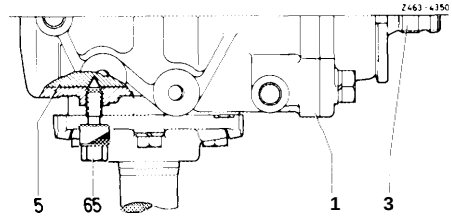
1 Steering gear	62 Closing plug
12 Pitman arm	95 Clamping sleeve
14 Hex. head bolt	96 Supporting ring
15 Self-locking hex. nut	97 Self-locking hex. nut
16 Locking ring	



Steering gear 2nd version

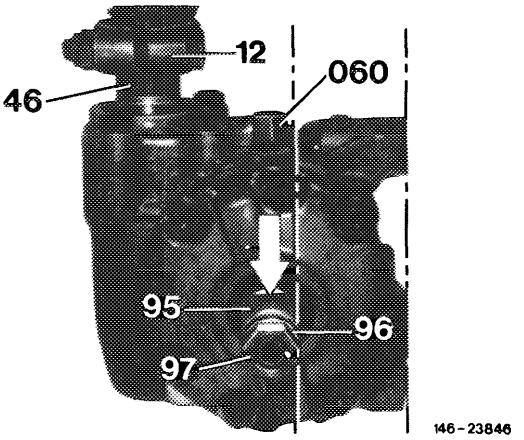
1 Steering gear	15 Self-locking hex. nut
12 Pitman arm	16 Locking ring
14 Hex. head bolt	62 Locking screw

12 Turn steering worm until the center point in operating piston (5) is accurately under threaded bore.



13 Screw center position check screw (060) into steering housing and locate power piston.

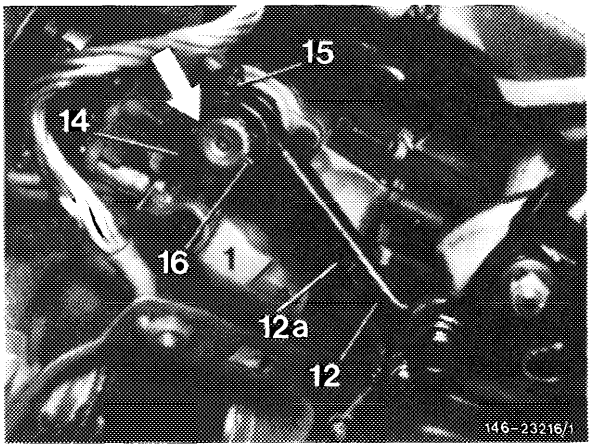
Note: a) On steering gear 1st version the two flats of the clamping sleeve (95) must be in parallel with contact surface of steering gear when in center position and the cutout on clamping sleeve (arrow) for clamping screw must be below.



b) Pay attention to code number (12a) of pitman arm (on both steering gear versions).

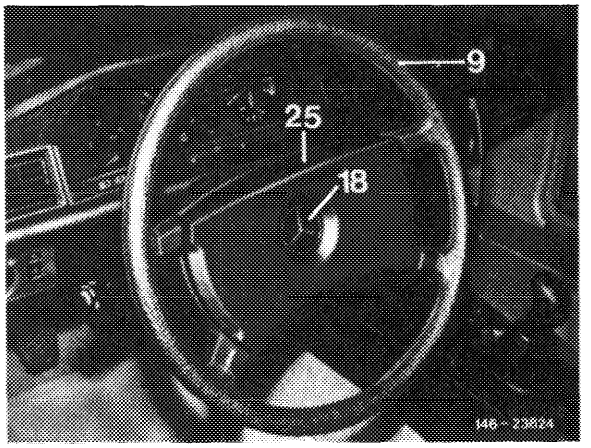
Lefthand steering = 0115
Righthand steering = 0116

c) The marking on pitman shaft (arrow) should point to parting line of pitman arm (also on both steering gear versions).



14 Remove steering coupling from steering spindle, check for wear and renew, if required, then slip steering coupling completely on parallel flats of lower steering spindle.

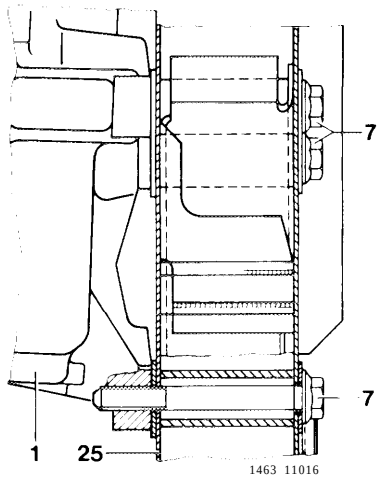
15 Turn steering wheel together with steering shaft into correct position; the upper spoke of steering wheel should be in horizontal position.



16 Insert steering gear 1 st version into steering spindle. Do not use force.

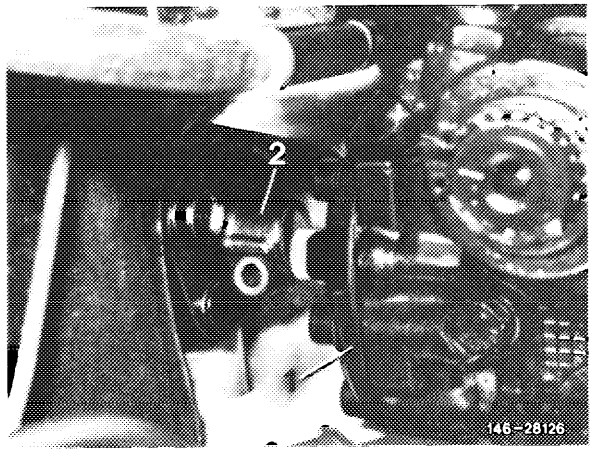
Fasten both steering gear versions with three new locking screws (7) to side member of frame floor. Tightening torque 70-80 Nm.

Attention!
Be sure to use new locking screws on principle.



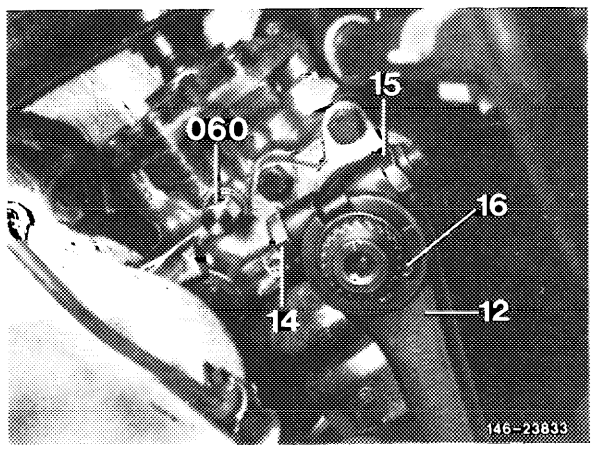
17 Slip steering coupling on splining of steering worm.

Note: Do not use force. Owing to structural design the corrugated tube of the lower steering spindle is relatively sensitive to lateral forces.

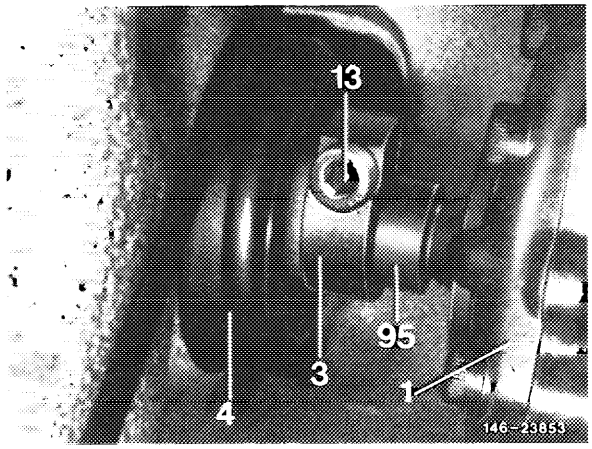


18 Screw out center control screw (060).

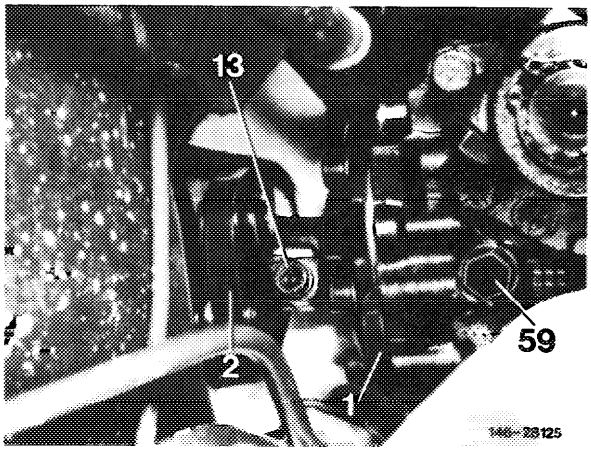
19 Screw in locking screw with new copper sealing ring into steering gear.



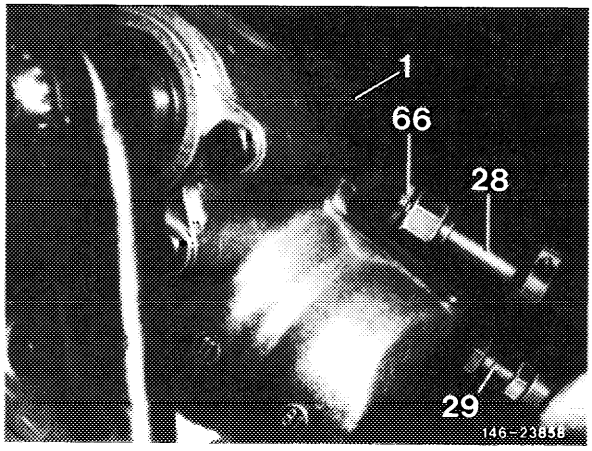
20 On steering gear 1st version screw hex. socket screw (13) into steering spindle (3) and tighten to 25 Nm.



21 On steering gear 2nd version screw both hex. socket screws (13) into steering coupling and tighten to 25 Nm.

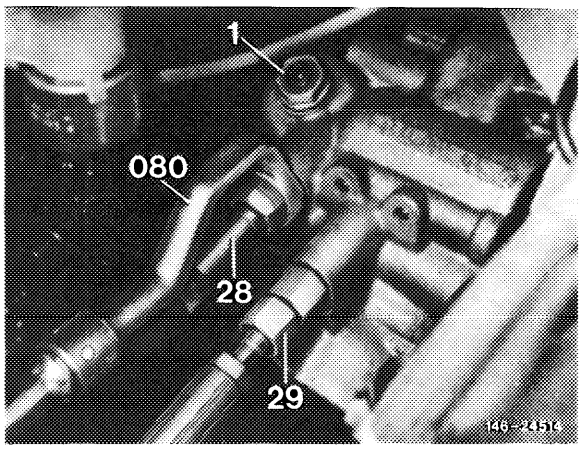


16 Remove blind plug, connect high-pressure expanding hose (29) and connecting tube (28) for return flow hose.

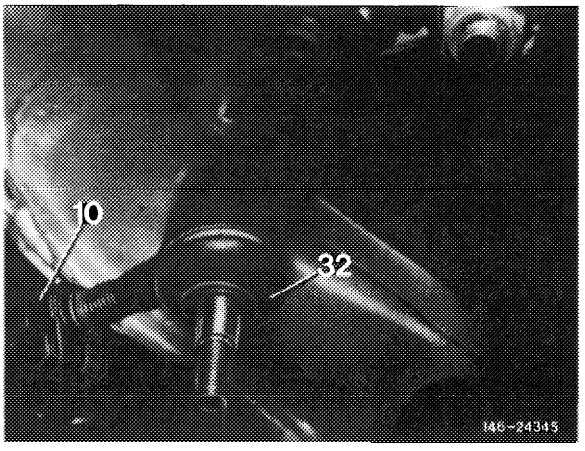


Note: For connecting return flow hose (28), use open socket wrench insert (080).

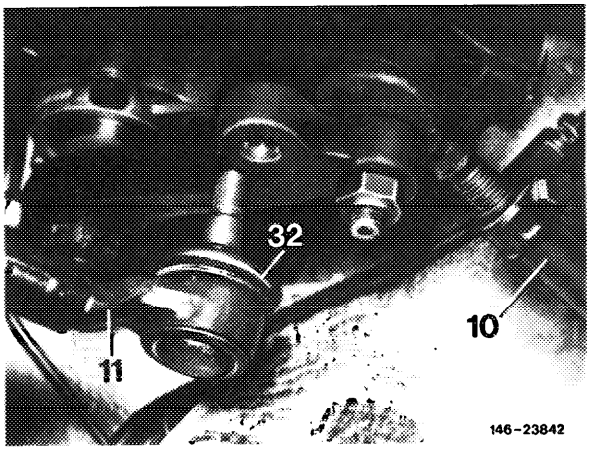
Attention!
Pay attention to perfect laying of hose. Even minor chafe marks may result in loss of oil and, as a consequence, in a breakdown of the hydraulic support.



17 Check rubber sleeve (32) on joint of track rod. When **on a used joint a damaged rubber sleeve is detected, the relevant joint must be completely replaced.** If the rubber sleeve was damaged during removal of track rod, replacement of the rubber sleeve will be sufficient (46-540 and 560).

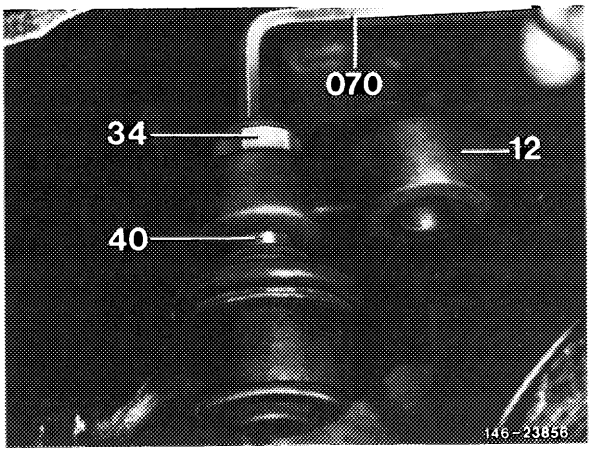


24 Check rubber sleeve (32) on joint of drag link. **If on a used joint a damaged rubber sleeve is detected, the drag link must be replaced.** If the rubber sleeve was damaged during removal of drag link, replacement of the rubber sleeve will be sufficient (46-550 and 560).



25 Perfectly remove any grease from ball pins as well as tapered seats in pitman arm. Then firmly press ball pins of drag link and track rod into taper of pitman arm, screw-on self-locking hex. nuts, while applying counterhold to ball pins with hex. socket wrench (070). Tighten self-locking hex. nuts to 35 Nm.

Note: Make sure to renew self-locking hex. nuts on principle.



26 Top up supply tank of power steering pump with specified oil type.

27 Run engine and turn steering several times to the left and the right until it is locked, top up oil simultaneously.

Note: The steering is self-venting.

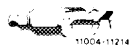
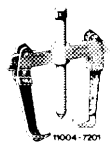
28 Check ball point position and toe-in (40–320).

Data

Part No.	Version	Code No.	Remarks
201 463 1501	left-hand steering	0115	For manual and power steering
201 463 1601	right-hand steering	0116	

Tightening torques	Nm
Self-locking hex. nut of clamping screw on pitman arm	**50**
Self-locking hex. nut on track rod and drag link	35

Special tools

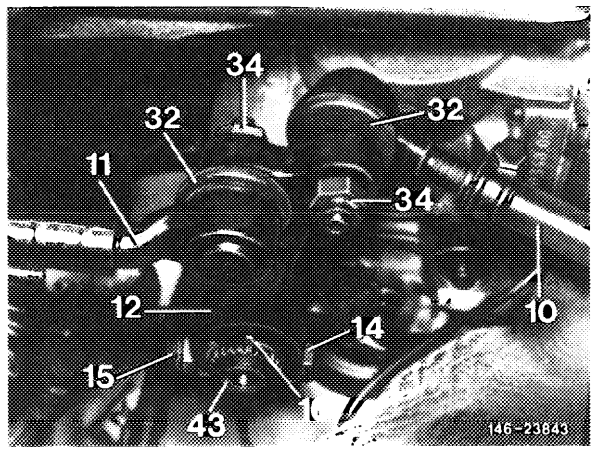
Puller for ball joint of track rod	11004-7226	201 589 08 33 00
Puller for ball joint of drag link	 11004-11214	201 589 07 33 00
Double-arm puller	 11004-7201	**000 589883300**

Adhesive agent

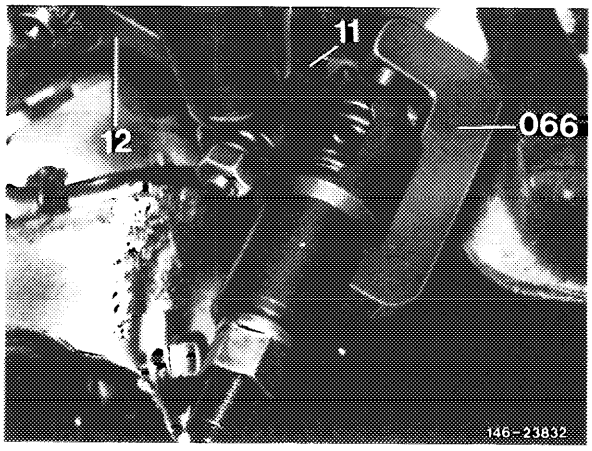
for pitman arm on pitman shaft Loctite 270	0029899371

Removal

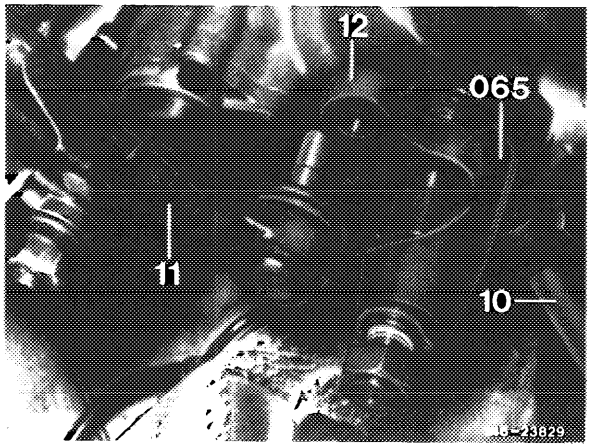
1 Screw off self-locking hex. nut (34) of drag link and track rod on pitman arm (12).



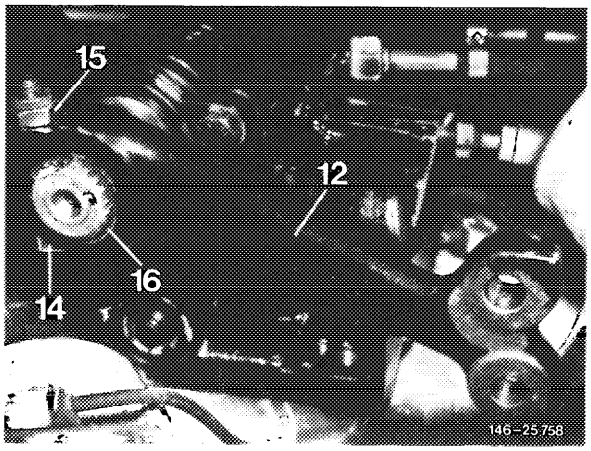
2 Force off ball joint of drag link (11) from pitman arm by means of puller (066).



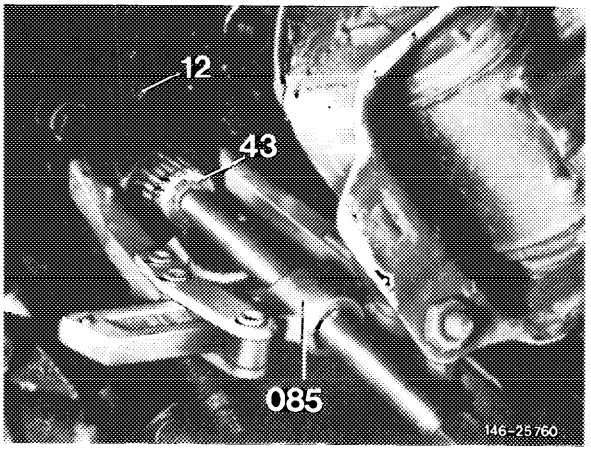
3 Force off ball joint of track rod (10) by means of puller (065).



4 Remove safety ring (16). Loosen hex. nut (15) and take off clamping screw (14).

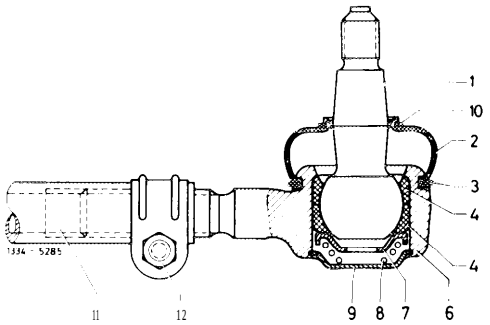


5 Take off pitman arm (12) from pitman shaft (43). If pitman arm is stuck, use double-arm puller (085).

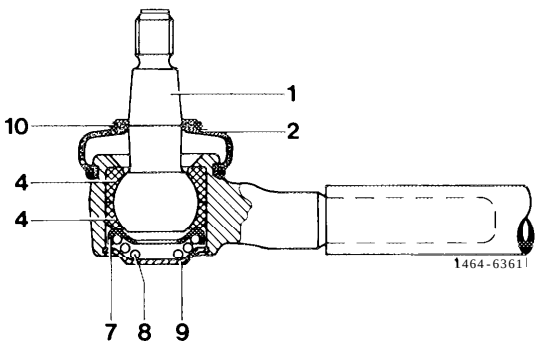


6 The pitman arm cannot be checked with workshop tools. **When in doubt,** in particular following an accident, renew steering gear including the pitman arm. For fitting reasons in relation to pitman shaft the pitman arm is not available as a spare part.

7 Check rubber sleeve (2) on the joints of track rod. If rubber sleeves are damaged, test ball joints for wear and replace, if required (46-540).

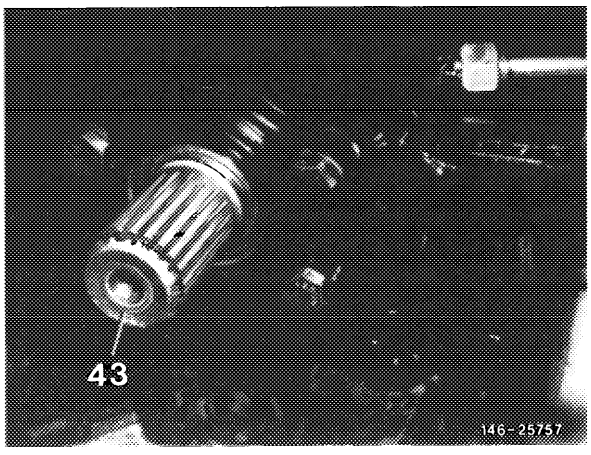


8 Check rubber sleeve (2) on the joints of drag link. If the sleeves are damaged, check joints for wear and replace drag link, if required (46-550).

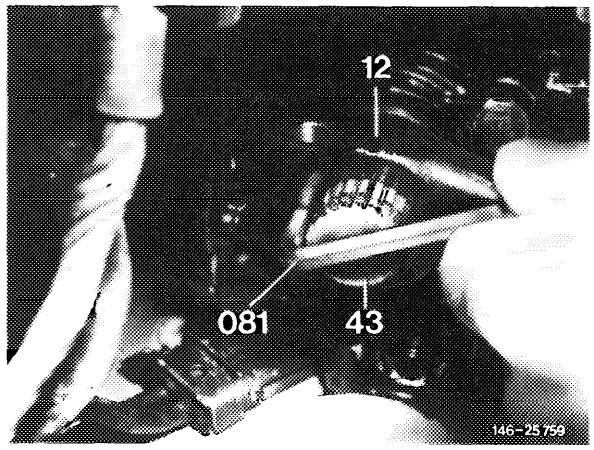


9 Clean serrated shaft section on pitman shaft and on pitman arm. Both parts must be oil and grease-free.

10 Cover serrated shaft section of pitman arm with Loctite 270.



11 Spread pitman arm (12) at parting line with a 6 mm hex. socket wrench.



12 Slide pitman arm in accordance with marking on pitman shaft, i.e. the notch in pitman shaft (43) must be in center of parting line.

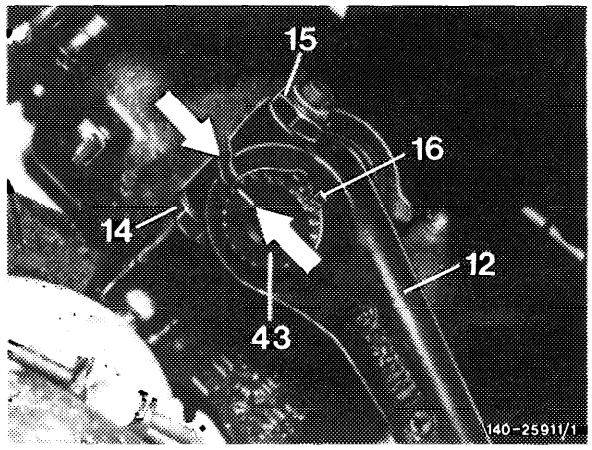
13 Insert clamping screw (14), using a new self-locking hex. nut (15), into pitman arm (12).

14 Measure ball point position (40-320). After adjustment to the prescribed dimension, tighten hex. nut (15) to 50 Nm.

Attention!
Make sure to renew self-locking hex. nut on principle.

15 Insert safety ring (16).

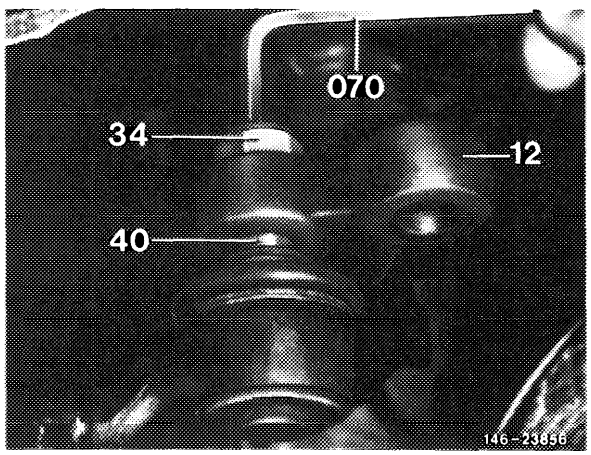
Attention!
The combination pitman shaft – pitman arm should harden at least 1 hour,



12 Perfectly clean from any grease the ball pins as well as the tapered seats in pitman arm. Then firmly press ball pins of drag link and track rod into taper of pitman arm, screw-on self-locking hex. nuts, while applying counterhold to ball pins by means of hex. socket wrench (070). Tighten self-locking hex. nuts to 35 Nm.

Attention!
Make sure to renew self-locking hex. nuts on principle.

17 Check ball point position and toe-in (40–320).



Data

Part No.	Version	Code No.	Remarks
201 463 1210	Lefthand steering	0112	1st version valid for models 201.02, 201.1 Not valid for model 201.03
201 463 1310	Righthand steering	0113	
2014631710	Lefthand steering	0117	2nd version valid for all models 201

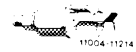
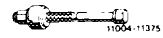
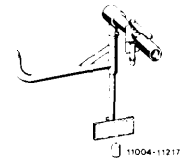
Adjusting value

Permissible difference in height of ball point position between pitman arm and intermediate steering arm	3 mm

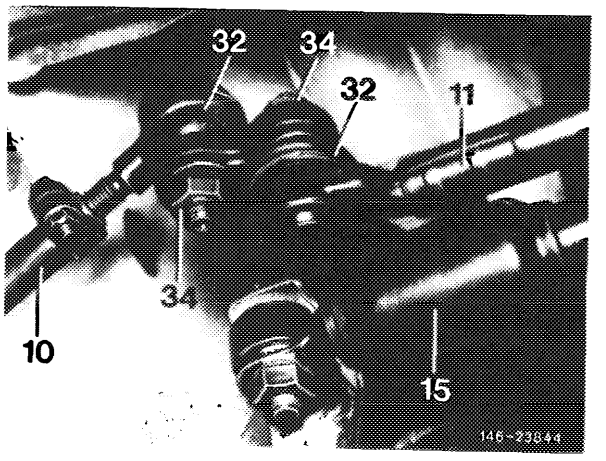
Tightening torques

	Nm
Self-locking hex. nut for attaching intermediate steering arm	90-100
Self-locking hex. nut on track rod and drag link	35

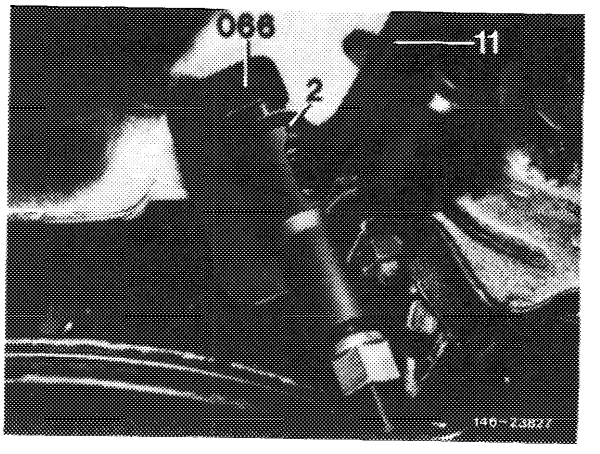
Special tools

Puller for ball joint of track rod to intermediate steering arm	11004-7226	201 589 08 33 00
Puller for ball joint of track link to intermediate steering arm	 11004-11214	201 589 07 33 00
Puller for rubber slide bearing	11004-7238	201 589 09 33 00
Installation tool for rubber slide bearing	 11004-11375	201 589 08 43 00
Measuring tool for control arm and ball point position	 11004-11217	201 589 00 21 00

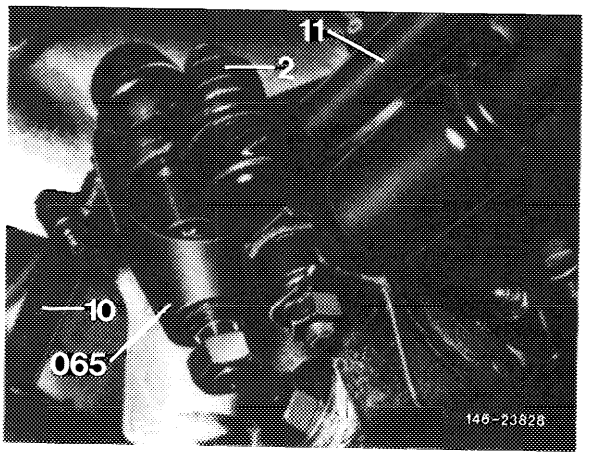
1 Unscrew self-locking hex. nut (34) from ball joint of drag link and track rod.



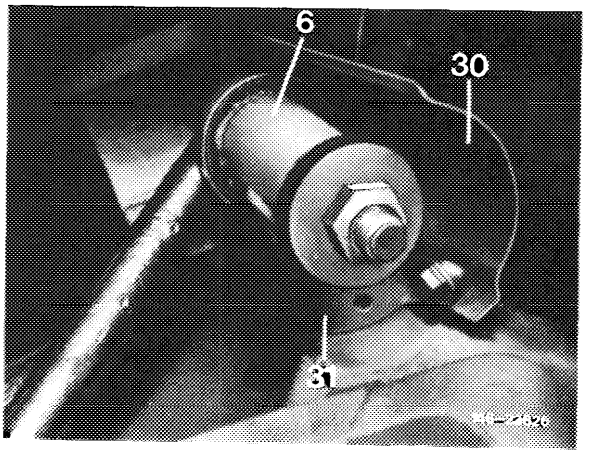
2 Force ball joint of drag link (11) from intermediate steering arm with puller (066).



3 Force ball joint of track rod (10) from intermediate steering arm with puller (065).

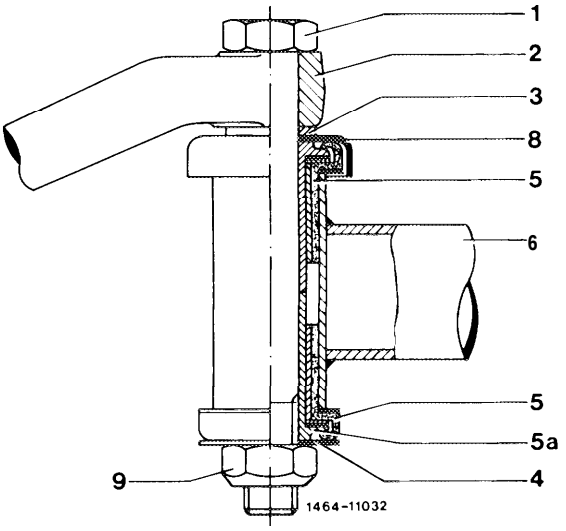


4 Loosen heat screen (30) on journal bearing.



5 Unscrew self-locking hex. nut (9) from hex. screw (1), remove sealing washer (4).

6 Remove hex, screw (1) together with intermediate steering arm (2) and dust cap (8). Watch out for washer (3), if any, inserted between intermediate steering arm and dust cap.

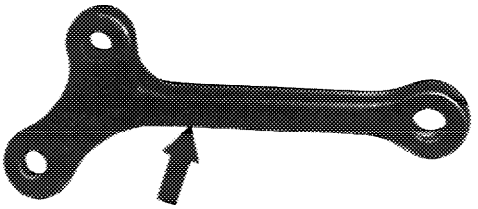


Checking and reconditioning

7 The intermediate steering arm cannot be checked with conventional workshop equipment. When in doubt, particularly following an accident, replace intermediate steering arm.

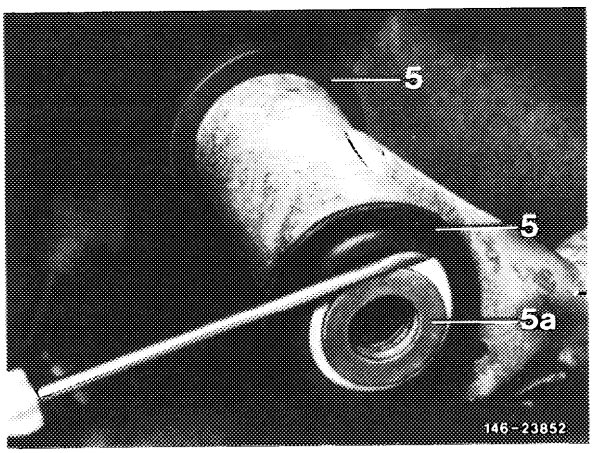
Pay attention to correct code number (arrow) of intermediate steering arm.

Attention!
In model 201.034 install intermediate steering arm with part No. 201 463 17 10 (code number 0117) only.

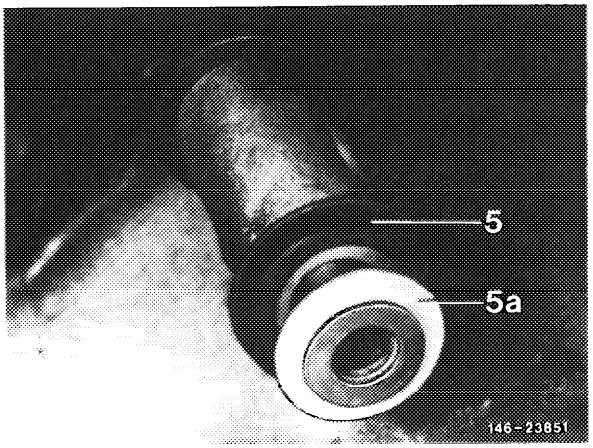


8 Check rubber slide bearing (5) in journal bearing for wear and renew, if required.

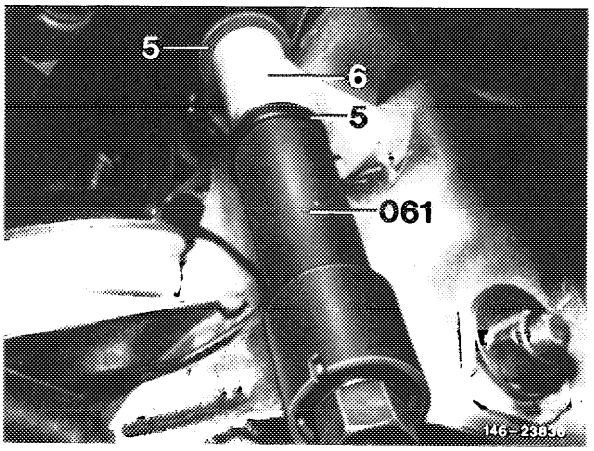
For this purpose, lift sealing lip of rubber slide bearing (5) by means of a screw driver.



9 Remove slide bushing (5a) from rubber slide bearing.

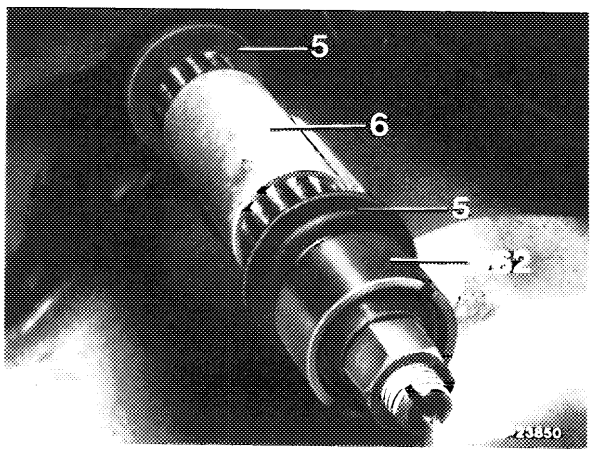


10 Remove both rubber slide bearings (5) from journal bearing by means of puller (061).

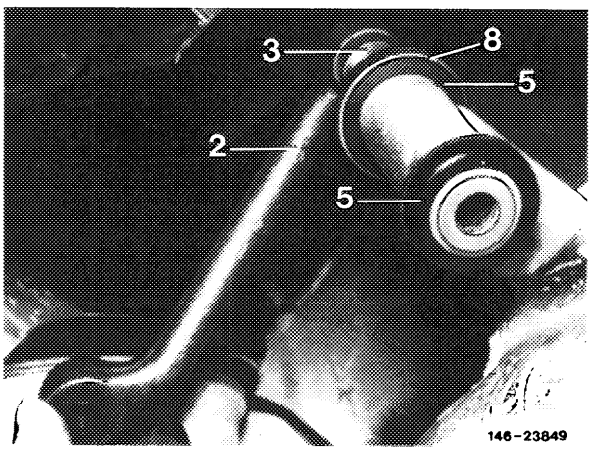


Installation

11 Coat rubber slide bearing (5) outside with slide fluid, e.g. with oil, and press into journal bearing (6) with installation tool (062).



12 Place dust cap (8) on upper rubber slide bearing.

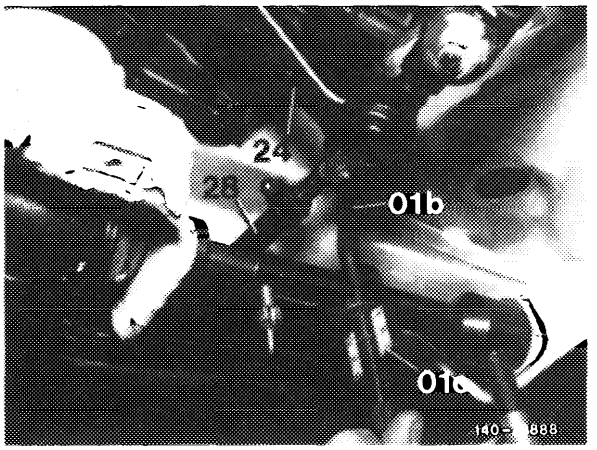


13 Insert hex. screw together with intermediate steering arm (2) and possibly available washer (3) into rubber slide sleeve (5).

Note: Make sure to mount hex. screw with screw head facing inter mediate steering arm.

14 Mount sealing washer (4), screw-on normal hex. nut (not self-locking) M 12 x 1.5 and tighten to approx. 70 Nm.

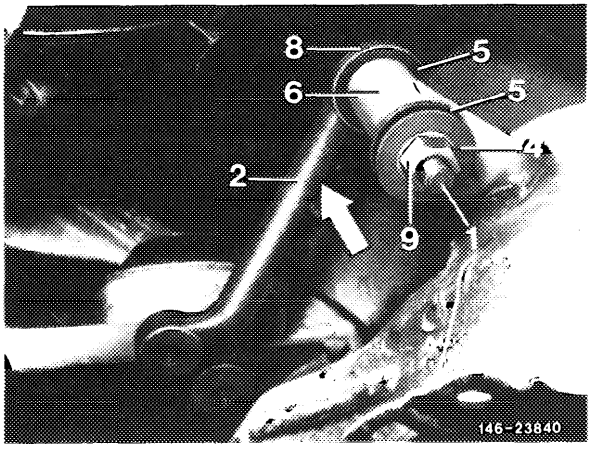
15 Measure permissible deviation in height of ball point location between pitman arm and intermediate steering arm. Max. permissible difference 3 mm. If the difference is larger, complete remedies (40-320).



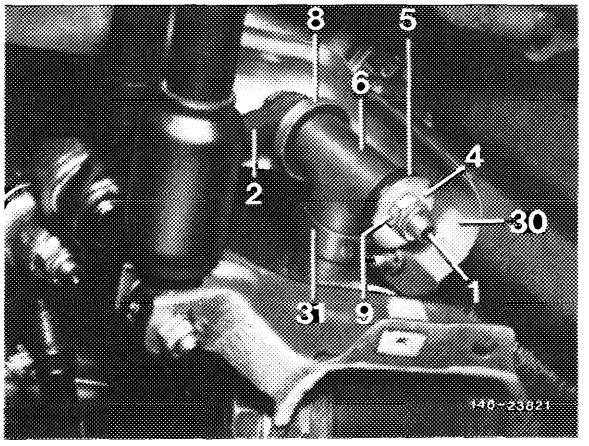
16 Unscrew hex. nut, then screw-on new self-locking hex. nut (9) and tighten to 90 Nm.

Note: Upon tightening of self-locking hex. nut, one thread of hex. screw should project beyond hex. nut.

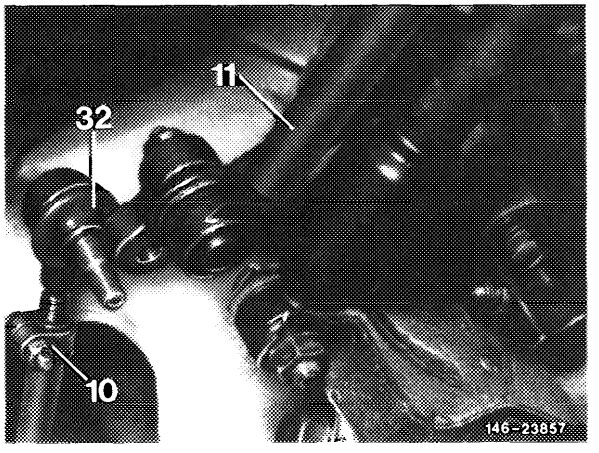
Attention!
Replace self-locking hex. nut on principle.



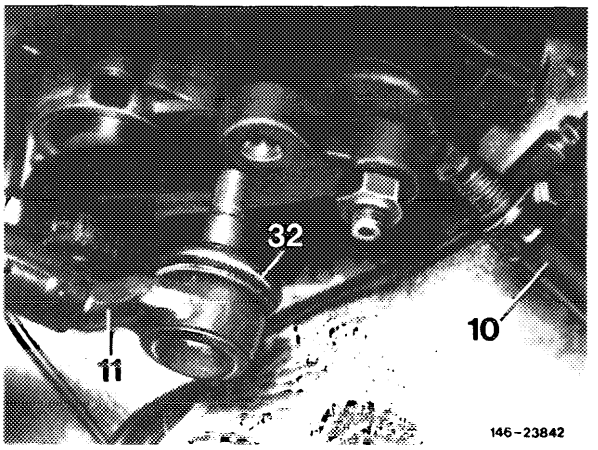
17 Attach heat screen (30) on journal bearing.



18 Check rubber sleeve (32) on joint of track rod. **If on a used joint a damaged rubber sleeve is detected, replace the relevant joint completely.** If the rubber sleeve was damaged during removal, replacement of rubber sleeve will be sufficient (46-540 and 560).

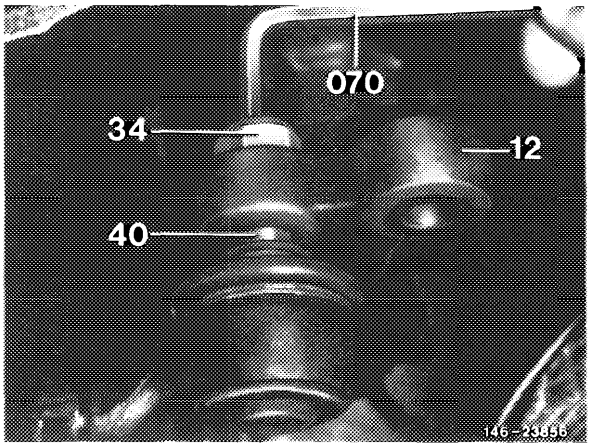


19 Check rubber sleeve (32) on joint of drag link. When **on a used joint a damaged rubber sleeve is detected, replace drag link.** If the rubber sleeve was damaged during removal, replacement of rubber sleeve will be sufficient (46-550 and 560).



20 Perfectly clean ball pins as well as tapered seats in pitman arms from any grease. Then firmly press ball pins into taper of pitman arm, unscrew self-locking hex. nut while applying counterhold to ball pins with hex. socket wrench (070). Tighten self-locking hex. nut to 35 Nm.

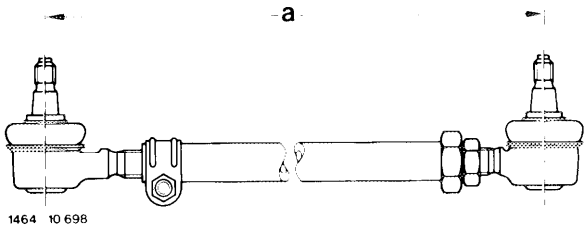
Note: Replace self-locking hex. nuts on principle.



21 Check ball point position and toe-in (40-320).

Data

Part No.	Length “a” adjusting dimension	Installation end	Remark
201 3300703	335 ± 2	Pitman arm end	Ball housing pin mounted with tapered clamping ring to steering knuckle arm (steering knuckle end)
201 330 12 03		Intermediate steering arm end	

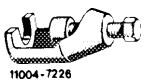


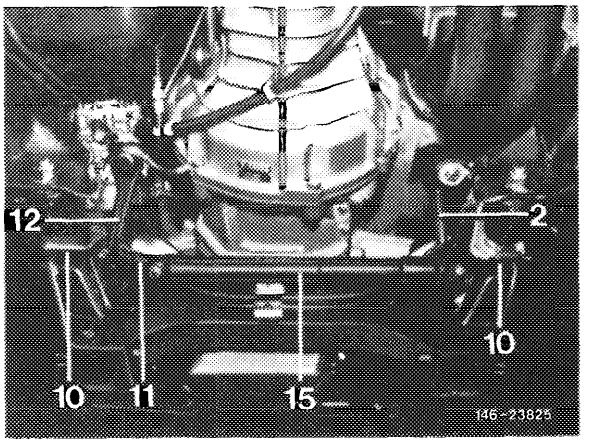
Approved grease types for ball joints

Multi-purpose grease	refer to Specifications for service products page 267

Tightening torques	Nm
Self-locking hex. nut for attaching track rod to steering arms	35
Hex. screw to clamp of track rod	10
Tapered clamping ring to track rod	30

Special tool

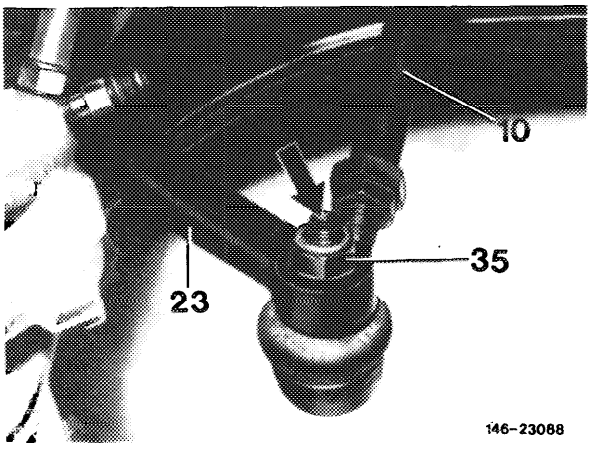
Puller for ball joints of track rod	 11004-7226	201 589 08 33 00



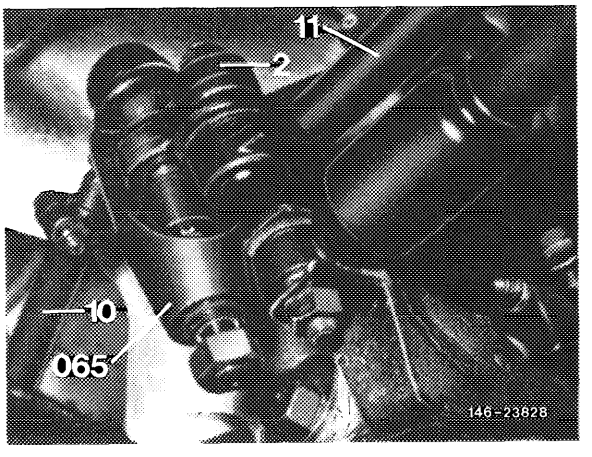
2 Intermediate steering arm
10 Track rod
11 Drag link
12 Pitman arm
15 Steering shock absorber

Removal

1 Unscrew self-locking hex. nuts (35) on joints of track rod.



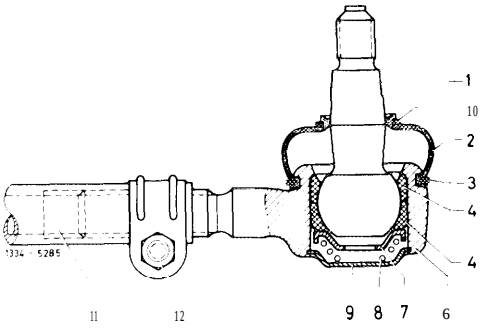
2 Force ball joints of track rod from steering arms with puller (065).



Checkup

3 Check joints of track rod. If track rod is moving too easily or if subject to play, replace respective track rod head.

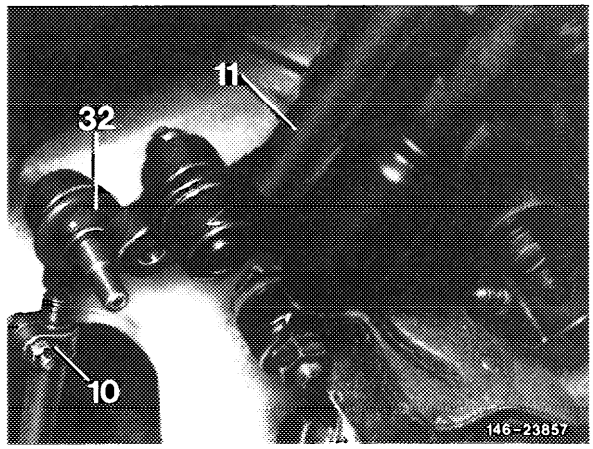
4 Check rubber sleeves (2) for joints, **If on a used joint a damaged rubber sleeve is detected, completely replace respective joint.**



5 If rubber sleeve (2) was damaged during removal, replacement of rubber sleeve will be sufficient.

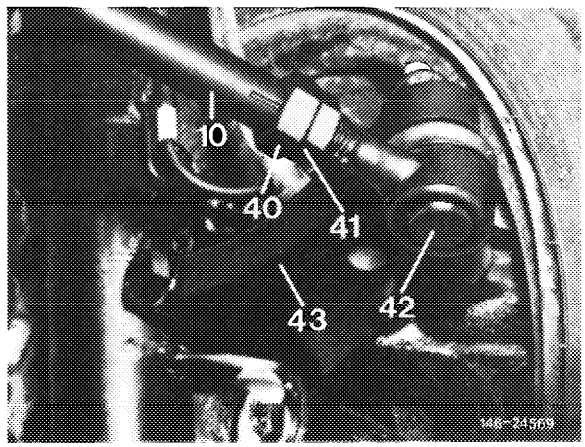
Installation

6 Perfectly clean ball pins as well as tapered seats in steering arms from any grease. Then firmly press ball pins into taper of steering arm.



Note: When **installing track rod, absolutely make sure that the ball joint secured by tapered clamping ring (40)** is attached to steering **knuckle arm** (steering knuckle end).

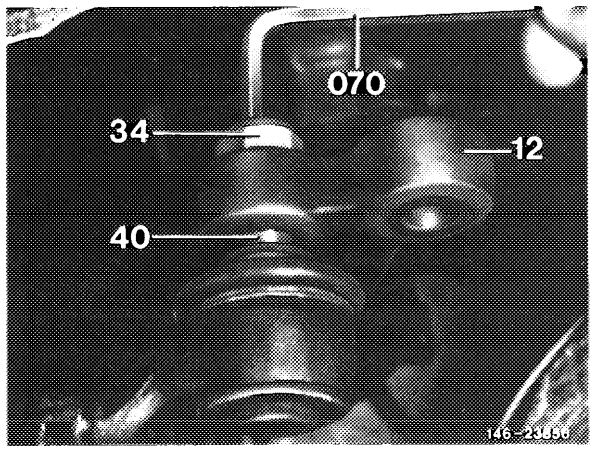
b) Make sure that different track rods are installed for left-hand and right-hand front wheel, respectively.



7 Screw-on new self-locking hex. nut **(34)** while applying counterhold to ball pins with hex. socket wrench (070). Tighten self-locking hex, nut to 35 Nm.

Note: The self-locking hex. nut must be renewed on principle.

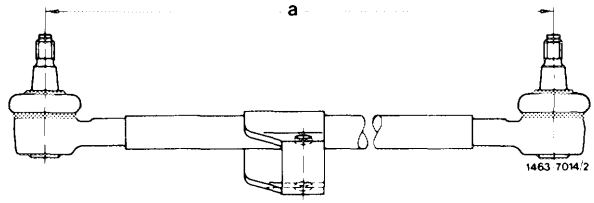
8 Check toe-in (40-320).



46–550 Removal and installation of drag link

Data

Part No.	Version	Length “a”
2014601405	left-hand and right-hand steering	487 ± 0.5

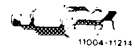


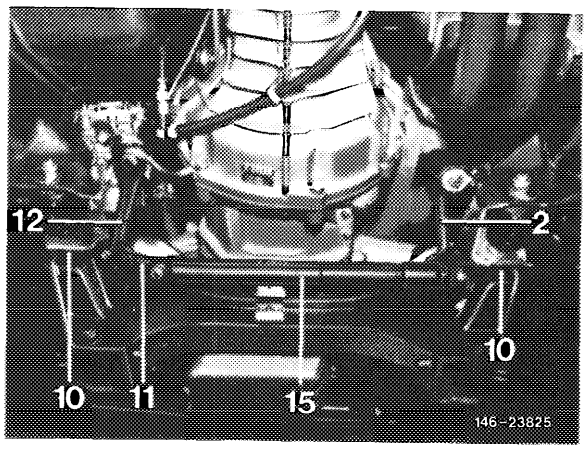
Approved grease types for ball joints

Multi-purpose grease	refer to Specifications for service products page 267

Tightening torques	Nm
Self-locking hex. nut for attaching drag link to steering arms	35
Self-locking nut for attaching steering shock absorber to drag link	50

Special tool

Puller for ball joints on drag link		201 589 07 33 00

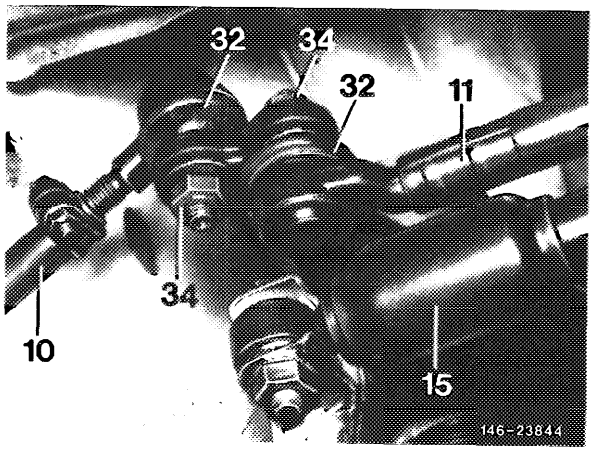


2 Pitman **arm**
10 Track rod
11 Drag link
12 Intermediate steering arm
15 Steering shock absorber

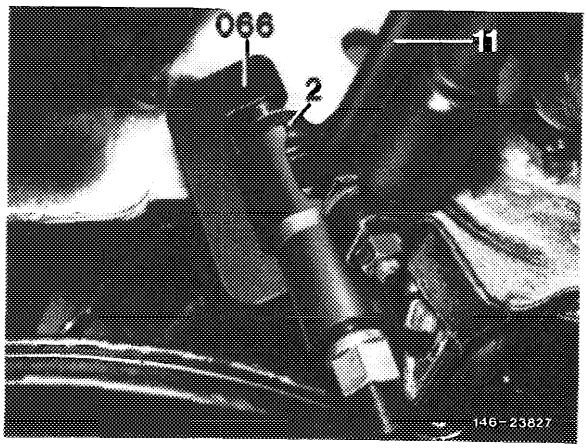
Removal

1 Screw off self-locking hex. nut (34) on joints of drag link.

2 Screw out hex. nut for attaching of steering shock absorber and take off steering shock absorber from drag link.



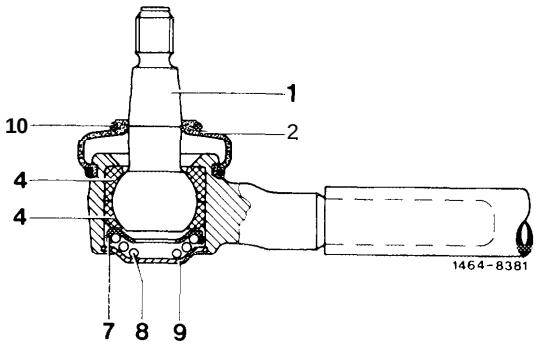
3 Force off ball joints of drag link (1 1) with puller (066).



Checkup

4 Check joints of drag link. If joints are moving too easily or in the event of play, be sure to replace drag link.

5 Check rubber sleeve (2) for joints. **If on a used joint a damaged rubber sleeve is detected, drag link must be renewed.**

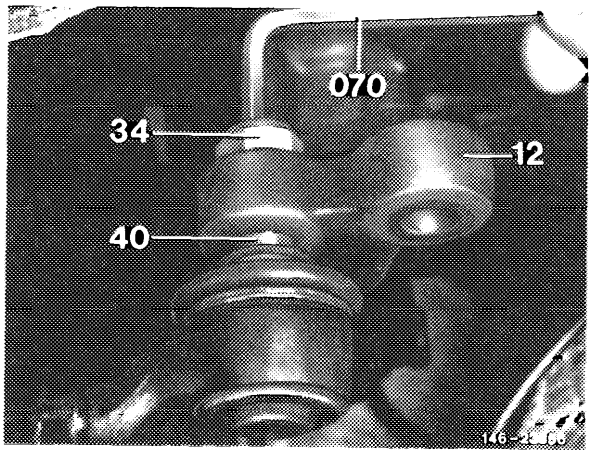


6 If rubber sleeve (2) was damaged during removal, it will be sufficient to replace rubber sleeve.

Installation

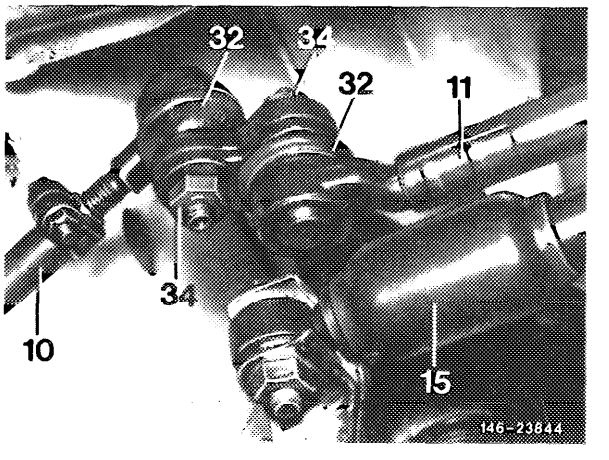
7 Perfectly clean ball pins as well as tapered seats in steering arms from any grease. Then tightly push ball pins into taper of steering arm, screw-on self-locking hex. nuts while applying counterhold to bal pins with hex. socket wrench (070). Tighten self-locking hex. nuts to 35 Nm.

Note: Make sure to replace self-locking hex. nuts or principle.



8 Attach steering shock absorber to drag link. Tighten self-locking hex. nut to 50 Nm.

Note: Make sure to renew self-locking hex. nut on principle.



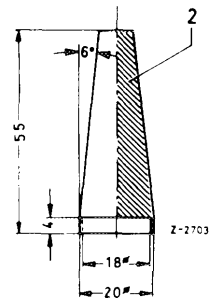
9 Check toe-in (40-320).

Approved grease types for ball joints

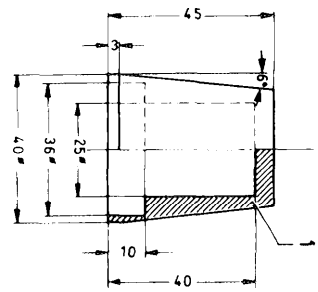
Multi-purpose grease	refer to Specifications for service products page 267

Self-made tools

Assembly sleeve for plastic ring



Assembly bushing for flat wire clamping ring

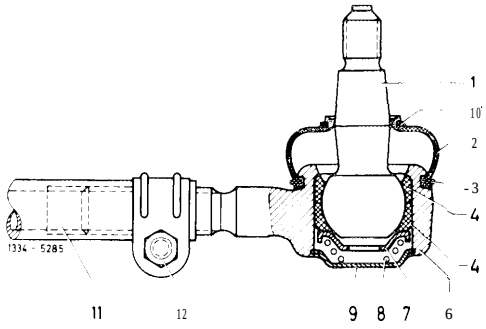


Note

The maintenance-free joints are provided with grease for life. On these joints, the **seal** which prevents the entry of dirt **is of decisive importance for the life of the joint. A rubber sleeve damaged during assembly should therefore be immediately replaced,** since otherwise the penetrating dirt may result in wear of joints. For this reason, make sure **that the joints are carefully checked at regular intervals,** When on a used joint a damaged sleeve is detected, the pertinent joint must be renewed completely,

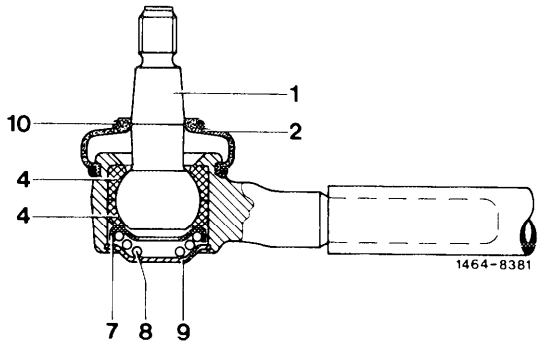
Replacing

1 **Remove flat wire clamping ring (3) and sleeve (2) together with plastic locking ring (10).**



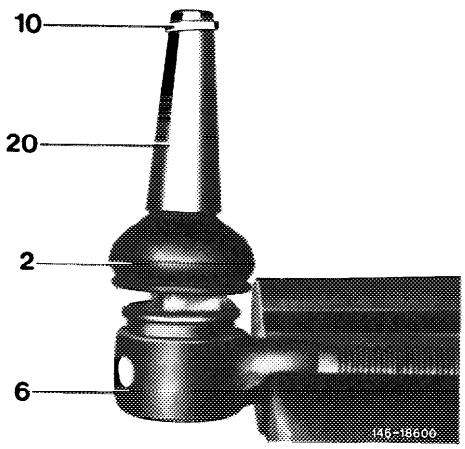
Track rod joint

2 Fill space between sleeve and joint with the specified grease.

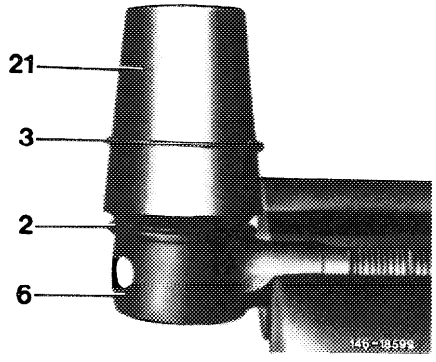


Drag link joint

3 Place rubber sleeve (2) and subsequently assembly sleeve (20) on ball pin. Insert plastic locking ring (10) over assembly sleeve into rubber sleeve.



4 Place assembly sleeve (21) on ball joint and over rubber sleeve (2), and insert flat wire clamping ring (3).

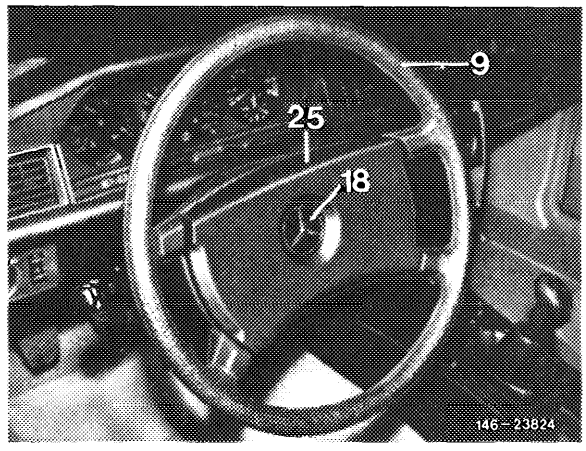


Tightening torque	Nm
Countersunk screw with hex. socket for attaching steering wheel to steering shaft	80

A. Steering wheel without Airbag unit

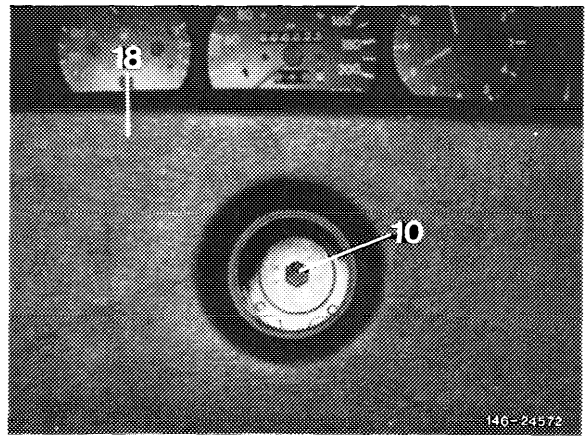
1 Remove company symbol (18) with a small screw driver from steering wheel pad (25).

Note: In order to avoid damage the pad must not be pulled off the horn carrier.



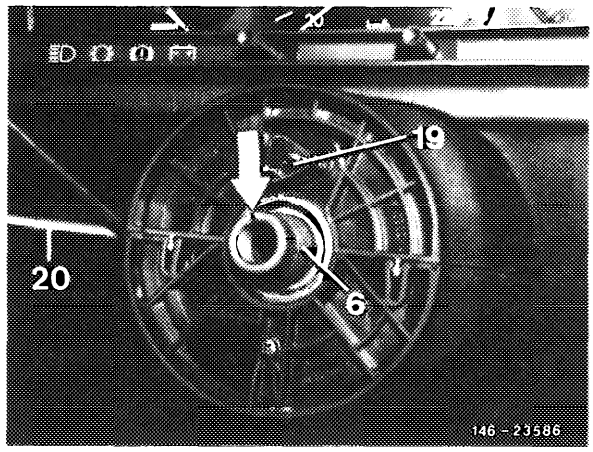
2 Screw-out countersunk screw (10) from steering shaft with the steering lock engaged.

3 Remove steering wheel from steering shaft.

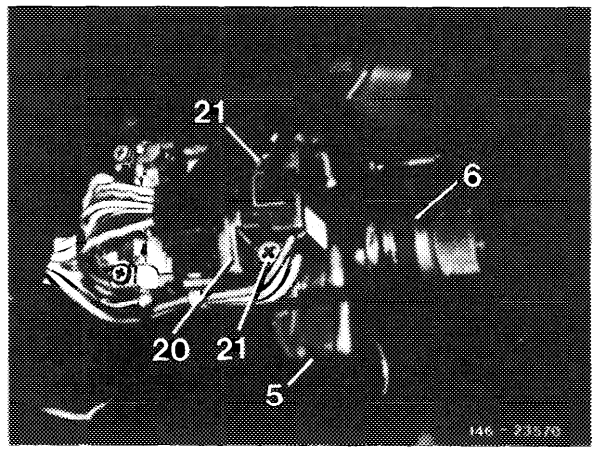


Installation

4 Turn steering shaft (6) in such a manner, that marking line (arrow) is pointing accurately upwards.



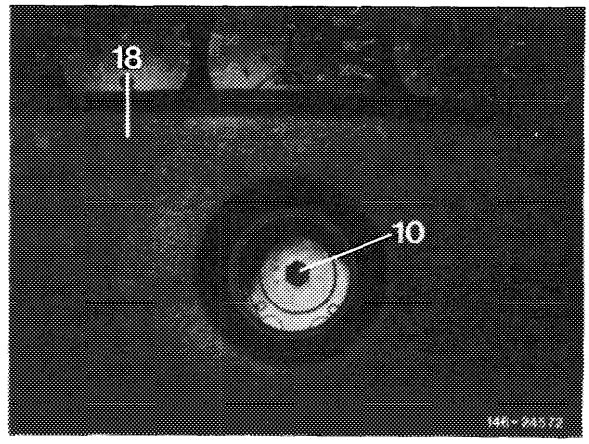
5 Check carbon brush for wear and renew, if required. For this purpose, loosen the two cables on instrument cluster (jacket tube represented without protective cover).



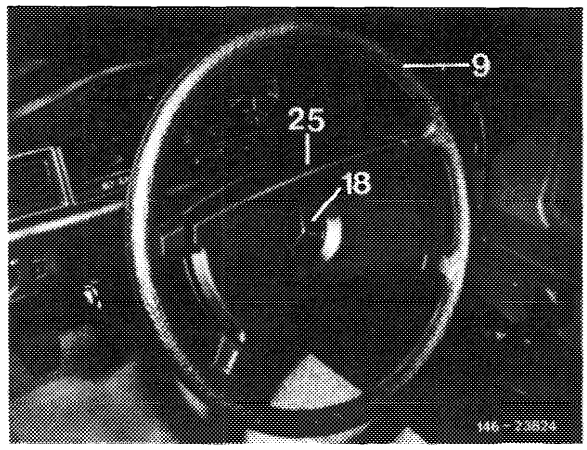
6 Place steering wheel on splining of steering shaft while making sure of horizontal position of spokes on steering wheel; the slightly curved spoke should be below.

7 Screw-in countersunk screw (10) into steering shaft with the steering lock engaged, and tighten to 80 Nm.

Note: Make sure to renew self-locking countersunk screw on principle.



8 Insert company symbol into steering wheel pad,



9 During trial run, check position of steering wheel in straight-ahead position of road wheels. If the steering wheel position when driving straight-ahead is not in agreement with front wheels, the steering wheel can be displaced in splining by max. 2 teeth to the left or right.

Note: If, thereafter, the position of the steering wheel and the straight-ahead position of wheels are not even now correct, check and adjust toe-in distribution, starting from the center position of steering gear (40–320).

10 Check horns for function and automatic return of combination switch.

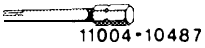
Note: Dirty or sticky steering wheels can be cleaned with a neutral type of household cleaner by washing the steering wheel with a lukewarm solution of the cleaner.

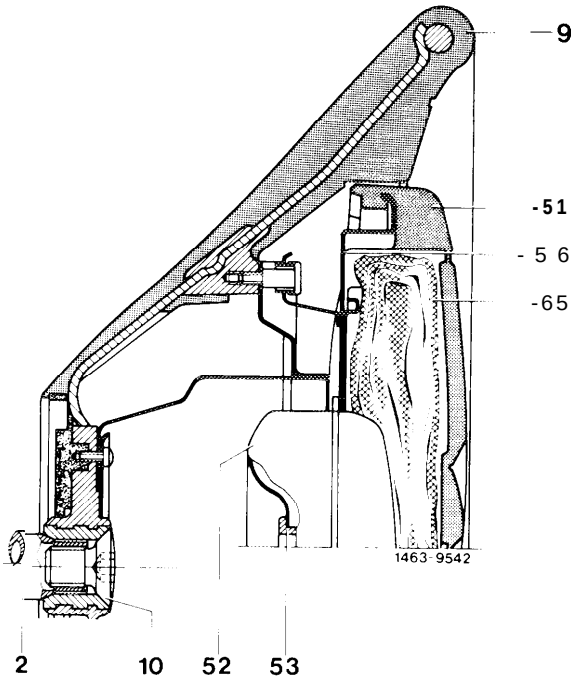
Do not use scouring compounds, since they will attack the plastic foaming.

B. Steering wheel with Airbag unit

Tightening torque	Nm
Oval head screw with Intorx	7

Special tool

Screw driver insert TX **30** 1/4'' hex., **60** mm long	 11004-10487	**126 589 00 10 00**



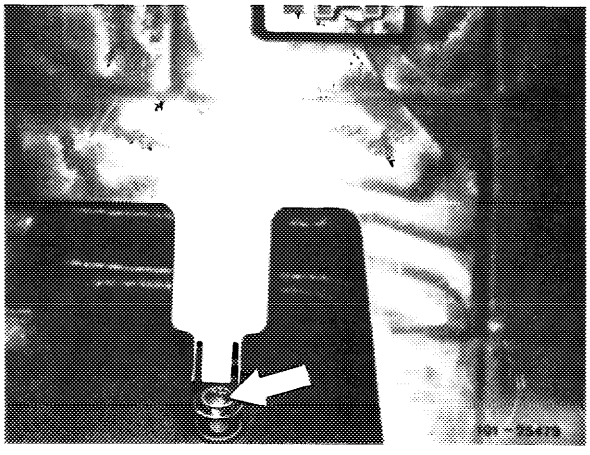
2 Steering shaft
9 Steering wheel
10 Countersunk screw
51 Airbag unit
52 Gas generator
53 Gas generator plug connection
56 Generator carrier
65 Airbag

Removal

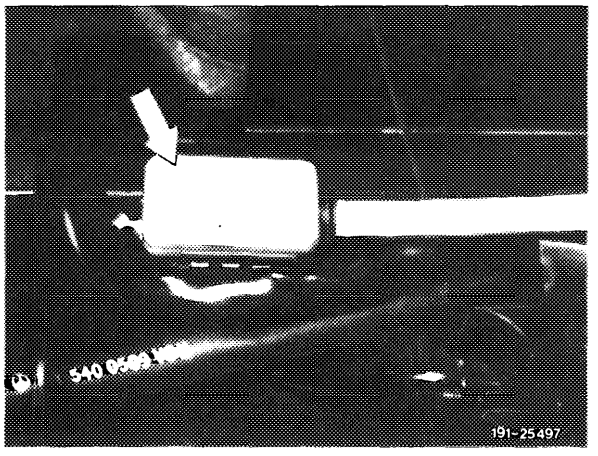
1 Turn ignition key to zero position, disconnect and cover negative pole of battery.

2 Remove floor mat in co-driver's foot well.

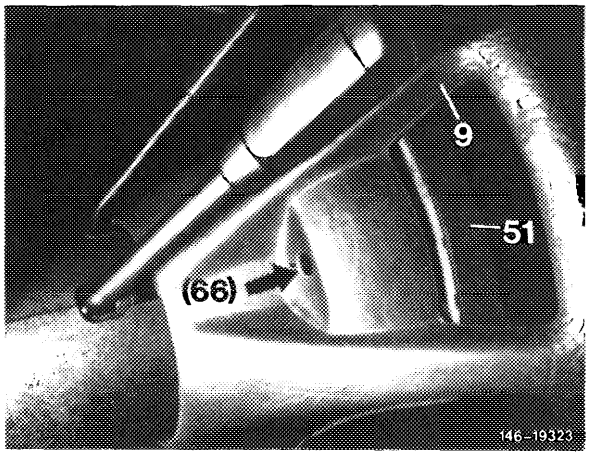
3 Loosen screw on foot support and remove foot support.



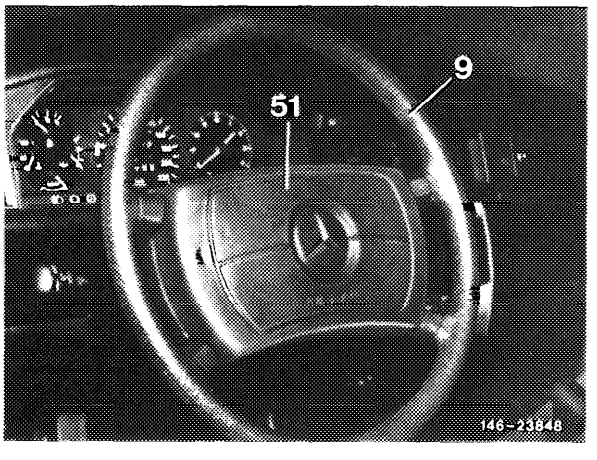
4 Pull off red 10-line plug connection of release unit at foot support.



5 Screw out both fillister-head screws (66) with Intorx (arrow) from generator carrier by means of screw driver insert. This will release the generator carrier from contact bridges.

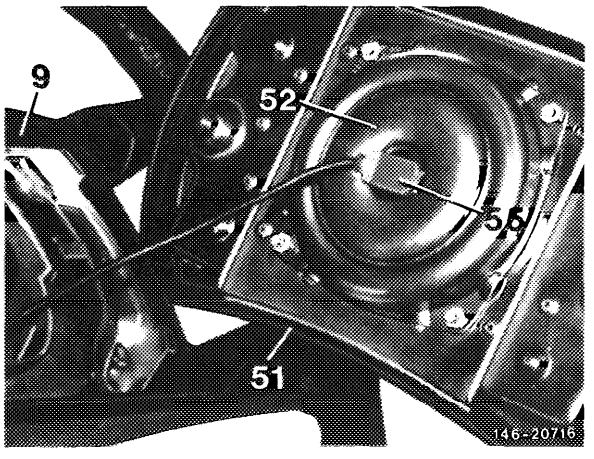


6 Remove complete airbag unit (51) from steering wheel.



7 Pull-out plug connection (55) from gas generator.

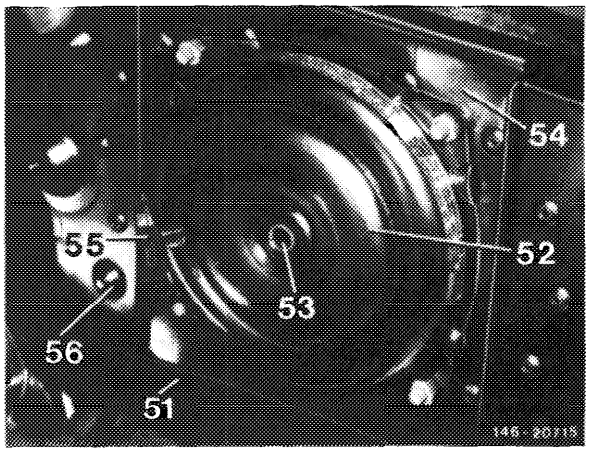
Note: By pulling-off the plug connection, a short circuit bridge will automatically become effective in gas generator.



8 Remove airbag unit from steering wheel.

Note: No additional job may be performed on the complete airbag unit. The airbag unit must be stored under personal supervision or, when it is removed for an extended period, under lock and key.

b) As a spare part, only the complete airbag unit is available.



Attention!
Always store the airbag unit after removal in such a manner that the padded face is showing **upwards.**

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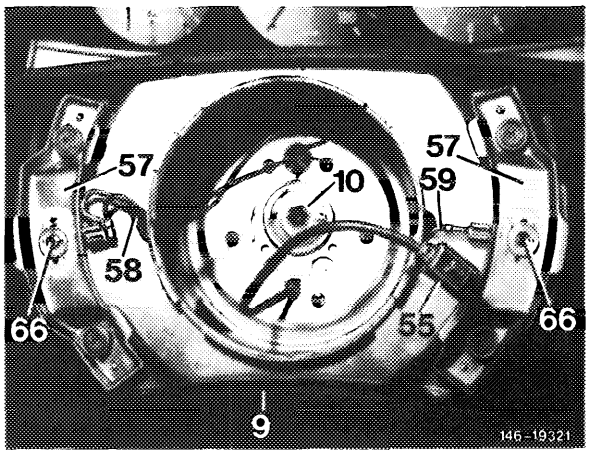
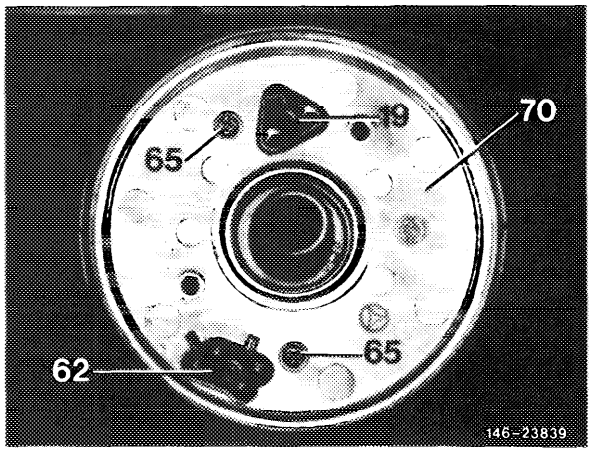
9 Unscrew countersunk screw (10) from steering shaft.



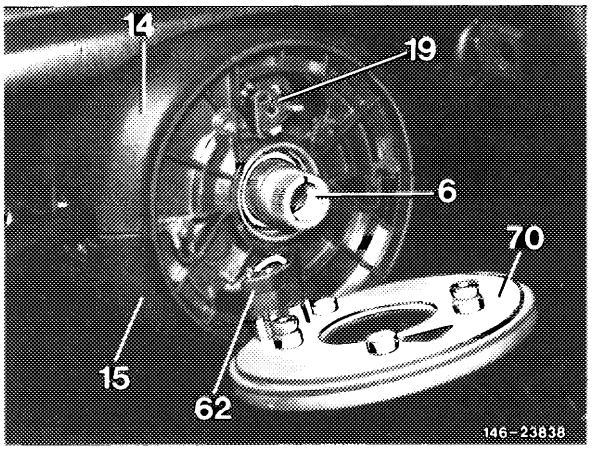
9 Steering wheel
10 Countersunk screw
55 Plug connection
57 Horn push buttons
58 Cable to horn
59 **Ground cable on steering wheel**
66 Fillister-head screw with Intorx

10 Remove steering wheel from steering shaft (2).

11 Check carbon brushes (19) for horn as well as (62) for airbag unit.

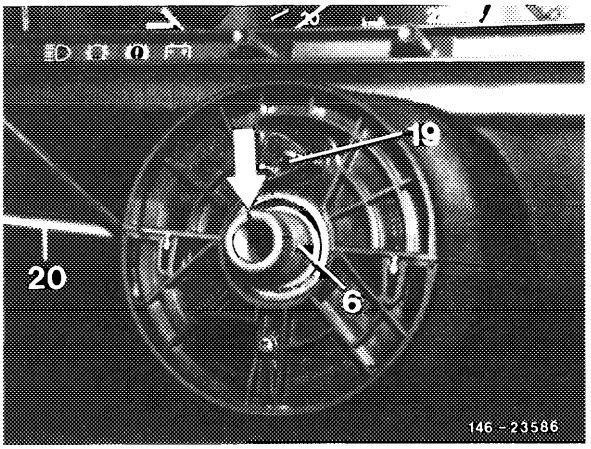


12 Remove cover plate (70) and replace carbon brushes, if necessary.



Installation

13 Turn steering shaft (6) in such a manner that marking (arrow) is pointing accurately upwards.

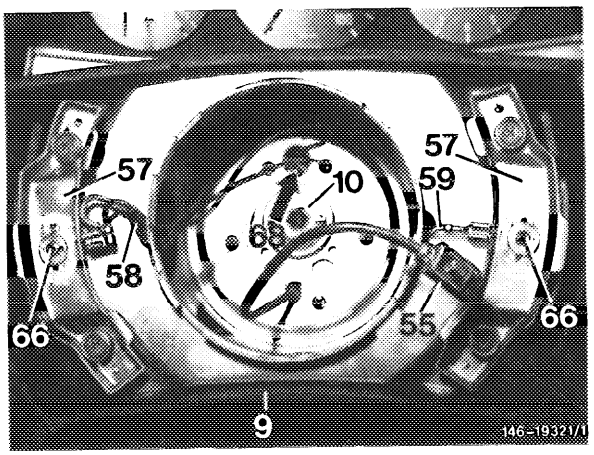


14 Place steering wheel on splining of steering shaft while making sure of horizontal position of spokes on steering wheel; the slightly curved spoke should be below.

15 Screw-in countersunk screw (10) into steering shaft and tighten to 80 Nm.

Note: Make sure to renew the self-locking countersunk screw on principle,

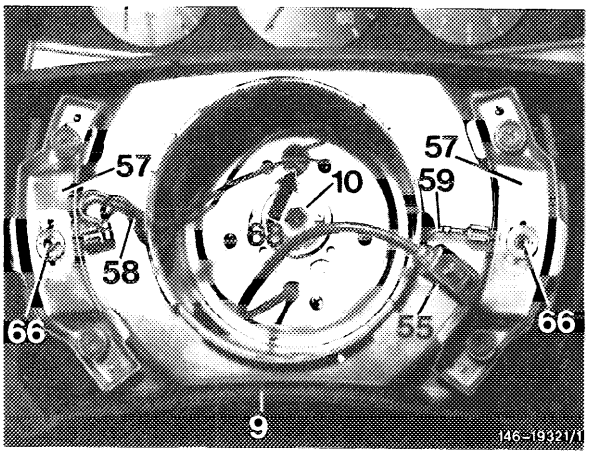
16 Pull-off cable (68) on plug connection of contact ring.



17 During trial run, check position of steering wheel in straight-ahead position of wheels.

18 If any correction should be necessary, the steering wheel can be displaced by max. 2 notches in steering shaft.

19 Connect cable (68) at plug connection of contact ring.



Installation of airbag unit

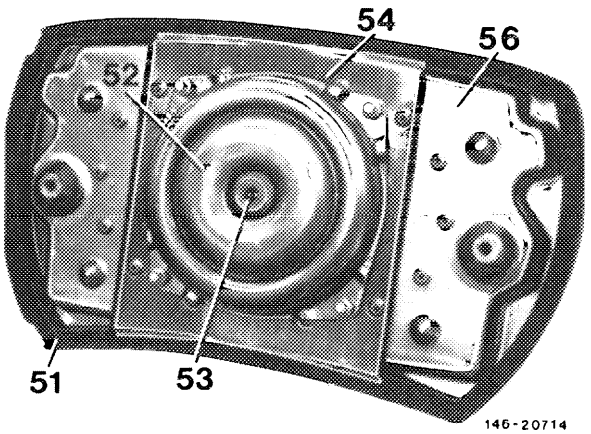
Attention!

a) The airbag unit must not be treated with grease, cleaning agents or similar compounds.

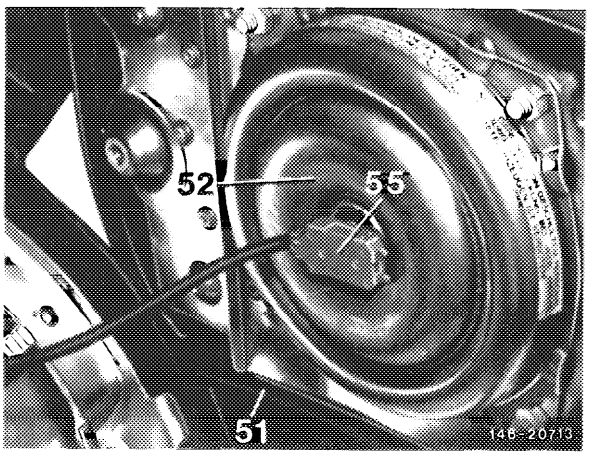
b) The airbag unit must not be exposed to temperatures over 100 °C, not even for a short period,

c) The airbag unit is sensitive to percussion. Should it fall from a height exceeding 50 cm to a hard underground, the airbag unit must no longer be installed, but returned to the Sindelfingen plant enclosed in a special packing (transportation means).

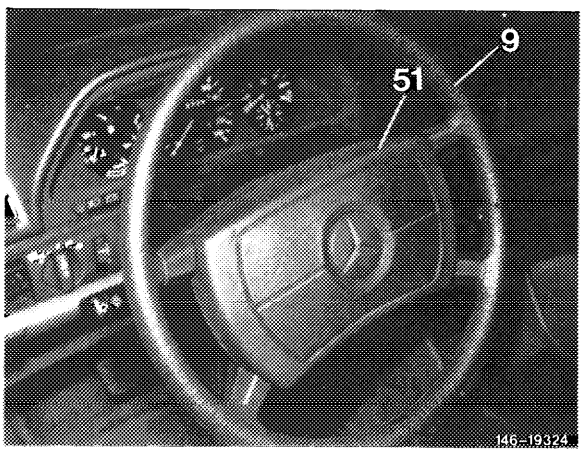
d) Prior to installation, check airbag unit for disconnection of ground cable on battery, pole covering and ignition key position to zero,



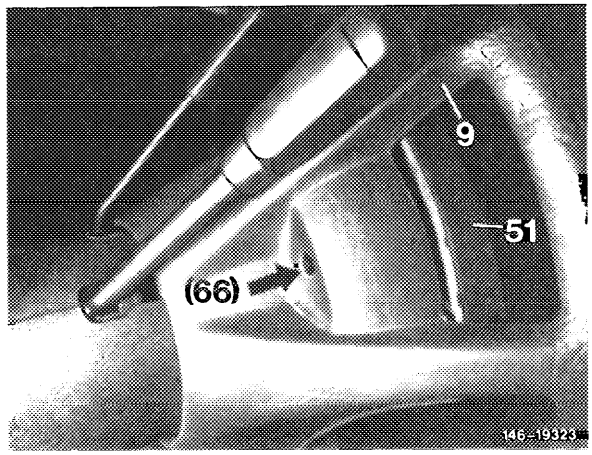
20 Connect plug connection (55) to gas generator (plug connection should audibly engage).

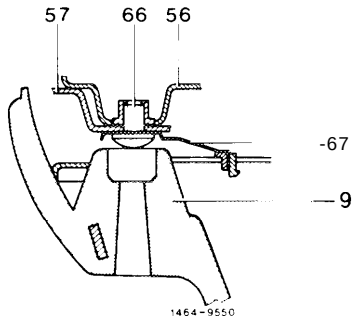


21 Place airbag unit (51) on steering wheel.



22 Screw-in fillister head screws (66) with Intorx (arrow) into generator carrier with insert. Tightening torque 7 Nm.



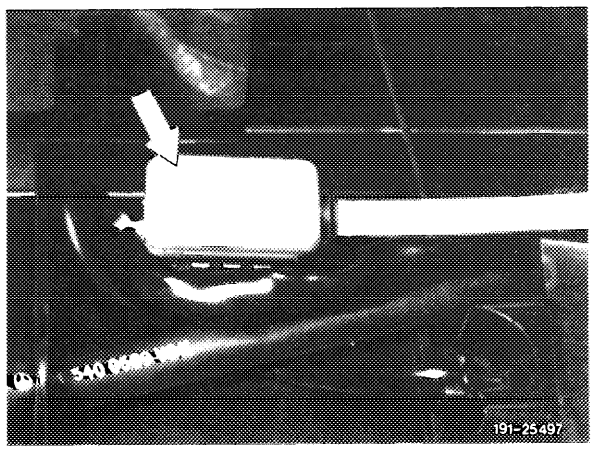


9 Steering wheel
56 Generator carrier
57 Contact bridges
66 Fillister-head screw with Intorx
67 Spring

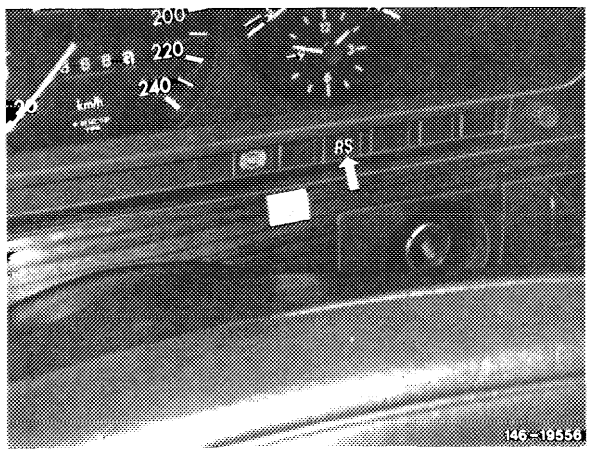
23 Check device by means of tester (91-700).

24 Following the testing operation, disconnect ground cable on battery and, with the ignition switched off, connect plug connection to releasing device. insert foot support into front wall and place foot mat into co-driver's foot well.

25 Connect ground cable to battery.



26 Observe control light while turning steering wheel completely into both directions with the engine running. Control light should then neither flash nor flare.



27 Check horns for function and automatic return of instrument cluster.

28 By knocking on the steering wheel rim, check whether a rattling noise is heard.

Note: Dirty or sticky steering wheels can be cleaned with neutral household cleaner, by washing the steering wheel with a lukewarm solution of the cleaner.

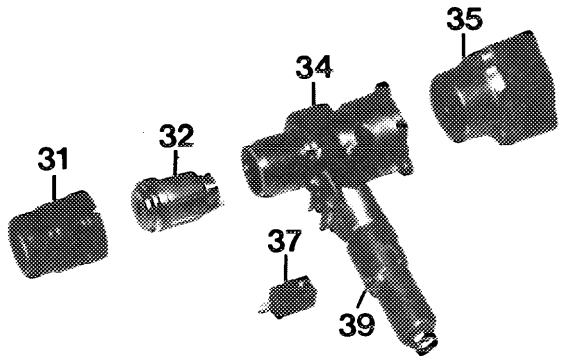
Do not use scouring compounds, since they will attack the plastic foaming.

The steering lock comprises three main components:

A. Ignition starting switch electrical section (35)

B. Locking cylinder (32)

C. Steering lock mechanical section (34)



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31 Cover
32 Locking cylinder
34 Steering lock
35 Ignition starting switch
37 Contact switch
39 Locking pin

A. Removal and installation of ignition starting switch

Removal

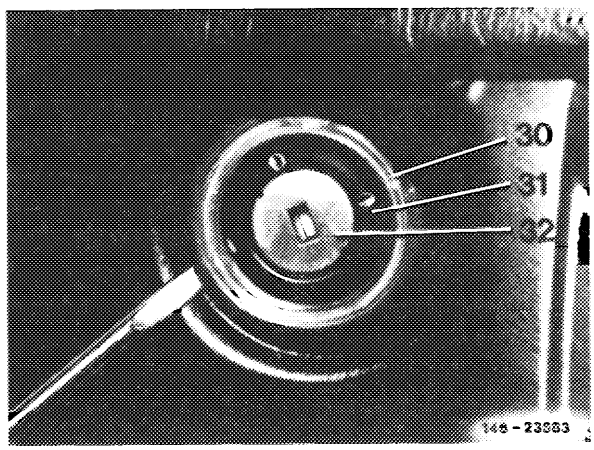
1 **Remove** cover on the left in driver's foot well.

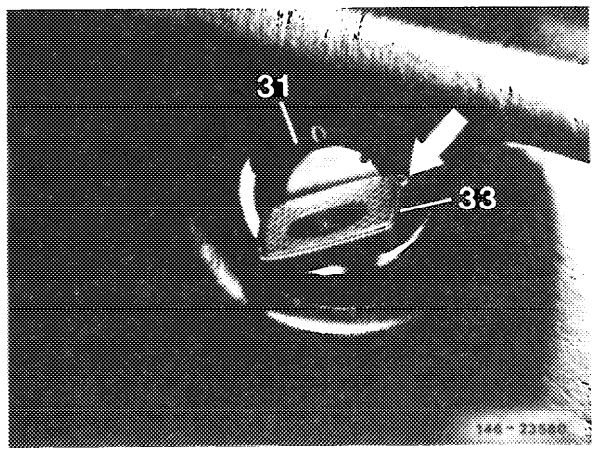
2 **Remove** steering **wheel 46-610.**

3 Remove instrument cluster. For this purpose, pull out instrument cluster as far as possible, release speedometer shaft, electrical plug connections and oil pressure line.

4 Remove rosette (30) by means of a small screw driver from instrument panel.

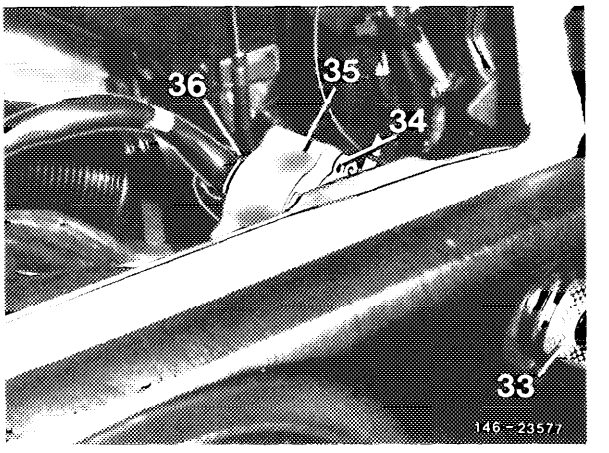
5 Turn locking cylinder to position "1" by means of ignition key.



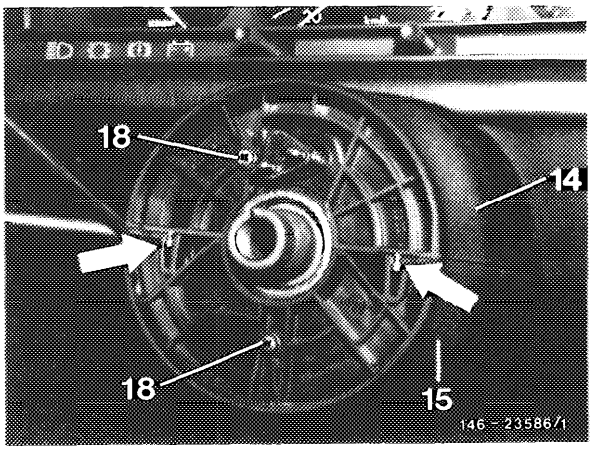


6 Remove plug connection (36) from starter switch (35).

Note: Plug connection can be released in position "1" only.

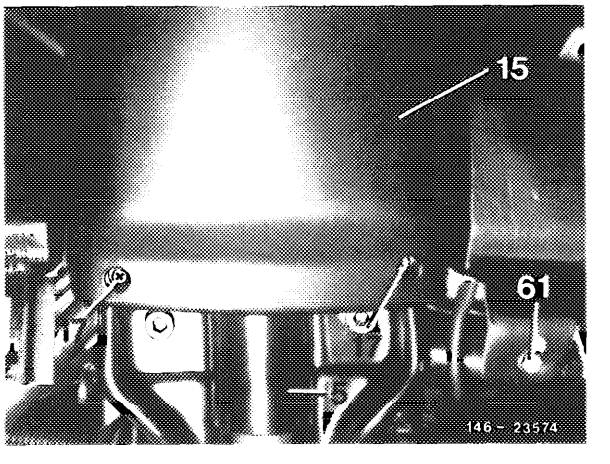


7 Remove jacket tube covering (14) and (15). For this purpose, unscrew both Phillips screws (18).

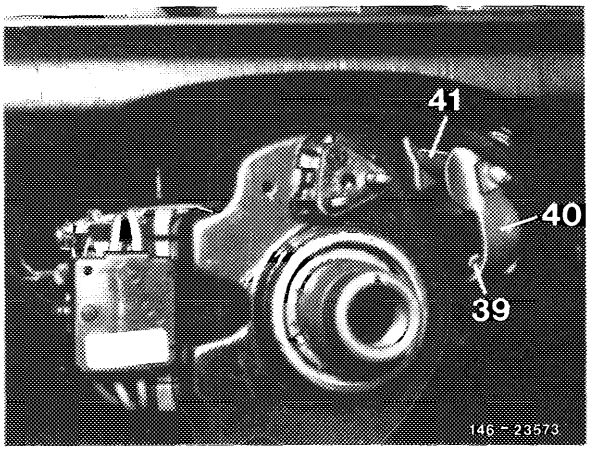


8 Unscrew both Phillips screws (17). Unclip lower part of jacket tube covering (15) from upper part and remove the two parts.

9 Unscrew locking screw (61) for instrument panel right of the jacket tube.

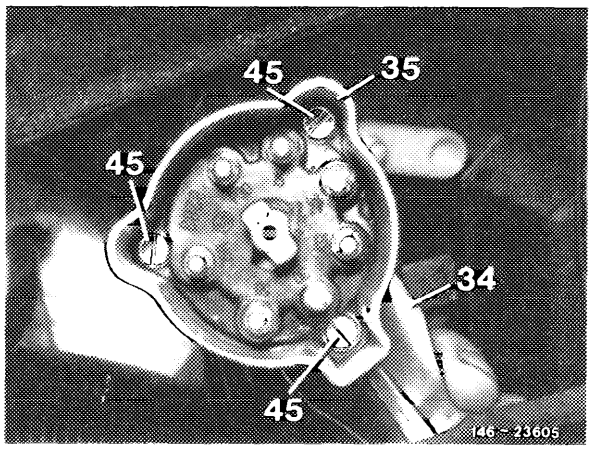


10 Release clamp (40) on jacket tube. Press-in locking pin (39) in position ''1'', and pull-out steering lock slightly from holder of jacket tube.



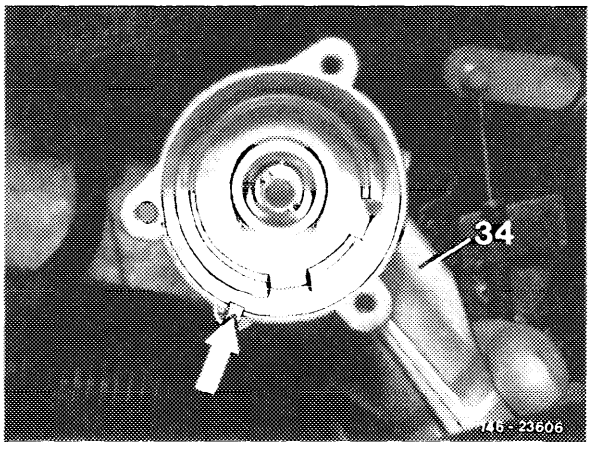
11 Pull-off ignition key at the right bottom section slightly to the rear. Swivel steering lock in such a manner that locking cylinder no longer reaches into detent of instrument panel. Take out steering lock from holder of jacket tube.

12 Unscrew locking screws for starter switch by means of a short screw driver from steering lock and remove starter switch.



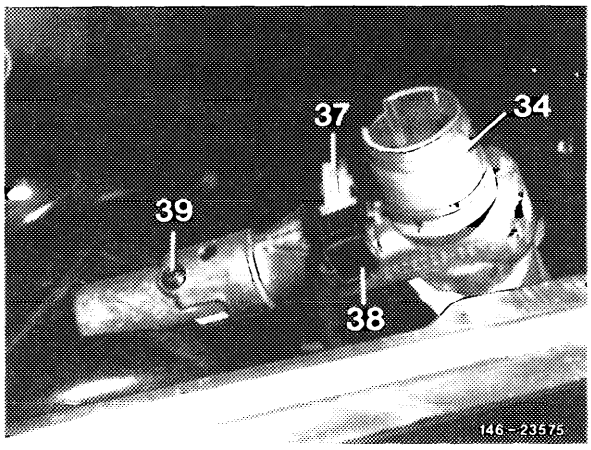
Installation

13 Attach starter switch to steering lock and plug in plug connection. While doing this, make sure that the switch is inserted with its fixing nose into detent of steering lock (arrow),

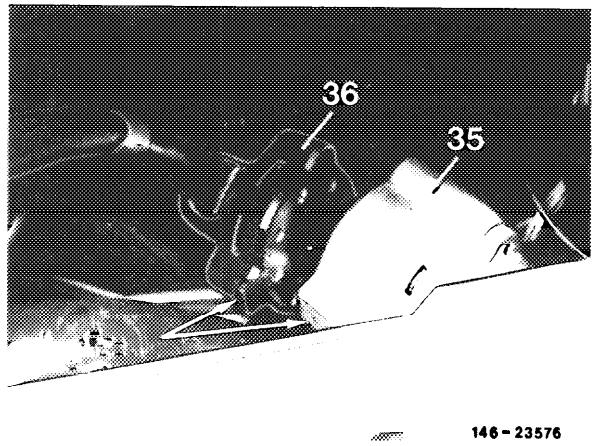


14 First press-in locking pin of steering lock into steering lock, and then locking pin (39).

15 Insert steering lock into holder of jacket tube while making sure that locking pin engages into bore of holder.

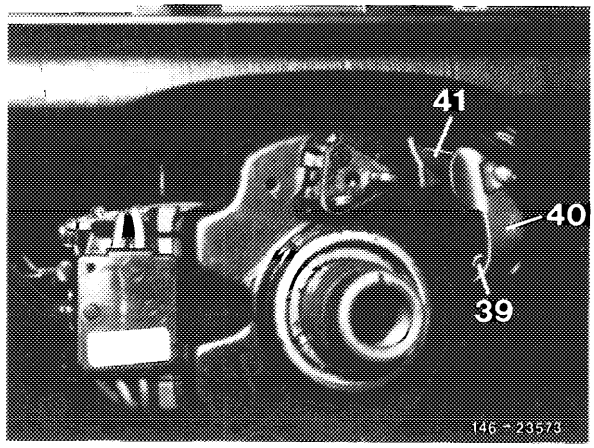


16 In position “1” of locking cylinder, plug-on plug connection (36) on to starter switch (35). Watch out for correct position of plug connection.



17 Insert rosette into instrument panel.

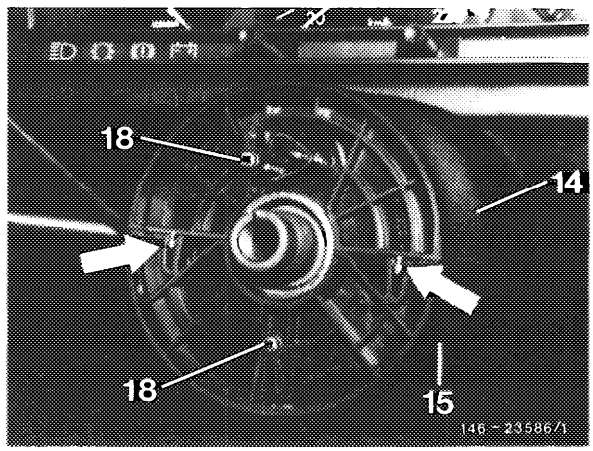
18 Tighten clamp on holder of jacket tube.



19 Install jacket tube covering.

20 Attach instrument panel right of jacket tube.

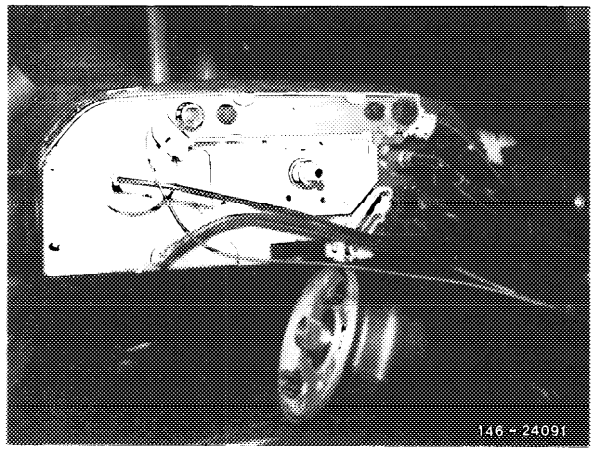
21 Install covering in driver’s foot well.



22 Install instrument cluster. For this purpose, connect plug connections, oil pressure line and speedometer shaft.

23 Install steering wheel.

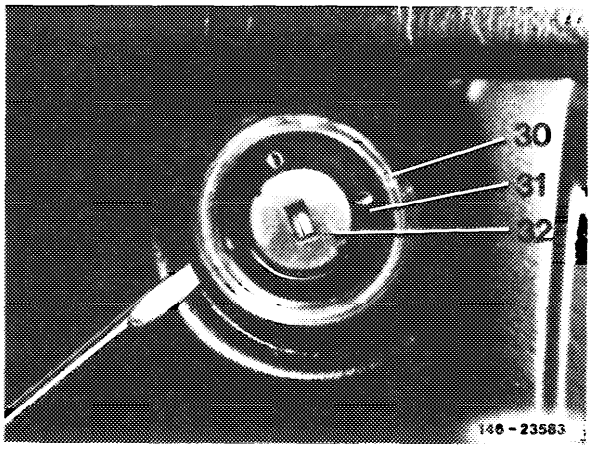
24 Check starter switch for function.



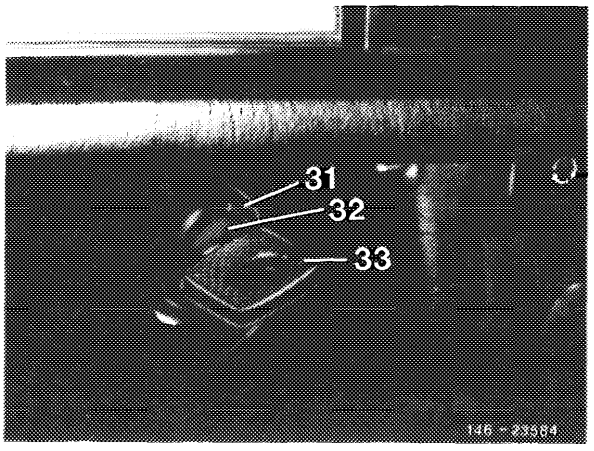
B. Removal and installation of locking cylinder

Removal

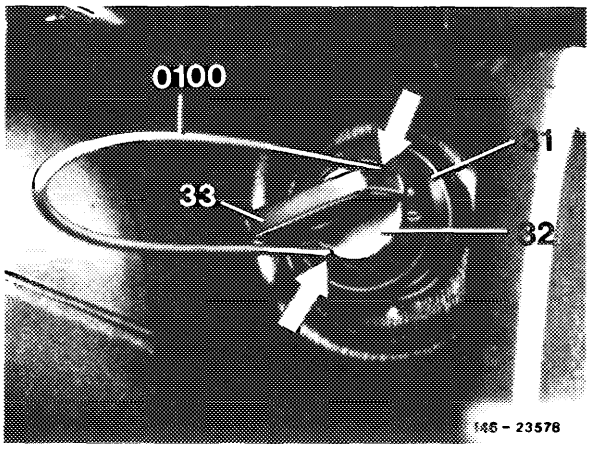
1 **Take rosette (30) out of instrument panel by means of a small screw driver.**



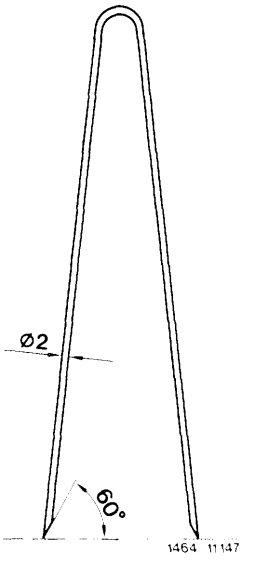
2 Turn locking cylinder with ignition key to position "1".



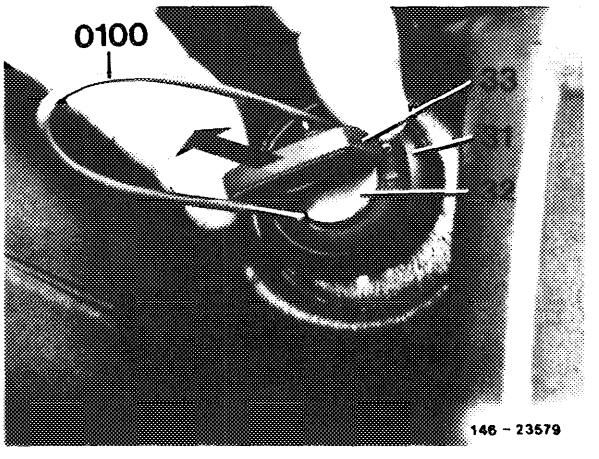
3 Insert releasing wire (0100) via bores (arrow) in locking cylinder. Then press-in releasing wire and, by overcoming the elastic resistance, unlock the safety detents.



Note: The releasing wire is self-made from a 2-mm thick steel wire according to the specified dimensions. Length of wire straightened-out = 400 mm.

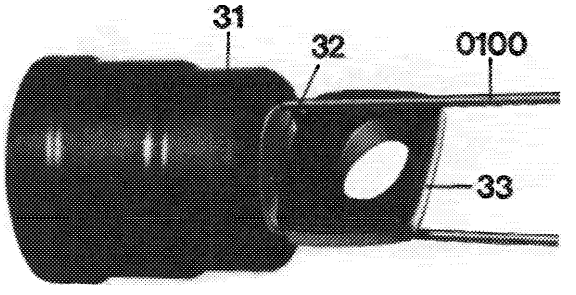


4 Remove locking cylinder (32) together with cover (31) from steering lock by means of ignition key (33).



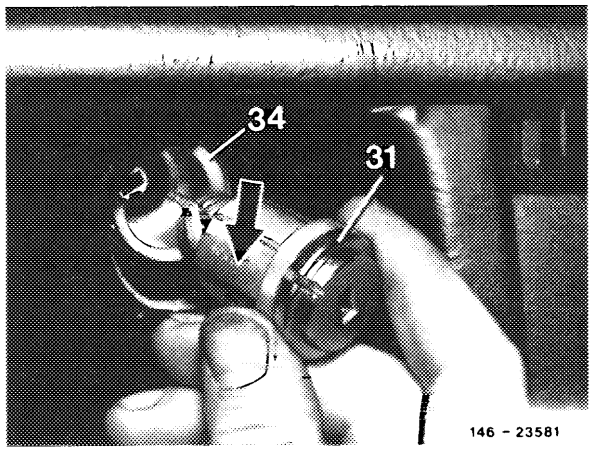
5 Take-out releasing wire (0100) from locking cylinder. Turn ignition key to ''0'' and pull off.

6 Take-out locking cylinder from cover.

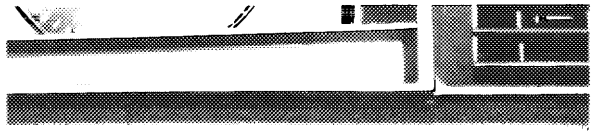


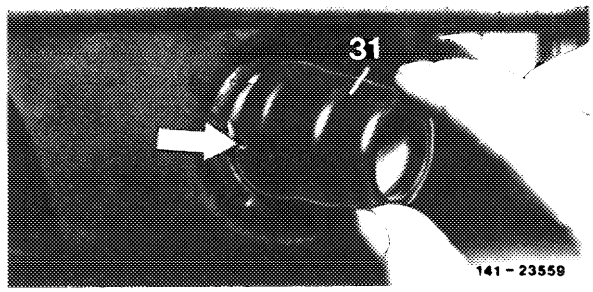
Installation

7 Insert locking cylinder (31) into steering lock (34) while making sure that the raised section on locking cylinder engages into groove of steering lock.



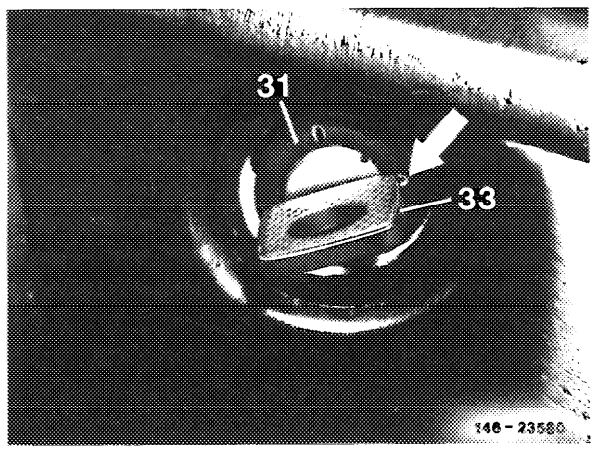
8 Position cover on steering lock in such a manner that the detent is directed to the left.





9 Turn locking cylinder by means of ignition key into position “1”; then press-in cover and locking cylinder into steering lock while making sure that both parts are engaging into steering lock.

Note: When the ignition key in position “1” is pointing to the mark on cover, then the detent on cover coincides with the raised section on steering lock. In this position only, locking cylinder together with cover can be installed into steering lock.



10 Check locking cylinder for function.

11 Insert rosette into instrument panel.

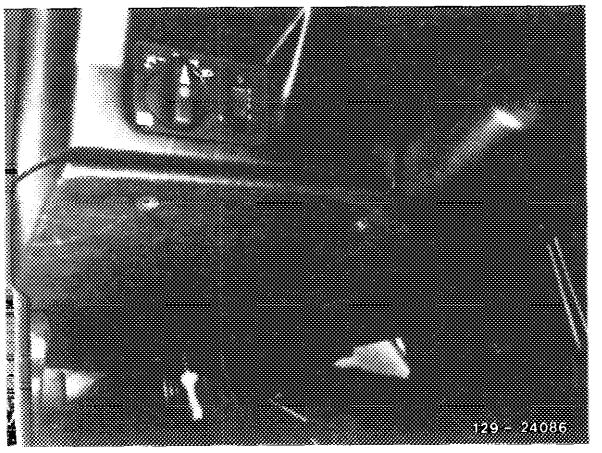
C. Complete removal and installation of steering lock

Removal

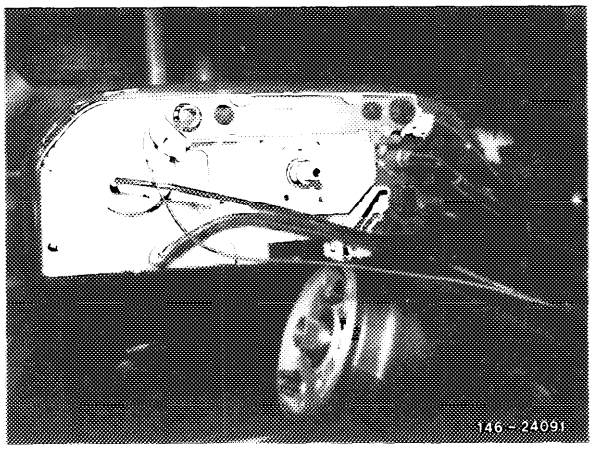
1 **Remove cover at the left of driver's foot well.**

2 **Remove steering wheel (46-610).**

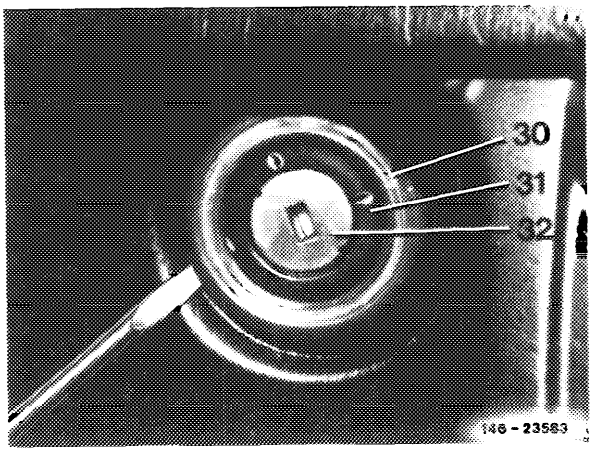
Note: On vehicles equipped with a restraining system (airbag **and belt straightener), make sure to observe the Safety Instructions (91-610).**



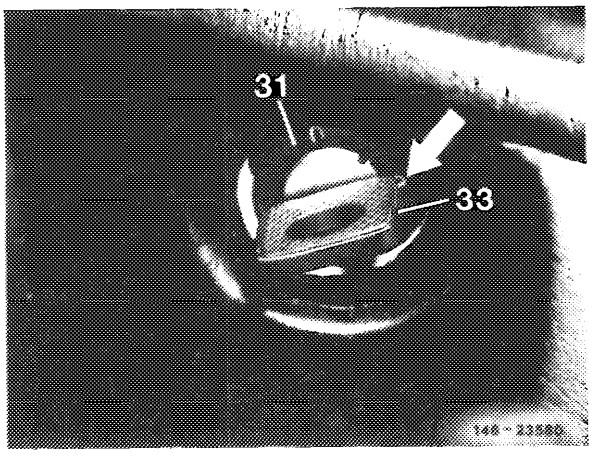
3 Remove instrument cluster. For this purpose pull-out instrument cluster as far as possible, release speedometer shaft, electrical plug connections and oil pressure line.



4 Take out rosette (30) from instrument panel by means of a small screw driver.

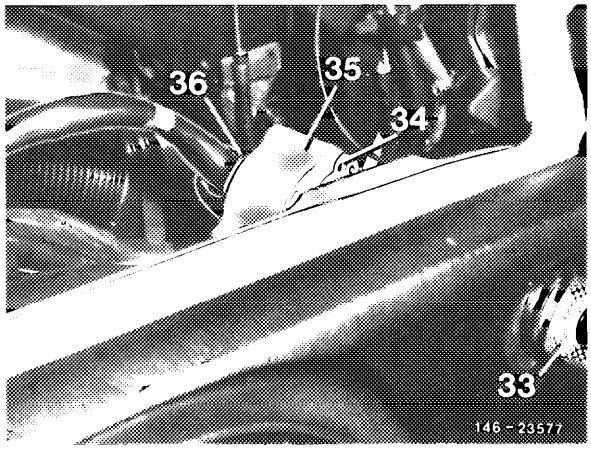


5 Turn locking cylinder **by means of ignition key into position "1".**

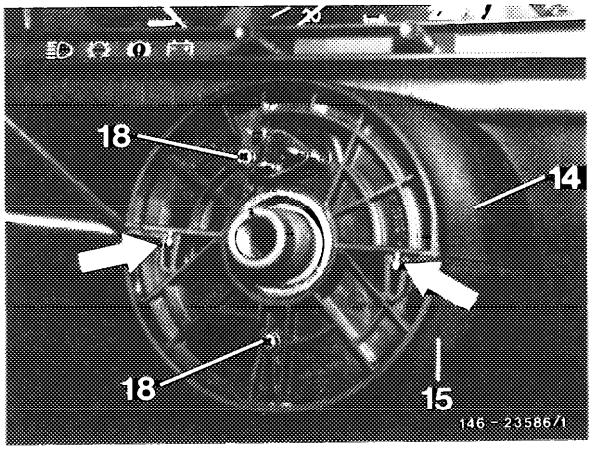


6 Take-off plug connection (36) from starter switch (35).

Note: The plug connection can be released in position "1" only.

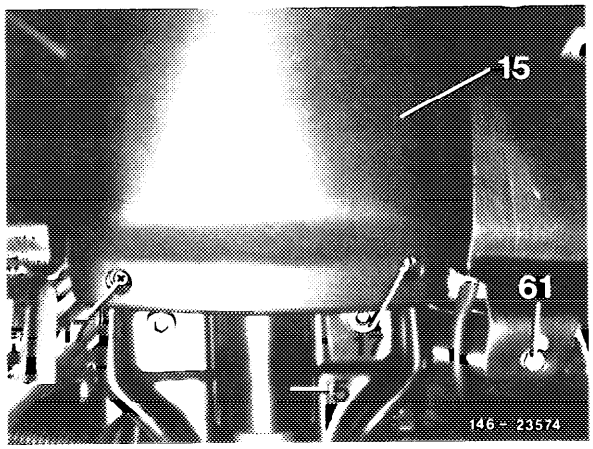


7 Remove jacket tube covering (14). For this purpose unscrew the two Phillips screws (15).

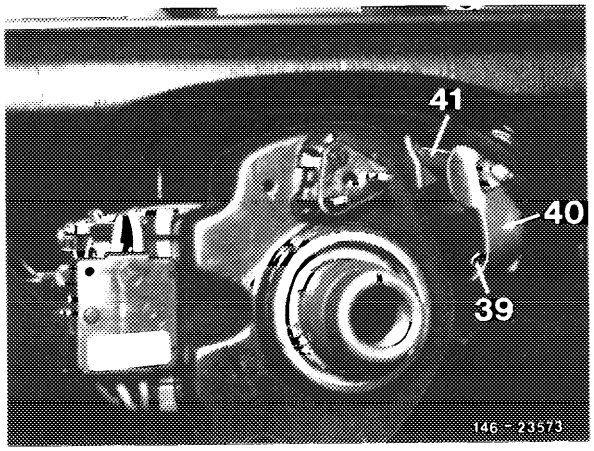


8 Unscrew both Phillips screws (17). Unclip lower part of jacket tube covering from upper part and remove both parts.

9 Unscrew locking screw (61) for instrument panel right of jacket tube.



10 Release clamp (40) on jacket tube. In position "1", press-in locking pin (39) and slightly pull-out steering lock from holder of jacket tube.

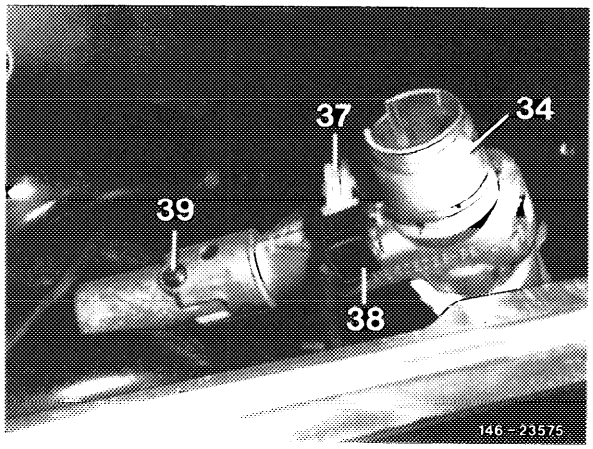


11 Pull-off ignition key, carefully pull instrument panel at the bottom right slightly to the rear, swivel steering lock in such a manner that locking cylinder no longer extents into detents of instrument panel. Take-out steering lock from holder of jacket tube,

12 Pull-off plug connection (38) from contact switch (37) and remove steering lock.

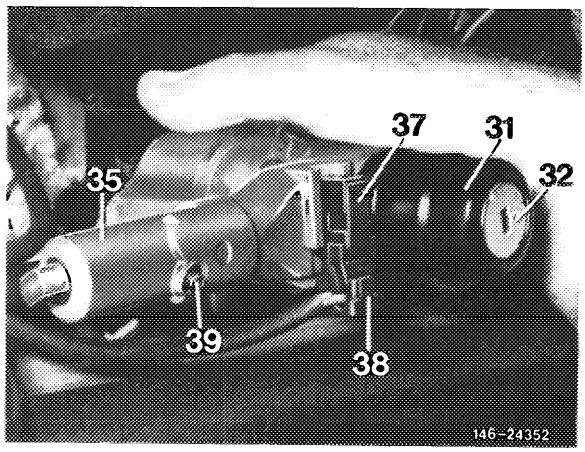
13 Remove contact switch (37) from steering lock.

Note: Contact switch can be removed in position “1” only.



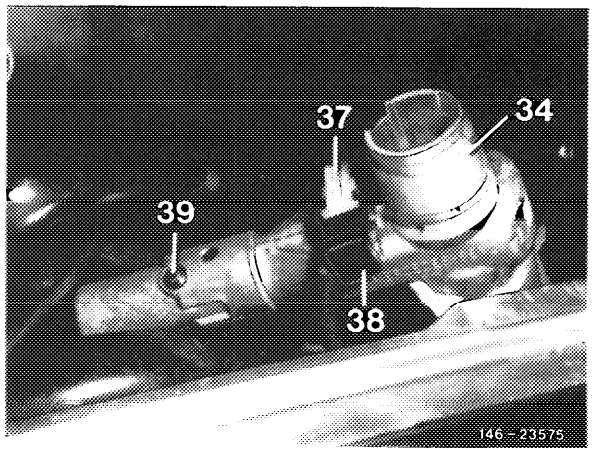
Installation

14 First press-in closing pins of steering lock, then the locking pin (39) itself.

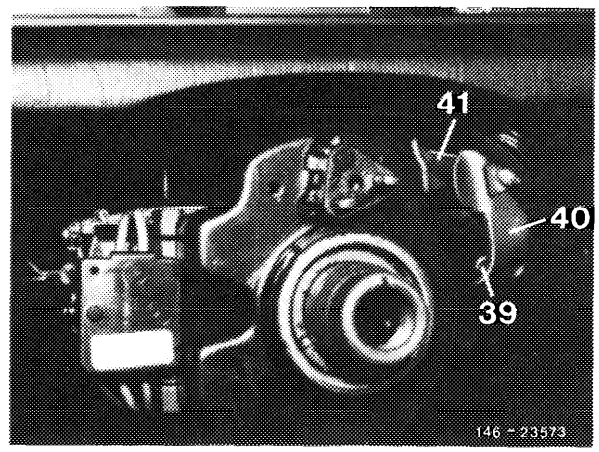


15 Install contact switch.

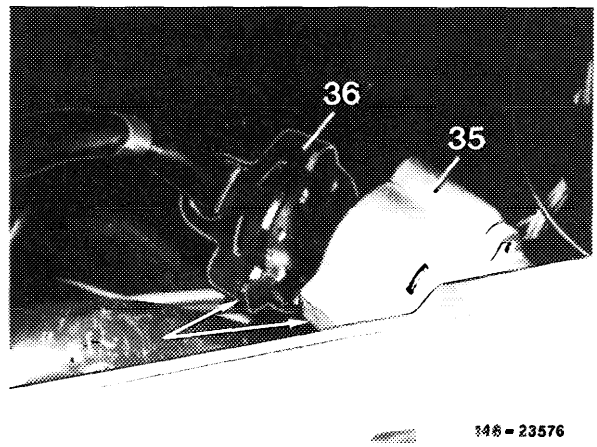
16 Connect plug connection to contact switch.



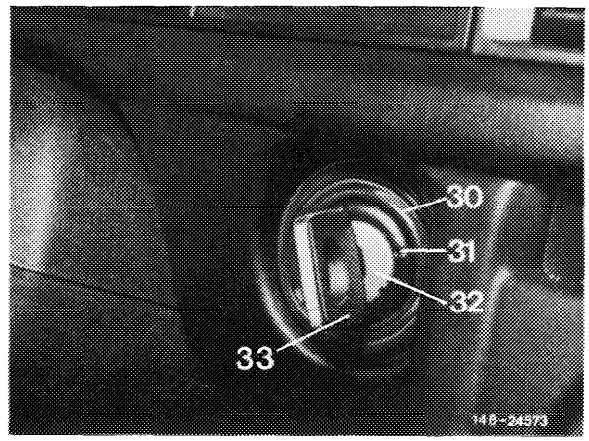
17 insert steering lock into holder of jacket tube, while making sure that locking pin (39) engages in bore of holder.



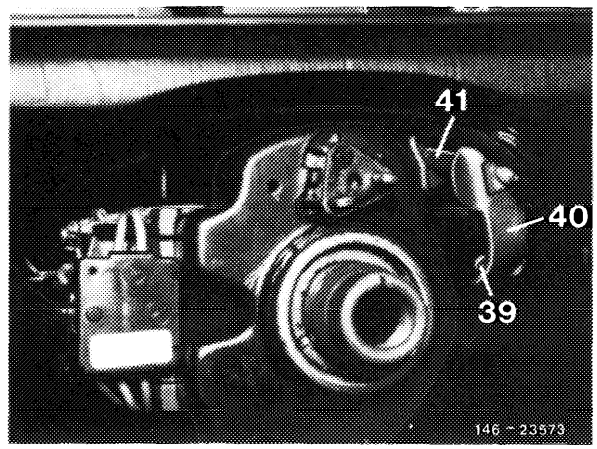
18 In position “1” of locking cylinder, plug-on plug connection (36) on to starter switch (35). Watch out for correct position of plug connection.



19 Insert rosette into instrument panel.

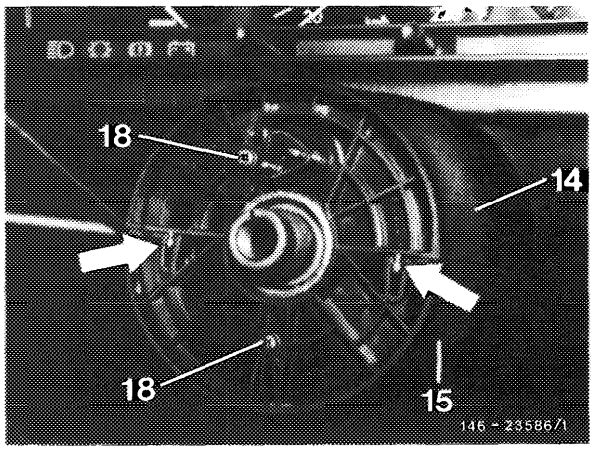


20 Tighten clamp on holder of jacket tube.



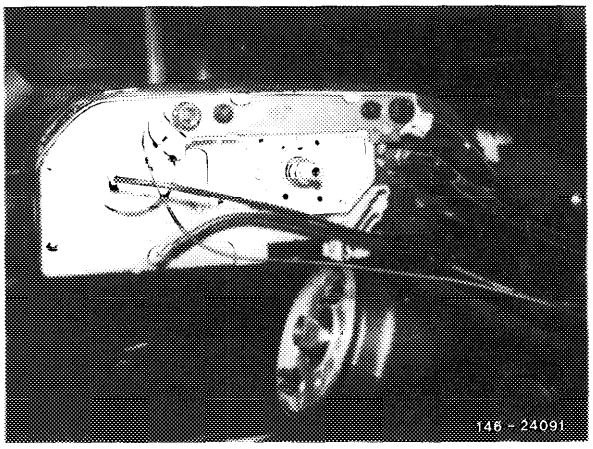
21 Install jacket tube covering.

22 Attach instrument panel right of jacket tube.



23 Install instrument cluster. For this purpose connect electrical plug connections, oil pressure line and speedometer shaft.

24 Install steering wheel.



25 Check steering lock for function.

26 Install lower covering.

Data

Power steering pump	Model	Opening pressure of pressure relief valve bar gauge pressure	Color code of type rating plate
VT 60	201.022 201.024 (up to August 84)	65	black
ZF 60	201.122 (up to November 84) 201.034 (up to September 84)	85	blue
VT61	201.023 201.024 (from September 84)	65	black
ZF 61	201.122 (from October 84) 201.034 (from October 84)	85	green

Oil types/Filling capacity and oil level checkup

Automatic transmission fluid (ATF)	refer to Specifications for service products page 236.2
or transmission oil	refer to Specifications for service products page 237
Filling capacity	approx. 0.6 litre
Oil level checkup	With the oil at operating temperature (approx. 80 °C), the oil level in supply tank should reach up to cast-in mark (approx. 20 mm below rim of tank). With the oil cold and at ambient temperature, oil level 6-8 mm below mark. For filling-up, use only perfectly clean oil, since even minor particles of dirt may cause trouble in the hydraulic system.

Tightening torques	Nm
Hex. screws on pulley	30
Cap screw of high-pressure expanding hose	25-30
Cap screw connection pipe (return flow)	35-45
Hex. screws for attaching pump in carrier	25

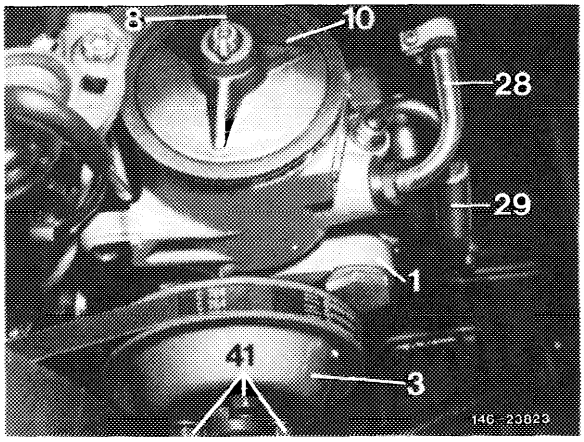
Special tool

Box wrench insert open 17 mm 1/2" square	11004-6359	000 589 68 03 00

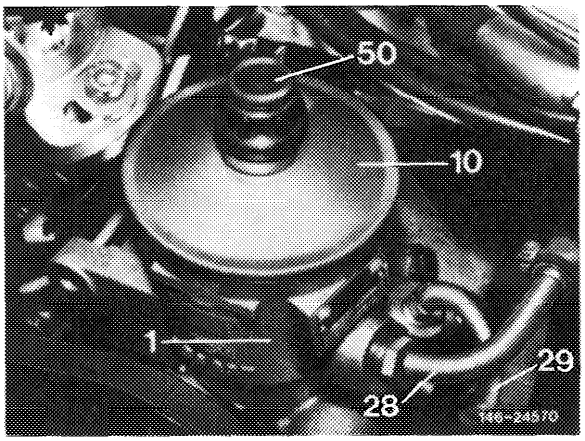
A. 1st version

Removal

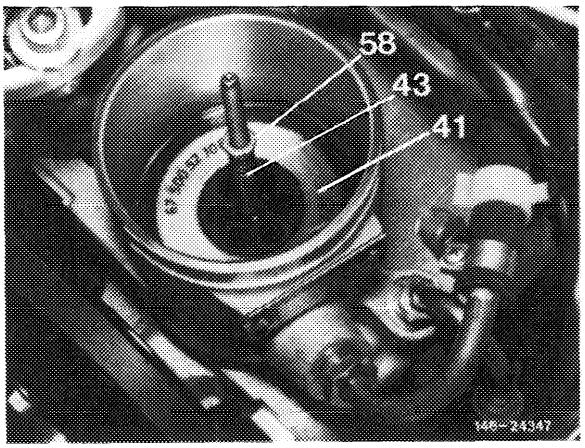
1 On the 1st version of power steering pump, unscrew wing nut (8) from pump housing and remove closing cover.



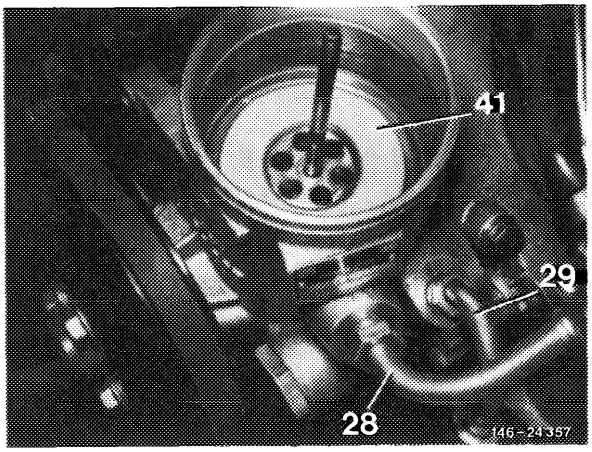
2 On the 2nd version, unscrew locking screw (50) together with blower from pump housing.



3 Unscrew hex. nut (58) and remove pressure spring from stud bolt.

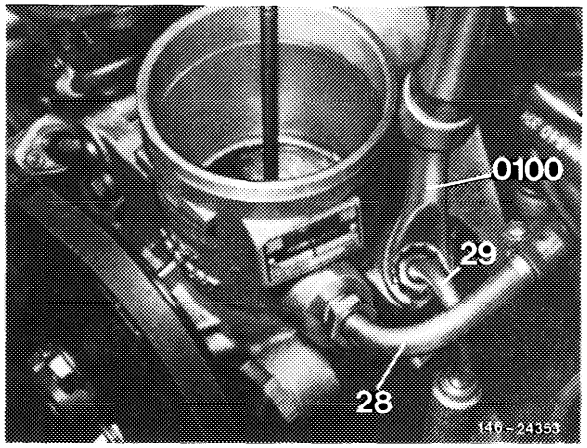


4 Take-out filter cartridge (41) from supply tank and drain oil by means of a syringe.

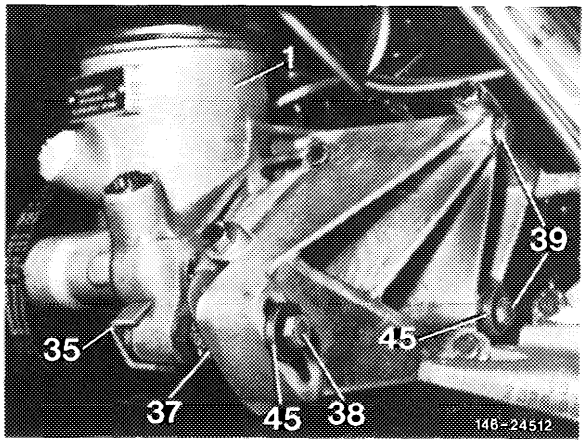


5 Release high-pressure expanding hose (29) on pump housing by means of box wrench insert (0100).

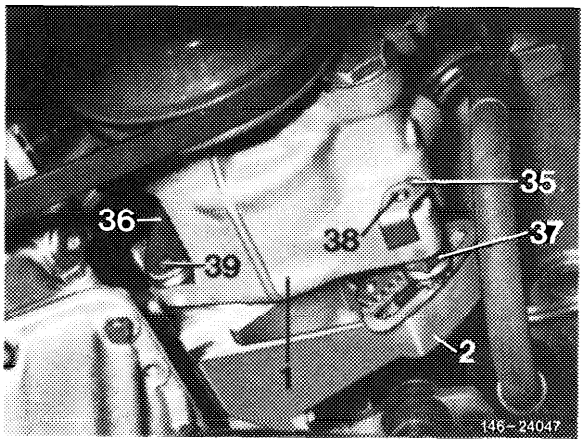
6 Release return flow hose (28).



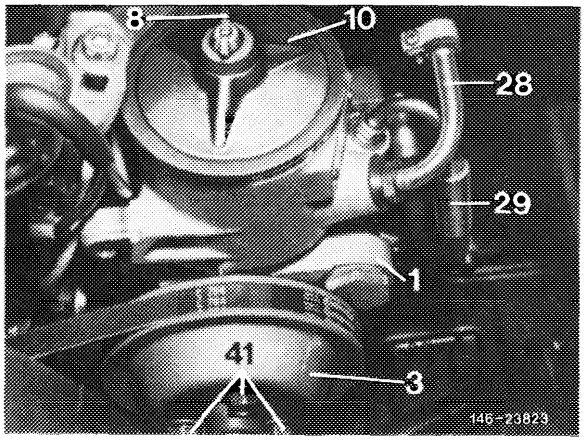
7 Release hex. screw (38) as well as the two screws (39).



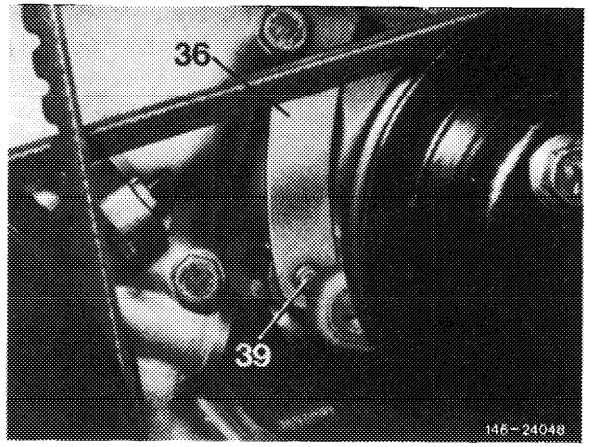
8 Swivel power steering pump toward engine by means of regulator wheel (37) and remove V-belt.



9 Unscrew hex. screws (41) for attaching V-belt, and remove driving shaft.

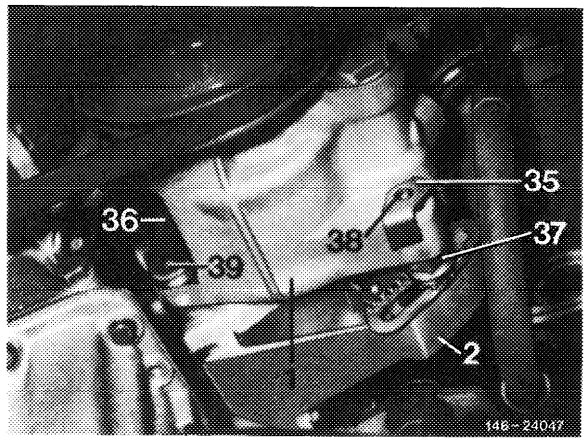


10 Unscrew both hex. screws (39) and remove threaded plate (36).



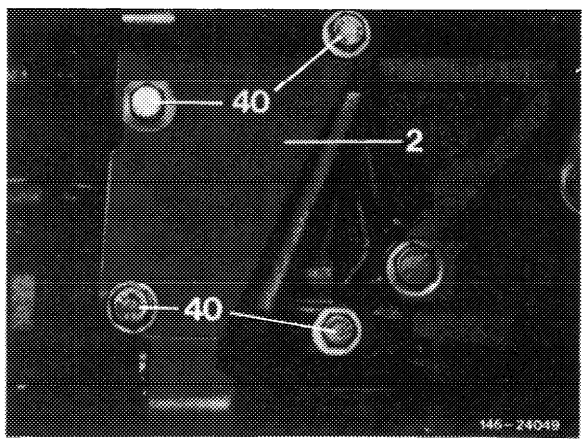
11 Unscrew hex. screw (38), remove locking nut (35) and regulator wheel (37).

12 Remove power steering pump.

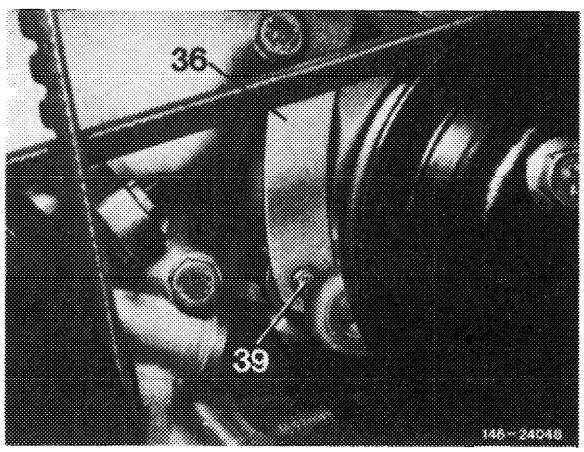


Installation

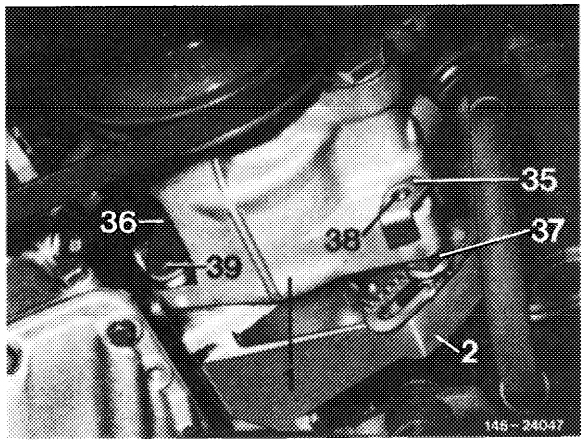
13 Check hex. screws (40) for attaching carrier (2) to cylinder crankcase for tight seat.



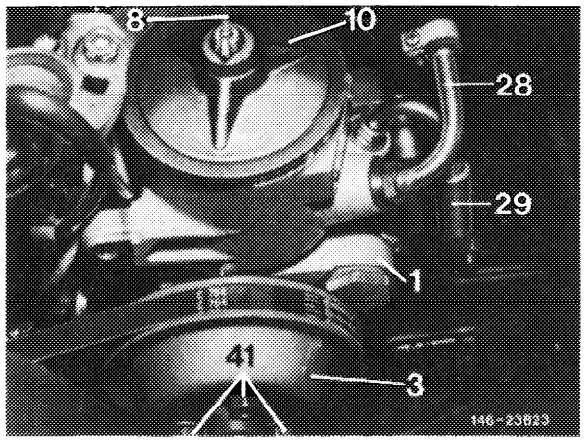
14 Insert power steering pump into carrier and attach to carrier by means of hex. screws (39) and the threaded plate (36); do not tighten hex. screws, however



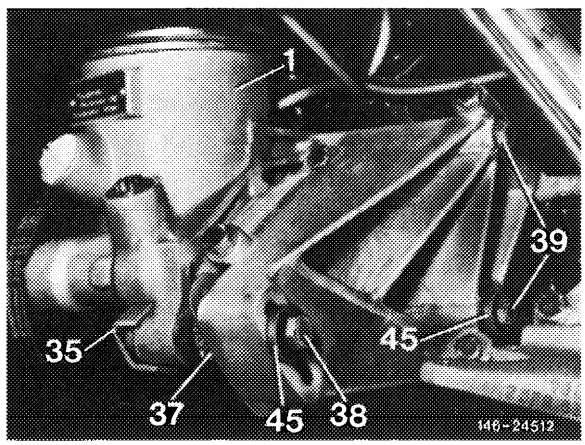
15 Insert regulator wheel (37) between power steering pump and carrier, and screw-in hex. screw (38) into fastening plate (35); do not tighten hex. screw, ho\Never.



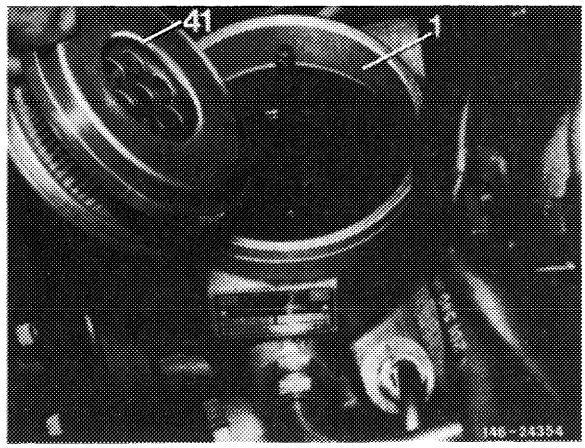
16 Attach pulley (3) on flange of driving shaft, position V-belt.



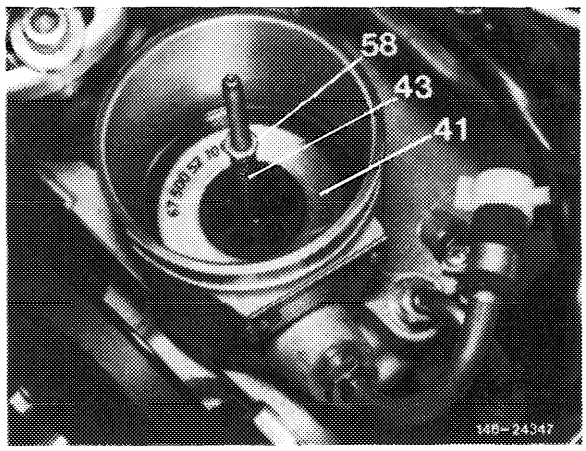
17 Tension V-belt by means of regulator wheel. Then tighten hex. screws.



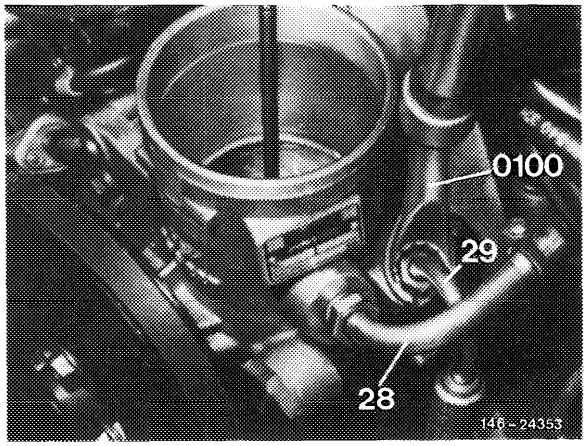
18 Insert filter cartridge (41) into pump.



19 Position pressure spring on stud bolt, screw-in hex.nut (58) up to the point when the spring is pre-tensioned.



20 Connect high-pressure expanding hose and return flow hose to pump housing. Pay attention to perfect arrangement of the hose.



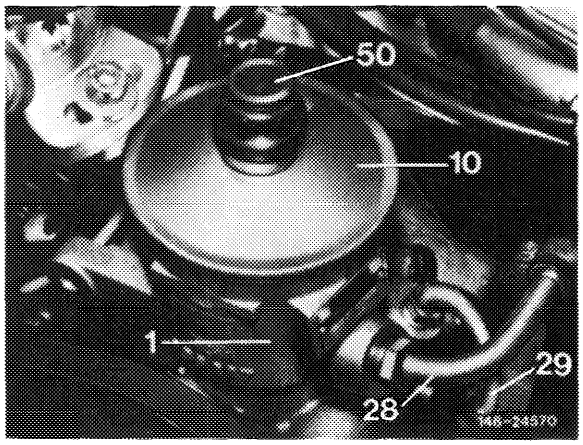
Note: Tighten high-pressure expanding hose by means of open box wrench insert.

21 Fill power system with the specified oil, top up oil with the engine running.

22 Completely turn steering several times to the left and the right for bleeding the system.

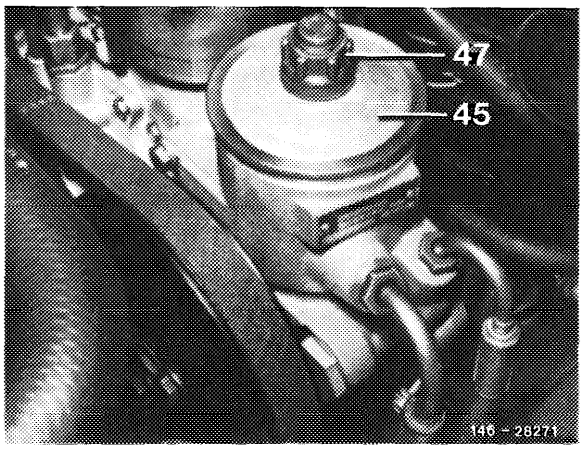
23 Check oil level and power system for leaks.

24 Attach closing cover for the 1st version on power steering pump by means of wing nuts and for the 2nd version by means of closing screw (50).



B. 2nd version (single-belt drive) — diesel engines

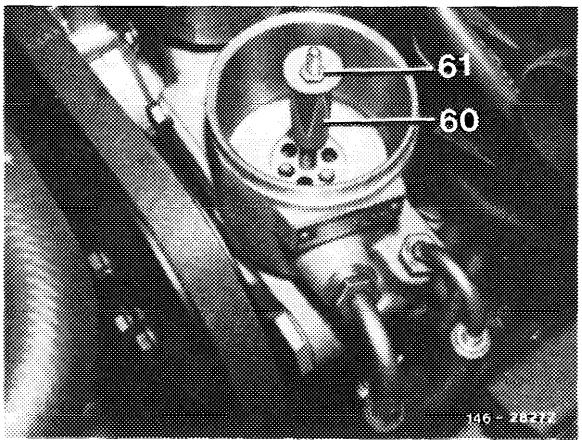
Below is a description of removal and installation of power steering pump VT 60 and ZF 60. The assembly of the power steering pump VT 61 and ZF 61 is essentially the same, so that these instructions can be followed.



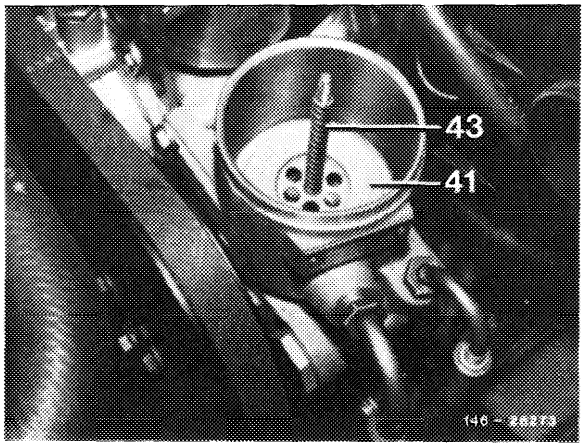
Removal

1 unscrew vent cap (47), remove closing cap (45).

2 unscrew hex. nut (61). Remove plastic sleeve (60) from stud.



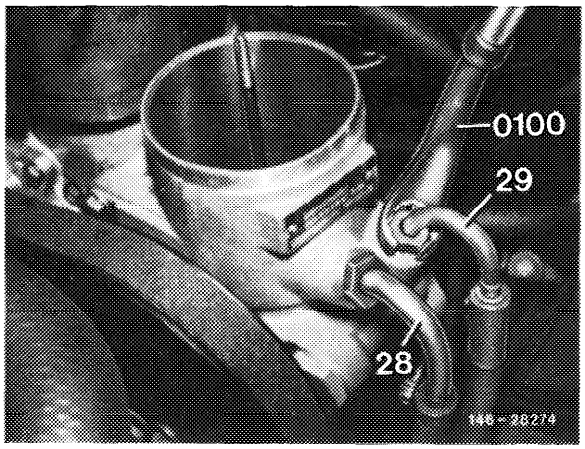
3 Take compression spring (43) and filter element (41) from reservoir and draw off oil by means of a syringe.



4 Loosen high-pressure expanding hose (29) on pump housing with box wrench element (0100).

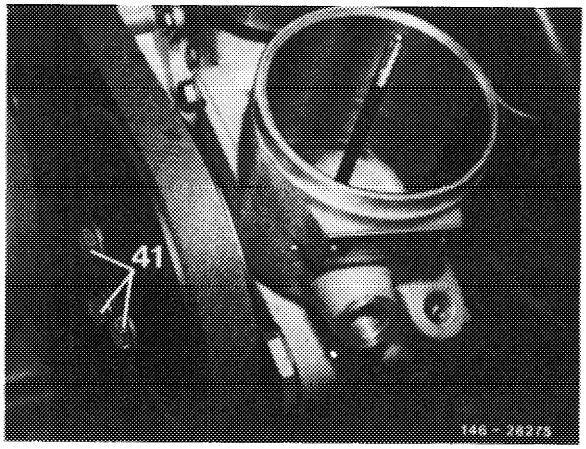
Note: On power steering pump VT 61 and ZF 61 the high-pressure expanding hose can be released by means of a conventional open-end wrench.

5 Release return flow hose (28).



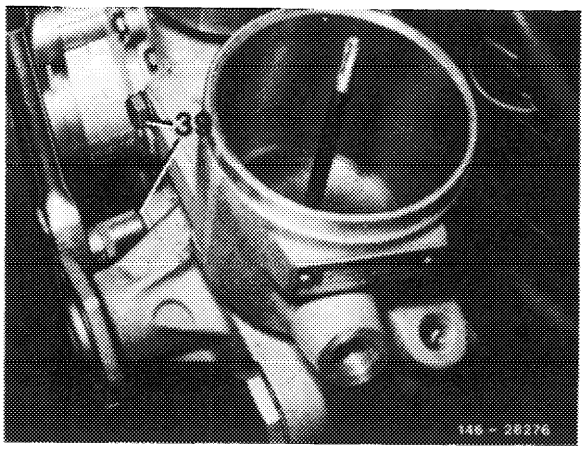
6 Slacken single-belt drive (13-340).

7 Unscrew hex. screws (41) for fastening pulley and remove pulley from drive shaft.



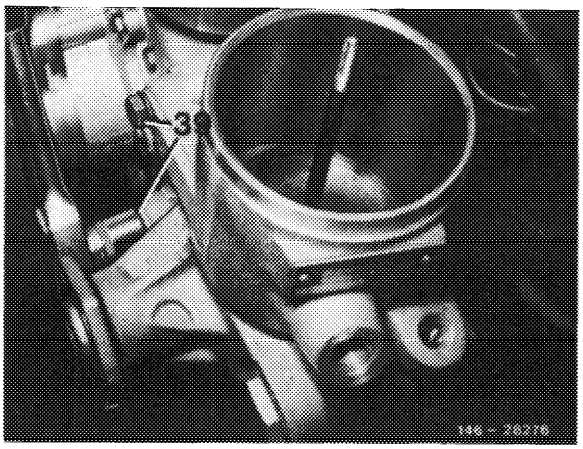
8 Unscrew hex. screws (39).

9 Remove power steering pump.



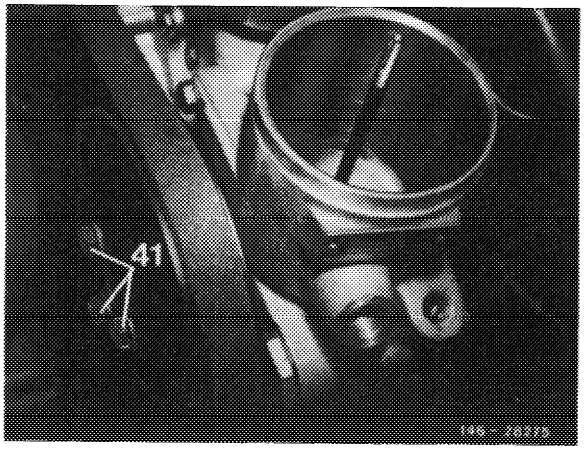
Installation

10 Insert power steering pump and fasten with hex. head screws (39).



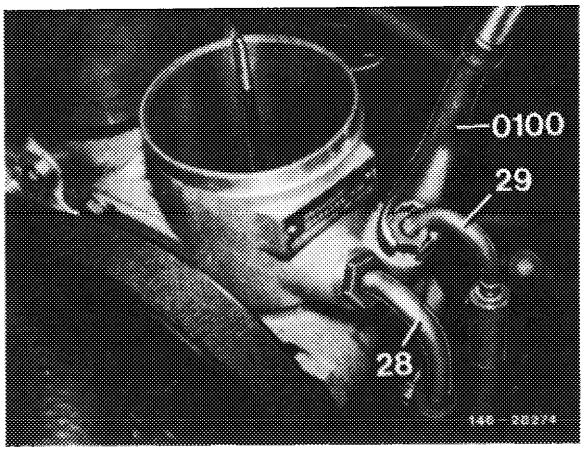
11 Fasten pulley (3) to flange of drive shaft, mount poly-V-belt.

12 Tension single-belt drive (13–340).



13 Connect high-pressure expanding hose and return flow hose to pump housing. Pay attention to perfect installation of hose.

Note: On power steering pump VT 60 and ZF 60 tighten high-pressure expanding hose with open box wrench element.



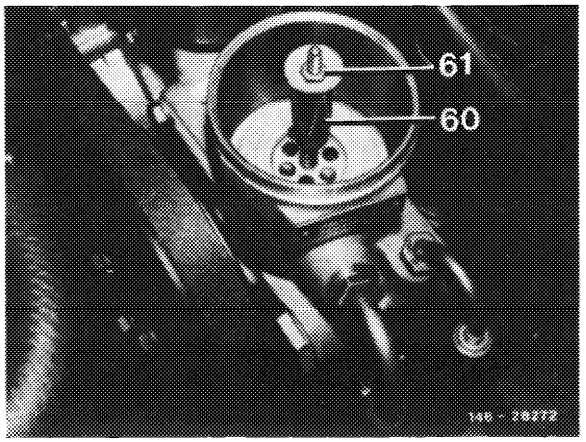
14 insert filter element (41) into pump.

15 Place compression spring and plastic sleeve on stud, screw in hex. nut (61) until the spring is preloaded.

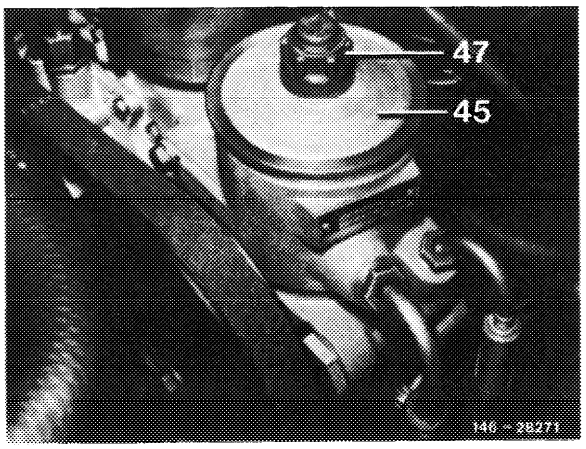
16 Fill servo system with specified oil, fill in oil up to mark with the engine running.

17 Turn steering wheel several times completely to the left and right up to lock, so that the system will be ventilated.

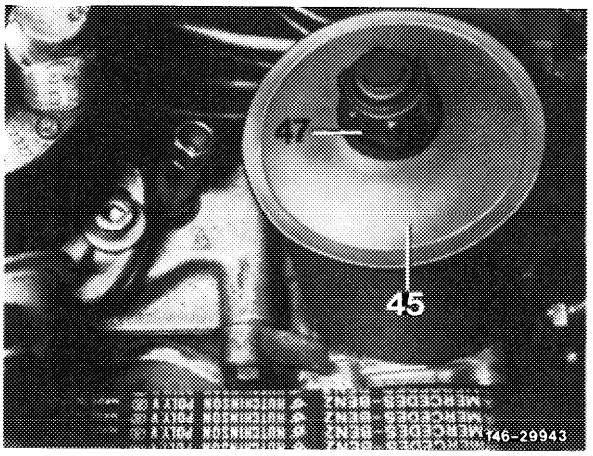
18 Correct oil level and check servo system for leaks.



19 Mount closing cap (45) and fasten with vent cap (47).



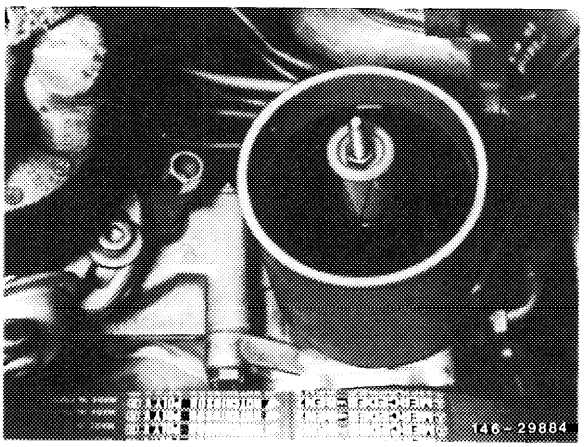
C. 2nd version (single-belt drive) — gasoline engines



Removal

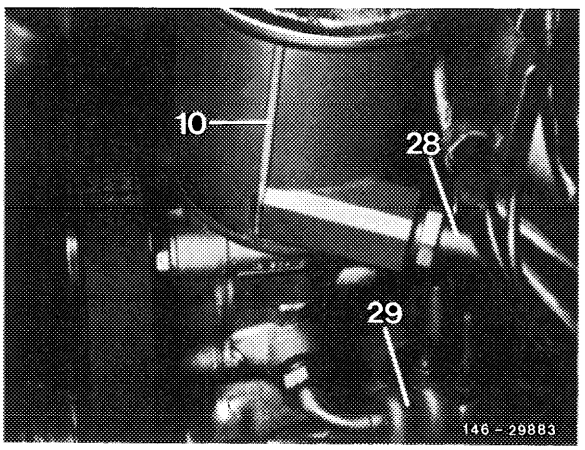
1 Unscrew vent cap (47), remove closing cap (45).

Note: Remove air cleaner housing prior to removing power steering pump.



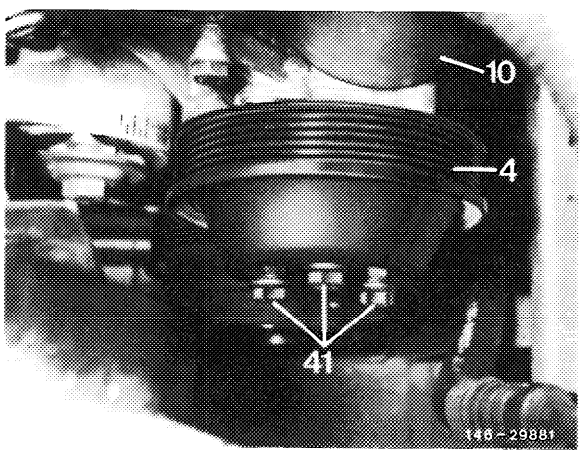
2 Unscrew hex. nut, remove plastic sleeve from stud.

3 Take compression spring and filter element out of reservoir and draw off oil with a syringe.



4 Loosen high-pressure expanding hose (29) on pump housing (10).

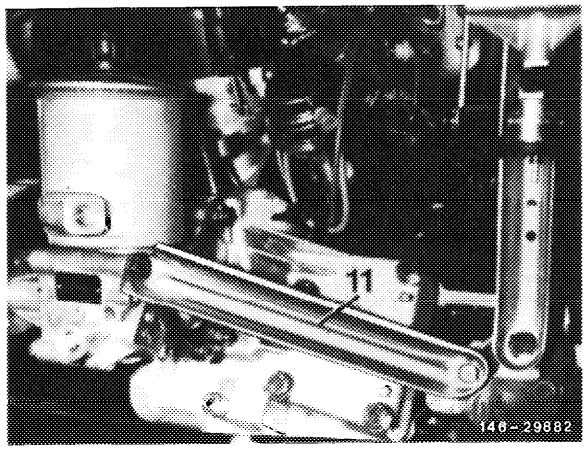
5 Loosen return flow hose (28).



6 Slacken single-belt drive (13-340).

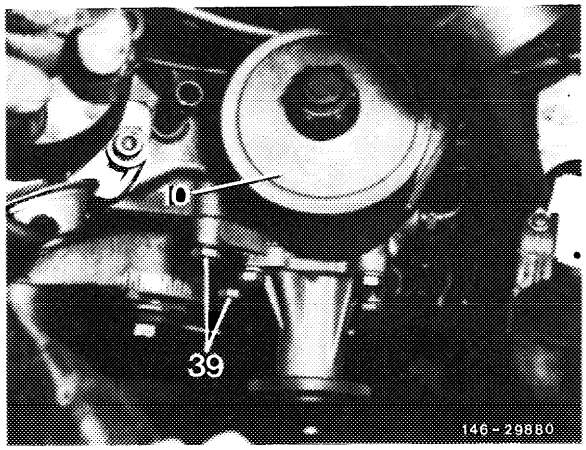
7 Unscrew hex. head screws (41) for fastening pulley and remove pulley (4) from drive shaft.

8 Unscrew strutting (11) on power steering pump and loosen on engine support.



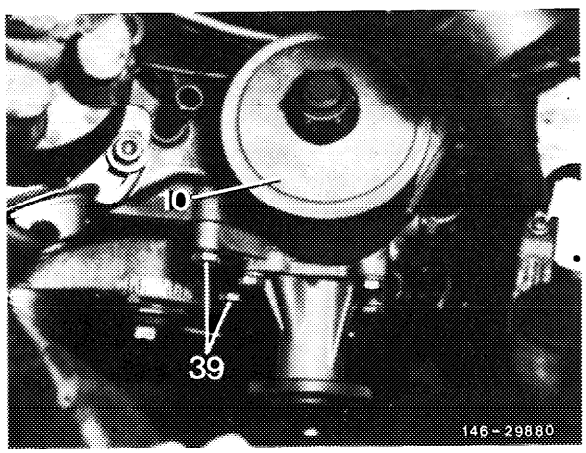
9 Unscrew hex. head screws (39).

10 Remove power steering pump.

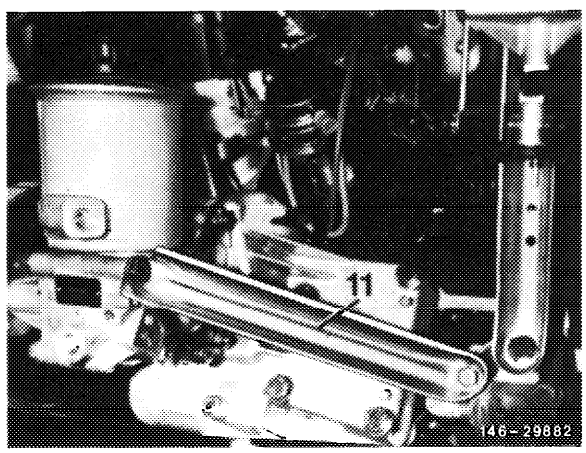


Installation

11 Insert power steering pump and fasten with hex. head screws (39).

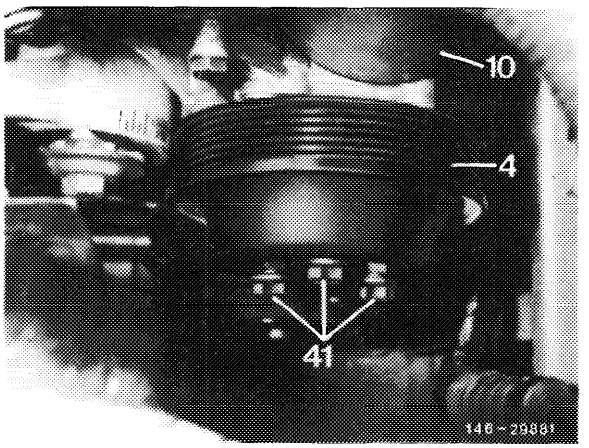


12 Fasten strutting (11) on power steering pump and fasten to engine support.

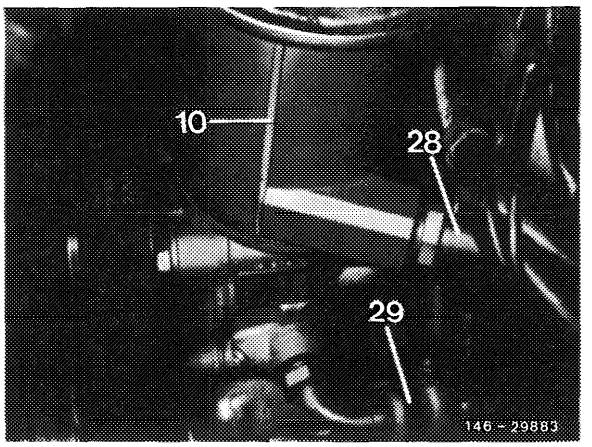


13 Fasten pulley (3) to flange of drive shaft, mount poly-V-belt.

14 Tension single-belt drive (13-340).



15 Connect high-pressure expanding hose (29) and return flow hose (28) on pump housing. Pay attention to perfect installation of hose.



16 Place filter element into pump.

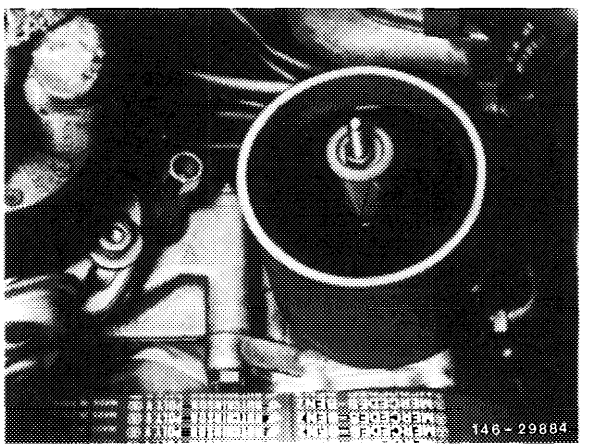
17 Place compression spring and plastic sleeve on stud, screw in hex. nut until the spring is preloaded.

18 Fill servo system with specified oil up to mark with the engine running.

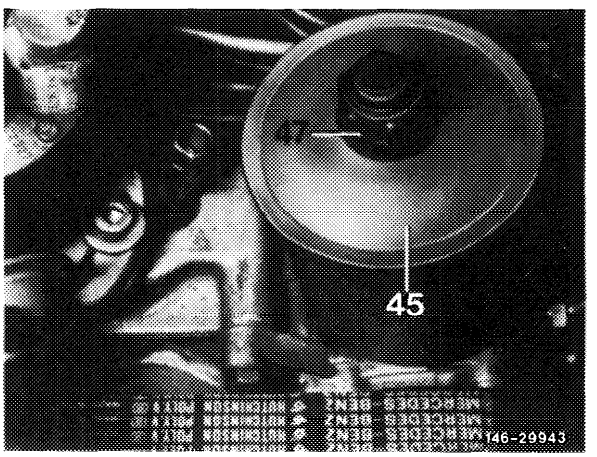
19 Turn steering several times completely to the left and right up to lock to bleed the system.

20 Correct oil level and check servo system for leaks.

21 Mount closing cap (45) and fasten with vent cap (47).



22 Mount air cleaner housing.

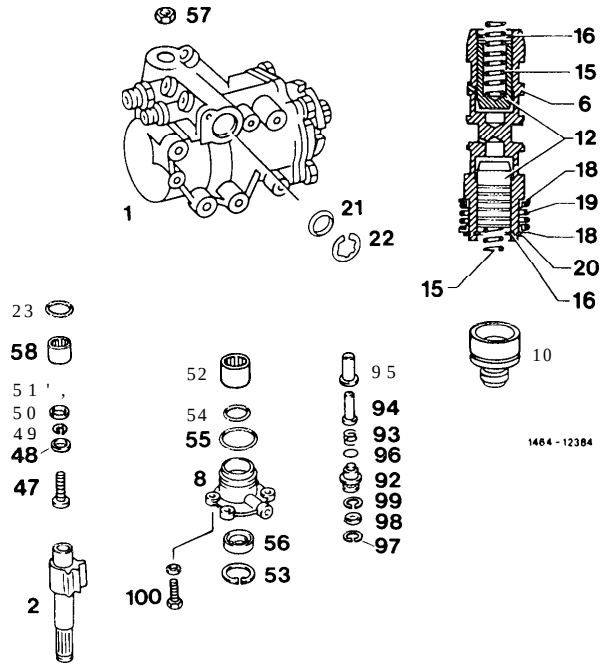


201.02 1 st version	201 460 57 01 LL 201 460 58 01 RL	765.901	11.5	–	10	Automatic compensation for play, malleable iron housing, with dowel sleeve
201.02 2nd version 201.1 1 st version	201 460 43 01 LL 201 460 49 01 RL	765.900	11.5	–	10	Automatic compensation for plav, light alloy housing, with dowel sleeve
201.02 3rd version 201.1 2nd version	201 460 66 01 LL 201 460 67 01 RL	765.903	11.5	–	10	Automatic compensation for play, light alloy housing, without dowel sleeve
201.03	201 460 72 01 LL	765.902	11.5	–	11	Automatic compensation for play, light alloy housing, without dowel sleeve

B. Mechanical steering 760 (L 1 Z, L 075 Z)

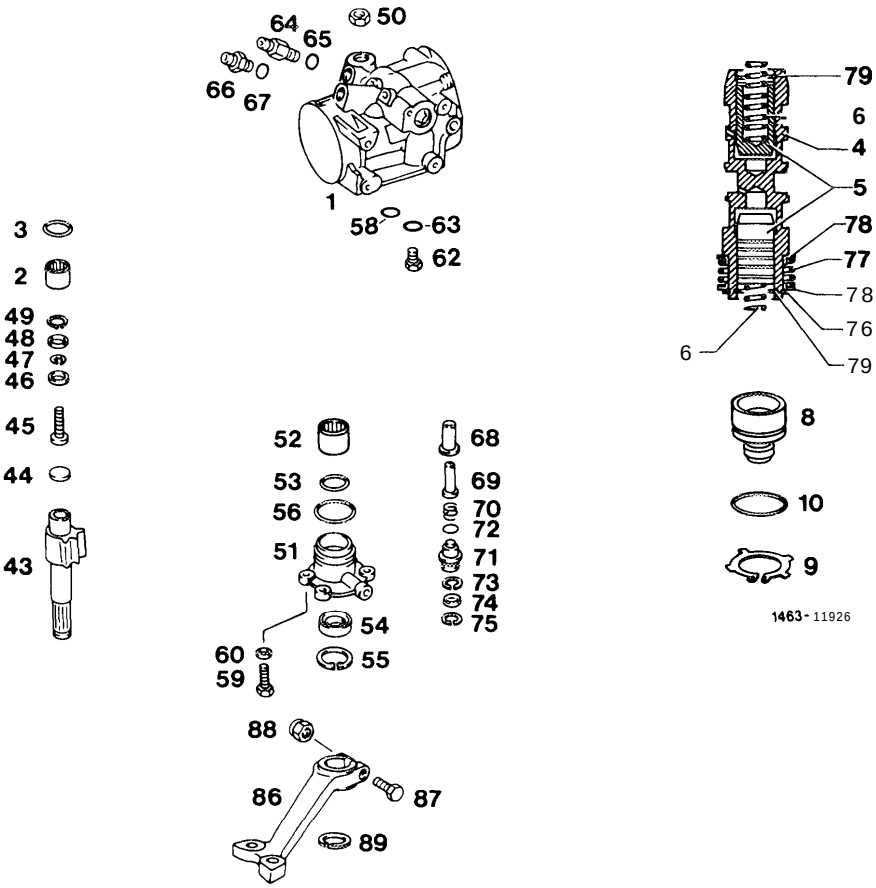
Installed in model	Part No. LL = lefthand steering RL = righthand steering	Steering gear	Pitch Ball circulation	Remarks
114,115 1 st version	115 460 1901 LL 1154602001 RL	760.100	9	Respective pitman arm 115 463 07 01 LL 1154630801 RL
114,115 2nd version	115460 21 01 LL 115460 2201 RL	766.100	10	Respective pitman arm 115463 1201 LL 115463 1301 RL
123 1 st version	123 460 38 01 LL 123 460 39 01 RL	760.100	9	Pitman shaft dia. 30 mm
123 2nd version	123 460 62 01 LL 1234606301 RL	760.100	9	Pitman shaft dia. 32 mm
201 1 st version	201 460 52 01 LL 201 460 55 01 RL	760.700	9	With dowel sleeve
201 2nd version	201 460 68 01 LL 201 460 69 01 RL	760.700	9	Without dowel sleeve

A. Steering gear 765.7 (LS 90)



1	Steering case	Clamp with special tool 123 589 03 59 00
2	Pitman shaft	Check for wear on bearing points and on tooth segment, as well as for distortion. Attention! Pay attention to toothing.
6	Control valve	Pay attention to different versions, **do** not disassemble!
8	Steering case cover with needle sleeve	Check needle sleeve for damage and quiet running. If needle sleeve is damaged, renew case cover.
10	Closing cap	
12	Reaction bolt	Different diameters, according to steering gear model designation
15	Compression spring	
16	Locking ring	
18	Thrust washer	
19	Compression spring	
20	Locking ring	
21	O-ring (closing cap)	Renew
22	Locking ring	Renew
23	O-ring	Renew
47	Adjusting screw	Mount free of play
48	Thrust washer	
49	Locking ring	Renew
50	Thrust ring	
51	Locking ring	Renew
52	Needle sleeve	Check, renew case cover if required
53	Locking ring	Renew
54	O-ring	Renew
55	O-ring	Renew
56	Radial sealing ring	Renew, special tool 116 589 07 43 00

B. Steering gear 765.9 (LS68)



1 Steering case ..... Check needle sleeve in steering case for damage and quiet running. Replace steering gear, if required. Special tool 201 589 00 59 00.

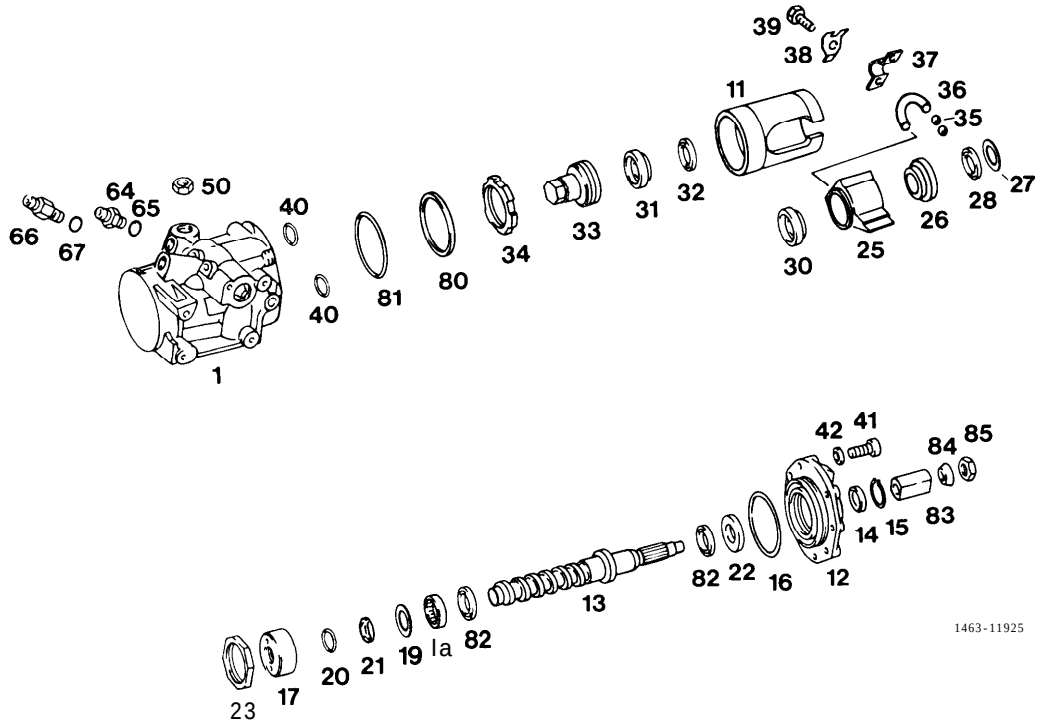
Light alloy	Malleable iron
765.900 LL	765.900 R L
765.902 LL	765.901
765.903 LL	765.902 RL
	765.903 R L
	765.904
	765.905

2 Needle sleeve (pitman shaft) ..... Check for wear and quiet running
3 O-ring (steering case — pitman shaft) ..... Renew
4 Control valve ..... **Attention!** Do not disassemble
5 Reaction piston ..... Check for easy operation
6 Compression spring reaction piston 2 each ..... **Attention!** Do not mix up springs
8 Closing cap
9 Locking ring ..... Renew
10 O-ring (closing cap) ..... Renew
43 Pitman shaft ..... Check for wear on bearing points and on tooth segment, as well as for distortion.
30 mm dia. = 765.900/90 I/902/903/905
32 mm dia. = 765.904
44 Thrust washer
45 Adjusting screw ..... Mount free of play. Note: item 95
46 Thrust washer
47 Locking ring ..... Renew
48 Thrust ring
49 Locking ring ..... Renew

50 Polystop nut	Renew, 60-65 Nm
51 Case cover with needle sleeve	Check needle sleeve for damage and quiet running. If needle sleeve is damaged, renew case cover. Special tool 201 589 06 15 00.

Light alloy	Malleable iron
765.900, 765.901 765.902, 765.903 765.905	765.904

52 Needle sleeve	Check, renew case cover, if required
53 O-ring.	Renew
54 Radial sealing ring	Renew
55 Locking ring	Renew
56 O-ring.	Renew
58 O-ring.	Renew
59 Hex. head screw	Renew, 25-28 Nm
60 Washer	
62 Closing plug.	35-40 Nm
63 Sealing ring	Renew
64 Screw connection (pressure side)	40-45 Nm
65 Sealing ring	Renew
66 Screw connection (return)	50-55 Nm
67 Sealing ring	Renew
68 Bushing	Check for easy operation
69 Spring bolt	Check for easy operation
70 Compression spring	
71 Cap	
72 O-ring.	Renew
73 Locking ring	Renew
74 Thrust ring	
75 Locking ring	Renew
76 Locking ring	
77 Compression spring	
78 Contact ring	Single parts of control valve
79 Locking ring	Do not disassemble control valve
86 Pitman arm	Install pitman arm (46–510) Be sure to pay attention to locking compound, curing time and ball point position. Special tool 000 589 88 33 00
87 Hex. head screw	
88 Nut	Renew
89 Locking ring	Renew



1	Steering case	Check needle sleeve in steering case for damage and quiet running. If required, replace steering. Special tool 201 589 00 59 00
11	Working piston	Special tool 201 589 02 59 00 201 589 01 59 00
12	Bearing cap	Special tool 201 589 05 31 00

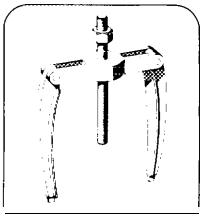
Special tool 201 589 05 31 00

Light alloy	Malleable iron
765.900, 765.901 765.902, 765.903 765.905	765.904

13	Steering worm	Check ball circuit for score marks Special tool 116 589 03 21 00 123 589 00 08 00 123 589 02 21 00
14	Radial sealing ring	Renew, special tool 201 589 05 31 00
15	Locking ring	Renew
16	O-ring.	Renew
17	Bearing insert with needle sleeve	Check needle sleeve in bearing insert for wear. If damaged, renew complete bearing insert. Special tool 201 589 00 07 00 123 589 01 16 00 201 589 02 09 00
18	Needle sleeve in bearing insert	
19	Axial washer in bearing insert	
20	O-ring.	Renew
21	Teflon ring	Renew
22	Washer	
23	Nut	220-240 Nm Special tool 201 589 02 09 00 126589001600
25	Steering nut	Check ball circuit for score marks Special tool 116 589 02 21 00
26	Bearing ring	
27	Axial washer	
28	Axial needle cage	Check for damage and quiet running

30 Inner race	
31 Outer race	
32 Ball cage	Check for damage and quiet running Special tool 123 589 01 16 00 201 589 03 09 00
33 Screw cover	
34 Slot nut	220-240 Nm Special tool 126 589 00 16 00 201 589 01 17 00
35 Steel ball.	23 each
36 Ball guide half	Check for damage
37 Fastening clamp	
38 Locking plate	Renew
39 Hex. head screw	12-15 Nm
40 O-ring (steering case bearing cap)	Renew
41 Screw	25-28 Nm
42 Washer	
50 Polystop nut	Renew, 60-65 Nm
64 Screw connection (pressure side)	40-45 Nm
65 Sealing ring	Renew
66 Screw connection (return)	50-55 Nm
67 Sealing ring	Renew
80 O-ring.	Renew
81 Teflon ring	Renew
82 Axial bearing	Check for quiet running and damage
83 Dowel sleeve (steering gear 769.900 and 765.901 only).	Pay attention to installation position item 14
84 Supporting ring (steering gear 769.900 and 765.901 only)	
85 Nut (steering gear 769.900 and 765.901 only).	50Nm

Special tools



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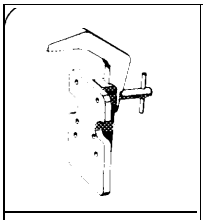

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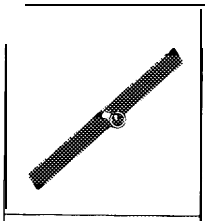

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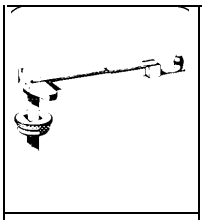

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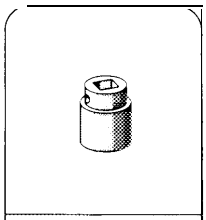

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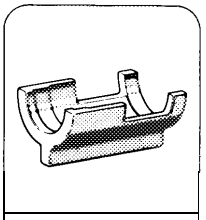

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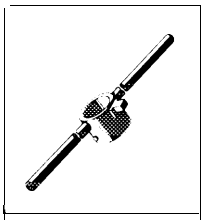

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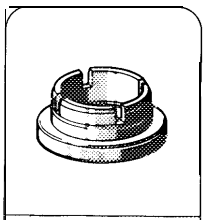

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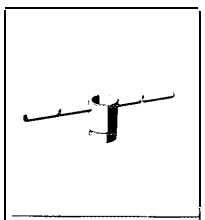

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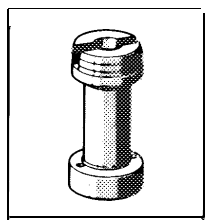

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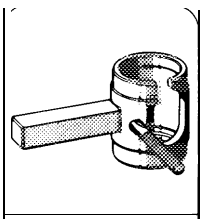

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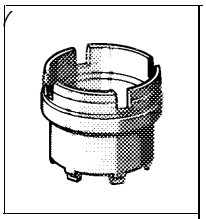

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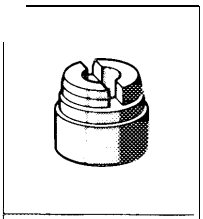

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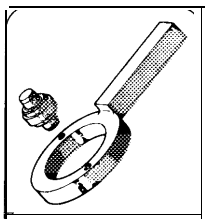

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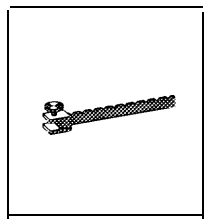

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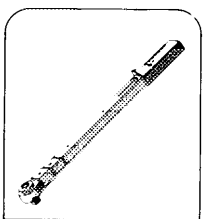
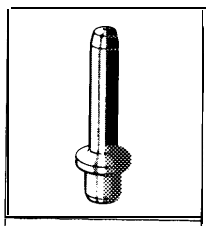


001 589 67 21 00



201 589 06 15 00

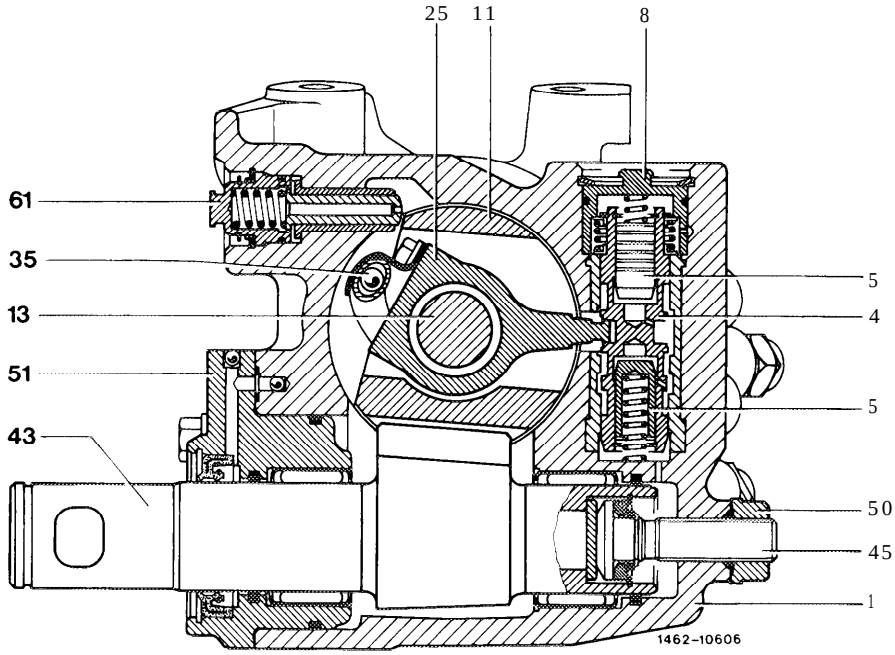
Conventional tools

Locking pliers, outside	e.g. made by Knipex, D-5600 Wuppertal Order No. 46/A 1
Locking pliers, inside	e.g. made by Knipex, D-5600 Wuppertal Order No. 44/J 1

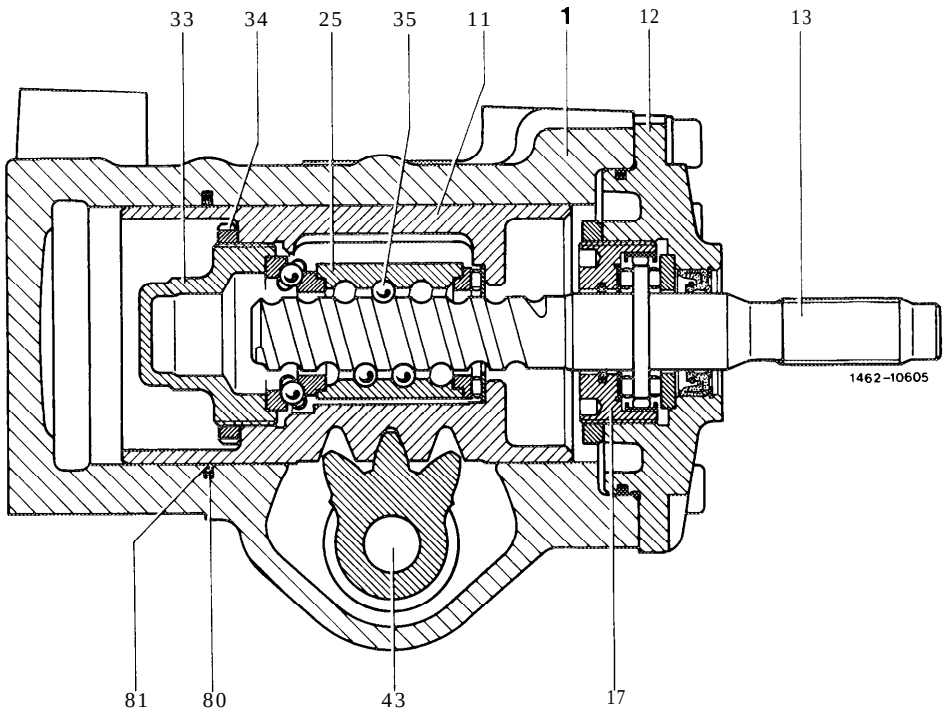
Data

Number of balls in circuit		23

Adjusting data		Ncm
Friction torque of steering worm in bearing cap prior to preloading bearing insert		⩽ 12
Additional friction torque of steering worm after preloading bearing cap		4–7
Friction torque of steering nut in working piston		6-l 0
Friction torque ball circuit steering worm -- steering nut	new steering	30-50
	used steering	5-50
Total friction torque		110-160



1 Steering case
4 Control valve
5 Reaction bolt
8 Closing cover
11 Working piston
13 Steering worm
25 Steering nut
35 Ball
43 Pitman shaft
45 Adjusting screw
50 Collar nut
51 Housing cover
61 Closing cap

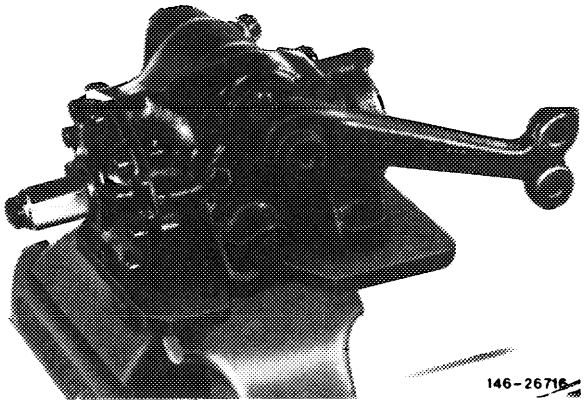


Steering case
11 Working piston
12 Bearing cap
13 Steering worm
17 Bearing insert
25 Steering nut
33 Screw cap
34 Slot nut
35 Ball
43 Pitman shaft
80 O-ring
81 Teflon ring

Disassembly

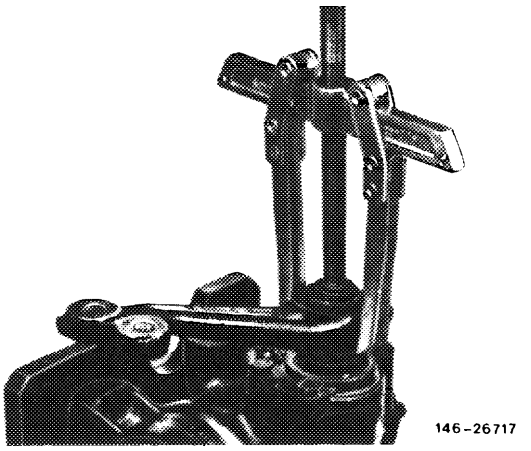
1 **Fasten steering to assembly fixture.**

Special tool 201 589 00 59 00

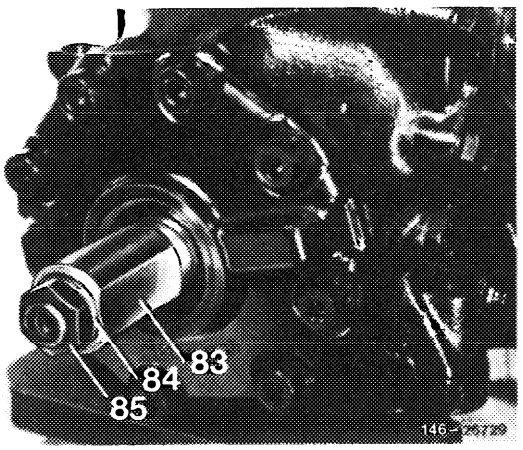


2 Remove locking ring, take off screw and pull pitman arm from pitman shaft.

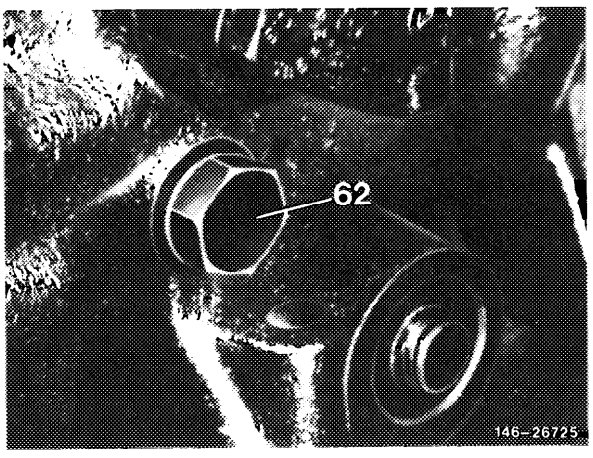
Special tool 000 589 88 33 00



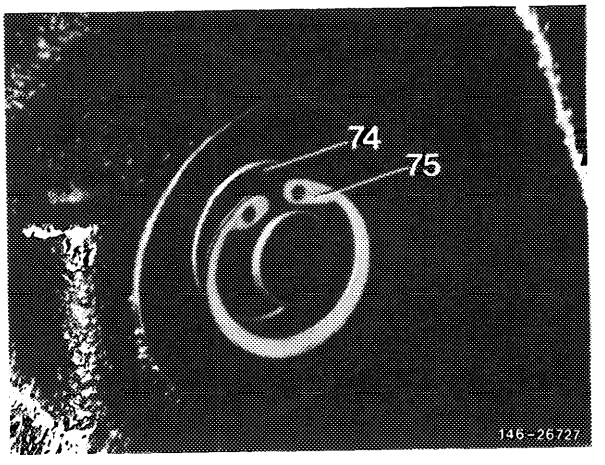
3 On steering gear 1st version, remove hex. nut (85) as well as dowel sleeve (83).



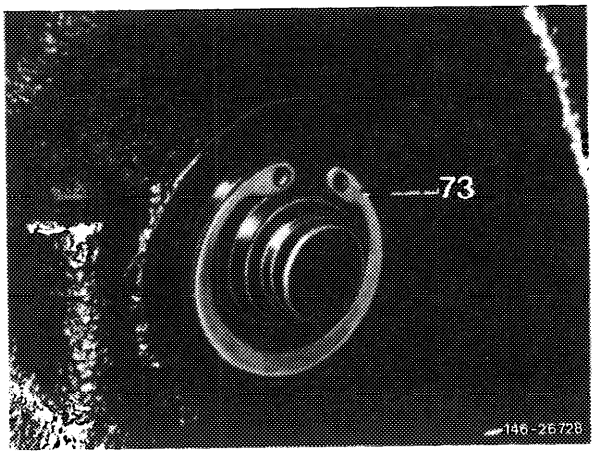
4 Unscrew closing screw (62) for center position and turn steering worm until working piston is approximately at lefthand or righthand lock.



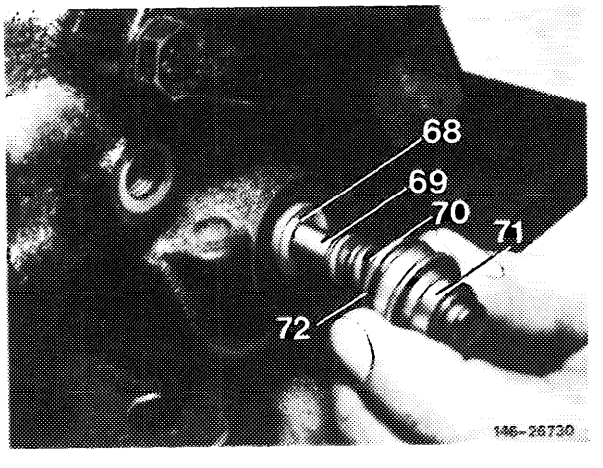
5 Take locking ring (75) and thrust ring (74) out of steering case.



6 Remove locking ring (73) from steering case.

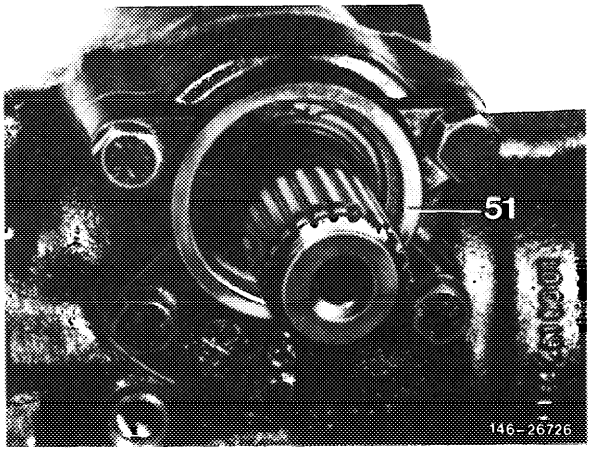


Remove cover (71), spring (70), spring bolt (69) and bushing (68).

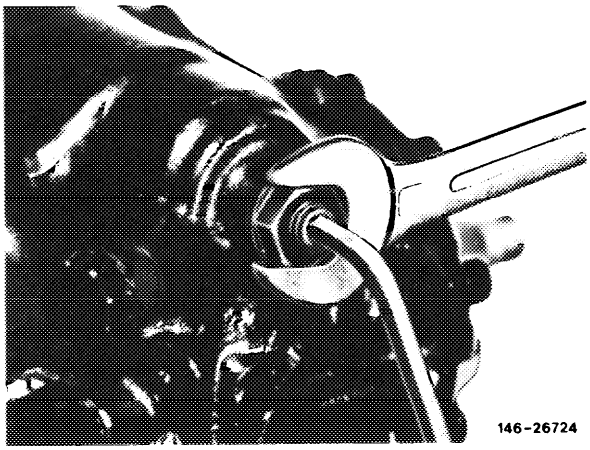


Attention!
Turn steering to center position. If steering is not in center position, the steering case will be damaged inside when the pitman shaft with case cover is forced out.

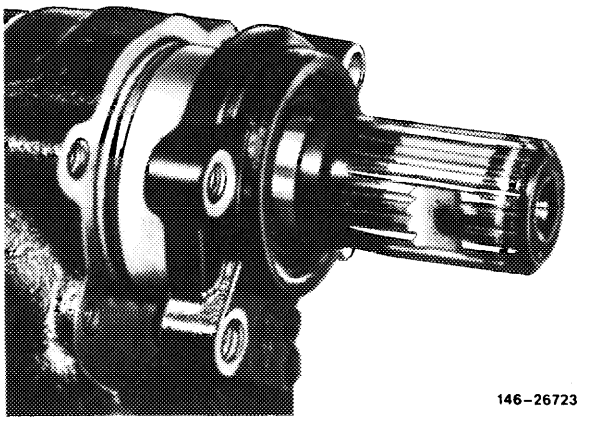
8 Unscrew self-locking hex. head screws for fastening steering case cover (51).



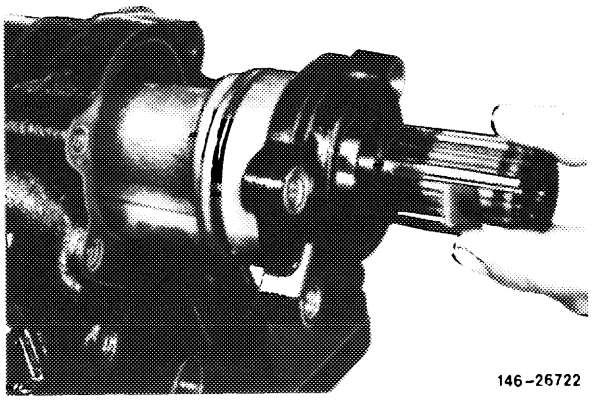
9 Unscrew self-locking hex. nut of adjusting screw while applying counterhold to adjusting screw.



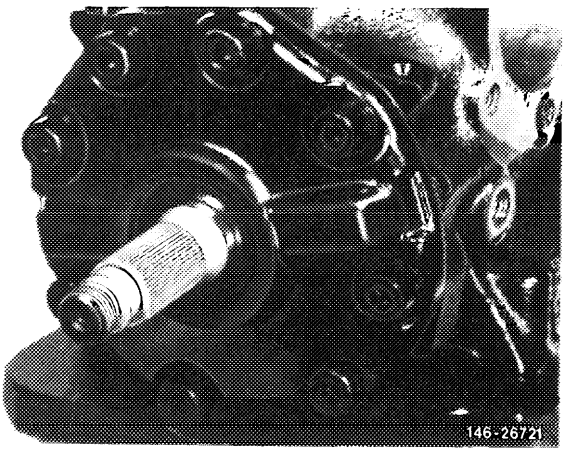
10 Turn adjusting screw to the right in center position of steering, as a result the pitman shaft and case cover will be forced out of steering case.



11 Pull pitman shaft out of steering case cover.



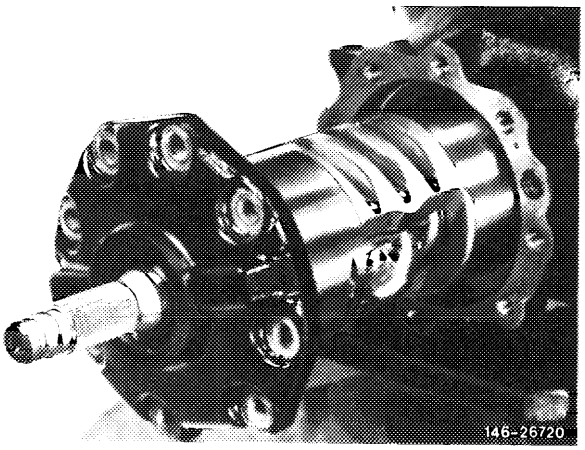
12 Unscrew hex. socket screws for fastening bearing cap.



13 Turn steering worm to the left until the bearing cap is pushed slightly out of steering case.

Attention!
Do not turn steering worm too much, since otherwise the bails will fall out of ball circuit.

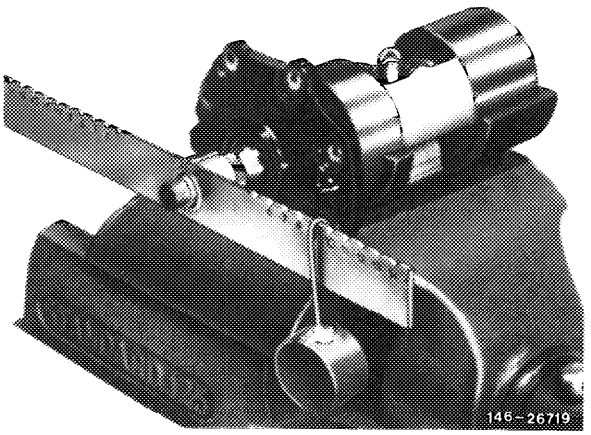
14 Remove bearing cap with steering worm and working piston out of steering case.



15 Place measuring device on splining of steering worm and measure friction torque of ball circuit. The friction torque steering nut — steering worm should amount to 5-50 Ncm (i.e. 50 g in notch "10" as lowest or 500 g in notch "6" to "12" as highest friction torque).

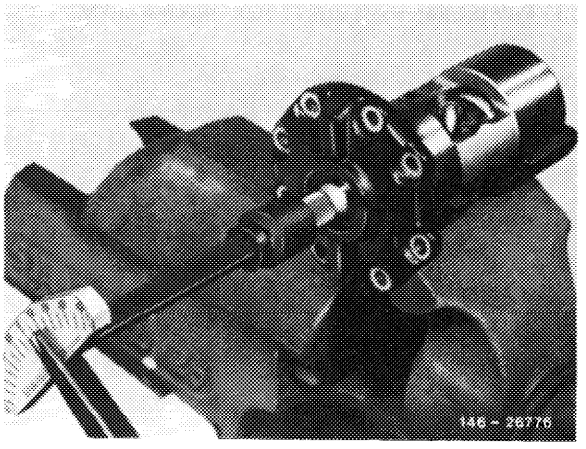
Special tool 116 589 03 21 00
201 589 02 59 00

If the friction torque is lower, the ball circuit has play, if it is higher, the ball circuit is damaged. In both cases, renew steering.

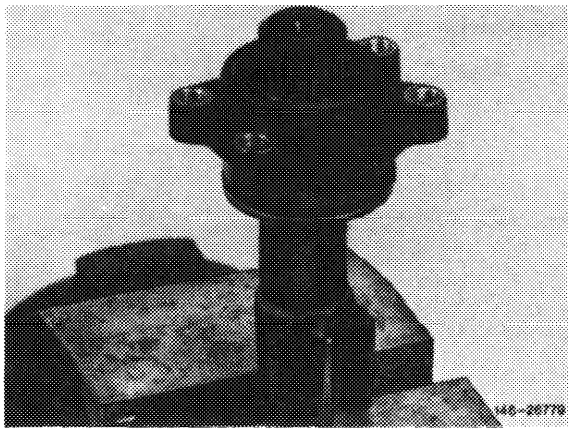


16 The friction torque can also be measured with torque wrench in combination with wrench socket.

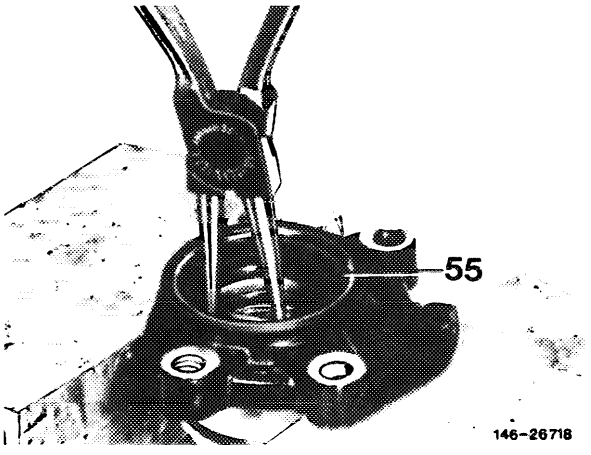
Special tool 123 589 02 21 00,
123589000800



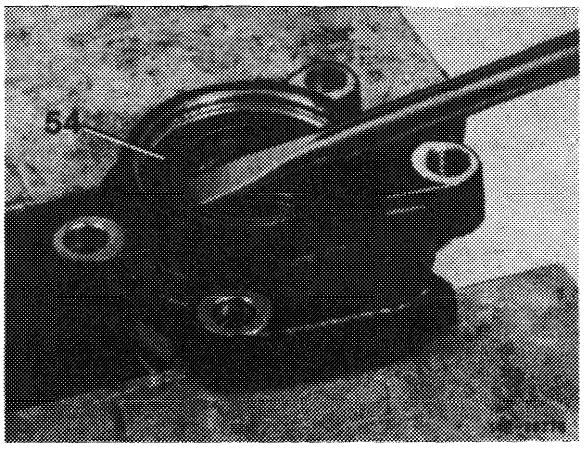
17 Remove steering case cover from pitman shaft.



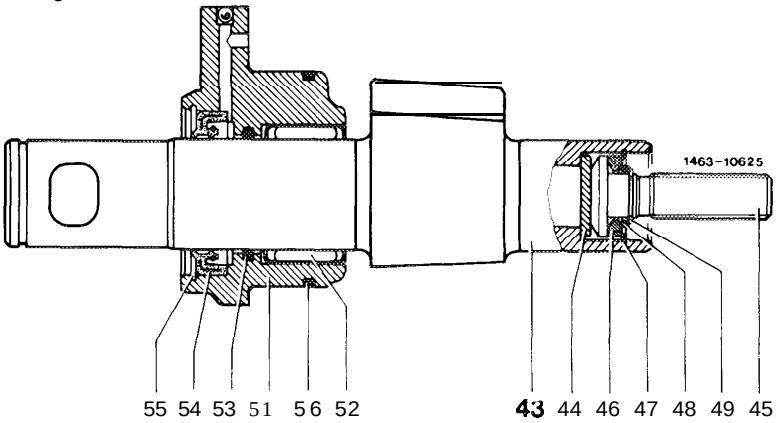
18 Take locking ring (55) out of steering case cover.



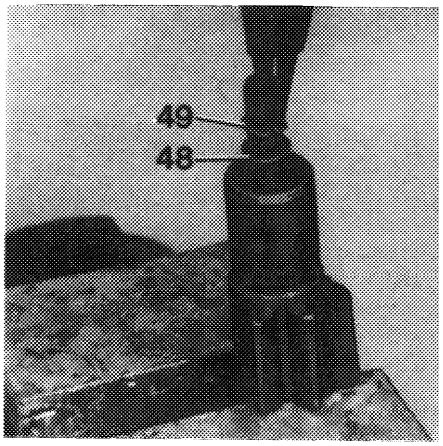
19 Force radial sealing ring (54) out of steering case cover by means of a screwdriver.



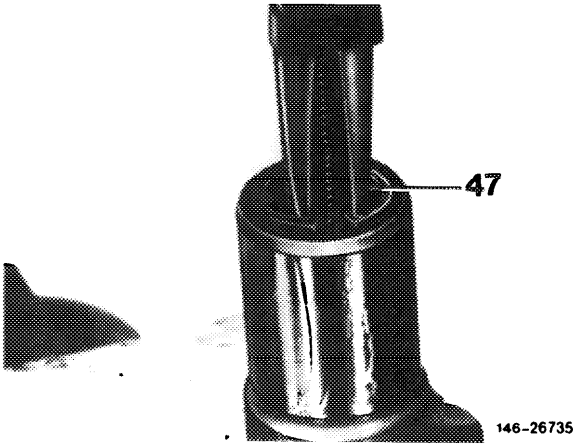
20 Remove O-rings (53 and 56) out of steering case cover.



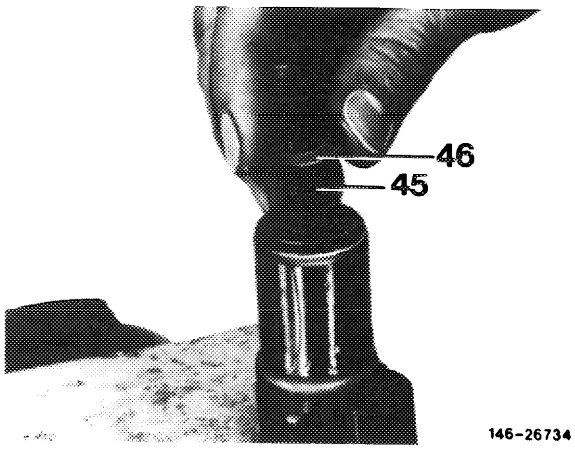
21 Take locking ring (49) out of adjusting screw. Then remove thrust ring (48).



22 Take locking ring (47) out of pitman shaft.

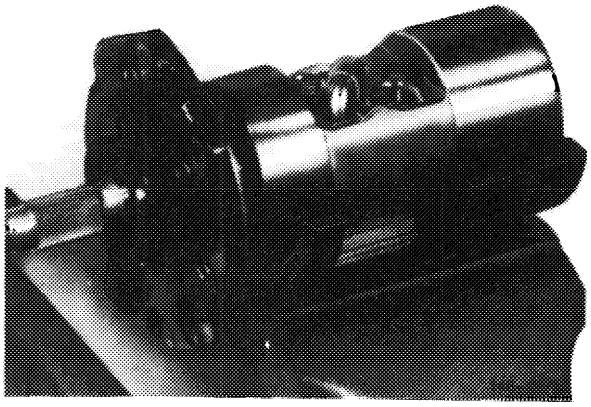


23 Remove adjusting screw (45) with thrust washer (46).

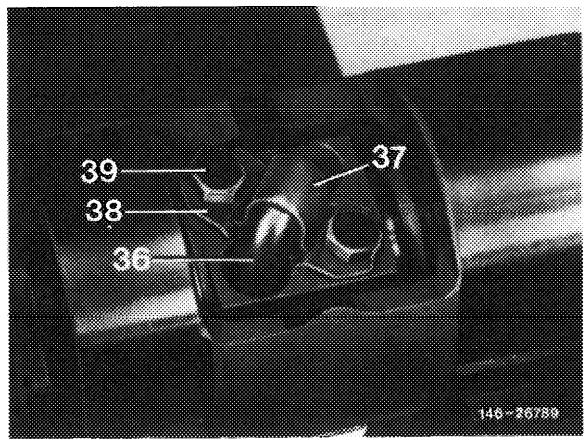


24 Place bearing cap with steering worm and working piston into assembly tray.

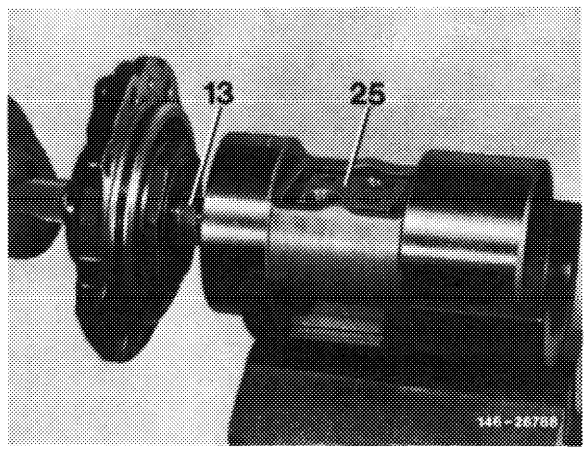
Special tool 201 589 02 59 00



25 Unbend locking plate (38), unscrew hex. head screws (39) and remove locking plate, holding clamp (37) and both ball guide halves (36).

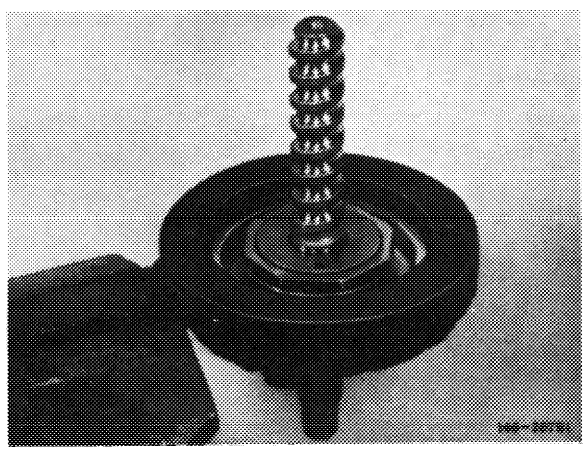


26 Unscrew steering worm (13) from steering nut (25). Make sure that no balls (23 each) are lost.



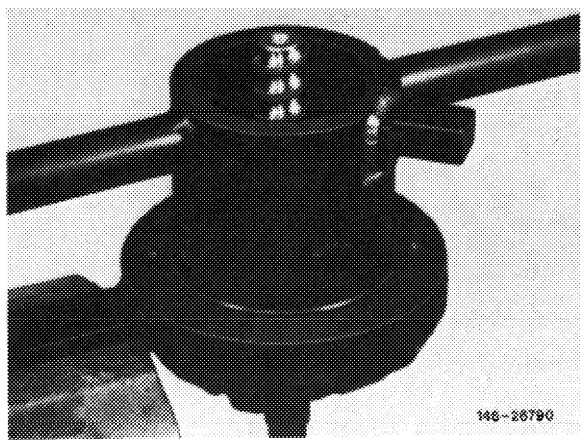
27 Remove O-ring from bearing cap and screw bearing cap into fixture.

Special tool 201 589 05 31 00



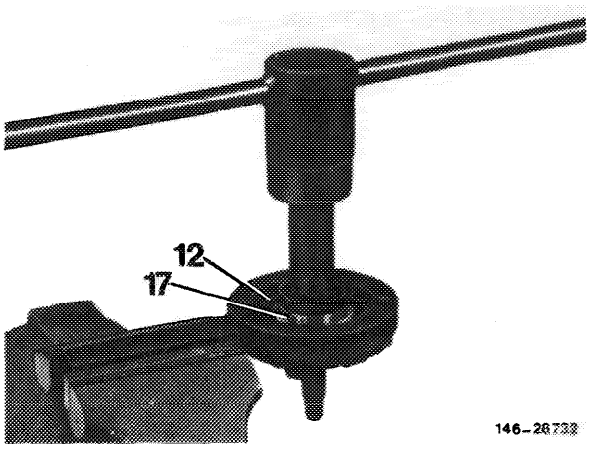
28 Unscrew hex. nut with tommy handle and socket wrench from bearing insert.

Special tool 201 589 02 09 00,
126589001600

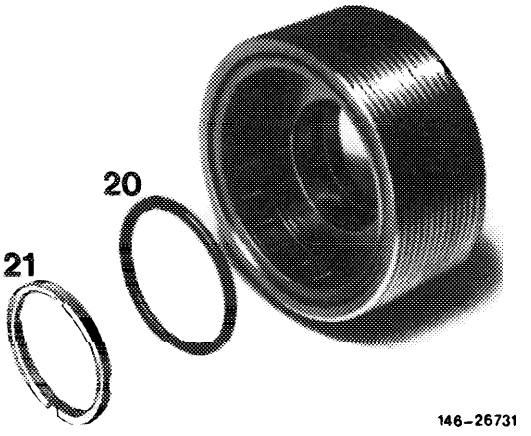


29 Unscrew bearing insert (17) with slot nut wrench out of bearing cap (12).

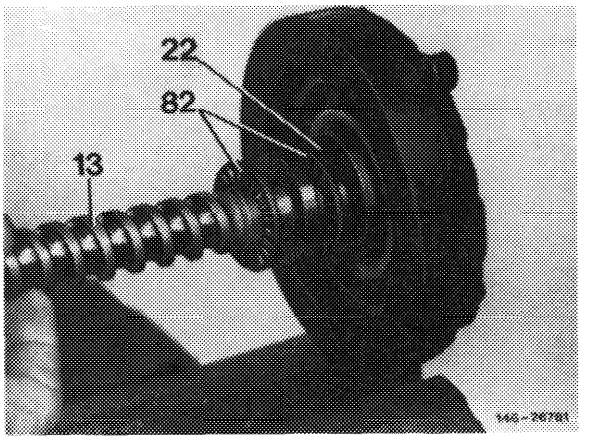
Special tool 201 589 00 07 00,
123 589 01 16 00



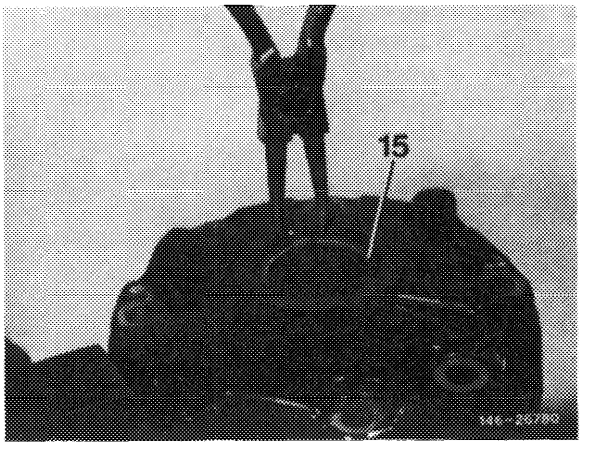
30 Take teflon ring (21) and O-ring (20) out of bearing insert.



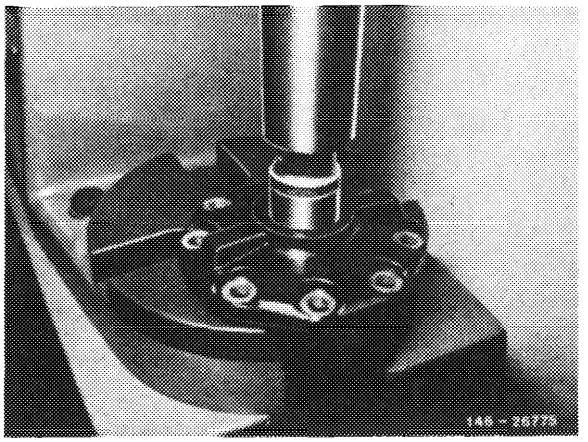
31 Pull steering worm (13) out of bearing cap, take axial bearing (82) and washer (22) from steering worm.



32 Remove locking ring (15) from bearing cap.

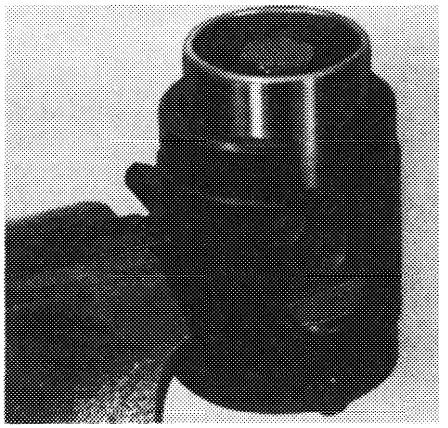


33 Force sealing ring out of bearing cap.



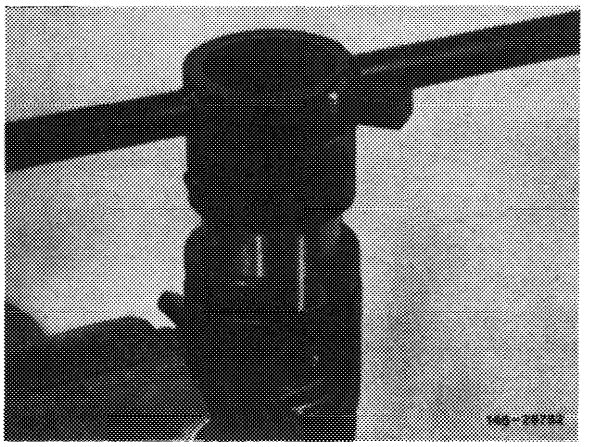
34 Insert working piston in assembly fixture and secure with plug.

Special tool 201 589 01 59 00



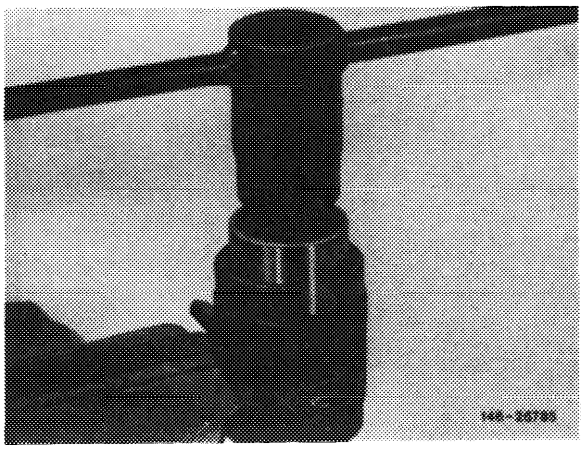
35 Unscrew slot nut with slot nut wrench and tommy handle from screw cover.

Special tool 126 589 00 16 00,
201 589 01 07 00

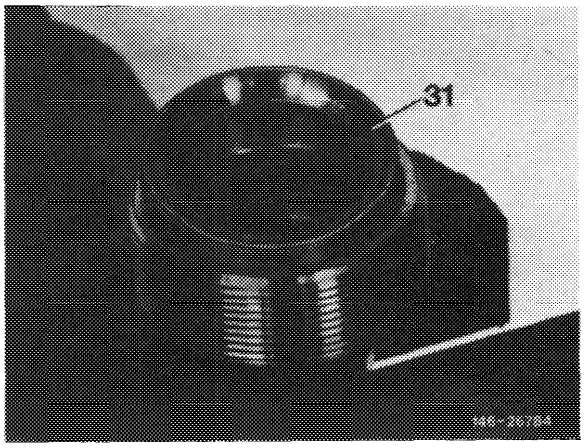


36 Unscrew screw cover with socket wrench and tommy handle from working piston.

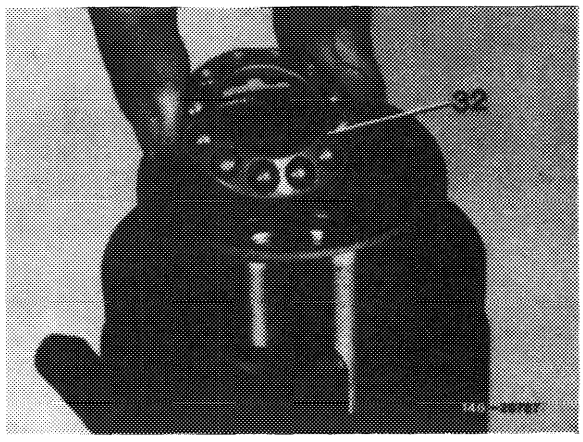
Special tool 123 589 01 16 00,
201 589 03 09 00



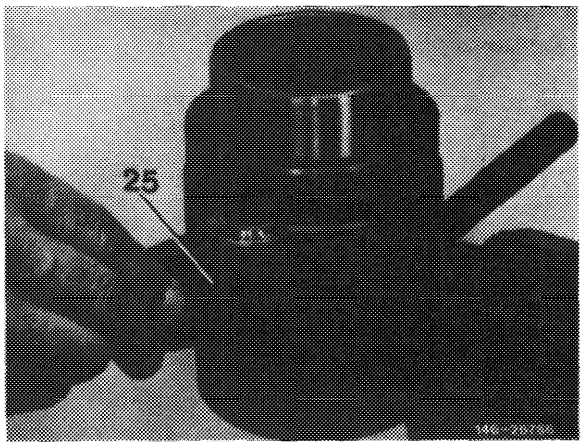
37 Take outer race (31) out of screw cover.



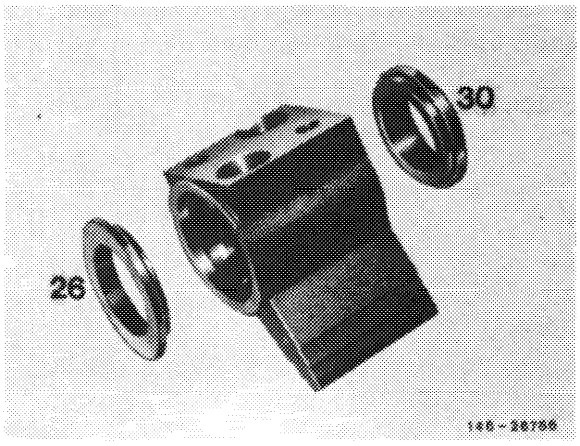
38 Remove ball cage (32) from steering nut.



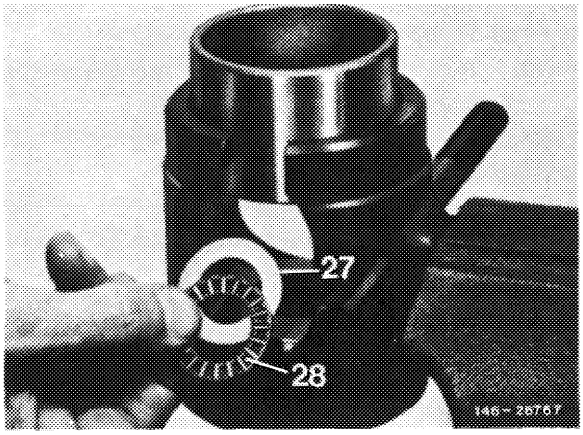
39 Remove steering nut (25) from working piston.



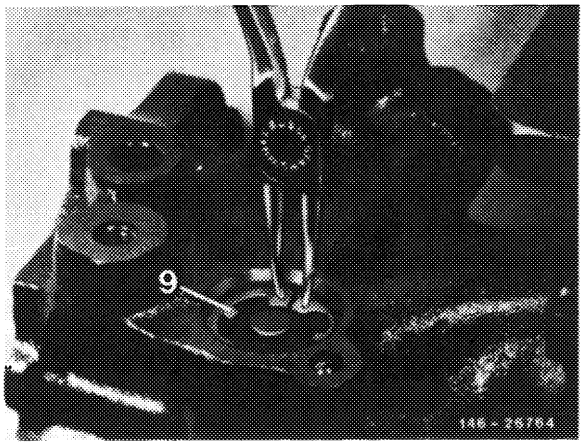
40 Force inner race (30) and bearing ring (26) **out** of steering nut.



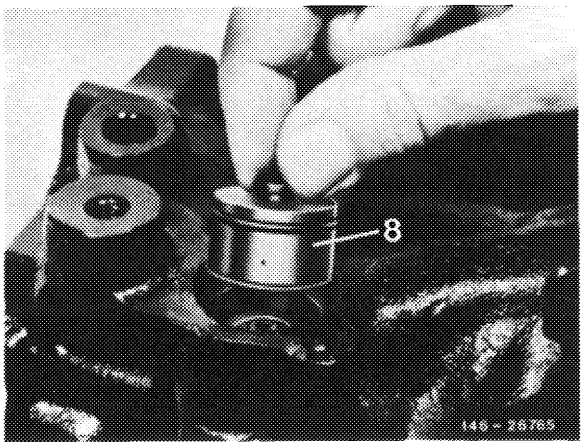
41 Take axial needle cage (28) and axial washer (27) out of working piston.



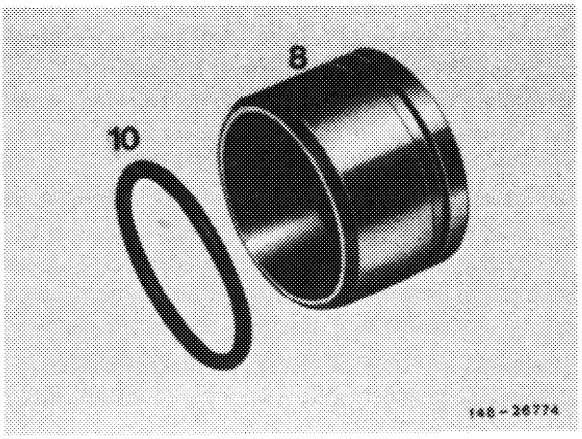
42 Take locking ring (9) out of steering case.



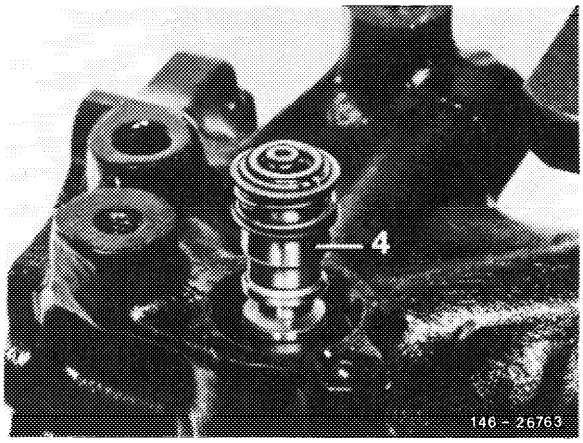
43 Pull closing cap (8) out of steering case.



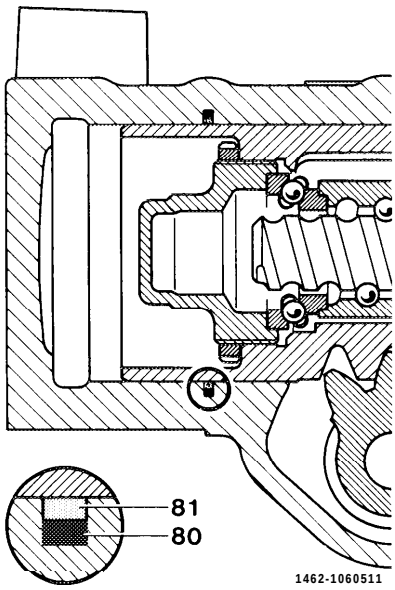
44 Remove O-ring (10) from closing cap (8).



45 Pull control valve (4) out of steering case. Make sure that the springs are not falling out of reaction piston.



46 Carefully remove teflon ring (81) and O-ring (80) from steering case.



Checking

Apply strict standards when checking steering components. When in doubt, replace respective part on principle.

Note: The ball circuit, that is, the steering worm and the steering nut, are assembled free of play at factory.

To maintain the specified clearance of 0.006 to 0.01 mm between straightedge of steering nut and control valve, both parts are assembled by selection. The same applies to steering case and the control valve mounted inside case. For this reason, except for gasket and bearing set, only the pitman shaft, the working piston and the case cover are available as spare parts.

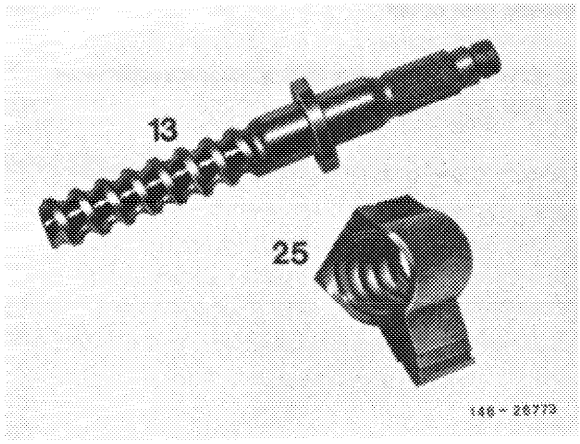
Steering worm, steering nut

47 Check ball circuit of steering worm (13) and steering nut (25).

If score marks are showing up, renew steering.

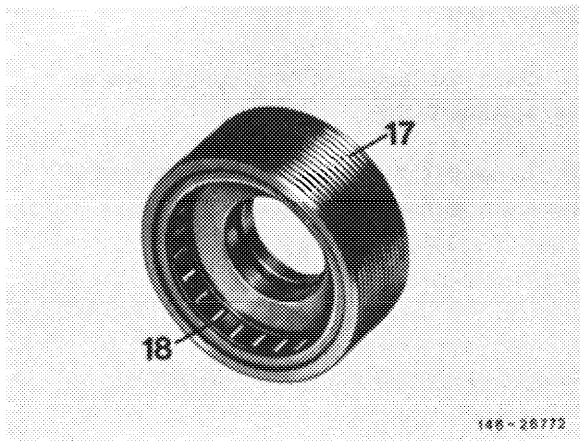
Note: Pitch of ball circuit

Steering gear: 765 900 = 10 mm
765 901 = 10 mm
765901 = 11 mm
765 903 = 10 mm
765 904 = 10.5 mm
765 905 = 10.5 mm



Bearing insert

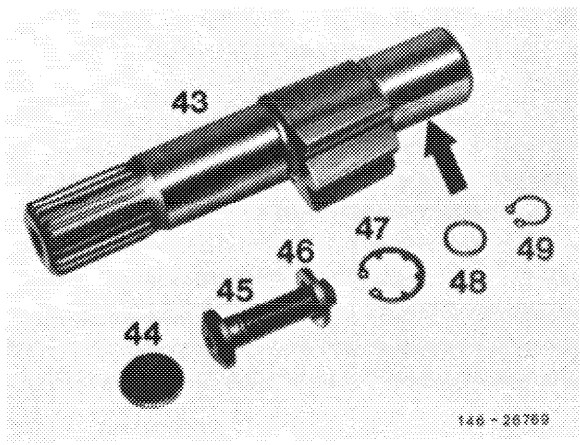
48 Check needle sleeve (18) for wear. If needle sleeve is damaged, completely renew bearing insert (17).



Pitman shaft

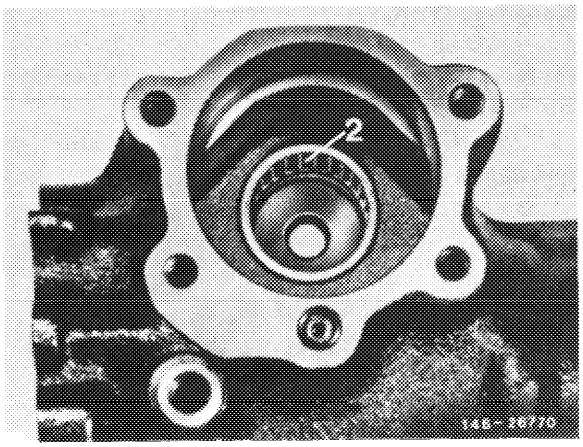
49 Check pitman shaft at bearing points and on tooth segment for wear. Check for distortion or other damage. Particularly check upper bearing point (arrow) of pitman shaft.

43 Pitman **shaft**
44 Thrust washer
45 Adjusting screw
46 Thrust washer
47 Locking ring
48 Thrust ring
49 Locking ring



Steering case

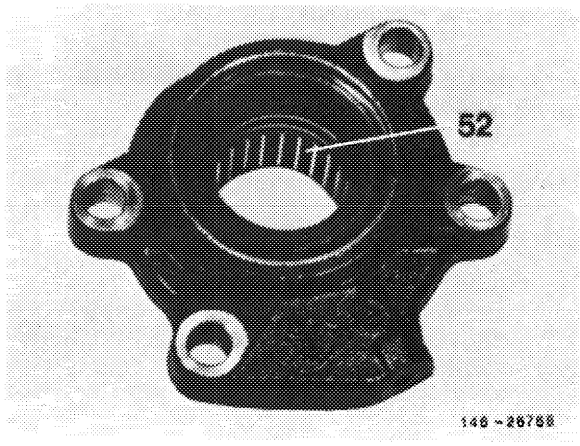
50 Check needle sleeve (2) in steering case for wear and quiet running. If needle sleeve is damaged, renew steering.



Steering case cover

51 Check needle sleeve (52) in steering case cover for wear and quiet running.

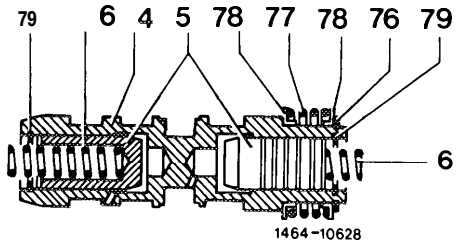
If needle sleeve is worn, completely renew cover.



Control valve

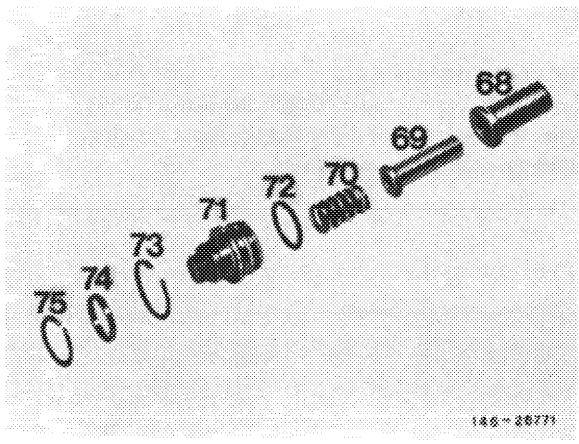
52 Check reaction piston (5) in control valve for easy operation.

53 Do not mix up springs (6) and compensating washers of both reaction pistons.



54 Check individual parts of compensation for play, particularly spring bolt (69) for wear.

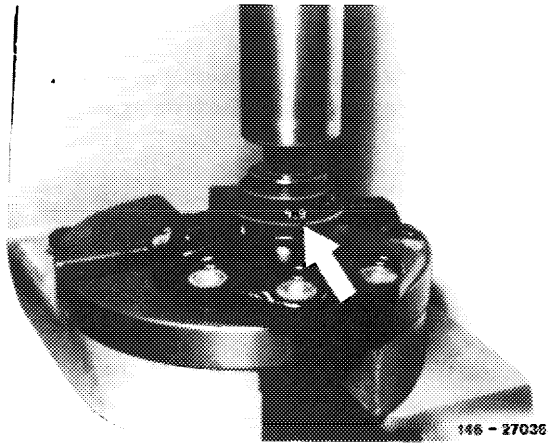
68 Bushing
69 Spring bolt
70 Compresston spring
71 Cap
72 O-ring
73 Locking ring
74 Thrust ring
75 Locking ring



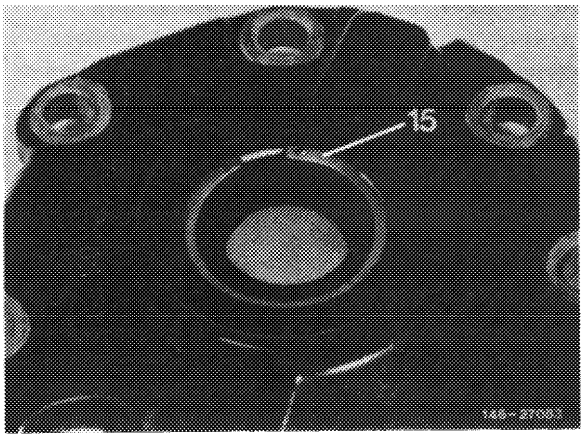
Bearing cap

55 Press sealing ring (14) with mandrel into bearing cap. Pressing-in depth 4.9 mm (arrow).

Special tool 201 589 05 31 05



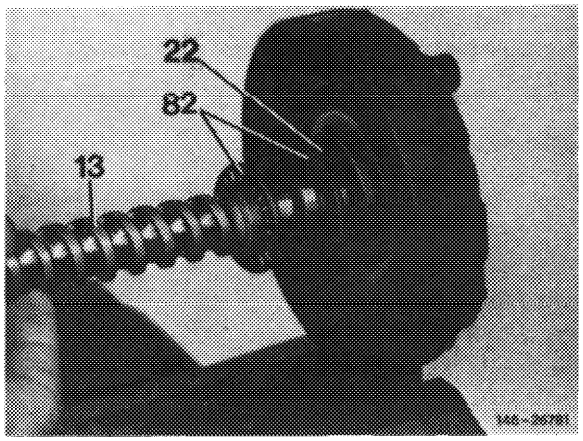
56 Insert locking ring (15) into bearing cap.



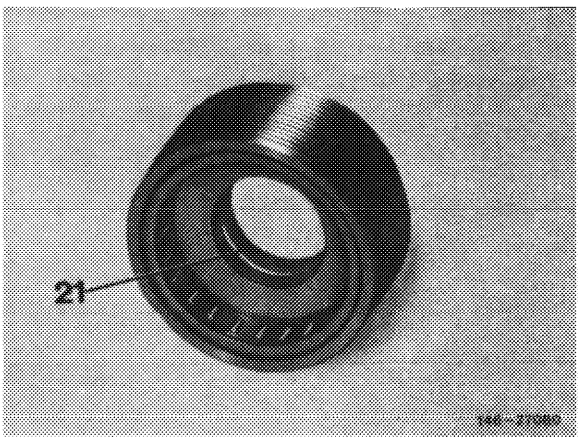
57 Screw bearing cap to fixture and clamp into vice.

Special tool 201 589 05 31 00

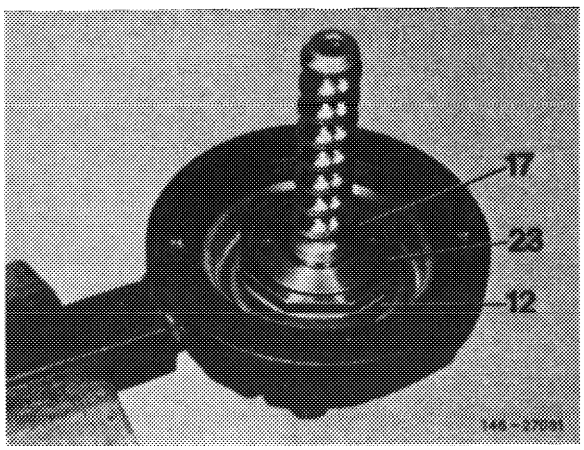
58 Slip washer (22) and axial bearing (82) on steering worm and insert steering worm into bearing cap. Make sure that the sealing ring is not damaged.



59 Insert O-ring and teflon ring (21) into bearing insert.

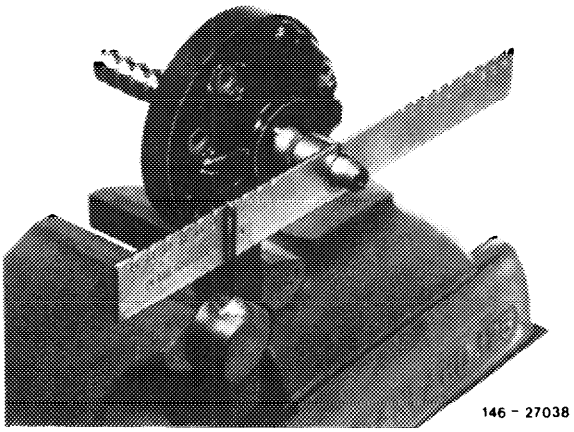


60 Screw bearing insert (17) into bearing cap (12) and tighten slightly. Screw hex. nut (23) with chamfer toward bearing cap on bearing insert.



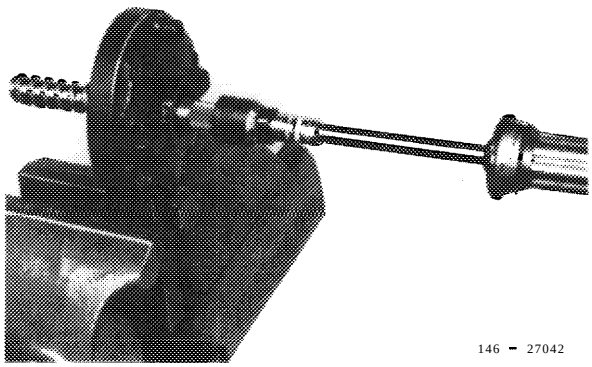
61 Measure friction torque of steering worm in bearing cap (sealing parts only); for this purpose, place measuring device on splining of steering worm. The friction torque should amount to ⩽ 12 Ncm = 200 g in notch 8-9 of measuring device.

Special tool 116 589 03 21 00



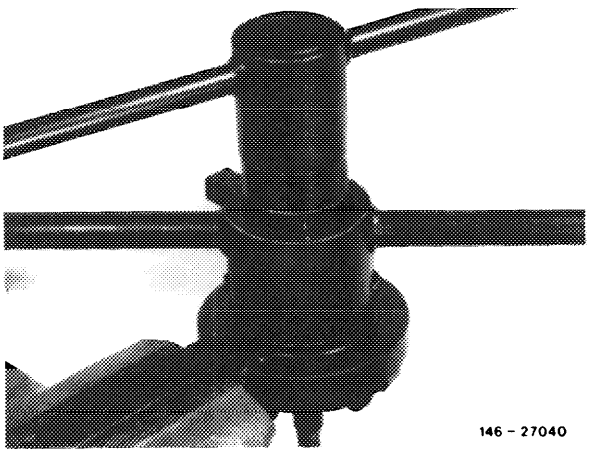
62 The friction torque can also be measured with torque screwdriver in combination with wrench socket.

Special tool 123 589 02 21 00
1 2 3 5 8 9 0 0 0 8 0 0

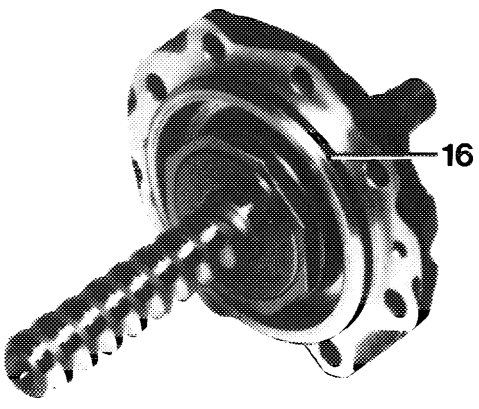


63 Tighten bearing insert (17) with socket wrench and tommy handle until an additional amount of friction torque of 4-7 Ncm is measured. Tighten hex. nut to 220-240 Nm and check friction torque once again.

Special tool 126 589 00 16 00
201 589 02 09 00
123 589 01 16 00
201 589 00 07 00



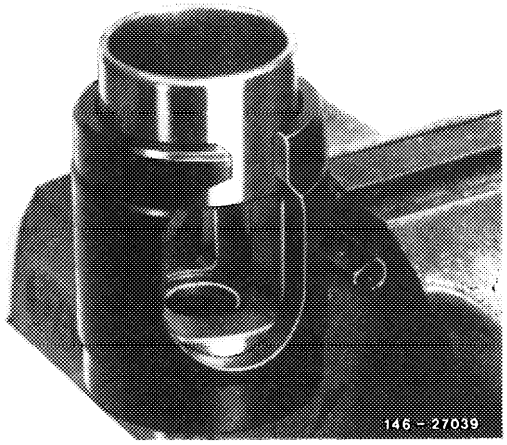
64 Remove bearing cap with steering worm from fixture and insert O-ring (16).



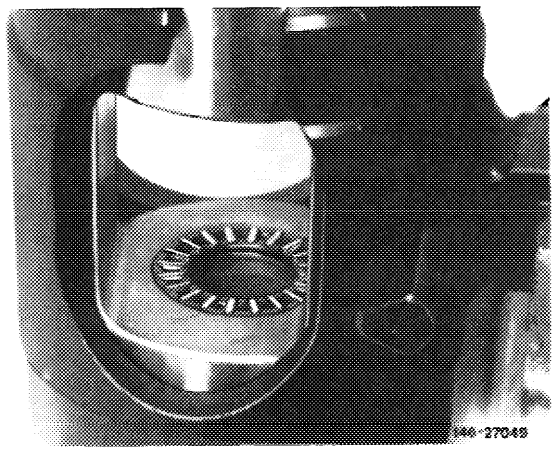
Working piston and steering nut

6 5 Insert working piston into fixture and secure with plug.

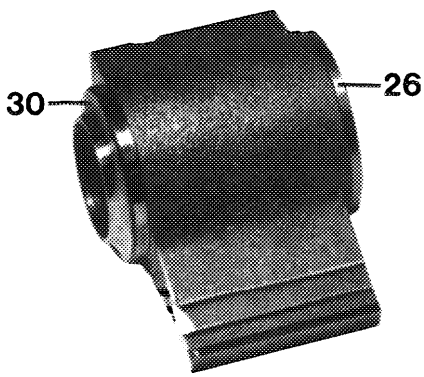
Special tool 201 589 01 59 00



6 6 Insert axial washer and axial needle cage into working piston.

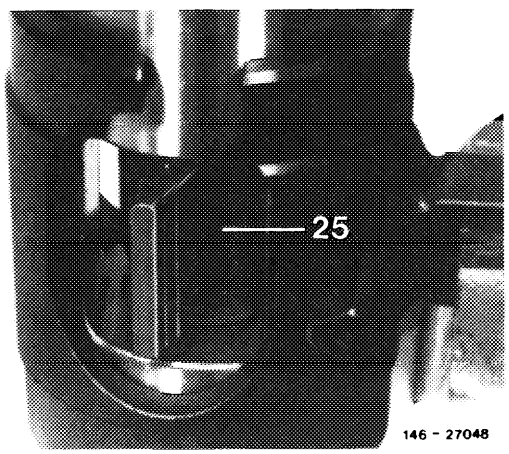


6 7 Insert bearing ring (26) and inner race (30) into steering nut.



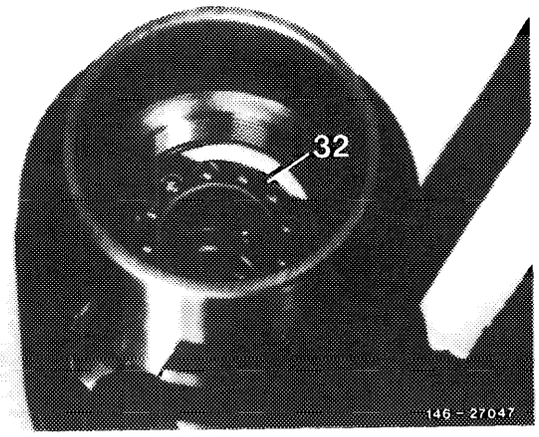
146 - 27035

68 Insert steering nut (25) into working piston in such a manner that the bearing ring rests on axial needle cage.

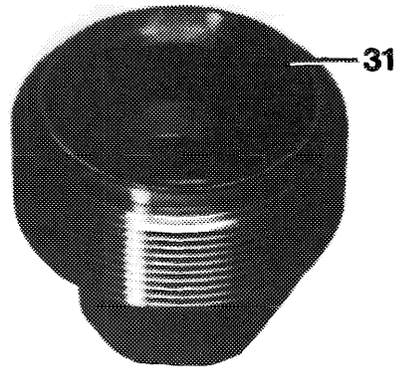


146 - 27048

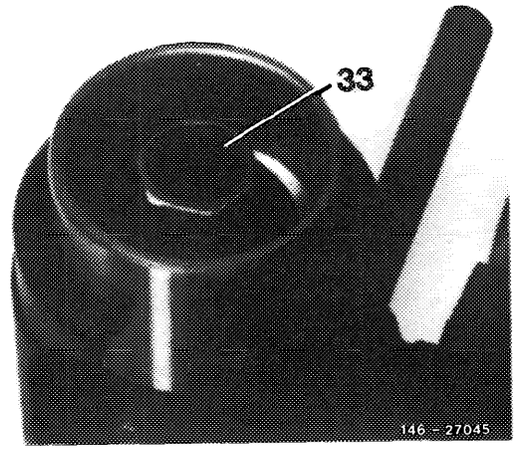
69 Place ball cage (32) on steering nut in working piston.



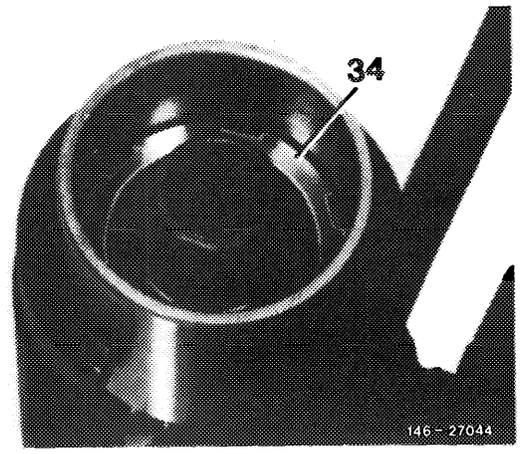
70 Push outer race (31) up to stop into screw cover.



71 Screw screw cover (33) into working piston.

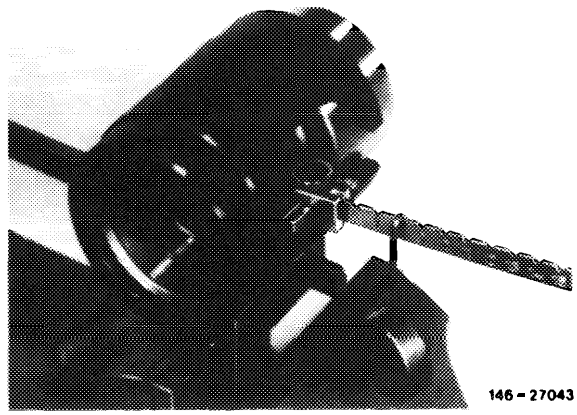


72 Screw slot nut (34) on screw cover and tighten slightly.



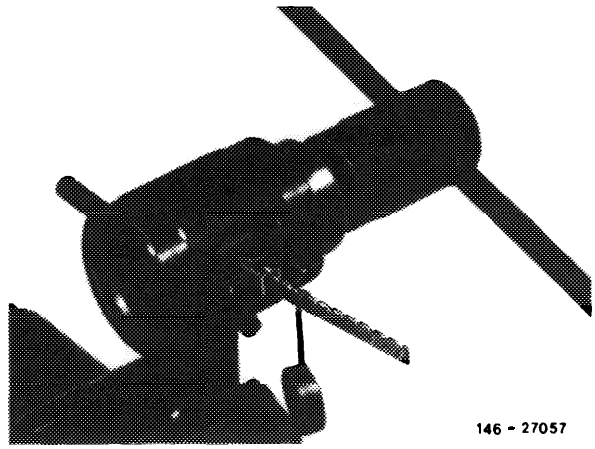
73 To measure friction torque of steering nut in working piston slip measuring device on straight-edge of steering nut.

Special tool 116 589 02 21 00



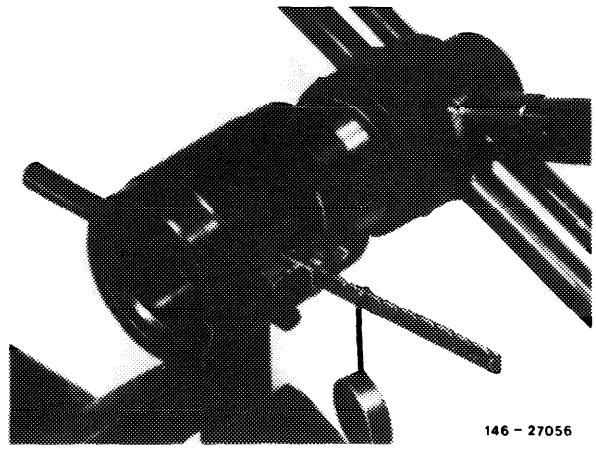
74 The friction torque should be 6-10 Ncm = 100 g in notch "6" to "10" of measuring device. To adjust screw cover tighten with socket wrench and tommy handle until the weight on measuring device is just barely turning the steering nut.

Special tool 123 589 01 16 00
201 589 03 09 00



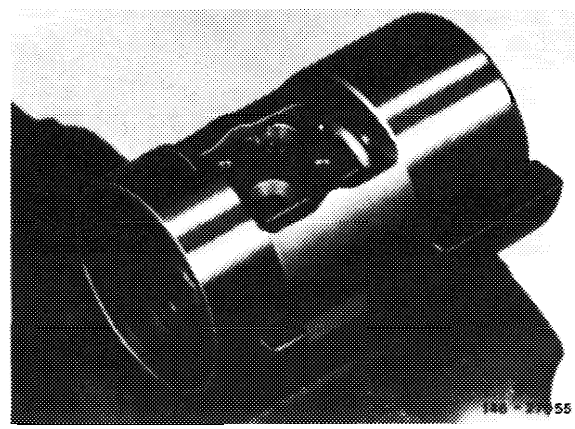
75 Tighten slot nut to a tightening torque of 200-240 Nm, while applying counterhold to screw cover. Then check friction torque of steering nut once again.

Special tool 126 589 00 16 00
001 589 67 21 00
201 589 01 07 00



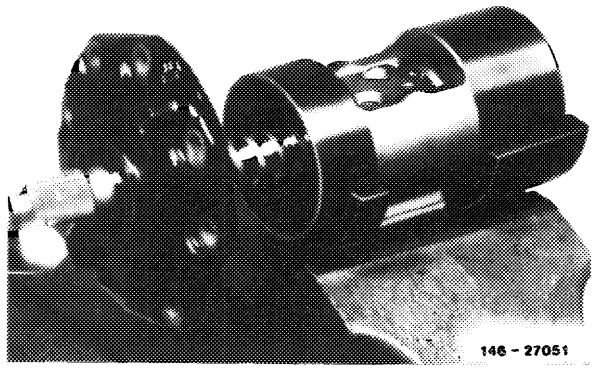
76 Remove working piston from device and place into assembly tray.

Special tool 201 589 02 59 00

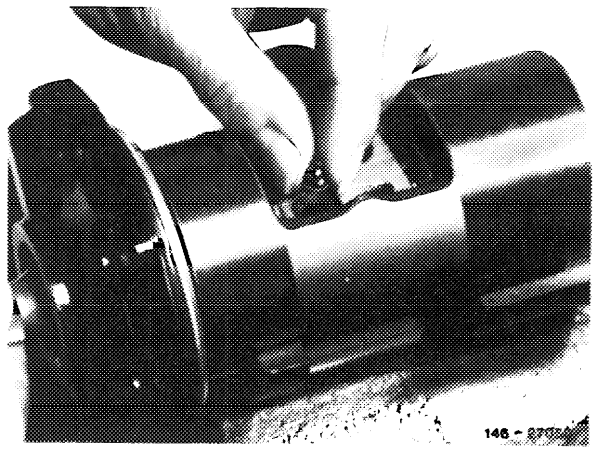


Steering worm, steering nut

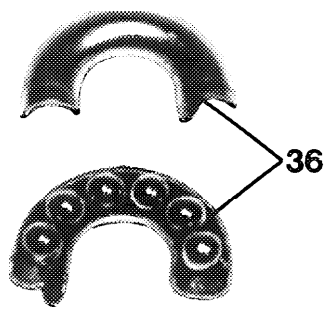
77 Introduce steering worm into steering nut until one ball race is fully seen through bore (for balls).



78 While slowly turning steering worm to the right, insert 17 balls into ball circuit.

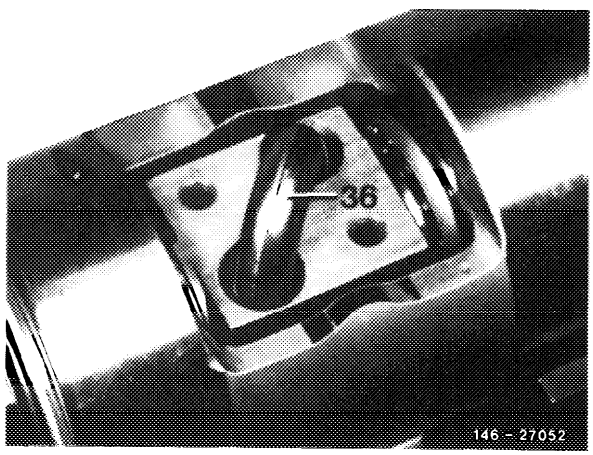


79 Fill one ball guide half (36) with grease and insert the remaining 6 balls. Place both ball guide halves on each other and close the openings with grease.

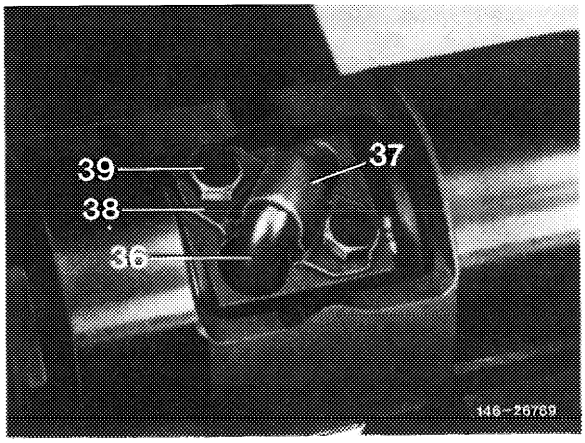


146 - 27053

80 Insert ball guide halves (36) into steering nut.



81 Mount fastening clamps (37) and locking plates (38) on steering nut. Screw in hex. screws (39) and tighten to 12-16 Nm. Lock hex. head screws.

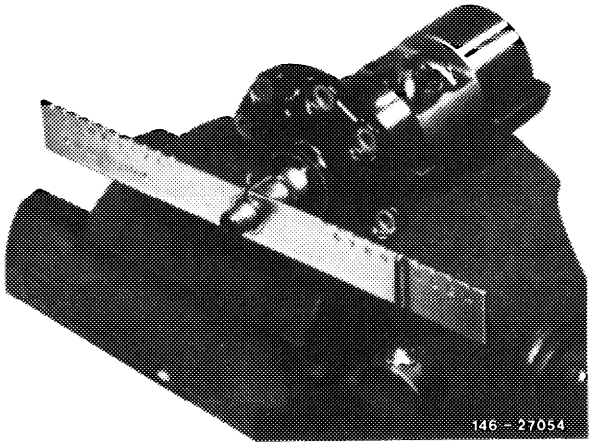


82 Place measuring device on splining of steering worm and measure friction torque of ball circuit.

Friction torque steering nut — steering worm should be 5—50 Ncm in mean range (i.e. 50 g in notch "10" as lowest or 500 g in notch "6" to "12" as highest friction torque).

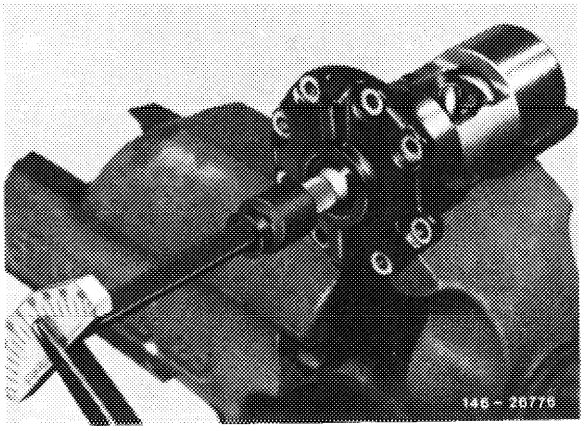
In a used steering gear the friction torque can increase outside center to 50 Ncm.

Special tool 116 589 03 21 00

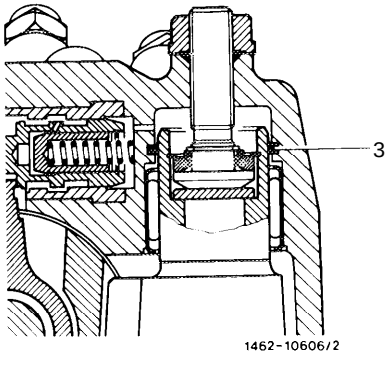


83 The friction torque can also be measured with the torque wrench in combination with a wrench socket.

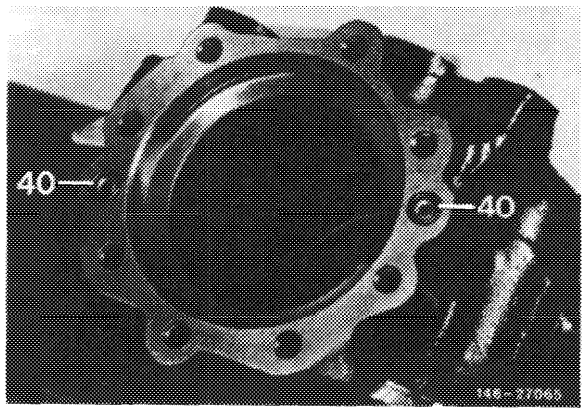
Special tool 123 589 02 21 00
1 2 3 5 8 9 0 0 0 8 0 0



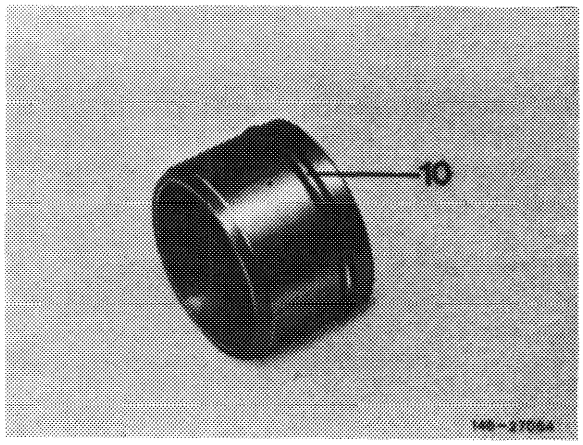
84 Insert O-ring (3) into steering case.



85 Insert O-rings (40) for bearing cap into steering case

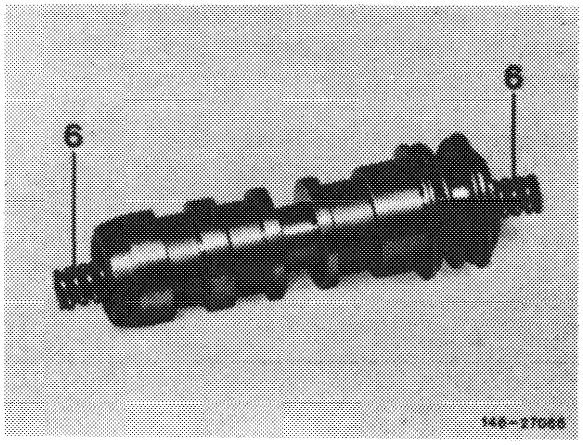


86 Insert O-ring (10) on closing cap for control valve.

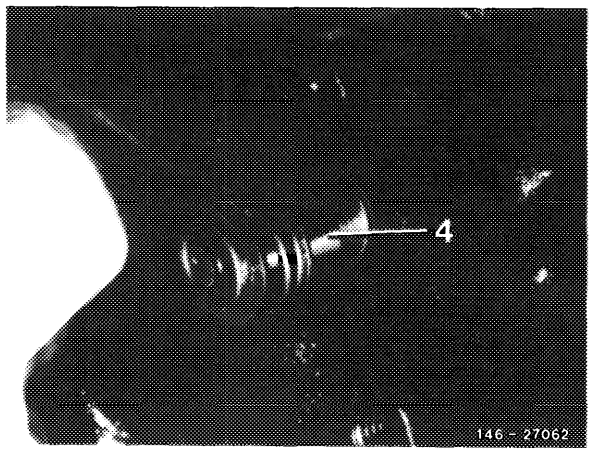


87 Grease springs (6) and insert into reaction pistons.

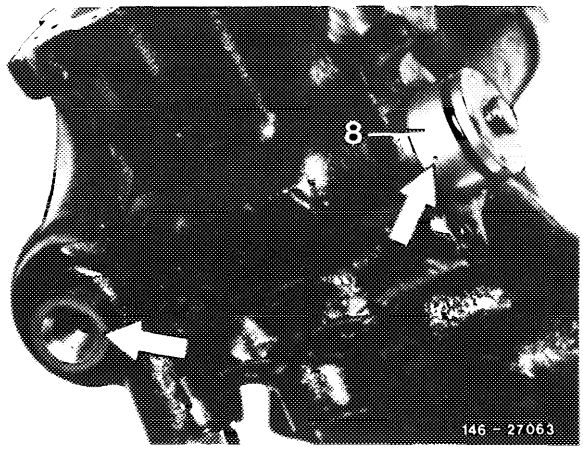
Atterntion!
Do riot mix up spr ings (6).



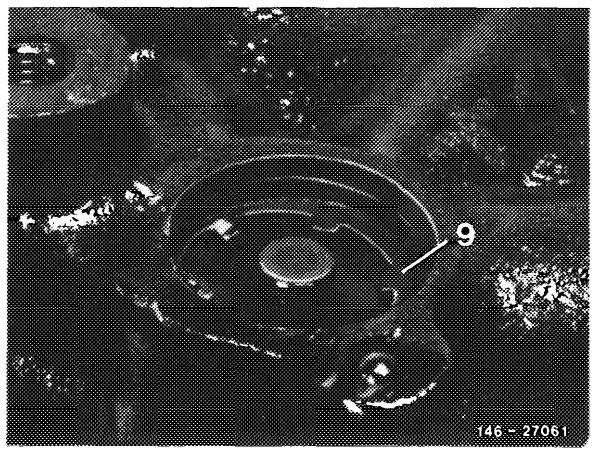
88 Insert control valve (4) into steering case, making sure that the springs are not falling out of control valvi3.



89 Punch closing cap (8) with a plastic hammer into steering case in such a manner that the bore in closing cap (arrow) points toward tapped hole for adjusting screw (arrow).



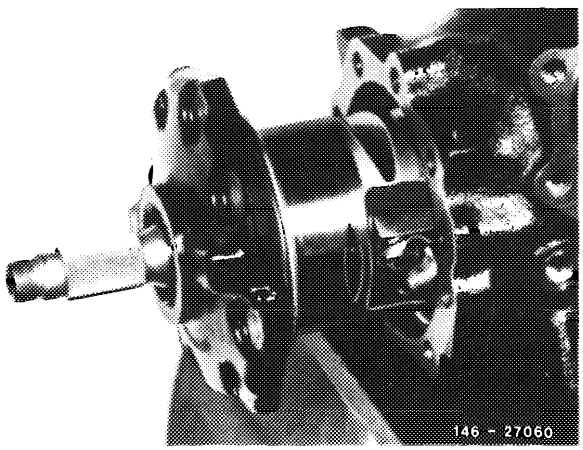
90 Insert locking ring (9) into steering case in such a manner that the lugs are pressing on closing cap. The locking ring should be correctly seated in groove of steering case.



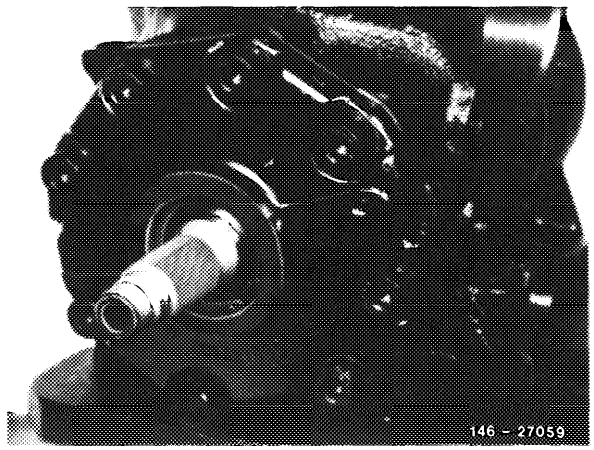
Steering case, working piston

91 Carefully introduce working piston complete with steering worm, steering nut and bearing cap into steering case, so that the straightedge of the steering nut is entering into groove of control valve.

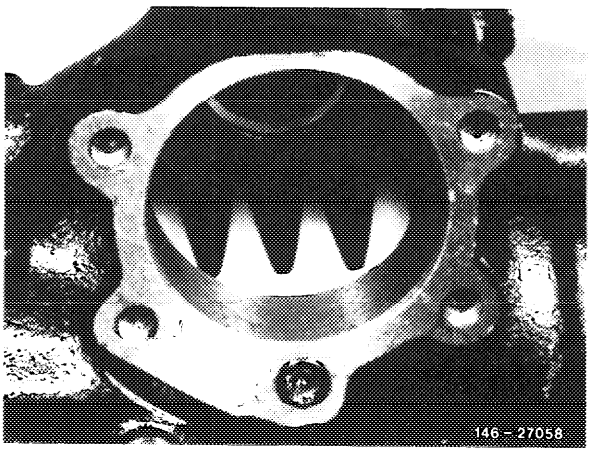
92 Turn bearing cap in such a manner that the oil channel on steering case is in alignment with oil bore in bearing cap. Pay attention to correct seat of O-rings.



93 Screw in hex. socket screws and tighten to 70-75 Nm.



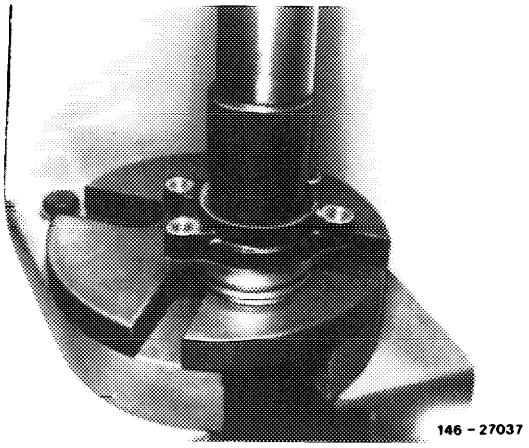
94 Turn steering worm in such a manner that the center tooth gap is in center of steering case.



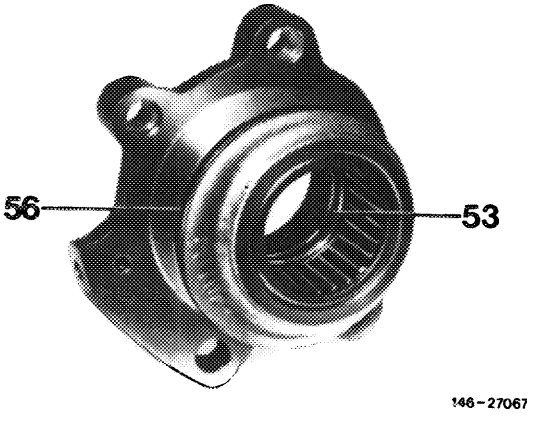
Pitman shaft, steering case cover

95 Press sealing ring with mandrel into steering case cover and mount locking ring.

Special tool 201 589 06 15 00

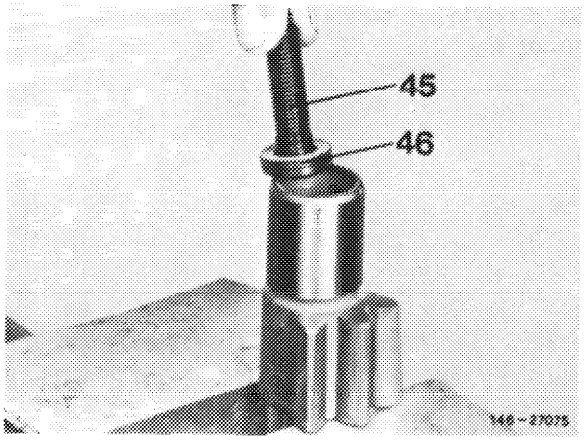


96 Insert O-rings (53) and (56) into steering case cover.

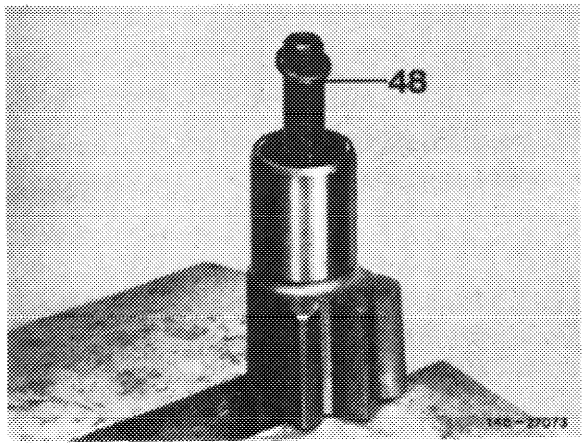


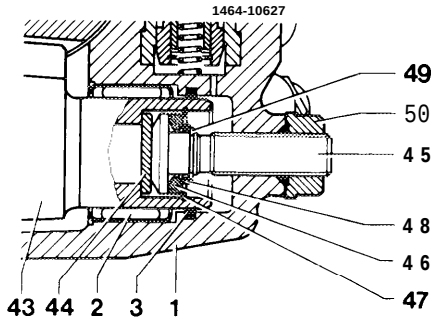
97 Insert adjusting screw (45) and thrust washer (46) into pitman shaft and mount locking ring. Pay attention to perfect seat of locking ring.

Note: The adjusting screw should be mounted in pitman shaft as much as possible free of play. For this purpose, thrust washers of the following thickness are available: 2.65 — 2.70 — 2.75 — 2.80 — 2.85 — 2.90 — 2.95 — 3.00 — 3.05 — 3.10 mm.

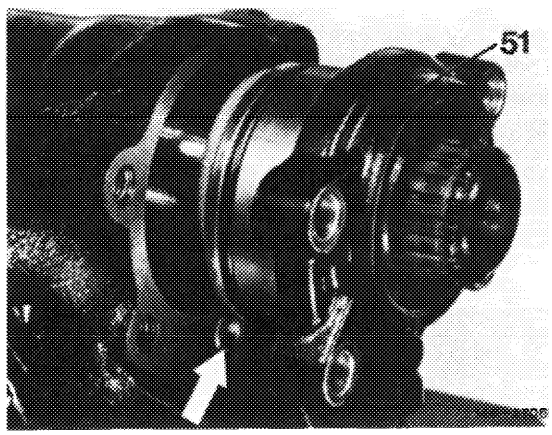


98 Place thrust ring (48) on adjusting screw and mount locking ring (49).



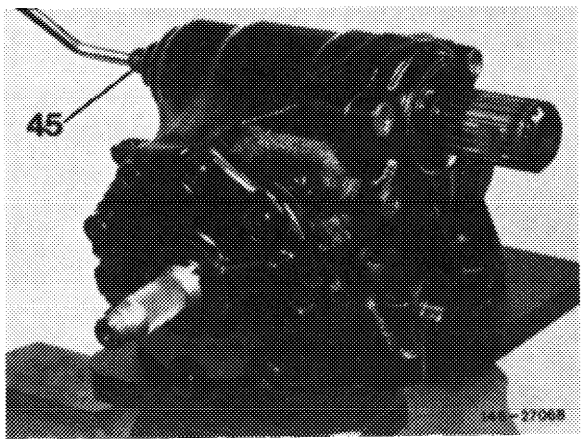


99 Slip steering case cover (51) on pitman shaft and introduce pitman shaft into steering case, so that the center tooth of the pitman shaft enters into center tooth gap of working piston. Pay attention to correct seat of O-ring (arrow).

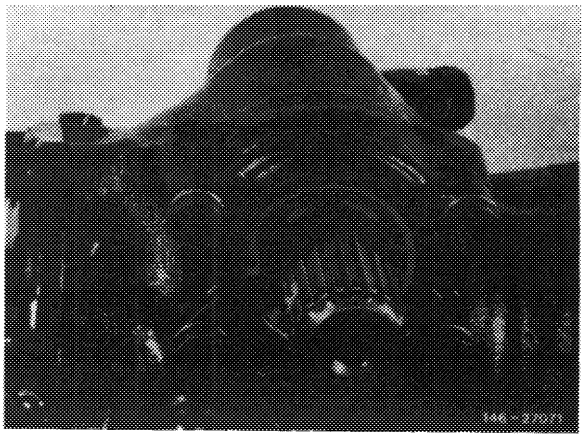


100 Screw adjusting screw (45) into steering case until it is hard to move.

101 Turn steering case cover in such a manner that the oil channel and the bore in steering case cover are one above the other. Press steering case cover against steering case.

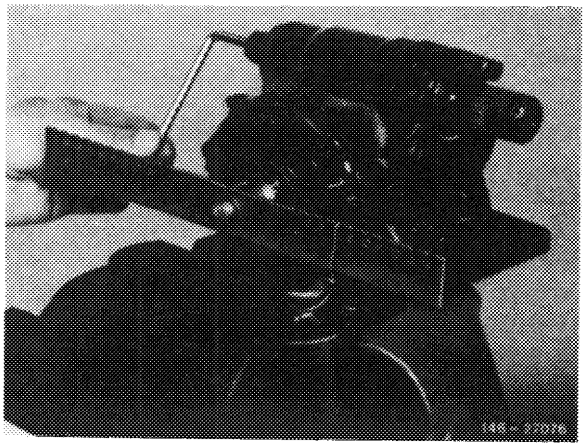


102 Screw new self-locking screws into steering case cover and tighten to 30-35 Nm.



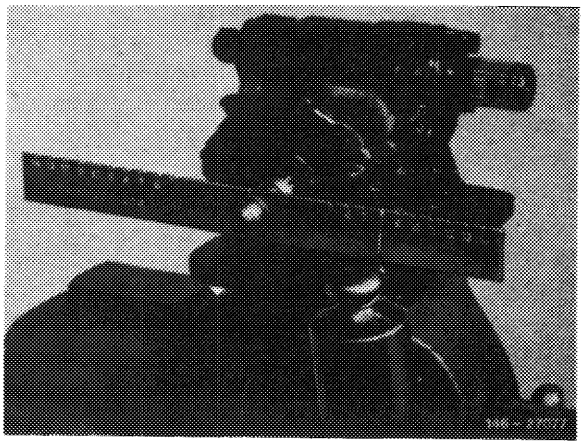
103 Loosen adjusting screw (45) until the steering worm can be easily rotated. Measure friction torque of steering worm and write down friction torque.

104 Slip measuring device on steering worm. Adjust pressure device of pitman shaft by turning adjusting screw counterclockwise until the friction torque is higher by 40-60 Ncm. This means that the friction torque of the steering worm amounts to 1 10–160 Ncm when the steering worm is turned beyond the center position. The steering is set correctly if a weight of 2000 g in notch “6” to “8” of measuring device turns the steering worm beyond center position.

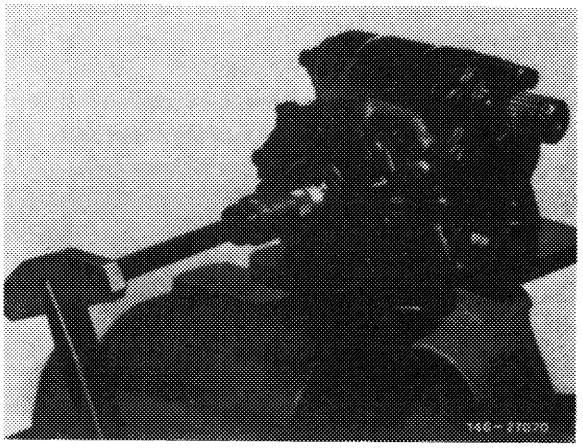


Special tool 116 589 03 21 00

Attention!
When turning beyond center position a slight pressure point should be felt. When the steering worm is turned from lock to lock, the steering should not bind.



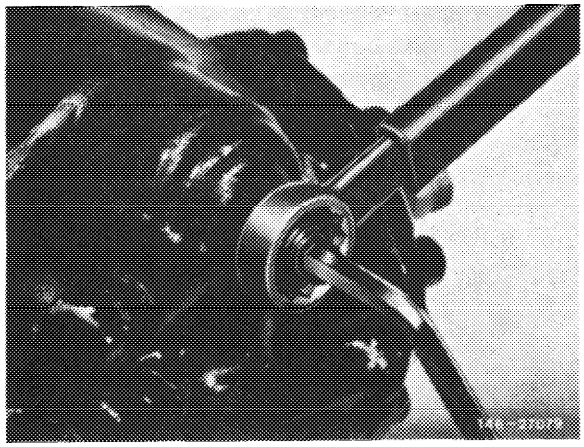
105 The friction torque can also be measured with torque wrench in combination with wrench socket.



Special tool 123 589 02 21 00
123589000800

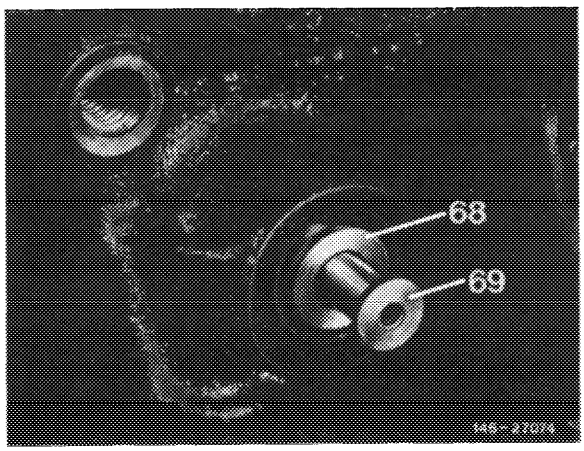
106 Screw SEAL-LOCK collar nut on adjusting screw and tighten to 60-65 Nm, while applying counterhold to adjusting screw.

107 Check total friction torque once again (item 104), which should amount to 1 10–160 Ncm = 2000 g in notch “6” to “8” of measuring device.



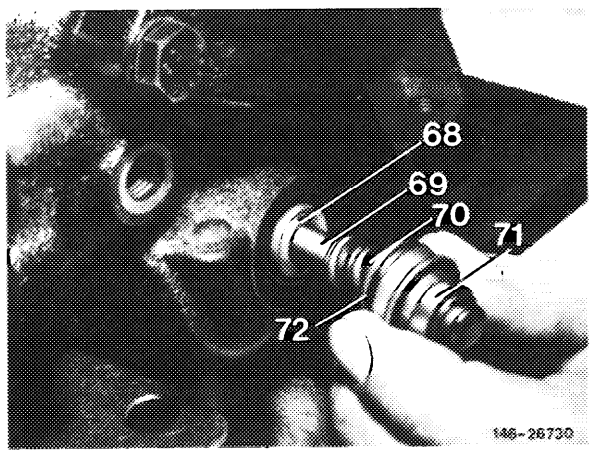
108 Slightly turn steering worm until the working piston is no longer in steering center.

109 Insert bushing (68) and spring bolt (69) into steer i ng case.

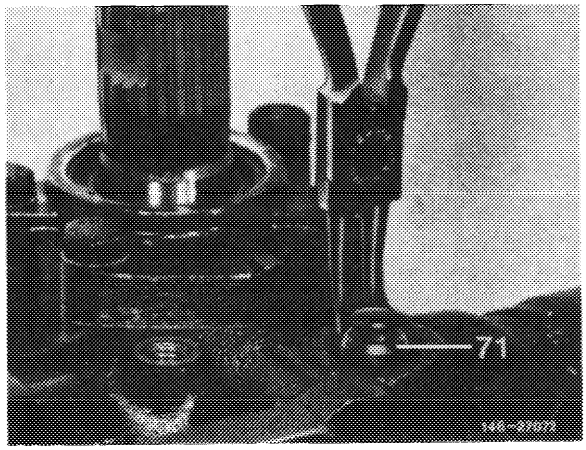


110 Renew O-ring (72) on cap (71).

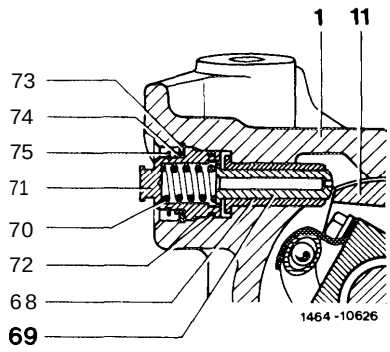
111 Insert compression spring (70) into cap and place cap with compression spring into steering case.



112 Push cap (71) against compression spring and insert locking ring.

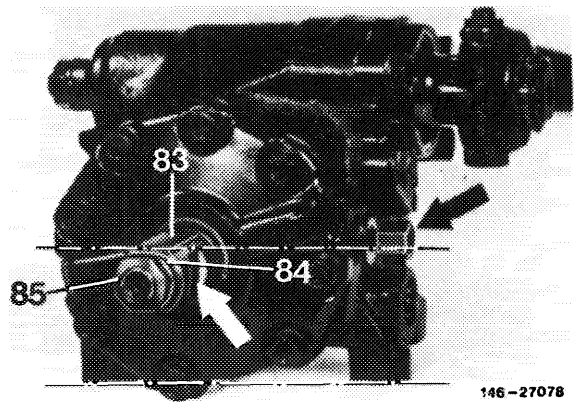


113 Place thrust ring (74) on cap and mount locking ring (75). Make sure that the locking ring is correctly seated in groove.



114 Screw center position control screw into steering (arrow), Slip dowel sleeve (83) onto steering worm so that the two surfaces are in parallel with fastening points of steering and the milled cut is pointing toward pitman arm (arrow).

115 Slip on supporting ring (84) and tighten nut (85) to 50 Nm.

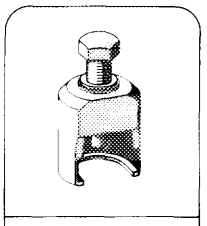


116 Unscrew center position check screw and screw in closing plug with sealing ring.

Note: Items 114 – 116 are valid for steering 765.900 only.

117 Install pitman arm (46-510).

Special tools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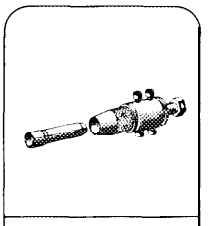
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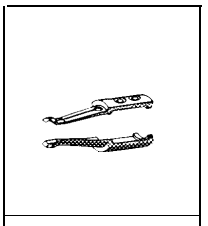
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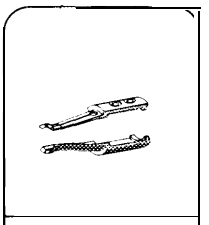
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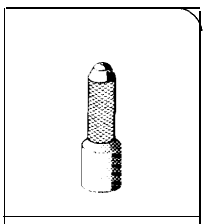
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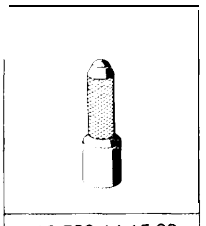

116 589 14 15 00

Self-made tools

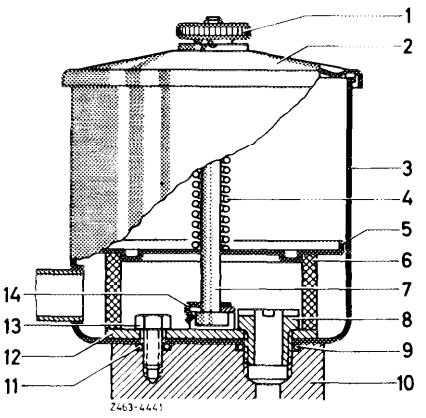
Punch	refer to section B item 17, Note
Assembly sleeve	refer to section B and C item 10, Note

A. Vickers power steering pump VP 27

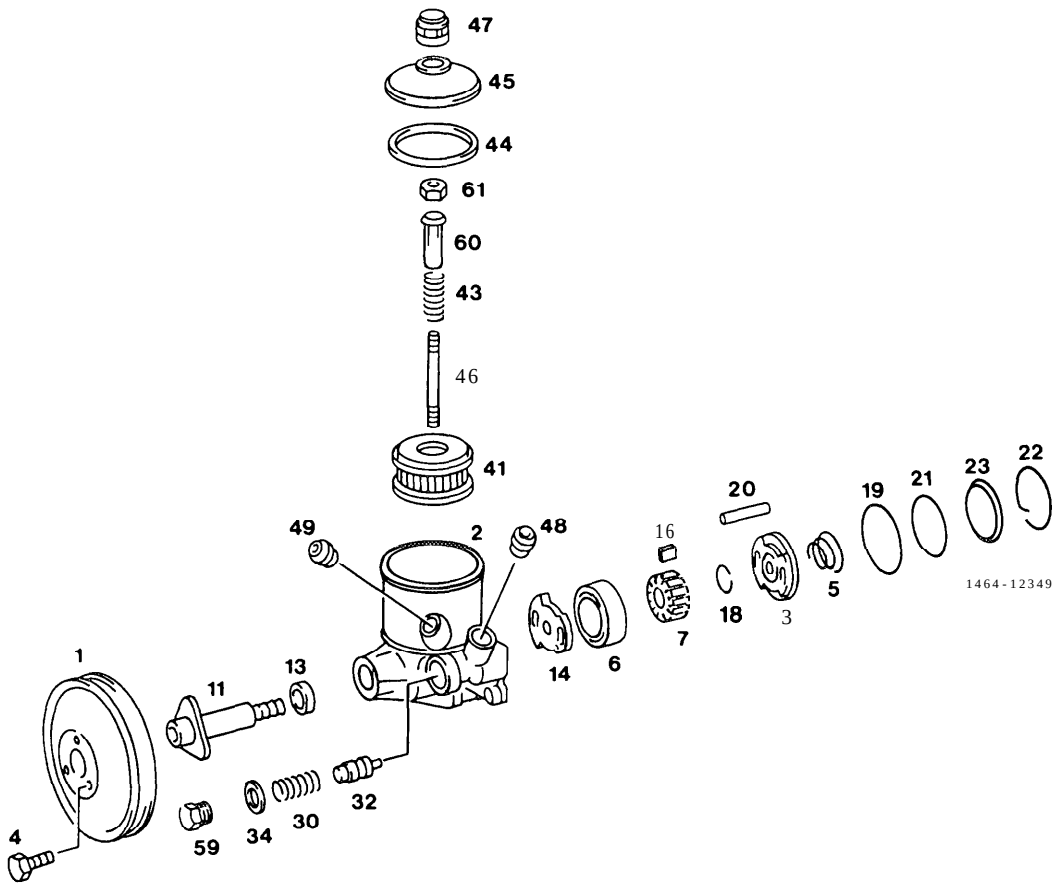
Disassemly

Supply tank

1 On power steering pump with screwed-on supply tank unscrew knurled nut (1) and remove closing cover (2) with paper gasket. Remove compression spring (4), settling plate (5) and filter ring (6). Unscrew hex. screw (13) and hollow screw (8). Remove supply tank (3) and O-rings (9 and 11) from pump housing (10).



D. Vickers power steering pump VT 60 and ZF power steering pump ZL 60



1	Pulley	
2	Pump housing	Check for damage
3	Pressure plate at cover end	Check ground surface for wear
4	Hex. head screws	
5	Compression spring	
6	Cam ring	Check slide surface for wear
7	Rotor with blade	Check slide surfaces for wear
11	Drive shaft	Check for wear
13	Radial sealing ring	Renew
14	Pressure plate at drive end	Check ground surface for wear
16	Blade	Check for easy operation
18	Locking ring	
19	O-ring	Renew
20	Cyl. pins	
21	O-ring	Renew
22	Circlip	
23	Cover	

30	Compression spring	
32	Volume control valve	Check ground surfaces for wear
34	Sealing ring	Renew
41	Filter pack	Check for contamination
43	Compression spring	
44	Gasket	
45	Closing cap	
46	Stud	
47	Vent cap	
48	Sealing cone	Renew distorted sealing cone
49	Sealing cone	Renew distorted sealing cone
59	Closing plug	
60	Plastic sleeve	
61	Self-locking hex. nut	Renew

Self **-made tool**

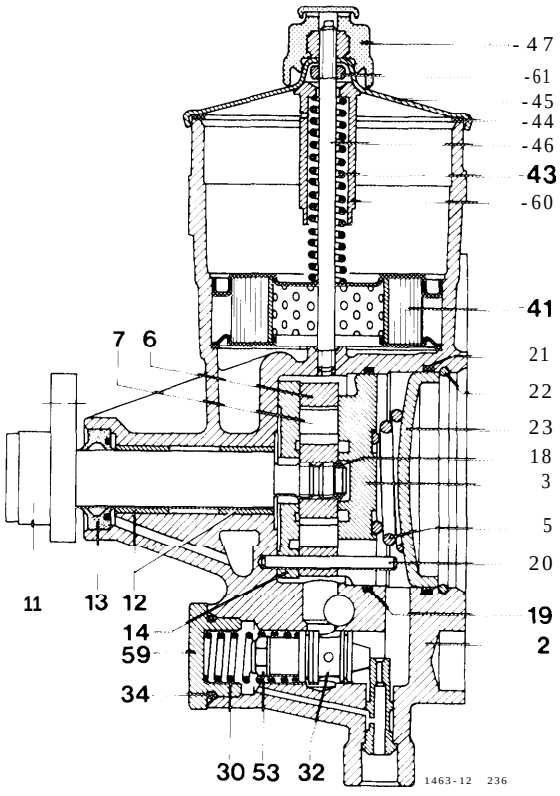
Punch	refer to Fig. item 4, Note

Disassembly

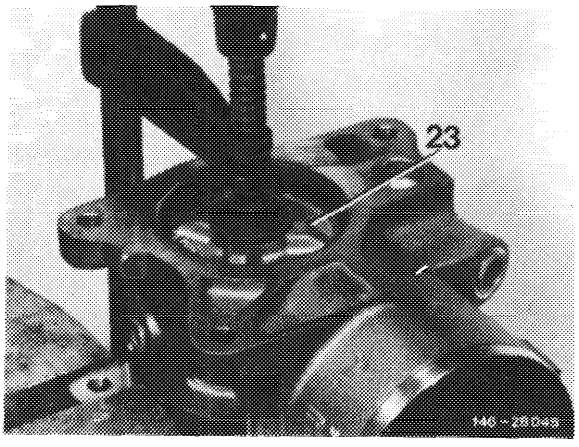
1 Unscrew vent cap (47), remove closing cap (45).

2 Unscrew self-locking hex. nut (61) from stud (46), remove plastic sleeve (60), spring (43) and filter pack (41).

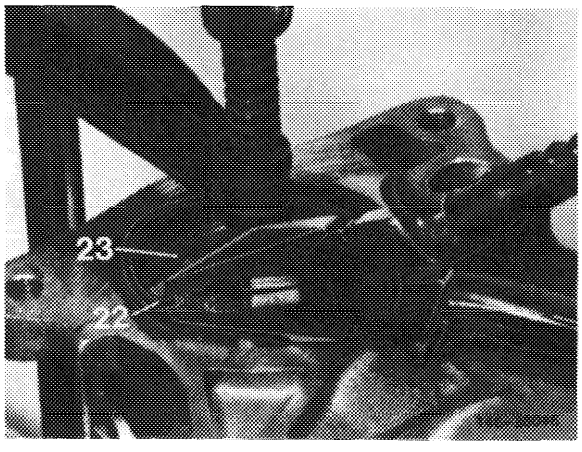
2 Pump housing
3 Pressure plate at cover end
5 Compression spring
6 Cam ring
7 Rotor with blade
11 Drive shaft
12 Bearing bushings
13 Radial sealing ring
14 Pressure plate at drive end
18 Locking ring
19 O-ring
20 Cyl. pin
21 O-ring
22 Circlip
23 Cap
30 Compression spring
32 Volume control valve
34 Sealing ring
41 Filter pack
43 Compression spring
44 Gasket
45 Closing cap
46 Stud
47 Vent cap
53 Valve screw
59 Closing plug
60 Plastic sleeve
61 Self-locking hex. nut



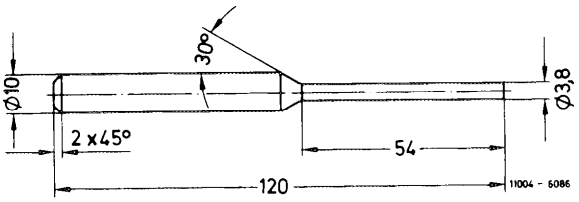
3 Force cover (23) slightly into housing by means of a hand press or a screw clamp.



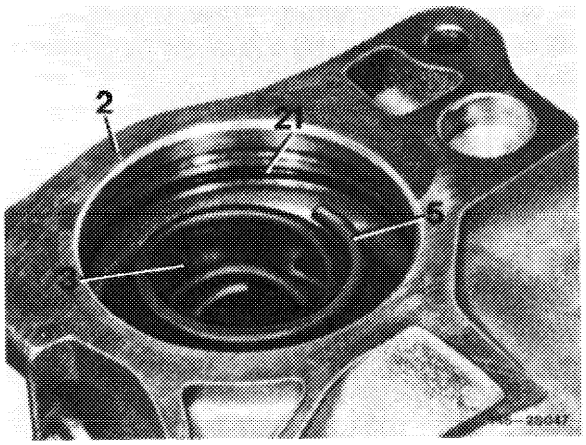
4 Take circlip (22) out of housing. Remove cover (23).



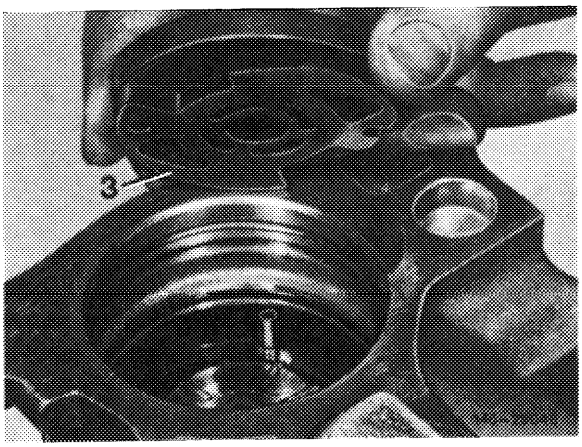
Note: On Vickers power steering pump, remove circlip with self-made punch through bore in housing.



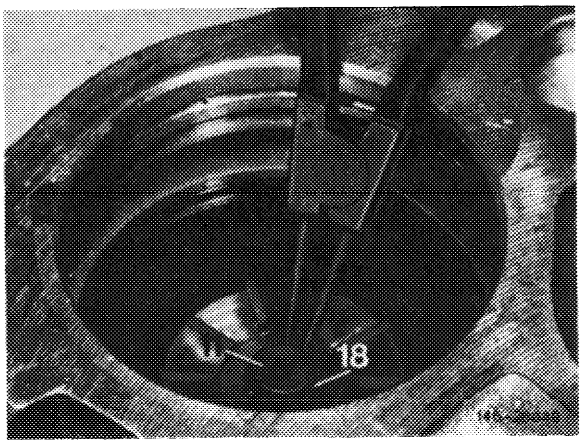
5 Remove spring (5) and O-ring (21) from pump housing (2).



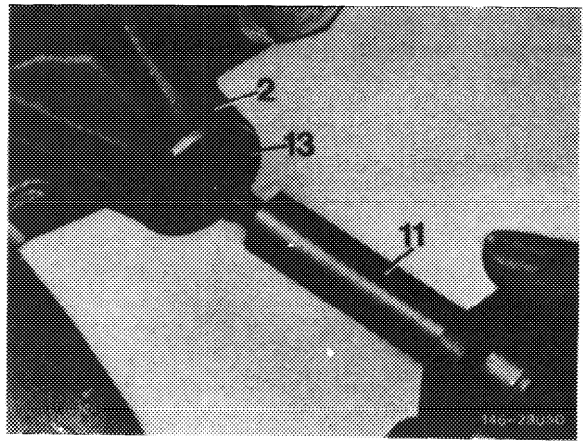
6 Remove pressure plate (3).



7 Take locking ring (18) out of drive shaft (11).



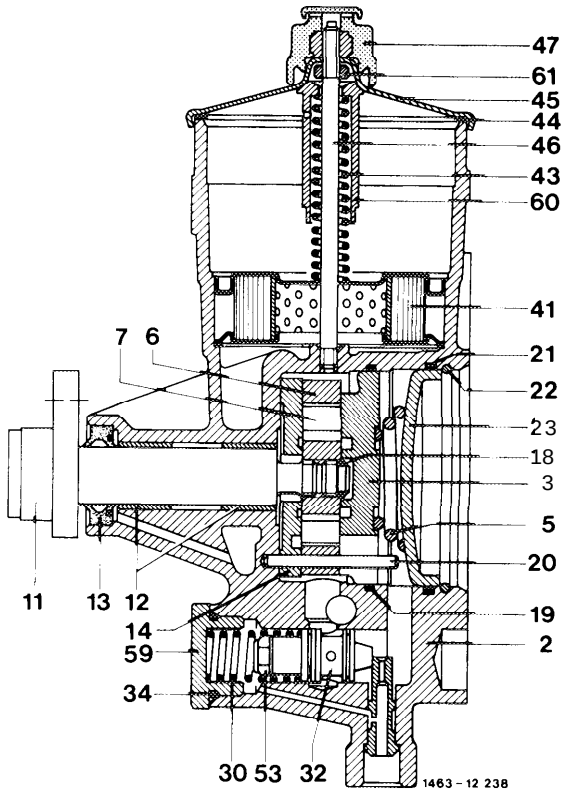
8 Loosen drive shaft by means of light hammer blows from rotor, remove drive shaft (11).



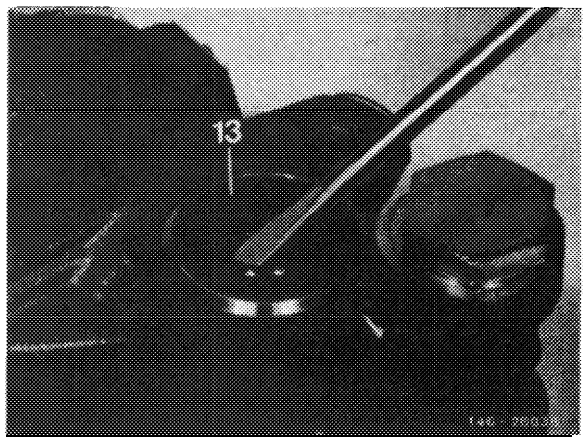
9 Remove rotor (7) with its 10 blades, cam ring (6) and pressure plate (14) at drive end from pump housing.

10 Remove cyl. pins (20).

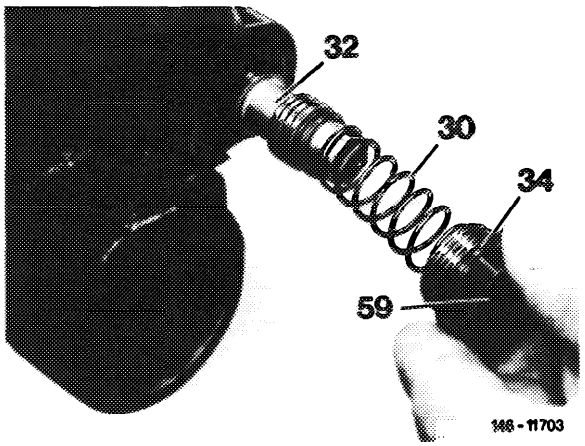
2 Pump housing
3 Pressure plate at cover end
5 Compression spring
6 Cam ring
7 Rotor with blade
11 Drive shaft
12 Bearing bushings
13 Radial sealing ring
14 Pressure plate at drive end
18 Locking ring
19 O-ring
20 Cyl. pin
21 O-ring
22 Circlip
23 Cover
30 Compression spring
32 Volume control valve
34 Sealing ring
41 Filter pack
43 Compression spring
44 Gasket
45 Closing cap
46 Stud
47 Vent cap
53 Valve screw
59 Closing plug
60 Plastic sleeve
61 Self-locking hex. nut



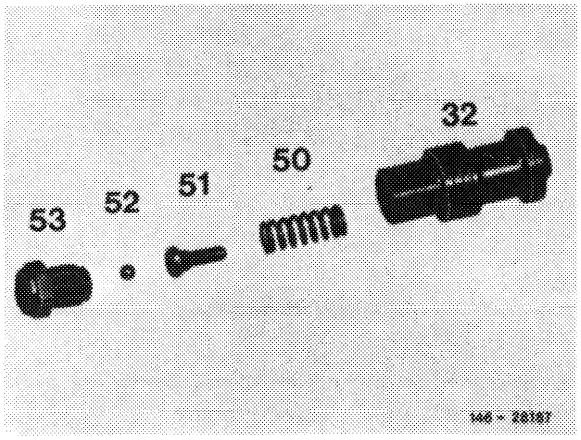
11 Force out radial sealing ring (13) by means of a screwdriver.



12 Screw closing plug (59) out of housing. Remove compression spring (30) and volume control valve (32).



13 Clamp volume control valve (32) at its unground part into vice and unscrew valve screw (53). Remove valve ball (52), valve cone (51) and compression spring (50) from volume control valve.



Repair sets	Vickers (65 bar)	ZF (65 bar)	Vickers (85 bar)
Gasket set	0004600461	0005868446	0004600461
Pump element	00046002 28	00046003 28	00046007 28
Drive shaft	000460 17 12 [1] 000 460 20 12 [2]	000 466 15 20 [3] 000 466 22 20 [4]	0004602012
Volume control valve	0004600684	00058687 46	0004601984

For power steering pump: [1] 201 460 06 80
201 4600980
[2] 201 460 1580
[3] 201 460 05 80
[4] 201 460 14 80

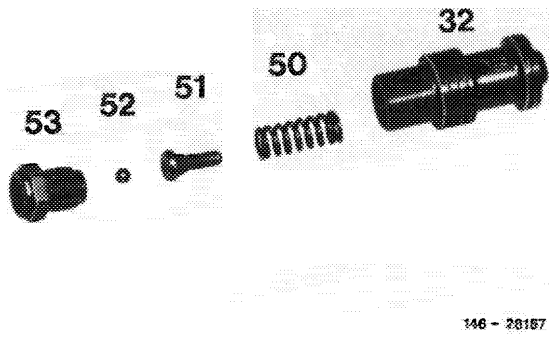
Note

When reconditioning power steering pump, use repair set of the same manufacturer.

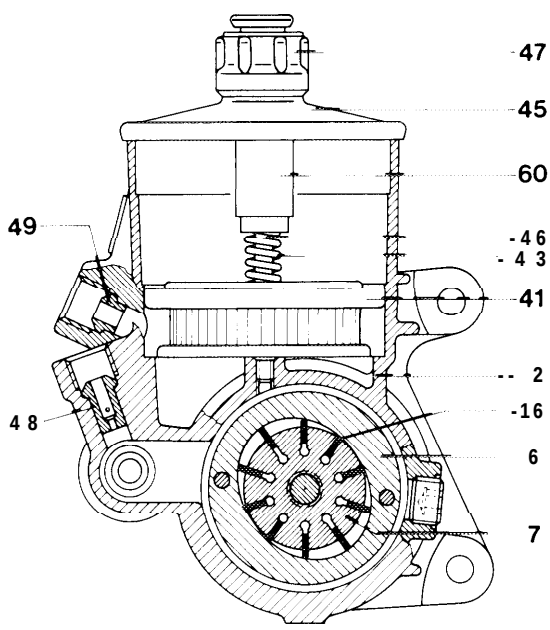
1 Check ground surfaces of volume control valve (32) and bore in pump housing for wear and damage. If slide surfaces are showing score marks, renew complete power steering pump. Never replace volume control valve only.

2 Check blades (16) in grooves of rotor (7) for easy sliding in rotor. Check slide surface of blade on cam ring (6) for wear. If required, recondition power steering pump by using repair set "pump element".

Note: There should be no noticeable marks on slide surface of cam ring, since the delivery capacity and quiet running of power steering pump depend on the absence of such marks.



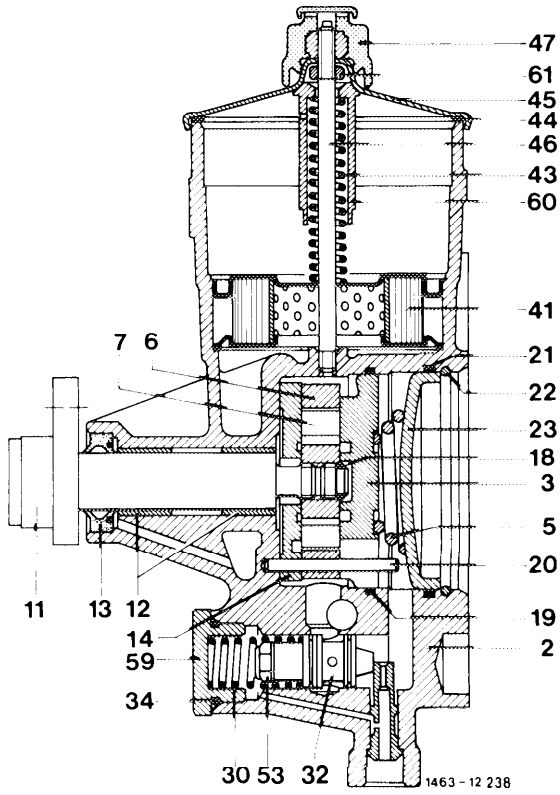
146 - 28157



2 Pump housing
6 Cam ring
7 Rotor
16 Blade
41 Filter pack
43 Compression spring
45 Closing cap
46 Stud
47 Vent cap
48 Sealing cone
49 Sealing cone
60 Plastic sleeve

3 Check ground surface of both pressure plates (14) and (3). If the pressure plates are worn, recondition power steering pump by **using repair set** "pump **element".**

2 Pump housing
3 Pressure plate at cover end
5 Compression spring
6 Cam ring
7 Rotor with blade
11 Drive shaft
12 Bearing bushings
13 Radial sealing ring
14 Pressure plate at drive end
18 Locking ring
19 O-ring
20 Cyl. pin
21 O-ring
22 Circlip
23 Cover
30 Compression spring
32 Volume control valve
34 Sealing ring
41 Filter pack
43 Compression spring
44 Gasket
45 Closing cap
46 Stud
47 Vent cap
53 Valve screw
59 Closing plug
60 Plastic sleeve
61 Self-locking hex. nut



4 Check drive shaft (11) and bearing bushings (12) for wear. If required, install bushings (12) from repair set "drive shaft".

5 Check both sealing cones (connection high-pressure expanding hose, return pipe). Renew distorted sealing cones. For this purpose, cut a thread of 7 or 10 mm for a few turns into sealing cone. Then pull sealing cone out of housing by means of a 7 or 10 mm screw.

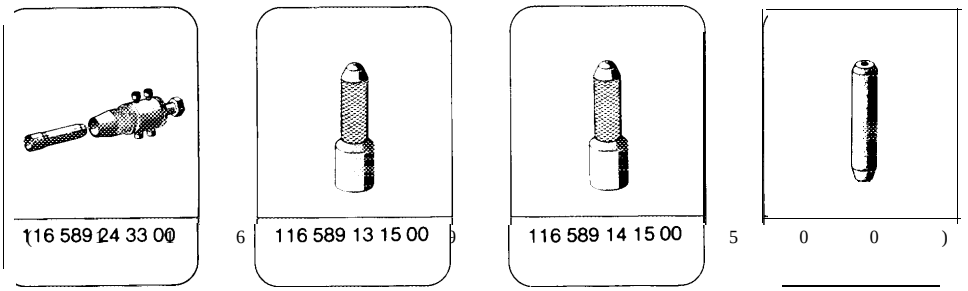
6 Position new sealing cone in housing and force into housing by screwing high-pressure expanding hose or return pipe into housing.

Data

End play of drive shaft	on new pumps	max. 0.7
	on used pumps	max. 1 .O

Tightening torques	Nm
Hex. screws on pump housing	35-40
Hollow screw for fastening supply tank	35-40

Special tools



Self -made tools

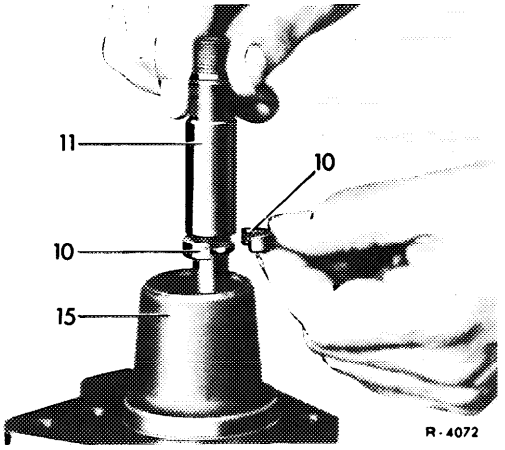
Pressing-in tool for bearing bushing	refer to Fig. item 2, note
Assembly sleeve	refer to section B fig. item 9, note
Assembly mandrel for needle bearing	refer to section B fig. item 2, note
Pressing-in mandrel for radial ball bearing and radial sealing ring	refer to section C fig. item 3, note

A. Vickers power steering pump VT 27

Drive shaft and sealing ring

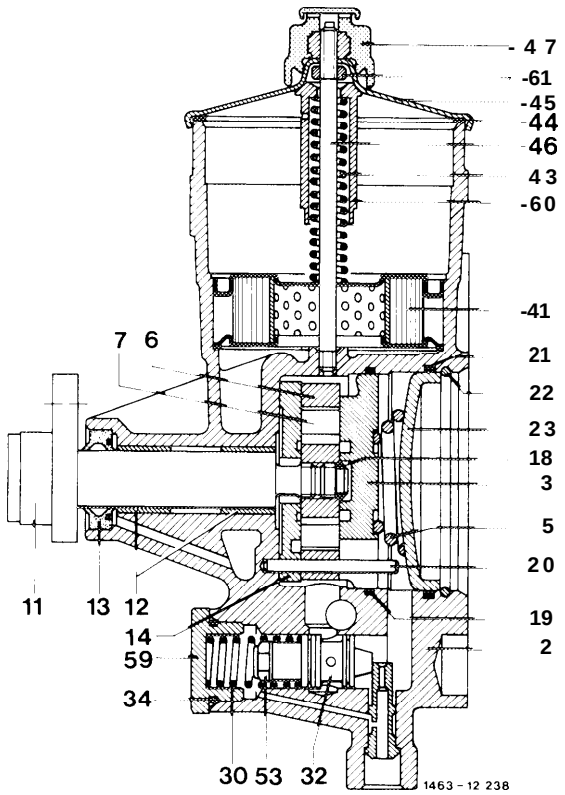
1 Place both shell halves (10) on drive shaft (11).

Note: Shell halves determine end play of drive shaft and are contained in repair set “drive shaft”.

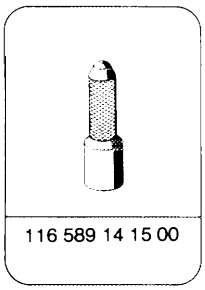


D. Vickers power steering pump VT 60 and ZF power steering pump ZL 60

2 Pump housing
3 Pressure plate at cover end
5 Compression spring
6 Cam ring
7 Rotor with blade
11 Drive shaft
12 Bearing bushings
13 Radial sealing ring
14 Pressure plate at drive end
18 Locking ring
19 O-ring
20 Cyl. pin
21 O-ring
22 Circlip
23 Cover
30 Compression spring
32 Volume control valve
34 Sealing ring
41 Filter pack
43 Compression spring
44 Seal
45 Closing cap
46 Stud
47 Vent cap
53 Valve screw
59 Closing plug
60 Plastic sleeve
61 Self-locking hex. nut



Special tool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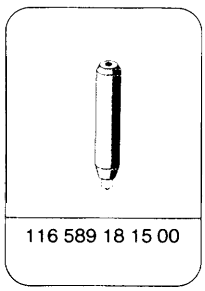
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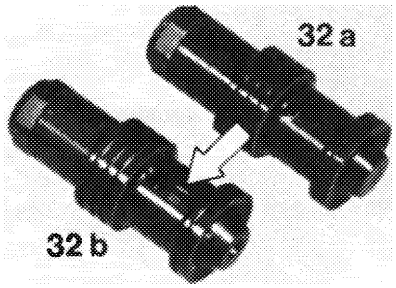
Note

Prior to assembly, moisten all parts with manual transmission oil.

1 **With a new volume control valve pay attention to correct opening pressure of pressure relief valve. Also pay attention to manufacturer, as well as to the mark (arrow) stamped into ZF valve.**



32a Vickers valve
32b ZF valve

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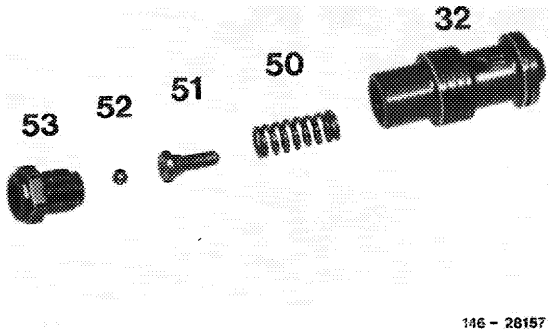
2 Clean volume control valve prior to assembly, immerse into manual transmission oil and insert into housing bore. The valve should slide easily in housing bore.

3 Install pressure relief valve into volume control valve. Insert compression spring (50), valve cone (51) and valve ball (52).



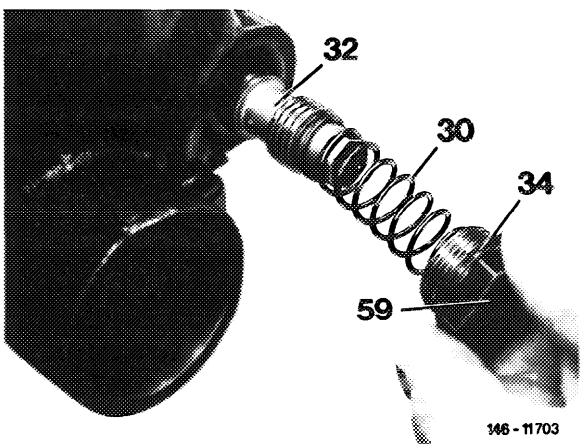
146 - 28157

4 Clamp volume control valve at its unground part into vice and tighten valve screw.

5 Insert volume control valve (32) and compression spring (30) into housing.

Note: Install volume control valve in such a manner that the valve screw of the pressure relief valve points toward closing plug.

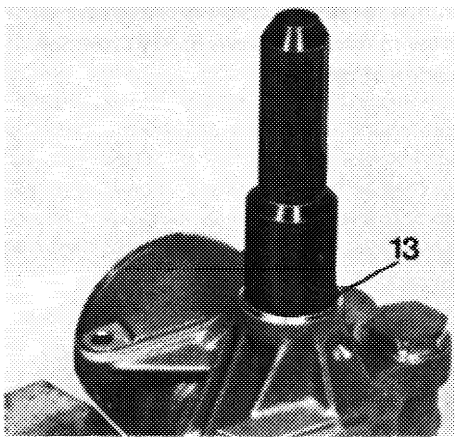
6 Screw in closing plug (59) with a new sealing ring and tighten.



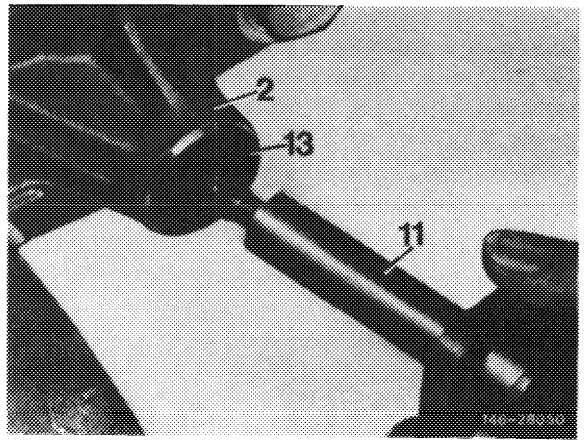
146 - 11703

7 Press radial sealing ring (13) into housing by means of a punch.

Special tool 116 589 14 15 00

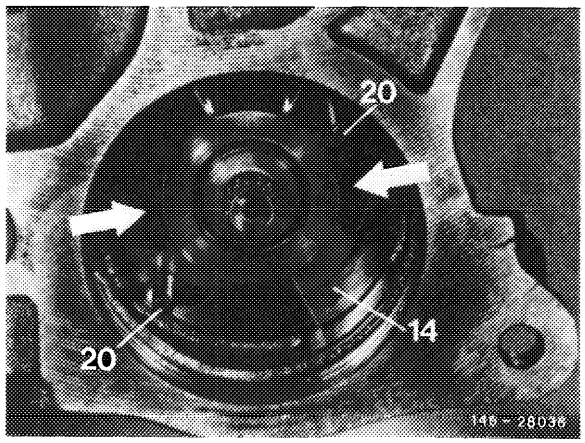


8 Slide drive shaft (11) into housing.



9 Insert pressure plate (14) at drive end with recesses (refer to arrows) toward rotor.

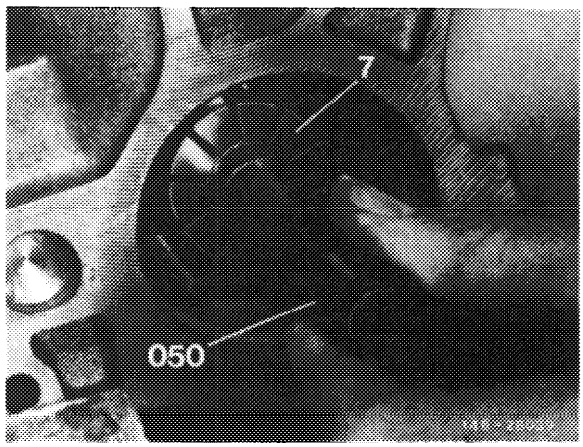
10 Insert cyl. pins (20).



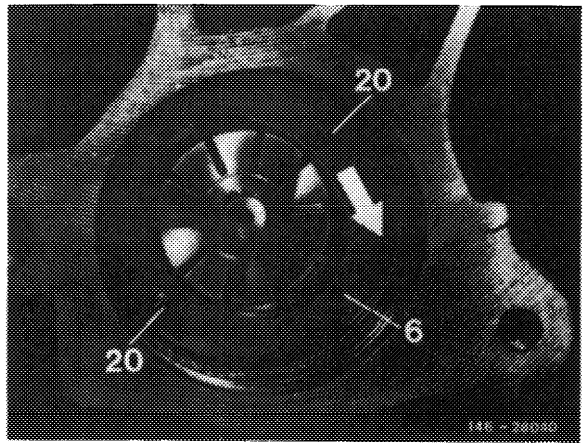
11 Insert rotor (7) into drive shaft. Chamfer on inside diameter of rotor toward pressure plate at drive end.

12 Insert locking ring (18) into groove of drive shaft (11) by means of assembly mandrel (050).

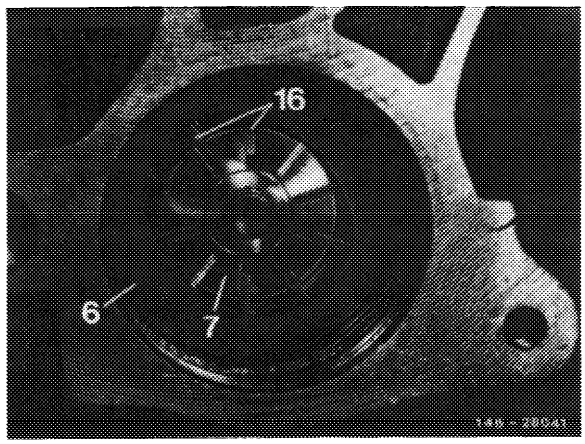
Special tool 116 589 18 15 00



13 Place cam ring (6) on cyl. pins (20) with cast-in directional arrow in upward direction. Pay attention to correct location of cam ring.



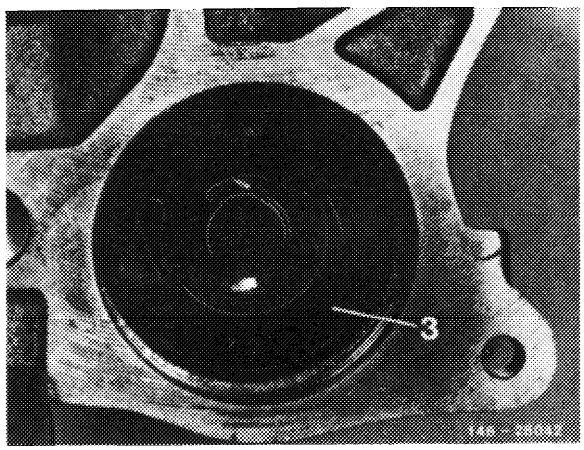
14 Insert blade (16) (10 each) with rounded off, metallically glistening sides toward cam ring (6) into rotor (7).



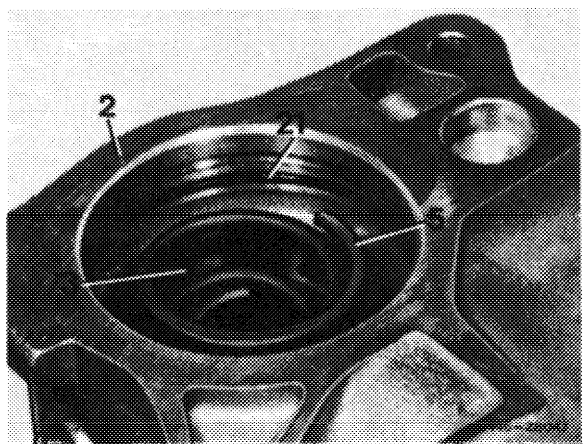
15 Insert O-ring (19) into housing.

Note: The O-rings (19) and (21) have different diameters. The O-ring (19) with small diameter seals the pressure plate (3), the larger O-ring (21) seals cover (23) in relation to housing.

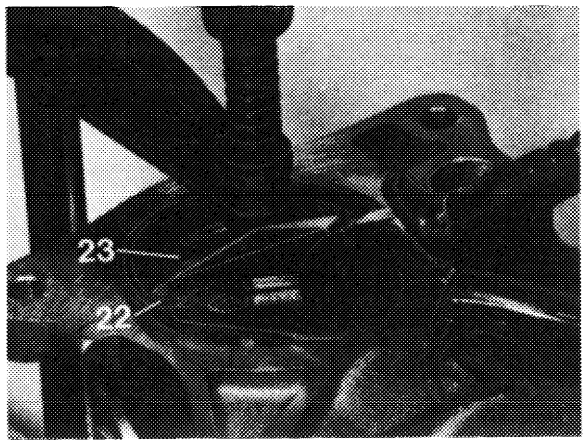
16 Insert pressure plate (3) into housing.



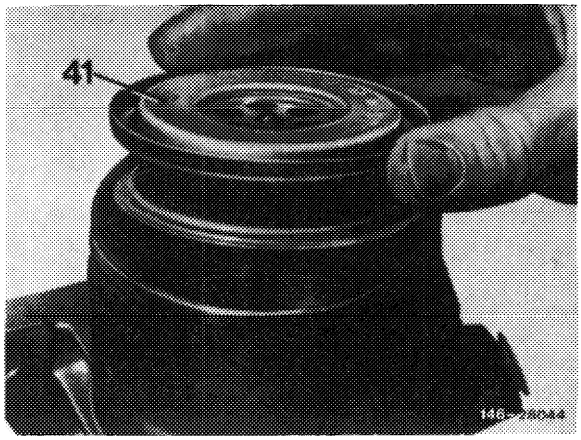
17 Insert O-ring (21) into housing. Place compression spring (5) on pressure plate (3).



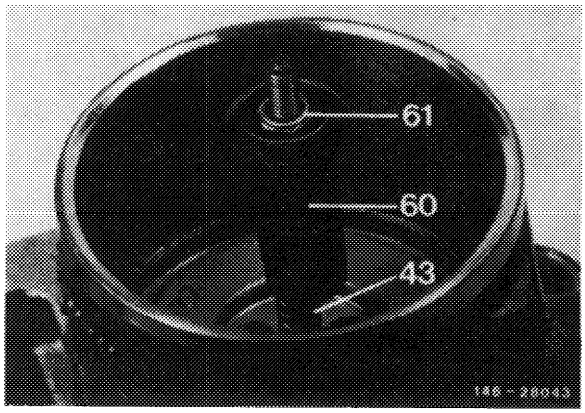
18 Mount cover (23). Then press cover slightly into housing by means of a hand press or a screw clamp. Insert circlip (22) into groove of housing, pay attention to correct location of ring.



19 Insert filter pack (4).



20 Insert spring (43) and plastic sleeve (60), compress slightly, then mount new self-locking hex. nut (61). Mount closing cover, screw on vent cap.



Job No.

Battery

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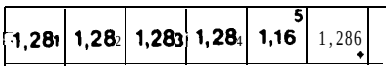
A. Testing battery

Visual checkup		for external leaks	
Check acid level **If the acid** level must be corrected by adding distilled water, recharge battery afterwards up to gassing.		**should reach** up to **mark.** On batteries on which the fluid level cannot be seen, keep adding distilled water until water is no longer flowing off at overfill guard.	
Battery state of charge	Climatic condition	Density at 20 °C (kg/dm³)	Procedure
charged	normal tropics	1.28*) 1.23*)	—
half charged	normal tropics	1.20 1.16	recharging required
discharged	normal tropics	1.12 **1.08**	recharge immediately
*) **Tolerance ± 0.01 kg/dm³**			
Test acid density in individual cells		Acid density should be the same in all cells.	

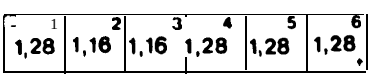
Example for defective batteries

a) Acid density in one cell deviates noticeable in downward directions.



Condition: Short-circuit in cell 5

b) Acid density deviates in two adjacent cells (e.g. 2 and 3) clearly from remaining measuring values in downward direction.



Condition: Leak in cell wall between cell 2 and 3.

The leaking cell wall and the connector operate as a conductor through which the cells are discharged.

Testing battery under load (perform only if no fault has been found during previous tests)		This test is possible only at uniform acid density of cells and an acid density of at least 1.24 kg/dm³				
Capacity	Ah	55	62	72	90	92
Load current (approx. 3-times capacity)[1]	A	165	190	265	270	280
Minimum voltage[2] after 10 s at acid density	V	9				10
	kg/dm³	1.24				1.28

1) **At 72 Ah higher.**
2) **After 10 seconds the test voltage should attain a constant value. Slight deviations have no influence. If the voltage drops considerably or completely collapses, the battery is defective.**

B. Charging battery

Batteries can be charged with DC only. For charging, the battery is separated from electric circuit of vehicle and connected to a charger:

Positive pole (+) of battery to positive pole of charger,

negative pole (—) of battery to negative pole of charger.

The charging current (A) should amount to 10 % of battery capacity, e.g. at 55 Ah a charging current of 5.5 A.

For recharging, higher currents may be employed up to start of gassing (2.4 V/cell).

Charge until acid density and charging voltage are no longer increasing within 2 hours. Note that the measuring value of the acid density changes by 0.01 per 15 °C temperature difference. If, for example, an acid temperature of 34 °C is measured, the simultaneously measured acid density should be increased by 0.01 to obtain the value referenced to 20 °C.

C. Handling battery when laying up vehicle

Prerequisite: Battery state of charge in order
Acid density min. 1.26 kg/dm³ (tropics 1.21 kg/dm³)

1. Disconnect negative terminal of battery.

This will prevent discharging by rest potential consumers or time clock.

2. Recharge battery after 3 months (acid density 1.28 kg/dm³, tropics 1.23 kg/dm³).

Attention!
Never leave battery standing about in discharged condition, since otherwise the plates will sulfate.

Sulfated plates will cause initial damage to battery and will lead to early breakdown.

Antifreeze in charged condition

		normal	tropics
charged		— 65	— 40
half-charged	in °C	— 30	— 13
discharged		— 12	- 6

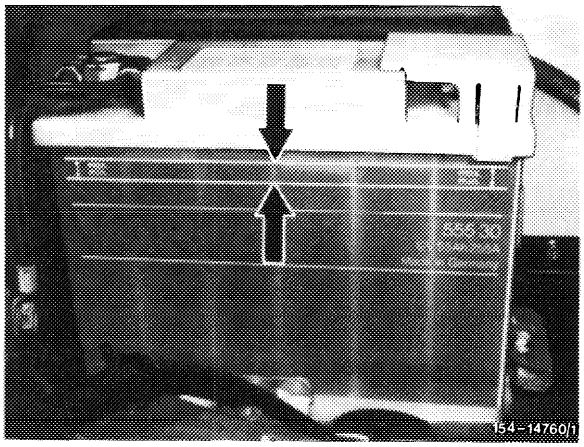
D. Batteries with overfill protection

These batteries are provided with rubber diaphragm elements and vent ducts in filter neck of battery cover. This will prevent an increase of fluid level above "max." mark when the batteries are filled.

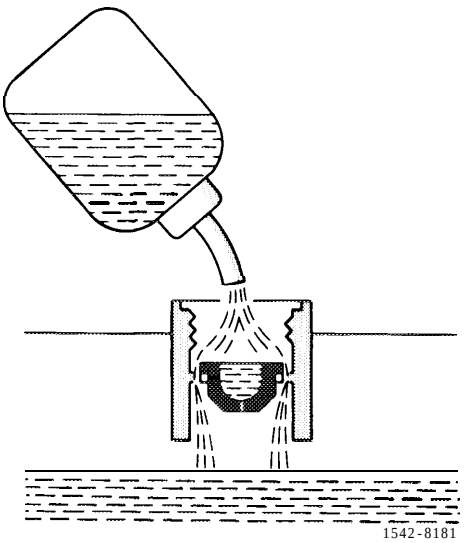
When refilling with distilled water, make sure that the diaphragm is not punched through or removed. Also make sure that on batteries with overfill protection no cell closing plug of former batteries without overfill protection is used. This type of cell closing plug has a vent bore at the top in cover.

Checking fluid level and adding distilled water

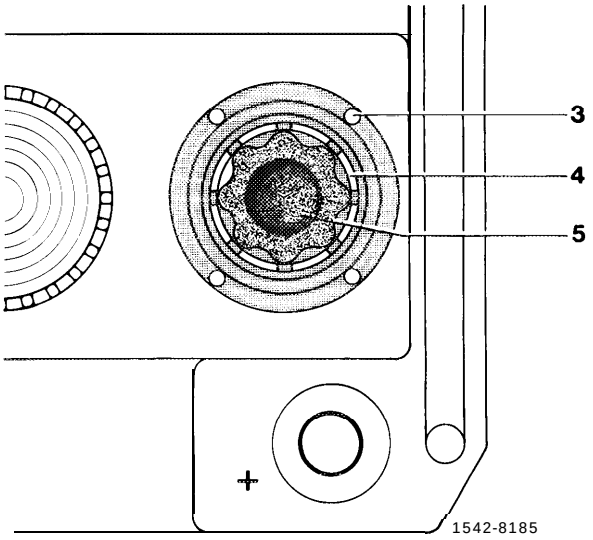
On batteries with overfill protection the fluid level is determined by means of the marks on outside of battery.



Refilling with distilled water

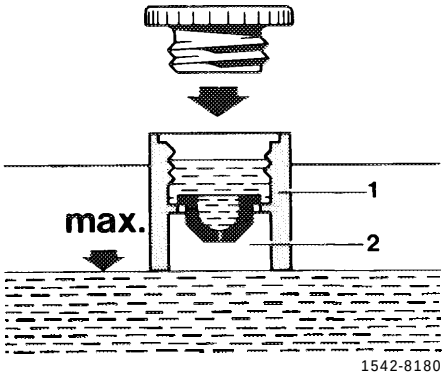


The distilled water flows through circularly located slots (4) into cell. The air displaced from cell flows through 4 vent bores (3) into the open air.



3 Vent bores
4 Filling in slots
5 Diaphragm

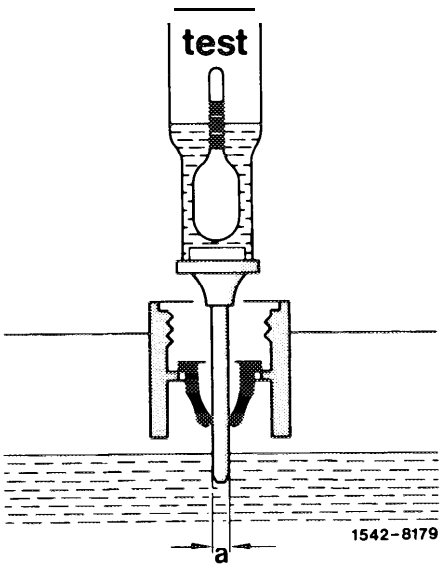
When the fluid level is at “max.” mark it will simultaneously close the vent ducts. As a result, the air can no longer escape and an air cushion (2) is established in cell. This air cushion prevents that additional fluid can flow into cell from filler chamber. The battery is filled up to max. capacity.



1 Vent duct
2 Air cushion

Checking acid density

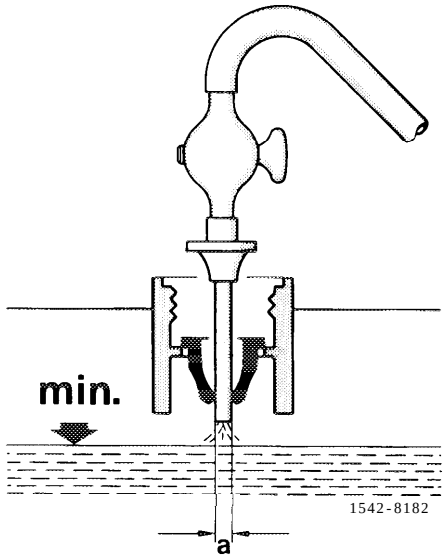
To check acid density, insert syphon through triple-slotted diaphragm and remove required quantity of fluid. Upon removal of syphon, the diaphragm will again be watertight.



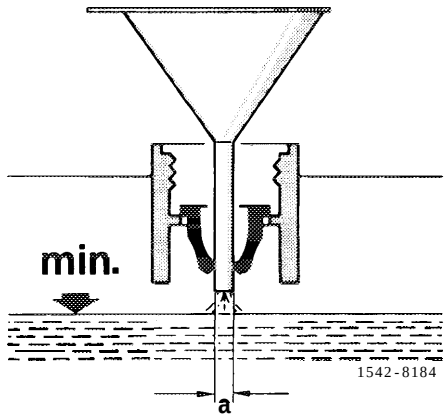
a = max. 9 mm

Initial filling of battery with acid

During initial filling with acid insert the filling device or a conventional funnel through diaphragm and fill battery up to “min” mark.

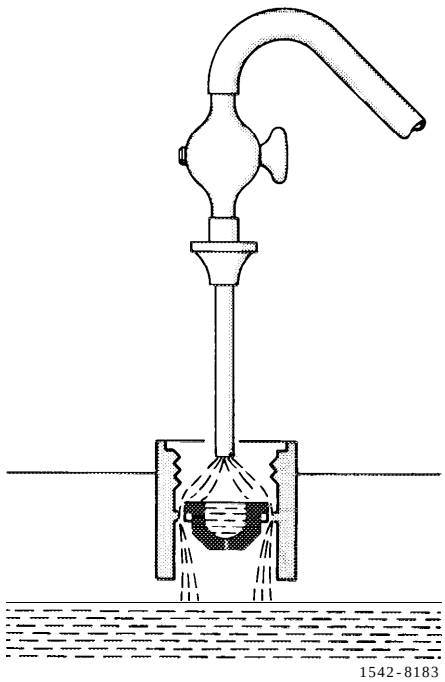


a = max. 9 mm



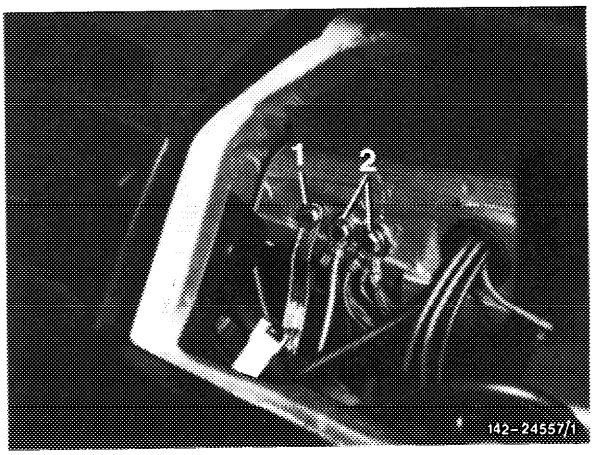
Continue filling in acid up to “max”. mark through slots with diaphragm closed.

Note: If a battery with overfill protection is scrapped, remove rubber diaphragm for emptying.



Designation: W 1

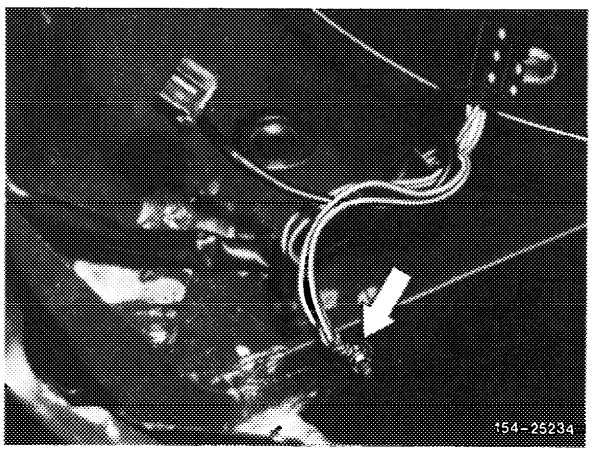
Layout: **Main ground, behind instrument cluster.**



1 Ground for central electrics
2 Ground of harnesses

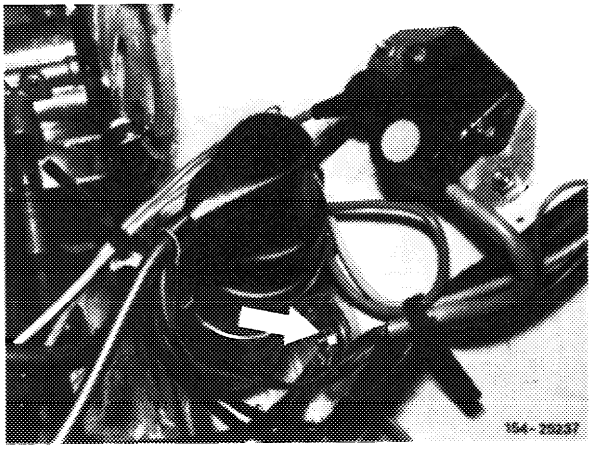
Designation: W 2

Layout: **Ground, front right at lamp unit.**



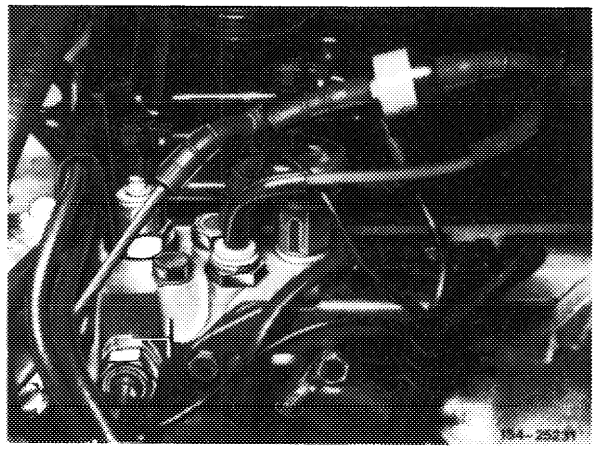
Designation: W 3

Layout: **Ground, wheelhouse front left at ignition coil.**



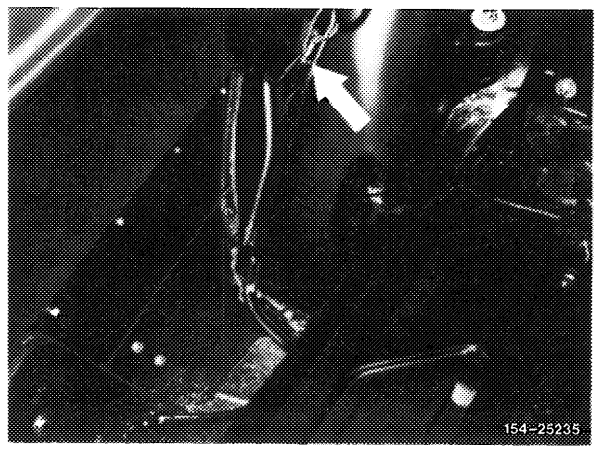
Designation: W 5

Layout: **Ground above engine (instrument screwed into engine).**



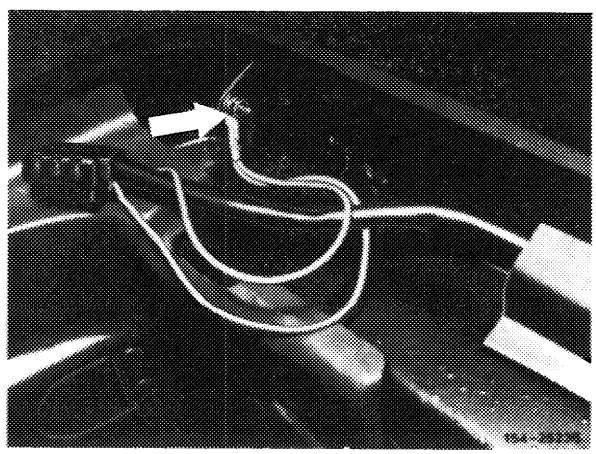
Designation: W 6

Layout: **Ground, trunk on wheelhouse, left.**



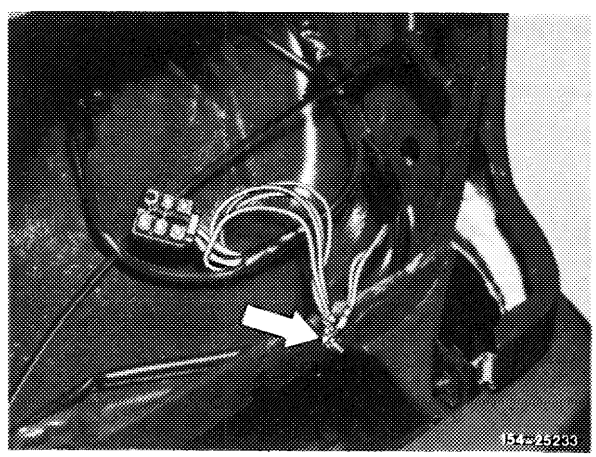
Designation: W 7

Layout: **Ground, trunk at the right near tail lamp unit.**



Designation: W 9

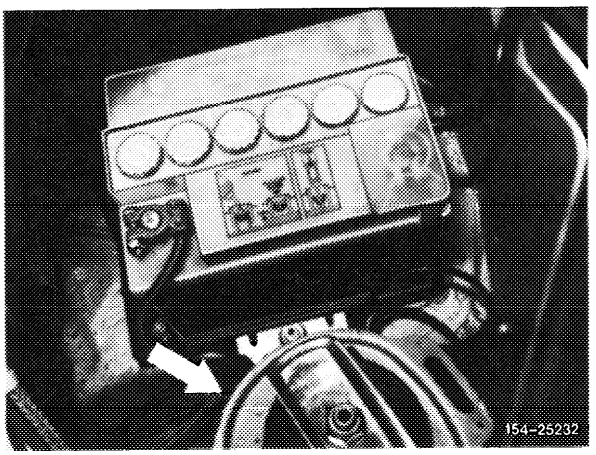
Layout: **Ground, front left at lamp unit.**



Lefthand steering vehicle

Designation: W 10

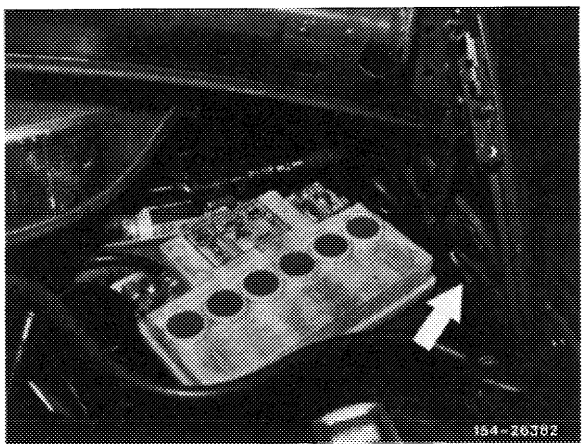
Layout: Ground, battery



Righthand steering vehicle

Designation: W 10

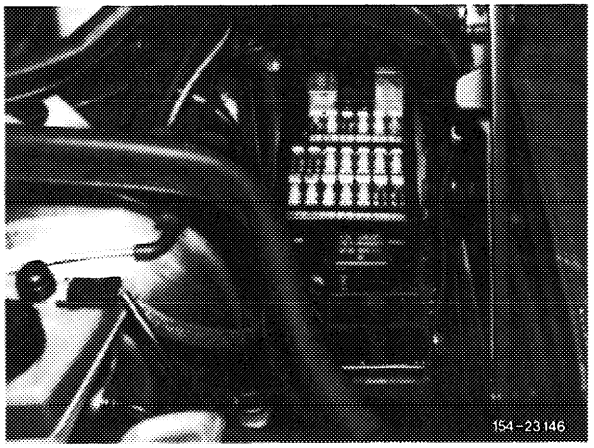
Layout: Ground, battery



A. Layout

The central electric system comprises the following components:

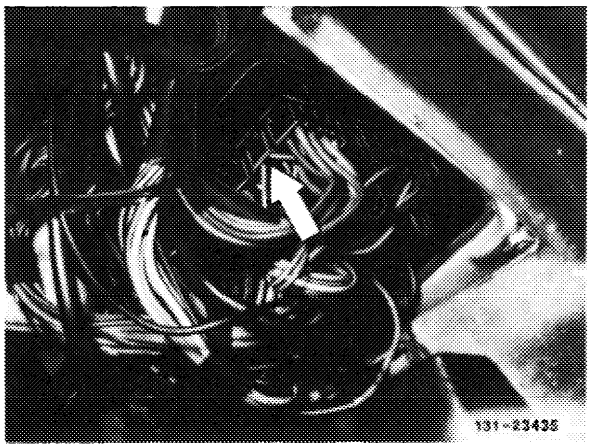
- Fuses
- Double contact with relay air conditioning
- Overvoltage protection
- Combination relay (turnsignal, heatable rear window, wiper)



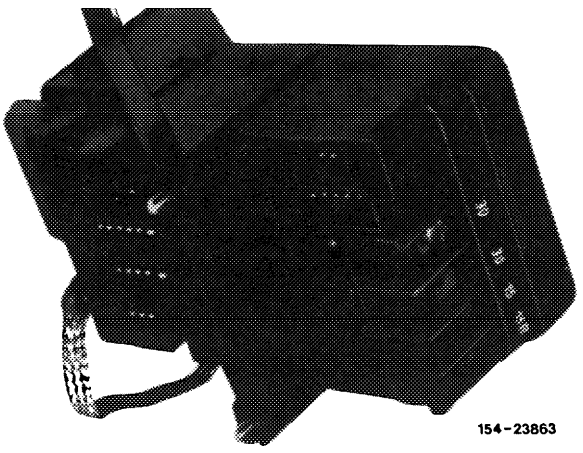
The central electric system permits subdivision of main harnesses used up to now into individual hernesses, e.g.:

- Harness for rotary light switch
- Harness for headlamp, left
- Harness for headlamp, right etc.

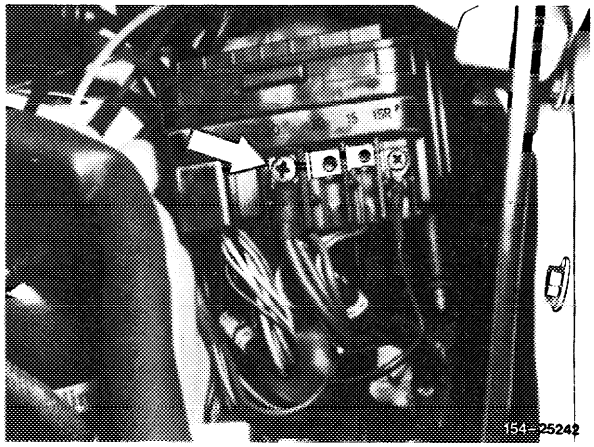
The individual harnesses are connected to central electric system by means of couplings.



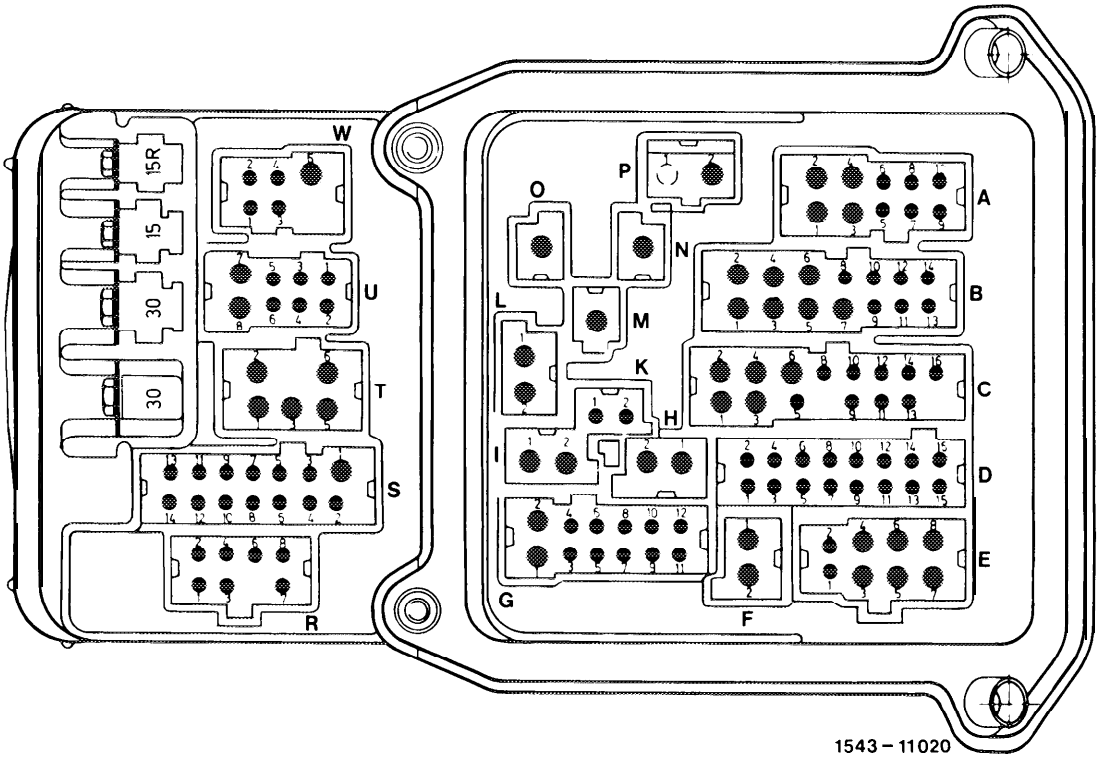
The cast in switchplate connects the individual harnesses with each other.



Feeding of terminal 30 proceeds on face of central electric system. In addition, there are other possible connections on terminal 30, 15 and 15 R.



B. Association of harness couplings to coupling fields

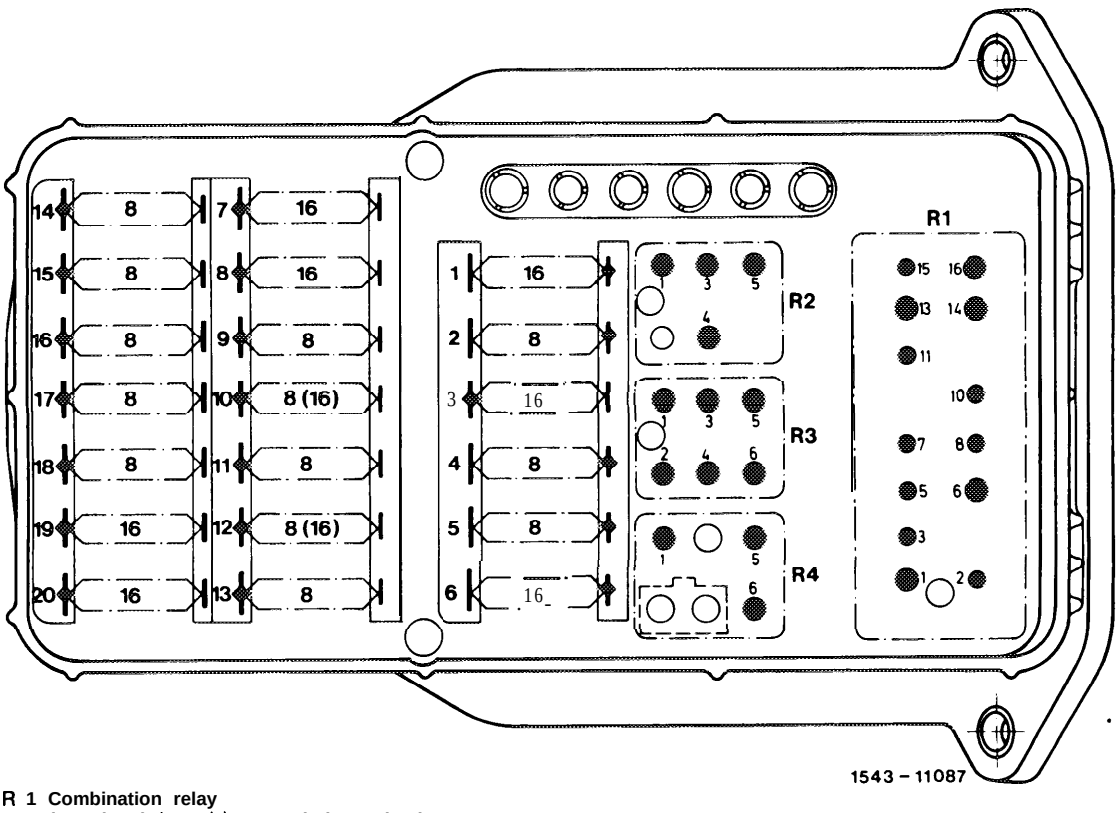


A Interior
B Turnsignal (flasher) switch
C Tail lamp units
D Instrument cluster
E Ignition starter switch
F Coupling with diode
((USA) coupling with bridge)
G Rotary light switch
H Vacant
Electric window opener
K Door contact
Lug, terminal 15/30
M ABS ((USA) vacant)
N Slide roof
O Interior/air conditioning
P Relay overvoltage protection
R Headlamp, right
S Headlamp, left
T Wiper motor
U Motor
W Air conditioning (engine side)

C. Layout of screw connections

Lines to	Cross section mm^2	Color	Engine version
Terminals 30, non-fused			
Cable connector engine	6	red	injection engine carburetor engine
Fuel pump relay	2.5	red	injection engine
Relay cutoff valve	0.75	red	carburetor engine
Relay intake manifold heater	2.5	red	carburetor engine
ABS (except USA) (special equipment):			
Relay return pump	4	red	
Relay magnetic valves	2.5	red	
Auxiliary heater (special equipment):			
Fuse element	2.5	red	
Terminal 15, non-fused			
ABS (except USA) (special equipment):			
Indicator lamp	0.75	black/red	
Terminal 15R, non-fused			
Airbag (special equipment):			
Indicator lamp	0.75	black	
Triggering unit			

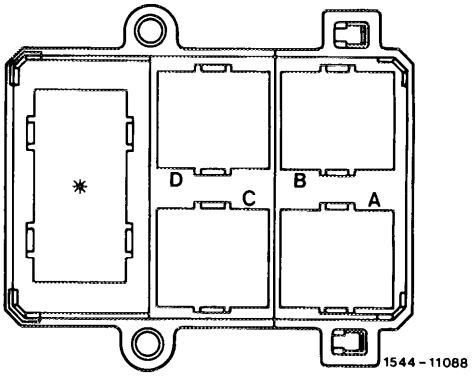
D. Layout of fuses and relays



R 1 Combination relay
(turnsignal, heatable rear window, wiper)
R2 Relay window opener
R3 Relay air conditioning
R4 Relay overvoltage protection

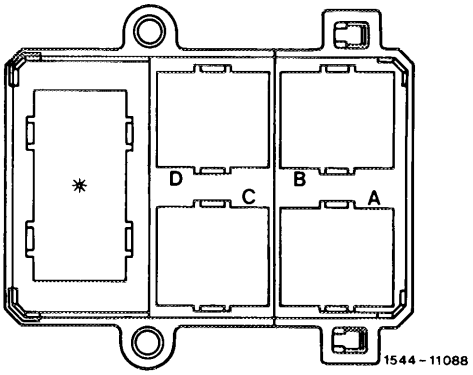
E. Layout of relays on relay holder

Note: The relay for heating intake manifold is marked in blue on face.



Standard version

A Fuse element for auxiliary heater
B Fuse element for seat adjustment
C Relay for heating intake manifold
D Relay for headlamp cleaning system
• Relay for fuel pump (injection engines only)

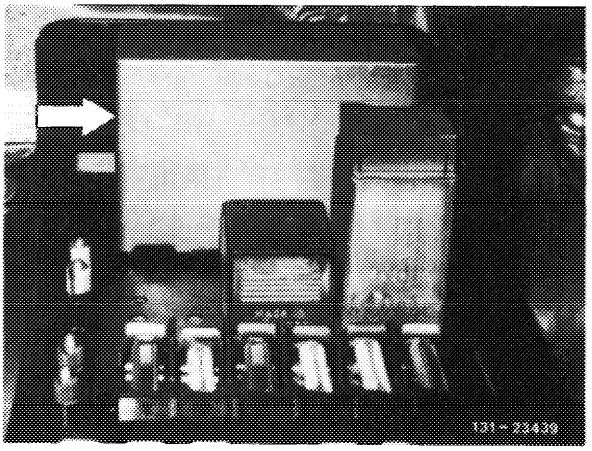


USA

A Vacant
B Fuse element for seat adjustment
C Relay for auxiliary fan 2nd stage
D Relay for comfort control, seat adjustment
• Vacant

F. Combination relay

The turnsignal flasher, the time relay of heatable rear window, as well as the interval rewiper electronics of windshield wiper are combined in one combination relay.



Note: The switched on heatable rear window is automatically switched off by combination relay below a battery voltage of approx. 11 volts.

Switching off is indicated by flashing of indicator lamp in switch of heatable rear window.

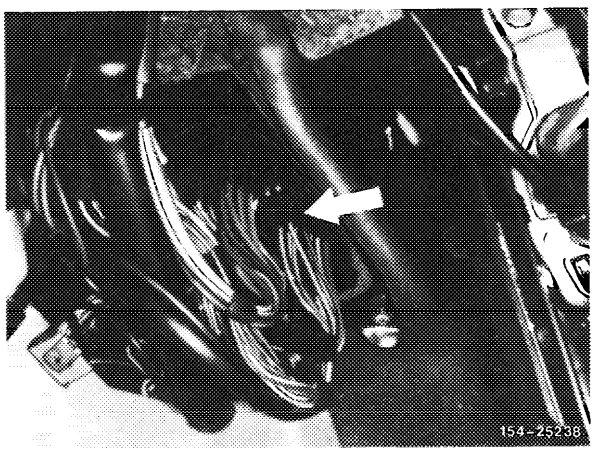
When the voltage increases to above approx. 11 volts, the heatable rear window is again automatically switched on,

Removal

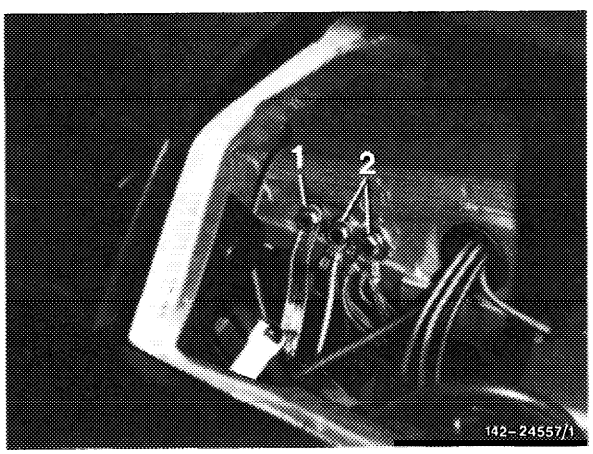
1 Disconnect negative terminal of battery.

2 Remove cover under instrument panel (68-150).

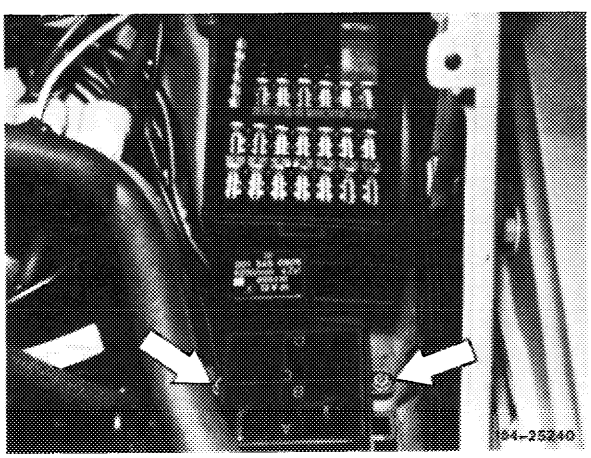
3 Pull couplings (arrow) in interior from central electrics.



4 Unscrew grounding strap (behind instrument cluster) (1).

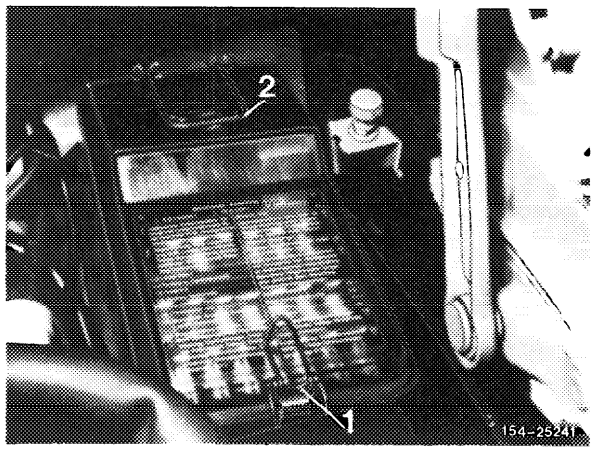


5 Remove relay holder (arrow).

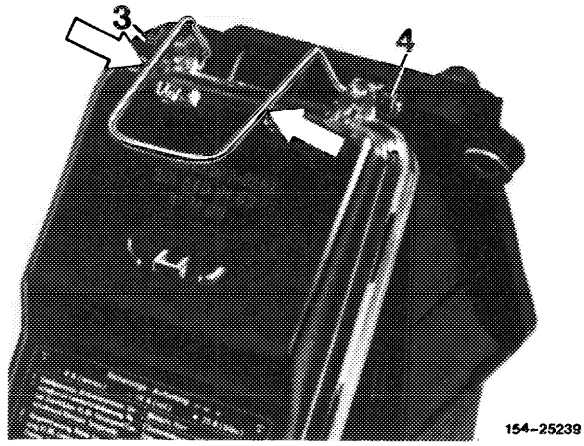


6 Open cover of central electrics on lock (1).

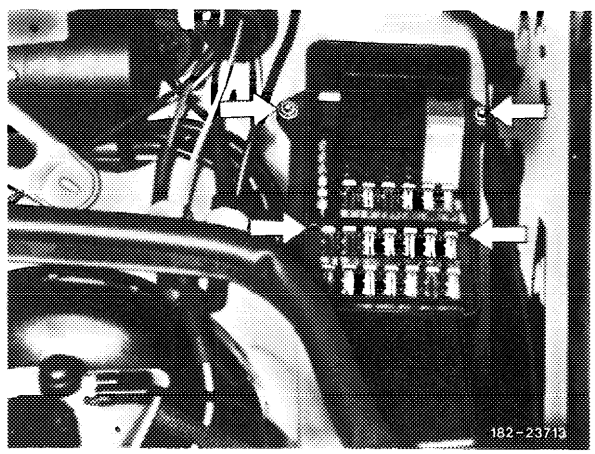
7 Unclip clamp (2).



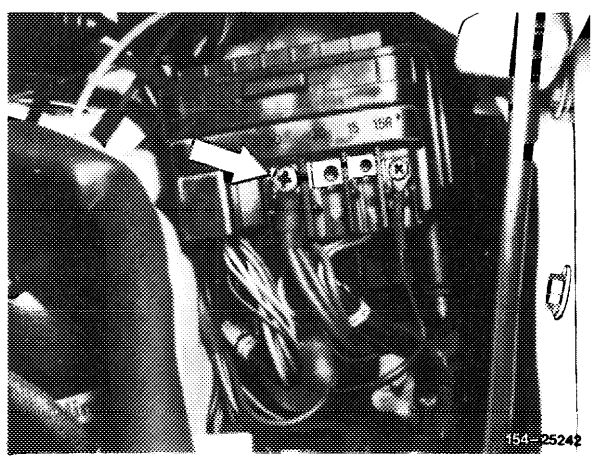
8 Compress clamp (2) (arrows), disengage at hinges at left (3) and right (4) and remove cover.



9 Unscrew fastening (arrows, 2 Phillips head screws at front and 2 nuts at the rear).

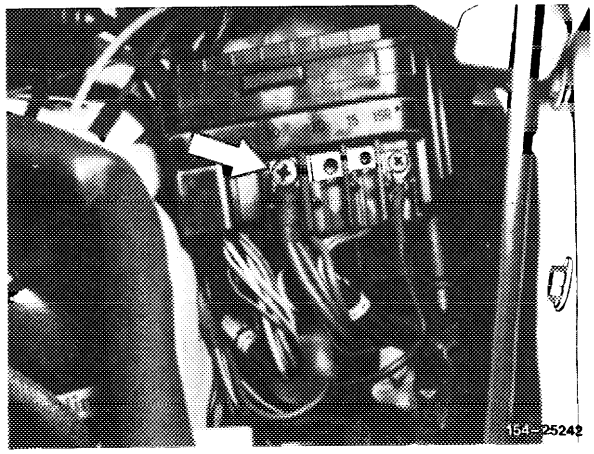


10 Pull central electric system forward and lift, unscrew lines from lug (arrow), pull off couplings and remove central electric system in forward direction.



Installation

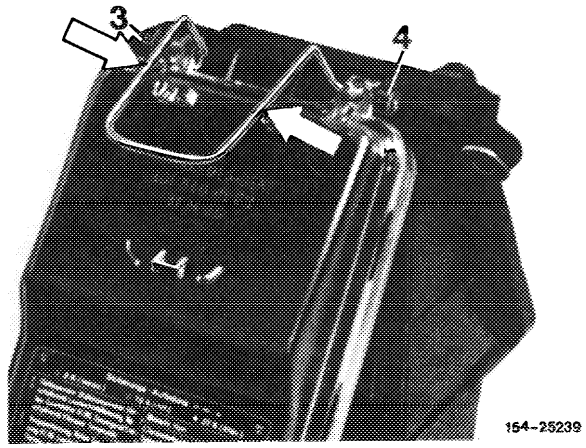
11 Move central electric system into installation position, plug on couplings and connect lines at lug (arrow) (for layout refer to 54–140).



12 Screw down central electric system, make sure that ground connecting strap is located in interior.

13 Mount cover on central electric system, engage clamp (arrows) in hinges at left (3) and at the right (4) and clip to cover.

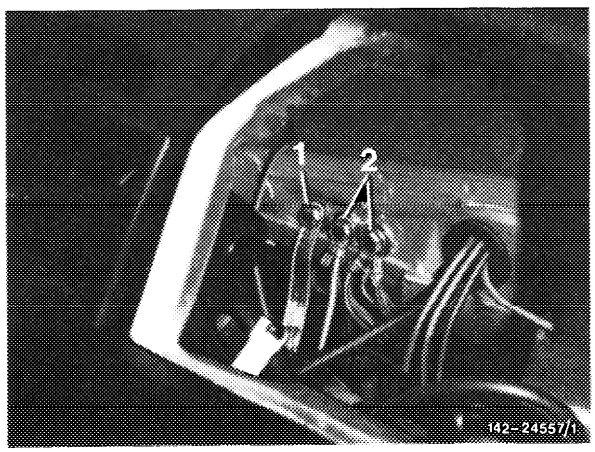
14 Mount relay holder.



15 Connect grounding strap.

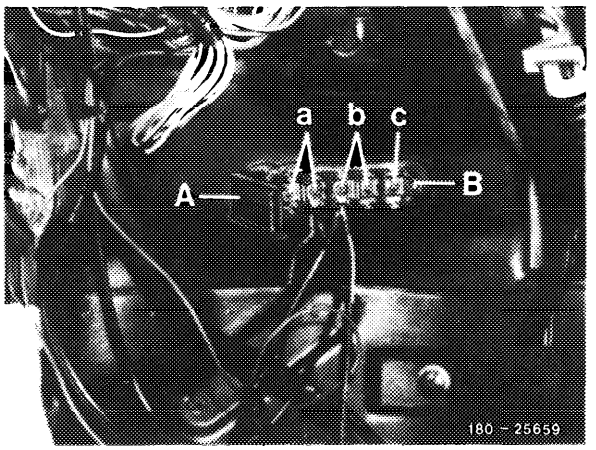
16 Plug couplings on central electric system in interior range.

17 Connect negative terminals of battery and check electric system for function.



18 Install cover under instrument panel.

The special equipment is connected to a 5-pole cable connector on lefthand side in legroom under lateral panelling.

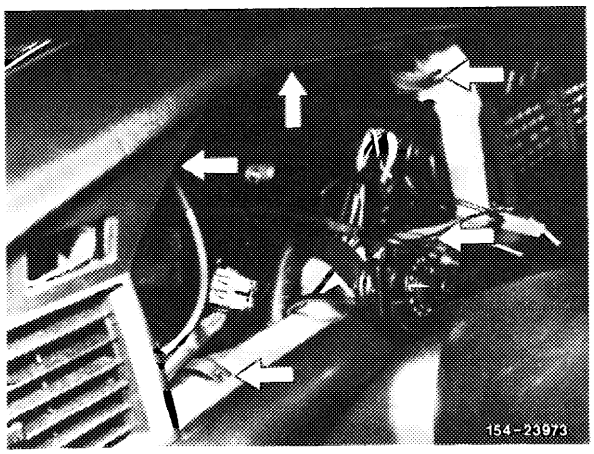


Layout of cable connector

a	b	c
Central electrics terminal 15 designation black	**Central electrics terminal 30 designation red**	**Stop lamp switch terminal 54 designation yellow**
Cruise control/tempomat **Revolution counter** **Adjustable outside rear-view mirror** **Outside thermometer** **Exhaust gas/speed warning** **Seat heater front left** **Seat heater front right** **Burglar alarm system** **Switchover valve rpm increase (automatic transmission)**	**Headlamp flasher, Portugal** **Central locking system control unit** **Electronics, radio** **Rear compartment lamp** **Automatic antenna** **Burglar alarm system** **Exit lamp**	**Cruise control/tempomat** **Anti-locking system (ABS)** **Burglar alarm system**

Note

The instrument cluster is held in place by means of five spring clips located on instrument panel.

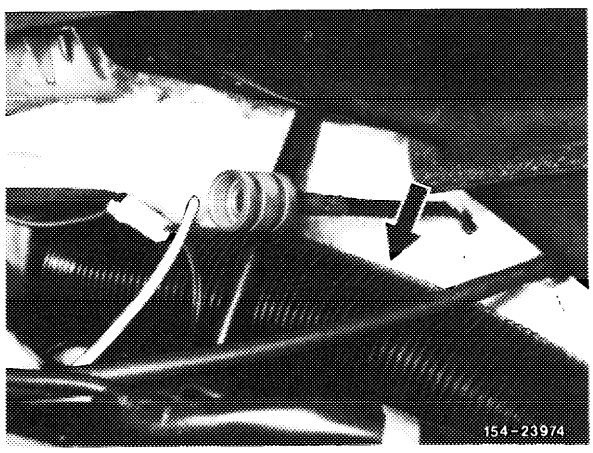


1 Remove cover under instrument panel, left.

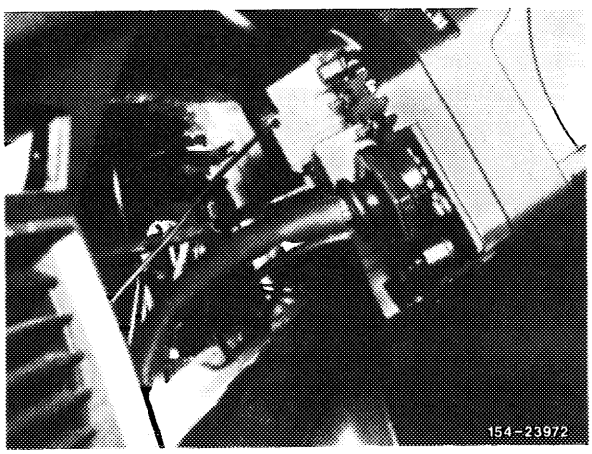
2 Remove hose (arrow) toward lefthand lateral nozzle from below.

3 Unscrew tachometer shaft on instrument cluster from below.

4 Push out instrument cluster from the rear.



5 Disconnect electrical connections and line for oil pressure gauge, remove instrument cluster.



Installation

6 For installation proceed vice versa.

7 When installing instrument cluster, push uniformly into instrument panel.

Layout of 15-pole coupling of instrument cluster

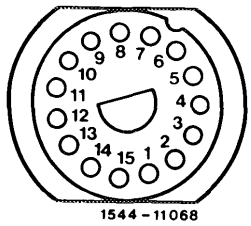
Model 201.022/024/122 1st version

Model 201.034 1st version

Model 201.023/024/034/122 2nd version

Note: 2nd version and model 201.034 1st version with engine oil, coolant and washing water level indicator.

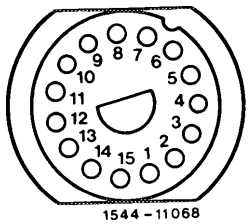
Model 201.022/024/122 1st version



1544-11068

No.	Designation	Line cross section	Line colors
1	Ground	0.5	brown
2	Sensor fuel reserve indicator	0.5	blue/green
3	Indicator lamp high beam	0.5	white/blue
4	Vacant	—	—
5	Indicator lamp brake lining wear indicator	0.5	brown/red
6	Terminal 15, fused	0.5	black/blue
7	Terminal 15, non-fused	0.5	blue/red
8	Indicator lamp ignition terminal 61	0.5	blue
9	Indicator lamp brake fluid readout	0.5	brown/red/white
10	Indicator lamp preglow system (diesel vehicles only)	0.5	black
11	Turn signal (flasher) control, right	0.5	black/green
12	Turn signal (flasher) control, left	0.5	black/white
13	Instrument lights terminal K	0.5	grey/green/purple
14	Temperature sensor, coolant	0.5	green
15	Sensor fuel gauge	0.5	blue/black

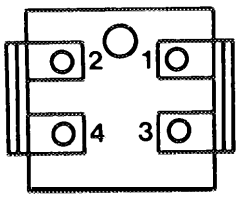
Model 201.034 1st version



1544-11068

No.	Designation	Line cross section	Line colors
1	Ground	0.5	brown
2	Temperature sensor coolant	0.5	green
3	Sensor fuel indicator	0.5	blue/black
4	Sensor fuel reserve indicator	0.5	blue/green
5	Switch engine oil level indicator	0.5	brown/blue yellow
6	Fuse 9, terminal 15, oil temperature indicator/voltmeter/stop watch	0.5	black/blue
7	High beam checkup	0.5	white/blue
8	Terminal 15 unfused ignition starter switch	0.5	blue/red
9	Charge indicator terminal 61	0.5	blue
10	Contact sensor brake lining wear indicator	0.5	brown/red
11	Switch brake fluid checkup	0.5	brown/red white
12	Switch coolant level indicator	0.5	brown/green
13	Turn signal checkup right	0.5	black/green
14	Turn signal checkup left	0.5	black/white
15	Rotary light switch terminal K	0.5	grey/green purple

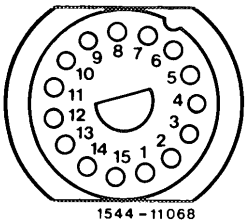
Layout of 4-pole coupling of instrument cluster 1st version



1544-12239

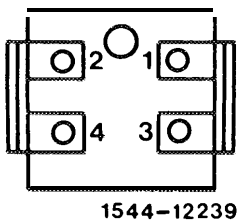
No.	Designation	Line cross sect ion	Line colors
1	Tank washer water system	0.5	brown/blue white
2	Line connector terminal 58 d	0.5	grey/blue
3	Switch parking brake	0.75	brown/red white
4	Warning buzzer contact	0.75	brown/green

Model 201.022/024/034/122 2nd version



No.	Designation	Line cross section	Line colors
1	Ground	0.5	brown
2	Temperature sensor coolant	0.5	green
3	Immersion tube sensor fuel indicator	0.5	blue/black
4	Immersion tube sensor fuel reserve indicator	0.5	blue/green
5	Switch engine oil level indicator	0.5	brown/blue yellow
6	Fuse 9, terminal 15,	0.5	black/blue
	oil temperature indicator/voltmeter/stop watch	0.5	black/blue
7	High beam checkup	0.5	white/blue
8	Terminal 15 unfused ignition starter switch	0.5	blue/red
9	Charge indicator terminal 61	0.5	blue
10	Contact sensor brake lining wear indicator	0.5	brown/red
11	Switch brake fluid checkup	0.5	brown/red white
	Switch parking brake	0.5	brown/red white
12	Switch coolant level indicator	0.5	brown/green
13	Rotary light switch terminal K	0.5	grey/green
14	Turn signal checkup left	0.5	black/white
15	Turn signal checkup right	0.5	black/green

Layout of 4-pole coupling of instrument cluster 2nd version



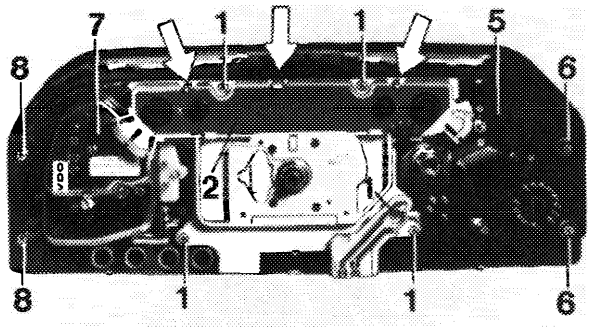
No.	Designation	Line cross section	Line colors
1	Tank washer water system	0.5	brown/blue white
2	Line connector terminal 58 d	0.5	grey/blue
3	Warning buzzer contact	0.75	brown/green
4	Oil pressure sensor	0.75	brown/white

Removal

1 Remove instrument cluster (54—250).

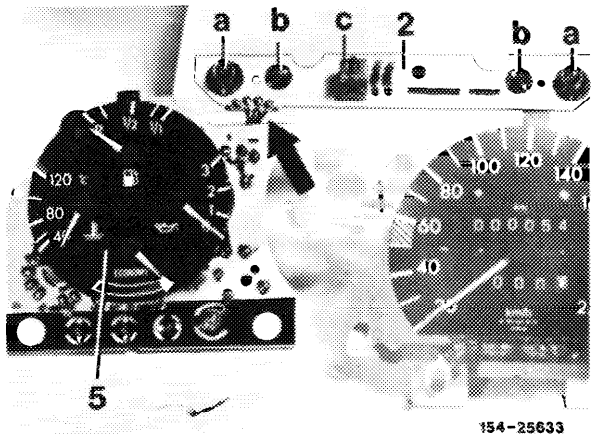
2 Remove speedometer (54-253).

3 Unscrew screws (6) and remove indicating instruments (5).



154-25230

Note: The lamp carrier can be separately renewed (54-262).



154-25633

2 Lamp carrier
5 Indicating instruments
a Instrument lamps
b Optical turnsignal (flasher) control
c Acoustic turnsignal (flasher) control

Installation

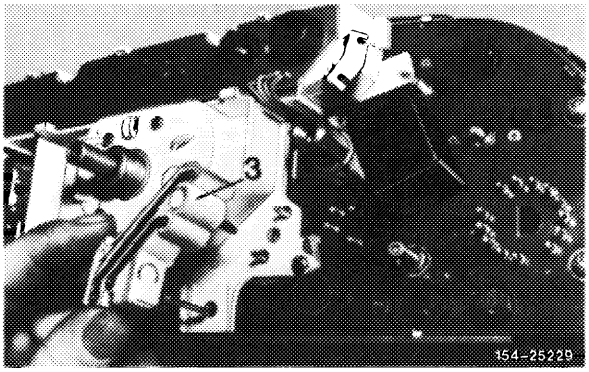
4 For installation proceed vice versa.

1 st version

Removal

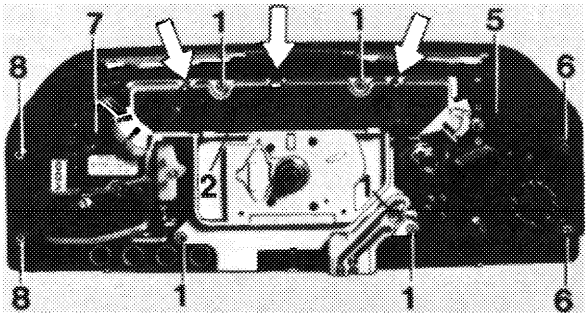
1 Remove instrument cluster (54–250).

2 Remove regulating resistance (3).



3 Unscrew screws (1).

4 Unclip lamp carrier (2) (arrows).

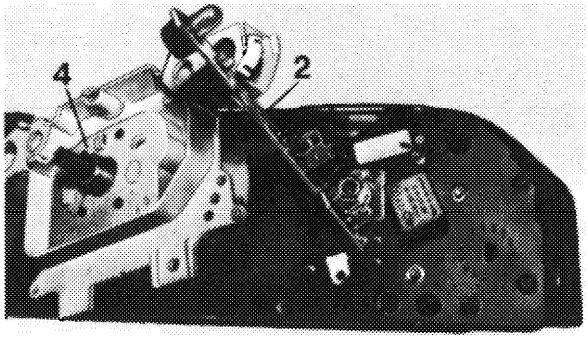


154-25230

5 Raise lamp carriers with acoustic turnsignal (flasher) control (2) laterally and remove speedometer (4).

Installation

6 For installation proceed vice versa.



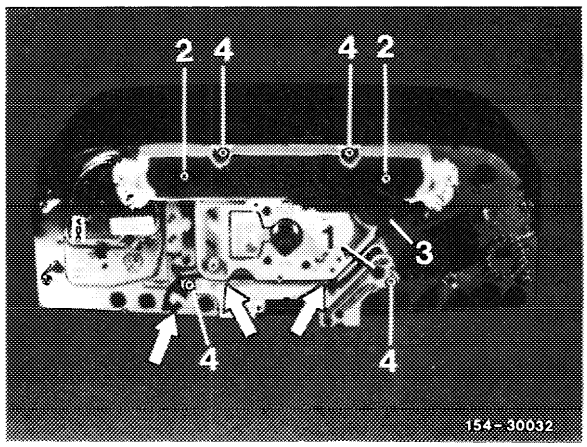
154-25228

2nd version

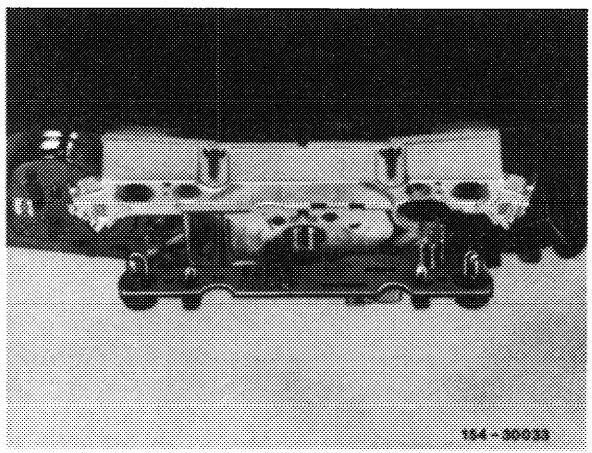
Removal

1 Instrument cluster removed (54–250).

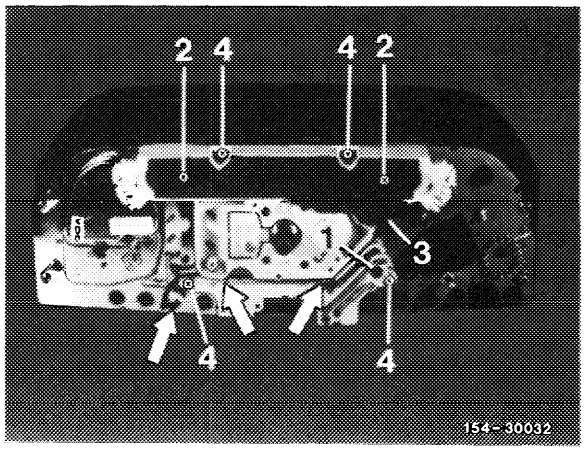
2 Remove rheostat (1).



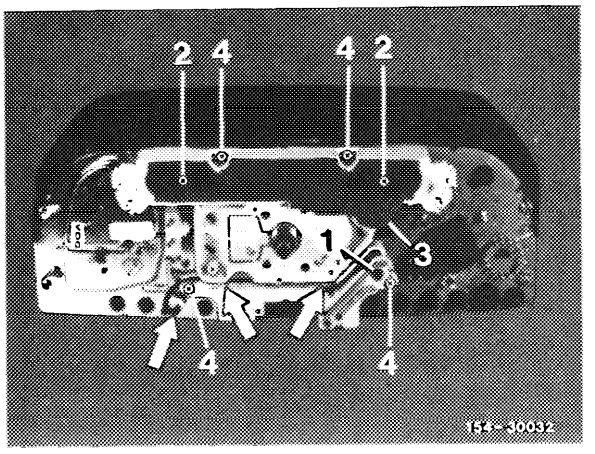
3 Remove lamp carrier. For this purpose, unscrew screws (2) and carefully pull off complete part.



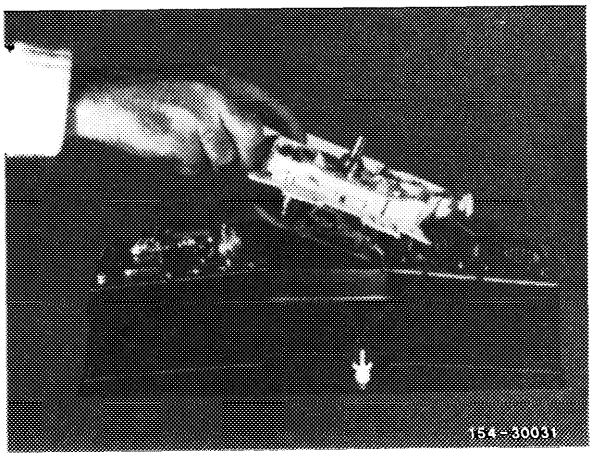
4 Unclip check lamp for washer water level and line (arrows).



5 Unscrew screws (4).



Remove speedometer.

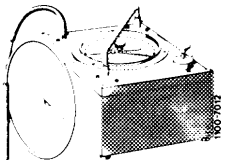


Installation

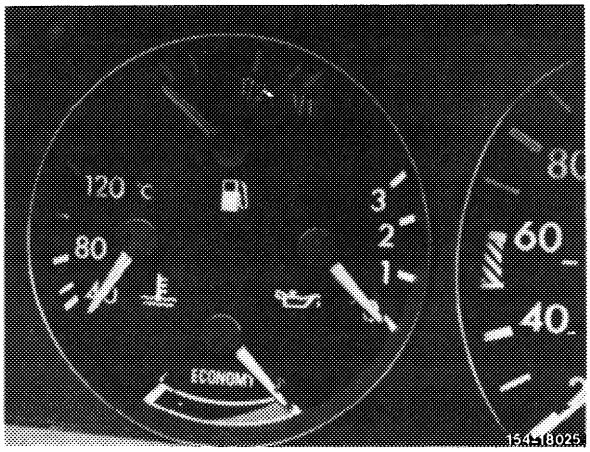
6 For installation proceed vice versa.

54-255 Checking indicator for economic driving (ECONOMY)

Special tools

Tester for vacuum O-1000 mbar		116589252100

Operation

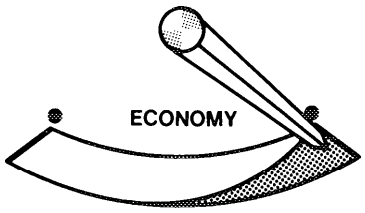


The indicator is connected to the intake manifold by way of a vacuum line and shows the momentary fuel consumption in dependence of intake manifold vacuum.

At a high intake manifold vacuum the needle is in black field of readout (fuel consumption low), under influence of falling intake manifold vacuum the needle moves into red field. The momentary fuel consumption increases.

With engine stopped, the needle is in red field against red stop pin.

Vacuum $\leqslant$ 0.08 bar.

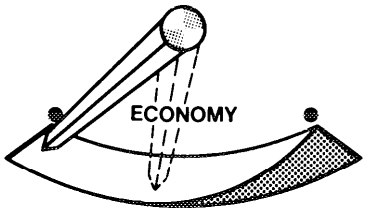


1544 – 10 868

Upon starting of engine the needle travels to the left and remains stopped in range of black indicating field depending on vacuum.

Needle against lefthand stop $\geqslant$ 0.585 bar.

Needle at starting point of red field approx. 0.4 bar.



1544-10869

Note

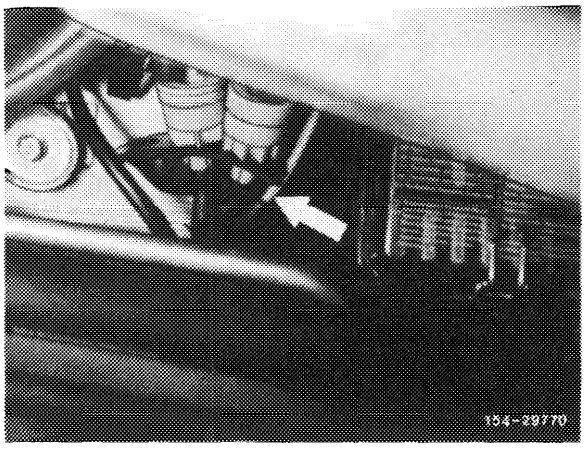
If the needle stops at righthand stop in red field, there is a leak in vacuum line to indicator (connecting point, line) or the indicator is defective.

Renew vacuum line and/or indicator.

If the readout is very slow, the cause may be oil in vacuum line and/or in indicator. A defective diaphragm of vacuum control unit on automatic transmission may cause oil to flow into vacuum system, which will then lead to failure of indicator.

Checking

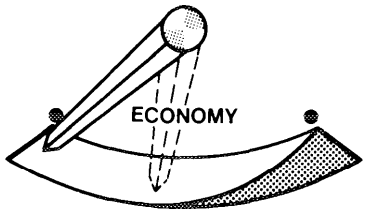
1 Pull vacuum line coming from intake manifold at distributor (arrow) and check vacuum at engine idle speed.



Nominal value: approx. 0.4-0.6 bar.

If nominal value is not attained, the vacuum line is dirty or leaking. Clean or renew vacuum line.

If the nominal value is attained, connect vacuum lines with each other, connect vacuum tester in-between. Run engine at idle.
Needle of indicator should be positioned as follows:



1544 – 10 869

Vacuum $\geqslant$ 0.585 bar at lefthand stop.

Vacuum approx. 0.4 bar at start of red field.

If so, there is a leak in vacuum system of beam range regulator and/or climate control.

Eliminate leaks.

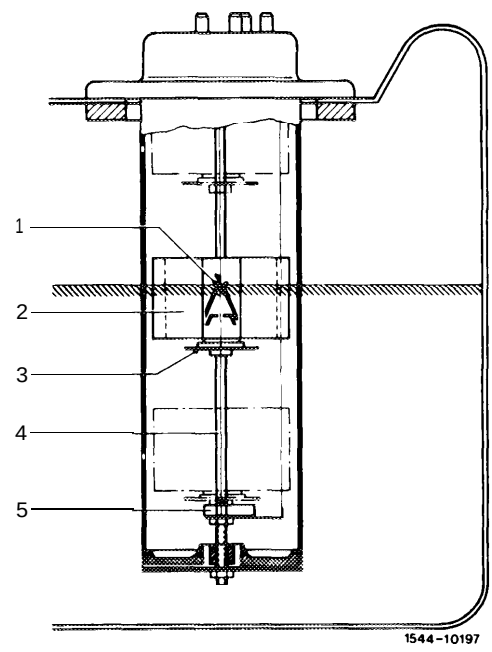
If on vehicles with automatic transmission a vacuum control unit on transmission is found to be defective, oil may have entered the indicating instrument and its line. Clean line and renew indicator.

54-256 Operation of transmitter for fuel gauge

Electrical function

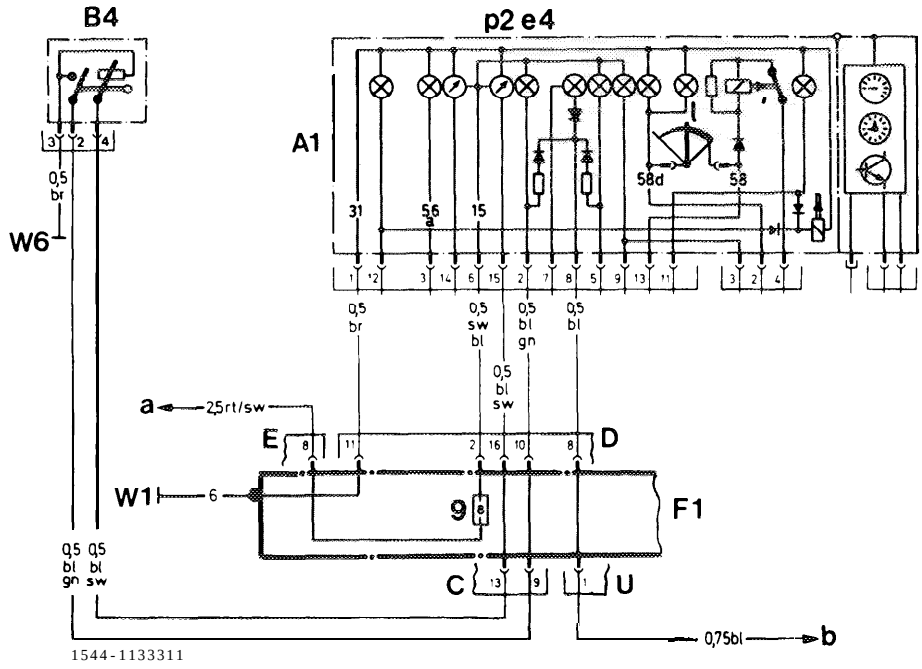
Under influence of decreasing fuel level, the sliding contact (1) on float (2) of immersion tube transmitter will increase the resistance value, The current will decrease and the indicator needle in instrument will then fall back.

If the fuel level drops still further, the reserve warning contact (5) in immersion tube transmitter, which connects the reserve warning lamp ground, is closed.



Transmitter (diagram)

1 Sliding contact
2 Float
3 Contact plate
4 Guide and contact rod
5 Reserve warning contact



Electric wiring diagram fuel gauge

A I Instrument cluster
e4 Fuel reserve warning
p2 Fuel gauge
B4 Transmitter fuel gauge
F1 Electrical center
W1 Main ground (behind instrument cluster)
W6 Ground, trunk on wheelhouse left

C 16-pole coupling (tail lamp unit harness)
D 16-pole coupling (instrument cluster)
E 8-pole coupling (ignition starter switch)
U 8-pole coupling (engine harness)
a To ignition starter switch S2/1 terminal 15
b To line connector X35 terminal 30/61 (battery) terminal 61

Test values transmitter, fuel gauge

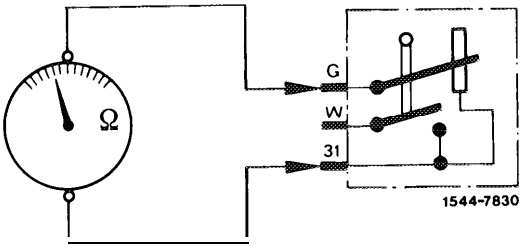
Resistance with float at top	1.9 ± 0.7 Ω
Resistance with float at bottom	78.3 ± 2.3 Ω

Note

The reserve warning lamp lights up with ignition switched on (checking function). As soon as the engine starts running, the lamp goes out provided the fuel tank holds more than the fuel reserve.

During checking function, the reserve warning lamp will light up weaker, for reserve stronger.

Testing transmitter, fuel gauge (removed)



Connect ohmmeter to terminal G and terminal 31 (⊥) and measure resistance.

a) In installation position (readout reserve, float below).

b) 1 80° turn (readout full, float at top).

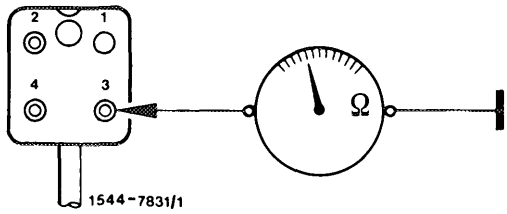
Testing reserve warning contact

Connect ohmmeter to terminal W and terminal 31 (⊥) and measure resistance.

a) Nominal value approx. 0 Ω in installation position.

b) Nominal value ∞ Ω turned by 180°.

Testing harness

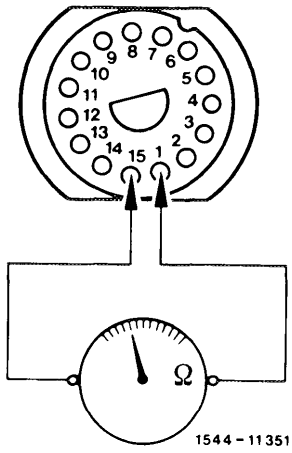


1 Pull coupling from transmitter of fuel gauge and measure resistance on jack **3 and** vehicle ground.

Nominal value approx. 0 Ω

(At test value ∞Ω the grounding line is interrupted),

2 Measure resistance on terminal G and terminal 31 (⊥) on installed transmitter of fuel indicator. The value depends on fuel content.



Put coupling back on transmitter for fuel gauge.

3 Pull coupling from instrument cluster and measure resistance between jack **1** and jack 15.

Nominal value: the value measured under 2. If the value is attained, the harness is in order (slight deviation caused by length of line is possible).

4 If the measured value is higher or at ∞Ω, the harness couplings (on instrument cluster, on main harness/tail lamp unit harness or on fuel gauge transmitter) are having poor contact, a dry solder joint or a line is interrupted.

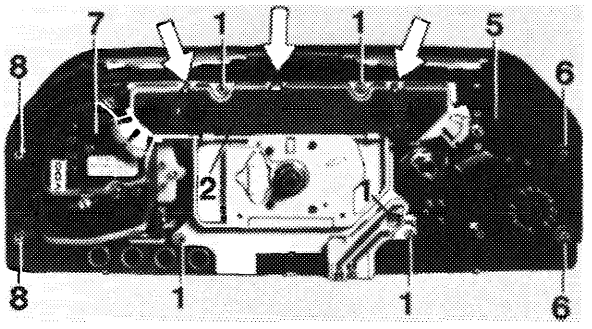
5 If no fault is found during tests, exchange indicating instrument.

Removal

1 Remove instrument cluster (54-250).

2 Remove speedometer (54-253).

3 Unscrew screws (8) and remove time clock/ revolution counter (7).



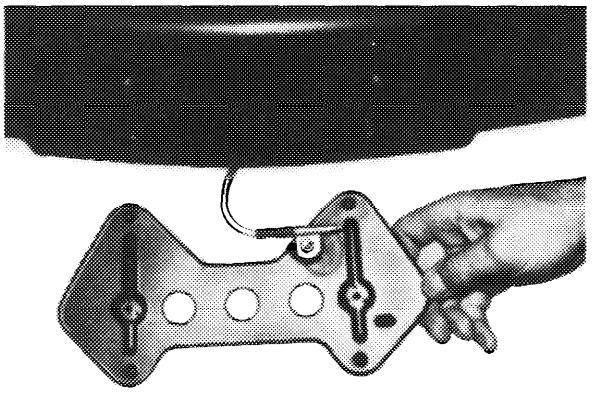
Installation

4 For installation proceed vice versa.

Test values

°C	Resistance (ohms)
0	9798 ± 98
20	3747 ± 71
40	1598 ± 40

Resistance values of temperature sensor in dependence of temperature.

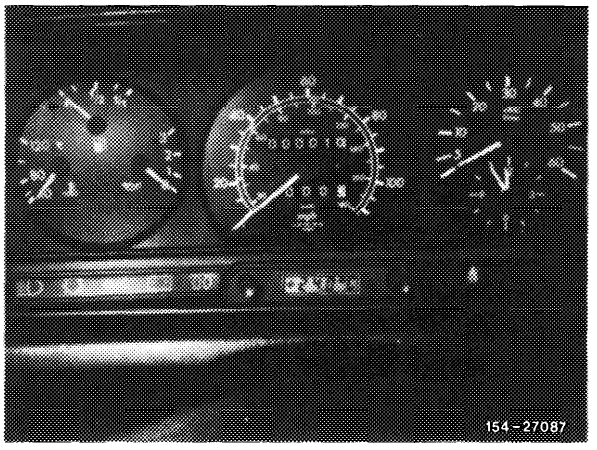


154-27085

Note

The temperature sensor is installed at front bumper behind licence plate.

The temperature indicator in instrument cluster is connected to voltage at key position "2". The temperature sensor activates the temperature readout according to outside temperature.



154-27087

Testing

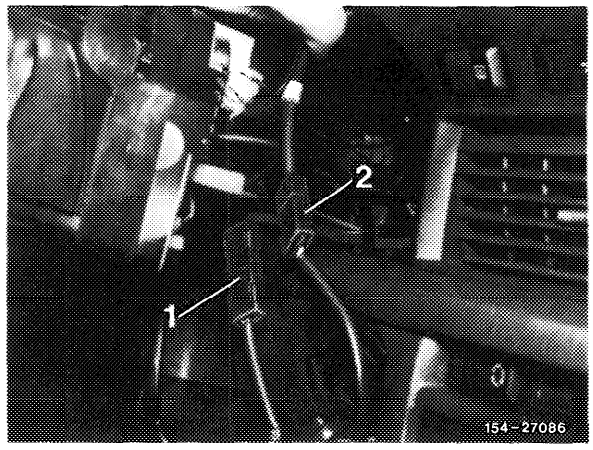
1 Remove cover under instrument panel at the left.

2 Separate 3-pole plug connection of temperature indicator behind instrument cluster.

3 Move ignition starter or glow starter switch into position "2"

4 Test for battery voltage with voltmeter at 3-pole coupling between lines 0.75 brown and 0.75 black/red.

If there is no voltage, repair interruption in line 0.75 black/red to cable connector interior or line 0.75 brown to main ground behind instrument cluster.



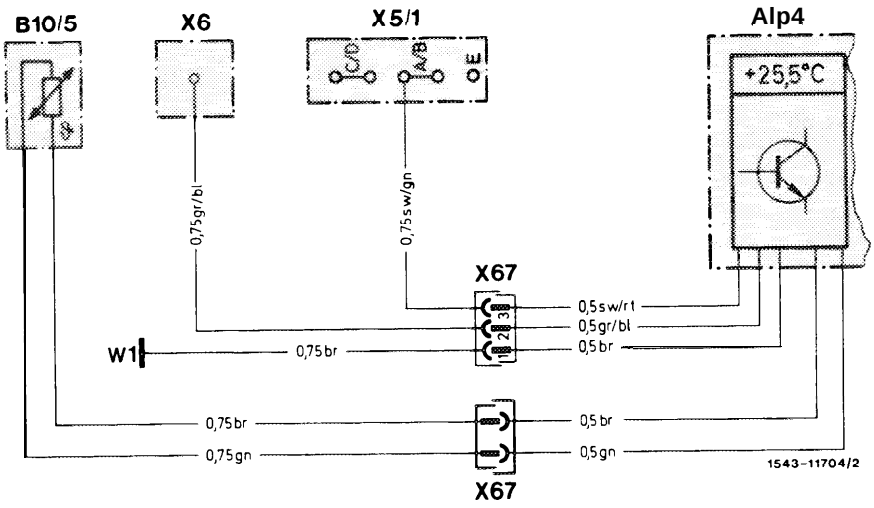
Plug connections

1 2-pole
2 3-pole

With voltage or ground connection indicated, separate 2-pole plug connection of temperature indicator behind instrument cluster and measure resistance between the two line plugs brown and green toward temperature sensor (test values).

In the event of deviationes from nominal value, renew temperature sensor together with electric line.

5 If electric lines, voltage supply and temperature sensor are in order, remove instrument cluster and renew outside temperature indicator.



Electric wiring diagram outside temperature indicator

Alp4 Outside temperature indicator
B10/5 **Outside temperature sensor**
W1 **Main ground (behind instrument cluster)**
x5/1 Line connector interior A/B terminal 15
X6 Line connector terminal 58 d
X67 Plug connections outside temperature indicator

54-262 Renewing lamp carrier with acoustic turn signal checkup

Note

On lamp carriers of 1st and 2nd version the lines are soldered-on. On 3rd version, the lamp carrier is connected to the indicating instrument with a plug connection,

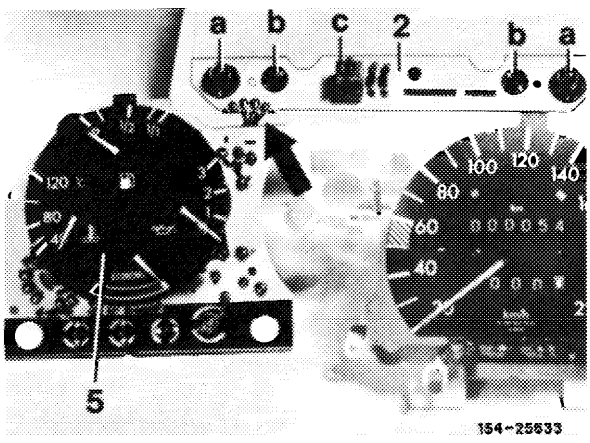
1 Remove instrument cluster (54-250).

2 Remove speedometer (54-253).

3 Remove indicating instruments (54-251).

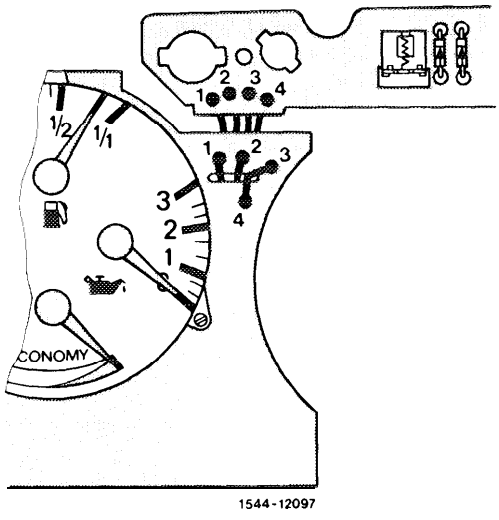
1st and 2nd version

4 Unscrew bulbs from removed lamp carrier and unsolder electric lines.

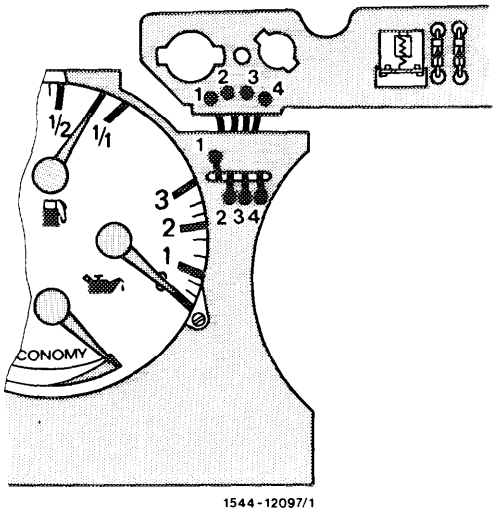


2 Lamp carrier
5 Indicating instruments
a instrument lights
b Optical turn signal checkup
c Acoustic turn signal checkup

5 Solder new lamp carrier to the 4 lines of the indicating instrument. Make sure that only lines with the same numbers (depending on version) are connected to each other.



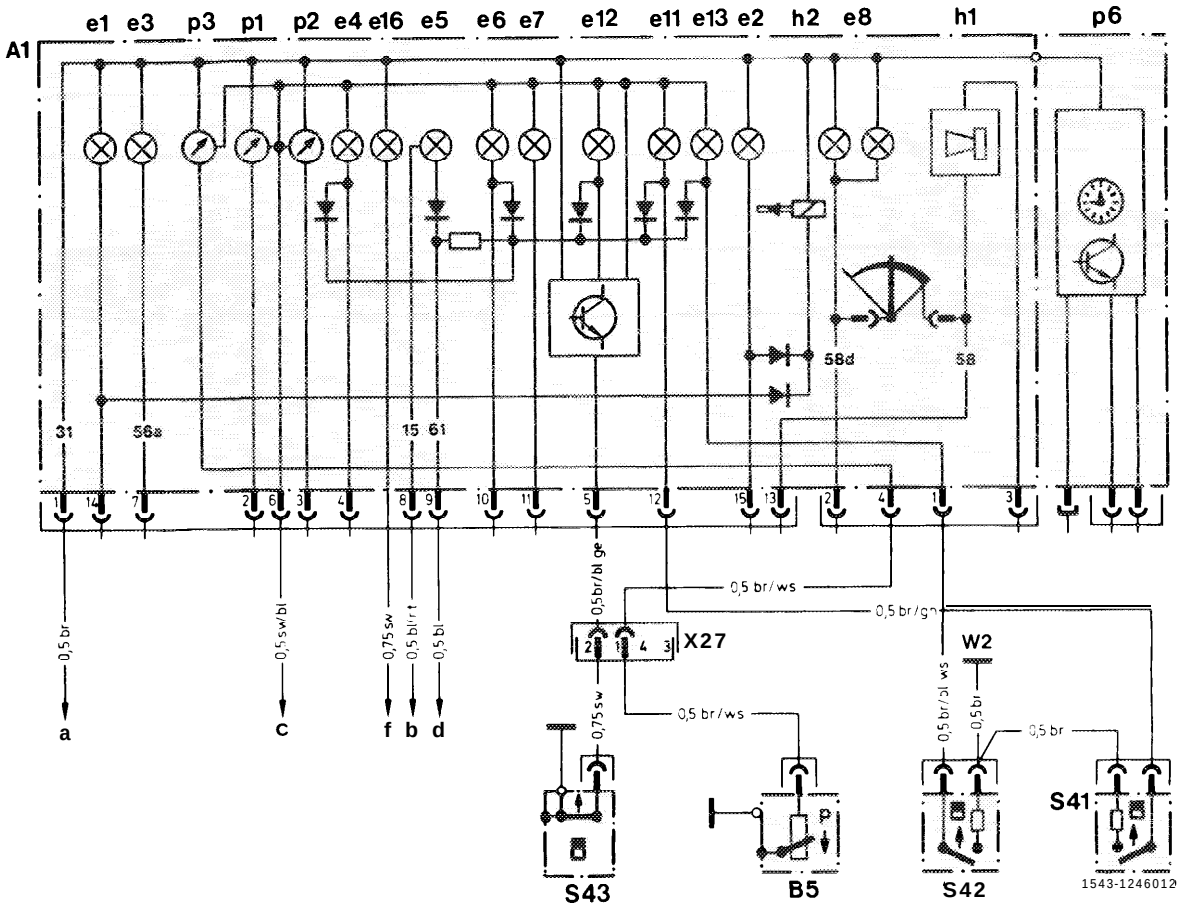
1st version
Indicating instrument with lamp carrier (conductor board)



2nd version
Indicating instrument with lamp carrier (conductor board)

6 Insert bulbs, assemble instrument cluster and mount back again on instrument panel.

7 Check electrical system for function.



Electric wiring diagram engine oil level indicator, coolant level indicator, washer water level indicator gasoline and diesel-engines-

A l Instrument cluster
- e1 Turn signal checkup left
- e2 Turn signal checkup right
- e3 High beam checkup
- e4 Fuel reserve warning
- e5 Charge indicator
- e6 Checkup brake lining wear indicator
- e7 Checkup brake fluid and parking brake
- e8 Instrument lights
- e l l Checkup coolant level
- e12 Checkup oil level
- e13 Checkup washer water level
- e16 Preglow checkup
- hl Warning buzzer
- h2 Turn signal checkup, acoustic
- p1 Temperature indicator, coolant
- P2 Fuel gauge
- P3 Oil pressure indicator
- p6 Electronic clock

B5 Transmitter oil pressure indicator
s41 Switch coolant level checkup
S42 Switch washer water level checkup
s43 Switch oil level checkup
w2 Ground, front right (near lamp unit)
X27 Plug connection starter harness
- a Main ground behind instrument cluster
- b Electrical center coupling D jack terminal 15 unfused
- c Electrical center coupling D jack 2 terminal 15 fuse 9
- d Electrical center coupling D jack 8 alternator terminal 61
  Preglow time relay terminal La (diesel engine only)

Ground connection points without designation— component directly on engine or body

Test values

Resistance on washer water level indicator at water level ,,max”	∞ Ω
Resistance on washer water level indicator at water level ,,min”	approx. 5 Ω
Battery voltage	approx. 12 V

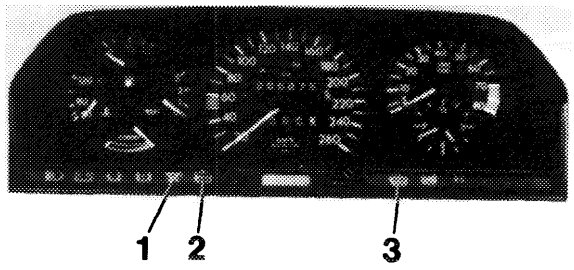
Conventional tool

Multimeter	e.g. Sun, DMM-5

Note

The indicator lamp lights up with the ignition switched on (checking function) and goes out as soon as the engine is running.

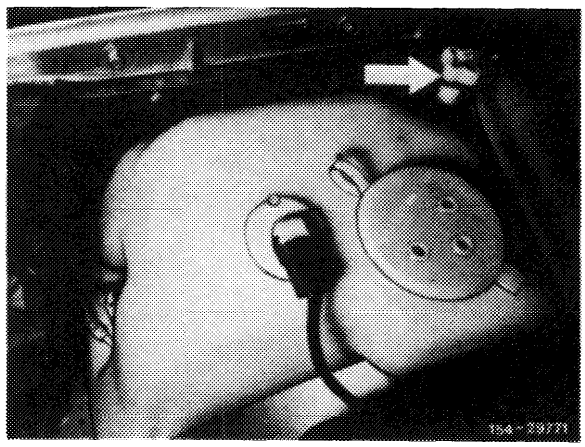
When checking function the indicator lamp lights up weakly, and brightly in the event of an interruption.



154-28120/1

1 Engine oil level indication
2 Coolant level indication
3 Washer water level indication

The washer water tank is fastened by means of a knurled nut.



In the event of complaints, such as:

A. Indicator lamp constantly lighting up with engine running and correct washer water level.

B. Indicator lamp not lighting up in key position ,,2''.

C. Indicator lamp not lighting up with engine running and washer water level below ,,min".

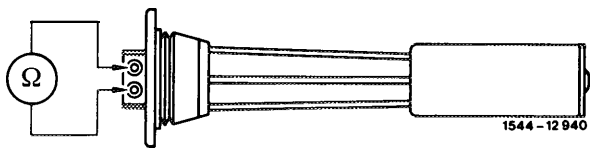
Testing

A. Indicator lamp constantly lighting up with engine running and correct washer water level

Testing washer water level indicator

With coupling pulled off, connect both plugs with multimeter and test resistance.

Readout: ∞ Ω



yes	no

Renew washer water level indicator.

Testing line

Remove instrument cluster. With multimeter connected to jack 1 of 4-pole coupling, test against ground (coupling plugged on washer water level indicator).

Readout: ∞ Ω

yes	no

Eliminate short to ground.

Renew indicating instrument.

End of test.

B. Indicator lamp not lighting up in key position „2“

Test function of bulb.

yes	no

Renew bulb.

Remove instrument cluster. Measure voltage, with multimeter connected to jacks 6 and 9 of 15-pole coupl ing.

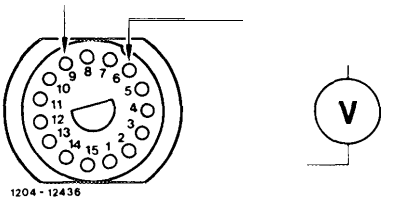
Readout: approx. 12 V

yes	no

Eliminate interruption according to electrical wiring diagram.

Renew indicating instrument.

End of test.

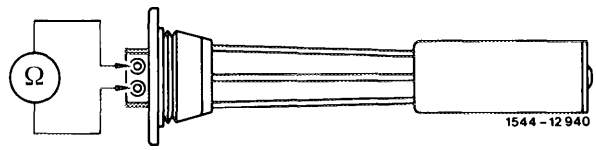


C. Indicator lamp not lighting up with engine running and washer water level below „min"
(section ,,B" in order)

Testing washer water level indicator

With coupling pulled off, connect both plugs with multimeter and test resistance.

Readout: approx. 5 Ω



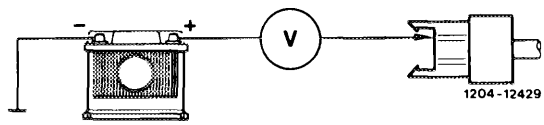
yes	no

Renew washer water level indicator.

Testing line

Connect multimeter with 2-pole coupling for washer water level indicator (brown line) and battery positive.

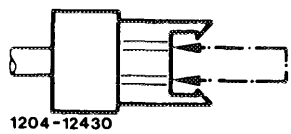
Readout: approx. 12 V



yes	no

Test ground connection, correct.

Bridge coupling for washer water level indicator. Indicator lamp should light up in key position ,,2''.



yes	no

Eliminate interruption according to electrical wiring diagram.

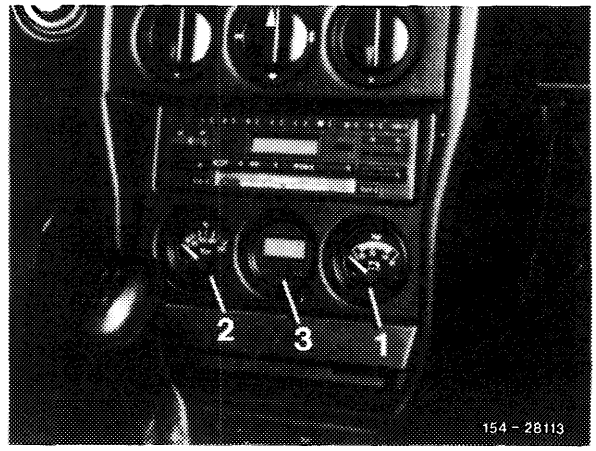
End of test.

Voltmeter

The voltmeter is connected to terminal 15 of 15-pole coupling of instrument cluster (jack 6). When the ignition is switched on, the voltage connected there is indicated.

Oil temperature indicator

The indicating instrument shows the oil temperature in oil filter housing by way of a transmitter.



1 Voltmeter
2 Oil temperature indicator
3 Stop watch

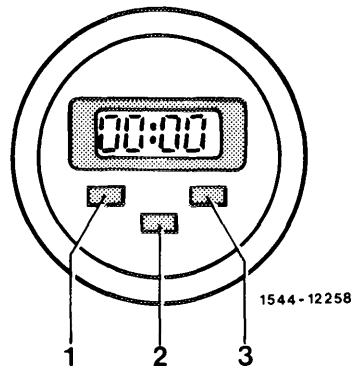
Stop watch

In key position ,,2'' the following functions can be called by means of the 3 buttons.

1 Button for measuring time

2 Button for measuring average speed on 1 km driving distance

3 Button for cancelling measured time



1. Measuring time

Pushing button 1 = start. The colon between digits will flash.

Pushing button 2 = stop. The stopped time is shown in display window.

Pushing button 3 = indication cancelled, or ignition off = indication cancelled.

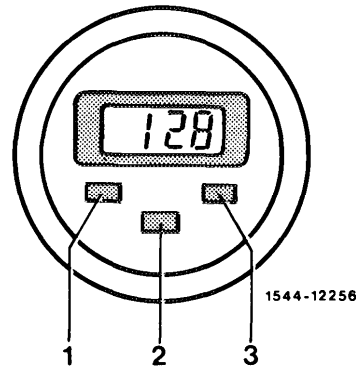
Time indication in display window:

From 00:00 to 59:99 = seconds and $^{1}/_{100}$ **seconds.**

After 1 minute from 01:00 to 59:59 = minutes and seconds.

After **1** hour from 01:00 to 09:59 = hours and minutes.

After 10 hours the time will again be measured in **seconds and $^{1}/_{100}$ seconds.**



2. **Measuring average speed for driving distance of 1 km**

Pushing button 2 = start. Colon in display window will flash.

Push button 2 again after driving 1 km = stop. The attained average speed is shown in display window.

Cancelling readout: push button 2 or switch off ignition.

3. **Measuring average speed for driving distance of 1 km while measuring time**

The average speed can also be measured while measuring time. This will not interrupt measuring of time.

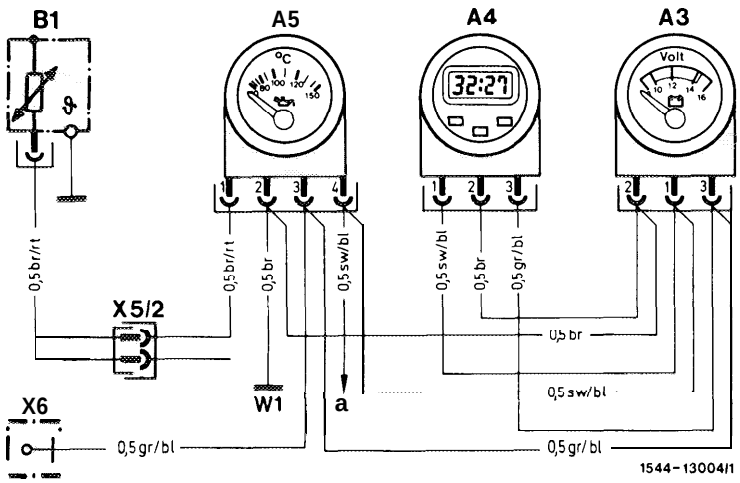
Pushing button 2 while measuring time = start, colon in display window will flash.

Pushing button 2 once again after driving 1 km = stop. Display window shows the attained average speed.

Pushing button 2 = display field shows the time running on.

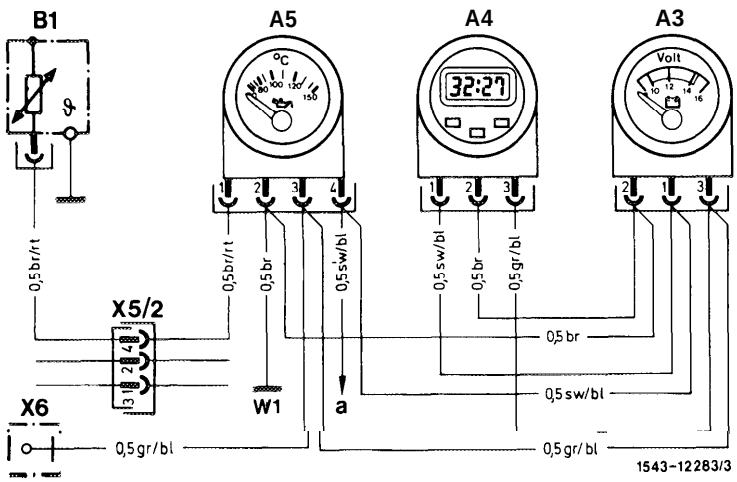
Cancelling readout: push button 2 or switch off ignition.

Wiring diagram auxiliary instruments Model 201.034



1 st version

A3 Voltmeter
A4 Stop watch
A5 Oil temperature indicator
B1 Oil temperature transmitter
W1 Main ground (behind instrument cluster)
X6 Line connector terminal 58 d
X5/2 Line connector interior/starter
a To 15-pole coupling instrument cluster jack 6, terminal 15
Grounding points without designation — component directly on engine or body



2nd version

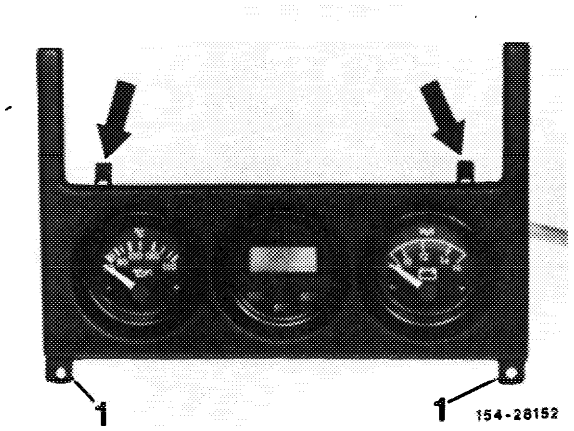
A3 Voltmeter
A4 Stop watch
A5 Oil temperature indicator
B1 Oil temperature transmitter
W1 Main ground (behind instrument cluster)
X6 Line connector terminal 58 d
X5/2 Line connector interior/starter
a To 15-pole coupling instrument cluster jack 6, terminal 15
Grounding points without designation — component directly on engine or body

Removal

1 Remove ashtray with holder.

2 Unscrew both fastening screws (1) and pull out console in downward direction, so that the two locking points (arrows) of center console are released.

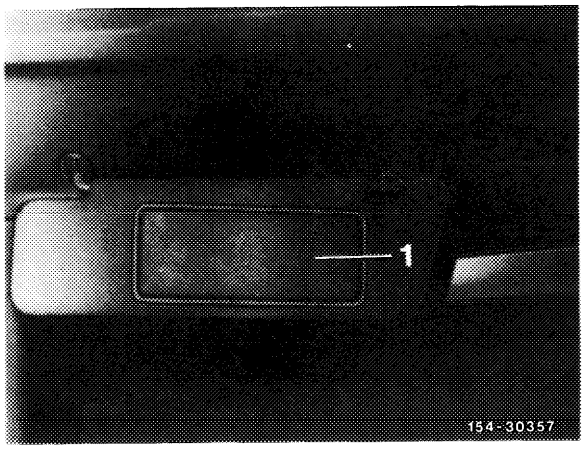
3 Pull the 3 couplings from individual instruments.



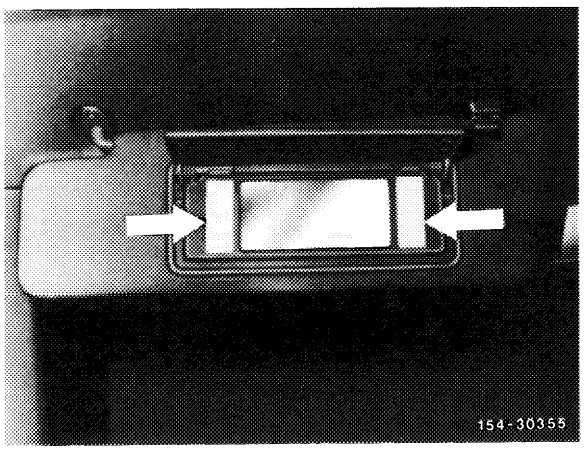
Installation

For installation proceed vice versa. Make sure that the longer electric line with 3-pole coupling is plugged on voltmeter.

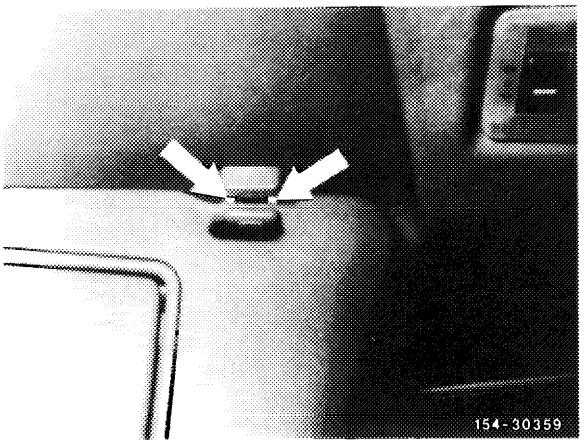
The mirror integrated in sun visor is provided with lights, which are switched on by swivelling the cover (1) in upward direction.



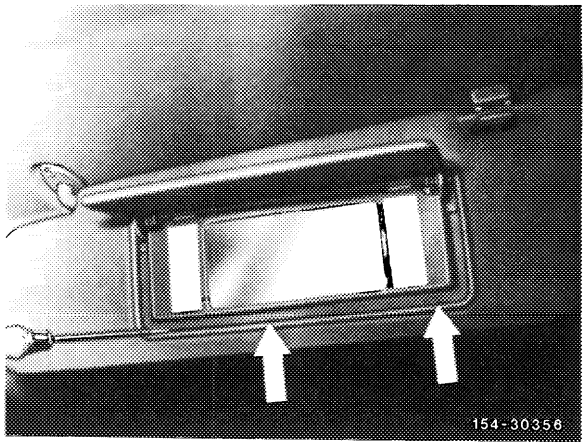
The lights are located at the left and right adjacent to mirror (arrows).



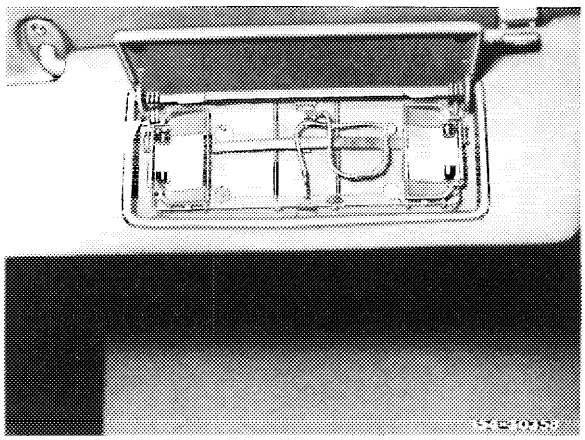
The voltage supply (positive and negative) for the lights comes from a pair of contacts (arrows) integrated in mounting bracket.



Unclip mirror for exchanging bulbs.



The switch contact for switching on the lights is located on hinge of cover (arrow).

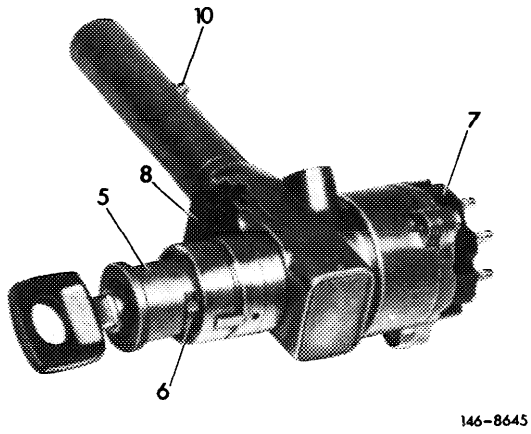


54-410 Warning device for safety belt, ignition key, light (USA)

The warning unit comprises 3 **functions:**

1. Warning when safety belt is not put on
2. Warning when ignition key is not pulled off
3. Warning when light is not switched off

Operation



146-8645

1. If with the ignition switched on and the driver's door closed (door contact switch left [7] opened) the safety belt is not put on by the driver, the warning buzzer will sound for 4-8 seconds. For this purpose, the electronic system of warning unit (2) is connected from terminal 10 via closed belt switch (terminal 9 of warning unit), positive to warning buzzer in warning unit.

   When the safety belt is put on, the belt switch will interrupt the circuit and the warning buzzer is switched off.

   The check lamp (1 r) connected in parallel with belt switch is operational up to end of respective time (4-8 seconds).

2. If with the driver's door open (door contact switch left [7] closed) the ignition key is not pulled off, the warning buzzer is positively activated by the electronic system via closed warning buzzer contact on ignition lock (5), terminal 5 on warning unit. The warning buzzer is switched off by pulling the ignition key off or after 4-8 seconds.

3. If the high beam, the low beam or the parking light are not switched off, with the ignition switched off, when the driver's door is opened, this will also be indicated by the warning buzzer.

   The warning buzzer is positively activated by terminal K on rotary light switch via electronic system in warning buzzer (terminal 4). When the driver's door is opened, the electronic system is negatively activated via the closed door contact switch left (7) and the warning buzzer will sound off.

The cruise control/Tempomat system is ready for use when the ignition is switched on. However, for actual operation, the vehicle speed should be above approx. 40 km/h. When the vehicle is running at the desired speed, touching of pushbutton switch for a short moment in direction of ,,accel — set" or ,,decel — set" serves to maintain this speed until the driver has set a new speed or switched off. To adapt the set speed e.g. to the traffic flow, hold pushbutton switch in direction of ,,accel — set" or ,,decel — set" until the desired speed is attained. On vehicles with new control unit (phased-in starting 9.86), recognized by coding plug, touching of pushbutton switch in direction of ,,accel — set" or ,,decel — set" will increase or reduce the speed by 1 km/h. The vehicle is accelerated at a controlled 0.7 m/s^2. The new speed will be held after the pushbutton switch is released. The cruise control/Tempomat is switched off when touching the pushbutton switch for a short moment in direction of ,,Off", when stepping down on brake pedal or on clutch pedal, the throttle control will move into idle speed position.
Switching off with pushbutton switch will activate the actuator motor, which moves the throttle control into idle speed position. On the other hand, when switching off by stepping down on brake pedal or clutch pedal, the power flow in actuator is immediately interrupted, the electromagnetic clutch will then be de-energized and a return spring will pull one gearwheel of actuator gear unit out of mesh. The return springs will pull the throttle control into idle speed position. After switching off, the system remains operational until the ignition is switched off. If upon actuation of brake or clutch or after switching off, the pushbutton switch is touched for a short moment in direction of ,,resume" at a vehicle speed above approx. 40 km/h, the vehicle will be automatically accelerated at 1 m/s^2 to the speed ,,set" last. The speed set last is cancelled when the ignition is switched off.

If the set speed is exceeded by accelerating, e.g. when passing another car, the vehicle will automatically return to the previously set speed when the accelerator pedal is released.

If the engine capacity is inadequate when driving uphill, the set speed will drop and will be automatically m-established as soon as the gradient has been overcome if the speed has not dropped below 40 km/h or the brakes have not been actuated in the meantime.

If engine braking effect is inadequate when driving downhill, the set speed is exceeded and the vehicle must be braked if necessary. If brakes were not actuated, the set speed will be automatically re-established as soon as the gradient is overcome.

Attention!
While driving with cruise control/Tempomat, the selector lever position "N" of the automatic transmission should not be engaged, since otherwise the engine will rev up.

Safety shifts

The speed set last in control unit will be cancelled when the ignition is switched off.
When the ignition is switched on, the value ,,0 km/h" is put into speed memory (Sp = Resume).
This will make sure that no unknown speed will be held in memory (resumed) when another trip is started, e.g. after changing the driver.

The speed is constantly monitored by the control unit. Each change of speed is picked up and evaluated. On control unit without coding plug by means of a shift step (differentiating link), on control unit with coding plug by means of a computer.

If a speed change is made with pushbutton switch, the shift step (differentiating link) together with an operation amplifier or the computer in control unit will make sure that the specified values are maintained at switch positions ,,accel— set" of 0.7 m/s^2 or at ,,resume" of 1 m/s*.

When braking or clutching, the electromagnetic clutch in actuator will be de-energized, the power flow will be immediately interrupted, since a return spring will pull one gearwheel of actuator gear unit out of mesh. The return springs will pull the regulating linkage into idle speed position.

If, for example, with a defective stop lamp switch, the vehicle is decelerated $>$ 1.5 m/s*, these data will be picked up on control unit without coding plug by the shift step (differentiating link) in control unit. The subsequently connected threshold value switch will activate the actuator motor, which will move the regulating linkage into idle speed position. On control unit with coding plug the delay is picked up by the computer and the power flow in actuator is interrupted similar to procedure while braking or clutching, since the electromagnetic clutch in actuator will be de-energized.

The time interval up to cutout depends on extent of delay.

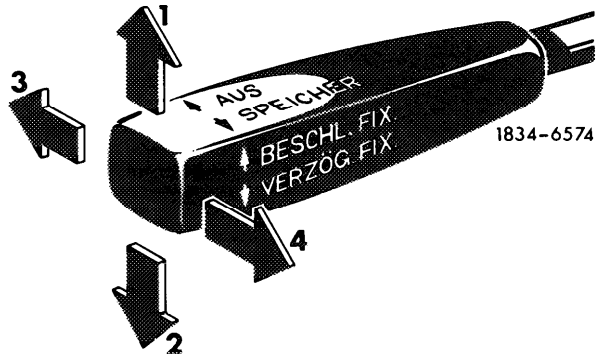
If the nominal speed is exceeded by more than approx. 6 km/h for any reason whatsoever, the speed monitoring unit will react. The electromagnetic clutch in actuator will be de-energized, the power flow in actuator is interrupted and the regulating linkage will move into idle speed position. If the speed is subsequently less than approx. 6 km/h, e.g. the speed is now only 5 km/h higher than the nominal speed, the electromagnetic clutch is again activated and the power flow in actuator is again established.

The operation of the electromagnetic clutch in actuator is monitored by the control unit (amplifier) each time the brakes are actuated. If the power flow in actuator is not interrupted in the event of a defective clutch, the control unit will activate the actuator motor which will then move the regulating linkage into idle speed position. This process is recorded by the control unit (amplifier) and the system will be made inoperative until the ignition is switched off. When the ignition is switched on again, the system will operate normally up to the next braking operation, when it will again be made inoperative under influence of defective electromagnetic clutch.

The cruise control/Tempomat system comprises the following components which are connected to each other by means of an electric harness.

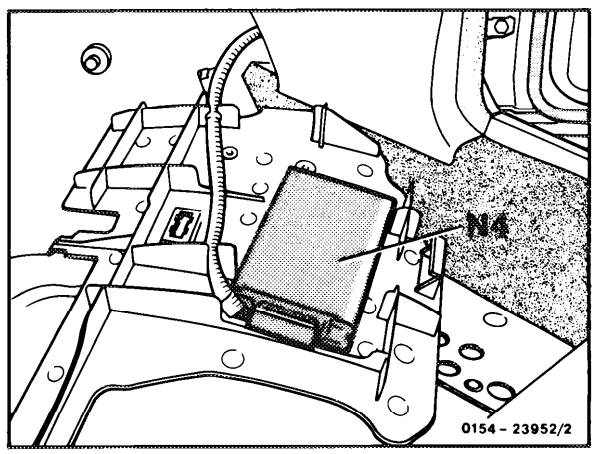
Pushbutton switch

Position "1" or
"2" touch = speed is set.
Position ''1'' hold = set speed is increased.
Position "2" hold = set speed is reduced.
Position ''3'' touch = cruise control is switched off.
Position "4" touch = the speed set prior to switching off is automatically re-established at a speed of above approx. 40 km/h (approx. 25 mph).



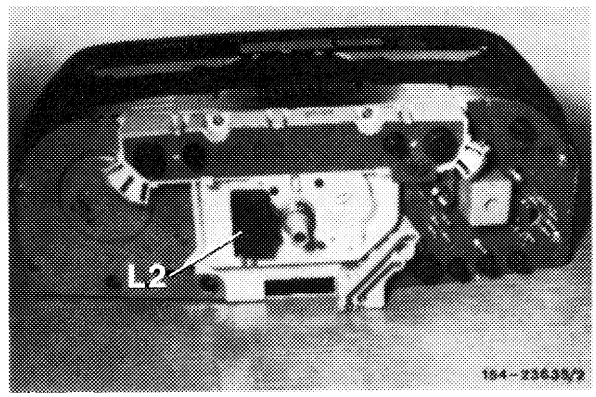
Control unit (amplifier)

The control unit (amplifier) (N4) compares the actual and the desired speed. In the event of a deviation from the desired speed, the control unit (amplifier) (N4) transmits the pertinent control signals to the actuator (M16) until the actual and the desired speed are again in agreement.



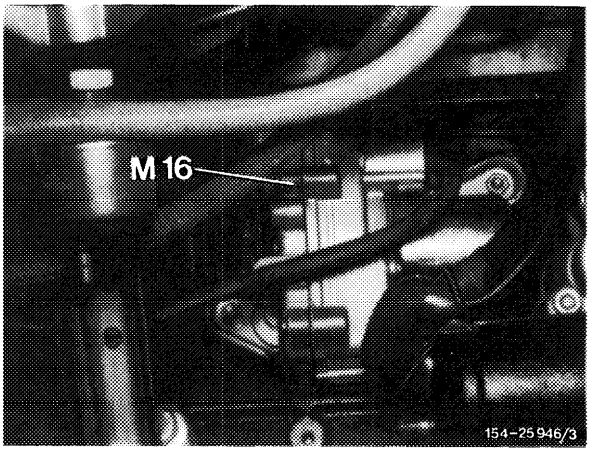
Transmitter

The control unit (amplifier) receives the actual speed signals from transmitter (L2) on speedometer.



Actuator

The actuator (M 16) receives its control signals from control unit (amplifier) and actuates the regulating linkage by way of a connecting rod. The actuator comprises an electric motor with gear unit, a one-way clutch, a potentiometer and an electromagnetic clutch.



The electric motor drives the output shaft provided with a one-way clutch by way of the gear unit.

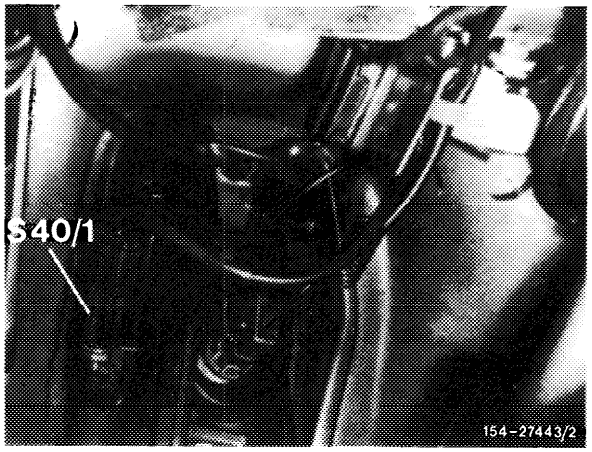
The one-way clutch permits, e.g. with the speed set, acceleration with accelerator pedal for passing other vehicles without a need for actuating the cruise control/Tempomat.

The potentiometer reports the position of the output shaft to the control unit/amplifier.

The electromagnetic clutch establishes the power flow between the electric motor and driven axle by engaging a gearwheel. It is engaged at the following switch positions: accel — set, decel — set and resume. The electromagnetic clutch is switched off by actuation of brake or clutch, but also when the system is switched off by means of pushbutton switch and when the regulating linkage has attained the idle speed position. When the electromagnetic clutch is switched off, the power flow is immediately interrupted by a return spring, which pulls a gearwheel out of mesh.

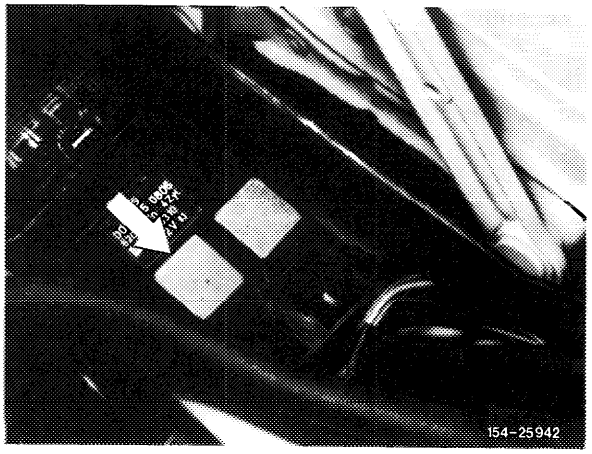
Switch on manual transmission actuated by clutch pedal

When stepping down on clutch pedal, the ground connection from stop lamps to control unit (amplifier) is interrupted by the switch (S40/1). The cruise control/Tempomat will then be switched off immediately similar to procedure while braking.



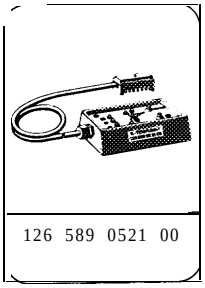
Relay on model 201.024 (standard version)

During operation of cruise control/Tempomat the relay will make the decel shutoff inoperational. The relay is painted yellow on surface for identification.



54-504 Testing with adapter

Special tool



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Prerequisite for testing

Prior to testing with adapter, check battery voltage (>11 V), stop lamps and speed indicator for function. If required, recondition according to condition and test cruise control/Tempomat for function prior to test by means of adapter.

Test cruise control/Tempomat with adapter only. If other testing and measuring instruments are used, the cruise control/Tempomat may be destroyed. During this test, the cruise control/Tempomat is tested with the exception of the control unit.

Faults can be found by means of adapter only if the cruise control/Tempomat is continuously inoperational. Complaints such as periodical failure or poor control characteristics (e.g. shaking) cannot be tested by means of the adapter. In such cases, proceed according to programmed repairs.

If testing with the adapter indicates a faulty component, check plug connections for good contacting prior to replacement. Plug sockets, for example, should not be widened. Widened plug sockets should be reshaped. Then check rejected component once again,

Preparing for test

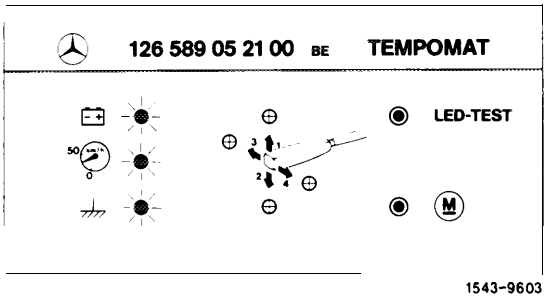
1 Expose control unit (amplifier) (refer to 54-565).

2 Pull 14-pole coupler from control unit (amplifier).

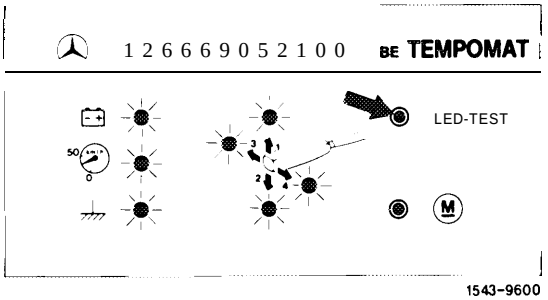
3 Connect test adapter to 14-pole coupler.

4 Switch on ignition. LED-readout of symbols for battery, km/h and ground will light up, provided no fault is indicated.

5 Push button “LED-TEST” of test adapter and check whether all LED-readouts are lighting up. If no LED-readout is lighting up, test connection of voltage supply and layout of 14-pole coupler (refer to wiring diagrams 54-580).

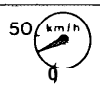
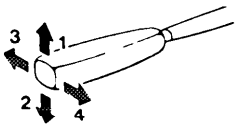


1543-9603



1543-9600

Survey test program

Test step	Actuation	Nominal readout	Possible cause for deviation from nominal readout
1		LED readout lights up	Lines wrongly connected. Lines are interrupted.
		LED readout lights up on models with grounding bridge.	Grounding bridge in 14-pole connector interrupted.
		LED readout may light up. 	Perform test step 6.
2	Actuate cruise control switch (positions 1-4) 	Pertinent LED readout lights up.	Lines interrupted. Switch defective.
3	Push push-button switch.	Regulating linkage moves uniformly to full throttle position and stops.	Regulating linkage and accelerator pedal not moving: Connecting rod not connected to actuator or regulating linkage. Lines interrupted or wrongly connected. Switch on clutch pedal defective. Actuator defective. Regulating linkage and accelerator pedal constantly moving to and fro. Poor contacting of plug connection harness/actuator harness. Actuator defective.
4	Push push-button switch. Regulating linkage in full throttle position. Step down on brake pedal. Then release pushbutton switch.	When operating brake pedal, regulating linkage will move immediately into idle speed position.	Regulating linkage hard to move. Actuator defective.
5 with manual transmission only	Push push-button switch. Regulating linkage in full throttle position. Step down on clutch pedal. Then release pushbutton switch.	Regulating linkage will move immediately into idle speed position, when operating clutch pedal.	Lines shorted. Switch on clutch pedal defective.
6	Move vehicle, at least for **2** wheel turns	LED readout flashing	Lines interrupted or wrongly connected. Sensor (transmitter) defective.

If no fault was found on previous tests:
1. Test blue line from connector actuator jack 5 to connector control unit jack 10 for short to ground by means of ohmmeter.
2. **On control units with coding plug, test coding plug R29 (54–506).**
3. Mount new control unit for tryout.

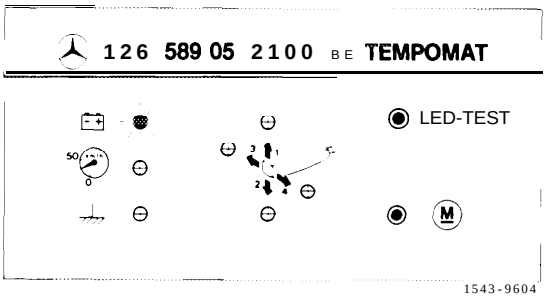
Test

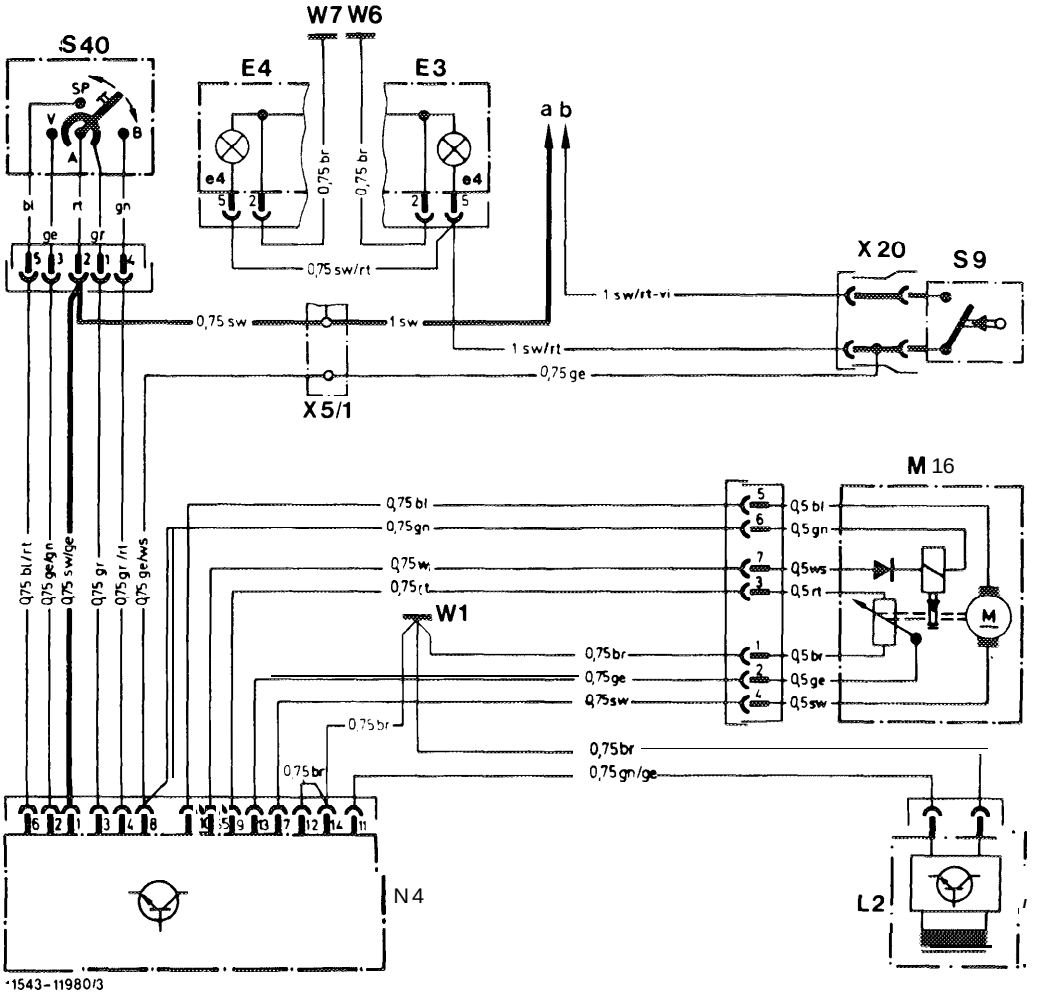
Test voltage supply.

LED-readout lights up

yes | no

Test lines for correct connection and for passage.





Example: 201.122 up to approx. 8.85

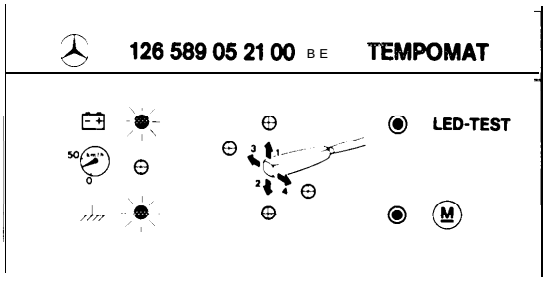
N4 Control unit cruise control/Tempomat
S40 Pushbutton switch cruise control/Tempomat
a To central electrical system F 1, connecting field L assignment 1

For vehicles with grounding bridge (refer to wiring diagram 54.8–580), test in 14-pole connector,

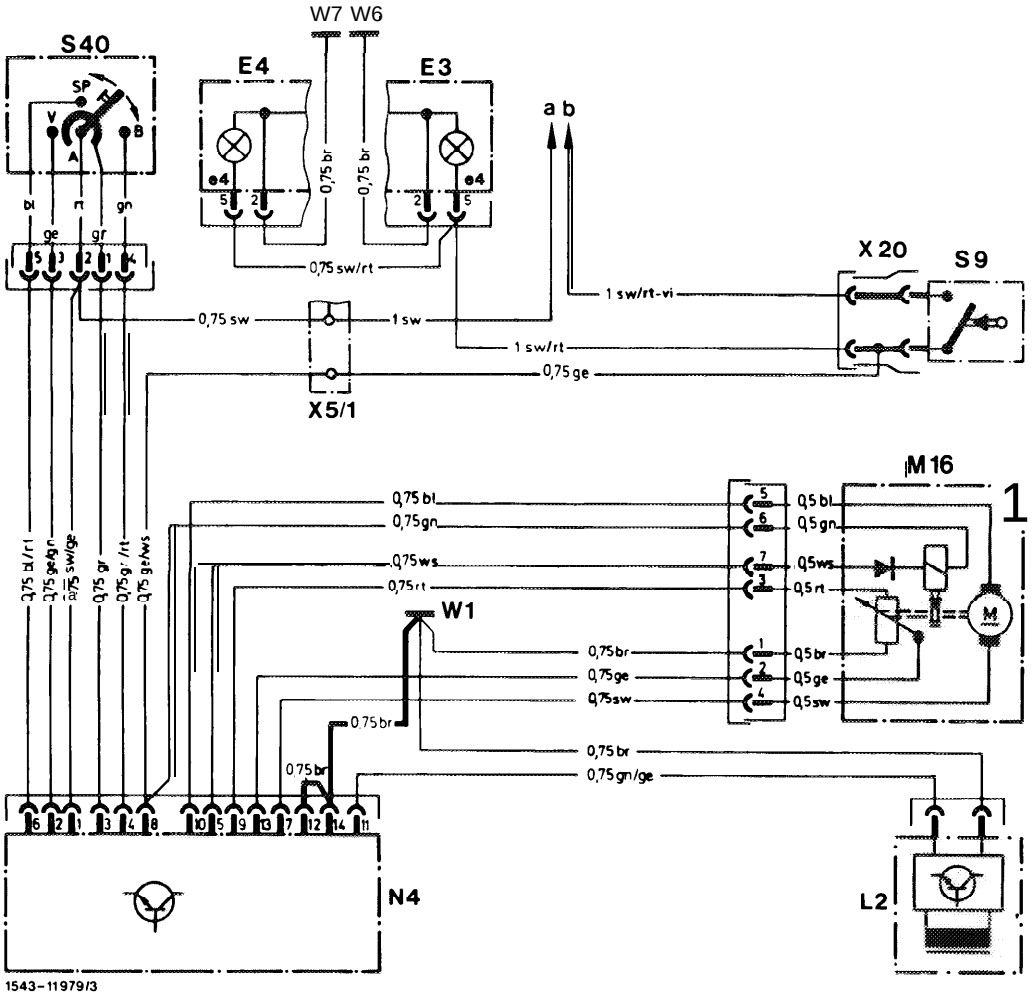
LED readout lights up

yes | no

Recondition grounding bridge in 14-pole connector.



1543-9606



1543-11979/3

Example: 201.122 up to approx. 8.85

N4 Control unit cruise control/Tempomat
W1 Main ground (behind instrument cluster)

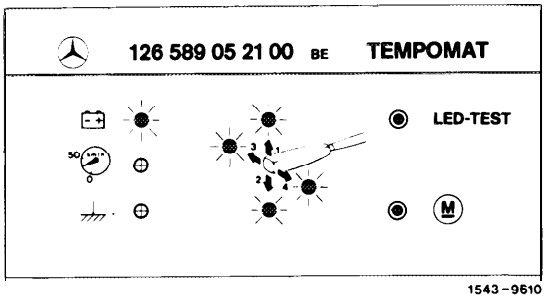
Test harness and pushbutton switch.

Switch position	LED-readout
Accel	1
Decel	2
Off	3
Resume	4

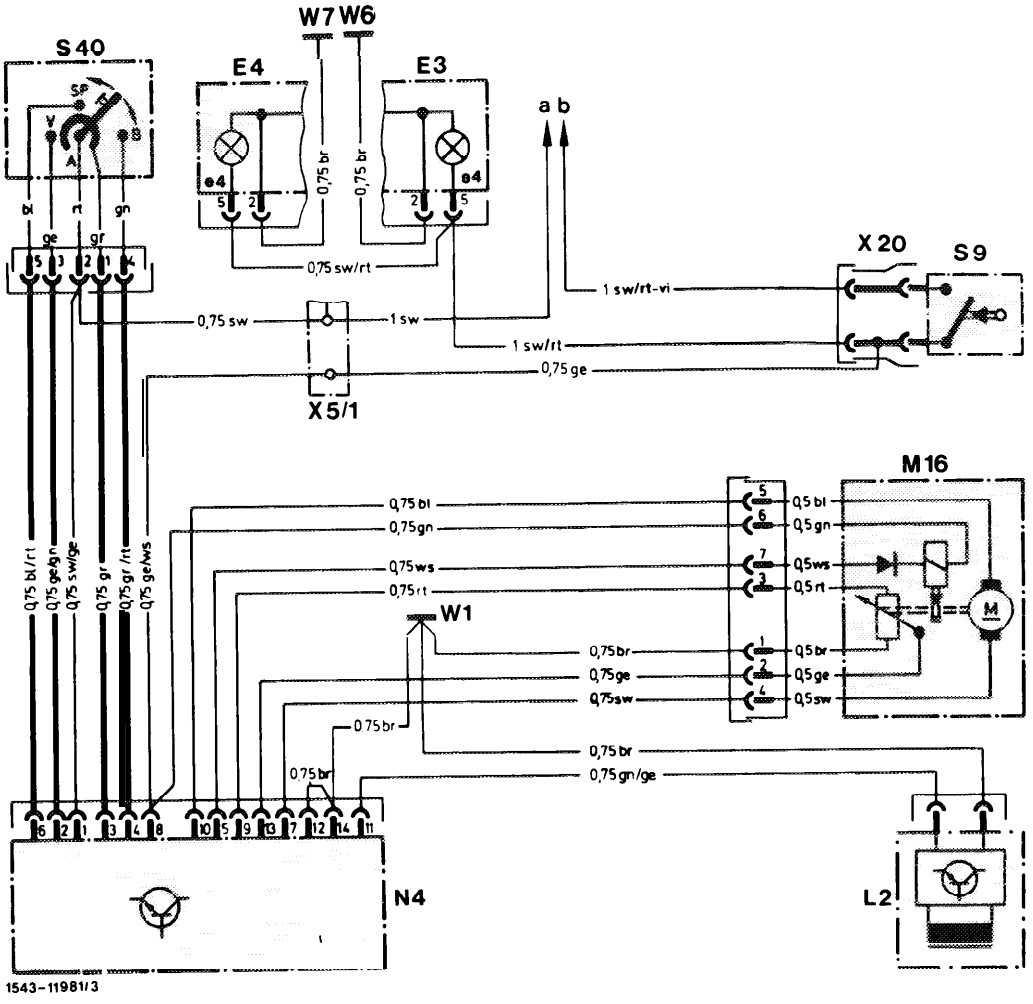
Respective LED-readout lights up

yes | no

Test lines for correct connection and passage.
Renew switch.



1543-9610



1543-11981/3

Example: 201.122 up to approx. 8.85

N4 Control unit cruise control/Tempomat
S40 Pushbutton switch cruise control/Tempomat
B Accel
V Decel
A Off
SP Resume

Test actuator.
Push pushbutton switch M.

Throttle control and accelerator pedal are moving uniformly to full throttle position and stop.

yes | no

Throttle control and accelerator pedal are not moving:

1. Test throttle control.
2. Test lines for correct connection or passage (54–580).
3. On vehicles with manual transmission, test switch on clutch pedal for passage.
4. Renew actuator.

Throttle control and accelerator pedal are constantly moving to and fro:

1. Test contacting of plug connections harness/actuator harness and harness/ control unit.
2. Renew actuator.

Throttle control and accelerator pedal are not pulled to full throttle position:

1. Test contacting of lines for actuator and ground for control unit.
2. Renew actuator.

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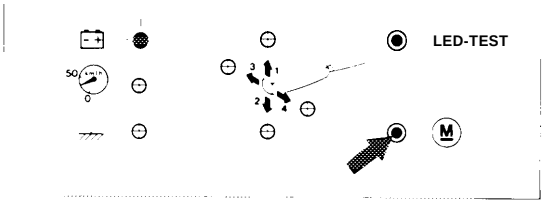
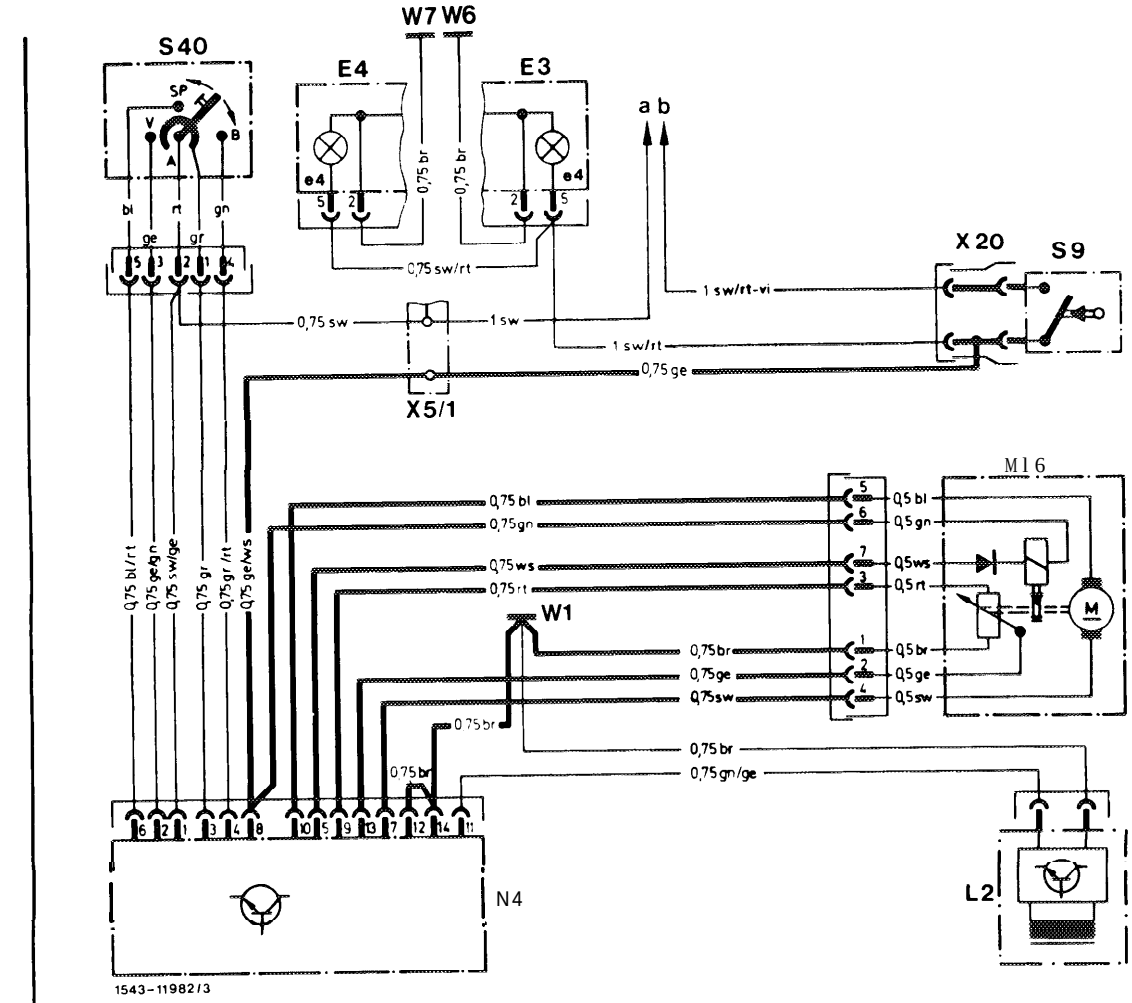


1543-9612



Example: 201,122 up to approx. 8.85

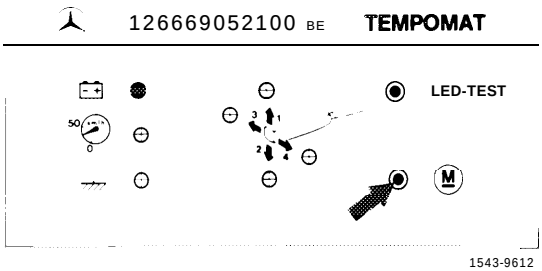
M16	Actuator cruise control/Tempomat
N4	Control unit cruise control/Tempomat
S9	Stop lamp switch
W1	Main ground (behind instrument cluster)

Test cruise control-cutout while braking.
Pushbutton switch M is pushed.
Throttle control and accelerator pedal are in full throttle position!
Depress brake pedal.

Throttle control and accelerator pedal are immediately moving into idle speed position.
Then release pushbotton switch.

yes | no

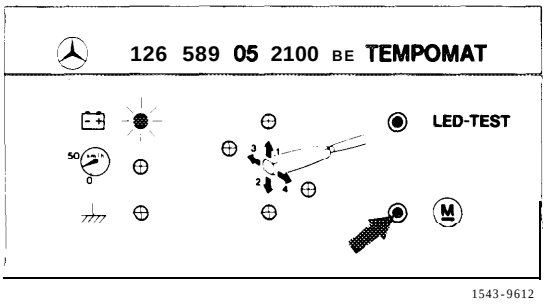
Test throttle control for easy operation.
Renew actuator.



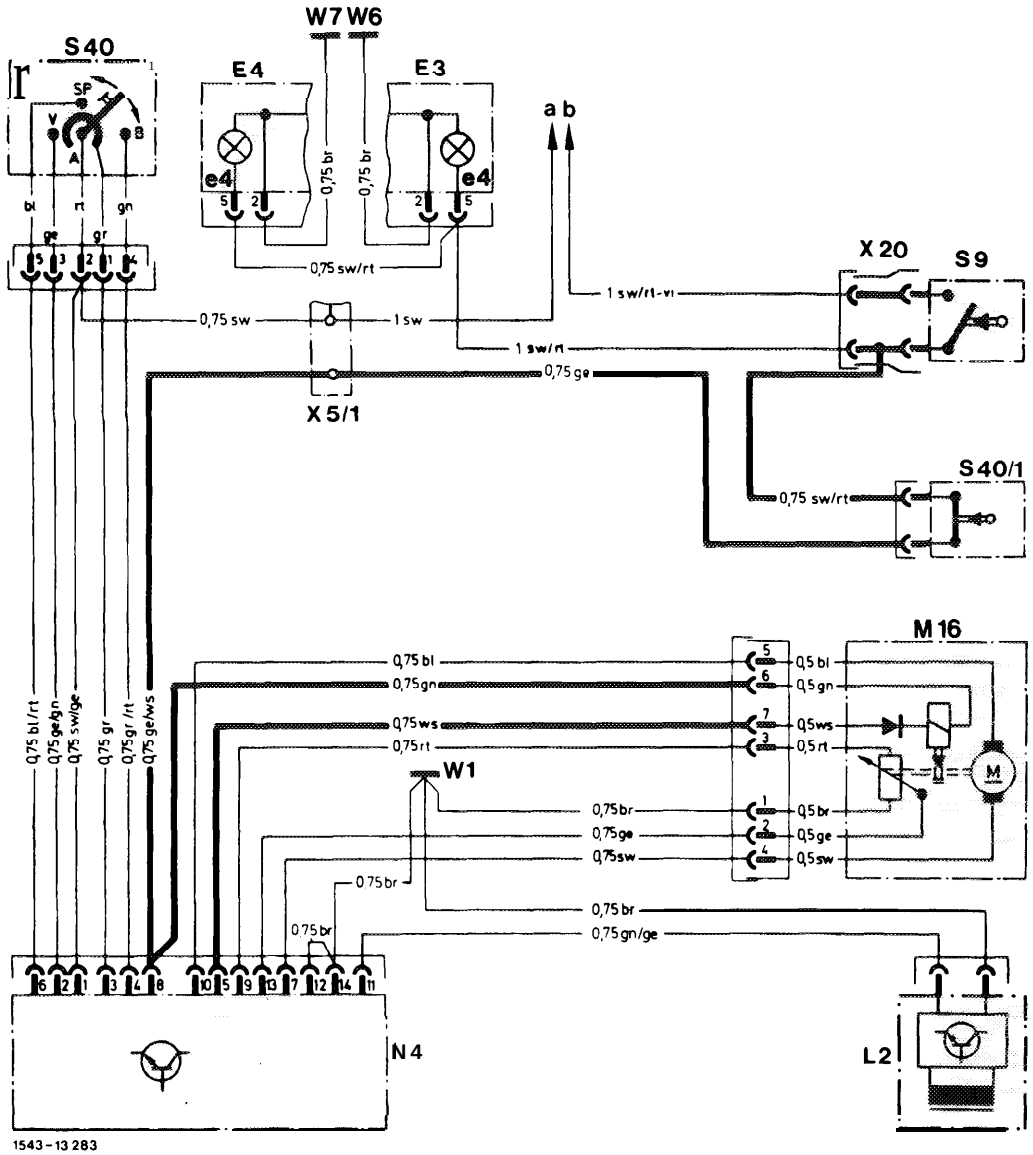
Test cruise control/Tempomat-cutout while declutching (with manual transmission only).
Pushbutton switch M is pushed.
Throttle control and accelerator pedal are in full throttle position!
Depress clutch pedal.

Throttle control and accelerator pedal are moving immediately into idle speed position. Then release pushbutton switch.

yes | no



Lines are shorted.
Switch on clutch pedal defective.



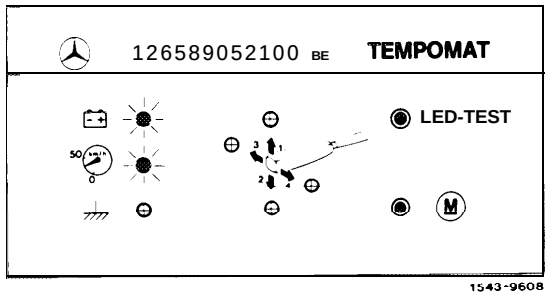
Example: 201.122 up to approx. 8.85

MI 6 Actuator cruise control/Tempomat
N4 Control unit cruise control/Tempomat
S9 Stop lamp switch
S40/1 Switch clutch pedal cruise control/Tempomat

Test harness and transmitter (sensor) on speedometer, the speed readout must be in order.
Move vehicle, for at least 2 turns of wheel.

LED readout flashes or lights up.

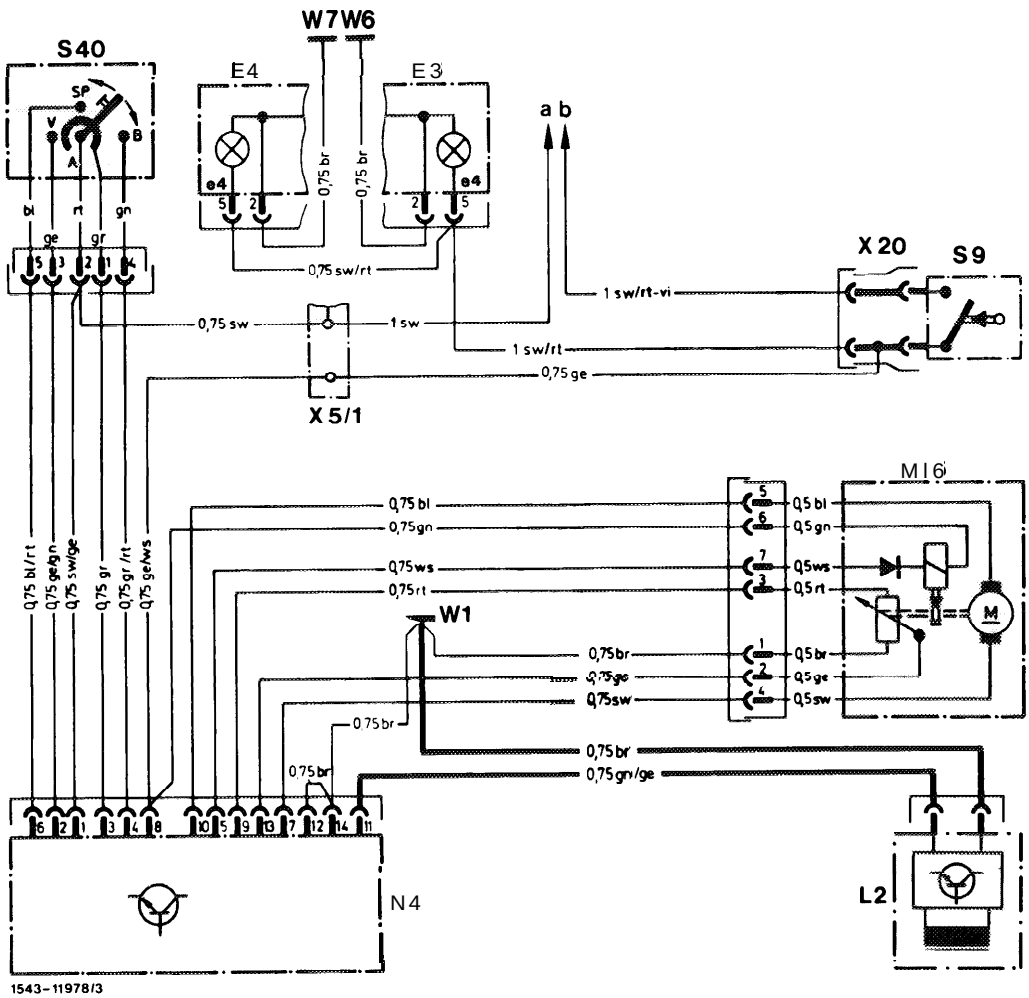
yes | no



1 On vehicles with Hall-effect speed sensor (starting approx. 9.85), test voltage supply (terminal 15) of Hall sensor on black line of 2-pole Hall sensor connector according to wiring diagram (54.8-580).

2 Test lines according to wiring diagram for short circuit and interruption.

3 Renew sensor.



Example: 201.122 up to approx. 8.85

L2 Inductive transmitter speed
N4 Control unit cruise control/Tempomat

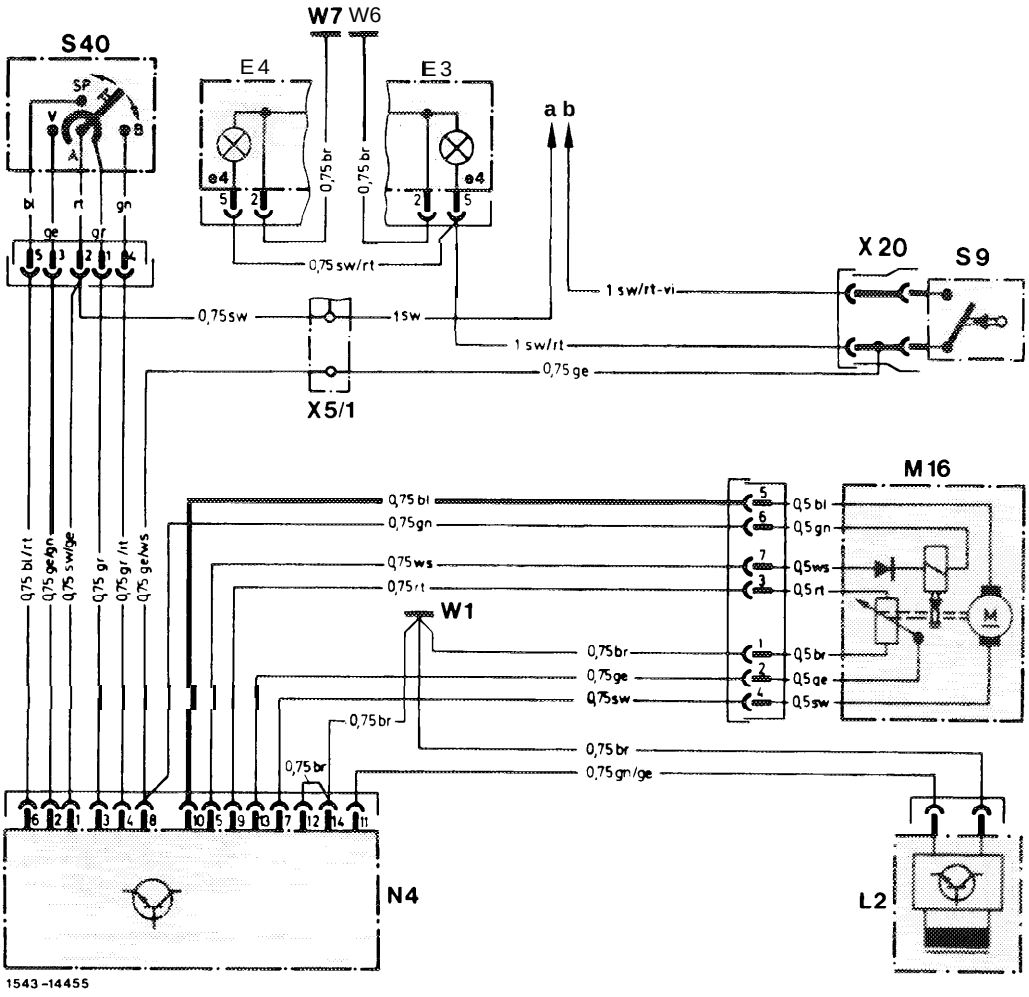
Disconnect test adapter.

Test blue line from connector actuator jack 5 to connector control unit jack 10 with ohm-meter for short to ground..

Short to ground

no	yes

Recondition or renew blue line.



Example: 201.122 up to approx. 8.85

MI6 Actuator cruise control/Tempomat
N4 Control unit cruise control/Tempomat

On control units with coding plug, test coding plug (R29), 54–506.

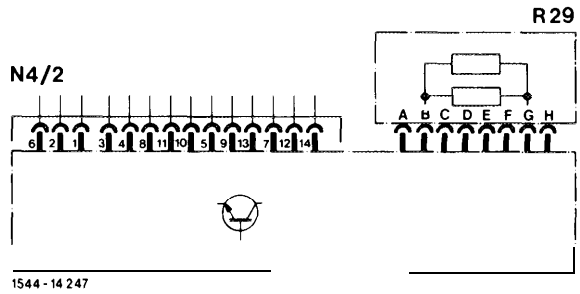
Coding plug in order

yes | no

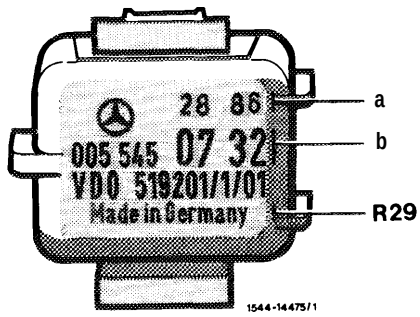
Renew coding plug (R29), 54-577

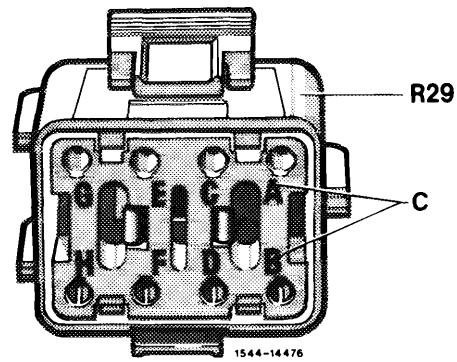
Renew control unit.

End of test



54–506 Testing coding plug





Coding plug (R 29) ..... Remove (54-577). Production date (a), part number (b), pin socket designation (c). On some coding plugs there is no pin socket designation A-G. These coding plugs must be tested as shown in illustration at the right.

Ohmmeter ..... Connect (refer to Table).

Resistance values ..... Test (refer to Table), renew coding plug (R 29) if values deviate.

Test table – resistance values

Part number	Connection ohmmeter to pin socket designation						
	E–G kΩ	E–F kΩ	E–B kΩ	E–D Ω	D - H	D - C Ω	A - D Ω
005 545 11 32	667– 695	52.4– 55.2	*1960–2040	∞	2.88- 3.00 kΩ	∞	< 10
0055454232	98– 102	19.6– 20.4	592– 616	∞	3.18- 3.30 kΩ	∞	< 10
0065452532	980–1020	39.4– 41	1470–1530	∞	1.98– 2.02 kΩ	< 10	∞
006 545 26 32	1470–1530	98 –102	*3570–3720	∞	325.4 -338.6 Ω	∞	< 10
006 545 61 32	980–1020	98 –102	*2940–3060	∞	3.92- 4.08 kΩ	∞	< 10

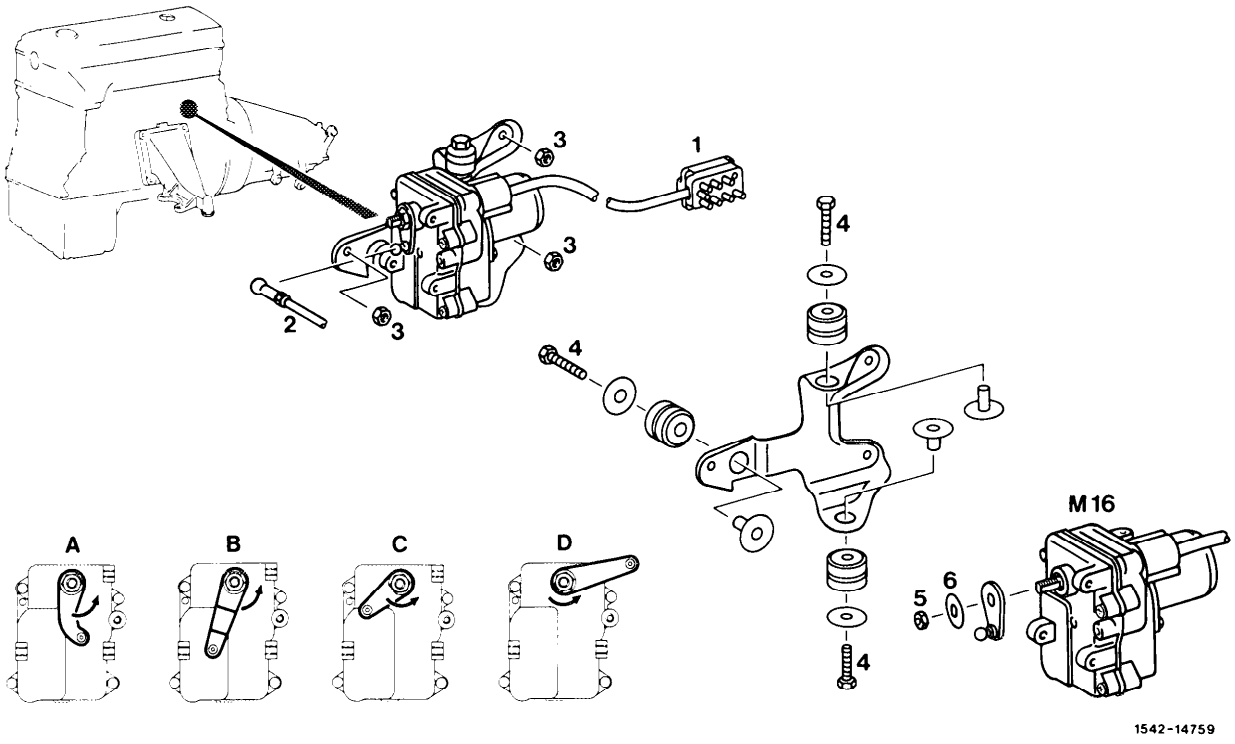
*This value cannot be measured with multimeter SUN DMM-5.

Conventional tool

Multimeter	SUN	DMM-5
	or	
	Thorn Emi	Avometer 2003

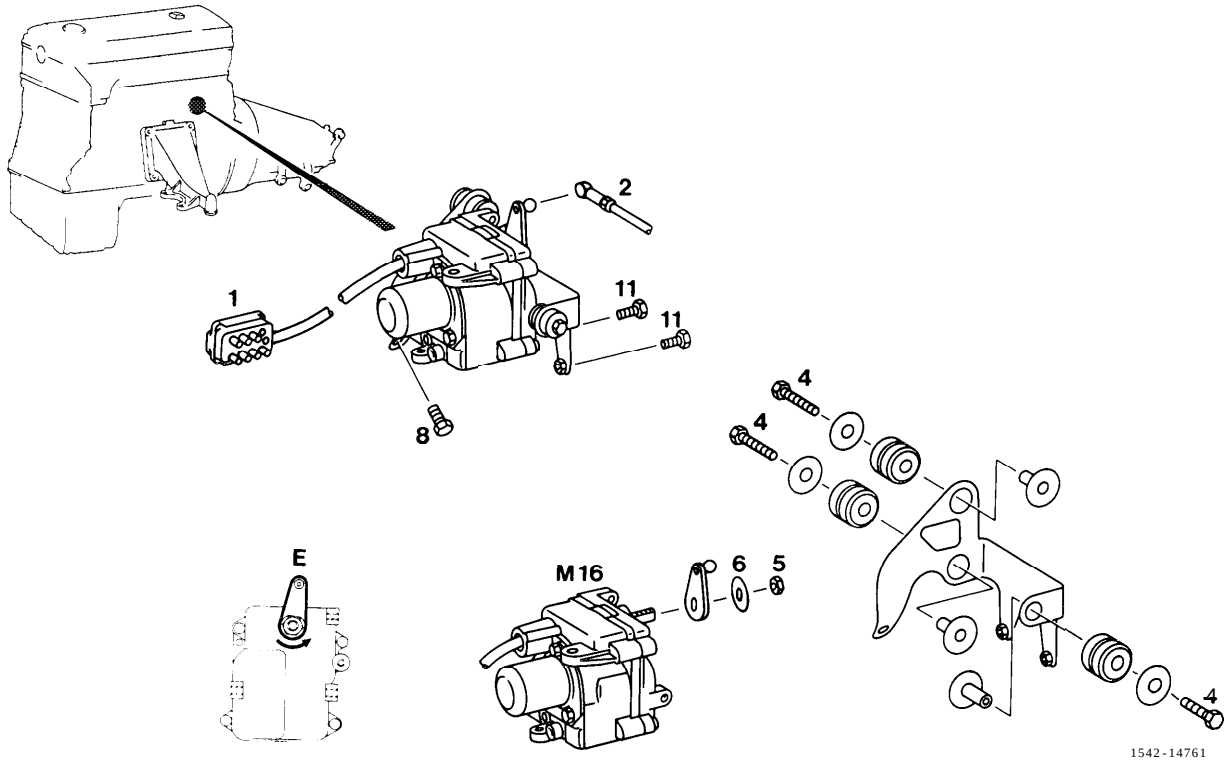
54-541 Removal and installation of actuator

A. Engine 102



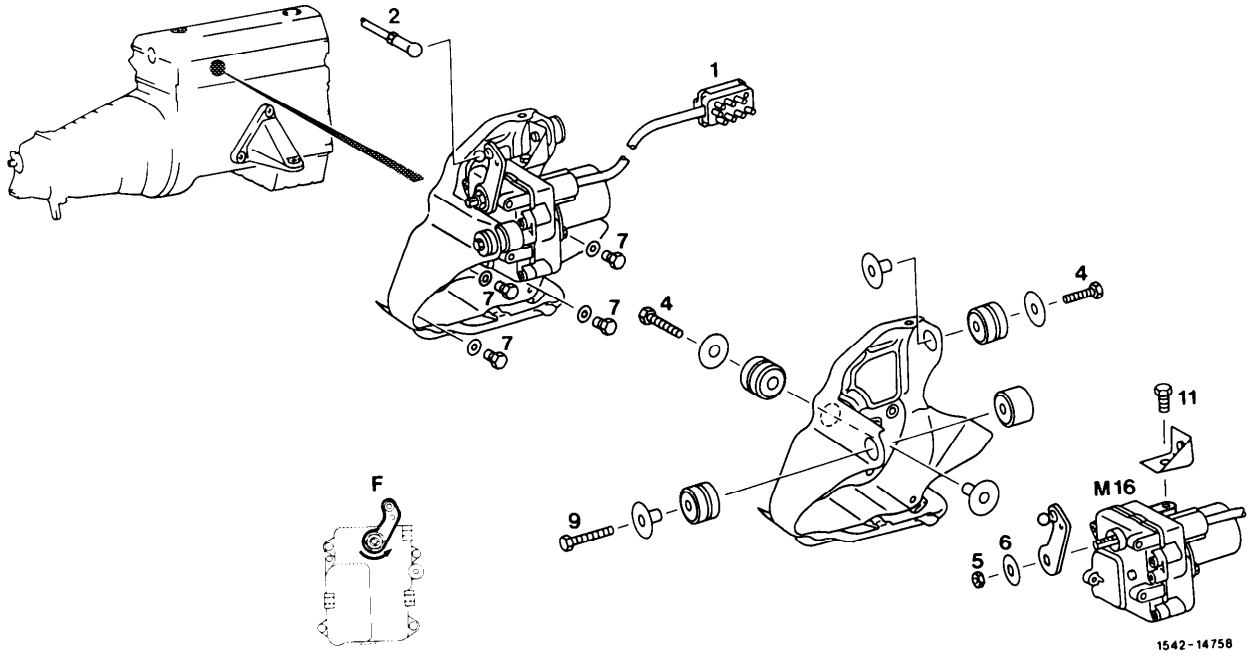
Battery	Disconnect
Air cleaner (except engines with Stromberg carburetor)	Remove
Engine compartment lining, below (on injection engines only)	Remove
Plug (1) on holder of diagnosis socket or on holder of hydraulic unit ABS	Pull from connector
Line of actuator (M16)	Expose
Connecting rod (2) on actuator (M16)	Disengage
Starter (on engine 102.983 only)	Remove
Fastening nuts (3)	Unscrew
Actuator (M16) with holder	Remove; on engines with injection system (except 102.983) remove ignition distributor cap and distributor finger, loosen distributor if required and turn clockwise toward engine or remove, set ignition following installation. On engine 102.983, extend actuator (M16) first at the two rear studs and remove with holder in downward direction.
Fastening screws (4) M6x28	Unscrew, 12 Nm
Lock washer (6)	Unlock
Fastening nut (5)	Unscrew, 10 Nm
Installation	In vice-versa sequence, while turning drive shaft of actuator (M16) opposite to direction of arrow against stop, lever (A Stromberg carburetor; B 2 E-E carburetor; C injection engines, except 102.983; D engine 102.983) mount and secure nut (5)
Function test	Perform on road

B. Engine 103



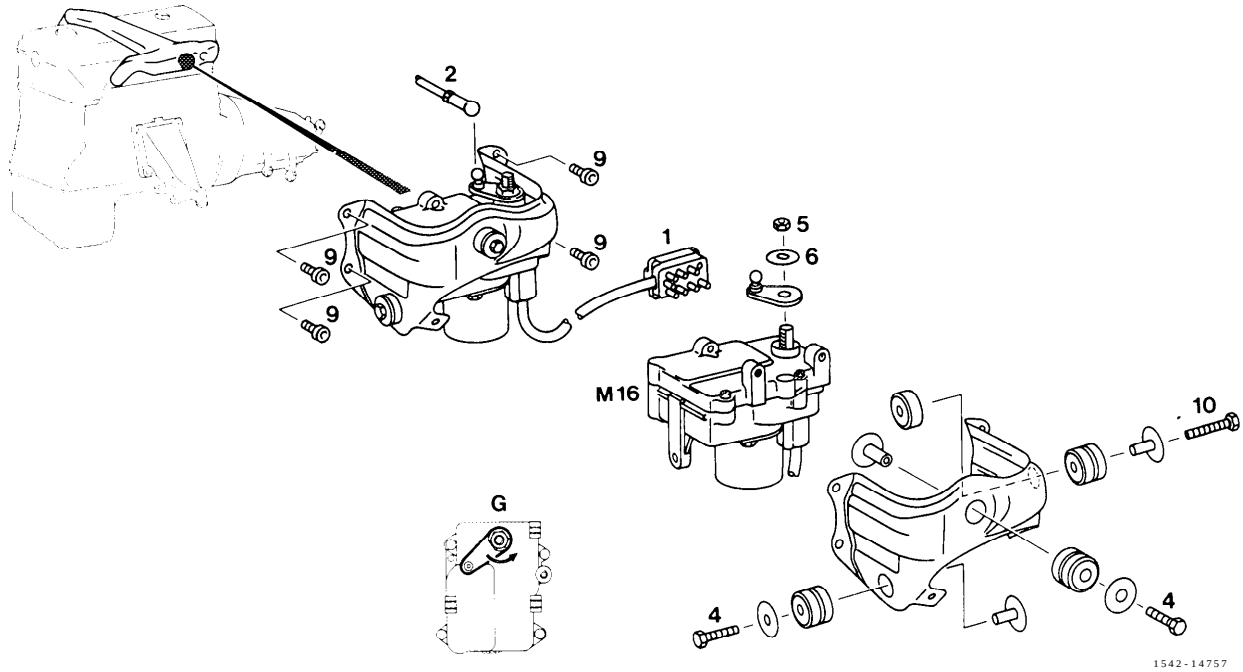
Battery	Disconnect
Air cleaner	Remove
Engine compartment lining, below	Remove
Plug (1) model 124 on holder of diagnosis socket or model 201 on holder of hydraulic unit ABS	Pull from connector
Line of actuator (M16)	Expose
Connecting rod (2) on actuator (M16)	Disengage
Fastening screws (11) M6x 12 and (8) M8x30	Unscrew
Actuator (M16) with holder.	Remove in downward direction. On model 124 with refrigerant compressor, loosen fastening screws for engine mounts and lift engine.
Fastening screws (4)M6x28	Unscrew, 12 Nm
Lock washer (6)	Unlock
Fastening nut (5)	Unscrew, 10 Nm
Installation	In vice-versa sequence, while rotating drive shaft of actuator (M16) opposite to direction of arrow against stop. Mount lever (E) and secure nut (5)
Function test	Perform on road

C. Engines 601, 602.91 and 603.91



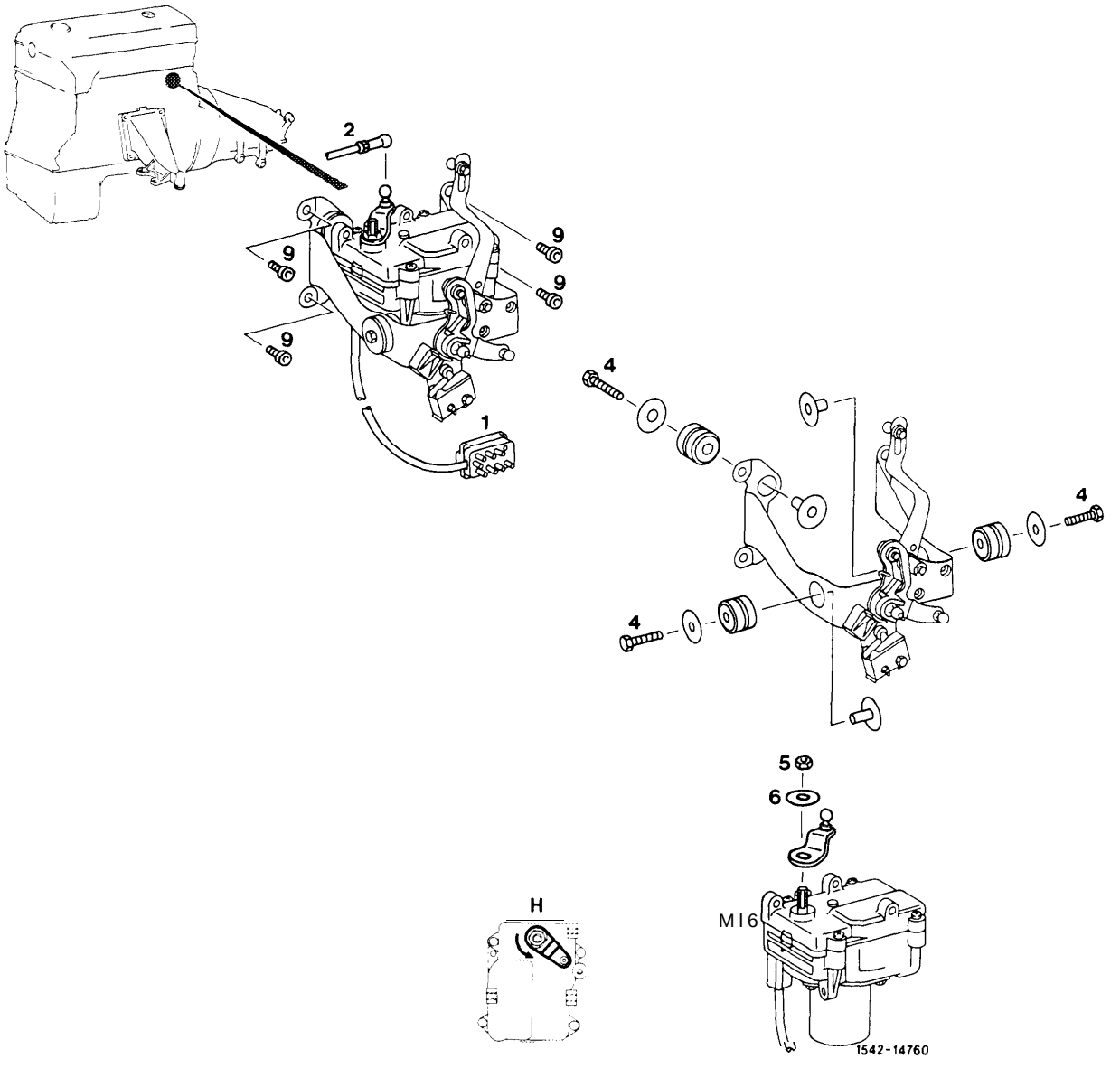
Battery	Disconnect
Plug (1) between coolant expansion tank and washer reservoir	Pull from connector
Line of actuator (M16)	Expose
Connecting rod (2) on actuator (M16)	Disengage
Fastening screws for shielding plate on holder (1st version only)	Unscrew
Fastening screws (7) M6x18	Unscrew
Actuator (M16) with holder	Remove
Fastening screws (4) M6x28	Unscrew, 12 Nm
Lock washer (6)	Unlock
Fastening nut (5)	Unscrew, 10 Nm
Installation	In vice-versa sequence, while turning drive shaft of actuator (M16) opposite to direction of arrow against stop, mount lever (F) and secure nut (5).
Function test	Perform on road

D. Engine 602.961



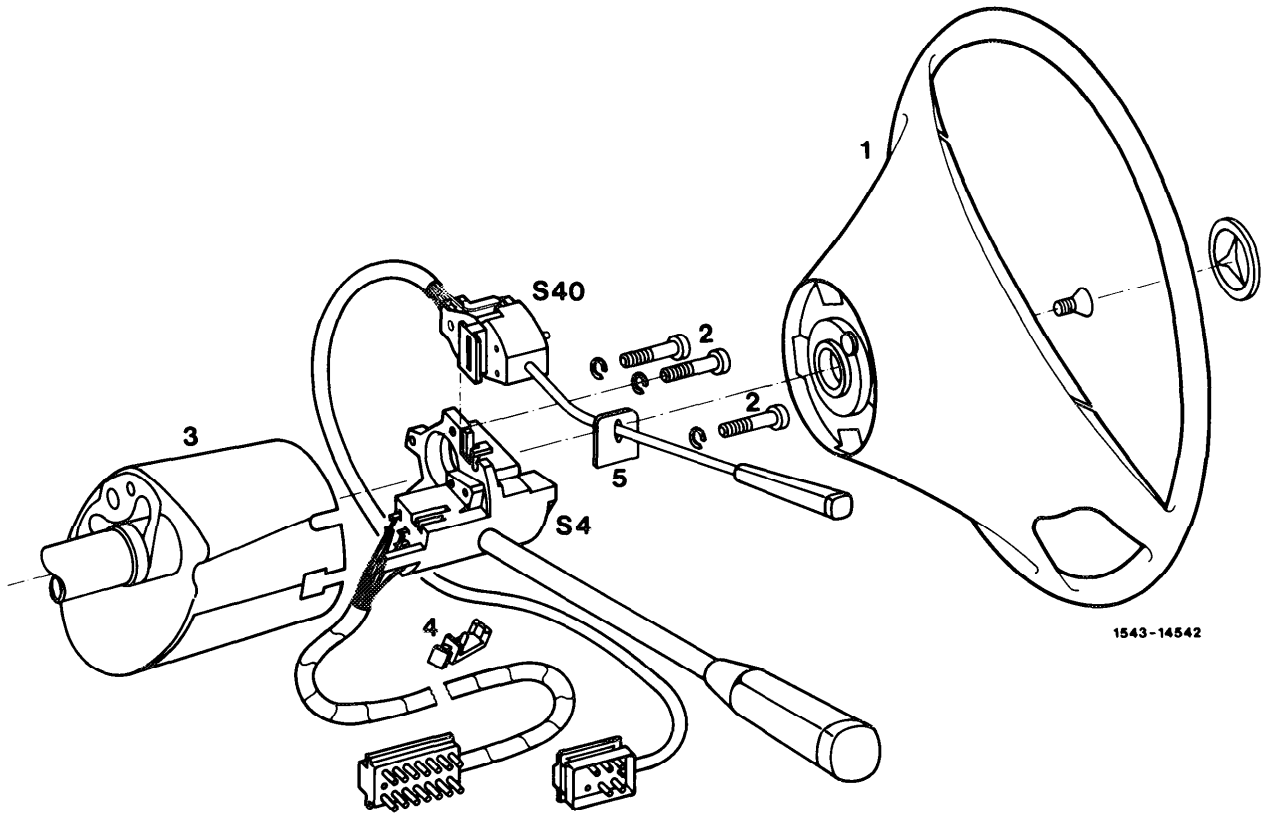
Battery	Disconnect
Plug (1) on holder for hydraulic unit ABS.	Pull from connector
Line of actuator (Ml 6)	Expose
Connecting rod (2) on actuator (M16)	Disengage
Fastening screws (9) M6x18	Unscrew
Actuator (M16) with holder.	Remove
Fastening screws (4) M6x28	Unscrew, 12 Nm
Lock washer (6)	Unlock
Fastening nut (5)	Unscrew, 10 Nm
Installation.	In vice-versa sequence, while turning drive shaft of actuator (M16) opposite to direction of arrow against stop, mount lever (G) and secure nut (5).
Function test	Perform on road

E. Engine 603.96



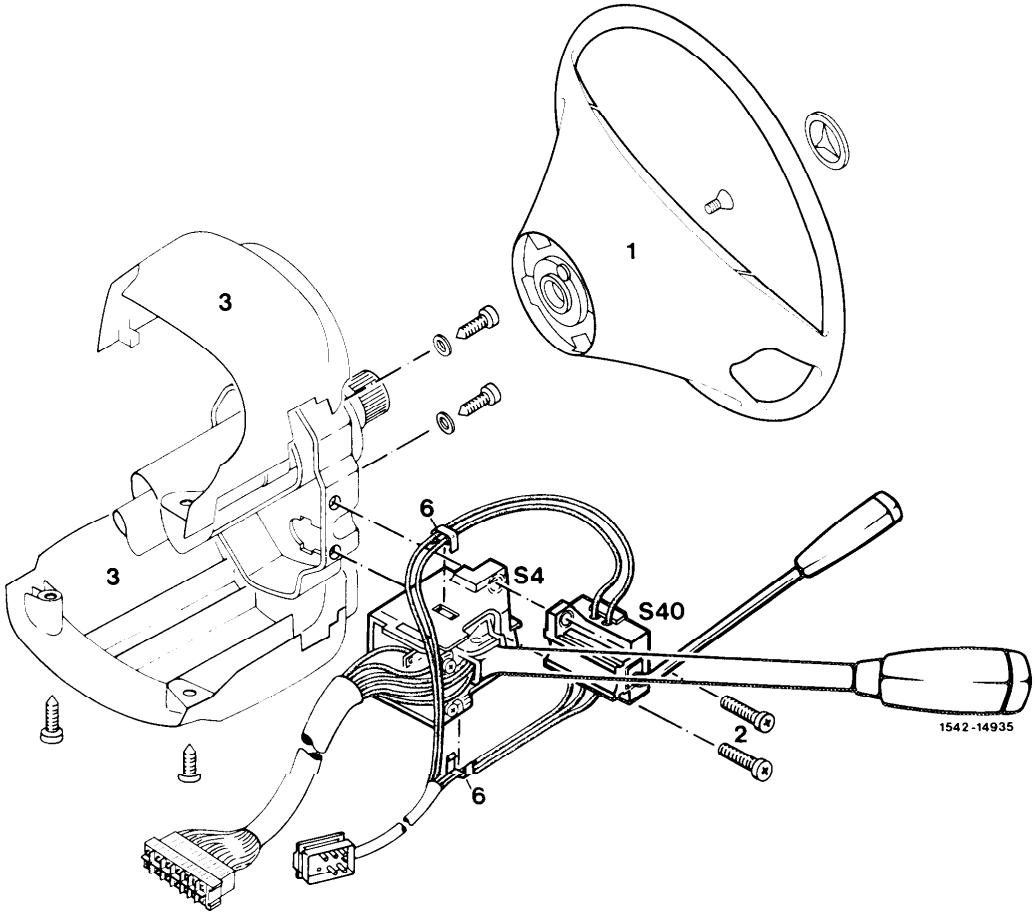
Battery	Disconnect
Air cleaner	Remove
Plug (1) on holder of diagnosis socket	Pull from connector
Line of actuator (M16)	Expose
Regulating linkage and control pressure cable control	Disengage
Connecting rod (2) on actuator (M16)	Disengage
Fastening screws (9) M6x18	Unscrew
Actuator (M16) with holder	Remove
Fastening screws (4) M6x28	Unscrew, 12 Nm
Lock washer (6)	Unlock
Fastening nut (5)	Unscrew, 10 Nm
Installation	In vice-versa sequence, while turning drive shaft of actuator (M16) opposite to direction of arrow against stop, mount lever (H) and secure nut (5).
Function test	Perform on road

A. Model 124 and 2nd version model 201 starting approx. middle of April 84

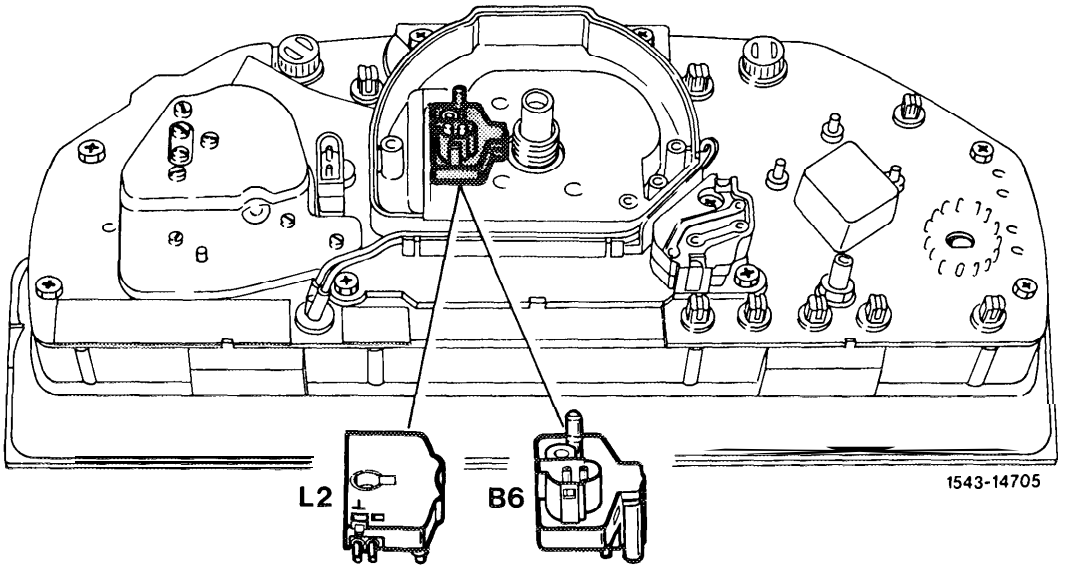


Battery	**Disconnect**
Cover at left under instrument panel	**Remove (68-150)**
Steering wheel (1)	**Remove**
Plug for switch (S40)	**Pull off**
Fastening screws (2)	**Unscrew**
Combination switch (S4) with switch (S40)	**Pull out for approx. 5 cm**
Line holder (4)	**Remove from clips**
Cruise control switch (S40)	**Pull from combination switch (S4)**
Cruise control switch (S40)	**Remove, while pulling up steering column lining (3) on model 201**
Rubber grommet (5)	**Remove from cruise control switch (S40)**
Installation	**In vice-versa sequence**
Function test	**Perform on road**

B. 1st version model 201 up to approx. middle of April 84



Battery	Disconnect
Cover at left under instrument panel	Remove (68– 150)
Plug for cruise control switch (S40)	Pull off
Steering wheel (1)	Remove
Steering column lining (3)	Remove
Clamps (6) on combination switch (S4)	Remove from clips
Fastening screws (2)	Unscrew
Cruise control switch (S40)	Remove
Installation	In vice-versa sequence
Function test	Perform on road

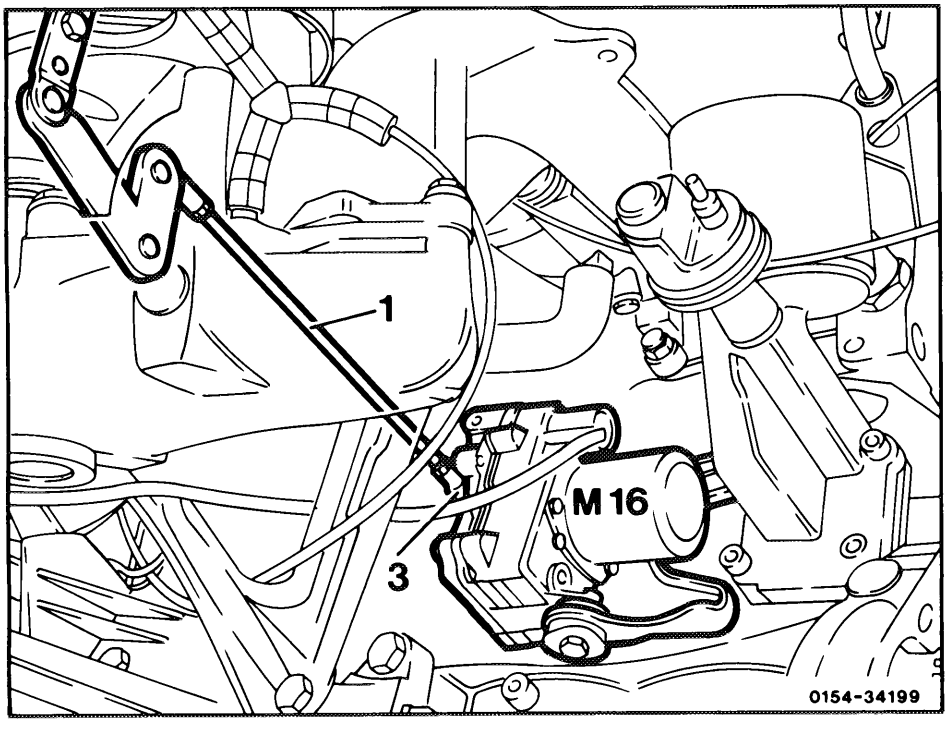


Instrument cluster	Remove (54–250)
Harness of transmitter.	Pull off
Fastening screw of transmitter	Unscrew and remove transmitter
Installation.	In vice-versa sequence
Function test	Perform on road

Note

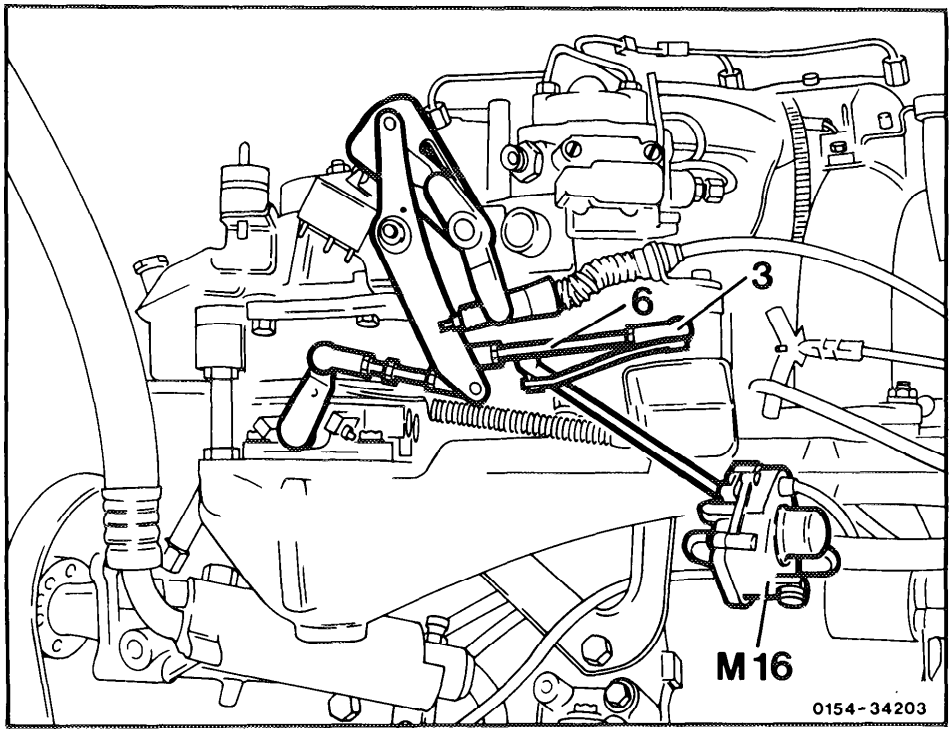
Model 124 and model 201 as of approx. 1985
Hall sensor road speed (B6)
Model 201 up to 1984 inductive transmitter,
road speed (L2)

C. Engine 102 with injection system, except engine 102.983



Connecting rod (1)	Disengage at actuator (M16)
Throttle control	Move into idle speed position
Lever of actuator (M16)	Push toward engine into idle speed position
Connecting rod (1)	Set approx. 1 mm or 1 turn shorter
Connecting rod (1)	Engage
Ball socket (3)	Lock

D. Engine 102.983



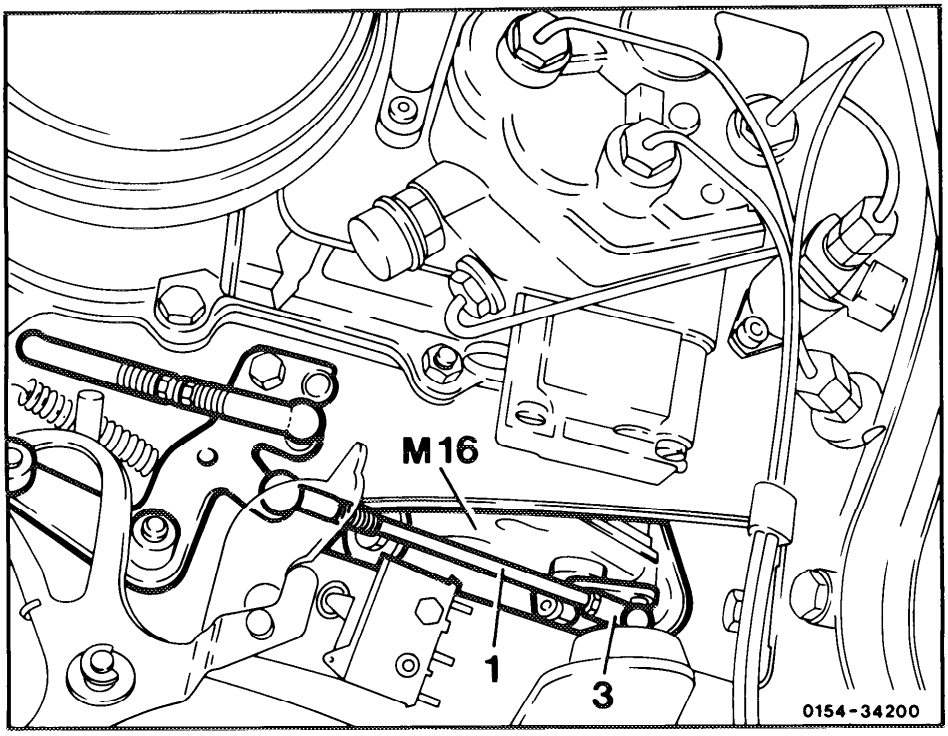
1st version up to approx. 30.06.86 (round rod)

Connecting rod (6) ..... Disengage at transfer lever
Throttle control ..... Move into idle speed position
Connecting rod (6). . . . . , Set approx. 1 mm or 1 turn shorter
Connecting rod (6). . . . . , Engage
Ball socket (3). . . . . , Lock

2nd version starting approx. 01.07.86 (profiled rod)

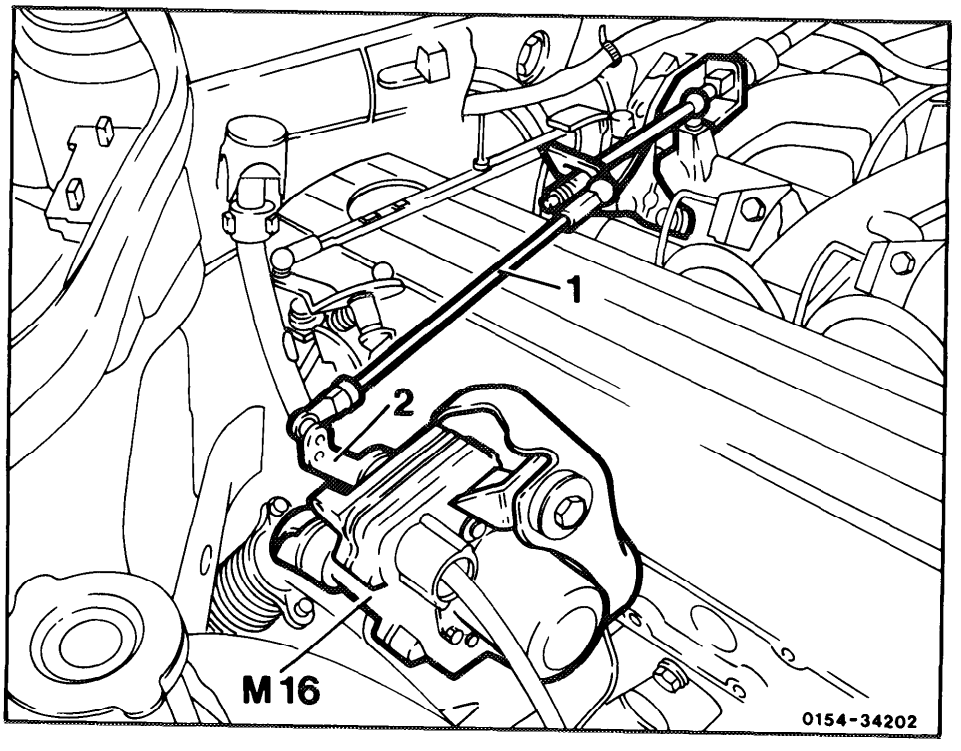
Hex. head screw . . . . . . Loosen on profiled rod (6)
Throttle control . . . . . , Move into idle speed position
Lever of actuator . . . . . , Lift approx. 1 mm from idle speed position
Hex. head screw . . . . . , Tighten in this position

E. Engine 103



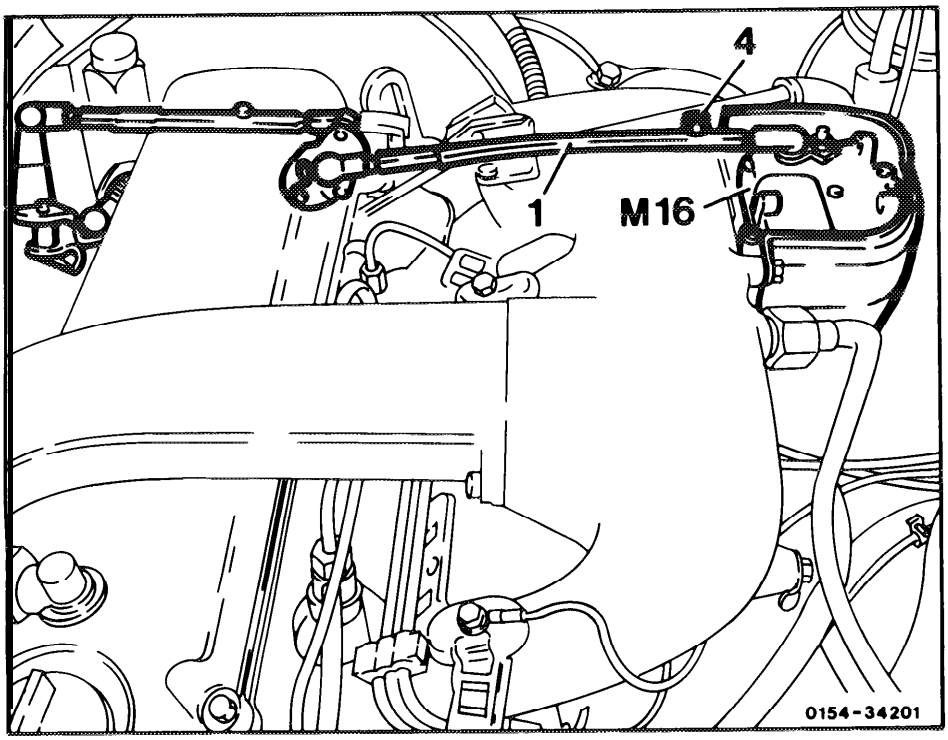
Air cleaner	Remove
Connecting rod (1)	Disengage at throttle control
Throttle control	Move into idle speed position
Lever of actuator (M16)	Force into idle speed position with connecting rod (1)
Connecting rod (1)	Adjust approx. 1 mm or 1 turn shorter
Connecting rod (1)	Engage
Ball head (3)	Lock
Air cleaner	Mount

F. Engines 601, 602.912 and 603.912



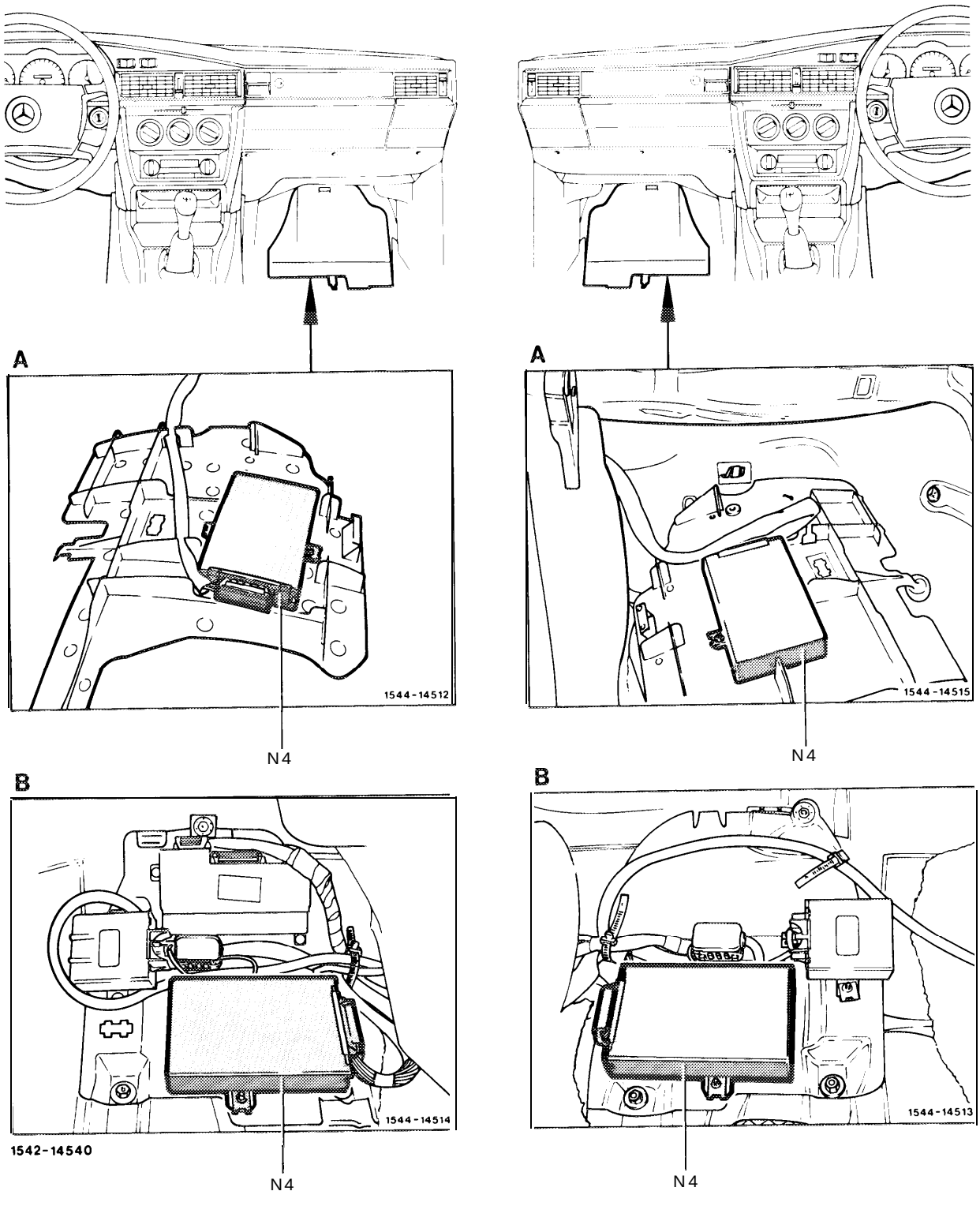
Connecting rod (1)	Disengage on actuator (M16)
Throttle control	Move into idle speed position
Lever (2) of actuator (M16)	Force away from engine in idle speed position
Connecting rod (1)	Adjust approx. 0.5 mm or 1 turn shorter
Connecting rod (1)	Engage

G. Engine 602.961



Hex. head screw (4)	Loosen at profiled rod (1)
Throttle control	Move into idle speed position
Lever of actuator (M 16)	Force toward engine into idle speed position
Profiled rod (1)	Adjust approx. 0.5 mm longer
Hex. head screw (4)	Tighten in this position

B. Model 201



Floor mat front right or left.	Remove
Legrest.	Remove
Connector of harness on control unit N4	Pull off
Control unit N4.	Unscrew from legrest (version A)
Fastening plate for control units	Remove (version B)
Control unit N4.	Unscrew from fastening plate (version B)

A = 1 st version
B = 2nd version

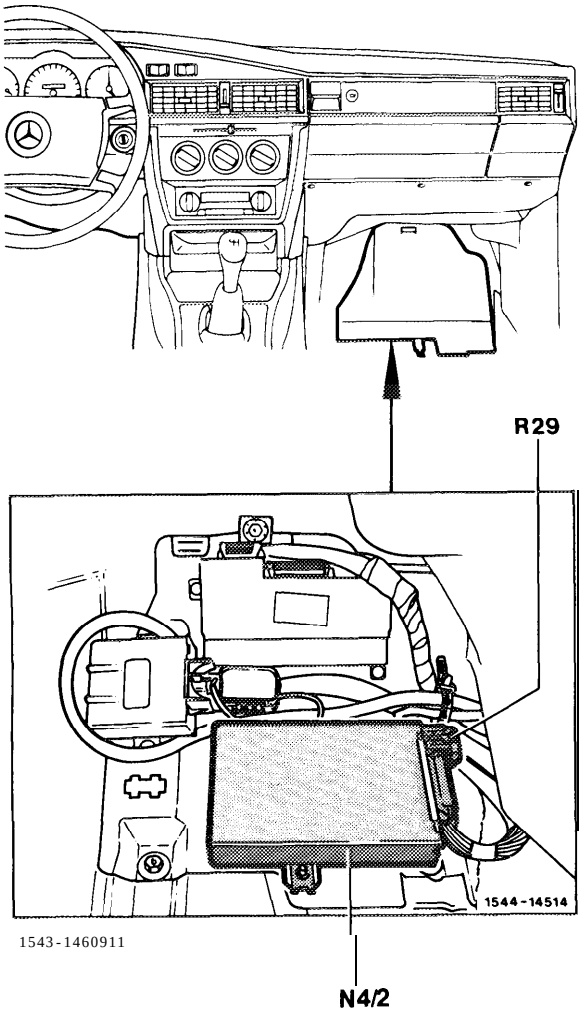
Installation	.....	In vice-versa sequence. On defective control unit be sure to check adjustment of connecting rod (refer to Note)
Function test	.....	Perform on road

Note

A new control unit with coding plug is installed on models 201.029/128. The other models are phased-in.

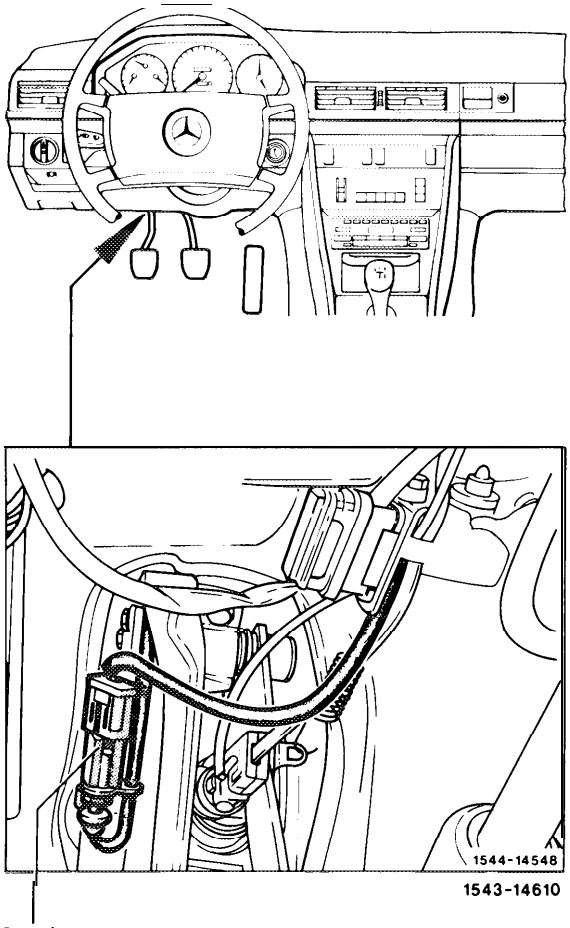
The new control unit with coding plug has no influence on wiring and thereby also not on wiring diagrams.

Model 201



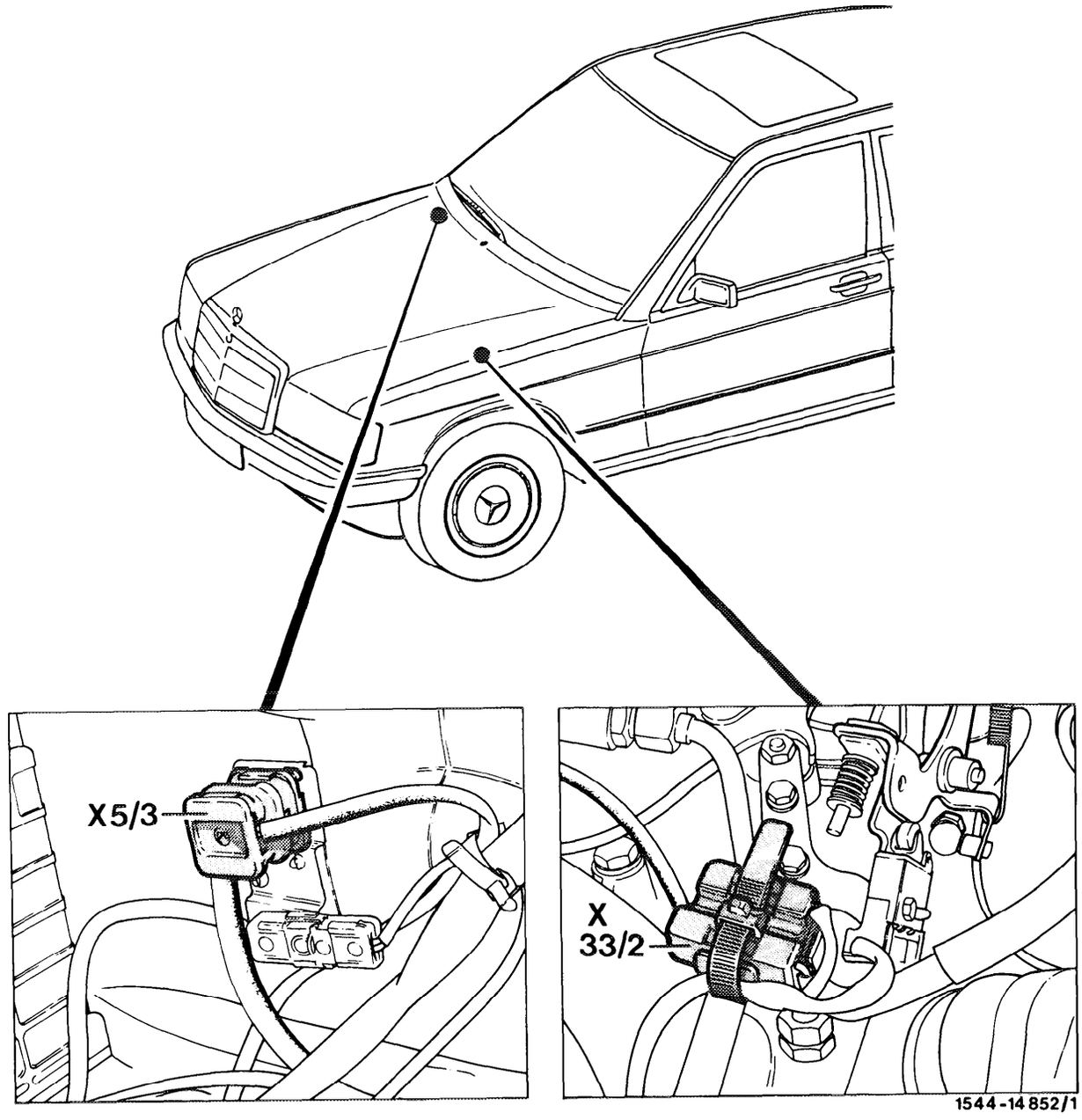
Floor mat front	Remove
Legrest	Remove
Coding plug (R29)	Pull from control unit (N4/2)
Installation	In vice-versa sequence
Function test	Perform on road

54-575 Removal and installation of switch on clutch pedal

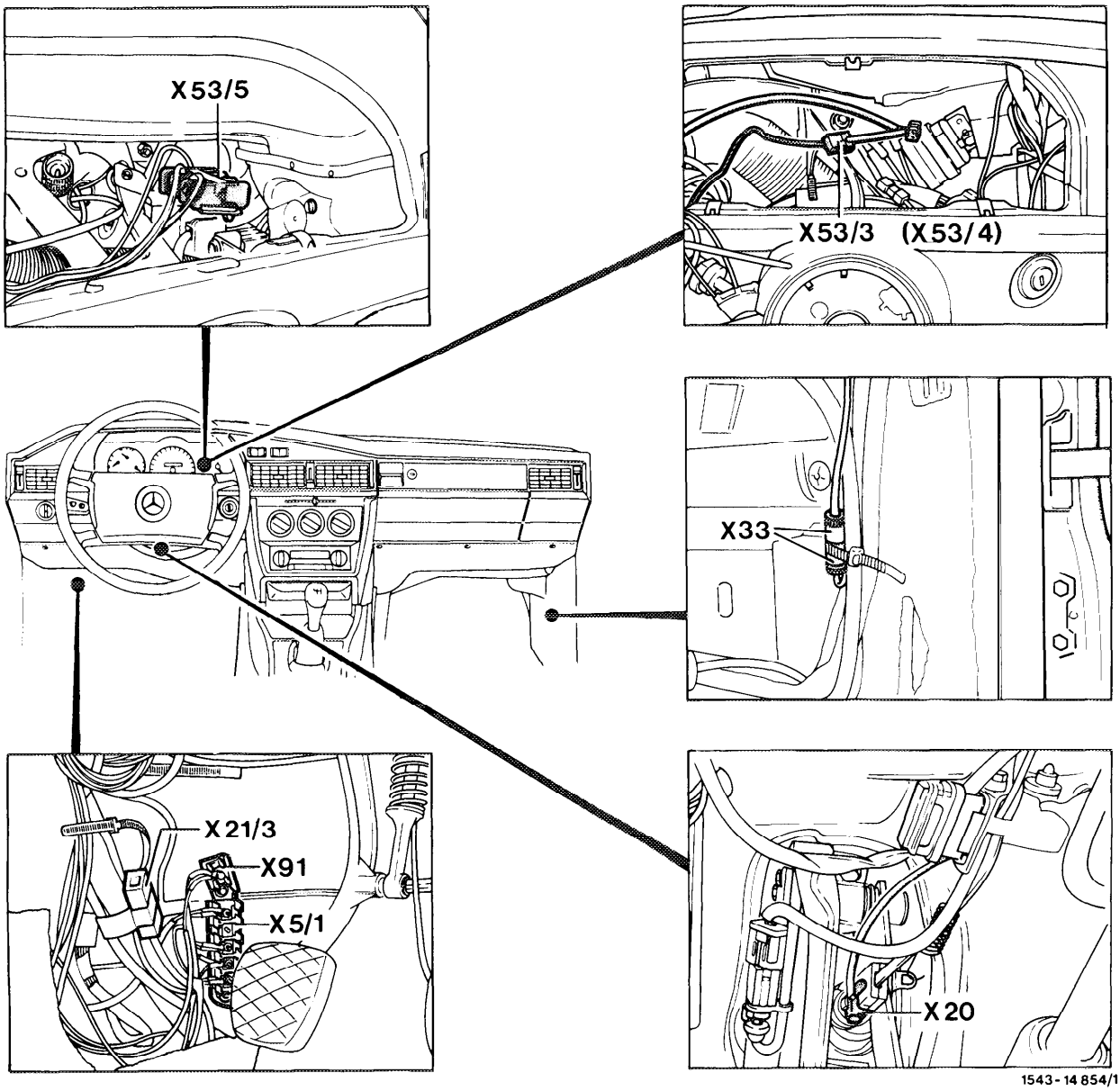


Cover at left or right under instrument panel	Remove (68-I 50)
Connector of switch (S40/1)	Pull off
Switch (S40/1)	Loosen and remove
Installation	In vice-versa sequence
Function test	Perform on road

B. Model 201



X5/3 Plug connection interior/compressor harness
X33/2 or 3311 Plug connection CIS-E/cruise control 2-pole



x5/1 Cable connector interior
x20 Plug connection stop lamp switch
X21/3 Cable connector stop lamp switch/cruise control/Tempomat 1 -pole
x33 Plug connection CIS-E/cruise control 1 -pole
x53/3 Plug connection Hall sensor/EGR 1 -pole
x53/4 Plug connection inductive transmitter/EG R 2-pole
x53/5 Multiple plug connection/Hall sensor (only if stop lamp signal is required for several special requests)
x91 Cable connector clutch pedal/cruise control 1 -pole

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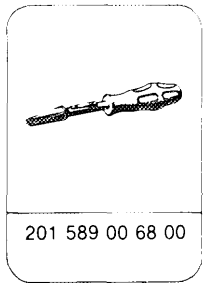
	Job No
Windshield	
Removal and installation of windshield glass	67-I 00
Removal and installation of ornamental frame on windshield	120
Rear window	
Removal and installation of rear window	200
Removal and Installation of ornamental frame on rear window	220

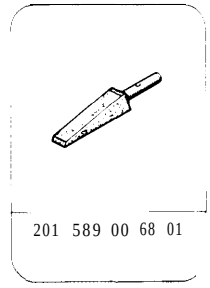
67-100 Removal and installation of windshield glass

Data

Primer edge on glass: top and laterally 10 mm; below 30 mm wide
Primer edge on body flange: top and laterally across entire width of fold; below 30 mm wide.

Special tools


201 589 00 68 00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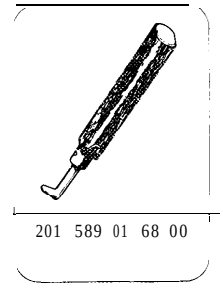

201 589 01 68 00

Conventional tool	Order number	e.g. company
Siphon	602-2	Karl Assfalg KG Buchstraße 149 D-7070 Schwabisch Gmünd

Note

The windshield glass is glued to body by means of Butyl tape. During removal and installation of windshield glass the tape is made plastic by heating. This is done best by electrical heating of a copper wire embedded in center of butyl tape. As an energy source, connect a transformer with 12 V output voltage or a well charged 12 V vehicle battery, which is specially used for repair jobs.

The heating time of the Butyl tape is usually approx. 15 minutes. At **the end of this period the Butyl tape attains approx.** 50 °C within connected range of copper wire. **This temperature is adequate for safe removal of glass.**

The following factors will influence the heating-up time:

1. Dia. of copper wire; 0.3, 0.4, 0.7 mm (the thicker, the shorter the heating time)

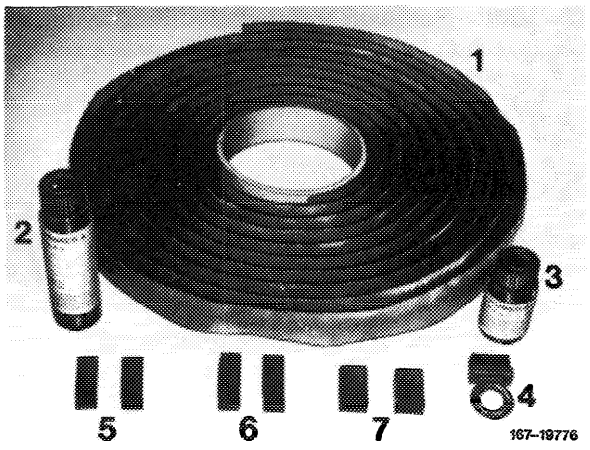
2. Age of Butyl tape (the older, the longer the heating time)

3. Temperature of glass and vehicle body (the colder, the longer the heating time)

4. Condition of glass (glass which is already damaged can be removed after a short heating up time by applying increased force).

Renewal of windshield glass requires use of repair kit for glazing, Part No. 126 670 01 93. The contents of this repair kit have been selected for use with models 107, 126 and 201.
The primer 126 670 00 93 is separately available, if required.

Contents of repair kit:



1 **Butyl tape, 4200 mm long, 10 ± 0.7 mm dia.**

2 Bottle with primer, component part A.

3 Bottle with primer, component part B.

4 Application sponge for primer.

5 Spacing pads for windshield (required on model 107 only).
Dimensions: 30 mm x 10 mm x 6 mm.

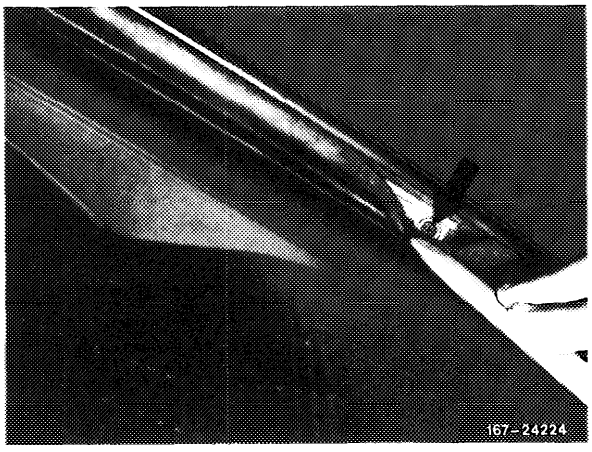
6 Spacing pads for side window glass (required on model 107 only).
Dimensions: 30 mm x 10 mm x 6 mm.

7 Spacing pads for rear window glass (required on model 107 only).
Dimensions: 20 mm x 13 mm x 10 mm.

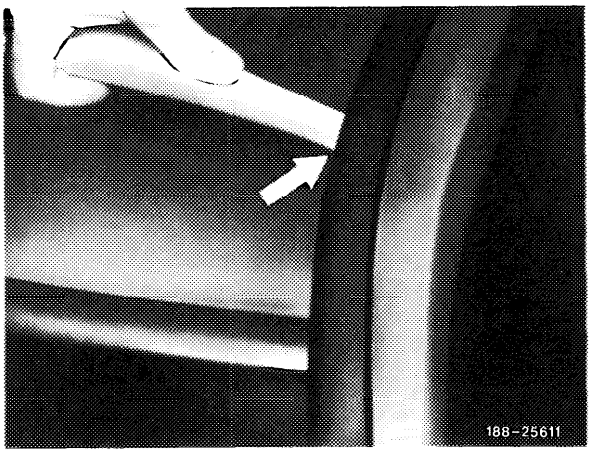
Removal

1 **Remove cover at air inlet (Group 83).**

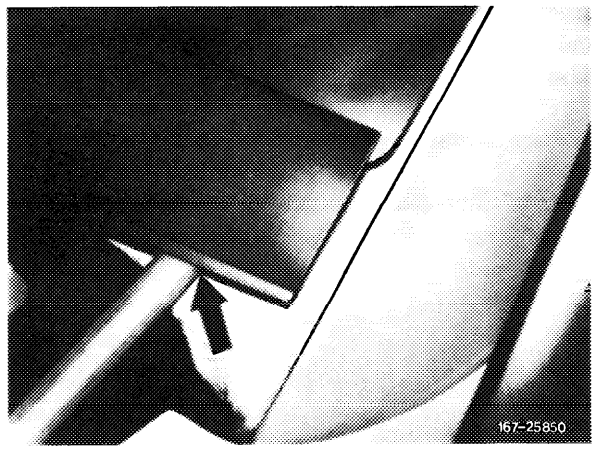
2 Push rubber lip on ornamental molding at the left and right sideways and unscrew the 4 screws underneath.



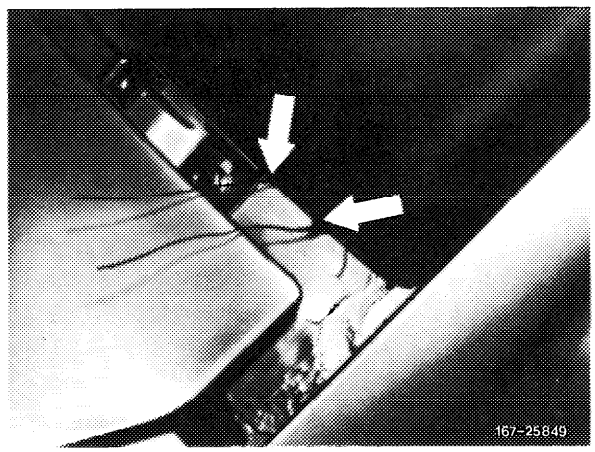
3 Pull ornamental molding left and right in roof range out of front holding clamps and remove.



4 **Pull off ornamental frame at bottom from the 5 holding clamps and remove.**

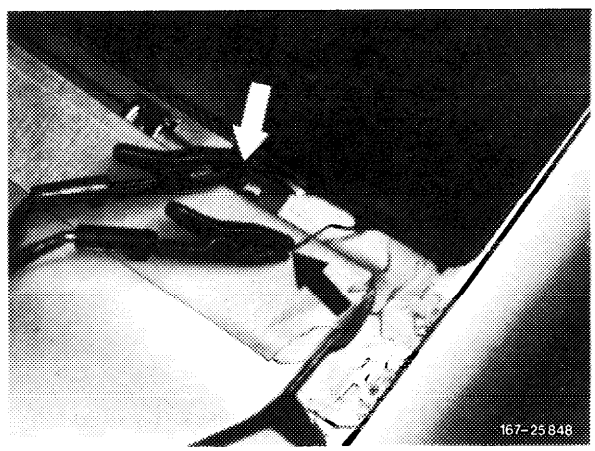


5 **Expose copper wire in adhesive cord and make bright at ends with emery paper.**

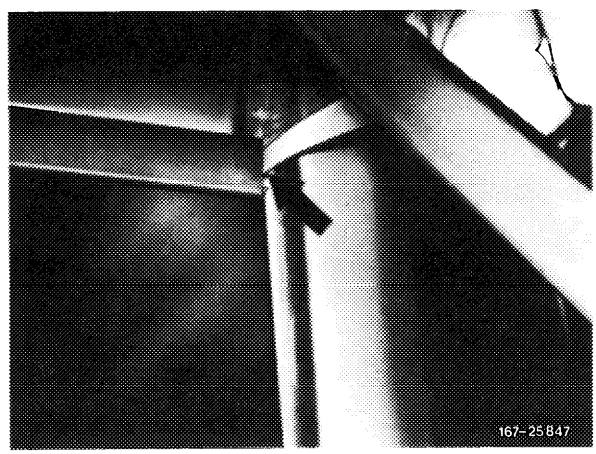


6 **Glue adhesive tape to the area of engine hood adjacent to windshild glass.**
Connect copper wire to current source (12 volts), e.g. vehicle battery, specially provided for heating-up, or to transformer (12 volts).

Note: When connecting, current will not be taken-up unless a spark has been generated. Heating-up time is approx. 15 min.



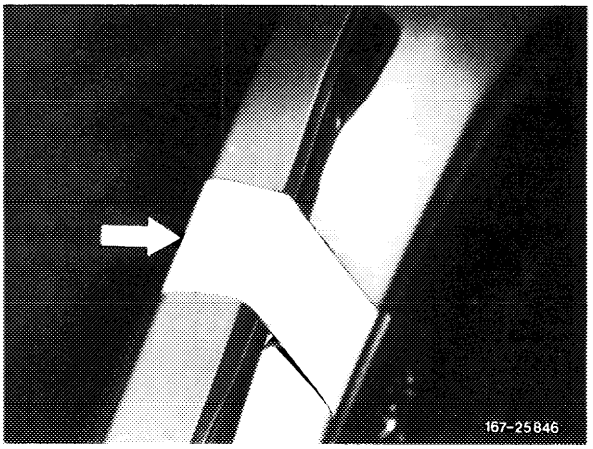
7 **Push ornamental frame at top out of the 5 holding clamps.**



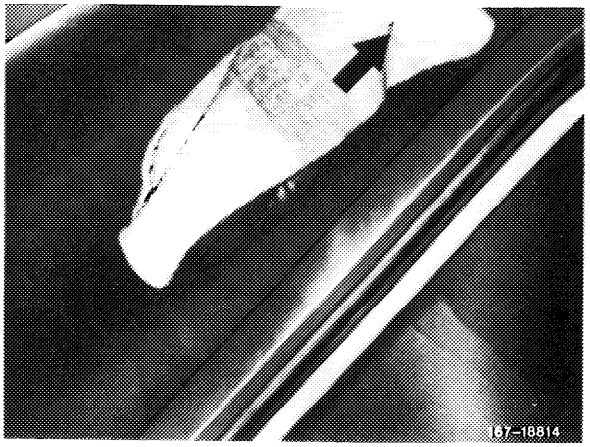
8 Pull ornamental molding on front wall pillar left and right carefully outwards and attach by adhesive tape.

9 Place suction lifter on glass.

Note: When replacing the glass, the new windshield can be prepared during the heating-up time (refer to item 17-23).

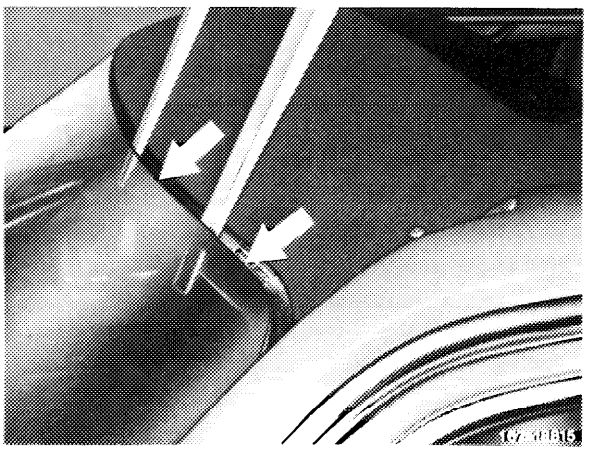


10 Push glass outwards in upper range with leg.



Shown on model 126

11 Insert assembly wedges in resulting gap between glass and body.

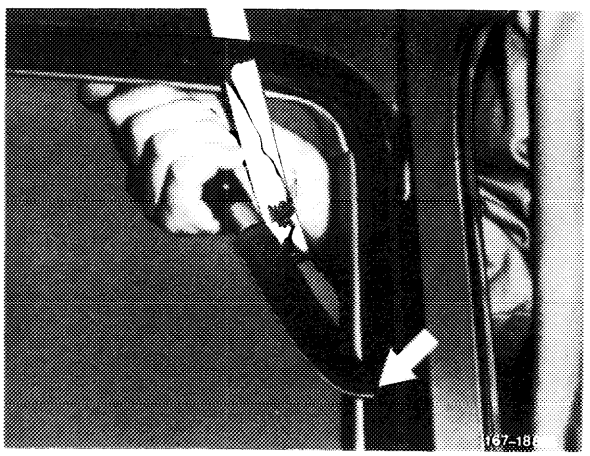


Shown on model 126

12 Carefully cut adhesive cord all around with an industrial knife, while inserting additional assembly wedges at cut spots to prevent successive gluing down

13 Remove windshield glass.

14 Disconnect current source.



Shown on model 126

Installation

15 Cut remains of adhesive cord with angular knife except for a few tenths of a millimeter from body flange and from glass, making sure that the paintwork and the glass are not damaged.

Note: The remaining adhesive material need not be removed.

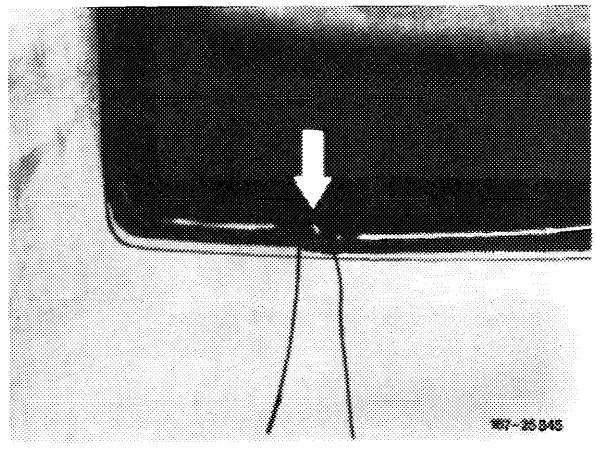
16 Check body flange for possible paintwork damage and repair, if required (pay attention to drying time).

17 Mix primer from repair kit. For this purpose, fill contents of the small bottle with component B into the large bottle, add component A and shake well.

18 Clean adhesive surfaces (on body and glass), from which the adhesive material has been completely removed, with benzine and rub dry. Then apply primer from repair kit and apply with sponge. Let primer air-dry for 5 minutes.

19 Place glass on a suitable support.

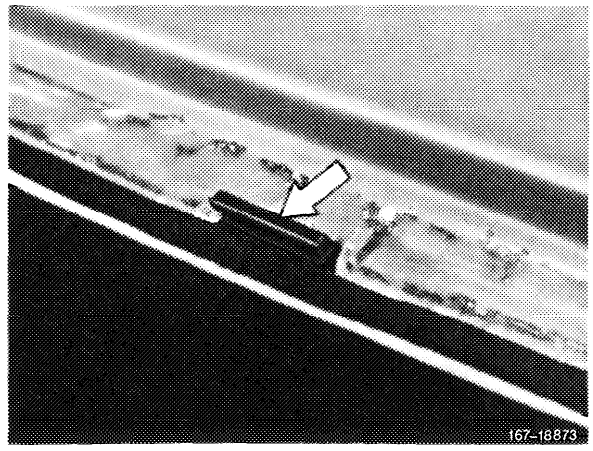
20 Place adhesive cord (butyl tape) from repair kit all-around on glass and apply slight pressure. Start at bottom left.



21 Cut off remaining length. Expose copper wire at ends of adhesive cord and rub to a bright finish with sanding paper.

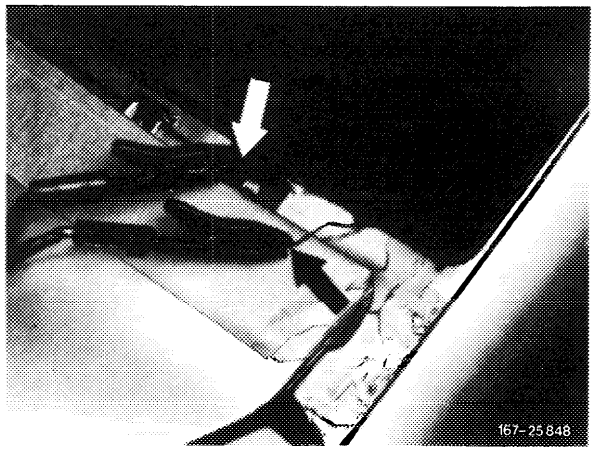
22 Connect ends of adhesive cord again by pushing these ends against each other.

23 Check whether space holder at top left is in body flange.



24 Mount windshield pane at lower angle brackets, center and carefully insert into body flange.

25 At both wire ends, connect power source (12 V), e.g. vehicle battery, which is made available specially for heating up, or transformer (12 V) and heat butyl cord. Push uniformly against pane and mount ornamental frame (the insertion depth is determined by the precisely fitting assembly of ornamental frames).



26 Disconnect power source.

27 Position wire ends of butyl cord against bottom edge of pane (do not cut off).

28 Continue installation in vice-versa sequence.

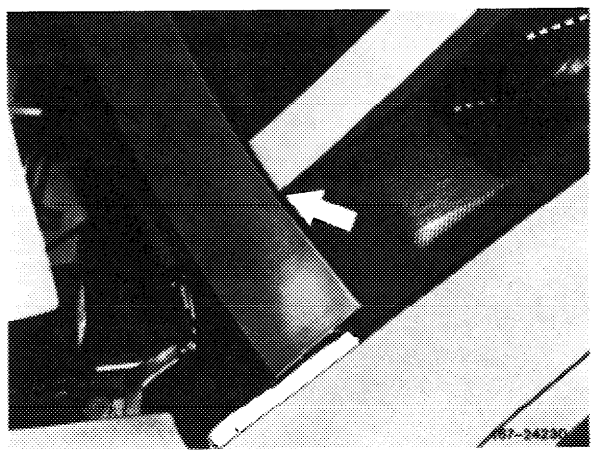
Note: The adhesive requires no drying time. Rain test can be made upon completion of the assembly jobs. Leaks, if any, can be sealed with MB universal sealing compound, part No. 003 989 01 71.

Removal

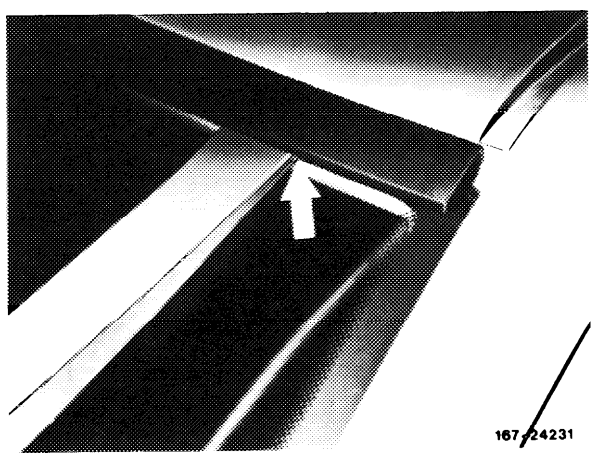
1 Remove ornamental molding on front wall pillar and on roof (88–855).

2 Remove wiper arm (group 82).

3 Push ornamental frame below out of 5 clips by means of plastic wedge and pull out of air intake cover in upward direction.



4 Push ornamental frame at top out of 5 holding clips by means of plastic wedge and remove.

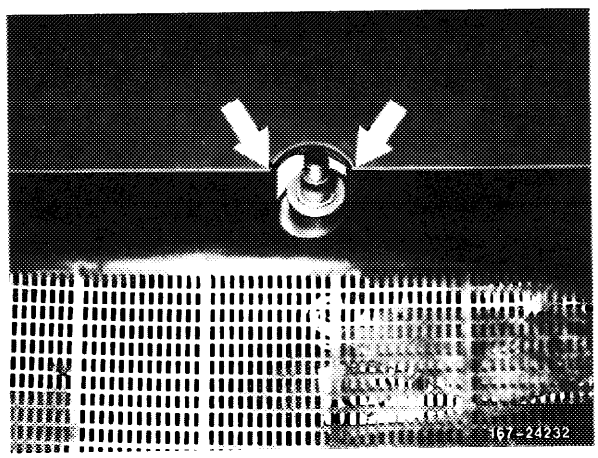


Installation

5 Slip ornamental frame below over air intake cover while centering ornamental frame on cutout for wiper shaft.

6 Push ornamental frame into 5 clips.

7 For further installation proceed vice versa.

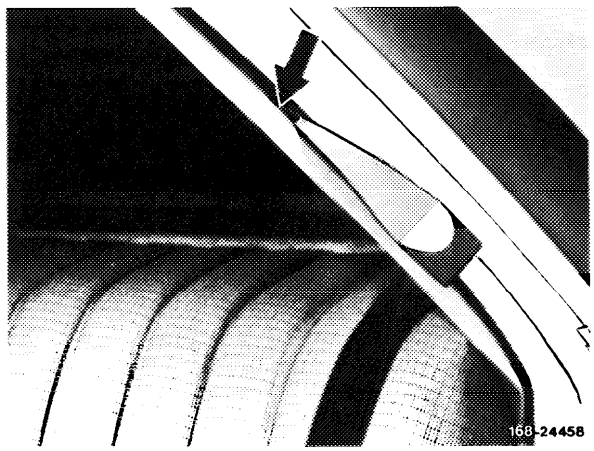


Removal

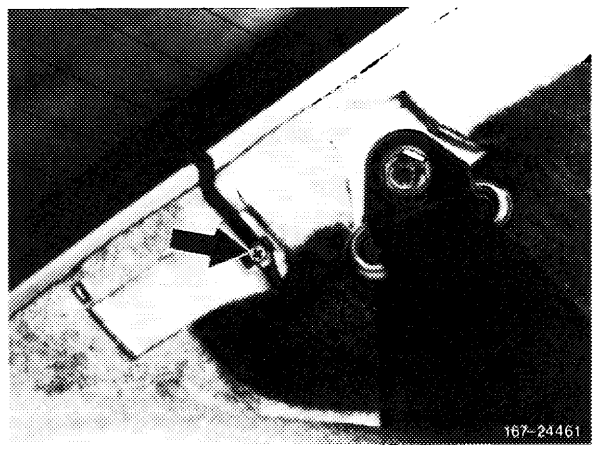
1 Remove hat rack (68-458).

2 Pull off edge protection in range of panelling (trim) on rear pillar left and right.

3 Force off holding clips on linings of rear pillar, front, with wedge toward center of vehicle, slip in upward direction and put down in rear passenger compartment.



4 Separate electric connections on cable connector on lefthand and righthand rear pillar.

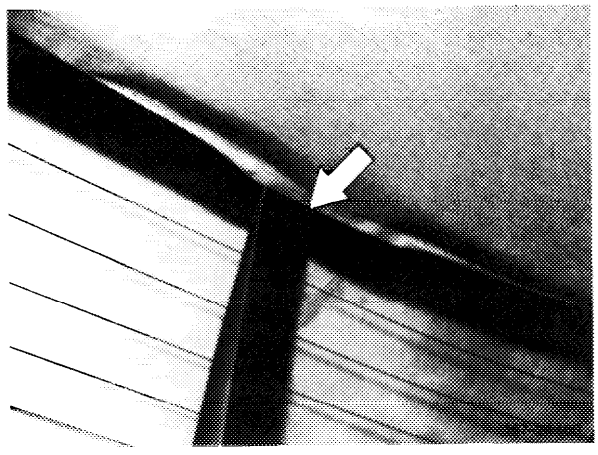


5 Push back rubber frame on vehicle inner side by means of a plastic wedge behind spot weld flange of window opening.

6 Carefully push rear window from inside in outward direction and remove. Pay attention to contact wires or lateral bus bars, respectively.

7 Remove ornamental frame on rear window (67–220)

8 Remove sealing frame from rear window.



Installation

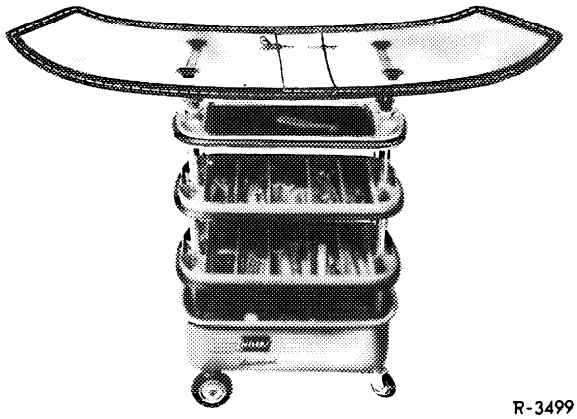
9 Place rear window with crown in downward position on corresponding base.

10 Pull sealing frame on rear window.

11 Install ornamental frame in sealing frame (67–220).

Note: Fill upper joint abutment of ornamental frame prior to assembly of cover with MB glass sealing compound, so that no water can flow over window glass.

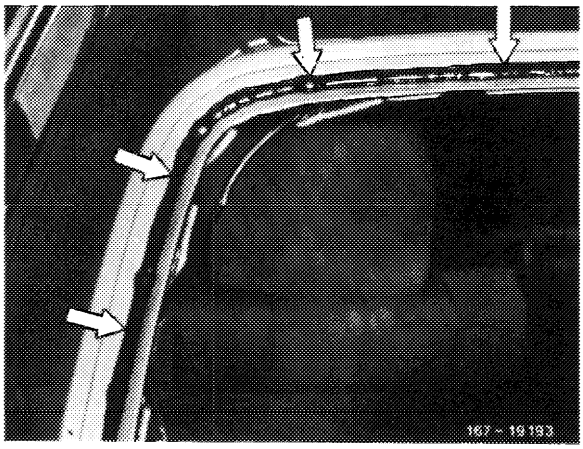
12 Insert two greased cords into holding slot of sealing frame and rub sealing frame with soap water.



R-3499

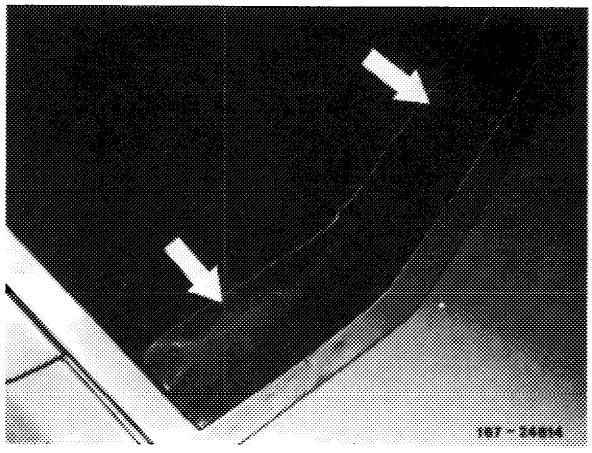
13 Apply MB glass sealing compound all-around in body flange.

14 Insert pre-assembled rear window with sealing frame from outside to window opening and align.



Shown on model 126

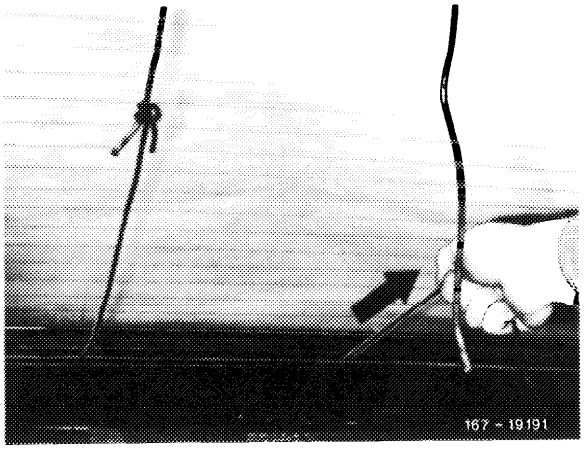
15 To avoid wind noises, align height of rear window in such a manner that upon installation the upper edge of the ornamental frame is O-I mm lower than the roof panelling.



Shown on model 126

16 Press lightly against rear window, while simultaneously letting a helper inside vehicle carefully pull out cord to lift the rubber lip of the sealing frame starting from below over spot weld flange of window opening.

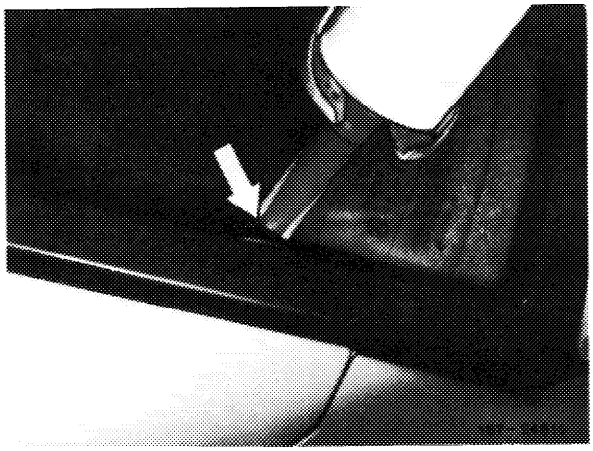
Note: Pull off cord in parallel with glass to prevent damaging rubber lip.



17 Seal with MB glass sealing compound all-around between glass and outside of sealing frame.

18 Continue installation in vice-versa sequence.

Note: Excess sealing material can be removed by dabbing with adhesive tape.



67–220 Removal and installation of ornamental frame on rear window

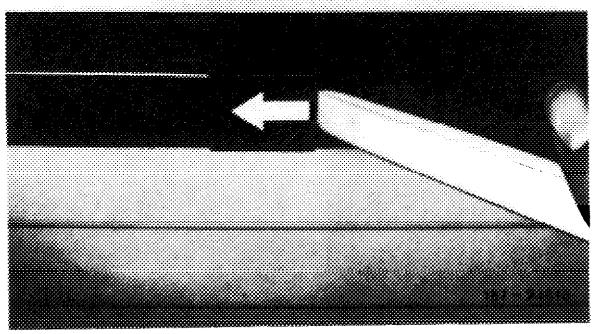
Removal

1 Remove rear window (67–200).

2 Set rear window on a suitable base.

3 Slide cover at top sideways.

4 Starting from above, push ornamental frame out of sealing frame by means of a plastic wedge.



Installation

Note: Prior to installing ornamental frame, slightly coat slot on sealing frame with benzine. Fill upper joint abutment of ornamental frame prior to assembly of cover with MB gl'ass sealing compound, so that no water can flow over rear window glass under cover.

5 For installation proceed vice versa.

	Job No.
Instrument panel	
Removal and rnstallatron of instrument panel	68-l 00
Removal and installation of cover for speaker	1 0 5
Removal and installation of glove box cover	120
Removal and rnstallation of lock on glove box cover	1 3 0
Removal and rnstallation of glove box	1 4 0
Removal and rnstallation of cover under Instrument panel	1 5 0
Center console	
Removal and rnstallation of center console	2 0 0
A. Center console upper half	
B. Center console lower half	
Removal and installation of cover on shift lever	2 3 0
Removal and rnstallation of cover on shift lever(automatic transmission)	2 3 1
Paneling (trim)	
Removal and Installation of reveal molding on windshield top	400
Removal and rnstallatron of reveal molding laterally on windshield	405
Removal and rnstallatron of headlining	430
Removal and rnstallatron of edge protectron under driver's and rear door	442
Removal and rnstallatron of paneling (trim) on rear pillar	449
Removal and rnstallatron of hat rack and first aid kit	458
Removal and rnstallatron of paneling (trim) on center pillar	470
Removal and installation of paneling (trim) on rear center piece	485
Removal and rnstallatron of cushioning elements on transmission tunnel, outside	492

Removal

1 Remove glove box (68-140).

2 Remove cover left and right under instrument panel (68-I 50).

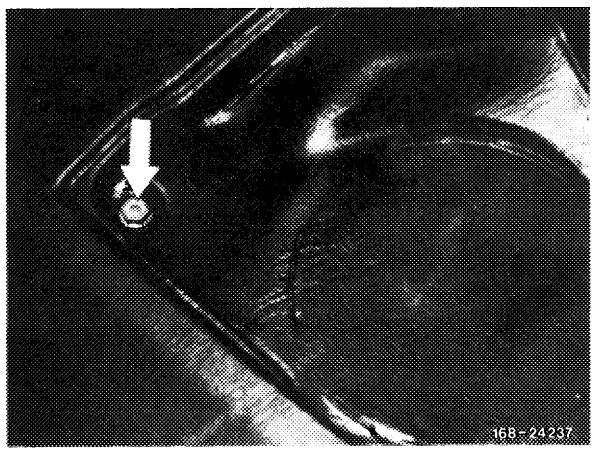
3 Remove reveal molding left and right on windshield (68–405).

4 Remove covering for both front speakers (68-105).

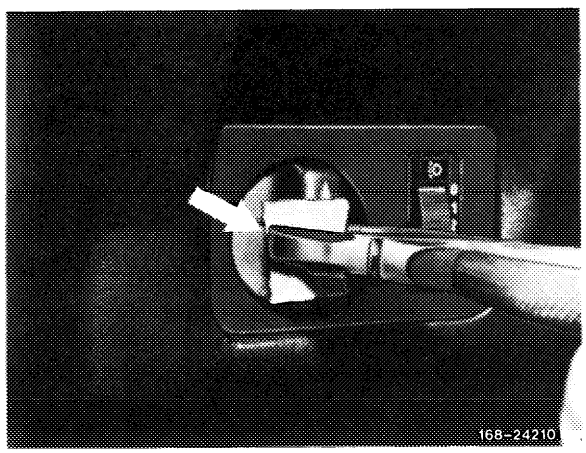
5 Remove steering wheel (group 46).

Remove instrument cluster (group 54).

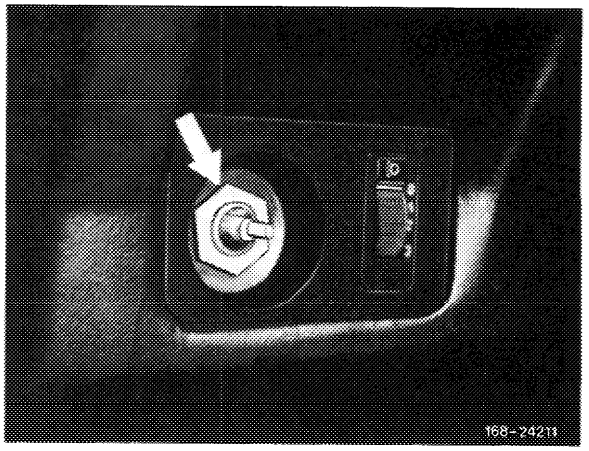
6 Remove screw in speaker cutout left and right.



7 Pull off control knob for rotary light switch.

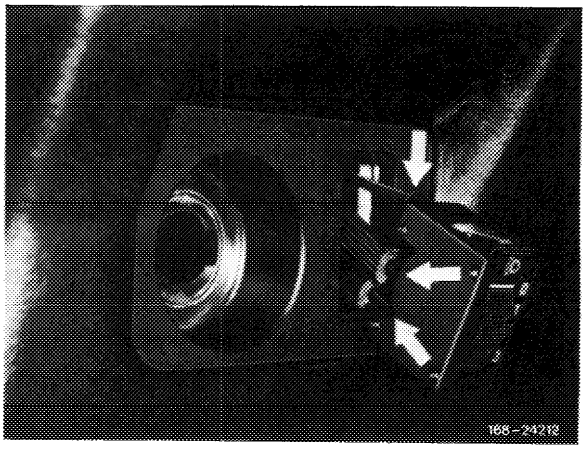


8 Unscrew nut on rotary light switch (width between flats 24 mm) and remove rotary light switch.

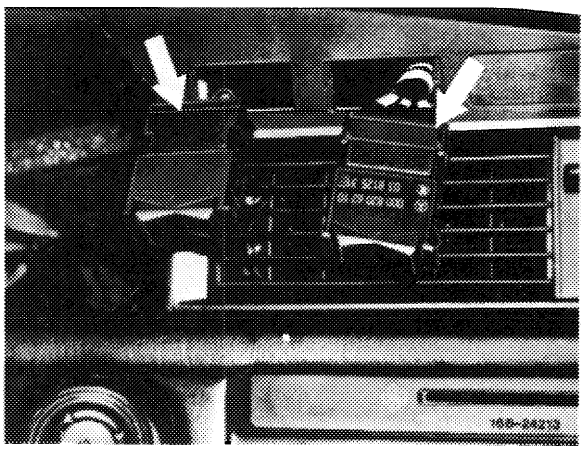


9 Push out switch for light range regulation and pull off connections.

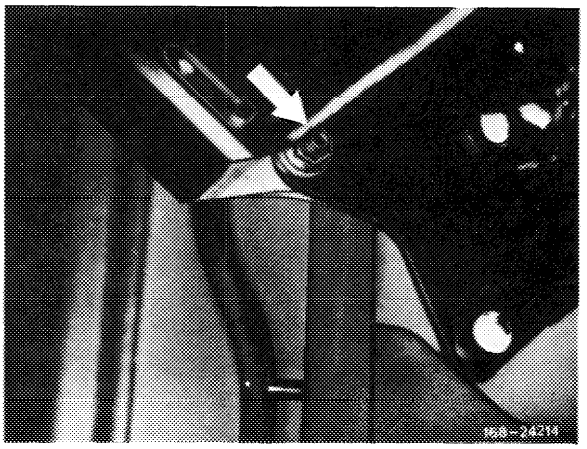
Attention! During installation, connect vacuum lines correctly: lilac at the top, lilac-yellow at the bottom.



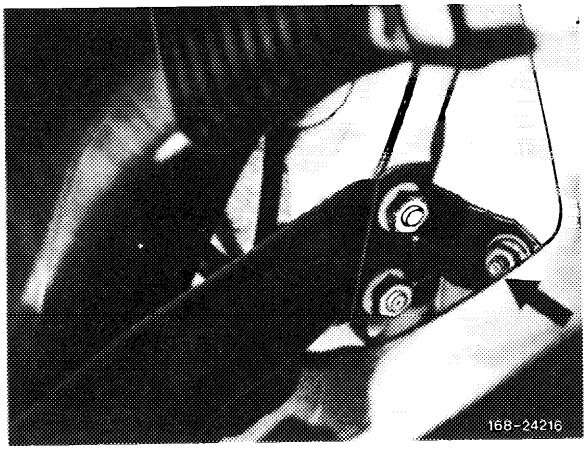
10 Push out switch in range of air jets center and pull off connections.



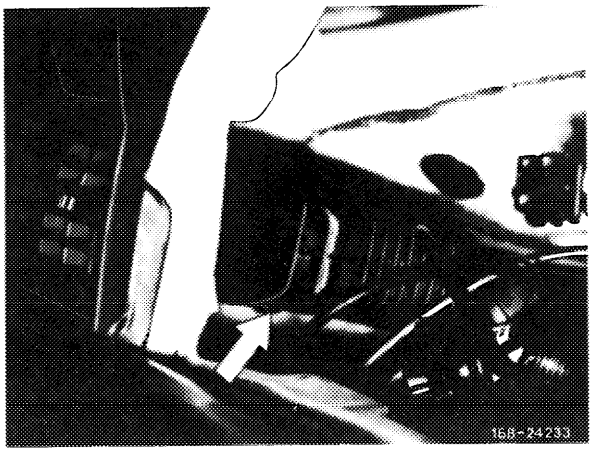
11 Unscrew fastening nut at bottom left and remove screw.



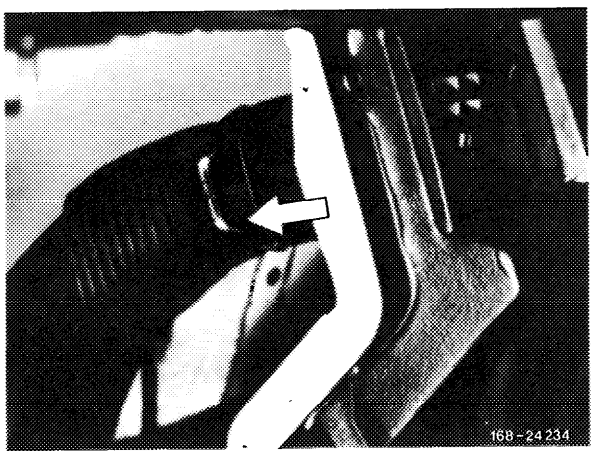
12 Pull off fastening nut bottom right and remove screw.



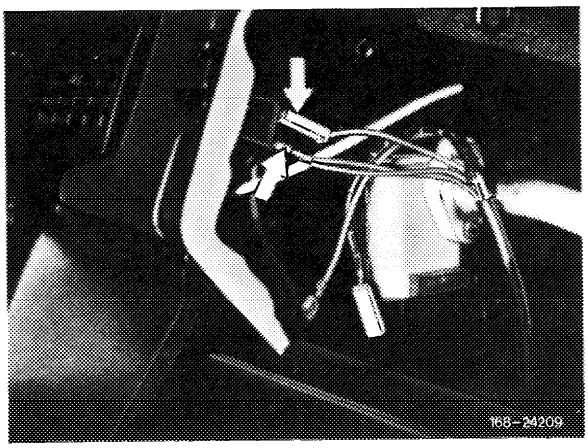
13 Pull off air duct on air jet outside left.



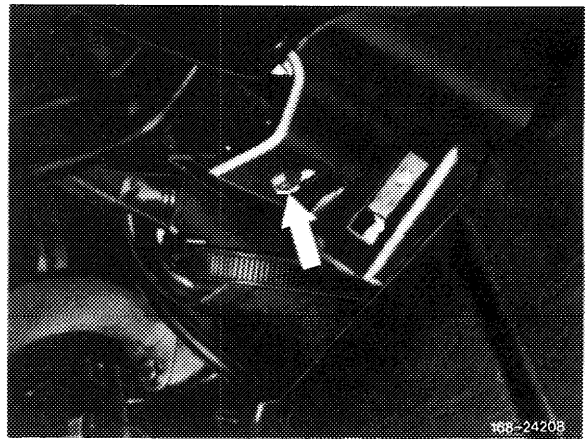
14 Pull off air duct on air jet outside right.



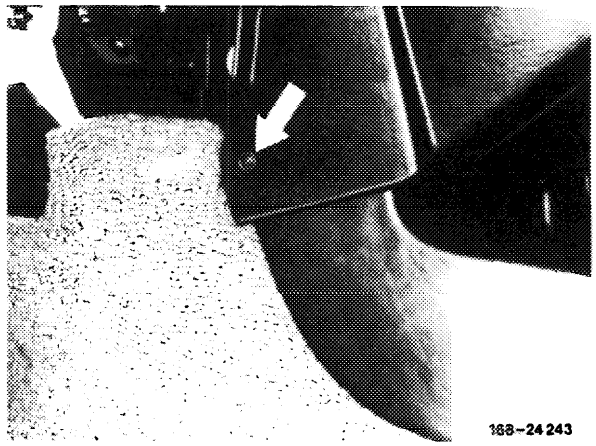
15 Pull off electrical connections on switch for glove box light.



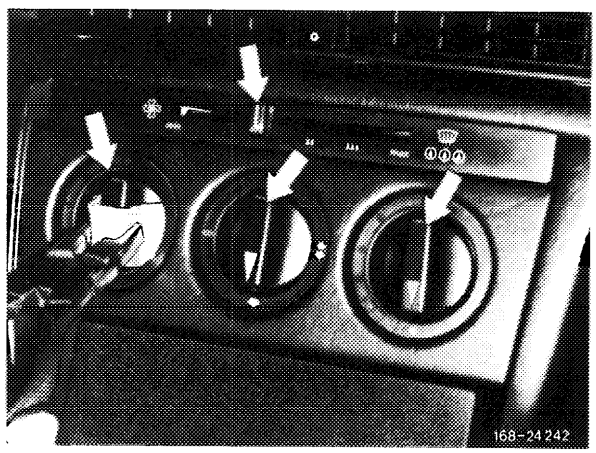
16 Unscrew fastening screw on stiffening pipe.



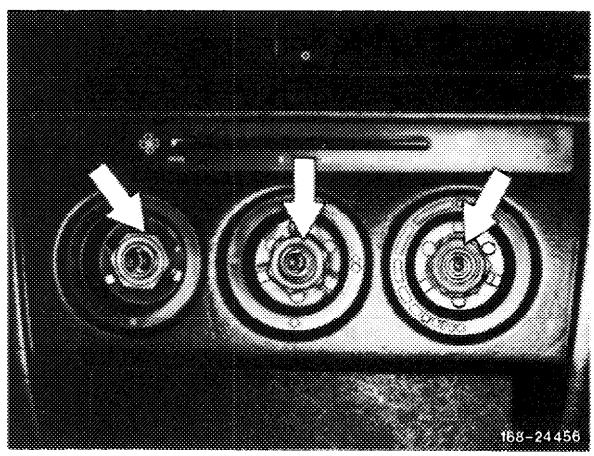
17 Unscrew screw on heater box left and right.



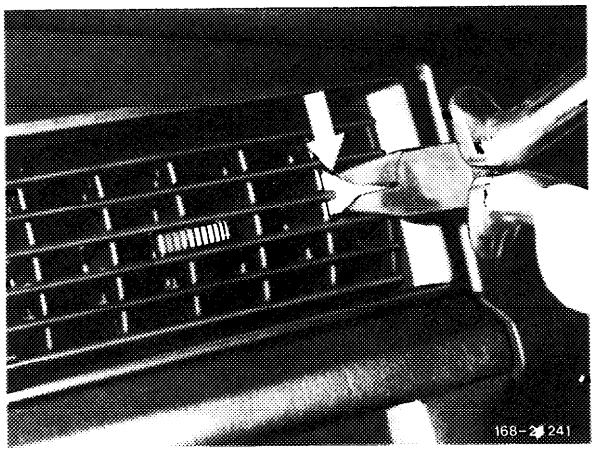
18 Pull off control knobs for blower-heater and air distributor switch.



19 Unscrew nuts on control unit.

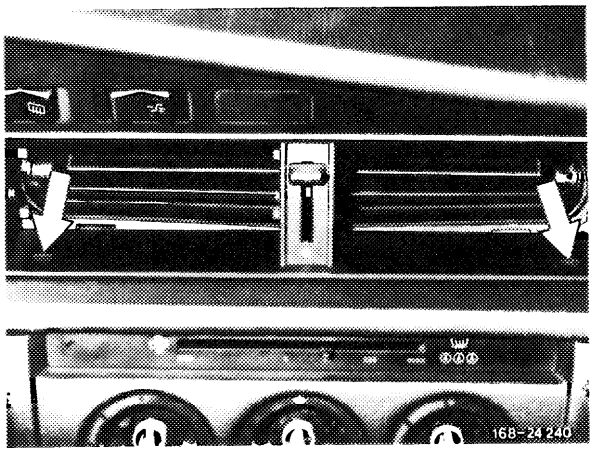


20 Pull out air jets on instrument panel center with padded flat nose pliers.

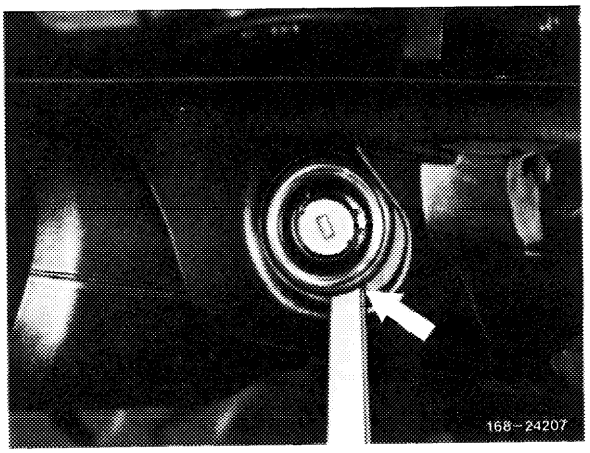


21 Unscrew screws on frame for air jets on instrument panel center.

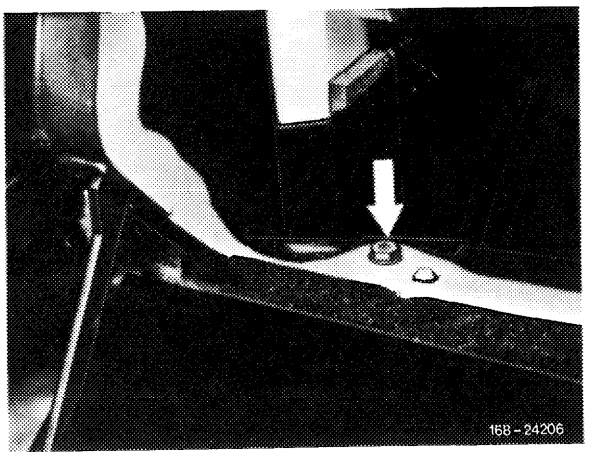
22 Remove console top, while pulling switch lights and electrical connections at the rear.



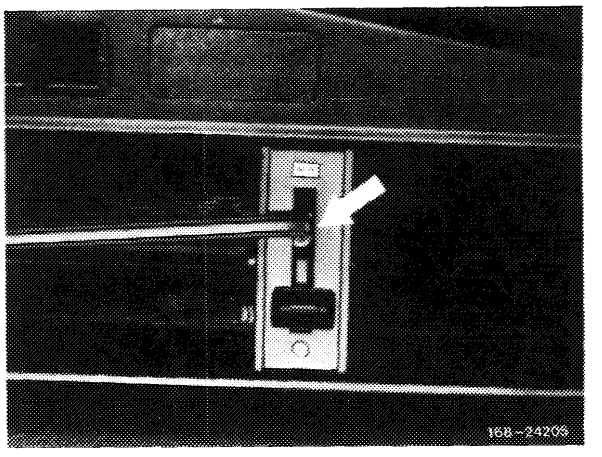
23 Force off escutcheon on ignition lock.



24 Unscrew fastening screw in range of glove box.

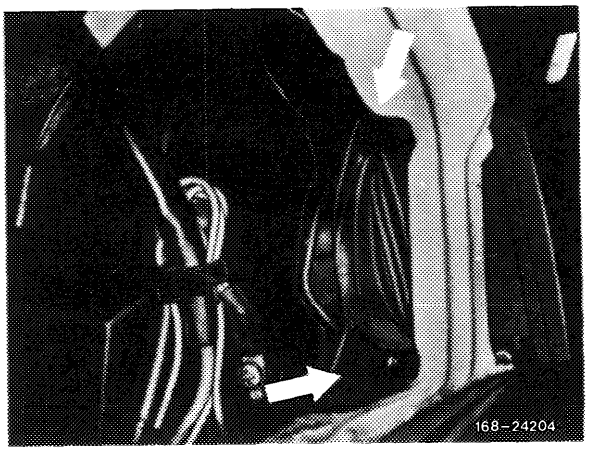


25 Close fresh air flap and unscrew screw on connecting lever.



26 Pull off rubber sleeve on connection for air jets in center.

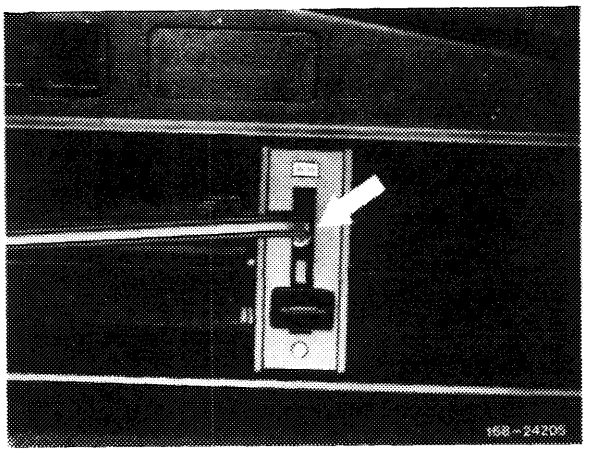
27 Pull out defroster nozzles on heater box and remove instrument panel.



Installation

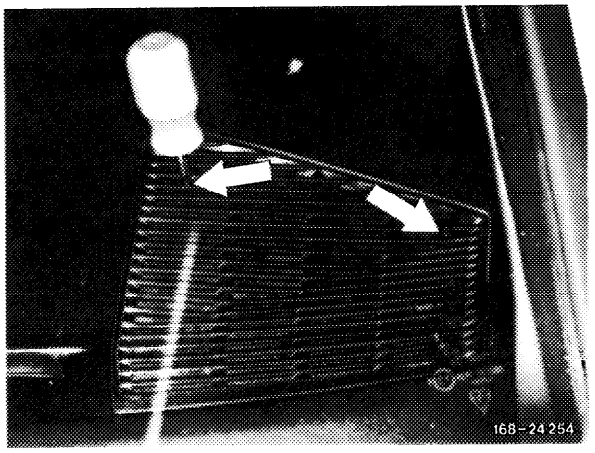
28 For installation proceed vice versa.

Note: At end of assembly jobs, set adjusting screws in such a manner that the fresh air flap is tightly sealing.



68-I 05 Removal and installation of cover for speaker

Removal



1 Unscrew screws on cover.

2 Pull cover to the rear and remove.

Installation

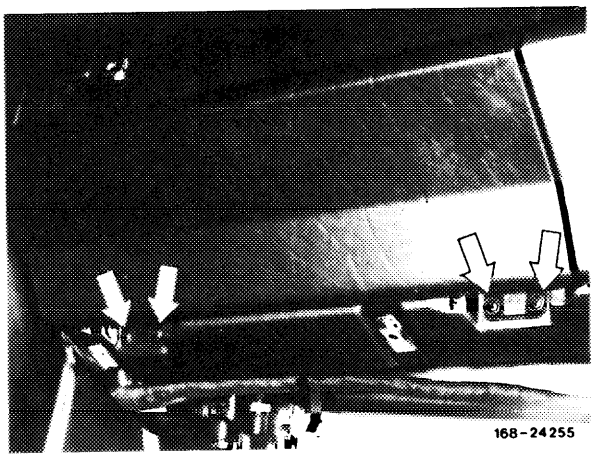
3 For installation proceed vice versa.

Removal

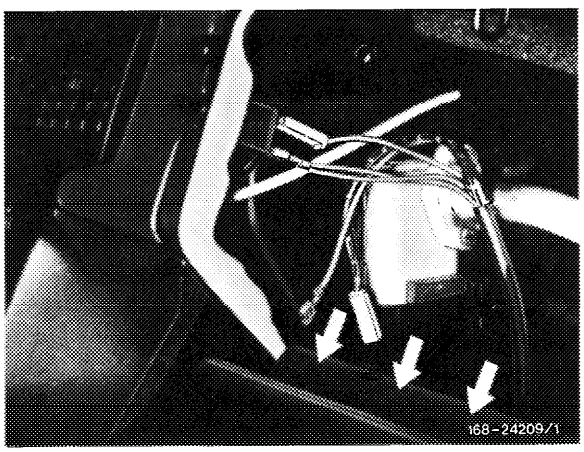
1 Remove cover at the right under instrument panel (68-I 50).

2 Remove glove box (68–140).

3 Unscrew screws on hinge of glove box cover.

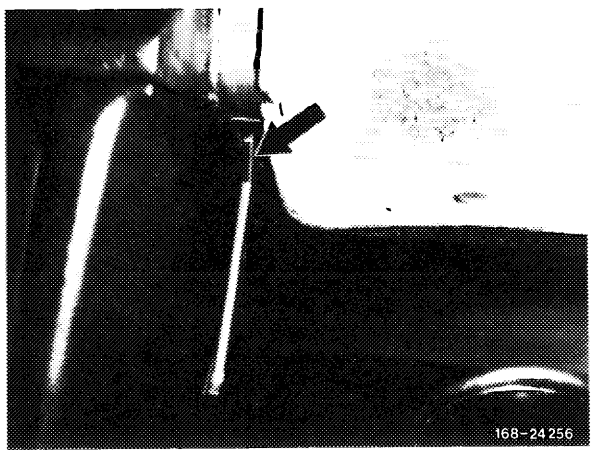


4 Disconnect cover strip on instrument panel.



5 Lift glove box cover in upward direction and disconnect both stop brackets on instrument panel.

6 Remove glove box cover.



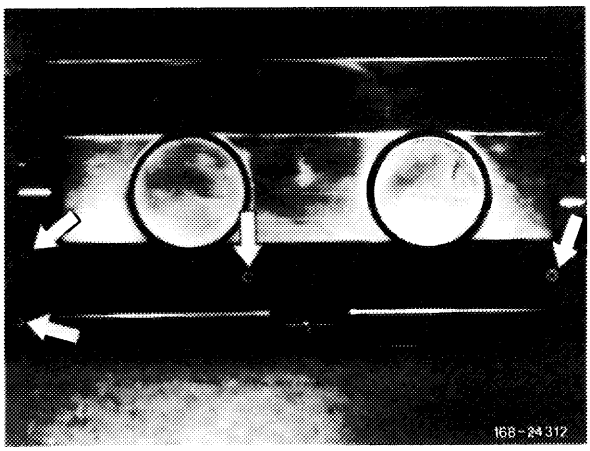
Installation

7 For installation proceed vice versa.

Removal

1 Unscrew screws on back of cover.

2 Remove lock complete with cover strip.

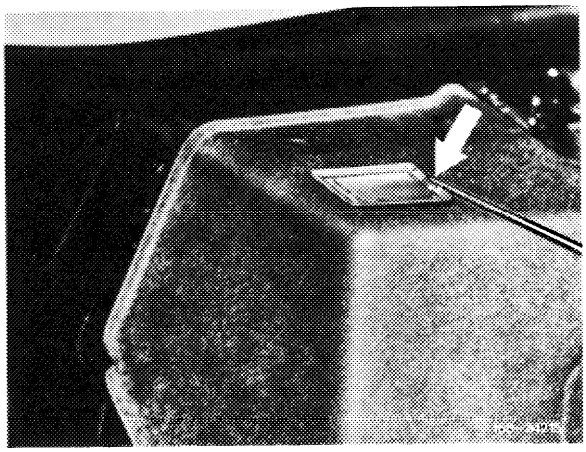


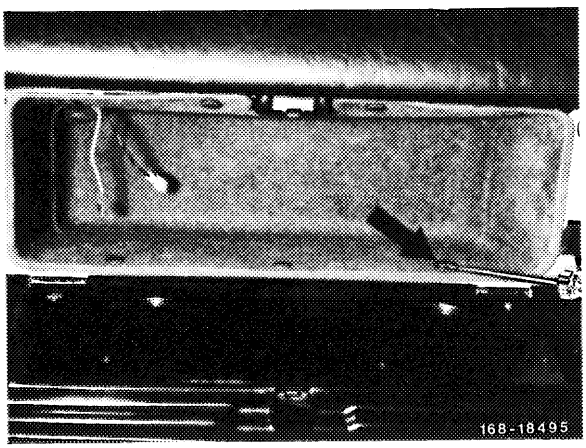
Installation

3 For installation proceed vice versa.

Removal

1 Push out glove box light and pull off electric connections.

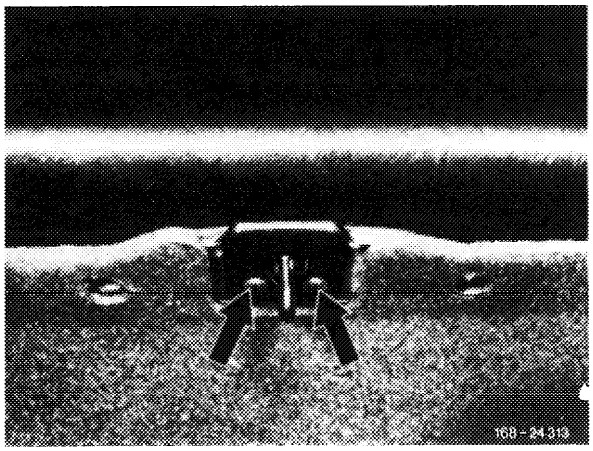




Shown on model 126

3 Unscrew screws on closing bracket.

4 Remove glove box from instrument panel.

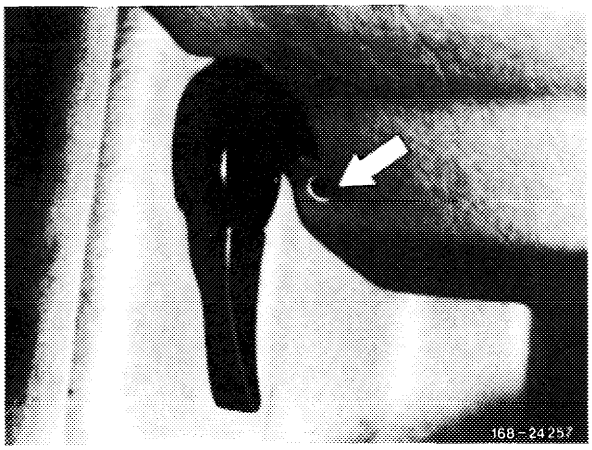


Installation

5 For installation proceed vice versa.

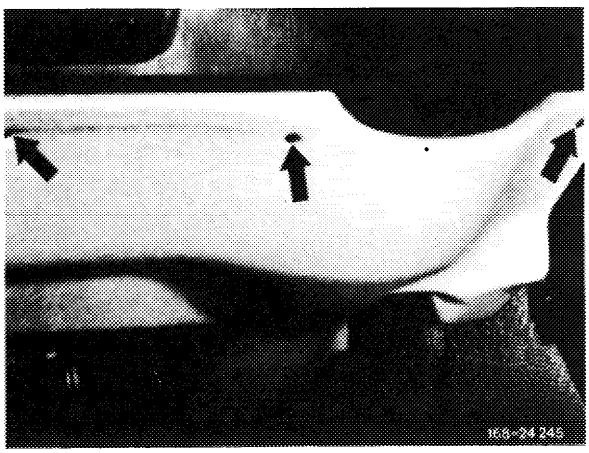
Removal

1 Unscrew outer screw.



2 Unscrew screws in connecting range of instrument panel.

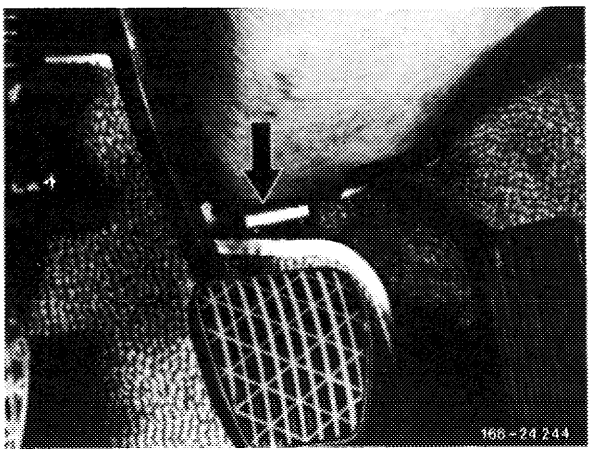
3 Remove cover.



Installation

4 Slip cover into mounting on front wall and screw on by means of the three screws in connecting range of instrument panel.

5 For further installation proceed vice versa.

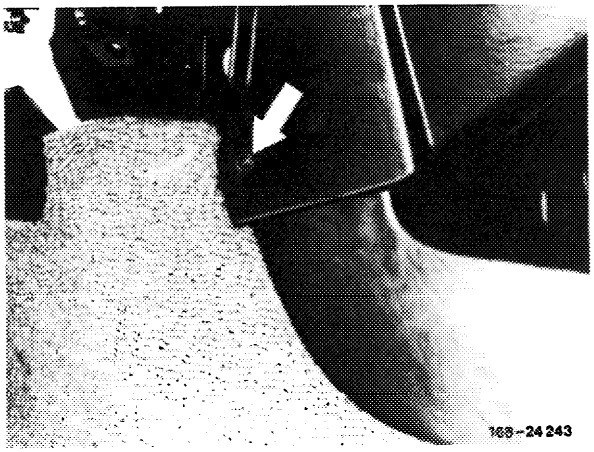


A. Center console upper half

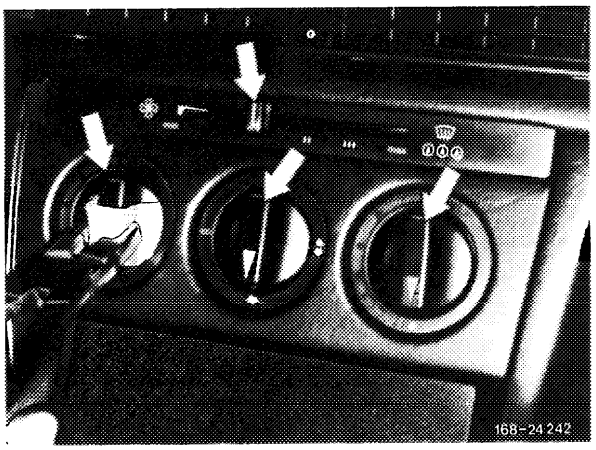
Removal

1 **Remove cover under instrument panel left and right (68-I 50).**

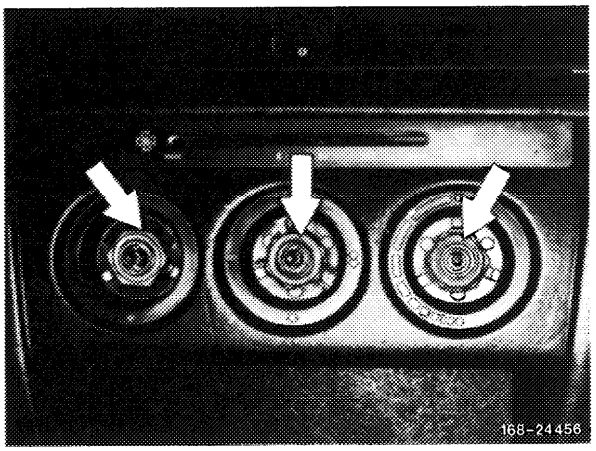
2 **Unscrew screw on heater box left and right.**



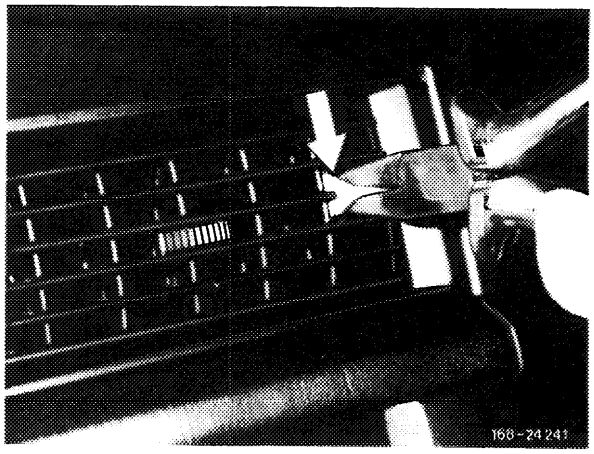
3 Pull off control knobs for blower, heater and air distribution switch.



4 Unscrew nuts on control unit.

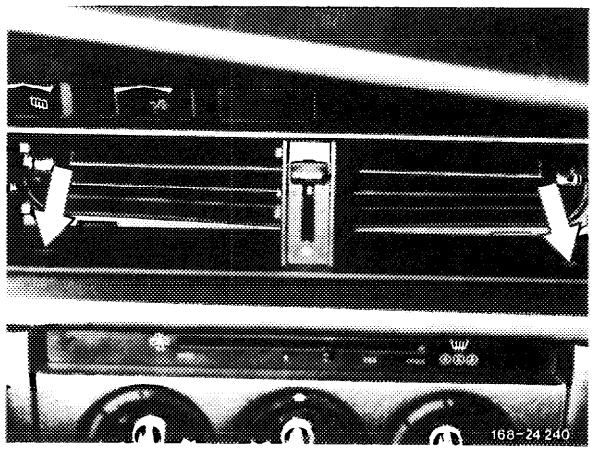


5 Pull out air jets on instrument panel center with padded flat nose pliers.



6 Unscrew screws on frame for air jets on instrument panel center.

7 Remove console top, while pulling off switch lights and electric connections on back.



Installation

8 For installation proceed vice versa.

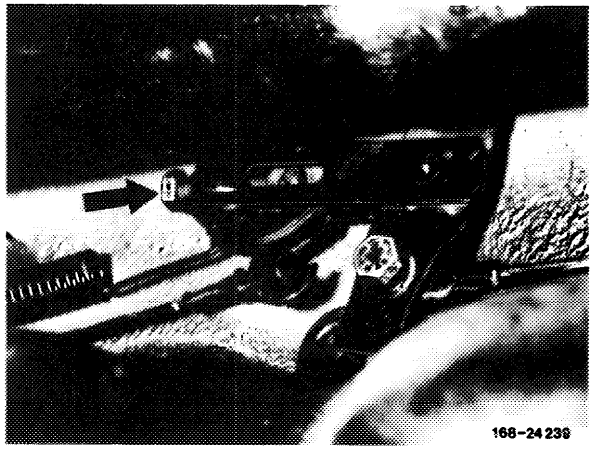
B. Center console lower half

Removal

1 Remove both floor mats for front seats.

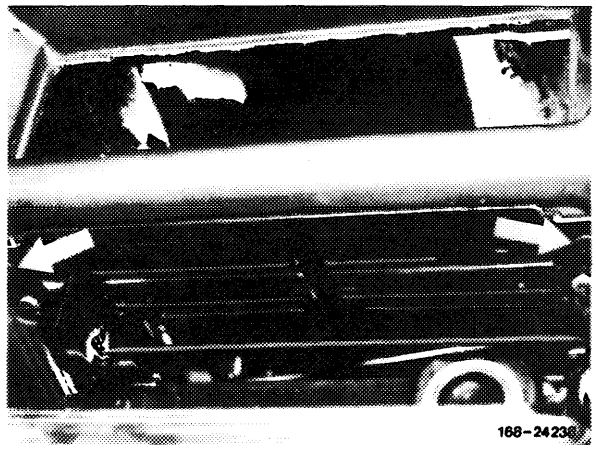
2 Remove covering on shift lever (68–230).

3 Slacken hand brake rope on compensator by slackening hex. head screw.

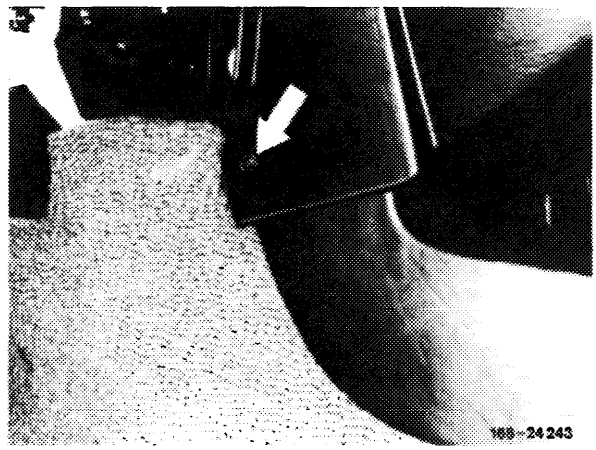


4 Remove ashtray and unscrew screws on ashtray housing.

5 Pull off electrical connection and remove ashtray housing.

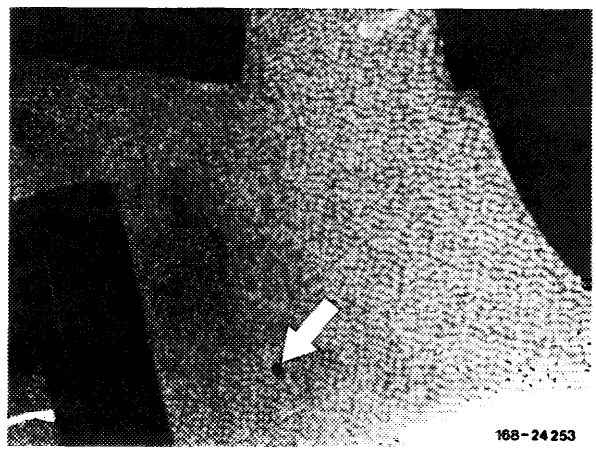


6 Unscrew screw on heater box left and right.

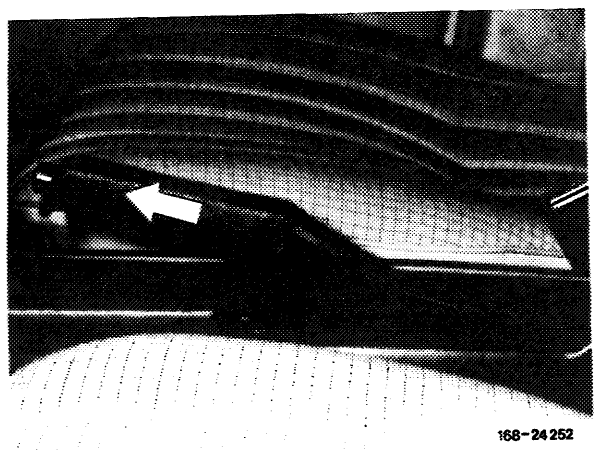


7 Unscrew screws on transmission tunnel on both sides.

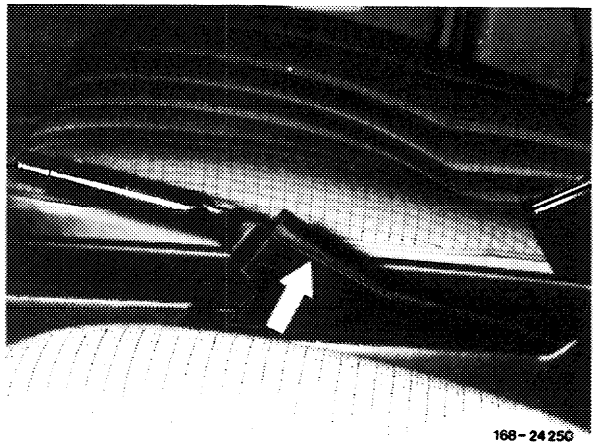
8 Remove accelerator pedal.



9 Pull off grip of hand brake lever in forward direction.

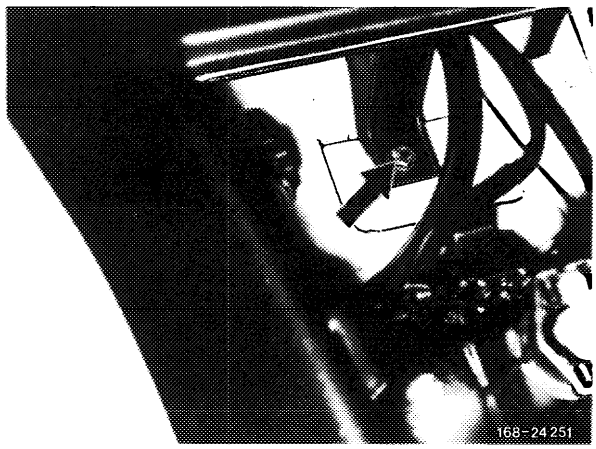


10 Pull off lining of hand brake lever in upward direction.

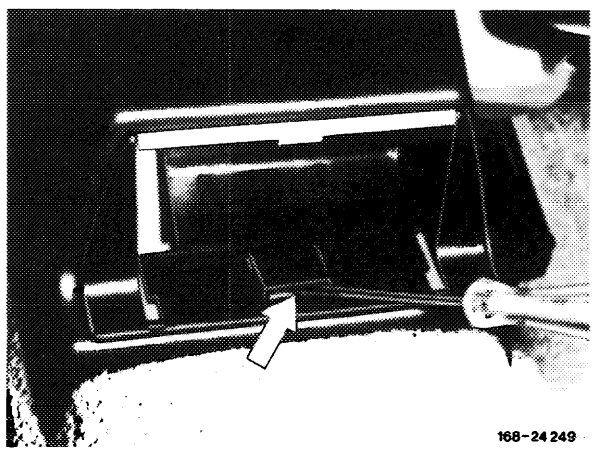


11 Unscrew screw in range of shift bracket.

12 Remove ashtray on center console rear.



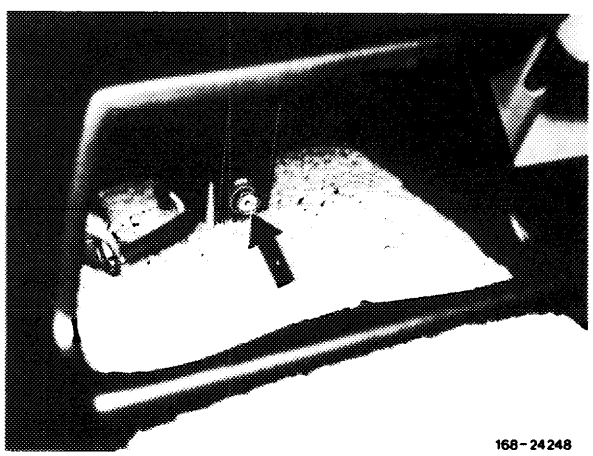
13 Push up holding clip on frame and remove ashtray frame.



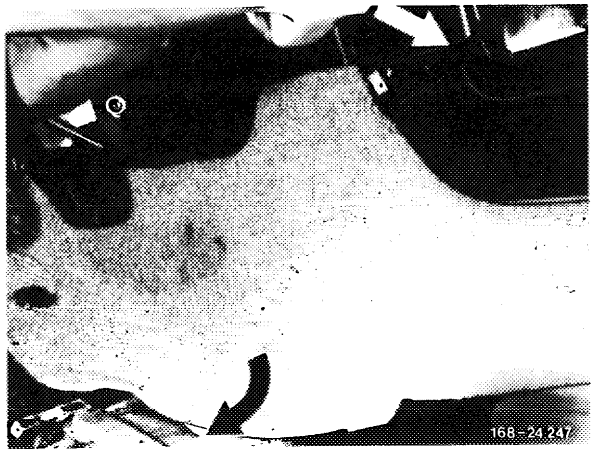
14 Unscrew screw on center console rear.

15 Move both seats toward the rear.

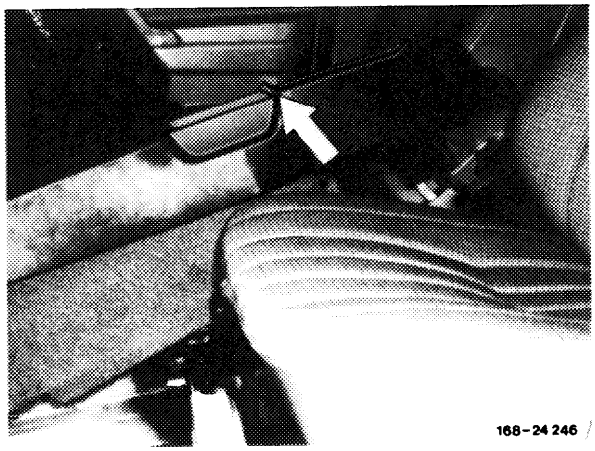
16 Set hand brake lever completely up.



17 Spread carpet on transmission tunnel at front below on both sides in outward direction. Lift center console at the rear and carefully pull out of console upper half (arrow).



18 Remove center console over hand brake lever.



Installation

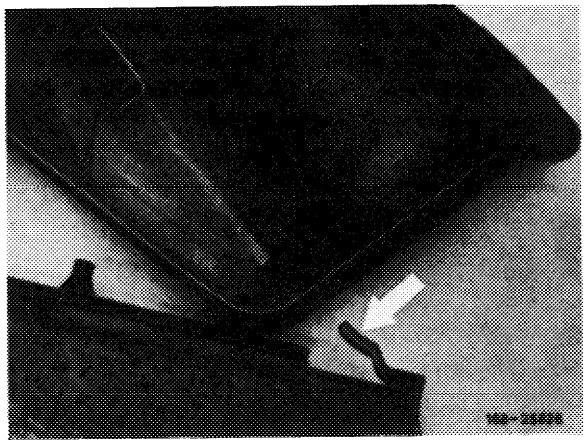
19 For installation proceed vice versa.

Note: When introducing hand brake lever, loosen hand brake lever and lower in downward direction together with console.

Adjust hand brake at end of assembly jobs.

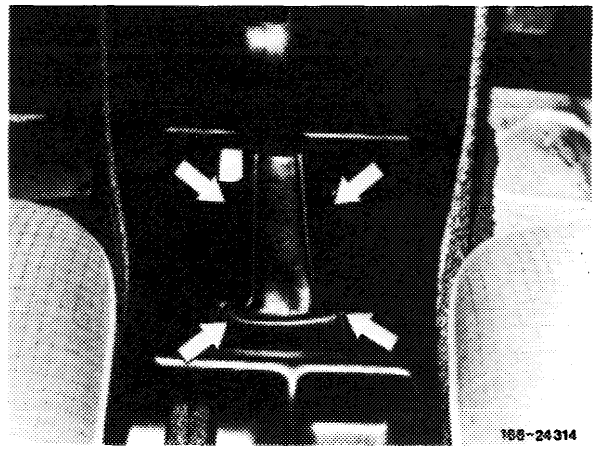
Attention!
In order to avoid malfunction of hand brake lever, make absolutely sure that the covering of the hand brake lever in the rear lower range is pressed **down** by the lug on the hand brake lever.

Adjust hand brake at end of assembly jobs.



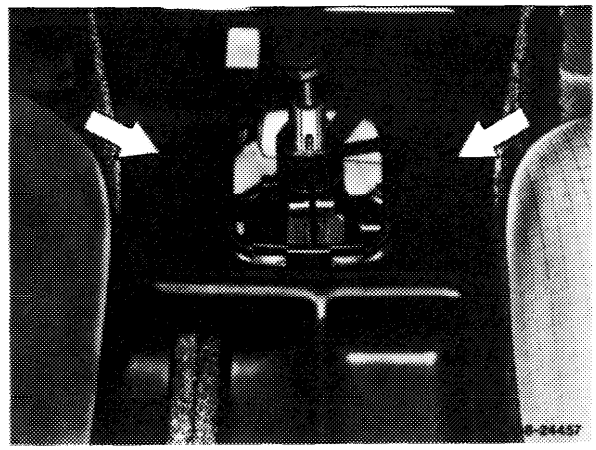
Removal

1 Disconnect rubber sleeve on cover.



2 Pull off plug connections on switches and remove cover.

3 Separate plugs from switches and remove cover toward the rear.



Installation

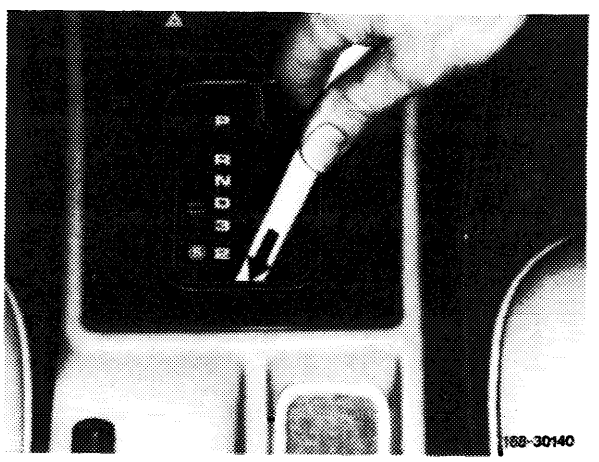
4 For installation proceed vice versa

68-23 1 Removal and installation of cover on shift lever (automatic transmission)

Removal, installation

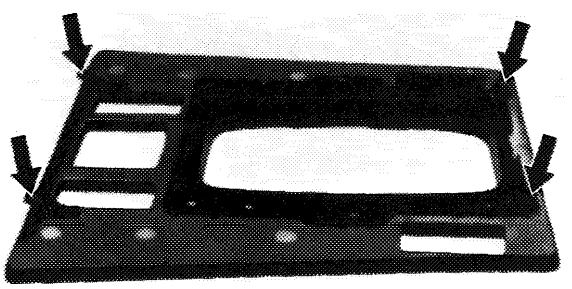
1 Lift cover in rear range by means of plastic wedge and pull out toward the rear.

2 Pull plug connections on switches and remove cover,



Installation

3 Attach plug connections to switches. Introduce cover with holding lugs at front and engage rear locks.

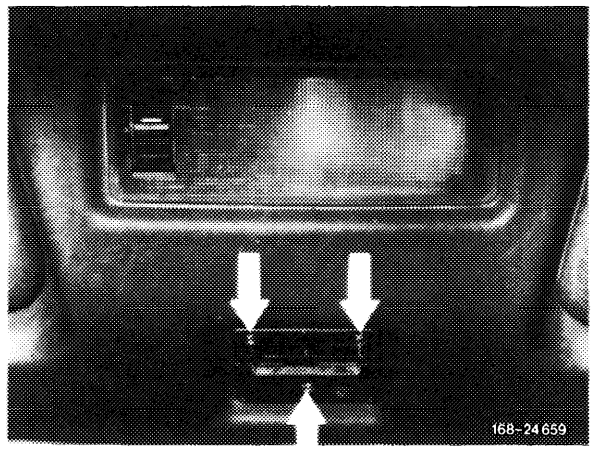


168 - 30290

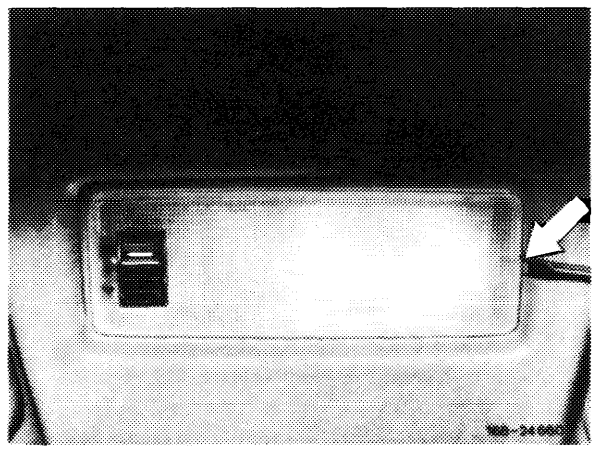
Removal

1 Remove reveal molding laterally on windshield (68–405).

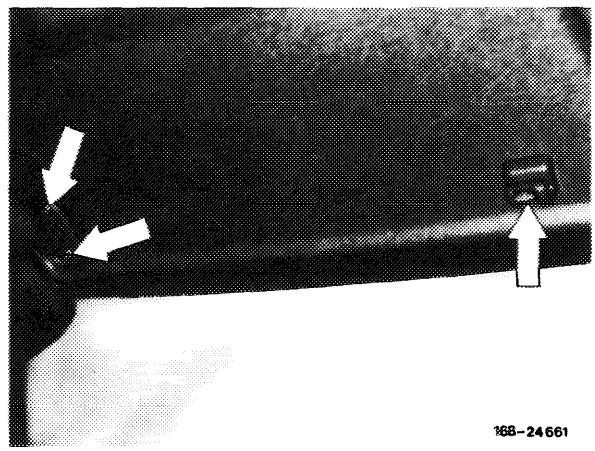
2 Disengage inside mirror and unscrew base plate.



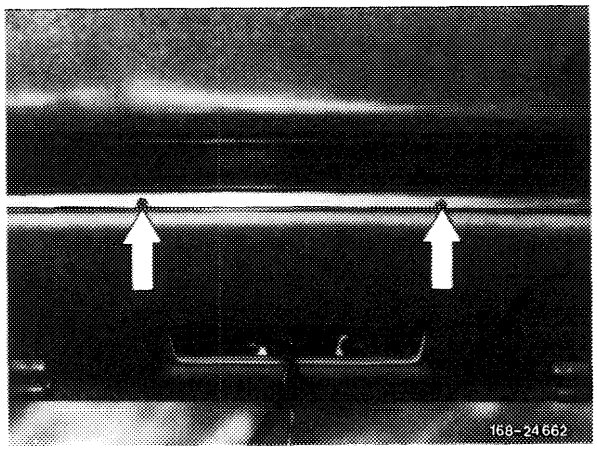
3 Push out dome lamp at recess and pull off plug.



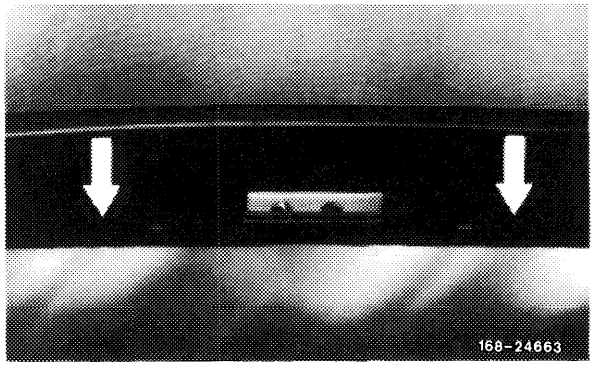
4 Unscrew sun vizor and counterbearing.



Note: On vehicles with sliding roof the reveal molding is clamped down by means of a chrome strip, which must be unscrewed first.



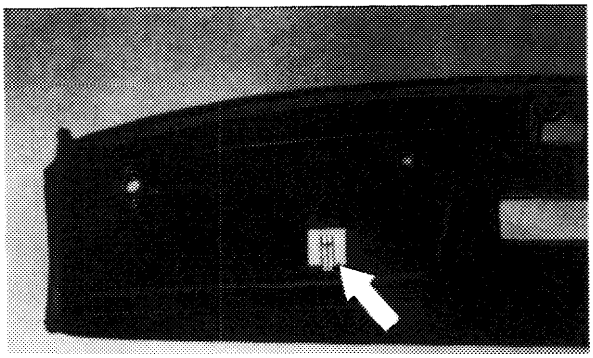
5 Pull reveal molding out of front roof frame in forward direction.



Installation

6 Attach reveal molding from the front to holder for fastening headlining.

7 For further installation proceed vice versa.

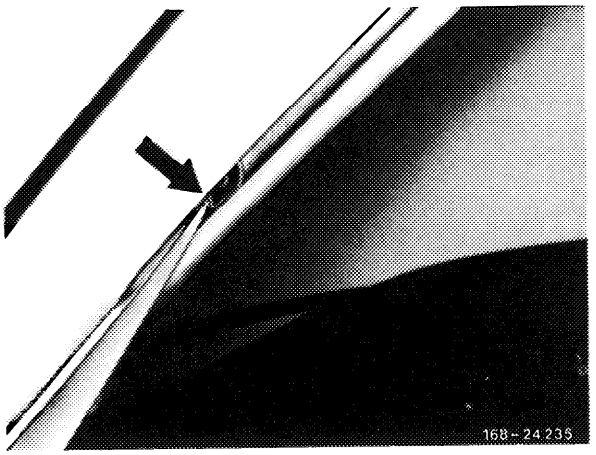


Removal

1 Pull off chafing strip in range of reveal molding.

2 Position plastic wedge in range of clips and force clips out of front wall pillar.

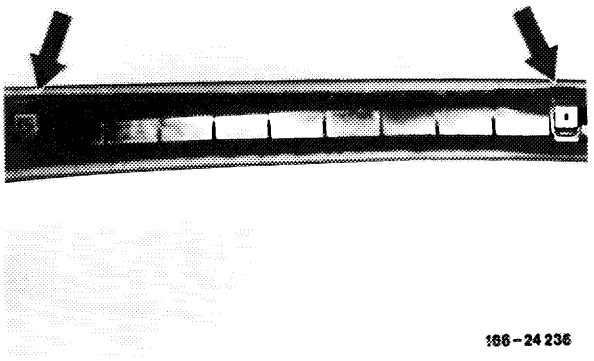
3 Release reveal molding from reveal molding on windshield top and remove.



Installation

4 Align clips on reveal molding.

5 For further installation proceed vice versa.



Removal

1 Remove reveal molding at windshield top (68-400).

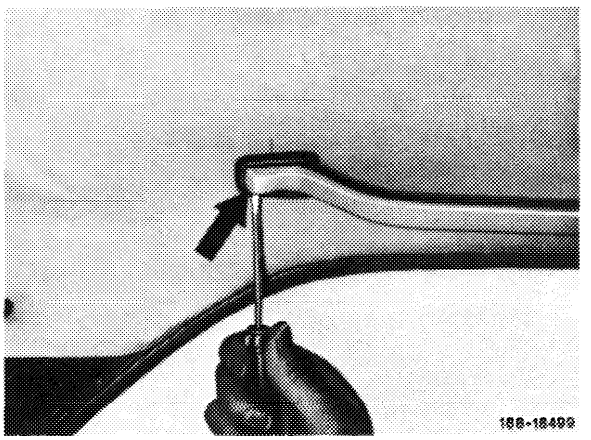
2 Remove rear window (67-200).

3 Remove paneling (trim) on center pillar (left and right) (68-470) (do not unscrew safety belt on side member).

Note: Remove vehicles with sliding roof, sliding roof cover (77-I 00).

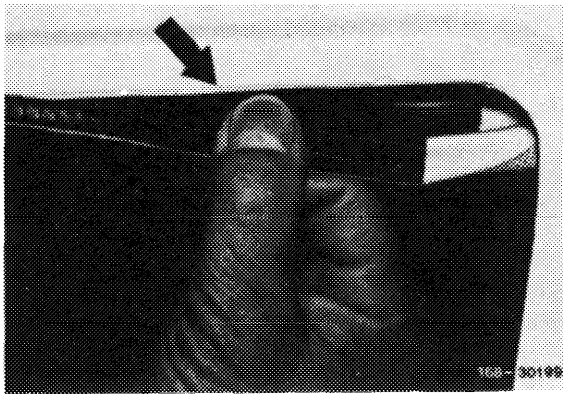
4 Pull off cover on hand grips, unscrew screws underneath and remove hand grips.

5 Pull off chafing strips in range of headlining.



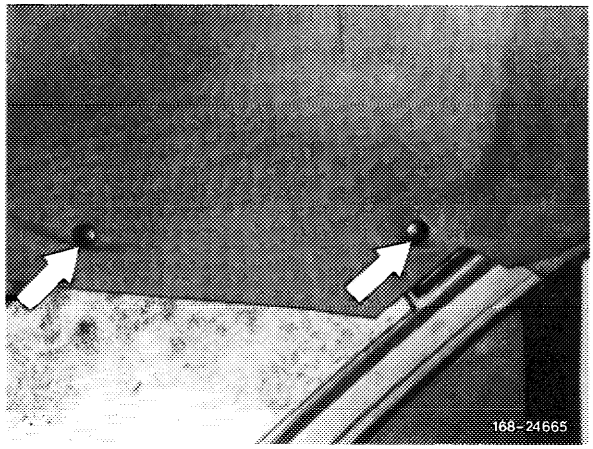
Shown on model 126

6 Disengage headlining at folded edge in door cutout.

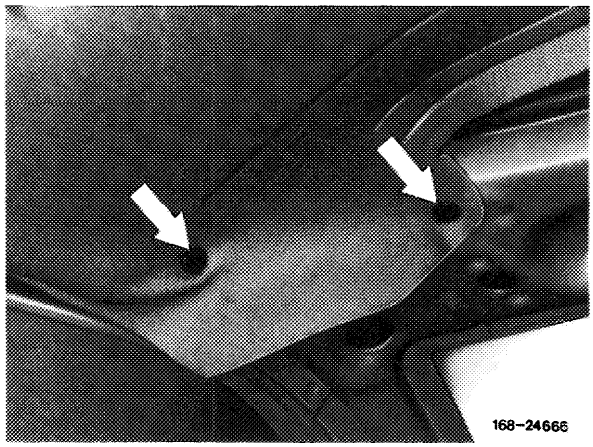


Shown on model 126

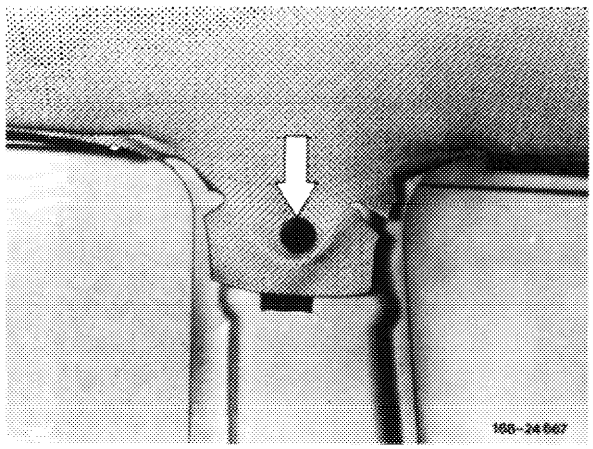
7 Push out clips on rear pillar left and right.



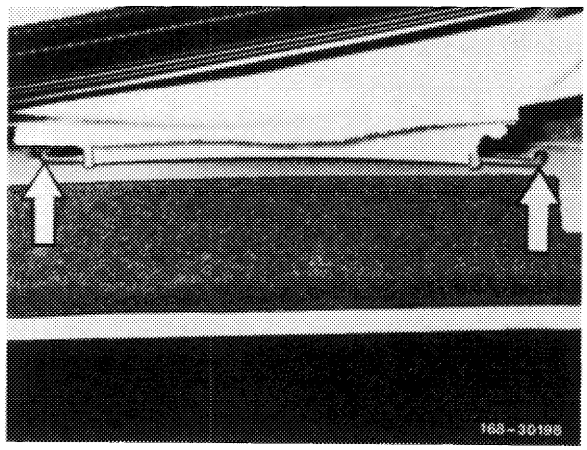
8 Push out clips on front wall pillar left and right.



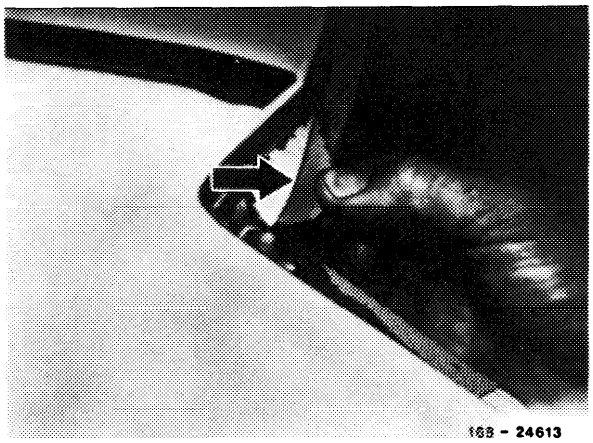
9 Push out clips on center pillar left and right.



10 Disengage wire bracket (4 each) laterally on roof frame.



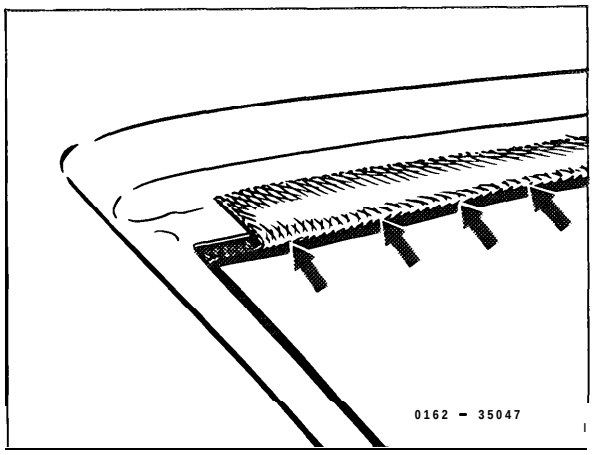
11 Release headlining at spot weld flange from rear window, top.



1 st version

12 Detach headlining at spot weld flange from rear window.

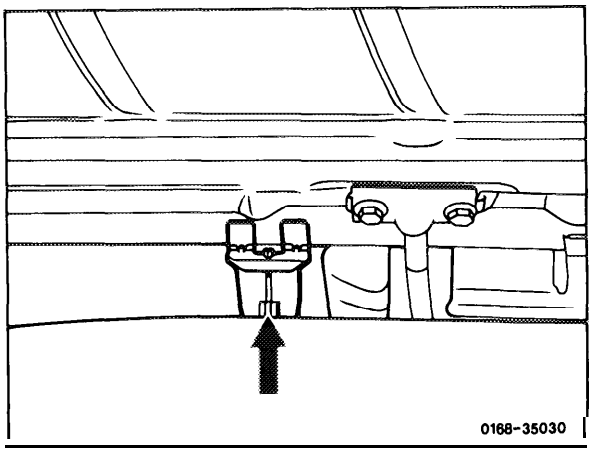
13 Disconnect bows starting at the rear.



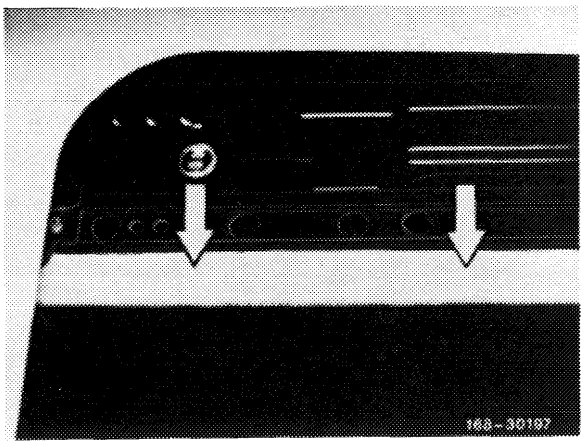
2nd version

14 Detach headlining from holding clamp (vehicles with electric sliding roof only).

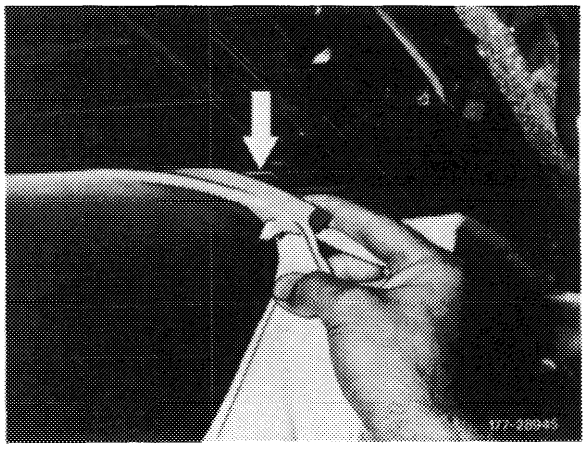
Attention!
On some vehicles with electric sliding roof the rear bow is additionally attached to teleflex tube by means of a cable strap, During removal, open cable strap and remove bow.



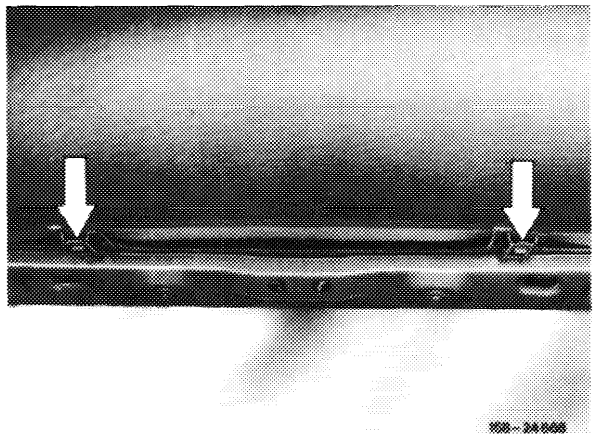
15 Pull out fastening strip on sliding roof frame laterally, removing chrome-plated rail at left and right for this purpose.



16 Pull mounting strips from plug-in channel of sliding roof frame.



17 Disengage headlining on roof frame, front, and remove.



Installation

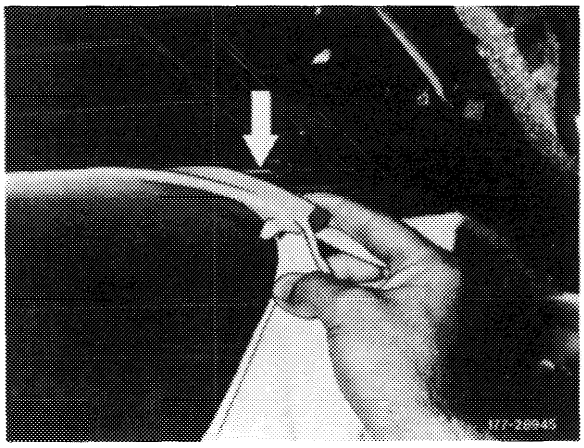
18 For installation proceed vice versa.

Note: On vehicles with sliding roof, fold mounting strip twice prior to slipping strip into sliding roof frame, rear.

Do **not** remove remaining adhesive on headlining with MB stain remover, nitro thinner etc., but remove carefully with cleaning benzine (with high flashpoint) with the doors opened, in a well ventilated room.

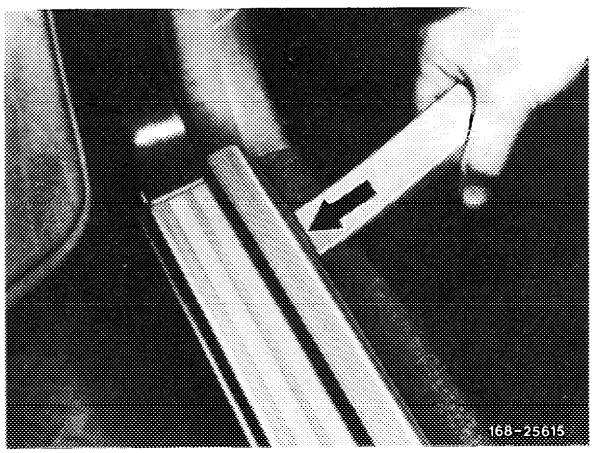
Caution! When working with cleaning benzine, pay attention to respective safety rules.

Dirty headlinings can be cleaned with MB plastics cleaner, a neutral dry foam cleaner, soap solution etc.

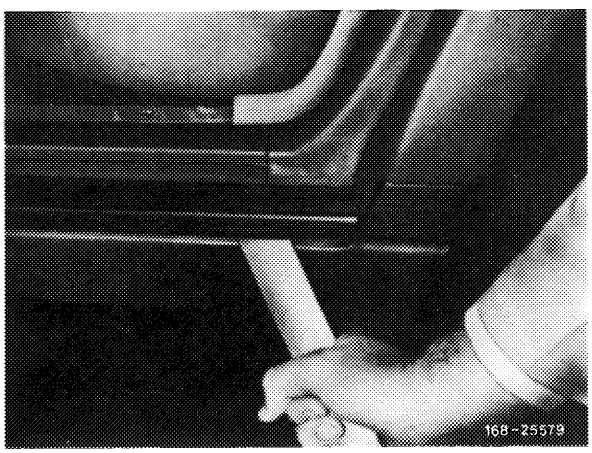


Removal

1 Press-off rail at entrance of driver's and rear door by means of a plastic wedge and take off.

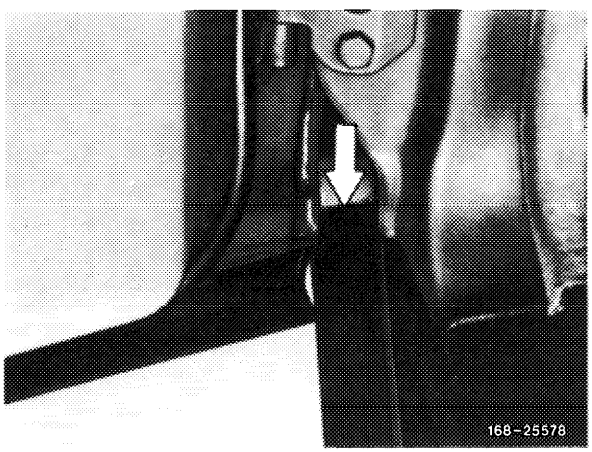


2 Press-off off edge protection starting at rear and by means of a plastic wedge and take off.



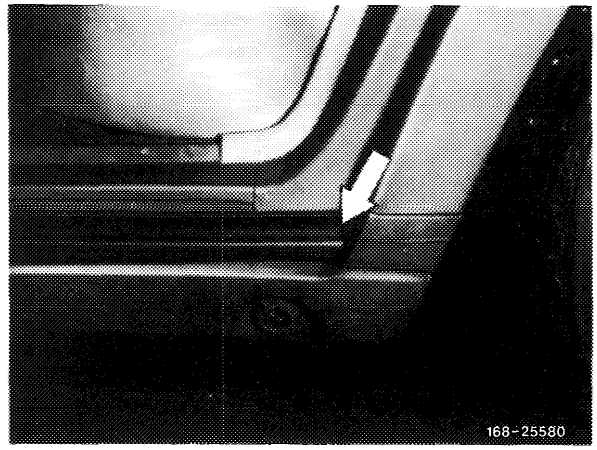
Installation

3 Insert edge protection at fender front.



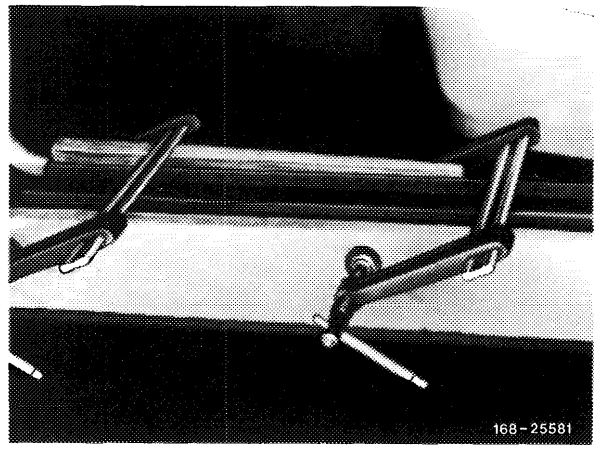
4 Adjust edge protection in such a manner that rear end is abutting to wheel housing.

Note: Inserted in the holding profile of edge protection is a butyl cord for sealing of sheet metal folding border.



5 Press edge protection onto sheet metal folding border, e. g. by means of two screw clamps and suitable wooden supports.

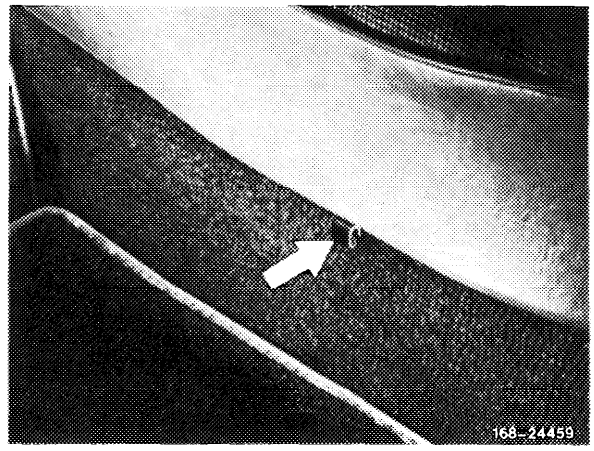
6 Install rail at the entrance of driver's and rear doors.



Removal

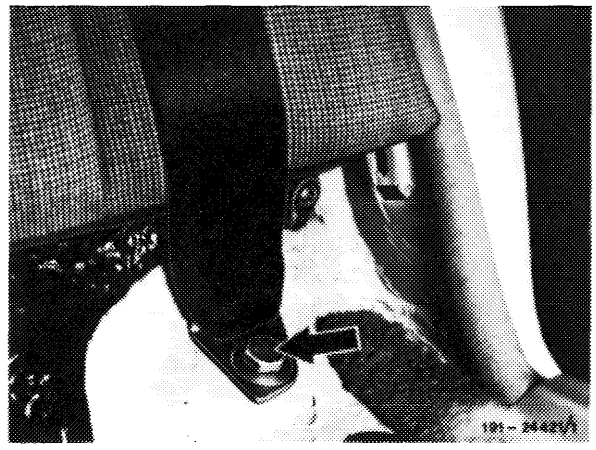
1 **Push detent at the left and right on rear cushion toward the rear and lift rear cushion at the front.**

2 Remove rear cushion.



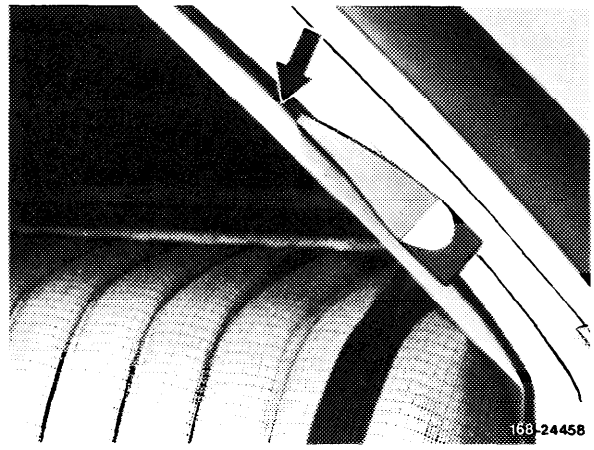
3 Unscrew belt end fitting on frame floor.

4 Pull off chafing in range of trim.



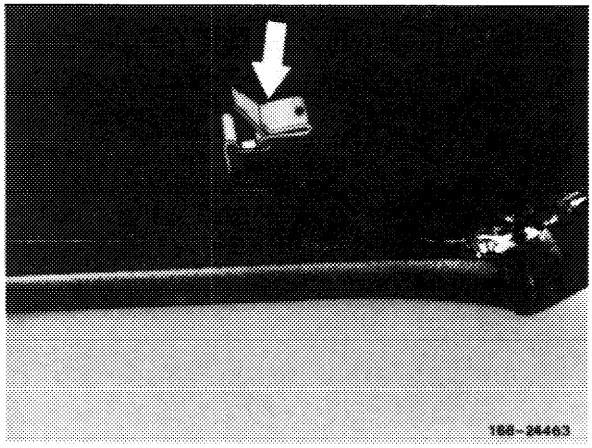
5 Push holding clips on trim at front toward vehicle center by means of wedge.

6 Push trim in upward direction and remove.



Installation

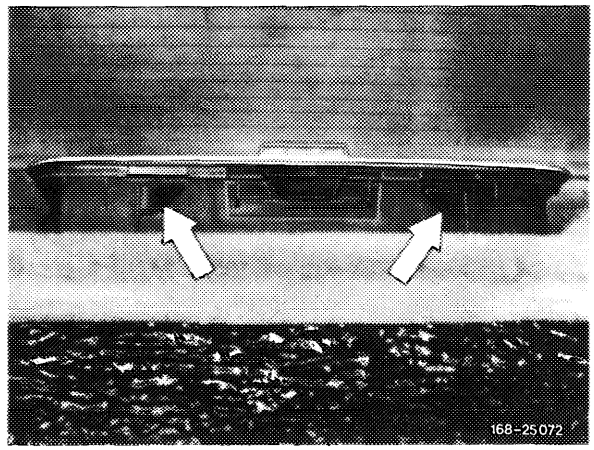
7 For installation proceed vice versa, while paying attention to perfect seat of clamp in recess provided on rear pillar.



Removal

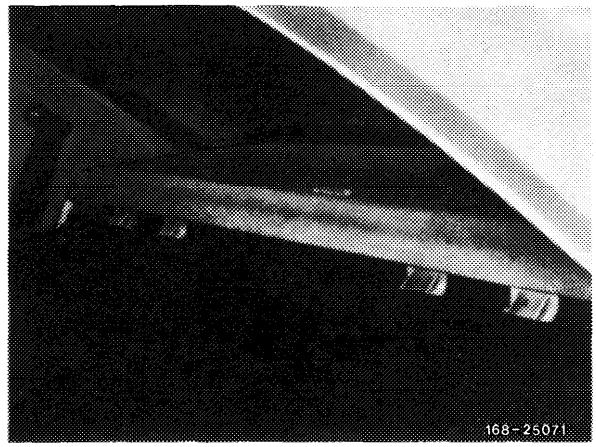
1 Remove rear seat and rear seat backrest (91-l 70).

2 Remove first aid kit. For this purpose, push out the two front holding lugs from the trunk rearwards and, simultaneously, the first aid kit upwards.



3 Take out first aid kit,

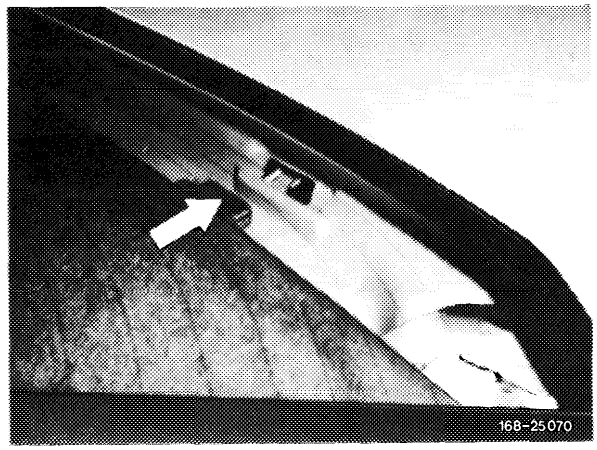
4 Pull out hat rack in forward direction.



Installation

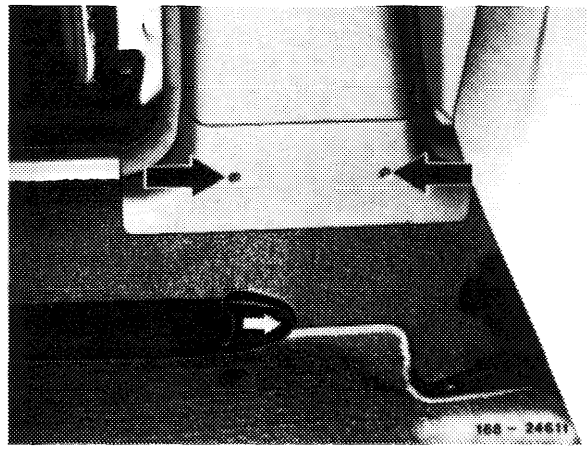
5 Slide-in hat rack, making sure that the lugs right and left are inserted into the recess at the rear.

6 For further installation proceed vice versa.



68-470 Removal and installation of panelling (trim) on center pillar

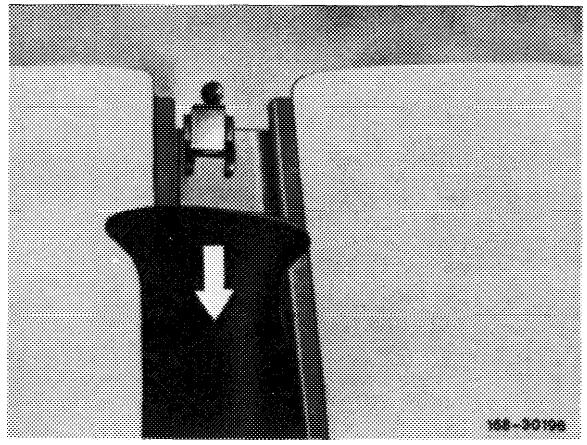
Removal



1 Unscrew screws on panelling (trim) below (upper arrows).

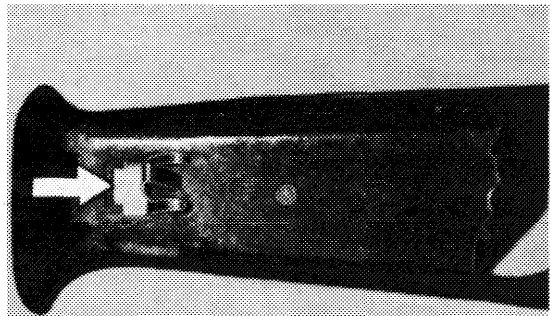
2 Swivel safety belt toward the rear, push off covering cap in forward direction and unscrew screw located underneath (lower arrow).

3 Pull off chafing strip in range of panelling (trim) on center pillar.



4 Pull panelling (trim) down from upper holding clip on center pillar.

Installation

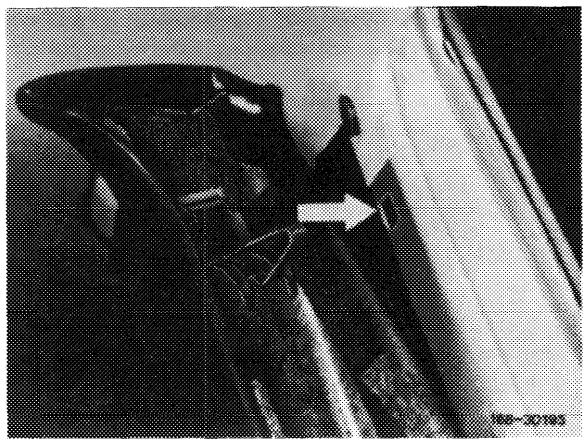


5 Remove upper holding clip on center pillar and insert into panelling (trim).

6 Lead belt end fitting through opening of panelling (trim) and fasten to side member.

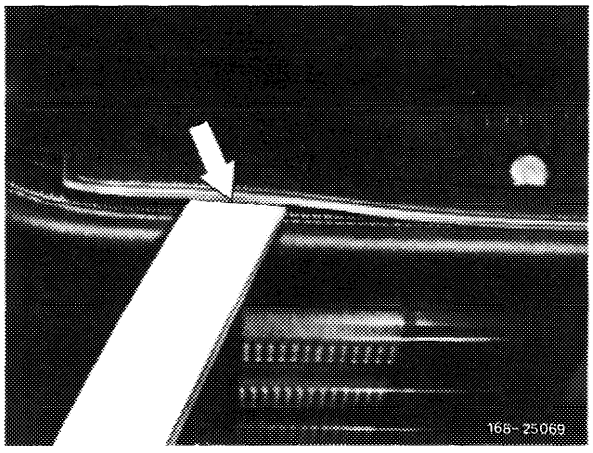
7 Engage panelling (trim) with holding clip at top into center pillar.

8 For further installation proceed vice versa.



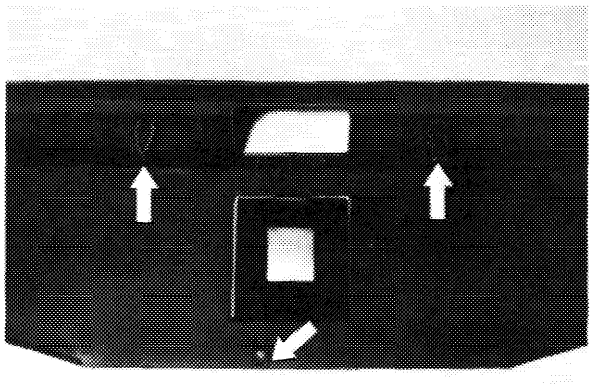
Removal

1 Carefully unclip panelling upwards by means of a plastic wedge and remove.



Installation

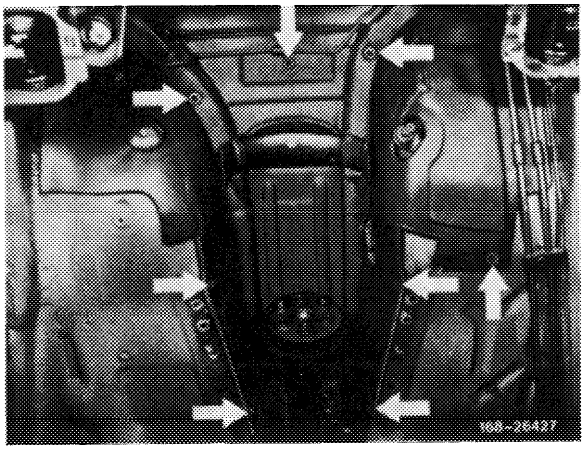
2 Place panelling on rear center piece and press-in or slide-in holding plug and holding tongue into location hole.



Note

Removal and installation of damping elements is possible only with the engine removed.

Removal



1 Remove shielding plate front right.

2 Unscrew plastic nuts (arrows) and remove damping elements in downward direction.

Installation

3 For installation proceed vice versa.

Attention!
Replace torn off or missing weld studs with a folding rivet nut and screw bolt. Collar screw parts set, part No. 000 990 12 10.

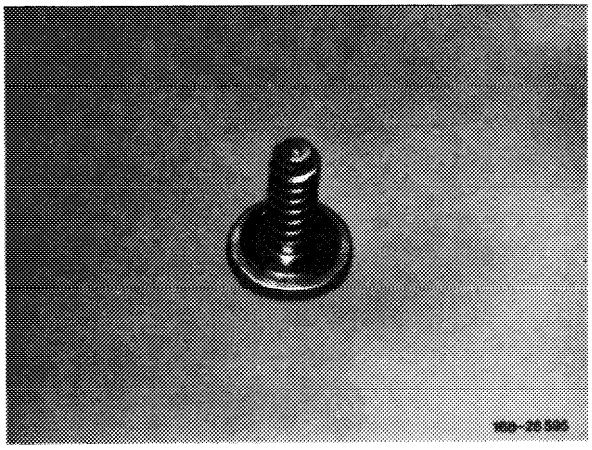
4 Mark bore and punch-mark.

5 Drill hole (9 mm dia.) and coat edge of hole with zinc dust paint.

6 Rivet folding rivet nut down to a form-lock seat by means of manual riveting tongs.

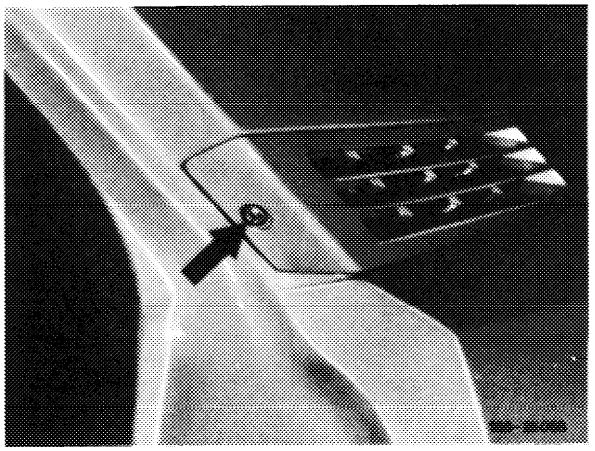
7 Coat threads of screw-in bolt with screw locking compound, part No. 002 989 94 71 and screw into folding rivet nut.

8 Fasten damping elements with plastic nuts.

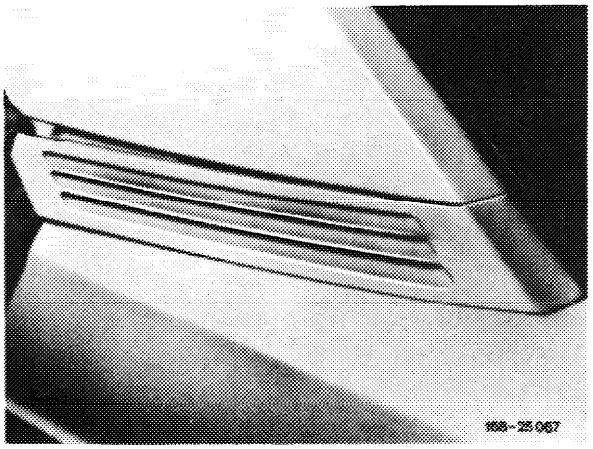


Removal

1 **Release screw on cover front.**



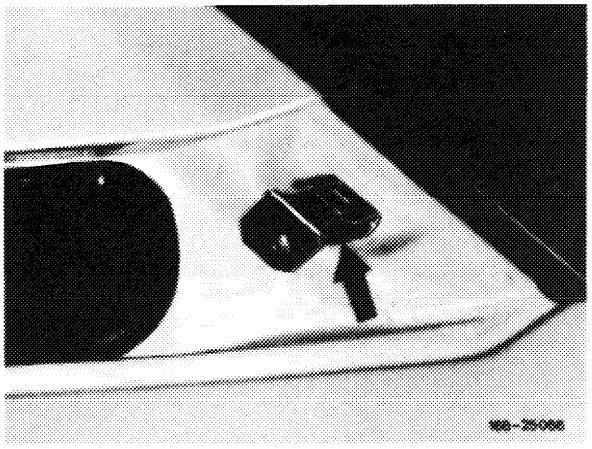
2 **Lift off cover front and pull out at the rear from holding clip.**



Installation

3 Adjust holding clip.

4 Press cover into holding clip and tighten at the front with a screw.



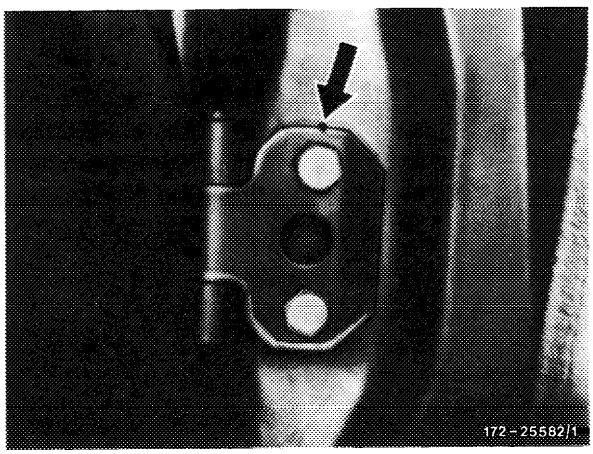
	Job No.
Removal and installation of driver's door, adjustment	72–050
Renewing driver'sdoor	051
Removal and installation of rear compartment door, adjustment	060
Renewing rear compartment door	061
Removal and installation of door lining on driver's door	100
Removal and installation of door lining on rear door	101
Removal and installation of hand grip on door lining	140
Removal and installation of sealing rail inside	160
Removal and installation of sealing rail outside	170
Removal and installation of electric window opener on driver's door	185
Removal and installation of electric window opener on rear door	187
Removal and installation of stationary window on rear door	197
Removal and installation of flexible window run channel	198
Removal and installation of door holder	210
Removal and installation of sealing frame on driver's or rear door	220
Removal and installation of inside door actuation on driver's door	230
Removal and installation of inside door actuation on rear door	231
Removal and installation of outside door handle on driver's door	240
Removal and installation of outside handle on rear door	241
Removal and installation of door lock on driver's door	250
Removal and installation of door lock on rear door	251

Note

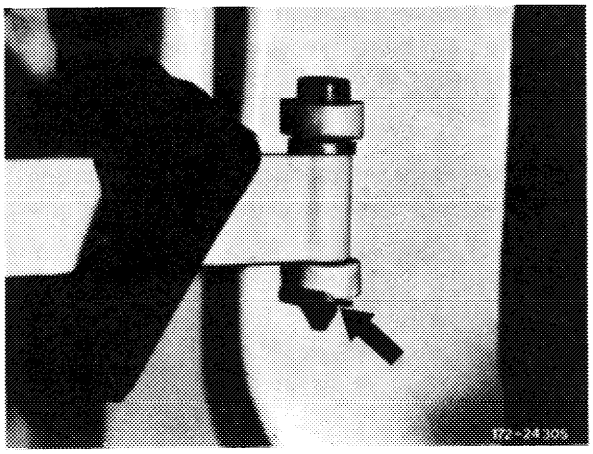
On vehicles with special equipment such as central locking system, electrically adjustable external rear view mirror or electric window opener, remove door lining (72-100). Disconnect connections of the pertinent special equipment and pull out through opening at front end of door inside panel.

Removal

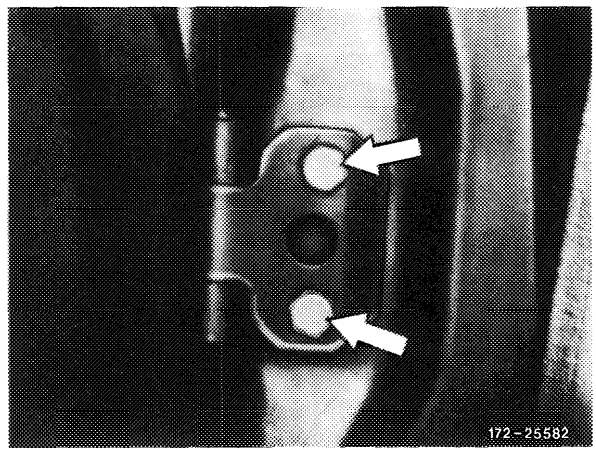
1 **Mark position of door hinges on matching surfaces of front wall pillar, at the upper and lower hinge each (e. g. by punch-marking) in order to avoid time-consuming adjustment when re-installing the door.**



2 **Remove lock on bolt for door holder and pull-out bolt in upward direction.**



3 Unscrew fastening **screws** on front wall pillar and remove door toward the rear



Installation

4 Position door at mark and slightly tighten fastening screws on hinges.

5 Align driver's door at hinge side in such a manner that door paneling of the driver's door is in alignment with contour of front fender or is max. 1 mm deeper.

6 Check air gap all-around the door and make corrections, if required. For air gap widths, refer to 60-070.

7 Tighten fastening screws on hinges.

8 Check adjustment of rear compartment door and correct, **if required.**

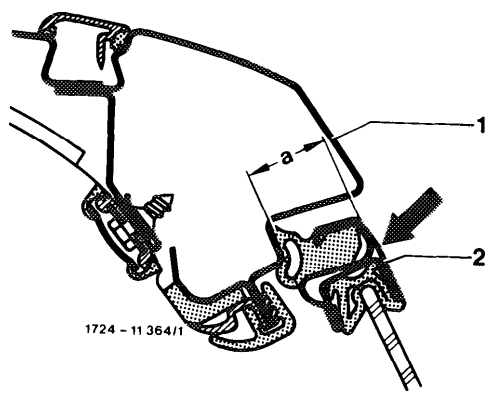
9 Adjust striker eye in such a manner that door paneling of driver's door is in alignment with door paneling of rear compartment door or projects by max. 1 mm.

10 Insert bolt on door holder and lock.

11 Check door for easy operation.

12 Check distance between window frames top and roof frame and align, if required. To prevent wind noise, a distance of 20.5-22 mm must be assured (dimension a).

13 Adjust **in the vertical range of window frame to a distance of 22-23.5 mm in relation to center pillar.**



1 Roof frame
2 Window frame
a 20.5-22 mm

Removal

1 Remove driver's door (72-050) and place on suitable base (table with foam fabric mat).

2 Unscrew door hinges.

3 Remove lining on driver's door (88-800).

4 Remove protective strip at driver's door (88-802).

5 Remove door handle outside on driver's door (72-240).

6 Remove external rear view mirror (88-900 or 88-905).

7 Remove sealing rail outside on driver's door (72-170).

8 Remove door lining on driver's door (72-l 00).

9 Remove sealing rail inside (72-160).

10 Remove sealing frame on driver's door (72-220).

11 Remove crank window on driver's door (72-190). On vehicles with "electric window opener" as special equipment, refer to 72-185.

12 Remove inside door actuation on driver's door (72-230).

13 Remove door lock on driver's door (72-250).

14 Remove door holder (72-210).

15 Remove flexible window run channel (72-198).

16 Remove element for central locking system.

Specified jobs on spare part door

17 Seal seams on door (97-400).

18 Paint spare part door.

19 Glue insulation to inside of door leaf (insulation is self-adhesive).

20 Perform repair preservation (97-l 50).

Installation

21 For installation proceed vice versa.

Attention!
Upon installation, adjust crank window (72-l 95).

The screw at top of handle is micro-encapsulated and should either be replaced or screwed-in with a screw locking compound.

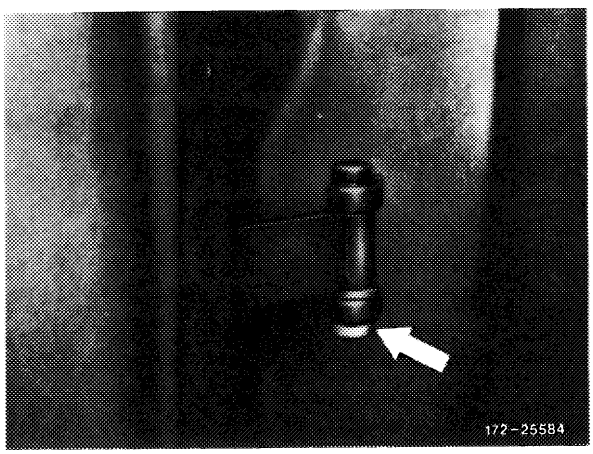
Note

Remove door lining on vehicles with central locking system or electric window opener as special equipment (72-I 01). Disconnect connections of the special equipment and pull out through opening at front end of inside door panel.

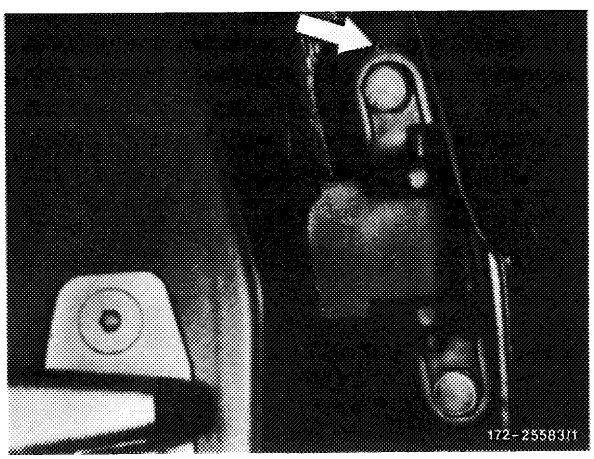
Removal

1 **Remove lock on bolt of door holder and pull out lock in upward direction.**

2 **Press-in catch band of door holder and close door.**

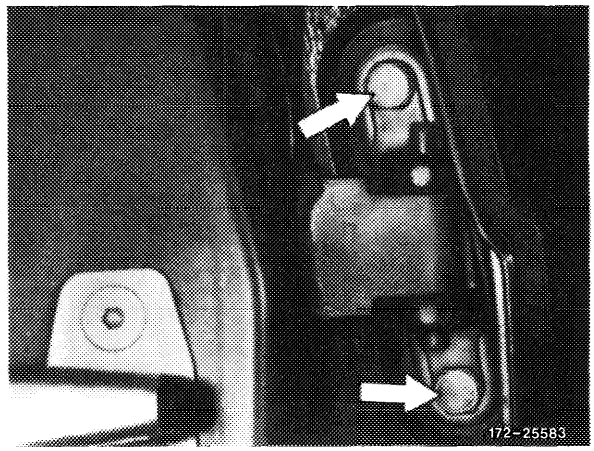


3 Mark location of door hinges at matching surfaces on rear compartment door, both on the upper and the lower hinge (e. g. by punch-marking) in order to avoid time-consuming adjustment when re-installing door.



4 Unscrew fastening screw on hinges.

5 Open door and remove toward the rear.



Installation

6 Position door at markings and slightly tighten fastening screws at hinges.

7 Adjust rear compartment door at hinge side in such a manner that door paneling of rear compartment door is in alignment with countour of driver's door or is max. 1 mm deeper.

8 Check air gap all-around the door and make corrections, if required.
For air gap widths refer to 60-070.

9 Tighten fastening screws on hinges.

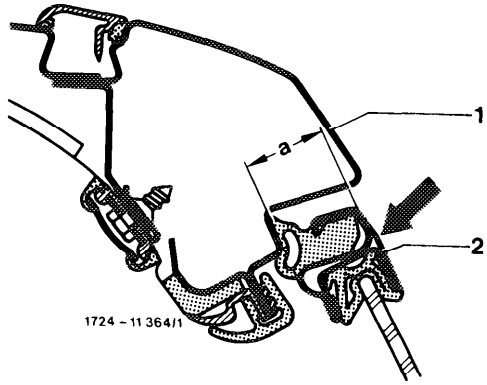
10 Adjust striker eye in such a manner that door paneling of rear compartment door is in alignment with rear fender or projects by max. 1 mm.

11 Insert bolt at door holder and secure.

12 Check door for easy operation.

13 Check distance between window frame and roof frame and align, if required. To prevent wind noise, a distance of 20.5-22 mm must be assured (dimension a).

14 Adjust in the vertical range of window frame to a distance of 22-23.5 mm in relation to center pillar.



1 Roof frame
2 Window frame
a 20.5-22 mm

72–061 Renewing rear compartment door

Removal

1 Remove rear compartment door (72-060) and p place on suitable base (table with foam fabric mat).

2 Remove lining on rear compartment door (88–800).

3 Remove protective strip on rear compartment door (88-802).

4 Remove door handle outside on rear compartment door (72-24 1) .

5 Remove sealing rail outside on rear compartment door (72-l 70).

6 Remove lining on rear compartment door (72-101).

7 Remove inside sealing rail (72-160).

8 Remove sealing frame on rear compartment door (72-220).

9 Remove crank window on rear door compartment (72-191).

On vehicles with “electric window opener” as special equipment, observe 72-l 87.

10 Remove inside door actuation on rear compartment door (72-231).

11 Remove door lock on rear compartment door (72-251).

12 Remove door holder (72-2 10).

13 Remove flexible window run channel (72-l 98).

14 Remove stationary window on rear compartment door (72-l 97).

15 Remove element of central locking system.

Specified jobs on spare part door

16 Seal seams on door (97-400).

17 Paint spare part door.

18 Glue insulation to inside of door leaf (insulation is self-adhesive).

19 Perform repair preservation (97-l 50).

Installation

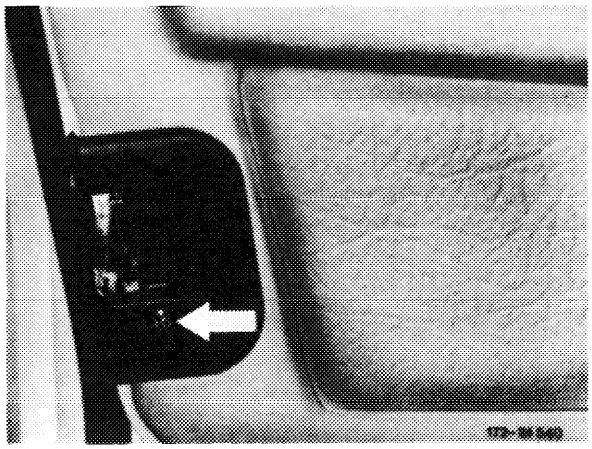
20 For installation proceed vice versa.

Attention!
The screw at top of handle is micro-encapsulated and should either be replaced or screwed-in with a screw locking compound.

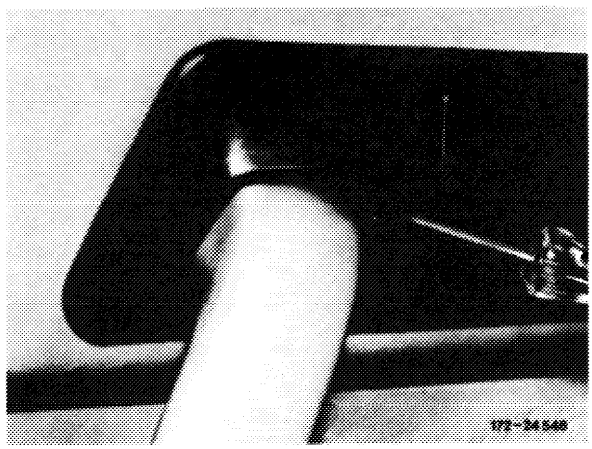
Removal

1 Remove enclosure on door lock.

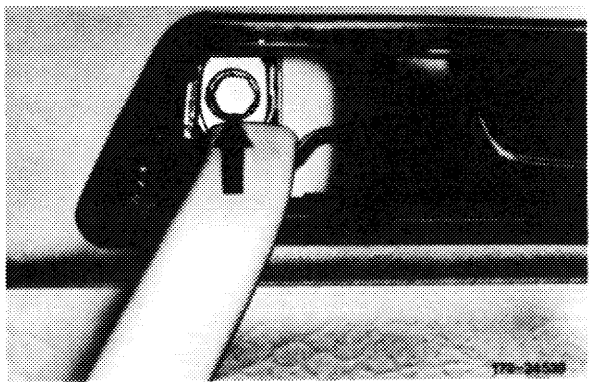
2 Remove window crank (72-I 10).



3 Push off cover.

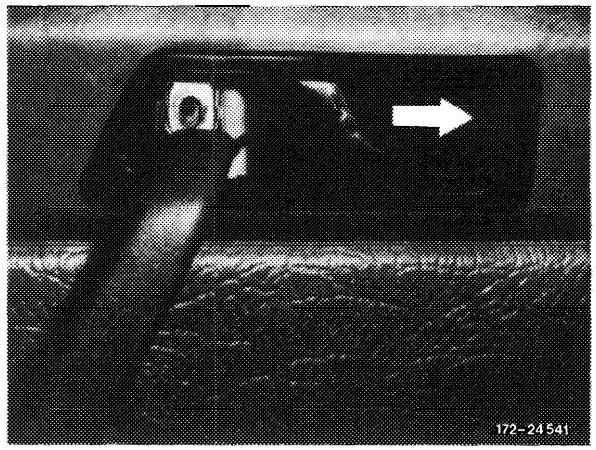


4 Loosen screw inside on hand grip.



5 Slide housing of inside door actuation in forward direction while releasing from inside door panel and linkage on inside door handle.

6 Pull door lining in upward direction out of holders and remove.



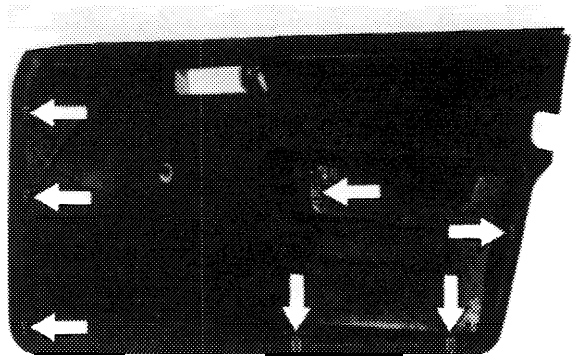
Installation

7 Engage door lining first with hook on door handle, inside (extended large hook). Then toward the top into sealing rail and enter with hook laterally and below at inside door panelling. For this purpose, lift door lining only to the extent that the large hook in range of door handle will not be disengaged.

8 For further installation proceed vice versa.

Note: If sealing sheet on inside door panel is damaged, renew prior to installing door lining,

The screw at top of handle is micro-encapsulated and should either be replaced or screwed in with a screw locking compound.



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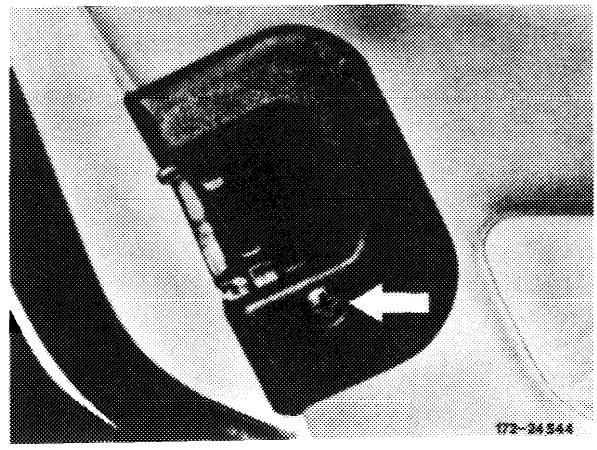
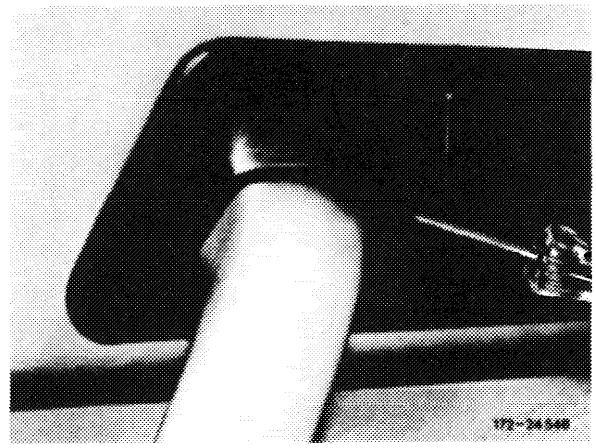
Removal

1 Remove enclosure on door lock.

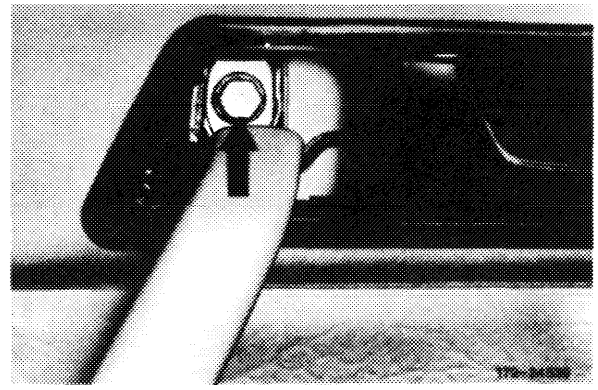
2 Remove window crank (72-I 10).



3 Push off cover.

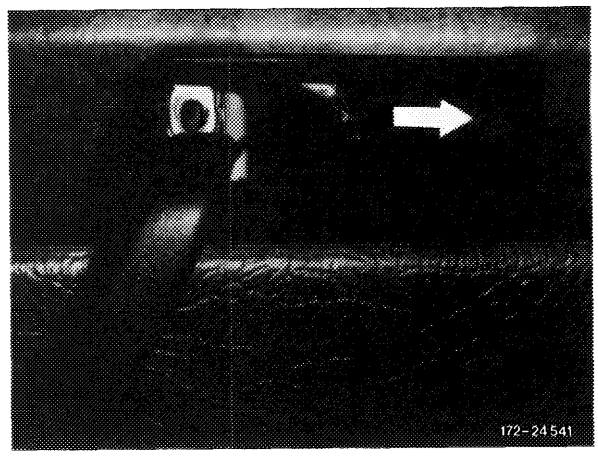


4 Unscrew screw inside of holding grip.



5 Slide housing of inside door actuation forward and release inside out of inside door panel and linkage on door handle.

6 Pull door lining out of holders in upward direction and remove.



Installation

8 Introduce door lining from above into sealing strip and locking button, while simultaneously entering with hook into inside door panel.

9 For further installation proceed vice versa.

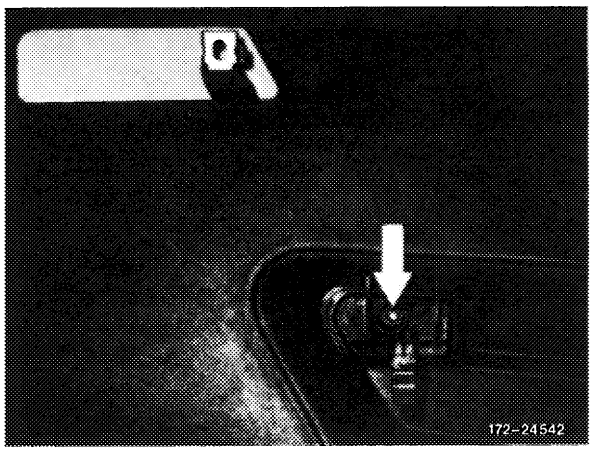
Note: If sealing sheet on inside door panel is damaged, renew prior to installing door lining.

The screw at top of handle is micro-encapsulated and should either be replaced or screwed-in with a screw locking compound.

Removal

1 Remove door lining on driver's door (72-100).

2 Unscrew screw on back of door lining and remove hand grip.



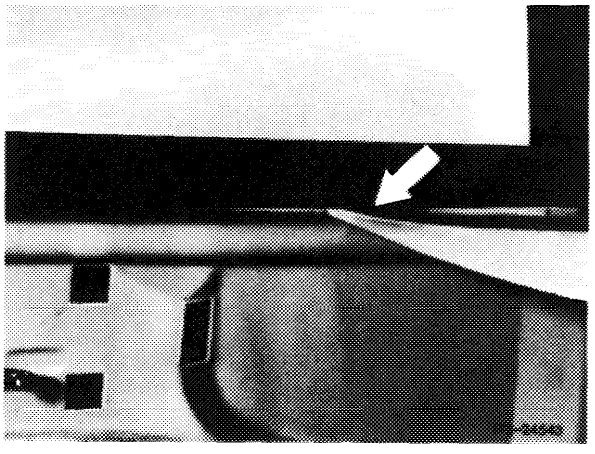
Installation

3 For installation proceed vice versa.

Removal

1 **Remove door lining on driver's door (72-100).**

2 Push sealing rail in upward direction from rebate by means of plastic wedge and remove.



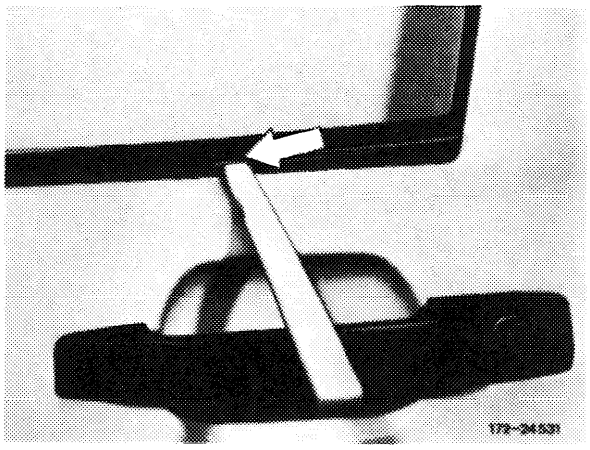
Installation

3 For installation proceed vice versa.

Removal

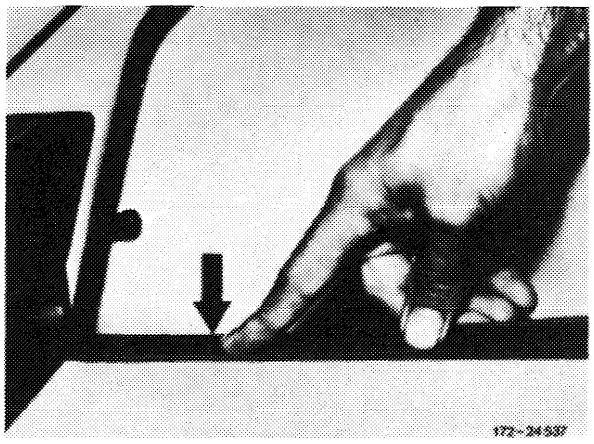
1 Set crank window completely down.

2 Push sealing rail carefully out of rebate by means of a plastic wedge, starting at the rear.



Installation

3 Insert sealing rail flush on window shaft front and push into rebate.



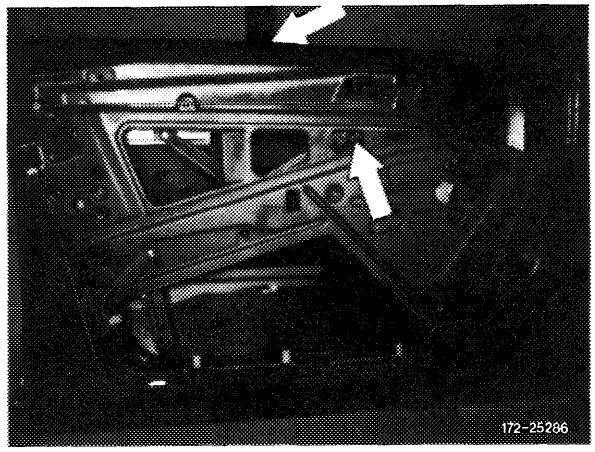
Removal

1 Remove door lining (72–100).

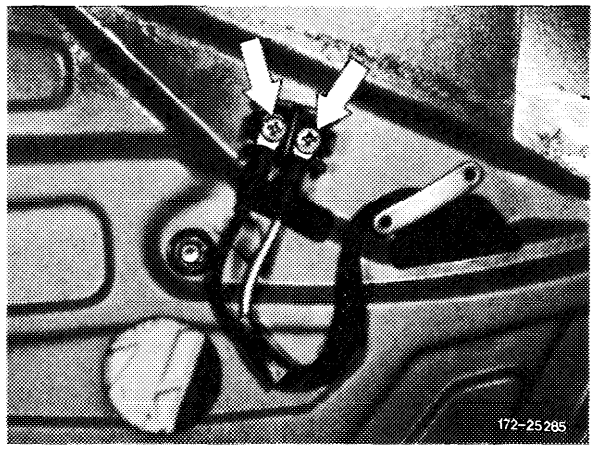
2 Remove plastic sheeting.

3 Crank window down until nut on window opening rail can be seen at the front incuout of inside door panel.

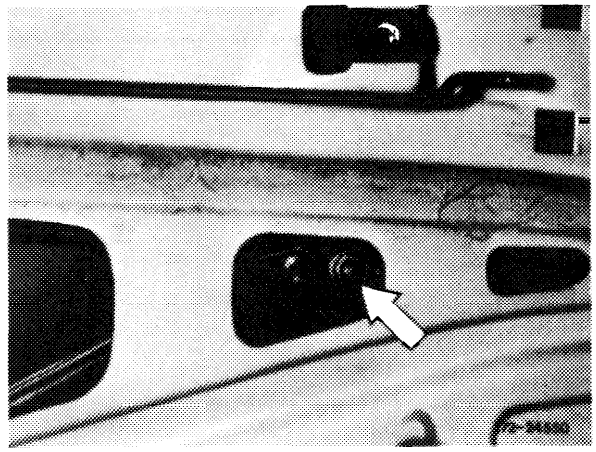
4 Protect window against sliding down by means of a plastic wedge.



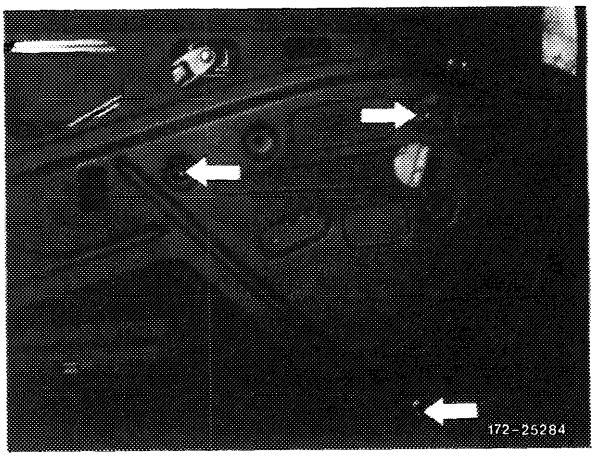
5 Disconnect electrical connections on cable connector.



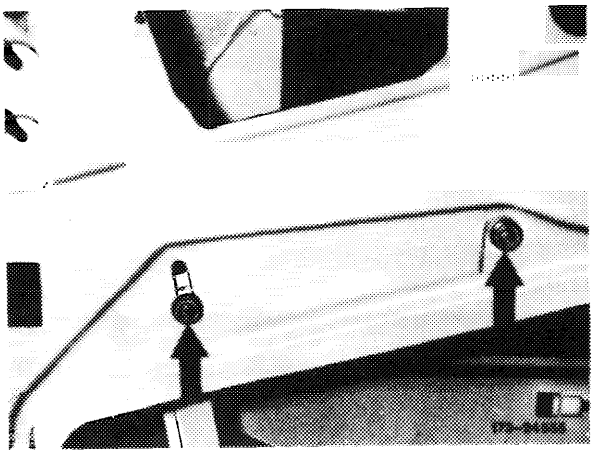
6 Unscrew nut on window opening rail front and remove window opener arm.



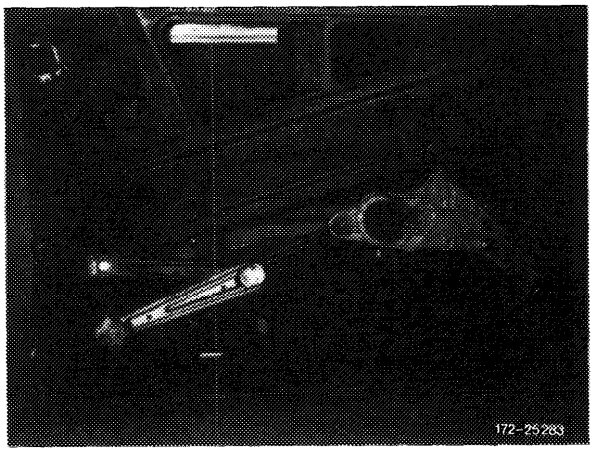
7 Unscrew nuts on window opener.



8 Unscrew nuts on guide rail and remove guide rail from guide element in forward direction.

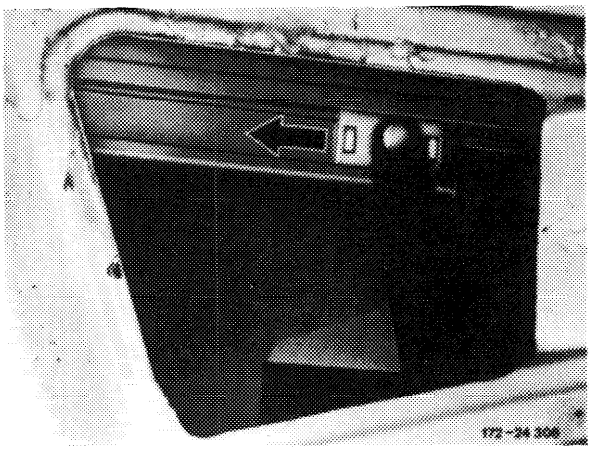


9 Pull out window opener with motor from window opener rail and take out in downward direction.

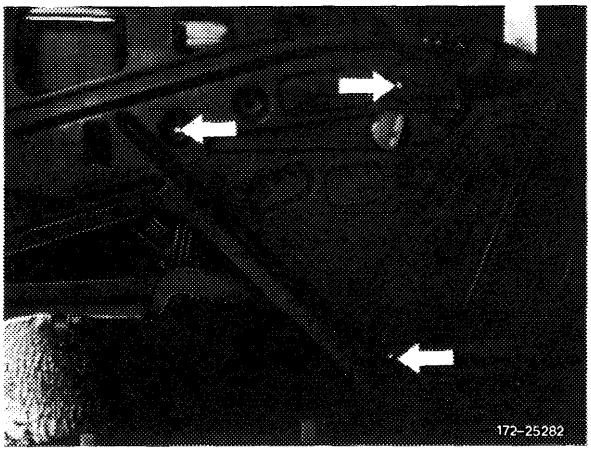


Installation

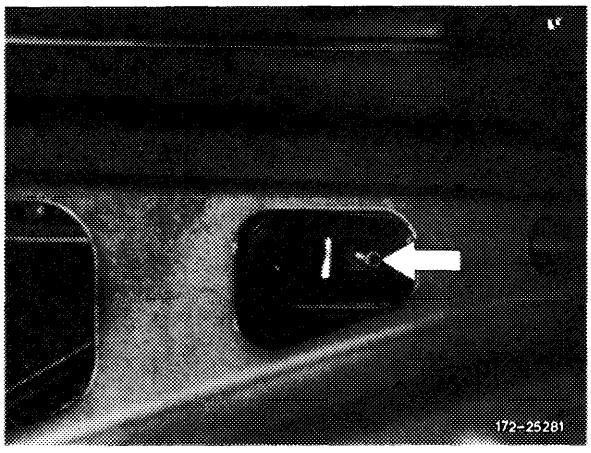
10 Insert window opener arm with guide element from front end into window opener rail.



11 **Slide-in window opener with the threaded bolt on inside door panel and attach.**



12 **Insert window opener arm at front into window opener rail and fasten with nut.**

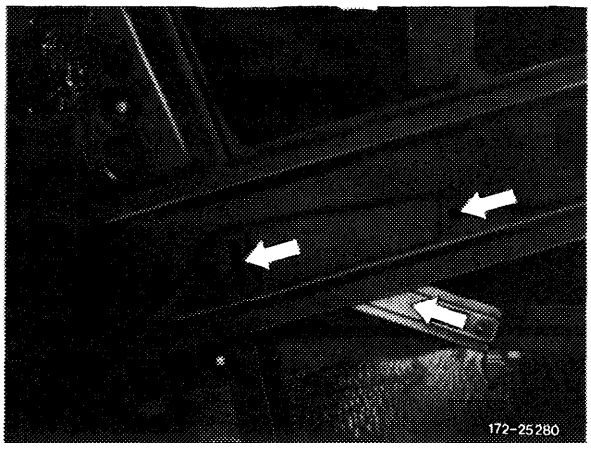


13 **Introduce guide rail from the front into guide member and attach at inside door panel.**

14 **For further installation proceed vice versa. Cables of the same color must be connected together.**

15 **Prior to attaching the door lining, adjust crank window (72-195).**

Note: **If door sheeting is damaged during removal, renew and carefully attach by glueing.**



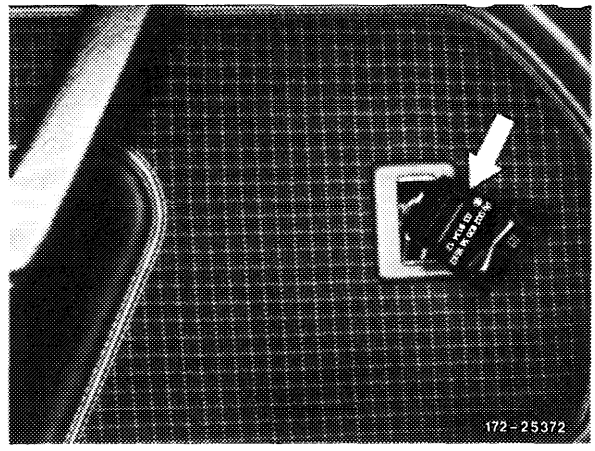
Removal

1 Crank rear window completely down.

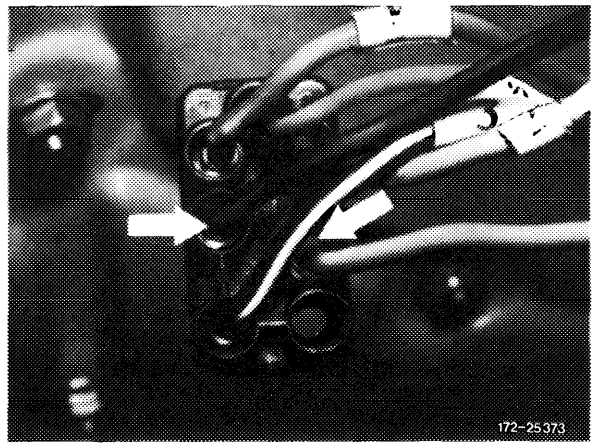
2 Press-out rocker-type switch from door lining and remove.

3 Dismantle door lining (72–101).

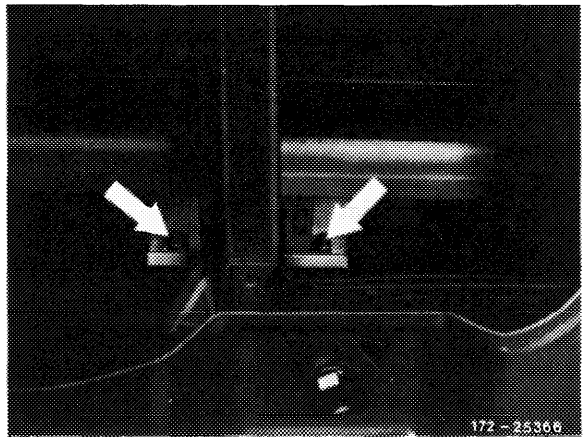
4 Remove plastic sheeting.



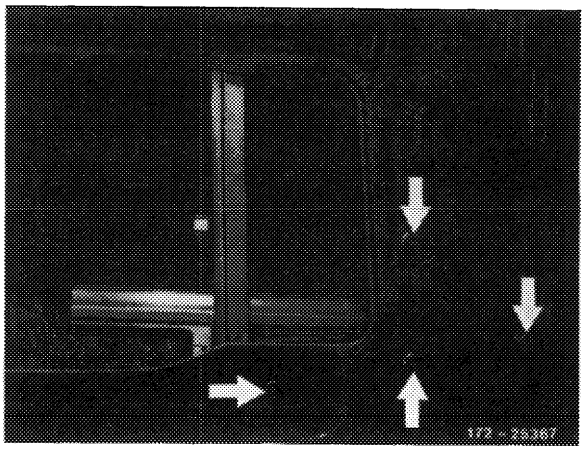
5 Open plug connection and pull out the electrical connection cables for the window opener motor.



6 Remove locking clamp from guide member.

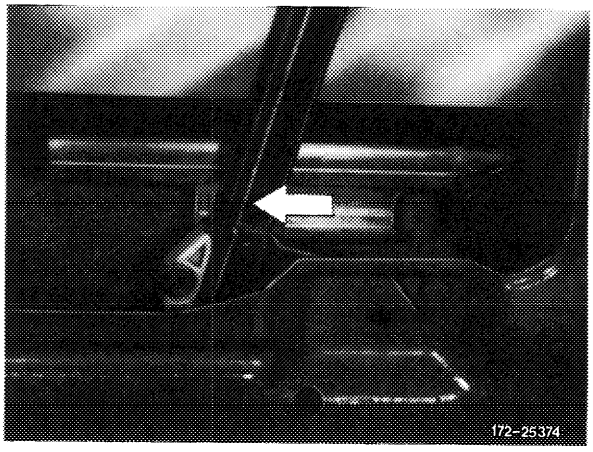


7 Unscrew nuts on window opener and screw on window opener guide rail below.

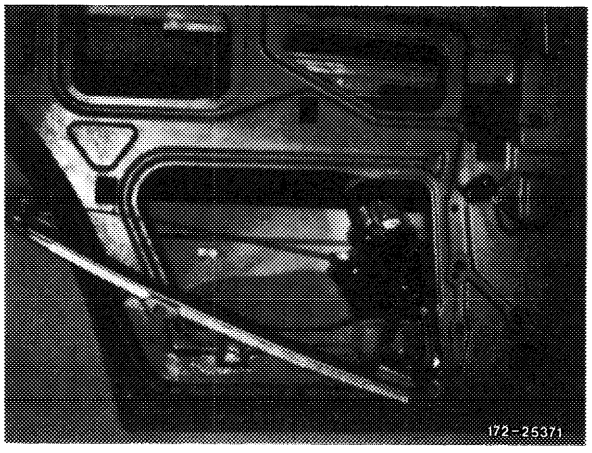


8 Remove window opener from inside door panel and swivel backwards, while sliding guide member from window opener rail outwards.

9 Pull electrical connecting cable from window opener motor out of holder on inner door panel.



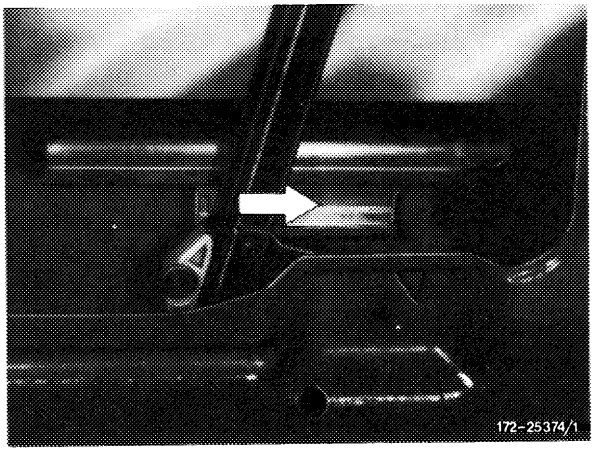
10 Remove window opener with motor by taking it out through assembly opening in downward direction.



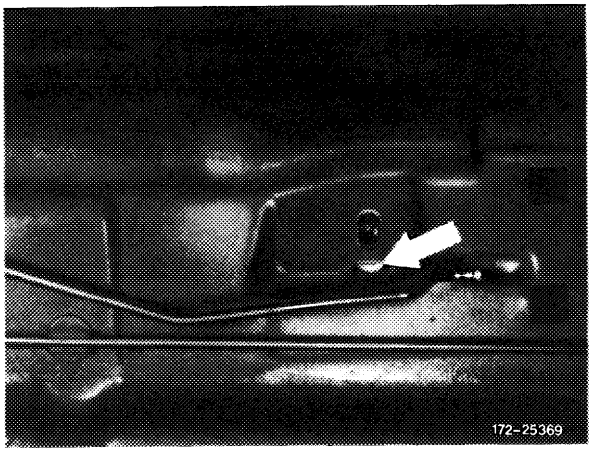
Installation

Attention!
The electric-cable rear window opener may only be actuated in installed condition, since only in connection with the inner door panel, it will have its required functional stiffness (danger of damage).

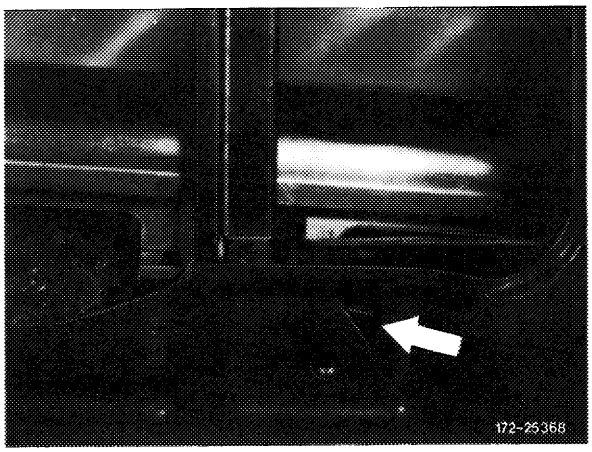
11 Introduce window opener with guide member into window opener rail and install locking clamp.



12 Introduce detent of window opener guide rail above into inner door panel.



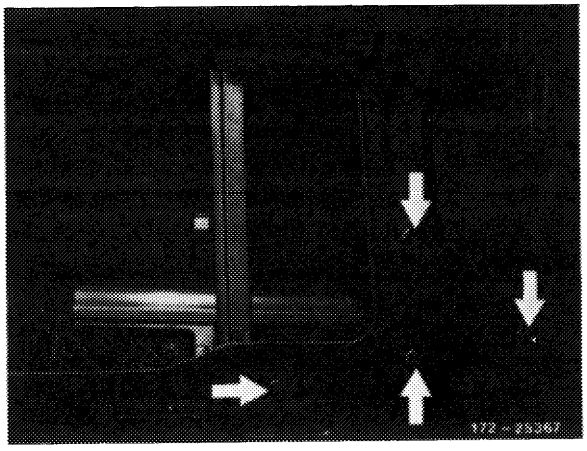
13 Introduce detent of window opener guide rail below into inner door panel.



14 Insert threaded bolt of window opener into inner door panel and tighten.

15 For further installation proceed vice versa.

Note: Connect electric connections on plug coupling in such a manner that the numbers on coupling and cable are in agreement.



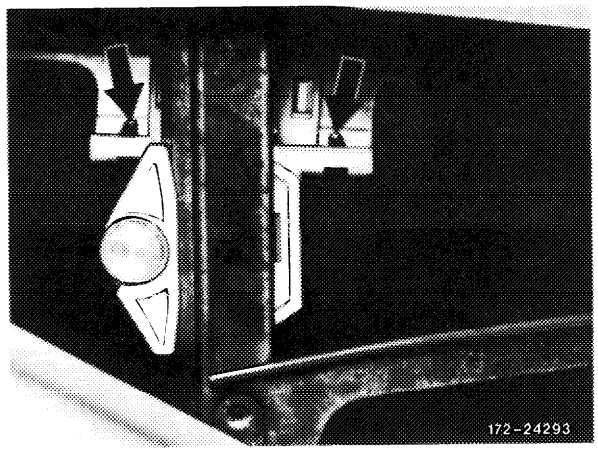
Removal

1 Remove door lining (72-101).

2 Remove plastic sheeting.

3 Remove sealing rail, inside (72-160).

4 Remove sealing rail, outside (72–170).



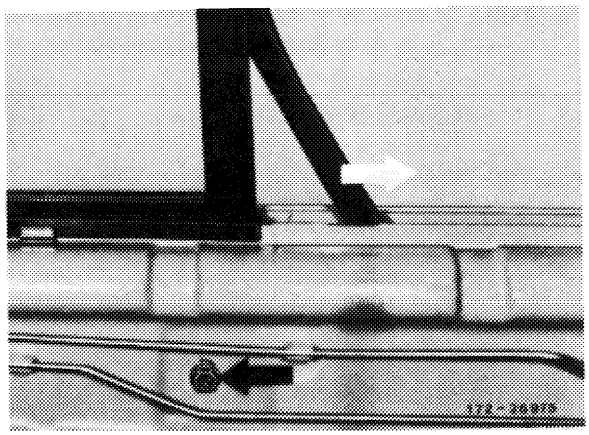
5 Turn crank window down.

6 Remove guide bracket from guide member.

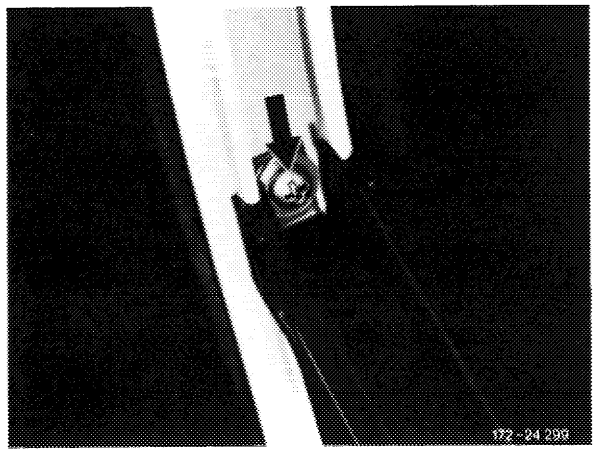
7 Push crank window to the rear while extending the window lifting rail out of guide member.

8 Lower crank window.

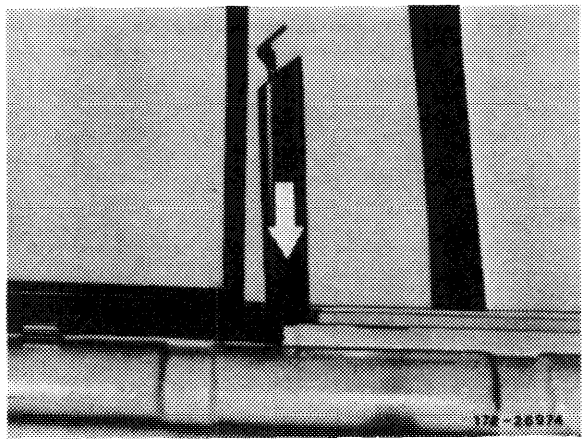
9 Pull out flexible window running rail at window web, rear, and unscrew screw on window web, below.



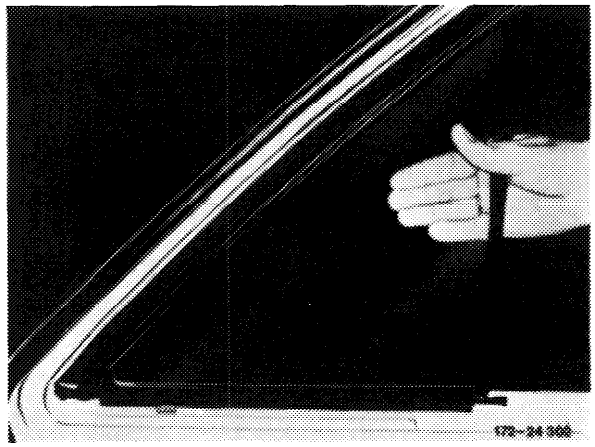
10 Unscrew screw on window web, top.



11 Remove window web in downward direction through opening in door inside panel.



12 Pull out window with sealing frame.



Installation

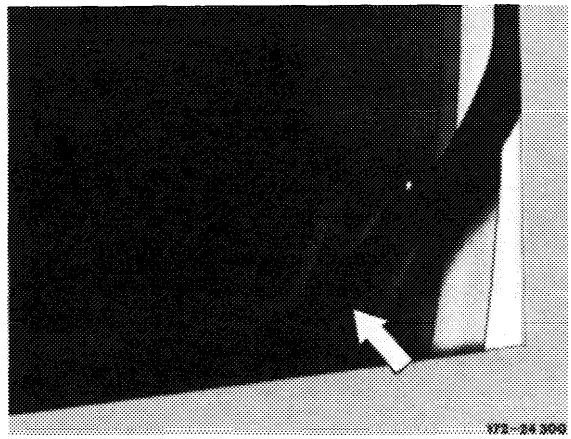
13 For installation proceed vice versa.

Note: For better assembly, rub sealing frame with soap solution.

Removal

1 **Remove crank window (72-190 or 72-l 91).**

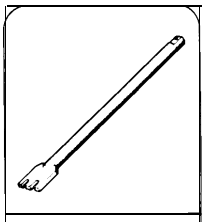
2 Pull window run channel out of rebate on door frame and remove.



Installation

3 For installation proceed vice versa.

Special tools

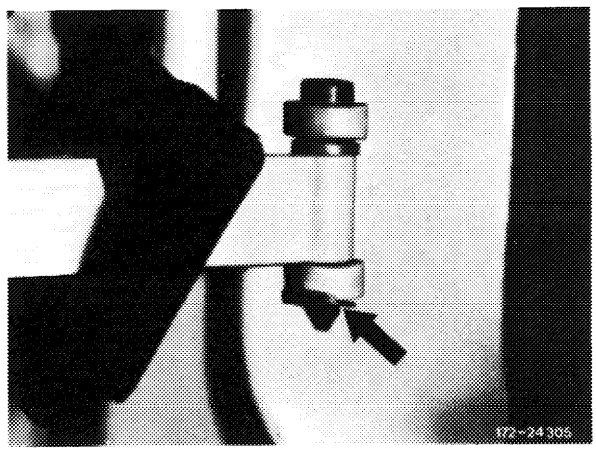


Removal, installation

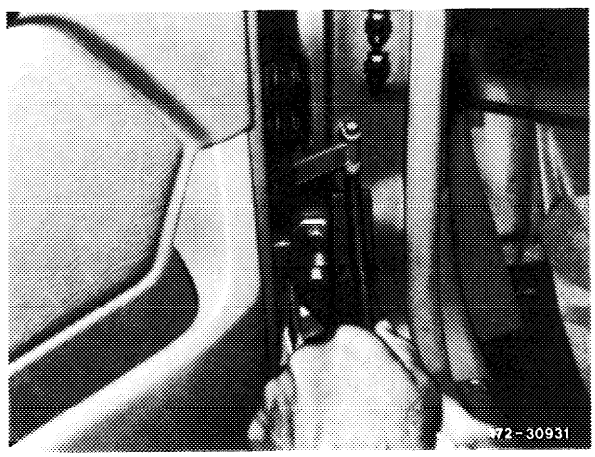
1 Remove door lining (72–100).

2 Pull off plastic sheeting in lower range.

3 Remove rubber sealing frame and protective lock on bolt.



4 Remove bolt with special tool and take off spacing washer.

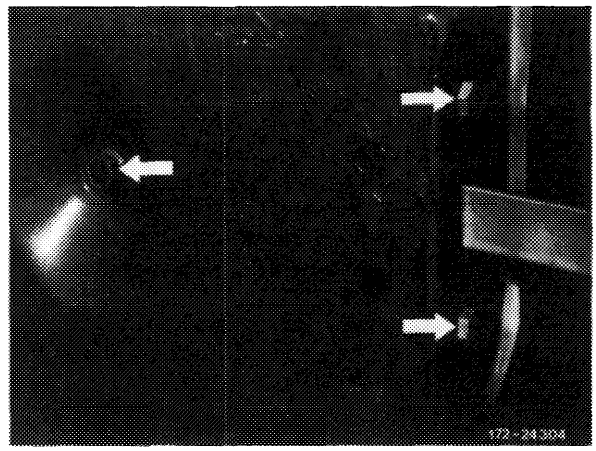


5 Unscrew the two outside screws and the inside screw.

6 Remove door holder.

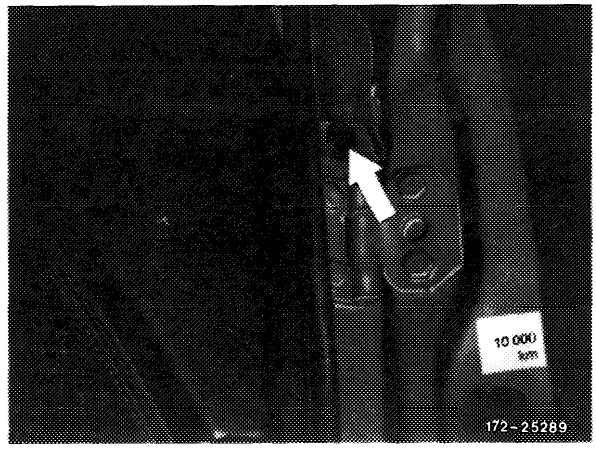
7 For installation proceed vice versa.

Note: The screws of door holder are micro-encapsulated and must be renewed or screwed in with screw locking compound.

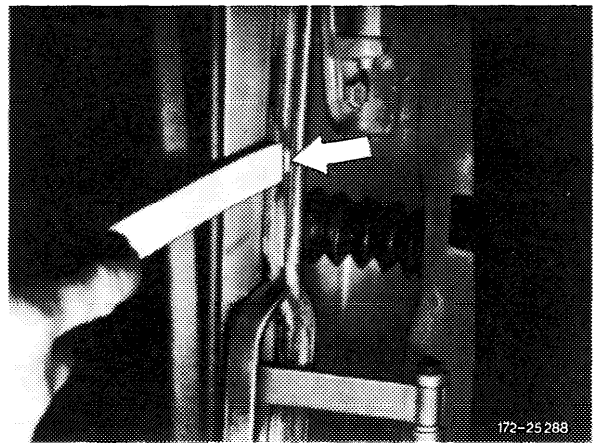


Removal

1 Press out clips on driver's door front side by means of a plastic wedge from door panel.

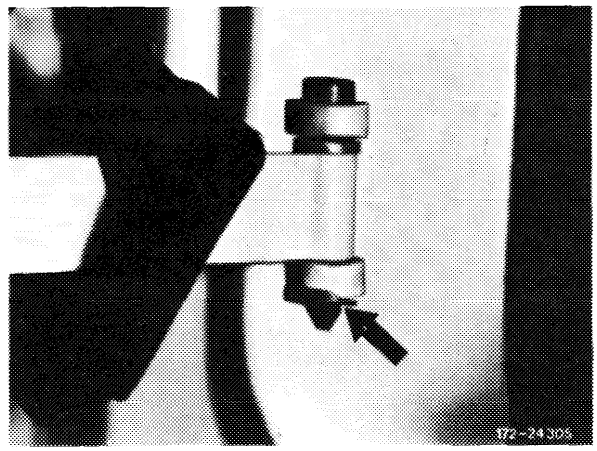


2 Press out clips in the front area of rear door (4 clips).

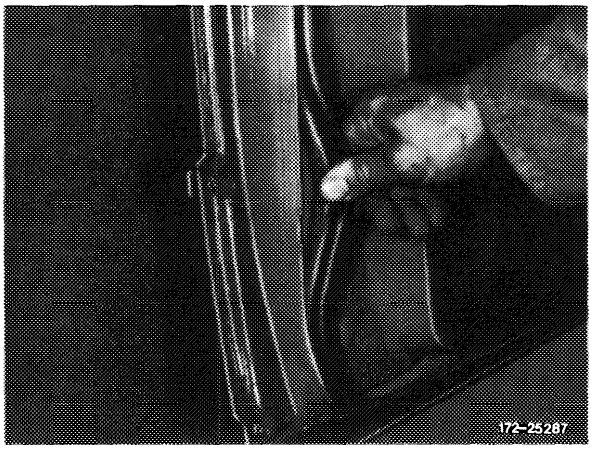


3 Remove lock and remove bolt on door holder.

Note: In order to avoid damage to the door, secure door again by the bolt immediately following removal or installation.



4 Pull out sealing frame from rebate and remove.

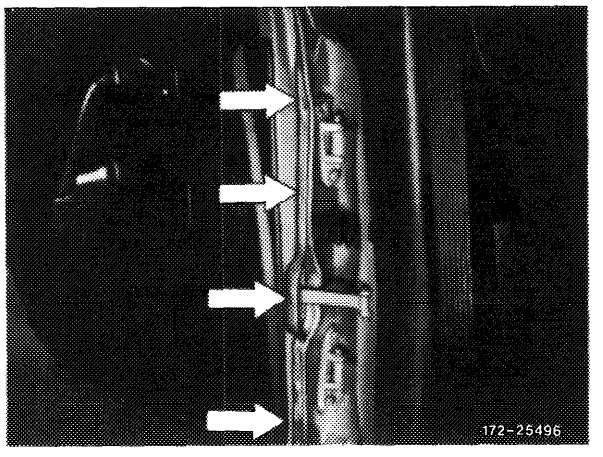


Installation

5 For installation proceed vice versa.

Note: Additionaly attach sealing frame by glueing in the area of the 4 clips (rear door).

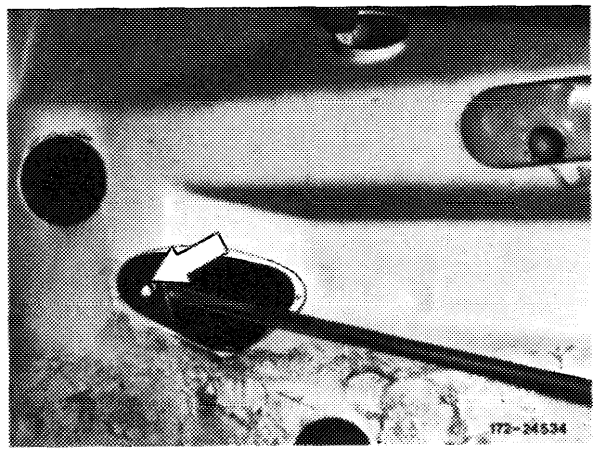
Always replace the clips.



Removal

1 Remove door lining (72–100).

2 Force pullrod from holding clip and release on door lock.



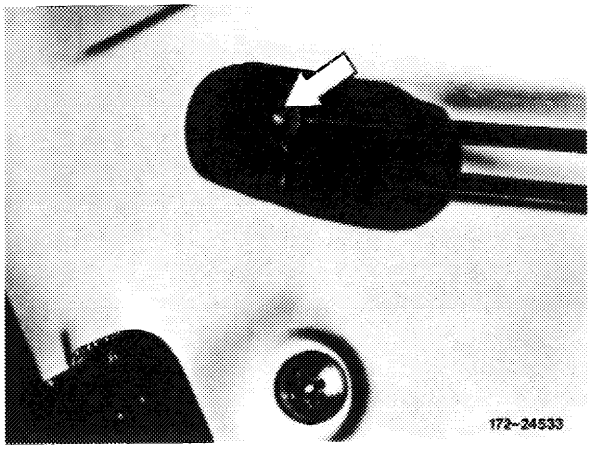
Installation

3 For installation proceed vice versa.

Removal

1 Remove door lining (72–101).

2 Force pullrod from holding clip and release on door lock.

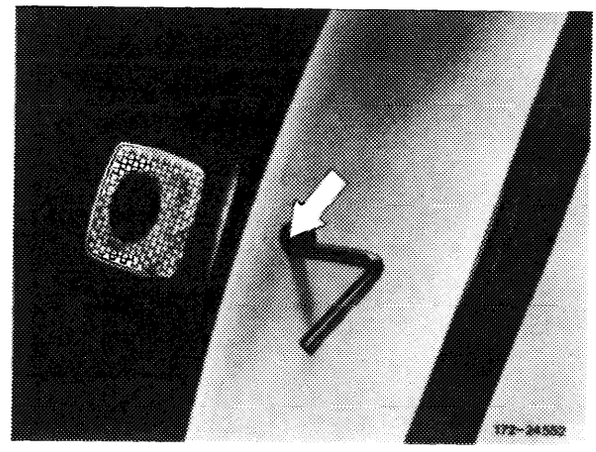


Installation

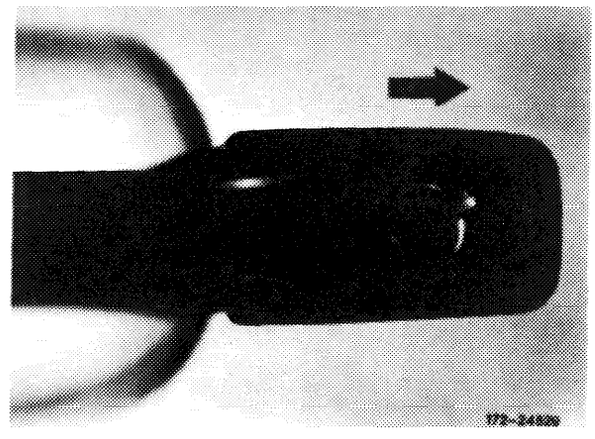
3 For installation proceed vice versa.

Removal

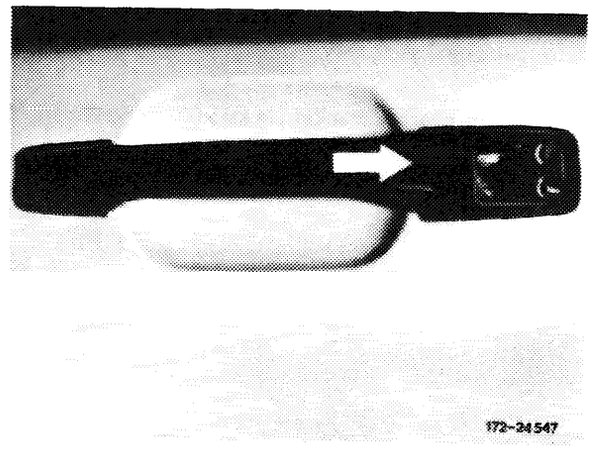
1 **Unscrew hex. socket screw (SW 3).**



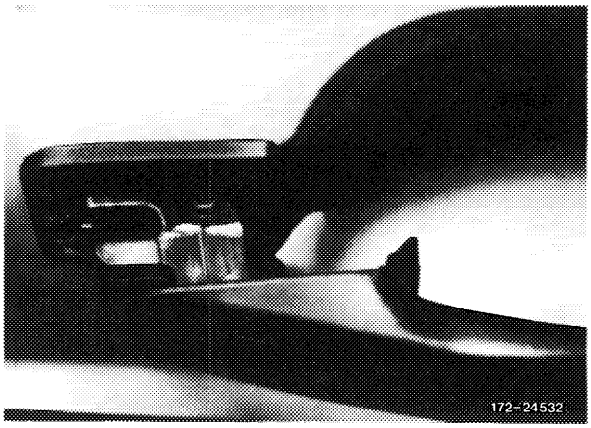
2 Insert door lock into closing cylinder, turn approx. 60" to the rear while simultaneously pushing closing cylinder to the rear out of detent on door panel and remove.



3 Push grab handle to the rear.

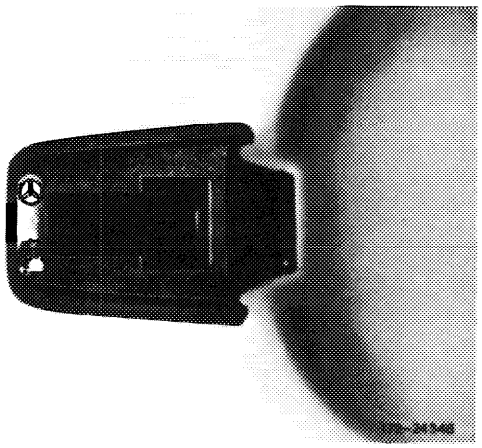


4 Remove grab handle front and rear from bearing bracket.

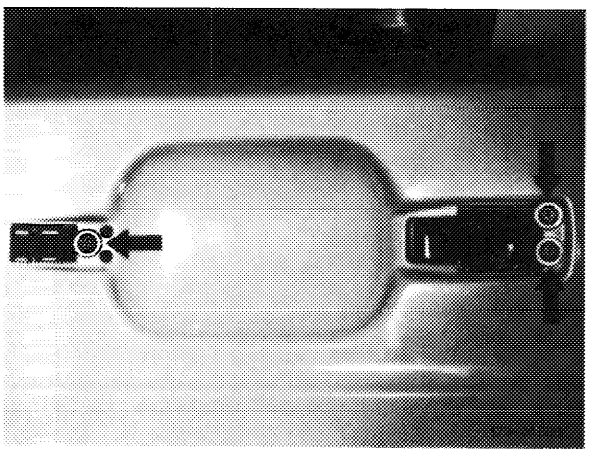


5 Remove rubber escutcheon.

6 Remove door lining (trim) (72-100) and loosen plastic sheeting in upper range.

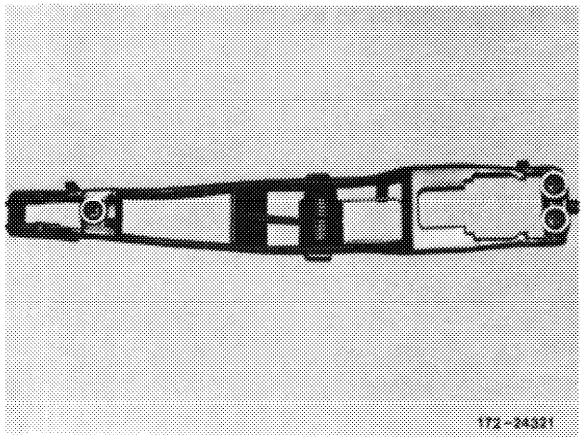


7 Loosen screws from bearing bracket.



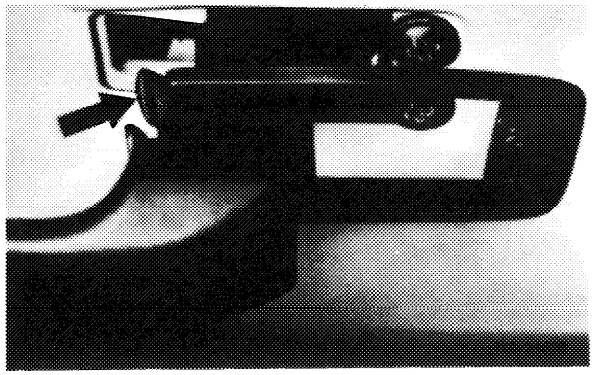
8 Pull bearing bracket from inside out of detent on door panel and slide forward.

9 Remove bearing bracket via assembly opening in inside door panel.



10 For installation proceed vice versa.

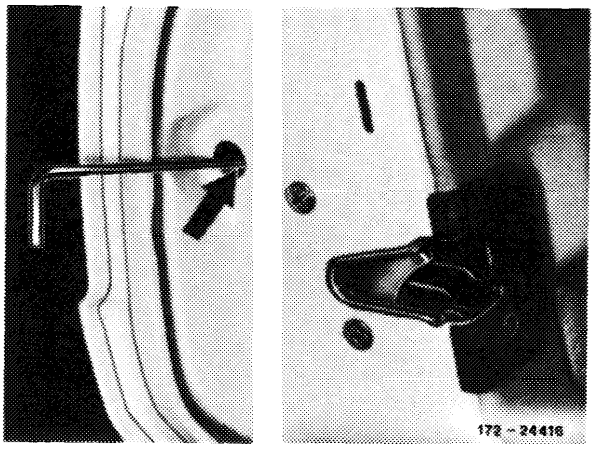
Note: When installing grab handle, insert link of rubber escutcheon between door panel and bearing bracket.



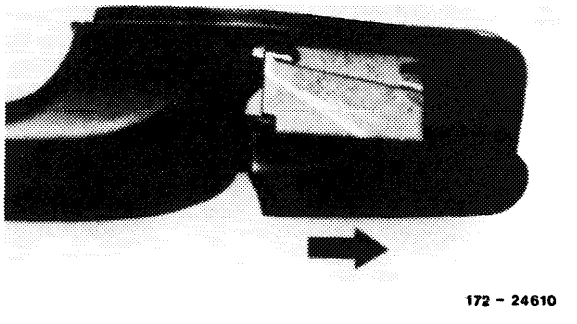
Removal

1 Pull sealing frame in door lock range out of rebate.

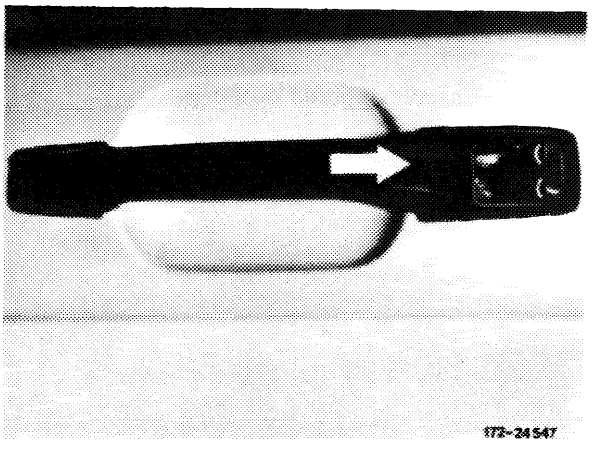
2 Unscrew hex. socket screw (SW 3).



3 Push cover toward the rear and remove.

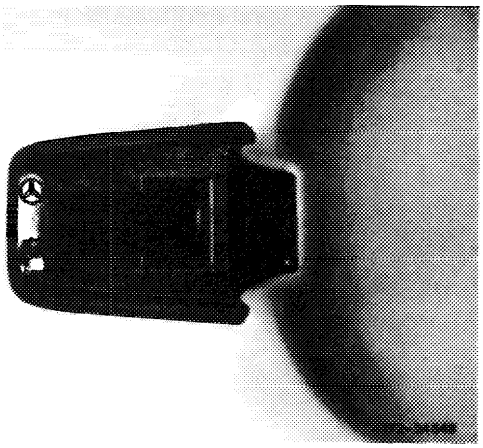


4 Push grab handle toward the rear and remove.

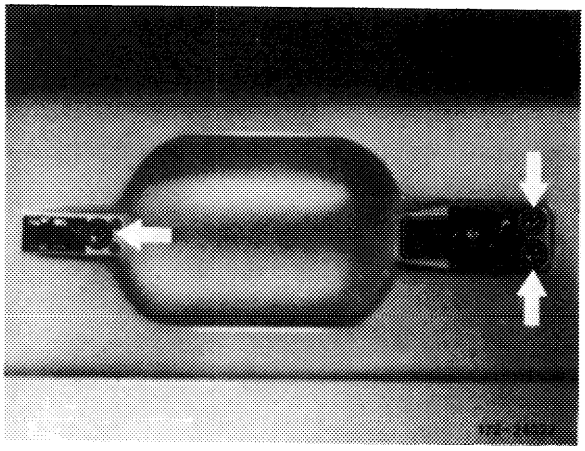


5 Remove rubber escutcheon.

6 Remove door lining (72-101) and loosen plastic sheeting at rear upper range.

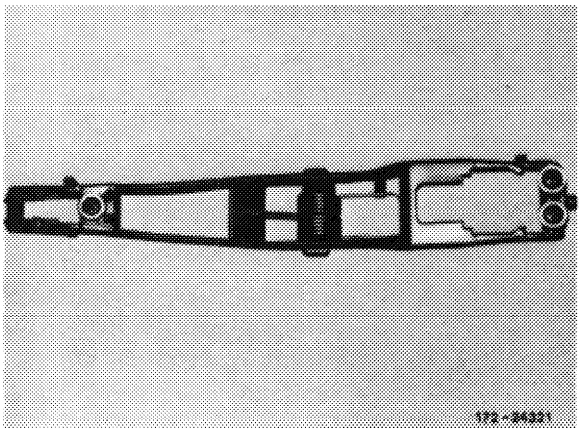


7 Loosen screws from bearing bracket.



8 Pull bearing bracket from inside out of detent on door panel and slide forward.

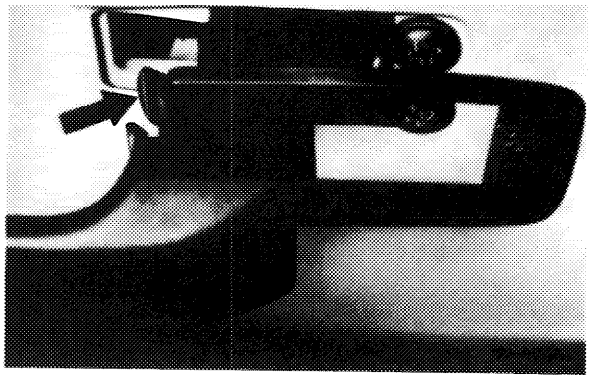
9 Remove bearing bracket via assembly opening in inside door panel.



Installation

10 For installation proceed vice versa

Note: When installing grab handle, the link of the rubber escutcheon must be inserted between door panel and bearing bracket.



Removal

1 Remove door lining (72-100).

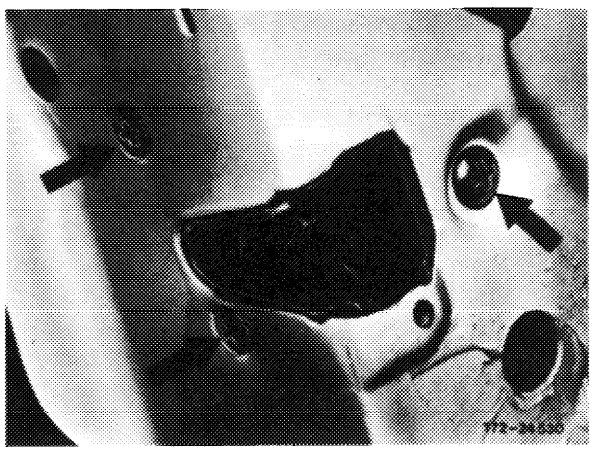
2 Remove door inside actuation (72-230).

3 Remove closing cylinder on outside door handle (72-240).

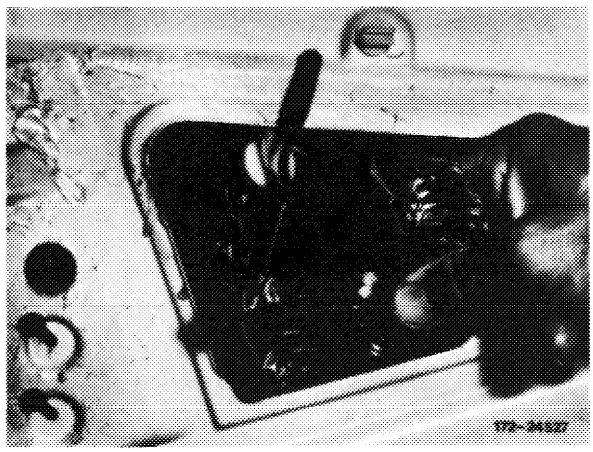
4 Loosen plastic sheeting in upper range.

5 Unscrew screws on door lock.

6 Lower door lock and swivel in forward direction around rear window opener rail.

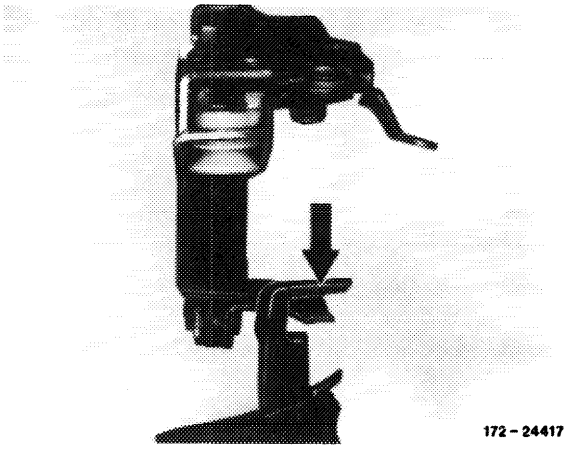


7 Remove door lock through upper assembly opening.

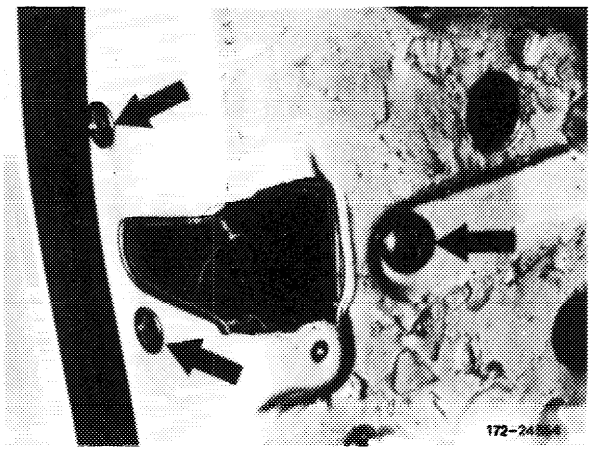


Installation

8 Insert door lock together with locking linkage through assembly opening into door in such a manner thtat the grab handle comes to rest behind actuating lever of door lock.

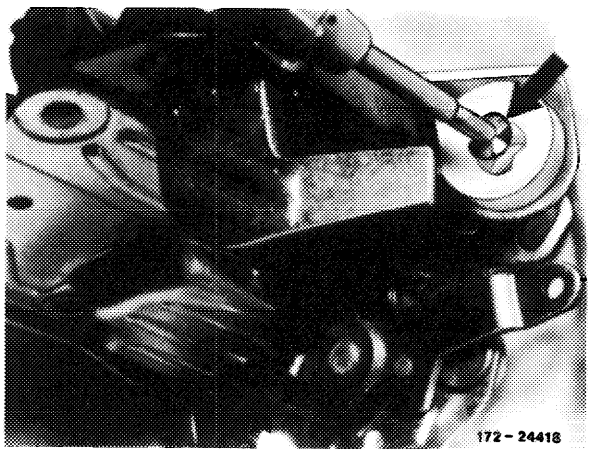


9 Tighten the two fastening screws on face first and then those on inside door panel.



10 Introduce closing cylinder with turning rod into turning nut on door lock.

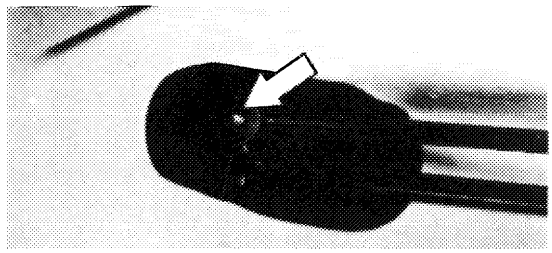
11 For further installation proceed vice versa.

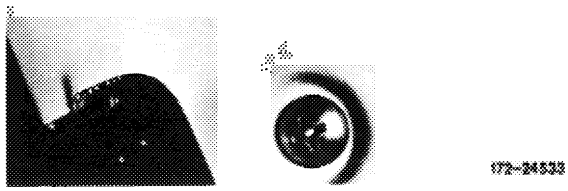


Removal

1 Remove door lining (72-101).

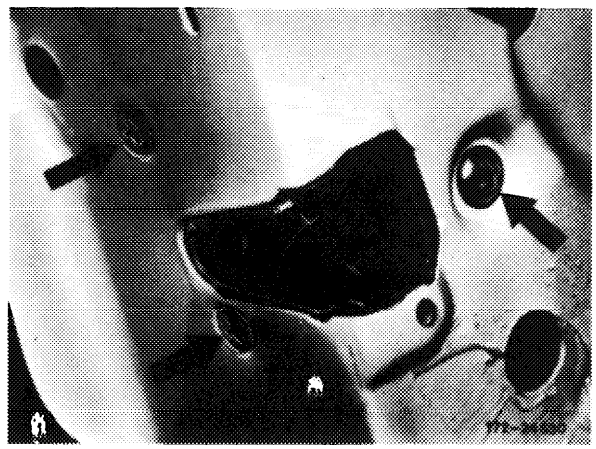
2 Release safety linkage and inside door actuation on door lock.





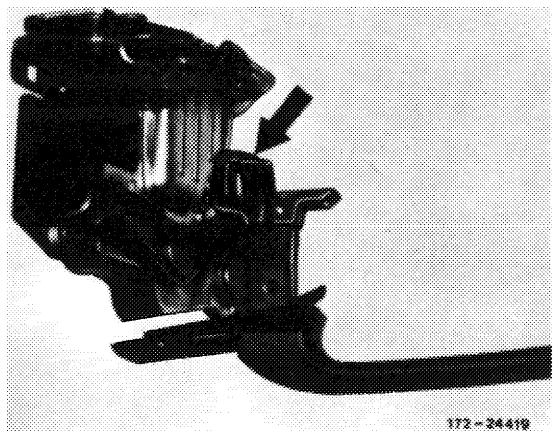
3 Unscrew screws on door lock.

4 Pull grab handle and remove door lock in downward direction out of door.



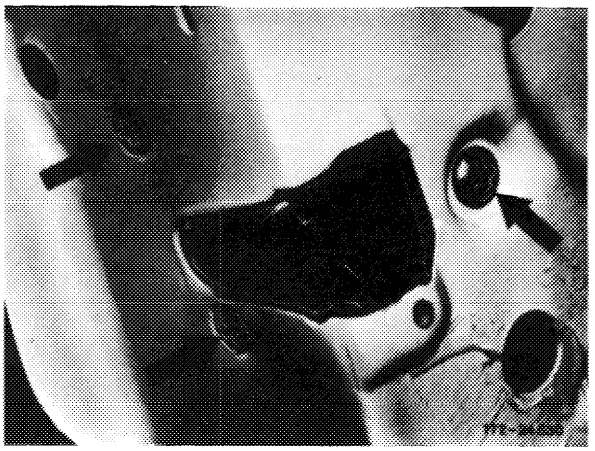
Installation

5 Pull grab handle and insert door lock. Make sure that the grab handle comes to rest behind actuating lever of door lock.



6 Tighten the two fastening screws on face first and then those on inside door panel.

7 For further installation proceed vice versa.



	Job No.
Removal and installation of sliding roof cover (sliding roof electrical)	77-l 00
Adjustment of sliding roof cover (sliding roof electrical)	110
Removal and installation of teleflex control	140
Removal and installation of teleflex tubing	150
Removal and installation of holder with motor and gear	180
Checking and adjusting slip clutch of sliding roof motor	195
Removal and installation of sliding roof wind deflector	250
Removal and installation of sliding roof frame	3 0 0

77–050 Removal and installation of headlining on sliding-lifting roof

Removal

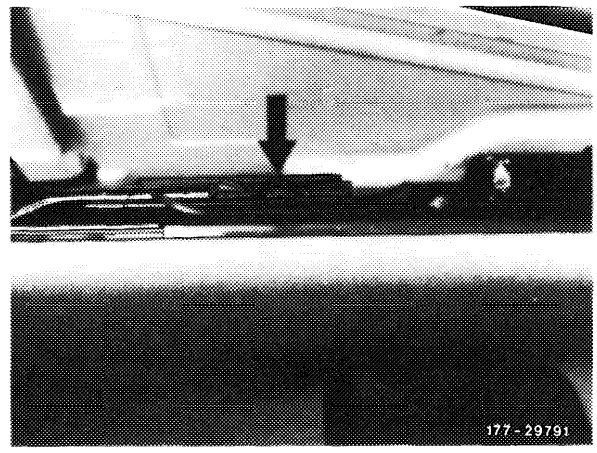
1 On sliding roof opened to 3/4, remove sliding roof headlining front from clips (4 clips).

2 Completely open sliding roof.

3 Pull out sliding roof headlining toward front in upward direction.

4 Check upper halves of clips on sliding roof headlining.

5 Check lower halves of clips on sliding roof.



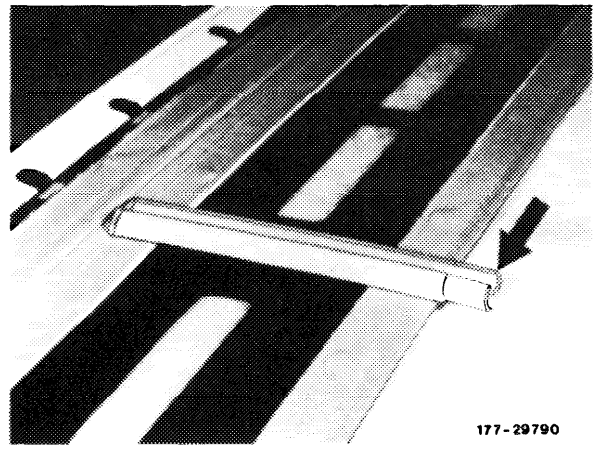
Installation

6 Close sliding roof and set both slide pieces horizontally.

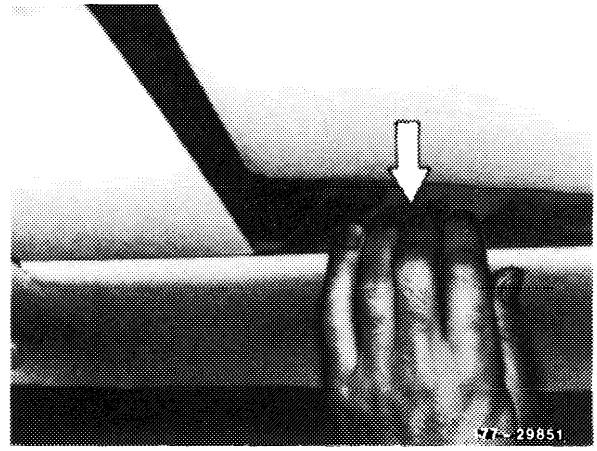
7 Completely open sliding roof.

8 Slip-in sliding roof headlining from front top until clips are knocking against sliding roof, while introducing teleflex tube into protective tube on sliding roof headlining.

9 Close sliding roof by half and insert sliding roof headlining audibly at front into clips (4 clips).



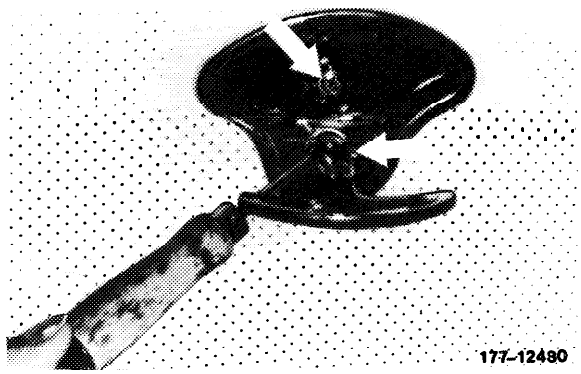
10 Close sliding roof, lift approximately by half at the rear and in this position check whether lateral screening can be perfectly pulled out and in.



A. Sliding roof, mechanical

Removal

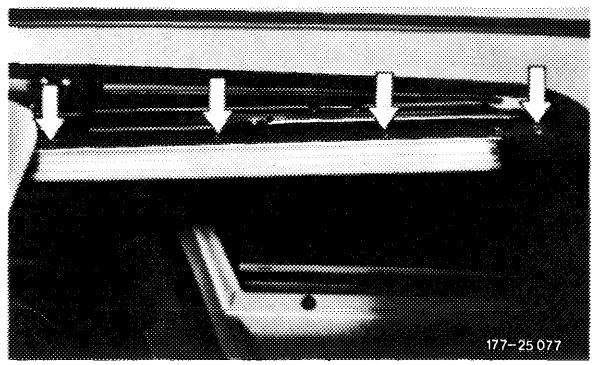
1 Unlock sliding roof and remove closing lever as well as trough.



2 With the sliding roof opened to three quarters, unclip sliding roof headlining at front and pull out in upward direction.

3 Completely open sliding roof and remove sliding rail left and right.

4 Lift off sliding roof in upward direction.



Installation

5 Prior to installation, thoroughly cover all sliding jaws and sliding rails with MB sliding paste 000 989 31 51 using a piece of felt or brush attached to an extension.

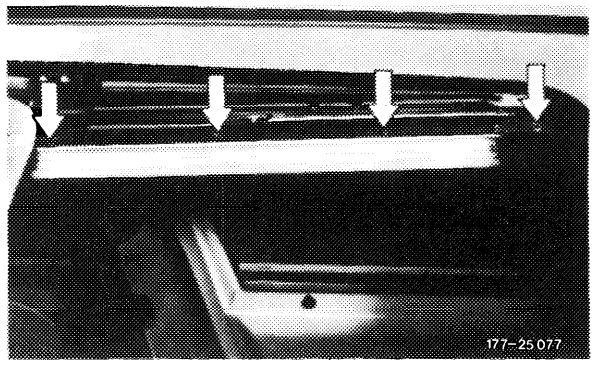
6 Introduce sliding roof from above and install sliding rails.

7 For further installation proceed vice versa.

B. Sliding roof, electrical

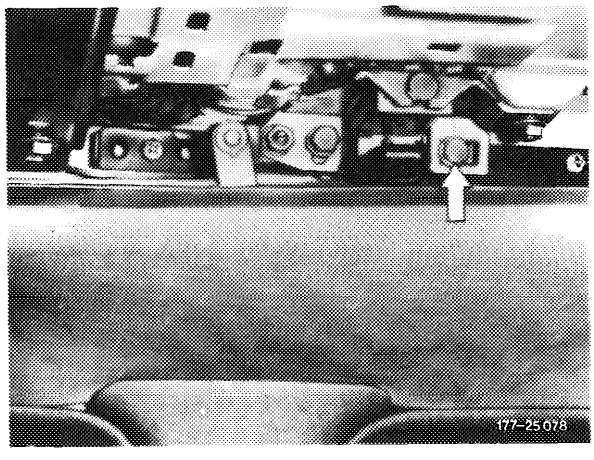
Removal

1 With sliding roof opened by 3/4, unclip sliding roof headlining at the front and remove in upward direction.



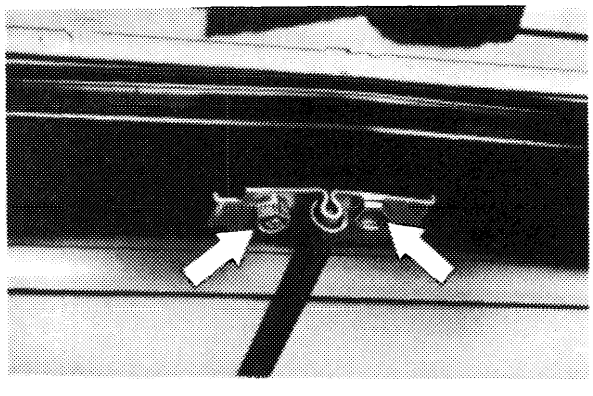
2 Open sliding roof completely and remove slide rail at the left and right.

3 Close sliding roof and unscrew locking screw left and right.



4 Unscrew guide plate at rear of sliding roof frame and remove.

5 Remove sliding roof cover in forward and upward direction.



Installation

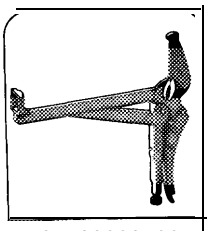
6 Thoroughly clean and coat slide jaws and slide rails prior to installation with MB slide paste, part No. 001 989 14 51.

7 For further installation proceed vice versa.

Note: Prior to installation of sliding roof headlining, adjust slide angle brackets and sliding roof cover (77-l 10).

C. Sliding-lifting roof

Special tool



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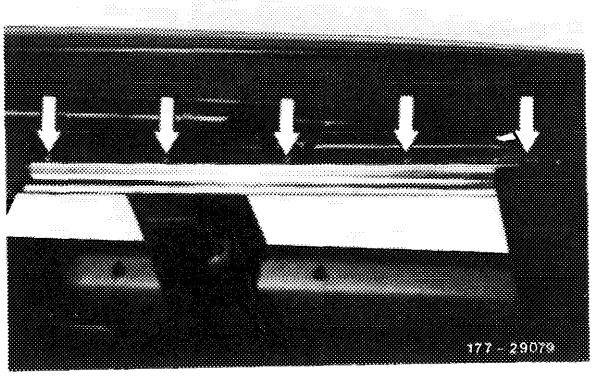
Removal

1 Remove sliding-lifting roof headlining (77–050).

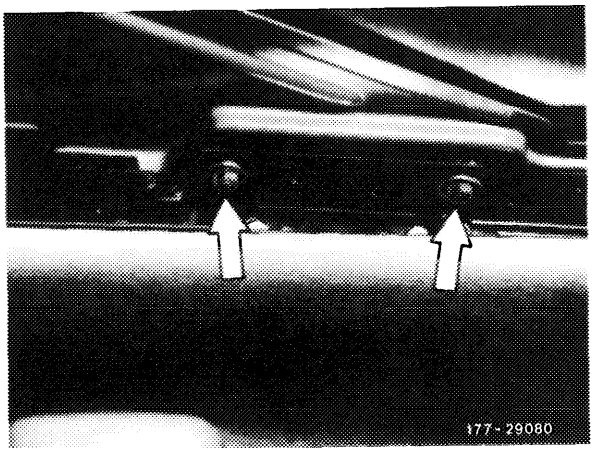
2 Remove slide rail left and right.

3 Close sliding-lifting roof.

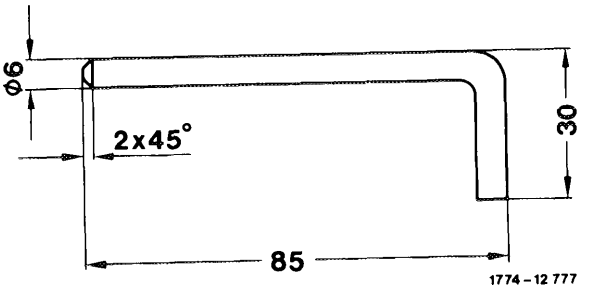


4 Unscrew nuts at left and right.

5 Remove sliding-lifting roof cover in upward direction.

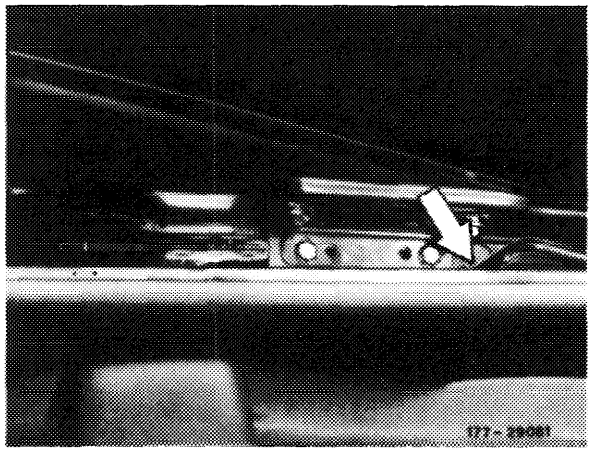


6 Make two centering bolts **(unless already** available).



7 Insert centering bolt into centering bore at left and right.

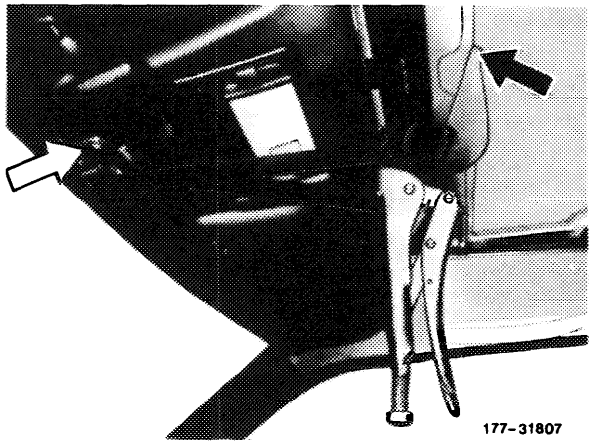
8 Remove rear view mirror, inside.



Installation

9 Insert sliding-lifting roof cover from top, position nuts, pretighten sliding-lifting roof cover with special tool, part No. 124 589 00 37 00 and tighten nuts.

10 For further installation proceed vice versa.

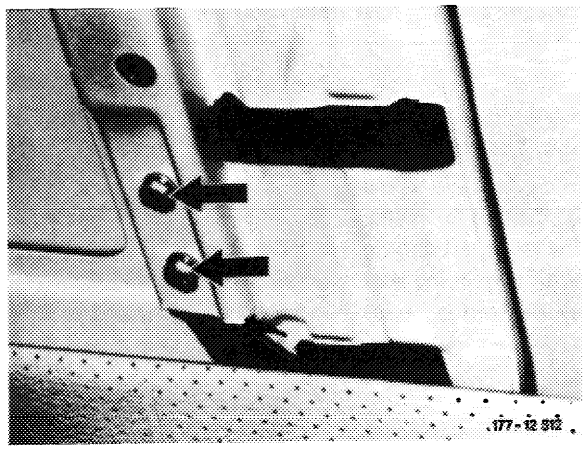


A. Sliding roof, mechanical

Note

Wind noise on sliding roofs can be prevented by adjusting the sliding roof cover in such a manner that the front endge is 0 to 1 mmdeeper and the rear edge 0 to 1 mm higher than the outer skin of the roof.

Adjusting sliding jaws front and rear

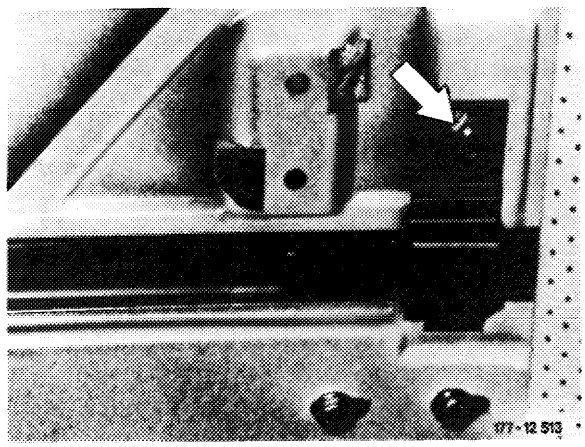


1 **Remove sliding roof headlining.**

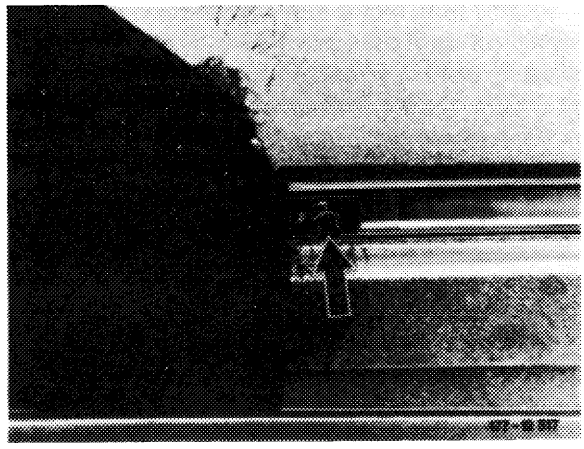
2 **Loosen fastening screws on slide angle brackets and push brackets inwards until the sliding jaws are seated laterally and the sliding roof is located accurately in center of cutout.**

Note: **Since the sliding roof frame has tolerances with regard to its total width, the lateral clearance should be checked at several points. Make sure that the sliding roof can be efficiently operated.**

Adjusting stop rods



3 **Loosen hex. nut on mounting bracket of stop rod left and right and adjust sliding roof cover in longitudinal direction in such a manner that the sliding roof has a perfect seal at the front edge.**



4 **With the sliding roof opened by half, loosen screw on stop rod inside left and right and adjust in such a manner that the sliding roof can be locked in any position and the closing lever operated applying normal effort. At the same time, make sure that the sliding roof is located in center of cutout.**

B. Sliding roof, electrical

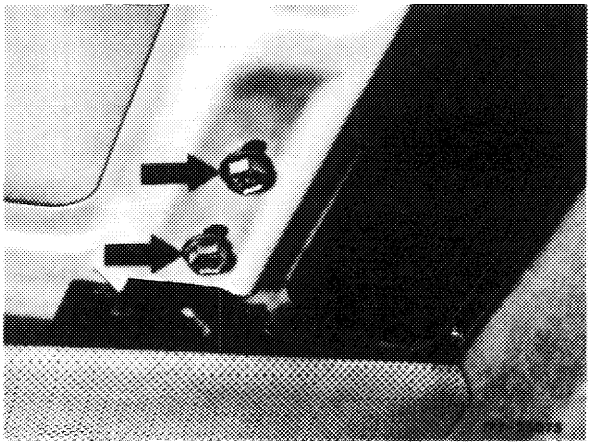
Note

Wind noise can be prevented on sliding roofs by adjusting the sliding roof cover in such a manner that the front edge is 0 to 1 mm deeper and the rear edge 0 to 1 mm higher than the outer skin of the roof.

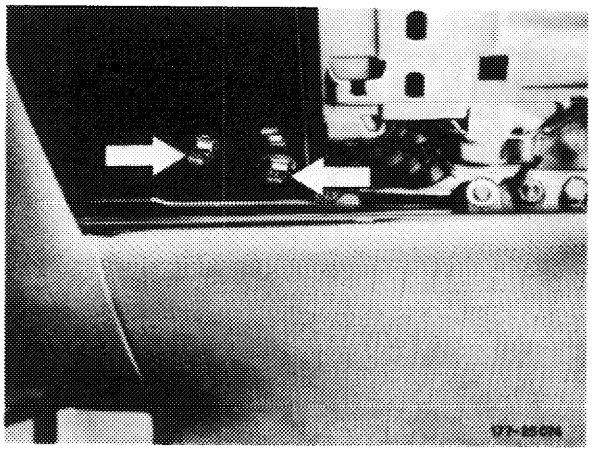
Adjusting sliding jaws front and rear

1 With sliding roof opened by 3/4, unclip sliding roof headlining at the front and remove in upward direction. Then close sliding roof.

2 Loosen fastening screws on slide angle brackets at the front left and right and push brackets inwards until the sliding jaws are seated laterally and the sliding roof is located accurately in center of cutout.

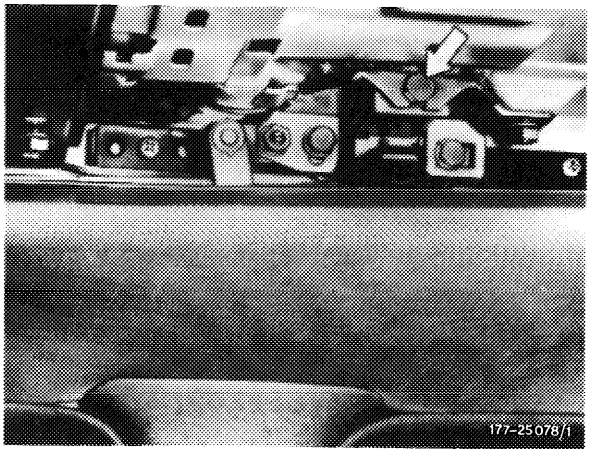


3 Loosen fastening screws at slide angle brackets of transportation bridge rear left and right and adjust brackets in the same manner as those in front.



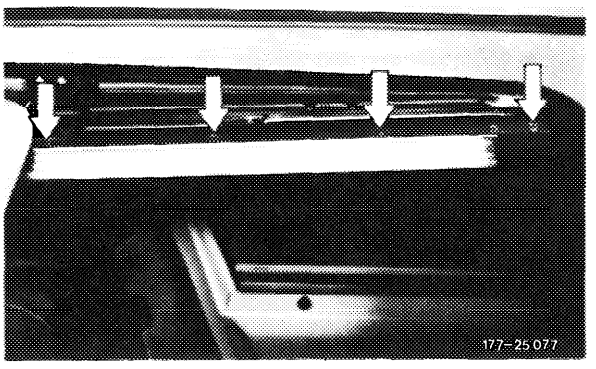
4 Slightly open sliding roof and position rear slide angle brackets of sliding roof cover by turning the adjusting screw inwards until the sliding jaws are seated laterally and the sliding roof is located accurately in center of cutout.

Note: Since the sliding roof frame has tolerances with regard to its total width, the lateral clearance should be checked at several points. Make sure that the sliding roof can be efficiently opened and closed.



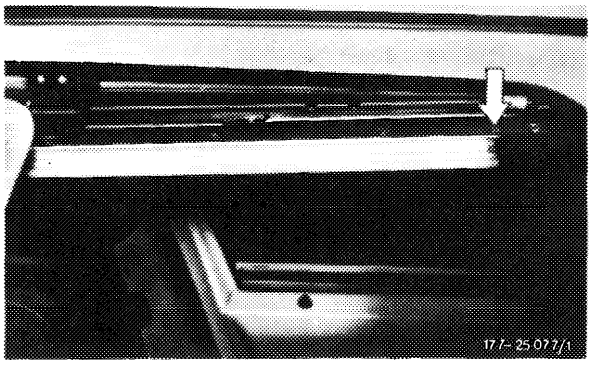
Front height adjustment

5 Open sliding roof and loosen fastening screws on slide rails.



6 Adjust height adjusting screw at the left and right in such a manner that the front edge of the closed sliding roof is 0 to 1 mm deeper than outer skin of roof.

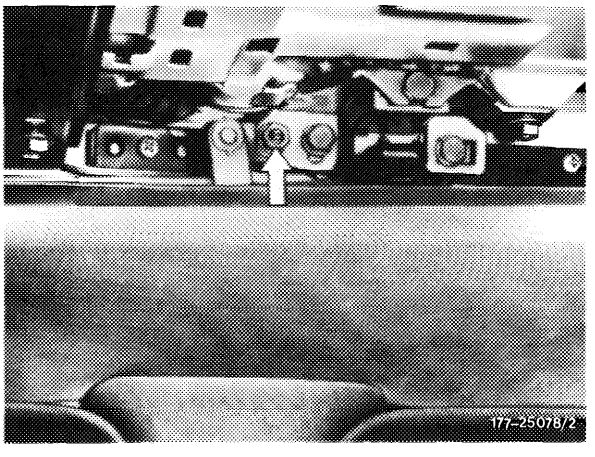
7 Tighten fastening screws of slide rails.



Rear height adjustment

8 Close sliding roof.

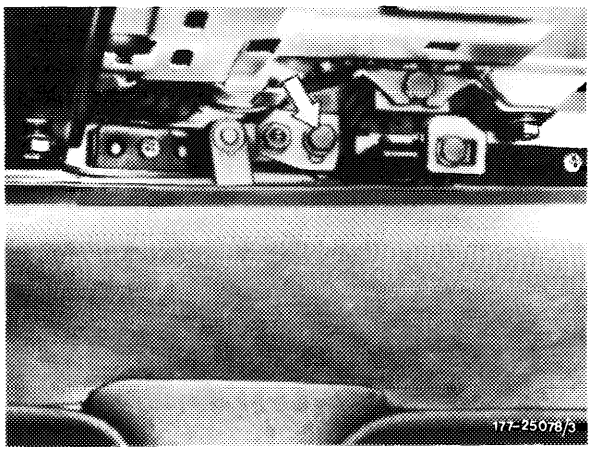
9 Loosen nut on lifting bracket.



10 Loosen screw on lifting bracket and adjust sliding roof cover in such a manner that the rear edge of the sliding roof cover is 0 to 1 mm higher than outer skin of roof.

11 Tighten nut and screw on lifting bracket.

12 Install headlining of sliding roof.

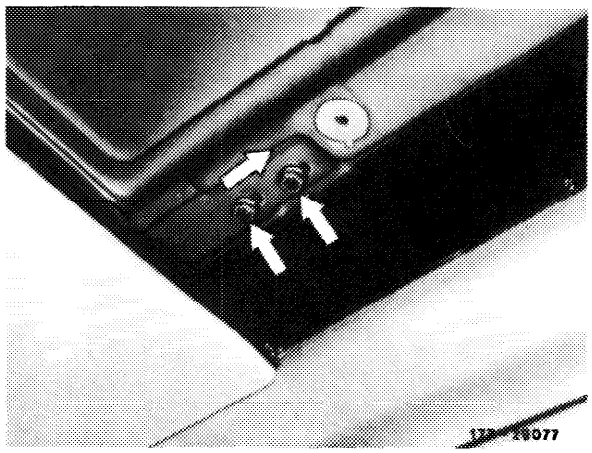


C. Sliding-lifting roof

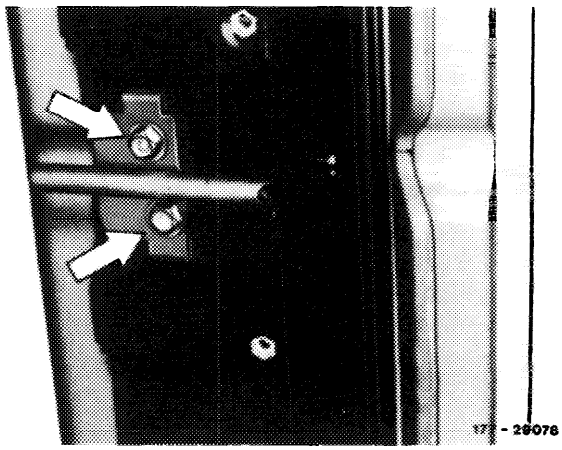
Adjusting slide shoes at front

1 Remove sliding-lifting roof headlining (77-050).

2 Loosen fastening screws on slide angle brackets front left and right and push slide angle brackets in inward direction until the slide shoes are abutting laterally and the sliding-lifting roof is seated accurately in center of cutout.

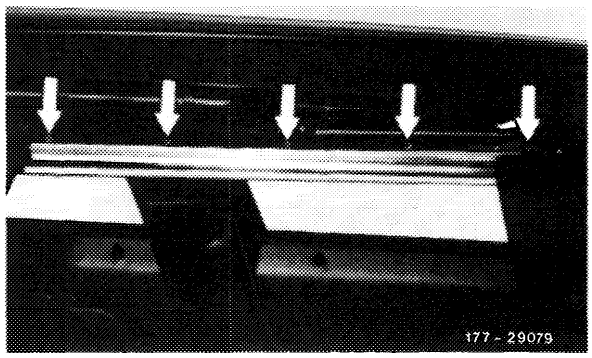


3 Since the sliding-lifting roof frame has tolerances in its total width, the lateral clearance must be checked at several points. For this purpose, unscrew teleflex control in transporting bridge and shift sliding-lifting roof cover manually.



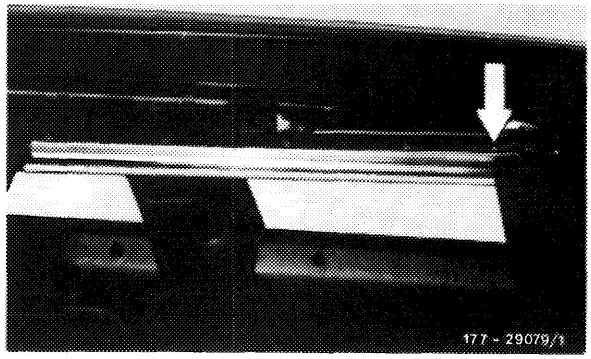
Height adjustment, front

4 Open sliding-lifting roof and loosen fastening screws on slide rails.



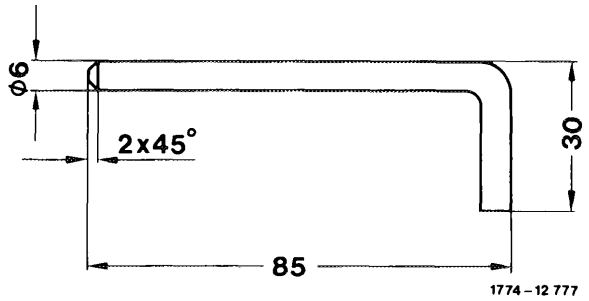
5 Adjust height adjusting screw **at left and right in such a manner that the front edge of the closed sliding-lifting** roof is approx. 0 to 1 mm deeper than the outer skin of roof.

6 Tighten fastening screws of slide rails.



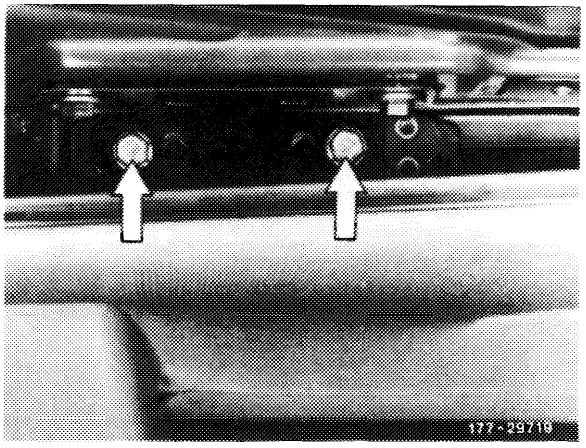
Height adjustment, rear

7 Make two centering bolts (unless already available).



8 Remove sliding-lifting roof headlining (77-050). Then close sliding roof.

9 Loosen screws on angle bracket left and right.

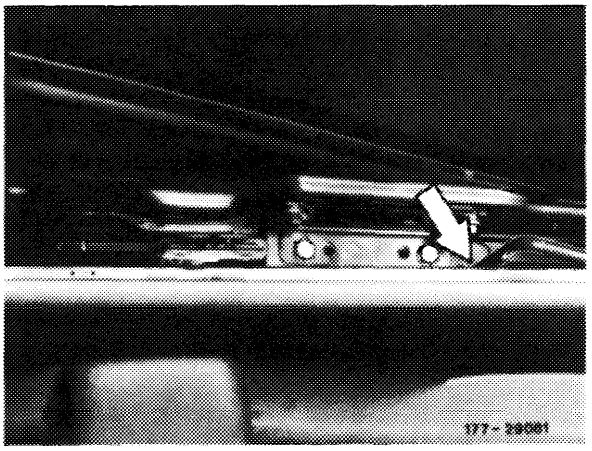


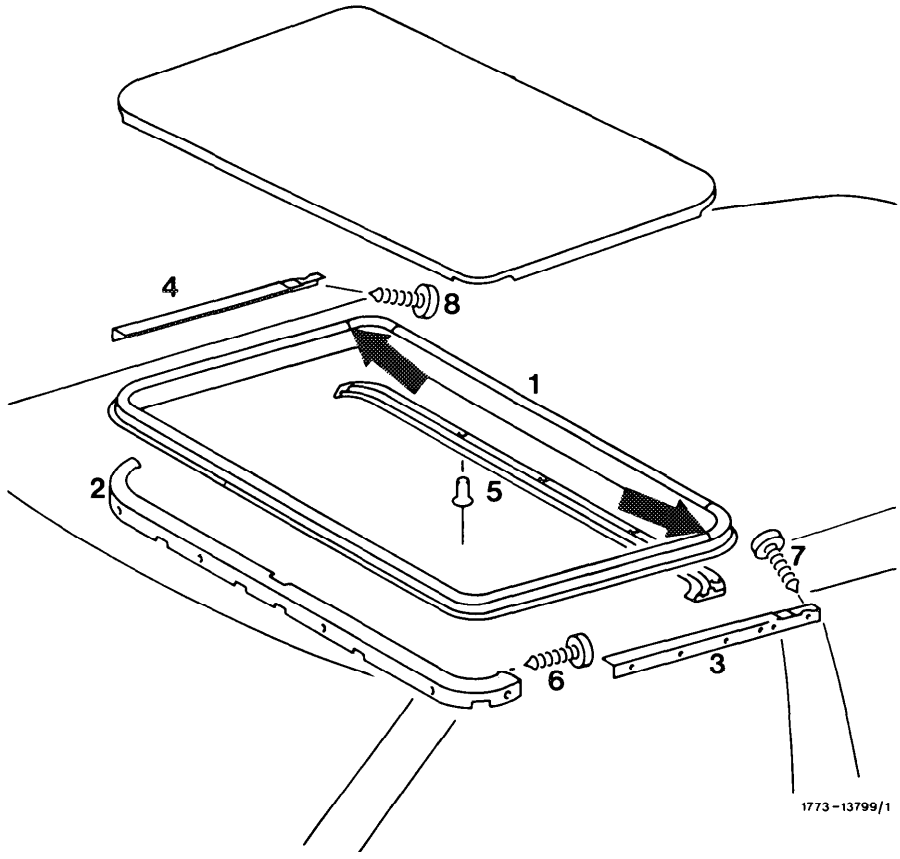
10 Insert centering bolts into centering bore left and right.

11 Adjust sliding-lifting roof cover in such a manner that starting from sliding position at the rear it is flush with roof or up to 1 mm deeper in radius range.

12 Tighten screws on angle bracket left and right.

13 Pull out centering bolts and install sliding-lifting roof headlining.





Sliding roof	Open, do not remove.
Installation position of sealing	Mark on roof cutout at connecting points (arrows).
Sealing (1)	Pull out of holding rail 2, 3, 4 and 5.
Wind deflector	Remove and install (77-250).
Screw (6)	Screw 6 each out and in.
Holding rail (2)	Remove and install (refer to installation instructions).
Screw (7) and (8)	Screw 8 each out and in.
Holding rail (3) and (4)	Slide toward the rear and remove in upward direction.
Holding rail (5)	Can be removed and installed only after removing sliding-lifting roof frame and drilling-out rivets (1 1 each).
Sealing (9)	Push into holding rail 2, 3, 4 and 5. The grooves on plug-in molding should face upwards.

Installation note

To make sure that the sealing (1) obtains an adequate hold in holding rail 2, 3 and 4, hold a 3 mm gap gauge in-between holding rail and roof paneling.

A. Sliding roof, electrical

Removal

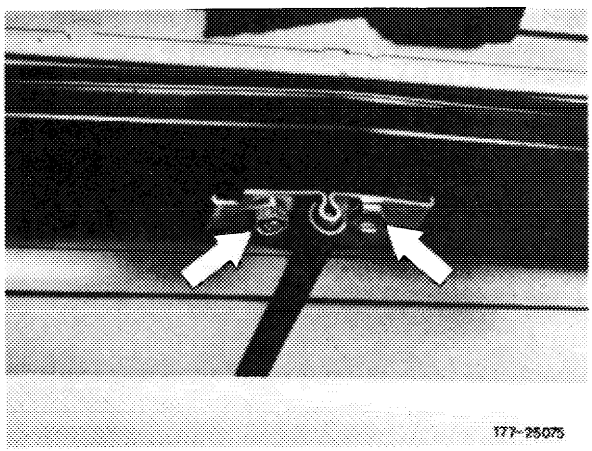
1 **Remove sliding roof headlining (77-100).**

2 **Close sliding roof.**

3 **Unscrew guide plate on transporting bridge and disengage.**

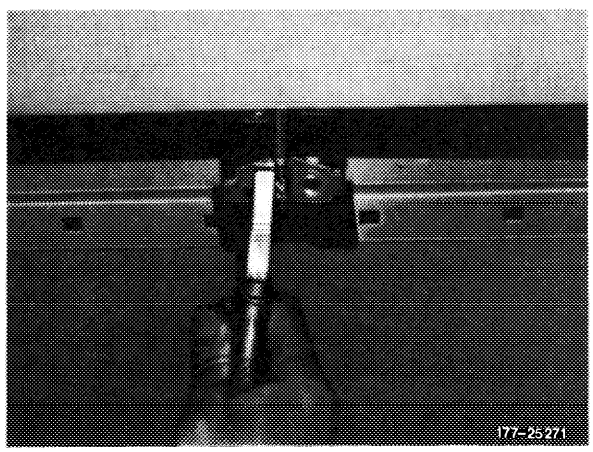
4 Actuate sliding roof switch in direction "closing", permit teleflex control to move completely forward and pull out.

Note: If the teleflex control cannot be moved with the electric drive, use emergency crank.



5 If the teleflex control cannot be operated in this manner either, remove teleflex control by means of a suitable flat-jawed pliers by turning in clock-wise direction and pulling at the same time.

6 If too much force is required, do not continue turning, since this might unwind the teleflex control and distort the teleflex tube. In such a case, disassemble gears of electric drive (77-I 80).

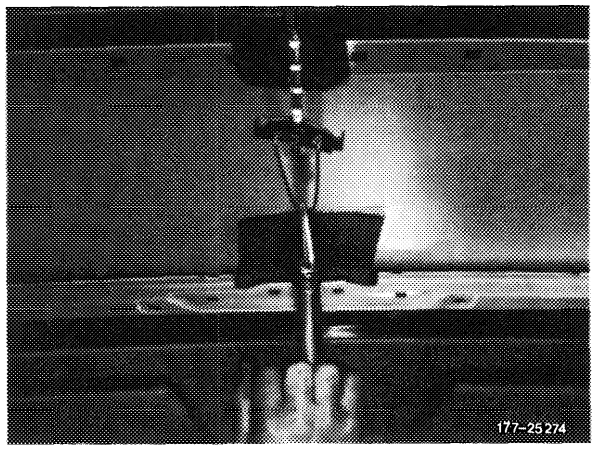


7 If, upon disassembly of gears, the teleflex control still cannot be removed, it has become distorted in the teleflex tube, which then also must be removed (77-150).

Installation

8 Thoroughly coat coil at end of new teleflex control with MB slide paste, part No. 001 989 14 51 and carefully introduce into teleflex tube.

9 The teleflex control should permit sliding inside of teleflex tube with a force of max. 50 N. **Check by means of a spring scale.**

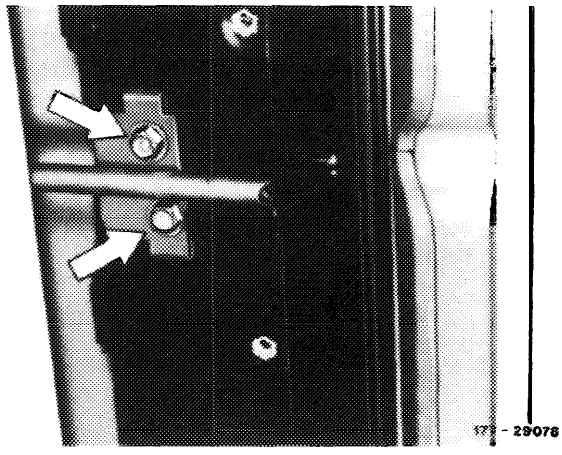


10 Insert teleflex control completely into teleflex tube and permit to run into gears of electric drive by actuating sliding roof switch in direction “open”.

11 For further installation proceed vice versa.

B. Sliding-lifting roof

Removal



1 Remove sliding-lifting roof headlining (77-050).

2 Unscrew guide plate on transporting bridge and disengage.

3 Push actuating switch to ,,Dach heben‘‘ (lift roof) and let teleflex control run out of gears.

4 Pull out teleflex control in forward direction,

Note: If the teleflex control cannot be moved with the electric drive, use emergency crank.

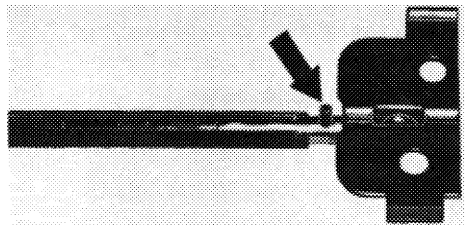
5 If the teleflex control cannot be pulled out, disassemble gear unit of electric drive (77–180).

6 If the teleflex control can still not be removed after disassembling gear unit, it is binding in teleflex tube and should be removed together with tube (77–150).

Installation

7 Coat coil at end of teleflex control with MB slide paste, part No. 001 989 14 51, and introduce into teleflex tube.

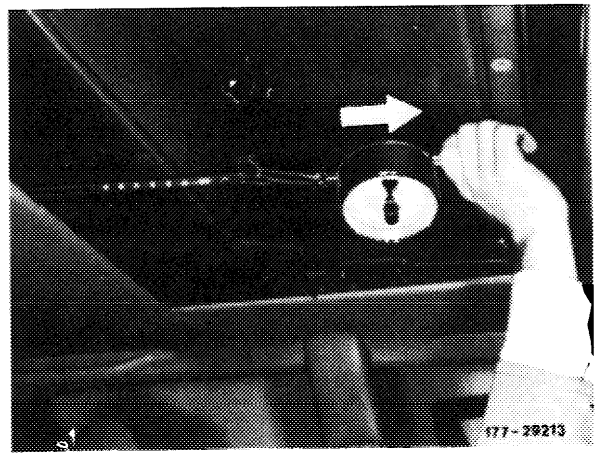
Note: When installing teleflex control, make sure that the guide member on teleflex control slides into opening of teleflex tube.



177 - 33608

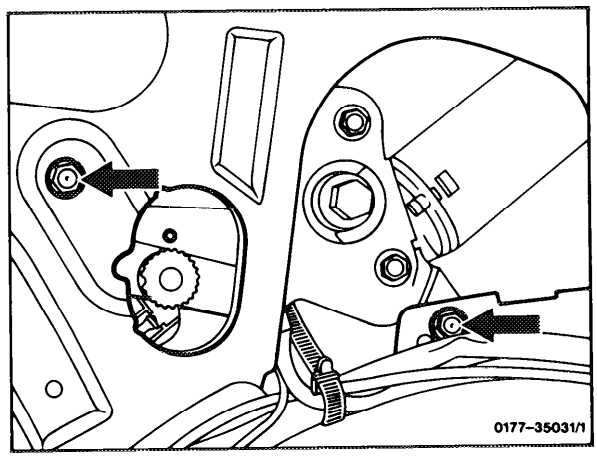
8 The force required for pulling out teleflex control should amount to max. 80 N. Make test with a spring scale.

9 Slide teleflex control completely into teleflex tube and push actuating switch to ,,Dach senken" (lower roof) and let control run into gearbox until the bores of guide plate and transporting bridge are overlapping.



177 - 29213

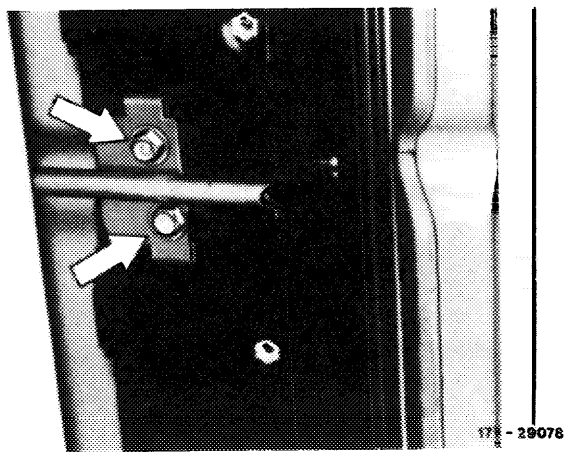
Note: If the teleflex control is not running into gearbox, loosen fastening screws on holder of drive unit.



0177-35031/1

10 Screw guide plate to transporting bridge.

11 Install sliding roof headlining.



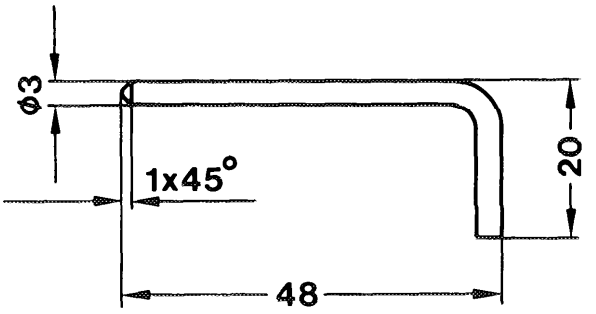
177 - 29078

Adjusting

1 Make centering bolt (unless already available).

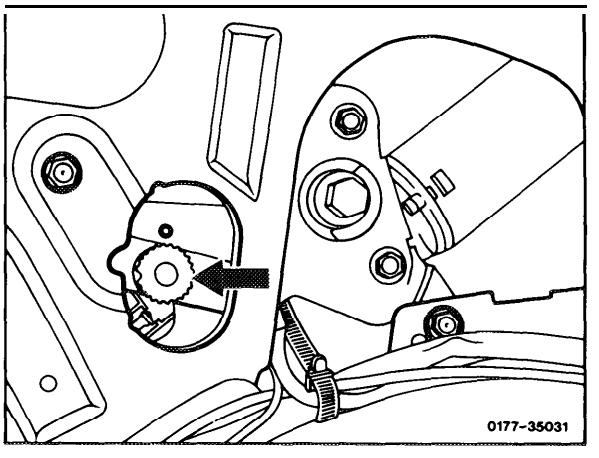
2 Remove trim on rear fender inside left.

3 Push actuating switch to ,,Dach heben'' (lift roof) until the sliding roof cover is completely lifted,



1774-12 766

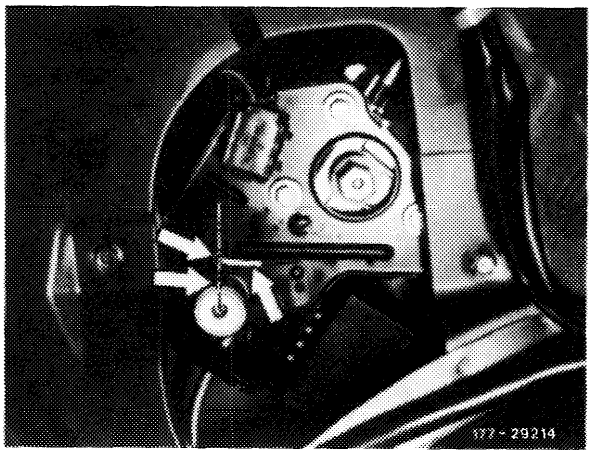
4 Move adjusting knob into adjusting position (pull out up to stop and push in for approx. 3 mm).



5 Turn adjusting knob until the centering bolt can be completely inserted into centering bore and the notch on knob points in direction of bore.

6 Push in adjusting knob and remove centering bolt.

Attention!
Do not actuate sliding roof motor with centering bolt inserted or adjusting knob pulled, since otherwise the control unit will be damaged and adjustments may be maladjusted.



Shown on model 124

7 If the sliding roof is not accurately closing with this basic adjustment, move adjusting knob again into adjusting position and turn knob for precision adjustment.

Turning knob clockwise = Sliding roof forward
Turning knob counterclockwise = Sliding roof rearward

Reference values:
One turn of knob changes location of sliding roof by approx. 45 mm.

8 Push adjusting knob and actuate sliding roof switch.

9 Mount trim on rear fender inside left.

Removal (without removing back window)

1 Remove sliding roof cover (77-100).

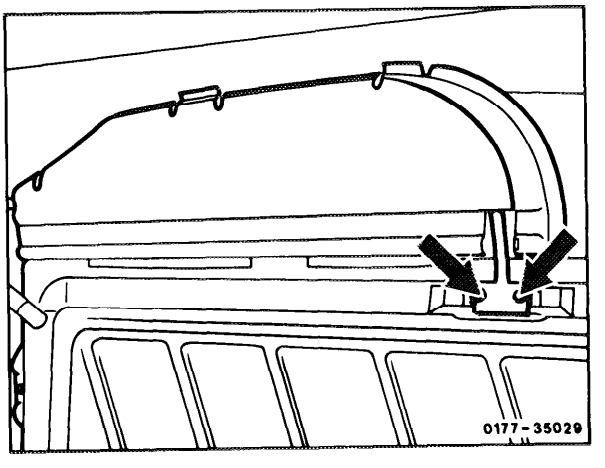
2 Remove teleflex control (77–140).

3 Remove holder with motor and gear unit (77–180).

4 Remove headlining up to back window (68–430).

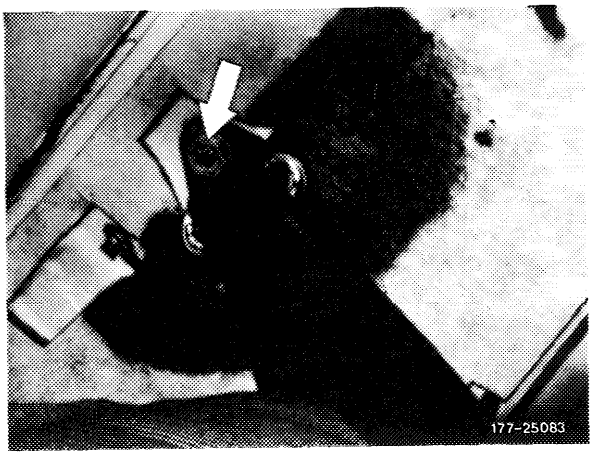
5 Force off cover over teleflex tube.

6 Unscrew fastening screws on holding plate for teleflex tube on sliding roof frame.



7 Unscrew screw on belt guide fitting rear left and put aside.

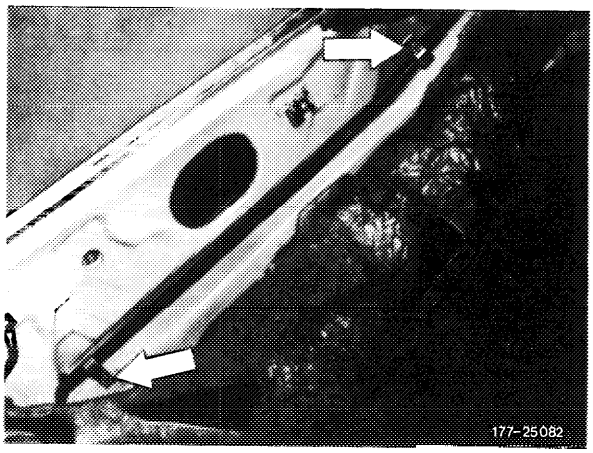
8 Pull off damping on rear pillar rear left.



9 Unscrew fastening clamps for teleflex tube on rear pillar.

10 Slip teleflex tube toward the rear and into trunk to the extent that it can no longer be pulled out of sliding roof frame.

11 Pull teleflex tube forward into vehicle interior and remove.



Installation

12 Introduce new teleflex tube from inside vehicle first into trunk and then into sliding roof frame.

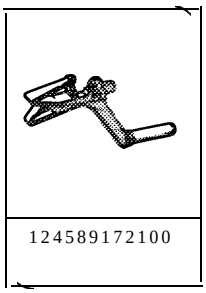
Attention!
Do not bend teleflex tube during installation, since the teleflex control will then bind.

13 Install holder with motor and gear unit.

14 Fasten teleflex tube to sliding roof frame and to rear pillar.

15 For further installation proceed vice versa.

Special tools



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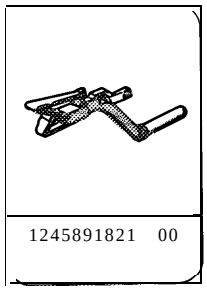

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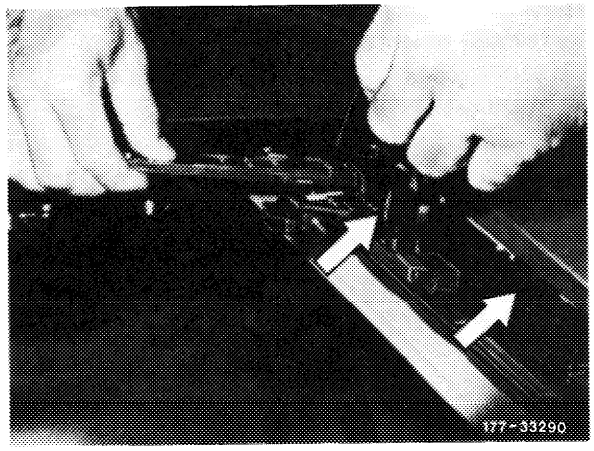
Removal

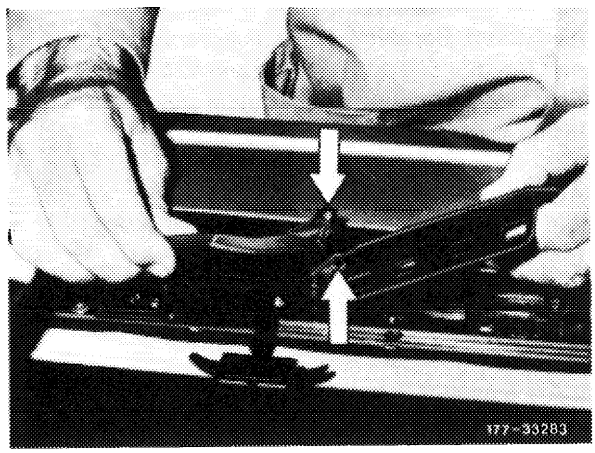
Attention!
Prior to removing lifting angle, unscrew lateral guide (slotted plate) from sliding-lifting roof frame (lower arrow).



1 Remove sliding-lifting roof cover (77-100).

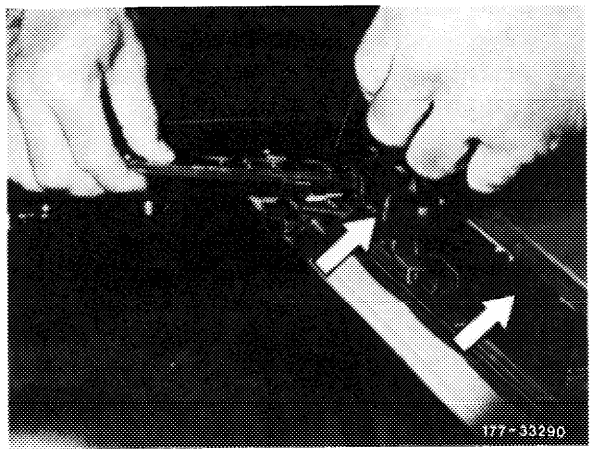
2 Unscrew teleflex control from transporting bridge.

3 Remove fastening angle for sliding-lifting roof cover from lateral guide (slotted plate) in upward direction and remove water gutter.



4 Unscrew transporting bridge and remove.

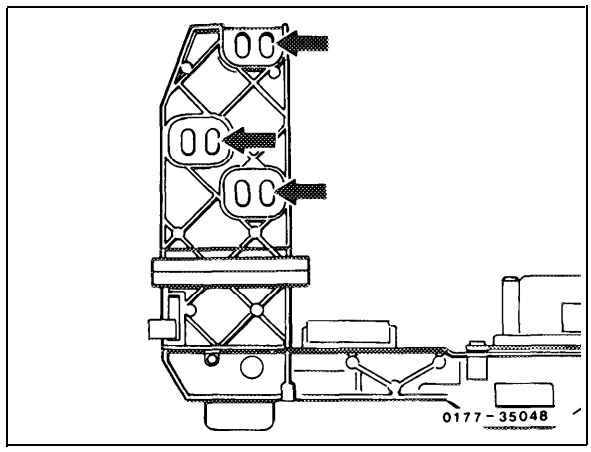
5 Slide lifting angle up to stop in forward direction, tilt in upward direction and remove diagonally in inward direction.



Installation

Attention!
During installation of lifting angle, pay attention to correct hole pattern (arrows).

6 Grease lifting angle prior to installation with MB slide paste, part No. 001 989 14 5 1, on slide shoes and moving parts.

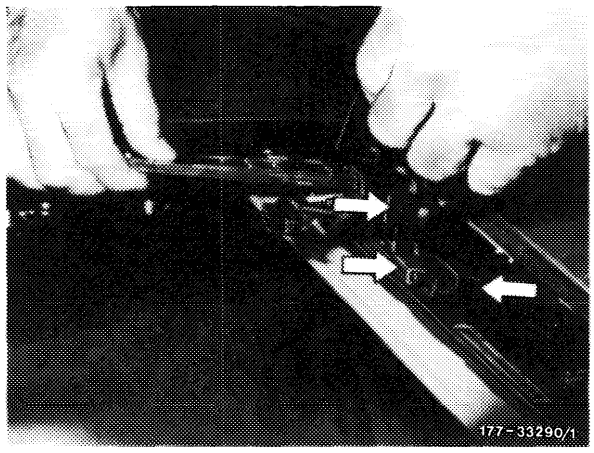


Note: During installation, pay attention to correct seat of slide shoes (arrows).

7 Install lifting angle.

8 Install transporting bridge, while pushing lifting angle slightly in outward direction by means of screwdriver and tighten.

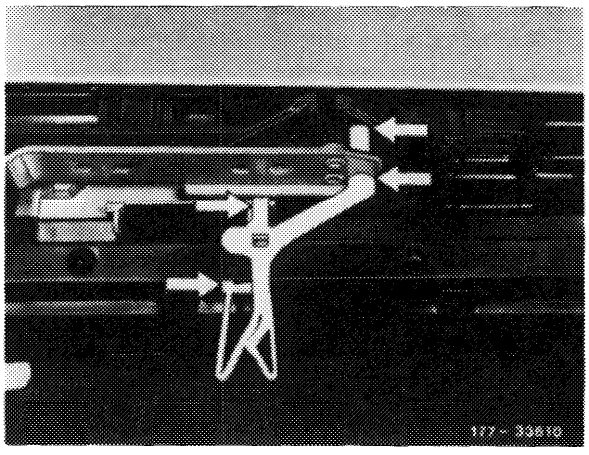
9 Install water gutter.



10 Perform basic adjustment on lifting angle mechanism. For this purpose, insert adjusting gauges, part No. 124 589 17 21 00 left and 124 589 18 21 00 right into guide plate (lateral guide) and groove in lifting angle.

Attention!
Pull off adjusting gauges only after sliding-lifting roof cover has been installed.

11 Install sliding-lifting roof cover (77-100).



Shown with sliding-lifting roof holding angle screwed off

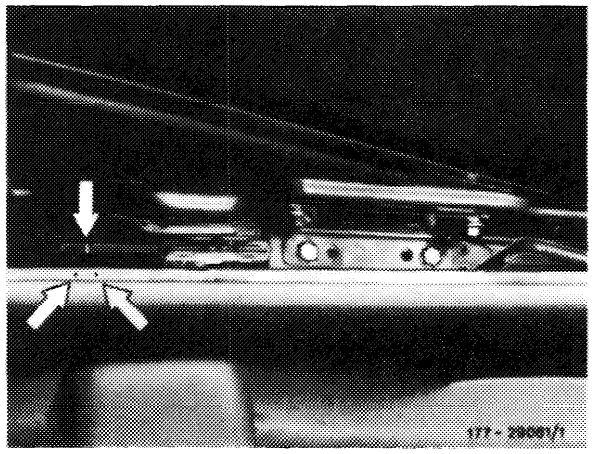
12 Screw teleflex control to transporting bridge.

13 Actuate sliding-lifting roof cover several times in all positions.

14 Check mark on holder of sliding-lifting roof headlining for marking on slide rail.

Note: If the mark is outside notches on slide rail, readjust teleflex control as required (77-140).

15 For further installation proceed vice versa.



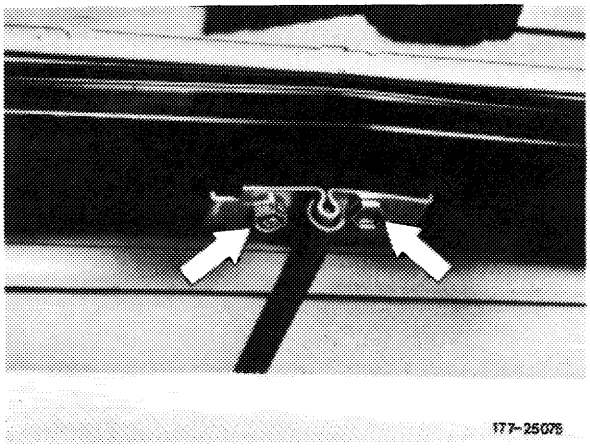
A. Teleflex control can be removed

Removal

1 Remove sliding roof headlining.

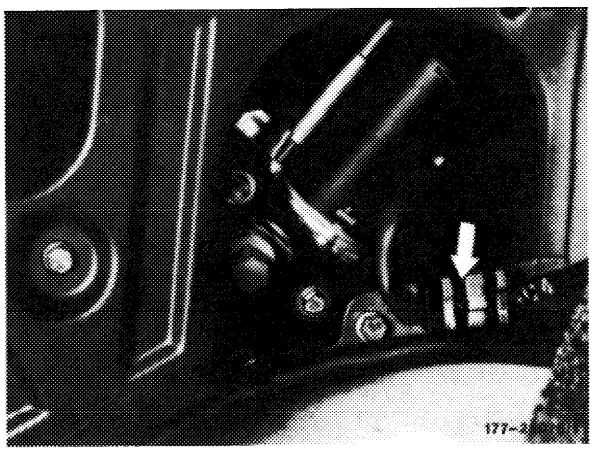
2 Unscrew guide plate from transporting bridge and disengage.

3 Permit teleflex control to run in forward direction out of gear unit of sliding roof motor.

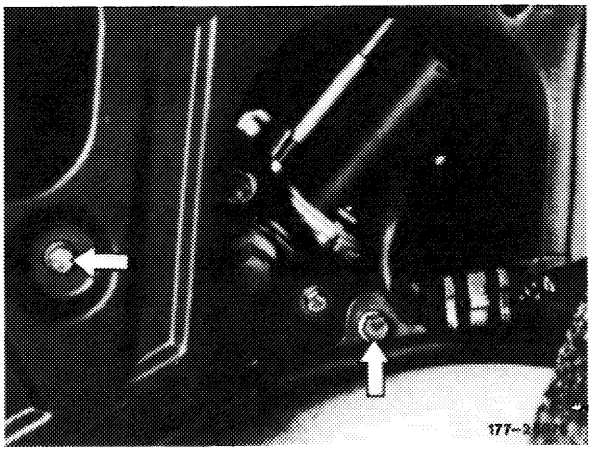


4 Remove cover in trunk on lefthand side.

5 Disconnect electric wires on sliding roof motor.

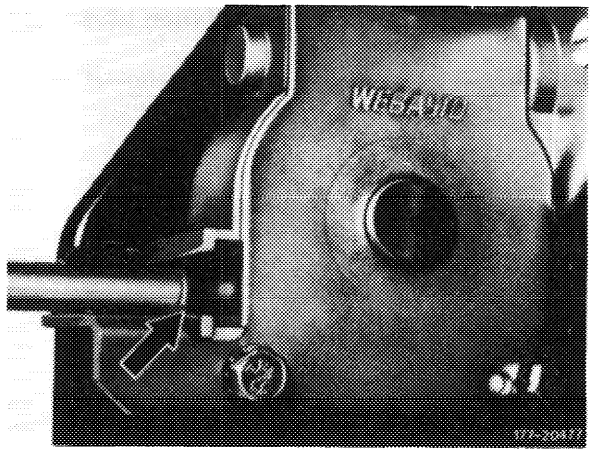


6 Unscrew fastening screws on mounting bracket.



7 Detach teleflex tube as well as extension tube at gear unit.

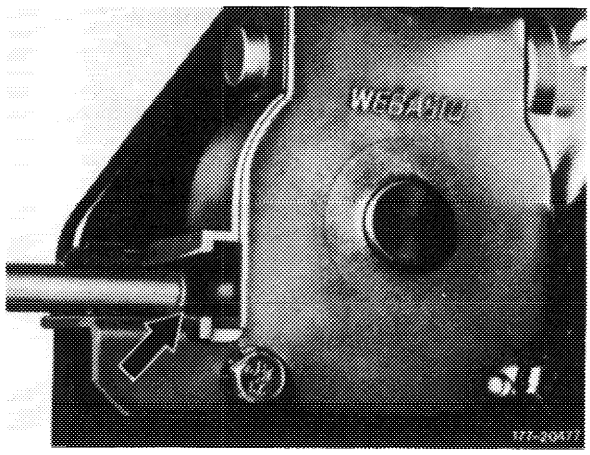
8 Remove mounting bracket with motor and gear unit.



Installation

Note: When clipping the teleflex and extension tubes, make sure that the bead at the tube is inserted into groove on gear unit.

9 For installation proceed vice versa.



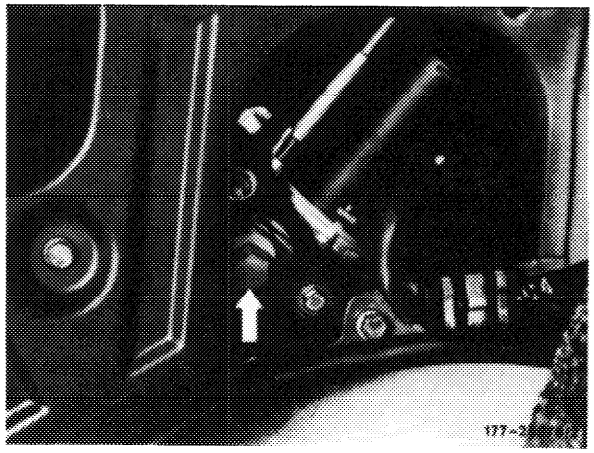
Attention!
If the teleflex control is stuck, disassemble the drive gear.

B. Teleflex control cannot be removed

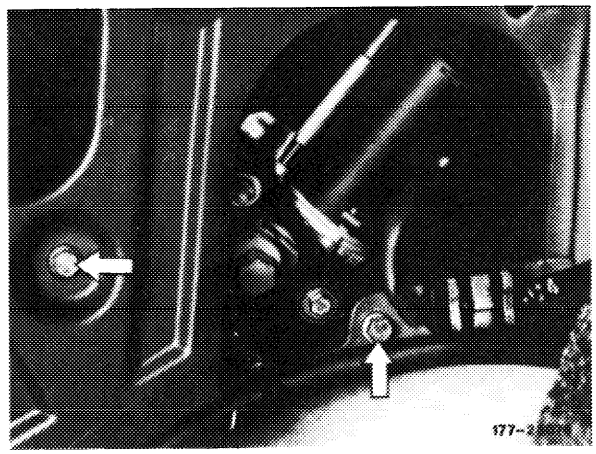
Removal

1 Remove cover in trunk on lefthand side.

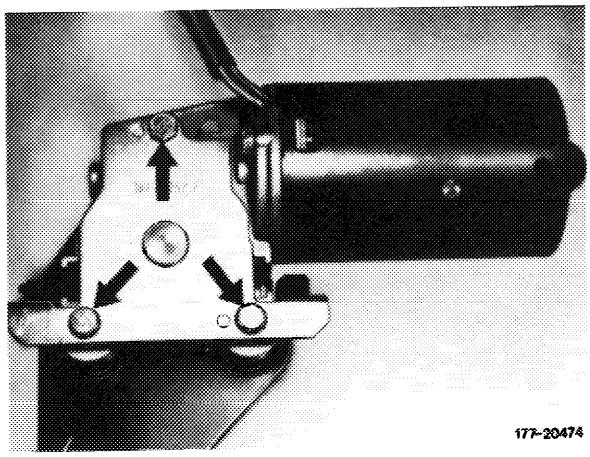
2 Press off plastic cap for emergency crank drive and unscrew hex. nut (17 mm) underneath, while holding gear axle with a fork wrench (6 mm) at the point provided therefor.



3 Unscrew fastening screws on mounting bracket.



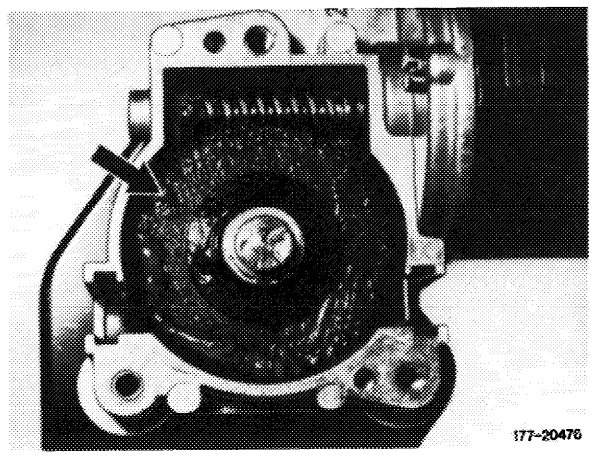
4 Slightly turn mounting bracket together with motor and unscrew cover on back of gear housing.



Shown with motor removed

5 Remove gear cover and take out large worm gear.

6 Remove mounting bracket with motor and gear unit.



Shown with motor removed

Installation

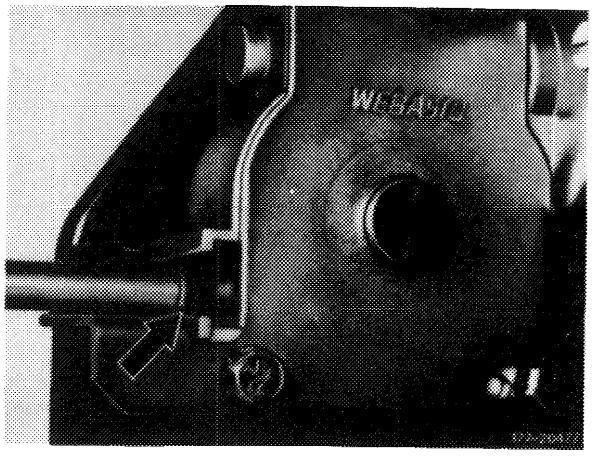
7 Assemble gear unit.

8 Install mounting bracket with motor and gear unit.

9 For further installation proceed vice versa.

10 Set slip clutch on gear unit (77-195).

Note: When clipping *teleflex* and extension tube, make sure that bead on tube is slipped into groove on gear unit.

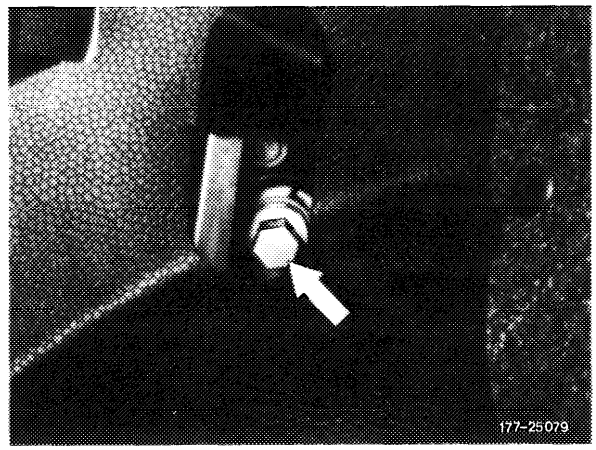


77–195 Testing and adjusting slip clutch of sliding roof motor (sliding roof electrical, sliding-lifting roof)

Checking

1 Open sliding roof by half.

2 Pull off cover above emergency crank drive and plug socket 16 mm (long) onto emergency crank drive.



3 Plug torque wrench onto socket and hold in place.

4 Let a helper operate sliding roof switch and read torque. Nominal value 5-6 Nm.
(Sliding-lifting roof nominal value 4-5 Nm).

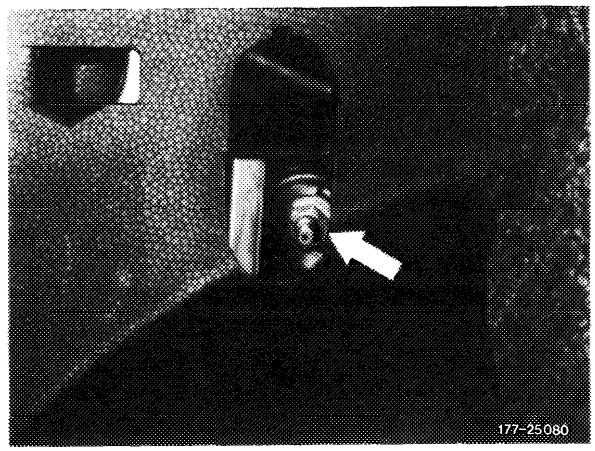
5 Pull off socket and close opening above emergency crank drive.

Drive

1 Open cover above emergency crank drive.

2 Pull off grey plastic cap for emergency crank drive and screw-in hex. nut underneath to increase torque, and screw out to reduce torque.

Note: Hold gear shaft with an open end wrench (6 mm) at the spot provided for this purpose to keep shaft from turning along.

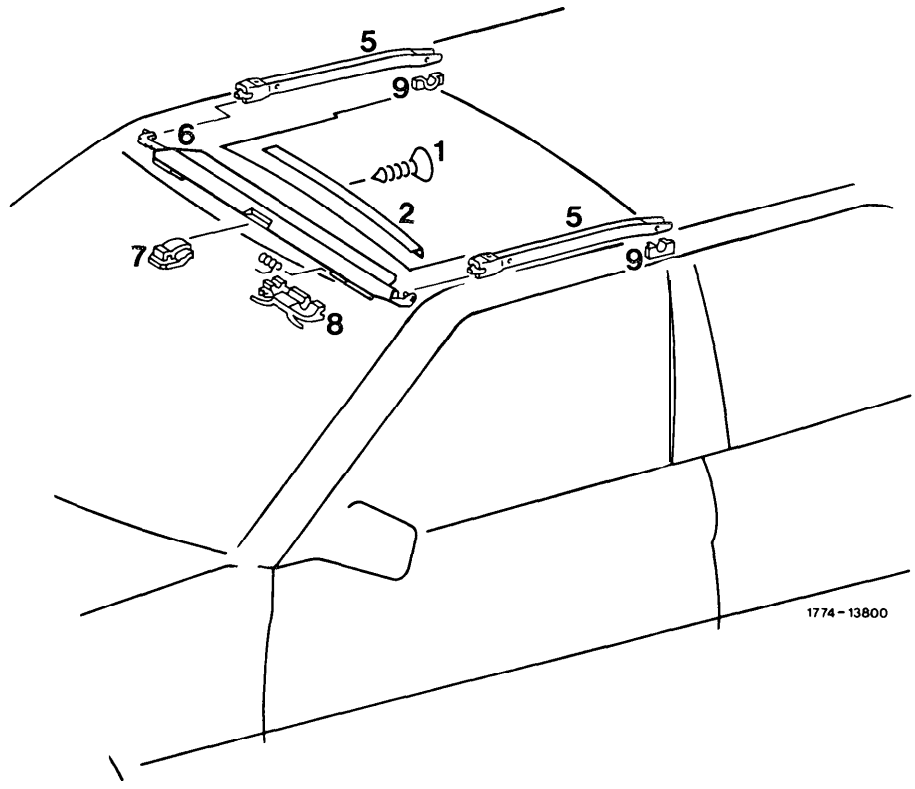


3 Turn hex. nut max. by 60°, then push-on grey plastic cap and check torque. Adjust torque, if required.

Attention!
Make sure that slip clutch is not obstructed.

4 Close opening above emergency crank drive.

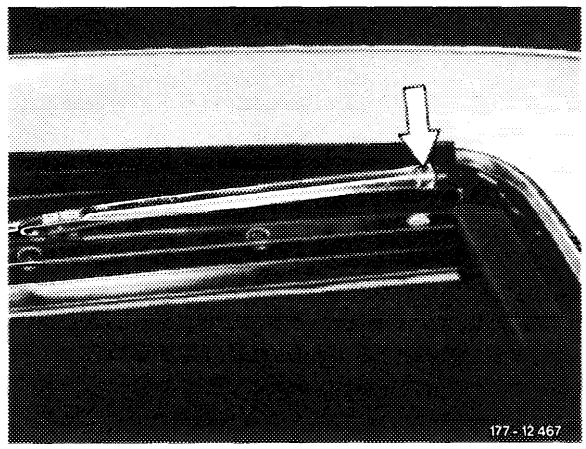
77-250 Removal and installation of wind deflector on sliding roof (sliding roof mechanical, electrical, sliding-lifting roof)



Screw (1)	Screw 6 each out and in
Chrome-plated rail (2)	Remove and install
Hold-down (5)	Remove and insert 2 each from bearing (9) and pull out of wind deflector (6) toward the rear.
Wind deflector (6)	Pull out of center bearing (7).
Wind deflector (6)	Carefully push out of shaft including bearing (8) at left and right by means of screwdriver.
Wind deflector (6)	Remove in upward direction.

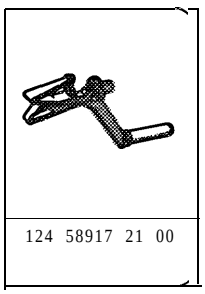
Adjustment

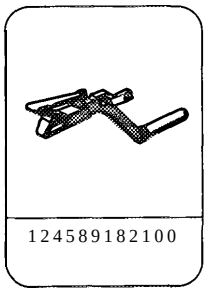
If the wind deflector wipes against sliding-lifting roof cover when entering recess, the height adjustment can be changed by readjusting on adjusting screw (arrow). If the wind deflector rattles in center bearing, the deflector can be slightly pre-tensioned. For this purpose, hold wind deflector in place at outer bearings, pull out of center bearing in center range and bend slightly in upward direction. Gap dimension when closing between cover and wind deflector 5 mm.



77–300 Removal and installation of sliding roof frame (sliding roof electrical, sliding-lifting roof)

Special tools (sliding-lifting roof)





Removal

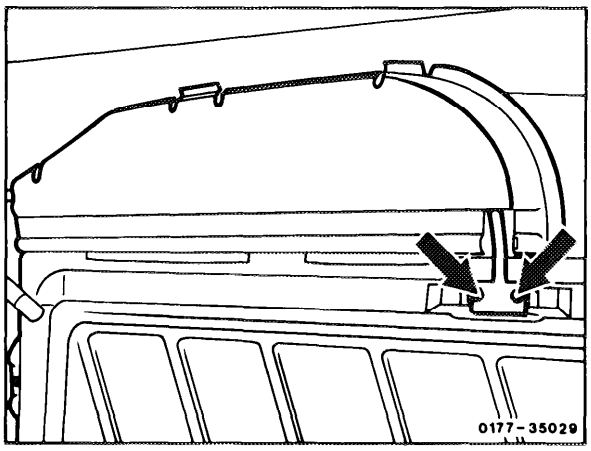
1 Remove sliding roof cover (77-100).

2 Remove teleflex control (77– 140).

3 Remove headlining up to back window (68-430).

4 Force off cover above teleflex tube.

5 Unscrew fastening screws on holding plate for teleflex tube on sliding roof frame rear.

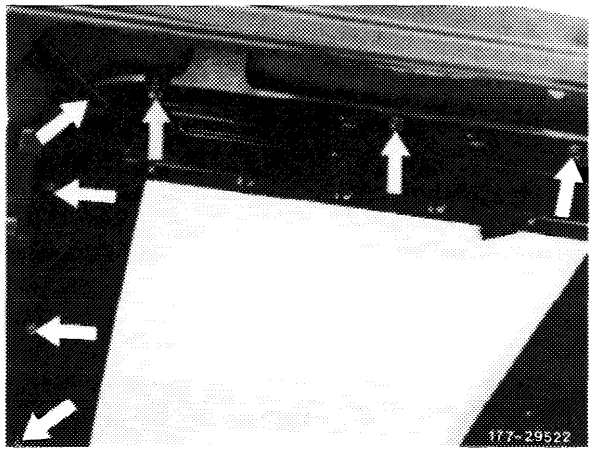


6 Pull off water drain hoses and unscrew screws.

7 Lower sliding roof frame at front and push in driving direction, while moving out teleflex tube at sliding roof frame rear.

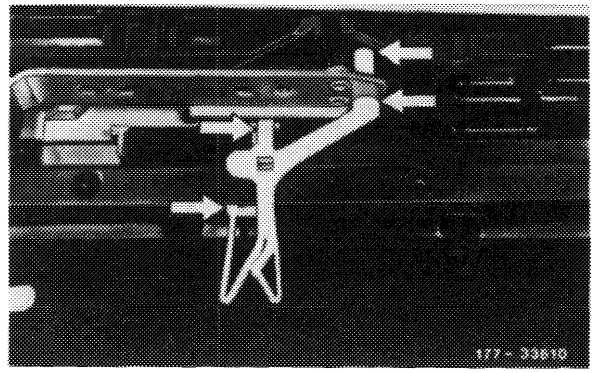
Attention! (Sliding-lifting roof)
Risk of injury when removing sliding-lifting roof frame caused by transporting bridge. For this purpose, be sure to wear protective gloves.

8 Remove sliding roof frame through rear side door.



Attention! (Sliding-lifting roof)
Prior to installation of sliding roof frame, insert adjusting gauges part No. 124 589 17 21 00 left and 124 589 18 21 00 right into guide plate (lateral guide) and groove in lifting angle.

Pull off adjusting gauges only after installing sliding-lifting roof cover.



Shown with sliding-lifting roof holding angle removed

9 Lift sliding roof frame through rear side door opening into vehicle interior.

Note: The two rear fastening screws have metric threads. To make sure that the sliding roof frame will be centered in relation to sliding roof cutout, tighten the two front fastening screws at left and right first.

10 Fasten teleflex tube to sliding roof frame rear and install cover.

11 For further installation proceed vice versa.

Job No.

Single door controlled system

Functional description 80-010
A. General
B. Components
C. Component
Checking function of central locking system 090
Checking electrical function of central locking system 104
Checking pneumatic function of supply pump 108
Checking electrical function of the switch in the driver's door 110
Checking pneumatic function of element 116
Checking central locking system for leaks 120
Removal and installation of electric switch in the driver's door 205
Removal and rnstallation of element in front passenger door 210
Removal and Installation rear door element 220
Removal and installation of tank flap element 230
Removal and installation of trunk lid element 240
Removal and installation of supply pump 270
Electrical wiring diagram 800
Function diagram 900

Multi-point controlled central locking system

Functional description 80-010
A. General
B. Components
C. Component
Checking function of central locking system 090
Checking electrical function of central locking system 104
Checking pneumatic function of supply pump 108
Checking electrical function of the control and working elements 112
Checking pneumatic function of element 116
Checking central locking system for leaks 120
Removal and Installation of control and working element ((S47, S48, S49) 215
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Removal and installation of tank flap element 230
A. 1st and 2nd version (up to approx. 03/87)
B. 3rd version (as of approx. 04187)
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A. As of 09/84 to approx. 04/85
B. As of approx. 05/85 to approx.03/86
C. As of approx. 0486
Function diagrams 900
A,. LHD vehicle
C. "Spider cable harness"

A. General

The central locking system is a single-pipe system, actuating the elements by means of pressure or vacuum (bi-pressure central locking system).
Central locking or unlocking is only possible from the driver's door by actuating the key or the safety button, with the door closed. The front passenger door, both rear doors, the trunk lid and the fuel tank flap are locked with vacuum and unlocked with pressure supplied from an electrically driven pump.

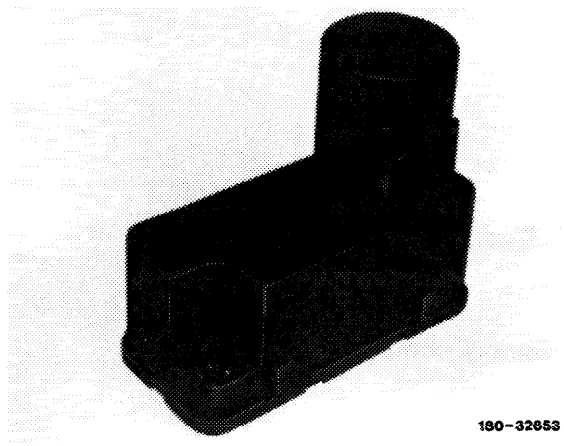
Advantages of the bi-pressure central locking system

- Reduced load on the vacuum system by means of a separate supply pump.
- Simplification of the pipe system.
- Leak-proof requirements of the system are low.
- Testing for repairs is simplified.
- The load on the elements is reduced as the system is pressureless when at rest.

B. Components

1. Supply pump

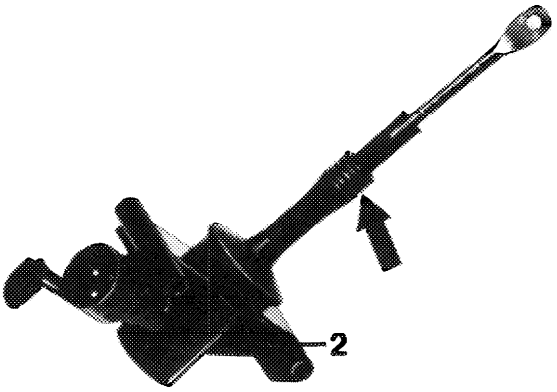
The supply pump generates a pressure or vacuum of approx. 0.5 bar within a time of approx. 2-3 seconds at 12 V battery voltage.



An electronic control ensures that the supply pump switches off after 25-60 seconds if heavy leaks exist in the system (safety switching time).
After the supply pump has come to a stop, the pressure in the pipe system is discharged after 15-20 seconds.

The change of the pressure direction is controlled by the clockwise or anti-clockwise rotation of the motor and the pump. In this way it is ensured that always the last command will be carried out.

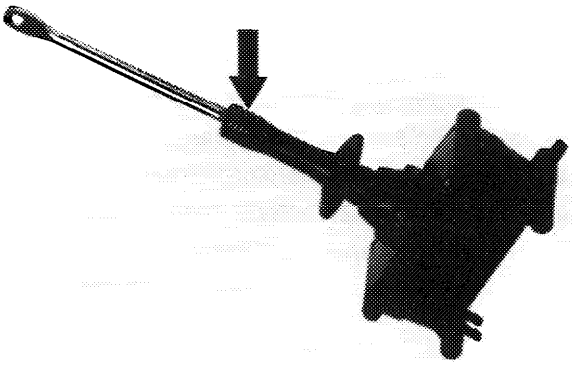
2. Switch in the driver's door
Continuous plus (circuit 30) is present at the alternating switch input side. When actuating the switch via the door lock, plus is connected to the output for the yellow control line during unlocking and to the output for the blue control line during locking.



180 - 25745

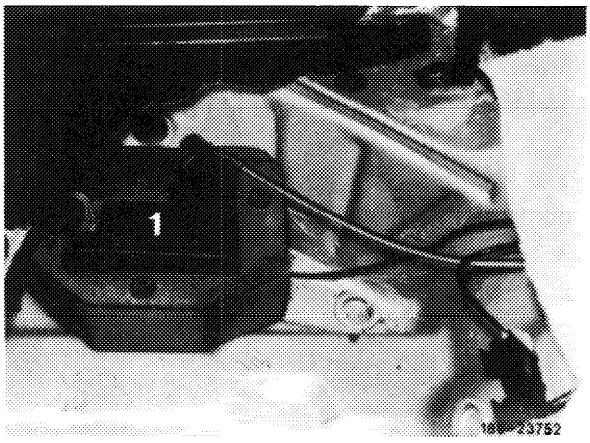
3. **Operating elements**
A pneumatic connector is provided on the operating elements.
Operation and design of the operating elements in the doors, on the trunk lid and the fuel tank flap are identical. For locking they are supplied with vacuum and for unlocking with pressure.

The elements for the trunk lid and the fuel tank flap differ from those of the doors only with regard to their final detent position. For external identification, an upper part of these elements is in color. The door elements however are black. The final detent position is carried out by means of a spring in the door lock.


180 - 23929

C. Component arrangement

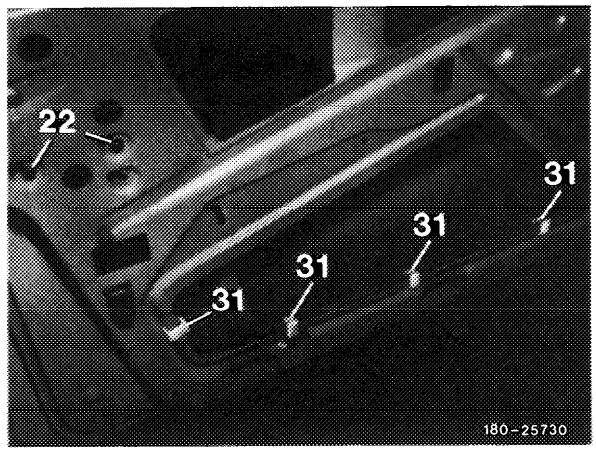
1. Supply pump



180 - 23752

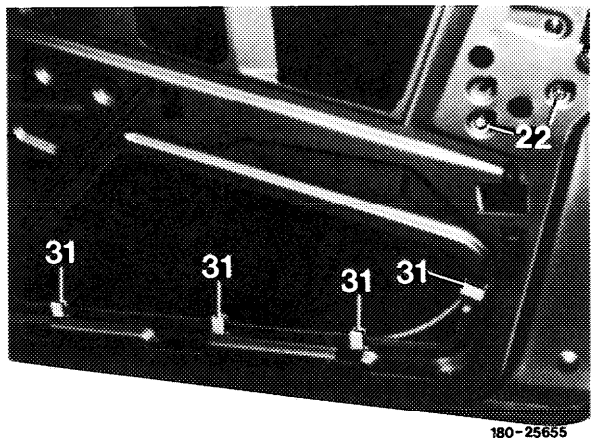
below the right rear seal

2. Switch in the driver's door



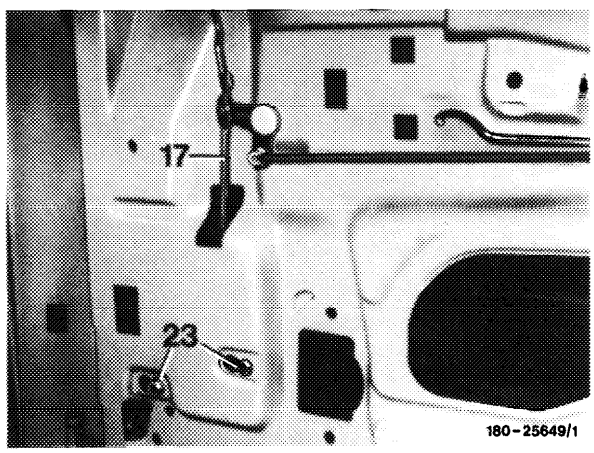
22 Mounting screws

3. Operating elements



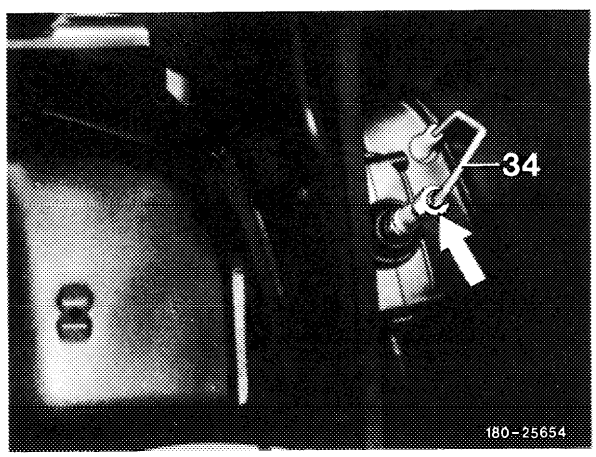
Front passenger door

22 Mounting screws

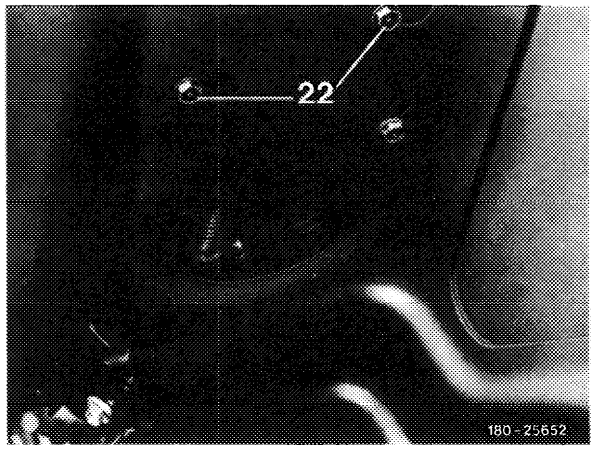


Right rear door
(left side mirror Image)

23 Mounting screws



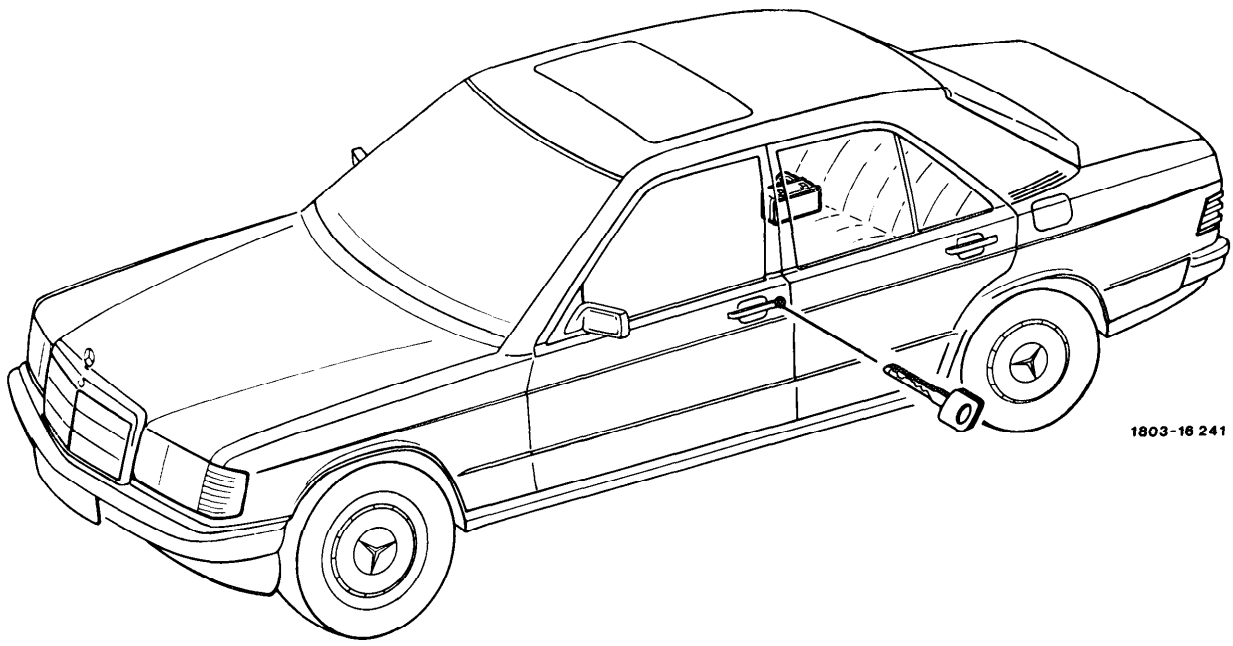
Fuel tank flap behind the right trunk lining



Trunk lid

22 Mounting screws

80-090 Checking function of central locking system



Unlocking and locking driver's door.
When doing so, check supply pump operation by listening.
All doors, trunk lid and fuel tank flap must be locked or unlocked in ≤ 3 seconds.

Is not locked or unlocked and supply pump does not operate:	Is not locked or unlocked although the supply pump operates:
80- 104 Check electrical function of the central locking system.	80-108 Check pneumatic function of the supply pump.
80-l 10 Check electrical function of the switch in the driver's door.	80-l 20 Check central locking system for leaks.
	80-l 16 Check pneumatic function of the element.

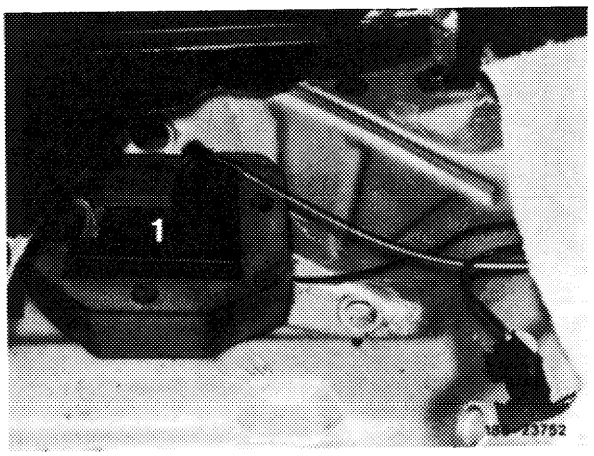
Commercially available tool

Digital multimeter	e.g. SUN DMM-5

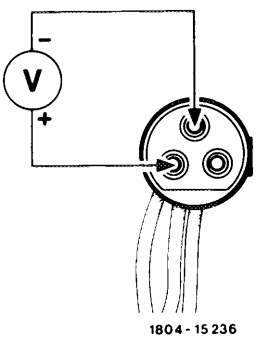
Test preparation

1 Expose supply pump and remove from the protective foam material cap (80-270).
2 Check fuse for central locking system, see enclosure in fuse box lid.
3 Remove key from steering lock.
4 Close driver's and front passenger doors.

5 Pull electrical cable harness coupling off supply pump.



Check voltage supply	
Connect voltmeter to the 3-pole coupling of the cable harness as shown in the drawing (flat portion facing down). Unlock driver's door. Nominal value: battery voltage > 10 V	
Yes	No

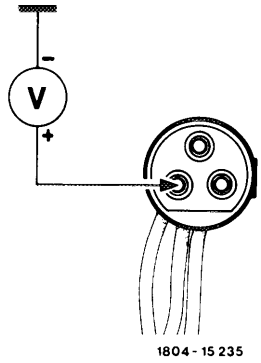


Ground check

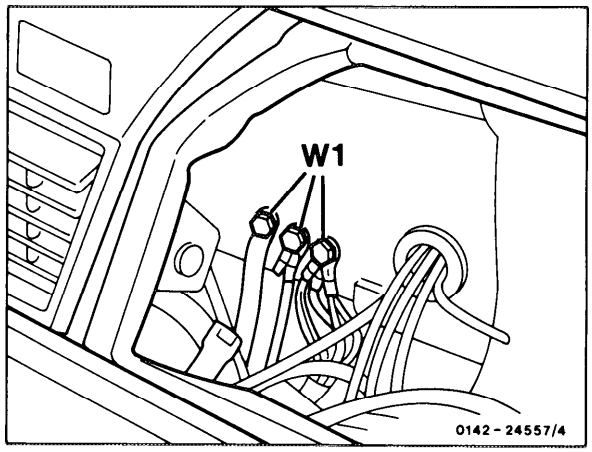
Connect voltmeter to 3-pole coupling of the cable harness as shown on the drawing (flat portion facing down).

Nominal value: battery voltage > 10 V

Yes	No



Check switch in driver's door (80-110).

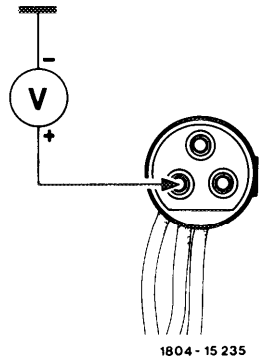


Check ground connection at main ground (W1) behind instrument cluster.

Unlock driver's door.

Nominal value: 0 V

Nominal value < 0.1 v	Nominal value > 0.1 v



Renew switch in the driver's door (80-205).

End of test

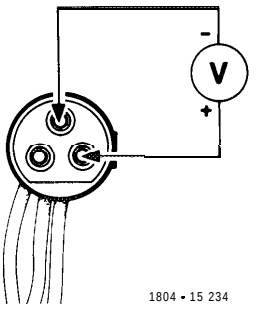
Check voltage supply on the supply pump with the driver's door locked.

Connect voltmeter to the 3-pole coupling of the cable harness as shown in the drawing (flat portion facing down).
Lock driver's door.

Nominal value: battery voltage > 10 V

Yes	No

Check switch in driver's door (80-110).



Unlock driver's door.

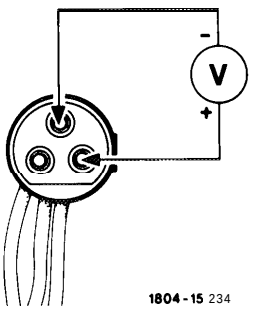
Nominal value: 0 V

Nominal value < 0.1 V	Nominal value > 0.1 V

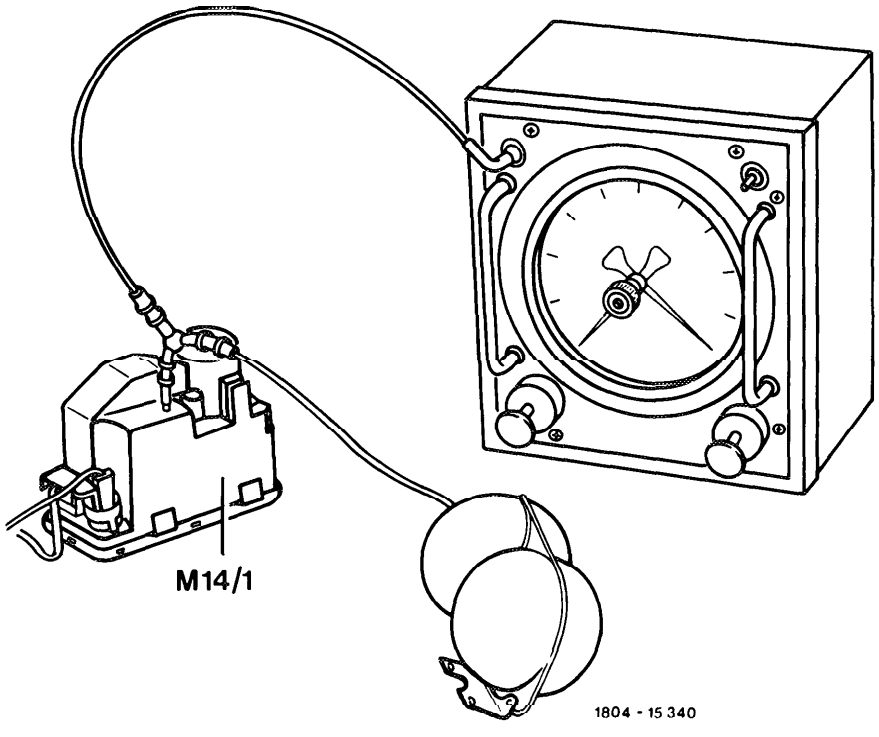
Renew switch in the driver's door (80-205).

Renew supply pump.

End of test

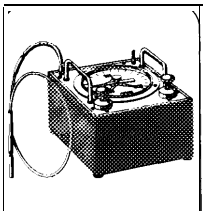


80408 Checking pneumatic function of the supply pump



Test preparation	Items 1-3.
Checking vacuum of the supply pump during locking	> 420 mbar in ≤ 3 s.
Checking pressure of the supply pump during unlocking	> 420 mbar in ≤ 3 s.
Checking safety switching time when the supply pump is separated from the pipe system	approx. 25-60 s.

Special tool



201 589 13 21 00

Parts for the test	Part No.
Tank	107 800 08 19
Distribution fitting	117 078 01 45
Plug	000 987 11 45

Test preparation

1 Connect tank with distribution fitting to the tester for vacuum and pressure systems to the vacuum side (black connectron).

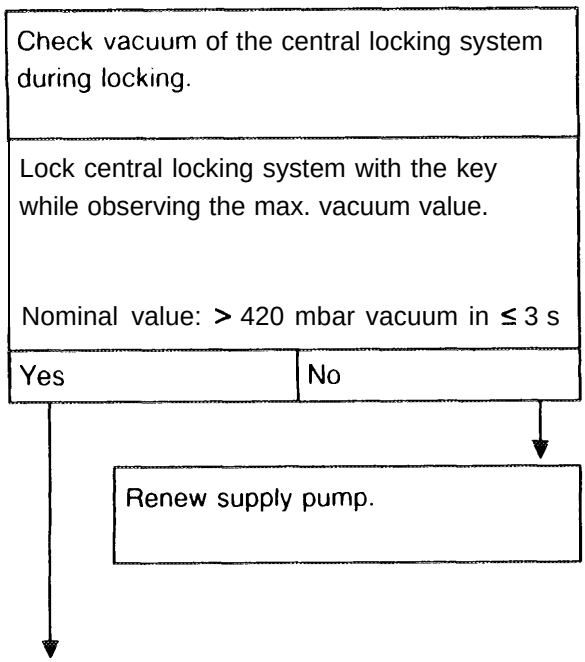
2 Remove supply pump and disconnect pneumatic pipe (80-270).

3 Connect tester for vacuum and pressure systems with tank to the supply pump.

Note

On the supply pump with pneumatic connection for orthopedic backrest, close the connection with plug part No. 000 987 11 45.

Test



Check pressure of the supply pump during unlocking.

Connect pneumatic pipe to the pressure connection (yellow) of the tester.
Unlock central locking system with the key while observing the max. pressure value.

Nominal value: > 420 mbar pressure in ≤ 3

Ja	Nein

Renew supply pump.

Check safety switching time when separating the supply pump from the pipe system.

Disconnect tester from the supply pump, actuate central locking system with the key while measuring safety switching time.
After approx. 25-60 s the supply pump must switch off.

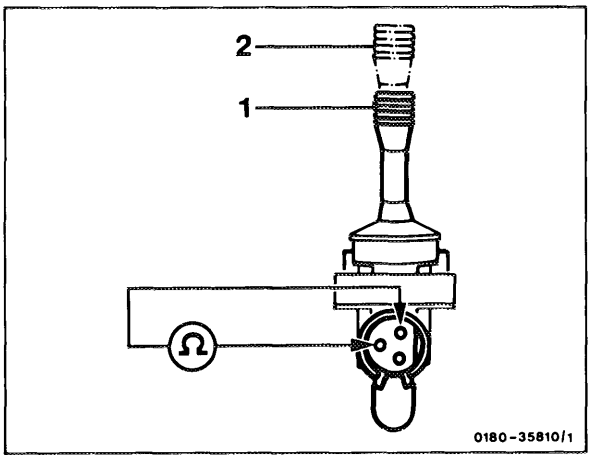
Yes	No

Renew supply pump.

Check central locking system for leaks (80-120).

End of test

80-l 10 Checking electrical function of the switch in the driver's door



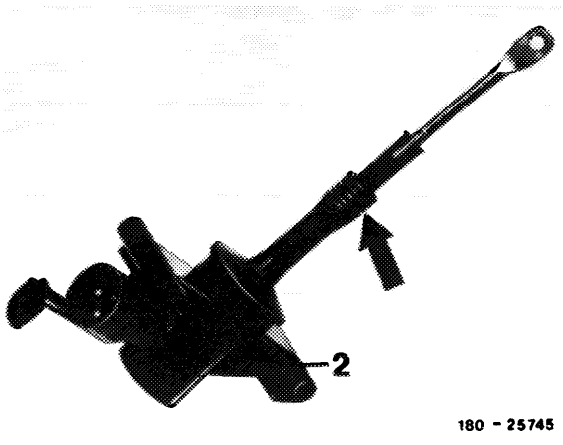
Test preparation	Items 1-3
Closing function of the switch	Check
Opening function of the switch	Check
Voltage supply of the switch	Check

Commercially available tool

Digital multimeter	e.g. SUN, DMM-5

Test preparation

1 Remove switch (80-205).
2 Pull off electrical cable harness.
3 Slide sliding sleeve (arrow) over the control rod attachment (a).



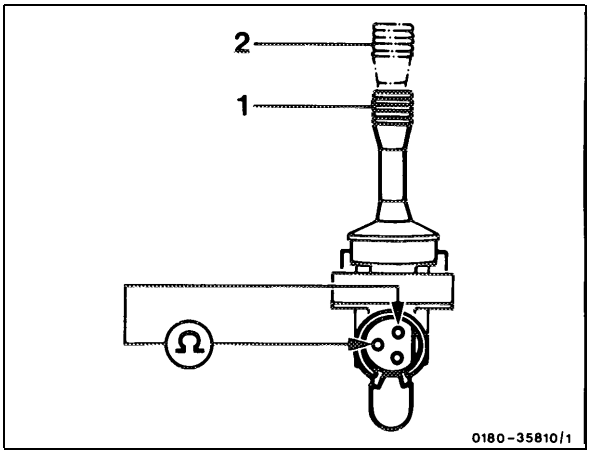
Test

Check closing function of the switch.

Connect digital multimeter for resistance measurement to the switch as shown in the figure.
Nominal value in position 1 ≤ 0.5 Ω
Nominal value in position 2 = ∞ Ω

Both nominal values in order	One nominal value not in order

Renew switch.

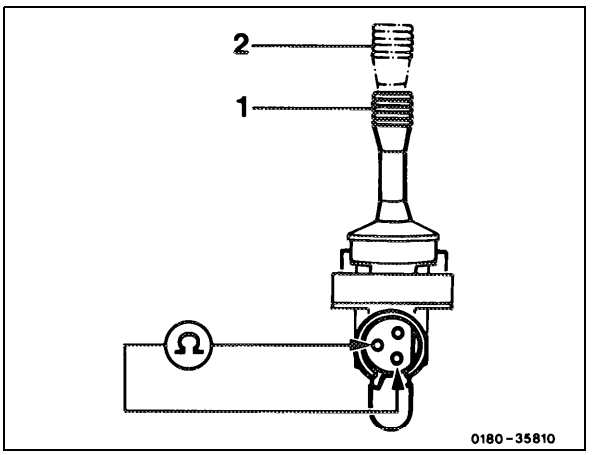


Check opening function of the switch.

Connect digital multimeter for resistance measurement to the switch as shown in the figure.
Nominal value in position 1 = ∞ Ω
Nominal value in position 2 ≤ 0.5 Ω

Both nominal values in order	One nominal value not in order

Renew switch.



Check voltage supply of the switch.

Connect digital multimeter to the electrical cable harness as shown in the figure.

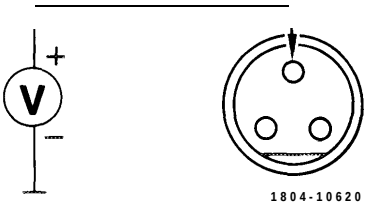
Nominal value: battery voltage > 10 V.

Yes	No

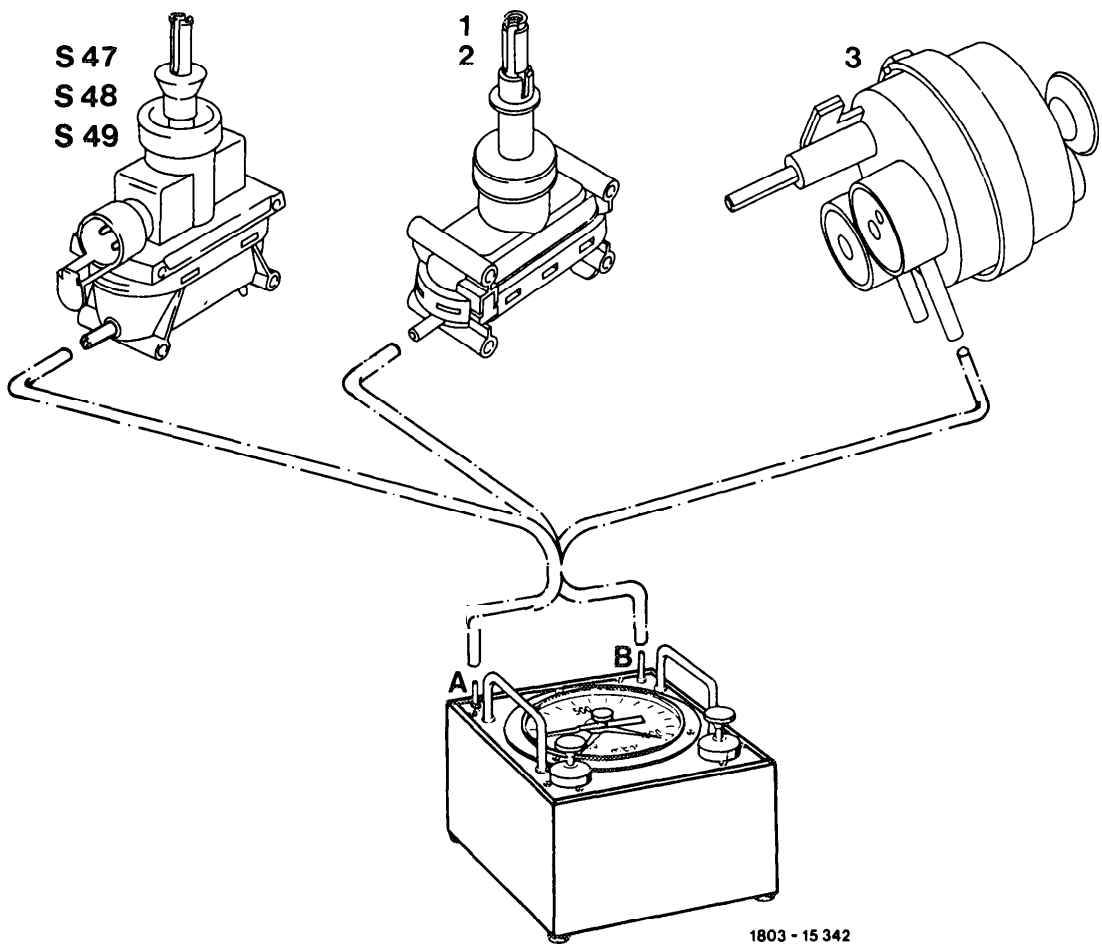
1 Check contacts of connectors.
2 Check cable, terminal 30, according to wiring diagram (80-800) for continuity. Renew cable harness if required.

1 Check contacts of the connectors.
2 Check control cable continuity according to the wiring diagram (80-800). Renew cable harness if required.

End of test

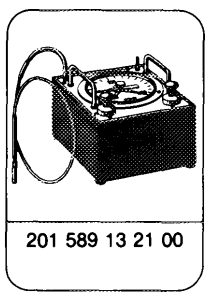


80-116 Checking pneumatic function of the element



Test preparation	Items 1-4
Checking the element for leaks in the pressure mode	Permissible leakage rate per minute at 600 mbar pressure = 30 mbar.
Checking leakage rate of the element in the vacuum mode	Permissible leakage rate per minute at 300 mbar vacuum = 30 mbar.

Special tool



201 589 13 21 00

Part required for the test	Part No.
Cap	000 987 11 45

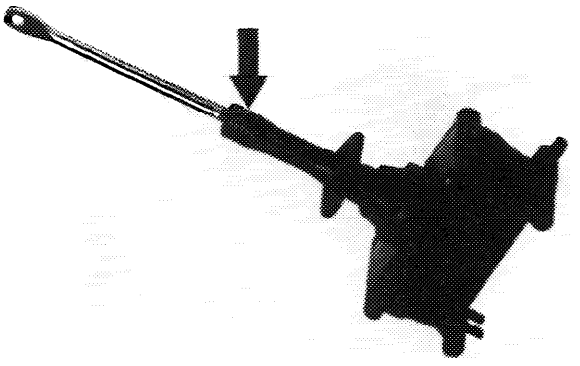
Test preparation

1 Remove element (80-210, 80-220, 80-230, 80-240).

2 Pull off pneumatic pipe.

3 Slide sliding sleeve (arrow) over the control rod attachment.

4 Connect tester for vacuum and pressure systems to the pneumatic connection of the element.



180 - 23929

Note

On elements with two pneumatic connections, close one connection with cap 000 987 11 45.

Test

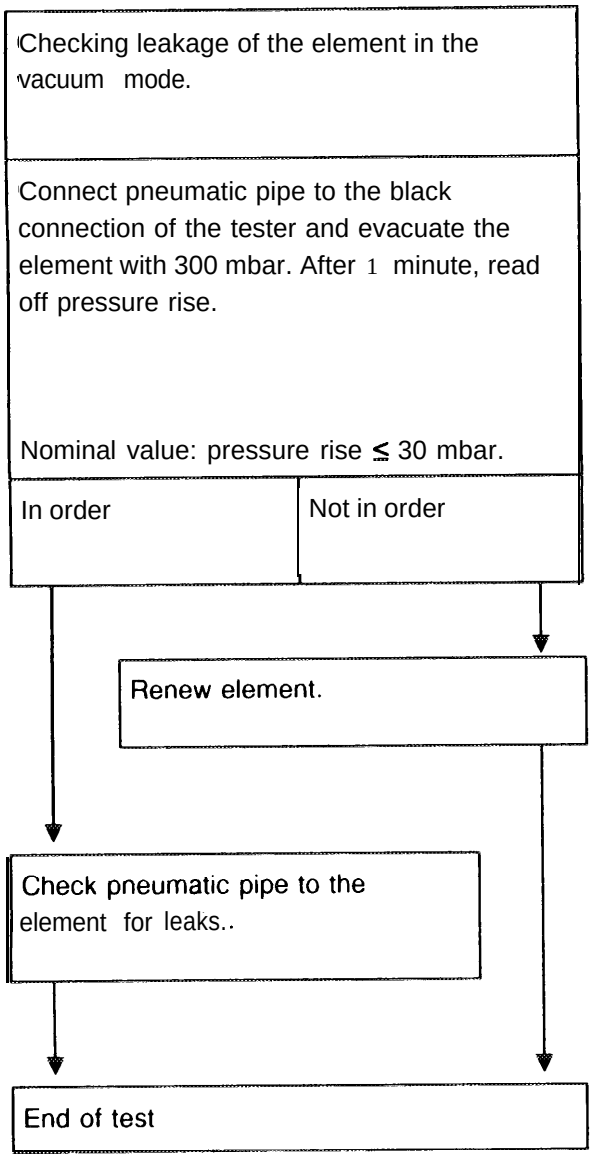
Check leakage of the element in the pressure mode.

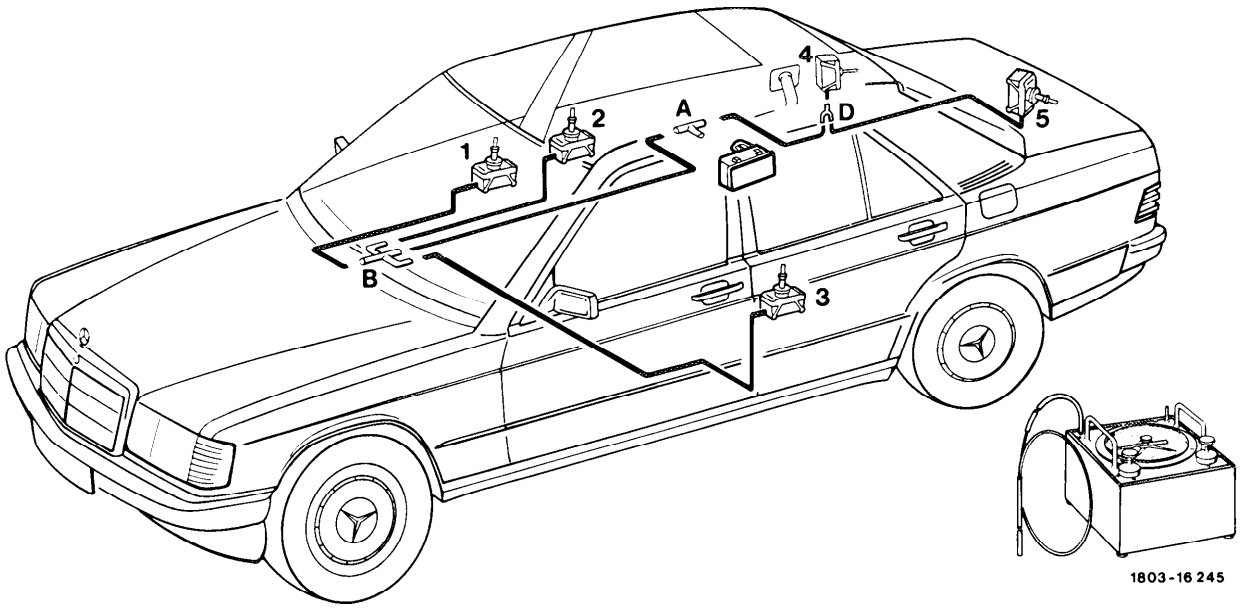
Connect pneumatic pipe to the yellow connection of the tester and apply a pressure of 600 mbar to the element. After 1 minute, read off pressure drop.

Nominal value: pressure drop ≤ 30 mbar.

In order	Not in order

Renew element.


Checking leakage of the element in the vacuum mode.
Connect pneumatic pipe to the black connection of the tester and evacuate the element with 300 mbar. After 1 minute, read off pressure rise.
Nominal value: pressure rise ≤ 30 mbar.
In order
Not in order
Renew element.
Check pneumatic pipe to the element for leaks..
End of test



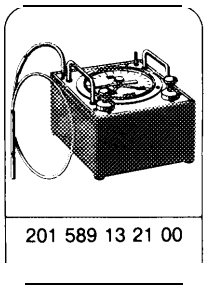
Connection or distribution fitting	Items to be tested	Subsequential test or remedy for leaks
A	Entire system	Check leaks on pipes to the passenger compartment or to the trunk.
	Elements and pneumatic pipes in the passenger compartment.	Check distribution fitting **B** for leaks.
	Elements and pneumatic pipes in the trunk.	Check distribution fitting **D** for leaks.

B	Pneumatic pipe to the distribution fitting **A**.	Repair or renew.
	Element (1) front passenger door with connection fitting and pneumatic pipe.	Check pipe, connection fitting and element individually for leaks. Repair or renew defective parts.
	Element in the rear door right (2) with connection fitting and pneumatic pipe.	Check pipe, connection fitting and element individually for leaks. Repair or renew defective parts.
	Element in the rear door left (3) with connection fitting and pneumatic pipe.	Check pipe, connection fitting and element individually for leaks. Repair or renew defective parts.
D	Pneumatic pipe to the distribution fitting **A**.	Repair or renew.
	Element trunk lid (5) with pneumatic pipe and connection fitting.	Check pipe, connection and element individually for leaks. Repair or renew defective parts.
	Element, tank flap (4).	Renew.

Data

Permissible leakage rate per minute of the entire system and elements at 600 mbar pressure and at 300 mbar vacuum	mbar	30
Permissible leakage rate per minute of individual pipes at 600 mbar pressure	mbar	0
Connection overlap length of the connection and distribution fittings	mm	12 ± 2

Special tool



201 589 13 21 00

Part required for the test	Part No.
Cap	000 987 11 45

Note

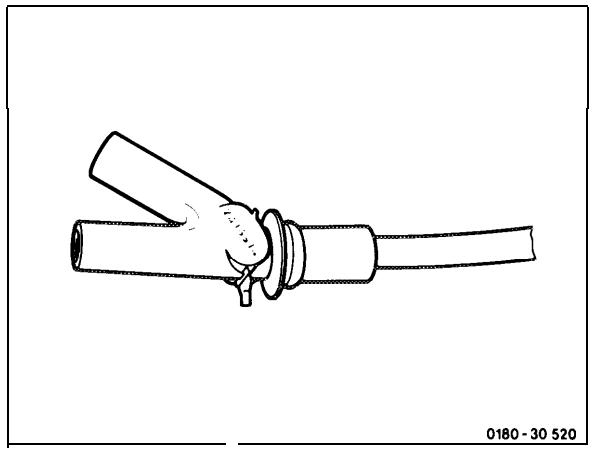
If not all elements work properly although no leaks could be detected, check the pipes, distribution and connection fittings concerned for kinks and free passage.

When conducting the leak test on individual pipes, connect the tester to one end of the pipe and close the other end with the cap 000 987 11 45.

The following test can be applied to all points of the above mentioned table.

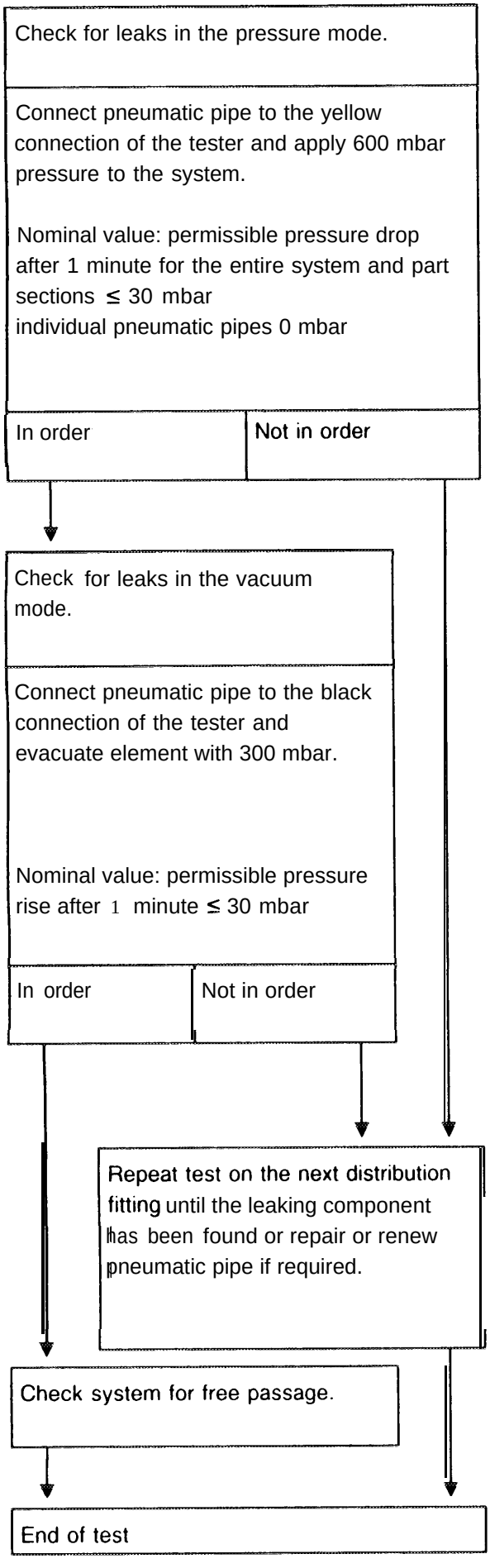
Test preparation

Connect tester for vacuum and pressure systems to the distribution fitting or pneumatic pipe.



0180-30 520

Test

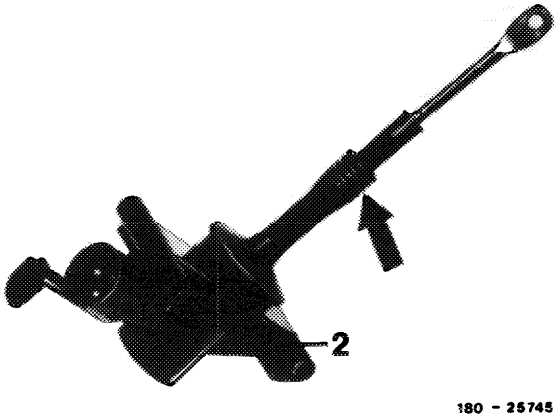

Check for leaks in the pressure mode.
Connect pneumatic pipe to the yellow connection of the tester and apply 600 mbar pressure to the system.
Nominal value: permissible pressure drop after 1 minute for the entire system and part sections ≤ 30 mbar
individual pneumatic pipes 0 mbar
In order
Not in order
Check for leaks in the vacuum mode.
Connect pneumatic pipe to the black connection of the tester and evacuate element with 300 mbar.
Nominal value: permissible pressure rise after 1 minute ≤ 30 mbar
In order
Not in order
Repeat test on the next distribution fitting until the leaking component has been found or repair or renew pneumatic pipe if required.
Check system for free passage.
End of test

80-205 Removal and installation of electric switch in the driver's door

Removal

1 Remove door lining (72-1 00).

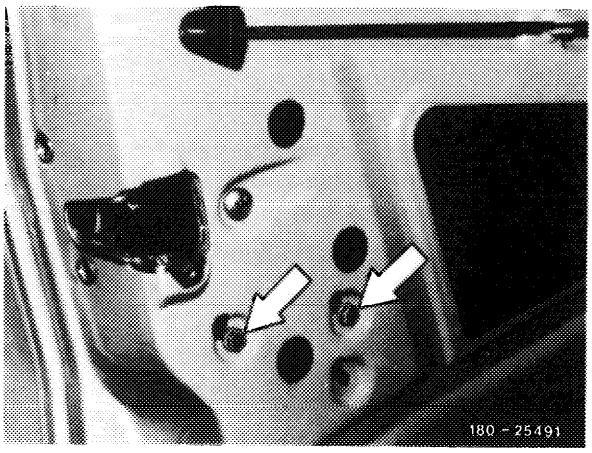
2 With the crank window closed, push sliding sleeve of the switch (arrow) fully down and disconnect control rod.



3 Loosen attaching screws (22) of the switch. Remove switch from the door aperture.

4 Remove triple coupling from the switch.

5 Check switch (80-l 10).



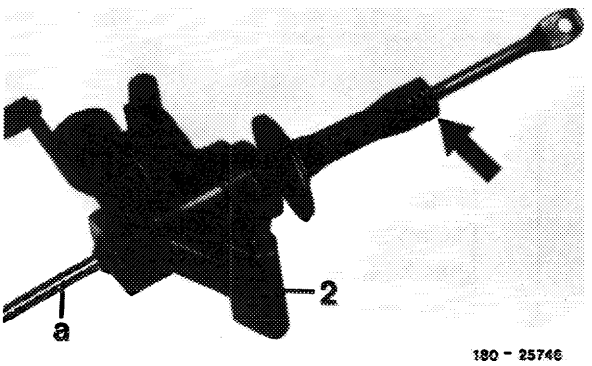
Installation

6 Before installing the switch (2), push sliding sleeve (arrow) fully down, while counterholding from below by means of a 4 mm arbor (a).

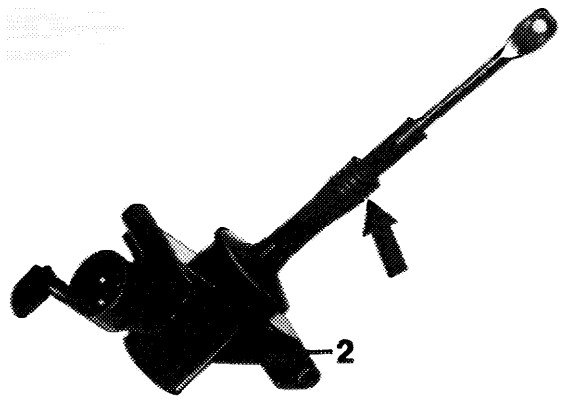
7 Connect electrical cable harness and attach switch with the existing screws.

Adjusting control rod

8 Fully pull out locking pin of the door (unlock).



9 Insert the control rod without preload into the rod connection of the switch and push the sliding sleeve (arrow) fully up.

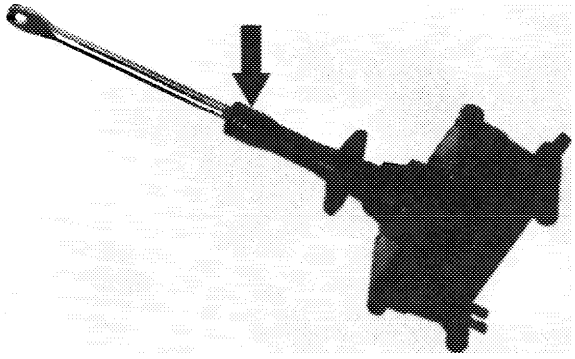


180 – 25745

Removal

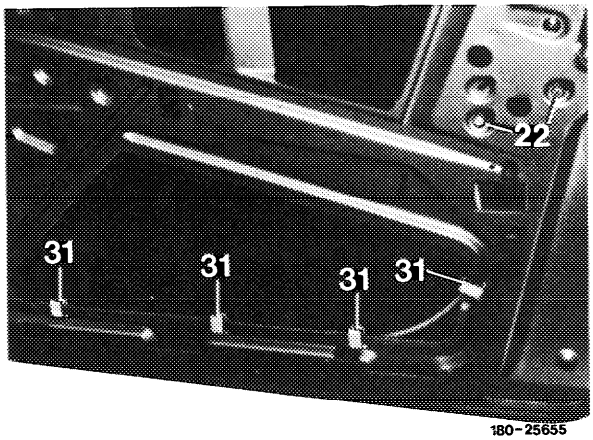
1 Remove door lining (72-100).

2 With the crank window closed, push sliding sleeve (arrow) fully down. To do so, pull hose off element and seal the element connection.



180 - 33929

3 Unscrew the attaching screws of the element at the points shown by the arrows, remove element from the door.



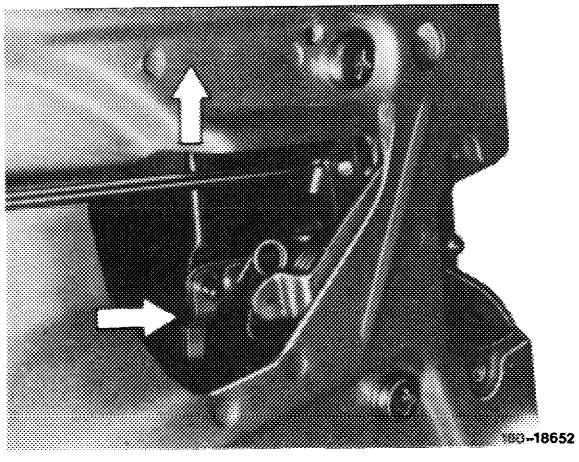
180-25655

Installation

The installation takes place in reverse order

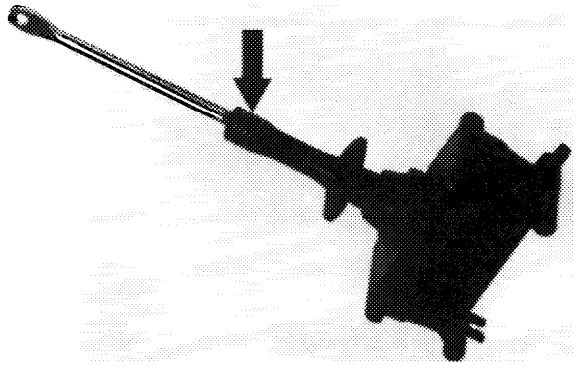
Adjusting the control rod

4 Fully pull out door locking pin (unlock).



180-18652

5 With the sliding sleeve pushed back (arrow), insert control rod without preload into the rod connection of the element and fully push up sliding sleeve (arrow).

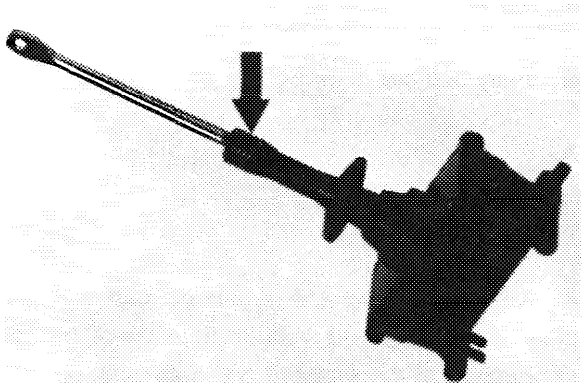


180 - 23929

Removal

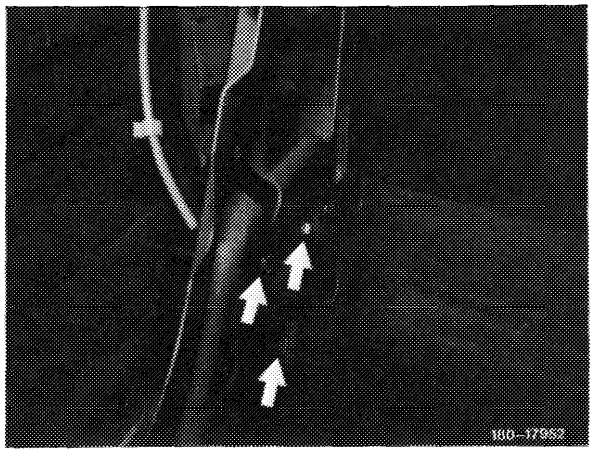
1 Remove door lining (72-101).

2 Slide sliding sleeve of the element (arrow) down. To do so, disconnect hose from the element and seal the connection from the element. Then disconnect control rod.



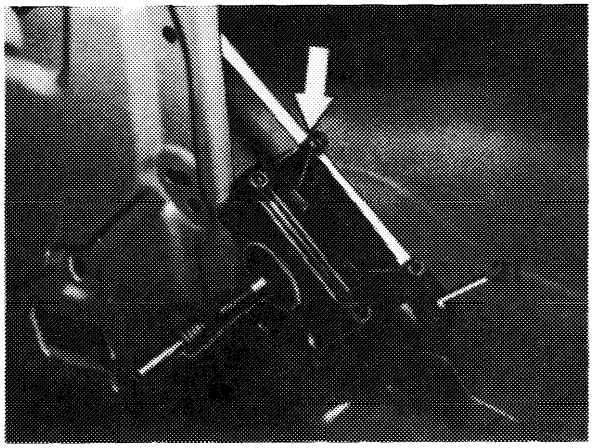
180 - 23929

3 Loosen attaching screws (arrows) of the element and disconnect element.



180-17952

4 Unclip the pneumatic pipe from the element (arrow) and pull off.

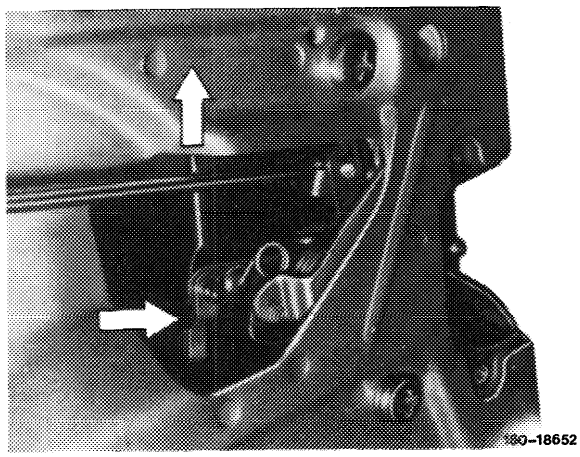


Installation

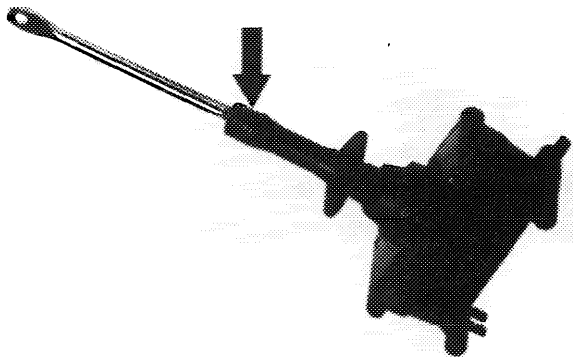
The installation takes place in reverse order.

Adjusting the control rod

5 Fully pull out door locking pin (unlock).



6 With the sliding sleeve pushed back (arrow), insert the control rod without preload into the rod connection of the element and fully push up sliding sleeve (arrow).



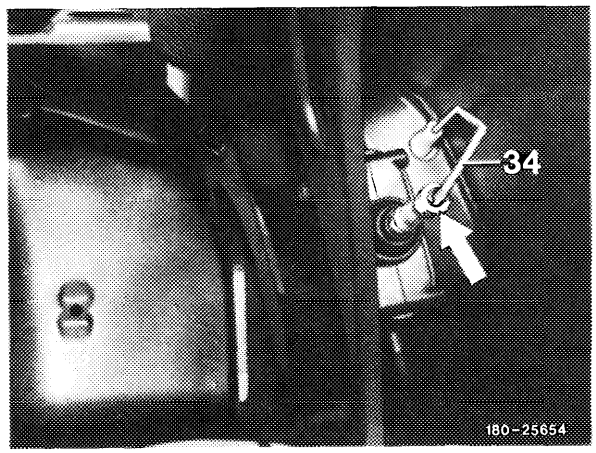
80-230 Removal and installation of tank flap element

Removal

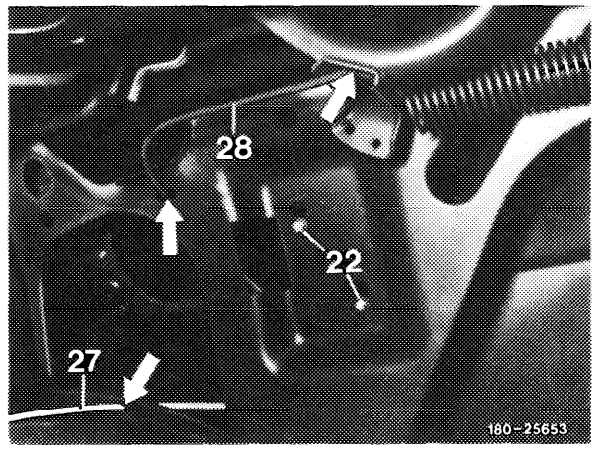
1 Remove right trunk lining (68-480).

2 Disconnect pneumatic pipe from the element.

3 Hold control rod (34) and open sliding sleeve (arrow) in the direction of the element. Then disconnect the control rod (34).



4 Loosen attaching screws (22) of the element and disconnect the element.

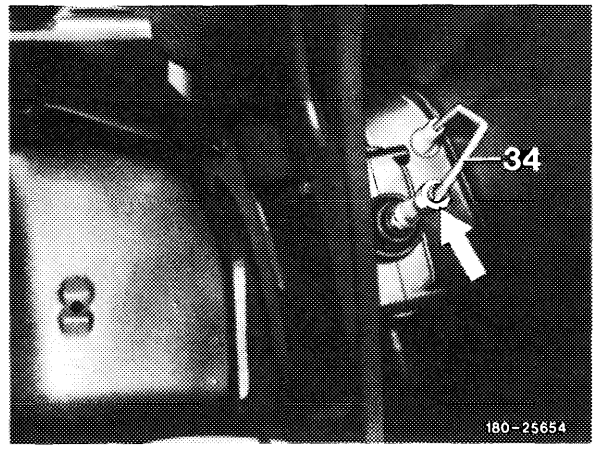


Installation

The installation takes place in reverse order. Note that the attaching screws should be half screwed into **the** element **before installation.**

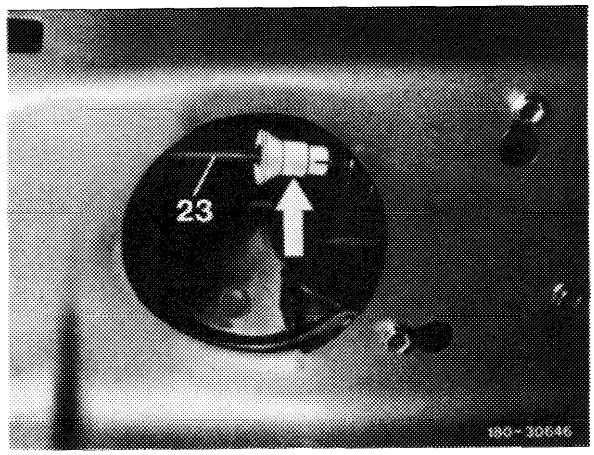
Adjusting the control rod

5 Insert control rod (34) in the guide sleeve of the tank flap. With the sliding sleeve pushed back (arrow), insert the control rod (34) with the thread into the rod connection until the control rod is flush with the guide sleeve in the tank flap. Then push guide sleeve (arrow) fully to the rear.

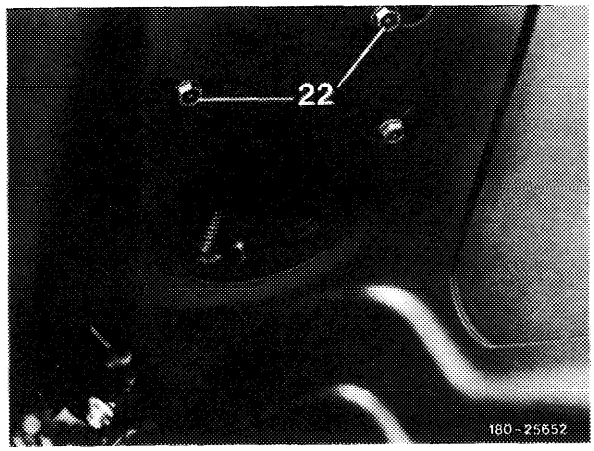


Removal

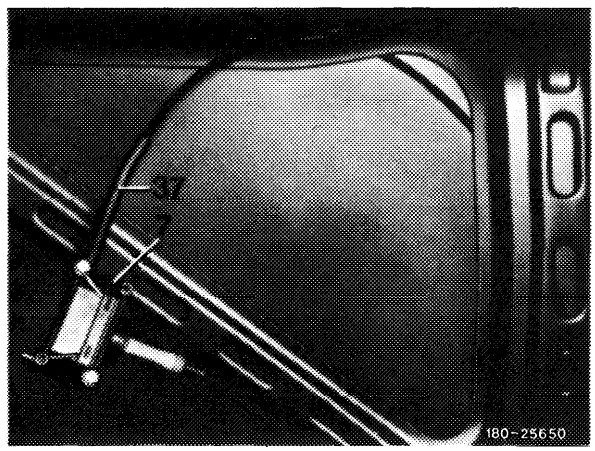
1 l-fold control rod (23) and push sliding sleev e (arrow) back in the direction of the element. Then disconnect the control rod.



2 Loosen two screws (22).



3 Remove element and pull off connection hose (37).

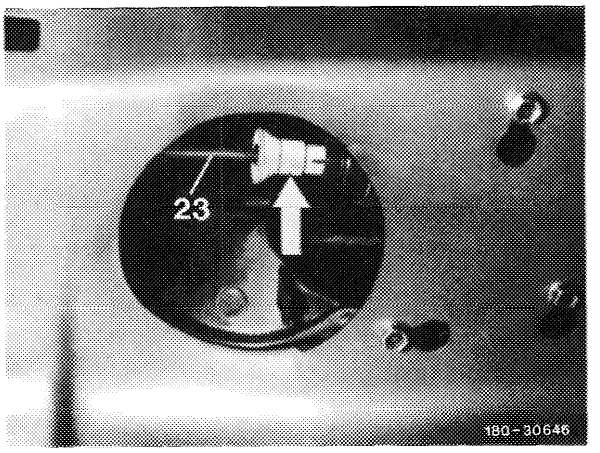


Installation

The installation takes place in reverse order. Note that the attaching screws should be screwed half into the element before the installation.

Adjusting the control rod

4 Insert the control rod of the rear lid lock at least 10 mm into the rod connection of the trunk lid element and fully push out sliding sleeve.



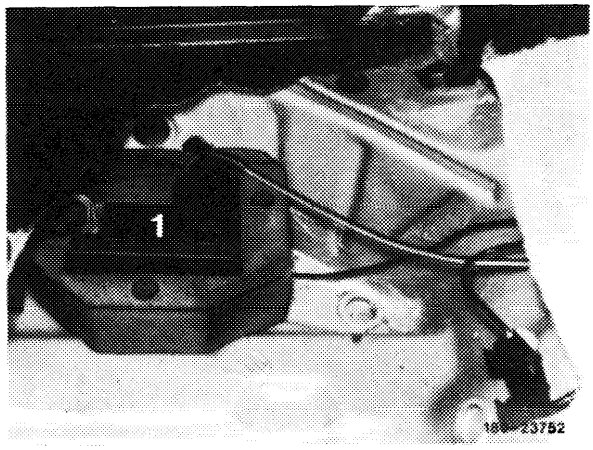
80-270 Removal and installation of supply pump

Removal

1 Remove rear seat cushion.

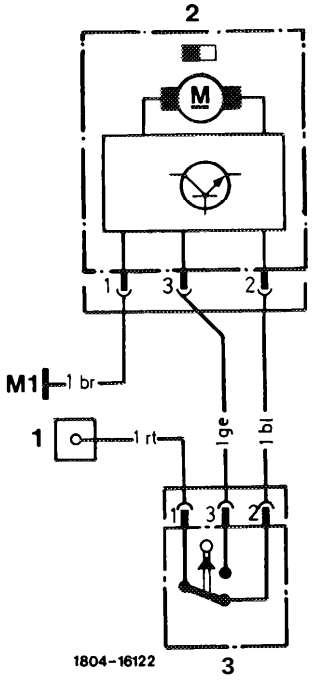
2 Open foam part.

3 Pull triple coupling and connection fitting off supply pump (1).

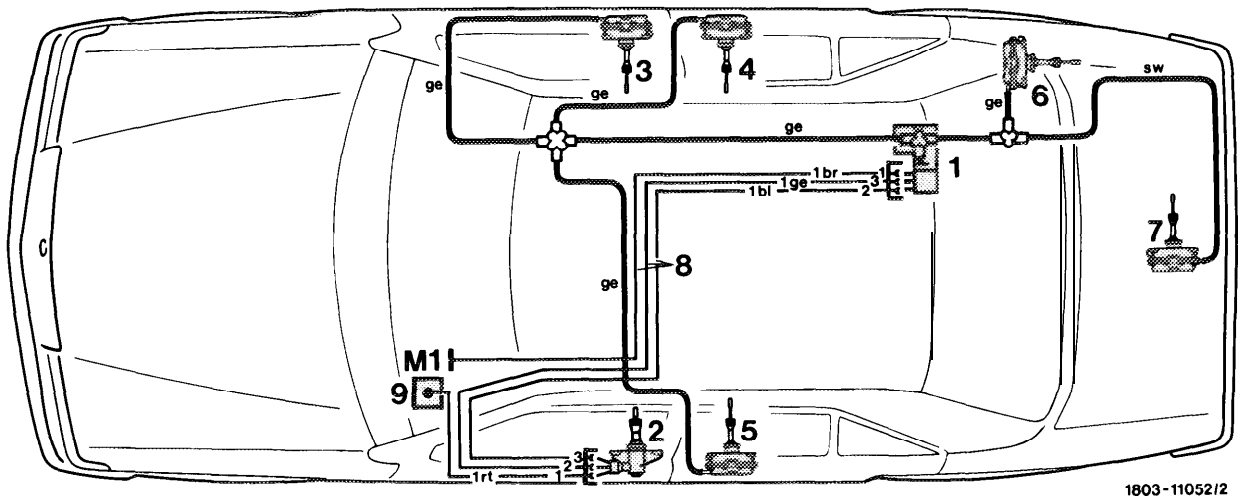


Installation

The installation takes place in reverse order.



1 Terminal in the footwell front left
2 Supply pump
3 Switch in driver's door
M1 Main ground behind Instrument cluster

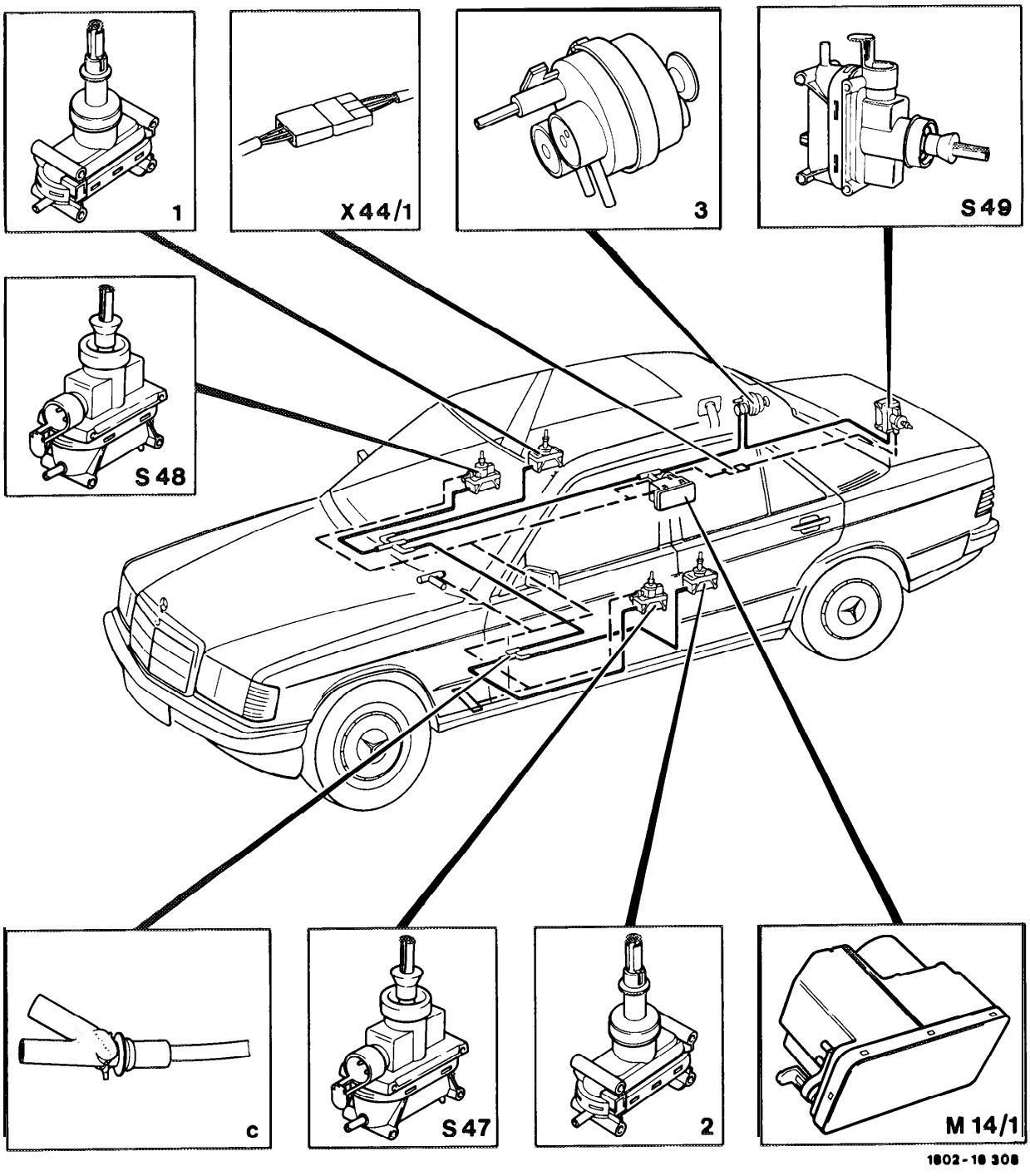


1 Supply pump
2 Switch in driver's door
3 Element, front passenger door
4 Element, rear door right
5 Element, rear door left
6 Element, tank flap
7 Element, trunk lid lock
8 Cable harness, central locking system
Yellow cable for unlocking
Blue cable for locking
9 Terminal, circuit 30
M1 Main ground (behind instrument cluster)

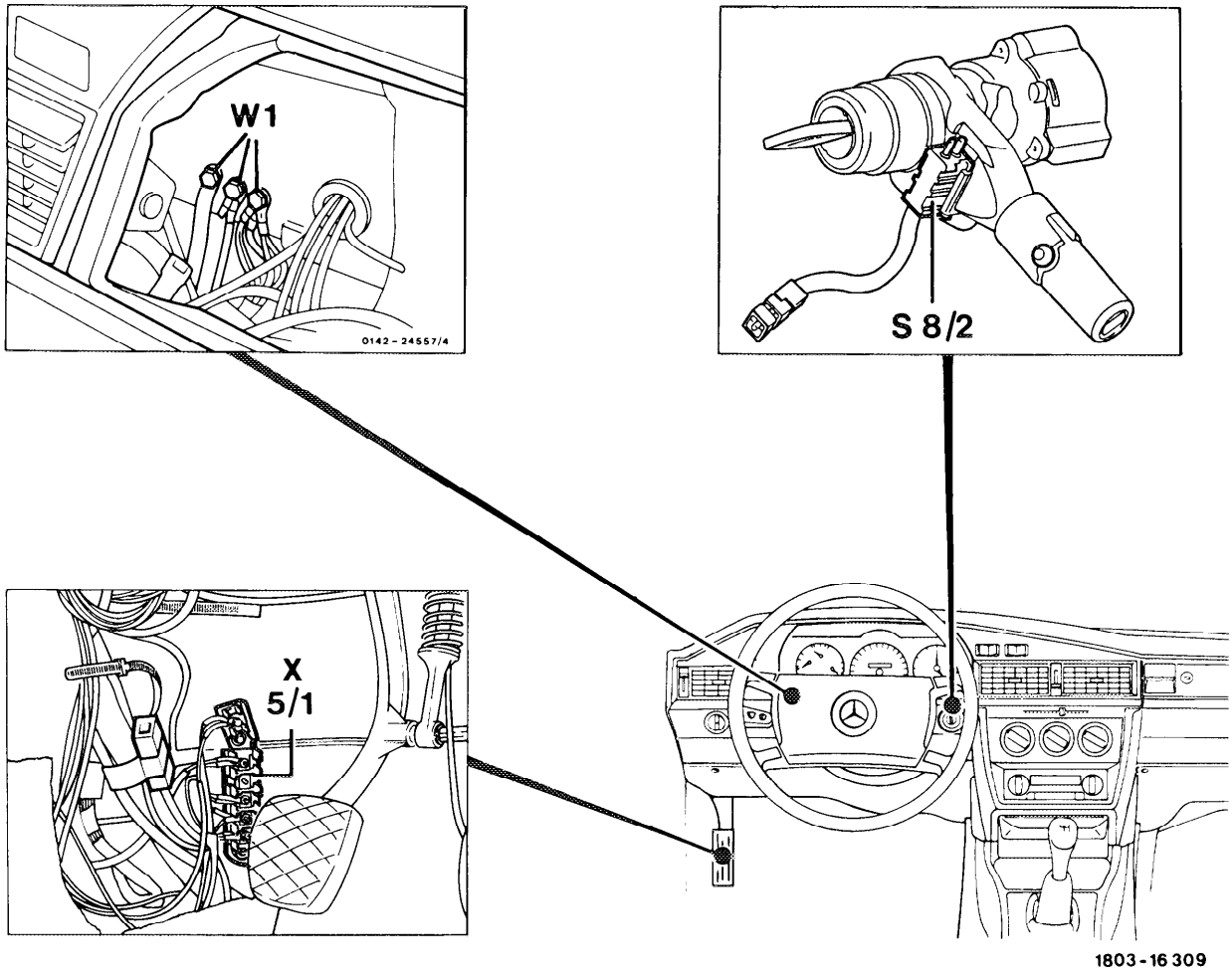
Note

On RHD vehicles, the parts 2, 3, 9 and M1 are arranged in mirror image.

A. General



1	Element, rear door right	M14/1	Supply pump central locking system
2	Element, rear door left	s47	Control and working element, driver's door left
3	Element, tank flap	S48	Control and working element, driver's door right
C	Distribution fitting	s49	Control and working element, trunk lid lock
– – –	Electrical cable	x44/1	Connector, central locking system/trunk lid lock
———	Pneumatic pipe		



S8/2 Warning buzzer contact, lighting/central locking system
W1 Maw ground (behind instrument cluster)
X5/1 Connector, interior, terminal 15/30

The multi-point controlled central locking system is based on the central locking system with single-door control. Central locking or unlocking is possible from the driver's door and front passenger door as well as from the trunk lid by actuating the key or the locking pin. All doors, the trunk lid and the tank flap are incorporated into the central locking system.

B. Operation

Driver's door

With the driver's door closed, the central locking system can always be operated. From the outside by means of the key, (locking by turning fully to the right, unlocking by turning fully to the left), from the inside by pressing the locking pin or pulling the handle in the door lining.

Front passenger door

The central locking system can be operated from the closed or opened front passenger door by means of the key, the locking pin or handle (similar to the driver's door).
However, central locking is only possible if the ignition key has been removed or, after it has been removed, is inserted again but not actuated (key position 0 in the steering lock). This procedure prevents an inadvertent locking-out in key positions 1 and 2 via the front passenger door.

Trunk lid

The central locking system can be operated with the key while the trunk lid is open or closed.
Unlocking:
Fully turn the key to the left and remove in vertical position.
Locking:
Fully turn the key to the right and remove in vertical position.
Additional locking:
Fully turn the key to the right and remove in the horizontal position. The trunk lid remains locked even with central unlocking of the doors.

Note

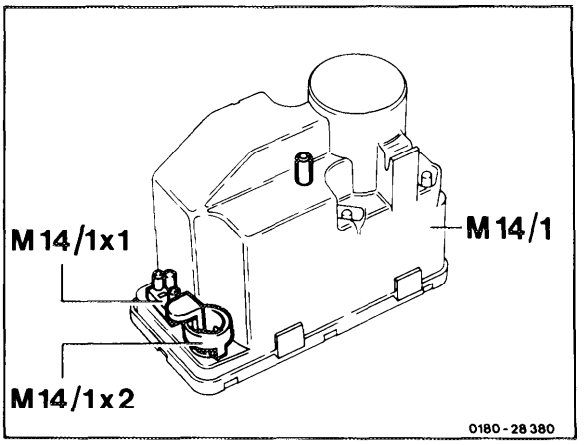
If the trunk lid is unlocked with the centrally locked vehicle, all doors and the tank flap are also unlocked. After closing the trunk lid, the vehicle must again be centrally locked.

C. Components

Supply pump (M14/1)

1st version, up to approx. 04/86.

The supply pump for multi-point control is provided with two electrical connections. Owing to the modified electronic switching function, this supply pump is not interchangeable with the previously known supply pump (single-door control).



The 2-pole connector (MI 4/1 x1, on vehicles with orthopedic driver's backrest, 3-pole MI 4/2x1) connects the supply pump with plus (terminal 30) and ground (terminal 31). Via the connector (MI 4/1 x2) the supply pump receives a negative control voltage from the control and working elements during locking and a positive control voltage during unlocking.

The supply pump generates pressure for unlocking and vacuum for locking (approx. 500 mbar).

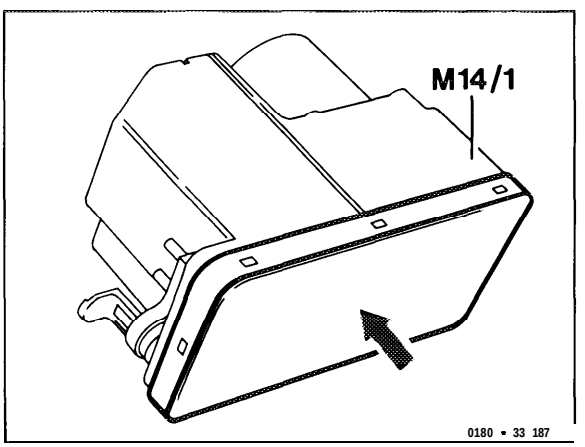
With severe leaks, the supply pump switches off after 25-150 s (safety switching time).

The electronic control is equipped with several logic functions which avoid wrong connections and faults.

2nd version as of approx. 05'86

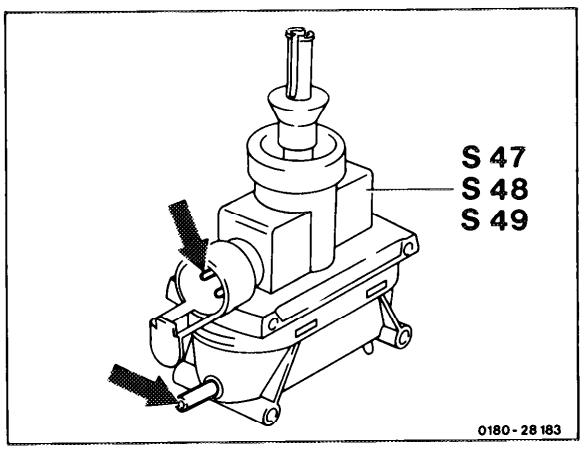
The supply pump control is equipped with a " Full Customer IC".

Besides the previous functions, this IC has the duty of recognizing faulty currents, in this way avoiding spontaneous functions due to creeping currents and switching off of the control inputs concerned. The supply pump can be identified by the light cover (arrow), previously black.

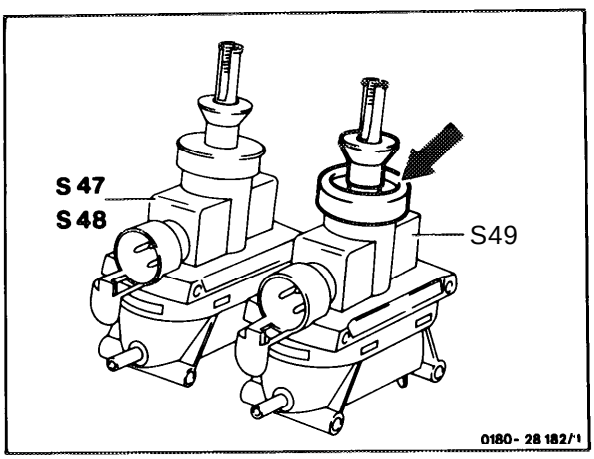


The electrical cable harness was revised at the same time. The ground cable of the control and working element for the trunk lid lock (S49) is now connected directly to the main grounding point (see electrical circuit diagrams 80-800); previously connected to the warning buzzer contact, lighting/central locking system (S8/2).
Production breakpoint: as of vehicle ident end No. A 301 102, F 229413.
In vehicles with lower vehicle ident end No., the modified supply pump may not be installed. The previous version continues to be applicable to these vehicles.

Control and working element (S47, S48, S49)
A combined control and working element is installed in the driver's and front passenger doors as well as in the trunk lid. This element is provided with an electrical and a pneumatic connection (arrows).



The elements for the doors are black. The element for the trunk lid has a boot or sliding sleeve (arrow) deviating in color. During repairs ensure that the elements are not interchanged, as the trunk lid element is provided with a harder boot for locating the upper and lower end stop.



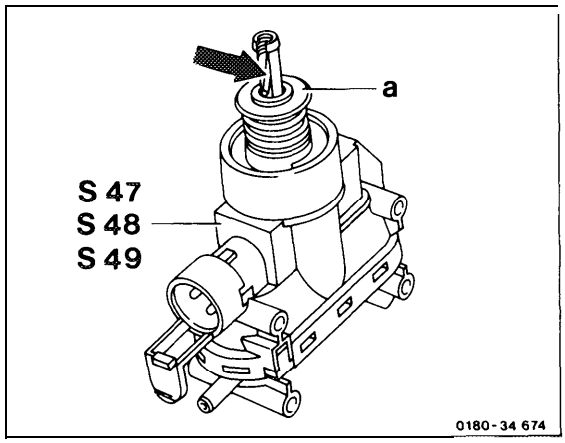
S47 Control and working element, driver's door left
S48 Control and working element, driver's door right
S49 Control and working element, trunk lid lock

The electric and pneumatic functions of all control and working elements are identical. The electric switch in the upper part of the element is constantly connected to positive and ground. The changeover switch sends a positive control voltage to the supply pump for unlocking and a negative control voltage for locking.

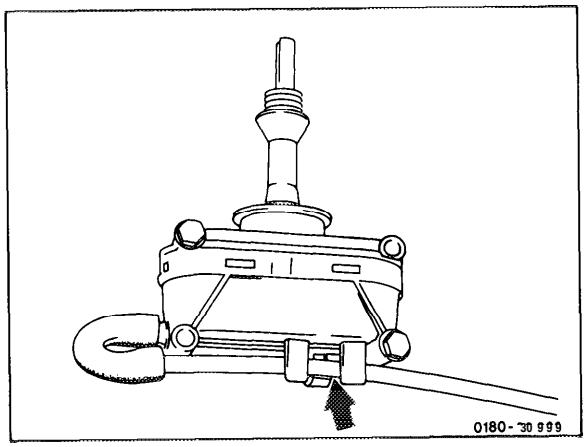
The lower chamber of the element is provided with pressure for unlocking and with vacuum for locking.

The electric and pneumatic sections of the element can be separated by a detent, in order to allow lock operation even with the element subject to pressure or vacuum.

Sliding sleeve lock (as of approx. 12 86 phased-in)
Inadvertent adjusting of the sliding sleeve (a) is avoided by means of an integrated support (arrow). When Inserting the connecting rod to the lock the adjusting lock is cancelled. Consequently the element is in the installation position. Adjusting faults on the door elements are no longer possible.



Rear door element
A pneumatic connection is provided on the rear door element. The lower chamber of the element is supplied with pressure for unlocking and with vacuum for locking. A clip (arrow) for attaching the pneumatic pipe is provided on the housing lower part.



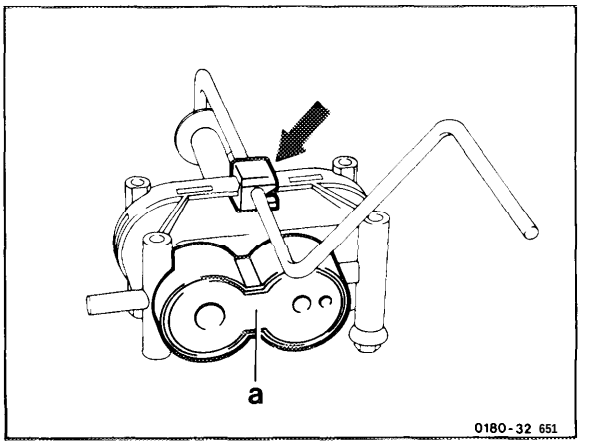
Tank flap element

1st version up to approx. 03/85

With regard to design and function, the element corresponds with the rear door element, but is provided with a harder boot for locating the upper and lower end stop. The distinguishing feature is the yellow sliding sleeve.

2nd version as of approx. 03/85 to approx. 03/87

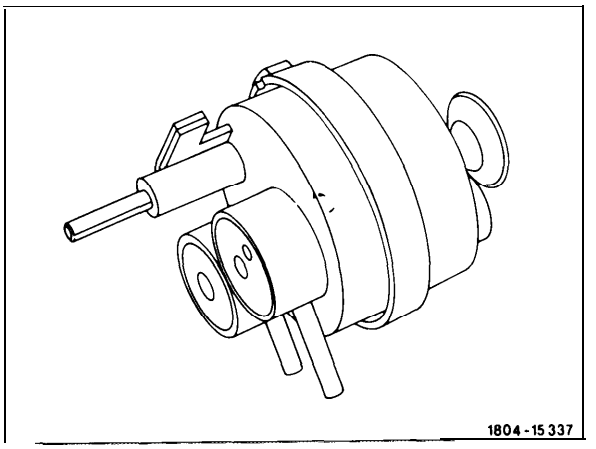
Element similar to the 1st version, however with anti-theft protection (a) and linkage guide (arrow). The anti-theft device prevents manual unlocking of the element via the tank flap.



3rd version

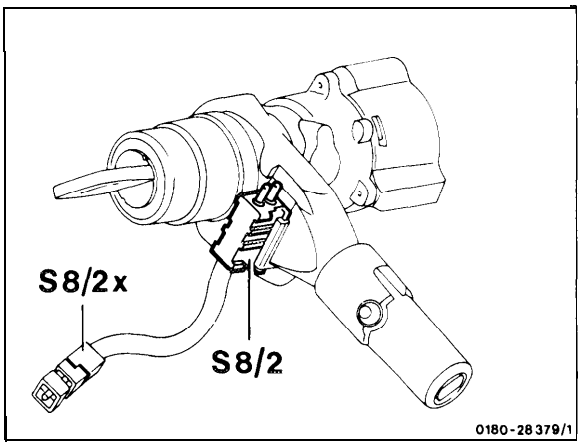
As of approx. 04 87, A 378642, F 357461

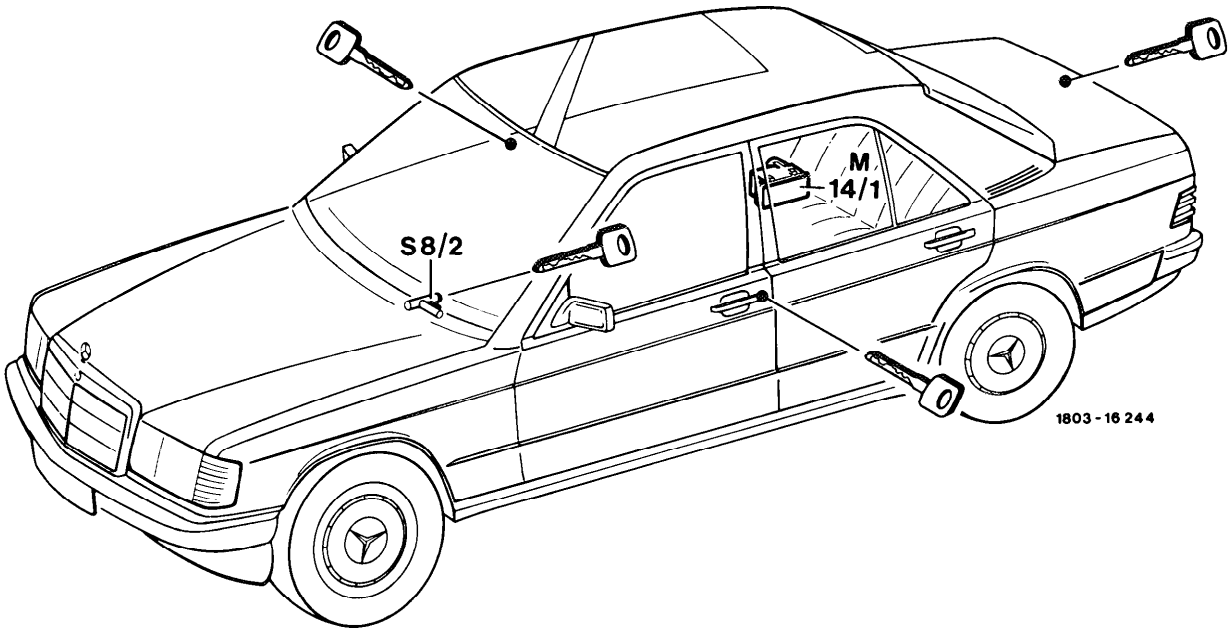
Clip-type element with direct locking linkage, anti-theft device and emergency unlocking button.



Warning buzzer contact, lighting/central locking system (S8/2)

This switch on the steering lock interrupts the ground connection to the control and working element in the front passenger door if the ignition key in the steering lock is in positions 1 or 2. In addition, ground connection to the control and working element in the trunk lid lock is interrupted as of approx. 05/85 to approx. 04/86.



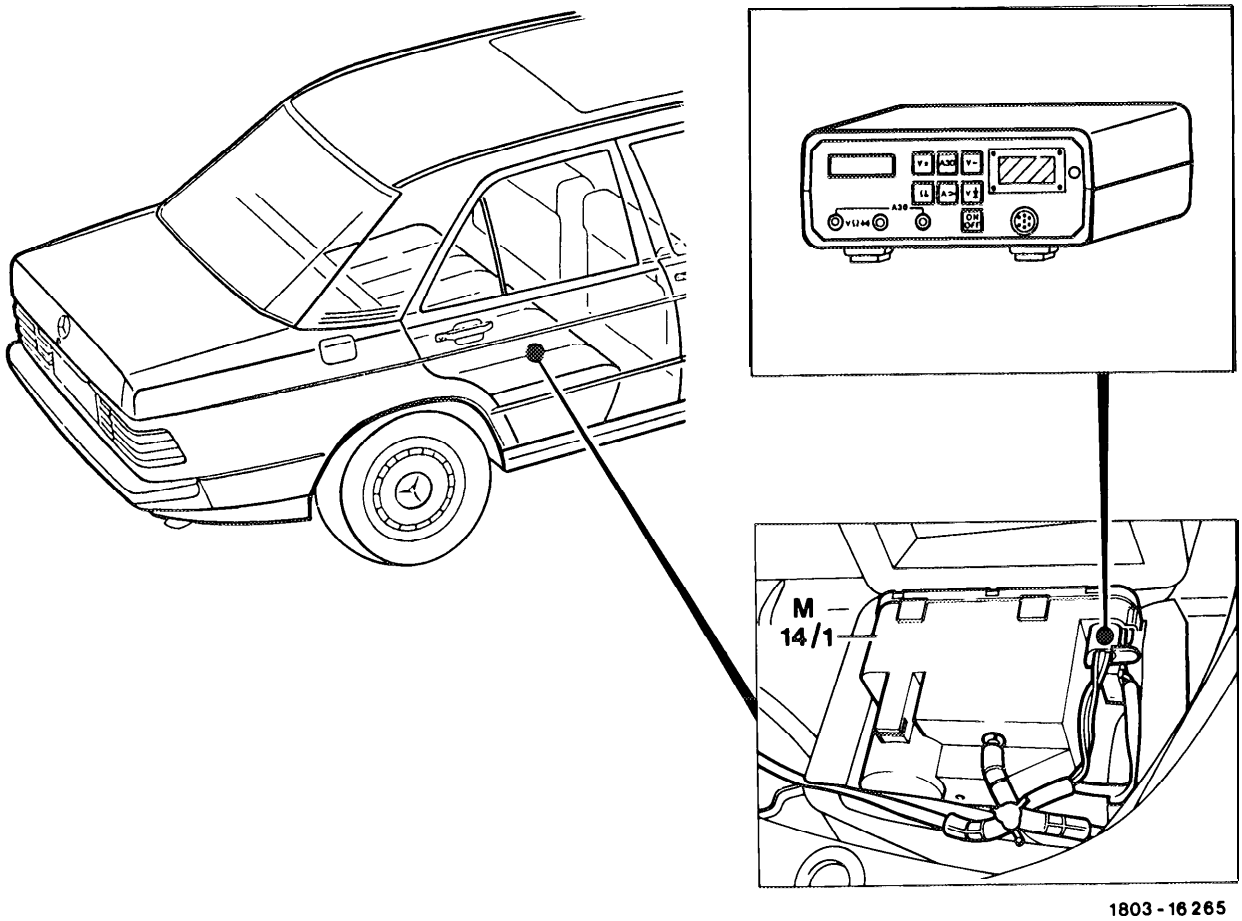


Unlocking and locking driver's, front passenger doors and trunk lid.
When doing so, check supply pump operation by listening.
All doors, trunk lid and tank flap must be locked or unlocked within 3 seconds.

Is not locked or unlocked and supply pump (Ml 4/1) does not operate:	Is not locked or unlocked although supply pump (M 14/1) operates:
80-104 Check electrical function of the central locking system.	80-108 Check pneumatic function of the supply pump.
80-112 Check electrical function of the control and working element.	80-I 20 Check central locking system for leaks.
	80-116 Check pneumatic function of the element.

After repairs, additionally check: Control and working element adjustment	To do so, slowly lock driver's and front passenger doors with a key and observe locking button on the other doors. After 6-8.5 mm travel of the locking button, the central locking system of the vehicle must have locked, if not, remove, install and adjust control and working element (80-215).
Locking-out protection on the front passenger door	Insert key in steering lock position 1 or 2 and press locking button on the front passenger door through the open window. The central locking system should not lock, renew warning buzzer contact lighting/central locking system (S8/2) (46-640) if required.

80-I 04 Checking electrical function of the central locking system



Test preparation	Items I-6
Check voltage supply of the supply pump	Battery voltage (> 10 V)
Check control voltage with vehicle unlocked	Battery voltage (> 10 V)
Check control voltage with vehicle locked	Battery voltage (> 10 V)
Check contacts of the coupling on the supply pump	According to condition: Eliminate faulty contacts or renew supply pump.

Commercially available tool

Digital multimeter	e.g. SUN DMM-5

Note

On vehicles with **EDW system,** disconnect intermediate plug of the EDW cable harness from the connector (Ml 4/1x2) or (Ml 4/2x2) and connect central locking system cable harness directly to the supply pump. Again check function of central locking system. If function is o.k., check EDW system.

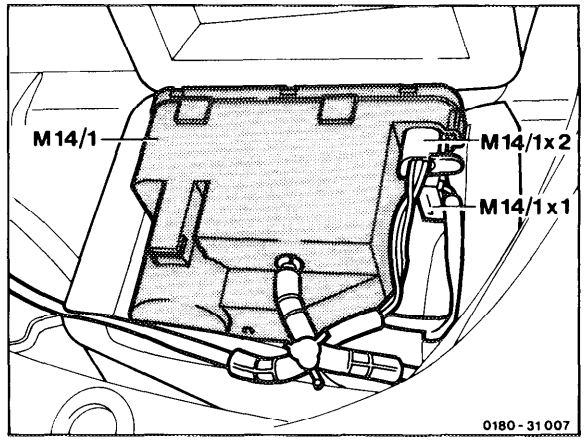
Test preparation

1 Expose supply pump (M14/1) and remove from the protective foam material cap (80-270).

2 Check fuse for central locking system, see enclosure in fuse box lid.

3 Remove key from steering lock.

4 Close driver's and front passenger doors.



5 Disconnect coupling (M14/1x1) of the electrical cable harness from the supply pump (Ml4 1).

6 Open coupling housing and reconnect jacks without housing (brown cable = ground).

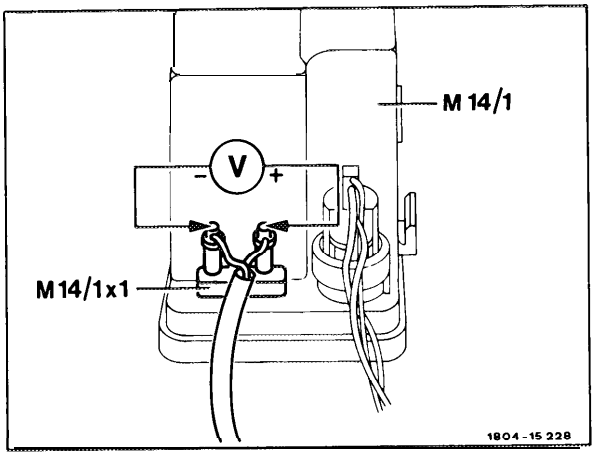
Test

Check voltage supply of the supply pump.

Connect digital multimeter as shown in the figure. Lock and unlock central locking system with the key. Then reinstall coupling housing.

Nominal value: battery voltage > 10 V

Yes	No

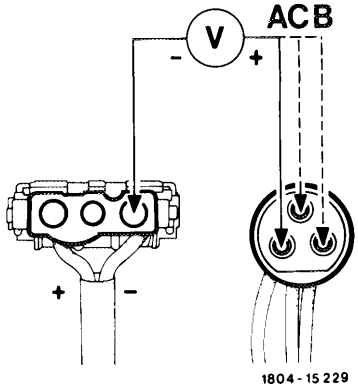


Check voltage supply according to wiring diagram (80-800).

Check control voltage with vehicle unlocked.

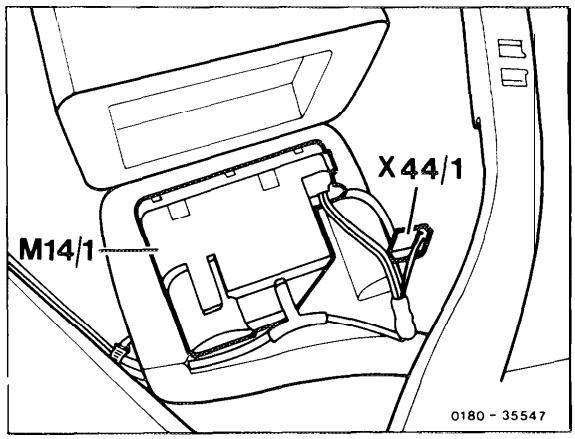
Unlock central locking system at all 3 operating points with the key.
Connect digital multimeter to the two couplings of the cable harness as shown in the figure one after the other in positions A, **B** and C (flat portion of the round coupling facing down).
Nominal value in position A, B and C: battery voltage > 10 V

Yes	No



No battery voltage in position:
A Check control and working element front passenger door (80-112).
B Check control and working element driver's door (80-l 12).
C Check control and working element trunk lid lock (80-l 12).

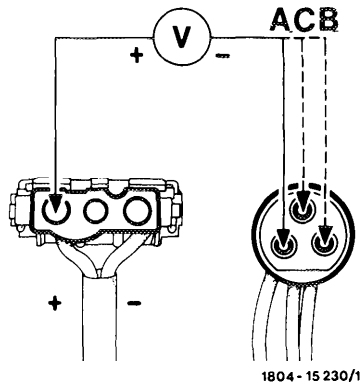
Note
Before the test, check the contacts of the connector central locking system trunk lid lock (X44 1) (see figure).



Check control voltage with vehicle locked.

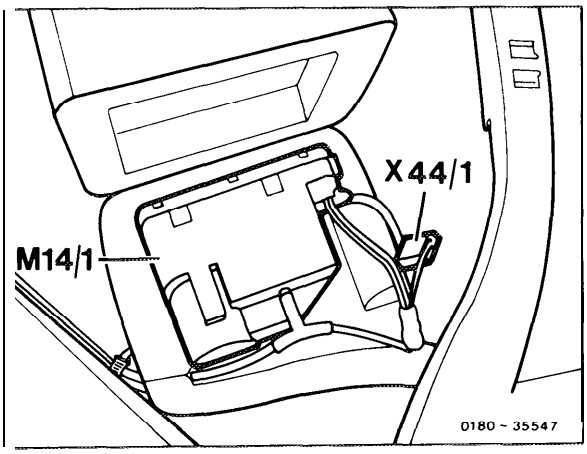
Lock central locking system at all 3 operating points with the key.
Connect digital multimeter to the two couplings of the cable harness as shown in the figure one after the other in positions A, B and C (flat portion of the round coupling facing down).
Nominal value in positions A, B and C: battery voltage > 10 V.

Yes	No



No battery voltage in position:
A Check control and working element front passenger door (80-112).
B Check control and working element driver's door (80-I 12).
C Check control and working element trunk lid lock (80-I 12).

Note
Before the test, check the contacts of the connector central locking system/trunk lid lock (X44/1) (see figure).



Check contacts of the couplings on the supply pump.

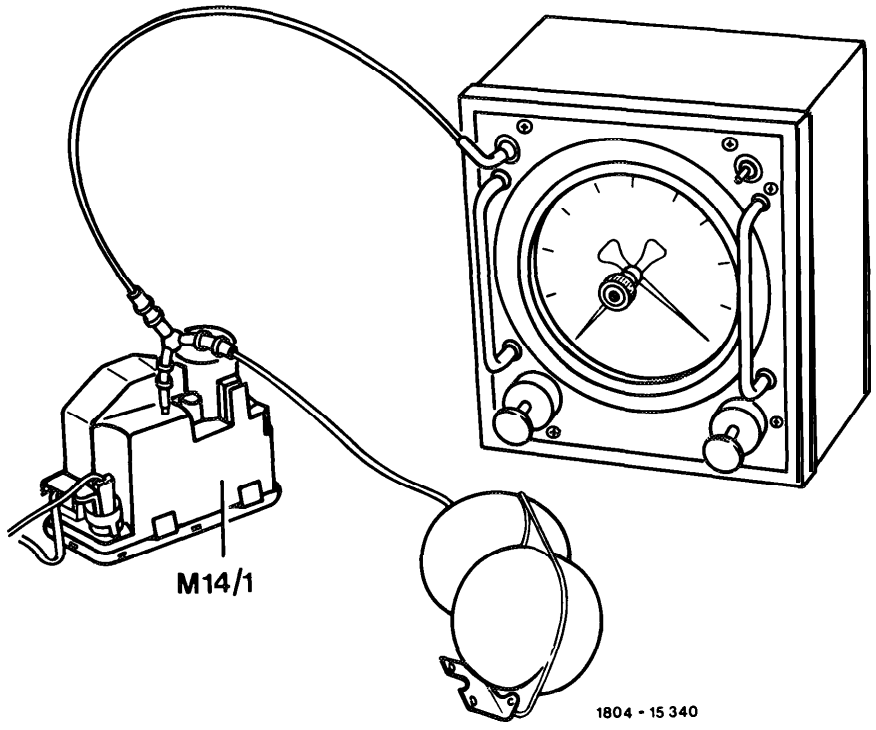
In order	Not in order

Eliminate contact fault..

Renew supply pump.
Note
Supply pump with white and black cover are **not** interchangeable (see 80-010 section **C).**

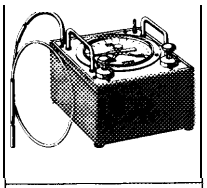
End of test

80-108 Checking pneumatic function of the supply pump



Test preparation	Items 1-3
Checking vacuum of the supply pump during locking	> 420 mbar in ≤ 3 s
Checking pressure of the supply pump during unlocking	> 420 mbar in ≤ 3 s
Checking safety switching time when the supply pump is separated from the pipe system	approx. 25-150 s.

Special tool



201 589 13 21 00

Parts required for the test	Part No.
Tank	107 800 08 19
Distribution fitting	117 078 01 45
Plug	000 987 11 45

Test preparation

1 Connect tank with distribution fitting to the tester for vacuum and pressure systems to the vacuum side (black connection).

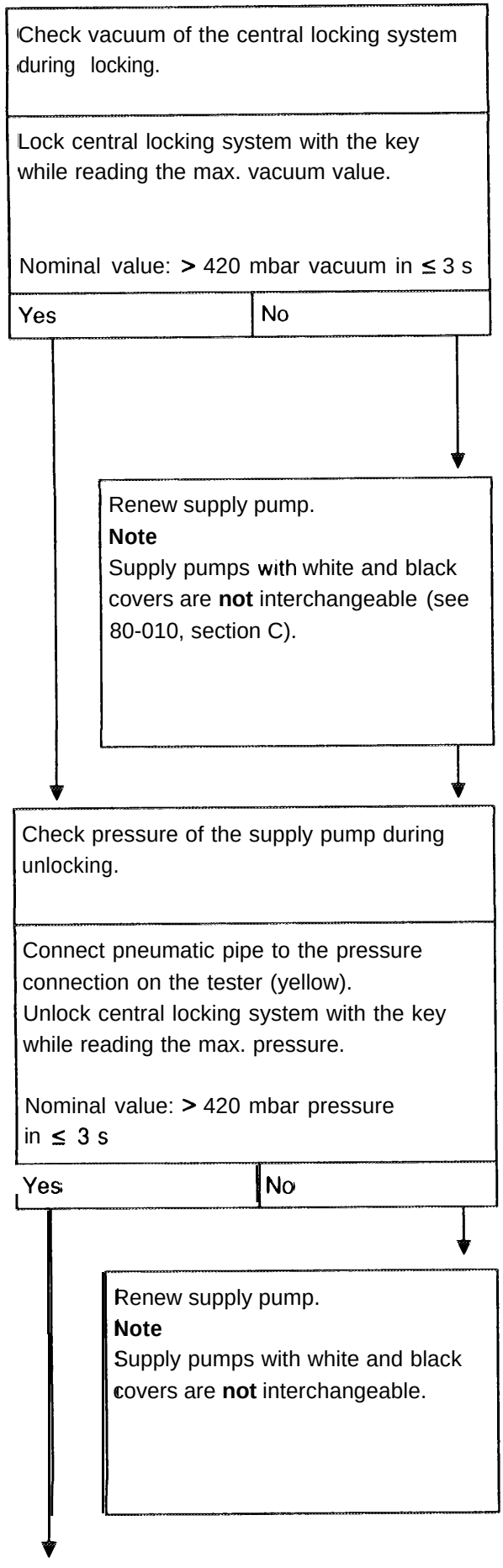
2 Remove supply pump and disconnect pneumatic pipe (80-270).

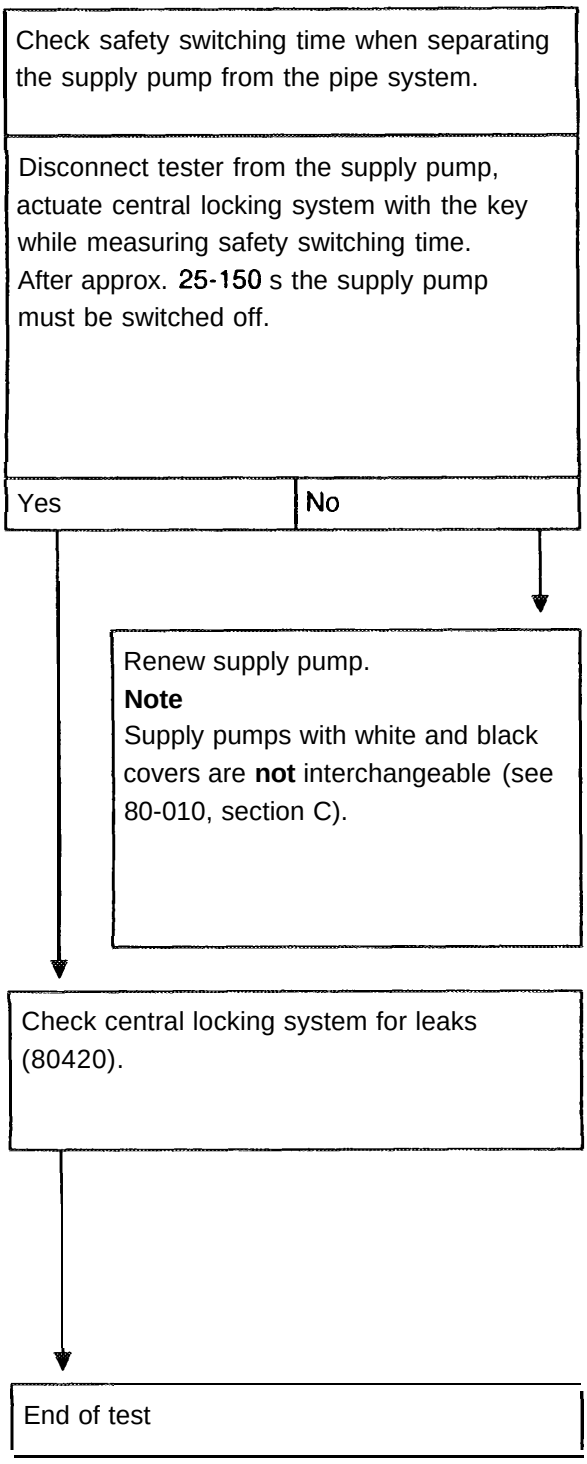
3 Connect tester for vacuum and pressure systems with tank to the supply pump (M14/1).

Note

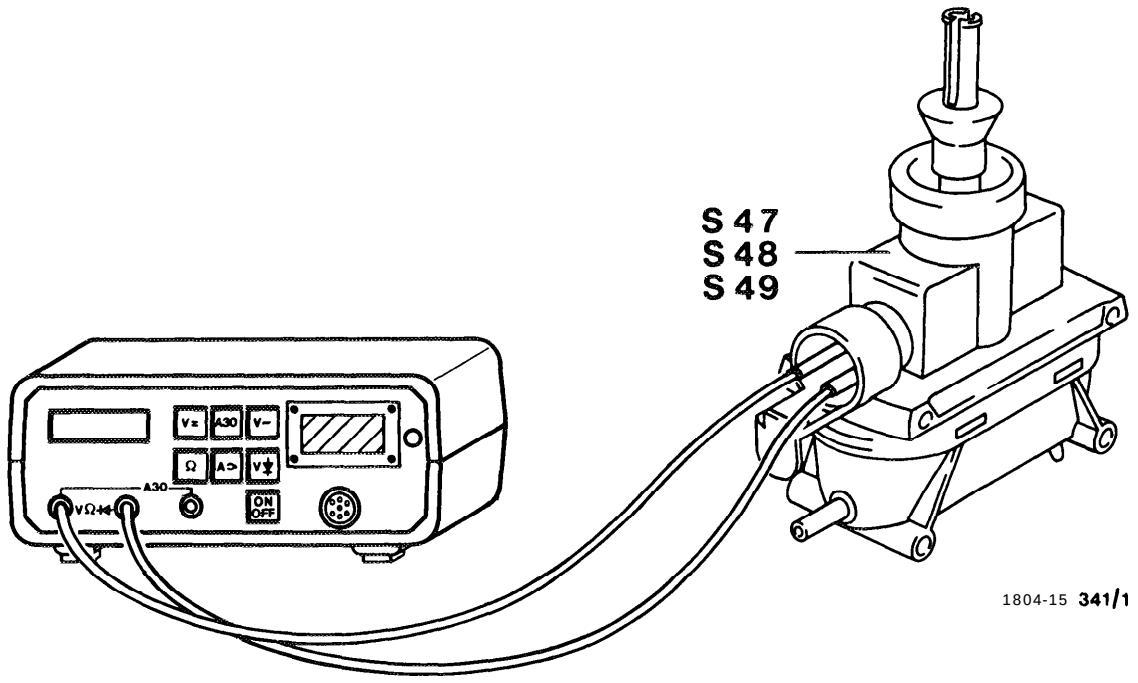
On the supply pump with pneumatic connection for orthopedic backrest, close the connection with plug part No. 000 987 11 45.

Test


Check vacuum of the central locking system during locking.
Lock central locking system with the key while reading the max. vacuum value.
Nominal value: > 420 mbar vacuum in ≤ 3 s
Yes
No
Renew supply pump.
Note
Supply pumps with white and black covers are not interchangeable (see 80-010, section C).
Check pressure of the supply pump during unlocking.
Connect pneumatic pipe to the pressure connection on the tester (yellow).
Unlock central locking system with the key while reading the max. pressure.
Nominal value: > 420 mbar pressure in ≤ 3 s
Yes
No
Renew supply pump.
Note
Supply pumps with white and black covers are not interchangeable.


Check safety switching time when separating the supply pump from the pipe system.
Disconnect tester from the supply pump, actuate central locking system with the key while measuring safety switching time. After approx. 25-150 s the supply pump must be switched off.
Yes
No
Renew supply pump.
Note
Supply pumps with white and black covers are not interchangeable (see 80-010, section C).
Check central locking system for leaks (80420).
End of test

80-112 Checking electrical function of the control and working element



Test preparation	Items 1-3
Locking function of the control and working element	Check
Opening function of the control and working element	Check
Voltage supply to the control and working element	Check

Commercially available tool

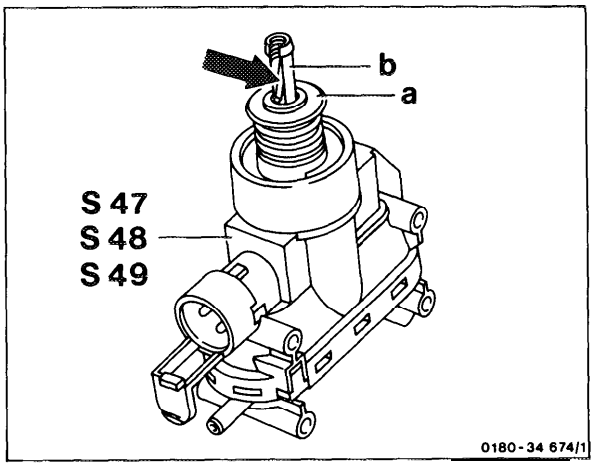
Digital multimeter	e.g. SUN, DMM-5

Test preparation

1 Remove control and working element (80-215).

2 Disconnect electrical cable harness and pneumatic pipe.

3 Slide sliding sleeve (a) over the control rod attachment (b) while pushing the sliding sleeve lock (arrow) if required.



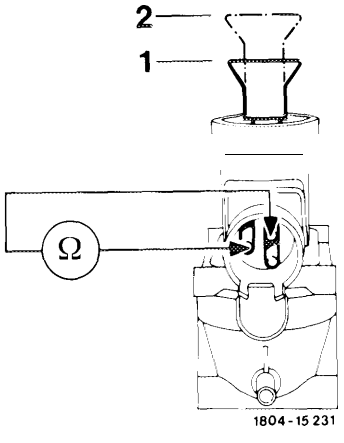
Test

Check locking function of the control and working element.

For the resistance measurement, connect the digital multimeter to the element as shown in the figure.

Nominal value in position 1 ≤ 0.5 Ω
Nominal value in position 2 = ∞ Ω

Both nominal values in order	One nominal value not in order



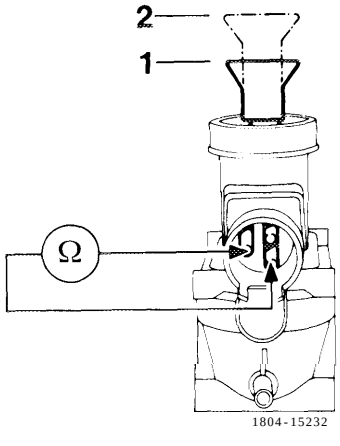
Renew element.

Check opening function of the control and working element.

For resistance measurement, connect digital multimeter to the element as shown in the figure.

Nominal value in position 1 = ∞ Ω
Nominal value in position 2 ≤ 0.5 Ω

Both nominal values in order	One nominal value not in order

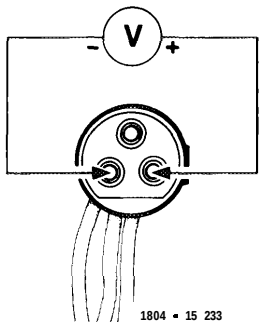


Renew element.

Check voltage supply of the control and working element.

Connect digital multimeter to the electrical cable harness as shown in the figure (ignition key on the steering lock removed).

Nominal value: battery voltage > 10 V.



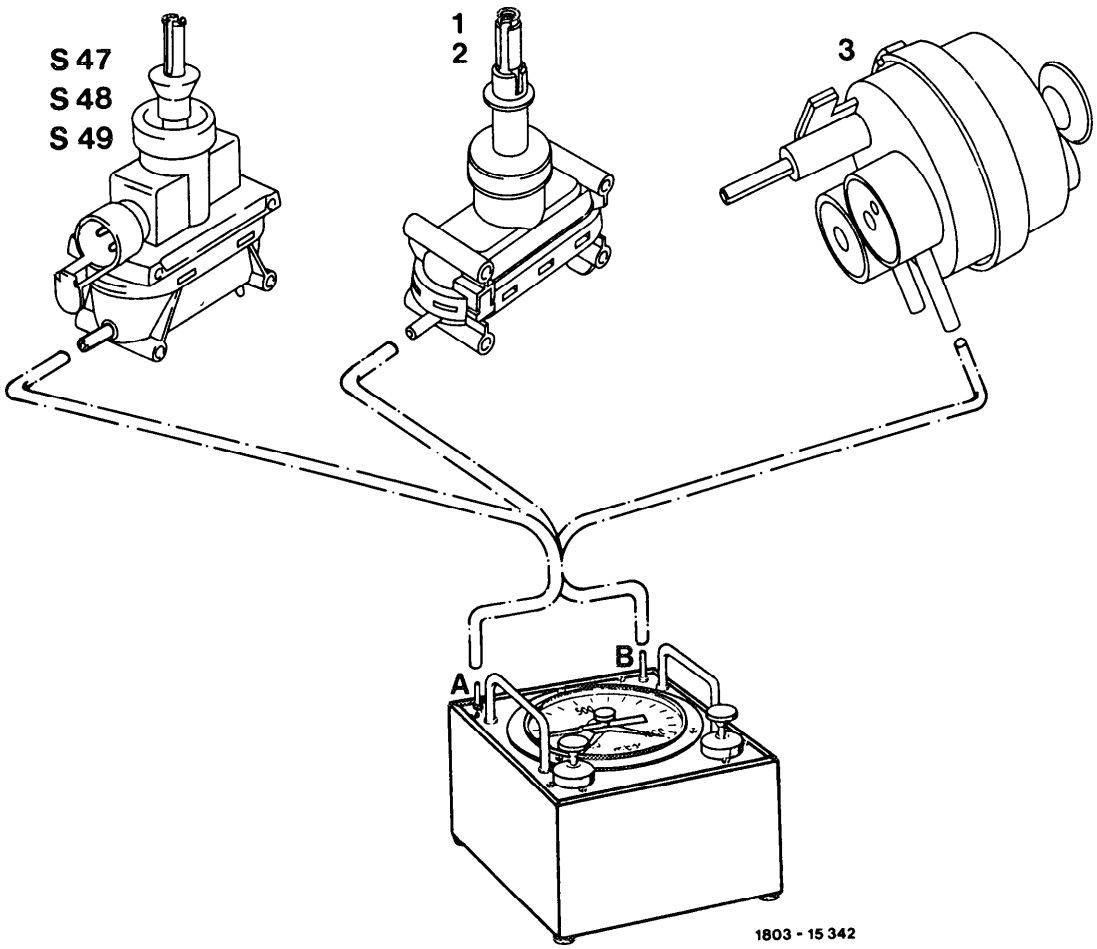
Yes	No

1 Check contacts of connectors.
2 Check cable, terminal 30 (red), ground wire (brown) warning buzzer contact S8 ‘2 and its ground cable (brown) for continuity according to wiring diagram (80-800). Repair or renew cable harness if required.

1 Check contacts of the connectors.
2 Check control cable (driver’s door blue, front passenger door green, trunk lid yellow) for continuity according to the wiring diagram (80-800).
Repair or renew cable harness if required.

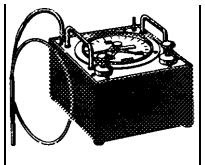
End of test

80-116 Checking pneumatic function of the element



Test preparation	Items l-4
Checking the element for leaks in the pressure mode	Permissible leakage rate per minute at 600 mbar pressure = 30 mbar.
Checking leakage rate of the element in the vacuum mode	Permissible leakage rate per minute at 300 mbar vacuum = 30 mbar.

Special tool

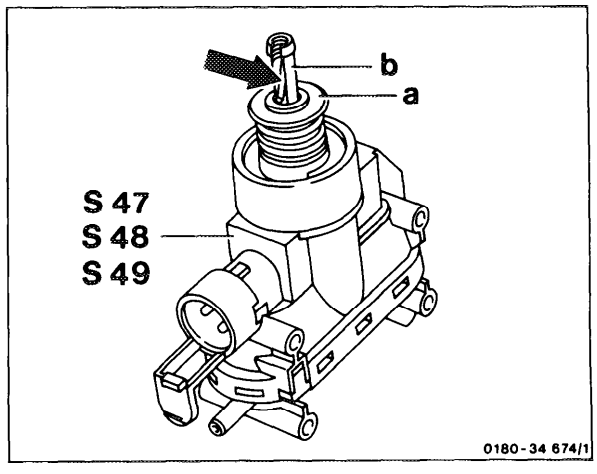


201 589 13 21 00

Part required for the test	Part No.
Cap	000 987 11 45

Test preparation

1 Remove element (80-215, 80-220, 80-230).
2 Disconnect electrical cable harness and pneumatic pipe.
3 Slide sliding sleeve (a) over the control rod attachment (b) while pushing the sliding sleeve lock (arrow) if required.
4 Connect tester for vacuum and pressure systems to the pneumatic connection of the element.



Note

On elements with two pneumatic connections, close one connectron with cap 000 987 11 45.

Test

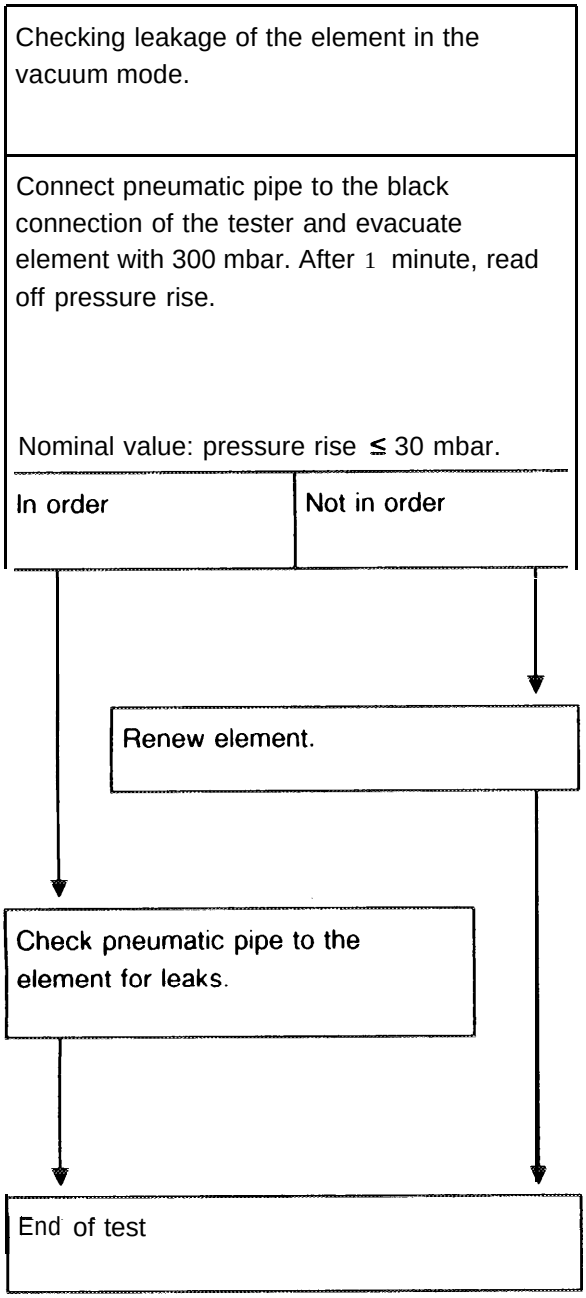
Check leakage of the element in the pressure mode.

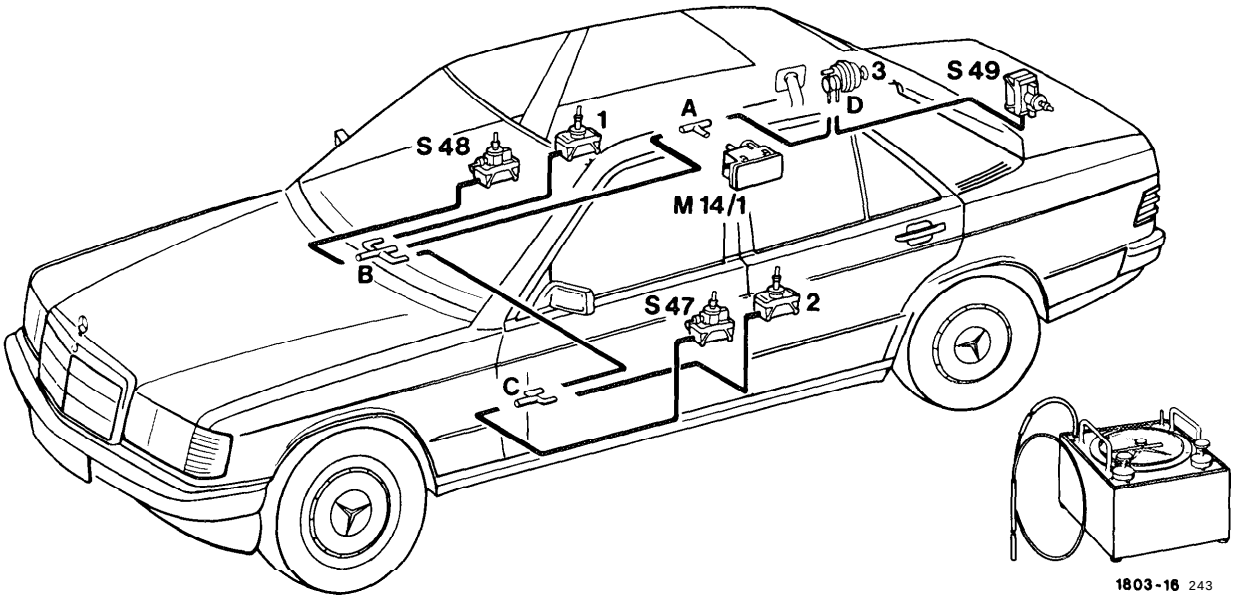
Connect pneumatic pipe to the yellow connection of the tester and apply a pressure of 600 mbar to the element. After 1 minute, read off pressure drop.

Nominal value: pressure drop ≤ 30 mbar.

In order	Not in order

Renew element.


Checking leakage of the element in the vacuum mode.
Connect pneumatic pipe to the black connection of the tester and evacuate element with 300 mbar. After 1 minute, read off pressure rise.
Nominal value: pressure rise ≤ 30 mbar.
In order
Not in order
Renew element.
Check pneumatic pipe to the element for leaks.
End of test



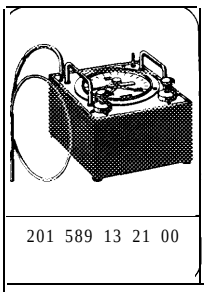
Connection of distribution fitting	Items to be tested	Subsequential test or remedy for leaks
A	Entire system	Check pipes to the passenger compartment or to the trunk for leaks.
	Elements and pneumatic pipes in the passenger compartment.	Check distribution fitting B for leaks.
	Elements and pneumatic pipes in the trunk.	Check distribution fitting or connection fitting D for leaks.

B	Pneumatic pipe to the distribution fitting A.	Repair or renew.
	S48 control and working element driver's door right with connection fitting and pneumatic pipe.	Check pipe, connection fitting and element individually for leaks. Repair or renew defective parts.
	Rear door right element 1 with connection fitting and pneumatic pipe.	Check pipe, connection fitting and element individually for leaks. Repair or renew defective parts.
	Elements and pneumatic pipes in the passenger compartment left.	Check distribution fitting **C** for leaks.
C	Pneumatic pipe to the distribution fitting **B**.	Repair or renew.
	S47 control and working element driver's door left with connectron fitting and pneumatic pipe.	Check pipe, connection fitting and element individually for leaks. Repair or renew defective parts.
	Left rear door element 2 with connection fitting and pneumatic pipe.	Check pipe, connection fitting and element individually for leaks. Repair or renew defective parts.
D	Pneumatic pipe to the distribution fitting A.	Repair or renew.
	S49 control and working element trunk lid with pneumatic pipe and connection fitting.	Check pipe, connection fitting and element individually for leaks. Repair or renew defective parts.
	Tank flap element 3.	Renew.

Data

Permissible leakage rate per minute of the entire system and elements at 600 mbar pressure and at 300 mbar vacuum	mbar	30
Permissible leakage rate per minute of individual pipes at 600 mbar pressure	mbar	0
Connection overlap length of the connection and distribution fittings	mm	12 ± 2

Special tool



201 589 13 21 00

Part required for the test	Part No.
Cap	**000 987** 11 **45**

Note

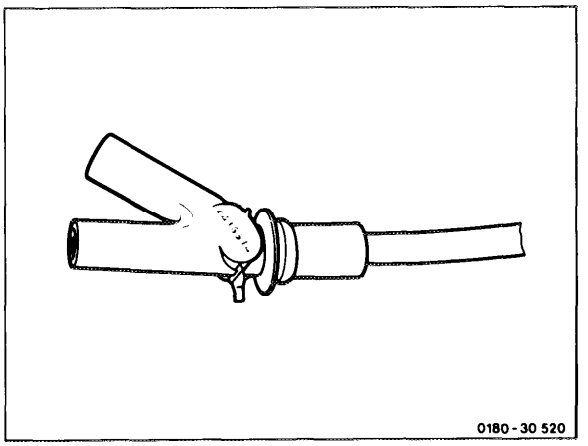
If not all elements work properly although no leaks could be detected, check the pipes, distribution and connection fittings concerned for kinks and free passage.

When conducting the leak test on individual pipes, connect the tester to one end of the pipe and close the other end of the pipe with the cap 000 987 11 **45.**

The following test can be applied to all points of the above list.

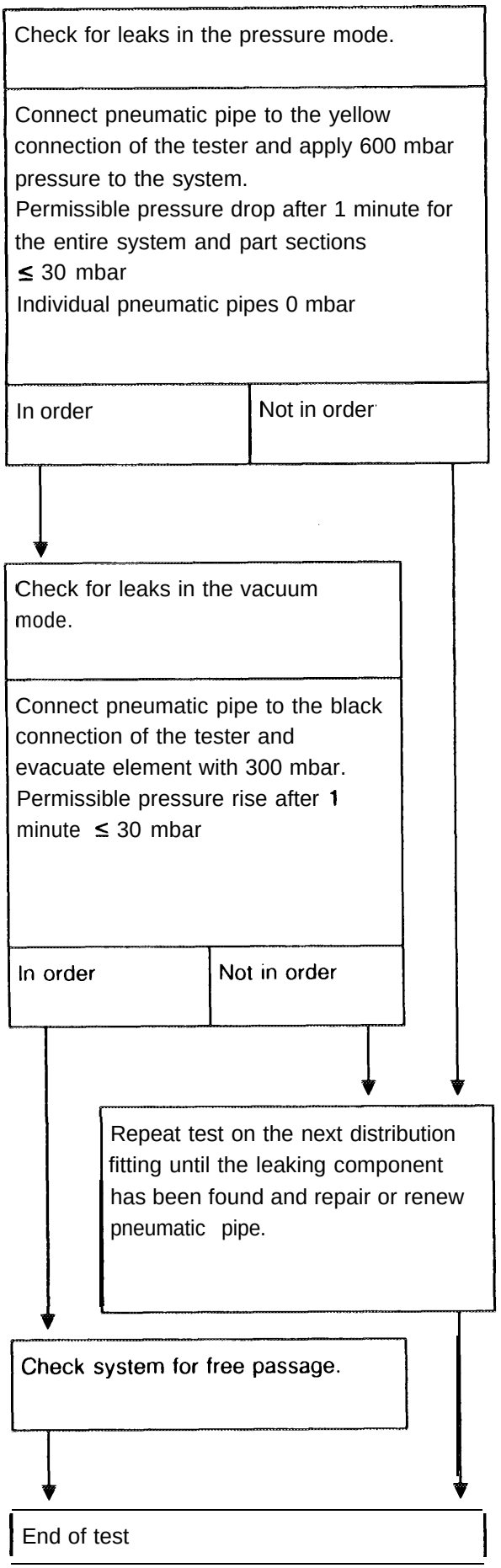
Test preparation

Connect tester for vacuum and pressure systems to distribution fitting or pneumatic pipe.

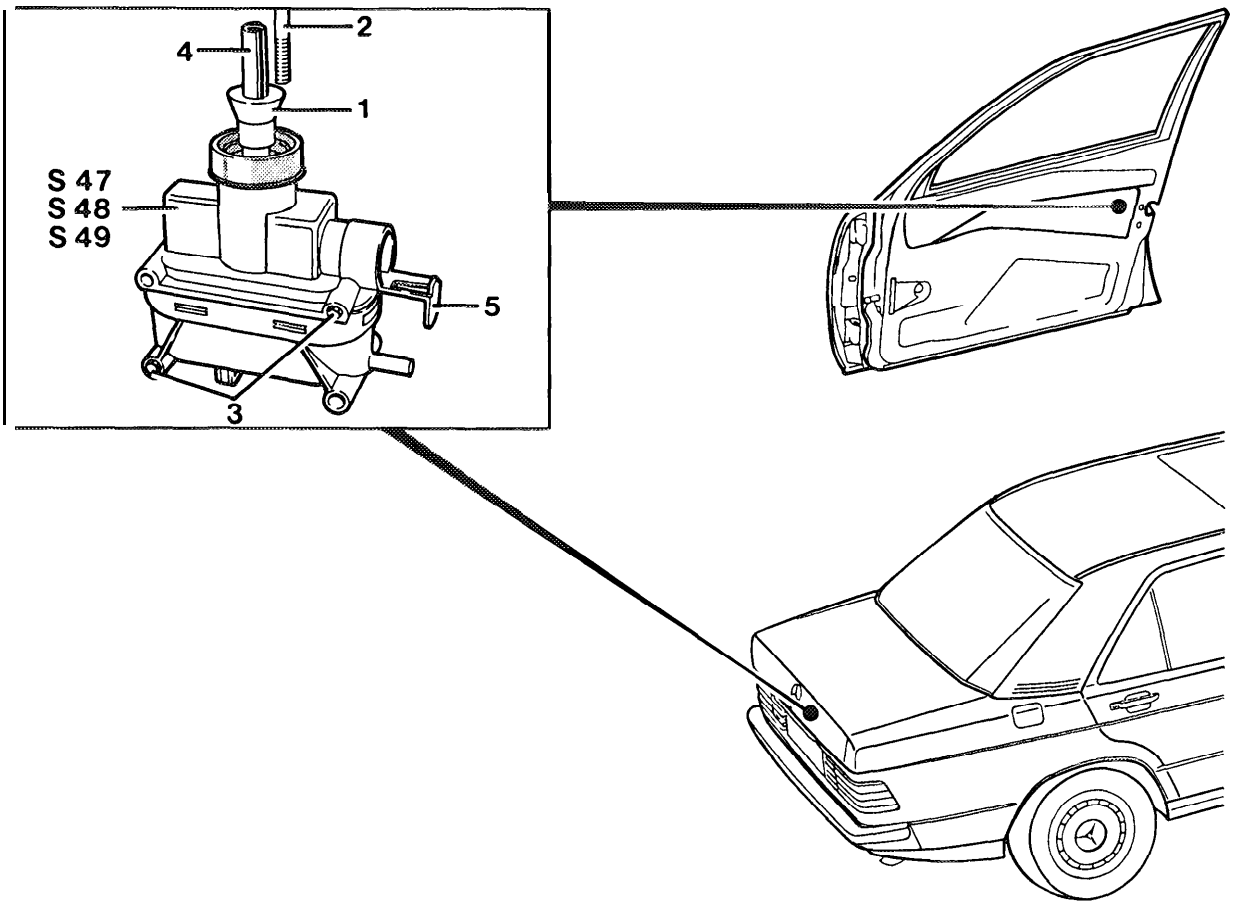


0180-30 520

Test


Check for leaks in the pressure mode.
Connect pneumatic pipe to the yellow connection of the tester and apply 600 mbar pressure to the system.
Permissible pressure drop after 1 minute for the entire system and part sections
≤ 30 mbar
Individual pneumatic pipes 0 mbar
In order
Not in order
Check for leaks in the vacuum mode.
Connect pneumatic pipe to the black connection of the tester and evacuate element with 300 mbar.
Permissible pressure rise after 1 minute ≤ 30 mbar
In order
Not in order
Repeat test on the next distribution fitting until the leaking component has been found and repair or renew pneumatic pipe.
Check system for free passage.
End of test

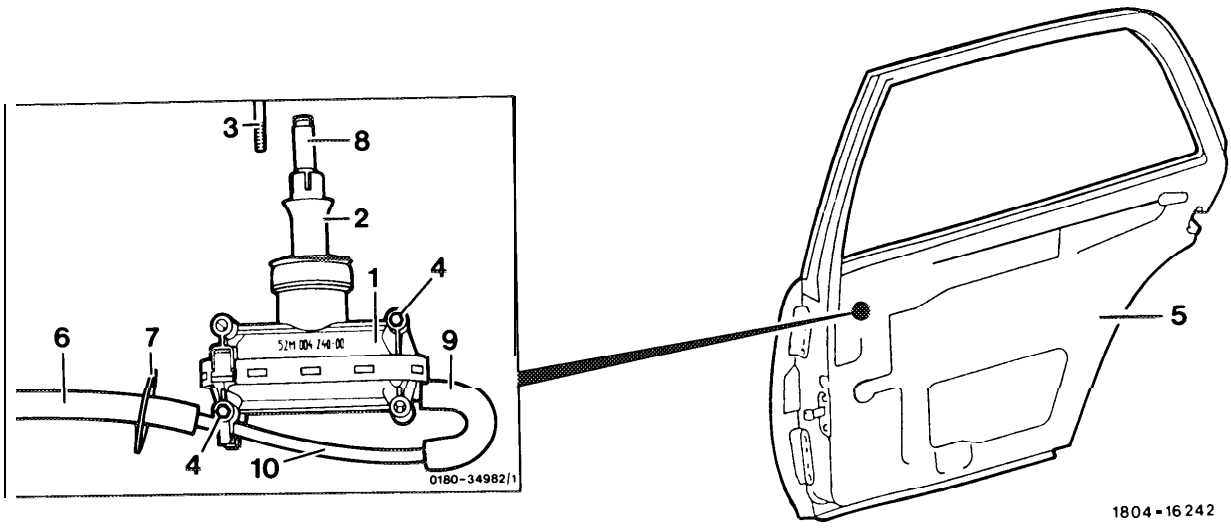
80-215 Removal and installation of control and working element (S47, S48, S49)



Door lining	Remove (not with control and working element trunk lid lock).
Sliding sleeve (1)	Push back.
Control rod (2)	Push out.
Screws (3)	Loosen.

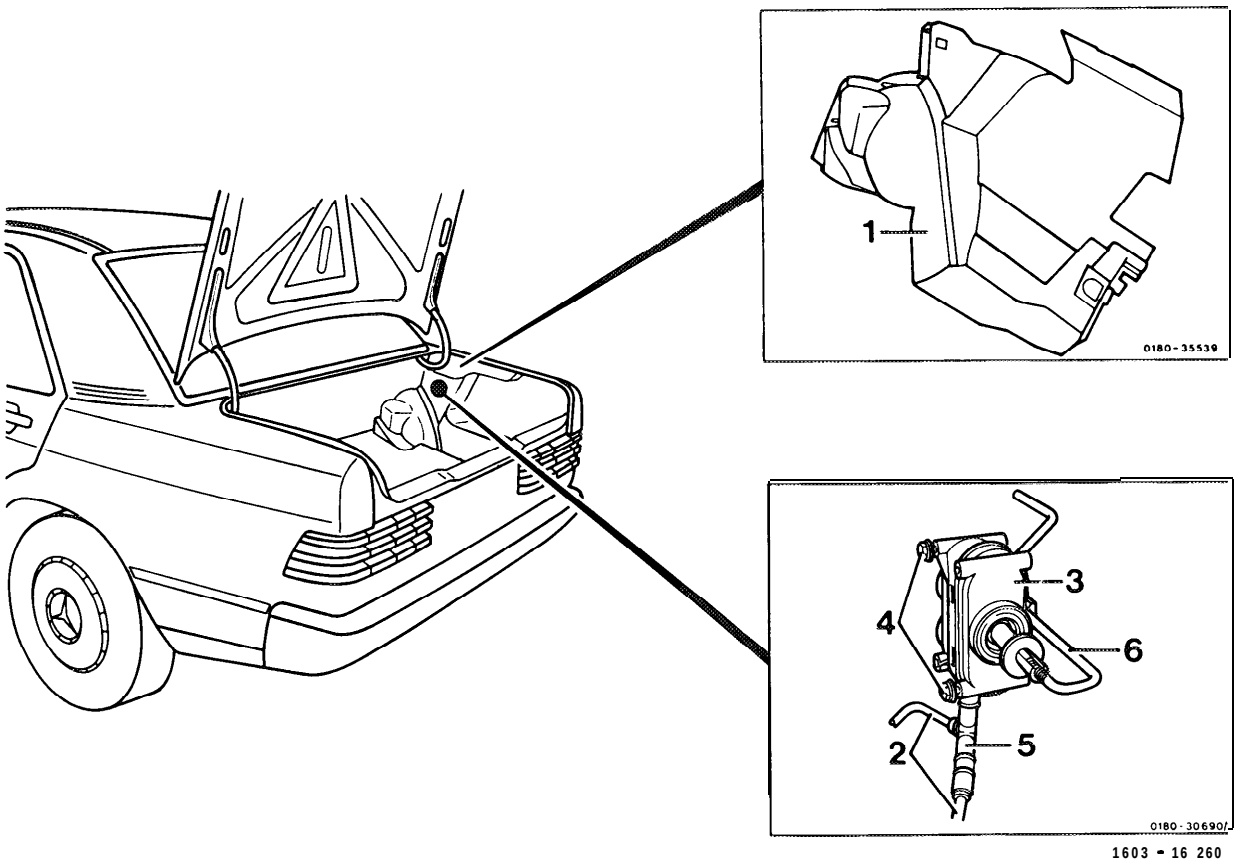
Control and working element (S47, S48, S49) . . .	Disconnect.
Tension unloading lever (5)	Push away.
Electrical cable and pneumatic pipe	Pull off.
Electric or pneumatic function of the control and working element (S47, S48, S49)	Check (80-l 12) and (80-l 16).
Bring control and working element (S47, S48, S49) in installation position	Push sliding sleeve (1) fully back and pull control rod attachment (4) out until it engages. On the control and working element for the trunk lid lock (S49), push control rod (2) fully away from the element.
Element in reverse order	Install.

80-220 Removal and installation of fear door element



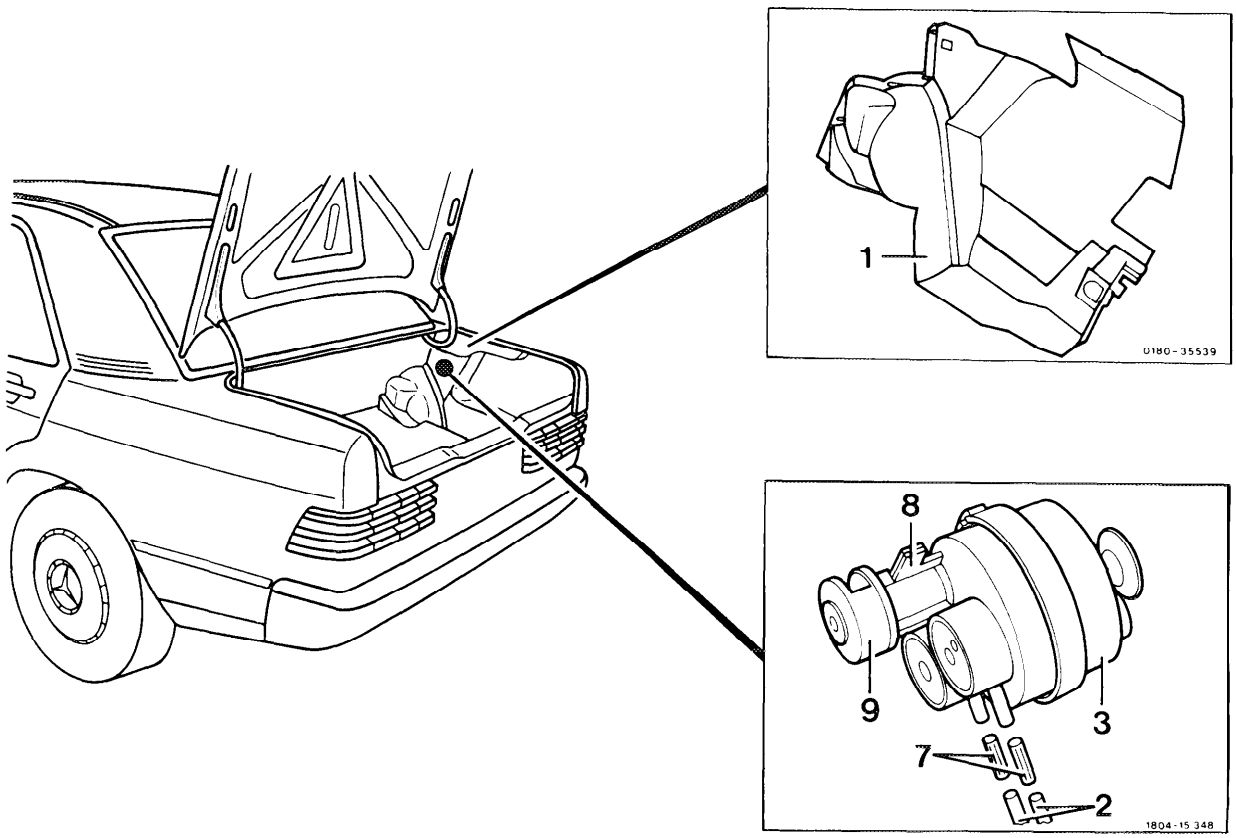
Door lining (5)	Remove.
Sliding sleeve (2)	Push back.
Control rod (3)	Push out.
Screws (4)	Loosen.
Element (1)	Disconnect.
Pneumatic pipe (6)	Pull off.
Pneumatic pipe (10) and shaped hose (9)	Check for damage.
Pneumatic function of the element (1)	Check (80-l 16).
Element (1)	Bring in installation position. Fully push back sliding sleeve (2) and pull control rod attachment (8) out until it engages.
Element (1)	Install in reverse order.
Rubber washer (7)	Shift up to the opening for the protective hose in the rear door.

A. 1st and 2nd version (up to approx. 03/87)



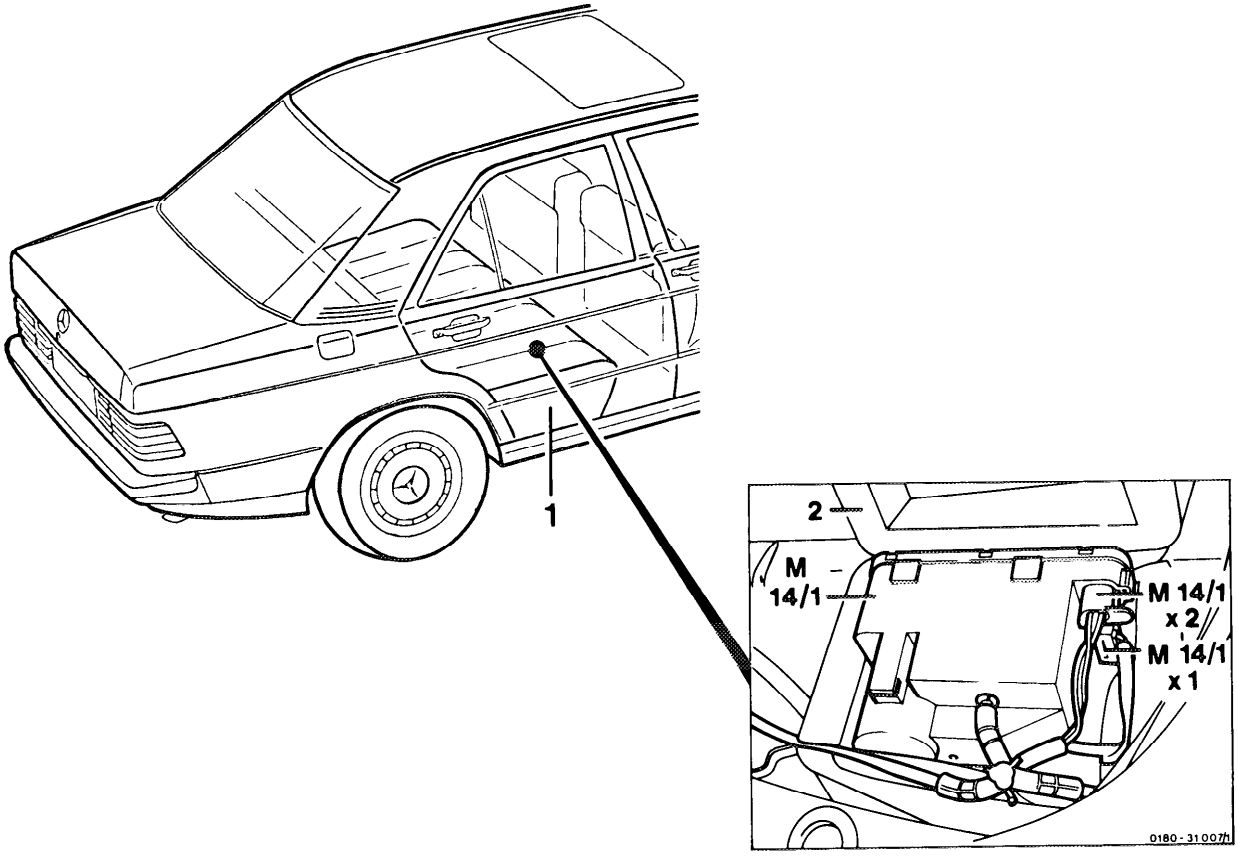
Lining (1) in the right trunk	Remove, install.
Pneumatic pipes (2)	Pull off, fit.
Screws (4)	Loosen, secure.
Distribution fitting (5)	Check for damage.
Pneumatic function of the element (3)	Check (80-l 16).
Control rod (6)	Adjust, until the tip is at the same level as the control rod guide.

B. 3rd version (as of approx. 04/87)



1803-16 279

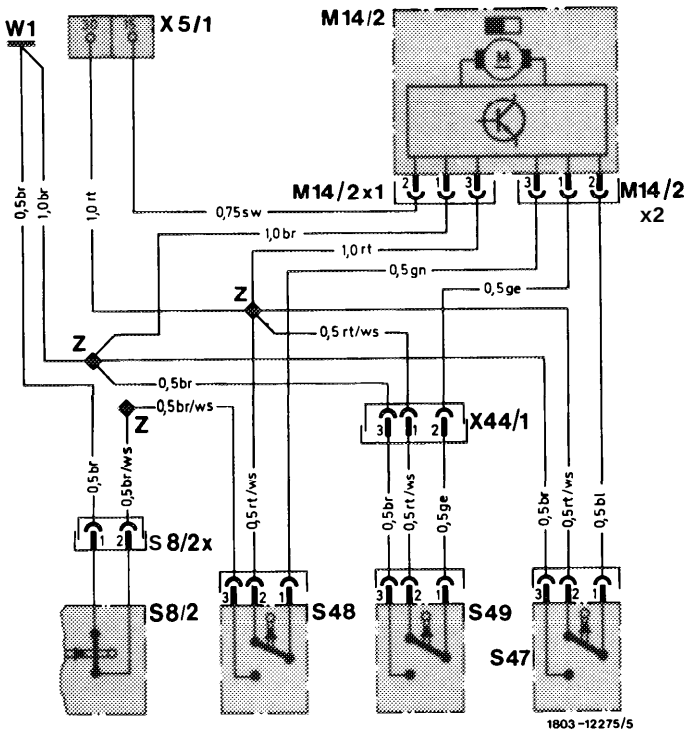
Lining (1) in the trunk right	Remove, install.
Pneumatic pipes (2)	Pull off, fit.
Connection fittings (7)	Check for damage.
Attaching strap (8)	Push away for removal.
Pneumatic function of the element (3)	Check (80-I 16).
Element (3)	For installation engage in guide sleeve (9).



1804 -16 246

Rear seat cushion (1)	Remove.
Foam material cube (2)	Pull out of trough and open.
Supply pump (M14/1)	Remove.
Pneumatic pipes or electrical cables	Pull off.
Electric function of the central locking system and pneumatic function of the supply pump	Check (80-104 and 80-108).
Supply pump (M14/1)	Install in reverse order.

A. As of 09/84 to approx. 04/85



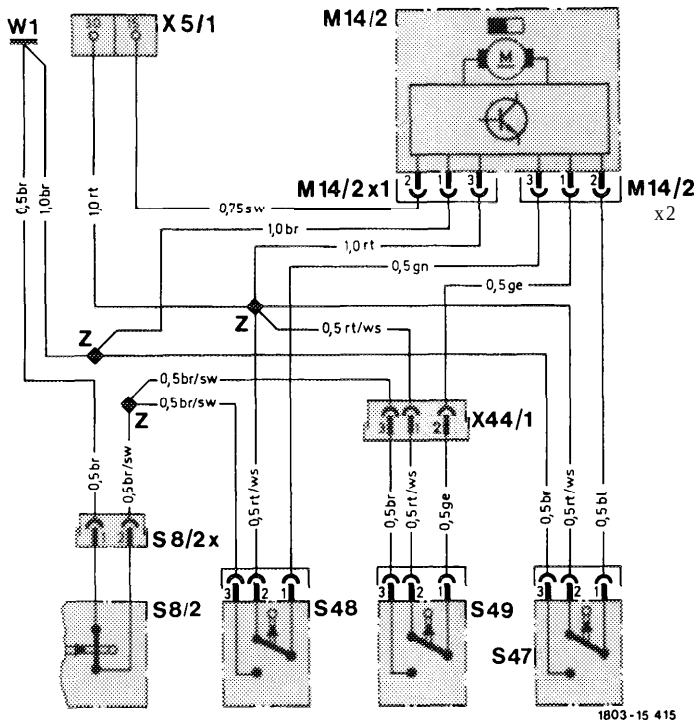
M14/2	Supply pump central locking system with orthopedic front seat back
M14/2x1	Connector, voltage supply, supply pump, central locking system with orthopedic front seat back
M 14/2x2	Connector, control cable, supply pump, central locking system with orthopedic front seat back (where applicable, EDW cable harness with Intermediate contact)
S8/2	Warning buzzer contact lighting/central locking system
S8/2x	Connector, warning buzzer contact lighting/central locking system
s47	Control and working element, driver's door left [1]
S48	Control and working element, driver's door right [1]
s49	Control and working element, trunk lid lock
W1	Main ground (behind Instrument cluster)
x5/1	Terminal block interior
x44/1	Connector, central locking system/trunk lid lock
Z	Connector sleeve (solder joint in harness)

[1] On RHD vehicle, cable connection S47 similar to S48 and S48 similar to S47

Note

Black cable from M14/2x1 jack 2 to X5/1 terminal 15 is only installed with orthopedic backrest.

B. As of approx. 05/85 to approx. 03186



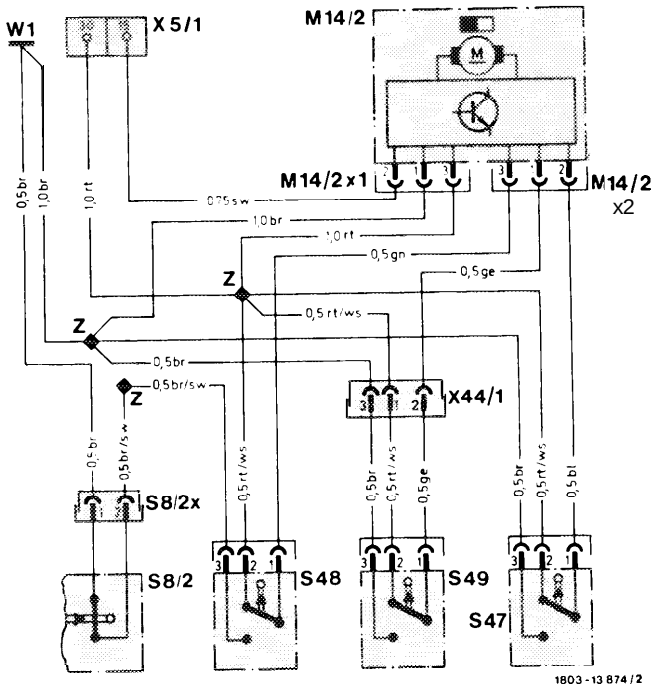
M14/2	Supply pump central locking system with orthopedic front seat back
M14/2x1	Connector, voltage supply, supply pump, central locking system with orthopedic front seat back
MI 4/2x2	Connector, control cable, supply pump, central locking system with orthopedic front scat back (where applicable, EDW cable harness with Intermediate contact)
S8/2	Warning buzzer contact lighting/central locking system
S8/2x	Connector, warning buzzer contact lighting/central locking system
s47	Control and working element, driver's door left [1])
S48	Control and working element, driver's door right [1])
s49	Control and working element, trunk lid lock
W1	Main ground (behind instrument cluster)
X5/1	Terminal block interior terminal 15/30
x44/1	Connector, central locking system/trunk lid lock
Z	Connector sleeve (solder joint in harness)

[1]) On RHD vehicle, cable connection S47 similar to S48 and S48 similar to S47

Note

Black cable from M14/2x1 jack 2 to X5/1 terminal 15 is only installed with orthopedic backrest.

C. As of approx. 04/86



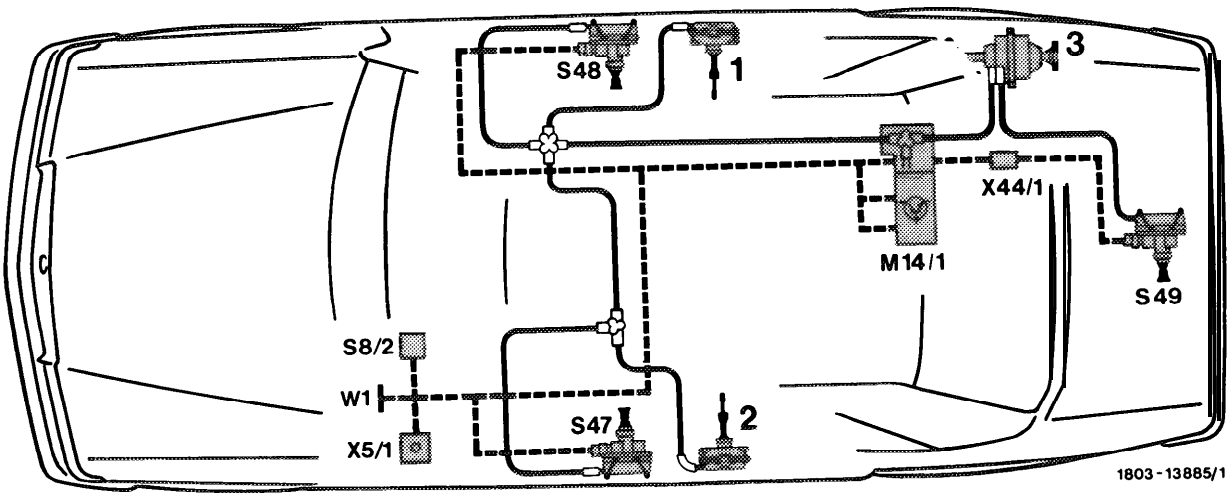
M14/2	Supply pump central locking system with orthopedic front seat back
M14/2x1	Connector, voltage supply, supply pump, central locking system with orthopedic front seat back
M14/2x2	Connector, control cable, supply pump, central locking system with orthopedic front seat back (where applicable, EDW cable harness with Intermediate contact)
S8/2	Warning buzzer contact lighting/central locking system
S8/2x	Connector, warning buzzer contact lighting/central locking system
s47	Control and working element, driver's door left [1])
S48	Control and working element, driver's door right [1])
s49	Control and working element trunk lid lock
W1	Main ground (behind instrument cluster)
X5/1	Terminal block interior terminal 15/30
x44/1	Connector, central locking system/trunk lid lock
Z	Connector sleeve (solder joint in harness)

[1]) On RHD vehicle, cable connection S47 similar to S48 and S48 similar to S47

Note

Black cable from M14/2x1 jack 2 to X5/1 terminal 15 is only installed with orthopedic backrest.

A. LHD vehicle

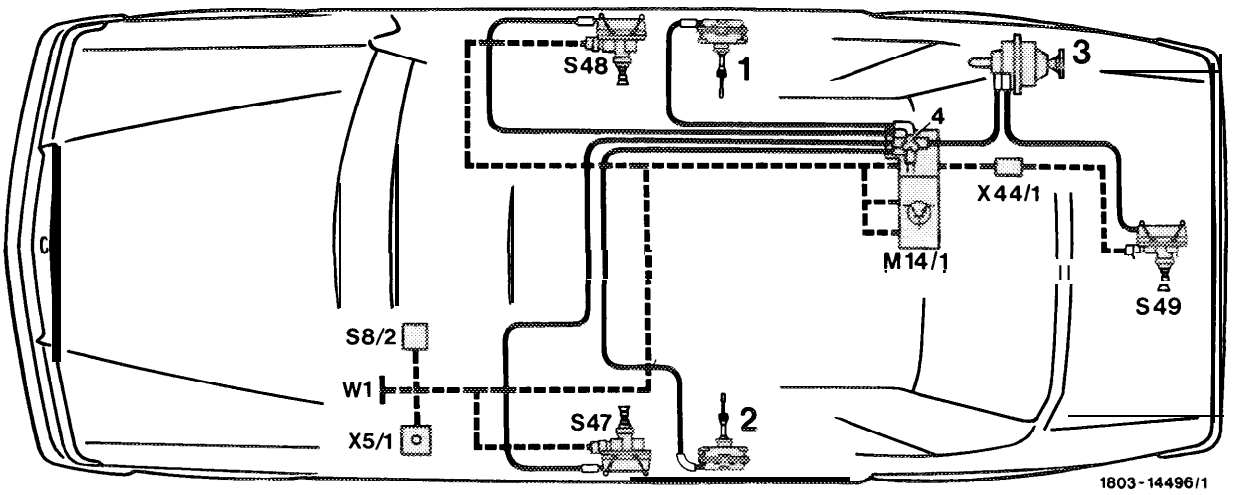


1	Element, rear door right
2	Element, rear door left
3	Element, tank flap
M14/1	Supply pump central locking system
S8/2	Warning buzzer contact lighting/central locking system
s47	Control and working element, driver's door left
S48	Control and working element, driver's door right
s49	Control and working element, trunk lid lock
W1	Main ground (behind instrument cluster)
x5/1	Connector, interior, terminal 15/30
x44/1	Connector, central locking system/trunk lid lock
- - - -	Electrical cable
——	Pneumatic pipe

C. "Spider cable harness"

Production breakpoint:

Vehicle ident end No.	
as of	up to
A 326859	A 329516



1	Element, rear door nght
2	Element, rear door left
3	Element, tank flap
4	6-fold distribution fitting
M14/1	Supply pump central locking system
S8/2	Warning buzzer contact lighting/central locking system
s47	Control and working element, driver's door left
S48	Control and working element, driver's door right
s49	Control and working element, trunk lid lock
W1	Main ground (behind instrument cluster)
X5/1	Connector, interior
x44/1	Connector, central locking system/trunk lid lock
_ _ _ _	Electrical cable
——	Pneumatic pipe

Job No.

Lamps
- Removal and installation of dome lamps front and rear 82-010
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- Removal and installation of switch for electrical sea adjustment 865

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- Operation of anti-theft warning system (EDW) **980**
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  - b) Electrical wiring diagrams .....
  - c) Switching system on and off .....
  - d) Layoutofcomponents .....

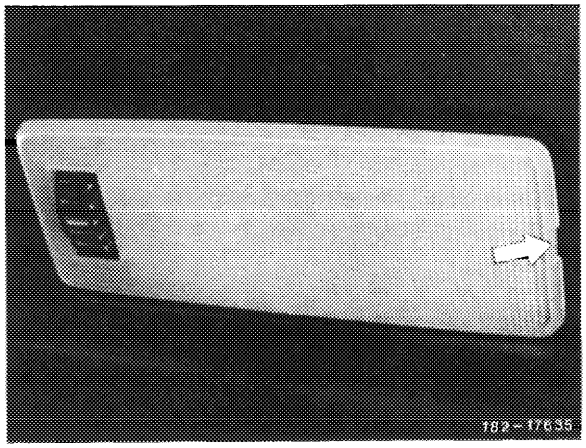
Dome lamp front

Removal

1 Disengage holding spring of dome lamp at recess.

2 Slightly pull out dome lamps and remove toward the right.

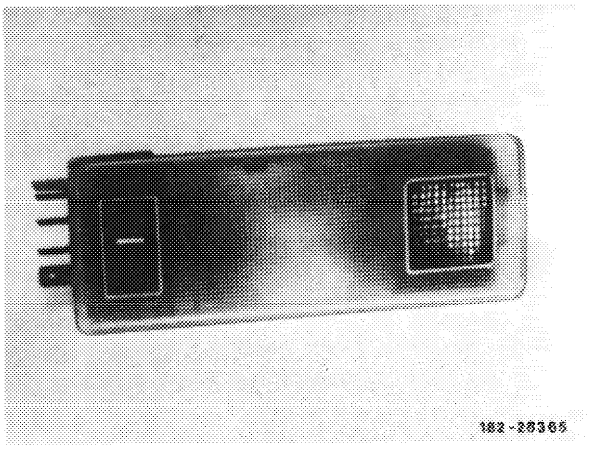
3 Pull off electrical connections.



Installation

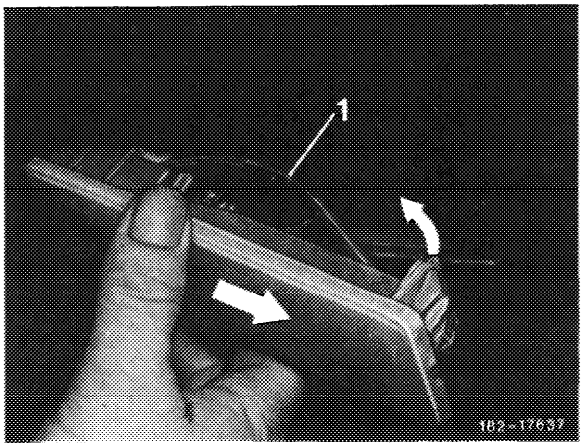
4 For installation proceed vice versa.

Note: The dome lamp of model 201.034 is equipped with an electronic cutout delay, a reading lamp is also installed, The time delay switch is installed in dome lamp. It cannot be separately replaced. After approx. 6 seconds the light is automatically switched off after the driver's door has been closed.



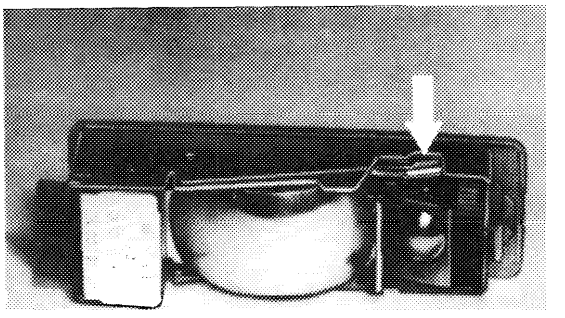
Renewing bulbs

Swing out reflector (1) and remove bulb.



Reading lamp: model 201.034

Push contact rail in direction of arrow, rotate lamp, so that the bulb can drop out.



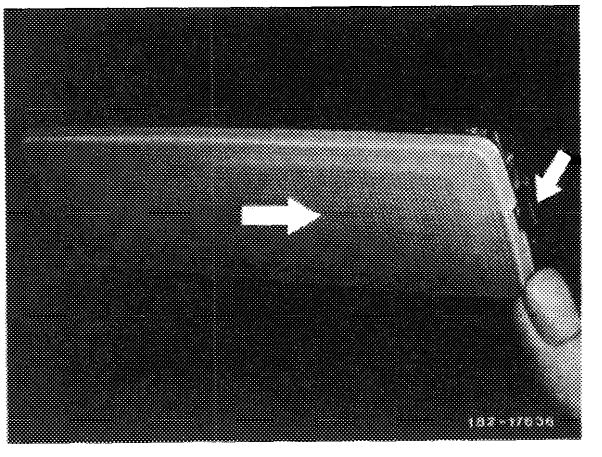
182-28368

Dome lamp rear

Removal

4 Disengage holding spring of dome lamp at recess. Slightly pull out dome lamp and remove toward the right.

5 Pull off electrical connections.



Installation

6 For installation proceed vice versa.

Adjusting table (dimensions in cm for test area at a distance of 10 m from headlamps)

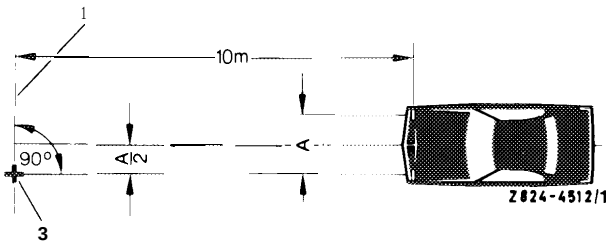
Type of vehicle	Load vehicle during adjustment as follows	Adjusting dimension "e" in cm	
		Main headlamps	Fog lamps
Passenger cars in which the upper reflector edge of headlamps is not more than 135 cm above vehicle base.	One person or 75 kg on driver's seat of the otherwise unloaded vehicle (curb weight*).	10	10

***) Curb weight is the weight of the vehicle ready for operation with completely filled, built-in fuel tank, including the weight of all the equipment carried along while driving (e.g. spare wheels and tires, replacement parts, tools, vehicle jack, fire extinguisher).**

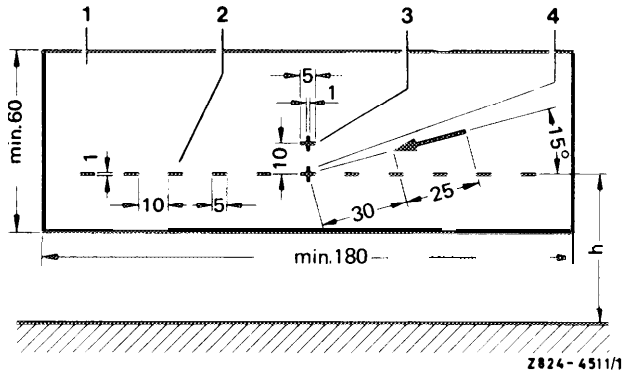
A. Preparations for adjustment

For adjusting headlamps, place vehicle on level ground. Even a slightly irregular surface under vehicle may falsify adjustments. Keep inflation pressure on all tires as specified. Load vehicle according to data in adjusting table and drive slowly on adjusting surface so that the spring adjustment will not change when the brakes are applied.

Adjust headlamps individually by switching off or covering the other headlamps. Whenever possible, make adjustments in a closed room, in a fairly dark environment, since the accuracy of the adjustment can be influenced by wind (movements of test surface) and by other light sources. Use a headlamp adjusting device whenever possible. Proceed accurately according to pertinent instructions. If no headlamp adjusting device is available, adjust by means of an adjustable, level test surface.



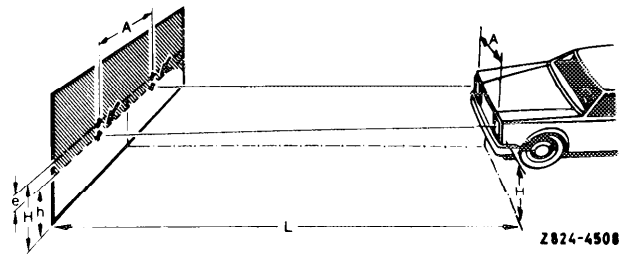
In an emergency, the test surface can also be drawn on a wall. The surface should be bright and provided with a central mark and a boundary line, in vertical relation to the vehicle longitudinal axis. For using the adjusting dimensions according to the adjusting table, the distance between the test surface and the headlamps to be adjusted should be 10 m.



Test surface
(dimensions in cm)

1 Test surface
2 Parting line
3 Central mark
4 Break
min. = minimum

At an incrased inclination of the light beam, e.g. on fog lamps, the distance should be 5 m; the specified adjusting dimensions are then cut to half. The central mark of the test surface should be located in the plane parallel to the vehicle longitudinal axis passing through the center of the headlamp to be adjusted. For each headlamp to be adjusted, the boundary line must be adjusted parallel to vehicle base and at height "h" above it.



To make sure that enough vacuum is available for beam range regulation, run engine for a short moment prior to adjusting headlamps, and establish a vacuum by accelerating several times for a few short moments. Then move regulating switch from "0" to "3" and check whether headlamps are adjusting. If headlamps are not adjusting, repair fault.

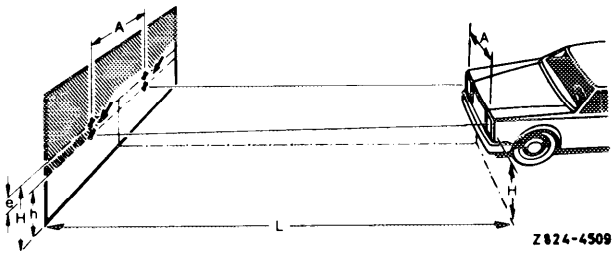
Check headlamp adjustment in basic position "0" of regulating switch and correct, if required.

Vehicles with level control

On vehicles with level control on rear axle, run engine at medium speed for approx. 30 seconds after mounting load and then permit vehicle to roll to a stop.

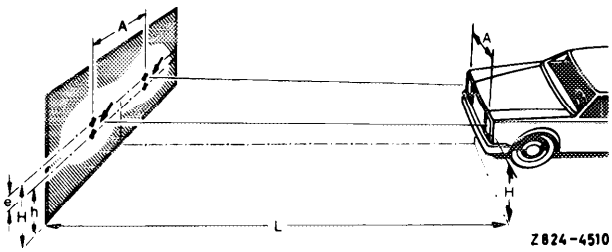
B. Main headlamps

The main headlamps are adjusted according to the asymmetric low beam. The light-dark boundary should touch the parting line to the left of center. The intersection between the lefthand (as much as possible horizontal) and the righthand rising portion of the light-dark boundary should be on the vertical line through the central mark. For easier determination of the point of intersection, the lefthand half may be alternately covered and uncovered several times.



The center of the high beam should be on the central mark. For headlamps on which the high beam and the low beam (dimmer) are adjusted together, deviations of 20 cm each of the right or left or of 15 cm up to 10 cm down are permitted.

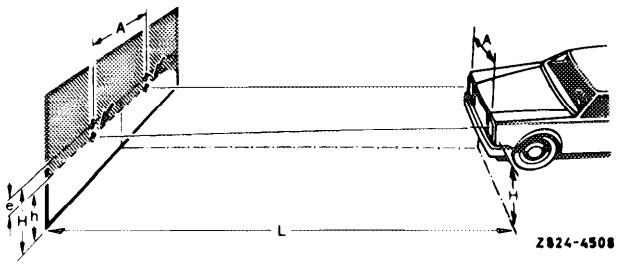
H = Height of headlamp center above base in cm
h = Height of parting line of test surface above base in cm
e = Adjusting dimension in cm (refer to adjusting table)
e = H - h



C. Fog lamps

On fog lamps the highest point of the light-dark boundary should touch the parting line and should run as horizontally as possible across the minimum width of the test surface. In lateral direction the fog lamps are adjusted in such a manner that the light distribution is as much as possible asymmetrical to the vertical line through the central mark.

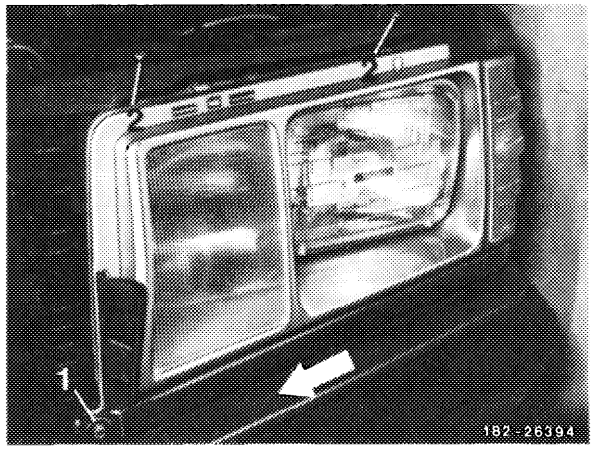
H = Height of headlamp center above base in cm
h = Height of parting line of test surface above base in cm
e = Adjusting dimension in cm (refer to adjusting table)
e = H - h



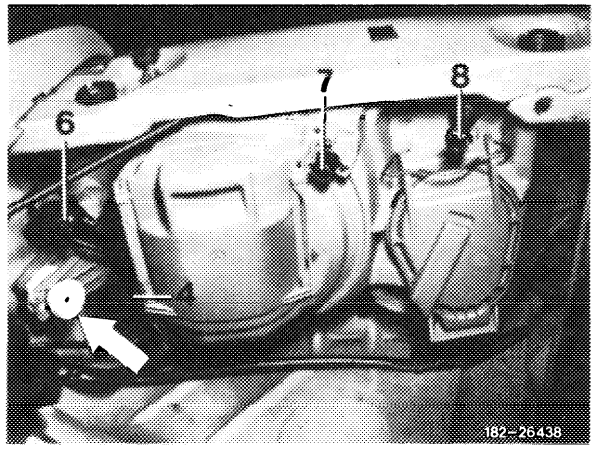
B. (USA)

Removal

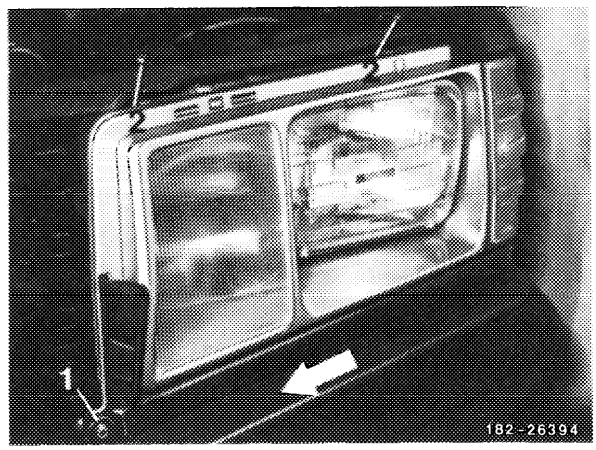
1 Unscrew cover (1) and remove in direction of arrow.



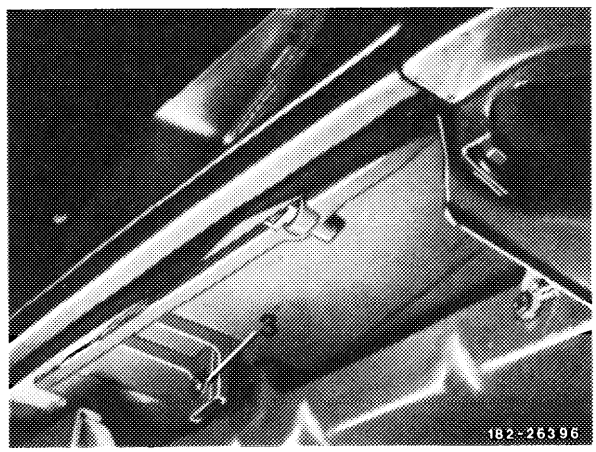
2 Unscrew knurled nut (arrow) of turnsignal lamp and slide turnsignal lamp out in forward direction.



3 Unscrew upper fastening (2).

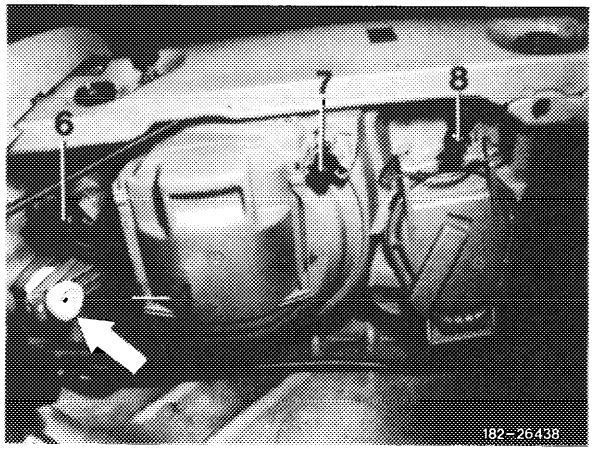


4 Unscrew lower fastening (3), remove lamp unit and pull off electrical connection.

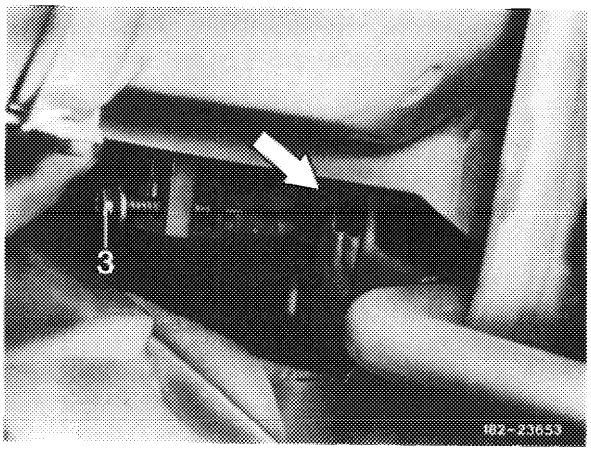


Installation

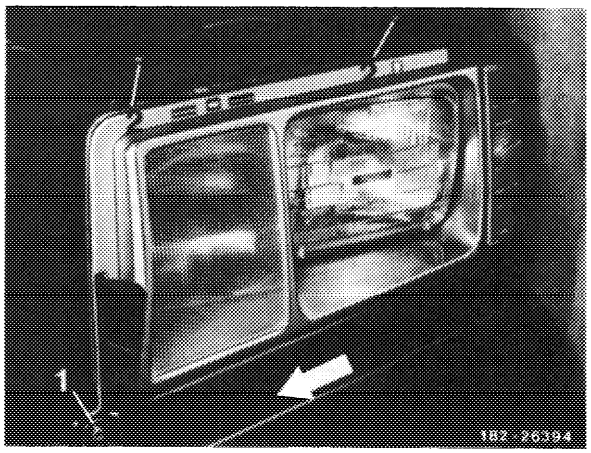
5 Plug-on electrical connection (4).



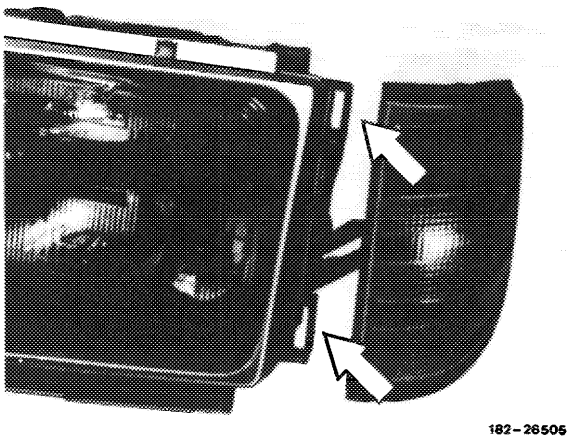
6 Introduce lower fastening into recess (arrow) and slightly tighten screw (3).



7 Position both upper screws (2) and tighten so that the lamp unit can still be moved.

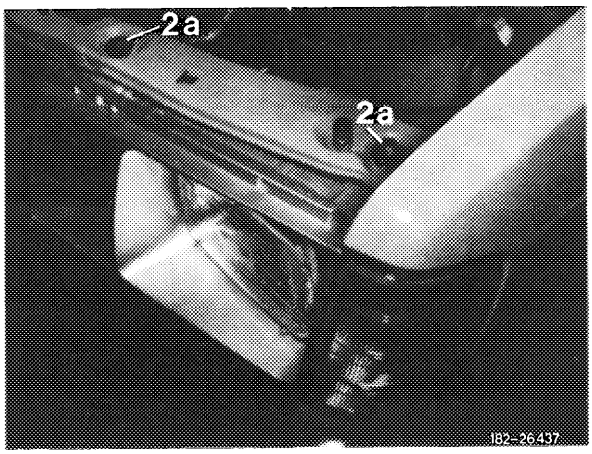


8 Install turnsignal lamp, making sure that the two lugs are slipped into guide (arrows).

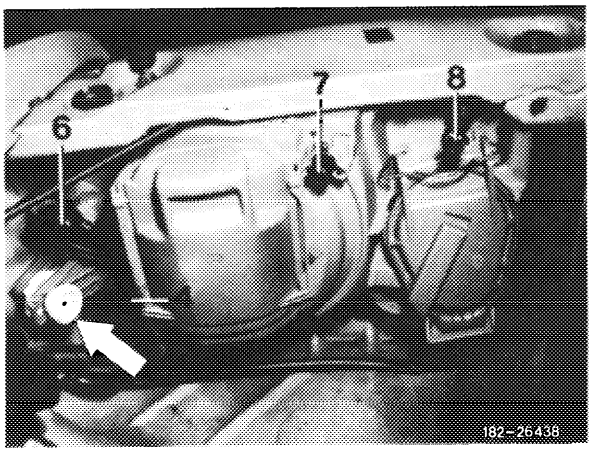


9 Close engine hood and adapt lamp unit in relation to engine hood and fender. Corrections in upward or downward direction can be made by means of plastic nuts (2a).

Tighten fastening screws at top and below.

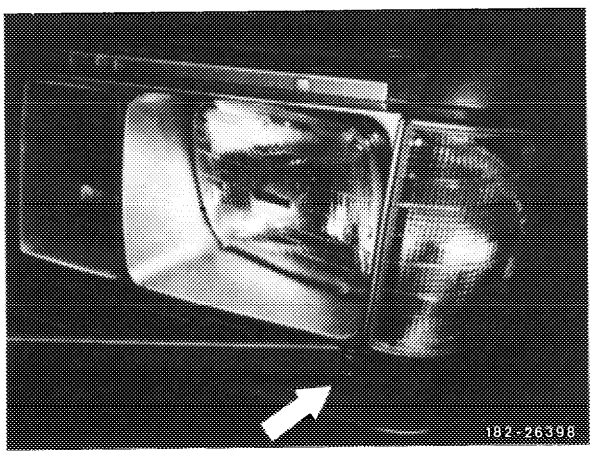


10 Check adjustment of headlamps and adjust, if required.



6 Adjusting screw for headlamp, left and right
7 Adjusting screw for headlamp, high and low
8 Adjusting screw for fog lamp, high and low

11 Engage cover on outside (arrows) and screw down.

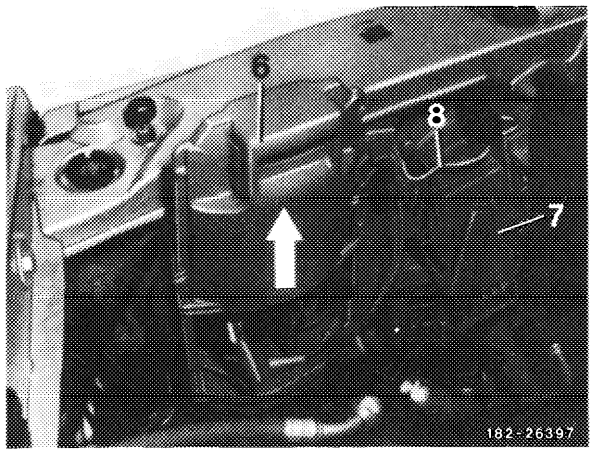


B. (USA) (sealed beam unit)

Removal

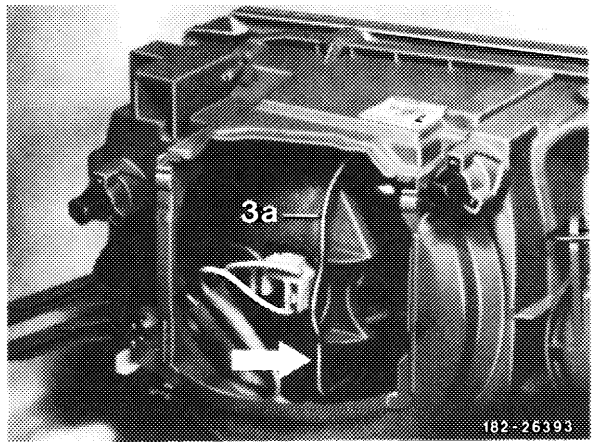
Main headlamp with bulb

1 Remove cover **(6)** in upward direction.

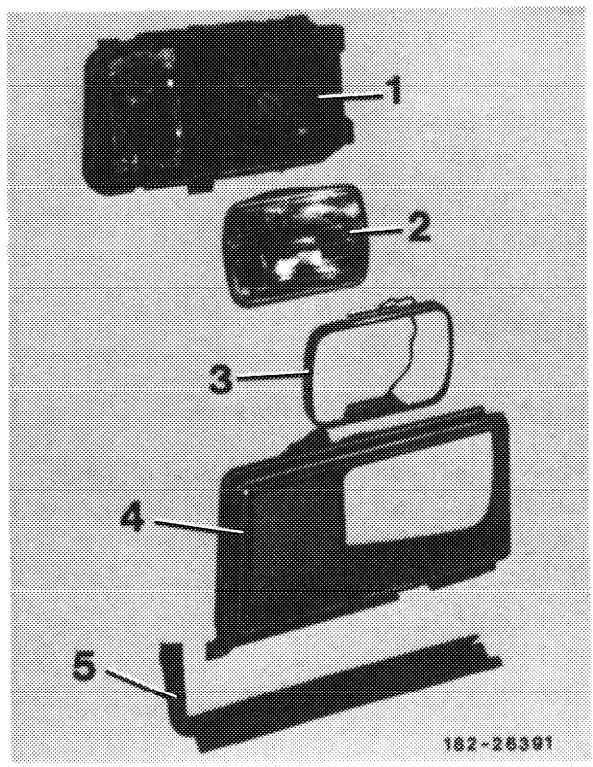


2 Pull off electrical connection.

3 Force off clip **(3a)** in direction of arrow.



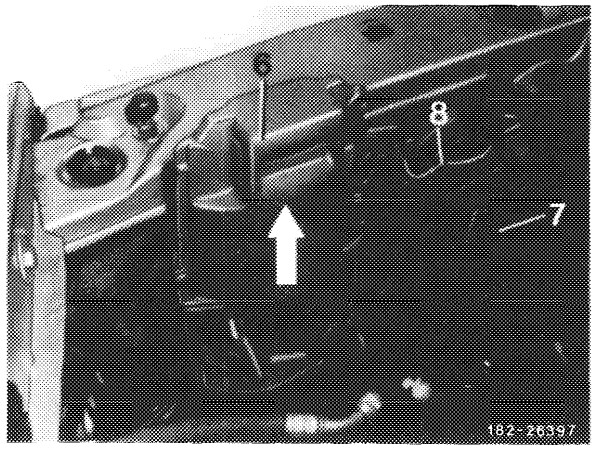
4 **Remove sealed beam unit** (2) in forward direction.



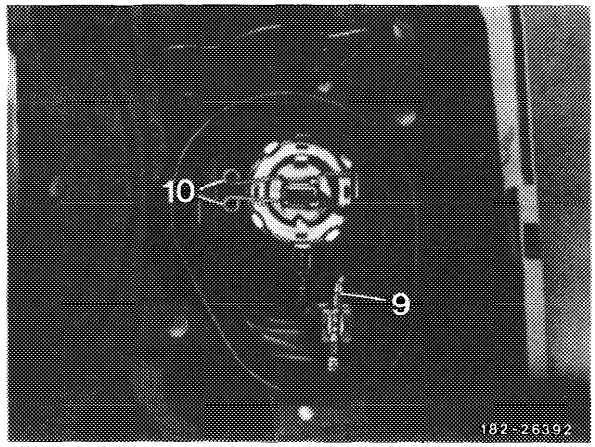
1 Housing
2 Sealed beam unit
3 Holding frame
4 Covering frame with lens
5 Rubber seal

Bulb for fog lamp

5 Push off clip (8) in upward direction and remove cover (7).



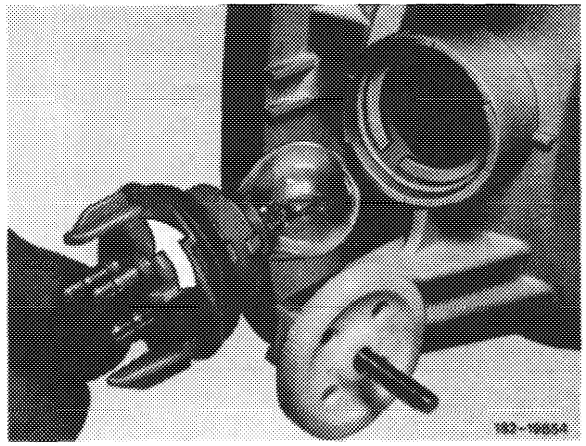
6 Pull off electrical connection (9), unclip fastening clamps (10) and remove H3-bulb.



Bulb for turnsignal and side marker lamp

7 Pull off electrical connection.

8 Loosen socket by turning to the left and remove. Unscrew bulb (12 V 2 1/5 W) from bayonet seat of socket.



Installation

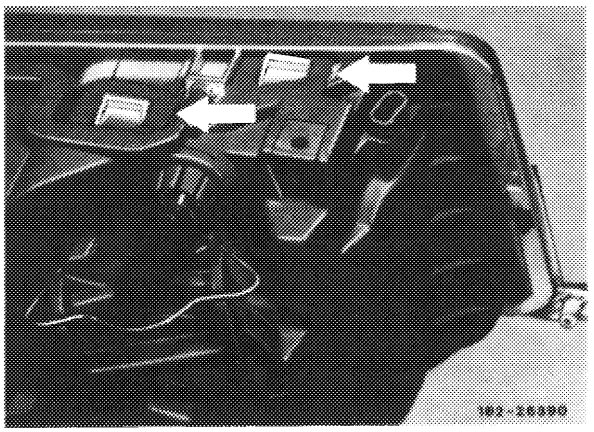
9 For installation proceed vice versa.

Note: During installation, pay attention to correct seat of bulb. Do not touch bulb with bare fingers on glass body, but use a soft rag free of grease.

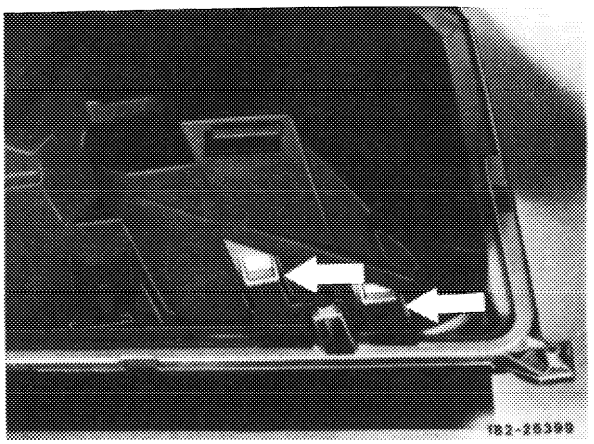
Removal

1 Remove lamp unit (82-052).

2 Unclip the 4 holding clamps (arrows), 2 on top and 2 below on housing, and remove covering frame with lens.



Holding clamps, top



Holding clamps, below

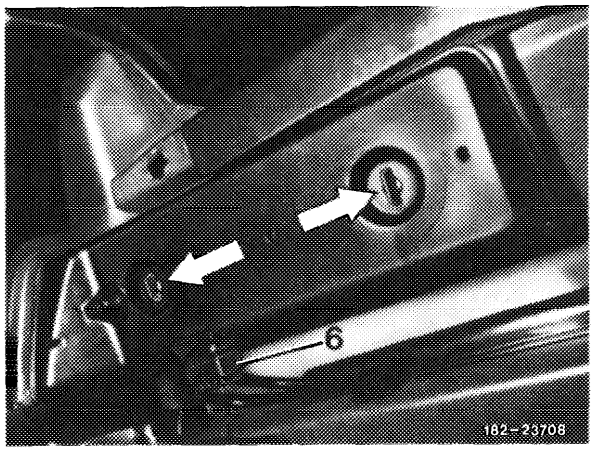
Installation

3 Place covering frame on housing and push on uniformly until holding clamps at top and bottom are audibly engaging.

Removal

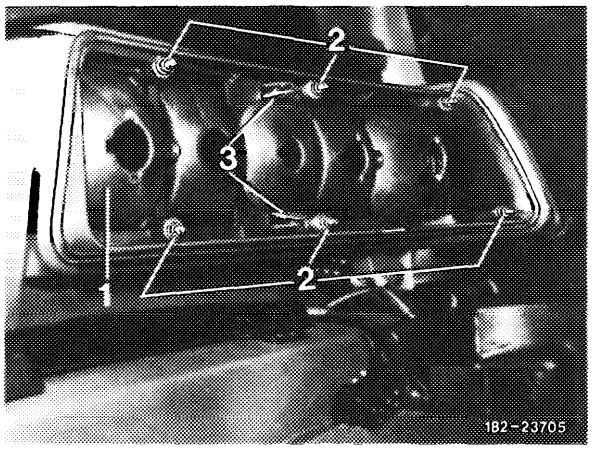
1 Unlock lamp carrier (arrows) and remove.

2 Pull off electrical connection (6).

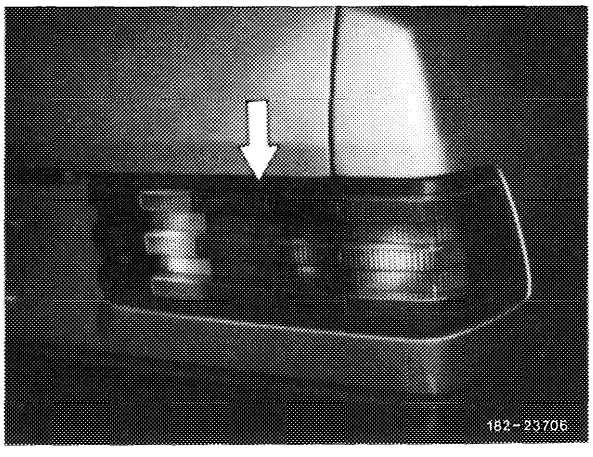


3 Unscrew 6 fastening nuts (2).

4 Unclip detent (3) and remove reflector (1).

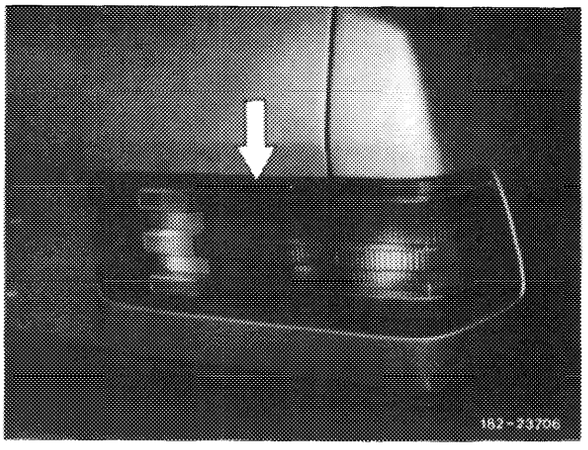


5 Remove light window (arrow) in outward direction.



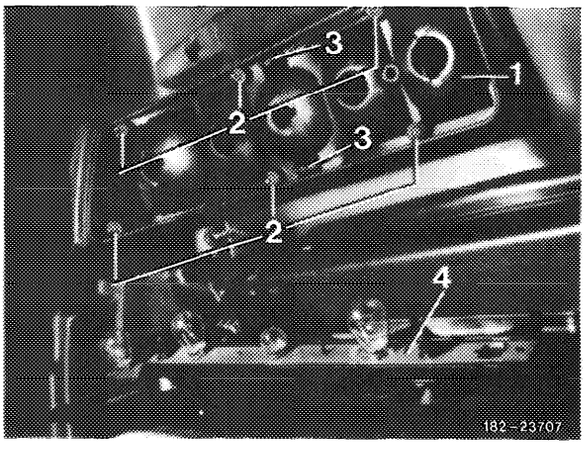
Installation

6 Insert light window with rubber seal from outside into body.



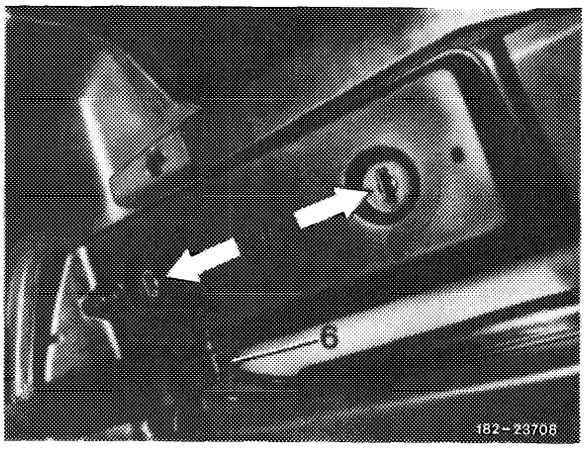
7 Mount reflector (1) and engage.

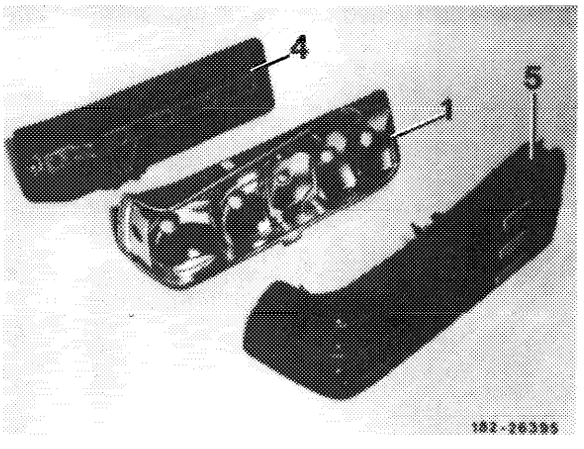
8 Uniformly screw down 6 fastening nuts (2).



9 Mount lamp carrier and lock.

10 Plug-on electrical connection (6).





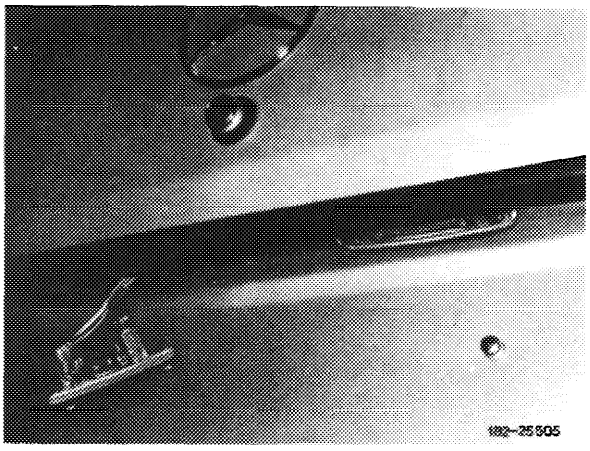
Tail lamp unit (USA)

1 Reflector
4 Lamp carrier
5 Light window

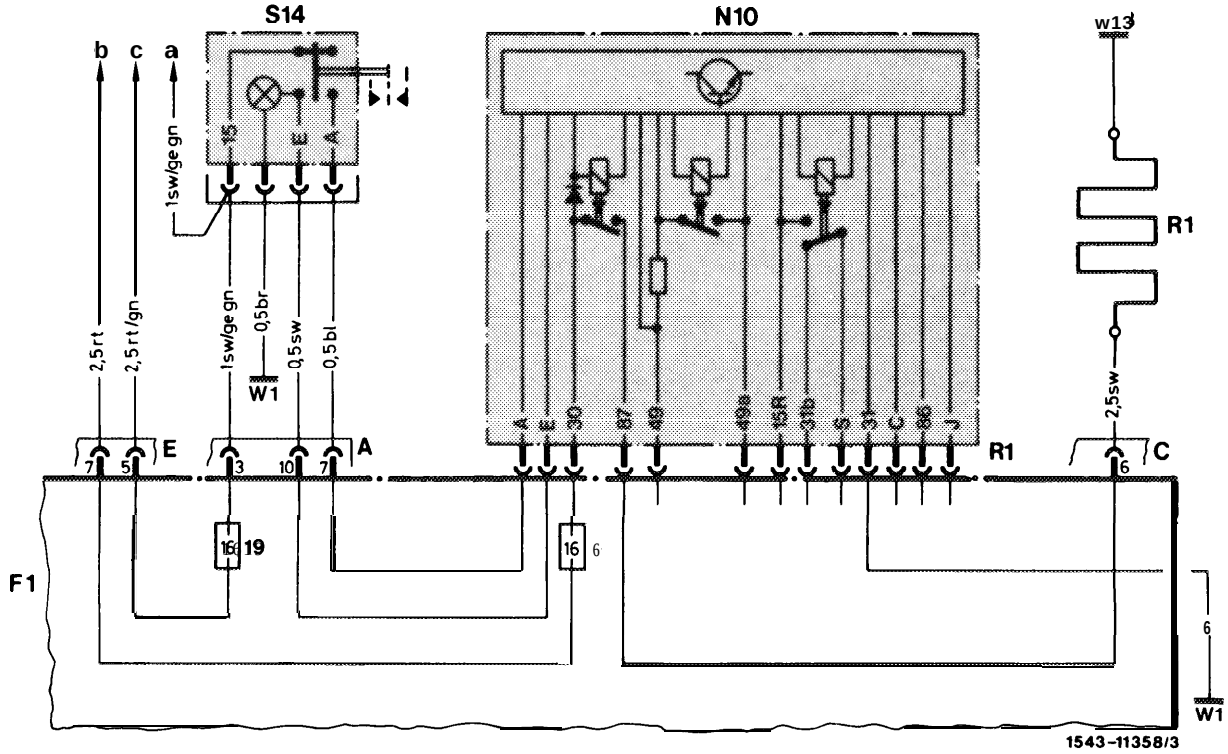
During removal and installation pay attention to the following items:

1 **The licence plate lamp is fastened by means of 2 screws.**

2 Upon removal of licence plate lamp, the bulb can be removed from socket.



3 When instelling licence plate lamp, pay attention to correct seat of seal.

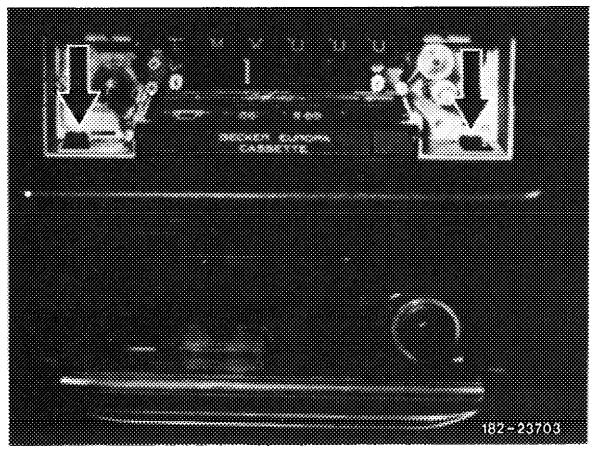


F1 Central electrical system
N10 Combination relay (turn signal, heatable rear window, wiper motor)
R1 Heatable rear window
S14 Switch heatable rear window
W1 Main ground (behind instrument cluster)
w13 Ground, heatable rear window

A lo-pole coupling harness interior
C 16-pole coupling harness tail lamp unit
E 8-pole coupling harness ignition starter switch
a To cigar lighter with ashtray light R3
b To ignition starter switch S 2/1 terminal 30
c To ignition starter switch S 2/1 terminal 15

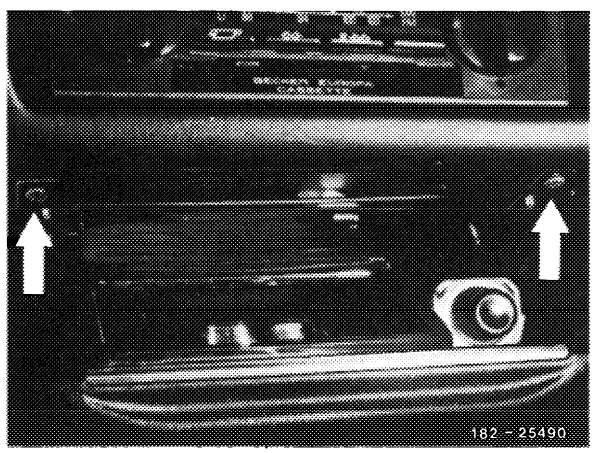
During removal and installation pay attention to the following items:

1 The radio is fastened by means of holder of ash-tray.



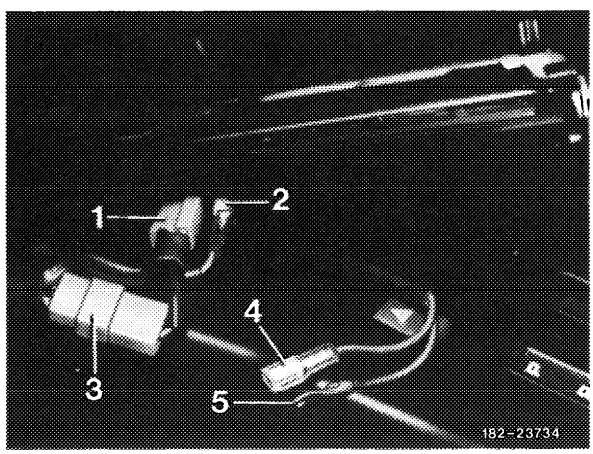
2 The holder is screwed to console by means of two screws.

Removal of knobs or molding of radio is not required, the radio can be completely pulled out of console.



3 The radio is electrically connected on cigar lighter.

Note: Antenna line as well as the control line for automatic antenna are not available as standard equipment.



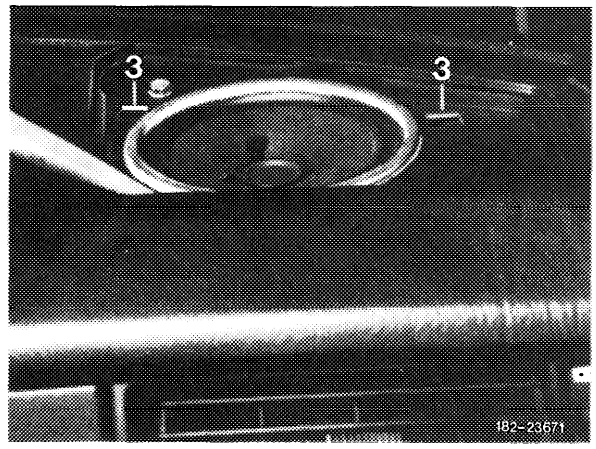
1 **Cigar lighter**
2 **Lamps**
3 **Intermediate coupling radio harness**
4 **Terminal 15 R (positive)**
5 **Terminal 31 (negative)**

During removal and installation pay attention to the following items:

Speaker, front

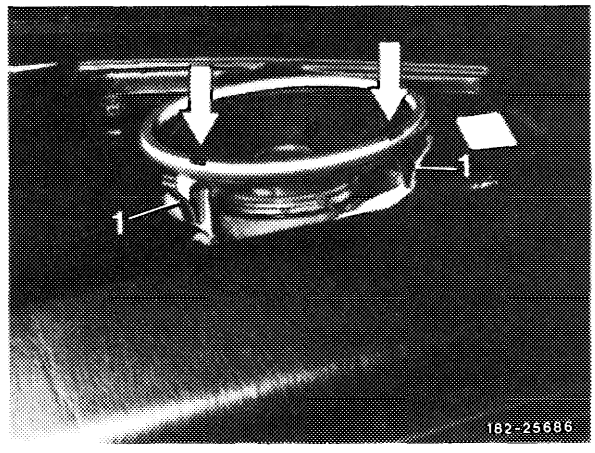
1 **The** speaker cover is engaged at the front in instrument panel and fastened at the rear by means of 2 screws.

2 The speaker can be pushed out of instrument panel by means of a plastic wedge.



3 Recess for cover

3 Speaker is held in instrument panel by means of 2 spring clamps (1).

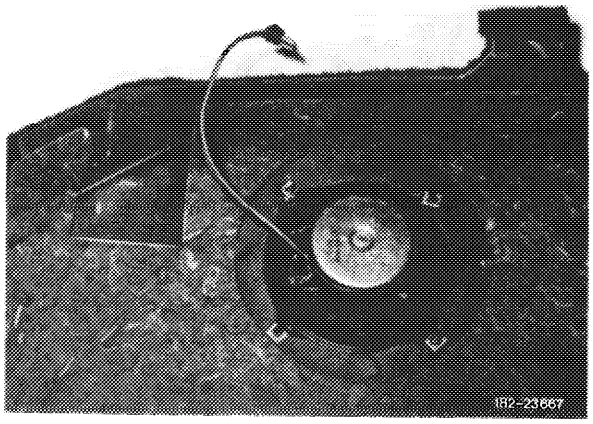


4 When installing speaker, insert into instrument panel first with support in forward position and push **in until the spring clamps are engaging.**

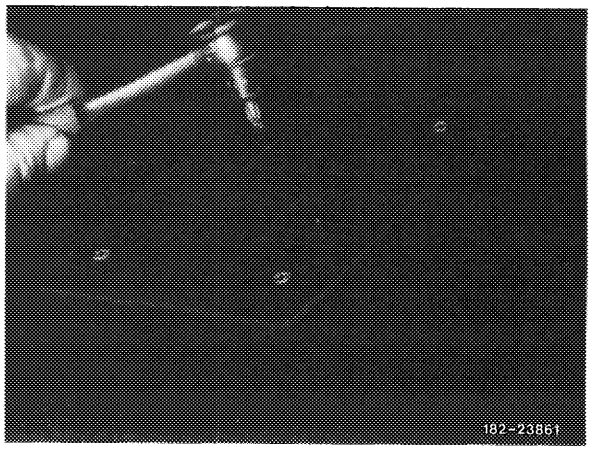
The two color marks (arrows) should point to the rear.

Speakers, rear

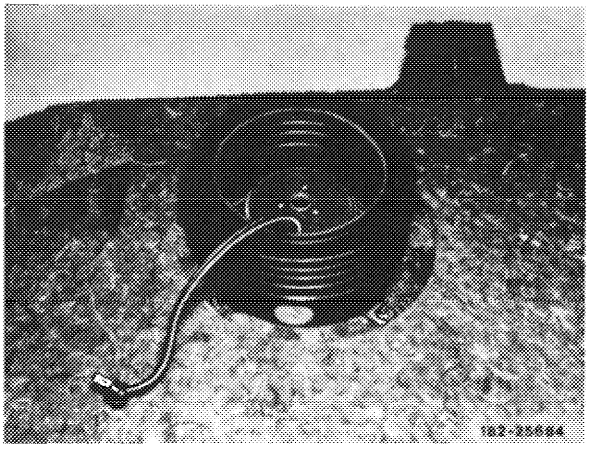
5 The rear speakers are screwed to hat rack together with speaker cover. They can be removed or installed complete with hat rack.



6 By means of an 1/4'' ratchet and a pertinent element, separate removal (without hat rack) is also possible.



7 The sound guiding hose together with the bore toward trunk will improve quality of sound.



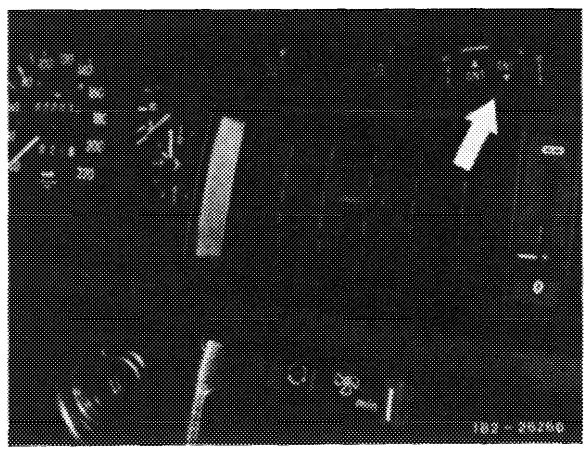
The antenna can be moved into three different positions by means of the antenna switch with the radio switched on.

Antenna switch in center position

The antenna extends automatically approx. 30 cm when the radio is switched on. Actuation of switch for a short moment extends antenna into position most favorable for reception.

Antenna switch engaged in extension position

Antenna extends to its full length.



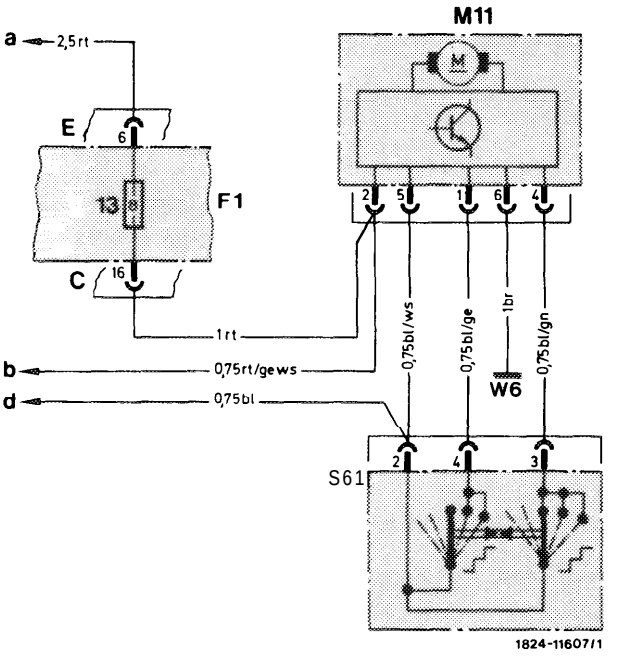
Antenna switch engaged in retracting position

Antenna is not extending, e.g. when playing cassettes or antenna retracts completely following previous extension.

If the ignition or the radio is switched off, the antenna retracts completely.

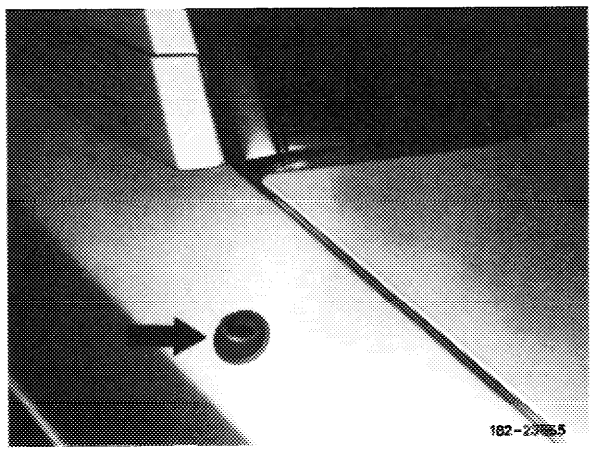
Wiring diagram automatic antenna (USA)

F1 Central electrical system
M11 Automatic antenna
S61 Switch automatic antenna
W6 Ground, trunk wheelhouse left
C 16-pole coupling tail lamp unit harness
E 8-pole coupling harness to ignition starter switch S2/1
a To ignition starter switch S2/1 terminal 30
b To trunk lamp El8
d Control line to radio A2

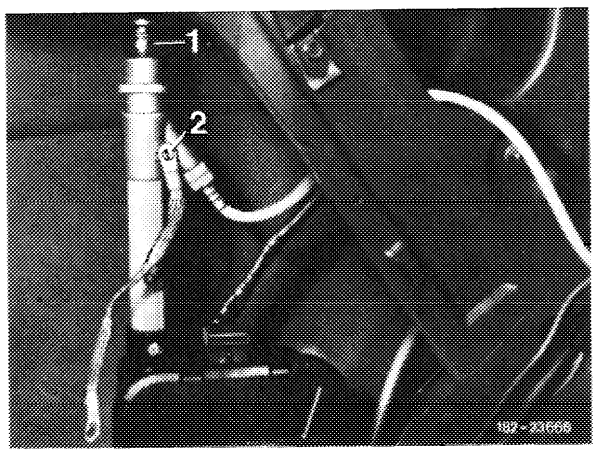


During removal and installation pay attention to the following items:

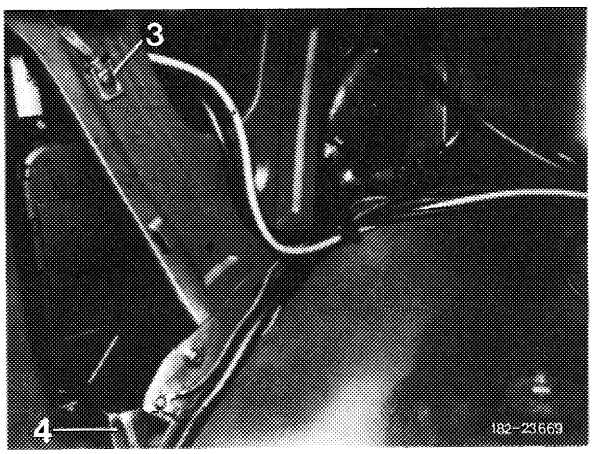
The antenna head is held in fender by means of a rubber grommet.



2 The required ground connection is made by means of a grounding strap.

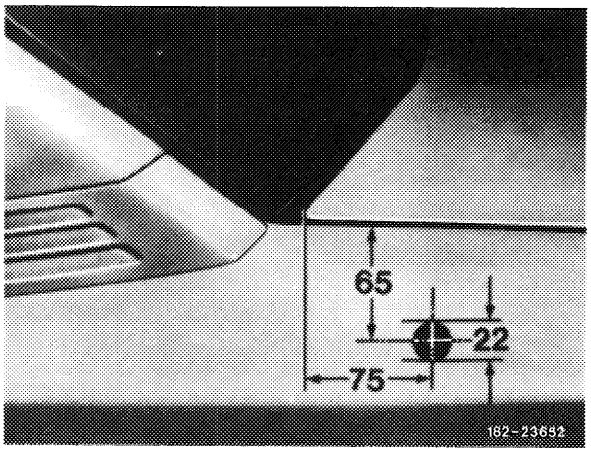


1 Antenna head
2 Grounding strap



3 Grounding strap connection
4 Fastening holder

3 Dimensions for drilling antenna bore in fender rear left.

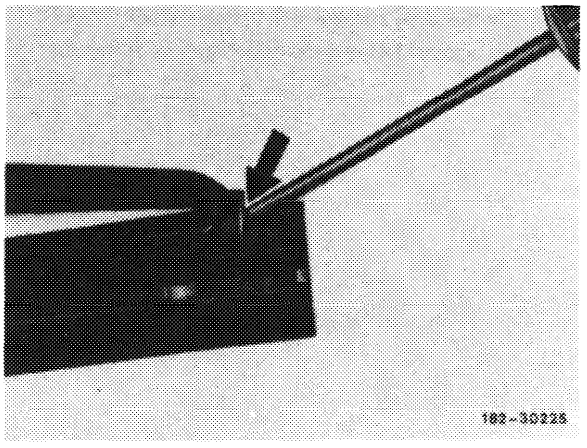


Removal

1 Remove wiper blade.

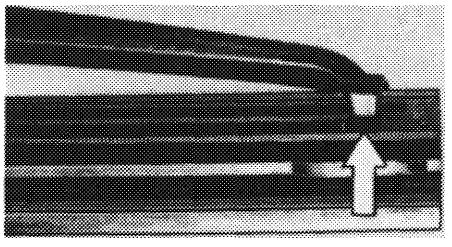
2 Push back both holding springs from direction of closed profilated rubber side and pull completely out of rubber.

3 Disconnect profilated rubber on holding clamps of wiper blade.

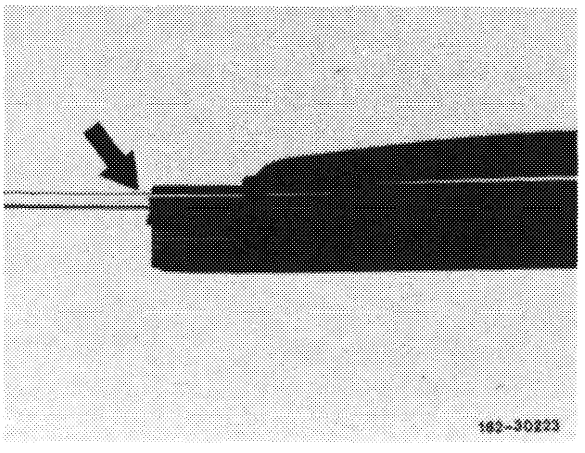


Installation

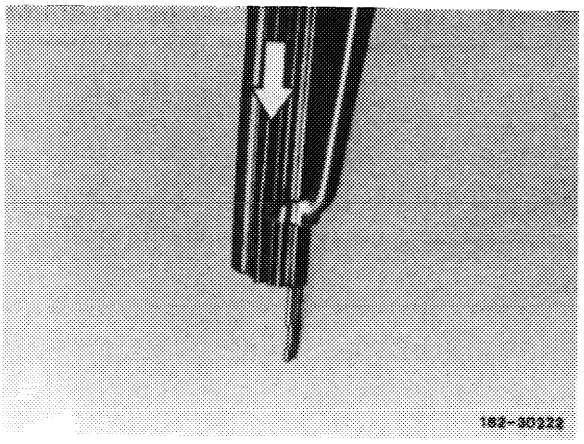
4 Engage profilated rubber on holding clamps of wiper blade.



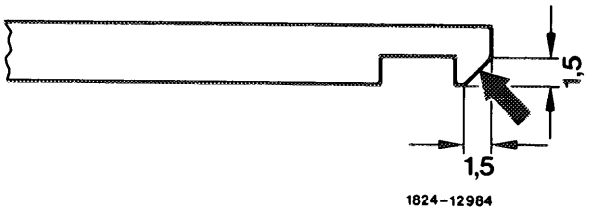
5 Slip holding springs from side of open profile into rubber in such a manner that the crown points toward windshield.



6 Place wiper blade with holding springs on a firm base and push holding springs one after the other into the profilated rubber.



Note: The holding springs will engage easier, if the front end is chamfered and wiped with soap water.



82-680 Removal and installation of wiper motor

Note

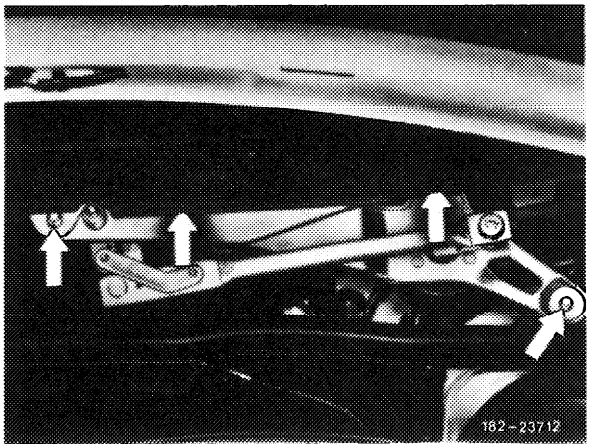
When working on wiper system, pull off ignition key. Movements on wiper arm or wiper linkage may lead to activation of automatic parking position system starting at ignition key position "1". Undesired movement of wiper may lead to hand injuries.

1 st version

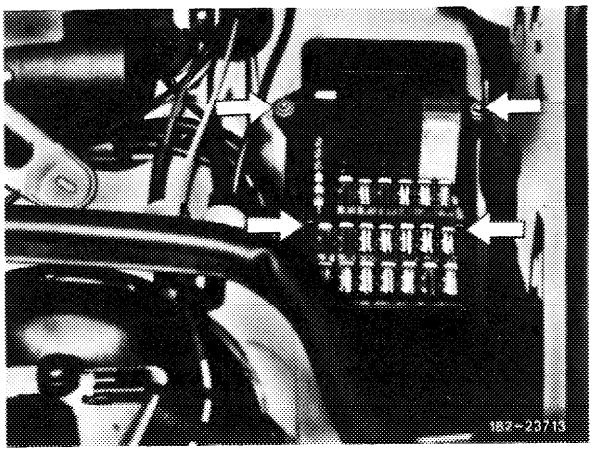
Removal

1 **Remove cover on air intake.**

2 Unscrew wiper system.



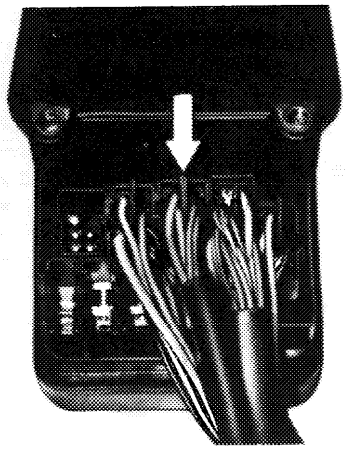
3 Remove cover of central electrics and unscrew screws.



4 Pull central electrics slightly forward, lift and pull out socket for wiper system in front half in downward direction.

5 Remove wiper system.

6 Unscrew nut on wiper motor shaft and push off crank arm with linkage.

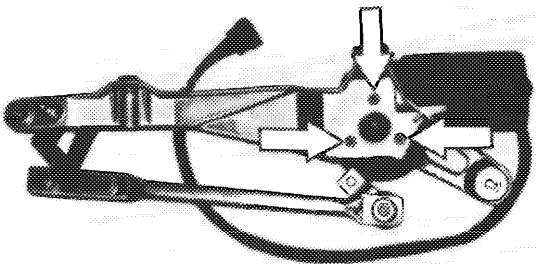


182-23716

7 Unscrew wiper motor.

Installation

8 Screw wiper motor to base plate.



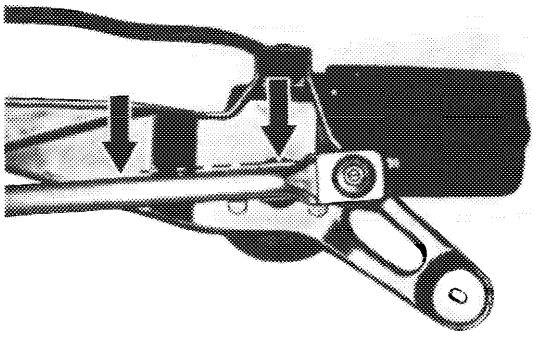
182-23714

9 Push crank arm on wiper motor shaft, making sure that crank arm and push rod are in parallel with each other.

10 Screw crank arm to wiper motor.

11 Install wiper system.

12 For further installation proceed vice versa.



182-23715

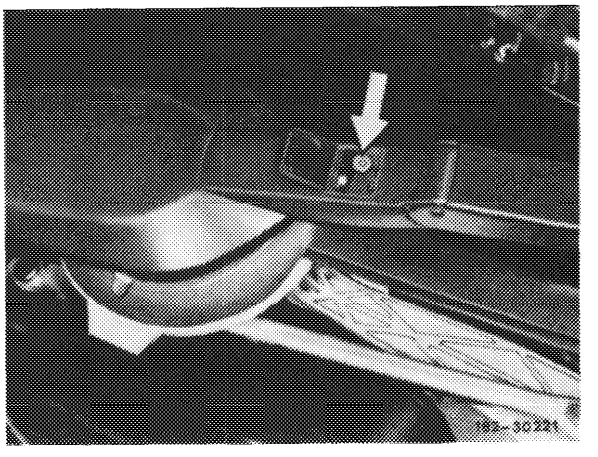
2nd version (panorama windshield wiper)

Removal

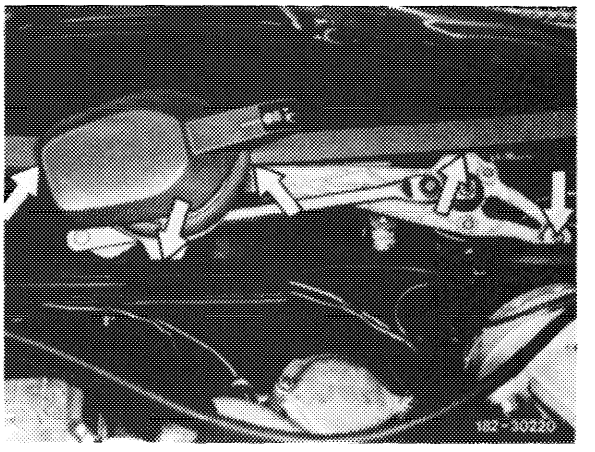
1 Remove cover on air inlet (Group 83).

2 Open cover plate, unscrew screw and remove.

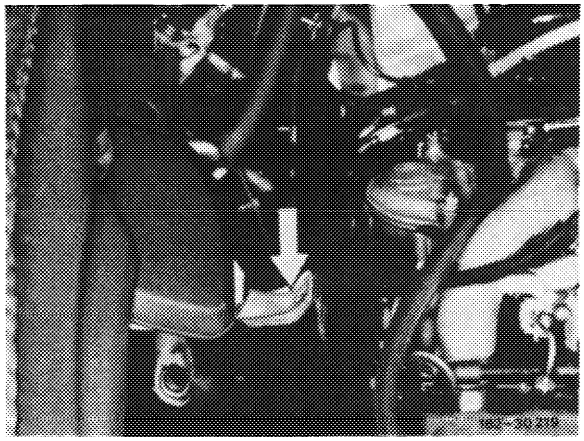
3 Pull off wiper arm.



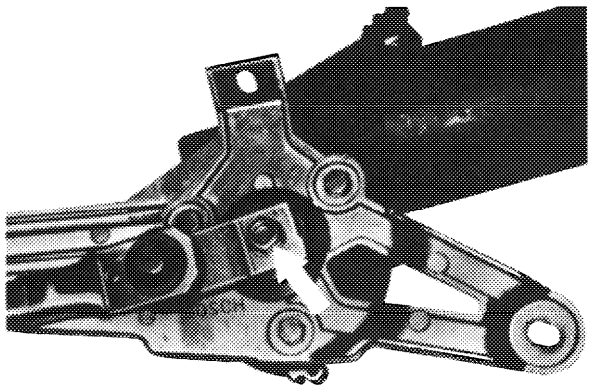
4 Unscrew nuts (5 each).



5 Pull off bearing bracket and remove wiper stop, while separating electric plug coupling.

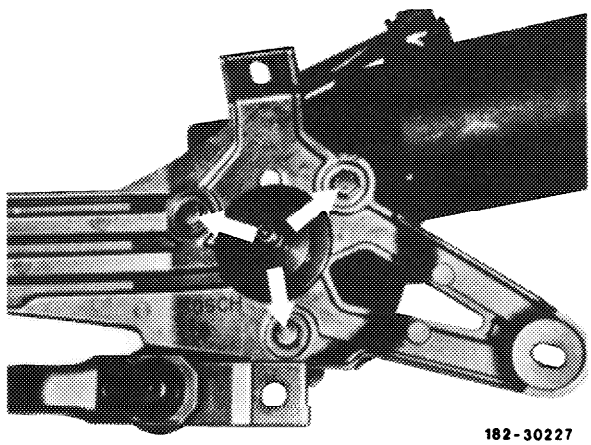


6 Unscrew nut on wiper motor shaft and force off crank arm.



162 -30226

7 Unscrew wiper motor and remove.

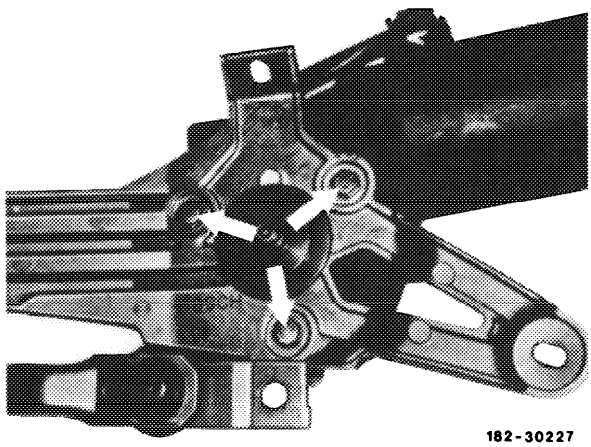


182-30227

Installation

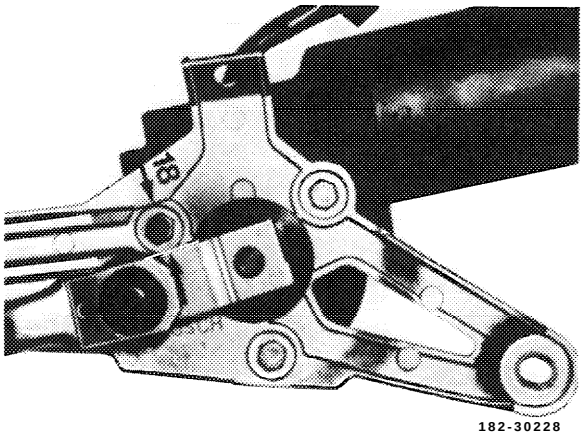
8 Screw on wiper motor (5 Nm).

Note: Wiper motor should be in parking position. Connect to cable assembly, if required and let run into parking position.

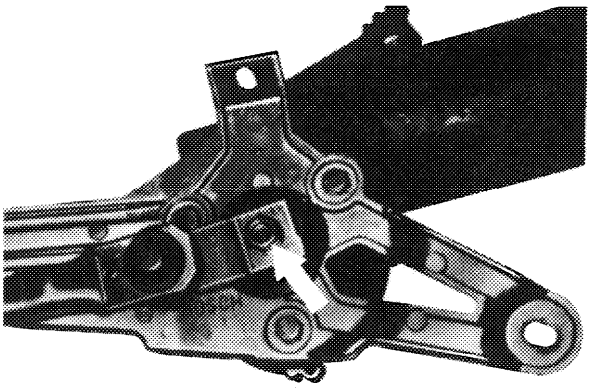


182-30227

9 Plug crank arm on wiper motor shaft and align.

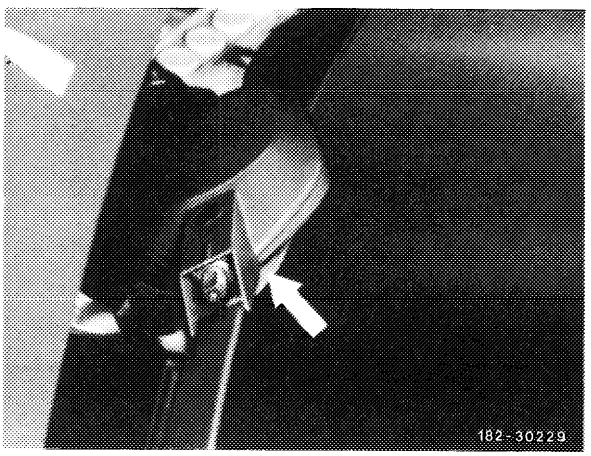


10 Screw on nut and tighten to 19 Nm.



11 Insert wiper unit, making sure that the sealing rubber rests on window pane.

12 Continue installation in vice-versa sequence.

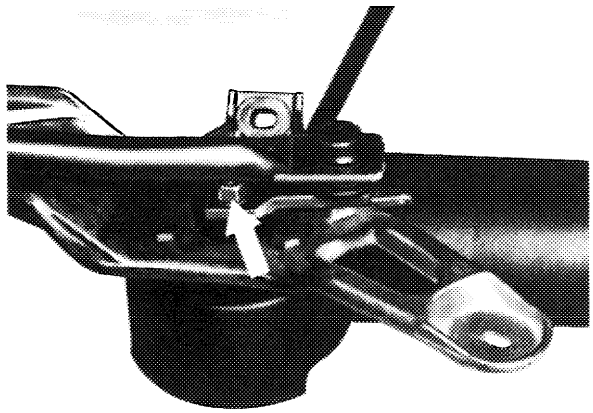


1 st version

Removal

1 Remove wiper unit (82–680).

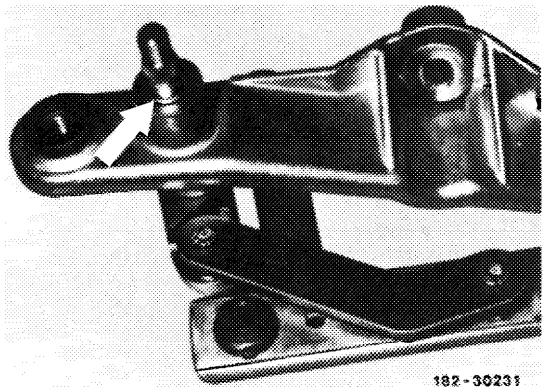
2 Unscrew nut on wiper motor shaft and force off crank arm.



182-30230

3 Force off locking ring on wiper shaft and pull wiper arm out of bearing.

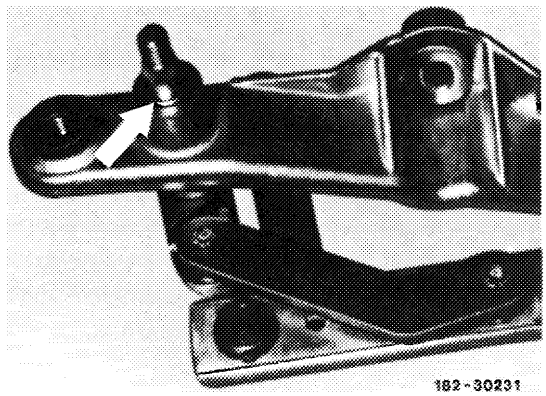
4 Remove wiper linkage.



182-30231

Installation

5 Slide wiper shaft into bearing and force on locking ring.



182-30231

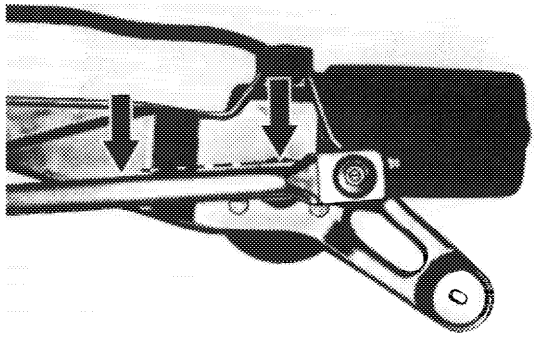
6 Press crank arm on wiper motor shaft, making sure that the crank arm and the pushrod are in parallel with each other.

Note: Wiper motor should be in parking position. Connect to cable assembly, if required, and let run into parking position,

7 Tighten crank arm (19 Nm).

8 Install wiper system.

9 For further installation proceed vice versa.



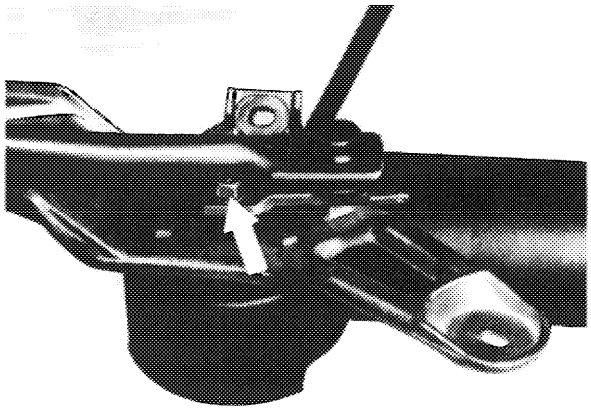
182-23715

2nd version (panorama windshield wiper)

Removal

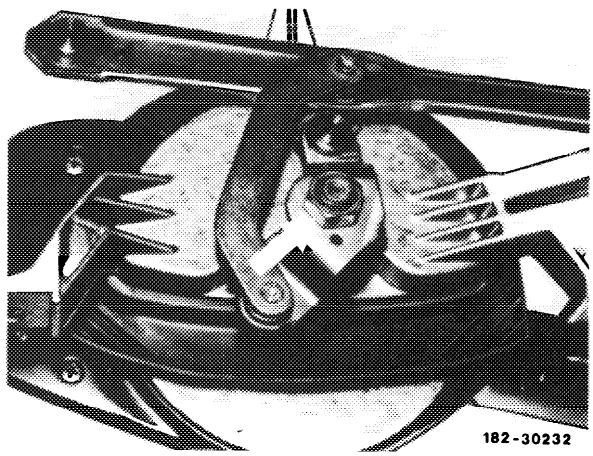
1 Remove wiper system (82-680).

2 Turn nut of wiper motor shaft and force off crank arm.



182-30230

3 Turn nut of wiper shaft and force off linkage.



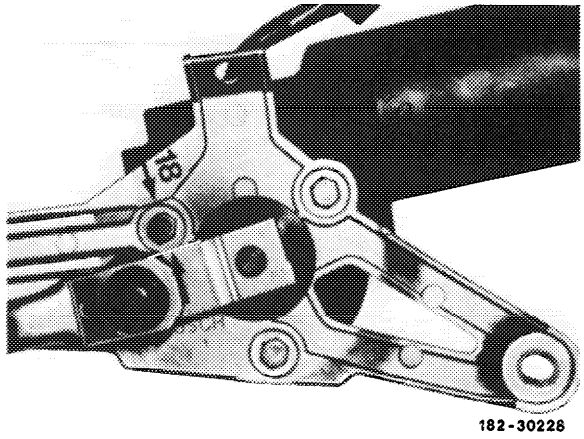
182-30232

Installation

4 Plug crank arm on wiper motor shaft and align.

Note: Wiper motor should be in parking position. If required, connect to cable harness and run into parking position.

5 Tighten nut to 19 Nm.



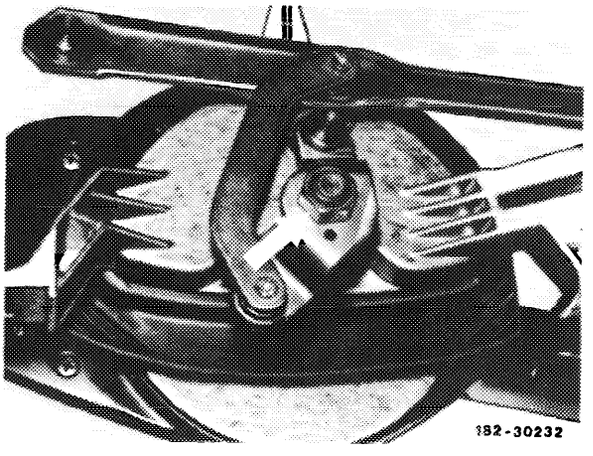
182-30228

6 Align gear head in such a manner that the markings are in alignment (parking position),

182-30233

7 Plug linkage on wiper shaft and tighten to 29 Nm.

8 For further installation proceed vice versa.



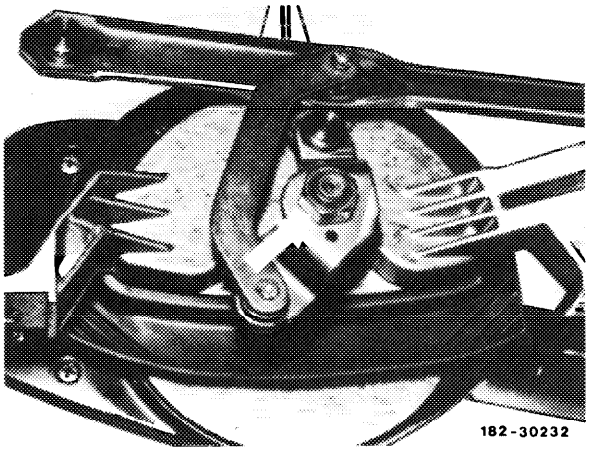
182-30232

82-765 Removal and installation of rubber seal under wiper gears

Removal

1 Remove wiper system (82–680).

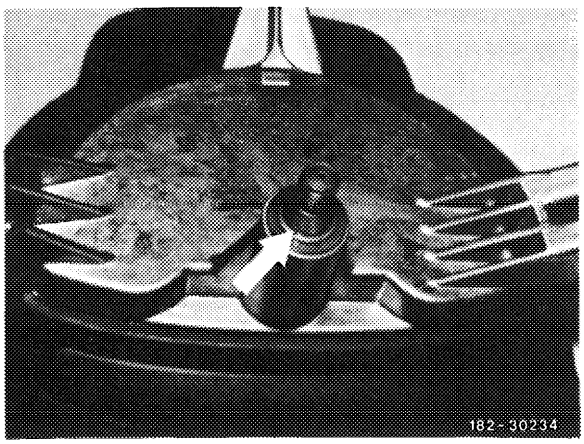
2 Turn nut of wiper shaft and force off linkage.



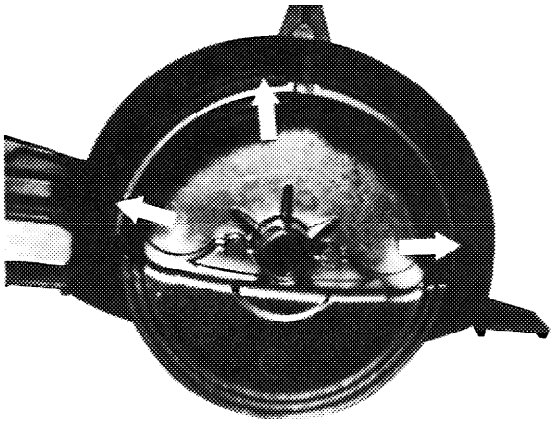
3 Force off locking ring.

4 Turn gear head into center position (angular in relation to plate) and pull out of bearing.

Note: Do not knock out with hammer. Gear head can be pulled out in center position only.

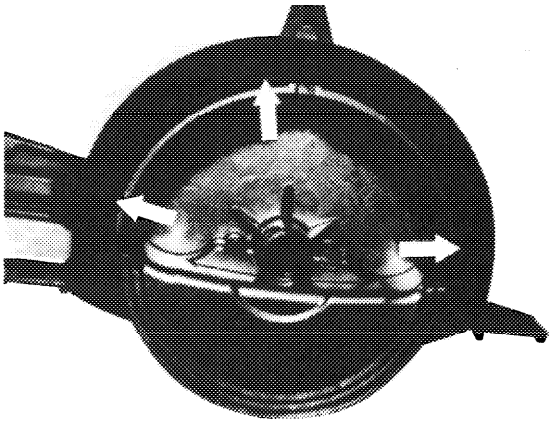


5 Remove rubber seal.



Installation

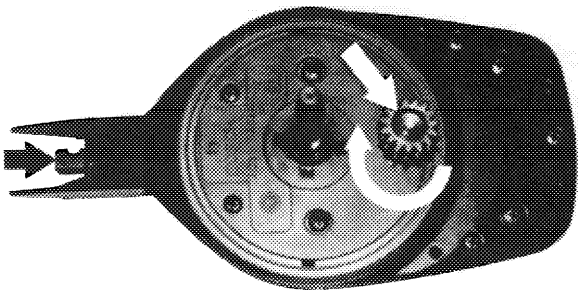
6 Coat rubber seal with MB universal glue and place on housing.



182-30235

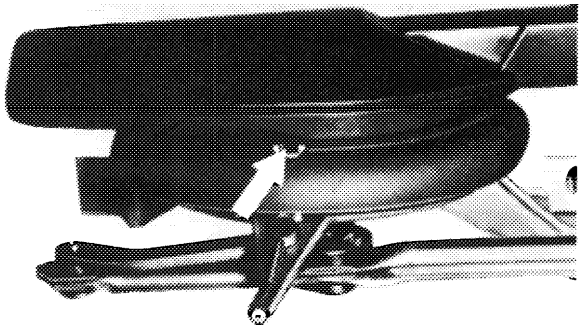
7 Introduce gear head in center position into bearing.

Note: Pushrod must be completely run in. Make corrections by turning gearwheel, if required.



182-30236

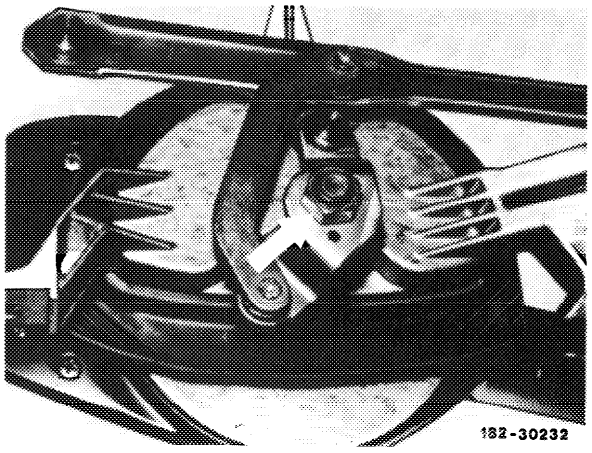
8 Align gear head in such a manner that the markings are in alignment (parking position).



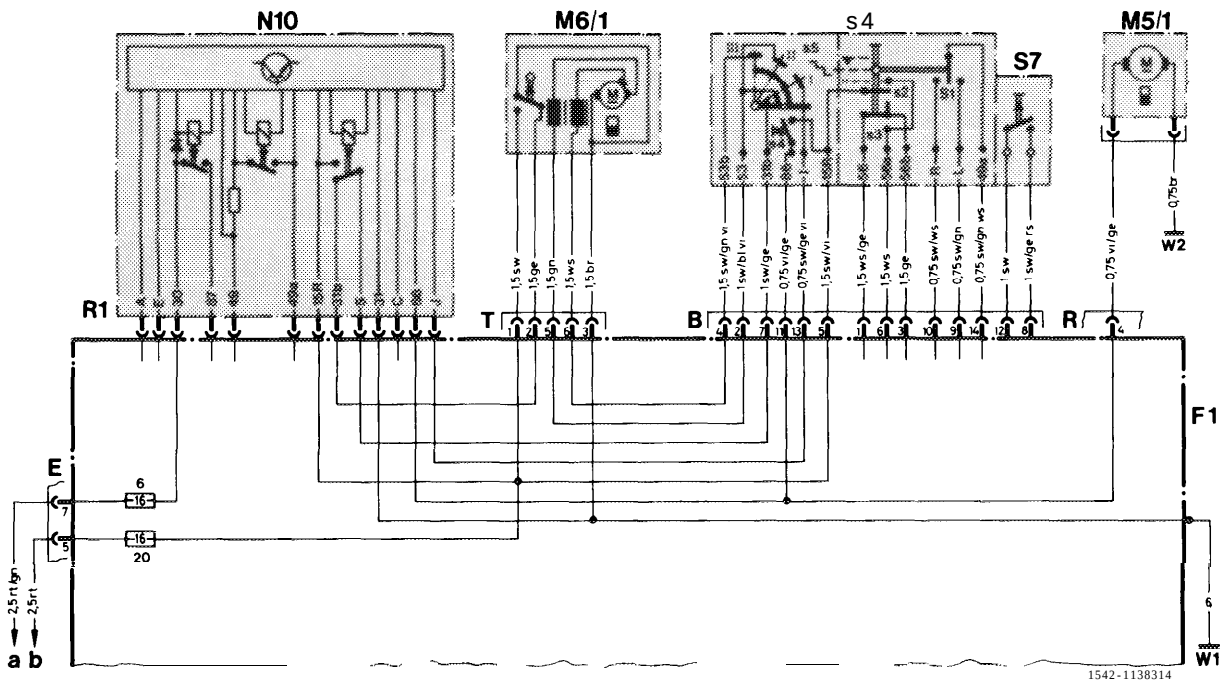
182-30233

9 Plug linkage on wiper shaft and tighten to 29 Nm.

10 For further installation proceed vice versa.



182-30232



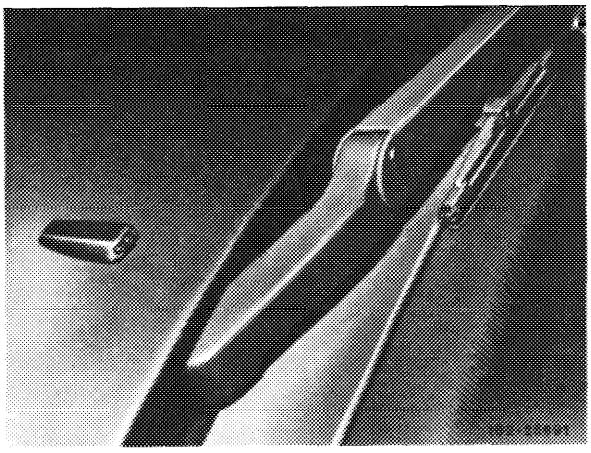
F1	Central electrical system
M5/1	Washer pump
M6/1	Wiper motor
N10	Combination relay (flasher, heatable rear window, wiper motor)
s4	Combination switch
s1	Turn signal switch
s2	Headlamp flasher switch
s3	Dimmer switch
s4	Washer switch
s5	Switch for wiper speed
s7	Horn contact
W1	Main ground (behind instrument cluster)
w2	Ground, front right (near lamp unit)
E	8-pole coupling and harness for ignition starter switch S2/1
R	8-pole coupling harness for lamp unit E2, right
a	To ignition starter switch S2/1 terminal 30
b	To ignition starter switch S2/1 terminal 15 R

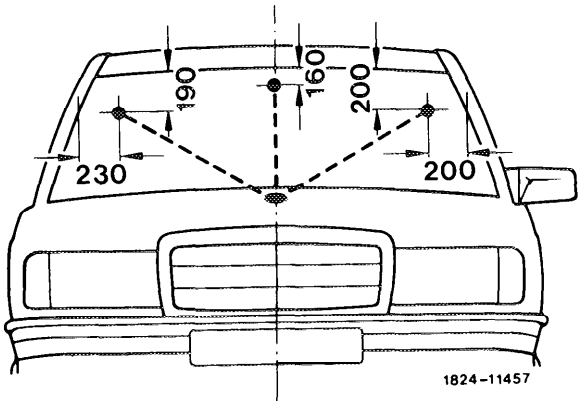
Electrically heated nozzle

1 st version

A PTC heater resistor is installed in three-jet nozzle. This PTC heater resistor increases its resistance with increasing heat.

After switching on ignition, a current of approx. 300 mA flows via PTC heater resistor and reduces with increasing heat to a settled current of 100 mA.

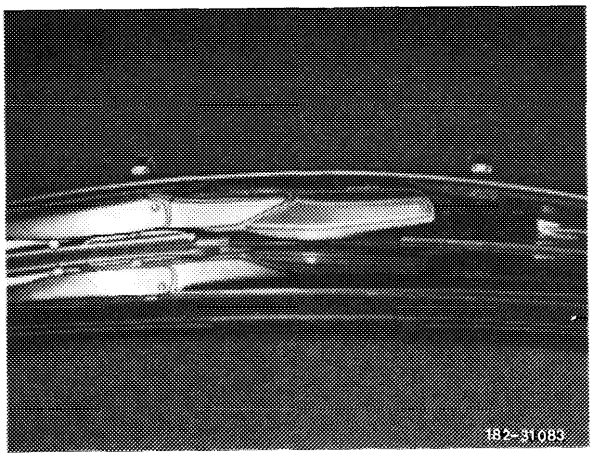


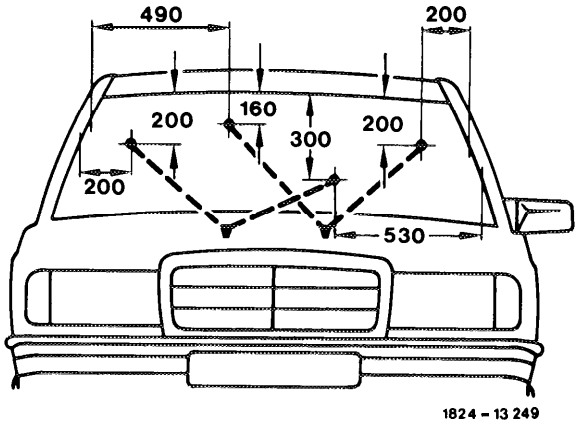


Nozzle adjustment

2nd version

Two double-jet nozzles are installed on version with lifting cam wiper. Operation, as well as removal and installation are similar in principle as on 1st version.

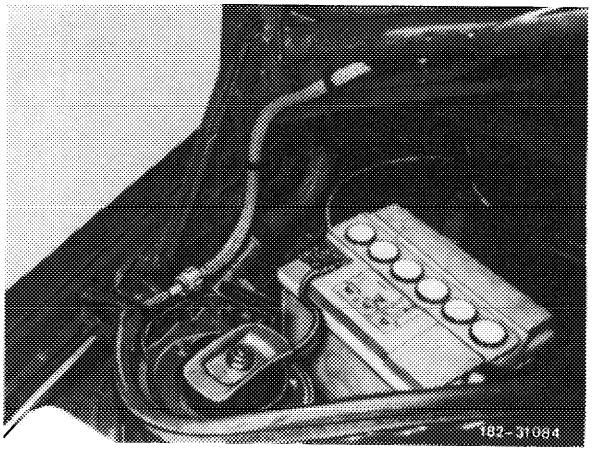




Nozzle adjustment 2nd version

Check valve

The check valve is located on front, righthand wheel house.



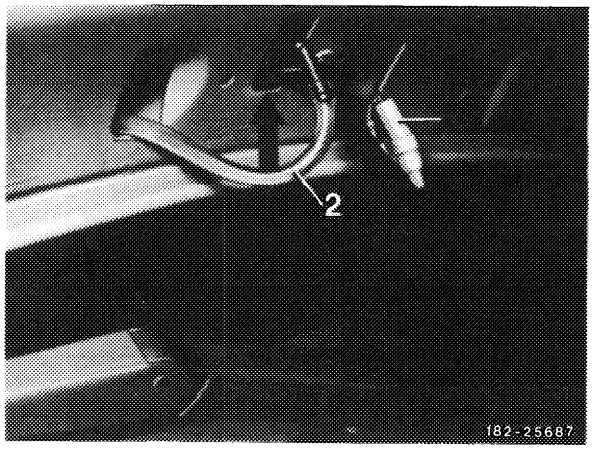
Repair note

Removing and installing nozzle

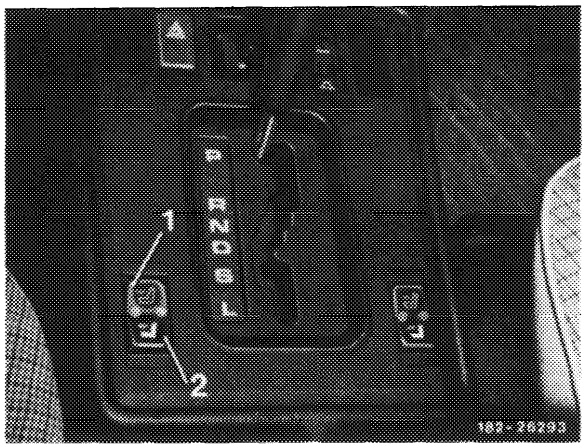
1 Pull off electrical connection (1) and hose (2).

2 Push out nozzle in direction of arrow and remove in upward direction.

3 During installation, push in until nozzle engages.



Actuation by means of a button which returns to its rest position after switching on.



Stage 1 or 2 are engaged by pushing once on respective symbol, during which one indicator lamp will light up in stage 1 and two indicator lamps in stage 2.

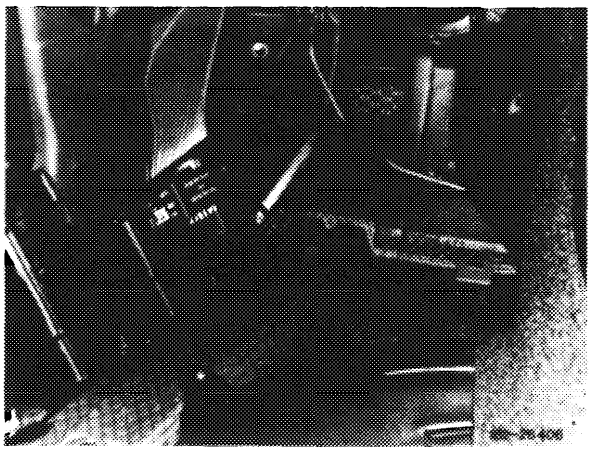
The heating system will be switched off when the same signal is pushed again.

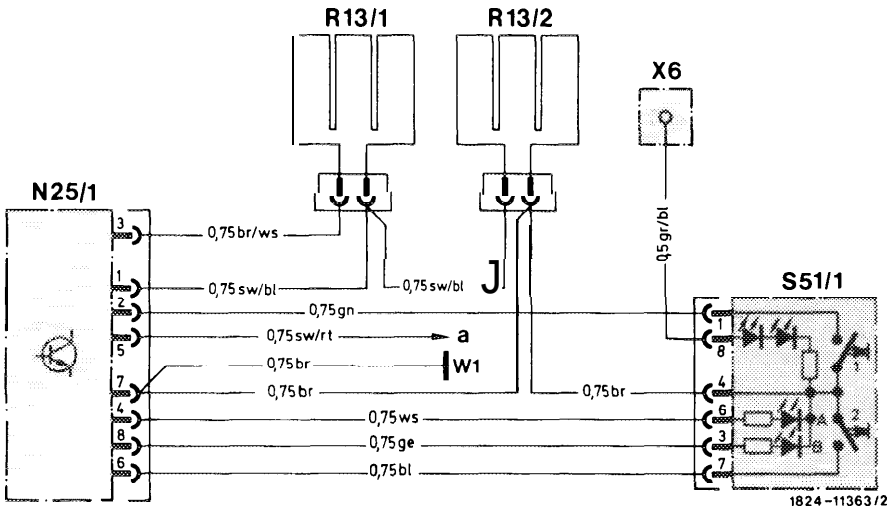
The On-period of the two heating stages is limited by an electronic relay. The relay is located behind cover in legroom under floor mat left or right.

After approx. 5 minutes follows an automatic switch-over from stage 2 (high heating capacity 60 W) to stage 1 (low heating capacity 15 W), and after approx. 30 minutes the seat heater will be switched off.

The automatic heating sequence is interrupted when the ignition starter switch (glow starter switch) is switched off.

When the ignition starter switch (glow starter switch) is switched on again, the seat heater switch must be newly actuated (similar to heatable rear window).



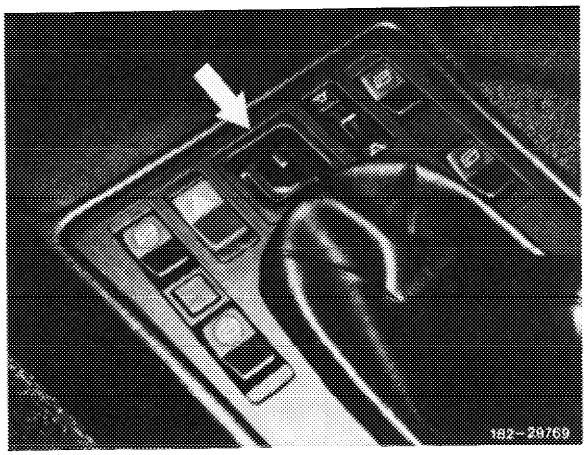


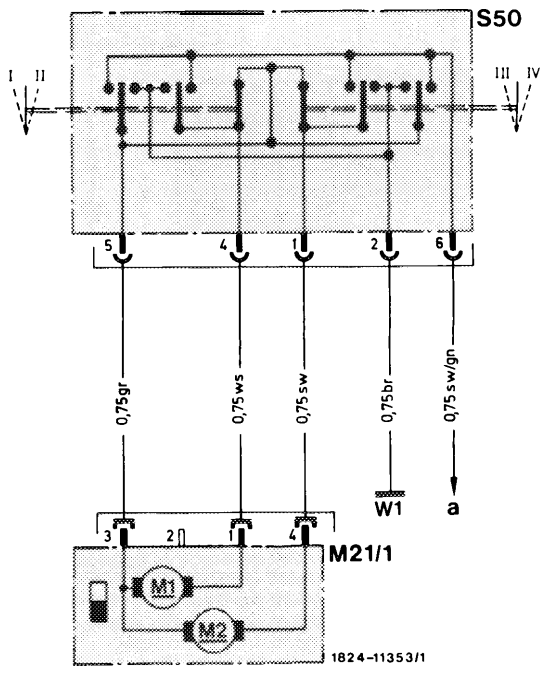
Wiring diagram seat heater left

N25/1 **Relay seat heater front left**
R13/1 **Heating cushion seat, front left**
R13/2 **Heating cushion backrest, front left**
S51/1 **Switch seat heater left**
W1 **Main ground (behind instrument cluster)**
X6 **Line connector terminal 58 d**
a **To line connector interior X5/1 terminal 15**

The righthand outside rear view mirror is electrically adjustable. Two motors in mirror are activated by a switch.

The mirror is vertically adjusted in upward or downward direction with motor M1. It is horizontally driven in inward or outward direction with motor M2.



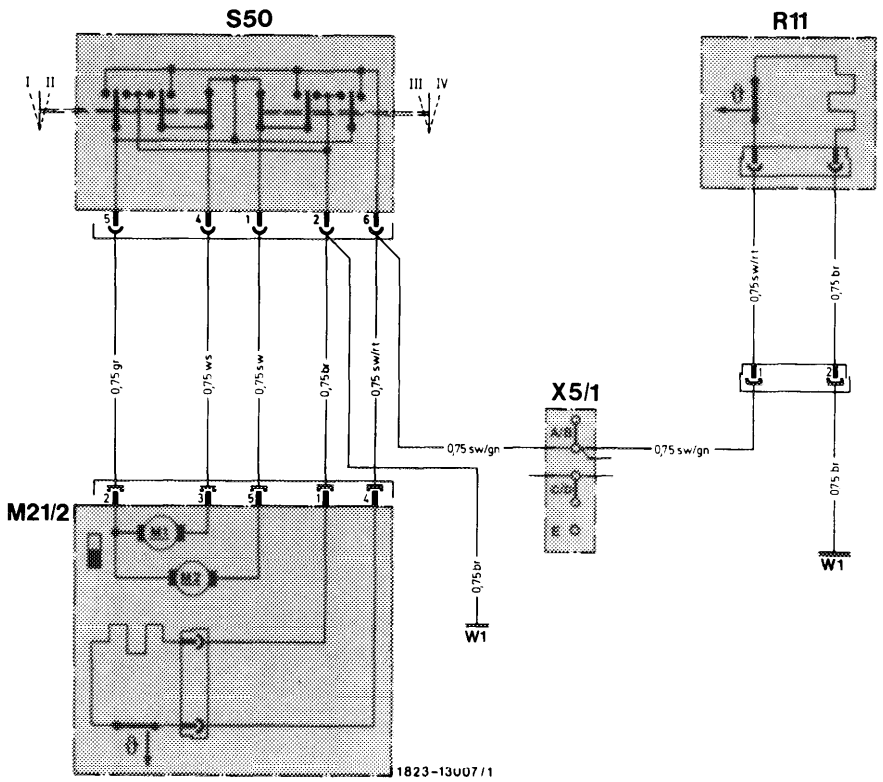


Wiring diagram electrically adjustable outside rear view mirror

M21/1 Outside mirror for front passenger, electrically adjustable
S50 Switch of electrically adjustable outside mirror
I Mirror adjustment vertically in upward direction
II Mirror adjustment vertically in downward direction
I II Mirror adjustment horizontally in inward direction
IV Mirror adjustment horizontally in outward direction
W1 Main ground (behind instrument cluster)
a To line connector interior X5/1 terminal 15

General

As special equipment there are mechanically and electrically adjustable outside rear view mirrors with electrical heater. The heater is on back of plate glass and firmly connected therewith. Also on back of mirror plate is a thermostat, which engages and disengages the heater depending on the prevailing temperature. The mirror glass can be separately replaced (88–900).



Wiring diagram outside rear view mirror with electrically heated plate glass

M21/2 Outside mirror, for front passenger, electrically adjustable and heated
R11 Outside mirror, for driver, electrically heated
S50 Switch, electrically adjustable outside mirror
- I Mirror adjustment vertically in upward direction
- II Mirror adjustment vertically in downward direction
- I II Mirror adjustment horizontally in inward direction
- IV Mirror adjustment horizontally in outward direction

W1 Main ground (behind instrument cluster)
x5/1 Line connector interior terminal 15

Operation

The heater is operational in key position 2 (terminal 15).

The thermostat engages the heater at ambient temperatures below 5 ± 3 °C. The heater is operational up to an ambient temperature of 15 ± 3 °C and switches off when this temperature is attained.

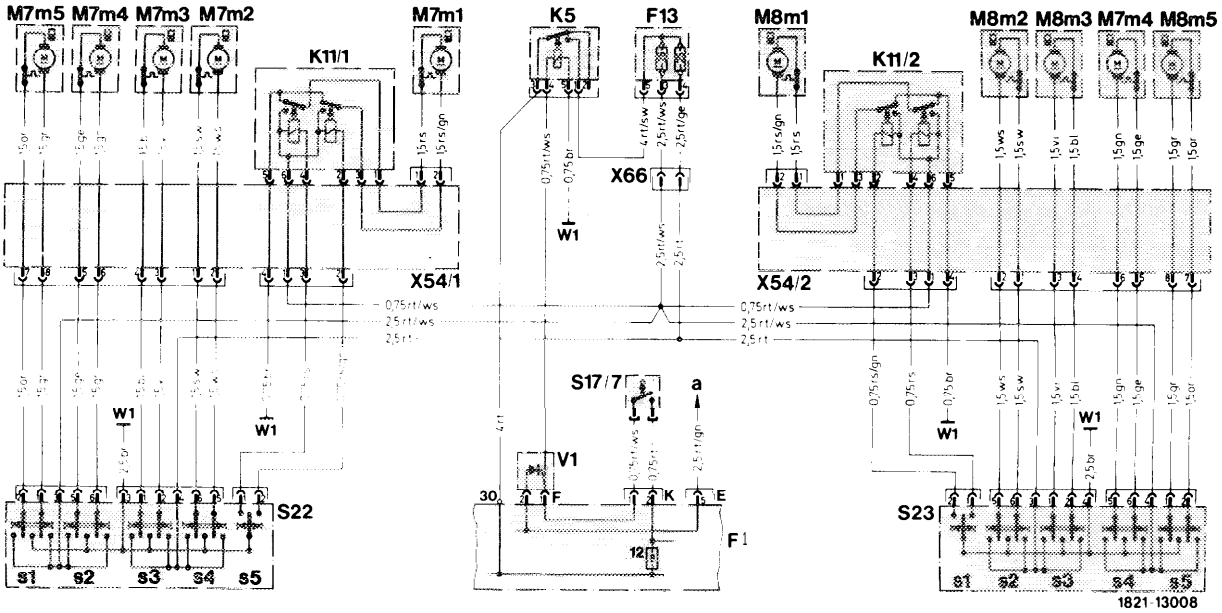
If the temperature drops again below 5 ± 3 °C, the heater is switched on again and will continue heating up to 15 ± 3 °C.

This procedure is repeated until the ambient temperature on mirror remains above 5 ± 3 °C or when the key is turned into position 1 or 0.

Power input	
Cut-in current	⩽ 4 amps
Continuous current	⩾ 1.5 amps

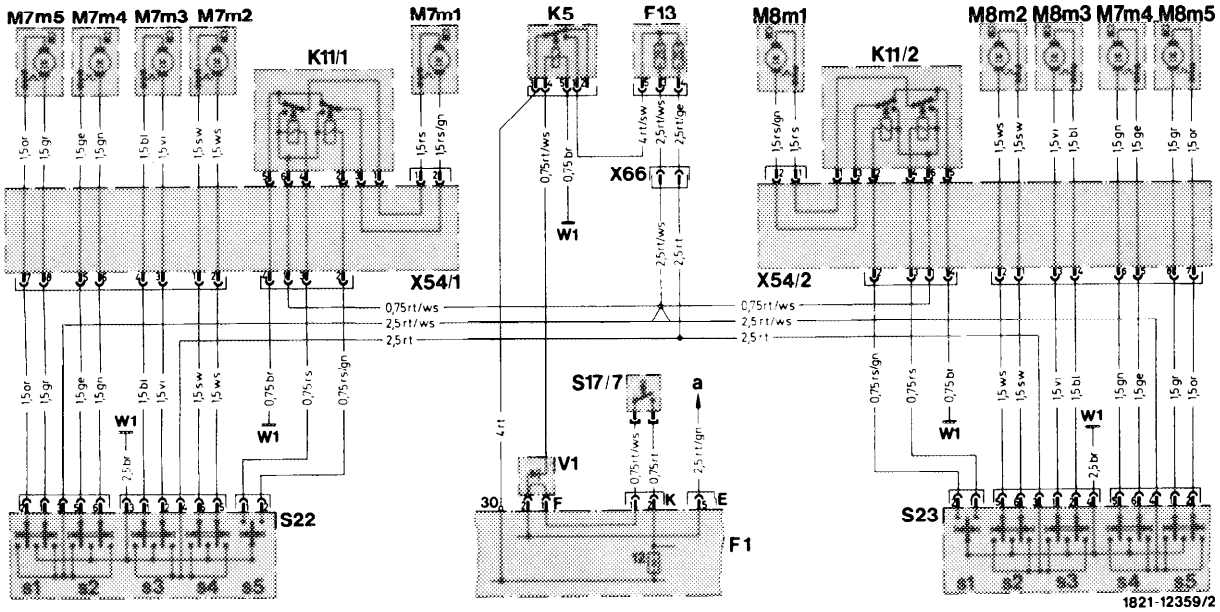
A. Version without memory circuit (position memory)
Seat, backrest and head restraint adjustment

Standard version



Wiring diagram electrical seat adjustment — seat at left and right (except@)

F1	Central electrical system
F13	Auxiliary fuse box, seat adjustment
K5	Relay seat adjustment
K11/1	Relay head restraint adjustment
K11/2	Relay head restraint adjustment
M7	Motor group seat adjustment, front left
M8	Motor group seat adjustment, front right
m1	Head restraint high/low
m2	Seat height front
m3	Seat forward/back
m4	Seat height rear
m5	Backrest
S17/7	Door contact switch comfort circuit, left
s22	Switch seat adjustment front left
S23	Switch seat adjustment front right
s1	Head restraint high/low
s2	Seat height front
s3	Seat forward/back
s4	Seat height rear
s5	Backrest
V1	Diode seat adjustment comfort circuit
W1	Main ground (behind instrument cluster)
x54/1	Contact making strip seat adjustment, front left
X54/2	Contact making strip seat adjustment, front right
X66	Plug connection seat adjustment
a	To ignition starter switch S2/1 terminal 15 R



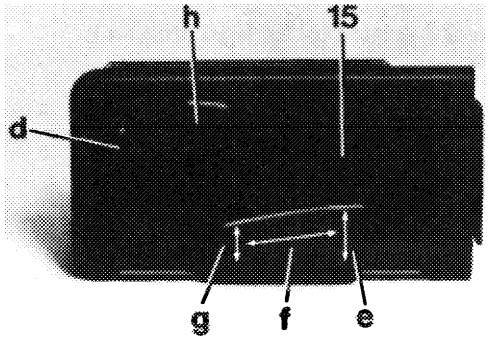
Wiring diagram electrical seat adjustment – seat left and right (USA)

Operation

The seats are adjusted by means of a switch combination which is located in door lining.

Note: The harness is connected to switch by means of three plug couplings.

The switch can be removed without disassembly of door lining.



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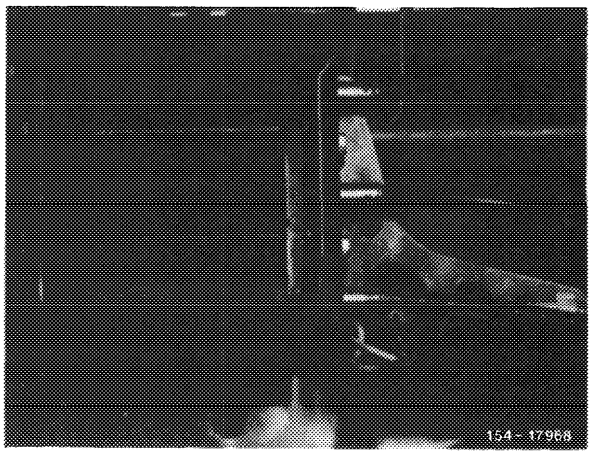
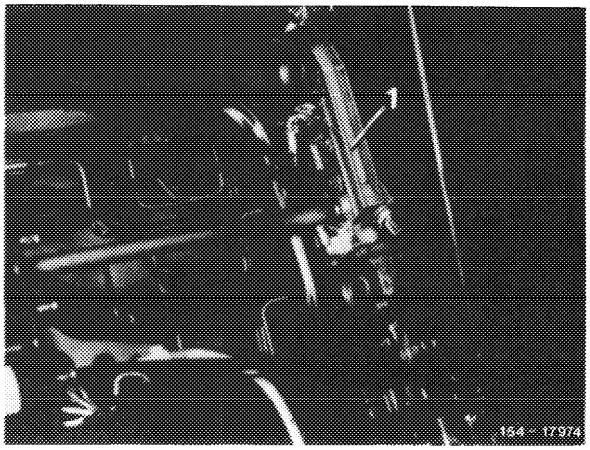
Switch, seat and head restraint adjustment

- 15 Switch
- d Head restraint high/low
- e Seat height front
- f Seat forward/back
- g Seat height rear
- h Backrest

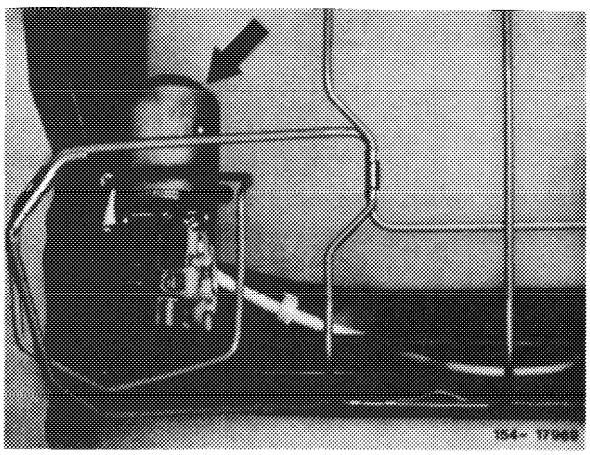
A group of three motors for longitudinal and height adjustment is located in seat frame.



For adjustment, the motors are driving a gear unit (1) by means of 3 shafts.



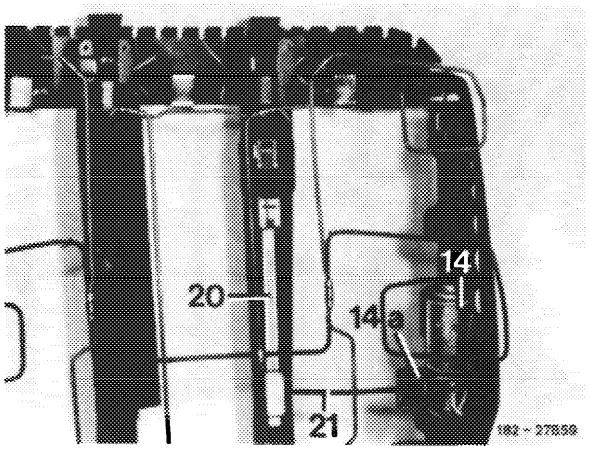
For backrest adjustment, the backrest frame is provided with an additional motor, which sets the backrest forward and back directly by means of a gear unit.



Adjusting motor for head restraint

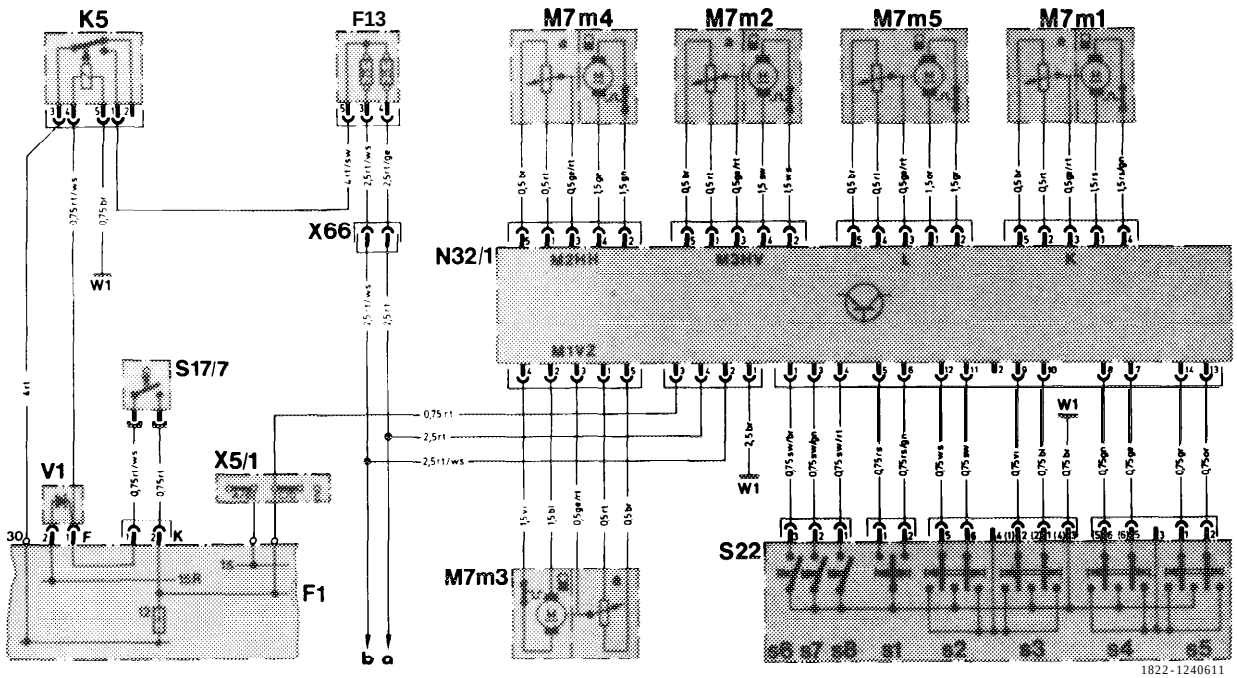
The adjusting motor (14) for head restraint is located in backrest frame.

The head restraint is adjusted by means of a rack (20) which is driven by the motor by way of a shaft (21).



B. Version with memory circuit (position memory)
Seat, backrest and head restraint adjustment

Standard version



Wiring diagram electrical seat adjustment with memory circuit left

F1	Central electrical system
F13	Auxiliary fuse box, seat adjustment
K5	Relay seat adjustment
M7	Motor group for seat adjustment, front left
m1	Head restraint high/low
m2	Seat height front
m3	Seat forward/back
m4	Seat height rear
m5	Backrest
N31/1	Control unit for seat adjustment with memory, front left
S17/7	Door contact switch for comfort circuit, left
s22	Switch for seat adjustment, front left
s1	Head restraint high/low
s2	Seat height front
s3	Seat forward/back
s4	Seat height rear
s5	Back rest
s6	Position button 1
s7	Position button 2
s8	Memory button
V1	Diode for seat adjustment comfort circuit
W1	Main ground (behind instrument cluster)
X5/1	Line connector, interior
X66	Plug connection for seat adjustment
a	To control unit N32/2 seat right connection No. 4
b	To control unit N32/2 seat right connection No. 2

Deviation seat right:
Item S22: Connections indicated by brackets

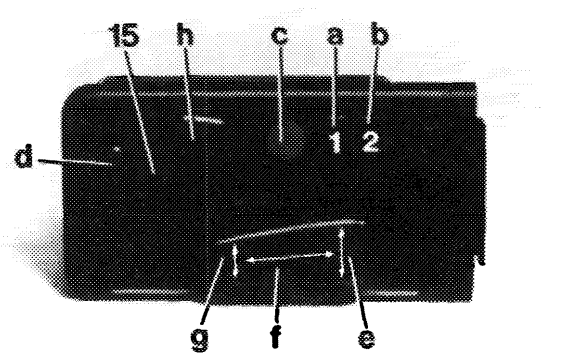
Handling

The seat and head restraint adjustment can be operated by means of a switch in door lining in key position 1 and 2 or with opened driver's door.

Two seat positions and the respective head restraint positions can be put into memory and called whenever required.

Switch, seat and head restraint adjustment

15 Switch
a Position button 1
b Position button 2
c Memory button
d Head restraint high/low
e Seat height front
f Seat forward/back
g Seat height rear
h Backrest



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Note: The harness is connected to switch by means of four plug couplings.

Memory for seat and head restraint position

1 Adjust position of seat and head restraint.

2 Push memory button (c).

3 Push position button 1 or 2.

The position button must be pushed within three seconds after pushing memory button (c), otherwise there will be no memory.

Calling memory position (seat and head restraint)

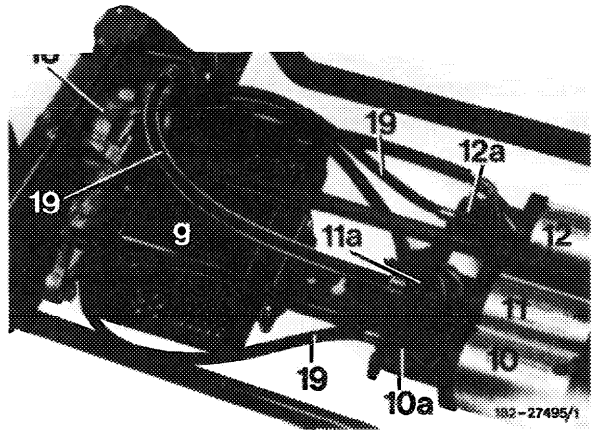
4 Push position button 1 or 2.

For operational reasons, keep position button down until the end position is attained and none of the motors is rotating any longer.

The simultaneous actuation of several buttons will interrupt the adjusting sequence. A position in memory can be attained only after pushing a position button once again.

The electronic control unit (9) is located below on seat.

If the voltage supply to control unit is interrupted (e.g. by a disconnected battery) the memory is extinguished. The seat and head restraint position must be again put back into memory.



Adjusting device

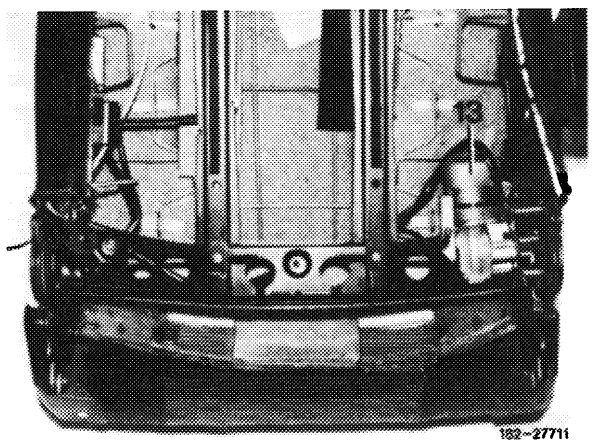
The seat is adjusted by a gear unit (18), which is driven by 3 motors (10, 11, 12) by means of 3 shafts (19). These parts are located below on seat.

The motors are each provided with a potentiometer (12a) as position transmitter for the memory. Depending on seat position, the potentiometer will transmit a given resistance value to memory of electronic control unit.

In the event of a defective potentiometer e.g. on motor of longitudinal adjustment, the longitudinal adjustment can no longer be put into memory. This will not impair adjustments.

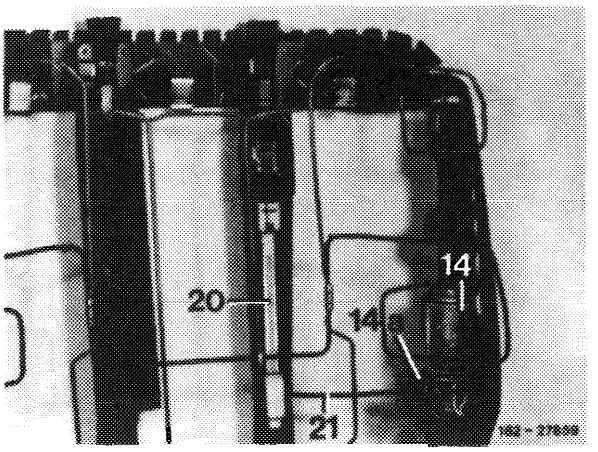
The motors, shafts, potentiometers and gear units of seat adjustment are individually replaceable.

The backrest is adjusted by means of a motor (13) with integrated potentiometer and gear unit. The motor is located on backrest frame.



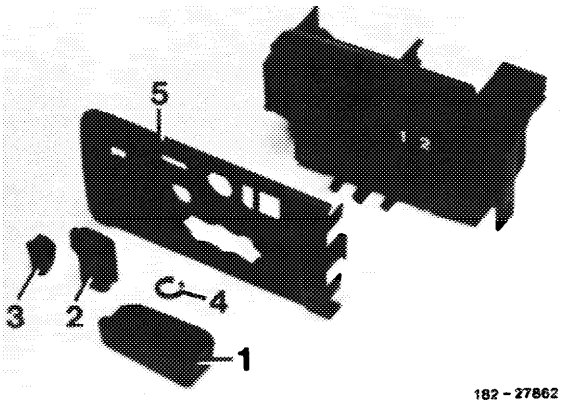
The adjusting motor (14) for head restraint is located in backrest frame.

The head restraint is driven by a rack (20), which in turn is operated by means of a motor and a shaft (21). A replaceable potentiometer (14a) is located on motor as position sensor.

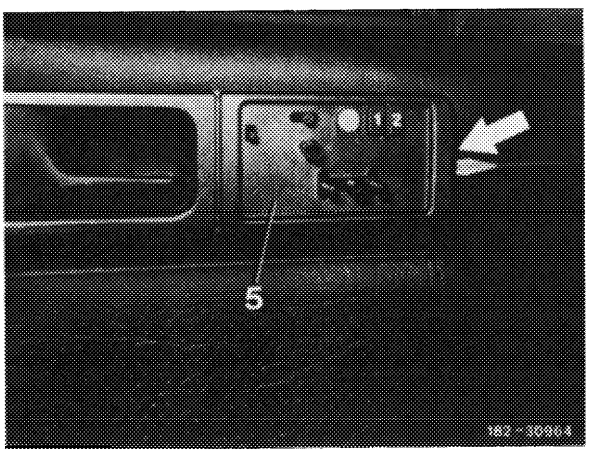


1 Disconnect negative terminal of battery.

2 Pull off handles (1, 2, 3) and fuse (4).

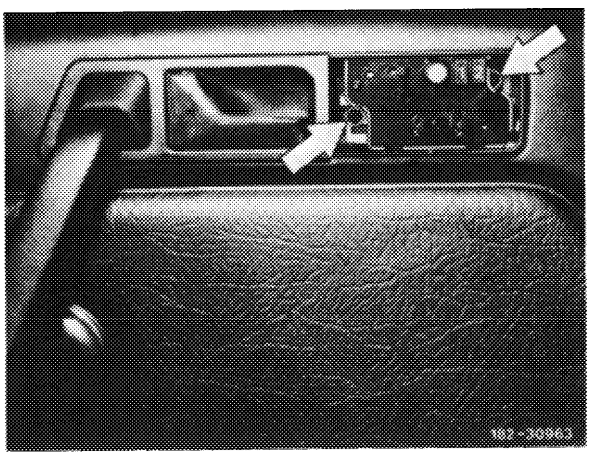


3 Unclip cover (5) (arrow) and remove.



4 Unscrew switches (arrows) and pull plug couplings of harness from switch.

5 Install switches in reverse order. Connect negative terminal of battery and check seat adjustment for function.



Basic version starting September 1985
starting 1986

a) General information

Basic version

The EDW system is a contact-controlled system with an acoustic alarm signal When triggered, the acoustic warning is sounded by an additional horn at approx. 30-second intervals.

(USA)
The EDW system is a contact-controlled system with an acoustic and an optical alarm signal. When triggered, the acoustic warning is sounded by an additional horn at approx. 60-second intervals, and after an interval of approx. 30 seconds once again for 60 seconds.

In parallel with the above, the dimmer and the tail lamp will flash for approx. 150 seconds. If the parking (tail) or standing lamp is switched on when the alarm is triggered, only the dimmer light will flash.

Basic version (USA)

The system is combined with locking system and can be switched on and off only with master key (identification, red clip) on front lefthand and righthand door, as well as on trunk lid lock.

The locking cylinder and switch are one unit and can be replaced as a complete unit only.

The protective range includes the following vehicle components:

- All vehicle doors
- Engine hood and trunk lid
- Radio (removal)
- Brake (actuation)
- Ignition (actuation, shorting)
- One-sided level change of vehicle (towing-off protection)

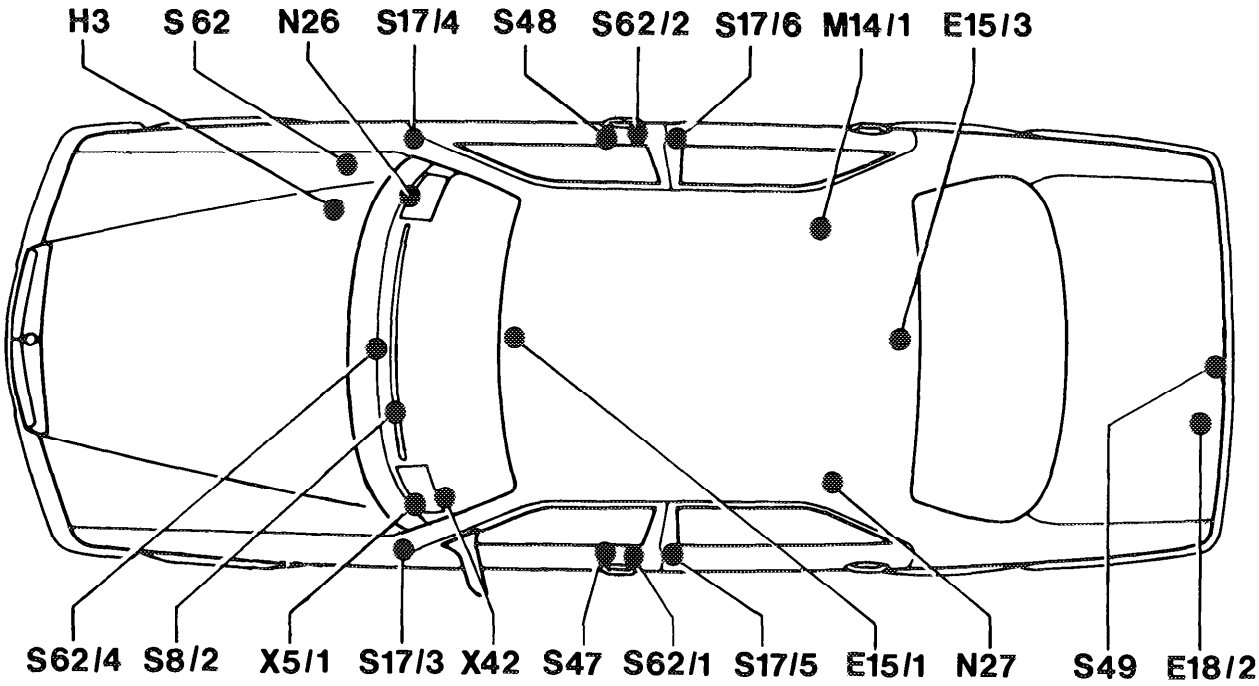
Note

Owing to general operational safety, no interruption of ignition is provided for.

If the vehicle is transported on an automobile ferry or an automobile excursion train, or if it is parked on an elevator platform garage, do not switch on the anti-theft system, since it will then be unintentionally released. In such a case, lock vehicle with secondary key only.

(USA) Radio anti-theft protection

If the radio is removed with the anti-theft alarm system switched on, the unit will become unusable and will be operational again only upon reconditioning by Becker, the manufacturer.



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Layout

E15/1	Dome lamp with switch, front
E15/3	Dome lamp, rear
E18/2	Trunk light with switch
H3	Alarm horn
M14/1	Supply pump central locking system
N26	Control unit EDW
N27	Release unit towing-off protection
S8/2	Warning buzzer contact, light/central locking system
S17/3	Door contact switch, front left
S17/4	Door contact switch, front right
S17/5	Door contact switch, rear left
S17/6	Door contact switch, rear right
s47	Switching and operating element, door front left
S48	Switching and operating element, door front right
s49	Switching and operating element, trunk lid lock
S62	Switch engine hood EDW
S62/1	Switch door EDW, front left (1–2 off, I-3 on)
S62/2	Switch door EDW, front right (1–2 off, I-3 on)
S62/4	Locking contact EDW, radio
x5/1	Line connector, interior
x37/1	Plug connection intermediate harness EDW, door front left, 3-pole
X37/2	Plug connection intermediate harness EDW, door front right, S-pole
X42	Plug connection EDW front/EDW rear, 12-pole

Vehicle keys

The following keys are included with EDW system:

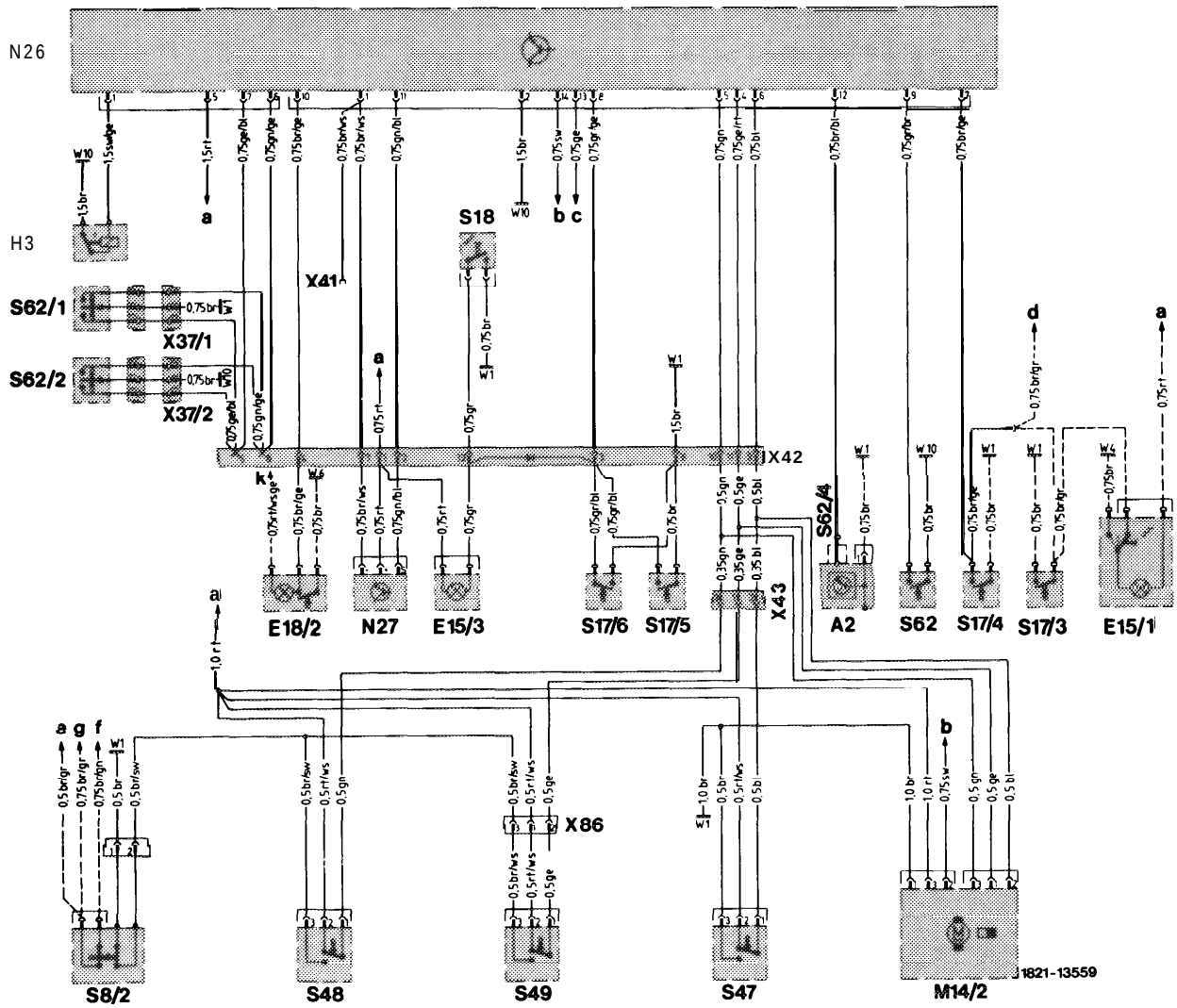
Main key, 2 each — with angular handle and red clip. With this key, the vehicle can be completely operated, while the EDW system is switched ,,On" or ,,Off" via locking cylinder of front lefthand and righthand door, as well as via rear lock.

Main key, 1 each — as reserve key, sealed in transparent plastic sheeting.

Secondary key, 1 each -with rounded-off handle. With this key, the vehicle can be operated except for glove box and trunk lid lock. Note that in such a case the EDW system is **not** switched ,,On" or ,,Off".

Note: Replacement keys are ordered similar to vehicles without EDW system according to code or lock number.

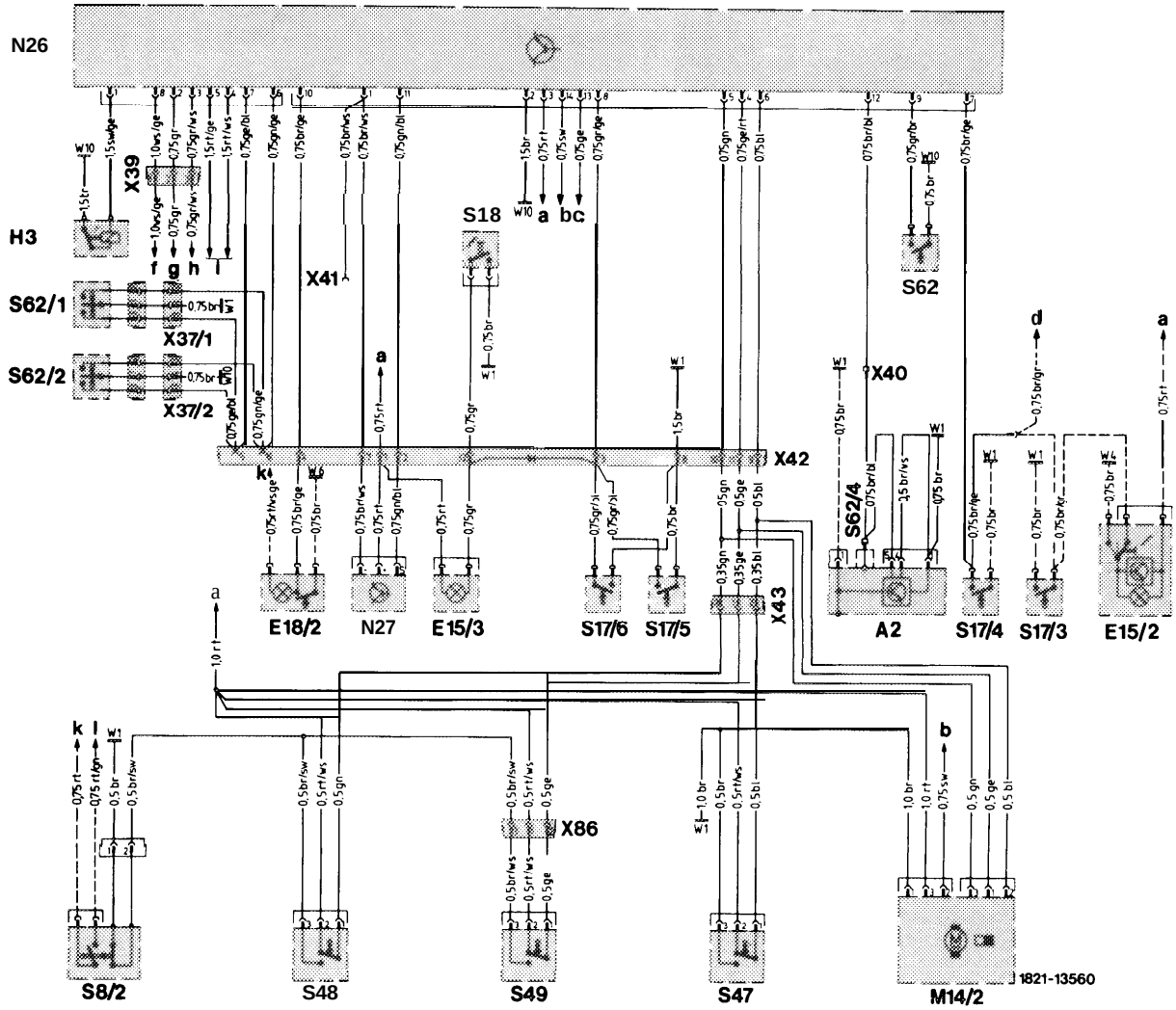
b) Electric wiring diagrams



Wiring diagram basic version

——— Main harness
Harness E DW system

A2	Radio
E15/1	Dome lamp with switch, front
E15/3	Dome lamp, rear
E18/2	Trunk light with switch
H3	Alarm horn
M14/2	Supply pump central locking system with orthopedic seat backrest, front
N26	Control unit EDW
N27	Releasing unit towing-off protection
S8/2	Warning buzzer contact, light/central locking system
S17/3	Door contact switch, front left
S17/4	Door contact switch, front right
S17/5	Door contact switch, rear left
S17/6	Door contact switch, rear right
S18	Switch dome lamp, rear
s47	Switching and operating element, door front left
S48	Switching and operating element, door front right
s49	Switching and operating element, trunk lid lock
S62	Switch engine hood EDW
S62/1	Switch for door EDW, front left (1–2 off, I-3 on)
S62/2	Switch for door EDW, front right (1–2 off, I-3 on)
S62/4	Locking contact EDW, radio
W1	Main ground (behind instrument cluster)
w4	Ground, dome lamp front
W6	Ground, trunk wheelhouse left
W10	Ground, battery
x37/1	Plug connection intermediate harness EDW, door front left, 3-pole
X37/2	Plug connection intermediate harness EDW, door front right, 3-pole
x41	Plug connection EDW connected ground
X42	Plug connection EDW front/EDW rear, 12-pole
x43	Plug connection EDW central locking system, S-pole
X44	Plug connection central locking system/ trunk lid lock
a	Feed fuse 15 terminal 30 } Line connector
b	Feed fuse 12 terminal 15 } Interior
c	Feed stop lamp switch
d	Warning buzzer contact
e	Door contact switch, front right
f	Warning buzzer
g	Dome lamp, front



Wiring diagram (USA)

--- Main harness
Harness EDW system

A2	Radio
E15/2	Dome lamp with time delay
E15/3	Dome lamp, rear
E18/2	Trunk light with switch
H3	Alarm horn
M14/2	Supply pump central locking system with orthopedic seat backrest front
N26	Control unit EDW
N27	Releasing unit towing-off protection
S8/2	Warning buzzer contact, light/central locking system
S17/3	Door contact switch, front left
S17/4	Door contact switch, front right
S17/5	Door contact switch, rear left
S17/6	Door contact switch, rear right
S18	Switch dome lamp, rear
s47	Switching and operating element, door front left
S48	Switching and operating element, door front right
s49	Switching and operating element, trunk lid lock
S62	Switch engine hood EDW
S62/1	Switch door EDW, front left (1–2 off, I-3 on)
S62/2	Switch door EDW, front right (1–2 off, I-3 on)
S62/4	Locking contact EDW, radio
W1	Main ground (behind instrument cluster)
W4	Ground dome lamp front
W6	Ground trunk wheelhouse left
W10	Ground battery
x37/1	Plug connection intermediate harness EDW, door front left, 3-pole
X37/2	Plug connection intermediate harness EDW, door front right, 3-pole
x39	Plug connection EDW rotary light switch
x40	Plug connection EDW radio I-pole
x41	Plug connection EDW connected ground
x43	Plug connection EDW central locking system, 3-pole
x44	Plug connection central locking system/trunk lid lock
a	Feed fuse 15 terminal 30 } Line connector
b	Feed fuse 12 terminal 15 } Interior
c	Feed stop light switch
d	Control unit belt warning
f	Feed dimmer light
g	Feed parking light terminal 58R
h	Feed parking light terminal 58L
i	Additional fuse box, EDW system (terminal 30)
k	Feed fuse 13 terminal 30
l	Control unit belt warning

c) Switching system on and off

Switching on

When closing door front left or right, the switch (wiring diagram item S 62/1 or S 62/2) is simultaneously operated. The connected ,,negative'' on switch via brown line (connection No. 1) is connected to the yellow/blue line (connection No. 3) and is switched as an impulse to control unit (N 26, connection No. 7 of B-pole coupling). The system is in switched-on condition.

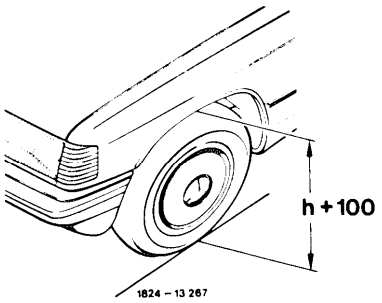
When the trunk is closed, the system is switched on by the switch element of central locking system at trunk lid lock. The ,,negative'' (line brown/white, connection No. 3) against switch element (S 49) is connected via 3-pole plug connection (X 43) with the yellow line of the 12-pole plug connection (X 42, connection No. 11) and is fed via yellow/red line to control unit (N 26, connection No. 4 of 14-pole coupling). The system is in switched-on condition.

When opening a door, the engine hood or the trunk lid, when removing the radio, when switching on or bridging the ignition lock or when actuating the service brake by way of the respective contact switch, the control unit is activated and the alarm is triggered.

If the level of the protected vehicle changes on one side, the alarm is also triggered.

An auxiliary unit developed as towing-off protection releases the alarm as follows:
- in the event of a level change of longitudinal axis by 2.2”
- in the event of a level change of transverse axis by 1.2”

that is, when the vehicle is raised, the alarm is triggered after max. 100 mm (measured on wheelhouse).



The system has a switching-on time delay of 15 seconds. If individual doors remain open for more than 15 seconds to remove items, after the system has been switched on, no alarm will be triggered at the end of the delay period. When the door is closed, this range is switched on, i.e. the alarm will be triggered when the door is opened again.

Alarm signal

Basic version

The alarm horn is activated by the control unit for approx. 30 seconds at intervals. The alarm of approx. 30 seconds will run off also when the releasing unit (e.g. the door) is immediately closed again.

(USA)

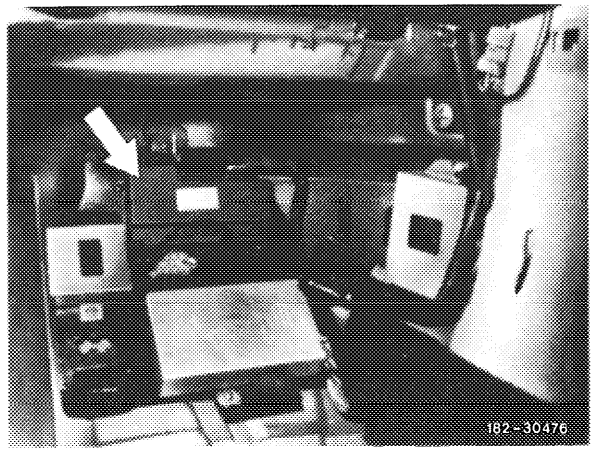
The control unit activates the acoustic alarm signal for approx. 60 seconds at intervals and after a pause of approx. 30 seconds for another 60-seconds interval. The optical alarm signal flashes simultaneously for approx. 150 seconds. The alarm will also run off, when the releasing unit (e.g. the door) is immediately closed again,

Switching off

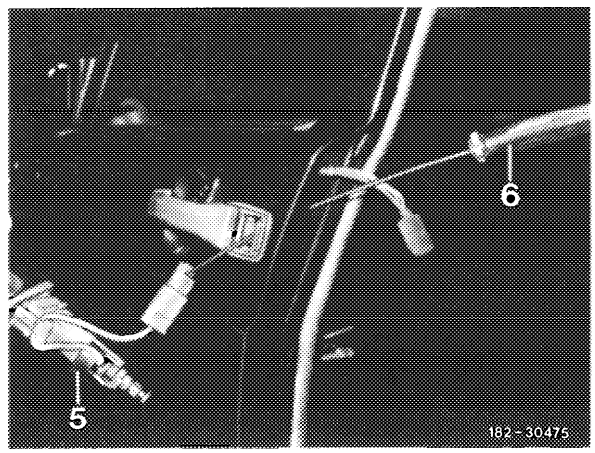
When the door is opened at front left or right, the switch (wiring diagram item S 62/1 or S 62/2) is simultaneously actuated. The ,,negative" against switch via brown line (connection No. 1) is connected to green/yellow line (connection No. 2) and switched as an impulse to control unit (N 26, connection No. 6 of 8-pole coupling). The system is in switched-off condition.

When the trunk is opened, the system is switched off by the switching element of the central locking system on trunk lid lock. The ,,positive" (line red/white, connection No. 1) against switch element (S 49) is connected via the 3-pole plug connections (X44/1 and X 43) with the yellow line of the 12-pole plug connection (X 42, connection No. 11) and fed via yellow/red line to control unit (N 26, connection No. 4 of 14-pole coupling). The system is in switched-off condition.

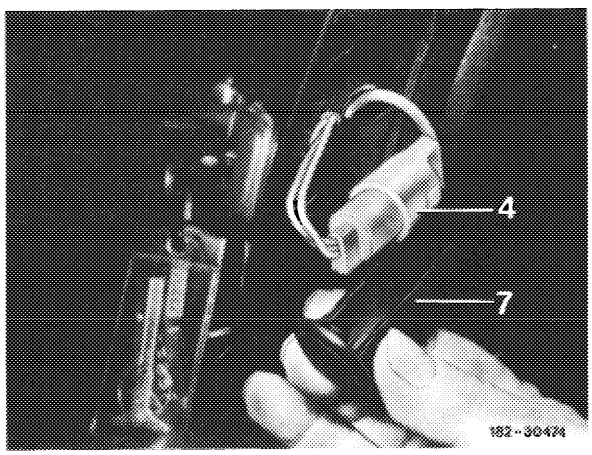
d) Layout of components



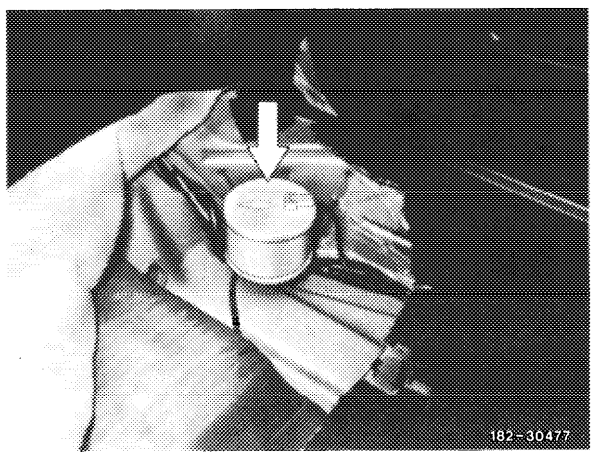
Control unit
(in legroom right, under foot support)



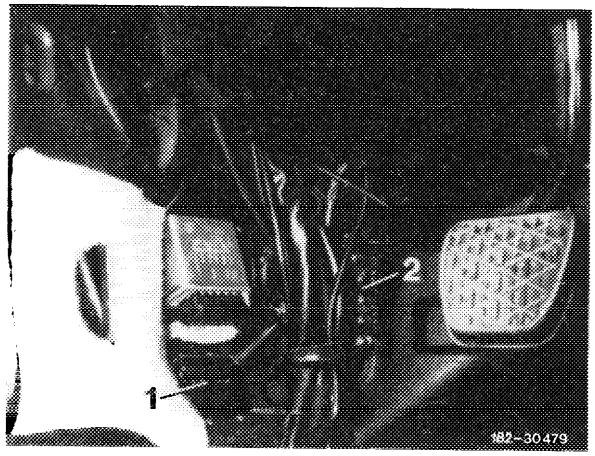
5 Switch on locking cylinder
6 Assembly tool



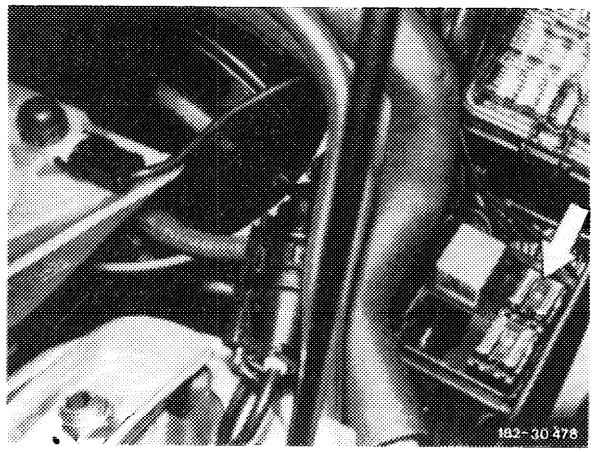
4 Plug connection, 3-pole
7 Cover



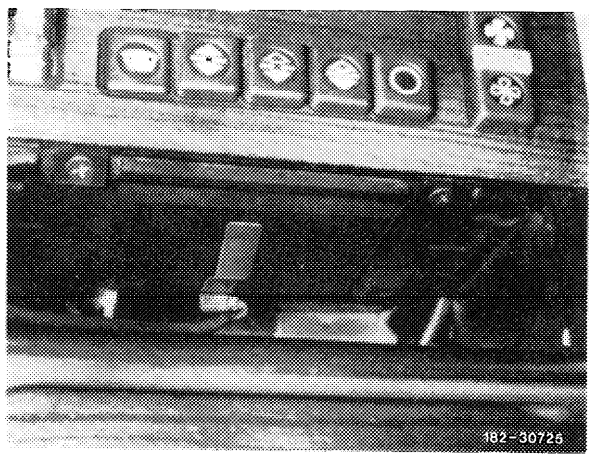
Release unit towing-off protection



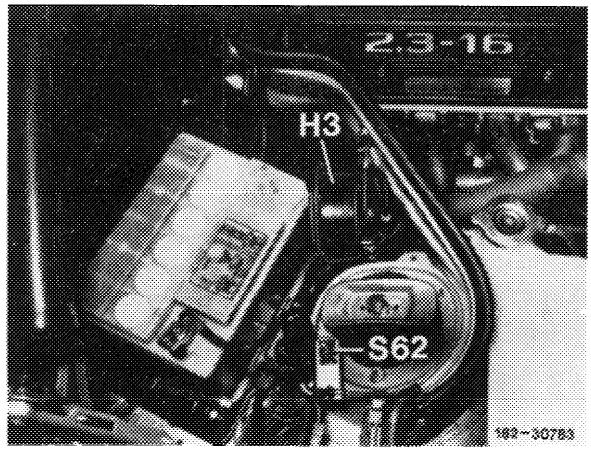
1 **Plug connection EDW front/EDW rear**
2 Line connector, interior



Additional **fuse box EDW**
((USA) only)

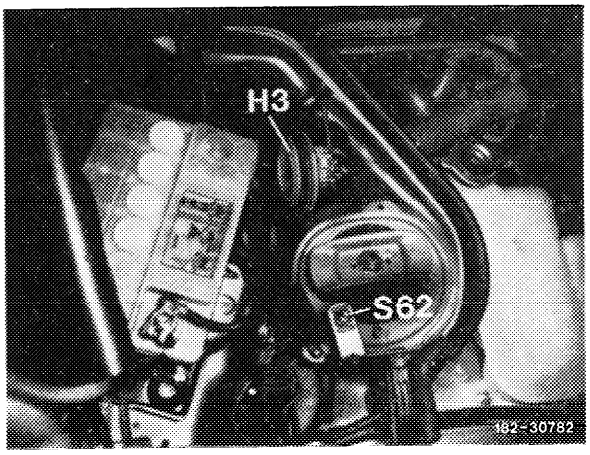


Fuse contact, radio



(USA)

S62 Switch, engine hood
H3 **Alarm horn**



Basic version

S62 Switch, engine hood
H3 Alarm horn

Job No.

Fender
Removal and installation of front fender 88-l 00

Bumper
Removal and installation of front bumper 200
Disassembly and reassembly of bumper front and rear 210
Removal and installation of rear bumper 220
A. Model 201.02 and 201 .1
B. Model 201.034

Engine hood
Removal and installation of engine hood 300
Adjustment of engine hood 302
A. Adjustment in longitudinal direction
B. Adjustment in crosswise direction
C. Adjustment in height (vertical adjustment)
Removal and installation of engine hood hinge 306
Removal and installation of cable control for engine hood . . . 310
Removal and installation of engine hood lock 320
A. Engine hood lock lower half
B. Engine hood lock upper half

Radiator shell
Removal and installation of radiator shell 400
Removal and installation of radiator grille 401
Removal and installation of trim strips on radiator grille 402
Removal and installation of Mercedes star 405

Trunk lid
Removal and installation of trunk lid 500
Removal and installation of trunk lid lock 502
Mounting model identification on trunk lid 505
Removal and installation of hinge lever for trunk lid 512

Replacement parts
Removal and installation roof paneling on side wall 800
Removal and installation of protective strip on side wall 802
Removal and installation of paneling on doors and fenders, outside (model 201.034) 810
Removal and installation of rear spoiler 820
Marking and drilling holes for spoiler on trunk lid 825
Removal and installation of paneling on side member 830
Removal and installation of rain strip on front wall pillar and roof 855
Removal and installation of outside rear view mirror 900
A. Mirror glass
B. Complete outside rear view mirror
Removal and installation of electrically adjustable outside rear view mirror 905
A. Mirror glass
B. Complete outside rear view mirror
Removal and installation of motor for electrically adjustable outside rear view mirror 910

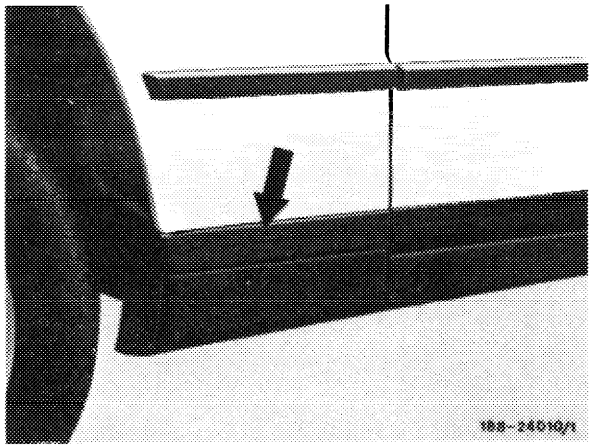
88–100 Removal and installation of front fender

Conventional tools

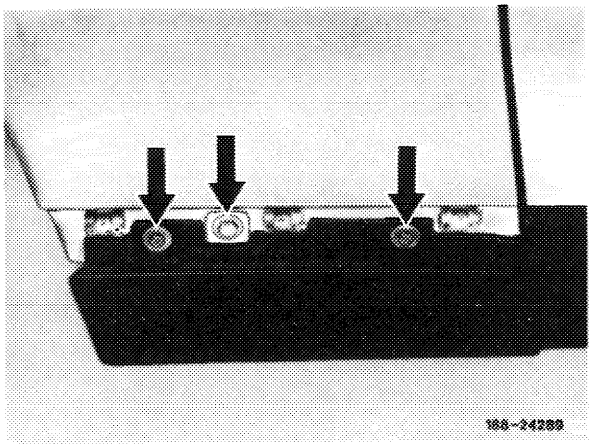
Ratchet 1/4''	Order No. TM 75 e. g. made by Snap-on Tools
Extension 1/4'', 150 mm long, "Wobble-Drive"	Order No. TMXW6 6 Rudolf-Diesel Street
Socket 1/4''	Order No. TMM 10 D-7104 Obersulm-Willsbach

Removal

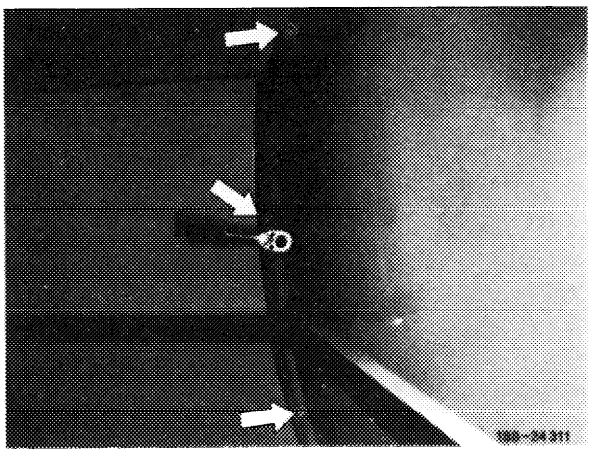
1 Remove cover at fender below.



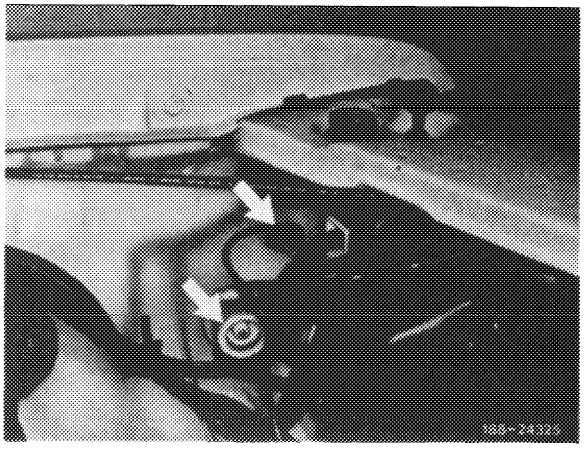
2 Unscrew screws on fender.



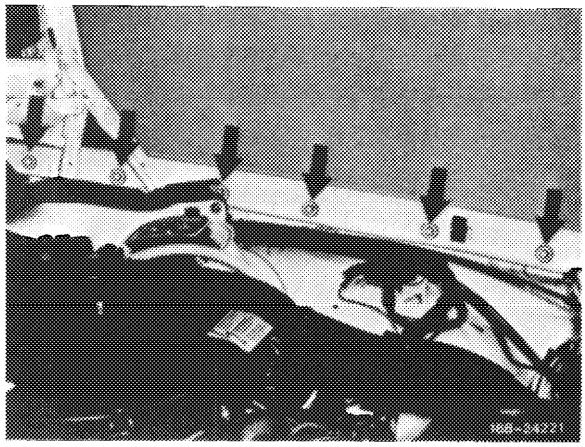
3 Mask driver's door in connecting range to front fender with adhesive tape and unscrew screws on front wall pillar.



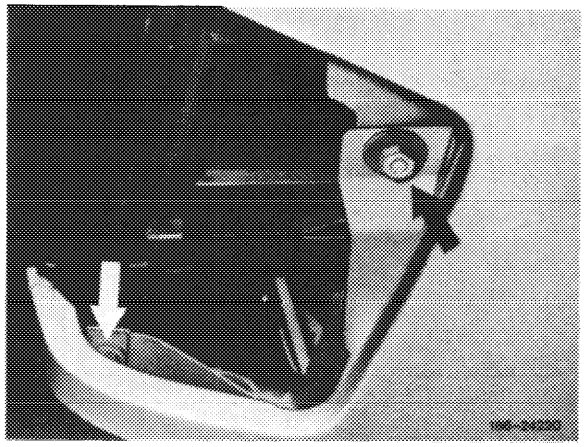
4 Unscrew knurled nut on turnsignal lamp (flasher), pull off electrical connection and push out turnsignal lamp (flasher).



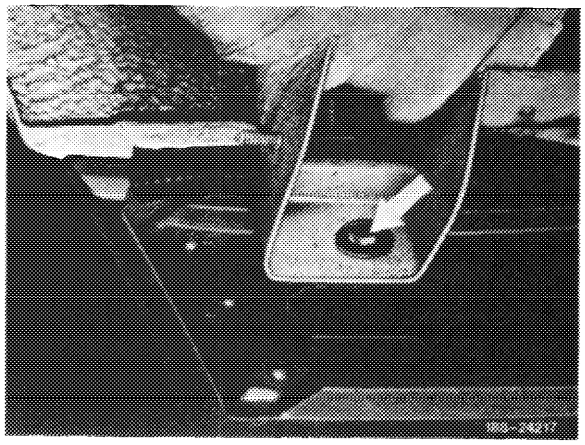
5 Unscrew screws on rebate top.



6 Unscrew screws in cutout of turnsignal lamp (flasher).

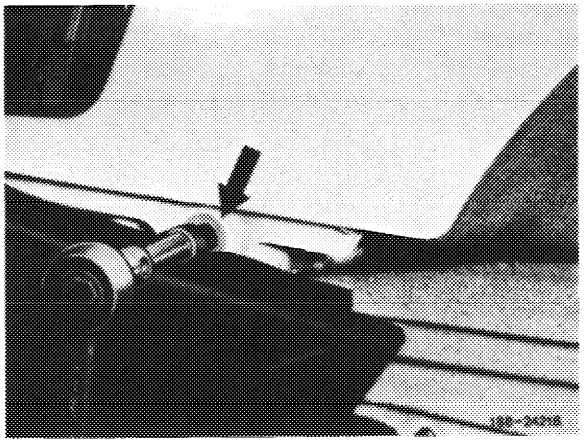


7 Unscrew fastening screw laterally on bumper.



8 Push bumper laterally in downward direction and unscrew screw.

9 Remove fender in forward direction.



Installation

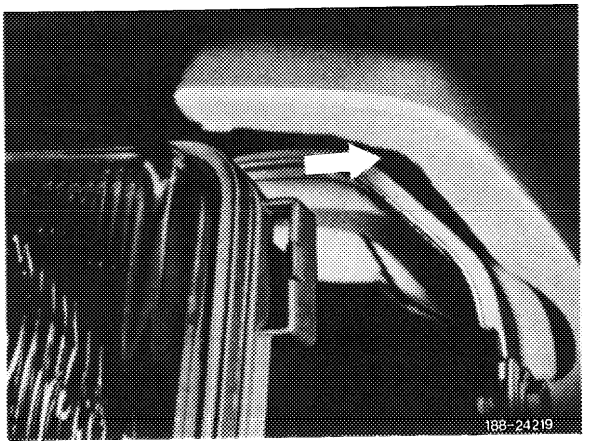
10 Provide spare fender with MB permanent underfloor protection.

11 Check rubber seal on inner fender for correct seat.

12 Mount front fender and fit.

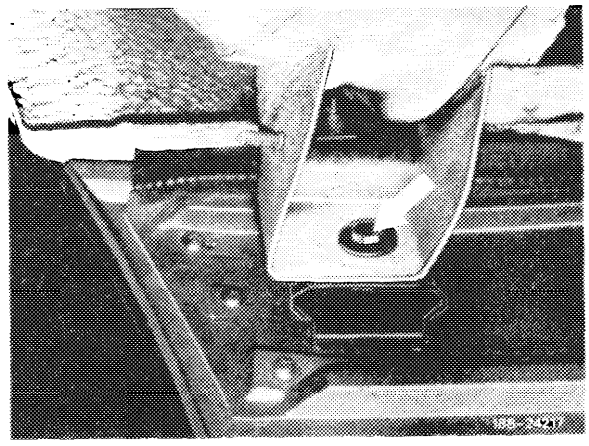
13 For further installation proceed vice versa.

14 Upon assembly of fender, preserve cavity above inner fender through opening in cutout for turnsignal lamp with cavity wax.

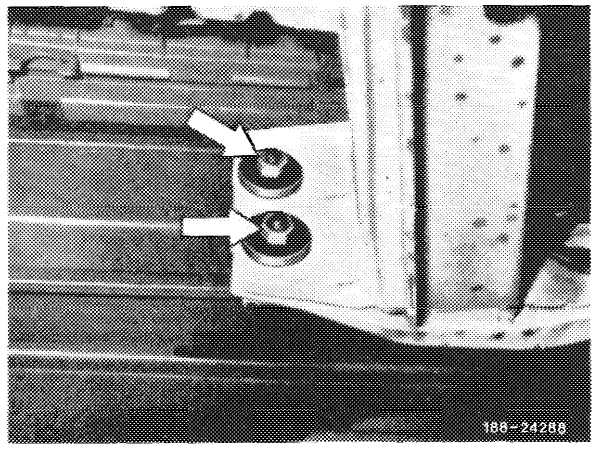


Removal

1 Unscrew screw on holder laterally left and right.

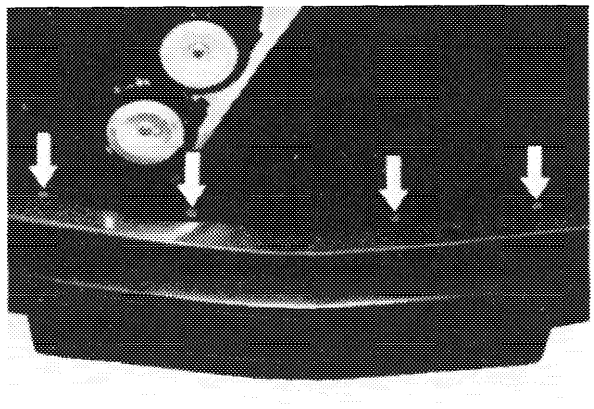


2 Unscrew nuts on side member left and right.



3 Push out clips in range of radiator.

4 Remove bumper in forward direction.



Installation

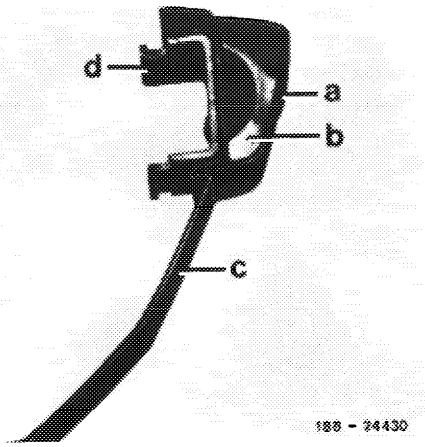
5 For installation proceed vice versa

188-24287

Note:

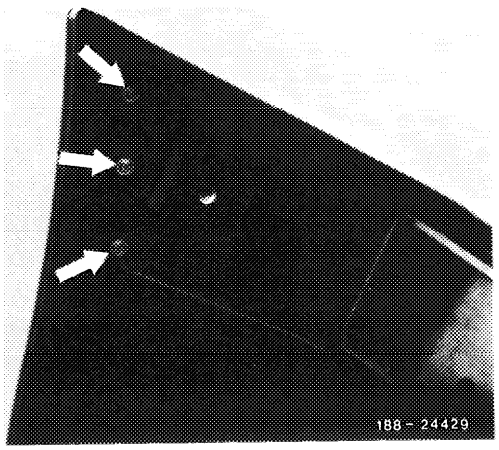
The bumper consists of the following components:

a = Protective strip
b = Energy-absorbing foam member
c = Trim
d = Stiffening



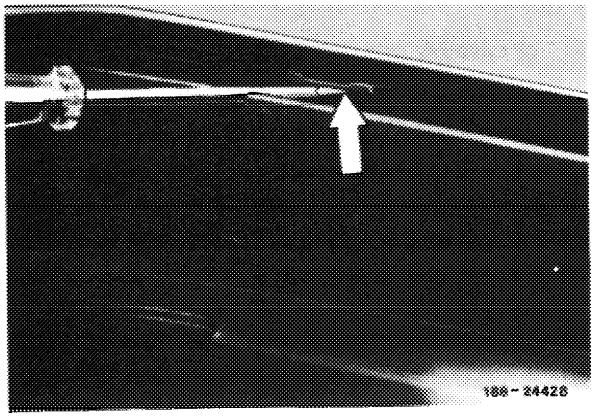
Disassembly

1 **Unscrew screws left and right.**

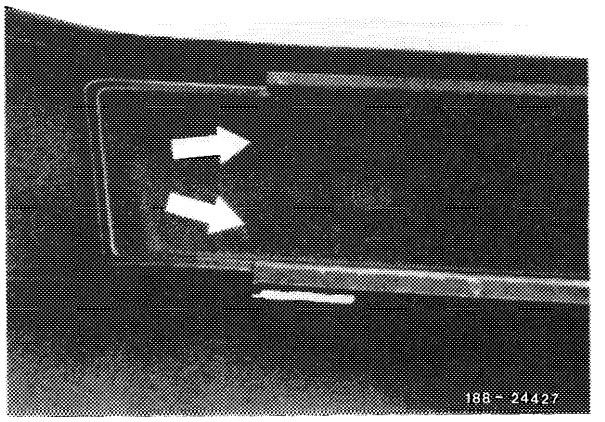


2 Push back holding straps in pairs, starting from outside.

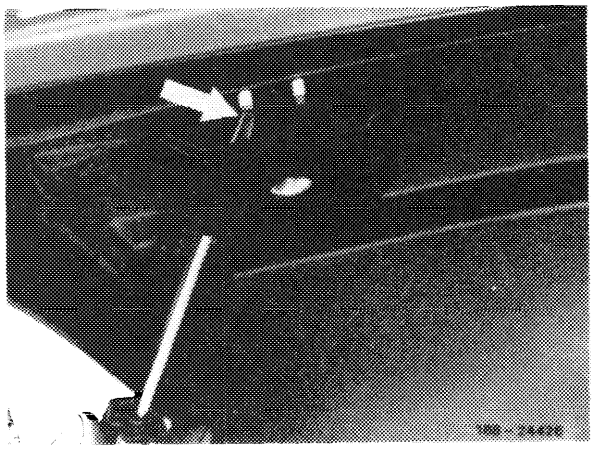
3 Remove protective strip and foam member.



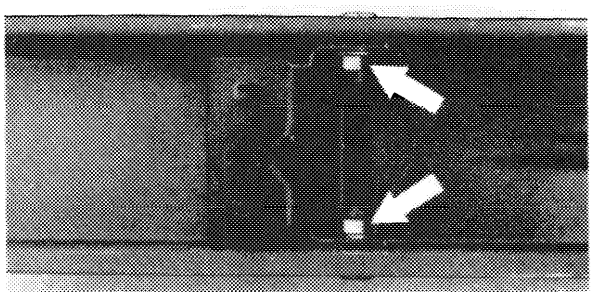
4 Push back clips and remove trim from stiffening.



5 Push back detent on threaded holders left and right, simultaneously slide threaded holder in downward direction and remove.



6 Unscrew screws on holders left and right and remove holders.



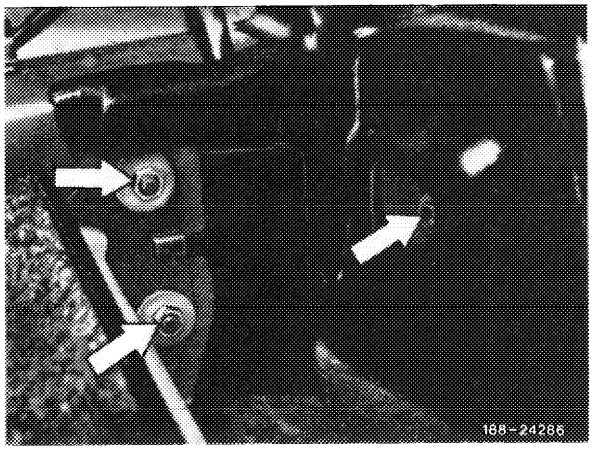
188 - 24431

Assembly

7 For assembly proceed vice versa.

A. Model 201.02 and 201.1

Removal



1 Open flaps in trim at inside of rear fender and unscrew screws located underneath.

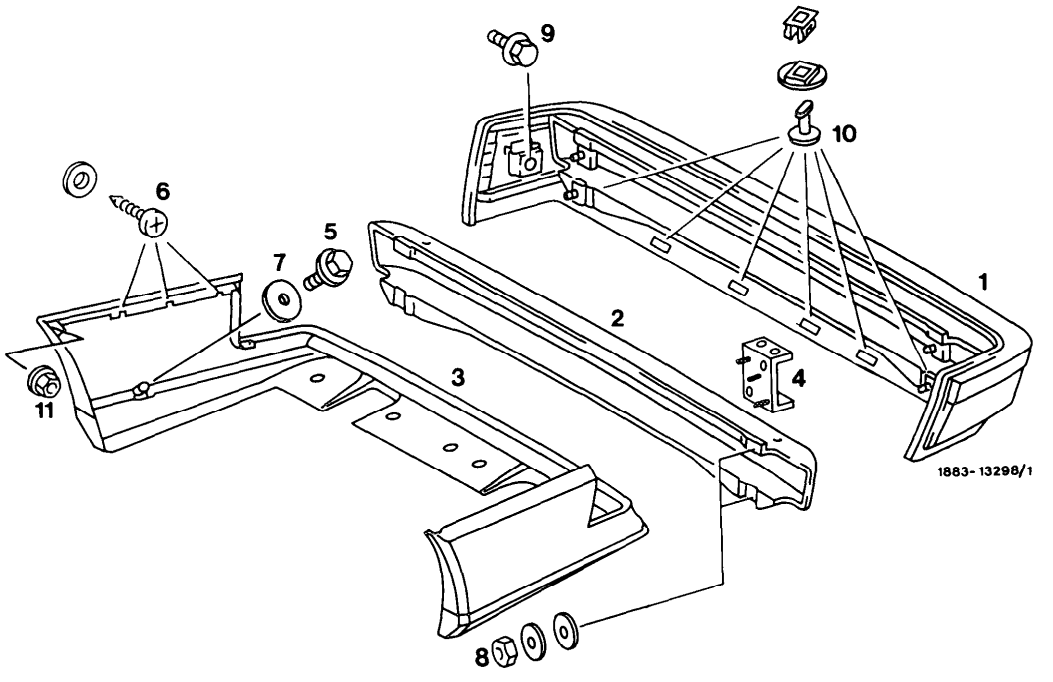
2 Remove bumper toward the rear.

Installation

3 For installation proceed vice versa.

Note: On vehicles with trailer coupling, refinish bumper, The scope of work is described in file for special equipment, Group 31.

B. Model 201.034



Complete bumper

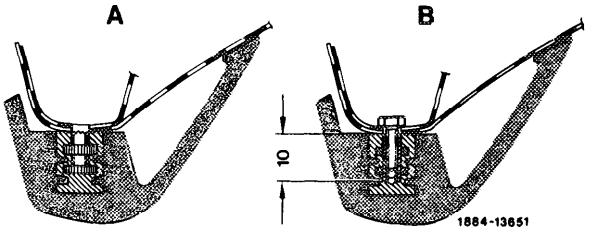
	Lateral panelling (2 each) in trunk.	Remove, install
5, 6, 9	Screws	Remove, install
11	Nut.	Remove, install
8	Nut	4 each, remove, install
1	Bumper	Remove toward the rear

Panelling, below

10	Plastic screws (6 each).	Turn by 90" through opening in panelling (3)
5, 6	Screw	Remove, install
3	Panelling	Remove toward the rear, while pushing downward

Note

With threaded bolt for nut (11) torn off, cut M5 threads into remaining part of threaded bolt. Replace nut **(11)** by screw, part No. 201 990 08 36.

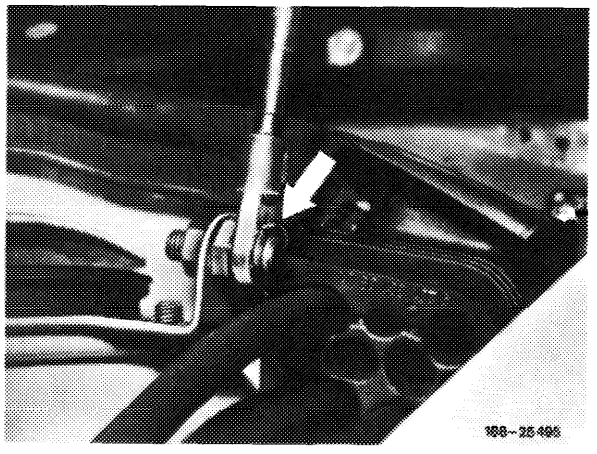


88-300 Removal and installation of engine hood

Removal

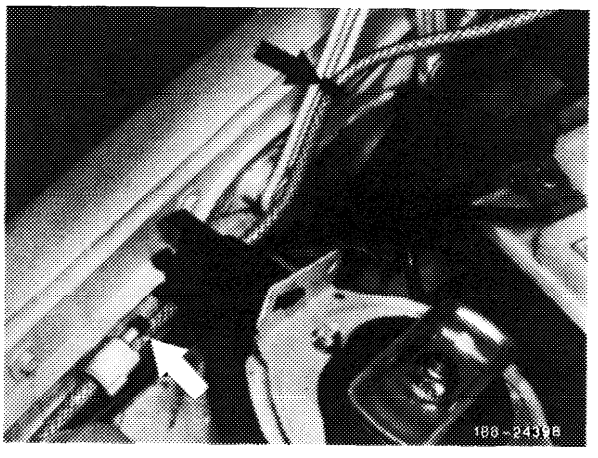
1 Move engine hood into 90° position.

2 Pull-off lock on lower bolt of gas pressure spring and remove gas pressure spring



Attention!
Do not completely slip in piston rod of gas pressure spring. Pressure reduction1

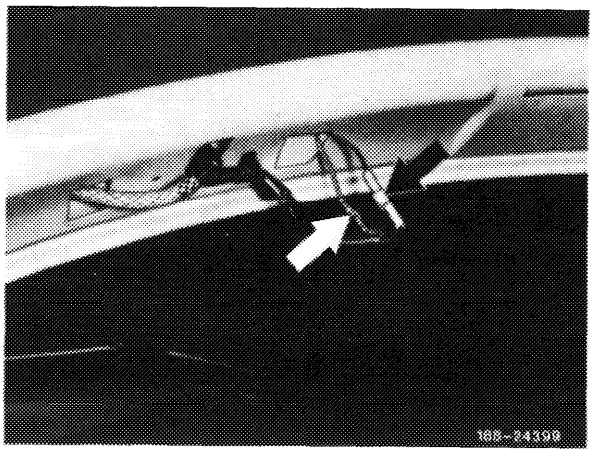
3 Pull off hose on check valve and release on holding clip.



4 Pull out connecting cable for heatable windshield washer nozzle in engine hood stiffening and separate plug connection.

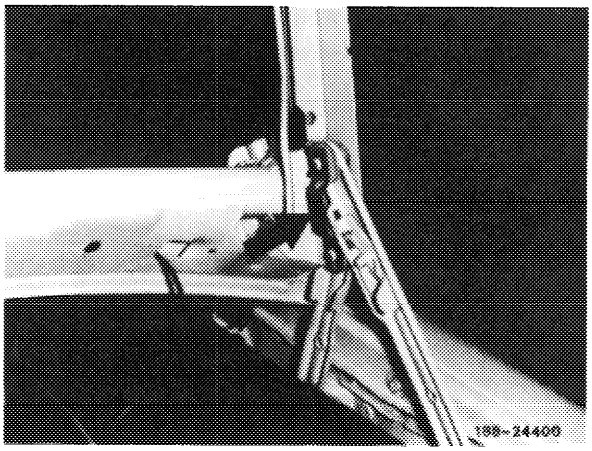
5 Tie cord to plug and pull connecting cable out of engine hood stiffening.

Note: The cord facilitates moving of connecting cable during installation.



6 Press lock from pin on engine hood hinge on both sides.

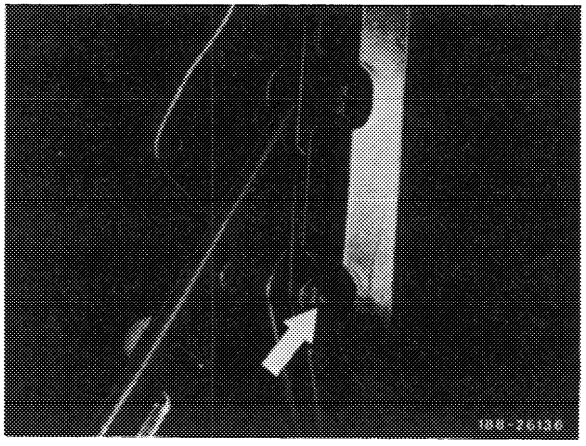
7 Knock out pin and remove engine hood.



8 Mark position of lower threaded bolt left and right und unscrew nut.

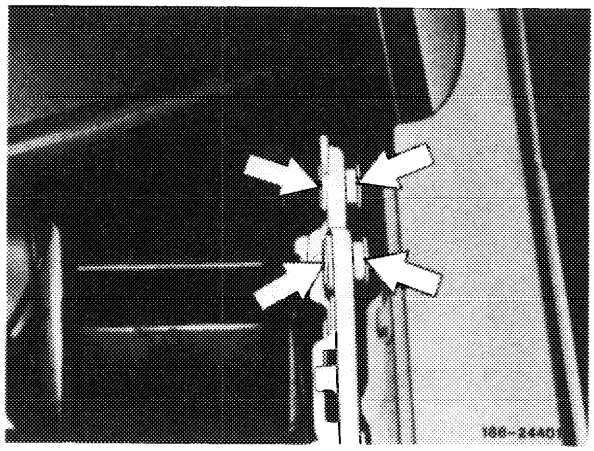
Note: This nut is not provided on all vehicles. After start of series production, the lower plug pin for additional height adjustment was changed into a threaded bolt.

9 Knock out bolt and remove engine hood.



Installation

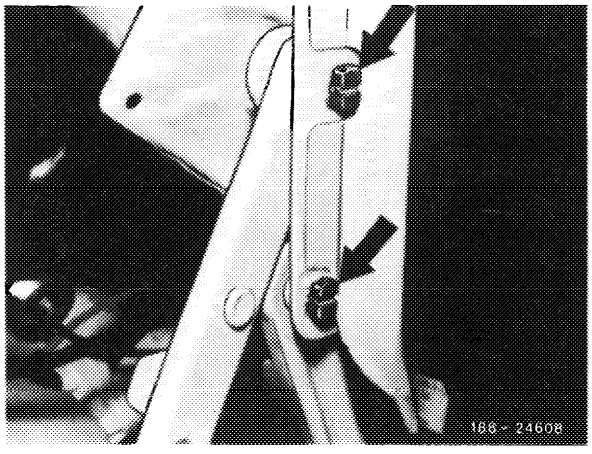
10 Push bearing bushings into hinge lever.



11 Fit engine hood and insert bolt.

1 st version

Align slot on bolt head horizontally.

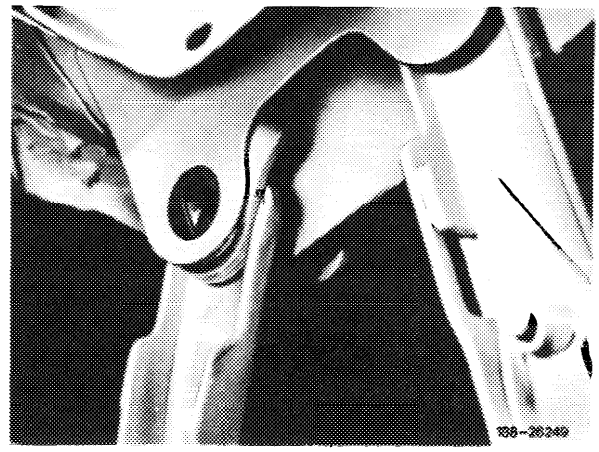


2nd version

Insert lower threaded bolt and turn until the square collar engages into the oblong hole at hinge lever.

Insert upper bolt and align slot of bolt head horizontally.

Position nut, place bolt on the previously applied marking and tighten nut.



12 Insert bolt lock.

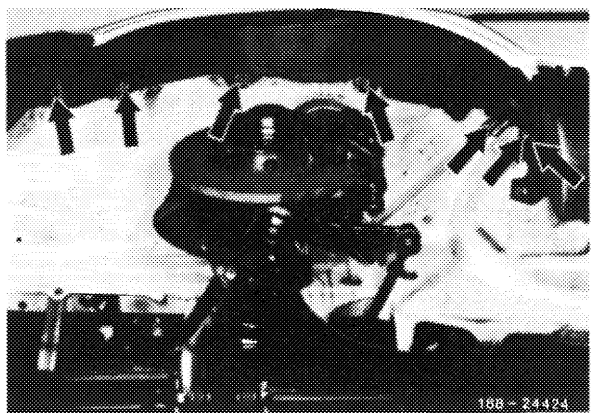
13 For further installation proceed vice versa.

Note: Perform adjustment jobs, if required, according to 88-302.

A. Adjustment in longitudinal direction

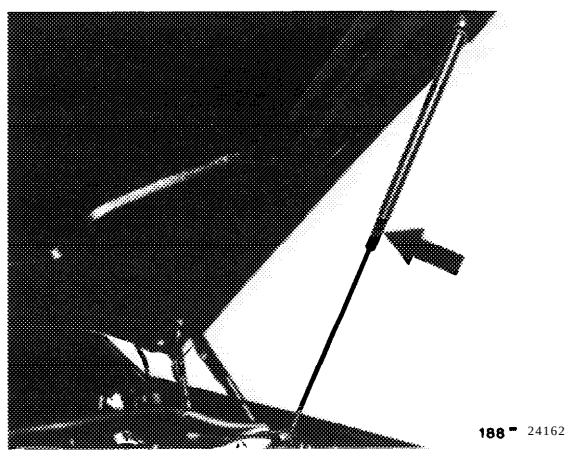
1 Remove inner fender at the left and right.

2 Move engine hood into vertical position (90°).

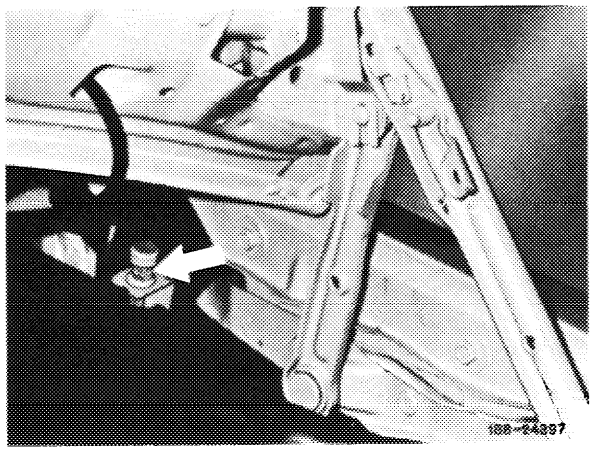


3 Completely remove gas pressure spring.

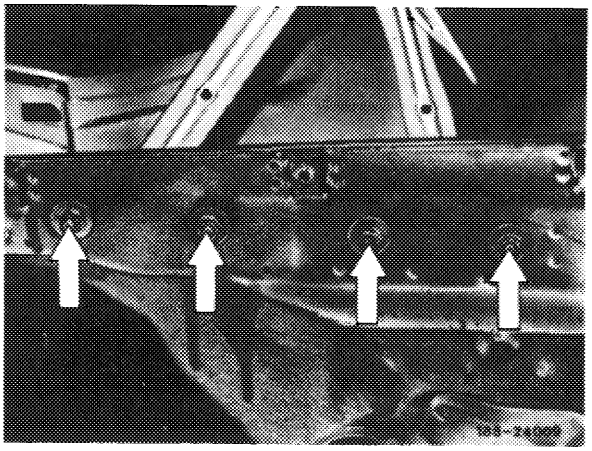
Attention!
Do not completely slip in piston rod of gas pressure spring. Pressure reduction1



4 Loosen counternut on rubber buffer at the rear left and right and turn rubber buffer in downward direction.



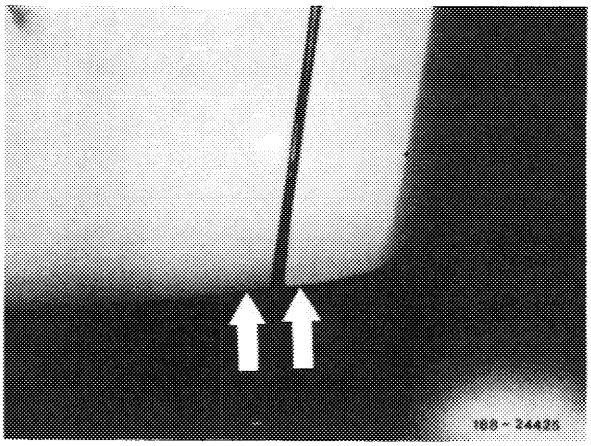
5 Loosen nuts on engine hood hinge in wheel house left and right.



Shown with front fender removed

6 Adjust engine hood in such a manner that the front edge of the fenders is in alignment with front edge of engine hood.

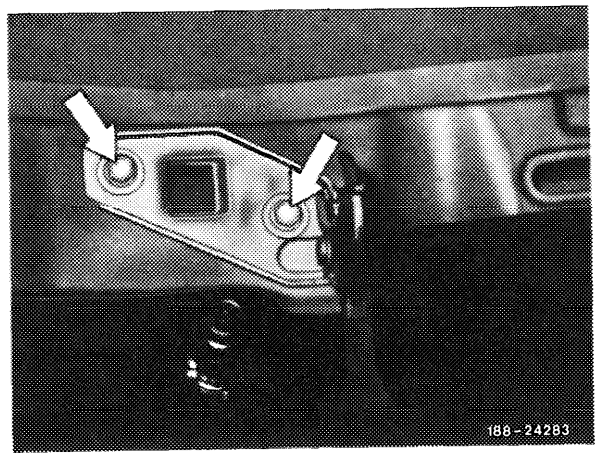
Note: The engine hood can be closed for adjustment in longitudinal direction. The fastening nuts are tightened from direction of wheel house.



Attention: When adjusting in longitudinal direction the rear height adjustment is simultaneously changed. For this reason, it will be necessary to correct the height adjustment (section C).

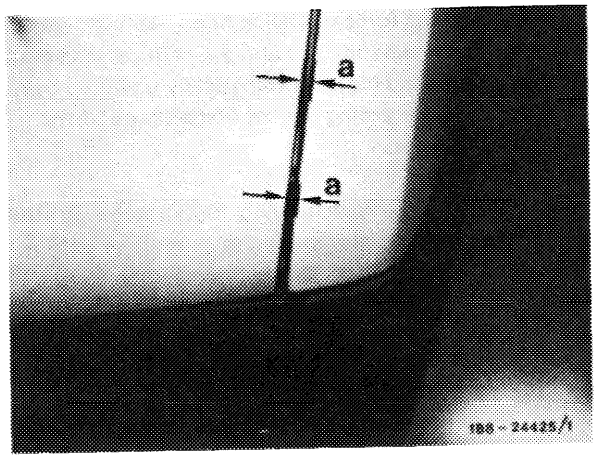
B. Adjustment in crosswise direction

1 Loosen screws on engine hood lock upper half.



2 Fit engine hood.
Air gap: a = 5 mm.

3 Tighten screws on engine hood lock upper half.

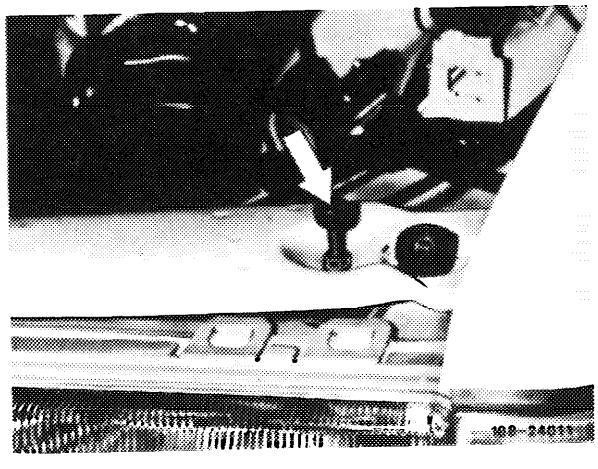


a = 5 mm

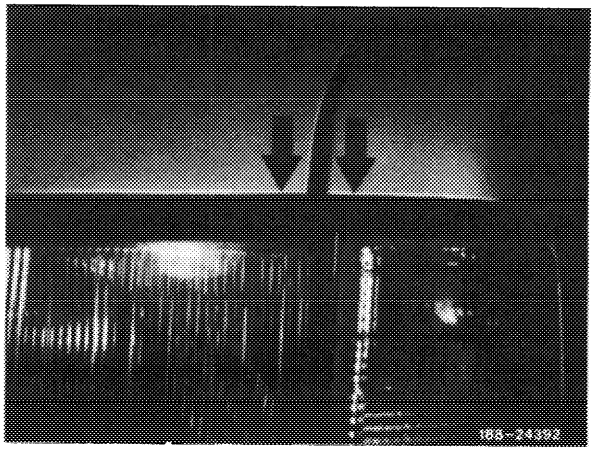
C. Adjustment in height (vertical adjustment)

1 st vefsion

1 Loosen counternut on stop buffer left and right.

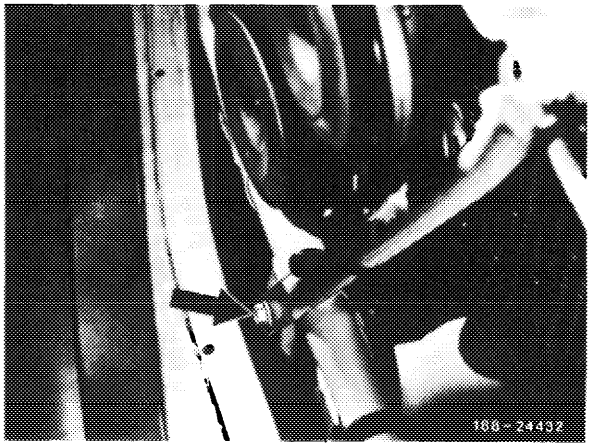


2 Adjust stop buffers at front in such a manner that the lower edge of the engine hood is in alignment with upper edge of turnsignal lamp cuout.



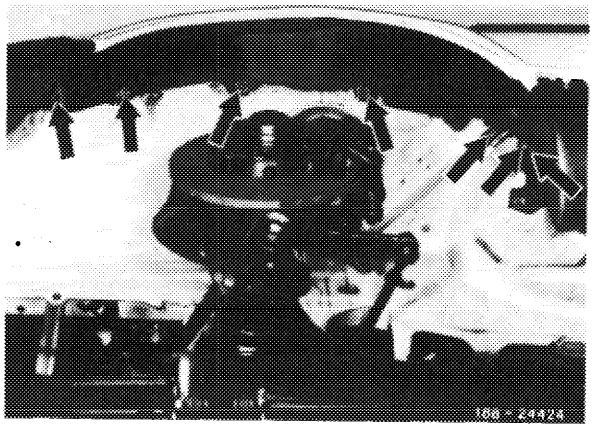
3 Check closing force of engine hood. Adjustment is correct, if engine hood rests under a light preload on rubber buffers and closes automatically under its own weight after overcoming the counterpressure of the gas pressure spring.

Note: If the lock is not engaging, loosen screw on strut of radiator stiffening below and push radiator stiffening in upward direction. This will reduce the closing force.



4 Remove inside fender left and right.

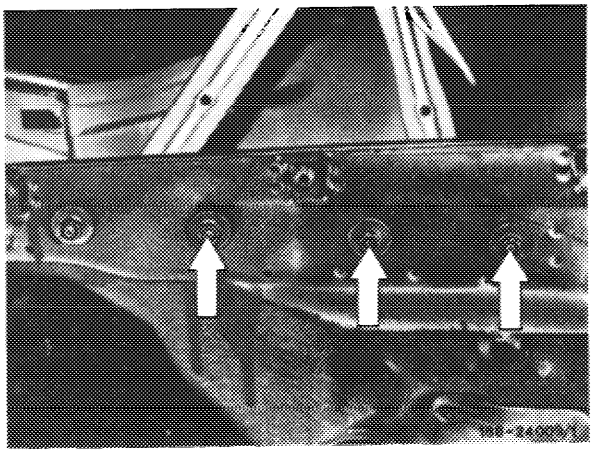
5 Move engine hood into vertical position (90°).



6 Loosen counternut on rubber buffer rear left and right and turn rubber buffer in downward direction.

7 Loosen nuts on engine hood hinge in wheel house left and right.

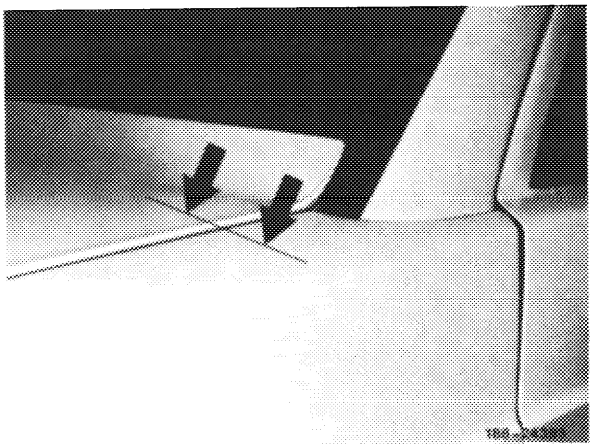
Note: Do not loosen front nut of engine hood hinge, since otherwise the gas pressure spring will displace the engine hood in lingitudinal direction.



Shown with front fender removed

8 Adjust engine hood in such a manner that the upper edge of the engine hood at the rear is in alignment with the upper edge of the front fender.

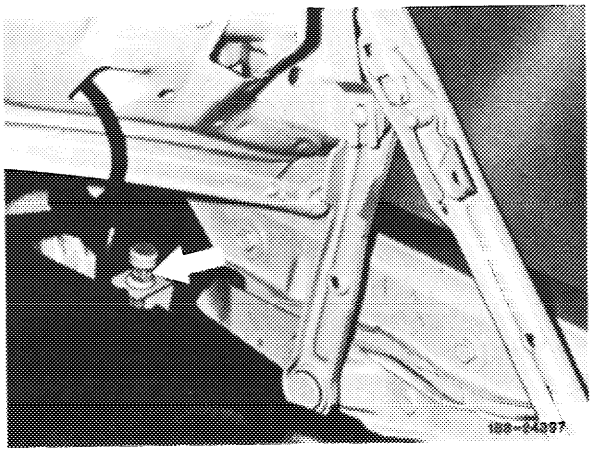
Note: The engine hood can be closed for rear height adjustment. The fastening nuts are tightened from direction of wheel house.



9 Set rubber buffers at the rear in upward direction until the engine hood rests at a light preload on rubber buffers, while paying attention to perfect fit between upper edge of engine hood and upper edge of front fender. Tighten counternut.

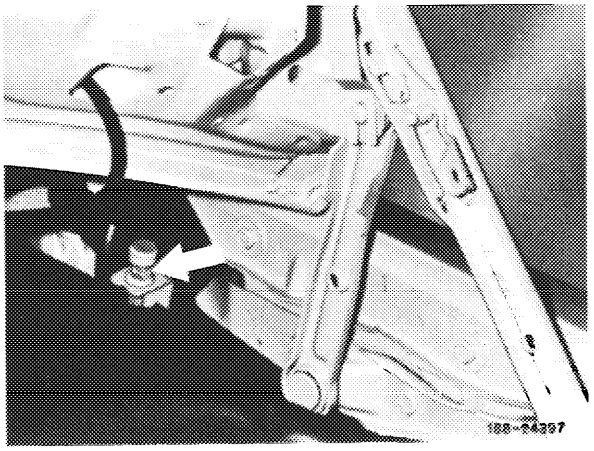
Note: The rear rubber buffers permit fine vertical adjustment.

10 For further procedure proceed vice versa.

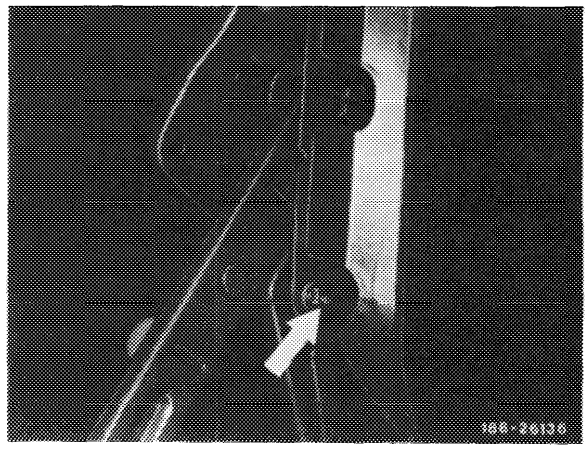


2nd version

1 Loosen counter-nut on rubber buffer rear left and right, and turn rubber buffer downwards.



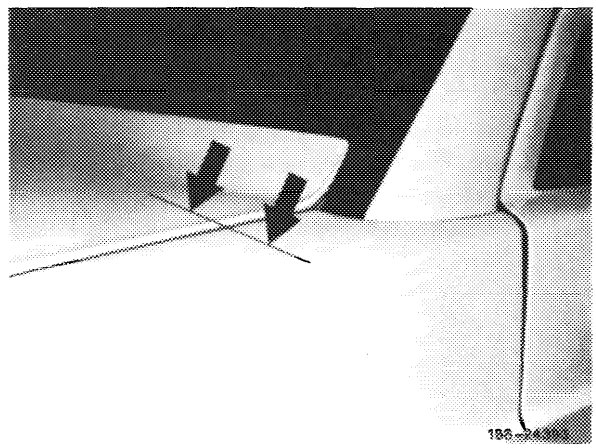
2 Loosen nut on lower threaded bolt.



3 Adjust engine hood in such a manner that the upper edge of engine hood is in alignment with upper edge of front fender.

4 Tighten nut.

Note: The adjusting path is max. 4 mm. In case of deviations in excess thereof, perform adjustment jobs as described under 1 st version.



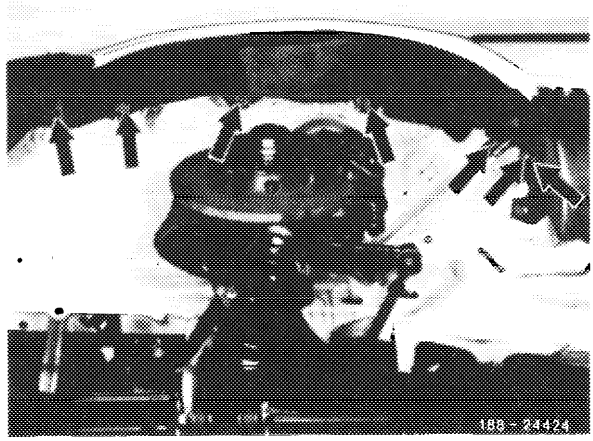
Removal

1 Remove engine hood (88–300).

2 Mark position of engine hood hinge on wheel housing in engine compartment.

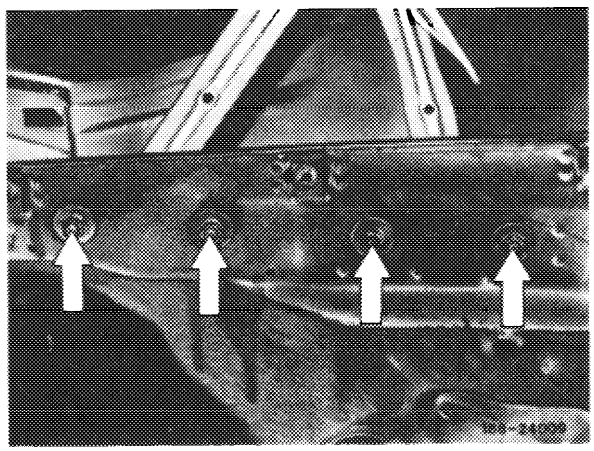
3 Remove inner fender.

4 Remove on the left side the low-pressure storage tank.



5 Unscrew nuts on engine hood hinge in wheel housing.

6 Remove engine hood hinge.



Installation

7 Place engine hood hinge on marking on wheel housing and tighten.

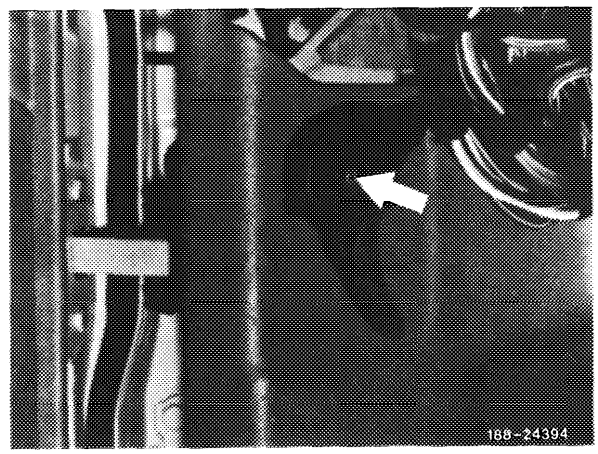
8 For further installation proceed vice versa.

Removal

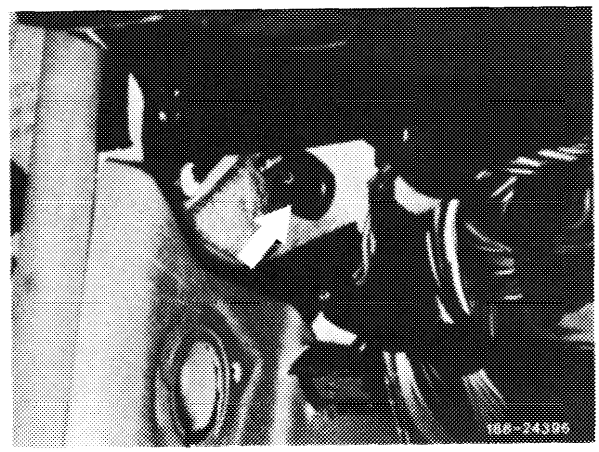
1 Remove cover under instrument panel at the left (68-l 50).

2 Unscrew screw on handle.

3 Disconnect hood cable control on handle and remove handle.

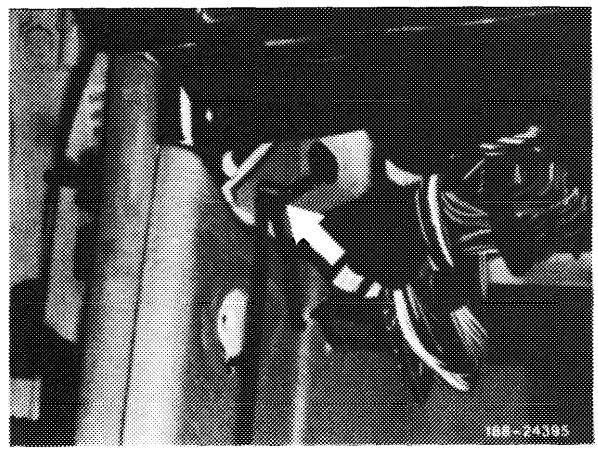


4 Remove rubber grommet on front wall pillar.

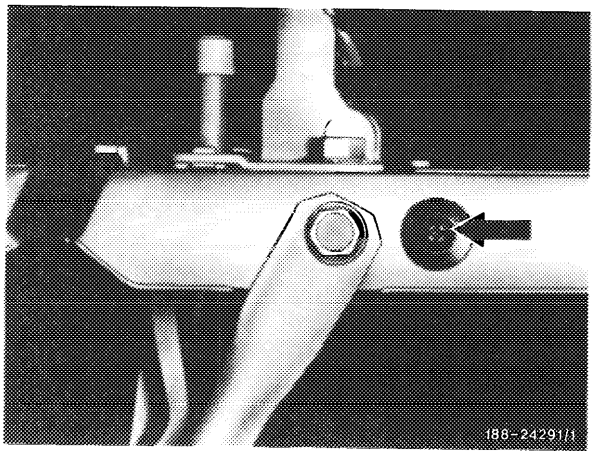


5 Tie cord to hood cable control.

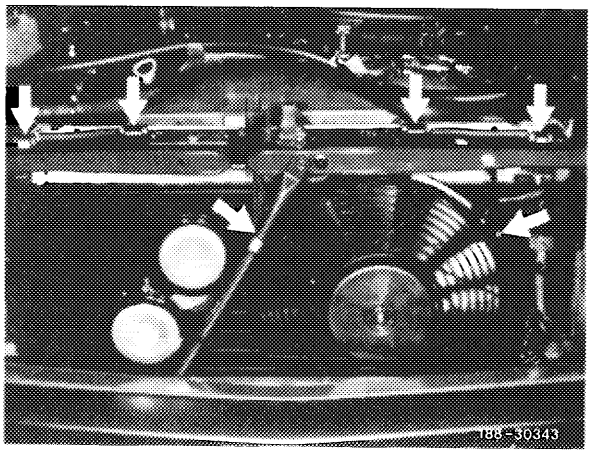
Note: The cord facilitates displacement of engine hood cable control during installation.



6 Push out clip on lock cover and remove cover.

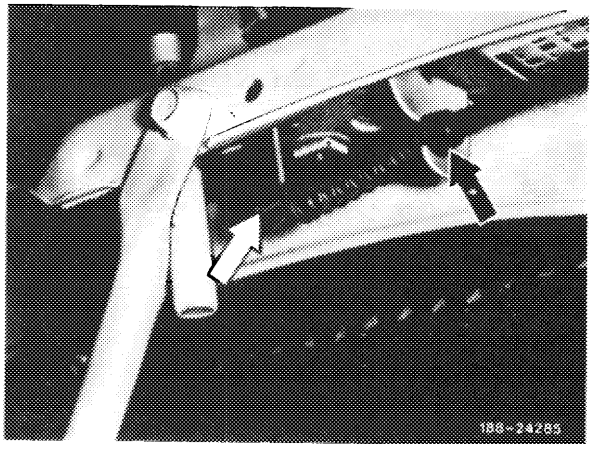


Note: On vehicles with air conditioning system, unscrew fan first (2 screws) when removing cover and then, after removing the 4 upper clips, swivel radiator to the rear.



7 Release hood cable control on holder and on lock.

8 Pull out cable control in forward direction.



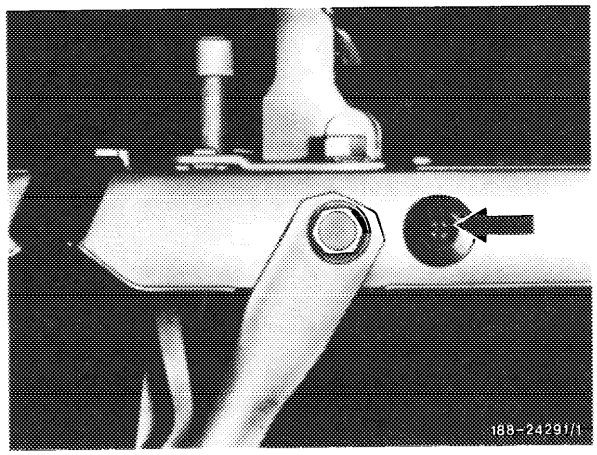
Installation

9 For installation proceed vice versa.

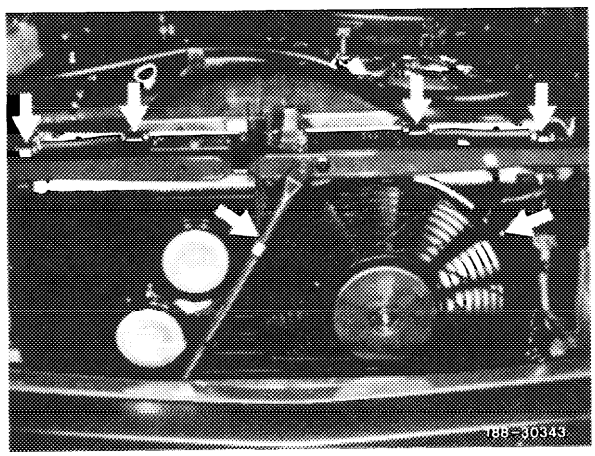
A. Engine hood lock lower half

Removal

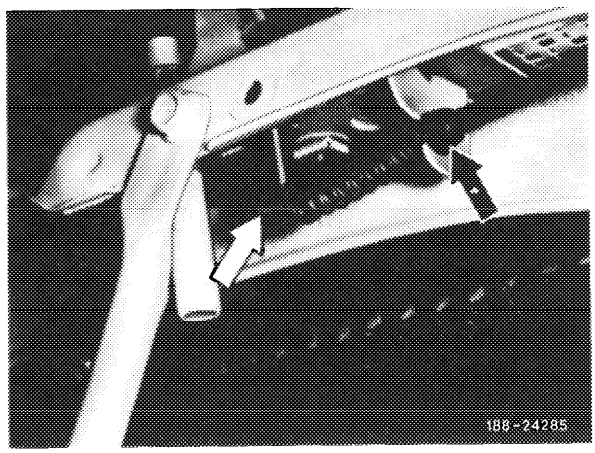
1 Push out clip on radiator stiffening and remove lock cover.



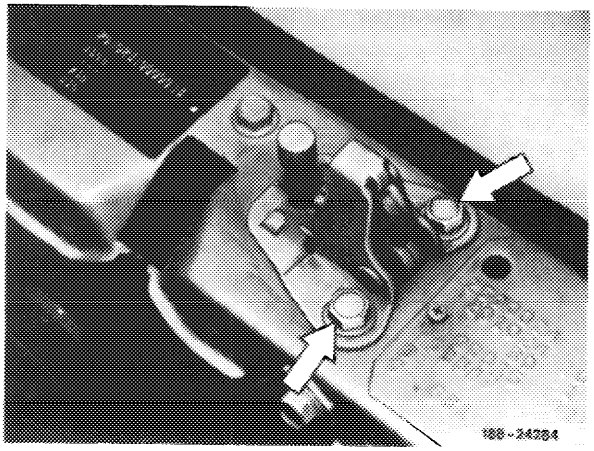
Note: On vehicles with air conditioning system, unscrew fan first (2 screws) when removing cover and then, after removing the 4 upper clips, swivel radiator to the rear.



2 Disconnect hood cable control on holder and on lock.



3 Unscrew screws on lock and remove lock.



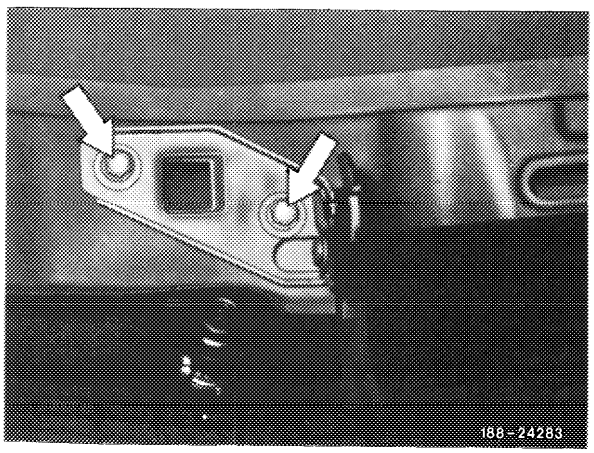
Installation

4 For installation proceed vice versa.

B. Engine hood lock upper half

Removal

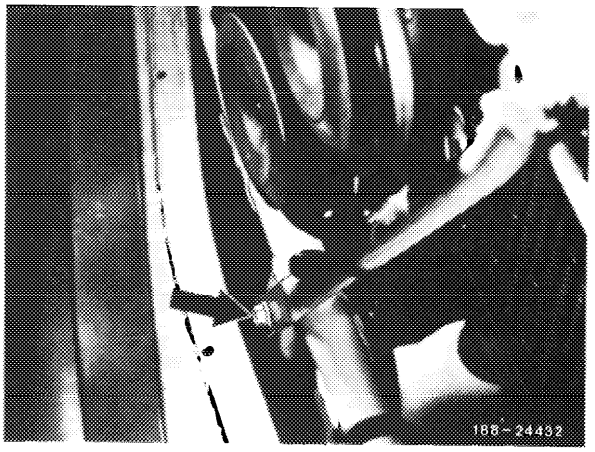
1 Unscrew screws and remove lock upper half.



Installation

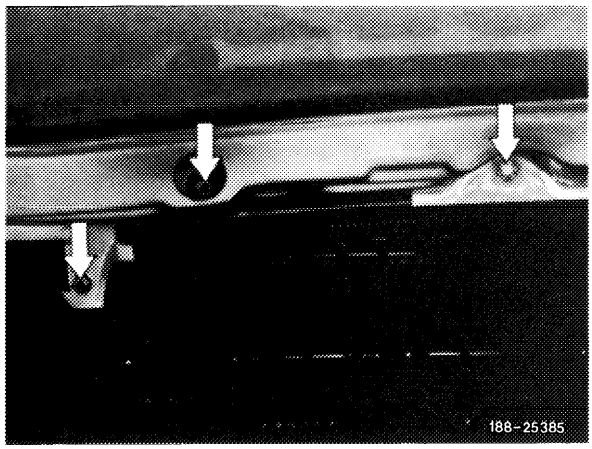
2 Screw on lock upper half.

3 If required, loosen screw below on strut of radiator stiffening and adjust radiator stiffening with lock to height.



Removal

1 **Unscrew the six fastening screws and remove radiator shell.**



Installation

Note: Prior to installation of radiator shell, make sure that shim is glued to radiator shell.

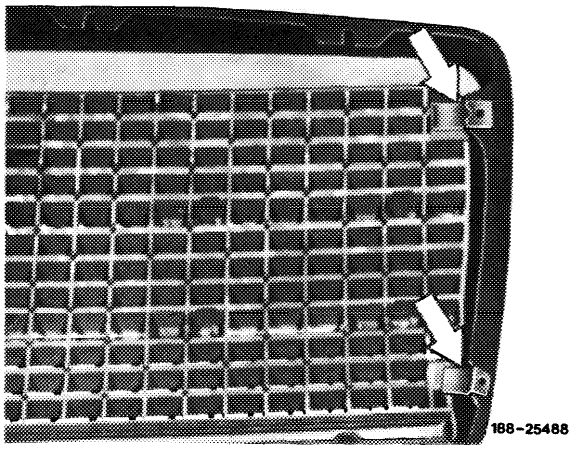
2 For installation proceed vice versa.

Removal

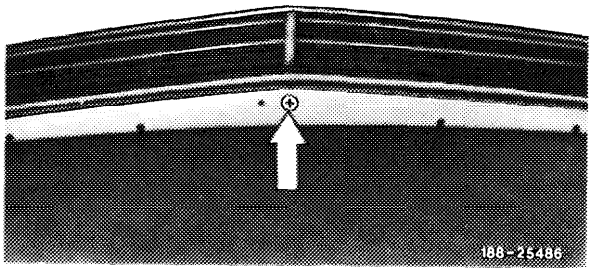
1 Remove radiator shell (88-400).

2 Remove pin clamps left and right.

Attention!
The pin clamps are pre-tensioned.

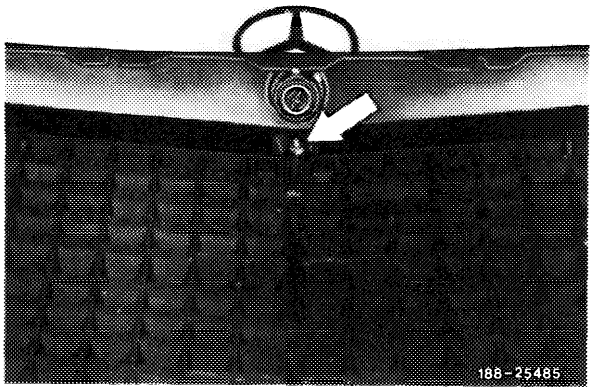


3 Unscrew screw at bottom of radiator shell.



4 Unscrew nut at top of radiator shell and remove company symbol.

5 Remove radiator grille.



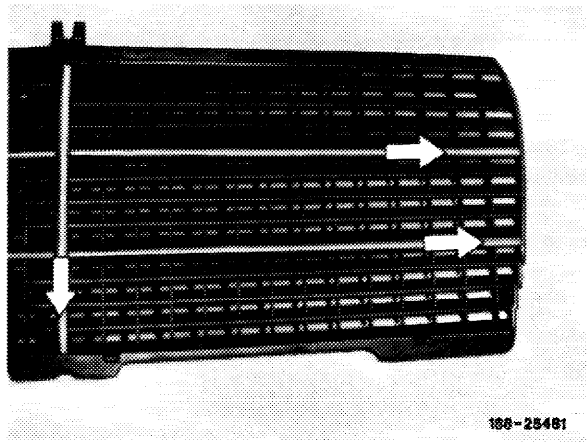
Installation

6 For installation proceed vice versa.

A. Removal of undamaged trim strips

1 Remove radiator grille (88-401).

2 Pull out horizontal trim strips in outward direction, vertical trim strip in downward direction.

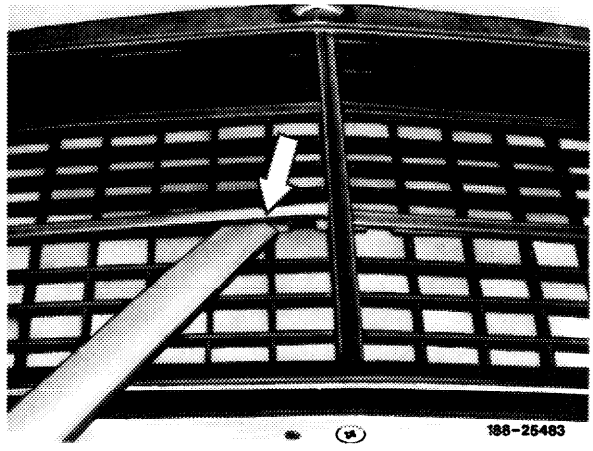


Installation

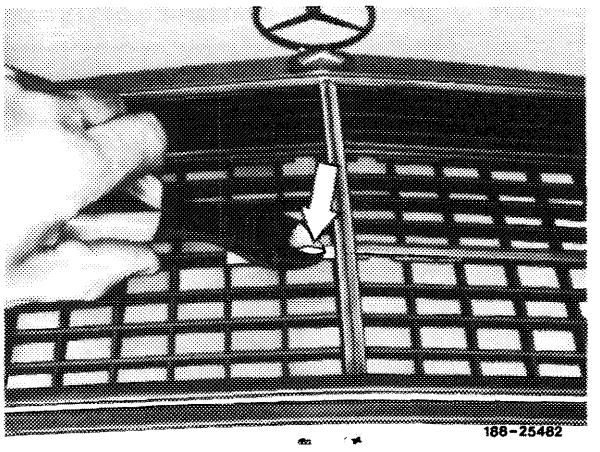
3 For installation proceed vice versa.

B. Removal of damaged trim strips

1 Lift damaged trim strip with plastic wedge or the like from cam and pull out from underneath radiator shell.



2 Pinch still existing holding cams.



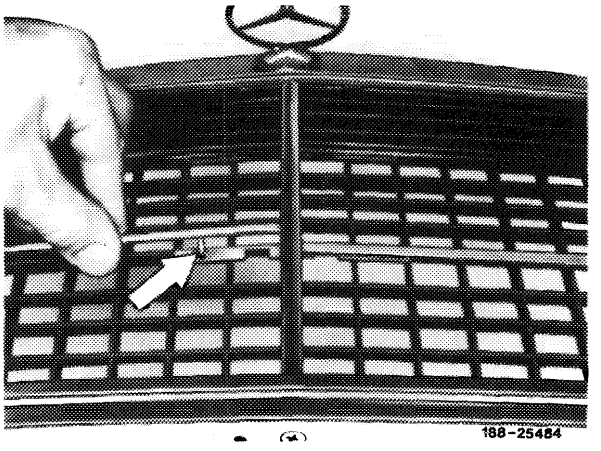
Installation

3 Insert plastic clips into new trim strip.

4 Insert trim strip between radiator grille and radiator shell and press in holding clips.

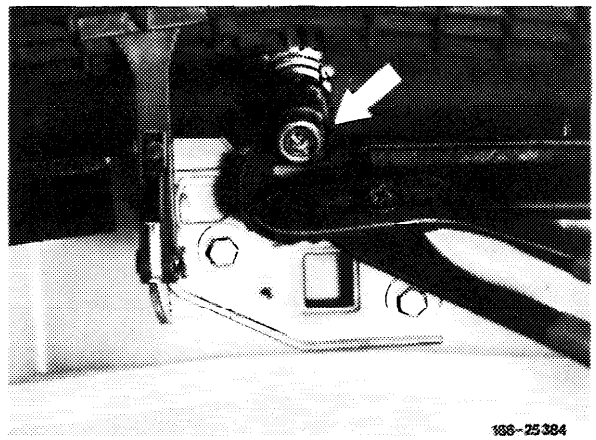
Note: Slightly grease clips prior to pressing them in.

5 Effect the renewal of the vertical trim strip in the same manner.



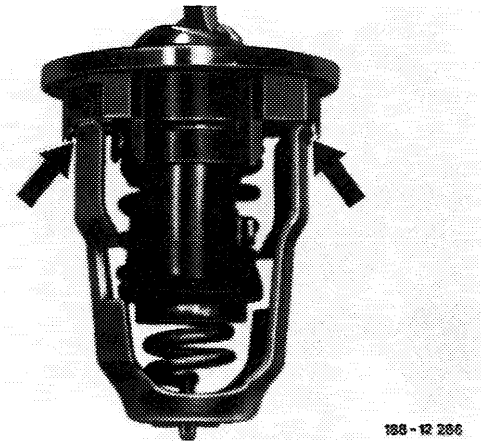
Removal

1 **Energetically pull spring clip down with water pump pliers and turn to the left by 90°.**



2 Make sure that the spring clip enters into the grooves of the rosette.

3 Pull Mercedes star out of radiator shell in upward direction.



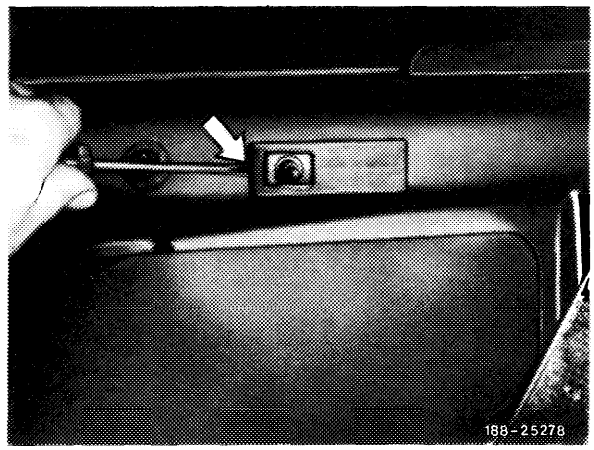
Installation

4 Insert Mercedes star into radiator shell and turn spring clip with water pump pliers by 90° in clockwise direction.

Removal

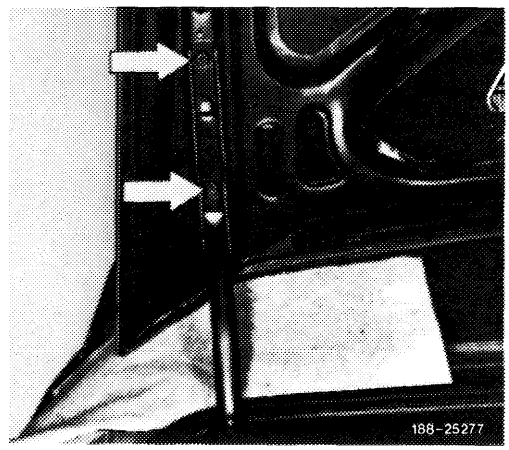
1 **Remove trunk lamp with switch and pull-off cable.**

2 **Unclip cable in range of trunk lid and pull out.**



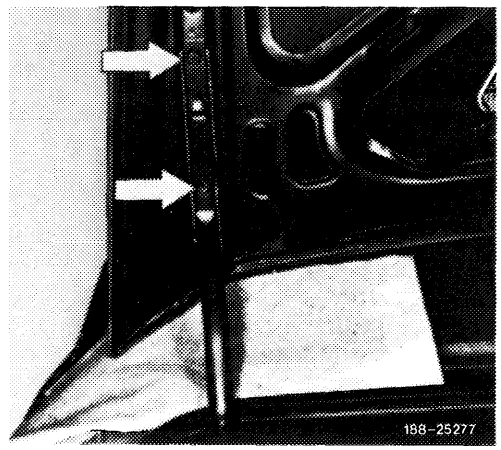
3 **Place one rag each under both corners and unscrew the screws on both sides of hinge.**

4 Remove trunk lid.



Installation

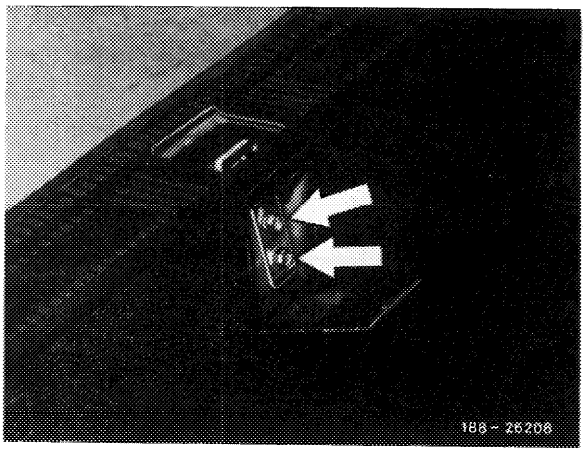
5 Screw trunk lid to hinges and align by centering in relation to the two sides prior to tightening screws.



6 Adjust closing bracket on rear center piece for perfect opening and closing of trunk lid.

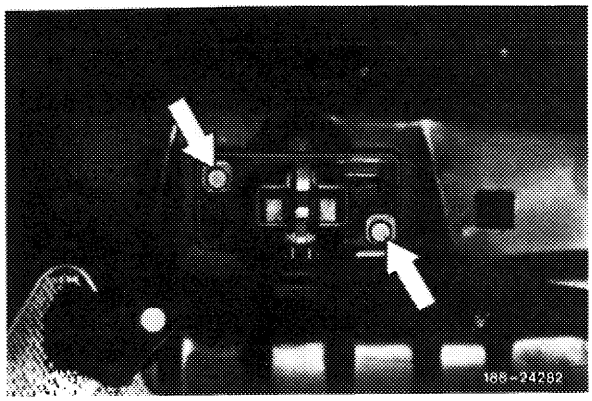
7 For further installation proceed vice versa.

Note: When renewing trunk lid, perform specified sealing and preserving jobs (97–400 or 97-I 50).



Removal

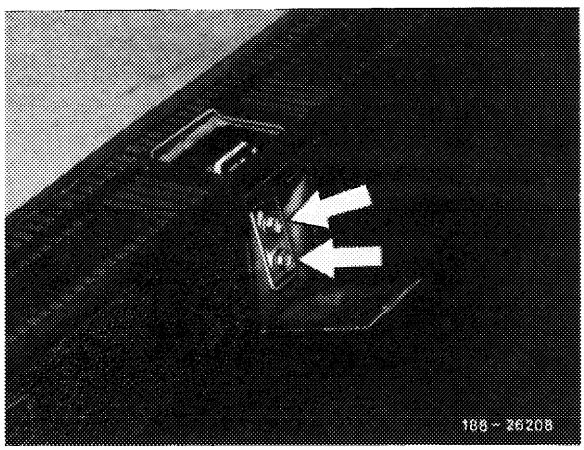
1 Unscrew screws and remove lock.



Installation

2 For installation proceed vice versa.

Note: The closing pressure of the trunk lid can be set as required by adjusting closing bracket at rear center piece.



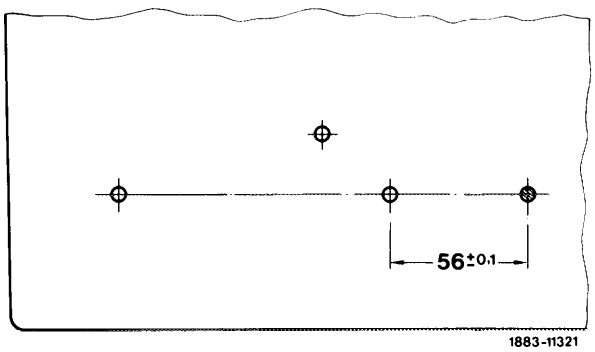
Note

When renewing a trunk lid of the model 190 E or 190 D, drill the additional hole **prior to painting.**

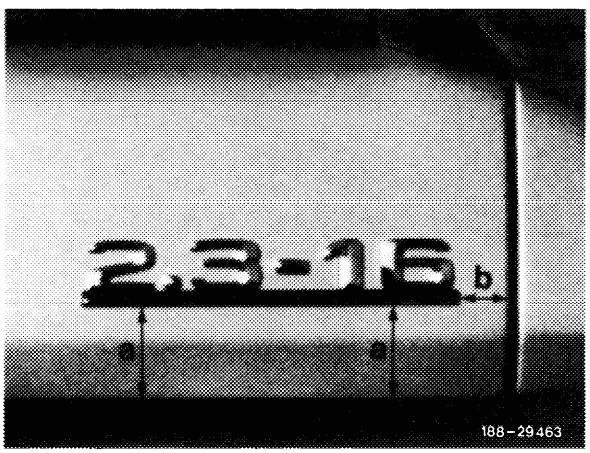
1 Identify drill hole according to illustration and punch-mark.

2 Drill hole, dia. 5.7 + 0.1 mm.

3 Remove chips and treat holes with zinc dust paint.



Note: The model identification mounted at the right is glued on. For mounting and removing, heat model identification and adhesive surface to approx. 40 °C (hot air radiator, blower or the like) and pull off for removal or press on for mounting.



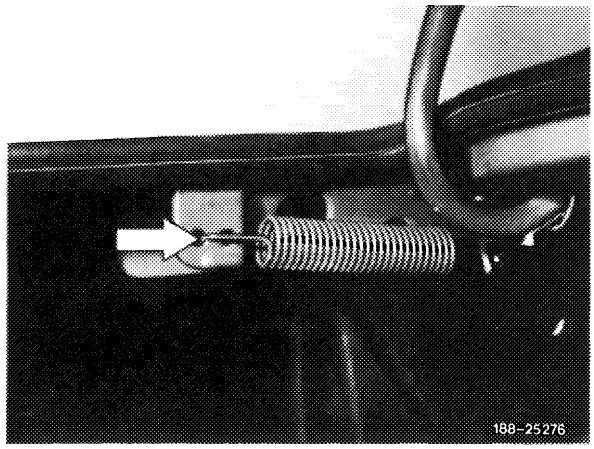
Layout on trunk lid, right
a 51mm b 28mm

Removal

1 Remove trunk lid (88–500).

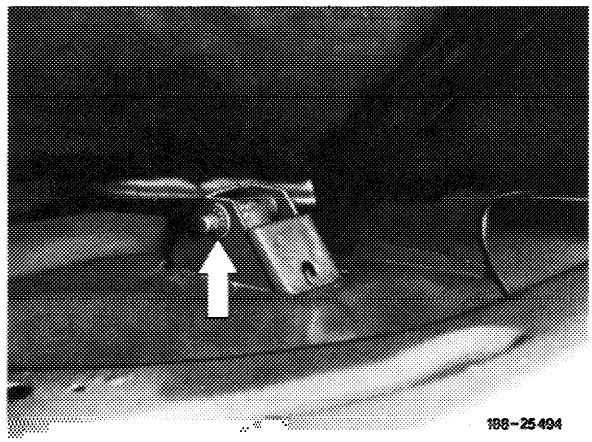
2 Remove hat rack (68–458).

3 Remove spring.



4 Detach insulating mat on hinge lever mount (use hot-air blower, if required) and press off lock on bolt.

5 Pull out bolt and remove hinge lever through trunk in downward direction.



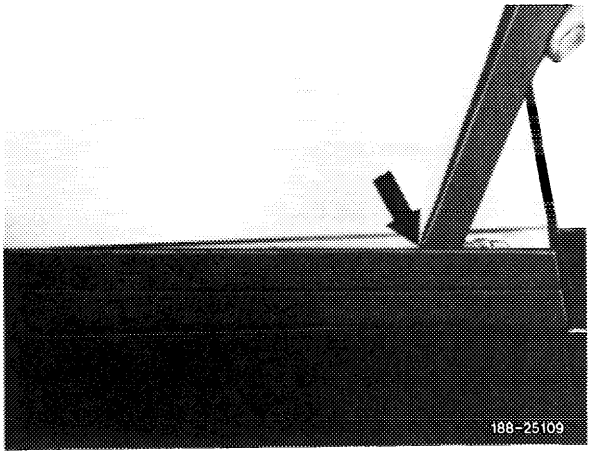
Installation

6 For installation proceed vice versa.

A. Paneling at front fender

Removal

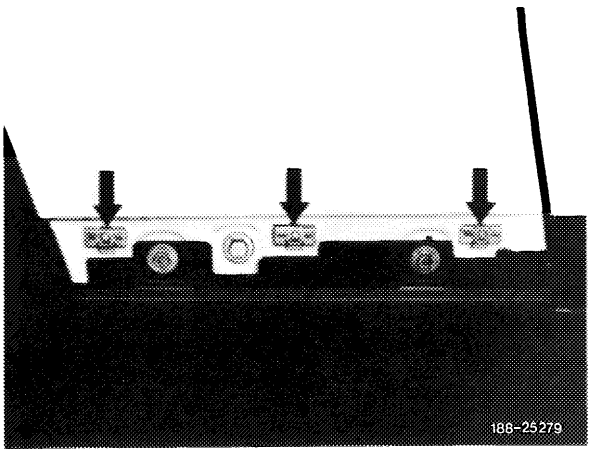
1 Press off paneling by means of a plastic wedge.



Installation

2 Press in clips and adjust.

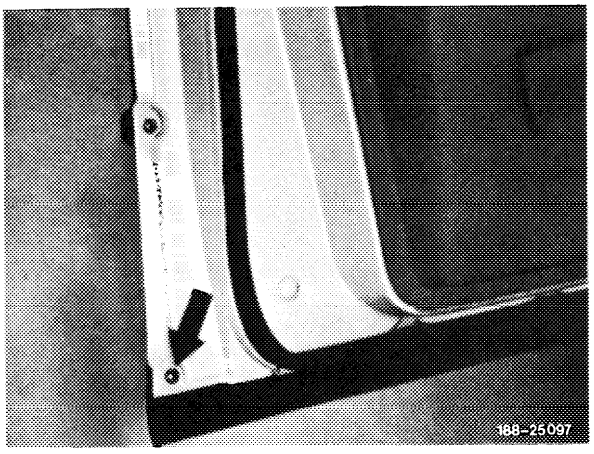
3 Position paneling and clip on.



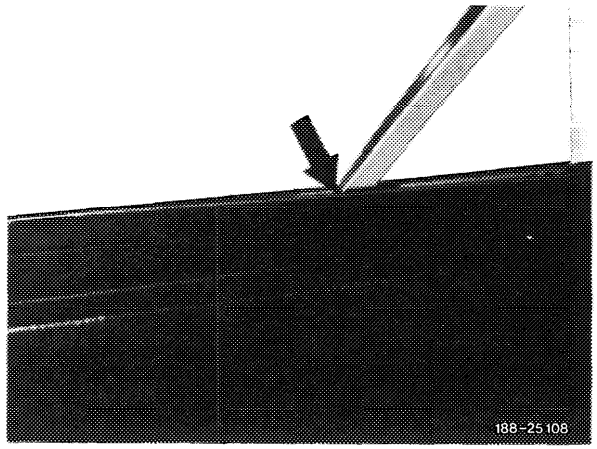
B. Paneling on driver's door

Removal

1 Unscrew screw on rebate.



2 Unclip paneling by means of plastic wedge and remove.

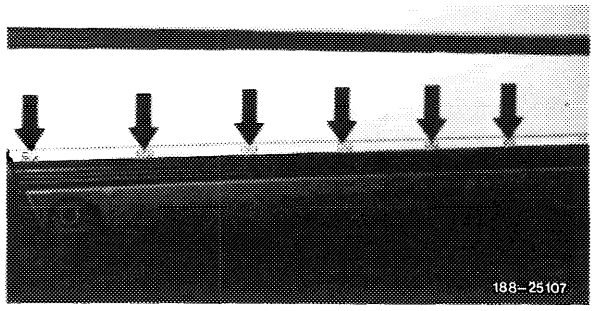


Installation

3 Press in clips and adjust.

4 Position paneling and clip in.

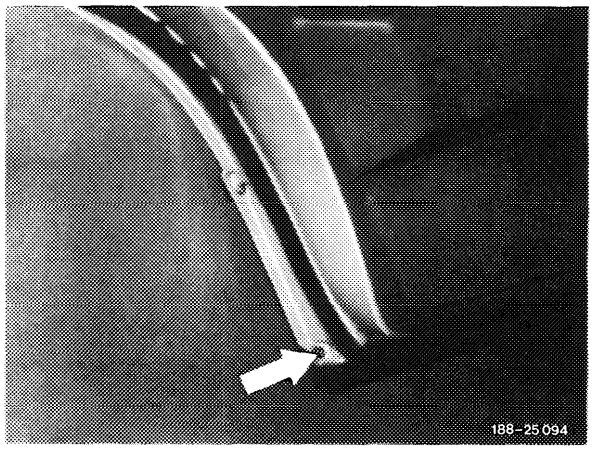
5 Tighten screw on rebate.



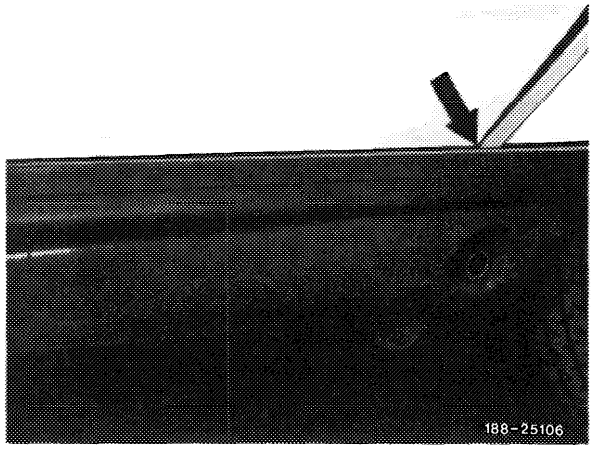
C. Paneling on rear door

Removal

1 Unscrew screw on rebate.



2 Unclip paneling by means of plastic wedge and remove.

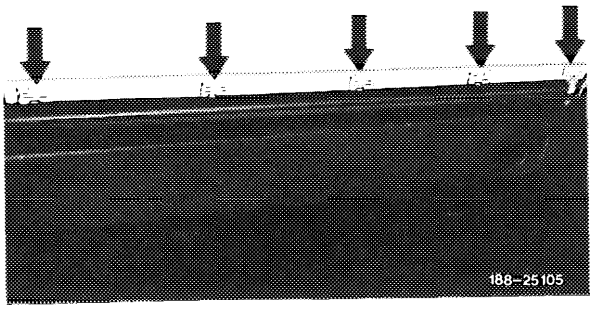


Installation

3 Press in clips and adjust.

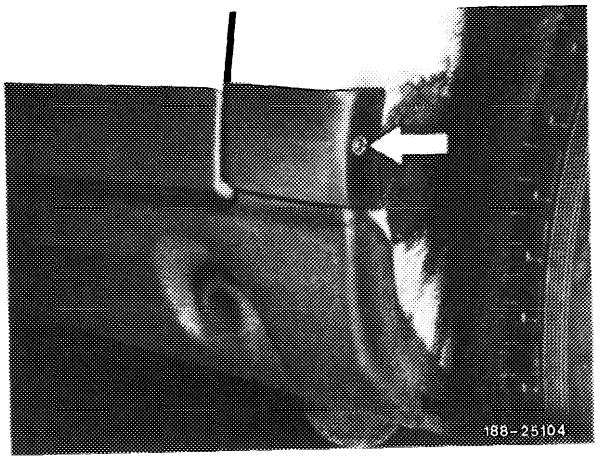
4 Position paneling and clip in.

5 Tighten screw on rebate.



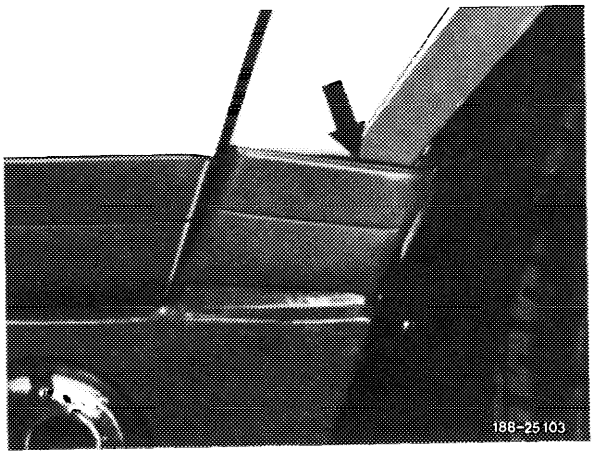
D. Paneling on rear fender

Removal

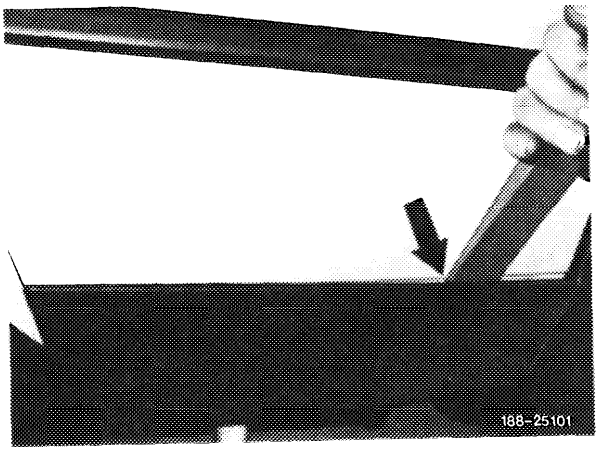


1 **Unscrew screw on rear fender.**

2 Unclip paneling by means of plastic wedge and remove.



3 Unclip paneling by means of plastic wedge and remove.

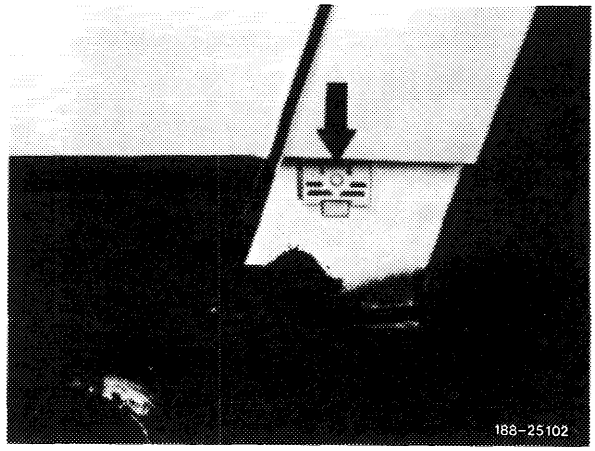


Installation

4 Press in clips and adjust.

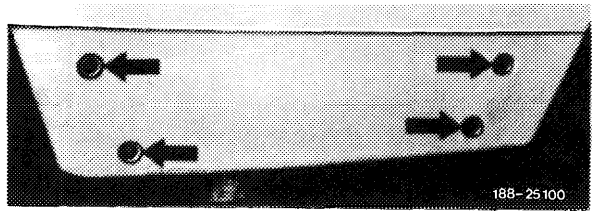
5 Position paneling and clip in.

6 Tighten screw on rear fender.



7 Press in lower half of clip.

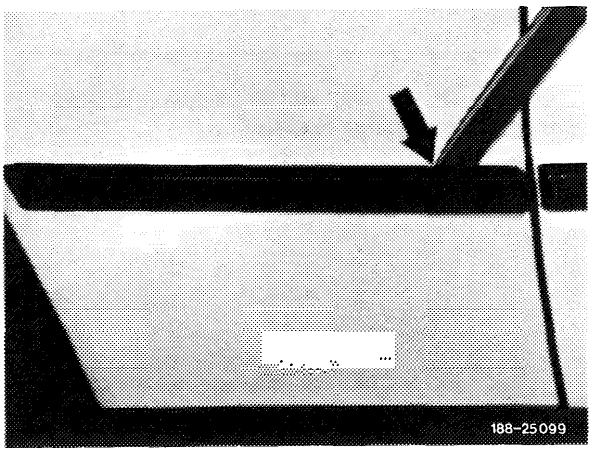
8 Position paneling and press in.



A. Protective strip on front fender

Removal

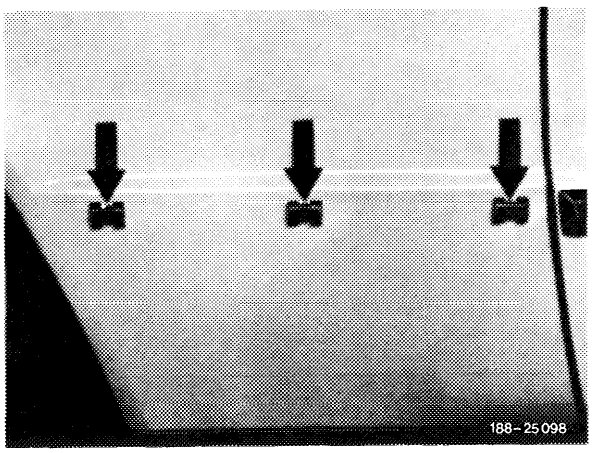
1 Press off protective strip by means of plastic wedge.



Installation

2 Press in clips and adjust.

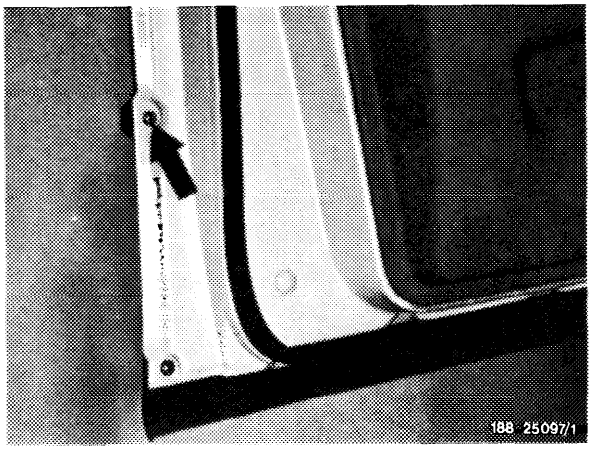
3 Position protective strip and clip in clips.



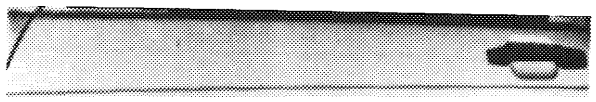
B. Protective strip on driver's door

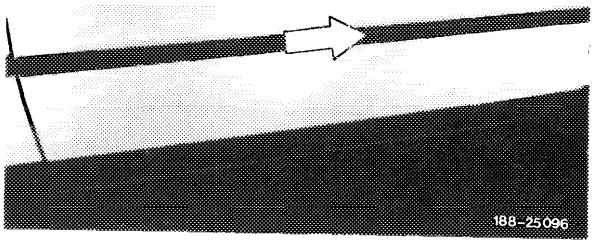
Removal

1 Unscrew screw on rebate.



2 Press protective strip rearwards and remove.

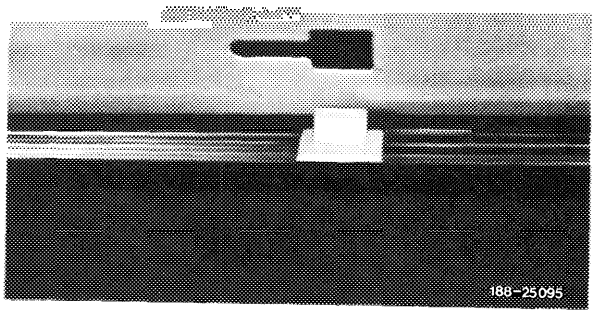




Installation

3 Insert protective strip with clips into cutouts of door paneling and slide forwards.

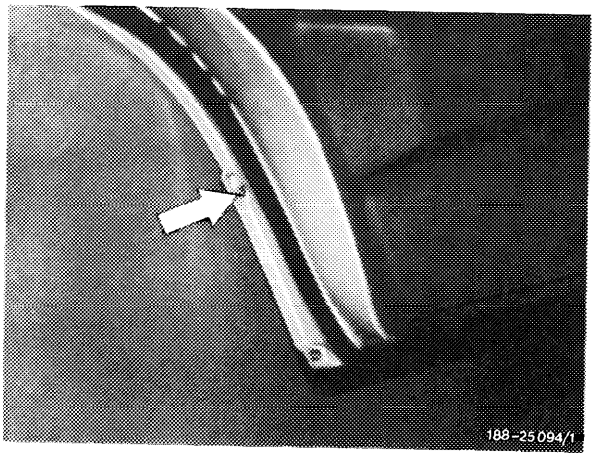
4 Tighten screw ***on*** rebate.



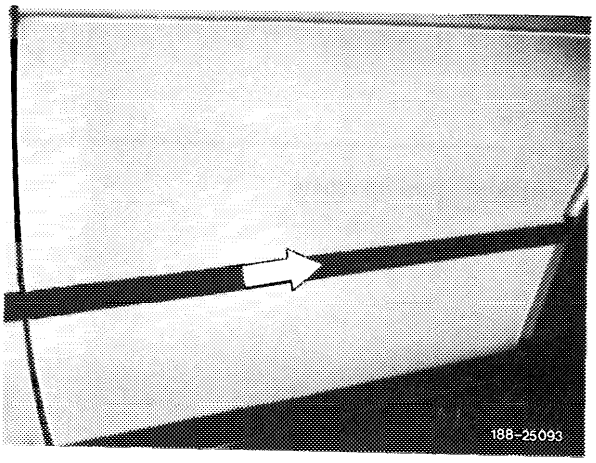
C. Protective strip on rear door

Removal

1 Unscrew screw on rebate.



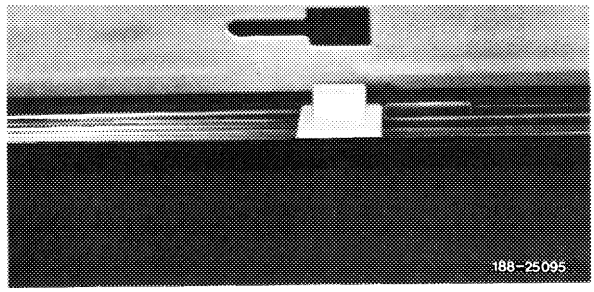
2 Press protective strip rearwards and remove.



Installation

3 Insert protective strip with clips into cutouts of door paneling and slide forwards.

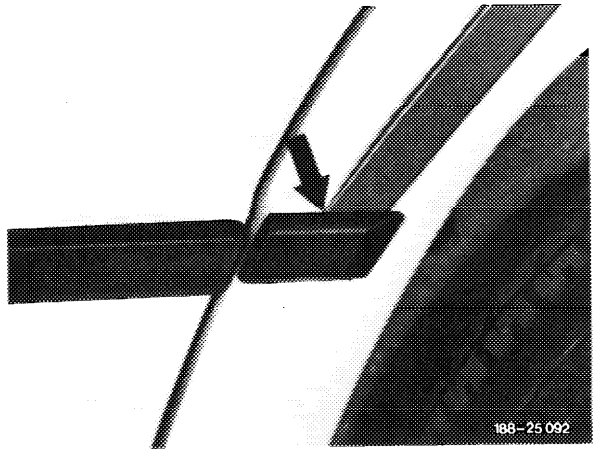
4 Tighten screw on rebate.



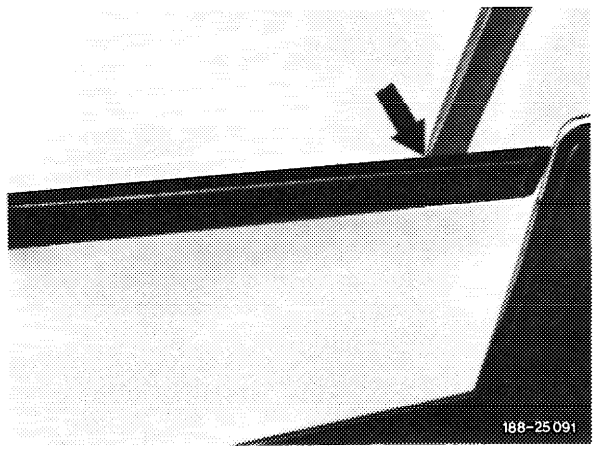
D. Protective strip on rear fender

Removal

1 **Press off protective strip front by means of plastic wedge.**



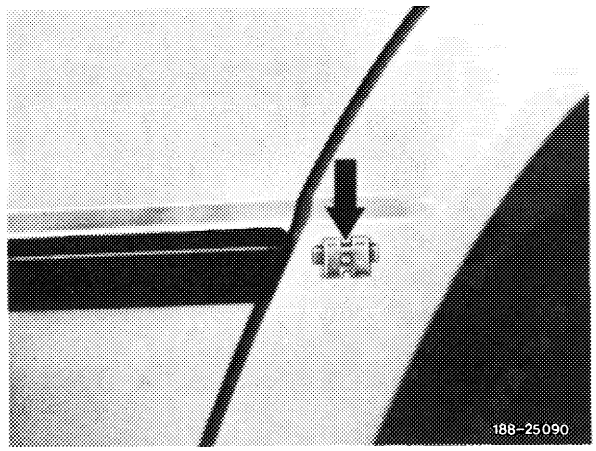
2 Press off protective strip rear by means of plastic wedge.



Installation

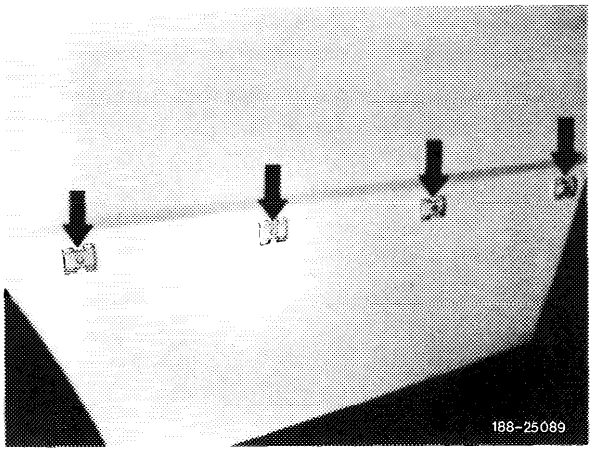
3 Press in clips and adjust.

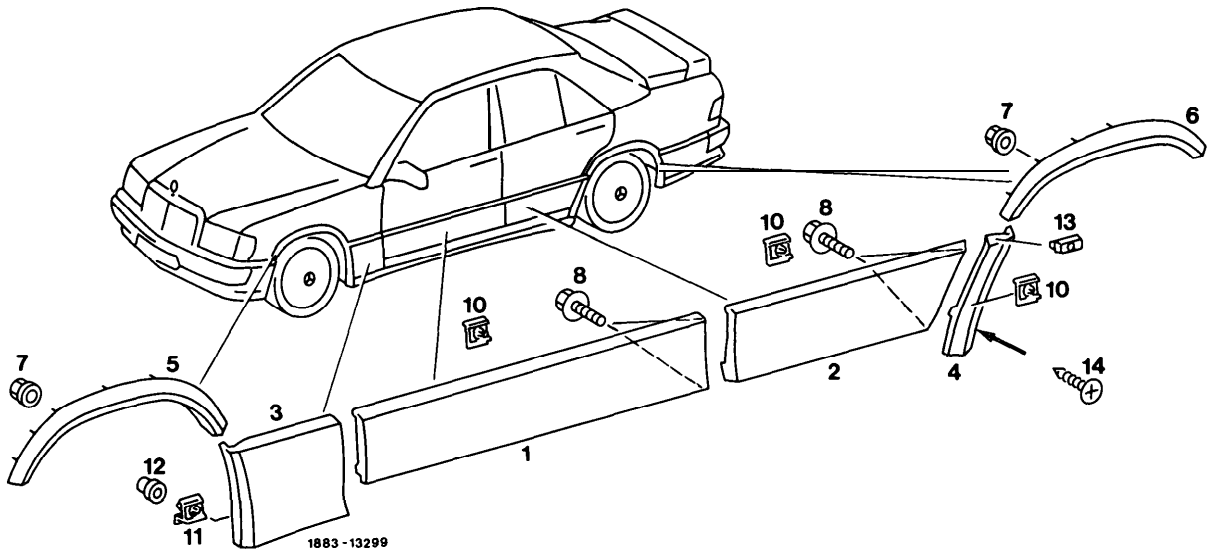
4 Position protective strip and clip in.



5 Press in clips and adjust.

6 Position protective strip and clip in.





Panelling for front or rear door

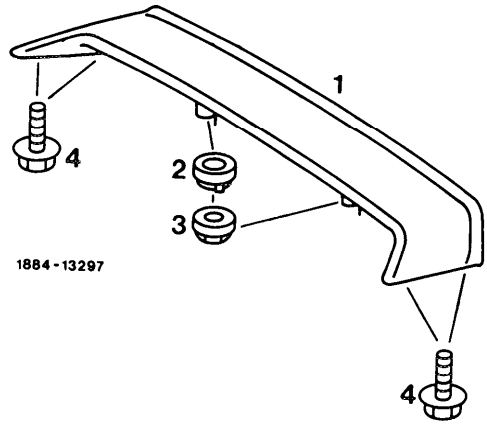
8 Screws (2 each)	Remove, install
1, 2 Panelling	Unclip below and pull out to the rear
10 Plugs	Insert below in door
1,2 Panelling	Introduce into cutouts of door panelling and fasten with clips below

Panelling on front fender

5 Wheelhouse panelling	Remove, install, unscrew 7 nuts (7) for this purpose
3 Panelling	Force off with plastic wedge and remove in upward direction
11, 12 Plugs, pushbutton lower half	Insert in front fender
3 Panelling	Insert into side member panelling below and fasten with clips on top

Panelling on rear fender

6 Wheelhouse panelling	Remove, install, unscrew 6 nuts (7) for this purpose
14 Screws	Screw in, screw out (arrow)
4 Panelling	Force off with plastic wedge
10, 13 Plugs, grommet	Insert into rear fender
4 Panelling	Insert into side member panelling below and fasten with clips on top

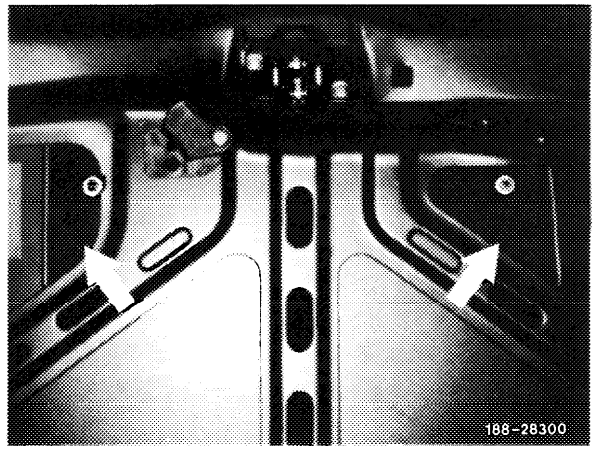


4 Screw (4 each). . . . . Remove, install
3 Nut (2 each) . . . . . Remove, install
1 Rear spoiler . . . . . Remove
2 Plastic mounts (6 each) . . . . . Insert in trunk lid prior to installing rear spoiler

Note

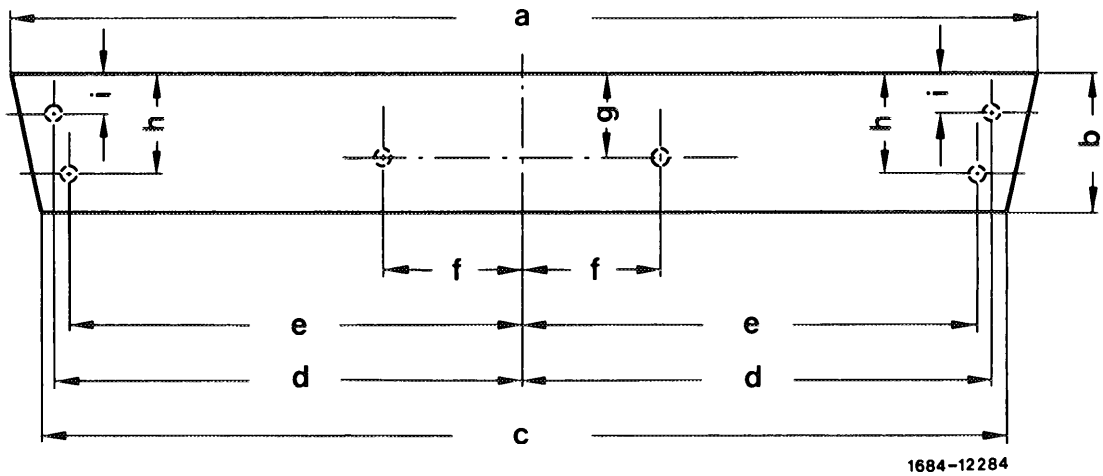
When renewing trunk lid, mark holes for trunk lid according to template and drill (88-825).

Reinforcing panels in range of center holes, glue on and align, using PU adhesive, part No. 003 989 11 71.



88-825 Marking and drilling holes for rear spoiler on trunk lid

Self-made tool



Paper template for rear spoiler

a	1220 mm	f	175 mm
b	150 mm	g	104 mm
c	1190 mm	h	140 mm
d	554 mm	i	45 mm
e	543 mm		

Note: This drilling template can also be ordered ready-for-use under spare part No. 201 589 06 23 00.

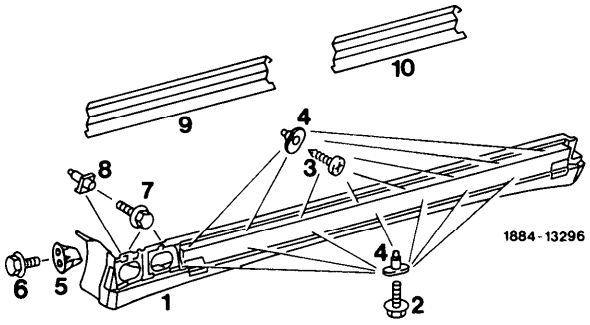
1 Glue paper template for rear spoiler on trunk lid, adjust dimension „J" in longitudinal direction and align crosswise on outer edge of trunk lid (arrows).

2 Punch-mark holes through paper template, drill to 8.5 mm dia. and deburr.

3 Prime edges of holes and apply paint top coat.

Dimension:
J 360 mm

88-830 Removal and installation of panelling on side member (model 201.034)

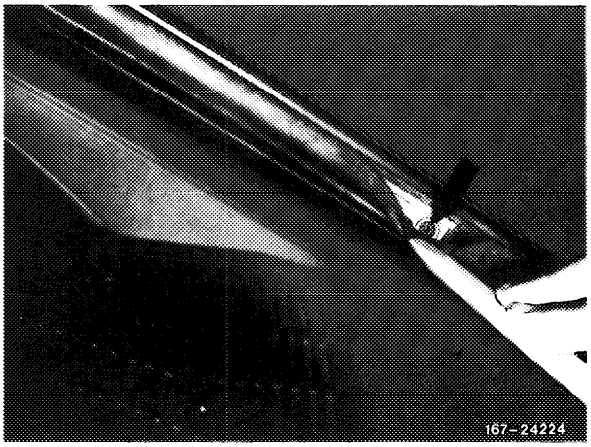


Panelling at wheelhouse front and rear removed
Panelling at front and rear fender removed

9, 10	Panelling above entrance (9) and (10)	Remove, install
6	Screws (2 each)	Remove, install
7	Screws (2 each)	Remove, install
3	Screws (8 each)	Remove, install
2	Screws (8 each)	Remove, install
1	Panelling on side member	Remove
4, 5, 8	Dowel in body	Insert and install panelling

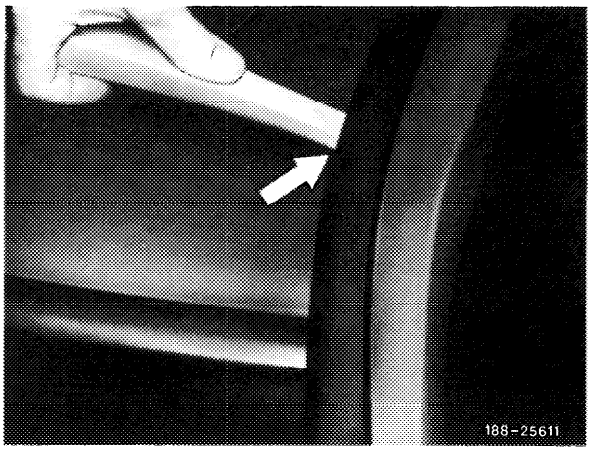
Removal

1 Press rubber lip aside and unscrew the 4 screws underneath on front wall pillar

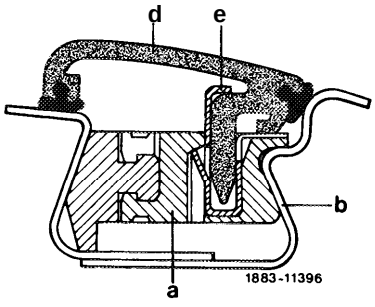


2 Press out rain strip, beginning at the front, in upward direction out of the 6 plug clamps and remove.

Note: Position assembly wedge at edge of roof channel (danger of damage).

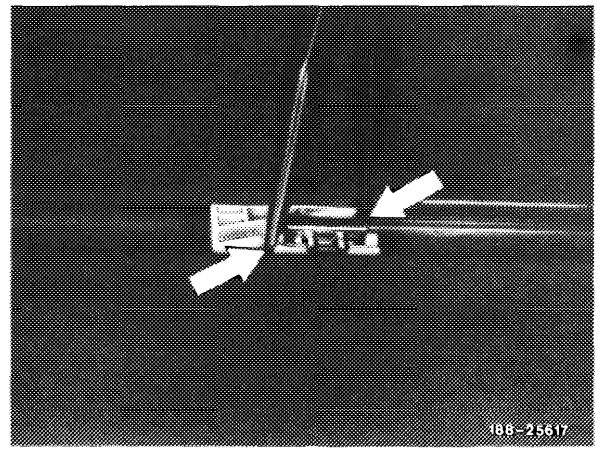


Attention!
If the rain strip cannot be pressed out of rear plug clamp, a hook clamp has been installed at this place. In this case, push out rain strip rearwards from hook clamp and remove.



a Holding element
b Roof channel
e Hook clamp
d Rain strip

3 Mark installation position of plug clips, then remove by means of pointed pliers.

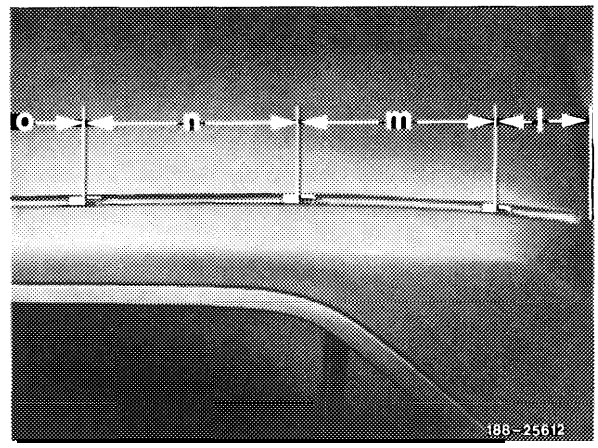


Installation

4 Insert plug clamps starting at the rear and adjust.

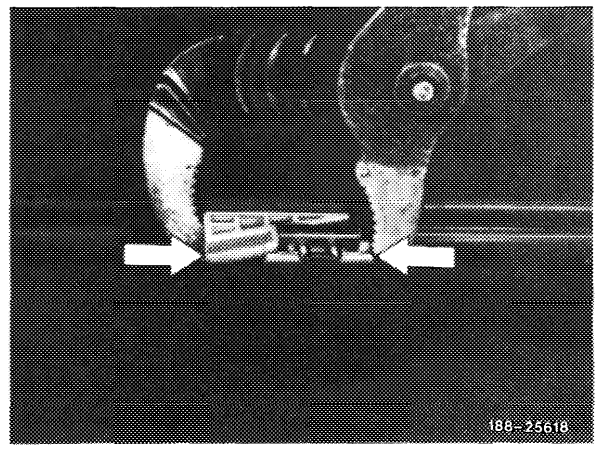
Position of plug or hook clamps (dimensions measured center-to-center of clamps) :

l 110 mm (in case of plug clamps)
l 142 mm (in case of hook clamps)
m 197mm
n 233 mm
0 210mm
The three front clamps at a distance of ''o''.



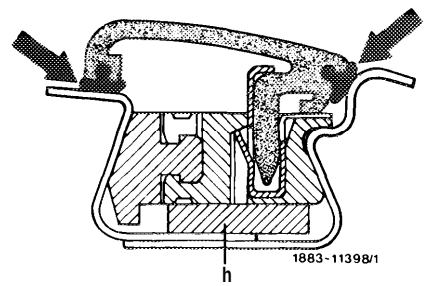
5 Install plug clamp by means of water pump pliers. For this purpose, press down the holding element of plug clamp until sufficient pre-tension is available.

Note: If a hook clamp is installed in the rear range, check height adjustment of hook clamp prior to the installation of rain strip.



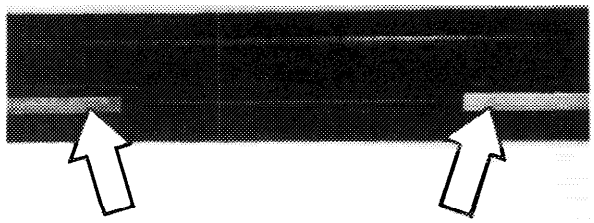
6 Adjust the height of hook clamp in such a manner that rain strip can be easily inserted and, at the same time, is resting against roof paneling. In case of corrections, make aluminum sheet strips and place underneath.

7 Coat the areas around rain strip adjacent to roof paneling with soap water.



h Shim

8 Align white plastic sectional elements in longitudinal direction in such a manner that they are not resting on the plug clamps.



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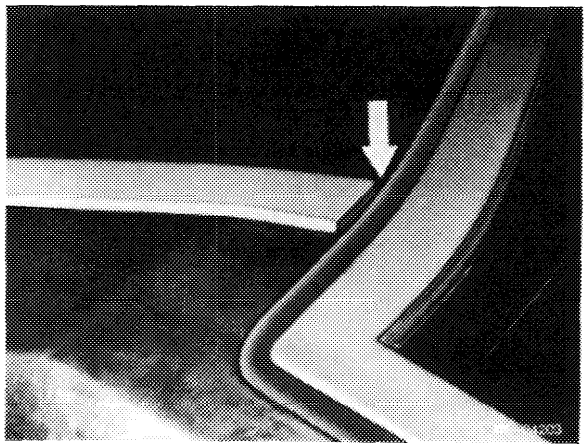
9 Insert rain strip from behind into hook clamp or put onto plug clamps and align in longitudinal direction in the rear roof area.

10 Press in rain strip, beginning at the rear, into plug clamps using a suitable wooden bar (approx. 150 mm long) and a long) and a rubber hammer.

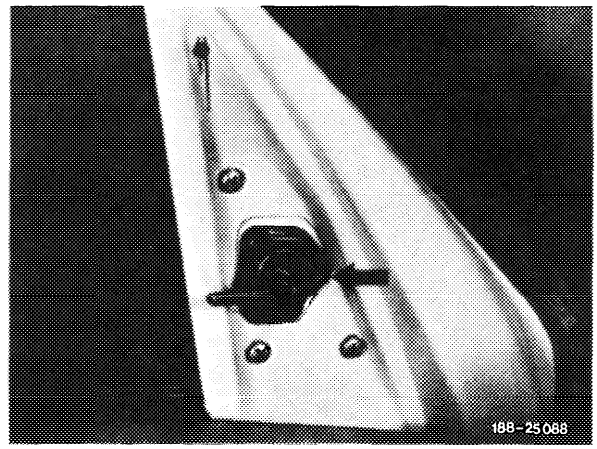
11 Screw on rain strip in the range of front wall pillar.



Note

If the outside rear view mirror is unintentionally changing position, tighten screw on adjusting mechanism as required.

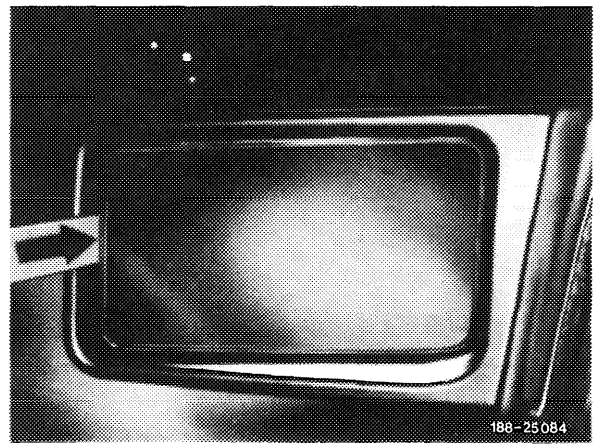
Note: Screw is located underneath cover plate.



A. Mirror glass

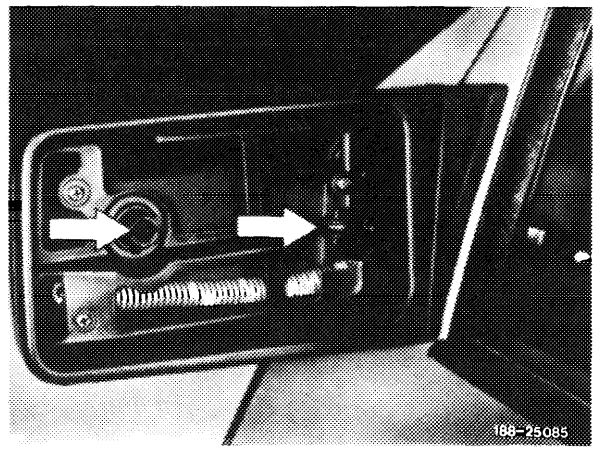
Removal

1 Push rear view mirror out by means of a plastic wedge und remove laterally.



Installation

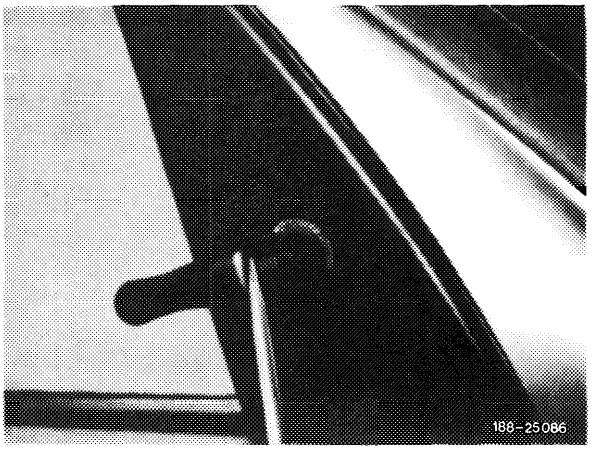
2 Attach mirror glass to adjusting lever and press in ball head into seat.



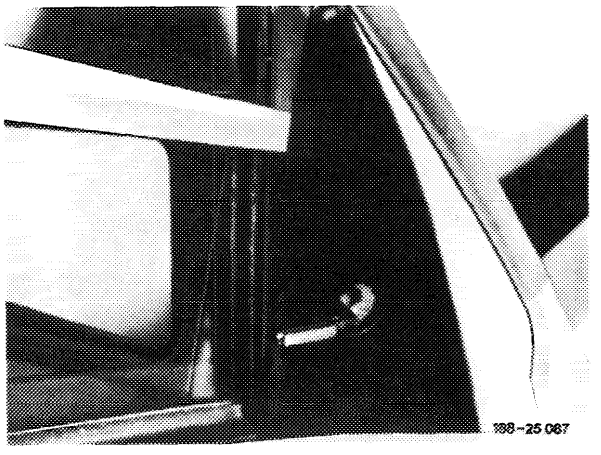
B. Complete outside rear view mirror

Removal

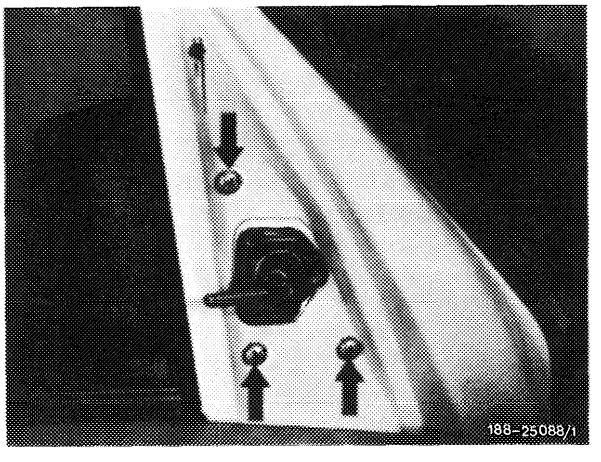
1 **Push plastic lock out of handle by means of a screwdriver and remove handle element.**



2 Unclip cover plate at top from door frame, pull in upward direction and disengage on inner door sheeting.



3 Unscrew screws and remove mirror.



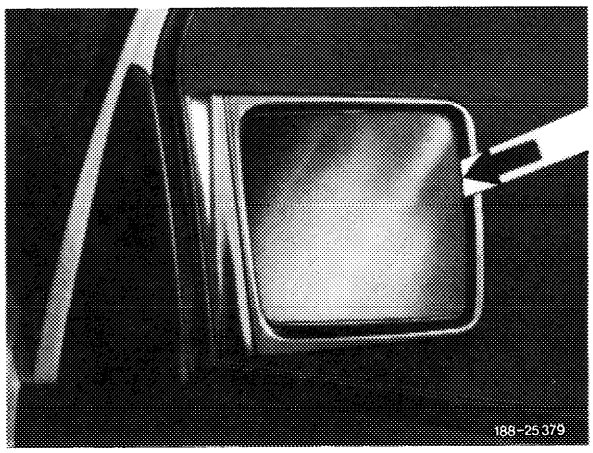
Installation

4 For installation proceed vice versa.

A. Mirror glass

Removal

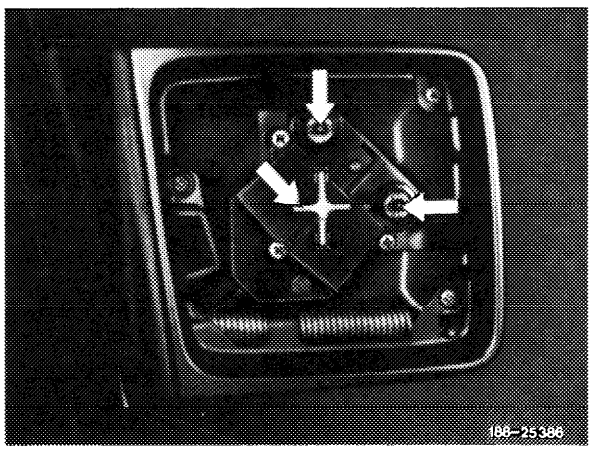
1 Push mirror glass out: by means of a plastic wedge and remove.

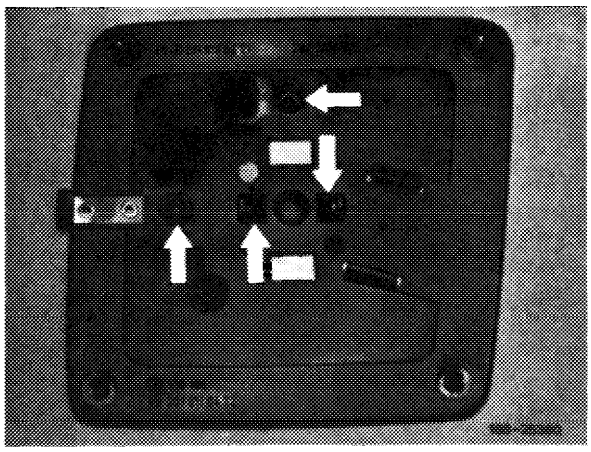


Installation

2 Align ball head seats on adjusting motor and audibly engage mirror glass into the 3 receiving points.

Note: Adjust upper pin horizontally, the lateral pins vertically.



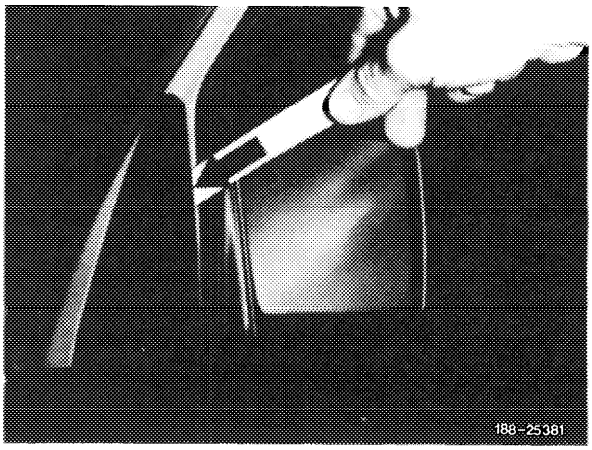


Receiving points on mirror glass reverse side.

B. Complete outside rear view mirror

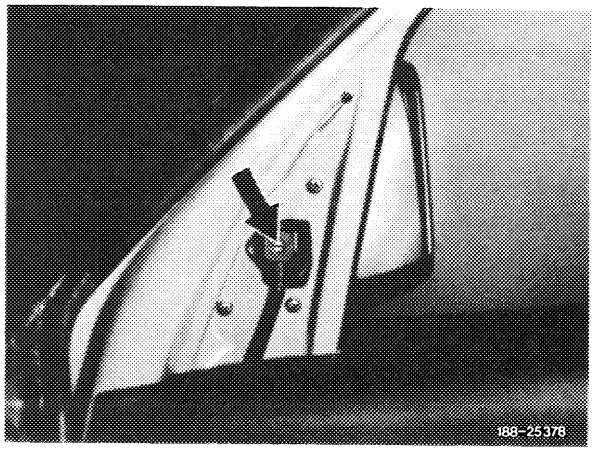
Removal

1 **Unclip cover plate at top from door frame, pull in upward direction and disengage on inner door sheeting.**

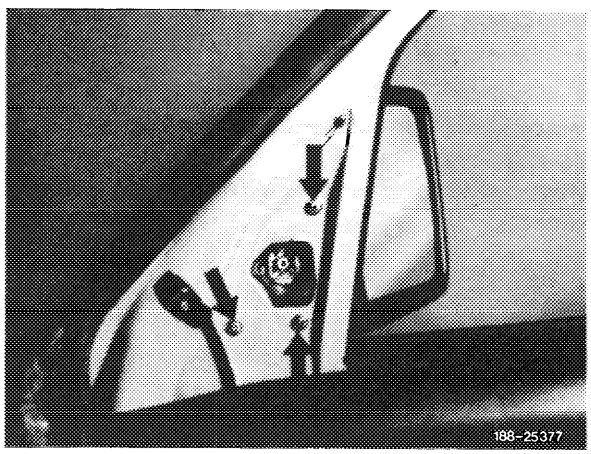


2 Remove foam fabric shim.

3 Unscrew fastening screw on plug connection for electric supply line and pull off plug.



4 Unscrew fastening screws for outside rear view mirror and remove mirror.

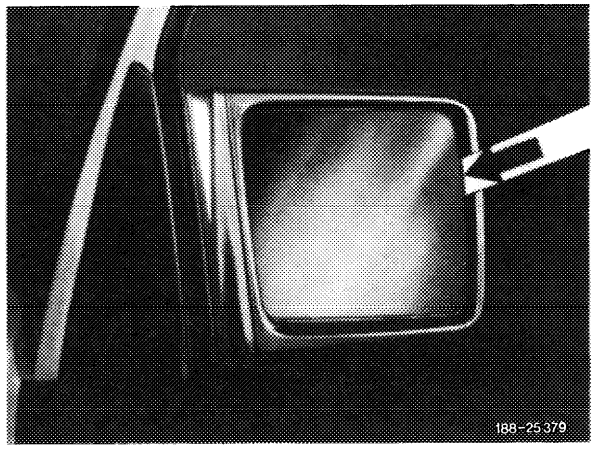


Installation

5 For installation proceed vice versa.

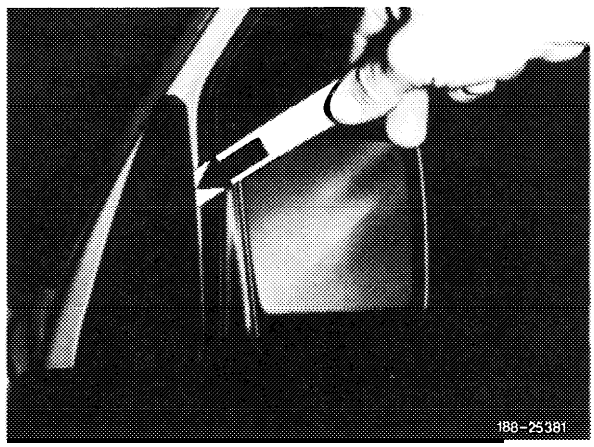
Removal

1 Remove mirror glass by pressing it out by means of a plastic wedge and remove.

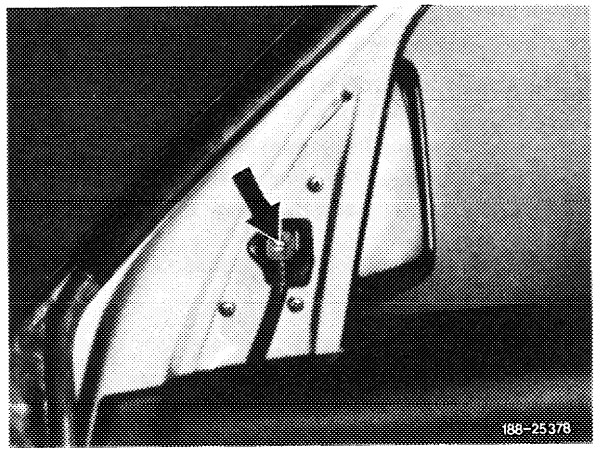


2 Unclip cover plate at the top from door frame, pull in upward direction and disengage on inner door sheeting.

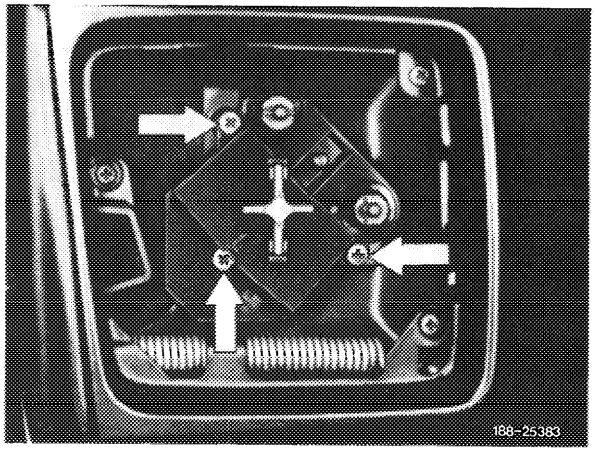
3 Remove foam fabric shim.



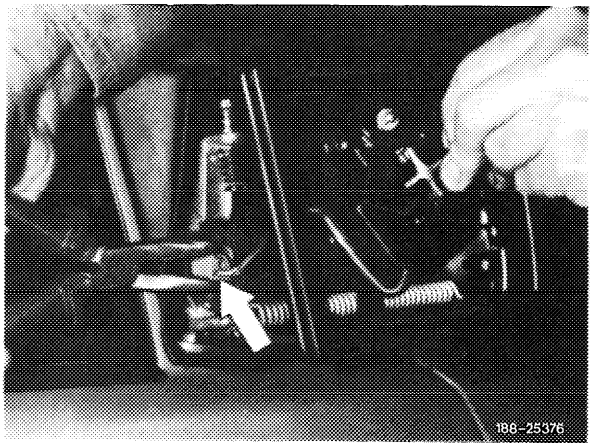
4 Unscrew fastening screw on plug connection for electric supply line and pull off plug.



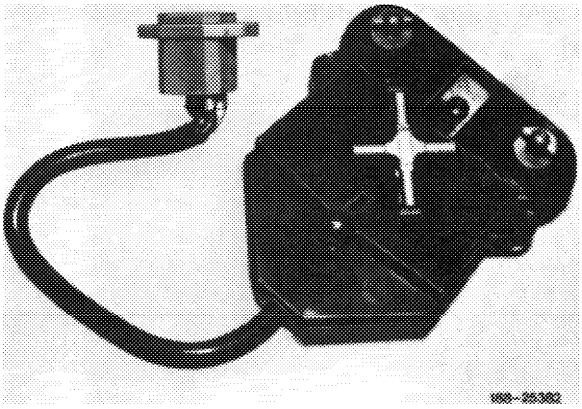
5 Unscrew fastening screws on electric motor.



6 Tip mirror housing in forward direction and hold it in position. Turn electric plug connection by means of a suitable flat-jawed pliers in clock-wise direction and remove from holder.



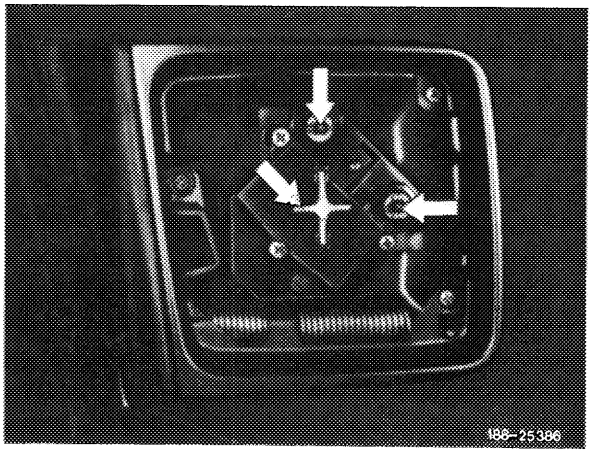
7 Pull electric connecting cable through mirror housing and completely remove electric motor.



Installation

8 For installation proceed vice versa.

Note: When pressing in the mirror glass into the 3 receiving points, align the plugs of the upper ball head seat horizontally and the lateral ones vertically.



Job No.

Driver's seat

Removal and installation of driver's 91-100
Removal and installation of front passenger's seat 110
Removal and installation of cover on driver's seat cushion 180
Removal and installation of cover on driver's seat backrest 182

Rear seat

Removal and installation of rear seat and rear seat backrest 170

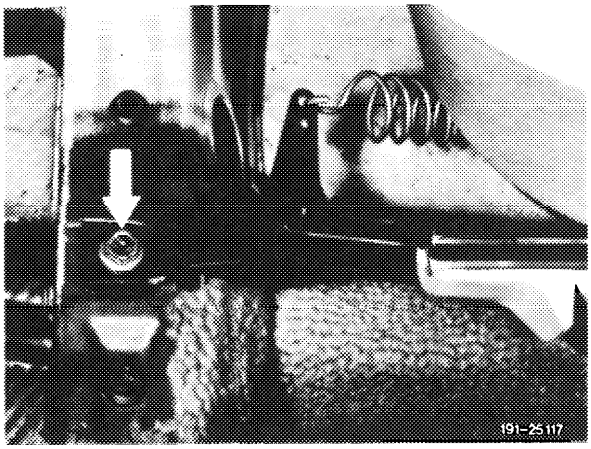
Safety belts

Removal and installation of front safety belt 500
Removal and installation of rear safety belt 510
Replacement specifications for safety belt 550

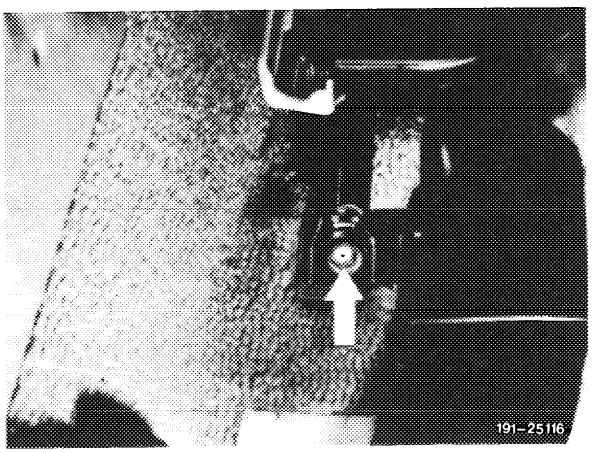
Removal

1 Unscrew screws at front on both seat guide rails, while pushing driver's seat toward the rear and height adjustment down.

2 Push driver's seat forward and height adjustrnent up.

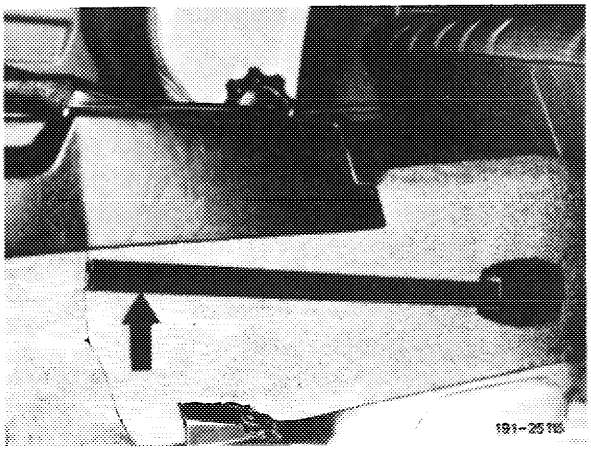


3 Unscrew screws at the rear on both seat guide rails.



4 Slightly raise driver's seat and pull out of slide rail in forward direction.

5 Remove driver's seat.

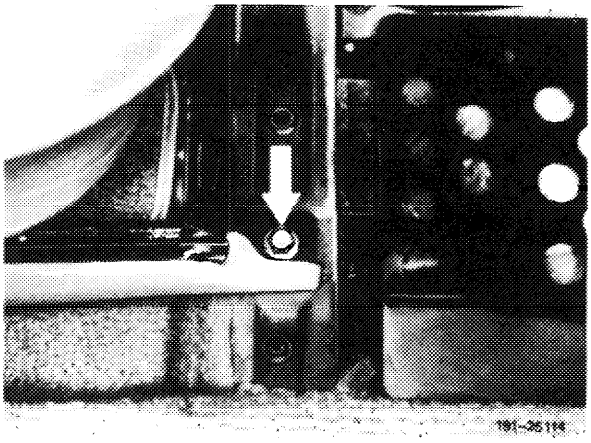


Installation

6 For installation proceed vice versa.

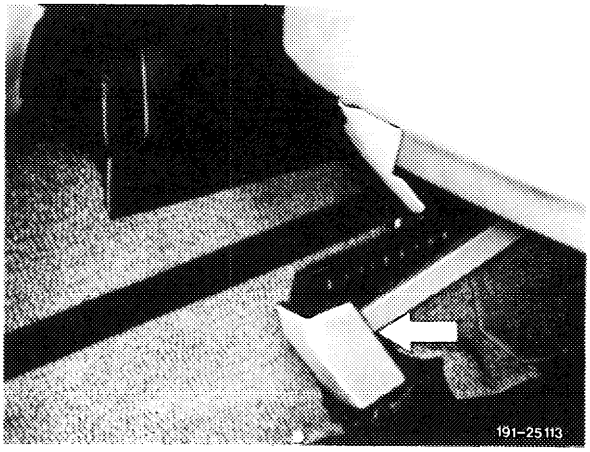
Removal

1 Slide front passenger's seat toward the rear and unscrew both screws at seat guide rails front.

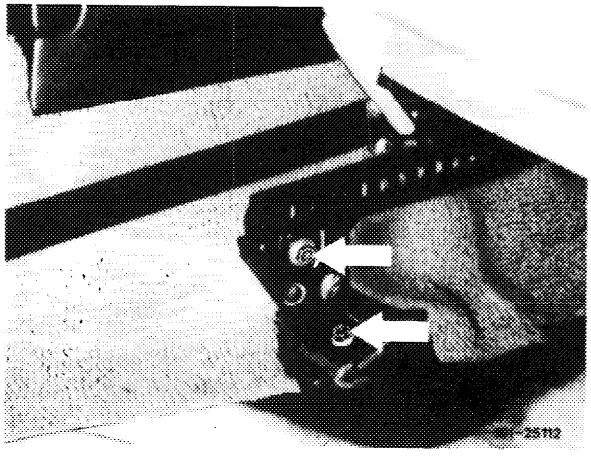


2 Slide front passenger's seat forward.

3 Push off covers at seat guide rails rear.

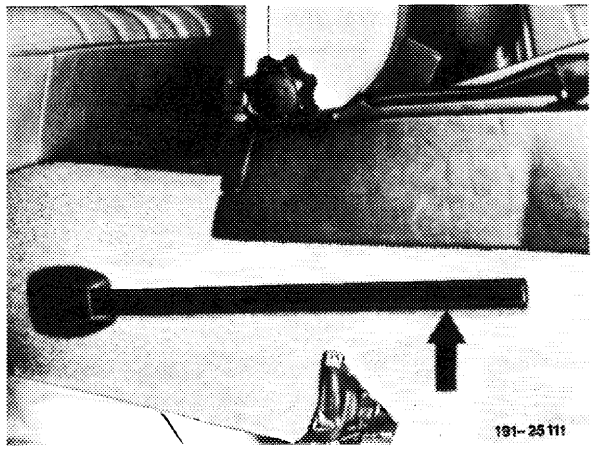


4 Unscrew screws on seat guide rails rear.



5 Slightly raise front passenger's seat and pull out of slide rail in forward direction.

6 Remove front passenger's seat.



Installation

7 Introduce front passenger's seat from the front into slide rail.

8 Position screws on seat guide rails rear.

9 Push front passenger's seat to the rear.

10 Position screws on seat guide rails front.

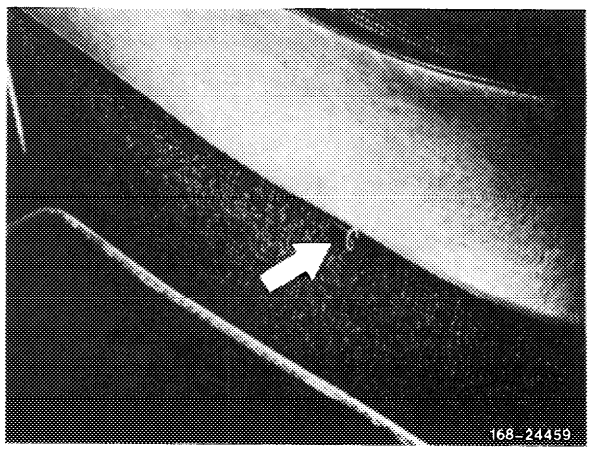
11 Tighten all fastening screws.

12 Clip covers for seat guide rails at the rear.

Removal

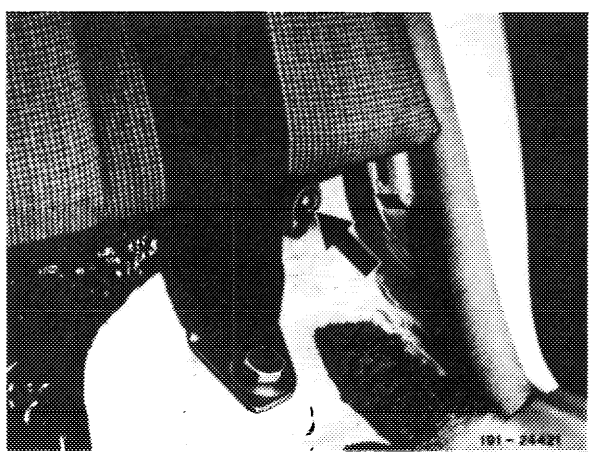
1 Push detent at left and right to the rear and lift rear seat at the front.

2 Lift out rear seat.



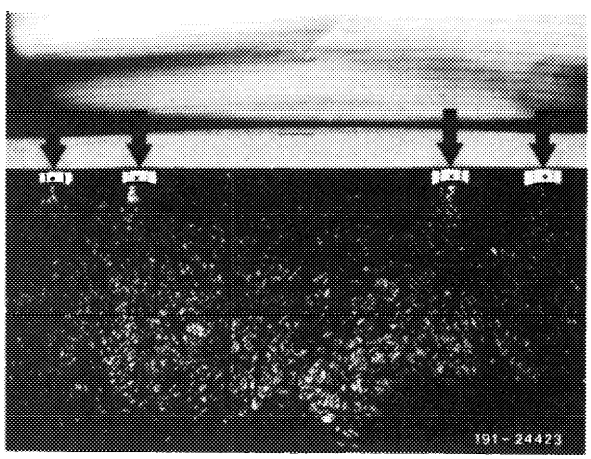
3 Unscrew the three screws on rear seat backrest below.

4 Push rear seat backrest in upward direction out of holders and remove.

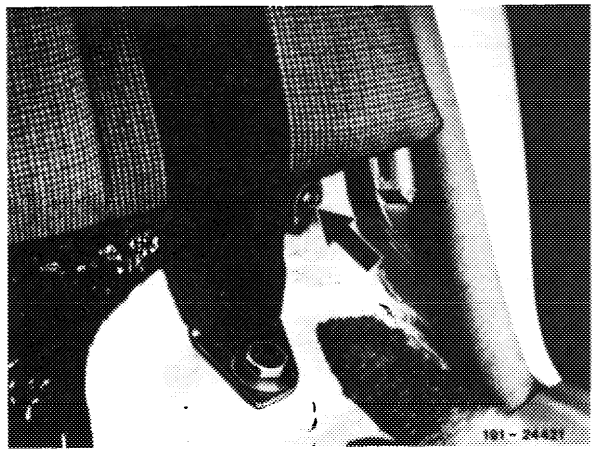


Installation

5 When installing rear seat backrest make sure that the 4 holders are engaging in rear seat backrest frame at top.

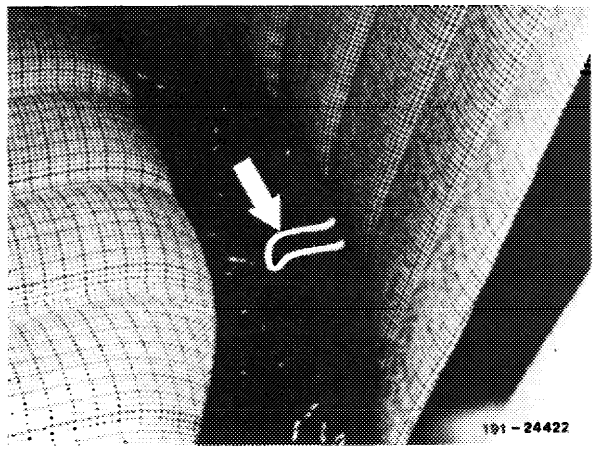


6 Screw down rear seat backrest below.



7 Introduce rear seat into rear holding brackets and push at front into detent.

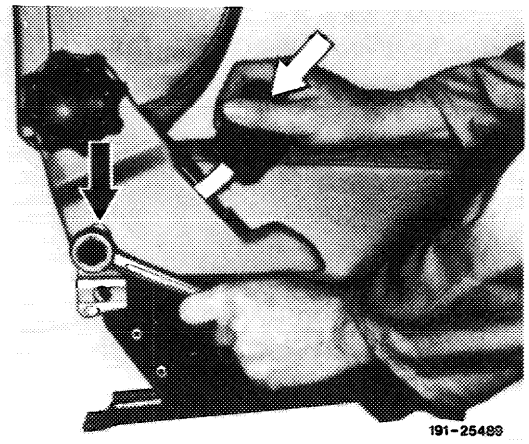
8 For further installation proceed vice versa.



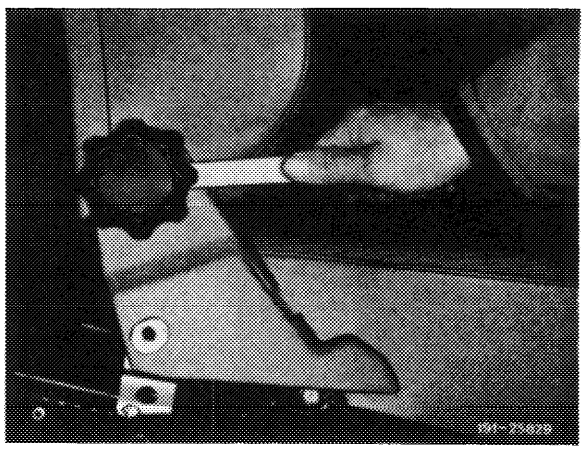
Removal

1 Remove driver's or front passenger's seat (91-100 or 91-l 10).

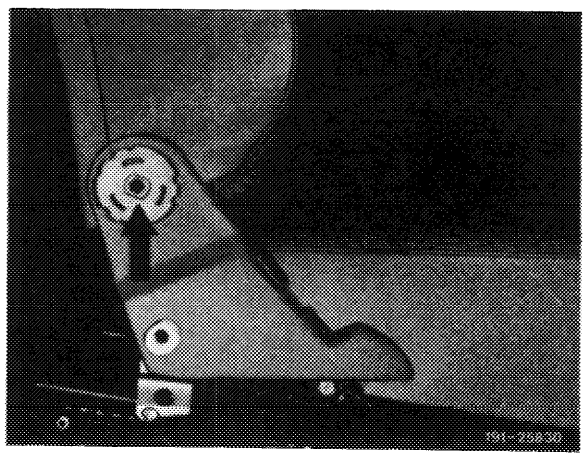
2 Unscrew screw on belt lock and remove belt lock.



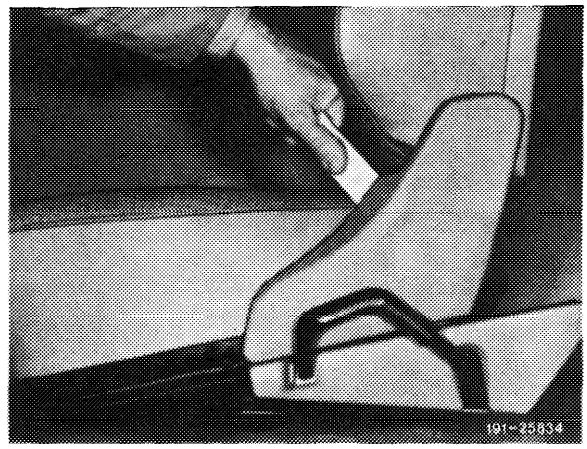
3 Press off hand wheel by means of a wedge.



4 Unscrew screw and remove plastic disc.

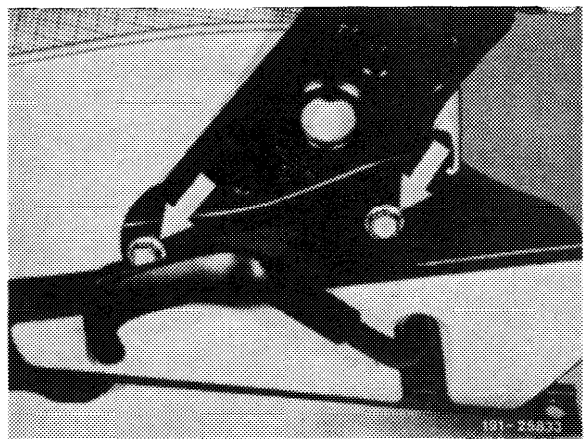


5 Carefully press off lining of reclining seat fitting left and right.

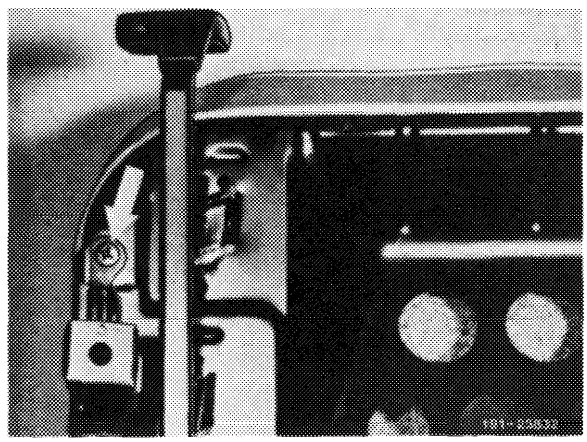


6 Unscrew screws on both sides of driver's seat cushion.

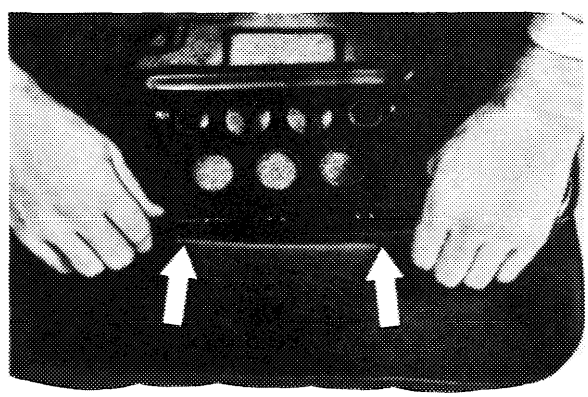
7 Remove driver's seat backrest from seat cushion.



8 Unscrew screw on seat rail left and right and remove seat rail from cushion frame.



9 Put cushion with cover down on a suitable pad and remove cover all-around cushion frame. For this purpose, press down on spring box.



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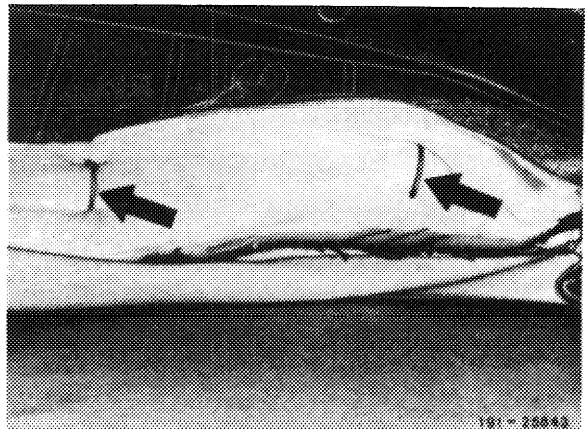
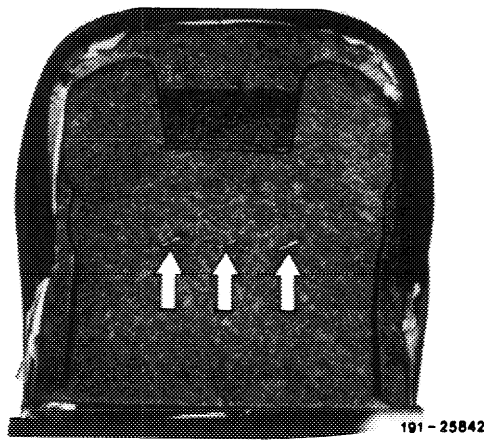
10 **Pull out** round-wire clamps from rubber hair mat.

11 **Remove** rubber hair mat with seat cover from seat cushion frame.



12 Open stapling hooks.

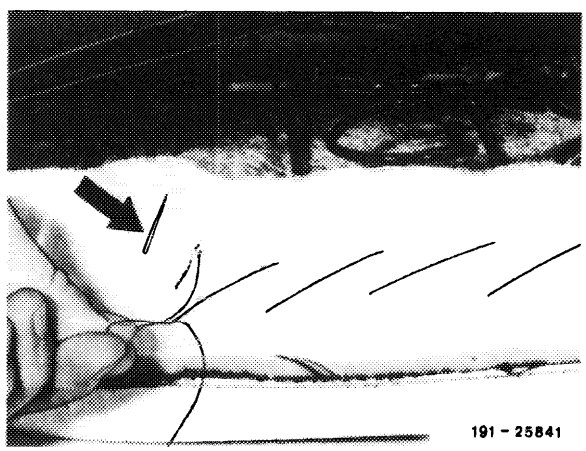
13 Remove cover from rubber hair mat.



Installation

14 **For installation proceed vice versa.**

Note: Attach nettle fabric and rubber hair mat on cushion frame by means of upholstery yarn (instead of round-wire clamps).

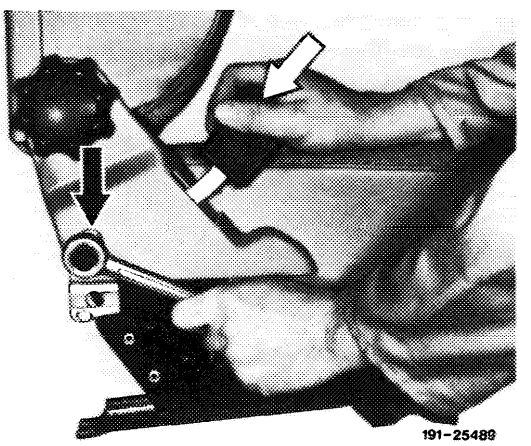


Removal

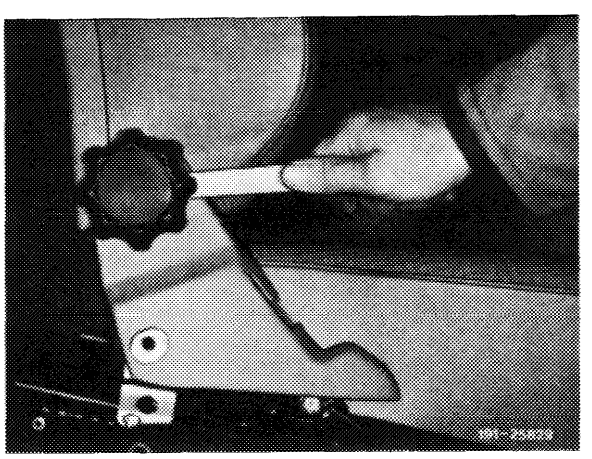
1 Remove driver's or front passenger's seat (91--100 or 91--110).

2 Remove headrest.

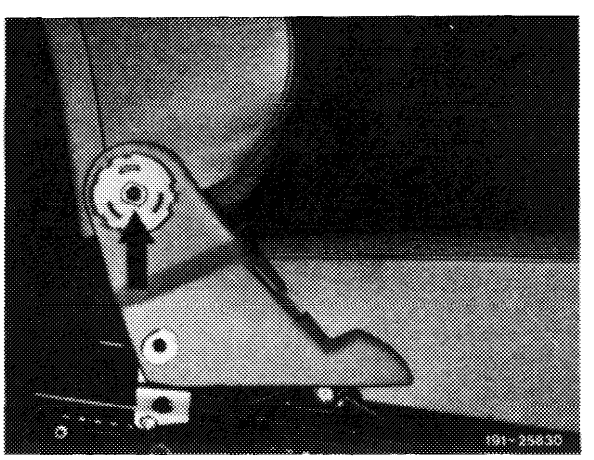
3 Unscrew screw on belt lock and remove belt lock.



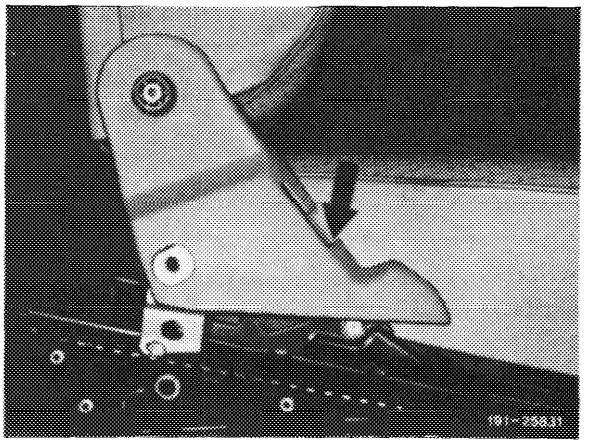
4 Press off hand wheel by means of a wedge.



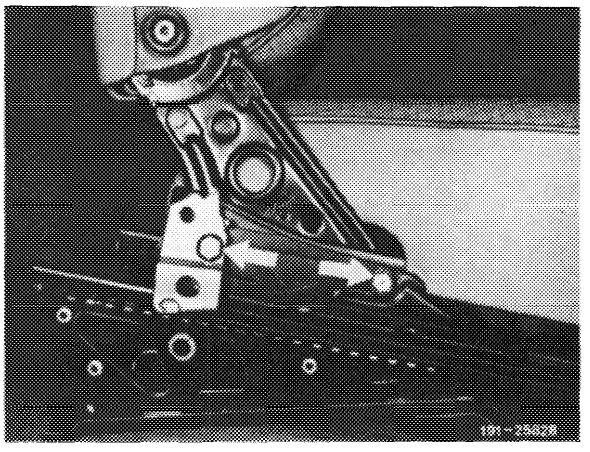
5 Unscrew screw and remove plastic disc.



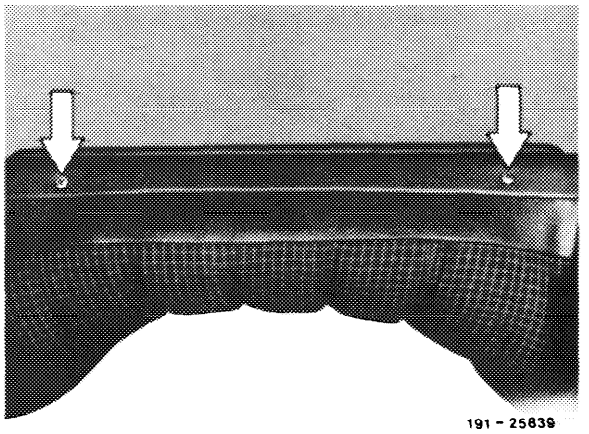
6 Carefully press off lining on reclining seat fitting.



7 Unscrew screws on both sides of cushion frame und remove backrest from cushion frame.

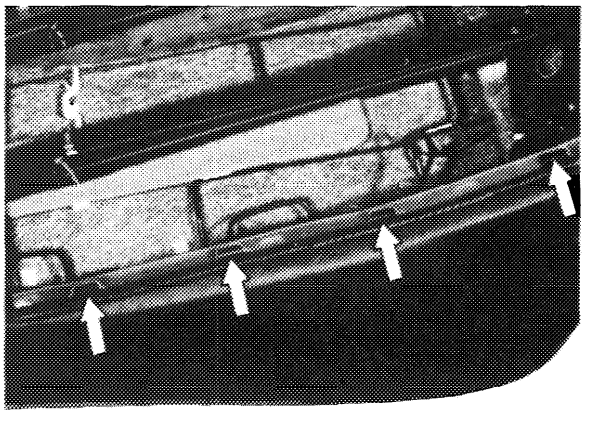


8 Unscrew screws on stretching element, pull stretching element downwards and remove.



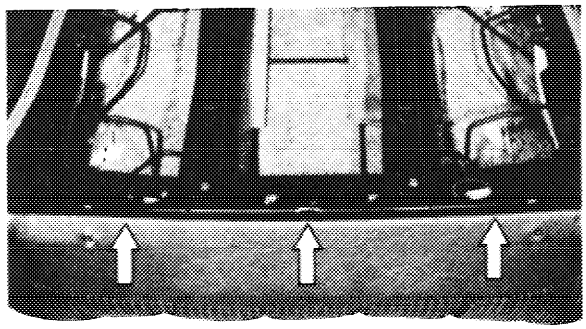
191 - 25839

9 Lift off backrest cover left and right starting from below. For this purpose, compress backrest frame.



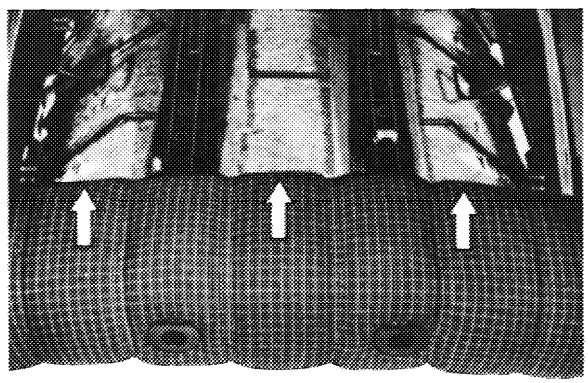
191 - 25840

10 Unclip backrest cover at bottom.



191 - 25838

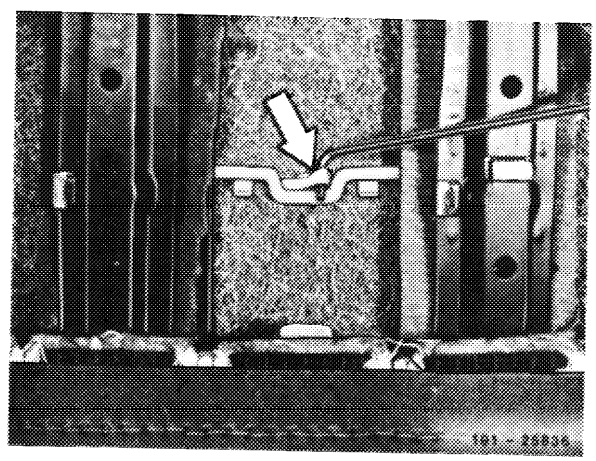
11 **Unclip backrest cover at top.**



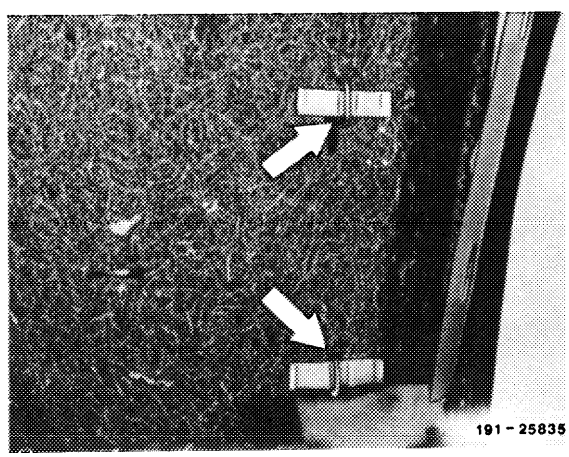
191 - 25837

12 **Unclip stretching strips on plastic clamp.**

13 **Remove rubber hair mat from backrest frame.**



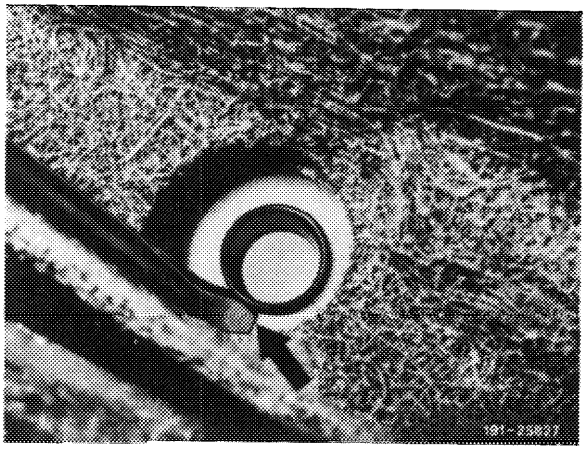
14 **Unclip clamps on reverse side of rubber hair mat and loosen nettle fabric pinned thereto.**



191 - 25835

15 Break open both plastic discs of flat eye of head-rest guide by means of slotted screwdriver, and remove flat eye from cover.

16 Remove cover from rubber hair mat.



Installation

17 For installation proceed vice versa.

Note: Sew nettle fabric to rubber hair mat by means of upholstery yarn (instead of round-wire clamps).

Note

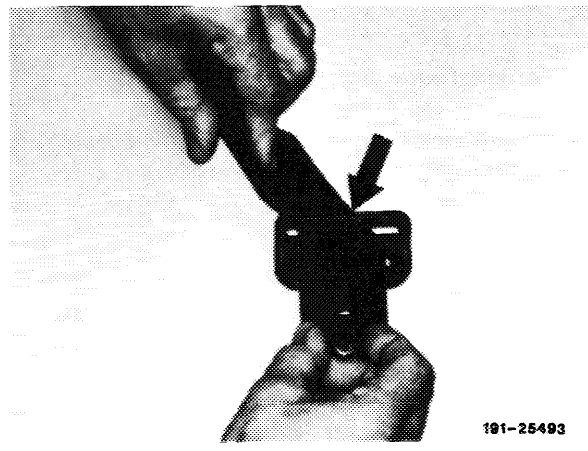
When reeling up belt, any noise on automatic reeling mechanism is operational.

In the event of complaints, unacceptable noise can be eliminated only by exchanging safety belt. Never use oil or grease to eliminate noise.

Likewise, do not disassemble automatic reel, since preloaded spring may cause accidents. Any automatic reels opened will not be accepted for warranty claims.

Latch on belt twisted

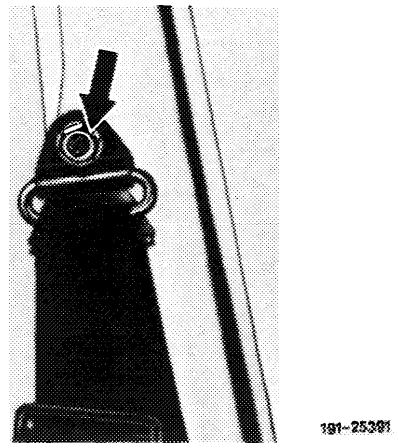
If the latch on belt has been twisted, pull back to its normal position as shown on illustration.



Removal

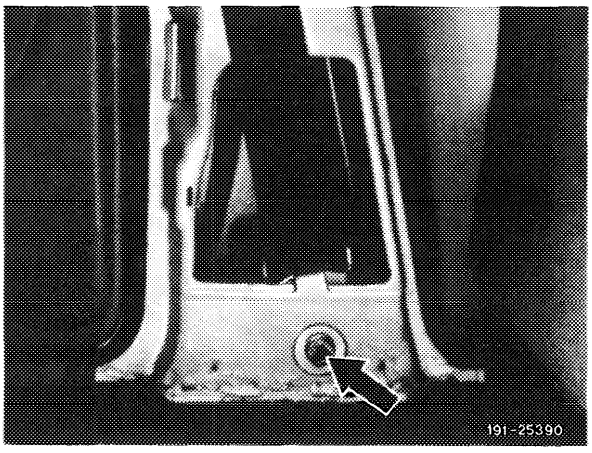
1 **Remove paneling on center pillar** (68–470).

2 Unscrew screw on belt guide fitting.



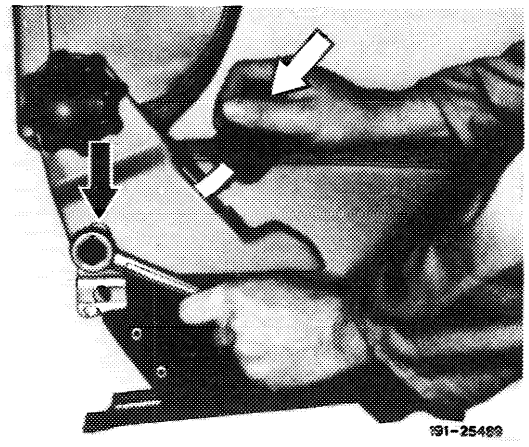
3 Unscrew screw on automatic reel and remove automatic reel.

4 Remove driver's seat or front passenger's seat (91–100 or 91–110).



5 Unscrew screw on belt lock while applying counterhold on belt lock.

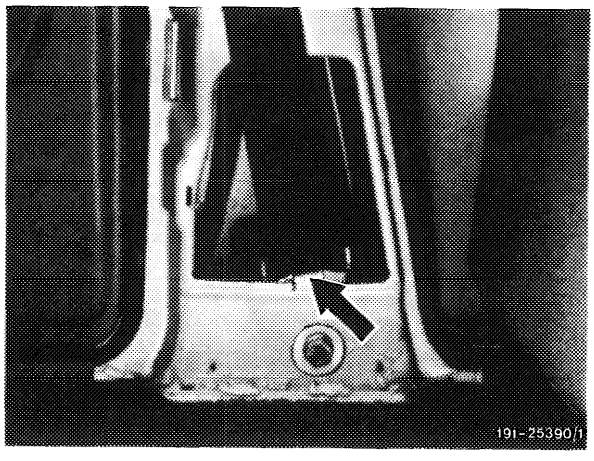
6 Remove belt lock.



Installation

7 For installation proceed vice versa.

Note: When installing automatic reel, pay attention to perfect seat of locking mechanism (arrow).



Note

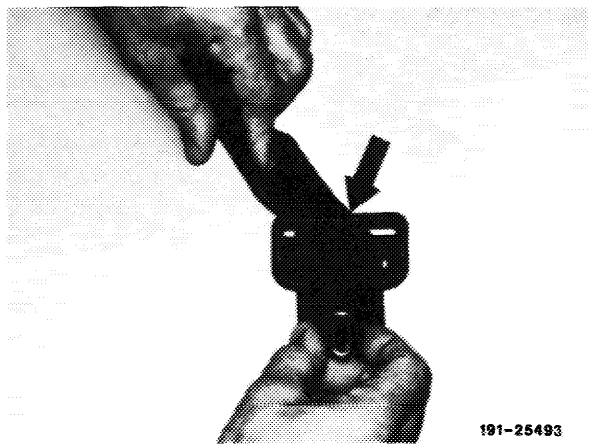
When reeling up belt, any noise on automatic reeling mechanism is operational.

In the event of complaints, unacceptable noise can be eliminated only by exchanging safety belt. Never use oil or grease to eliminate noise.

Likewise, do not disassemble automatic reel, since preloaded spring may cause accidents. Any automatic reels opened will not be accepted for warranty claims.

Latch on belt twisted

If the latch on belt has been twisted, pull back to its normal position as shown on illustration.



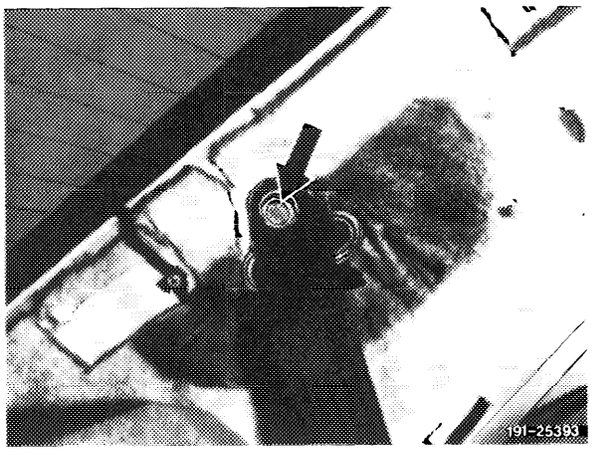
Removal

1 Remove paneling on rear pillar(68–449).

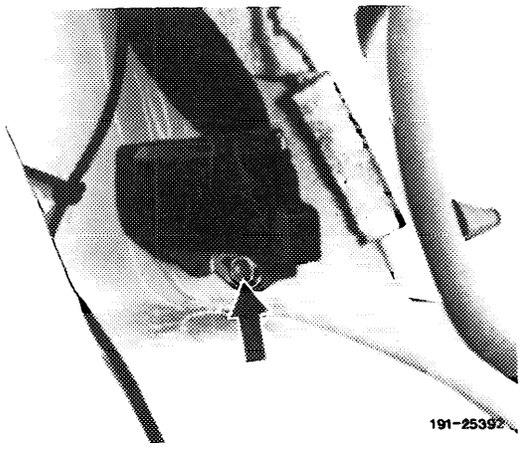
2 Remove rear seat backrest (91-l 70).

3 Unscrew fastening screw on rear pillar.

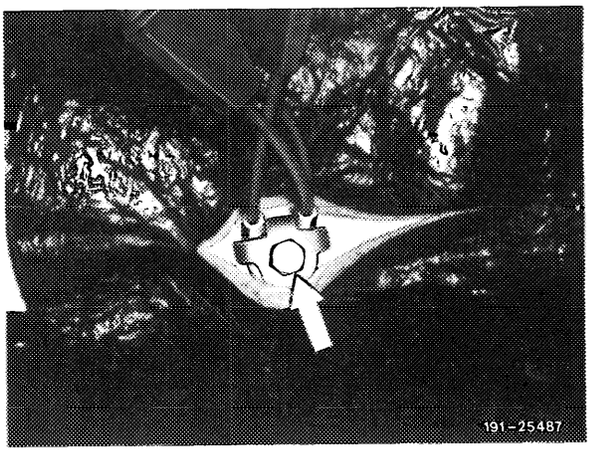
4 Unclip insulating (damping) mat on rear wall in range of automatic reel.



5 Unscrew screw on automatic reel and remove automatic reel.



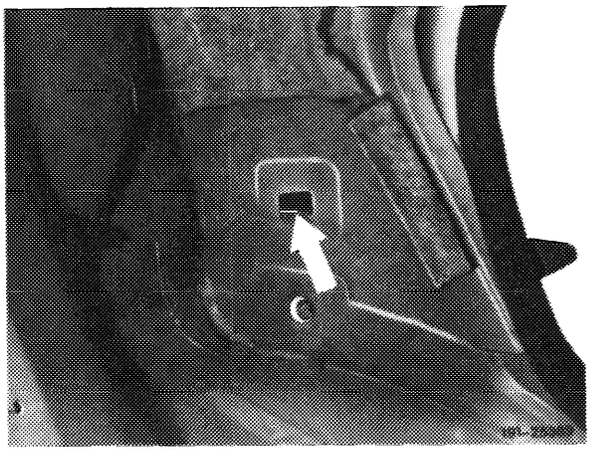
6 Unscrew screw on belt lock and remove belt lock.



Installation

7 For installation proceed vice versa.

Note: When installing automatic reel, pay attention to perfect seat of locking mechanism (arrow).



Note

Belt tensioners are installed since September 1984.

Check or renew belt tensioner (refer to airbag and belt tensioner 91–750).

A. For mechanical damage

If safety belts are inexpertly handled (cleaned wrongly, put away in unfavorable location or pinched), the belt strap may suffer damage.

For this reason, perform a visual checkup of belts during each maintenance service.

If the belt shows cut fibres or e.g. damage caused by a burning cigarette, inform customer about the need for changing belt. Chafing marks without cut fibres do not require a change of safety belt.

If a customer refuses replacement of a damaged belt, a pertinent remark should be made on repair order.

In the event of a complaint "safety belt not reeling up correctly", check prior to removal whether belt is guided back manually as specified and whether inexpert handling may have resulted in twisting the belt behind the lining by 180°. Remove lining for this purpose.

B. Following accidents

Note

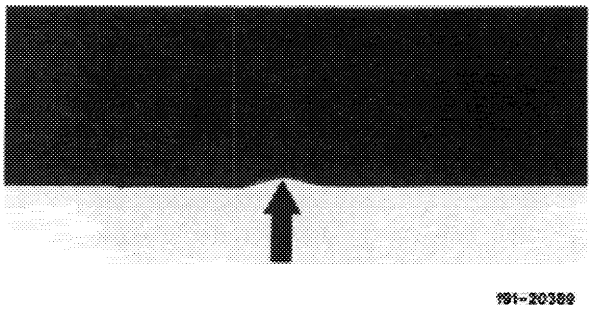
Renewal of a complete safety belt or individual, damaged parts such as holding rail, automatic reel or belt lock, depends on visible deformations.

Characteristic damage

Stage 1

1 **Plastic coating of holding rail dented. Seat can no longer be correctly adjusted.**

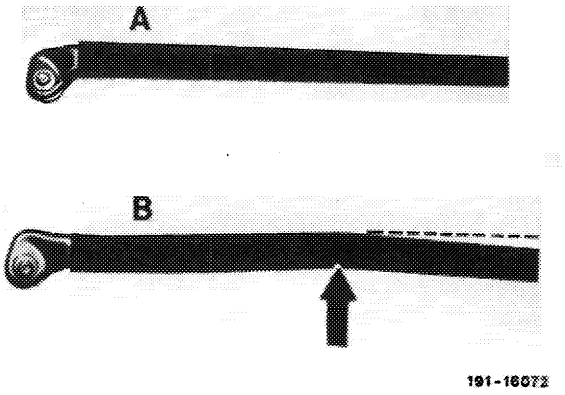
Remedy: Renew holding rail.



191-20382

2 Holding rail deformed. Seat can no longer be correctly adjusted.

Remedy: Renew holding rail.



191-16072

Shown on model 123

A Holding rail not damaged
B Holding rail distorted

Stage 2

1 **Holding rail badly distorted. Seat can no longer be adjusted.**

2 Automatic reel not functioning.

Remedy: Renew holding rail and automatic reel.

	Job No.
A 32 Suspension	A3211
A 33 Front axle	A33/1
A 35 Rear axle	A35/1
A 40 Chassis measurement, Wheels and tires	A40/1
A 42 Brakes	A42/1
A 46,47 Steering, Fuel system	A46/47/1
A 49 Exhaust system	A4911
A 54 Electrical system	A54/1
A 68 Interior	A6811
A 82 Body electrical system	A82/1
A 83 Climate control system	A83/1
A 88 Detachable body components	A8811
A 91 Seats, restraint systems	A91/1

Suspension

Shock absorber (damper) strut – front axle

The damper strut is identified by 3 red stripes with a depression (arrow) in the outer tube to increase tire clearance.

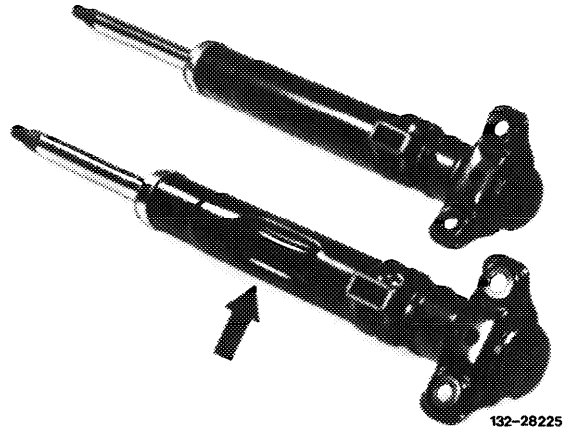
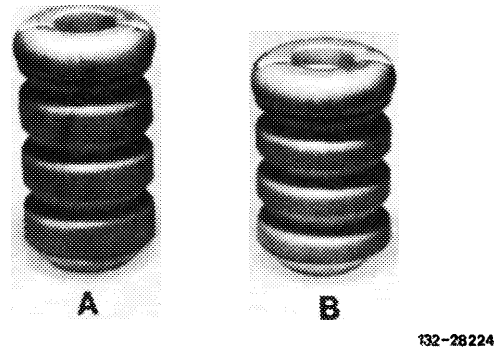


Fig. 32/1

The additional polyurethane (PU) spring (B) is harder and shorter compared with version (A).



Pig. 32/2

A Model 201.024
Length 96 mm

B Model 201.034
Length 83 mm

Shock absorber (suspension) strut – rear axle

As on the front axle damper strut, the suspension strut is identified by 3 red stripes.

Torsion bars

The front axle torsion bar has a diameter of 23 mm (22 mm on model 201.024).

The torsion bar on the rear axle has been modified both in shape and in dia. (16 mm instead of 13 mm on model 201.024). The torsion bar links have torsional rubber bushings on both sides.

The lever on the torsion bar for actuating the levelling valve as well as the mounting bracket, are adapted to the larger torsion bar dia.

bevel control – rear axle

A level control system, similar to the one used on model 123.193, is also used on model 201.034.

The oil reservoir, levelling valve, and suspension struts are a new development.

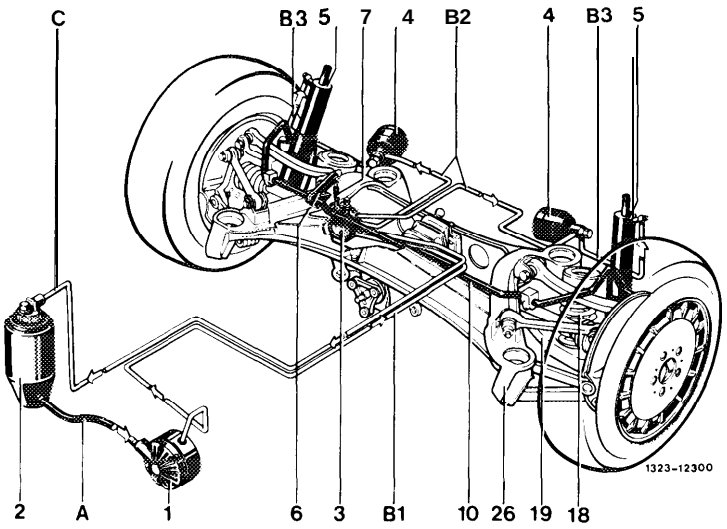


Fig. 32/3

1 Hydraulic oil pump
2 Oil reservoir
3 Levelling valve
4 Pressure reservoir
5 Suspension strut
6 Lever on torsion bar
7 Connecting rod
10 Torsion bar
18 Rear spring
19 Spring link
26 Rear axle carrier
A Suction line (oil reservoir to hydraulic oil pump)
B1 Pressure line (hydraulic oil pump to levelling valve)
B2 Pressure line (levelling valve to pressure reservoir)
B3 Pressure line (pressure reservoir to suspension strut)
C Return line (levelling valve to oil reservoir)

Oil reservoir

The reservoir is located on the right side in the engine compartment and has a capacity of 1.15 liter at the min. mark and 1.35 liter at the max. mark. The level control system has a total capacity of approx. 2.0 liters of hydraulic fluid.

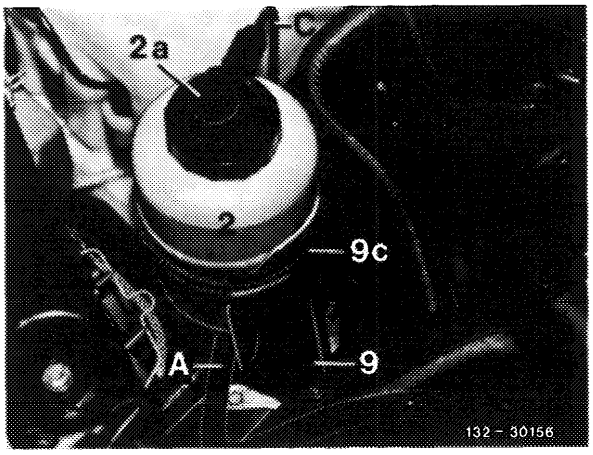


Fig. 32/4

2 Oil reservoir
2a Cap with oil dipstick
9 Oil reservoir mounting bracket
9c Holding spring
A Suction line (oil reservoir to hydraulic oil pump)
C Return line (levelling valve to oil reservoir)

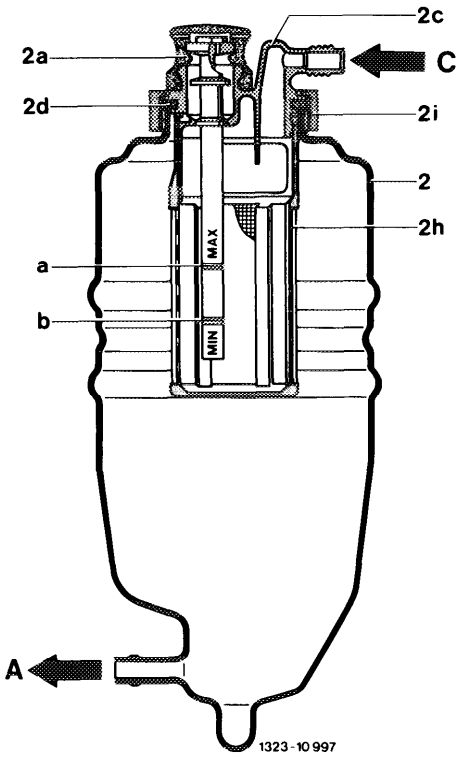


Fig. 32/5

2a Cap with oil dipstick
2c Cover with connection
2d Rubber seal ring
2h Filter element
2i Fastening nut
a Max. mark
b Min. mark
A Suction line (oil reservoir to hydraulic oil pump)
C Return line (levelling valve to oil reservoir)

To increase passenger comfort, a new hydraulic oil and modified rubber diaphragms in the pressure reservoirs are now used. The pressure reservoirs can be identified by a yellow dot.

Caution!
When filling the system, only use MB-hydraulic oil (part no. 000 989 91 03) as shown on the label on the oil reservoir (in engine compartment).

Checking oil level

Vehicle in curbweight condition:
Level between MIN and MAX

Vehicle with full load:
Level below MIN (not quite visible on dipstick).

Specified oil:
MB-hydraulic oil
Part no. 000 989 91 03 (1 liter container)

Hydraulic oil pump

The hydraulic oil pump is driven by the exhaust camshaft and is flanged to the righthand side of the cylinder head.

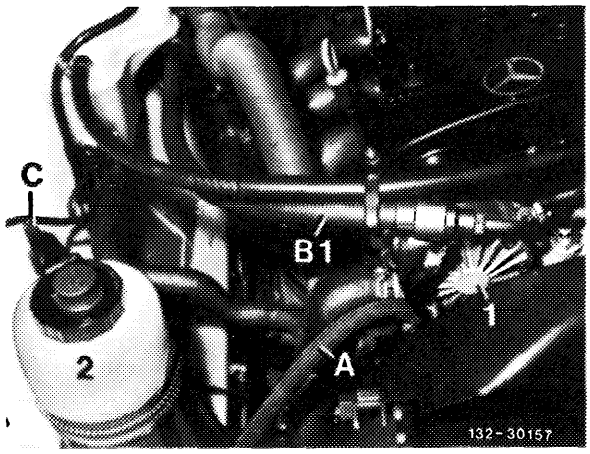


Fig. 32/6

1 Hydraulic oil pump
2 Oil reservoir
A Suction line (oil reservoir to hydraulic oil pump)
B1 Pressure line (hydraulic oil pump to levelling valve)
C Return line (levelling valve to reservoir)

Levelling valve

The levelling valve operates the same as before. It is light weight due to its compact construction.

The opening pressure of the pressure relief valve is 143 ± 10 bar.

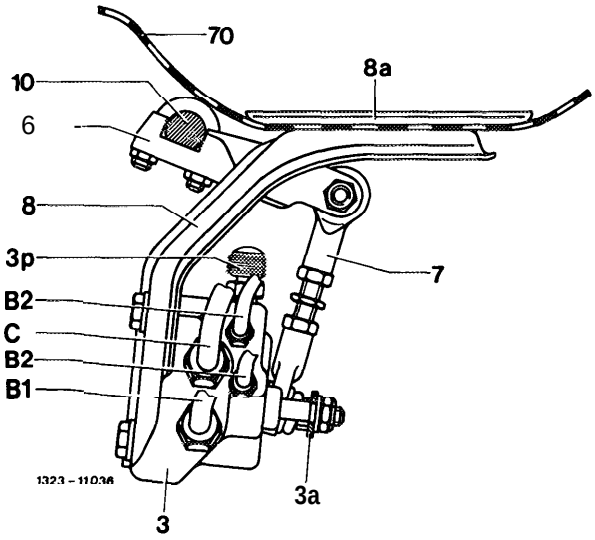


Fig. 32/7

3 Levelling valve
3a Lever on levelling valve
3p Oil drain plug
6 Lever on torsion bar
7 Connecting rod
8 Mounting bracket
8a Reinforcing plate
10 Torsion bar
70 Frame floor
B1 Pressure line (hydraulic oil pump to levelling valve)
B2 Pressure line (levelling valve to pressure reservoir)
C Return line (levelling valve to oil reservoir)

The connecting rod is attached in bore “a” of the lever.

Levelling valve “control point” adjustment

Insert a 4 mm dia. pin into bore **“c”** and the housing bore for adjustment of vehicle level loaded with 100 kg (refer to Test and adjustment values, vehicle level p. 222).

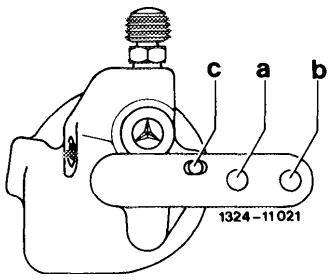


Fig. 32/8

a Bore for connecting rod ball joint
c Locating bores in lever and housing for control point position of levelling valve (4 mm dia. pin)

Caution:
The bleed screw in the levelling valve has a conical seat without point (B) and should not be mixed up with the previous bleed screw (A, with point).

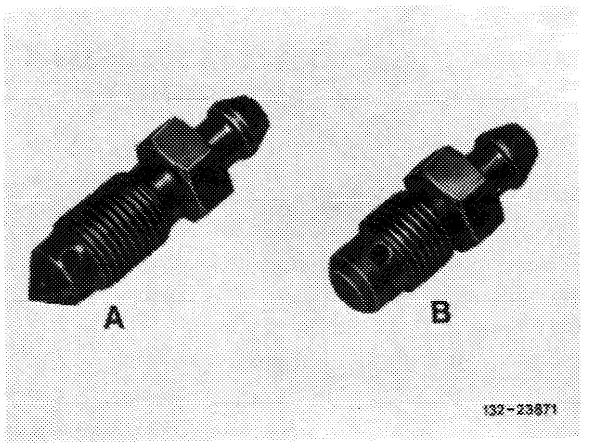


Fig. 32/9

A Bleed screw, previous version
B Bleed screw, current version

Repair note

The test procedures "Checking hydraulic oil pump and levelling valve" and "Checking pressure reservoir" can be performed as before. However, to connect the pressure tester 126 589 02 21 00 to the levelling valve use an additional flexible test line 201 589 03 63 00 (038g).

The test line is installed after unscrewing the bleed screw (3p).

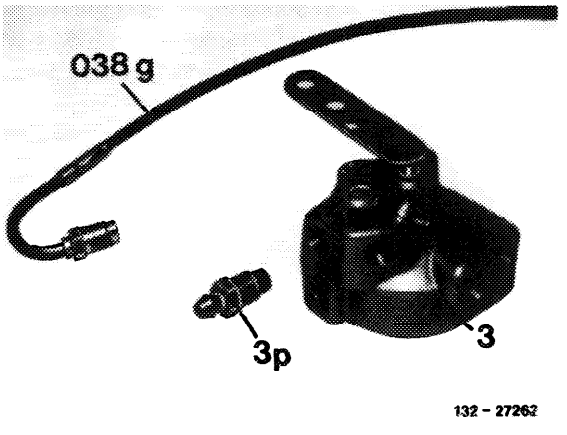


Fig. 32/10

3 Levelling valve
3P Bleed screw
038g Test line

Suspension struts on rear axle

The suspension struts are mounted between the dome of the frame floor and the spring link. The spring compression stop is integrated in the suspension strut (model 123.193 has an additional rubber bumper).

When installing the suspension strut, be sure that the pressure line (B3) for the pressure reservoir is mounted in the correct location.

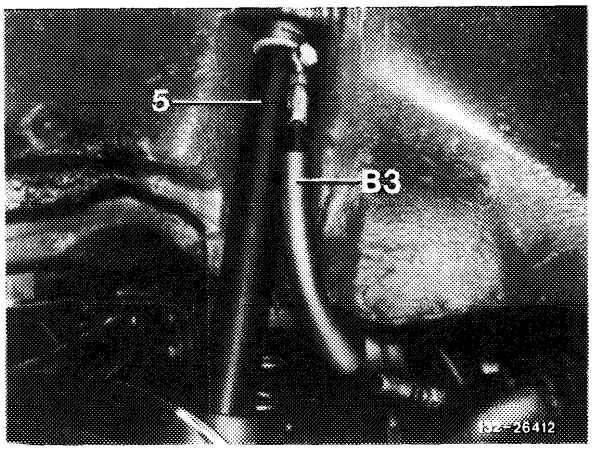


Fig. 32/11

5 Suspension strut
B3 Pressure line (pressure reservoir to suspension strut)

Distance "a" of suspension strut mounting bracket in relation to wheelhousing can be used to verify the correct location.

"a" at rebound = 3 ± 1mm
at rest = 6 ± 1mm
(curbweight condition)

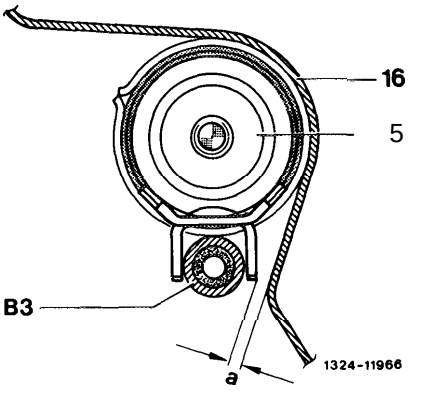


Fig. 32/12

5 Suspension strut
a Distance, mounting bracket to wheelhousing

Testing and adjusting values

Cross-reference, springs – shock absorbers

Front spring Part No.	Damper strut, front Part No.	Rear spring Part No.	Suspension strut, rear Part No.
201 321 28 04 201 321 29 04	201 320 11 30	201 324 32 04	201 320 08 13

When installing springs, refer to tables "Adjustment of springs"!

Adjustment of springs (cross reference, springs– rubber mounts)

A point system, based on various optional equipment, is used to determine several weight groups. Additional points for each option must be added to the base points for the standard vehicle. The total points are then used to determine the proper front or rear spring/rubber mount combination.

Front springs – number of points

Base points (standard vehicle)	Model 201.034	35
Additional points for each option	Automatic transmission	5
	Sliding roof, electric	2
	Underfloor protection (steel plate)	1

Total points	Front spring Part No.	Height of rubber mount (in mm) depending on total points and spring color code	
		blue	red
31 - 36	201 321 28 04	18	23
37 – 41	201 321 29 04	8	13
42 – 47	201 321 29 04	13	18

The part numbers for the rubber mounts are the same as for other 201 models.

Rear springs – number of points

Base points (standard vehicle)	Model 201.034	17
Additional points for each opiton	Sliding roof, electric	3
	Head restraints, rear	1

Total points	Front spring Part No.	Height of rubber mount (in mm) depending on total points and spring color code	
		blue	red
up to 20	201 324 32 04	8	13
21 - 26		13	18

The part numbers for the rubber mounts are the same as for other 201 models.

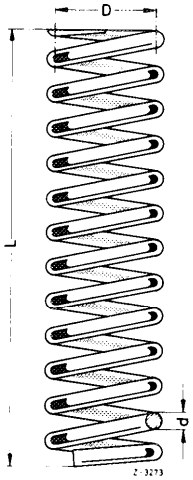


Fig. 32/13
Front and rear springs
L = Free length
D = Mean coil dia
d = Wire dia

Test values of springs

Part No.	Spring travel per 1000 N load	Wire dia. "d"	Spring load, N	Test height (mm)
Front springs				
201 321 28 04	20.7	14.0	6420 ± 220	240
201 321 29 04	18.8	14.4	7100 ± 240	240
Rear springs				
201 324 32 04	24.0	11.9	3310t 190	213.5

Front axle

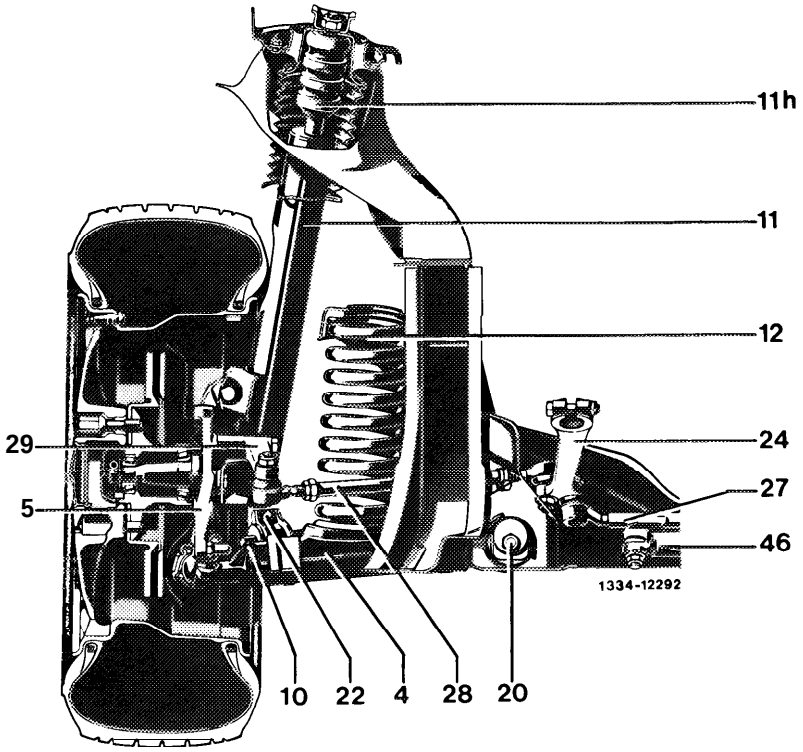


Fig. 33/1

4 Wishbone (control arm)
5 Steering knuckle
10 Torsion bar
11 Damper strut
11 h PU supplementary spring
12 Front spring
20 Eccentric bolt, rear
22 Torsion bar bushing on wishbone
24 Pitman arm
27 Drag link
26 Tie rod
29 Steering knuckle arm
46 Steering damper

Wishbone (control arm)

The reinforced wishbone (control arm) has the same two-part bushing with clamping sleeve as installed on model 201.024. The torsion rubber bushings have a shore hardness of 63, compared with 50 on model 20 1.024.

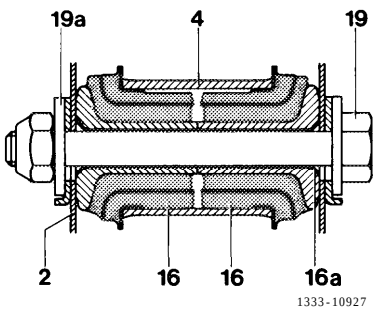


Fig. 33/2

2 Frame cross member
4 Wishbone (control arm)
16 Torsion rubber bushing
16a Clamping sleeve
19 Eccentric bolt (camber adjustment)
19a Eccentric washer

Repair note

The torsion rubber bushings are installed so that the flat surfaces (arrows) are horizontal on the front bushings and vertical on the rear bushings (Fig. 33/3 and 33/4).

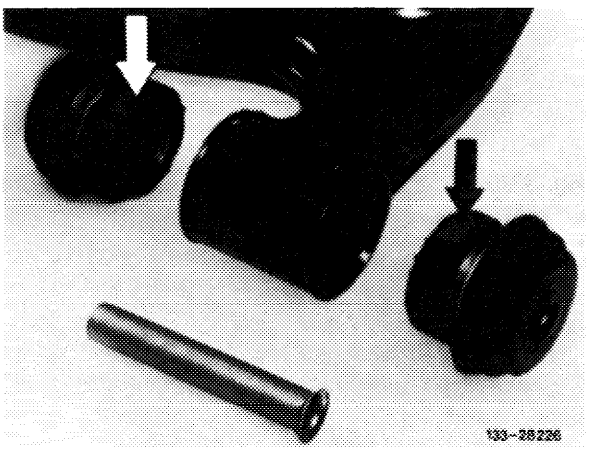


Fig. 33/3 Front bushings, horizontal flats

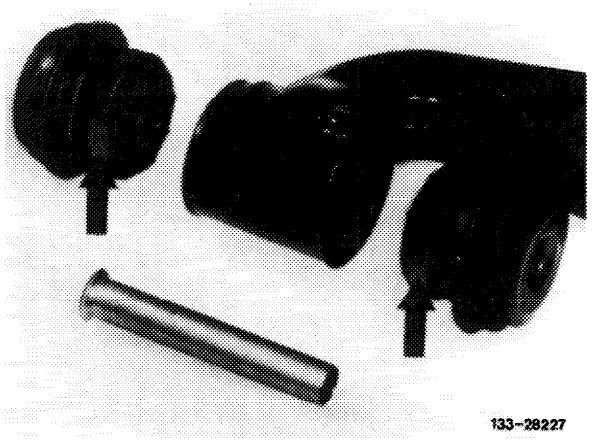


Fig. 33/4 Rear bushings, vertical flats

Steering knuckle

The steering knuckles are reinforced at the load bearing points, as well as at the outer bearing journal. They can be identified by the number stamped inside, left = 24 07 01 and right = 24 07 02.

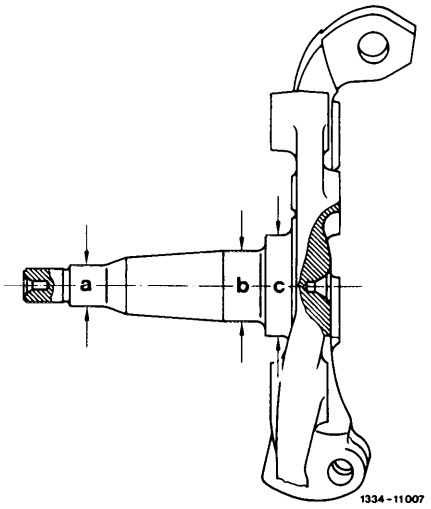


Fig. 33/5

a Outer bearing seat 19.05 mm
b Inner bearing seat 31.75 mm
c Running surface for 45 mm seal ring

Front wheel hub

The front wheel hub can be recognized by the larger flange dia., and the larger seat for the outer tapered roller bearing (Fig. 33/6).

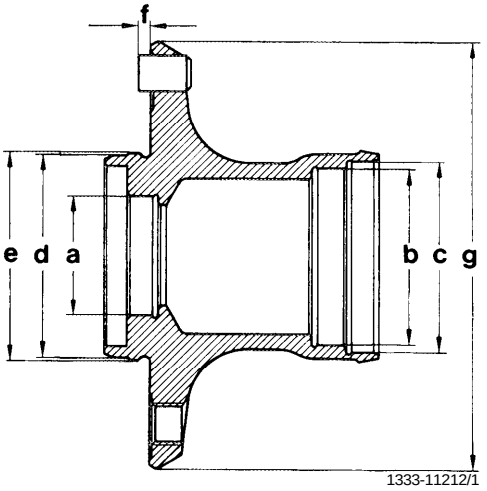


Fig. 33/6

a Outer bearing seat $\frac{45.220}{45.195}$ mm
b Inner bearing seat $\frac{59.117}{59.098}$ mm
c Seat for seal ring $\frac{64.046}{64.000}$ mm
d Seat for rim $\frac{66.400}{66.354}$ mm
e Seat for brake disk $\frac{66.990}{66.971}$ mm
f Protrusion for roll pin 3.6 - 3.8
Q flange dia 150

Grease capacity of front wheel bearing:
High-temperature bearing grease,
part no. 000 989 49 51 (150 g container)

Total capacity	approx. 65 g
Hub with bearing	approx. 50 g
Hub cap	approx. 15 g

Steering knuckle arm

The contours of the steering knuckle arm have been changed in the area of brake caliper, the stamped identification is as follows:

left = 0110
right = 0111

The new steering knuckle arms are now valid for all 201 models. The previous steering knuckle arms (identification: left = 0108, right = 0109) must not be installed on model 201.034.

Rear axle

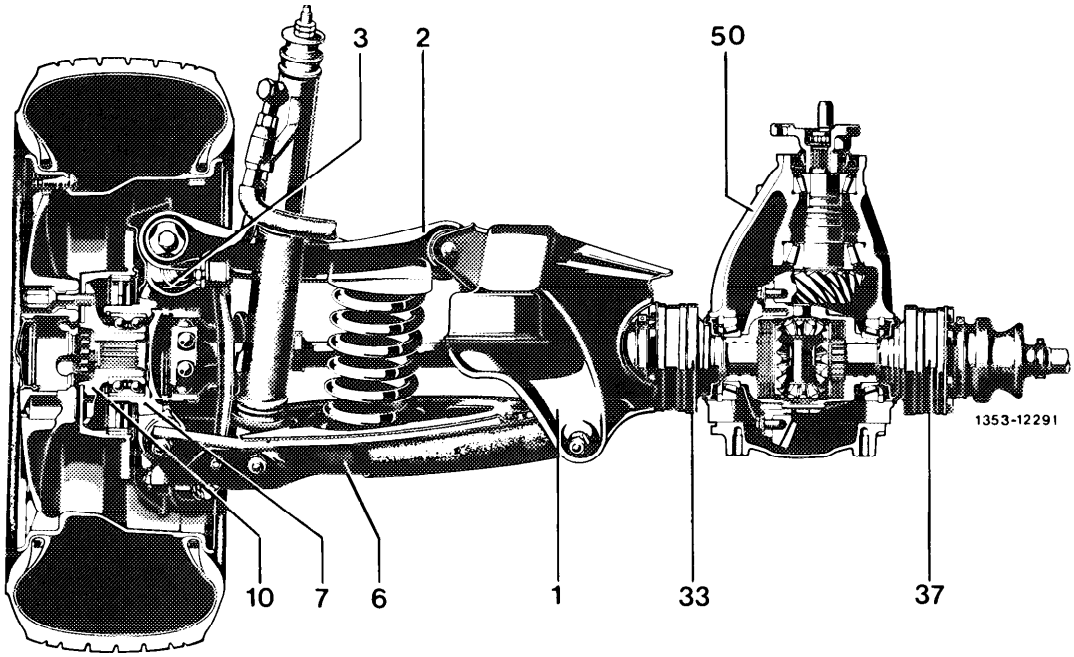


Fig. 35/1

1 Rear axle carrier
2 Camber strut
3 Pulling strut
6 Spring link
7 Wheel carrier
10 Axle shaft flange
33 Connecting flange
37 Axle shaft
50 Center piece

Rear axle center piece

The rear axle center piece is larger, has a gear set with a ring gear dia. of 185 mm, and a ratio of 3.27.

The rear axle has limited slip differential. Use MB limited slip differential oil, part no. 000 583 09 04.

For a functional description refer to the section models 107, 126, 201.

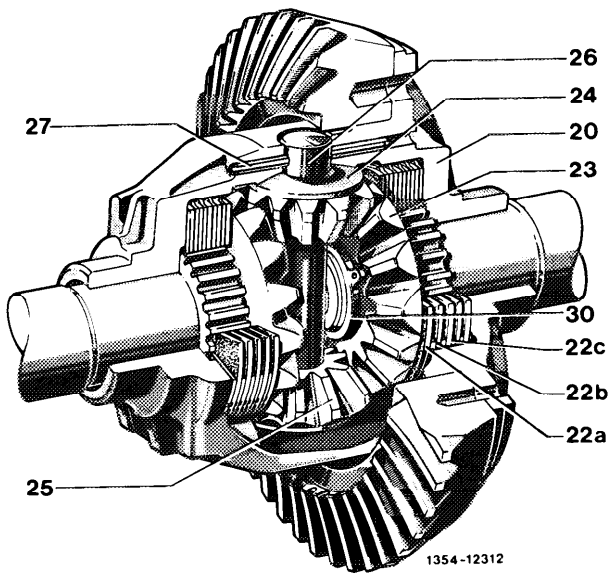


Fig. 35/2 Differential

20 Differential case
22 a Friction disk with lining on one side
22 b Friction disk without lining
22 c Friction disk with lining on both sides
23 Side gear
24 Spherical washer
25 Differential pinion
26 Drfferential pinion shaft
27 Roll pm
30 Retaining ring

The bolt circle on the drive pinion flange is 90 mm.

Due to the larger constant velocity joints, the connecting flanges for the rear axle shafts have a bolt circle dia. of 94 mm each.

Rear axle shafts

The large constant velocity joints (ball dia. of 22 mm) are similar to those of model 201.024 (ball dia. of 19 mm).

The grease capacity is 120 g of longterm grease (120 g tube, part no. 001 989 03 51/11).

Wheel guidance

The following parts differ from the wheel guidance parts of model 201. 024.

a) The rear axle shaft flange dia. is 153 mm

b) The camber link has a modified profile to increase rigidity.

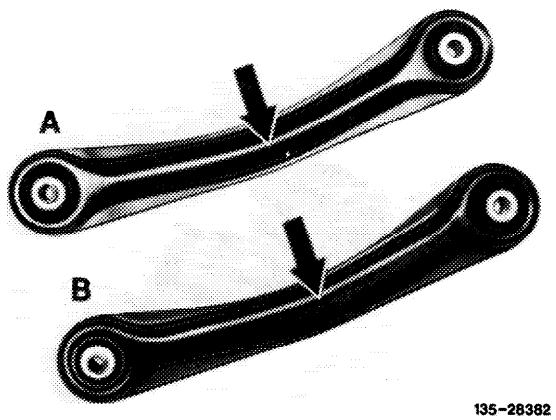


Fig. 35/3

A Camber strut model 201.024
B Camber strut model 201.034

c) The pulling link has modified torsion rubber bushings at the inner and outer pivots, mounted on the wheel carrier side with an M 12 x 1.5 screw.

Assembly note

Install the pulling link so that the rubber bushing with the light-alloy inner bushing is on the rear axle carrier side; and the rubber bushing with the steel inner bushing is on the wheel carrier side.

Tightening torque for inner and outer mounting: 70 Nm.

d) Spring link with modified torsion rubber bushing (with steel outer bushing and a supporting disk on inner bushing). The spring link is different for lefthand and righthand side.

Assembly note

Mount spring link so that the supporting disc on the rubber bushing points forward (in driving direction).

Wheels

Cross-reference, wheels – tires – recommended tire brands

Rim Designation Part No.	Summer tires tubeless		Winter tires tubeless	
	Tire size	Tire brand	Tire size	Tire brand
7 J x 15 H 2 ET 44 Light alloy 201 400 13 02 or 201 400 10 02	205/55 VR 15	PIRELLI P6	205/55 R 15 87 T M + S	PIRELLI MS WINTER 190

Rims

Only forged light-alloy rims are available.

The rims have a wheel offset (distance ET from rim center to rim mounting surface) of 44 mm.

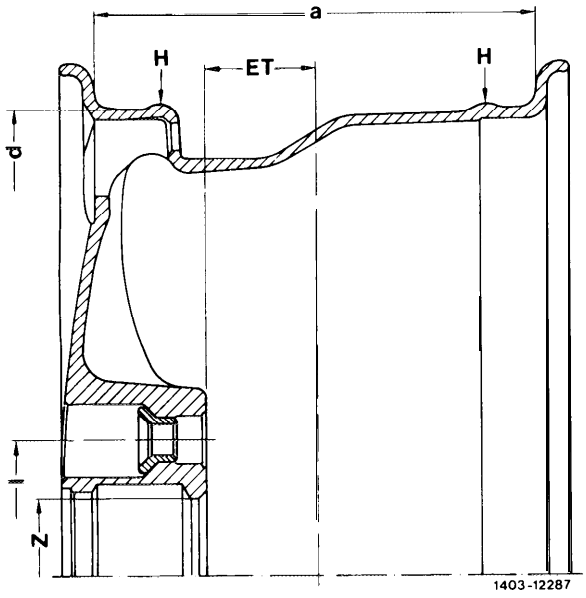


Fig. 40/1

ET Wheel offset = 44 mm
H Hump (rim with safety shoulder)
a Rim width in inches
d Rim dia. in inches (measuring point)
l Hole circle dia. = 112 mm
z Centering bore dia. = 66.5 ± 0.1 mm

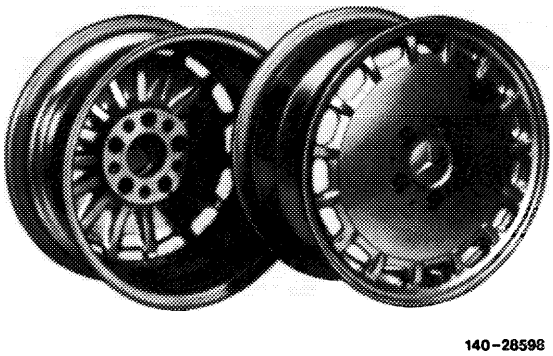


Fig. 40/2 Rim inner and outer side

Wheel attachment

The wheel bolts, part no. 201 400 00 70, have a shank length "L" of 40 mm. The hollow bolt head "K" is 22.5 mm high at the hex. head and is closed off with a light alloy cap.

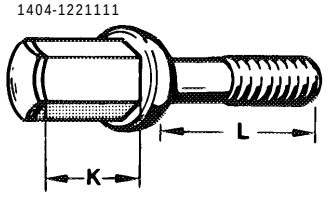


Fig. 40/3 Wheel bolt

Mounting of wheel to vehicle

Screw the “alignment stud”, which comes with the spare tire, into the upper threaded hole of the hub prior to installing the wheel.

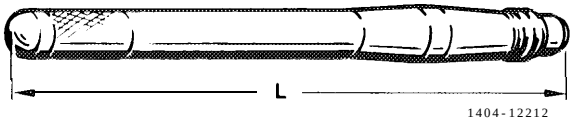


Fig. 40/4 Alignment stud length “L” 122 mm

Mounting tires

Use rubber valve, part no. 000 400 03 13 (length from seat to end of thread is 41 mm).

Balancing of wheels

When balancing wheels, use the new balancing weights with separate spring retainer (2a) on the outside of the rim and adhesive balancing weights (2b) on the inside of the rim.

Caution!

Do not use the balancing weight with separate spring retainer or a hammered-on balancing weight on the inside of the wheel. Damage to the outer ball joint of the tie rod will result.

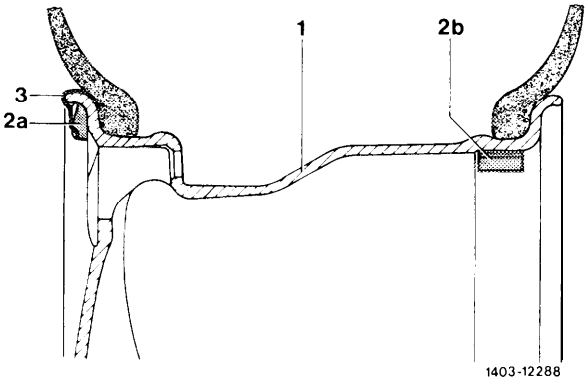


Fig. 40/5

1 Light-alloy wheel
2a Balancing weight with separate spring retainer (wheel outer side)
2b Adhesive balancing weight (wheel inner side)
3 Spring retainer

When attaching an adhesive balancing weight, make sure that the inside wheel surface is free of dirt and grease. Adhesive residue of old balancing weights should be removed with solvent.

Adhesive balancing weights

Weight	Part No.
10 g	201 401 09 94
20 g	201 401 02 94
30 g	201 401 03 94
40 g	201 401 04 94
50 g	201 401 05 94
60 g	201 401 06 94
70 g	201 401 07 94
80 g	201 401 08 94

fire inflation pressure

Tire pressure label:
Basic color: silver, lettering color: red

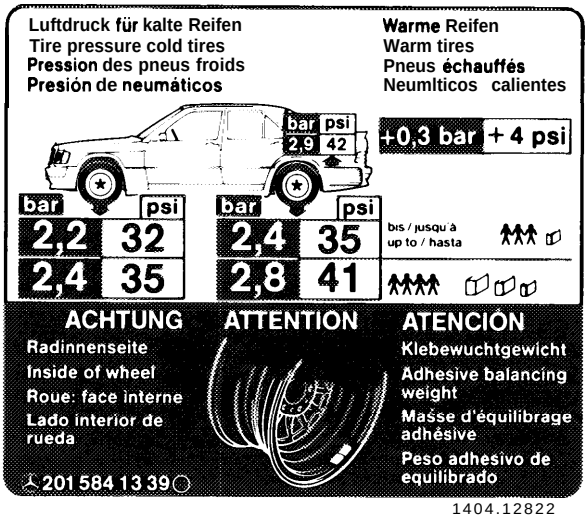


Fig. 40/6

Snow chains

Use MB snow chain with gripping studs RUD-matic system.

Part No.	201 583 02 16
Code No. [1])	46 380

[1]) The code number is stamped into the closing hook on the tensioning chain

Chassis measurement

The thicker wheel surface requires longer spacer pins for attaching the new quick-clamping fixture for the wheel alignment measuring components. The longer spacer pins and the new quick-clamping fixture are available under tool no. 124 589 01 31 00 and are applicable to all models.

The longer spacer pins are also available individually under tool no. 124 589 01 31 20.

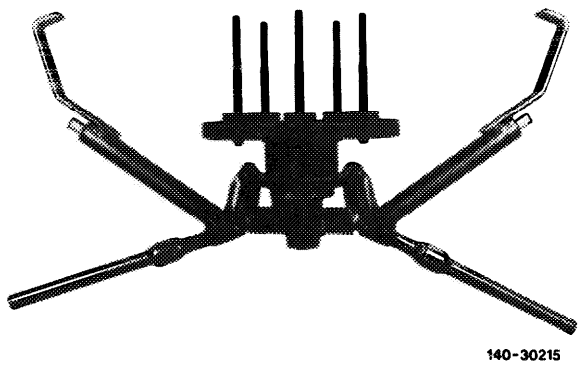


Fig. 40/7 Quick-clamping fixture

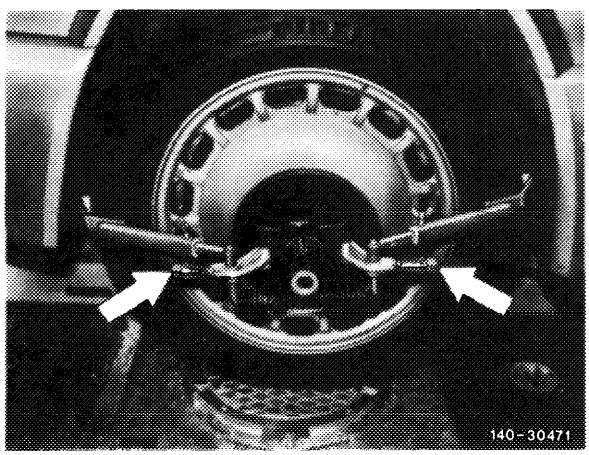


Fig. 40/8 Quick-clamping fixture attached to front wheel (the levers [arrows] are engaged)

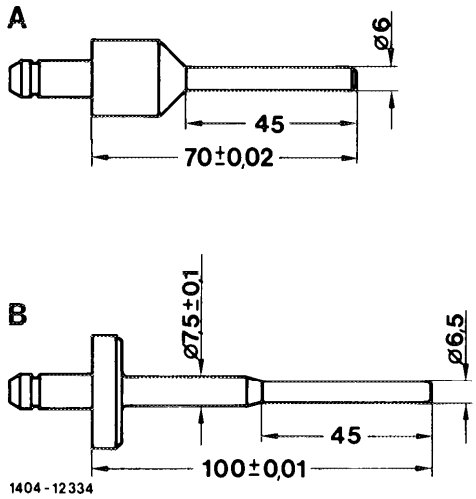


Fig. 40/9

A Spacer pin 1st version, tool no 901 589 01 27 00
B Spacer pin 2nd version, tool no 124 589 01 31 20

Measuring vehicle level and wheel alignment in curb-weight condition, as well as measuring and adjusting vehicle level on the rear axle under load are basically the same as for model 201 (For testing and adjusting values refer to page 222).

Pay attention to the following instructions:

1. Adjustment of vehicle level under load

When adjusting the vehicle level under load, always approach the control point from a lower vehicle level by pushing the lever on the levelling valve in the upward (filling) direction.

2. **Measuring toe angle on rear axle**

Measure toe angle change in the following cases only:

- In case of handling complaints, e.g. rear of vehicle moves sideways when driving over bumps.
- Extreme tire wear.
- After accident repairs requiring replacement of wheel guidance components.

Measuring

The toe angle change is now measured only by direct measurement, that is, by measuring the toe-in per wheel before and after a spring deflection of approx. 60 mm.

Indirect measurement using wheel carrier tilt as a reference, is no longer permitted.

Corrections

The toe angle change can be corrected by installing an eccentric rubber bushing on the tie link. The bore of the rubber bushing has a center offset of 1.45 mm. A correction of toe angle change by approx. 0° 08' is possible. An arrow for direction of installation is moulded into the rubber bushing.

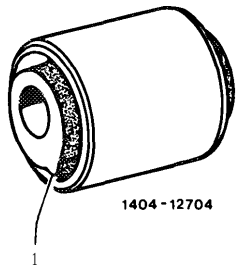


Fig. 40/10 Eccentric rubber bushing

Part no. 124 352 43 65
1 Arrow for direction of installation

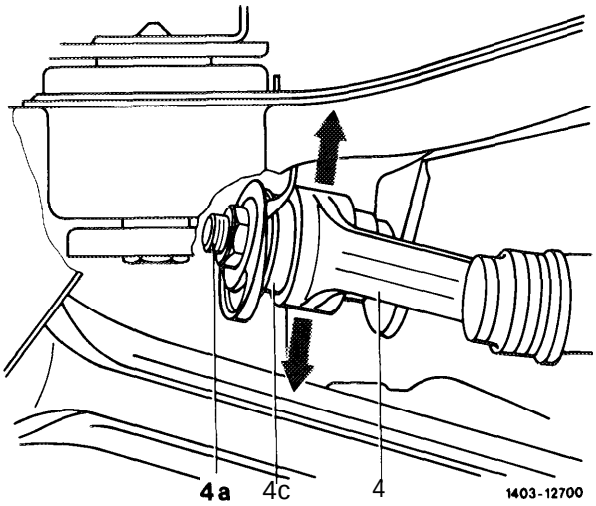


Fig. 40/11 Tie link pivot point on rear axle carrier

4 Tie link
4a Eccentric bolt with hex. nut
4c Rubber bushing

For removal and installation of the tie link rubber bushing on the vehicle, use special tool 124 589 02 43 00.

Note

- Prior to removing tie link, mark position of eccentric bolt in relation to rear axle carrier.
- Install eccentric rubber bushing, on tie link with arrow pointing down.

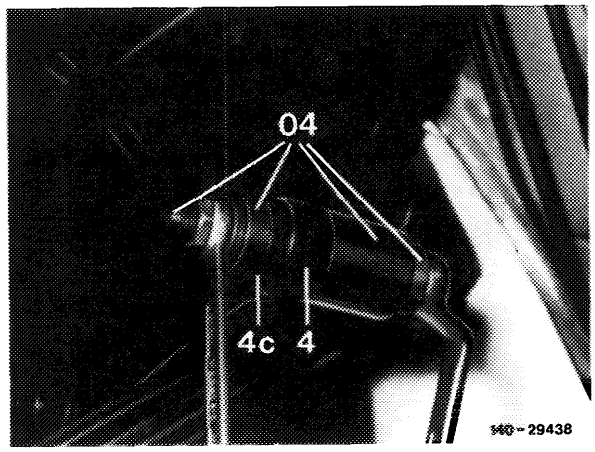


Fig. 40/12 Removal and installation of rubber bushing

4 Tie link
4c Rubber bushing
04 Removal/installation tool

Example for correcting toe angle change

Measured toe angle change via **60** mm deflection (from vehicle level +10 mm to -50 mm) on rear axle')	Required correction	
	Change of tie link inclination using eccentric rubber bushing	corresponding toe angle change

Example (Fig. 40/13)

0° 12' in (-) direction (from +0° 10' to −0° 02')	Direction of installation: Arrow pointing downwards	by approx. 0° 08' in (+) direction (from +0° 10' to +0° 06')

[1]) Produce this deflection by loading trunk with approx 200 kg or by using pull fixture 201 589 11 31 00 (refer to Introduction Manual, Model Year 1986. Model 126 rear axle, vehicle level)

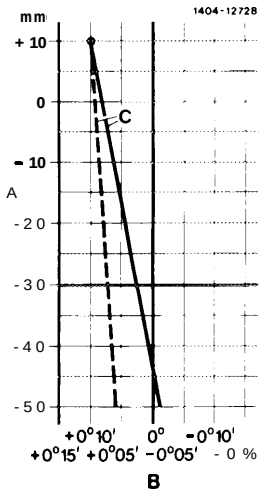


Fig. 40/13

A Vehicle level
B Toe-m
C Toe angle change per wheel (solid line prior to correction, dashed line following correction)

Test and adjustment values

Vehicle level

Front axle level curbweight condition mm	Rear axle level curbweight condition mm	loaded (control point)[1] mm
$+12\ ^{+10}_{-15}$	$+13\ ^{+10}_{-12}$	-12 ± 10[2]

[1]) Vehicle load approx 100 kg in trunk or by using pull fixture 201 589 1131 00 (refer to Introduction Manual, Model Year 1986, Model 126 rear axle, vehicle level)
[2]) Tolerances for vehicle level refer to test only Maintain nominal values during adjustment

Wheel adjustment on front axle, curbweight condition

Values for wheel adjustment

Front wheel camber	Wheels in straight-ahead position, toe 0°	$-00\ 20' \ ^{+10'}_{-20'}$ [1])
	Permissible difference between left and right side	0° 20'
	Wheels in straight-ahead position, toe 0° [2])	$10° 30' \pm 30'$ [1])
Caster	against wheel stop	$10° \pm 30'$ [1])
	Permissible difference between left and right side	0° 30'
Toe-in (front wheels pushed apart with 90 - 110 N)		0° 20' ± 10' or 2.5 ± 1 mm')
Toe difference angle (toe-out) at 20° turn of inner wheel		$-0° 40' \pm 30'$ [3])
Max. permissible steering wheel turn at inner wheel (steering knuckle stop pin touching stop bracket on wishbone)		43° [4])[5])
Ball joint reference location (measuring point) = distance "a" between wishbone bushing axis and inboard ball joint end of tie rod (pitman or idler arm in straight-ahead position)		30 ± 2 mm[6])
Permissible ball joint height difference between pitman and idler arms		3 mm

[1]) When making correcttons, adjust to nominal value
[2]) Measure with mechanical caster gauge 201 589 02 21 00.
[3]) Value specified without toe-in. It must be added when determming toe difference angle (without toe-m).
[4]) Measuring in special cases possible with turntables only.
[5]) The outer wheel turning angle will be 7° to 11 ° less than the inner, when inner wheel stop is against wishbone stop
[6]) Correction is made on idler arm in upward or downward direction by addition or removal of a washer

Front wheel camber adjustment
(the adjustment is made at the front wishbone bushing eccentric bolt)

Camber adjustment range (theoretical) at nominal caster value	from − 0° 30' to + 0° 20'

Front wheel caster adjustment
(the adjustment is made at the rear wishbone bushing eccentric bolt)

Caster adjustment range (theoretical) at nominal camber value	from + 9° 35' to + 11° 20'

Wheel adjustment on rear axle

Rear wheel camber

Vehicle level	corresponds to rear wheel camber
+ 20 mm	− 0° 55' ± 30'
+ 10 mm	− 1° 10' ± 30'
0 mm	− 1° 25' ± 30'
− 10 mm	− 1° 40' ± 30'
- 20 mm	− 1° 55' ± 30'

Rear wheel toe-in in curbweight condition

Total toe-in of rear wheels	$+0°\ 25' \begin{smallmatrix}+10'\\-05'\end{smallmatrix}$ or $3 \begin{smallmatrix}+1\\-0.5\end{smallmatrix}$ mm[1])
Permissible toe-in per wheel (use values for checking only)	between + 0° 30' and − 0° 05' or + 3.5 mm and − 0.5 mm[2])

[1]) When making corrections, adjust to nominal value while equally dividing value between both wheels.
[2]) During factory assembly of the rear axle, the rear wheels are adjusted equally However, with the rear axle installed, the actual values may fall anywhere within the tolerance after allowing for tolerances on the frame floor to which the rear axle carrier is bolted Therefore correction is not required

Additional mechanical chassis measurement

Chassis measurements (beam compass) and checking wishbone bearing inclination on accident vehicles or vehicles suspected of accident damage, is the same as other 201 models.

The following additional information should be noted.

- Prior to performing chassis measurements, the vehicle must be levelled by appropriate loading to ensure that it is not tilted forward or rearward. If the vehicle is not levelled front to rear, measurements V4, H3 and H10 will be incorrect when measured directly.

Measurement	Permissible difference between left and right side or tolerance on distance
H3	$1532\ ^{+2}_{-3}$
H8	480 ± 2.5

- Measurement H 10 is only required during body repairs on accident vehicles.
  The measuring point is accessible only after removing the exhaust system rearward of the flange connection.

Propeller shaft

The front and the rear propeller shaft have a tube dia. of 60 mm and a coupling flange bolt circle dia. of 90 mm. Both front and rear shafts use a standard flexible coupling similar to the one on the rear shaft of models 201.024/122.

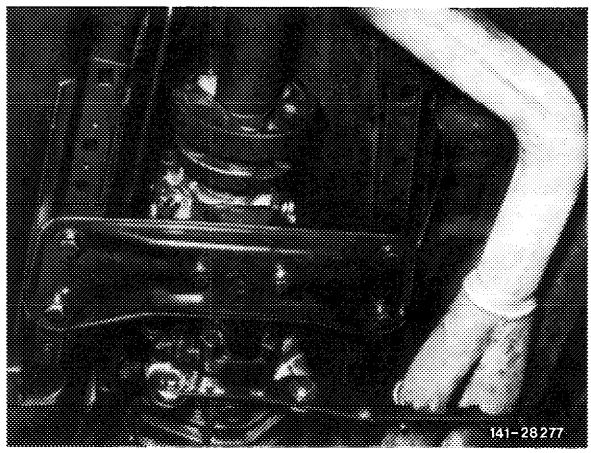


Fig. 41/1

Brakes

Front wheel brake

The front wheel brake has vented brake discs 22 mm thick with a diameter of 284 mm.

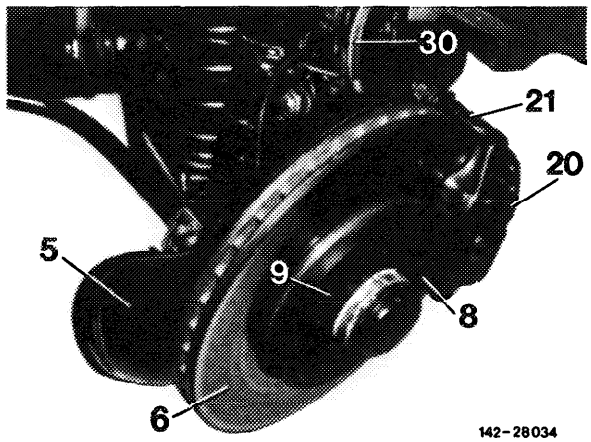


Fig. 42/1

Due to the modified brake disc the floating calipers are wider. The piston dia. is 54 mm. The brake pads are 19.3 mm thick and 110 mm wide.

Rear wheel brake

The brake pads are 15.5 mm thick, therefore, the brake calipers are wider than on the other 201 models and identified by a stamped-in 11 (arrow).

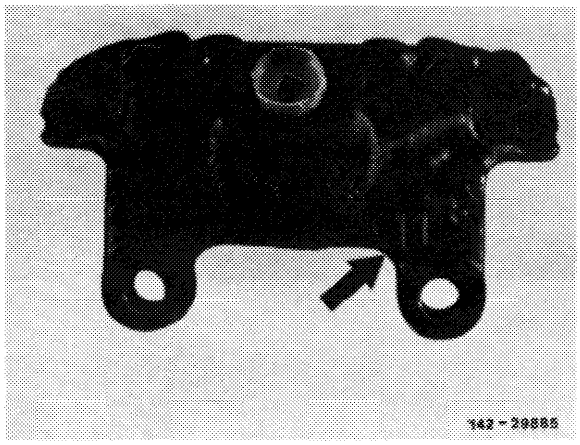


Fig. 42/2

Brake discs

The brake discs on the front and rear axle are additionally fastened with a hex socket button head cap screw at the front wheel hub and the rear axle shaft flange.

Parking brake

The adjusting wheel has 15 teeth.
Adjust: Turn adjusting wheel until the vehicle wheel can no longer be rotated, then turn back adjusting wheel by approx. 5 – 6 teeth until the vehicle wheel turns freely.

Brake booster

The double diaphragm brake booster has a diameter of 8/9".

Anti-lock brake system (ABS)

The anti-lock brake system is standard equipment.

Tandem master cylinder

The tandem master cylinder with central check valve is made of light alloy. The bore diameter for the primary circuit is 15/16" and for the secondary circuit is 3/4".

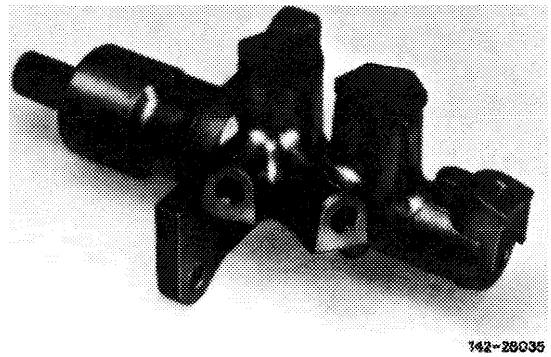


Fig. 42/3

Steering

Steering gear

Power steering 765.902 (LSA 068) is standard equipment. The housing is made of light alloy. The ratio in the center position is 13.28 and the total ratio is 15.14.

Power steering pump

The pressure relief valve of the power steering pump opens at 85 -90 bar. The part no. of the power steering pump is 201 460 16 80.

Idler arm and steering linkage

The idler arm, part no. 201 463 17 10 is reinforced. The part no. of the drag link (with increased swivel angle of ball joints) is 201 460 15 05.

Fuel system

The fuel tank has a capacity of 70 liters, of which approx. 8.5 liters are reserve.

The fuel tank partition is one piece

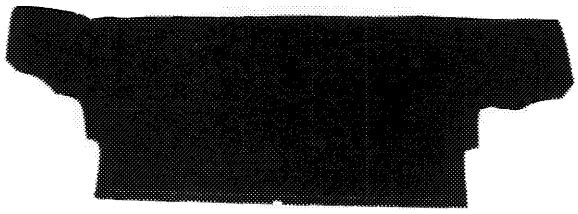
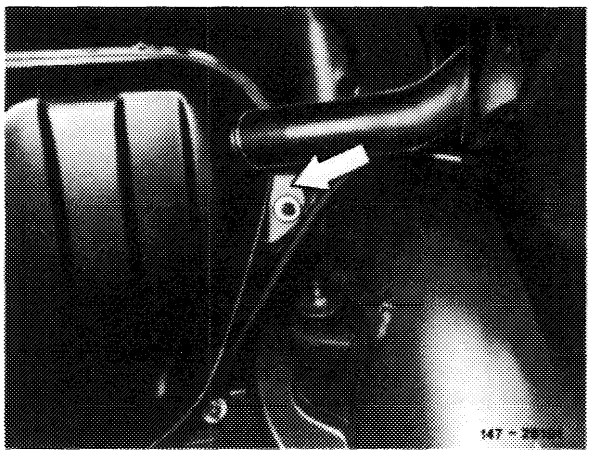


Fig. 47/1

Reinforcing plates (arrow) are used at the upper mounting points of the fuel tank to provide reliable attachment. They must be re-installed after performing repair work.



Pig. 47/2

Exhaust system

Compared with model 201.024, the exhaust system has larger mufflers and larger pipe cross sections.

The flange connections to the exhaust manifold are flared on the dual front exhaust pipes.

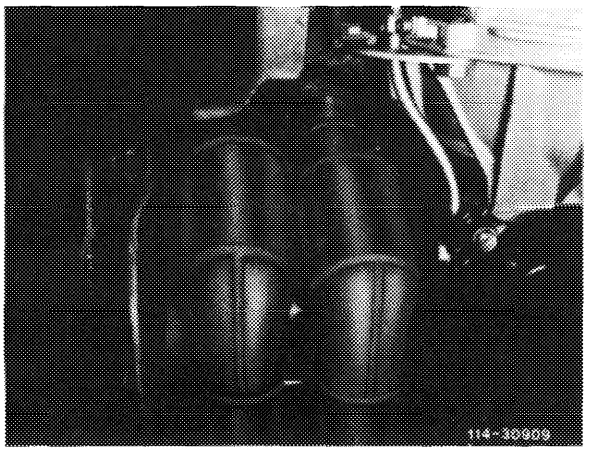


Fig. 49/1

The location of the flange connection between the front and the rear exhaust pipes and the center muffler is the same as model 201.024.

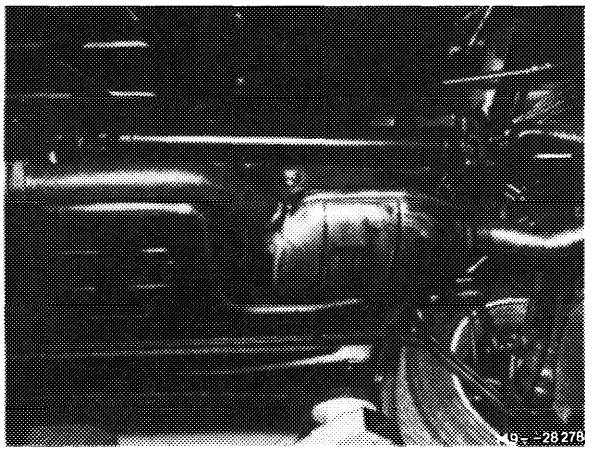


Fig. 49/2

The rear muffler has dual tailpipes that are curved downward. Attachment with rubber hangers as on model 201.024.

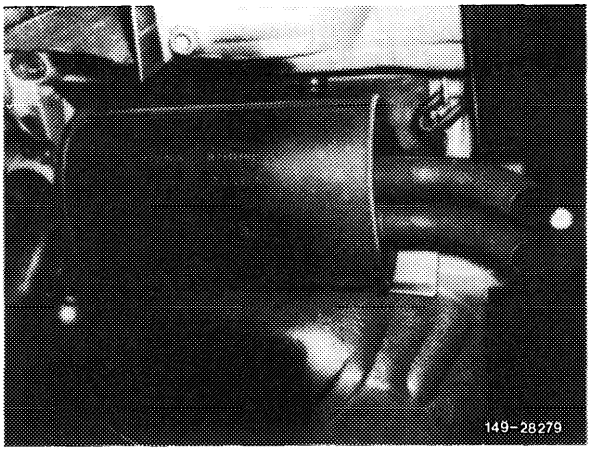


Fig. 49/3

Primary (front) catalysts and underfloor catalysts are the same as on model 201.024.

Electrical system

Instrument cluster

The O_2-sensor replacement indicator lamp has been replaced by an O_2-sensor malfunction indicator lamp. If the indicator lamp (13) comes on it indicates a malfunction in the O_2-sensor circuit.

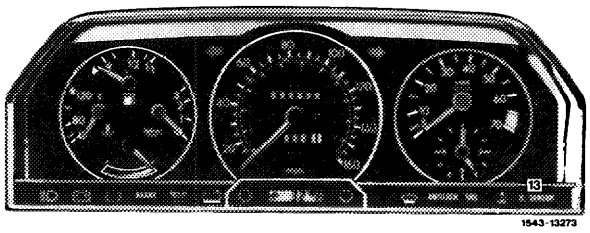


Fig. 54/1

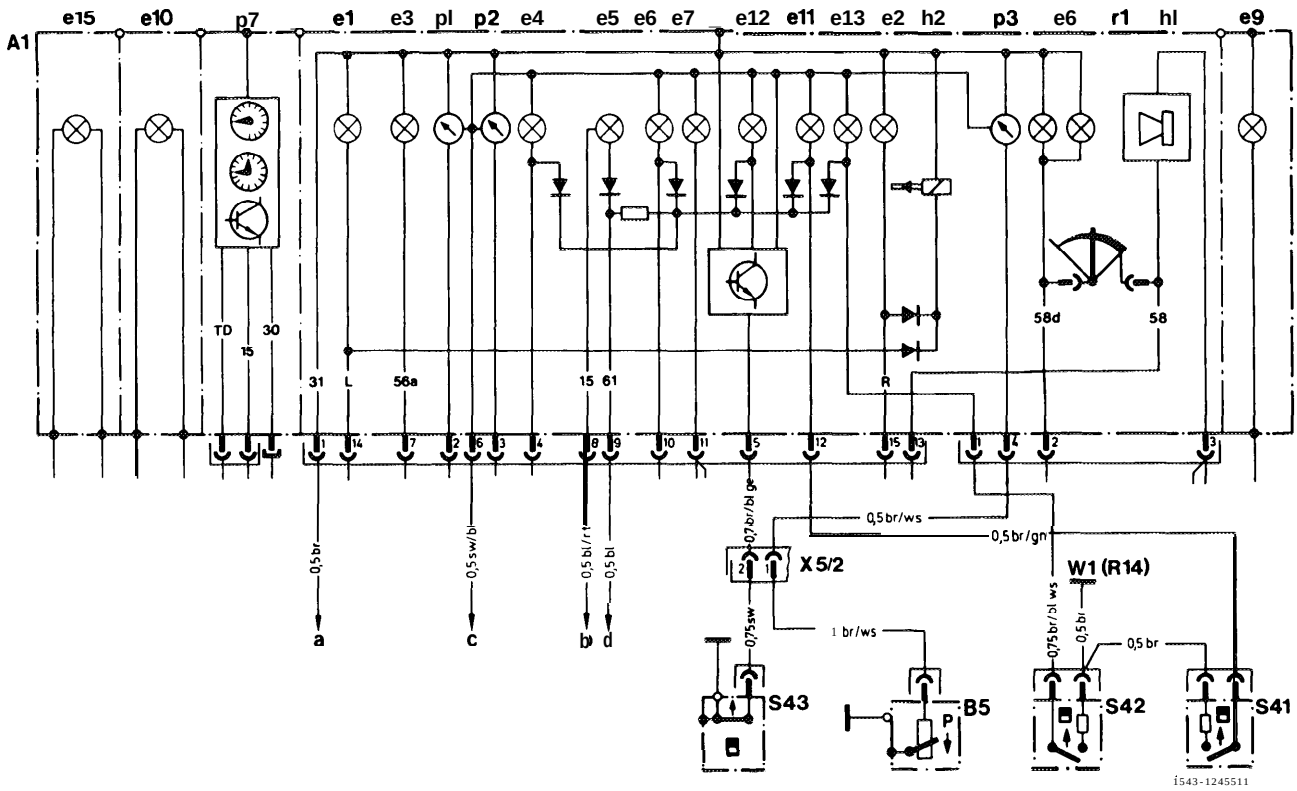


Fig. 54/2 Wiring diagram

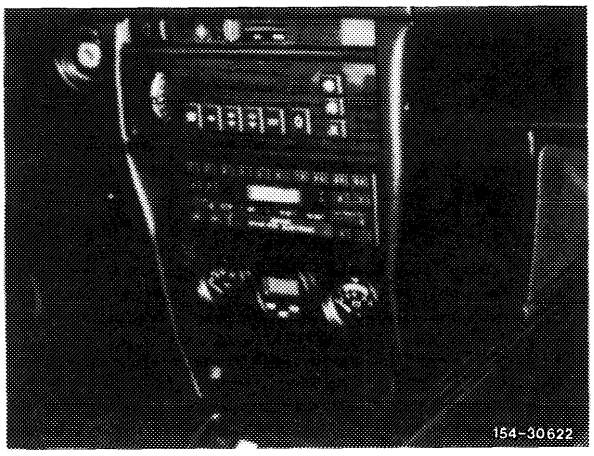
A	1	Instrument cluster
A	le1	Turn signal indicator, left
A	le2	Turn signal indicator, right
A	le3	High beam indicator
A	le4	Fuel reserve indicator
A	le5	Charge indicator
A	le6	Brake pad wear indicator
A	le7	Low brake fluid level/parking brake indicator
A	1e8	Instrument illumination
A	1e9	Fasten seat belt indicator
A	1e10	O_2-sensor malfunction indicator
A	le11	Low coolant level indicator
A	le12	Low oil level indicator
A	le13	Low windshield washer fluid level indicator
A	le15	SRS malfunction indicator
A	lhl	Warning buzzer
A	lh2	Audible turn signal solenoid
A	lrl	instrument illumination dimmer
A	lpl	Coolant temperature gauge
A	1p2	Fuel level gauge
A	1p3	Oil pressure gauge
A	1p7	Clock/Tachometer

S	41	Low coolant level switch
S	42	Low windshield washer fluid level switch
s	43	Low oil level switch
B	5	Oil pressure sending unit
x	5/2	Harness connector, interior/starter, 4 pole
	a	Electrical center connector D, socket 11, to main ground W1
	b	Electrical center connector D, socket 15, circuit 15 (unfused)
	c	Electrical center connector D. socket 2, circuit 15, fuse no. 9
	d	Electrical center connector D, socket 8, alternator circuit 61
W1	(R14)	Main ground behind instrument cluster via blower motor resistance group

bl = blue
br = brown
ge = yellow
gn = green
rt = red
sw = black
ws = white

Additional Instrumentation

The vehicle has a voltmeter, an oil temperature gauge, and a digital stop watch as standard equipment.



ng. 54/3

Voltmeter

The voltmeter is connected to circuit 15 of the 15-pole connector of the instrument cluster (pin socket 6). When the key is in steering lock position "2", the voltmeter indicates the respective voltage.

Oil temperature gauge

The oil temperature is sensed by a temperature sensor in the oil filter housing and indicated on the gauge.

Stop watch

With the key in steering lock position "2" the following functions can be activated using the 3 buttons.

1 Button for measuring elapsed time

2 Button for measuring average speed for 1 mile driving distance

3 Button for resetting elapsed time

1. Measuring elapsed time

Press button 1 to start. The colon in the display flashes.

Press button 1 again to stop. The display shows the elapsed time.

Press button 3 to reset the display to zero, (or when not moving turn key to steering lock position "1" or "0").

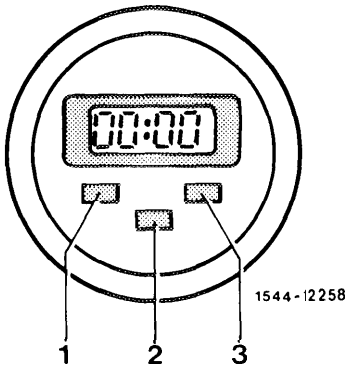


Fig. 54/4

Time display:

From 00:00 to 59:99 – in seconds and 1/100 seconds.

After 1 minute from 01:00 to 59:59 – in minutes and seconds.

After 1 hour from 01:00 to 09:59 – in hours and minutes.

After 10 hours the time will again be measured in seconds and 1 /100 seconds.

2. Measuring average speed for 1 mile driving distance

Press button 2 to start. The colon in the display flashes.

Press button 2 again after driving 1 mile. The display now shows the average speed during that mile.

Press button 2 (or turn key to steering lock position "1" or "0" when not moving) to reset the display.

3. **Measuring average speed for 1 mile driving distance while measuring elapsed time**

The average speed can also be measured while measuring elapsed time. Measuring of elapsed time will not be interrupted.

Press button 2 while measuring elapsed time to start. Colon in display flashes.

Press button 2 again after driving 1 mile. The display now shows the average speed during that mile. Press button 2 again to display the elapsed time.

Press button 2 (or when not moving turn key to steering lock position "1" or "0") to reset the display.

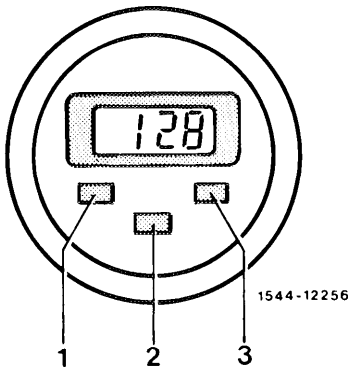


Fig. 54/5

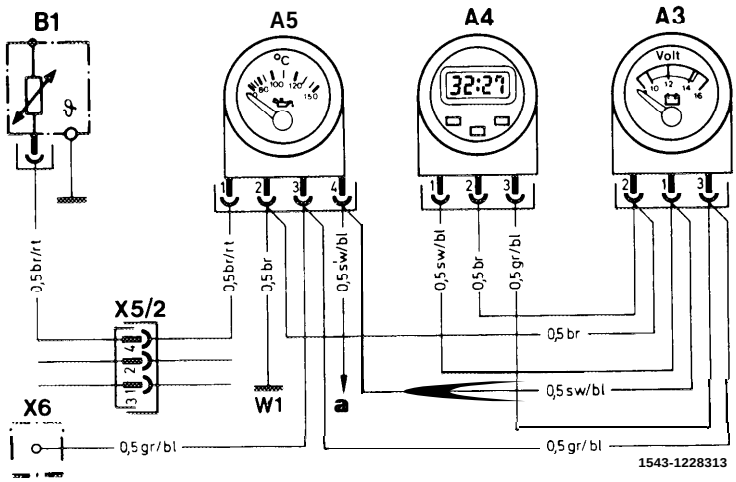


Fig. 54/6 Wiring diagram, additional instrumentation

A3	Voltmeter
A4	Digital stop watch
A5	011 temperature gauge
B1	Temperature sensor, engine oil
W1	Main ground behind instrument cluster
X5/2	4-Pole plug connection, starter harness (near battery)
X6	Terminal block, circuit 58 d
a	To 15-pole instrument cluster connector Pm socket 6, circuit 15

Removal and installation of console with additional instrumentation

Remove ashtray with holder. Unscrew both fastening screws (1) and pull out panel in downward direction so that the two locks (arrows) of the center console are cleared. Pull the 3 connectors from the individual instruments.

During installation, make sure that the longer electrical harness with the 3-pole connector is plugged on the voltmeter.

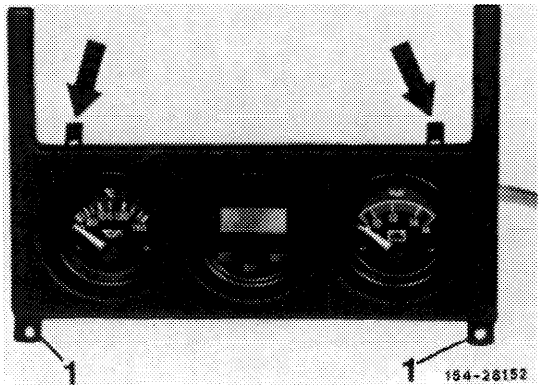


Fig. 54/7

Illumination of switch and control elements

The illumination rheostat in the instrument cluster (terminal 58d) used up to now has been supplemented by an electronic illumination control unit (terminal 58D), phased-into production therefore not available on early model year 1986 vehicles. The electronic illumination control unit is located on the cross-member behind the instrument cluster.

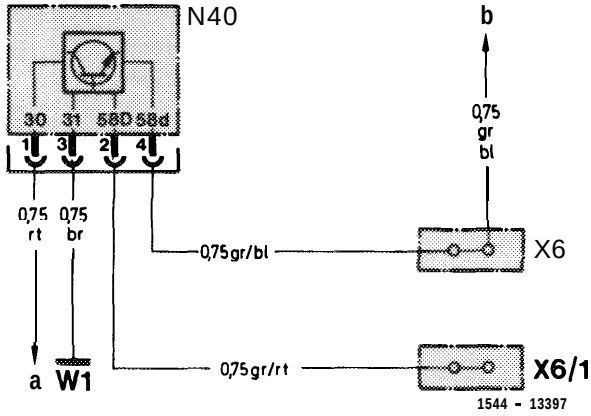


Fig. 54/8 Wiring diagram, electronic illumination control unit

N40	Illumination control unit
W1	Main ground (behind instrument cluster)
X6	Plug connection, terminal 58d
X6/1	Plug connection, terminal 58D
a	to plug connection X5/1 (circuit 30)
b	to 4-pin connector, terminal 2, instrument cluster (circuit 58d)

Interior

The leather interior upholstery is only available in black.

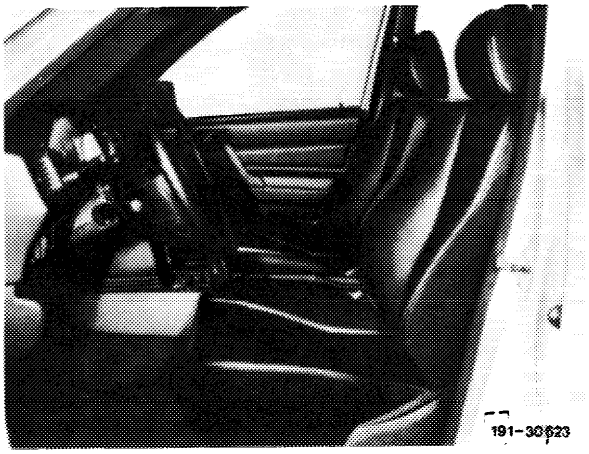


Fig. 68/1

The center console has been modified for mounting additional instruments in the area of the ashtray.

Instrument panel trim, door linings, headlining etc. are similar to other 201 models.

Spare wheel cover

The spare wheel cover has been modified to accommodate the wider tires.

Electrical system, radio, dome lamp

Radio

A new Grand Prix radio is installed. Refer to model 126 section for a complete description.

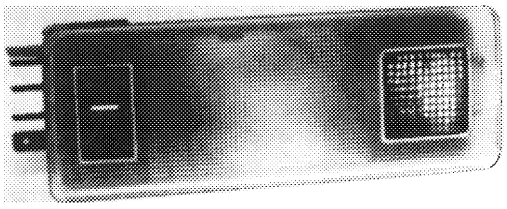
To remove the radio, remove panel with voltmeter, engine oil temperature gauge and digital stop watch (refer to Group 54).

Radio anti-theft protection

Refer to model 126 section.

Front interior/reading lamp

This lamp assembly has an electronic shutoff delay and a passenger-side reading lamp.



182-28365

Fig. 82/1

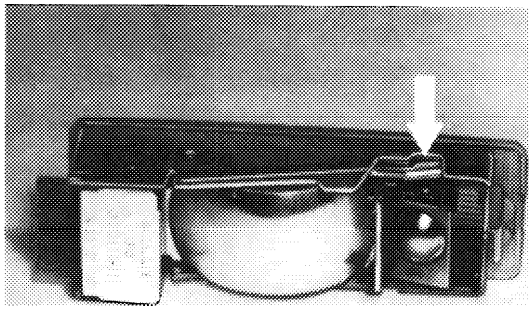
Repair note for replacing bulbs

Reading lamp:

Push contact bar in direction of arrow, so that bulb can drop out.

Dome lamp:

Tilt out reflector and remove bulb.



182-28366

Fig. 82/2

High mounted stop lamp

A third, high mounted, stop lamp is located on the trunk lid integrated into the rear spoiler. It operates parallel to the other stop lamps.

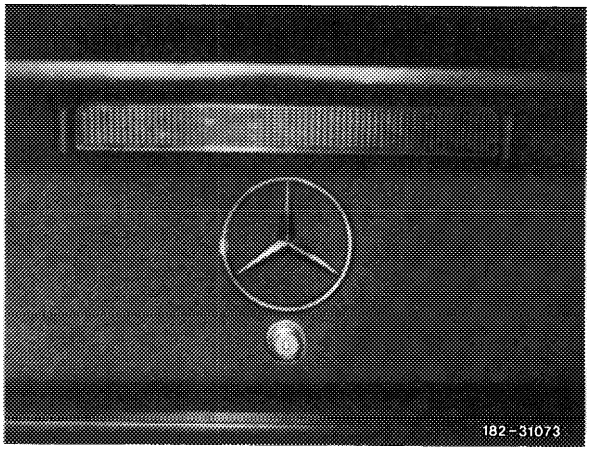


Fig. 82/3

Tempmatic climate control

With the exception of the filling capacities and the engine fan actuation, the construction and function of the Tempmatic climate control is the same as on the 1985 model 201.024.

Filling capacities

Refrigerant oil in compressor: 150 cm^3
R 12 refrigerant: 0.95 kg

Actuation of the engine fan clutch

At a refrigerant pressure of 20 bar the high pressure switch (S32) provides the input signal to the double contact relay (K8) which actuates the engine fan clutch and auxiliary fan low speed simultaneously.

Previously the high pressure switch (S32) only actuated the auxiliary fan low speed.

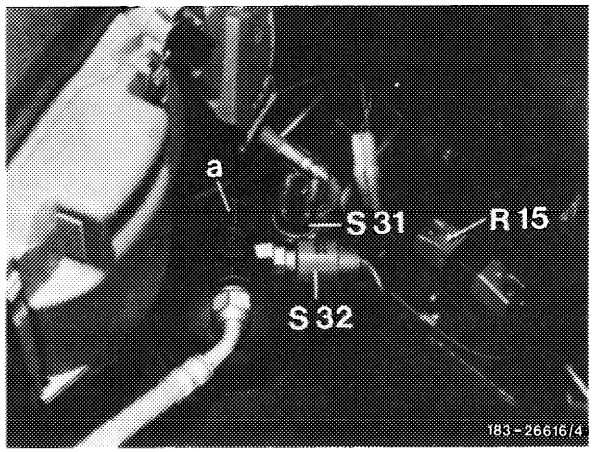


Fig. 83/1
S32 Refrigerant high pressure switch

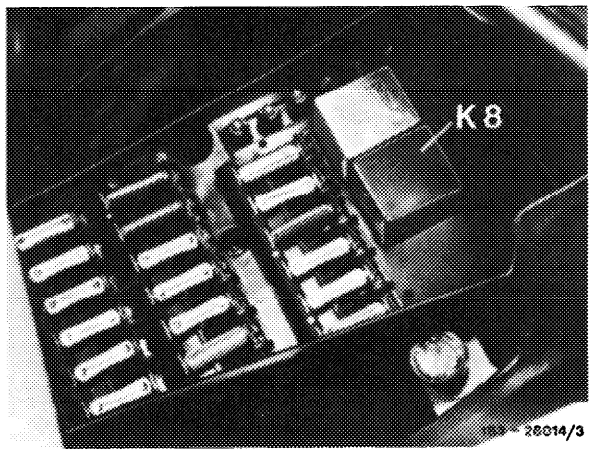
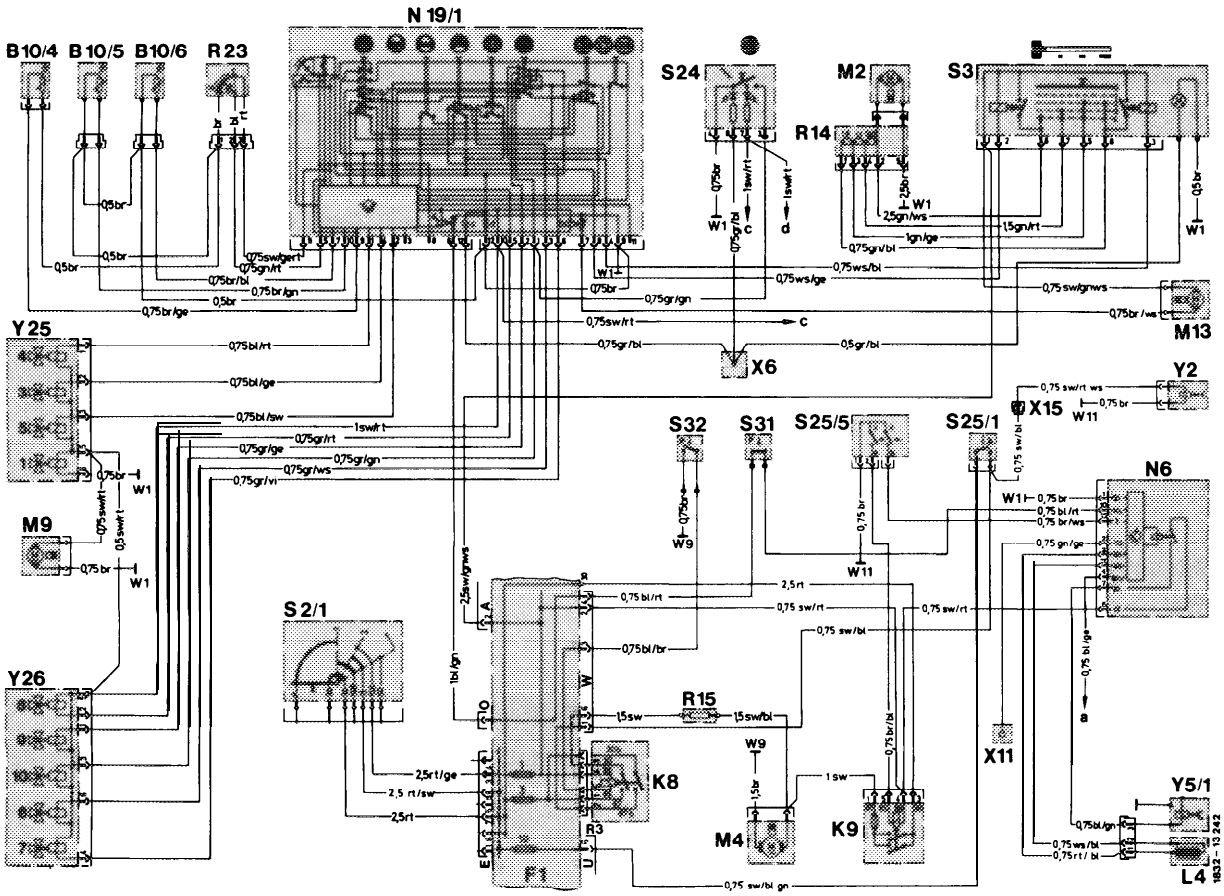


Fig. 83/2
K8 Double contact relay

Wiring diagram



Rg. 83/3 Wiring diagram, Tempmatic climate control

B	10/4	in-car temperature sensor
B	10/5	Outside air temperature sensor
B	10/6	Evaporator temperature sensor
F	1	Central electric, fuse 1 : 16 A
		fuse 3 : 16 A
		fuse 10 : 8 A
K	8	Double contact relay for auxiliary fan and engine fan clutch
K	9	Auxiliary fan relay
L	4	A/C compressor rpm sensor
M	2	Blower motor
M	4	Auxiliary fan
M	9	In-car sensor aspirator blower
M	13	Auxiliary coolant pump
N	6	A/C compressor protective cutout
N	19/1	Pushbutton switch unit
		a Compressor relay
		b Auxiliary coolant pump relay
		c Illumination
		d Fuse, 2 A
R	14	Blower resister group
R	15	Auxiliary fan resister
R	23	Feedback potentiometer
s	2/1	Ignition switch
s	3	Blower switch
S	24	Fresh/recirculation air switch
S	25/1	Coolant temperature switch (100°C) engine fan clutch
S	25/5	Coolant temperature switch (105/115°C)
		a 105°C, auxiliary fan
		b 115°C, compressor protective cutout
s	31	Refrigerant low pressure switch
		open: 2 bar/closed: 2.6 bar
S	32	Refrigerant high pressure switch for engine and auxiliary fans
		closed: 20 bar/open: 15 bar
w	1	Main ground /behind instrument cluster)
w	9	Ground, front (at head lamp assembly)
w	11	Ground, engine
X	6	Terminal block, circuit 58d
x	11	Diagnostic socket
x	15	Connector Plug, engine fan to coolant temperature switch
Y	2	Engine fan clutch
Y	5/1	A/C compressor clutch
Y	25	Switchover valve unit (4 connections)
		4 Switchover valve for blend air flaps (cold)
		3 Switchover valve for heater valve (warm)
		5 Switchover valve for heater valve (closed)
		1 Switchover valve for heater valve (open)
Y	26	Switchover valve unit (5 connections)
		8 Switchover valve for legroom flaps
		9 Switchover valve for fresh/recirculating air flap (short stroke)
		10 Switchover valve for fresh/recirculating air flap (long stroke)
		6 Switchover valve for defroster flaps (short stroke)
		7 Switchover valve for defroster flaps (long stroke)
a		to electronic control unit CIS-E, Terminal 19
c		to hazard warning switch, Terminal 15
d		to fasten seat belt control unit, Terminal 8 (terminal connection 15)

Detachable body components, external paneling

External paneling

Through the use of bolted-on polyurethane (PUR) trim, the front and rear fenders are wider at the wheel-housings.

The lower belt-line and rocker panels are covered with PUR panels up to bumper level.

All these PUR components are painted in vehicle color. In the rocker panel area they are painted with DB 7167 deep dark grey.

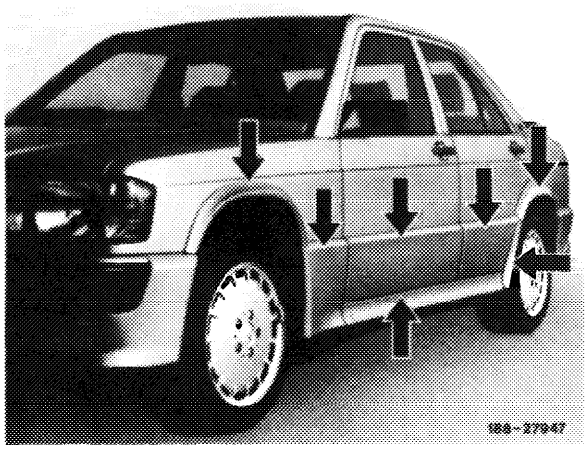


Fig. 88/1 Trim on fenders, side members and doors

Bumpers

The front bumper is designed as a spoiler for improved aerodynamics.

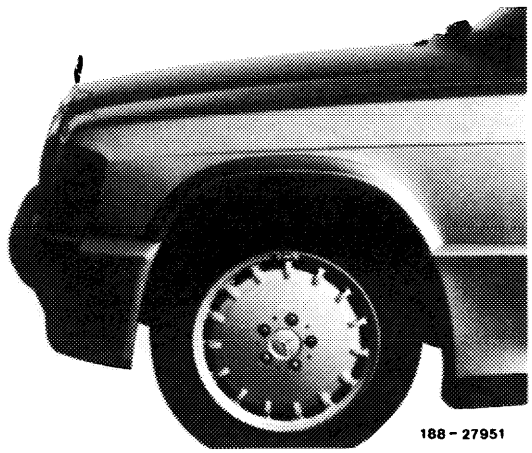
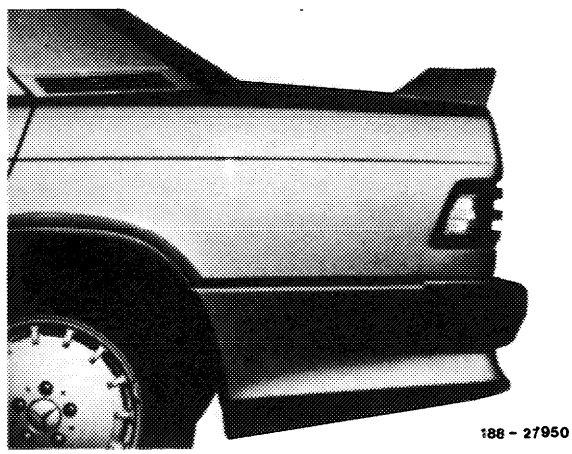


Fig. 88/2 Bumper, front

The rear bumper extends forward to the wheel housings.



Pig. 88/3 Bumper, rear

The bumper paneling is also painted in vehicle color. Only the lower edge and the protective strips are painted with deep dark grey (like the rocker panels).

Rear spoiler

The rear spoiler is bolted to the trunk lid and painted in vehicle color. The trunk lid springs are stronger due to the increased weight.

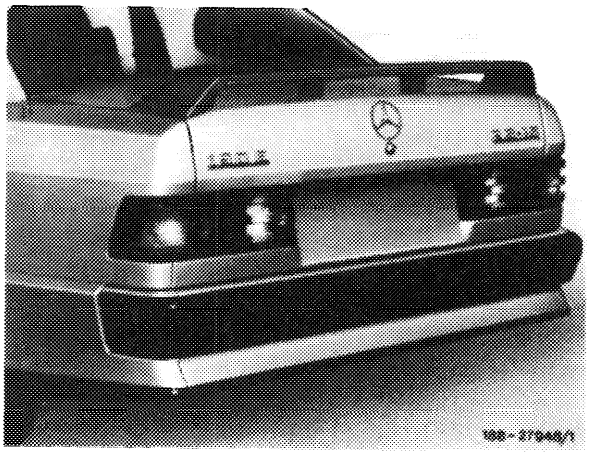


Fig. 88/4 Rear spoiler

Seats, restraint systems

Seats

The front seats have a distinctive shell-shaped design for good lateral support.

Both front seats are electrically adjustable. The driver's seat also has the two-position memory function.

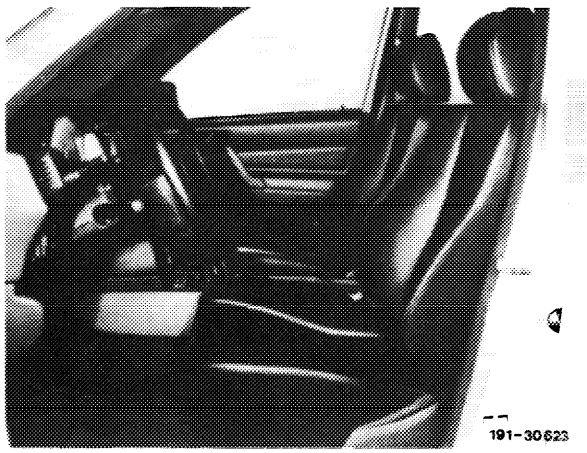


Fig. 91/1 Driver's seat

There are two seats in the rear, their shell-shaped design provides distinctive single seat comfort.

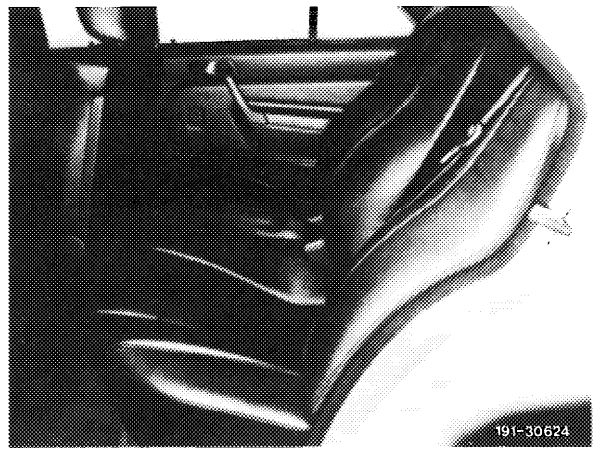


Fig. 91/2 Rear compartment

Head restraints

The head restraint shape is adapted to the new seat design. The switch for head restraint adjustment is located in the seat adjustment switch group. Rear seat head restraints are optionally available.

Supplemental Restraint System (SRS)

The driver airbag and emergency tensioning retractors on both front seat belts are standard equipment.

The rear seats have the standard three-point seat belts. The belt buckles are integrated with the rear seats.

Job No.

B 32 Suspension	. . . . .	B32/1
B 35 Rear axle	. . . . .	B35/1
B 54 Electrical system	. . . . .	B54/1
B 80 Central locking system	. . . . .	B80/1
B 83 Climate control system	. . . . .	B83/1
B 88 Detachable body components	. . . . .	B88/1

Suspension

Model 107

Springs

The springs on model 107 have a new spring rate tuned to the vehicle. In addition, the spring-rubber mount combination is determined according to a point system. Refer to tables for testing and adjusting values.

Shock absorbers – front axle

The shock absorbers, color code: one green stripe, are shorter and harder compared with the former version. An additional polyurethane (PU) bottoming spring, similar to that of model 126, has a length of 95 mm.

Do not install the previous shock absorbers (color code: four green stripes) on the new front axle.

Torsion stabilizer bar – front axle

The new torsion bar has a diameter of **26** mm (formerly **25** mm). Accordingly, the bore of the torsion bar mounts has been enlarged from 23.5 mm to 24.5 mm.

The frame floor mounting and the connection to lower control arm have not been changed.

Model 126

Cross references for springs-shock absorbers as well as spring-rubber mount combinations are shown in the table for testing and adjusting values.

Model 201.126

Torsion stabilizer bar

A new front torsion bar, repositioned with respect to the engine, has been installed. Due to its larger diameter of 24 mm (22 mm at each end), new rubber bushing mounts are required.

The holding clamps to the front end are the same as the model 124 except rotated 180°.

The new rear torsion bar includes an altered form with connecting links (identical to model 124) that now have torsional rubber mounts on both ends (Fig. 32/1).

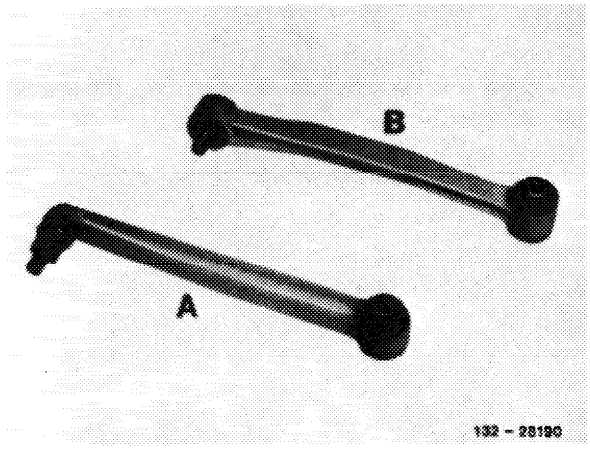


Fig. 32/1 Torsion bar links

A **Old** version
B New version

Data concerning springs, shock absorbers, and adjustments can be found in tables included in this section.

Models 126.039/045

Level control – rear axle

The following changes were made compared to the system known from the model 123.193.

Oil supply reservoir

The reservoir is located at the left side of the engine compartment.

Models 201.02/1

Rear axle center piece mounting

Since January 1985 production, a 13.5 mm long spacer sleeve (50b) is installed at the front mount.

The rear axle center piece has a cast-on rib (arrow) for identification.

Note:

On a rear axle center piece **without** a rib, the spacer sleeve must not be installed.

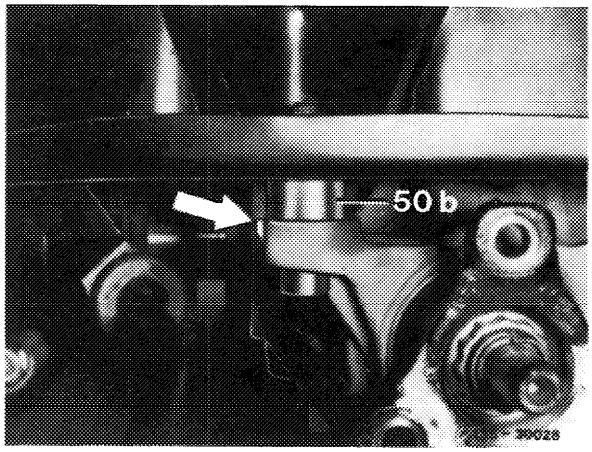


Fig. 35/7

Cruise control, models 201.024/034/126

The induction transmitter on the speedometer was replaced by a Hall-effect sensor.

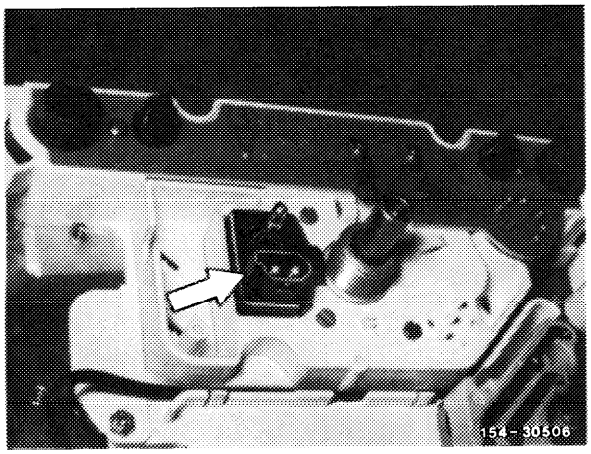


Fig. 54/25 Location of Hall-effect sensor

The mounting of the control unit was modified. It is now mounted on a plate in the right front footwell.

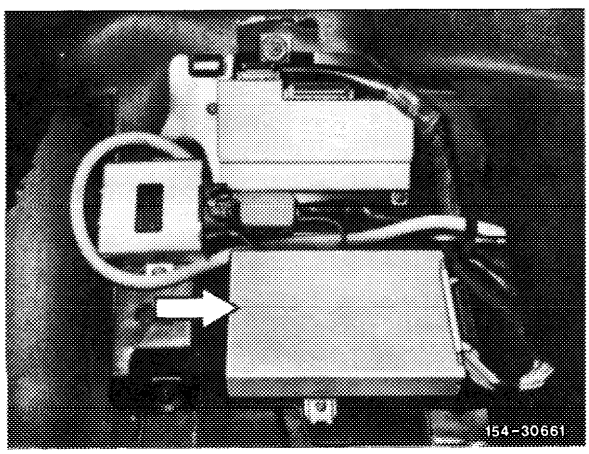


Fig. 54/26 Location of cruise control control unit

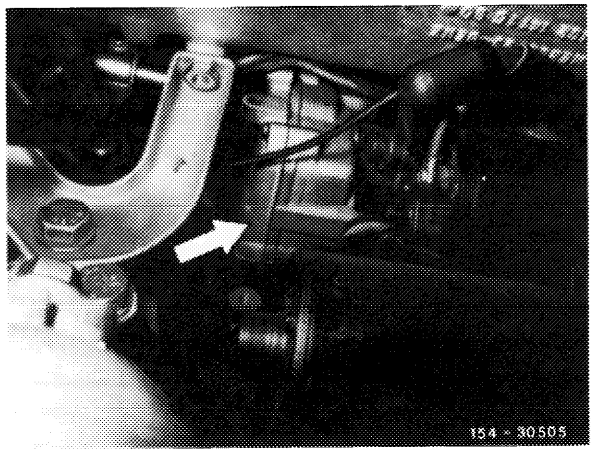


Fig. 54/27 Location of cruise control actuator, model 201.034

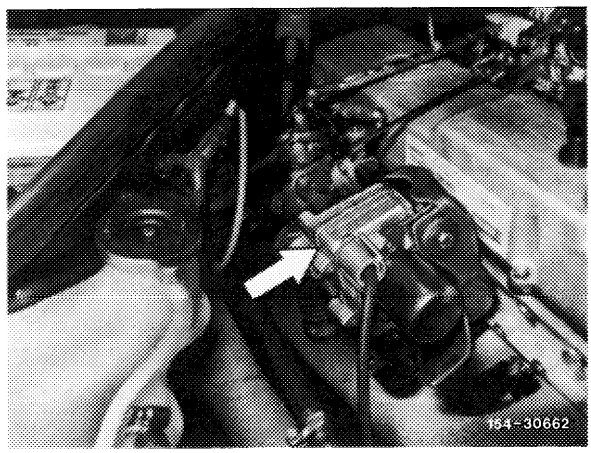


Fig. 54/28 Location of cruise control actuator, model 201 .126

Repair note:

The test procedure in the microfiche “Cruise control systems”, model 201, Group 54 can still be used.

When testing with adapter, the test step 6 must be performed as on vehicles with electronic speedometer. When the vehicle is stationary, the LED indicator may be on or off depending on the position of the 12 pole magnet in the speedometer. The Hall-effect sensor can therefore be tested only while driving; the LED indicator should flicker at low speeds.

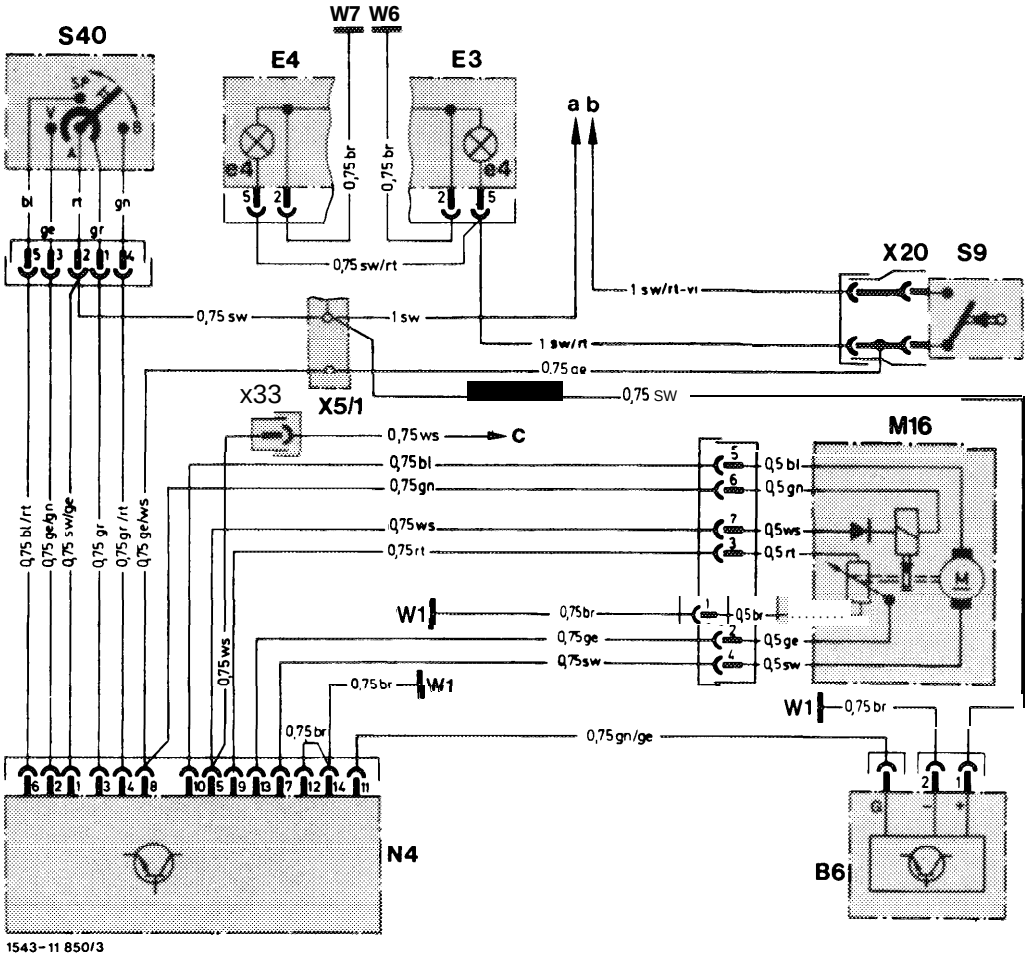


Fig. 54/29 Wiring diagram, cruise control (E-Tempomat) models 201.024/034 with automatic transmission

B	6	Hall-effect sensor
E	3	Tail lamp unit, left
e	4	Stop lamp
E	4	Tail lamp unit, right
e	4	Stop lamp
M	16	Cruise control actuator
N	4	Cruise control control unit
s	9	Stop lamp switch
S	40	Cruise control switch
		A = off
		B = Accel
		SP = Resume
		V = Decel
W	1	Main ground (behind instrument cluster)
W	6	Ground, trunk, left wheel-housing
w	7	Ground, trunk, right wheel-housing
X	5/1	Plug (5-pin), passenger compartment
X	20	Plug, brake light switch
X	33	Plug (1 -pin), CIS-E/cruise control
a		to electrical center, harness plug L, terminal 1
b		to electrical center, harness plug C, terminal 1
c		to CIS-E control unit, terminal 6

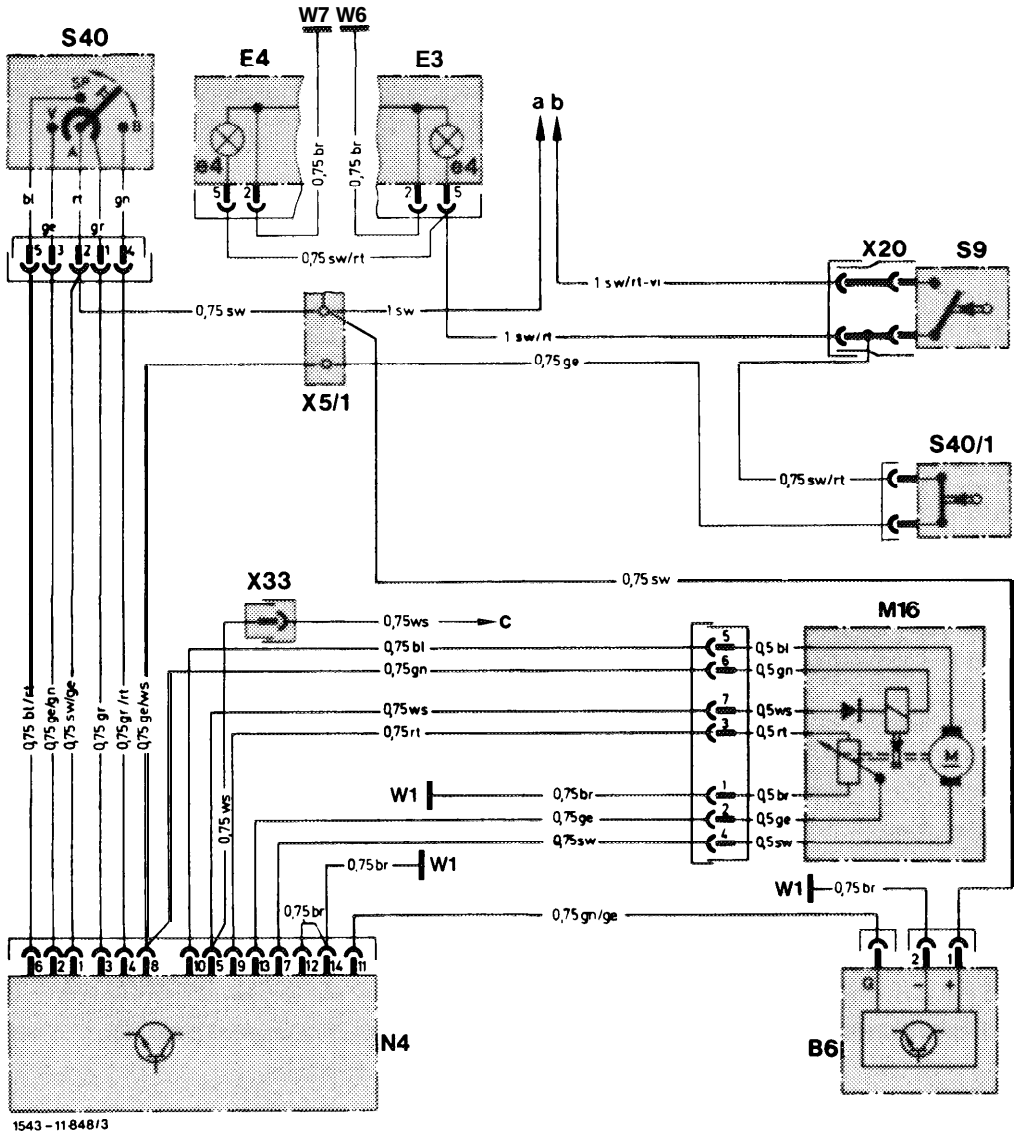


Fig. 54/30 Wiring diagram, cruise control (E-Tempomat) models 201.024/034 with manual transmission

B	6	Hall-effect sensor
E	3	Tail lamp unit, left
e	4	Stop lamp
E	4	Tail lamp unit, right
e	4	Stop lamp
M	16	Cruise control actuator
N	4	Cruise control control unit
S	9	Stop lamp switch
S	40	Cruise control switch
		A = oft
		B = Accel
		SP = Resume
		V = Decel
s	40/1	Clutch pedal switch
w	1	Main ground (behind instrument cluster)
W	6	Ground, trunk, left wheel-housing
w	7	Ground, trunk, right wheel-housing
X	5/1	Plug (5-pin), passenger compartment
X	20	Plug, brake light switch
X	33	Plug (1 -pin), CIS-E/cruise control
a		to electrical center, harness plug L, terminal 1
b		to electrical center, harness plug C. terminal 1
c		to CIS-E control unit, terminal 6

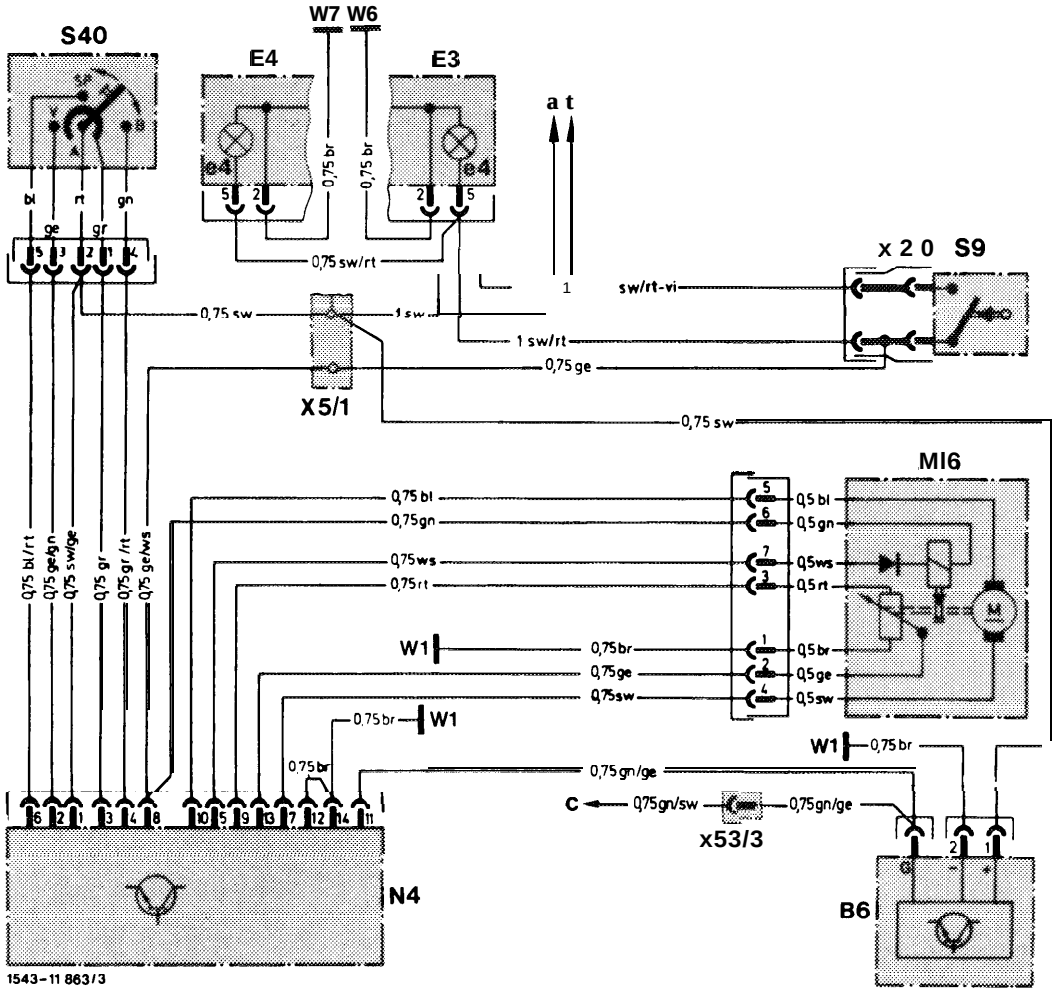


Fig. 54/31 Wiring diagram, cruise control (E-Tempomat) models 201.126 with automatic transmission

B	6	Hall-effect sensor
E	3	Tail lamp unit, left
e	4	Stop lamp
E	4	Tail lamp unit, right
e	4	Stop lamp
M	16	Cruise control actuator
N	4	Cruise control control unit
s	9	Stop lamp switch
S	40	Cruise control switch
		A = Off
		B = Accel
		SP = Resume
		V = Decel
w	1	Main ground (behind instrument cluster)
W	6	Ground, trunk, left wheel-housing
w	7	Ground, trunk, right wheel-housing
X	5/I	Plug (5-pin), passenger compartment
X	20	Plug, brake light switch
X	53/3	Plug (1 pin) Hall-sensor/EGR
a		to electrical center, harness plug L. terminal 1
b		to electrical center, harness plug C, terminal 1
c		to EGR control unit, terminal 5

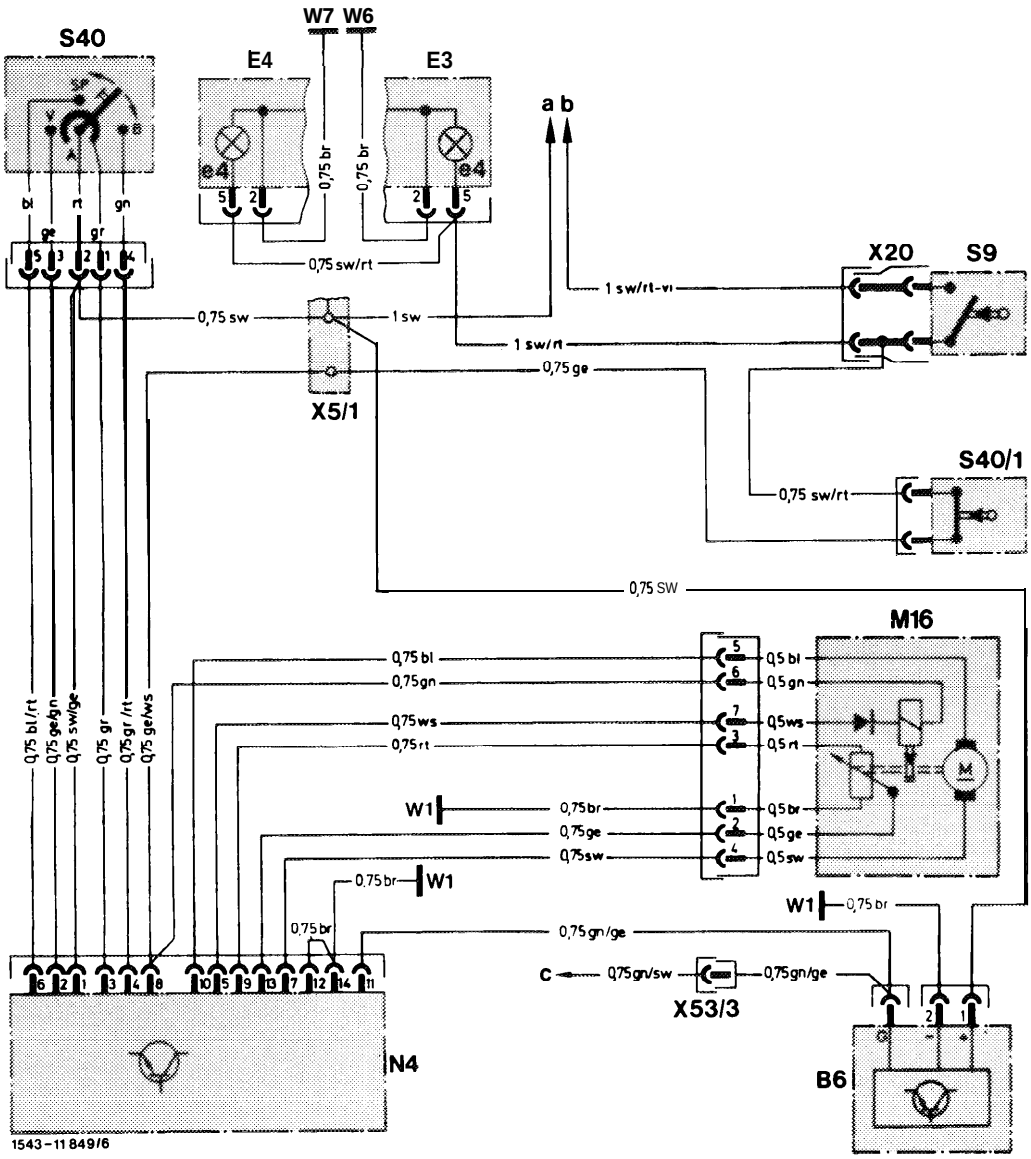


Fig. 54/32 Wiring diagram, cruise control (E-Tempomat) models 201.126 with manual transmission

B	6	Hall-effect sensor
E	3	Tail lamp unit, left
e	4	Stop lamp
E	4	Tail lamp unit, right
e	4	Stop lamp
M	16	Cruise control actuator
N	4	Cruise control control unit
s	9	Stop lamp switch
s	40	Cruise control switch
		A = oft
		B = Accel
		SP = Resume
		V = Decel
s	40/1	Clutch pedal switch
w	1	Main ground (behind instrument cluster)
W	6	Ground, trunk, left wheel-housing
w	7	Ground, trunk, right wheel-housing
X	5/1	Plug (5-pin), passenger compartment
X	20	Plug, brake light switch
X	53/3	Plug (1 -pin), Hall-sensor/EGR
a		to electrical center, harness plug L. terminal 1
b		to electrical center, harness plug C, terminal 1
c		to EGR control unit, terminal 5

Wiring diagram

The electrical wiring of the central locking system was standardized to be compatible with the future T-model. Locking of the vehicle from the right front door **and the trunk lock** is only possible if the key is removed from the steering lock.

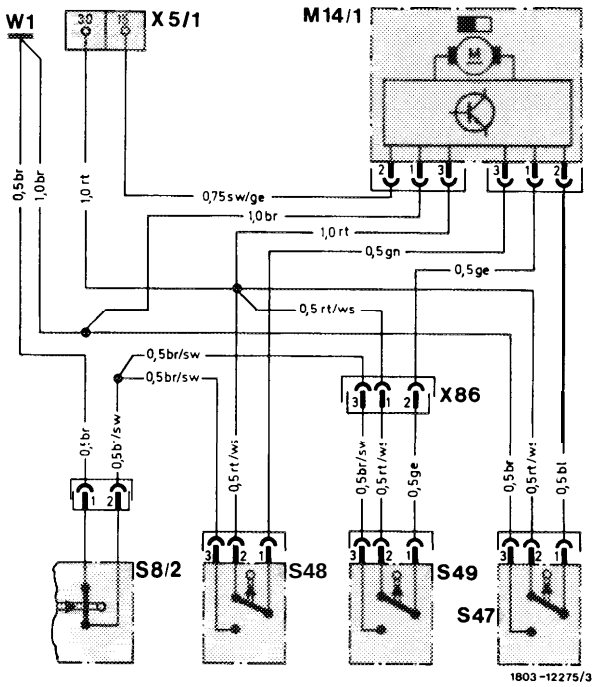


Fig. 80/4 Wiring diagram, central locking system Model 201

M	14/1	Supply pump
S	8/2	Key warning contact
s	47	Actuator, driver's door
S	48	Actuator, right front door
s	49	Actuator, trunk lid lock
w	1	Main ground (behind instrument cluster)
X	5/1	Terminal block, interior
x	86	Connector, central locking system rear (3-pin)

C 29, 32 Pedals, Suspension C29,32 1
C 33 Front axle C33/ 1
C 35 Rear axle C35/1
C 40 Wheels, Chassis measurements C40/1
C 41,42 Propeller shaf, Brakes C41,42/1
C 46,49 Steering, Exhaust system C46,49/ 1

Pedals

Models 201.0281029

Due to the increased contact pressure of the clutch pressure plate, a stronger over-center spring is installed.

The clutch pedal travel is 150 mm.

Suspension

Models 124.026, **201.028/029/1 28**

Springs

The front springs and rubber mounts are adapted to the increased front axle load (see testing and adjusting values).

Torsion bars

On models 201.0291128, a new front torsion bar is installed. As in model 124, the torsion bar diameter is reduced at each of the wishbone bearings.

Model	Torsion bar diameter (mm) Front Axle	Rear Axle
201.028	22	13
201.029	25	14
201.128	24	13

Damper (shock absorber) struts – front axle

On models 201.029 and 201.128, the front damper strut is adapted to the increased front axle load.

Color code = 4 red stripes

The wire stop ring used to hold the bellows (sleeve) in place on the damper strut is replaced with a plastic ring.

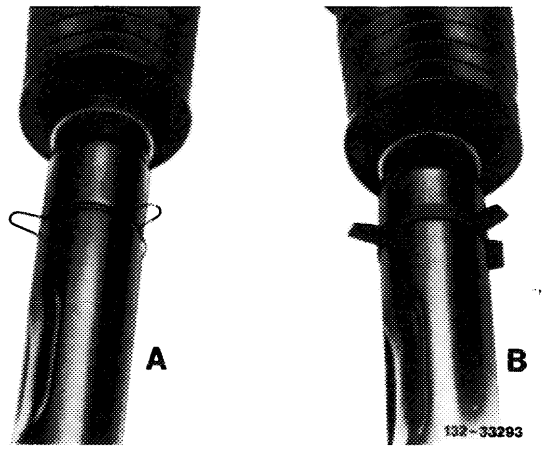


Fig. 32/1

A previous version
B new version

The plastic ring (B) replaces the wire stop ring (A) on all models.

Models 201.028/029/128

Cross reference, springs – shock absorbers

Model	Front spring Part Number	Damper strut Part Number	Rear spring Part Number	Rear shock absorber Part Number
201.028	201 321 22 04 201 321 23 04	201 320 14 30	201 324 25 04	201 326 08 00
201.029 201.128	201 321 23 04	201 320 20 30		

When installing springs, refer to tables “Adjustment of Springs”!

Front springs – number of points

Base points[1]) (standard vehicle)	Model 201.028	37[2])
	Model 201.029	46[3])
	Model 201.128	53
Additional points for option	Anti-lock brake system (ABS)	2
	Sliding roof	2
	Headlamp cleaning system	1

[1]) The base points include: Automatic transmission, Tempmatic climate control, anti-lock brake system (ABS) only models 201.029/128, supplemental restraint system (SRS).
[2]) With 5-speed manual transmission 33 base points.
[3]) With 5-speed manual transmission 42 base points.

Adjustment of front springs

Total points	Front spring Part Number	Height of rubber mounts (mm) according to total points and spring color code	
		blue	red
31–35	201 321 22 04	13	18
36–40	201 321 22 04	18	23
41–46	201 321 23 04	8	13
47–51	201 321 23 04	13	18
above 51	201 321 23 04	18	23

Wear springs – number of points

Basic points[1]) (standard vehicle)	Model 201.028	8[2])
	Model 201.029	9[3])
	Model 201 .128	14
Additional points for option	Sliding roof	3

[1]) The base points include: Automatic transmission.
[2]) With 5-speed manual transmission 7 base points.
[3]) With 5-speed manual transmission 8 base points.

Adjustment of rear springs

Total points	Rear spring Part Number	Height of rubber mounts (mm) according to total points and spring color code	
		blue	red
up to 10	201 324 25 04	8	13
11–16	201 324 25 04	13	18
above 16	201 324 25 04	18	23

Front axle

Models 201

Wishbone (control arm)

The wishbones are the same as in model 124.

The front and rear torsion rubber bushings for the wishbones are also from model 124.

Steering knuckle

The steering knuckle arms (arrow) were reinforced.

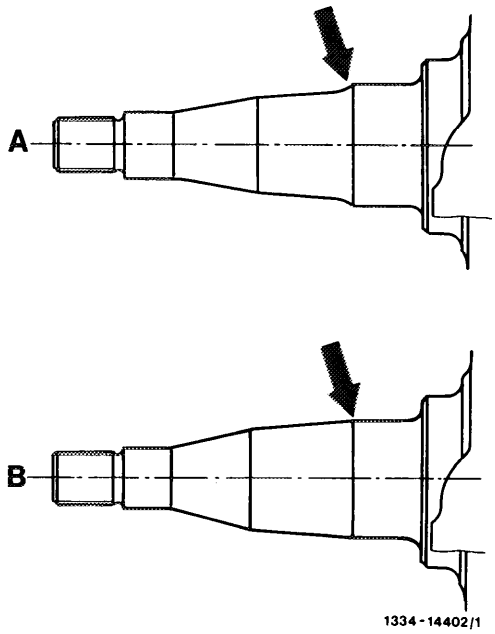


Fig. 33/1

A Version up to July 1986
B Version as of August 1986

The bearing dimensions remain unchanged.

In the future, the new version steering knuckle will be phased into production on all 201 models and will supersede the existing replacement part.

Rear axle

Models 124.026, 201.028/029/128

General information

The rear axle is similar to that of model 201.034, however, without the limited slip differential.

Models 124,201

Wheel guidance

During Model Year 1986, the reinforced pulling link from the 124 Station Wagon was also phased into production on the above models (material thickness = 3.0 mm, previously 2.75 mm). The previ cation marks (2 bumps) are no longer pi

Gear set and rear axle shaft

Model	Trans-mission	Rear axle center piece		Number of teeth	Pinion shaft flange dia. mm	Rear axle shaft with cons velocity joints	
		Ring gear dia. mm	Ratio			Ball dia. mm	Inner bolt circle dia. mm
124.026	All	185	3.27	49:15	90	22.225	94[2])
201.028						19.05	86[1])
201.029						22.225	94[2])
201.128			2.65	45:17			

[1]) The grease capacity is 100 g.
[2]) The grease capacity is 120 g.

Wheels, chassis measurements

Models 124.026, 201.028/029/1 28

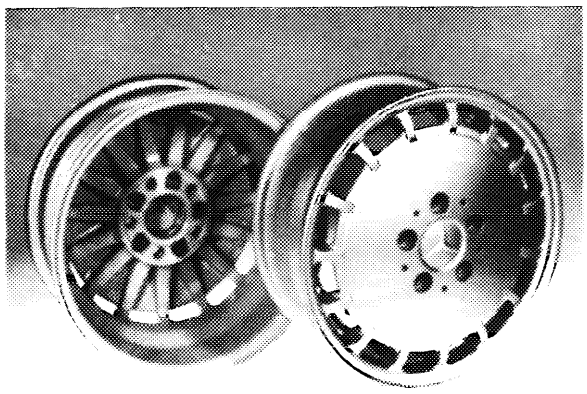
Cross-reference, rims – tires – recommended tire brands

Model	Rim designation Part. Number	Summer tires Belted (radial) tubeless		Winter tires Belted (radial) tubeless	
		Tire size	Tire brand	Tire size	Tire brand
124.026	6 ½ J x 15 H 2 ET 49 light alloy 1244001802 (124 400 19 02)	195/65 VR 15	CONTINENTAL CV 51 GOODYEAR EAGLE NCT 65 MICHELIN MXV PIRELLI P 6 UNIROYAL rallye 340/65	195/65 R 15 91 T M+S	CONTINENTAL SUPER CONTACT TS 740 PIRELLI MS WINTER 190
201.028 201.128	6 J x 15 H 2 ET 49 light alloy 201 400 15 02 (201 400 16 02)	185/65 R 15 87 H	CONTINENTAL CH 51 DUNLOP D 8 MICHELIN MXV PIRELLI P6	185/65 R 15 87T M+S	CONTINENTAL TS 740 GOODYEAR ULTRA GRIP 3
201.029		185/65 VR 15	MICHELIN MXV UNIROYAL rallye 340/65		

Light alloy rims

Models 201.028/029/1 28 are equipped with vented front disc brakes requiring new light alloy rims with modified ribs on the inside of the rim.

This version of the light alloy rim replaces the previous version for all model 201 vehicles.



Pig. 40/1 Previous version

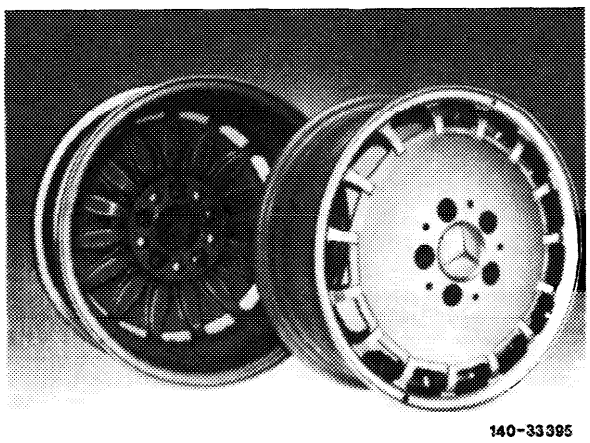


Fig. 40/2 New version

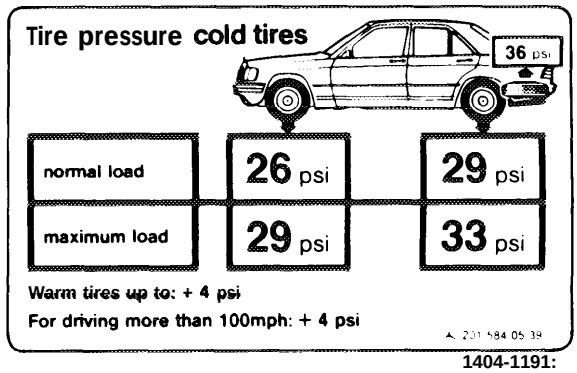
Note:
14" rims must not be used.

Tire inflation pressure

Tire pressure label:

Models 201.028

Basic color red, color of lettering silver.

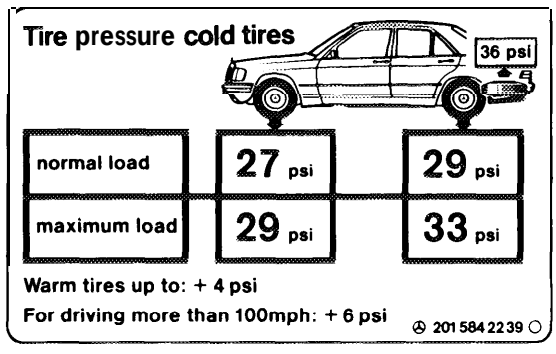


1404-1191:

Fig. 40/4

Models 201.0291128

Basic color silver, color of lettering red.



1404 -14685

Fig. 40/5

Models 124 and 201

Additional mechanical chassis alignment

As in model 124, the transmission tunnel cross-member is attached to the frame floor with screws, thus requiring special tool 124 589 27 63 00 with the central check bore “K” for chassis measurement and alignment.

The attachment is adjustable and fits model 124 as well as 201.

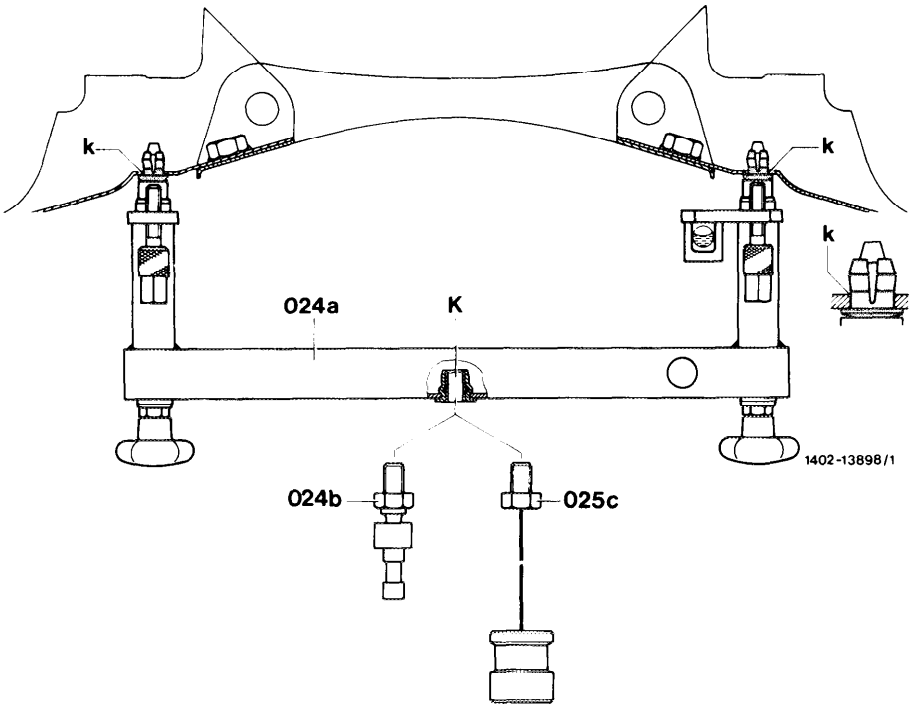


Fig. 40/6

024 a Attachment with alignment level
024 b Retaining pin for telescopic measuring rod for wheel base measurement
025 c Plumb bob for chassis alignment
K Check bore in special tool
k Check bore in frame floor

Propeller shaft

Model 201.028/029/128

The tube diameter of the front and rear shaft is 60 mm. The bolt circle diameter of the shaft flange is 90 mm.

Models equipped with manual transmission have vibration dampers with metal sleeves.

Model 201.028 with automatic transmission has a vibration damper without metal sleeves.

Model 201.029 with automatic transmission does not have a vibration damper.

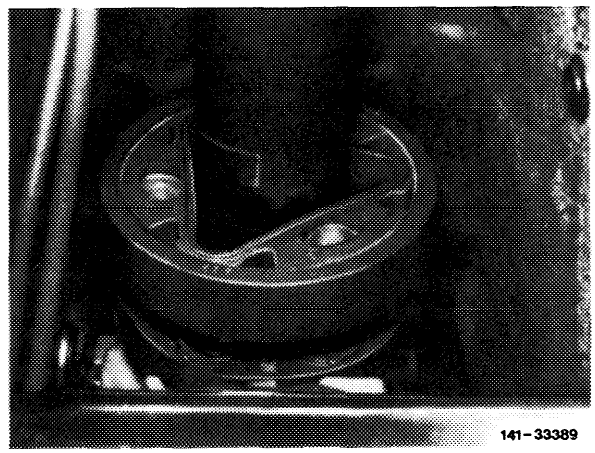


Fig. 41/1 Vibration damper with rollers

Flexible couplings

A soft flexible coupling is used on the transmission side to cushion acceleration and deceleration shock loads. A standard flexible coupling is used on the rear axle.

Brakes

Model 201.028/029/128

Front wheel brake

The vented brake disc dia. is 262 mm, its thickness is 22 mm.

The floating calipers have a piston dia. of 54 mm. The brake pads are sound absorbing.

Model 201.029/128

Brake booster and tandem master cylinder

A dual diaphragm brake booster with respective diameters of 8" and 9", is installed.

The tandem master cylinder bore diameter for the primary circuit is 23.81 mm and for the secondary circuit 19.05 mm.

Steering

Model 201.029/128

Power steering pump

The pressure relief valve opens at 85 ± 5 bar.

Exhaust system

Model 201.028

The catalyst system is identical to model 201.024.

Center and rear mufflers

To provide sufficient noise suppression, the mufflers were specifically adapted to the engine. The rear muffler tailpipe is bent downwards.

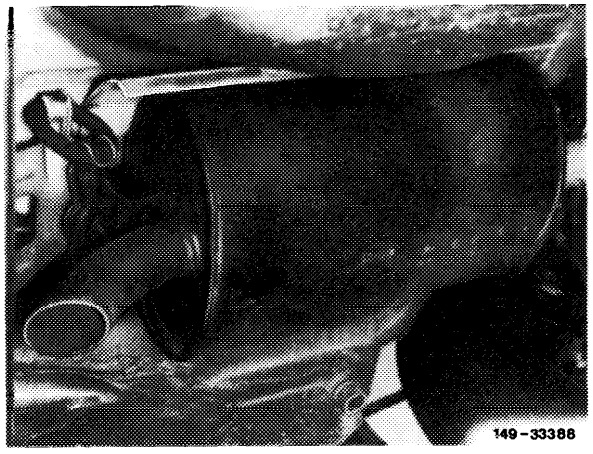


Fig. 49/1

Model 201.029

The catalyst system consists of two primary catalysts with a diameter of 90 mm each and a 9" long underfloor catalyst.

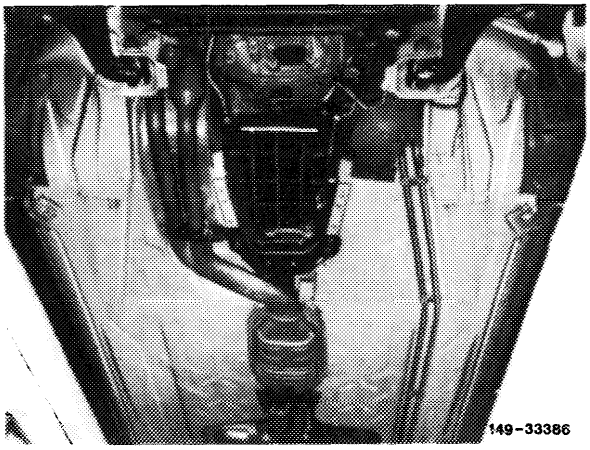


Fig. 49/2

D 54 Electrical system D54/1
D 77 Sliding roof D77/1
D 82 Body electrical system D82/1

Cruise control system

Cruise control amplifier

Models 124, 126.024/025, 201.028/126

A new cruise control amplifier with a reference resistor, as known from models 201.029/128, is installed.

This amplifier was phased into production during model year 1987 in models 107 and 126.03104.

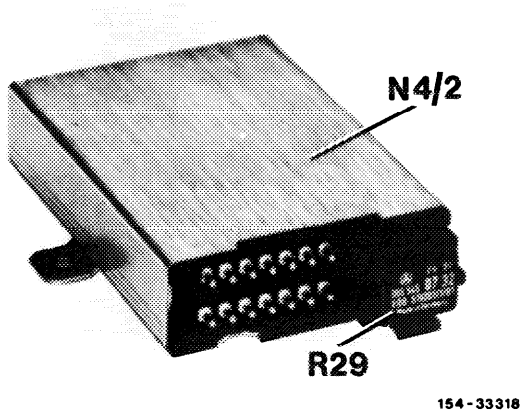


Fig. 54/1

N 4/2 Cruise control amplifier
R29 Reference resistor

Wiring diagrams

The wiring diagrams were changed due to the new cruise control amplifier (N 4/2) and ground connection for the cruise control actuator (M16). Except for model 107, the ground connection is now via a looped wire from the cruise control amplifier (N 4/2).

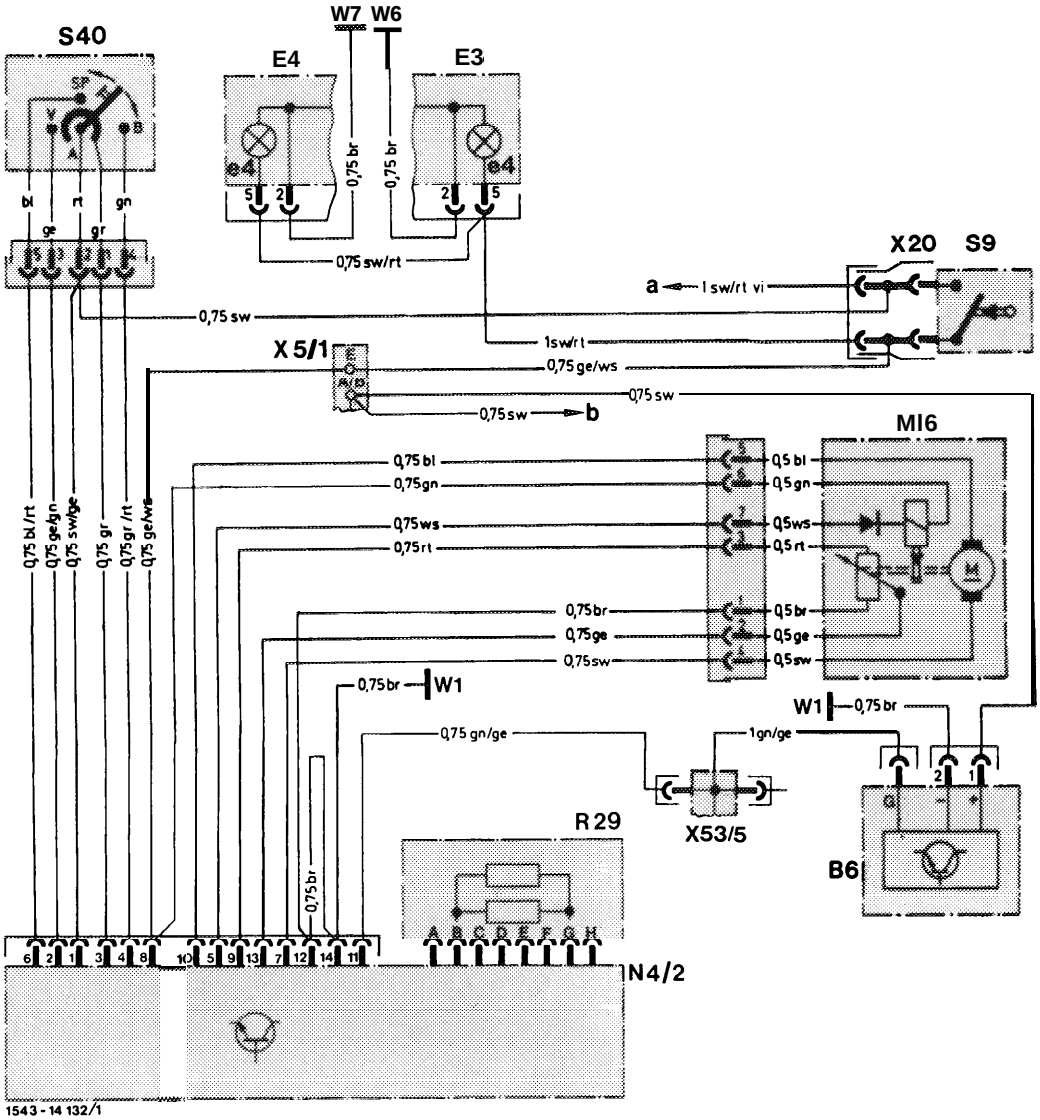


Fig. 54/7 Wiring diagram, Cruise control, models 201.028/029 with automatic transmission

B	6	Hall-effect speed sensor
E	3	Left taillamp unit
	e4	Stop lamp
E	4	Right taillamp unit
	e4	Stop lamp
M	16	Cruise control actuator
N	4/2	Cruise control amplifier with reference resistor
R	29	Cruise control reference resistor
s	9	Stop lamp switch
s	40	Cruise control switch
		SP = Resume
		V = Decelerate/set
		A = off
		B = Accelerate/set
w	1	Main ground (behind instrument cluster)
W	6	Ground, left rear wheelhousing
w	7	Ground, right rear wheelhousing
X	5/1	Terminal block, interior (5-pole)
		A/B Identifying color: black
		E Identifying color: yellow
x	20	Connector, stop lamp switch
x	53/5	Connector, Hall-effect sensor (model 201 029 only)
a		to electrical center, harness plug C, terminal 1
b		to electrical center, harness plug L, terminal 1

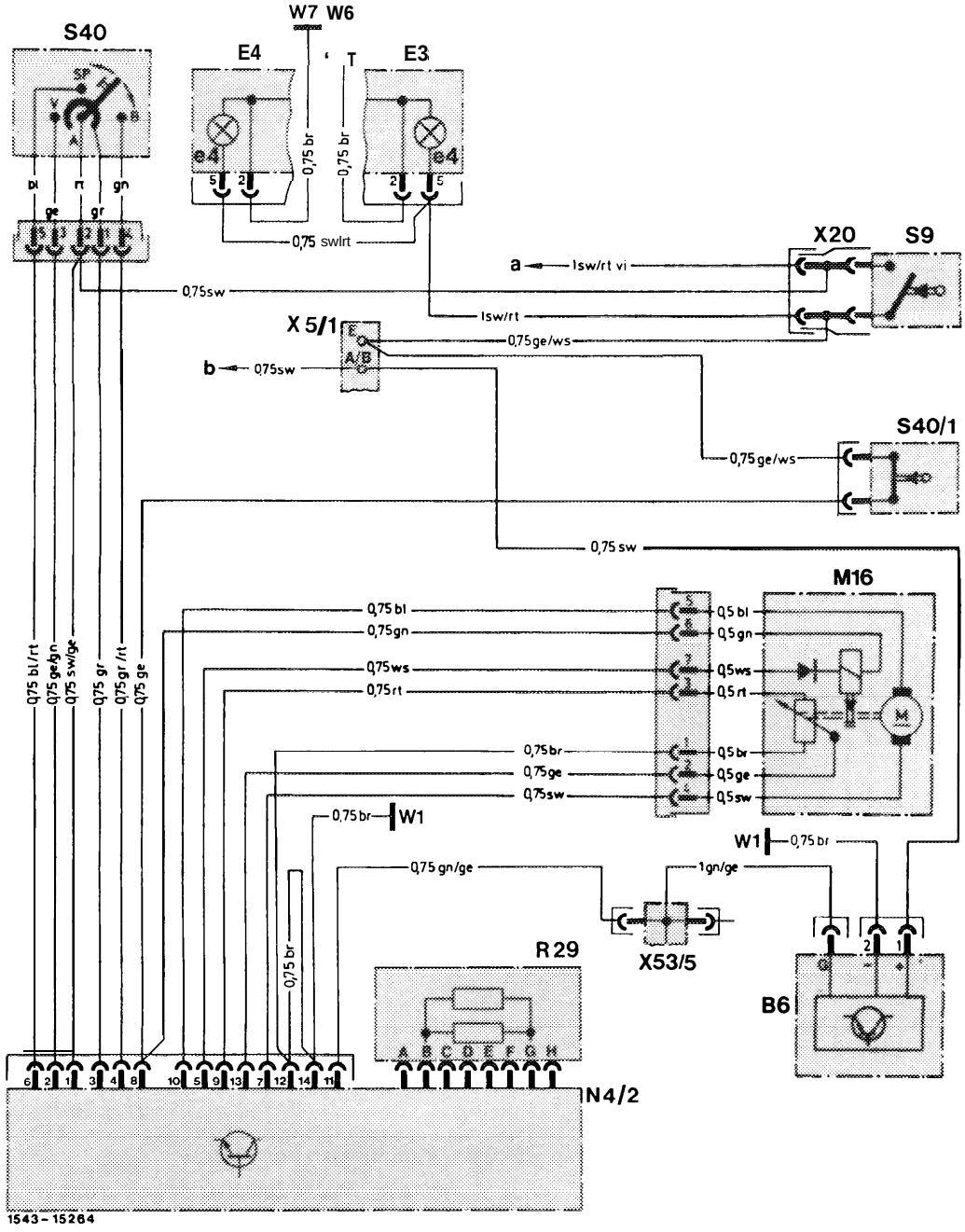


Fig. 54/8 Wiring diagram, Cruise control, models 201.028/029 with manual transmission

B	6	Hall-effect speed sensor
E	3	Left taillamp unit
	e4	Stop lamp
E	4	Right taillamp unit
	e4	Stop lamp
M	16	Cruise control actuator
N	4/2	Cruise control amplifier with reference resistor
R	29	Cruise control reference resistor
s	9	Stop lamp switch
S	40	Cruise control switch
	SP	Resume
	V	Decelerate/set
	A	Off
	B	Accelerate/set
S	40/1	Clutch pedal switch (cruise control)
w	1	Main ground (behind instrument cluster)
W	6	Ground, left rear wheelhousing
w	7	Ground, right rear wheelhousing
X	5/1	Terminal block, interior (5-pole)
	A/B	Identifying color: black
	E	Identifying color: yellow
x	20	Connector, stop lamp switch
x	53/5	Connector, Hall-effect sensor (model 201.029 only)
a		to electrical center, harness plug C, terminal 1
b		to electrical center, harness plug L, terminal 1

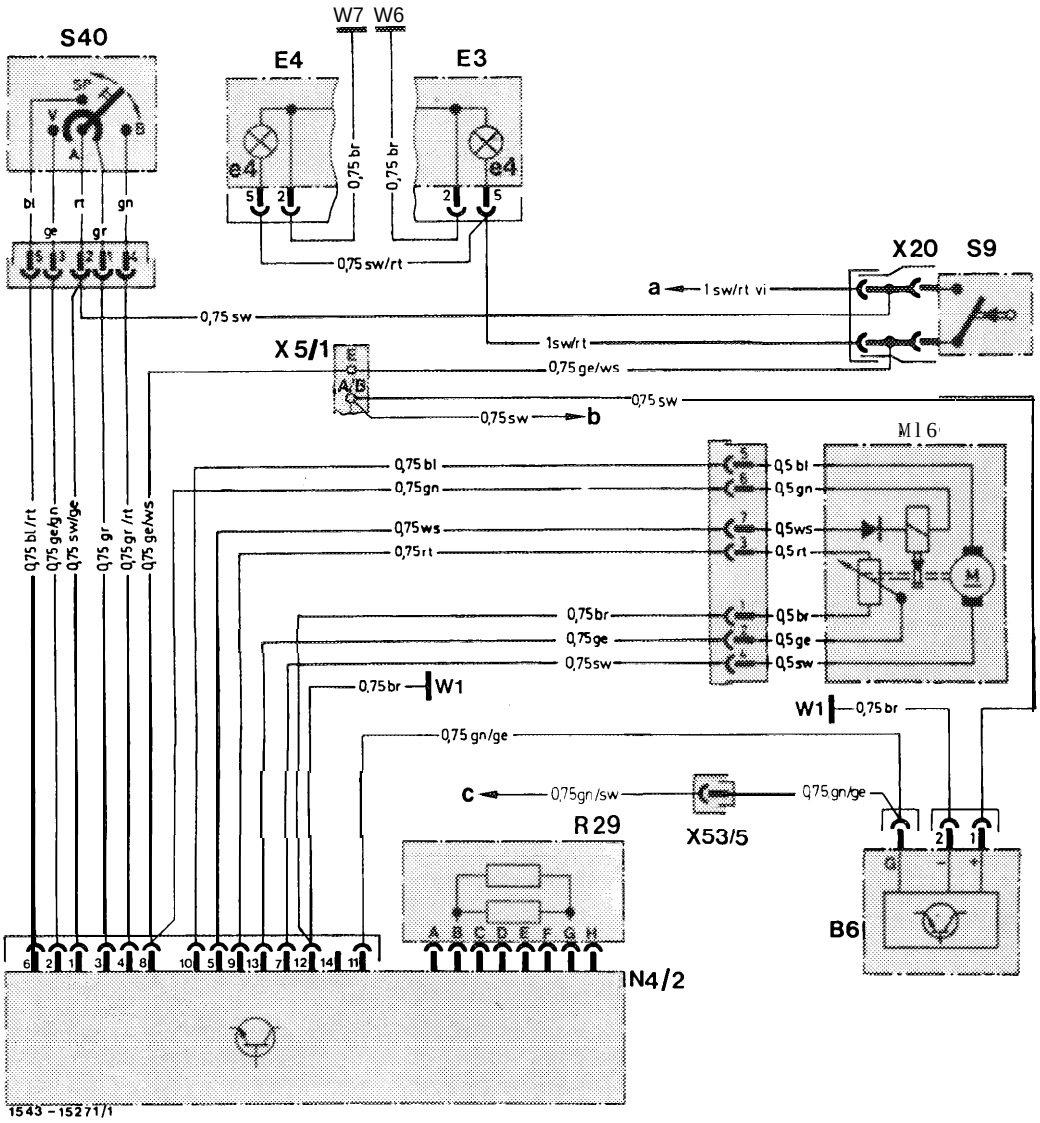


Fig. 54/9 Wiring diagram, Cruise control, model 201.126 with automatic transmission

B	6	Hall-effect speed sensor
E	3	Left taillamp unit
	e4	Stop lamp
E	4	Right taillamp unit
	e4	Stop lamp
M	16	Cruise control actuator
N	4/2	Cruise control amplifier with reference resistor
R	29	Cruise control reference resistor
s	9	Stop lamp switch
s	40	Cruise control switch
		SP = Resume
		V = Decelerate/set
		A = off
		B = Accelerate/set
W	1	Main ground (behind instrument cluster)
W	6	Ground, left rear wheelhousing
w	7	Ground, right rear wheelhousing
X	5/1	Terminal block, interior (5-pole)
		A/B Identifying color: black
		E Identifying color: yellow
x	20	Connector, stop lamp switch
x	53/3	Connector, Hall-effect sensor/EGR (I-pole)
a		to electrical center, harness plug C, terminal 1
b		to electrical center, harness plug L. terminal 1
c		to EGR control unit N37/2

Instrument Cluster

Models 107, 124, 126, 201

On the right side of the instrument cluster, the "ANTI-LOCK" indicator lamp was changed to "ABS" and "O_2 SENSOR" to "CHECK ENGINE".

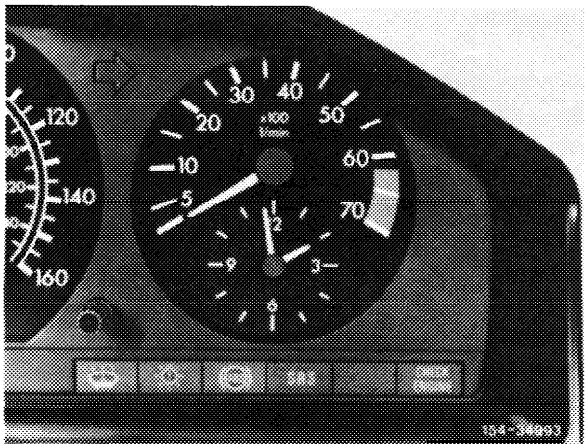


Fig. 54/10

An additional fuse for circuit 58d (instrument illumination) is installed in the instrument cluster of models 124,126 and 201. This change was phased-in during model year 1987.

The fuse is designed as a printed circuit protection and is located in the instrument cluster within one of the bulb socket holders.

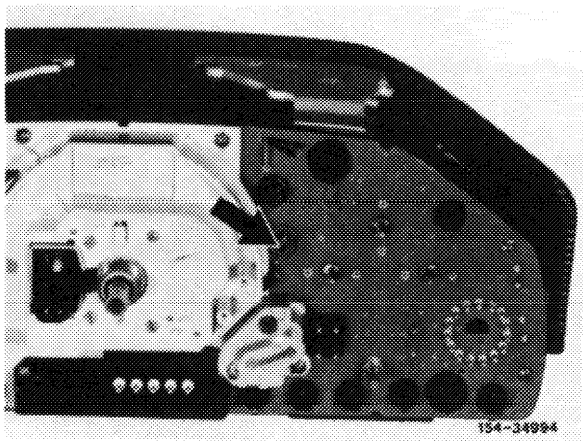


Fig. 54/11

For easier identification, the socket holder is colored red and must be replaced as a unit, if required.

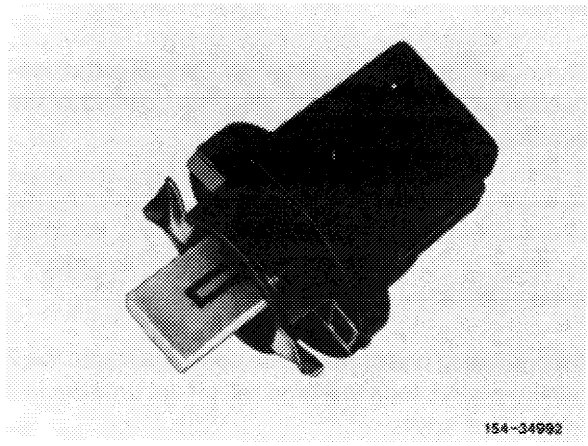


Fig. 54/12

Fuel gauge

Model 201

The indication of the fuel reserve was changed in connection with the modified installation position of the sending unit (see group 47).

To avoid flickering of the fuel reserve lamp during the change-over from regular to reserve fuel, the lamp receives an electronic signal for approximately 2 minutes from the initial illumination.

If the sending unit contacts are open again after the 2 minute period, then the lamp will go out until the fuel level drops again.

Separate fuse for blower motor

Model 201

On model 201 the fuse for the blower motor was changed from a 25 A fuse in the fuse box to a 30 A fuse in an auxiliary fuse holder (as in models 124 and 126).

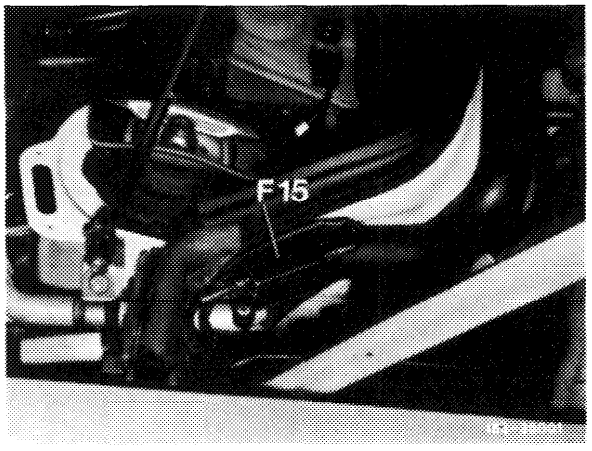


Fig. 54/16 Model 201

F15 Auxiliary fuse holder (blower motor)

Rear window wiper

Model 124.090

Since February 1987, the station wagon rear window wiper operates differently.

Operation:

With the front windshield wipers on, the rear window wiper will be automatically engaged if the car is shifted into reverse.

The logic circuitry also recognizes interval and continuous wiping.

Sliding roof

Sliding roof with rear pop-up feature

Model 201

An electrically operated sliding roof with rear pop-up feature, known from models 124 and 126, is available as a no-cost option.

The pushbutton switch S 13/2 for the sliding/pop-up roof is now illuminated. The intensity can be adjusted with the rheostat in the instrument cluster along with the other instruments.

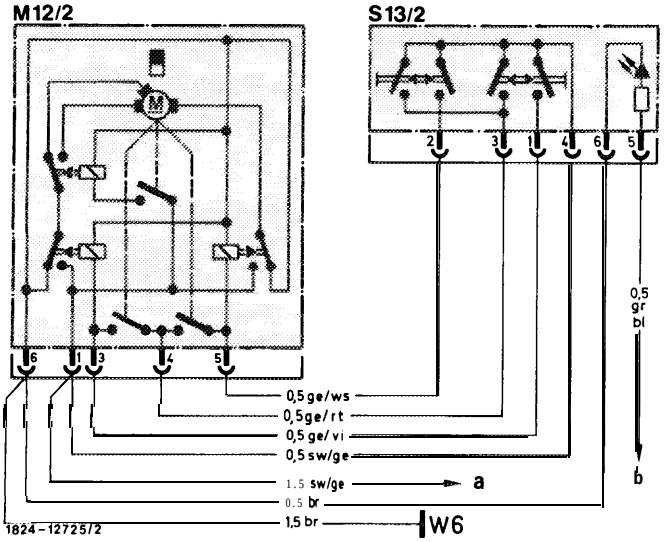


Fig. 77/1 Wiring diagram, sliding/pop-up roof

M	12/2	Sliding/pop-up roof motor
S	13/2	Sliding/pop-up roof switch
W	6	Ground, left rear wheelhousing (in trunk)
a		Connector for electrical equipment, terminal 5 (models 124. 126) Electrical center, connector N (model 201)
b		Connector for electrical equipment, terminal 4 (models 124, 126) Terminal block, circuit 58d (heater box) (Model 201)

Anti-theft alarm system

Models 107, 124, 126, 201

The alarm system can now be armed and disarmed with the valet key (round head) from the driver or passenger door, as is the case with the main key. Now, the modified valet key also has a red dot.

Therefore, the tumbler sleeve of the lock cylinder on the driver and passenger door was changed (models 107, 124, 126). The lock cylinder assemblies, from this modification on, have a new part number.

A new special tool, 924 589 002100, is available for detecting malfunctions in the anti-theft alarm system. It stores into memory information on which sensor(s) has activated the alarm, but does not provide information on how the alarm was armed/disarmed.

Wiper arm cover

Models 124,201

The wiper arm was changed. The light alloy covering with the small additional plastic flap has been replaced with a one part plastic cover.

This new version cover is no longer attached with screws, but is snapped onto the wiper arm. To remove the wiper arm, the cover must be pulled off toward the bottom. To do so, bring the wiper arm to its maximum extended position by first turning the windshield wiper switch in position II and then moving the wiper arm by switching the ignition key on and off again when the wiper arm has reached the 45° position.

WARNING!
Remove the ignition key from steering lock when working on the windshield wiper system. With the key in steering lock position 1 or 2, movement of the wiper arm could cause the automatic park feature of the wiper to engage. This could result in hand injuries.

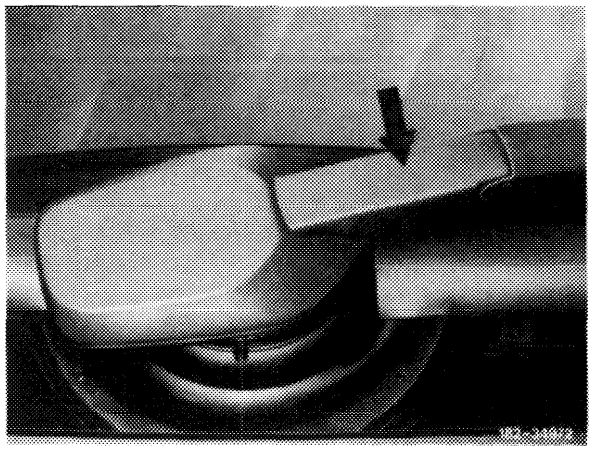


Fig. 82/8 Wiper arm cover

Wiper arm and wiper blade

Model 201

Along with the new version wiper arm cover, the wiper arm was shortened and the attachment point on the wiper blade was moved to reduce the pressure of the wiper blade against the windshield. In addition, the "claws" on the wiper arm which hold the wiper blade were modified.

Replacement note: Due to the modified attachment point, the new version wiper blade cannot be installed on the previous version wiper arm. Likewise, the previous version wiper blade cannot be installed on the new version arm.

Service Manual
Tempmatic Climate Control
Model 201

Mercedes-Benz
service

Mercedes-Benz of **North** America, Inc.
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Introduction

This Service Manual is the product of existing technical publications. Special care has been taken to provide accurate information on removal, disassembly, assembly, inspection, installation, and adjusting procedures, backed with the technical data necessary to do the job.

Mercedes-Benz of North America, Inc. recommends that repairs to, and maintenance of, Mercedes-Benz automobiles be performed only by Mercedes-Benz trained personnel at authorized Mercedes-Benz dealerships.

The information contained in this special publication is ordinarily issued by Mercedes-Benz of North America, Inc., in conjunction with supplementary service literature and special tools supplied only to its authorized dealers. The repair and maintenance procedures outlined herein are procedures to be used by trained Mercedes-Benz service and dealership personnel. Supplementary service literature will not be provided with this publication, but may be contained in reprints of this Service Manual.

Please note that this manual has been compiled from various sources, some of which cover models other than the subject of this book. Always refer to the model and system identification information.

The information contained in this manual was accurate to the best of our knowledge at the time the manual was approved for publication. However, the right is reserved to make production, design and specification changes at any time, without notice and without obligation to give notice. Any such changes will not be contained in this manual.

Mercedes-Benz of North America, Inc. assumes no liability for any damage to person or property caused by the utilization of this publication to effect maintenance of repair work on Mercedes-Benz automobiles.

MERCEDES-BENZ OF NORTH AMERICA, INC.
Technical Publications

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Tempmatic climate control 83

Appendix, model years 1985, 1986, 1987

Instructions for use of service manual 00-005
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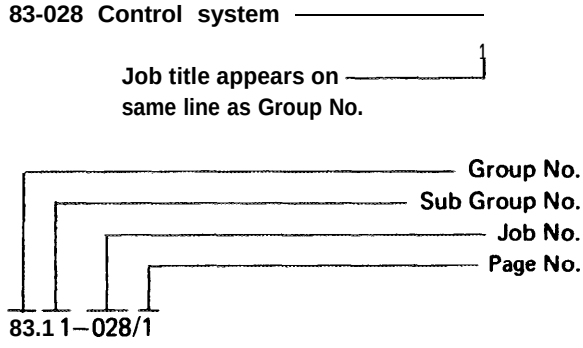
Engine identification

This manual may refer to engine types other than in your model. Therefore, be sure to follow only the instructions that apply to the engine in your particular model.

Each section is separated by an easily visible dividing page followed by the job index page. The first page of a typical job description looks like this:



Data and part numbers

Technical data, tightening torques and tools are listed at the beginning of each job.

All dimensions are in metric units, unless otherwise indicated. Any part numbers given are only used for identification and easier diff erentation between individual components and are not intended for ordering purposes.

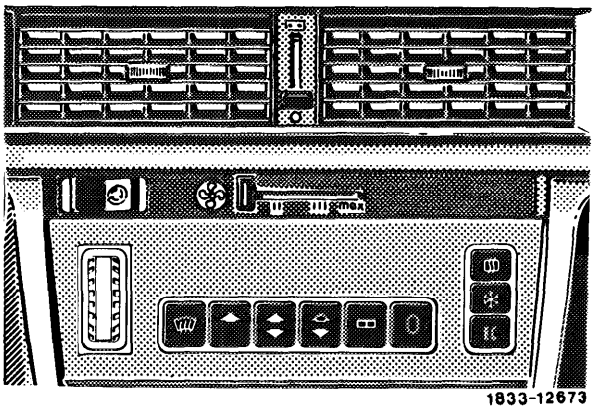
When procuring parts from your MB Dealer Parts Department, be sure to specify engine and chassis number (refer to Vehicle Identification Number Location).

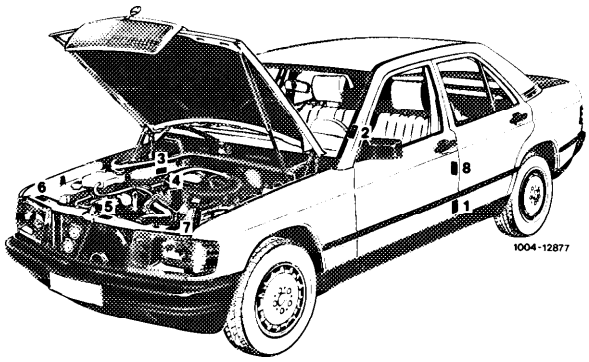
This manual applies to the following passenger cars, starting model year 1984:

Model	Engine	USA model year From	To	Chassis
190 D 2.2	601.921	1984	1985	201.122
190 D 2.5	602.911	1986	1987	201.126
190 D 2.5 Turbo	602.96 1	1987	—	201.128
190 E 2.3	102.961	1984	1984	201.024
190 E 2.3	102.985	1985	1986	201.024
190 E 2.3	102.985	1987	—	201.028
190 E 2.3-16	102.983	1986	—	201.034
190 E 2.6	103.942	1987	—	201.029

Control panel

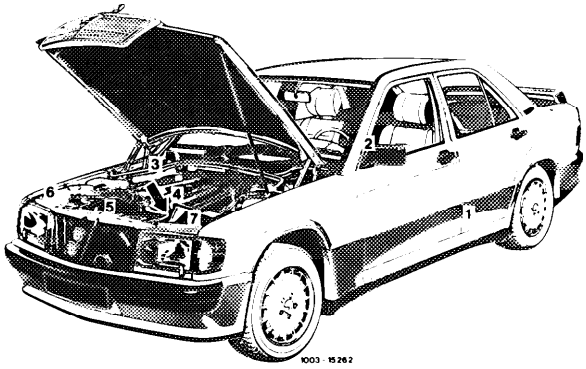
All of the above models (except model year 1987 and later, see appendix) are equipped with the Tempmatic climate control panel shown in the illustration.





All models except model 190 E 2.3-16

1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Chassis No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag
8 Emission Control Tag
Catalyst Information



Model 190 E 2.3-16

1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag

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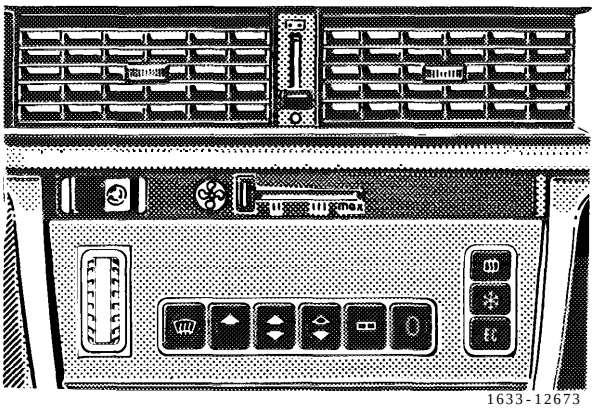
A. General information

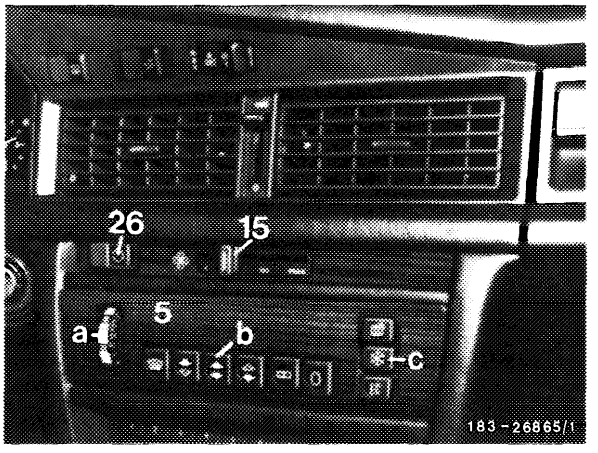
Model 201 has a blend air heating system in combination with air conditioning — **Pempmatic climate** control. The cooling and heating air temperatures are automatically controlled.

For adaptation to weather conditions, a number of functions, including air distribution, can be push-button-controlled (b), independent of in-car temperature. Open, close or adjust dashboard center and side outlets as required.


1633-12673

The blower can be manually adjusted except for modes or

A change from fresh air to recirculated air intake can be made at any time by means of switch (26).



183-26865/1

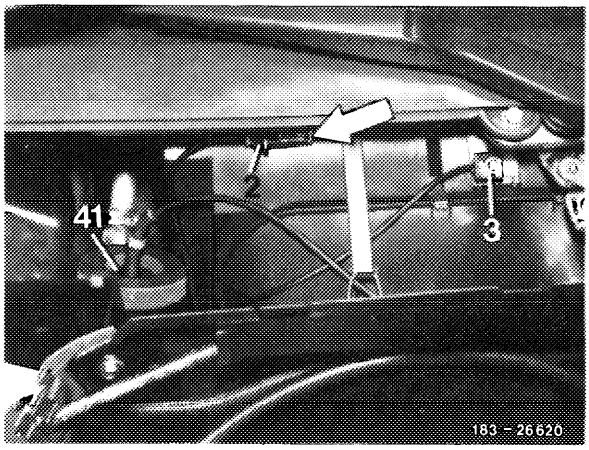
5 Control unit consists of:
a Temperature selector wheel
b Pushbutton switch with 6 functions
c Air conditioning switch (mode buttons)
15 Blower switch
26 Fresh/recirculated air switch

The "cooling" mode requires the pressing of button (c) into position (max. dehumidification) or (normal) and to push one of the buttons of pushbutton switch (b).

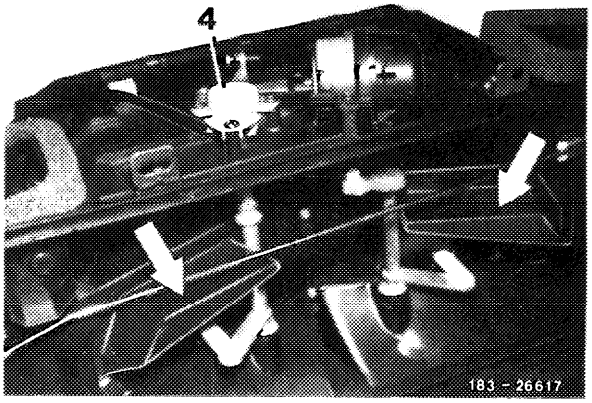
The system operates only with the engine running.

B. Function of temperature control

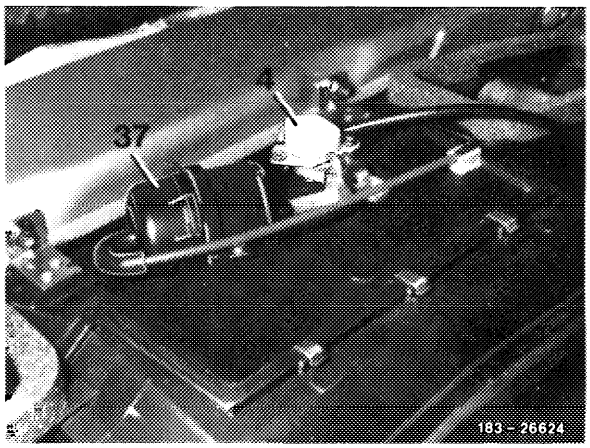
The in-car temperature is controlled by blend air flaps. If “heating” is required, the heater valve is fully opened by a vacuum element (41) and remains fully open during the heating period.



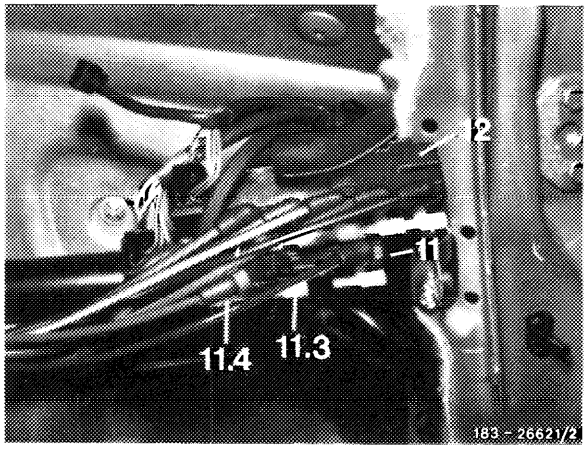
The blend air flaps (arrow) mix unheated air with the heated air, routed through the heat exchanger. The position of the blend air flaps is indicated by a feedback potentiometer for flap position (4) flanged to the shaft of the blend air flaps, and transmitted to the electronic system in the control unit.



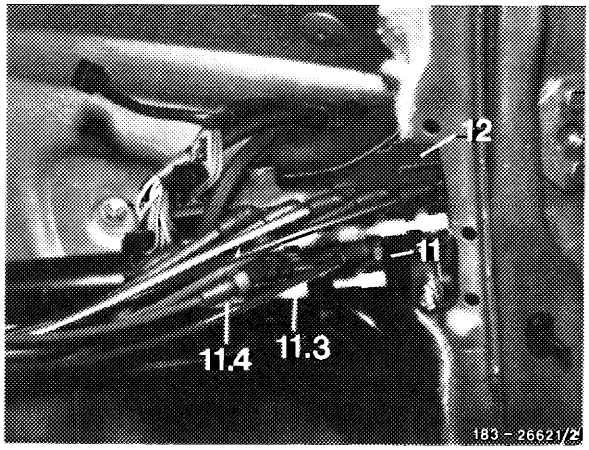
The blend air flaps are operated via levers by a vacuum element (37). The vacuum element is connected to 2 switchover valves.



The switchover valve (11.4) supplies the vacuum element with vacuum through an orifice, so that the blend air flaps are moving toward “cold”. The second switchover valve (11.3) connects the vacuum element to atmosphere also through an orifice, so that the blend air flaps are moved in the direction of “warm” by the spring in the vacuum element. From max. cooling or not heating up to max. heating and vice versa the blend air flaps require approx. 20 seconds each.



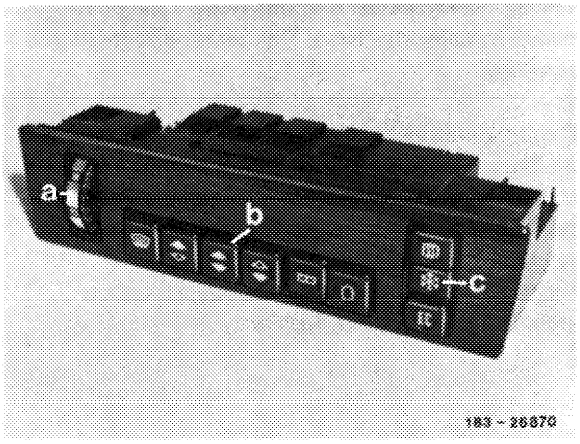
Example:



If **there is a temperature difference between in-car sensor and preset value on temperature wheel (e.g. too cold by 0.3 °C) the electronic system** will energize the switchover valve "warm". Valve **(1 1.3) opens and slowly connects the vacuum element** (37) to atmosphere by an orifice. The spring in vacuum element moves the blend air flaps in direction of "warm" until the feedback potentiometer for flap position (4) indicates the resistance value which corresponds with the temperature difference. The switchover valve (11.3) "warm" will then close and the blend air flaps will stop. Vice versa, the switchover valve (11.4) "cold" is opened. The vacuum element is supplied with vacuum until the proper position of the blend air flaps has been attained. The switchover valve **(11.4)** "cold" will then close. If no heating is required, the heater valve is closed and the blend air flaps are resting against the "cold" stop. In such a case, the temperature in evaporator is probed and the air conditioning system is switched on, if required.

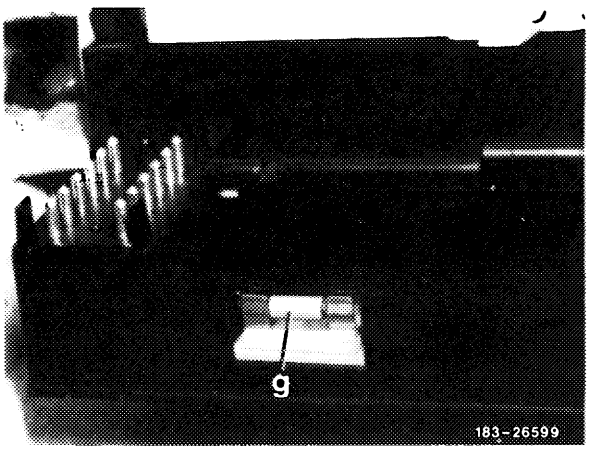
C. Pushbutton switch unit with electronic temperature control

The pushbutton switch unit consists of a temperature wheel (a), a pushbutton switch (b) with 6 push-buttons and a mode switch for air conditioning (c). The pushbutton switch unit houses the electronic system for controlling interior temperature and 1 relay each for connecting the current for the electromagnetic clutch of the refrigerant compressor (air conditioning compressor) and auxiliary coolant pump.



a Temperature wheel
b Pushbutton switch unit with 6 functions (buttons)
c Mode switch for air conditioning system with 3 functions (buttons)

A fuse (g) is located at the rear of the pushbutton switch unit as protection for the electronic system and conductors against short-circuits.

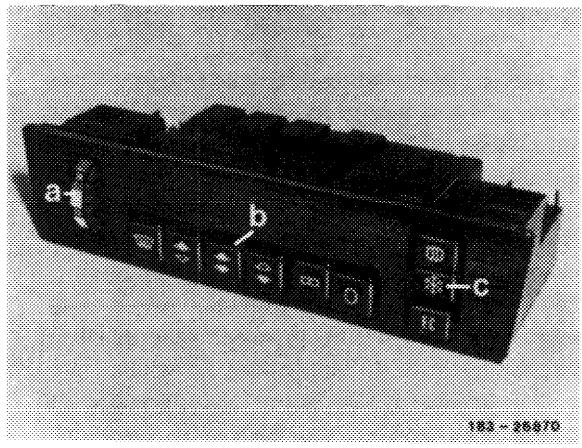


g Fuse, 2 amps

Temperature wheel (a)

The temperature wheel (a) provides stepless interior temperature control in a temperature range from approx. 16 °C to 32 °C. If the temperature wheel is set at the end position “MIN”, the system operates at full cooling capacity, provided the air conditioning system has been switched on. If it is set at the end position “MAX”, the system operates at full heating capacity.

Rotation of the temperature wheel changes the resistance (potentiometer), transmitting the new resistance value into the electronic system of the temperature control.



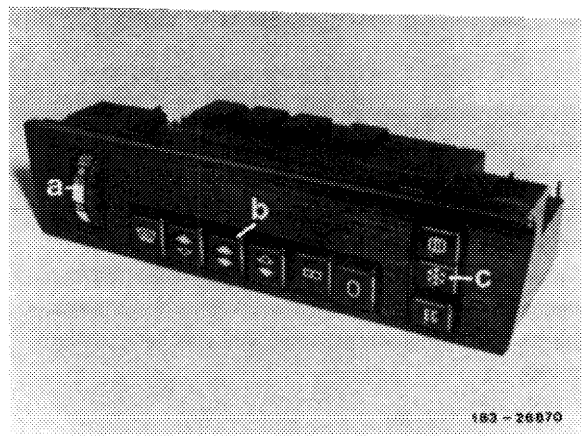
Pushbutton switch (b) with function selection

Function (pushbutton) selection

The blower runs at max. speed in 4th stage at 100 % fresh air supply, provided the switch fresh air/ recirculating air is set to fresh air.

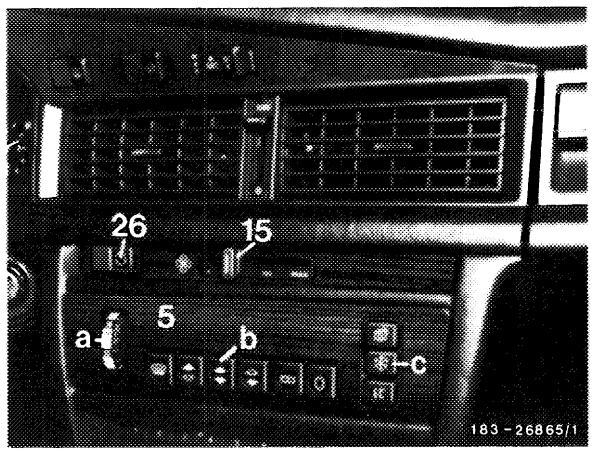
The blower switch and the temperature wheel are bypassed (inoperative) and the recirculating pump runs continuously. The windshield is provided with max. heated air depending on motor temperature. The air feed to center and side outlets can be set manually using the levers. The center outlets should be closed.

The functions of the air conditioning mode switch are bypassed (cancelled) and the air conditioning system operates at max. capacity similar to adjustment , provided the outside temperature is above 0 °C. To guarantee perfect function of “defrost”, the fresh air/recirculating air switch should always be set to fresh air.



Function (pushbutton) selection

The blower runs in the stage to which the blower switch has been set, but at least in 1 st stage. The blower stages can be changed by the blower switch. The heating or cooling capacity is controlled in accordance with nominal value adjustment on the temperature wheel in combination with the mode switch of the air conditioning system (c). If the air conditioning has been switched on, with the switch for fresh air/recirculating air (26) set to fresh air and the temperature difference (preset temperature on temperature wheel in relation to outside temperature) is greater than 8 °C, the system will automatically switch to recirculating air.



The recirculating air mode is also influenced by the interior temperature. From interior temperatures of 25 °C to 50 °C the temperature difference is constantly reduced toward 0 °C. If the temperature difference (outside temperature drops) reduces to approx. 5 °C, the system is again switching to fresh air.

With the heater valve opened, the recirculating pump runs continuously in heating mode.

All the air flow is directed to the windshield. Air flow to center and side outlets can be adjusted manually using the respective levers.

Pushbutton selection

Similar to pushbutton selection except for air distribution, defroster nozzle flaps and legroom flaps opened.

Pushbutton selection

Similar to pushbutton selection except for air distribution, leak air from defroster nozzles, legroom flaps fully opened.

Pushbutton selection

Similar to pushbutton selection except for air distribution. Air out of center and side outlets only. Center and side outlets must be opened manually.

Pushbutton selection

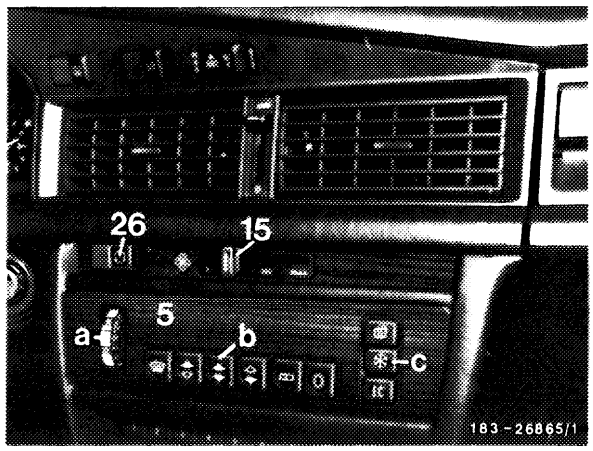
Blower is switched off and the fresh air/recirculating air flap is closed.

Recirculating pump is not running. Temperature control continues operating and the heater valve is opened or closed as required. Air conditioning is switched off.

Note: If none of the selection pushbuttons is depressed, this function conforms to selection .

Air conditioning mode switch (c) with pushbutton selection

Functioning of the air conditioning mode switch requires engagement of one of the selections on the pushbutton switch unit:



Pushbutton selection

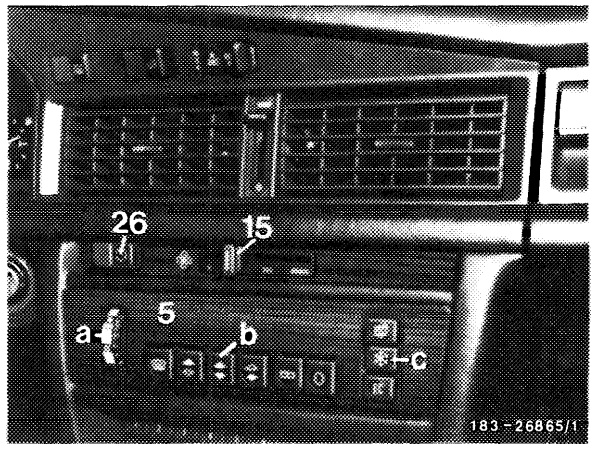
This selection dehumidifies the fresh air, while also dehumidifying the vehicle's interior air.

The refrigerant compressor is constantly switched on and the evaporator temperature is constantly regulated to 0 °C – i-2 °C.

If necessary, the temperature set on the temperature wheel is achieved by additional heating.

Pushbutton selection (normal adjustment)

With this mode selection the refrigerant compressor is also engaged as necessary. During the heating operation and as long as no cooling is required, the system operates (refrigerant compressor off) similar to mode selection . But if the temperature in the vehicle increases by approx. 0.8 °C above nominal value (wheel value), the compressor begins to operate. The air conditioning output is then regulated according to deviation between nominal/actual value.



An additional requirement for engagement of the refrigerant compressor is that the blend air flaps and the heater valve are closed. The outside temperature should also be > 0 °C.

Pushbutton selection (economy)

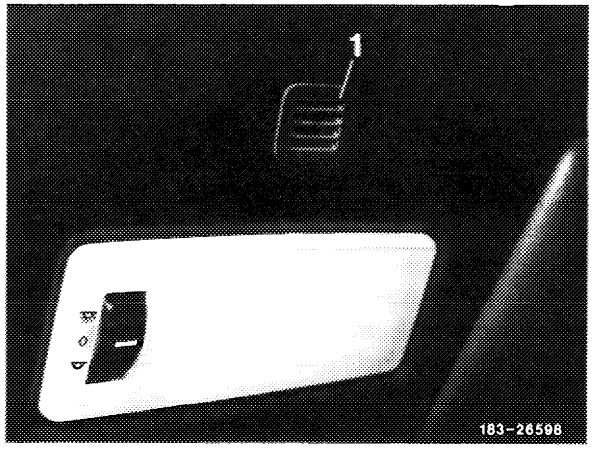
In this position, the refrigerant compressor is switched off and the system operates with 100 % fresh air. If the temperature in the vehicle rises above the value set on the temperature wheel, unheated outside air will be routed into the vehicle.

Note: If none of the air conditioning mode buttons is depressed, it will correspond with selection .

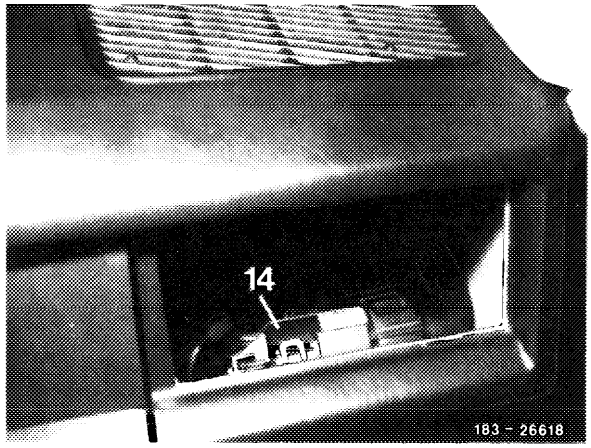
D. Temperature sensor and feedback potentiometer for flap position

In-car temperature sensor

The in-car temperature **sensor** (1) is **located** in roof frame lining, in range of interior lamp.
The resistance of current flow through the in-car temperature sensor is influenced by the temperature of the passenger compartment and fed into the electronic system of the pushbutton switch unit.



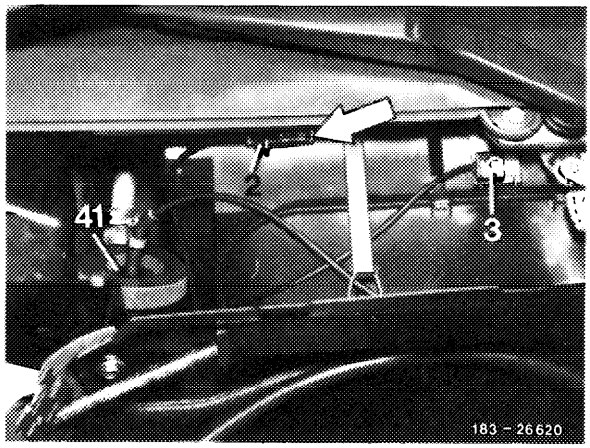
An aspirator blower (14), which is connected to the sensor by a hose and runs with the ignition switched on, provides continuous air flow past the in-car temperature sensor. This increases the accuracy of temperature control inside vehicle.



Location of aspirator blower (14) for In-car temperature sensor

Ambient sensor and temperature sensor for air conditioning

The ambient sensor (2) is located on the top of the evaporator housing. The sensor transmits its resistance value under influence of outside temperature into the electronic system of pushbutton switch unit.
The temperature sensor air conditioning system (3) is located in evaporator housing. It senses the evaporator rib temperature and transmits its resistance into the electronic system of the pushbutton switch unit.



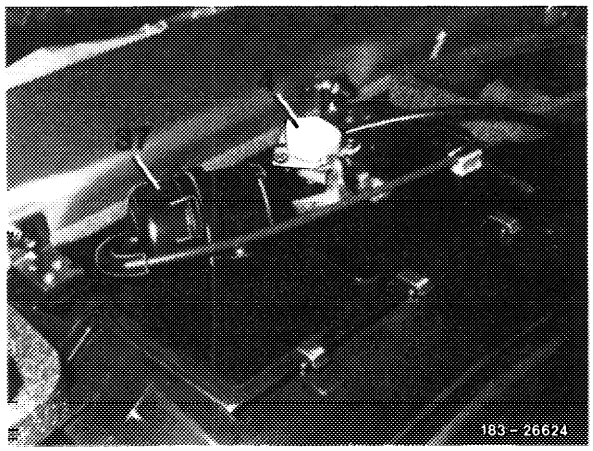
Location of ambient sensor (2) and temperature sensor air conditioning (3)

Note: These temperature sensors have a negative temperature coefficient (NTC) of resistance, allowing the sensor resistance to decrease with increasing temperature. For testing of temperature sensor refer to (83–039).

Feedback potentiometer for flap position

The feedback potentiometer for flap position (4) is located on top of heater box. It is actuated by the vacuum element (37) together with the blend air flap (refer to function of temperature control).

The quality of the temperature control depends on the adjustment of the feedback potentiometer for flap control, particularly during the cooling mode. For testing and adjusting refer to (83–039).

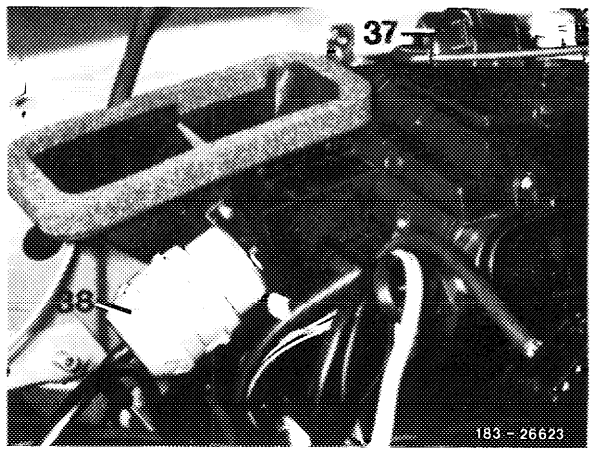


Location of feedback potentiometer for flap position (4)

E. Vacuum elements and switchover valves

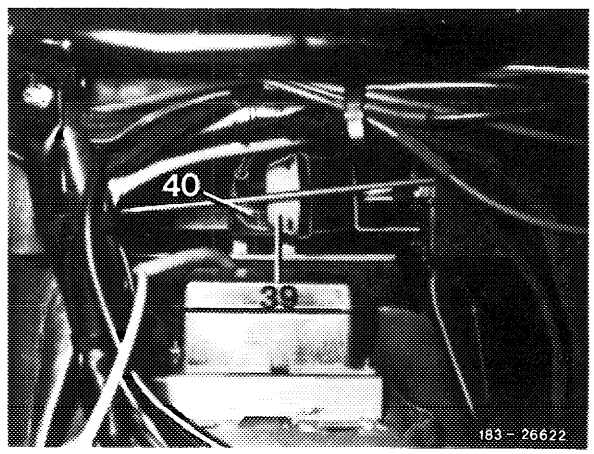
There are 3 vacuum elements on the heater box, of which 2 vacuum elements (38 and 39) actuate the air flaps at top and bottom and 1 vacuum element (37) actuates the blend air flaps.

Without vacuum of vacuum elements (37 and 38) the defroster nozzle flaps are opened and the blend air flaps are in position “full heating”.



Location of vacuum elements for blend air flaps (37) and defroster nozzle flaps (38)

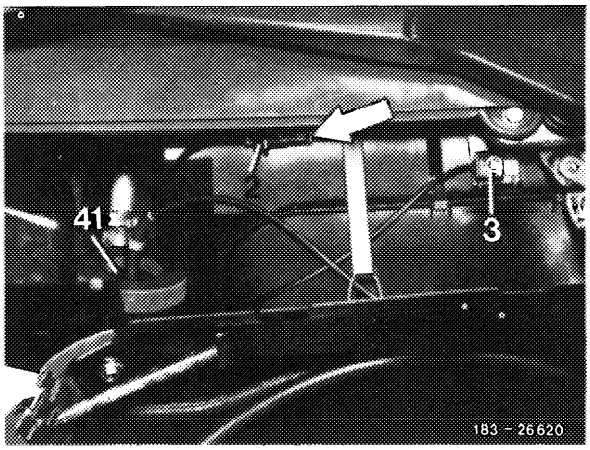
Without vacuum to vacuum elements (39 and 40) the legroom flaps are closed and the fresh air/ recirculating air flap is in the fresh air mode position.



Location of vacuum element for legroom flaps (39) and fresh air/recirculating air flap (40)

The vacuum element (41) with heater valve is located below the air intake grille next to the evaporator housing. The heater valve is actuated by the vacuum element (4 1).

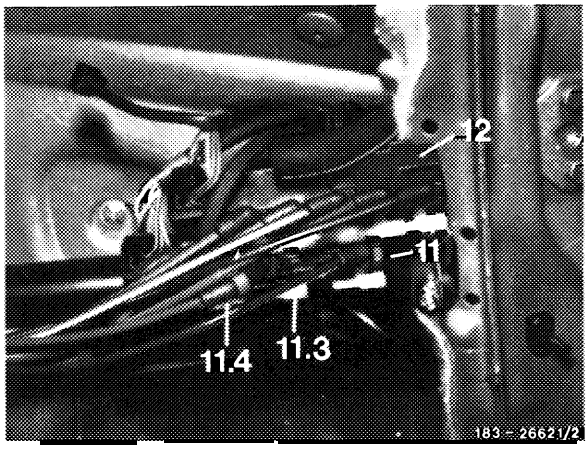
With vacuum applied, the heater valve is “closed”; without vacuum the heater valve is “opened” (refer to vacuum diagram 83-028, section B).



Location of vacuum element (41) with heater valve

Switchover valves

The switchover valves for the vacuum elements, comprising 2 units, switchover valve strip (1 1) 4 connections and switchover valve strip (12) 5 connections, are located one above the other under instrument panel, right.



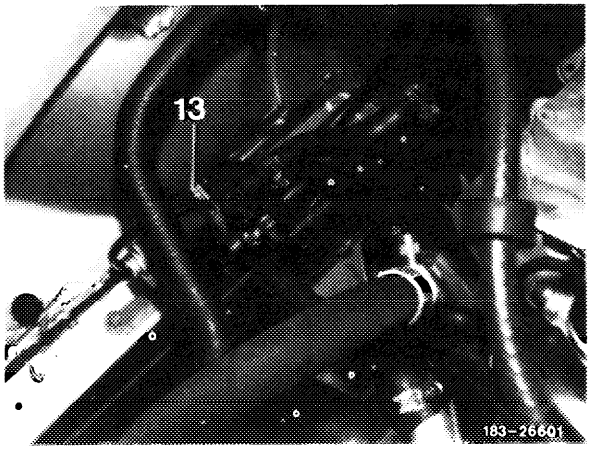
Location of switchover valves

11 Switchover valve strip, 4 connections
12 Switchover valve strip, 5 connections

F. Recirculating pump for hot water

The recirculating pump is located in the return flow of heating water circuit and is running continuously along in heating mode.

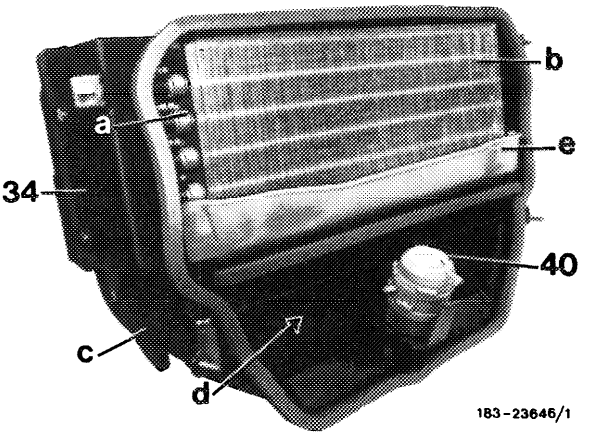
As soon as no more heat is required, i.e. when the blend air flaps and the heater valve are closed, the electronic system in pushbutton unit disconnects the recirculating pump. The recirculating pump is also disconnected during pushbutton (mode) selection 8 .



Location of recirculating pump (13)

G. Evaporator housing with evaporator and fresh air/recirculating air flap

The 6-row evaporator with 6 inlets and its housing is located in component compartment, between front wall and bulkhead.



34 Evaporator housing
a Evaporator tube
b Fins
c Condensate water drain hose left (right side mirror image)
d Fresh air/recirculating air flap
e Condensate water tray
40 2-stage **vacuum element**

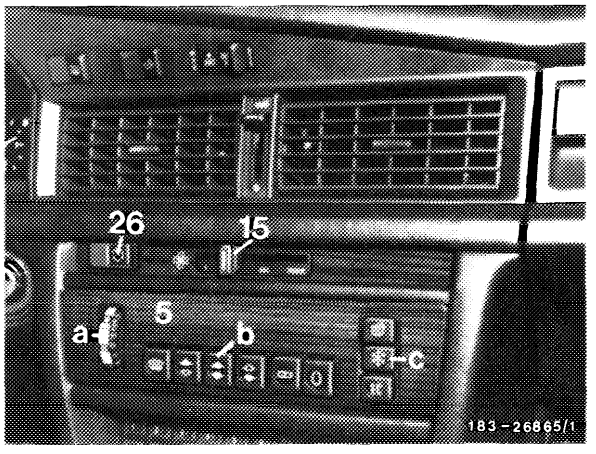
The fresh air/recirculating air flap (d) and the 2-stage vacuum element (40) for the fresh air/recirculating air flap are located on the evaporator housing,

The evaporator tubes and the fins are made of aluminum (a).

H. Blower switch and blower motor

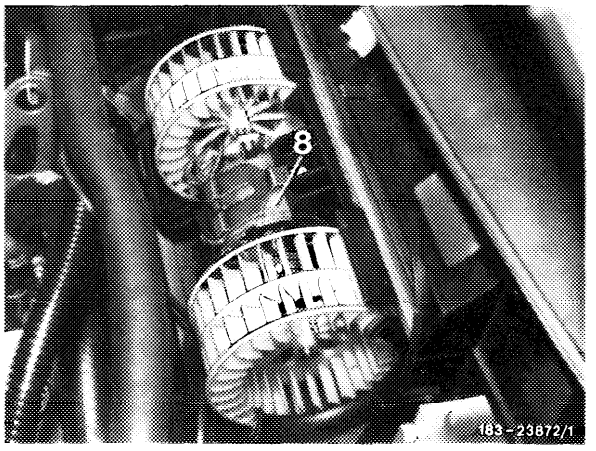
The blower motor is controlled by the 4-speed blower switch. If the speed control lever is against the lefthand stop, the blower motor runs in 1st speed, when one of the pushbuttons is pressed:

The blower can only be switched off with button



Location of blower switch(15)

A radial blower with two fan wheels (four-flow) and 123 mm fan diameter is used as blower motor. The power input in 4th blower stage and 13 V battery voltage amounts to approx. 21 amps.

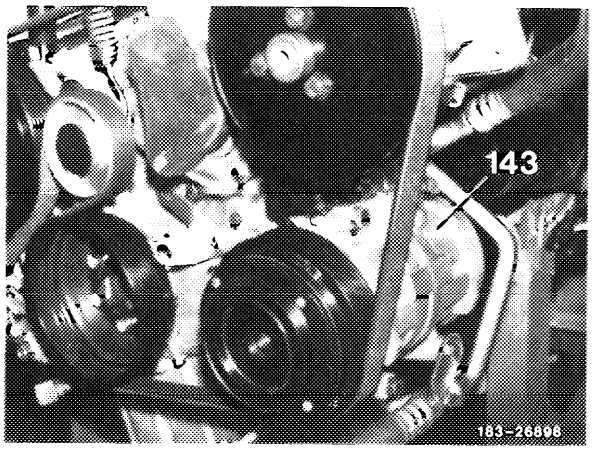


Location of blower motor (8)

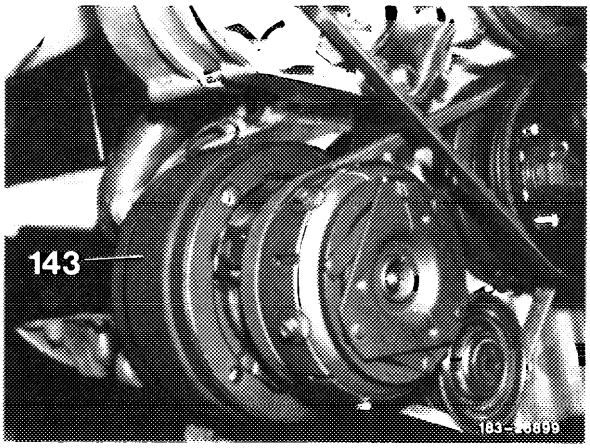
J. Refrigerant (air conditioning) compressor

The diesel engine has a swash plate refrigerant compressor, made by Nippondenso.

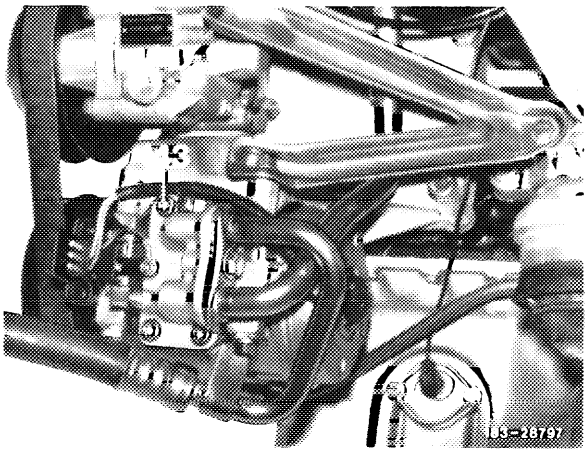
Vehicles with gasoline engine up to model year 84 have a Delco R 4 refrigerant compressor and starting model year 85 the Nippondenso compressor. The filling capacity of air conditioning system is 1 .1 kg refrigerant R 12 on both models.



Location of refrigerant compressor (143) Nippondenso on engine 601



Location of refrigerant compressor (143) Delco R 4 on engine 102 up to model year 84



Location of refrigerant compressor (143) Nippondenso on engine 102 starting model year 85

K. Function and components of compressor cutout

General information

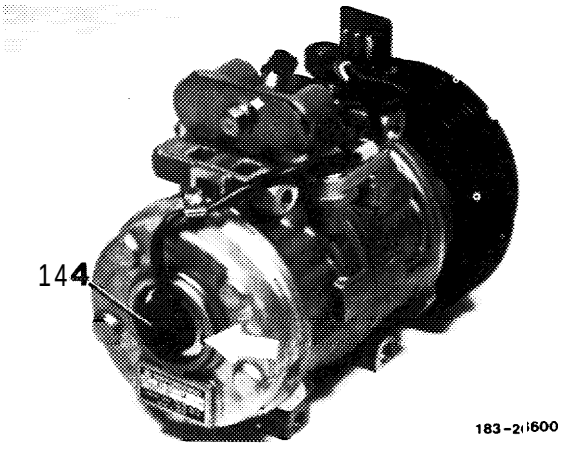
On engine **601** starting model year 84 and on engine 102 starting model year 85 the accessories and therefore the refrigerant compressor are driven by one common V-belt. To ensure continued operation of the accessories in case of a jammed refrigerant compressor the compressor's electromagnetic clutch is switched off by a control unit.

Components of compressor cutout

1. Rpm sensor
2. Control unit
3. Microswitch
   (on vehicles with automatic transmission only)

1. Rpm sensor

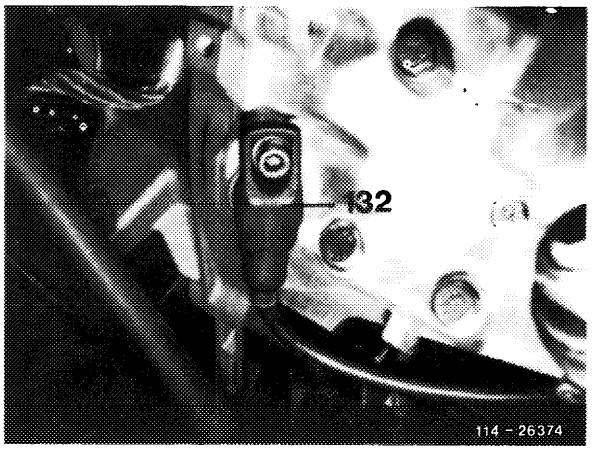
The rpm sensors are measuring the rpm of the engine and the refrigerant compressor. They consist of a magnetic core and a coil. When the ring gear or shaft of refrigerant compressor rotates, an alternating voltage is induced in coils of rpm sensor, which is used as an input signal to the control unit.



Location of rpm sensor for refrigerant compressor (144)

The alternating voltage and thereby the frequency increases or decreases depending on rpm.

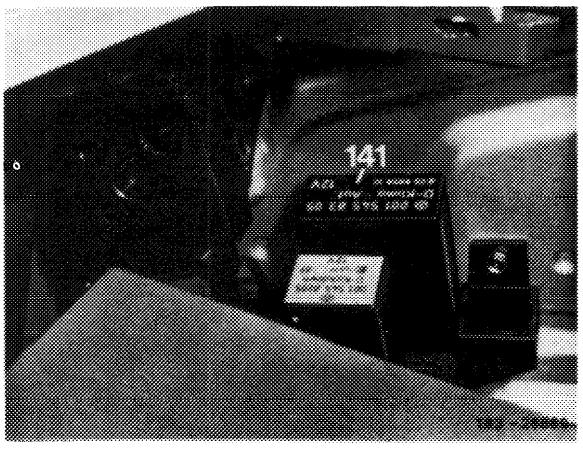
Note: The engine speed of model 201.024 is picked up from terminal TD on line connector of diagnosis plug.



Location of rpm sensor engine 601 on ring gear of flywheel (132)

2. Control unit for compressor cutout

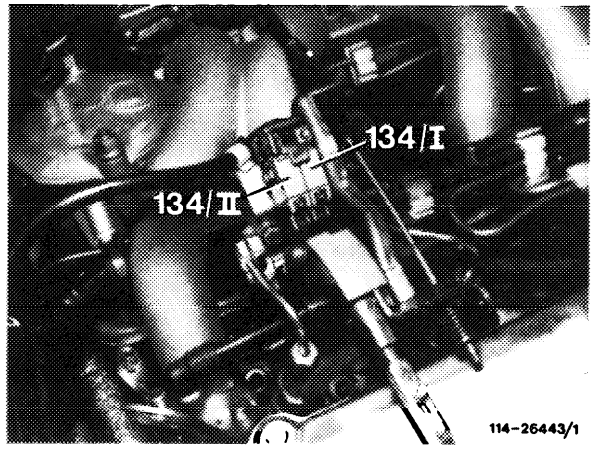
The control unit compares the two speeds (rpm) of engine and refrigerant compressor and will cut out the refrigerant compressor at a difference in speed of approx. 30 %.



Location of control unit for compressor cutout (141)

3. Microswitch on model 201.122 with automatic transmission only

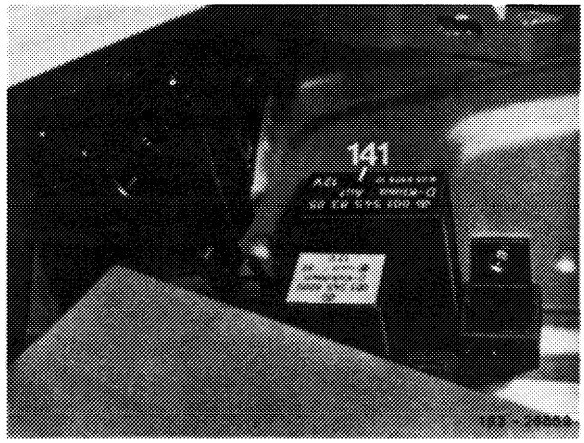
At engine speeds between 1050 and 2150 rpm (/min) with full load, the compressor is cut out by the microswitch via control unit (141) for improved moving-off conditions (improved low engine speed performance).



Location of microswitch (134/I) only connected on vehicles with automatic transmission

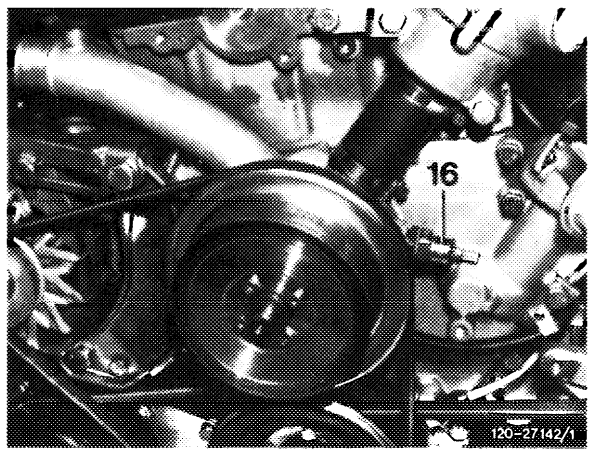
Functional description of compressor cutout

If the ignition and the air conditioning are switched on and the engine is not running, the refrigerant compressor remains switched off.

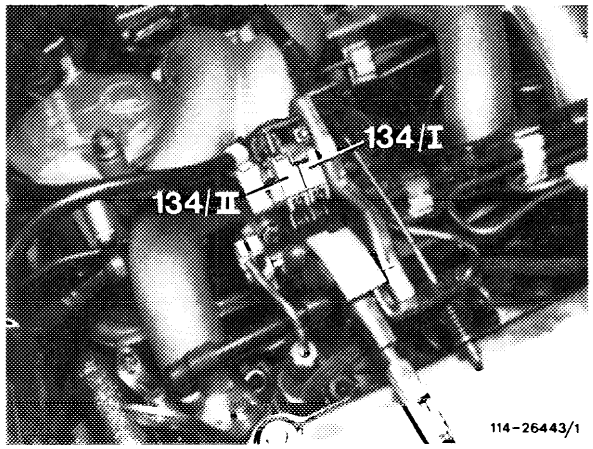


After starting the engine on vehicles up to model year 84 the refrigerant compressor is activated by the control unit (141) as from an engine speed of approx. 500 rpm.
On vehicles as from model year 85 the refrigerant compressor will be activated only after approx. 10 seconds as soon as an engine speed of approx. 600 rpm has been attained (to stabilize the engine speed).
The control unit compares the two speeds of the ring gear and the refrigerant compressor 2 seconds after the compressor comes on (to compensate for clutch slippage during cut-in). If there is an rpm difference of more than 30 % as soon as the compressor comes on, this condition is checked for a period of 200 milliseconds. If the rpm difference equalizes within 200 milliseconds, the compressor remains engaged. If the rpm difference remains (i.e. due to a jammed compressor) the control unit will immediately cut out the compressor. This process is again repeated when the ignition is switched off and the engine is restarted.

To prevent thermic overloading of engine 102, the refrigerant compressor is switched off at approx. 110 °C coolant temperature by temperature switch (23), by switching to ground, via control unit (141). The temperature switch opens at approx. 103 °C and the refrigerant compressor is again on.

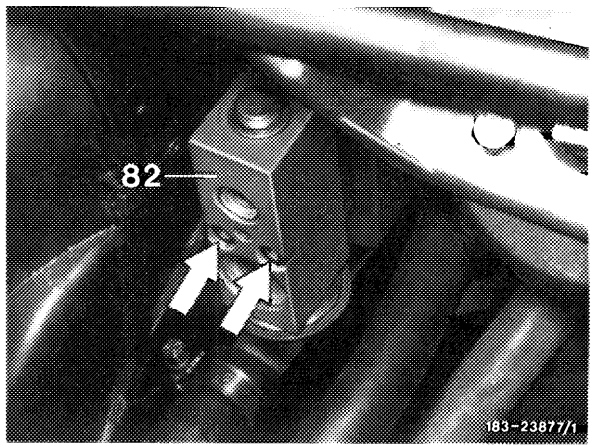


On model 201 .122 with automatic transmission the refrigerant compressor is switched off at full load at approx. 1050 rpm engine speed. After attaining an engine speed of approx. 2 150 rpm the refrigerant compressor is again switched on. If the accelerator pedal is released before an engine speed of 2150 rpm is attained, the control unit will immediately connect the refrigerant compressor. This will improve moving-off conditions of vehicle.



L. Expansion valve and lines

The expansion valve is similar to the block valve used on models 123 and 126, with a cooling capacity of 6.9 kW (6000 kcal/h).

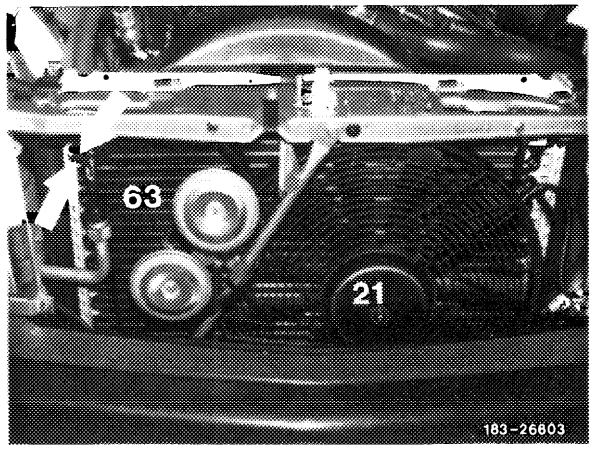


Location of expansion valve (82) on evaporator housing

M. Condenser, auxiliary fan and receiver drier

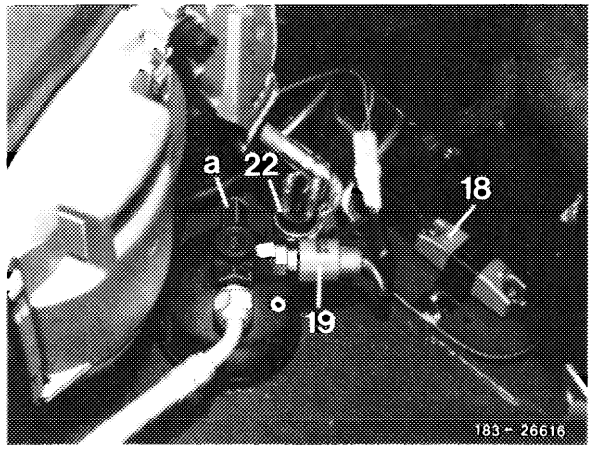
The condenser (63) is attached to a rubber mount on radiator supporting frame. On model 201 .122 it has a block depth of 22 and on model 201.024 of 26 mm. Its tubes having a diameter of 8 mm are made of aluminum. The condenser has a dual flow system, i.e. the refrigerant vapor flows through two parallel lines (arrows).

All models with air conditioning system have an electric auxiliary fan.



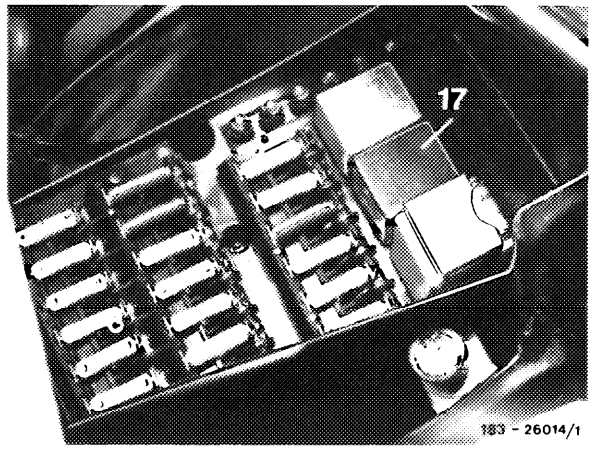
Location of condenser (63) and auxiliary fan (21)

The auxiliary fan is activated for one by the pressure switch (19) in receiver drier, via relay (17) and via pre-resistor (18). In parallel with pressure switch, the auxiliary fan is directly activated by the temperature switch 100 °C (16) on engine via relay (20).

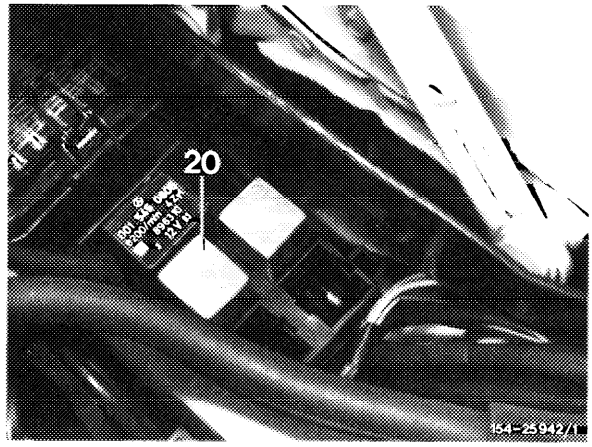


Location of receiver drier and pre-resistor (18) for auxiliary fan

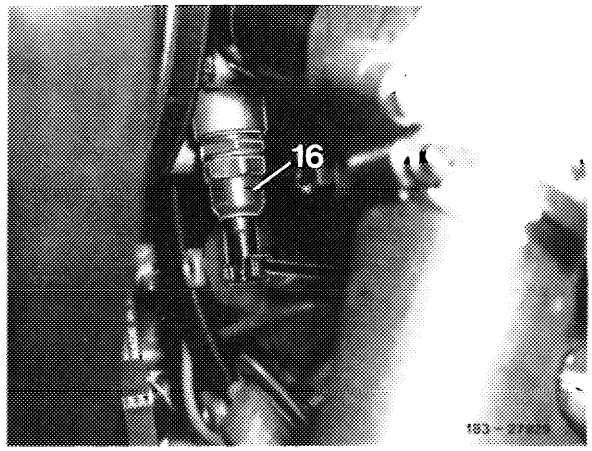
19 Pressure switch for auxiliary fan
22 Pressure switch, refrigerant compressor
a Vacuum valve



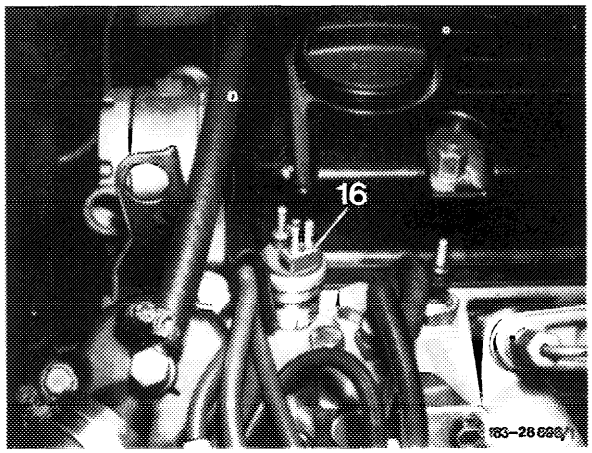
Location of relay (17) for auxiliary fan via pre-resistor (18)



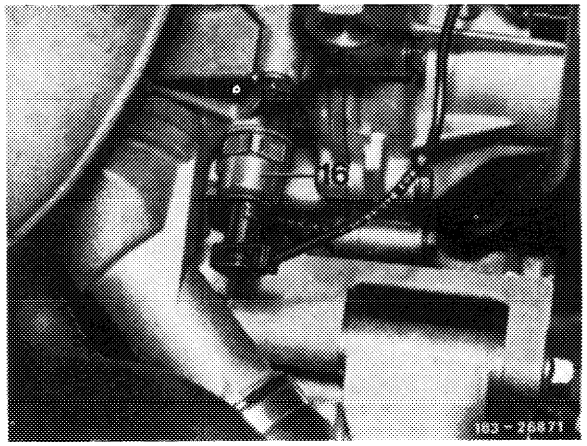
Location of relay (20) for auxiliary fan



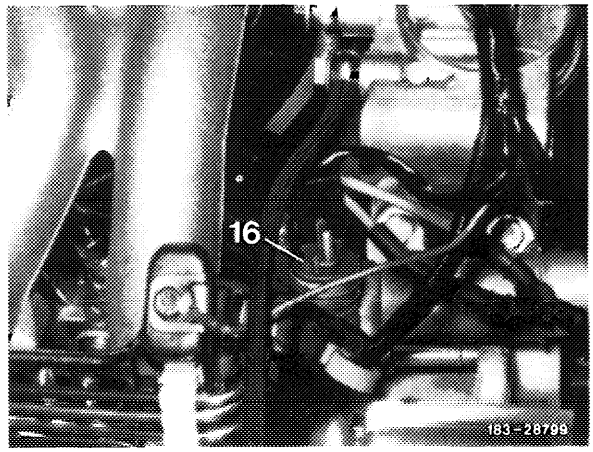
Location of temperature switch 100 °C (16) for auxiliary fan on engine 102 up to model year 84



Location of temperature switch (16) 100 °C for electromagnetic clutch engine fan and 110 °C for auxiliary fan on engine 102 starting model year 85

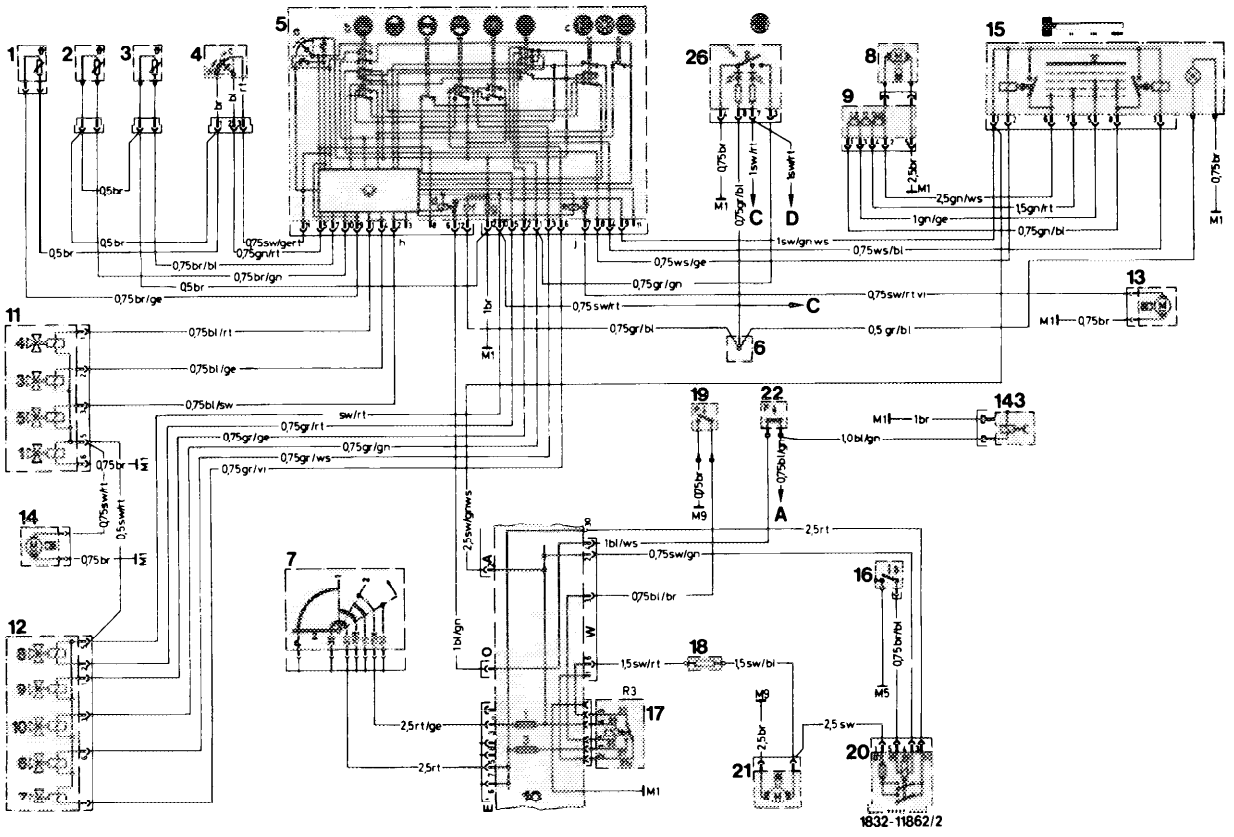


Location of temperature switch 100 °C (16) for auxiliary fan on engine 601 up to model year 84



Location of temperature switch (16) 100 °C for electromagnetic clutch engine fan and 110 °C for auxiliary fan on engine 601 starting model year 85

A. Wiring diagrams



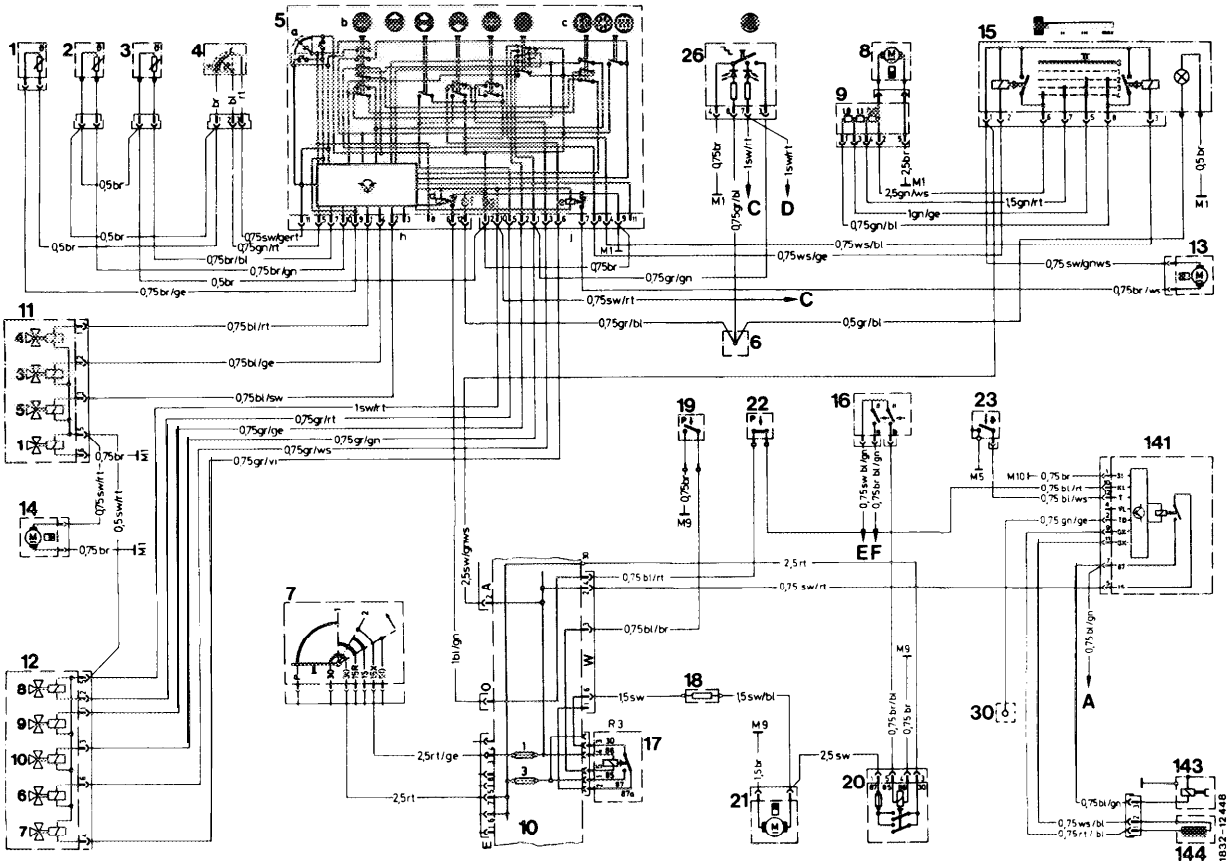
Tempmatic control system, model 201.024 up to model year 84

1 In-car temperature sensor
2 Ambient sensor, outside air temperature
3 Temperature sensor, air conditioning
4 Feedback potentiometer for flap position
5 Pushbutton switch unit, consisting of:
- a Temperature wheel
- b Pushbutton switch unit
- c Mode switches for air conditioning
  - Air conditioning on, controlled via temperature sensor (3) to 0 °C evaporator temperature
  - Air conditioning controlled via pushbutton switch unit (electronic system)
  - Air conditioning off
- d Relay for refrigerant compressor
- e Relay for recirculating pump
- f Lights
- g Fuse: 2 amps
- h 12-pin connector at left side of pushbutton switch unit
- i 12-pin connector, at right side of pushbutton switch unit

6 Connector terminal 58d
7 Starter switch
8 Blower motor
9 Pre-resistor, blower motor
10 Electrical center with fuses
Fuse 1 = 16 A
Fuse 3 = 16 A
11 Switchover valve unit,4 connections
- 11.4 Switchover valve for blend air flaps ("cold")
- 11.3 Switchover valve for blend air flaps ("warm")
- 11.5 Switchover valve for heater valve ("closed")
- 11.1 Switchover valve for heater valve ("open")

12 Switchover valve unit, 5 connections
- 12.8 Switchover valve for legroom flaps
- 12.9 Switchovervalve for fresh air/ recirculating air flap (small stroke)
- 12.10 Switchover valve for fresh air/ recirculating air flap (large stroke)
- 12.6 Switchover valve for defroster nozzle valves (small stroke)
- 12.7 Switchover valve for defroster nozzle flaps (large stroke)

13 Recirculating pump
14 Aspirator blower for in-car temoerature sensor
15 Blower switch
16 Temperature switch 100 °C for auxiliary fan
17 Relay auxiliary fan pre-resistor
18 Pre-resistor auxiliary fan
19 Pressure switch auxiliary fan
On 20 bar/Off 15 bar
20 Relay auxiliary fan
21 Auxiliary fan
22 Pressure switch refrigerant compressor
On 2.6 bar/Off 2.0 bar
26 Switch, fresh air/recirculating air
143 Electromagnetic clutch Refrigerant compressor
A To electronic control unit (CIS-E) terminal 19
C To hazard warning switch (connection terminal 15)
D From seat belt indicator, terminal 8 (connection terminal 15)
M1 Common ground (behind instrument cluster)
M5 Ground connection, engine (unit screwed into engine)
M9 Ground connection, front left (near headlight)
M10 Ground connection, battery



Tempmatic control system, model 201.024 starting model year 85

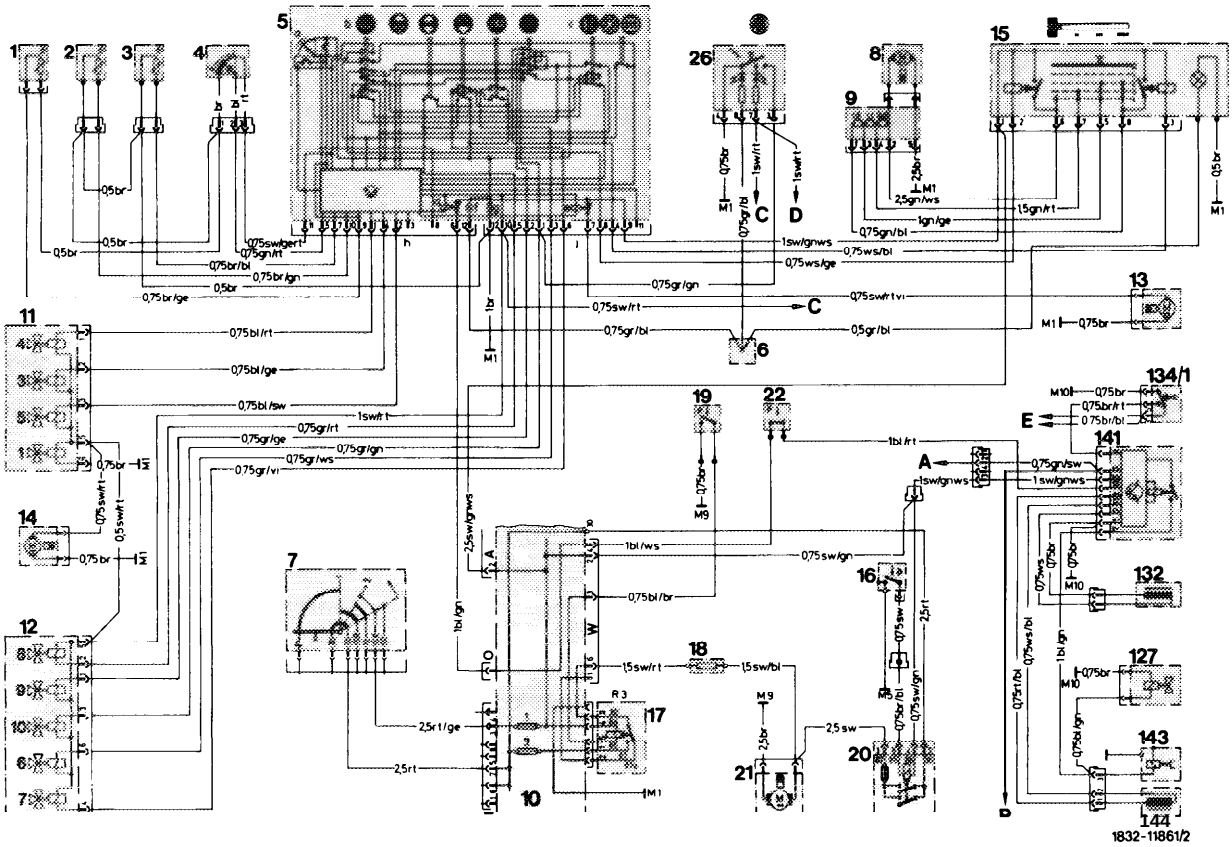
1 In-car temperature sensor
2 Ambient sensor, outside air temperature
3 Temperature sensor, air conditioning
4 Feedback potentiometer for flap position
5 Pushbutton switch unit, consisting of:
- a Temperature wheel
- b Pushbutton switch unit
- c Mode switches for air conditioning
  - Air conditioning on, controlled via temperature sensor (3) to 0 °C evaporator temperature
  - Air conditioning controlled via pushbutton switch unit (electronic system)
  - Air conditioning off
- d Relay for refrigerant compressor
- e Relay for recirculating pump
- f Lights
- g Fuse: 2 amps
- h 12-pin connector at left side of pushbutton switch unit
- i 12-pin connector, at right side of pushbutton switch unit

6 Connector terminal 58d
7 Starter switch
8 Blower motor
9 Pre-resistor, blower motor
10 Electrical center with fuses
Fuse 1 = 16 A
Fuse 3 = 16 A
11 Switchover valve unit,4 connections
- 11.4 Switchover valve for blend air flaps ("cold")
- 11.3 Switchover valve for blend air flaps ("warm")
- 11.5 Switchover valve for heater valve ("closed")
- 11.1 Switchover valve for heater valve ("open")

12 Switchover valve unit, 5 connections
- 12.8 Switchover valve for legroom flaps
- 12.9 Switchover valve for fresh air/ recirculating air flap (small stroke)
- 12.10 Switchover valve for fresh air/ recirculating air flap (large stroke)
- 12.6 Switchover valve for defroster nozzle valves (small stroke)
- 12.7 Switchover valve for defroster nozzle flaps (large stroke)

13 Recirculating pump
14 Aspirator blower for in-car temperature sensor
15 Blower motor
16 Temperature switch
- a 100 °C for electromagnetic clutch, engine fan
- b 110 °C for auxiliary fan

17 Relay auxiliary fan pre-resistor
18 Pre-resistor auxiliary fan
19 Pressure switch auxiliary fan
On 20 bar/Off 15 bar
20 Relay auxiliary fan
21 Auxiliary fan
22 Pressure switch refrigerant compressor
On 2.6 bar/Off 2.0 bar
23 Temperature switch 110 °C for compressor cutout
26 Switch, fresh air/recirculating air
30 Socket (diagnosis) with line connector TD
141 Control unit compressor cutout
143 Electromagnetic clutch Refrigerant compressor
144 Rpm sensor, refrigerant compressor
A To electronic control unit (CIS-E) terminal 19
C To hazard warning switch (connection terminal 15)
D From seat belt indicator, terminal 8 (connection terminal 15)
E To electrically heated windshield washer nozzle (terminal 15)
F To electromagnetic clutch engine fan
M1 Common ground (behind instrument cluster)
M5 Ground connection, engine (unit screwed into engine)
M9 Ground connection, front left (near headlight)
M10 Ground connection, battery



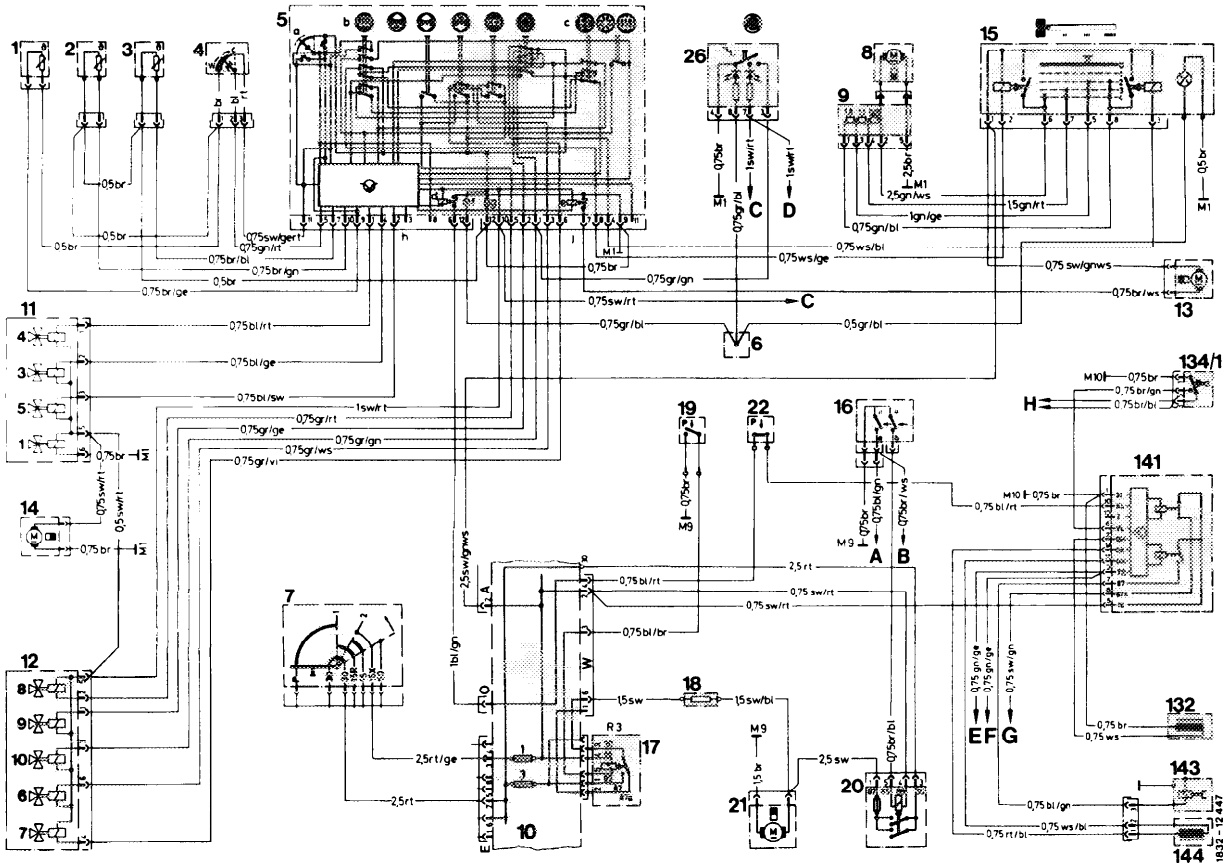
Tempmatic control system, model 201 ,122 up to model year 84

1 In-car temperature sensor
2 Ambient sensor, outside air temperature
3 Temperature sensor, air conditioning
4 Feedback potentiometer for flap position
5 Pushbutton switch unit, consisting of:
- a Temperature wheel
- b Pushbutton switch unit
- c Mode switches for air conditioning
  - Air conditioning on, controlled via temperature sensor (3) to 0 °C evaporator temperature
  - Air conditioning controlled via pushbutton switch unit (electronic system)
  - Air conditioning off
- d Relay for refrigerant compressor
- e Relay for recirculating pump
- f Lights
- g Fuse: 2amps
- h 12-pin connector at left side of pushbutton switch unit
- i 12-pin connector, at right side of pushbutton switch unit

6 Connector terminal 58d
7 Preglow start switch
8 Blower motor
9 Pre-resistor, blower motor
10 Electrical center with fuses
Fuse 1 = 16 A
Fuse 3 = 16 A
11 Switchover valve unit,4 connections
- 11.4 Switchover valve for blend air flaps ("cold")
- 11.3 Switchover valve for blend air flaps ("warm")
- 11.5 Switchover valve for heater valve ("closed")
- 11.1 Switchover valve for heater valve ("open")

12 Switchover valve unit, 5 connections
- 12.8 Switchover valve for legroom flaps
- 12.9 Switchover valve for fresh air/ recirculating air flap (small stroke)
- 12.10 Switchover valve for fresh air/ recirculating air flap (large stroke)
- 12.6 Switchover valve for defroster nozzle valves (small stroke)
- 12.7 Switchover valve for defroster nozzle flaps (large stroke)

13 Recirculating pump
14 Aspirator blower for in-car temperature sensor
15 Blower motor
16 Temperature switch 100 °C for auxiliary fan
17 Relay auxiliary fan pre-resistor
18 Pre-resistor auxiliary fan
19 Pressure switch auxiliary fan
On 20 bar/Off 15 bar
20 Relay auxiliary fan
21 Auxiliary fan
22 Pressure switch refrigerant compressor
On 2.6 bar/Off 2.0 bar
26 Switch, fresh air/recirculating air
127 Switchover valve rpm stabilization (with automatic transmission only)
132 Rpm sensor ring gear for flywheel
134/1 Microswitch for compressor cutout at full load (connected only on vehicles with automatic transmission)
141 Control unit compressor cutout
143 Electromagnetic clutch Refrigerant compressor
144 Rpm sensor, refrigerant compressor
A To 4-pin plug connection, interior
B To relay kickdown limit, terminal 2
C To hazard warning switch (connection terminal 15)
0 From seat belt indicator, terminal 8 (connection terminal 15)
E To switchover valves for EGR (California only)
M1 Main ground (behind instrument cluster)
M5 Ground connection, engine (unit screwed into engine)
M9 Ground connection, front left (near headlight)
M10 Ground connection, battery



Tempmatic control system, model 201 ,122 starting model year 85

1 in-car temperature sensor
2 Ambient sensor, outside air temperature
3 Temperature sensor, air conditioning
4 Feedback potentiometer for flap position
5 Pushbutton switch unit, consisting of:
- a Temperature wheel
- b Pushbutton switch unit
- c Mode switches for air conditioning
  - Air conditioning on, controlled via temperature sensor (3) to 0 °C evaporator temperature
  - Air conditioning controlled via pushbutton switch unit (electronic system)
  - Air conditioning off
- d Relay for refrigerant compressor
- e Relay for recirculating pump
- f Lights
- g Fuse: 2amps
- h 12-pin connector at left side of pushbutton switch unit
- i 12-pin connector, at right side of pushbutton switch unit

6 Connector terminal 58d
7 Preglow starter switch
8 Blower motor
9 Pre-resistor, blower motor
10 Electrical center with fuses
Fuse 1 = 16 A
Fuse 3 = 16 A

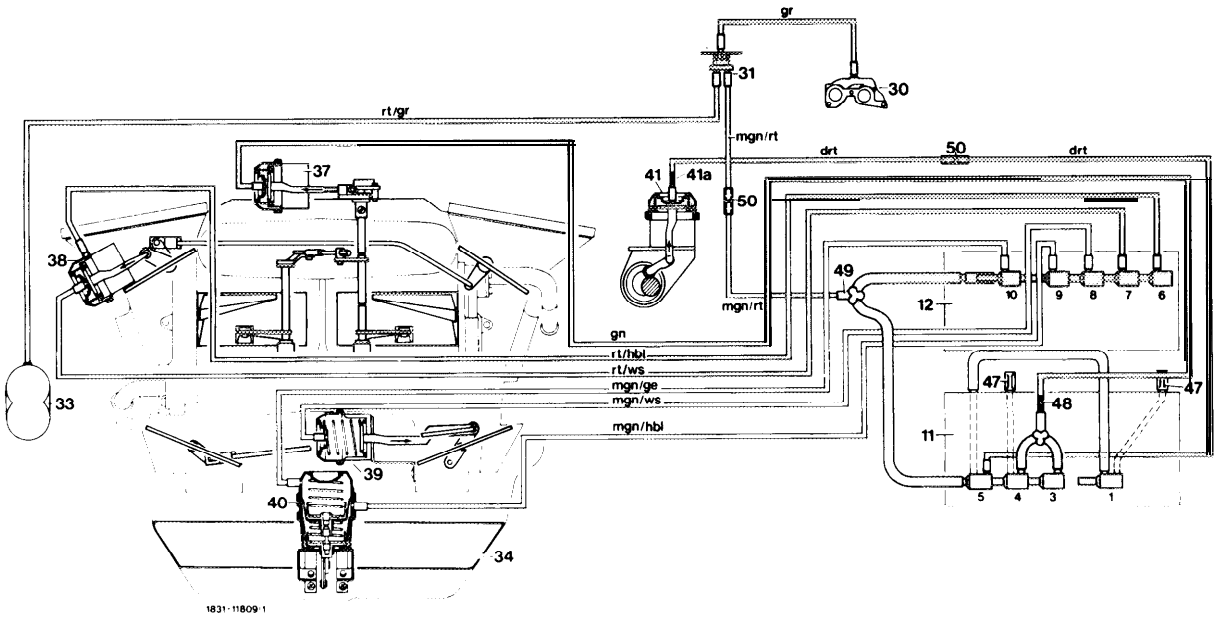
11 Switchover valve unit,4 connections
- 11.4 Switchover valve for blend air flaps ("cold")
- 11.3 Switchover valve for blend air flaps ("warm")
- 11.5 Switchover valve for heater valve ("closed")
- 11.1 Switchover valve for heater valve ("open")

12 Switchover valve unit, 5 connections
- 12.8 Switchover valve for legroom flaps
- 12.9 Switchover valve for fresh air/ recirculating air flap (small stroke)
- 12.10 Switchover valve for fresh air/ recirculating air flap (large stroke)
- 12.6 Switchover valve for defroster nozzle valves (small stroke)
- 12.7 Switchover valve for defroster nozzle flaps (large stroke)

13 Recirculating pump
14 Aspirator blower for in-car temperature sensor
15 Blower motor
16 Temperature switch
- a 100 °C for electromagnetic clutch, engine fan
- b 110 °C for auxiliary fan

17 Relay auxiliary fan pre-resistor
18 Pre-resistor auxiliary fan
19 Pressure switch auxiliary fan
On 20 bar/Off 15 bar
20 Relay auxiliary fan
21 Auxiliary fan
22 Pressure switch refrigerant compressor
On 2.6 bar/Off 2.0 bar
26 Switch, fresh air/recirculating air
132 Rpm sensor ring gear for flywheel
134/1 Microswitch for compressor cutout at full load (connected only on vehicles with automatic transmission)
141 Control unit compressor cutout
143 Electromagnetic clutch Refrigerant compressor
144 Rpm sensor, refrigerant compressor
A To electromagnetic clutch engine fan
B To control unit emission control, terminal 6
C To hazard warning switch (connection terminal 15)
D From seat belt indicator, terminal 8 (connection terminal 15)
E To control unit emission control, terminal 4
F To control unit electronic idle speed control terminal 10
G To kickdown switch
H To switchover valves for EGR
MI Main ground (behind instrument cluster)
M5 Ground connection, engine (unit screwed into engine)
M9 Ground connection, front left (near headlight)
M10 Ground connection, battery

B. Vacuum diagram



Mode selection cooling – fresh air

11 Swrtchover valve unit, 4 connectrons
- 11.5 Swrtchover valve for heater valve (“closed”)
- 11.4 Swrtchover valve for blend air flaps (“cold”)
- 11.3 Swrtchover valve for blend air tlaps (“warm”)
- 11.1 Swrtchover valve for heater valve (“open”)

12 Switchover valve unit, 5 connectrons
- 12.10 Swrtchover valve for fresh air/ recirculating air flap (large stroke)
- 12.9 Swrtchover valve for fresh air/ recirculating air flap (short stroke)
- 12.8 Swrtchover valve for legroom flaps
- 12.7 Swrtchover valve for defroster nozzle flaps (large stroke)
- 12.6 Swrtchover valve for defroster nozzle flaps (short stroke)

30 Vacuum connection on intake manifold
31 Check valve
33 Vacuum reservoir
34 Evaporator housing with fresh air/ recirculating air flap
37 Vacuum element for blend air flaps (“cold”)
38 Vacuum element for defroster outlet flaps (flaps “closed”)
39 Vacuum element for legroom flaps (flaps “closed”)
40 Vacuum element for fresh air/ recirculating air flap (flap “open”)
41 Vacuum element for heater valve (heater valve “closed”)
41a Orifice
47 Closing cap
48 Orifice (vented within 20 seconds)
49 3-point distributor
50 Connecting hose

bl = blue
drt = dark red
ge = yellow
gn = green
gr = grey
hbl = light blue
mgn = middle green
rt = red
ws = white

83-035 Testing refrigerating capacity of air conditioning system (quick test)

Data

Difference between coldest and warmest outlet temperature max. (cutting out/cutting in time of refrigerant compressor)	3 °C
Coldest air outlet temperature out of center nozzle (center outlet)	3.5 °C

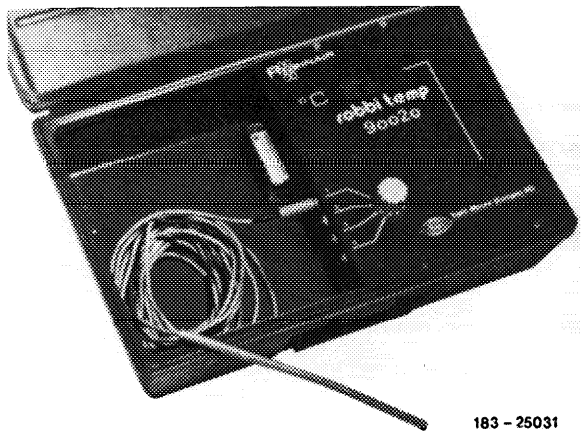
Conventional tools

2 thermometers	-20 °C to + 70 °C

Digital temperature measuring instrument with 4 measuring probes

Robbi temp	90020
Air temperature measuring probe (4.5 m cable length)	90023

Supplier e.g.:
Switzerland: Kent-Moore (Europe) AG
P.O. Box, Cl-l-6340 Baar
Germany: Fa. Kälte-Fischer
Postfach 266, Augsburger Str. 289-291
D-7000 Stuttgart 60

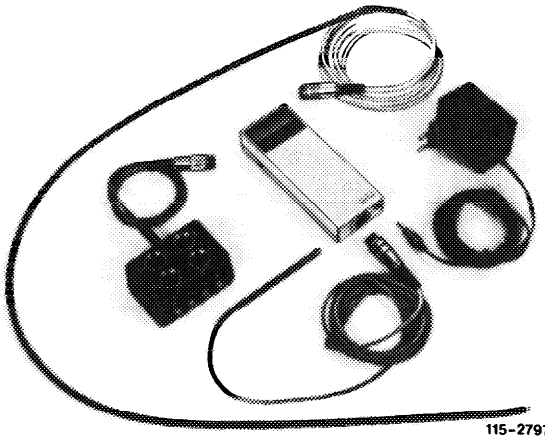


183 - 25031

Digital temperature measuring instrument with 4 measuring probes

Therm	2263-2
Measuring point changeover switch with 4 connections	2235-4
Air temperature measuring probe (3 m cable length)	w 453-5

Supplier e.g.:
Germany: Ahlborn Meß- und Regelungstechnik in der Eichenfeldstraße I-3, D-81 50 Holzkirchen


115-27973

Quick test

For air conditioning systems free of complaints. Test after minor repairs, longer stationary periods or the like.

Test procedure for ambient (interior) temperatures from +20 °C to +40 °C. Check values can be read after approx. 5 minutes.

Test conditions

1 The vehicle should not be in the sunlight during test.

2 Check tension of V-belt for compressor drive.

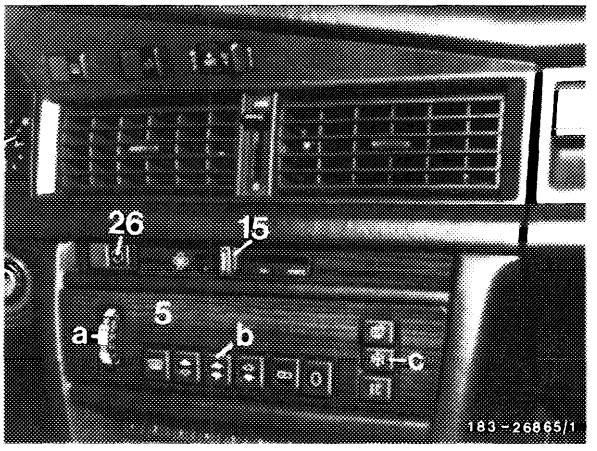
3 Check auxiliary fan for function, while switching on ignition and bypassing the two flat plugs on pressure switch (19), or connecting 1 -pin connector of 100 °C switch to ground. Pay attention to direction of rotation of auxiliary fan (clockwise).

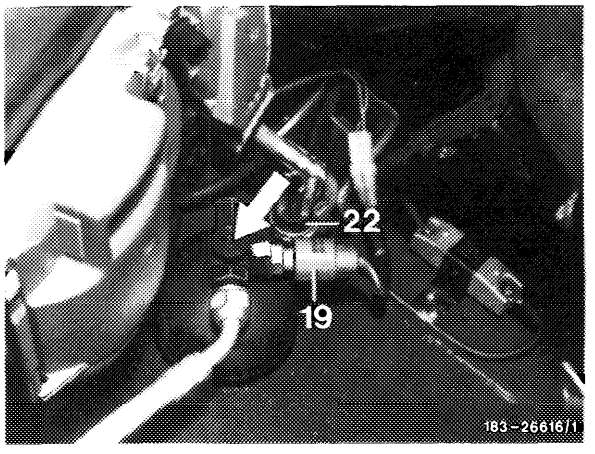
4 Check fluid level in air conditioning system; for this purpose, pull one line from pressure switch (22), run engine at idle (>700/min) and engage air conditioning system by means of function selection ⓜ. Clean sight-glass (arrow) in receiver drier. Watch sight-glass while simultaneously plugging line on pressure switch (22). Refrigerant should rise shortly after switching on electromagnetic clutch and should then flow free of bubbles (i.e. refrigerant no longer visible).

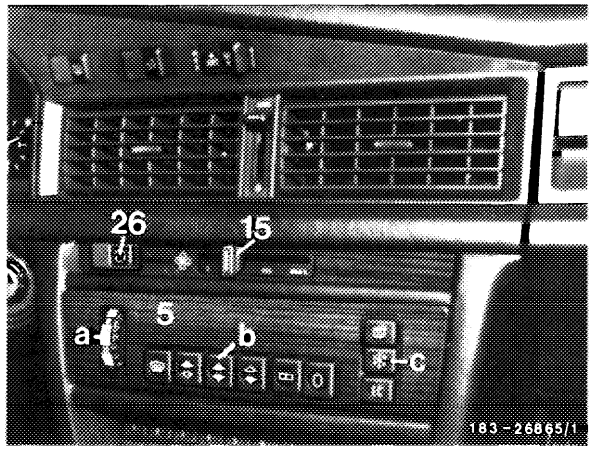
Attention1
In the event of major refrigerant losses or an empty system, the voltage for the refrigerant compressor is interrupted by the pressure switch (22). When the pressure increases to 0.6 bar above the cutout pressure, the circuit is again closed.

5 Check whether the heater shuts off in selector wheel position “MI N”. For this purpose, let engine run at idle and engage air conditioning system with function selection ❄. Set temperature selector wheel (a) to “MIN”. Refrigerant compressor should be on after 20 seconds at the latest.

Note: If the refrigerant compressor is not engaging, bridge lines from pressure switch (22) and check fluid level according to item 4. If the refrigerant compressor is still not engaging, test entire system with socket box and volt-ohmmeter, refer to 83-039. On model 201.024 starting model year 85 and on model 201 .122 there may be an additional fault on compressor cutout, for testing refer to 83-040.







1 Set temperature selector wheel (a) to 'MIN".

2 Switch on function selection ⊜ of pushbutton switch (b) and function selection ⊜ of switch air conditioning system (c).

3 Set blower switch (15) to 2nd blower stage.

4 Open center and side outlets and switch off switch (26) (fresh air).

5 Insert one thermometer into lefthand or right-hand center outlet (25).

6 Position one thermometer for ambient temperature (room temperature) approx. 2 m from driver's side outside vehicle.

7 Open window and close vehicle doors. Run engine at approx. 2000/min.

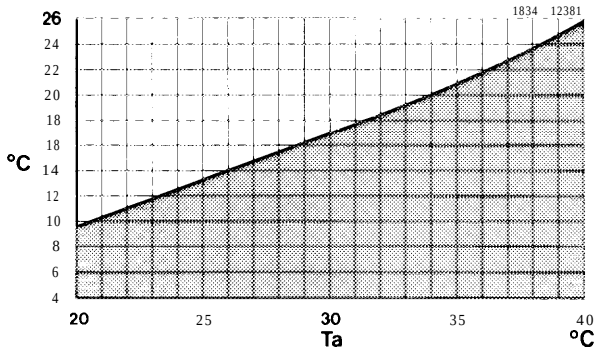


Diagram for model 201.024

Ta = Outside temperature "C

8 After approx. 5 minutes read air outlet temperature at center outlet and outside temperature and compare with data of diagrams.

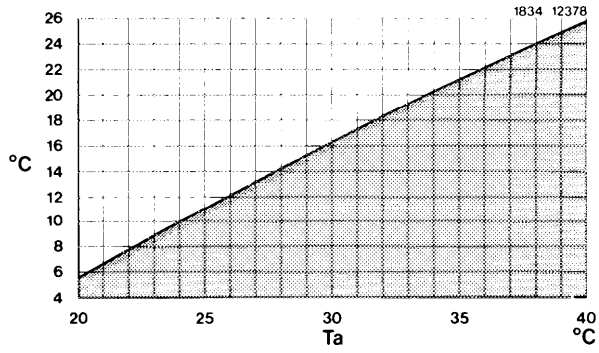


Diagram for model 201 .122

Ta = Outside temperature °C

Attention!

The air outlet temperature on center outlet should not be below +3.5 °C. If the value is less than specified, check temperature sensor of air conditioning system and renew, **if required, refer to 83-I 33 or test electric lines from temperature sensor for air conditioning to pushbutton switch unit for ground short. If there is no remedy, renew pushbutton switch unit.**

83-036 Testing refrigerating capacity and suction/high pressure of air conditioning system

Data

Difference between coldest and warmest outlet temperature max. (cutting out/cutting in time of refrigerant compressor)	3 ° C
Coldest air outlet temperature out of center nozzle (center outlet)	3.5 °C

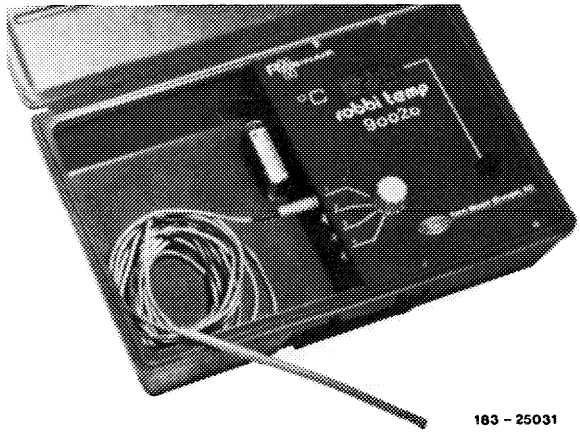
Conventional tools

1 suction pressure gauge	or assembly tester	1 bar vacuum to 10 bar gauge pressure
1 high pressure gauge		O-40 bar gauge pressure
2 thermometers		**-20 °C to + 70 "c**
1 hygrometer		

Digital temperature measuring instrument with 4 measuring probes

Robbi temp	90020
Air temperature measuring probe (4.5 m cable length)	90023

Supplier e.g.:
Switzerland: Kent-Moore (Europe) AG
P.O. Box, CH-6340 Baar
Germany: Fa. Kälte-Fischer
Postfach 266, Augsburger Str. 289-291
D-7000 Stuttgart 60

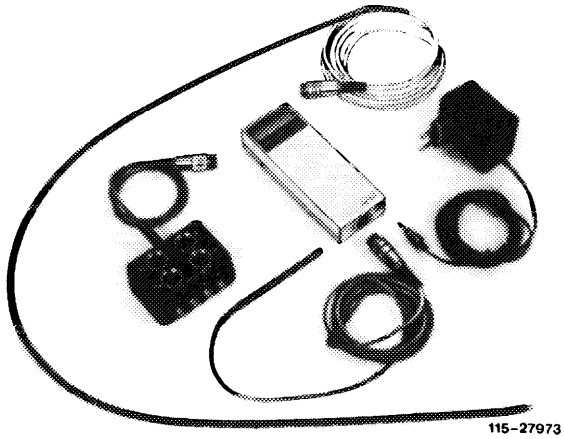


183 - 25031

Digital temperature measuring instrument with 4 measuring probes

Therm	2263-2
Measuring point changeover switch with 4 connections	2235-4
Air temperature measuring probe (3 m cable length)	w 453-5

Supplier e.g.:
Germany: Ahlborn Meß- und Regelungstechnik in der Eichenfeldstraße 1-3, D-81 50 Holzkirchen


115-27973

Functional test

In the event of complaints on air conditioning system or for trouble diagnosis.

For a checkup in workshop in the event of complaints owing to insufficient cooling capacity or for a trouble diagnosis on air conditioning systems, proceed according to test method applicable for ambient temperatures from +20 °C to +40 °C.
All test values can be read after 10 minutes constant operation.

Test conditions

1 The vehicle should not be in the sunlight during test.

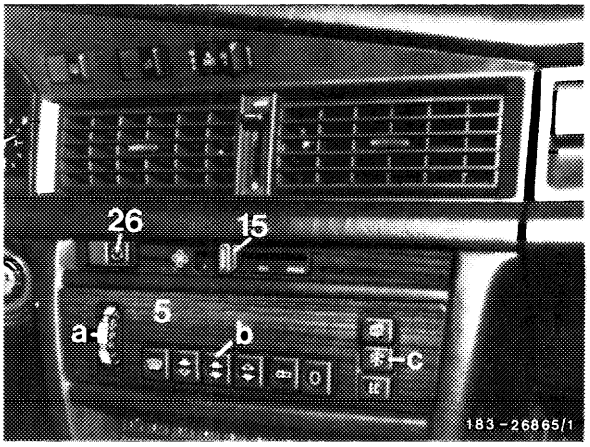
2 Check tension of V-belt for compressor drive.

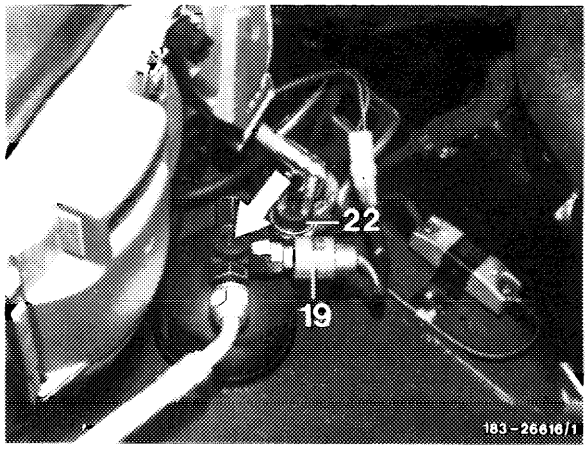
3 Check auxiliary fan for function, while switching on ignition and bypassing the two flat plugs on pressure switch (19), or connecting 1 -pin connector of 100 °C switch to ground. Pay attention to direction of rotation of auxiliary fan (clockwise).

4 Check fluid level in air conditioning system; for this purpose, pull one line from pressure switch (22), run engine at idle (>700/min) and engage air conditioning system by means of function selection . Clean sight-glass (arrow) in receiver drier. Watch sight-glass while simultaneously plugging line on pressure switch (22). Refrigerant should rise shortly after switching on electromagnetic clutch and should then flow free of bubbles (i.e. refrigerant no longer visible).

Attention!
In the event of major refrigerant losses or an empty system, the voltage for the refrigerant compressor is interrupted by the pressure switch (22). When the pressure increases to 0.6 bar above the cutout pressure, the circuit is again closed.

5 Check whether the heater shuts off in selector wheel position “MI N”. For this purpose, let engine run at idle and engage air conditioning system with function selection . Refrigerant compressor should be on after 20 seconds at the latest.



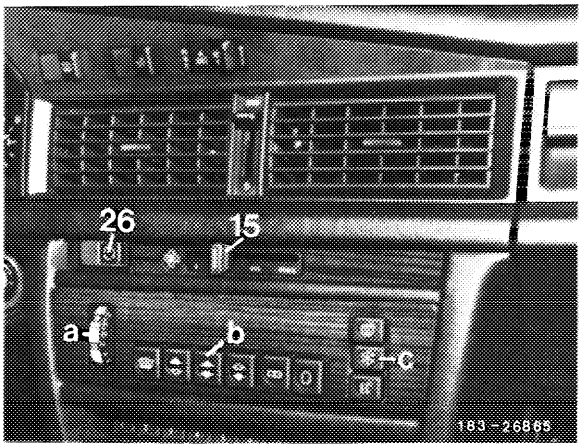


Note: If the refrigerant compressor is not engaging, bridge lines from pressure switch (22) and check fluid level according to item 4. If the refrigerant compressor is still not engaging, test entire system with socket box and volt-ohmmeter, refer to 83-039. On model 201.024 starting model year 85 and on model 201 .122 there may be an additional fault on compressor cutout, for testing refer to 83-040.

Testing

1 Set temperature selector wheel (a) to 'MI N".

2 Switch on function selection ⊖ of pushbutton switch (b) and function selection ⊖ of switch air conditioning system (c).



3 Set blower switch (15) to 4th blower stage.

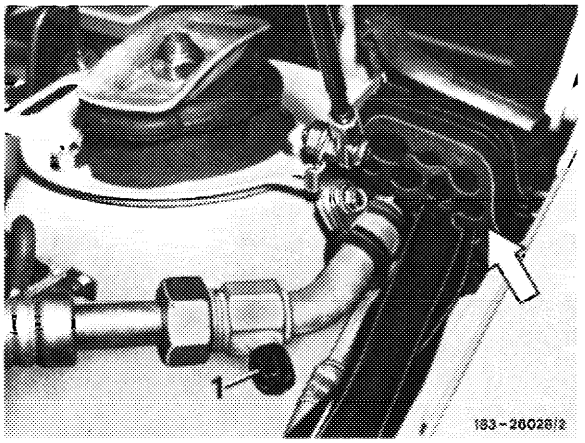
4 Open center and side outlets and switch off switch (26) (fresh air).

5 Insert one thermometer into lefthand or right-hand center outlet.

6 Position one thermometer for ambient temperature (room temperature) approx. 2 m from driver's side.

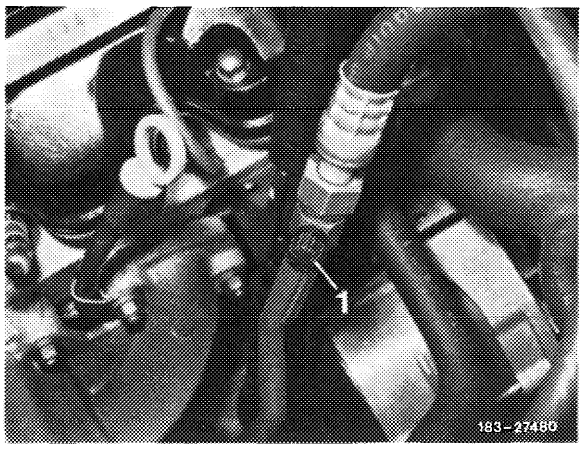
7 Place a hygrometer into tray of center console.

8 Unscrew closing caps (1). Then connect hose line of suction pressure or high pressure gauge to service valves. Make sure that the connecting nipple of the hose lines has a pressure pin in center.

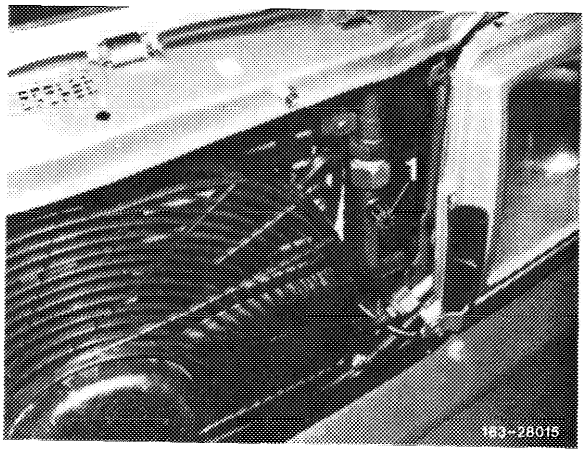


1 Closing cap of suction line on all models

9 Open window and close vehicle doors.

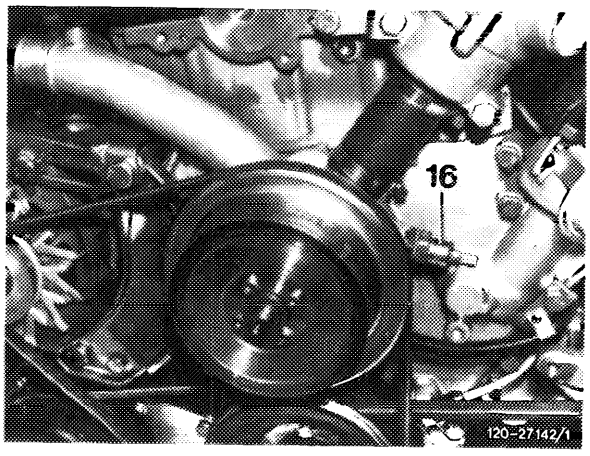


1 Closing cap on pressure line engine 102 up to model year 84

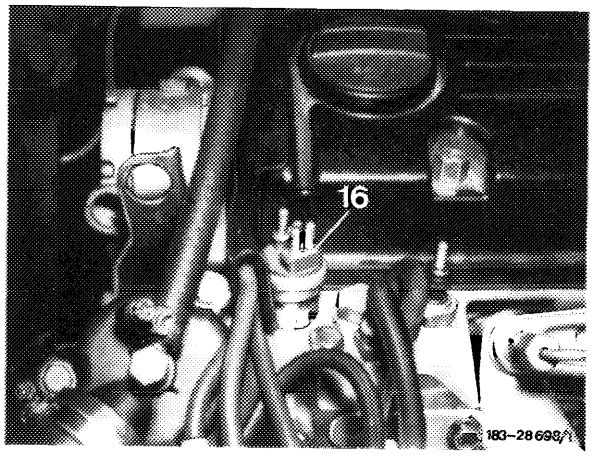


1 Closing cap on pressure line engine 601 and engine 102 starting model year 85

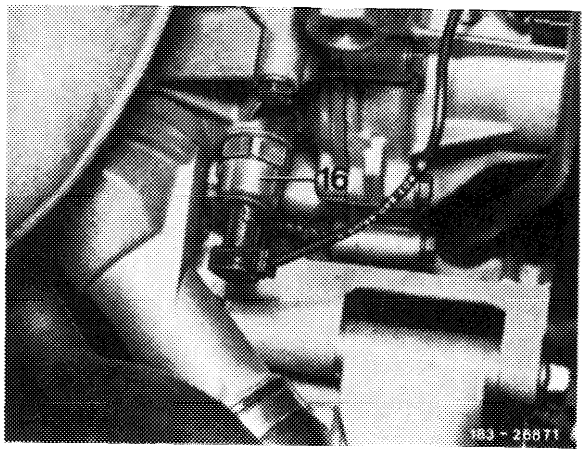
13 Pull 1 -pin connector from temperature switch 100 °C (16) and connect to ground, so that the auxiliary fan runs along during entire test procedure.



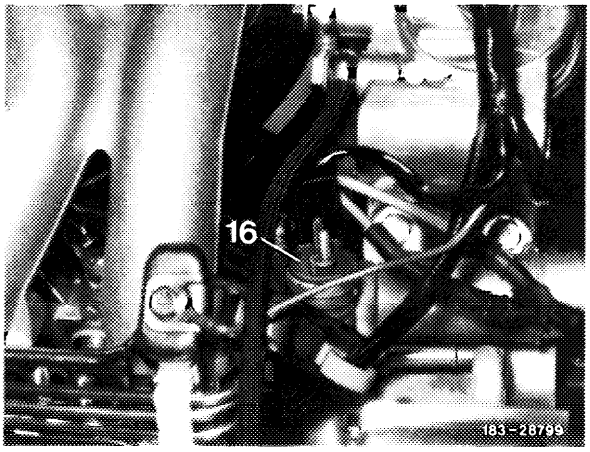
16 Temperature switch 100 °C engine 102 up to model year 84



16 Temperature switch 100 °C engine 102 starting model year 85



16 Temperature switch 100 °C engine 601 up to model year 84



16 Temperature switch 100 °C engine 601 starting model year 85

14 **Run engine at approx. 2000 rpm.**

15 After operating engine for approx. 10 minutes, read values on thermometers and pressure gauges, as well as on hygrometer.

Note: Specified values, refer to diagram, are max. values and must not be exceeded.

16 Check intake and high pressure in dependence of ambient temperature, using the diagrams for this purpose. Also check air outlet temperature (mean value of two cold air outlet temperatures) also according to diagram values. (The difference between the coldest and the warmest outlet temperature should not be higher than 3 °C). Check temperature sensor, if required, renew, if necessary (refer to 83–133) or connect new pushbutton switch unit for a tryout.

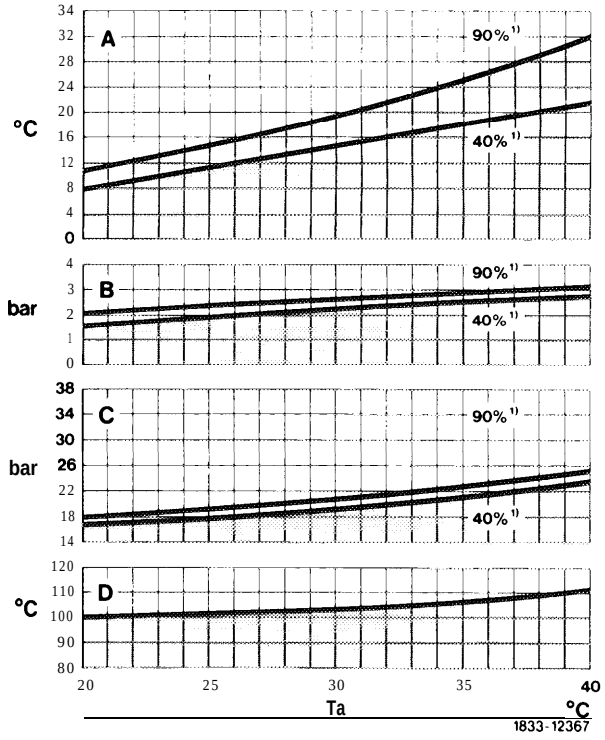


Diagram for model 201.024

1) Relative humidity
Ta Outside temperature (°C)
A Air outlet temperature (°C)
B Pressure in front of compressor (bar)
C Pressure following compressor (bar)
D Coolant temperature (°C)

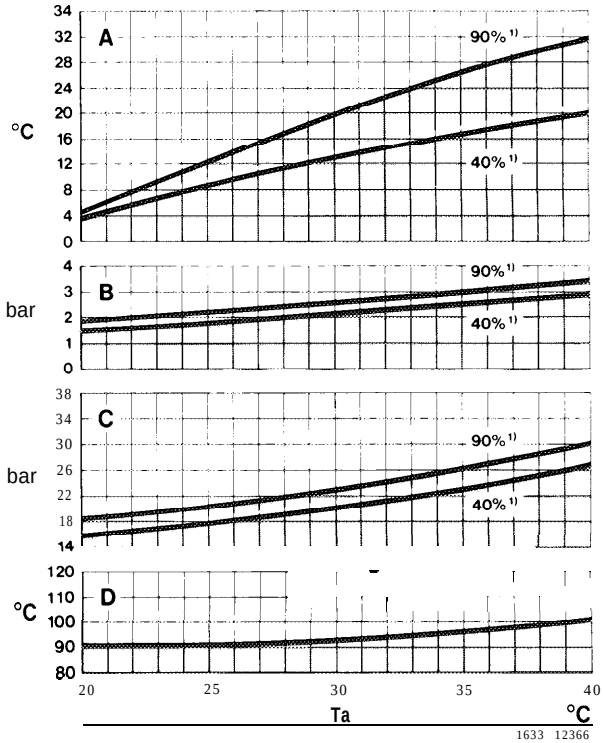


Diagram for model 201 .122

1)Relative humidity
Ta Outside temperature (°C)
A Air outlet temperature (°C)
B Pressure in front of compressor (bar)
C Pressure following compressor (bar)
D Coolant temperature (°C)

17 Check cutout temperature, setting blower switch (15) to stage 1 for this purpose. Run engine at approx. 2000 rpm. Following 3rd cutout of electromagnetic clutch the air outlet temperature at center outlet should not be less than approx. +3.5 °C.

Note: If the respective value is less than specified, check temperature sensor of air conditioning system and renew, if required, refer to 83-133 or test electric lines from temperature sensor of air conditioning system to pushbutton switch unit for ground short. If there is no remedy, renew pushbutton switch unit.

18 Take hose lines from service valves and close service valves again with closing caps.

19 Plug 1 -pin connector to temperature switch 100 °C(16).

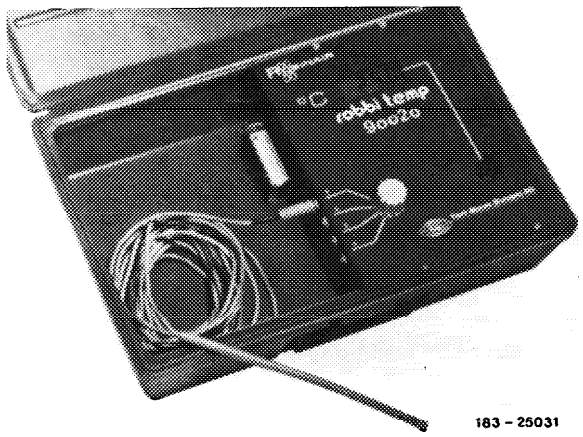
20 Remove thermometer and hygrometer from vehicle.

83-038 Testing control quality at different temperature adjustments, as well as heating capacity

Conventional tools

Digital temperature measuring instrument with 4 measuring probes
Robbi temp 90020
Air temperature measuring probe 90023
(4.5 m cable length)

Supplier e.g.:
Switzerland: Kent-Moore (Europe) AG
P.O. Box, CH-6340 Baar
Germany: Fa. Kälte-Fischer
Postfach 266, Augsburger Str. 289-291
D-7000 Stuttgart 60

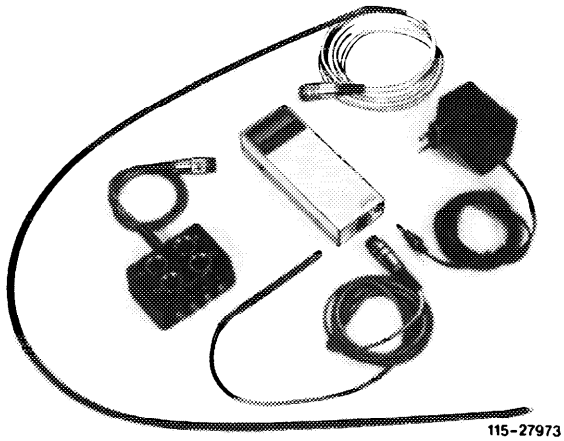


183 - 25031

Digital temperature measuring instrument with 4 measuring probes
Therm 2263-2

Measuring point changeover switch with 4 connections 2235-4
Air temperature measuring probe w 453-5
(3 m cable length)

Supplier e.g.:
Germany: Ahlborn Meß- und Regelungstechnik in der Eichenfeldstraße I-3, D-81 50 Holzkirchen.


115-27973

Data

Adjustment of temperature wheel	Temperature to be attained at headroom level °C
Engage prior to "MIN"	16 ± 1
22	22 ± 1
Engage prior to "MAX"	30 ± 2

Note

Perform test not in workshop, but on cooled-out vehicle parked overnight in the open air. In-car temperature < 20 °C.

Test conditions

1 Outside temperature $< 15\,^{\circ}C$ (possibly in the morning).

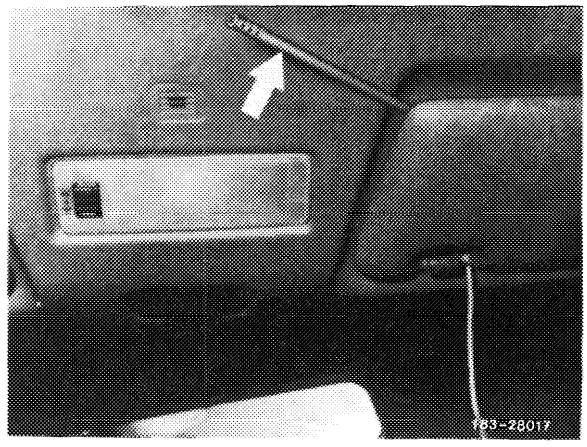
2 Driving time up to starting measurements approx. 10 minutes. At outside temperatures $< 0\,^{\circ}C$ a longer measuring drive will be required.

3 Windows and sliding roof closed.

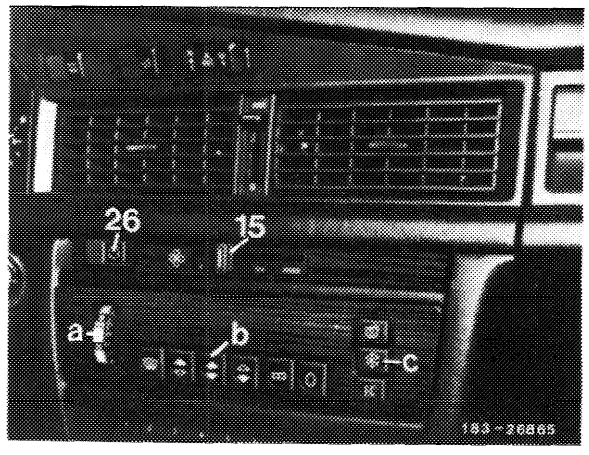
4 Do not run engine to operating temperature first.

Testing control quality

1 Apply measuring probe at sun vizor (right) (arrow) and connect to measuring instrument. Then switch on measuring instrument.



2 Engage mode selection ⛑ of pushbutton switch unit (b) and mode selection ❄ of switch air conditioning (c).



3 Set blower switch (15) to stage I I and switch off switch (26) (fresh air).

4 Close center outlet.

5 Set temperature wheel (a) to 22.

6 Start engine and drive off immediately (approx. 30-35 mph).

7 After approx. 1 O-l 5 minutes, read temperature on measuring instrument. Nominal value 22 $\pm 1\,^{\circ}C$. If the temperature is not attained, test system with socket box volt and ohmmeter (refer to 83–039).

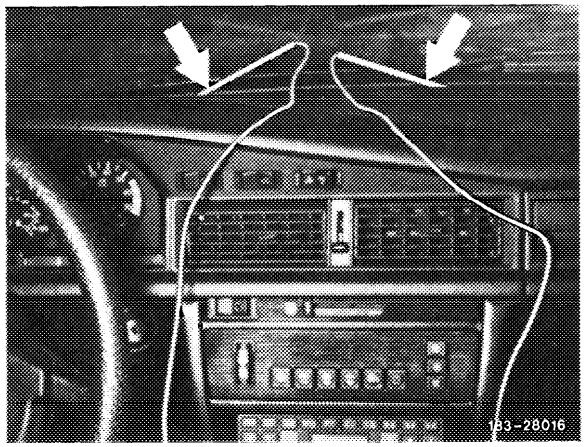
Note: Depending on complaint, test temperature prior to "MIN" engaged (corresponds to 16 $\pm 1\,^{\circ}C$) or prior to "MAX" (corresponds to 30 $\pm 2\,^{\circ}C$). Following each adjustment of temperature selector wheel, wait for approx. 7 minutes. If during adjustment prior to "MAX" the temperature is not attained, check heating capacity.

Checking heating capacity

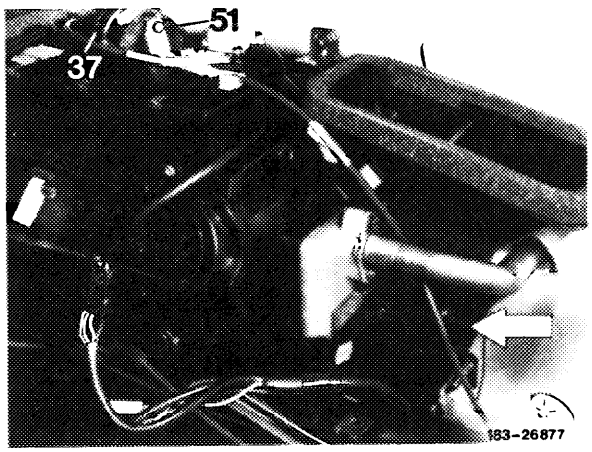
1 Plug one measuring probe (arrow) each into left-hand and righthand defroster nozzle.

2 Engage mode selection of pushbutton switch unit.

3 Run engine at operating temperature at approx. 2000 rpm for 5 minutes. Nominal value: > 55 °C.



Note: If the temperature is not attained, check whether the blend air flaps are fully open (perceived by the air coming out of righthand outlet, arrow) and recondition, if required. If in order, renew heater valve for a tryout and flush cooling system, if required. If there is no remedy, renew heat exchanger.



83-039 Testing system with socket box, volt and ohmmeter, and remedies

Special tools

Socket box	Test table for socket box
124 589 00 21 00	124 589046300

Note

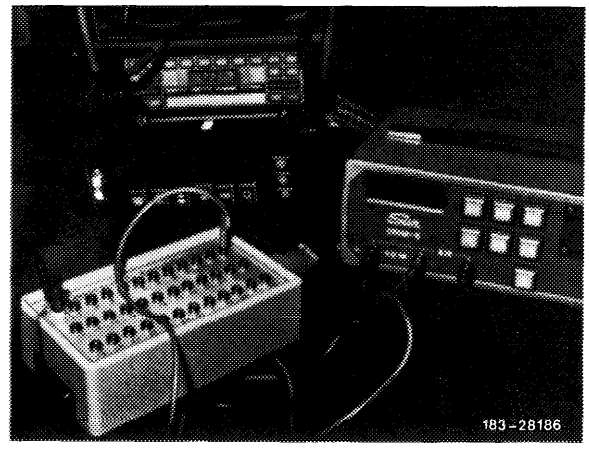
Perform test program if cause of trouble is unknown or if the in-car temperature set on temperature wheel is not attained.

Prior to starting the following test, check fuses 1 and 3 in electric center.

Preparations for test

1 **Remove pushbutton switch unit (refer to 83-I 12).**

2 Connect socket box to harness for pushbutton switch unit by connecting the line of socket box marked red with lacing of harness marked red (pushbutton switch unit remains disconnected up to test step 3).

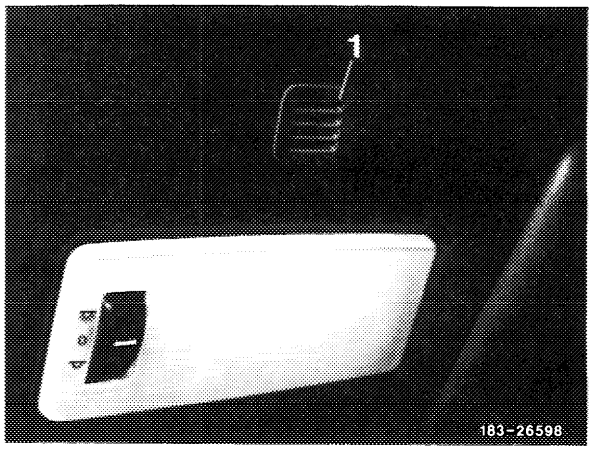


Test program

Test step 1

Testing in-car temperature sensor (1) with lines.

Ohmmeter on sockets	Ambient temperature in °C	Nominal value in kΩ
1 and 21	+15	15.2 – 17.2
	+20	11.5 – 13.5
	+25	9.5 – 10.5
	+30	7.5 – 8.5
	+35	6.0 – 7.0
	+40	4.5 – 5.5
	+45	3.5 – 4.5



Yes	No

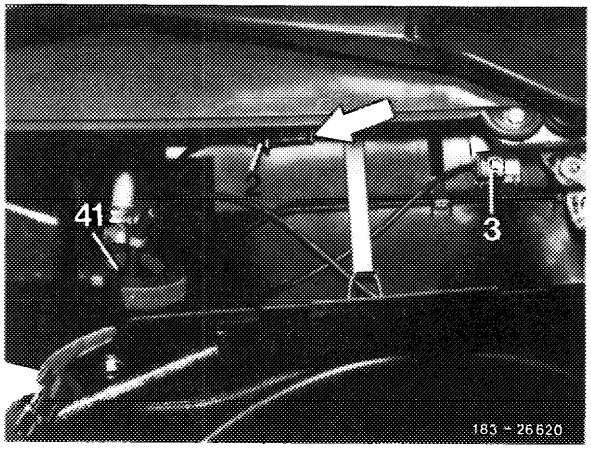
1. Test line 9 of lefthand connector and line 12 of righthand connector for interruption or line 9 of lefthand connector for ground short.

2. Renew in-car temperature sensor (1) (83–130).

Test step 2

Testing outside temperature sensor (2) with lines.

Ohmmeter on sockets	Ambient temperature in °C	Nominal value in kΩ
1 and 22	+15	4.0 – 4.6
	+20	3.1 – 3.9
	+25	2.4 – 3.0
	+30	1.9 – 2.3
	+35	1.6 – 2.0
	+40	1.4 – 1.6
	+45	1.1 – 1.3



Yes	No

1. Test line 10 of lefthand connector for interruption or ground short..

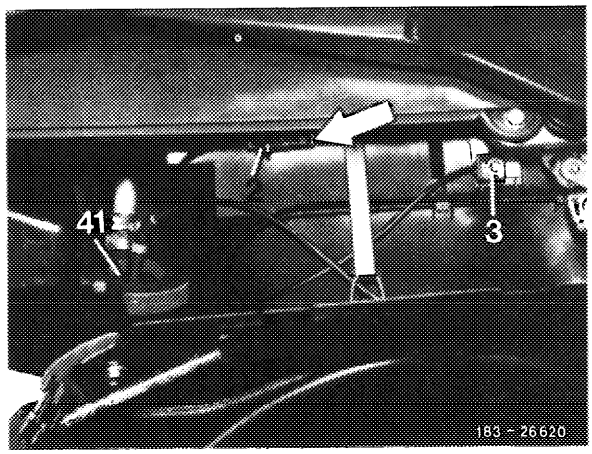
2. Renew outside temperature sensor (2) (83–132).

Test step 3

Testing temperature sensor air conditioning system (3) with lines.

Ohmmeter on sockets	Ambient temperature in °C	Nominal value in kΩ
1 and 19	0	57 – 67
	+5	46 – 54
	+10	37 – 45
	+15	31 - 36
	+20	24 – 28
	+25	20 – 24
	+30	14 - 16
	+35	13 - 15

Yes | No



1. Test line 7 of lefthand connector for interruption or ground short.

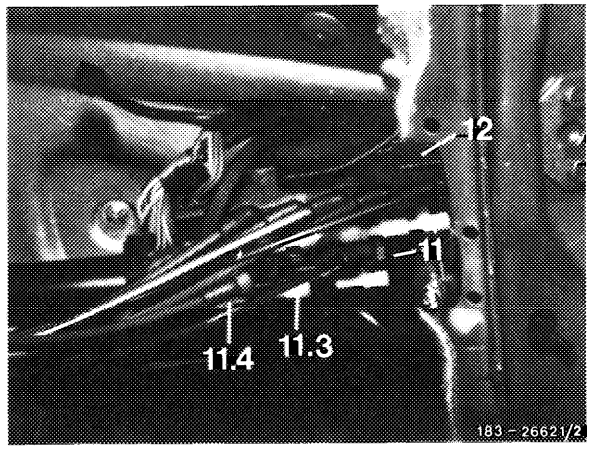
2. Renew temperature sensor air conditioning system (3) (83-193).

Test step 4

Testing switchover valve unit with 4 connections (11) and lines for interruption or ground short.

Ohmmeter on sockets	Nominal value in Ω
10 and 12 10 and 14 10 and 16	60 – 70

Yes | No



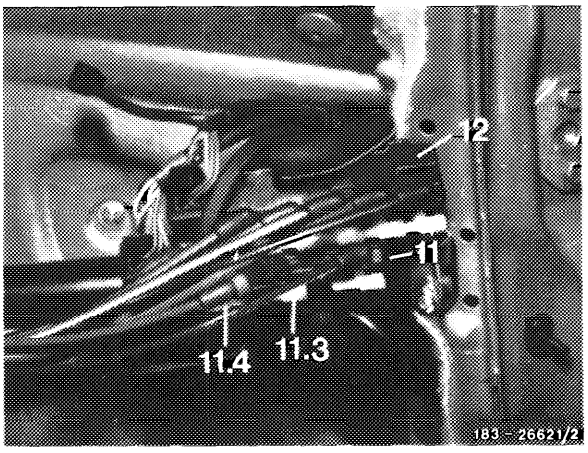
1. Test lines 1, 2 and 4 of lefthand connector for interruption or ground short.

2. Renew switchover valve unit with 4 connections (11) (83-I 53).

Test step 5
Testing switchover valve unit with 5 connections (12) and lines for interruption or ground short.

Ohmmeter on sockets	Nominal value in Ω
10 and 2	
10 and 3	
10 and 5	**60 — 70**
10 and 6	
10 and 12	

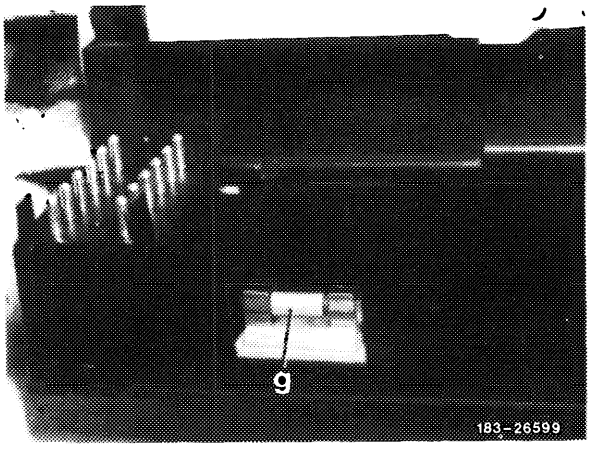
Yes	No



1. Test lines 1, 2, 3, 5 and 6 of righthand connector for interruption or ground short.

2. Renew switchover valve unit with 5 connections (83–153).

Preparations for test step 6-9
Test fuse (g) on pushbutton switch unit with ohmmeter in installed condition. Then connect both connectors from socket box to pushbutton switch unit, while plugging line with red adhesive tape to lefthand plug of pushbutton switch unit. Let engine run at idle.



Test step 6
Testing voltage supply for pushbutton switch units (input).

Voltmeter on socket	Nominal value
1 –	
10 +	> 11 V

Yes	No

Fuse No. 11 defective or line interrupted.

Test step 7
Testing voltage supply for blower switch, recirculating pump and refrigerant compressor (input).

Voltmeter on socket	Nominal value
1 –* 9 –**	
9 +* 10 +**	> 11 v

*up to model year 84 **starting model year 85

Yes	No

Fuse No. 1 defective or line interrupted.

Test step 8
Testing voltage supply for recirculating pump.

Voltmeter on socket	Mode selection button	Nominal value
1 –* 7 –**		
7 +* 10 +**		> 11 v

*up to model year 84 **starting model year 85

Yes	No

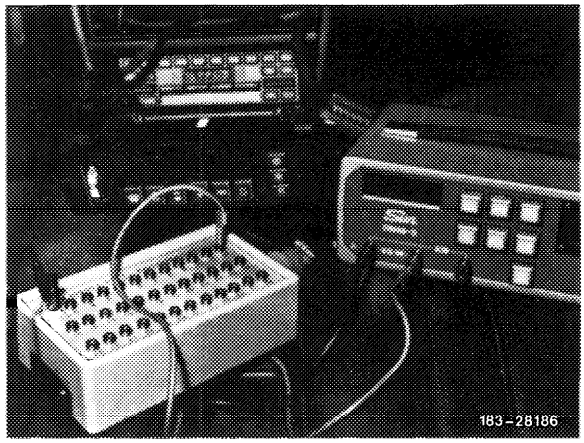
Test step 9
Testing voltage supply for refrigerant compressor.

Voltmeter on socket	Mode selection buttons	Nominal value after 20 s
1–* 18–**		> 11 v
18+*10+**	Engage temp. wheel at "MI N"	

*up to model year 84 **starting model year 85

Yes	No

Preparation for test step **10–20**
Connect positive of voltmeter to socket 10. Positive of voltmeter remains connected to socket 10 up to test step 19.



Test step 10
Testing voltage supply for blower switch stage 1 to max.

Voltmeter on socket	Mode selection button	Nominal value
4		> 11 v

Yes	No

Test step 11
Testing voltage supply for blower switch stage max.

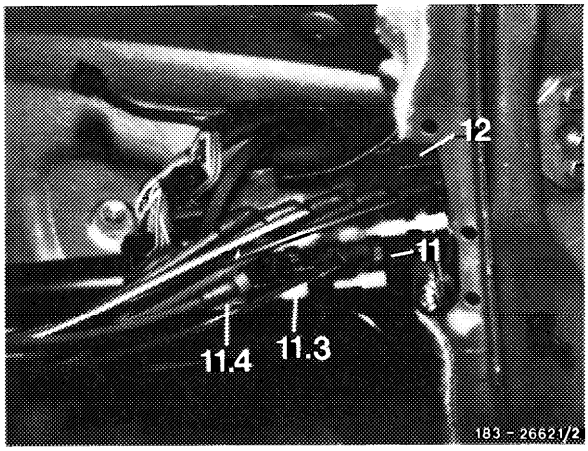
Voltmeter on socket	Mode selection button	Nominal value
8		> 11 V

Yes	No

Test step 12
Testing voltage supply for switchover valve of blend air flaps "cold" (11.4).

Voltmeter on socket	Mode selection button	Nominal value after 10 s
13	Engage temp. wheel at "MI N"	> 11 V

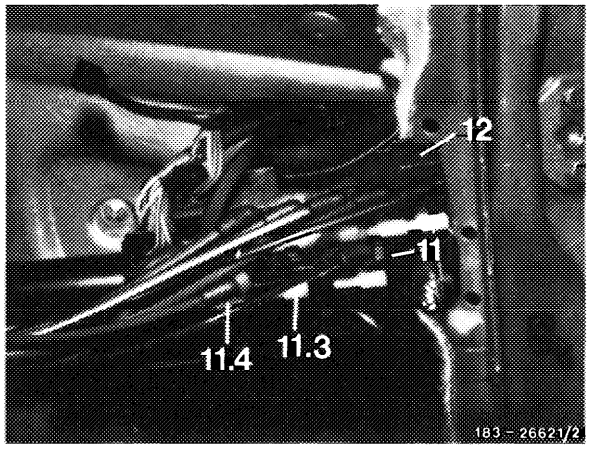
Yes	No



Test step 13
Testing voltage supply for switchover valve of blend air flaps "warm" (11.3).

Voltmeter on socket	Mode selection button	Nominal value after 10 s
16	Engage temp. wheel at "MAX"	> 11 V

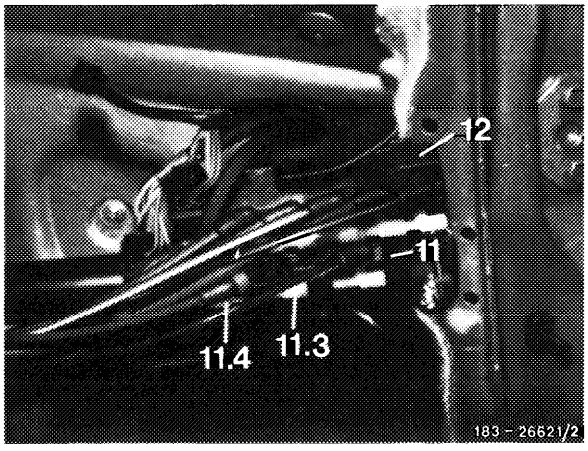
Yes	No



Test step 14
Testing voltage supply for switchover valve of heater valve (11.5).

Voltmeter on socket	Mode selection button	Nominal value after 10 s
14	Engage temp. wheel at "MI N"	> 11 v

Yes	No



Test step 15
Testing voltage supply for switchover valve of legroom flaps (12.8).

Voltmeter on socket	Mode selection button	Nominal value each
5	then	> 11 v

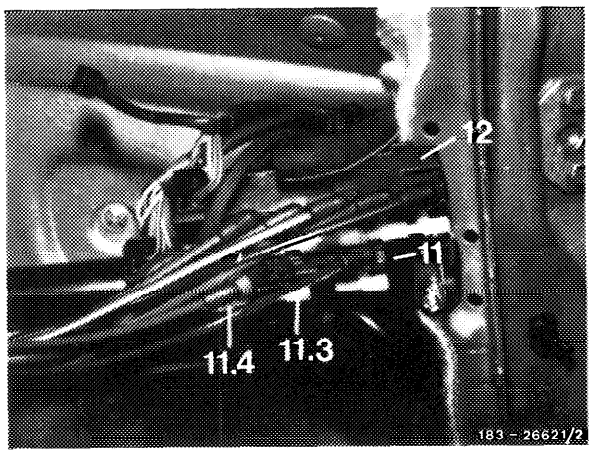
Yes	No

Test step 16

Testing voltage supply for switchover valve of fresh air/recirculating air flap, short stroke (12.9).

Voltmeter on socket	Mode selection button	Nominal value
2		> 11 v

Yes | No

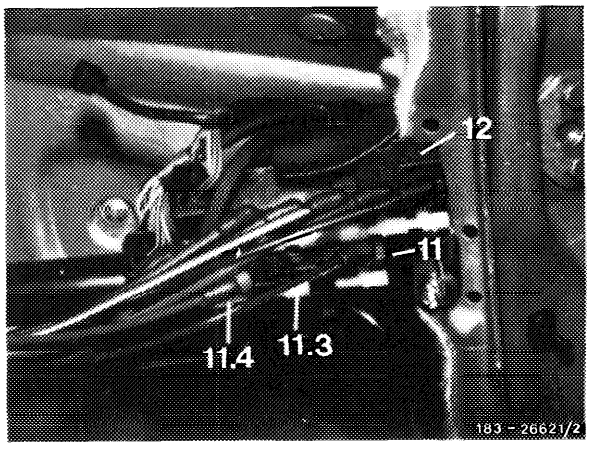


Test step 17

Testing voltage supply for switchover valve of fresh air/recirculating air flap, long stroke (12.10).

Voltmeter on socket	Mode selection buttons	Nominal value after 10 s
12	Engage temp. wheel at "MIN"	> 11 v

Yes | No



Test step 18

Testing voltage supply for switchover valve of defroster nozzle flaps, short stroke (12.6).

Voltmeter on socket	Mode selection button	Nominal value
3		> 11 v

Yes | No

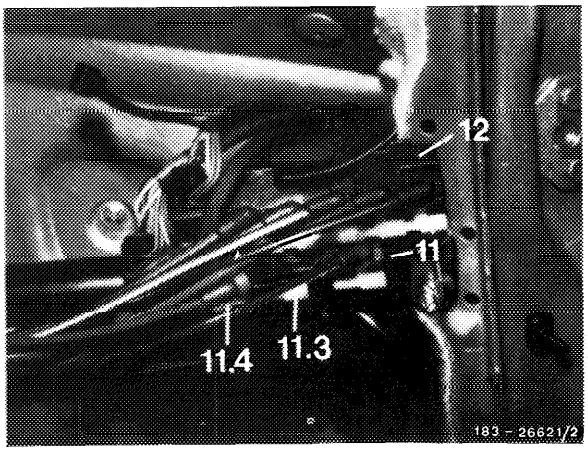
Test step 19

Testing voltage supply for switchover valve of defroster nozzle flaps, long stroke (12.7).

Voltmeter on socket	Mode selection button	Nominal value
6		> 11 V

Yes | No

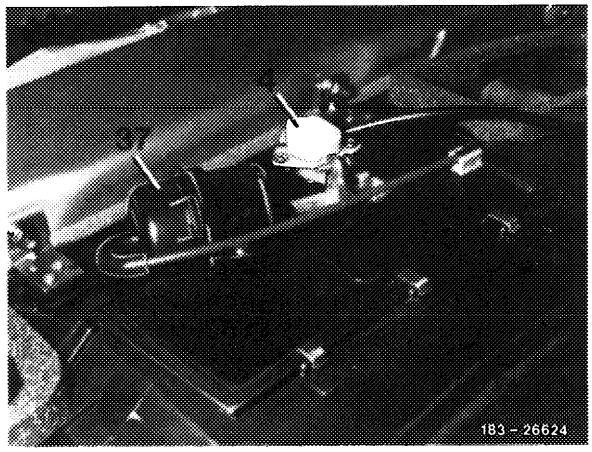
Exchange push-button switch unit.



Test step 20
Testing potentiometer for flap position (4).

Voltmeter on socket	Mode selection button	Nominal value each after 40 s
17+		
1–	Engage temp. wheel at	
	"MIN",	3.9 – 4.4 v
	then at "MAX"	0.3 – 1.2 V

Yes	No



1. Renew pushbutton switch unit for tryout.

2. Adjust potentiometer for flap position, renew if required (83–134).

Attention!
If there is no voltage change, test heater vacuum system for leaks (83-045). If the vacuum system is leaktight, renew switch-over valve unit with 4 connections (83-I 53).

End of test

A. Testing with electromagnetic clutch of refrigerant compressor not connected

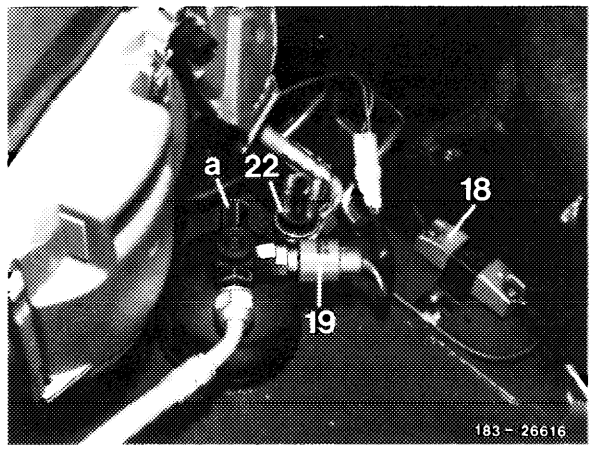
Attention!
A prerequisite for test is perfect functioning of refrigerant compressor activation.
For this purpose:

- Switch on ignition, push mode selection button and for air conditioning system.

- Connect voltmeter to blue/white line (input) of pushbutton refrigerant compressor (22) and up to model year 84 to vehicle ground, starting model year 85 to positive. Nominal value: battery voltage. If there is no voltage, test air conditioning system according to wiring diagram (refer to 83-028).

- Connect voltmeter to blue/red line (output) of pushbutton switch refrigerant compressor (22) and up to model year 84 to vehicle ground, starting model year 85 to positive. Nominal value: battery voltage.

If there is no voltage, test high pressure of air conditioning system. Renew pushbutton switch (22) at a pressure of > 3 bar.
Refill air conditioning system at a pressure of < 2 bar and eliminate leak.



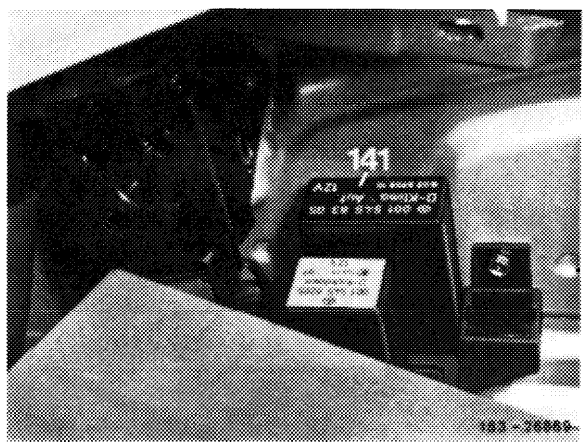
Testing **voltage supply** for **control unit compressor cutout (141)**

Pull control unit (141) from 12-pin connector. Connect voltmeter to terminal 5 + and terminal 1 – of 12-pin connector.

Nominal value: battery voltage

Yes	No

Test harness according to wiring diagram (refer to 13-028) and recondition, if required.



Testing control voltage for refrigerant compressor of pushbutton switch refrigerant compressor (22) to control unit (141)

Connect
voltmeter to terminal 10+* 5+** / 1−* 10−**
of 12-pin connector.
***up to model year 84 **"starting model year 85**

Nominal value: battery voltage

Yes	No

Test harness from terminal 10 to pressure switch (22) and recondition, if required.

Testing electromagnetic clutch refrigerant compressor and supply line

Bridge terminal 5 and 7 on 12-pin connection. Start engine for a short moment and check whether refrigerant compressor is running.

Yes	No

Test electromagnetic clutch of refrigerant compressor and renew, if required (refer to 83-526) or recondition supply line for refrigerant compressor.

Testing rpm sensor refrigerant compressor (144)

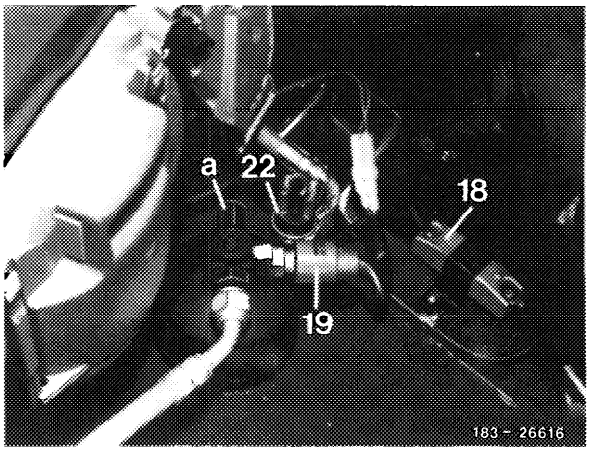
Connect voltmeter to terminal 9 and 11 of 12-pin connector and set voltmeter to alternating voltage ~. Terminal 5 and 7 of 12-pin connection remain bridged.

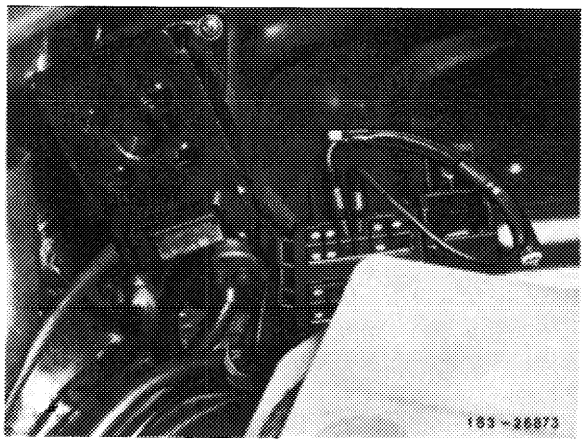
Run engine at idle speed (approx. 750 rpm).

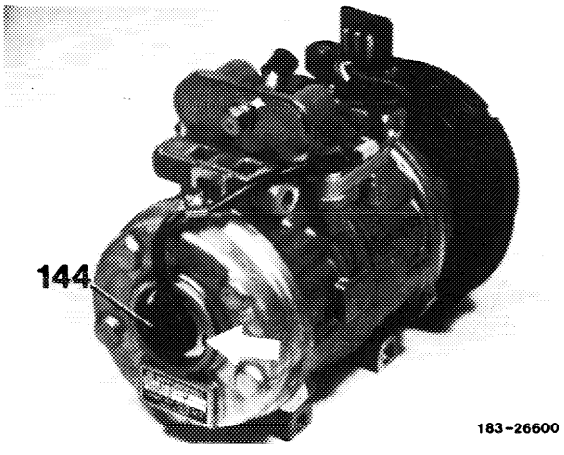
Nominal value: min. 0.3 V ~

Yes	No

Stop engine and test resistance of rpm sensor (144) on terminal 9 and 11.
Nominal value: 530 to 650 Ω, renew rpm sensor, if required (refer to 83-516).







Model 201 with gasoline engine

Testing transistorized rpm signal (TD)

Connect voltmeter to terminal 1 and 2 of 12-pin connector and set voltmeter to DC. Run engine at idle speed (approx. 750 rpm).
Nominal value: approx. 8.5 V

Model 201 with diesel engine

Testing rpm sensor on starter ring gear

Connect voltmeter to terminal 1 and 2 of 12-pin connector and set voltmeter to AC. Run engine at idle speed (approx. 750 rpm).

Nominal value: approx. 4 V ~[1])

[1]) Increasing voltage at increasing engine speed

Yes

Model 201 with gasoline engine
Eliminate interruption to line connector of diagnosis socket.

Model 201 with diesel engine
Stop engine and test resistance of rpm sensor (132) on terminal 1 and 2.

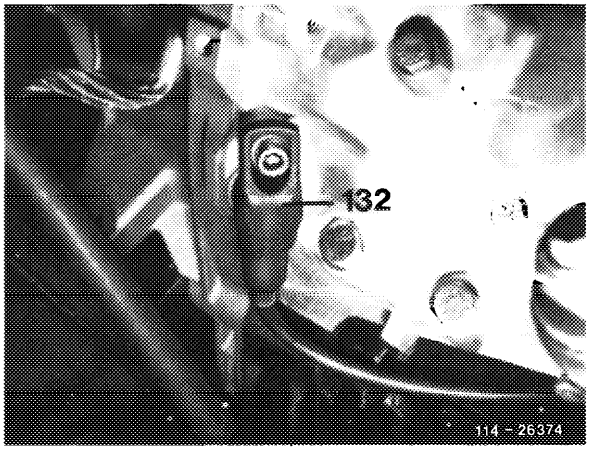
Nominal value: 1.9 ± 0.2 kΩ, renew rpm sensor, if required (refer to 83-517).

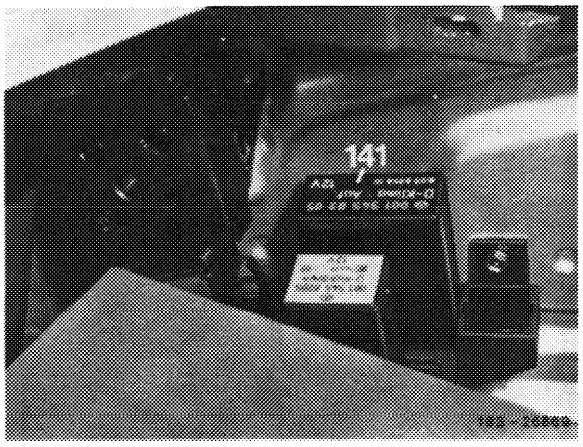
No

Renewing control unit (141).

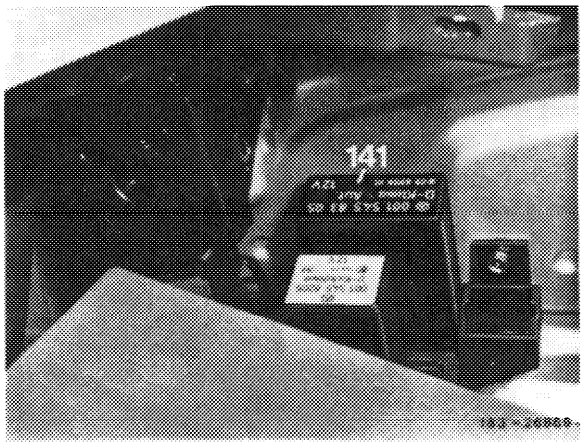
Testing air conditioning for function.

End of test





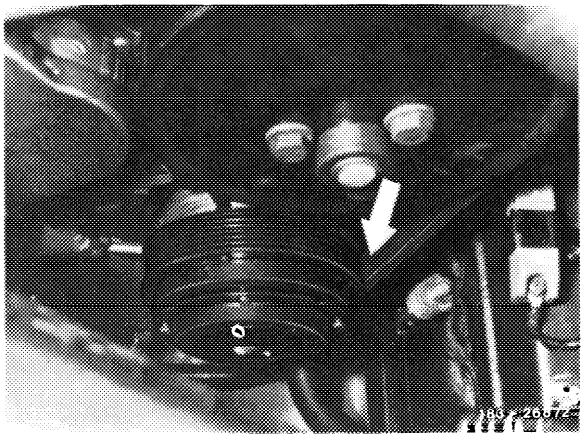
B. Testing cutout of electromagnetic clutch of refrigerant compressor via control unit compressor cutout (141)



Run engine at idle speed.

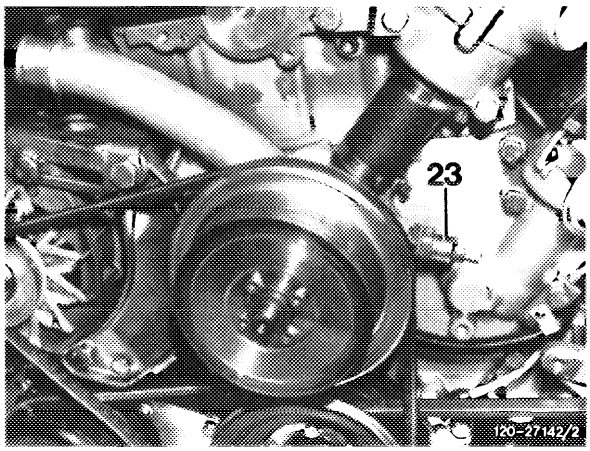
2 Engage temperature wheel to "MIN", set blower to stage 4 and adjust mode selection buttons and

3 Spray with a water jet in-between V-belt and pulley of electromagnetic clutch of refrigerant compressor until the refrigerant compressor is switched off, while applying intermittent acceleration. If the refrigerant compressor is not switched off by control unit (141), renew control unit.



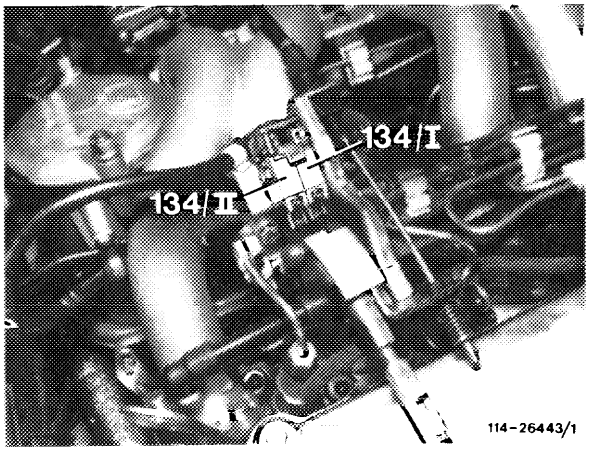
Attention!
Following cutout of refrigerant compressor, the compressor may be started again via control unit (141) after stopping and renewed starting of engine.

4 On model 201 with gasoline engine, check whether the refrigerant compressor is switched off by temperature switch **110** °C **(23).** For this purpose, start engine again, pull 1 -pin connector from temperature switch **110** °C (23) and connect to ground.



The refrigerant compressor must be switched off immediately. If required, eliminate line interruption or renew control unit (141).

5 On model 201 with diesel engine and automatic transmission, check whether refrigerant compressor is switched off by microswitch 134/1, as follows:
Run engine at idle. Watch electromagnetic clutch of refrigerant compressor and apply full throttle for a short moment. The electromagnetic clutch must remain switched off up to 2150 rpm and then switch on again. If the electromagnetic clutch is not switched off, renew microswitch 134/1 or control unit 141.

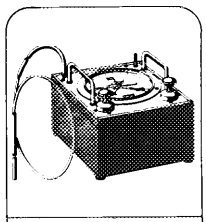


83-045 Testing vacuum system for blend air flaps, fresh air/recirculating air flap, defroster nozzle flaps, legroom flaps and heater valve for leaks

Data

Permissible leaking per vacuum circuit (without vacuum reservoir)	**30 mbar/min at 400 mbar vacuum**
Permissible leaking of check valve	**60 mbar in 10 min at 300 mbar vacuum**
Permissible leaking of remaining components	**20 mbar/min at 300 mbar vacuum**

Special tools



201 589 13 21 00

Self-made tool

1 blind plug	**0009871145**

Note

The vacuum test is subdivided into 5 test circuits (A to E). In the event of a given fault (e.g. legroom flaps not opening) the respective circuit can be tested first.

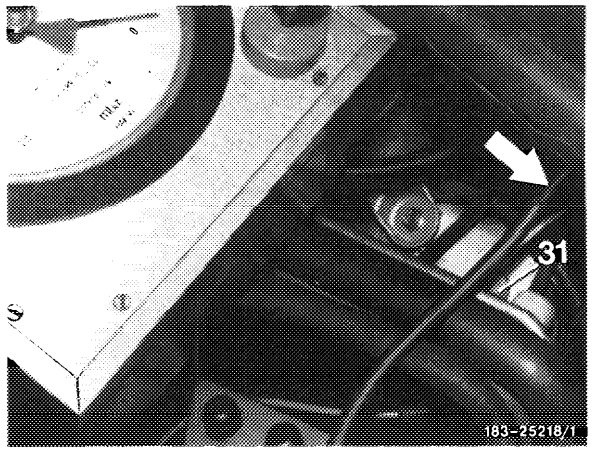
If a leak is suspected in entire vacuum system for heating, start with test step "a" and "b" and then test all the test circuits completely until the faulty vacuum circuit is found.

a) Testing **check valve (31)**

1 Pull vacuum line medium green/red and red/grey (on model 201.024 only) from check valve (31). Connect tester (arrow) to one of the two connections.

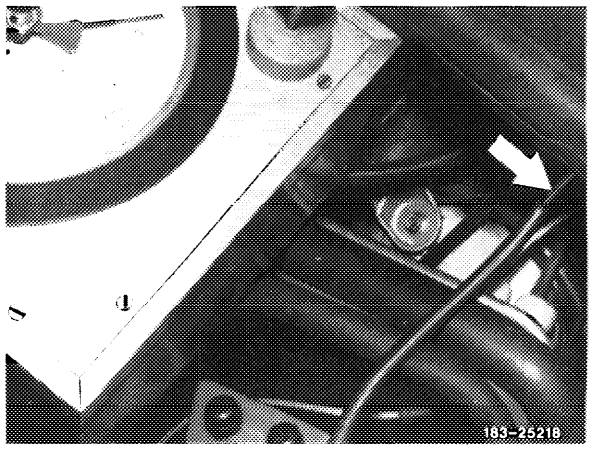
2 On model 201.024, close second connection on check valve with blind plug. Then evacuate with tester and read pressure gauge.

3 If the pressure gauge indicates an increase in pressure, renew check valve.



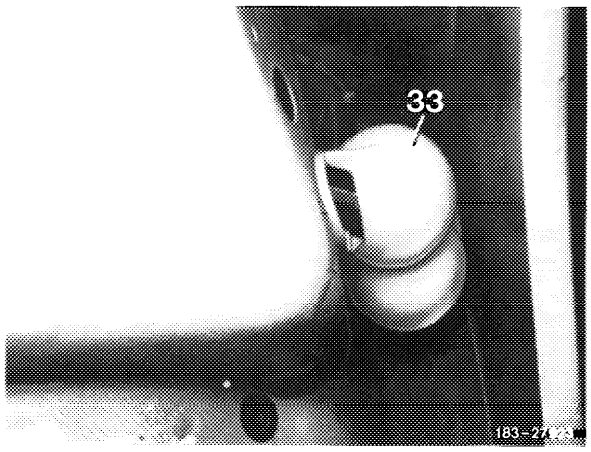
b) Testing vacuum reservoir (33) with vacuum line red/grey (model 201.024 only)

4 Pull vacuum line red/grey from check valve (31) and connect tester (arrow) to vacuum line.



5 Evacuate with tester and read pressure gauge.

6 If readout on pressure gauge changes, remove reservoir (33) and check for leaks. Renew, if required or renew vacuum line red/grey.



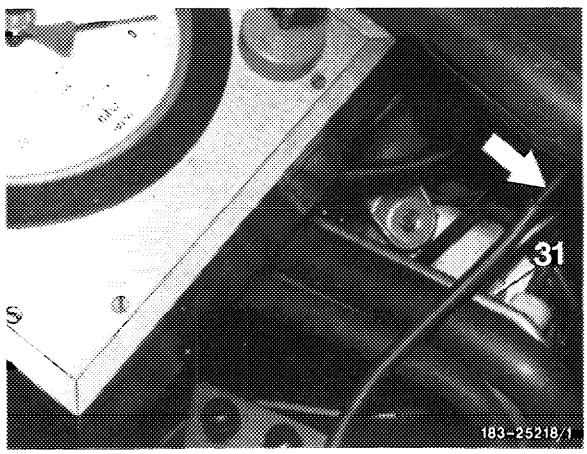
Layout vacuum reservoir (33) under front fender left (model 201.024 only)

Preparing for test

1 Pull vacuum line medium green/red from check valve (31) and connect tester to vacuum line.

2 Switch on ignition.

Note: The tester remains connected during entire test on vacuum line medium green/red.

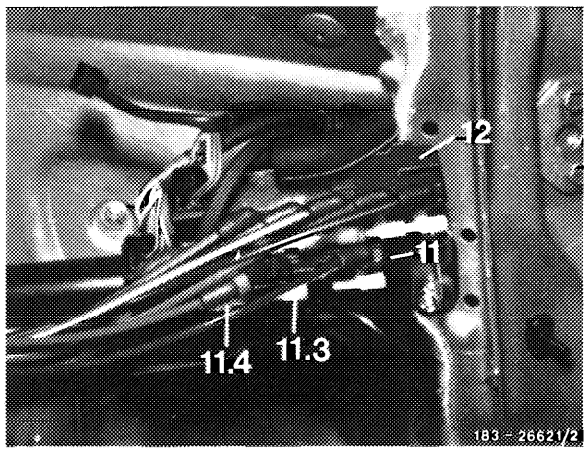


A. Testing vacuum circuit 1, vacuum line medium green/red and input of valve unit 11 and 12

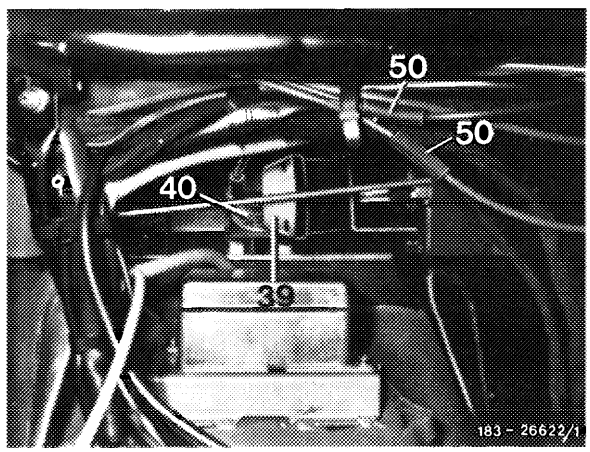
1 Push mode selection button (VW) on pushbutton switch unit.

2 Evacuate with tester (approx. 400 mbar) and read pressure gauge.

3 If readout on pressure gauge changes, test switchover valve unit (11) and (12) individually and test vacuum line medium green/red and renew, if required.



Note: If a leak shows up on vacuum unit medium green/red, the leak may also be on connecting hose (50) (maybe pulled off).

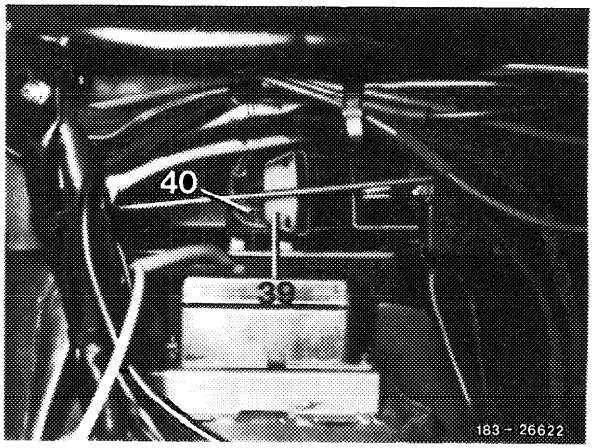


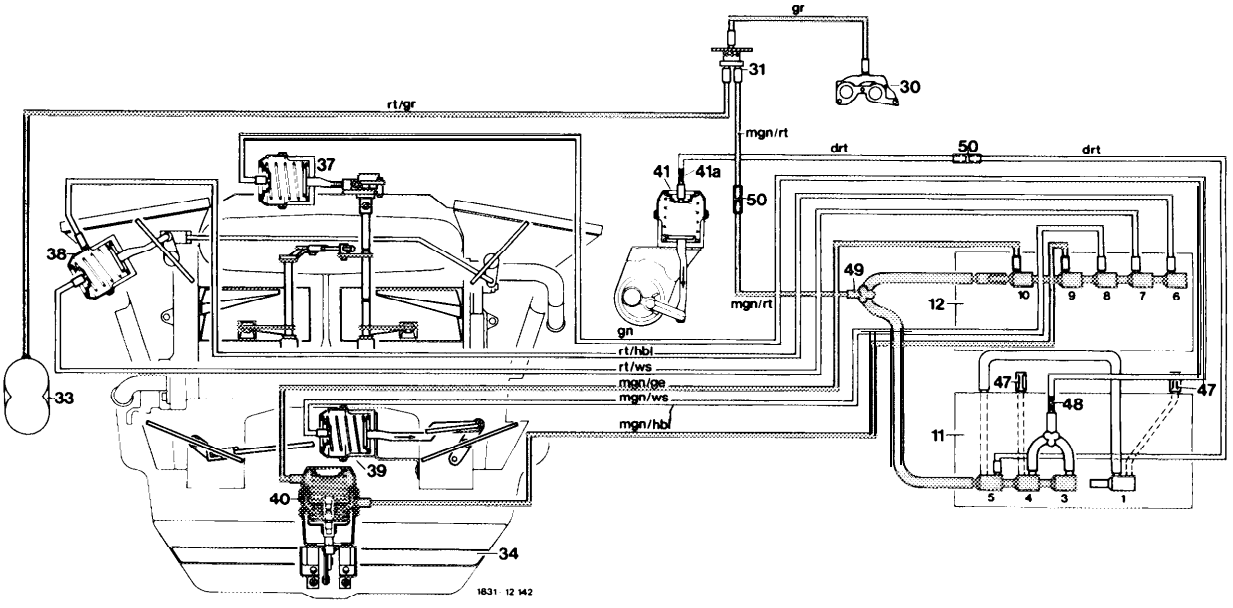
B. Testing vacuum circuit 2, vacuum element (40) for fresh air/recirculating air flap (short and long stroke) with vacuum lines

1 Push mode selection button ● on pushbutton switch unit and engage temperature wheel at "MAX".

2 Evacuate with tester (approx. 400 mbar) and read on pressure gauge.

3 If readout on pressure gauge changes, test vacuum element (40) directly or renew (83-165 section "D") or test vacuum lines medium green/light blue and medium green/yellow, and renew if required.





Vacuum circuit 2, mode selection ● and temperature wheel engaged at "MAX".

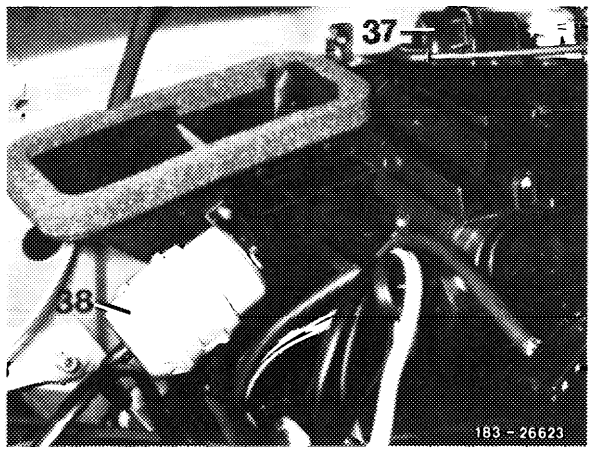
40 Vacuum element for fresh air/recirculating air flap

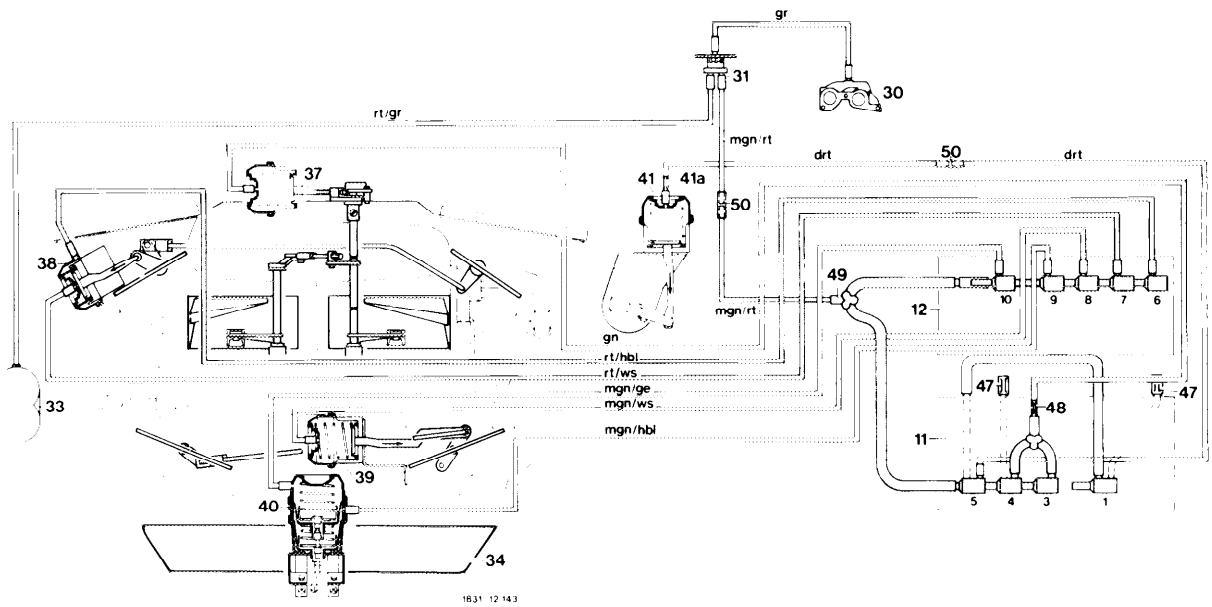
C. Testing vacuum circuit 3, vacuum element (38) for defroster nozzle flaps (short and long stroke) with vacuum lines

1 Push mode selection button on pushbutton switch unit. Temperature wheel remains at “MAX”.

2 Evacuate with tester (approx. 400 mbar) and read pressure gauge.

3 If readout on pressure gauge changes, test vacuum element (38) directly and renew, if required (83-165 section “B”), or test vacuum lines red/light blue and red/white and renew, if required.





Vacuum circuit 3, mode selectton and temperature wheel engaged at “MAX”

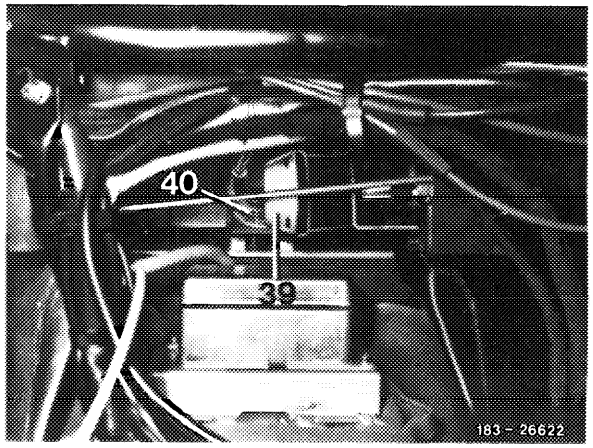
38 Vacuum element for defroster nozzle flaps

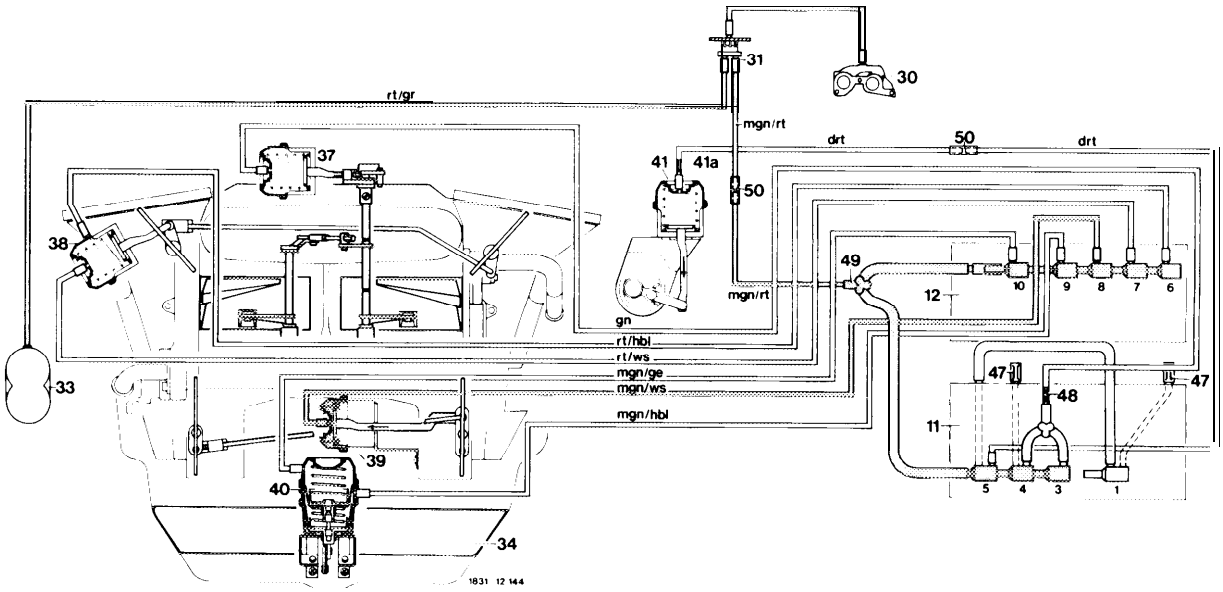
D. Testing vacuum circuit 4, vacuum element (39) for legroom flaps with vacuum lines

1 Push mode selection button ⊖ on pushbutton switch unit, temperature wheel remains engaged at "MAX".

2 Evacuate with tester (approx. 400 mbar) and read pressure gauge.

3 If readout on pressure gauge changes, test vacuum element (39) directly and renew, if required (83-165 section ''C''), or test vacuum line medium green/white and renew, if required.





Vacuum circuit 4, mode selection ⊖ and temperature wheel engaged at "MAX"

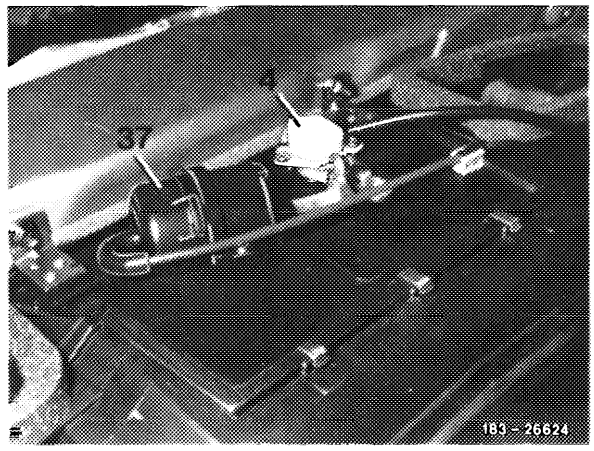
39 Vacuum element for legroom flaps

E. Testing vacuum circuit 5, vacuum element (37 and 41) for blend air flaps and heater valve with vacuum lines

1 Push mode selection button on pushbutton switch unit and set temperature wheel to “MIN” (not engaged).

2 Evacuate with tester, wait for approx. 5 seconds and evacuate again. Repeat approx. 5 times, because the vacuum element (37) is provided with vacuum by way of an orifice. Then read pressure gauge.

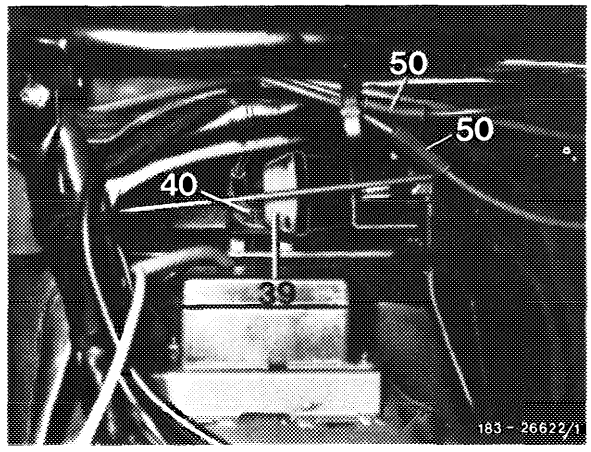
Note: If the temperature difference (preset temperature at temperature wheel in relation to outside temperature) is above 8 °C, the vacuum element (40) for fresh air/recirculating air flap is also provided with vacuum.

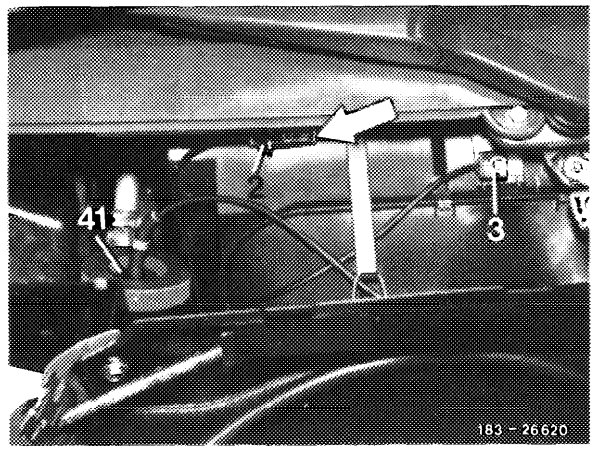


3 If readout on pressure gauge changes:

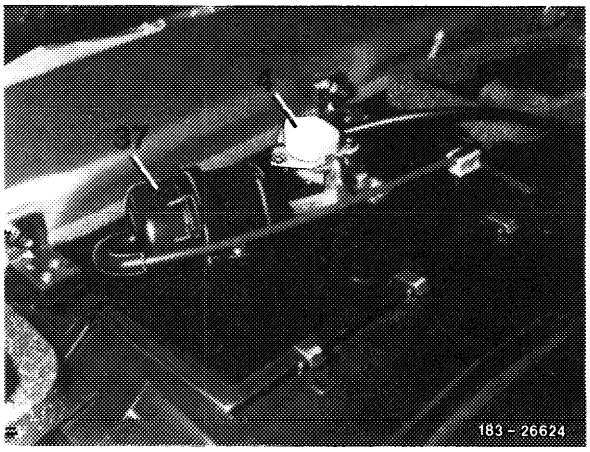
a) Test vacuum element (41) for heater valve directly and renew, if required (83-1 15) or test vacuum line dark red and renew, if required.

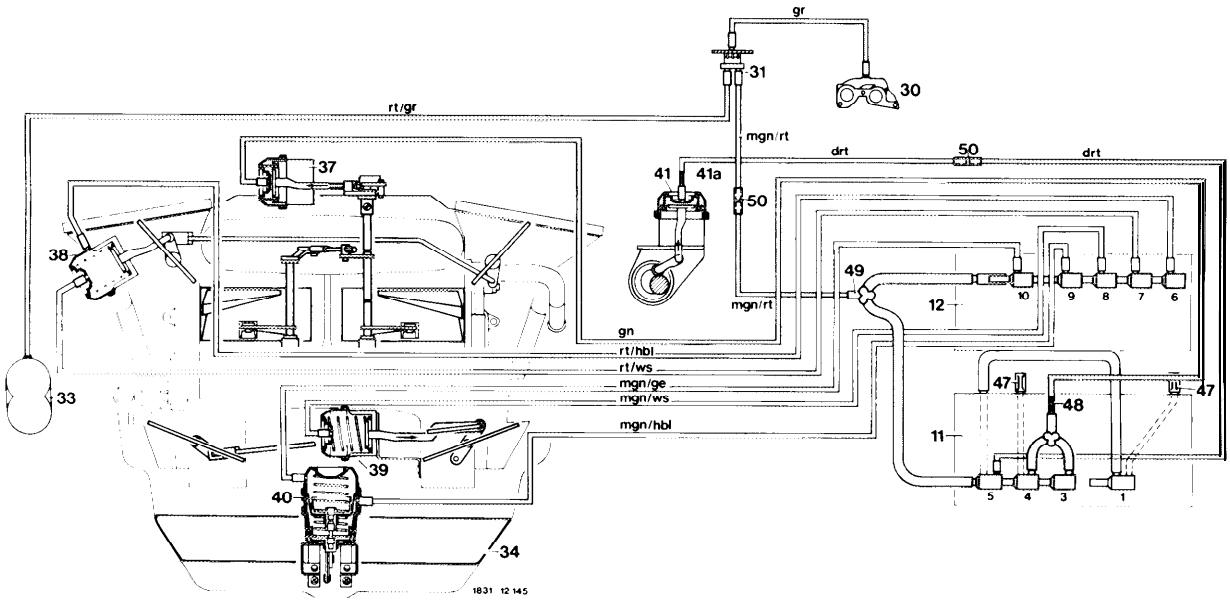
Note: If the vacuum line dark red shows a leak, the leak may also be at connecting hose (50).





b) Test vacuum element (37) directly and renew, if required (83-I 65 section "A") or test vacuum line green and renew, if required.



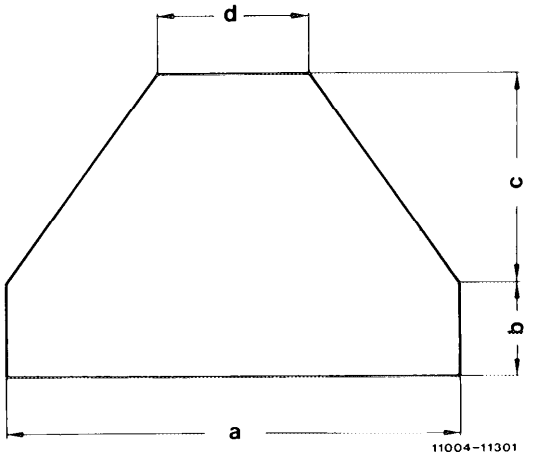


Vacuum circuit 5, mode selection and temperature wheel at "MIN" (not engaged)

37 Vacuum element for blend air flaps
41 Vacuum element for heater valve
50 Connecting hose

Self **-made tool**

Guide plate
Plate thickness approx. 0.8 mm



a 350 mm
b 70 mm
c 180mm
d 120mm

Removal

1 Disconnect battery.

2 Drain coolant.

3 Remove instrument panel (68-I 00).

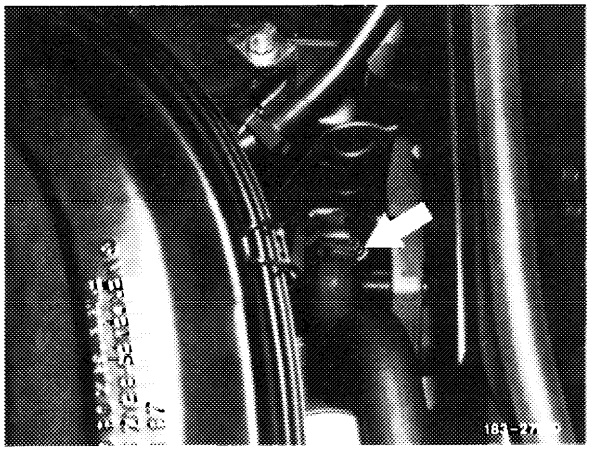
4 Remove pushbutton switch unit (83–112).

5 Remove radio.

6 Remove center console top.

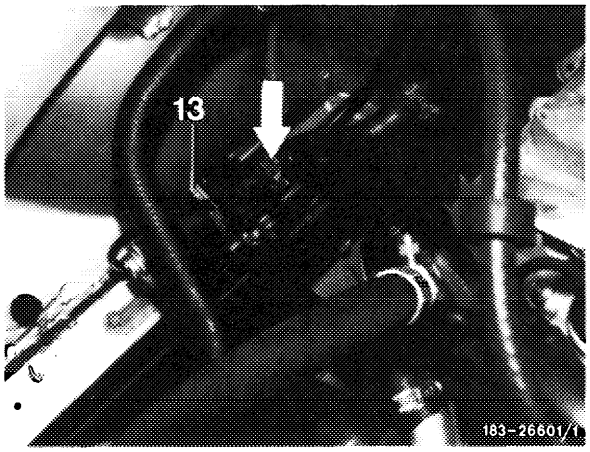
7 Remove cover of air intake (83–140).

8 Disconnect feed hose (arrow) on engine.



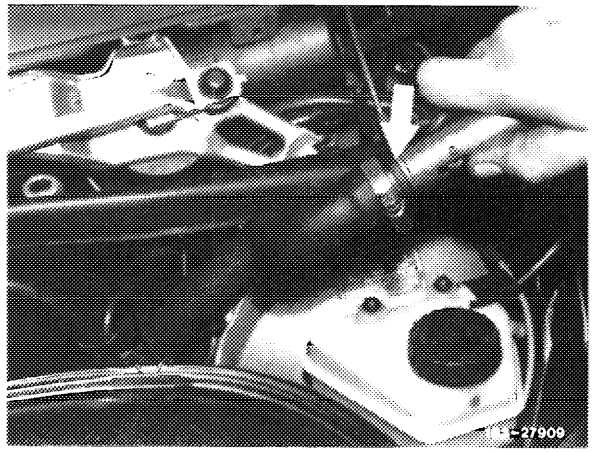
9 Disconnect return hose (arrow) on recirculating pump (13). Then disconnect and connect vacuum line on heater valve for a short moment.

10 Set container under return flow hose.

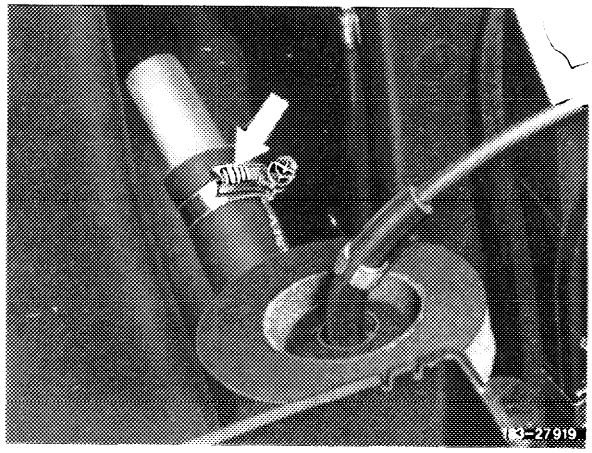


11 Position compression air nozzle (arrow) at feed hose and blow remaining coolant out of heat exchanger.

12 Reconnect feed and return flow hose.

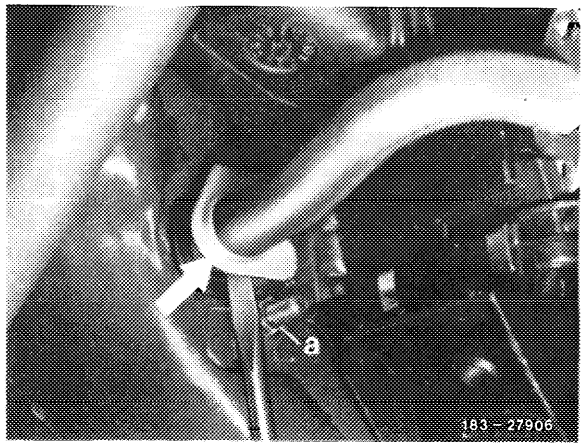


13 Disconnect feed and return flow hose (arrow) on heat exchanger.



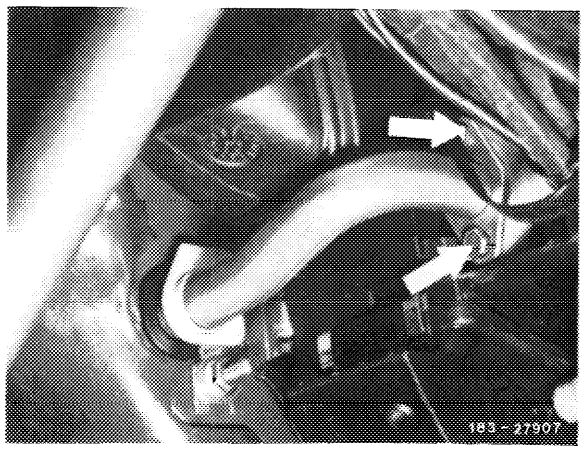
14 Remove pipe holder (arrow) from holding bracket bottom left.

15 Loosen nut (a).



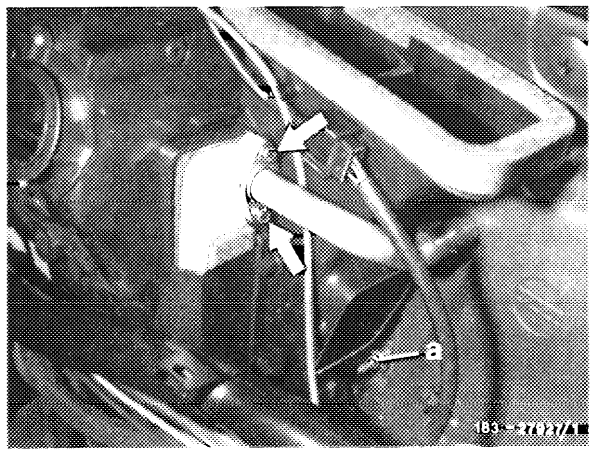
16 Unscrew feed pipe (arrow) on heat exchanger and pull out of front wall toward the rear.

17 Pull lefthand and righthand air duct for lateral venting from heater box.



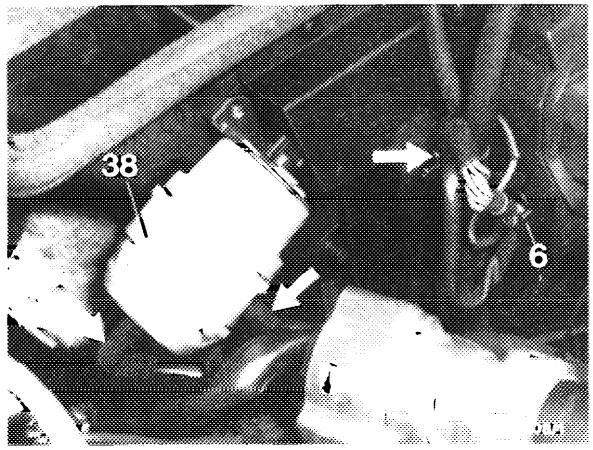
18 Unscrew return flow pipe (arrow) on heat exchanger and pull out of front wall toward the rear.

19 Loosen nut (a).

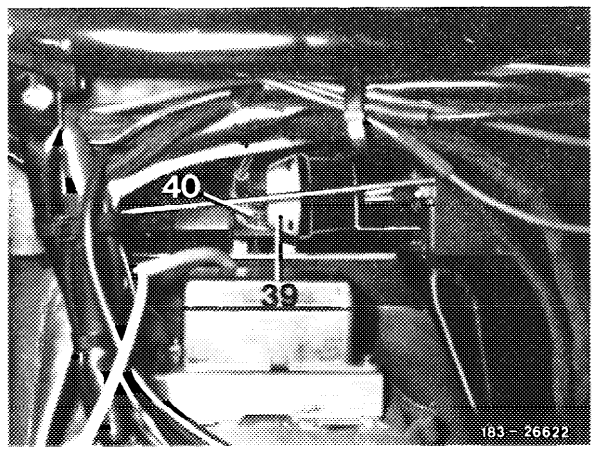


20 Loosen cable strap (arrow) on heater box and pull line connector (6) out of heater box.

21 Pull both vacuum lines (arrow) from vacuum element (38).



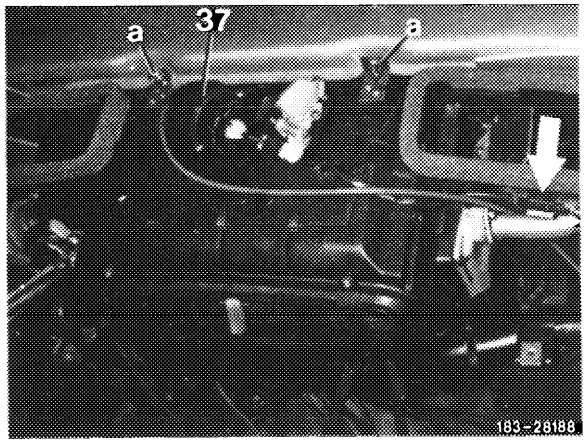
22 Pull vacuum line from vacuum element (39).



23 Pull vacuum line from vacuum element (37). Separate plug connection (arrow).

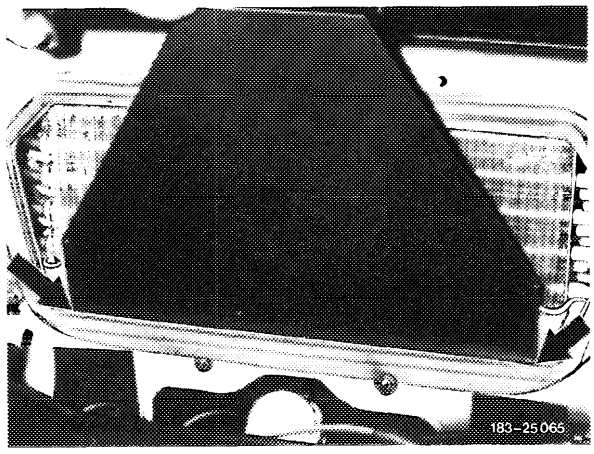
24 Unscrew both nuts (a).

25 Lift heater box out in upward direction.



26 Insert guide plate between front wall and condensate water pan (arrow).

Attention!
Be sure to insert guide plate, so that the condensate water pan is not buckling in downward direction when the heater box is inserted.

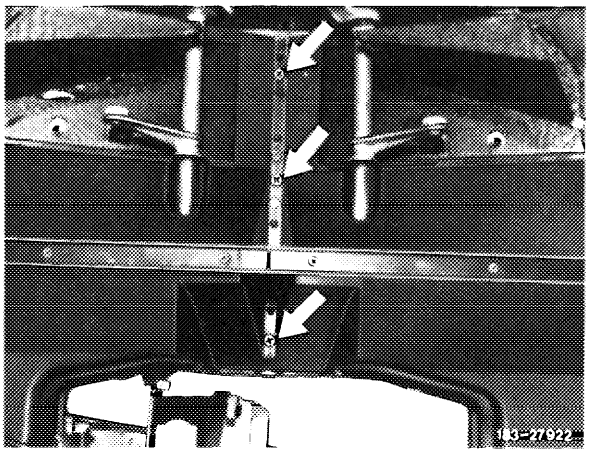


27 Insert heater box. Then pull out guide plate in upward direction.

28 For further installation proceed vice versa.

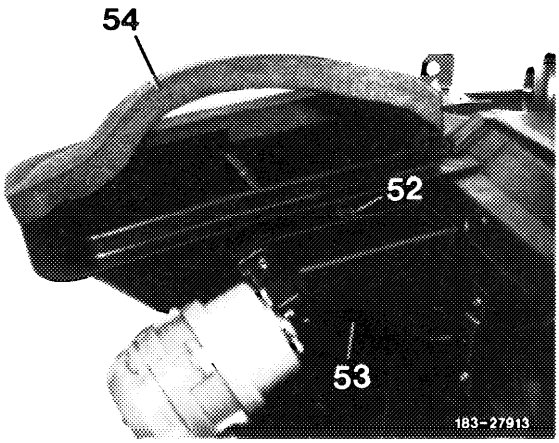
1 Remove heater box (83-100).

2 Unscrew 3 screws (arrow) on heater box.

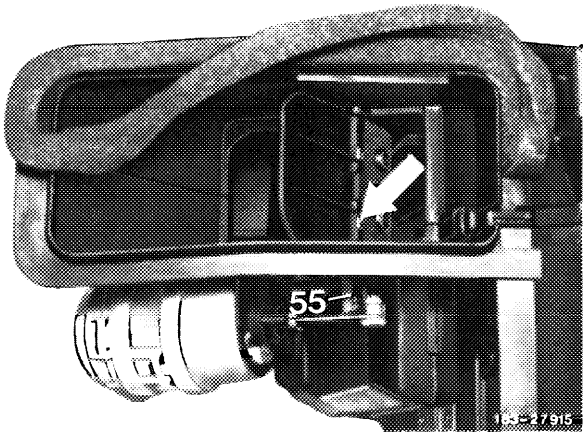


3 Remove rivet (52) and take cover (53) from heater box.

4 Loosen sealing rubber (54) on lefthand and righthand defroster nozzle up to half.

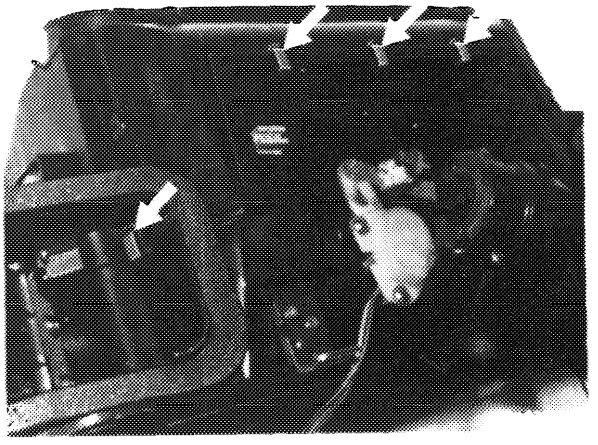


5 Pull shaft (55) partially out of lefthand defroster nozzle while pushing against engaging lug (arrow).

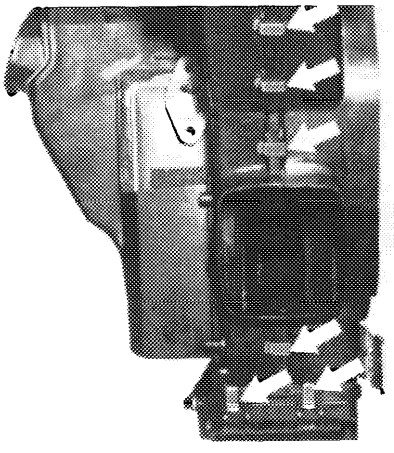


6 Push clamps (arrows) off at parting point of heater box

- top

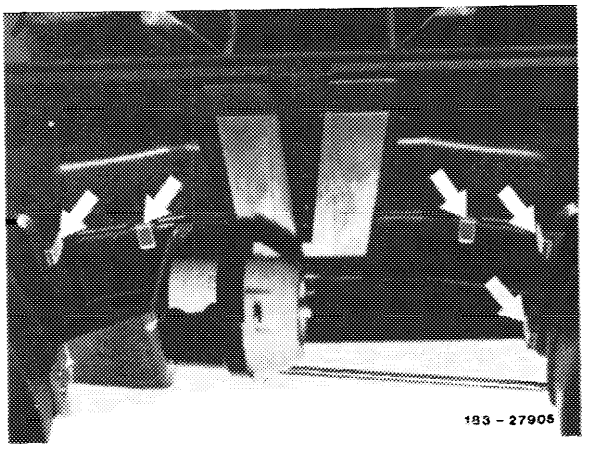


- laterally left and right



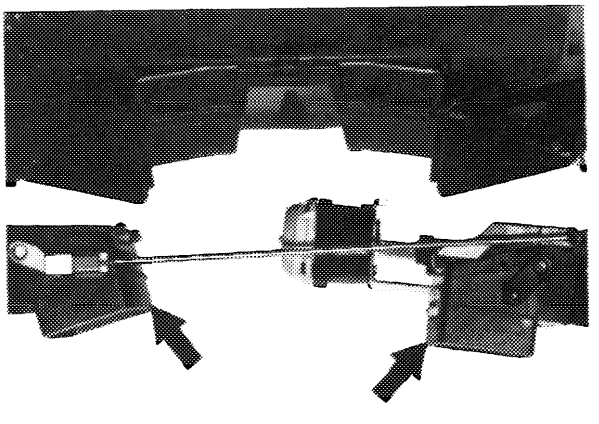
183 - 27904

- bottom



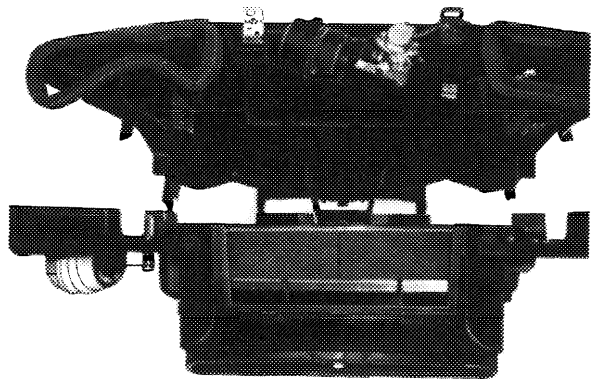
183 - 27905

7 Lift both legroom nozzles (arrow) with connecting rod from heater box.



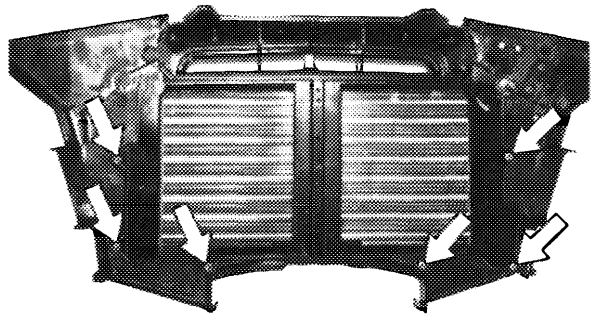
183-27911

8 Pull heater box apart at parting point.



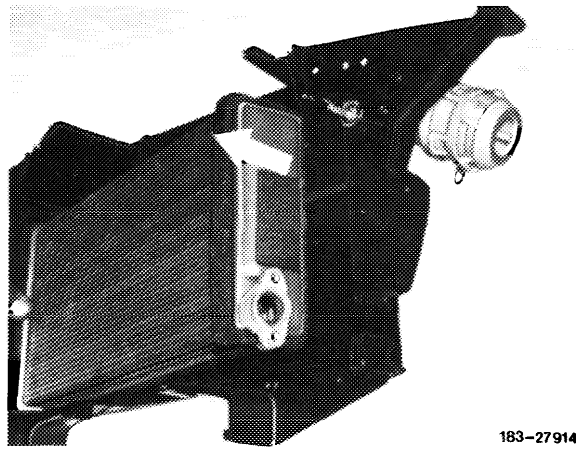
183-27916

9 Unscrew screws (arrow) on holding frame of heat exchanger and lift off holder frame.



183-27917

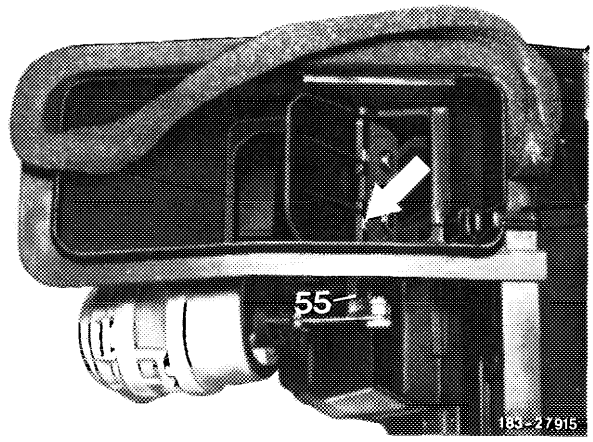
10 Lift heat exchanger out of heater box.



183-27914

11 Install in vice-versa sequence.

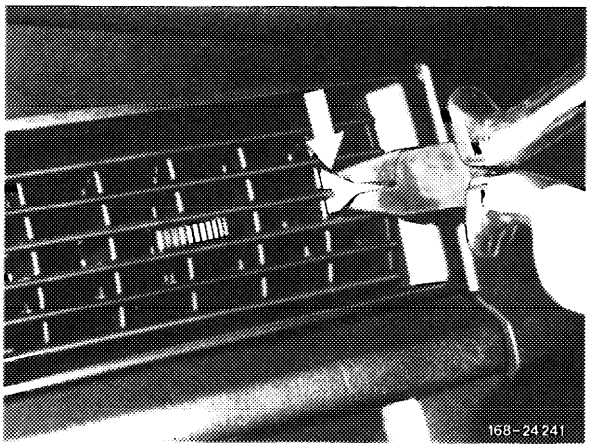
Note: When assembling heater box, make sure that the bearings of the defroster nozzle flaps are correctly seated on housing and that the lug (arrow) of shaft (55) engages at lefthand defroster nozzle flap.



183-27915

A. Removal and installation

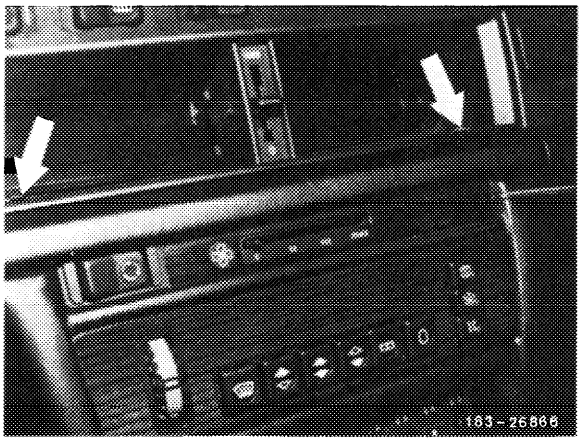
1 **Pull out both outlets at instrument panel center.**



2 Loosen both screws (arrow) and push center console top slightly down.

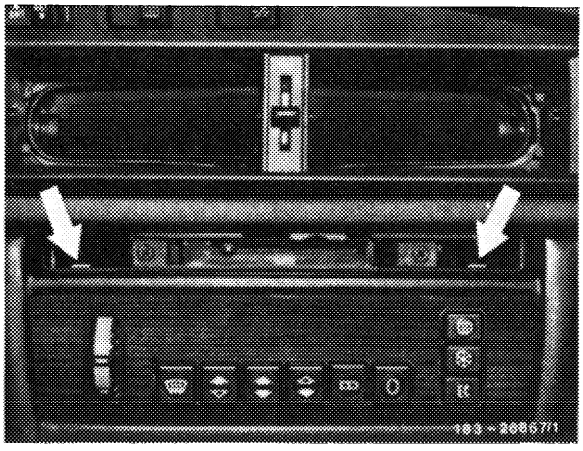
3 Pull knob from blower switch and pull molding for blower switch out of center console.

4 Pull connector from switch fresh air/recirculating air.



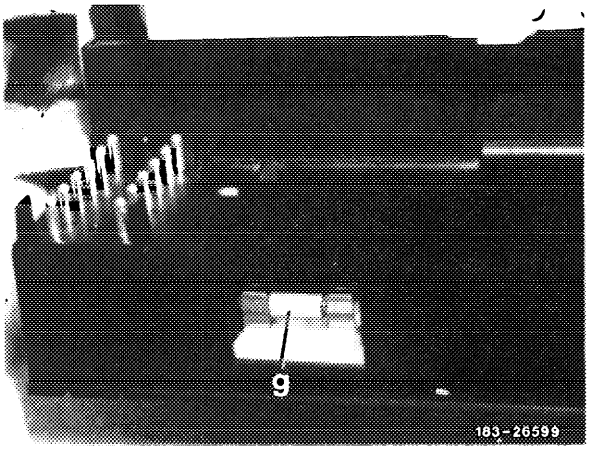
5 Lift both clamps (arrow) with a pointed tool and pull out complete pushbutton switch unit.

6 Pull both 12-pin connectors from pushbutton switch unit.



7 Install in vice-versa sequence, while plugging electric line with red adhesive tape into lefthand connecting plug of pushbutton switch unit.

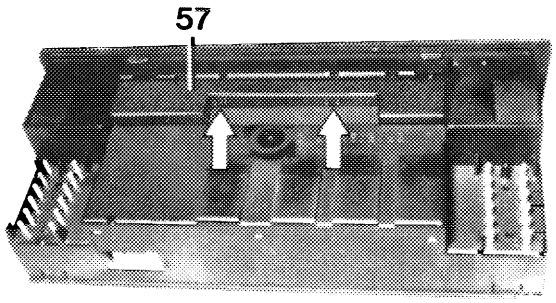
Note: The fuse for electronics in pushbutton switch unit is at the rear on pushbutton switch unit.



9 Fuse 2 amps

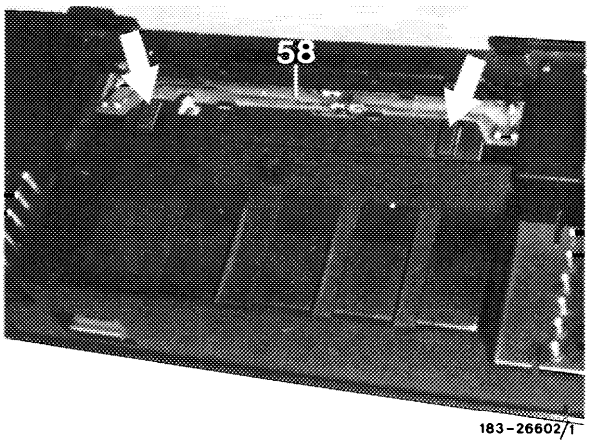
B. Renewing bulbs for lamps

1 Remove cover (57) in upward direction, while pushing against both hooks (arrow).



2 Push both engaging lugs (arrow) slightly down and pull lamp socket (58) out to the rear. Then remove bulbs from lamp socket.

3 Install in vice-versa sequence.

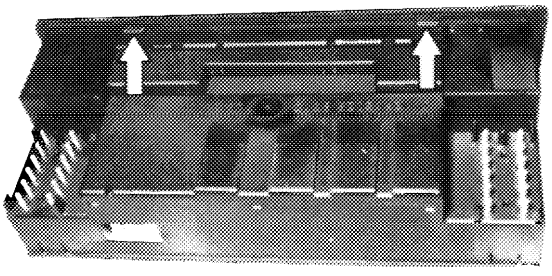


C. Removal and installation of wood panelling

1 Pull both clamps (arrow) in upward direction.

2 Remove wood panelling in forward direction.

3 Install in vice-versa sequence.

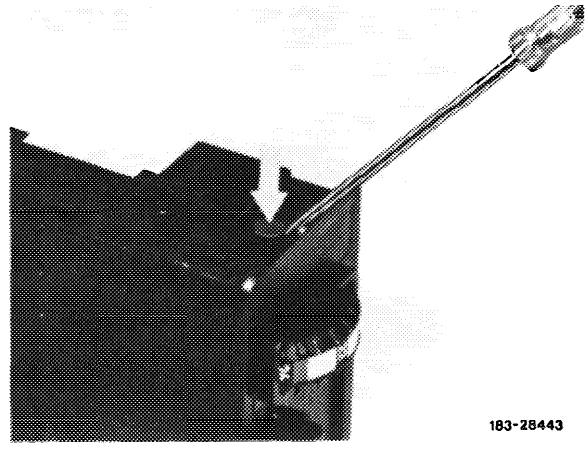


D. Removal and installation of temperature wheel (without potentiometer)

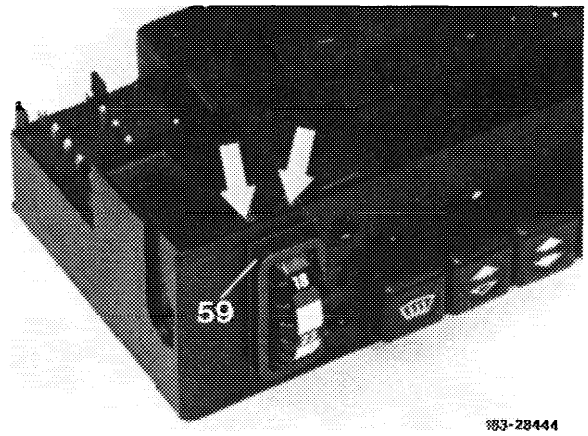
Removal

1 **Remove wooden panelling (refer to section C).**

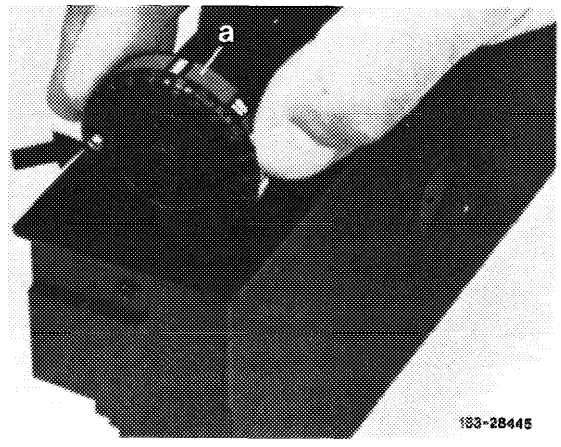
2 Position temperature wheel between "MI N" and 18 °C, then push out drive pin (arrow) with screwdriver.



3 Push engaging lugs (arrow) down and tilt frame (59) forward.



4 Remove temperature wheel (a) from pushbutton switch unit.



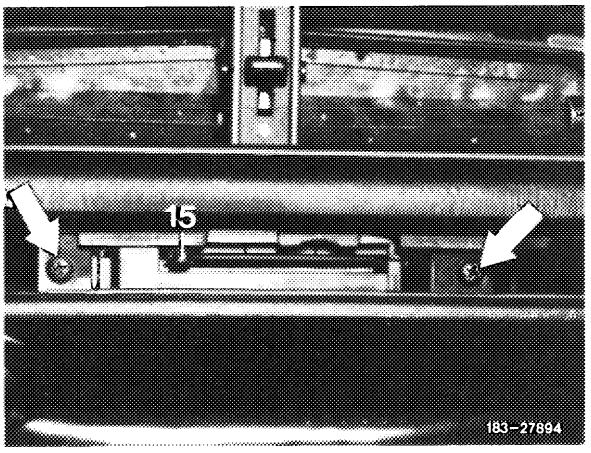
Installation

5 Insert ball (arrow) and temperature wheel (a) in position "MIN" to 18 °C into pushbutton switch unit. Then push drive pin into pushbutton switch unit, while turning temperature wheel until the drive pin engages in wheel. Continue installation in vice-versa sequence.

83-I 13 Removal and installation of blower switch

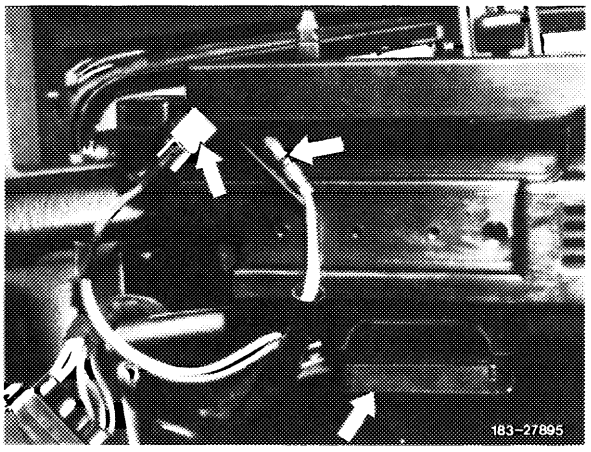
1 Remove pushbutton switch unit (83-I 12, section A).

2 Unscrew both screws (arrow) and remove blower switch (15) through opening for pushbutton switch unit.



3 Pull electric connector, glow bulb socket and light conductor (arrow) from blower switch.

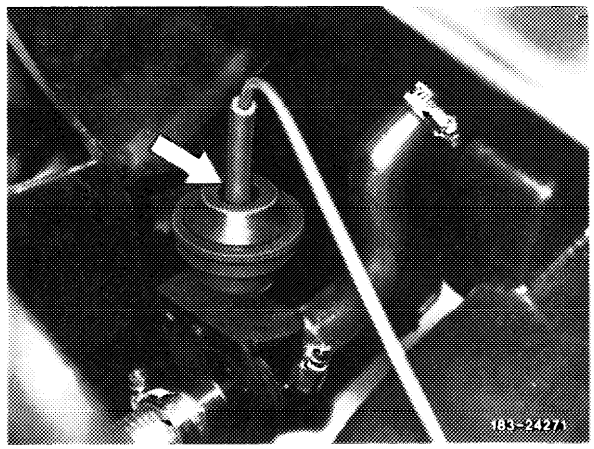
4 Install in vice-versa sequence.



83-I 15 Removal and installation of heater valve

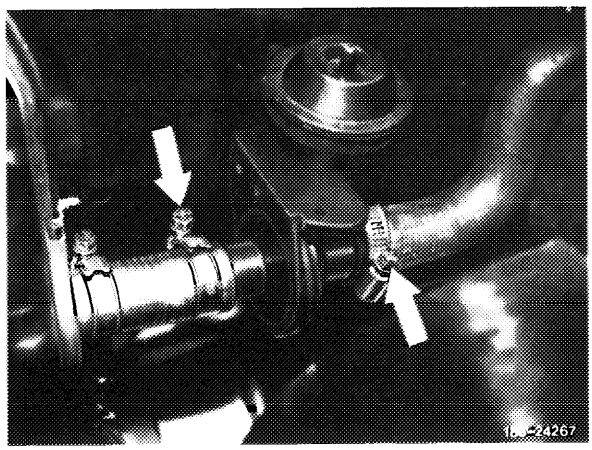
1 Remove cover on air inlet (83–140).

2 Pull off vacuum line (arrow) on heater valve.



3 Loosen hose clamps (arrow) on heater valve.

4 Pull off hoses and remove heater valve.



5 Install in vice-versa sequence.

Attention!
When inserting heater valve, the letters "water inlet" should face front wall.

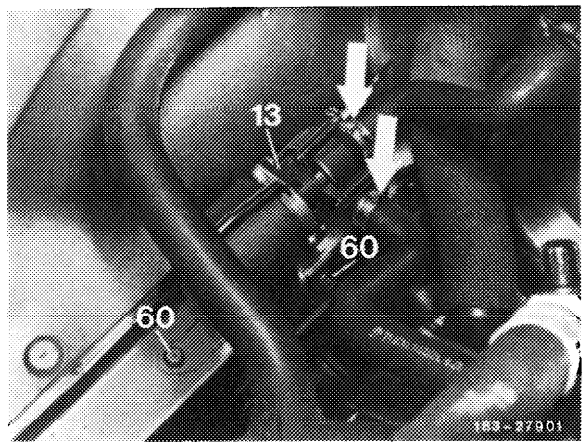
83-117 Removal and installation of recirculating pump

1 Partially drain coolant.

2 Disconnect both hose straps (arrow) on recirculating pump (13).

3 Separate electric plug connection.

4 Unscrew both screws (60).



5 install in vice-versa sequence.

6 Fill in coolant and check cooling system for leaks.

83-120 Removal and installation of blower motor

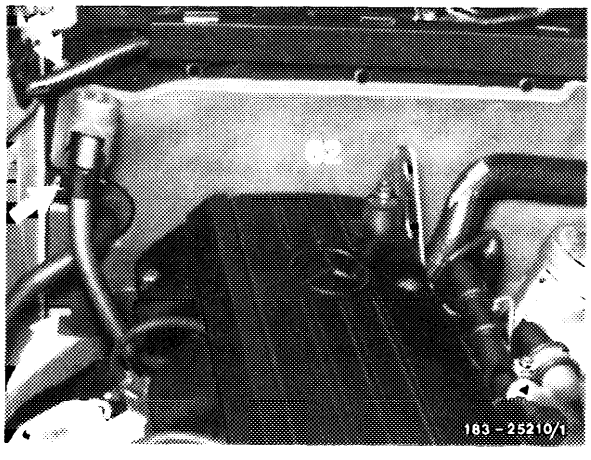
Data

Current input at 13 V ± 0.2 V 4th stage	21 A
Blower speed	rpm (1/min)
Detent 1	1800
Detent 2	2600
Detent 3	3500
Detent 4	4100
Air volume at 12 V (kg/h)	550

Removal

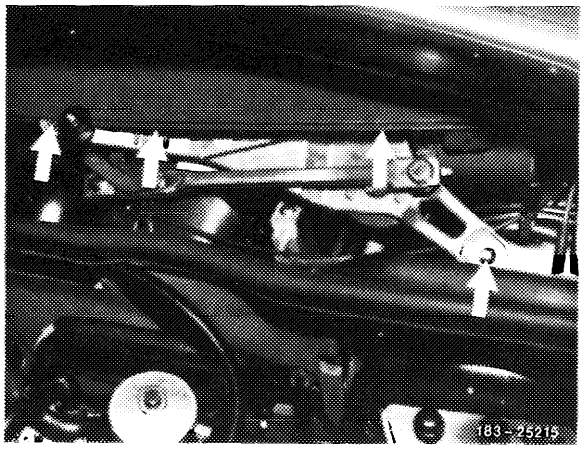
1 Remove cover on air inlet (83-l 40).

2 Loosen bulkhead (62), unscrewing screws (arrow) at left and right for this purpose. Then pull bulkhead forward up to engine.



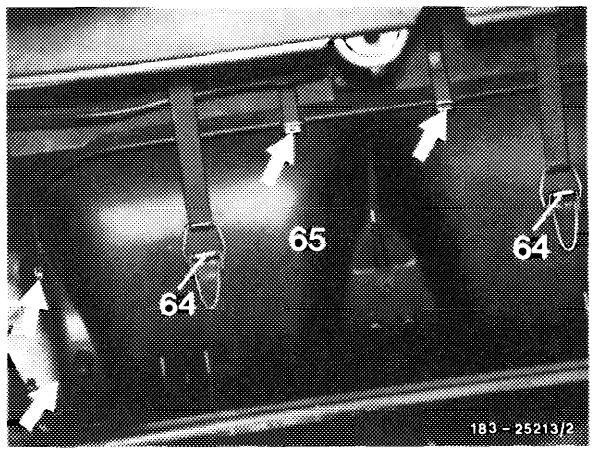
3 Remove wiper arm.

4 Unscrew screws (arrow) on wiper linkage and put wiper linkage with motor aside.



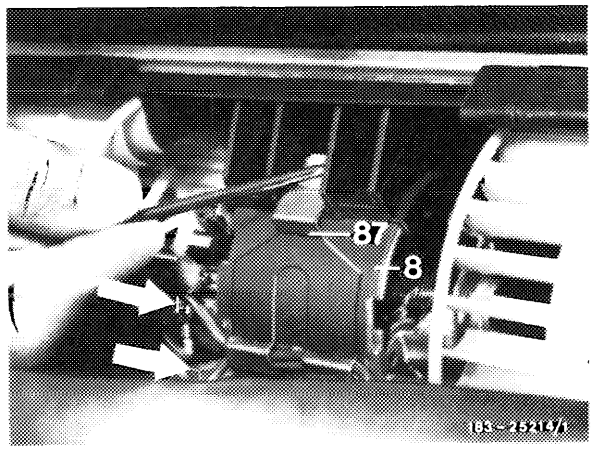
5 Loosen clamping straps (64) and unclip clamps (arrow) laterally and on top.

6 Lift out cover (65) in upward direction.



7 Unclip holding strap (87) with a pointed tool (e.g. tracer pin).

8 Pull off flat plug (arrow) and lift out blower motor (8).

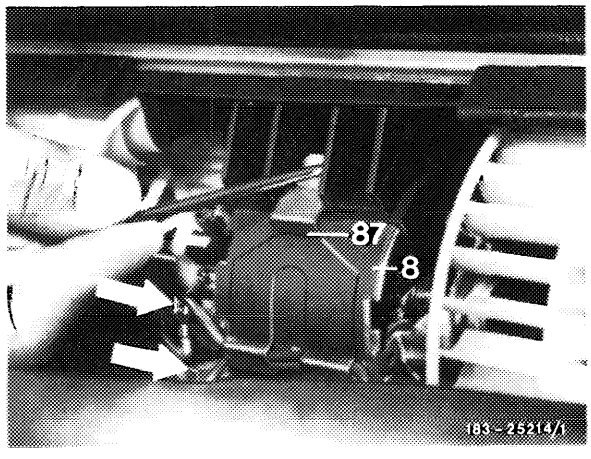


Installation

9 Insert blower motor (8) into holder in such a manner that the connections are pointing in driving direction and that the motor housing is held in motor holder.

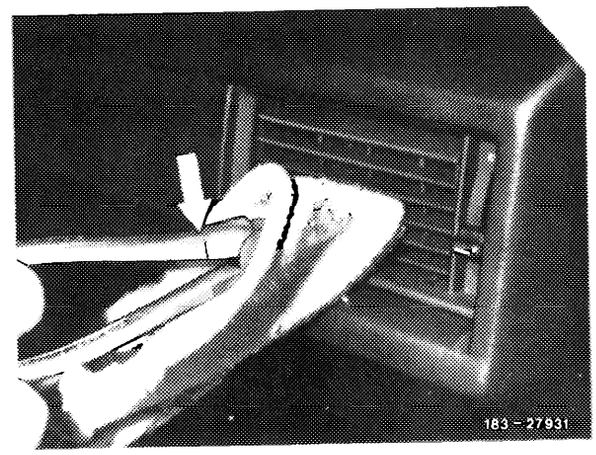
10 Install in vice-versa sequence.

11 Test blower motor for function, paying special attention to noises, since fan wheels may wipe against housing.

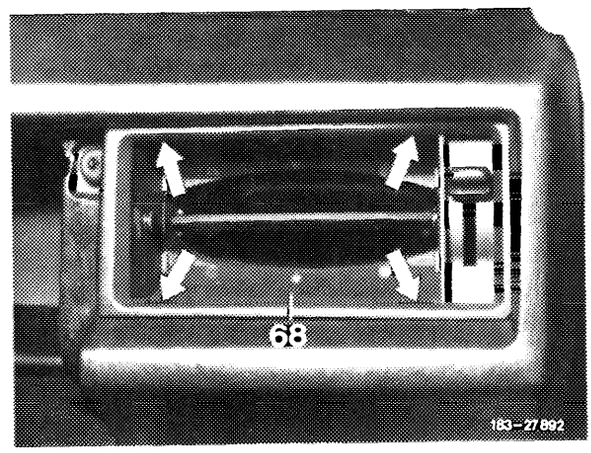


1 Remove **glove** box.

2 Pull righthand lateral outlet from instrument panel by means of flat pliers (arrow).



3 Push frame (68) for outlet out of instrument panel, while slightly raising the four detent lugs (arrow).

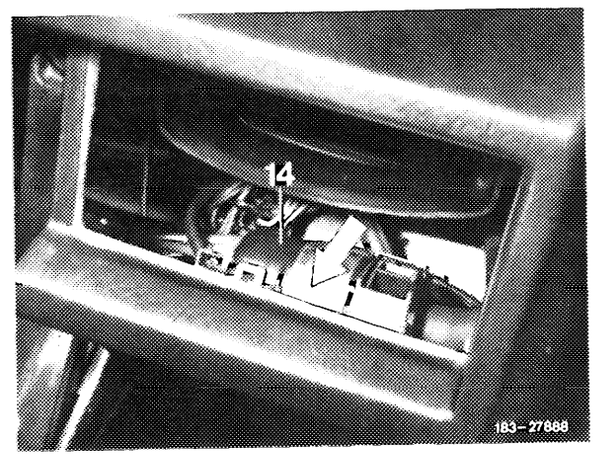


4 Unclip aspitator blower (14) from holder (arrow).

5 Pull hose and 2-pin connector from venting blower.

Install in vice-versa sequence.

6 Check aspirator blower for function, switch on ignition for this purpose.



83-I 30 Removal and installations, testing of in-car temperature sensor

Test values

Sensor temperature in °C approx.	Resistance in kΩ
+20	11.5 to 13.5
+25	9.5 to 10.5
+30	7.5 to 8.5
+35	6.0 to 7.0
+40	4.5 to 5.5
+45	3.5 to 4.5

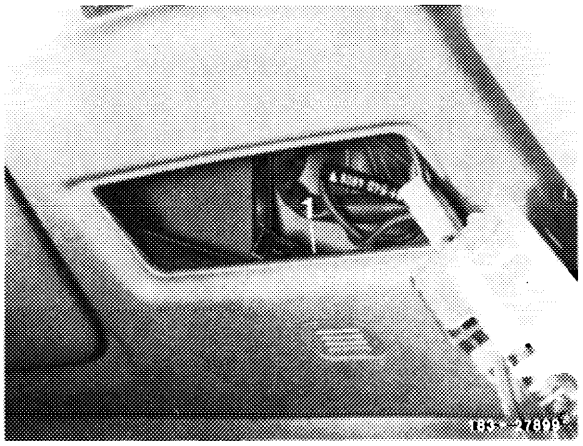
1 Pull out dome lamp.

2 Force off in-car temperature sensor (1) in upward direction.

3 Pull 2-pin connector and vent hose from in-car temperature sensor.

4 Test temperature sensor with ohmmeter.

5 Install in vice-versa sequence.

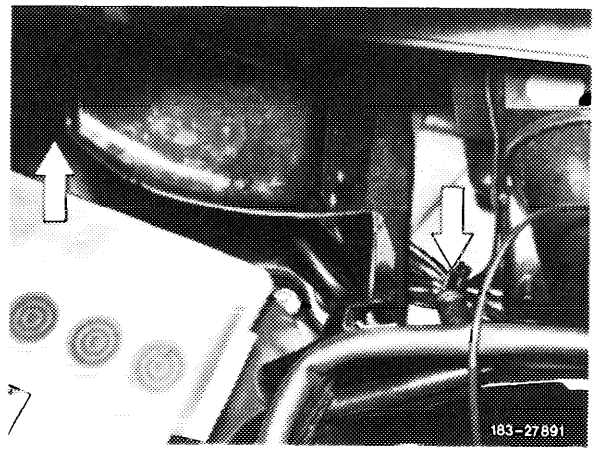


Test **values**

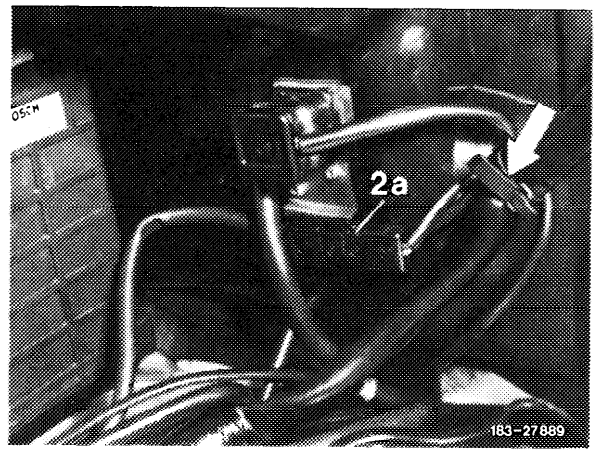
Sensor temperature in °C approx.	Resistance in kΩ
+20	3.1 to 3.9
+25	2.4 to 3.0
+30	1.9 to 2.3
+35	1.6 to 2.0
+40	1.4 to 1.6
+45	1.1 to 1.3

1 Remove heater valve (83-I 15).

2 Loosen cable strap (arrow).



3 Loosen cable strap (arrow) and separate 2-pin plug connection (2a).

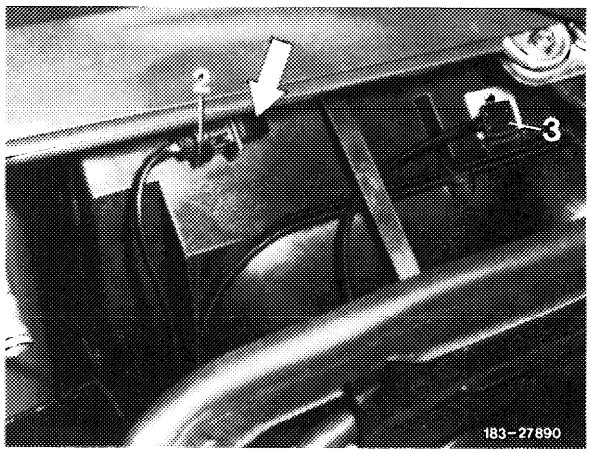


4 Pull outside temperature sensor (2) from holder.

5 Test temperature sensor with ohmmeter.

6 Install in vice-versa sequence.

Note: Opening of outside temperature sensor (arrow) should face evaporator housing.



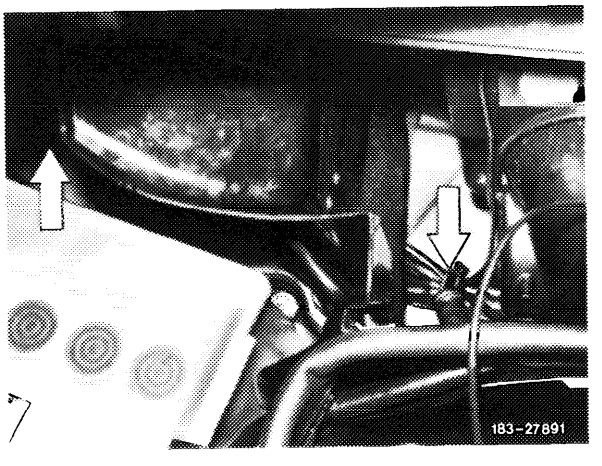
83–133 Removal and installation, testing of temperature sensor for air conditioning system

Test values

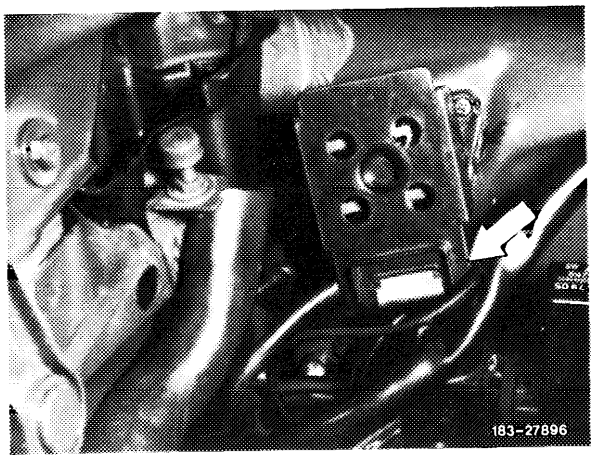
Sensor temperature in °C approx.	Resistance in kΩ
± 0	57 to 67
+ 5	46 to 54
+10	37 to 45
+15	30 to 36
+20	24 to 28
+25	20 to 24
+30	14 to 16
+35	13 to 15

1 Remove heater valve (83-I 15).

2 Loosen cable straps (arrow).



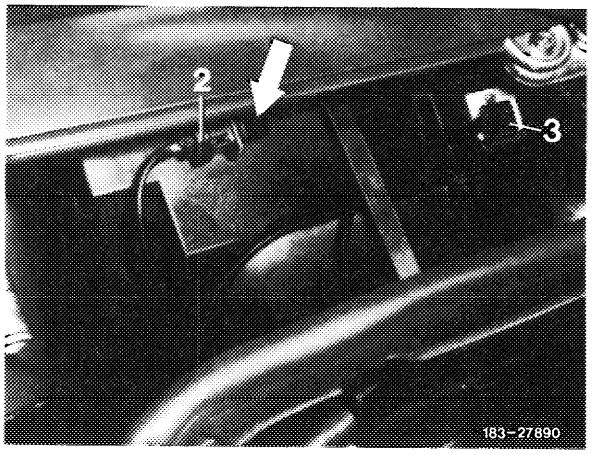
3 Separate 2-pin plug connection (arrow).



4 Pull temperature sensor (3) out of guide tube.

5 Test temperature sensor with ohmmeter.

6 Install in vice-versa sequence.



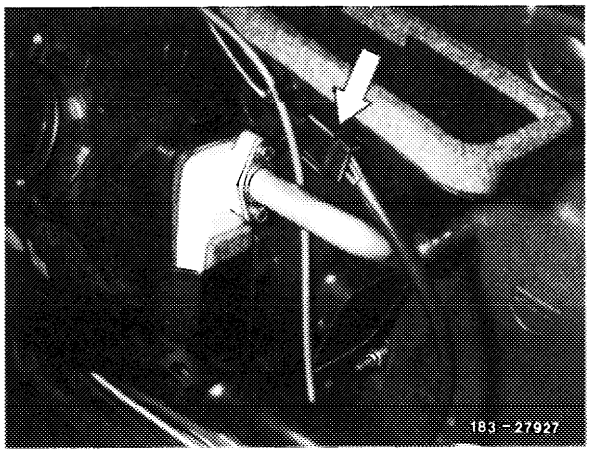
Special tools

Socket box	Test cable for socket box
124 589 00 21 00	124 589 04 63 00

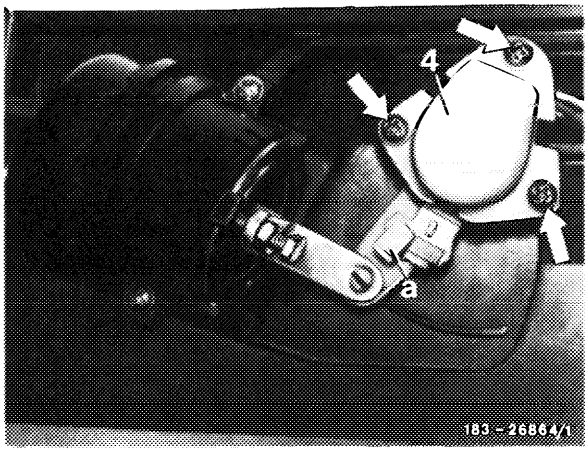
Removal

1 Remove instrument panel (68-100).

2 Separate 3-pin plug connection (arrow).



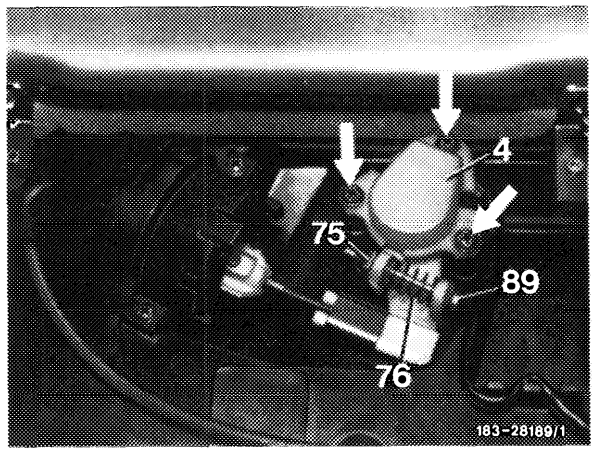
3 On version 1, unscrew 3 screws (arrow) and pull potentiometer for flap position (4) from lever (a) of blend air flaps.



1 st version

4 On 2nd version, unscrew screw (89). Then remove nut (75) and spring (76).

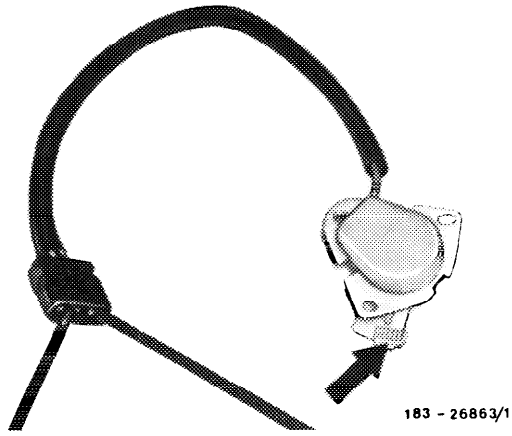
5 Unscrew 3 screws (arrow) and lift off potentiometer for flap position (4).



2nd version

Testing

6 Connect ohmmeter to terminal 1 and 2 of potentiometer for flap position and slowly move lever (arrow) from stop to stop. The resistance should be from approx. 8 Ω to 4.4 ± 1 kΩ without interruption. Renew return potentiometer, if required.



Installation

7 Mount potentiometer for flap position depending on version on heater box and connect.

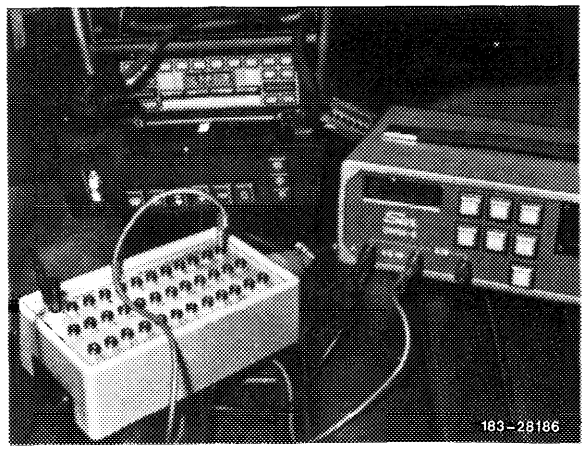
Adjustment

8 Connect control unit and socket box, while plugging electric lines with red adhesive tape to lefthand connecting plug of control unit.

9 Connect voltmeter positive to socket 17 and connect ground to socket 1 of socket box.

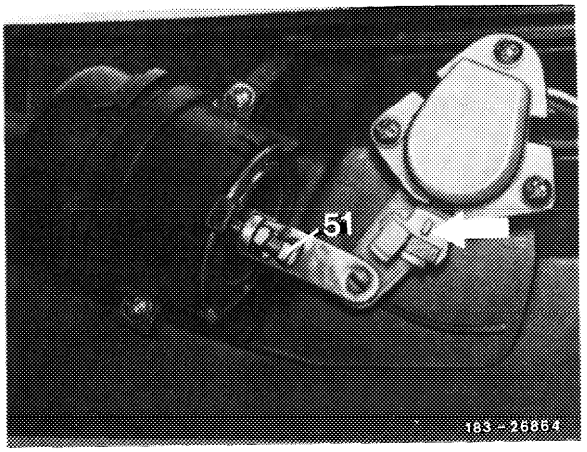
10 Close oil line for oil pressure gauge and run engine at idle speed.

11 Engage temperature wheel at “MIN” and wait for approx. 60 seconds.



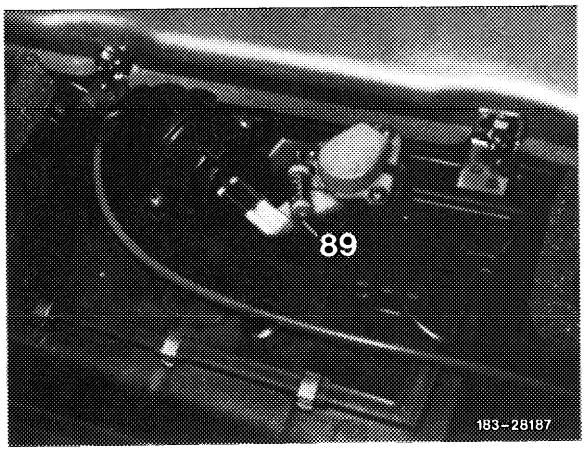
12 Set voltage to 4 ± 0.1 bar.

On 1st version adjust to the left or right by bridging segment on lever (arrow) of potentiometer for flap position, adjust stop screw (51) slightly, if required.



1 st version

10 On 2nd version, turn adjusting screw (89) to the left or right.



2nd version

11 Engage temperature wheel at “MAX”, wait for approx. 60 seconds and test voltage 0.3-l .2 V.

Attention!
If the voltage is not attained, check whether the blend air flaps can be moved from position “full heating” to “full cooling”. For this purpose, disconnect connecting rod from vacuum element and move on lever of potentiometer from stop to stop.

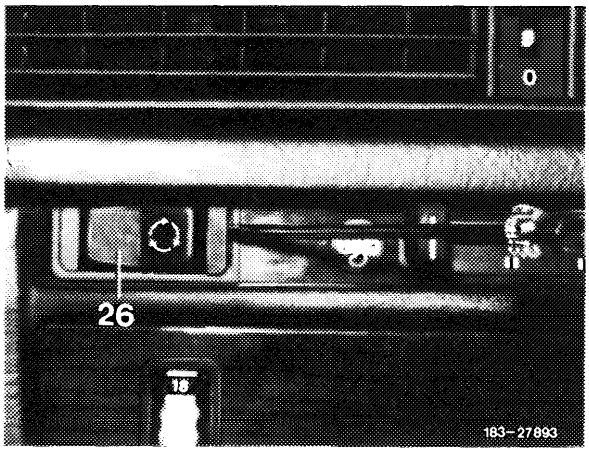
12 Install instrument panel.

13 Check heater for function.

1 Unclip the springs at left and right on switch (26) by means of a flat, wedge-shaped tool and pull out switch.

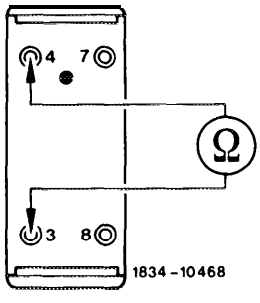
2 Pull connector from switch.

Install in vice-versa sequence.

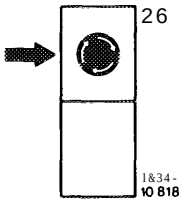


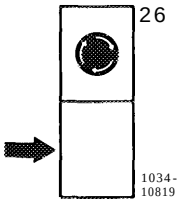
Testing

Connect ohmmeter to terminal 3 and 4.



Switch 26		Nominal value
Push symbol (arrow, top)	ON	= 0 to 1 Ω
Push without symbol (arrow, below)	OFF	= ∞



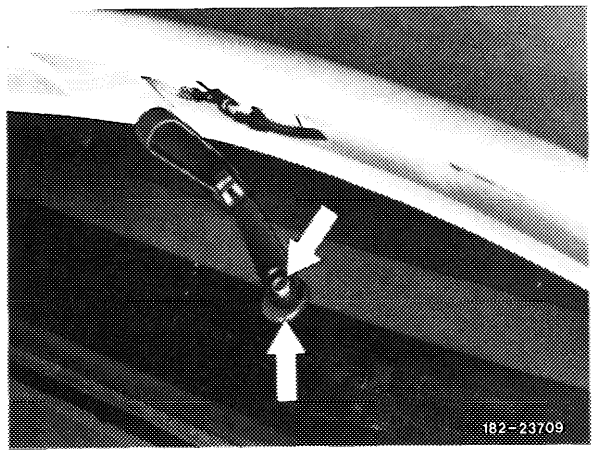


83-140 Removal and installation of cover at air inlet

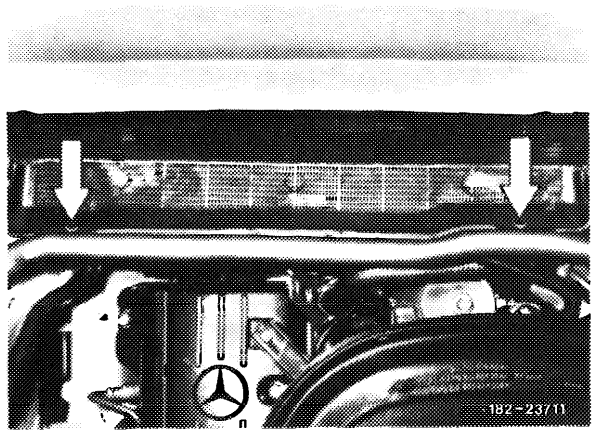
1 Open engine hood to 90° position.

2 Open cover on wiper arm, unscrew nut underneath and pull off wiper arm (upper arrow).

3 Push round cover from wiper shaft (lower arrow).



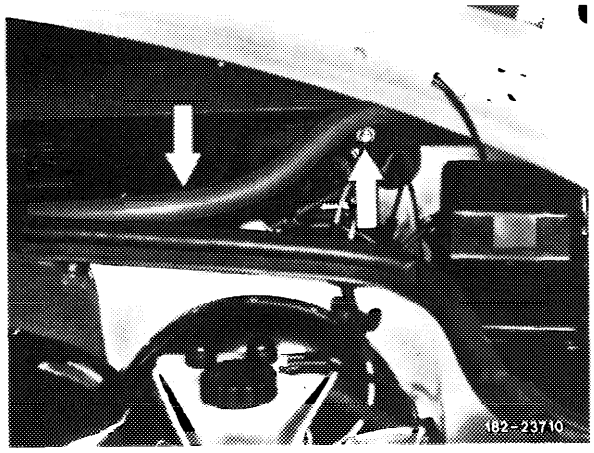
4 Push out clips on partition.



5 Pull rubber seal at left and right from cover at air inlet and unscrew screws (arrow).

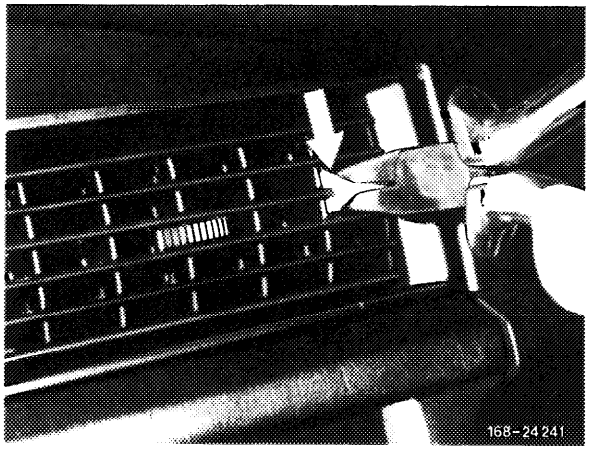
6 Pull out cover at air inlet from lower trimstrip at windshield pane and remove.

7 Install in vice-versa sequence.



1 **Pad flat pliers with a rag and pull outlet at left and right out of mount.**

2 Install in vice-versa sequence.

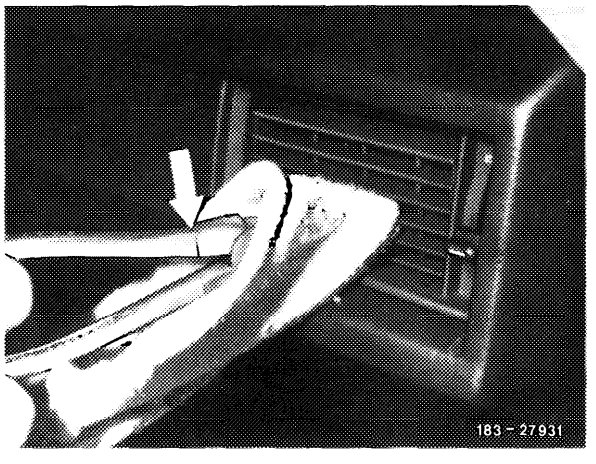


83-153 Removal and installation of switchover valve unit with 4 or 5 connections

Removal

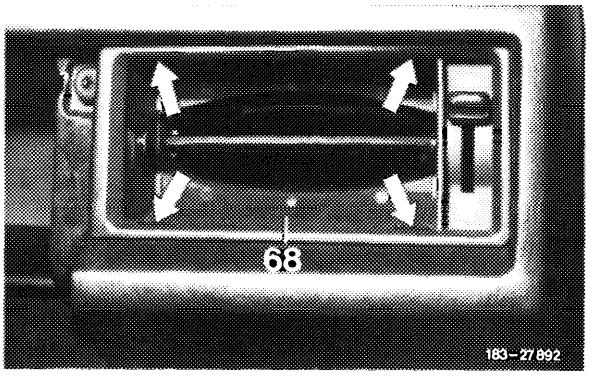
1 Install glove box.

2 Pull righthand lateral outlet from instrument panel.



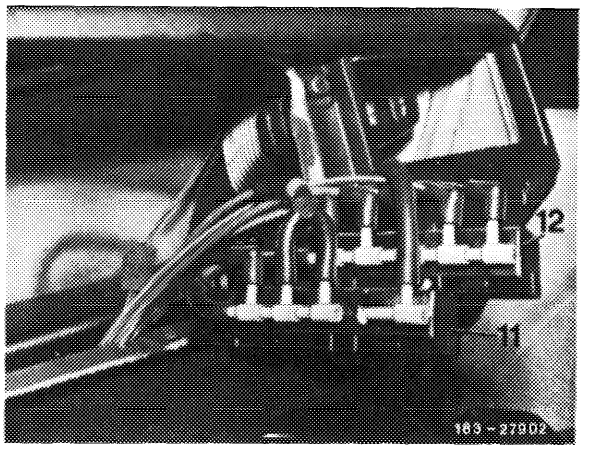
3 Push frame (68) for lateral outlets out of instrument panel while slightly lifting the four detent lugs (arrow).

4 Remove venting blower (83-122).

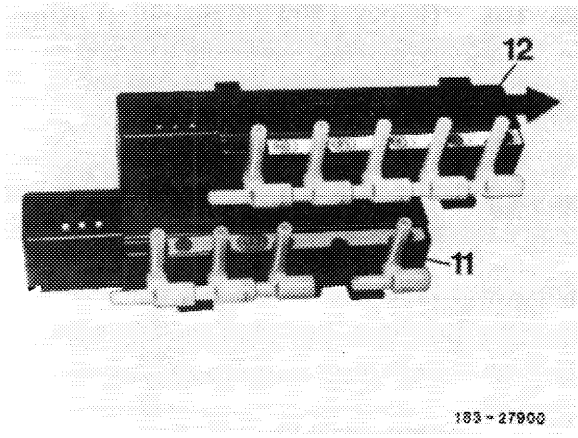


5 Unclip switchover valve units (11 and 12) from holder.

6 Pull vacuum lines and both 6-pin connectors from switchover valve units.



7 Force switchover valve unit (12) to the right (arrow) from switchover valve unit (1 1).



installation

8 Slip switchover valve unit (12) up to stop on switchover valve unit (11).

9 Plug vacuum lines according to respective color identification of switchover valves on pertinent switchover valves (also refer to vacuum diagram 83-028, section B).

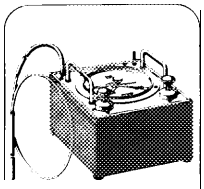
10 Plug 6-pin connector with red adhesive tape to switchover valve unit (11).

11 For further installation proceed vice versa.

Data

Permissible leaking of vacuum elements	20 mbar/min at 300 mbar vacuum
Plug-on length of connections	10–12 mm

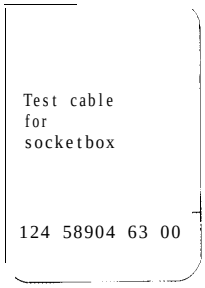
Special tools



201 589 13 21 00

Socket box

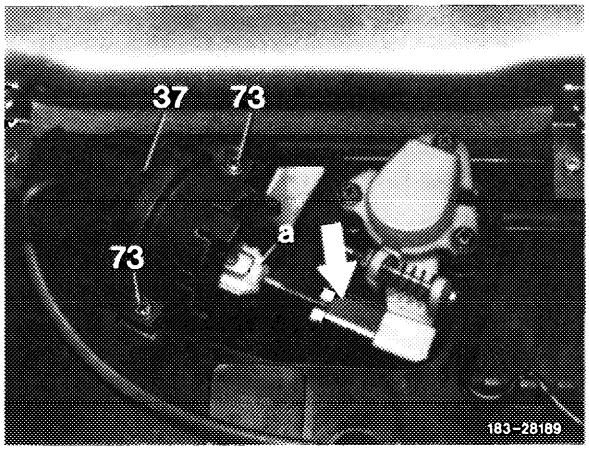
124 589 00 21 00



Test cable for socketbox

124 58904 63 00

A. Vacuum element (37) for blend air flaps



Removal

1 Remove instrument panel (68-100).

2 Pull vacuum line from vacuum element (37).

3 Unclip clamp (arrow) from connecting rod (a).

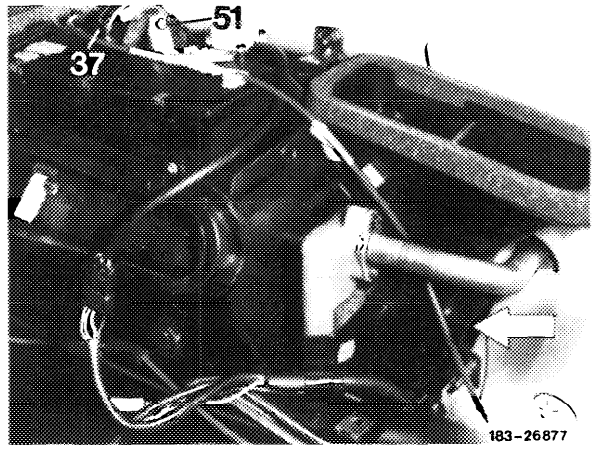
4 Unscrew both screws (73).

Installation

5 Fasten vacuum element to heater box and mount connecting rod.

6 Connect vacuum tester to vacuum element (37) and evacuate with tester to approx. 400 mbar vacuum.

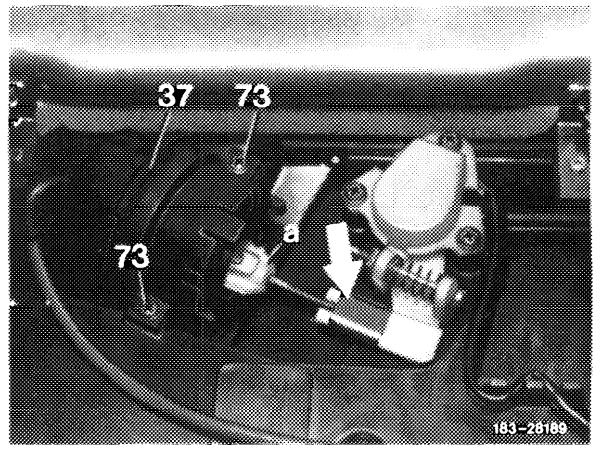
7 On 1 st version, check whether stop screw (51) rests against vacuum element (37). Simultaneously, the blend air flaps (noticed by the air coming out of lateral outlets at the right, arrow) must be closed. Adjust stop screw (51), if required.



1 st version

8 On 2nd version, check whether the blend air flaps (noticed by the air coming out of lateral outlets, right) are closed. If required, turn connecting rod (a) to the left or right.

9 Disconnect vacuum tester and connect vacuum line green to vacuum element (37).



2nd version

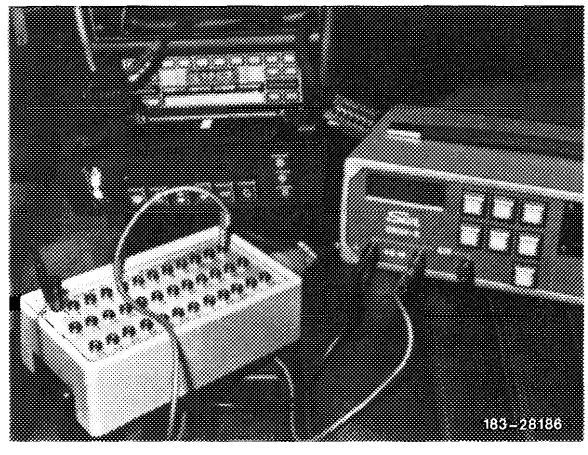
10 Connect socket box on control unit, while plugging electric lines with red adhesive tape to lefthand connecting plug of control unit.

11 Connect voltmeter + to socket 17 and — to socket 1 of socket box.

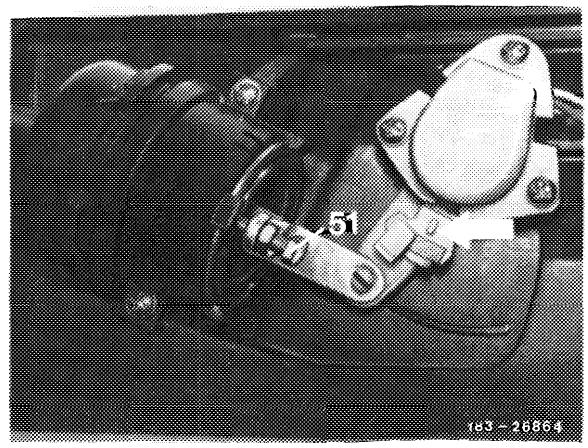
12 Close oil line for oil pressure gauge and run engine at idle speed.

13 Engage temperature wheel at “MIN” and wait for approx. 60 seconds.

14 Set voltage to 4 ± 0.1 V:

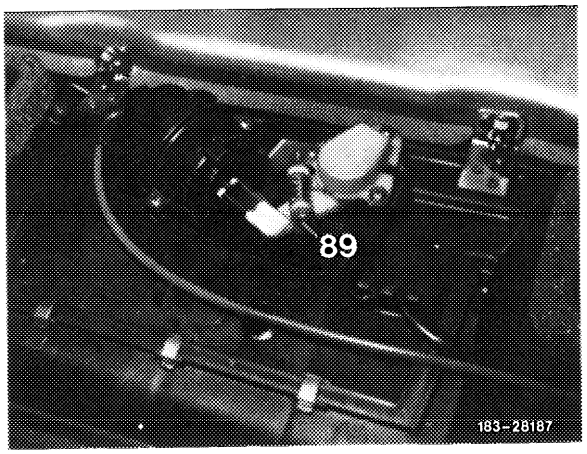


On 1st version adjust to the left or right by bridging the segment on lever (arrow) of potentiometer for flap position. Slightly adjust stop screw (51), if required.



1 st version

15 On 2nd version, turn adjusting screw (89) to the left or right.



2nd version

16 Engage temperature wheel at “MAX”, wait for approx. 60 seconds and test voltage 0.3-l .2 V.

Note: If the voltage is not attained, check whether the blend air flaps are moving from position “full heating” to “full cooling”. Make blend air flaps operable, if required.

17 Close socket box on control unit.

18 Install instrument panel.

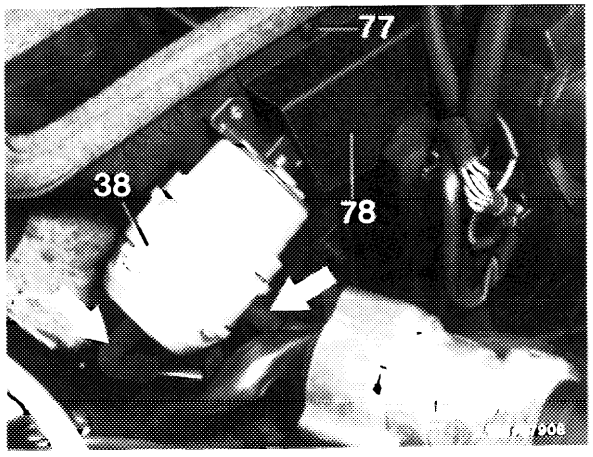
19 Check heater for function.

B. Vacuum element (38) for defroster nozzle flaps

1 Remove instrument cluster.

2 Pull both vacuum lines from vacuum element (38).

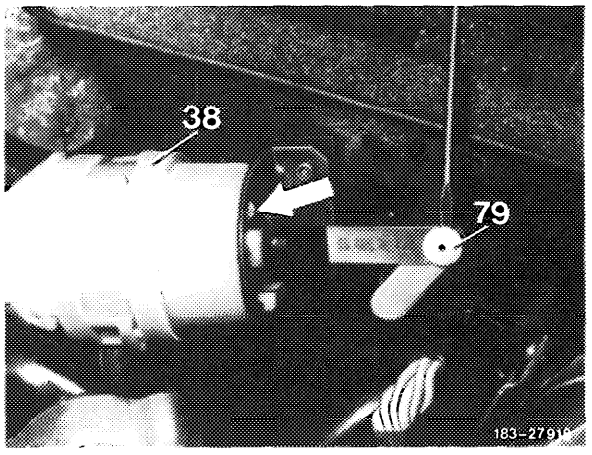
3 Take out rivet (77) and remove cover (78).



4 Remove clamp (79).

5 Push down detent (arrow) of bayonet lock while simultaneously turning vacuum element (38) to the left.

Install in vice-versa sequence.

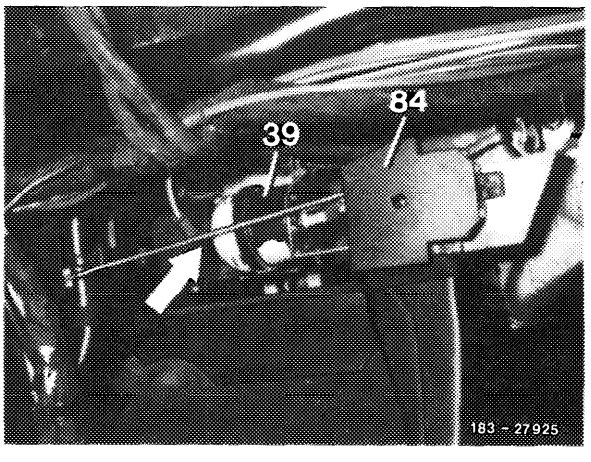


C. Vacuum element (39) for legroom flaps

1 **Remove center console top (68-200).**

2 Pull vacuum line (arrow) from vacuum element (39).

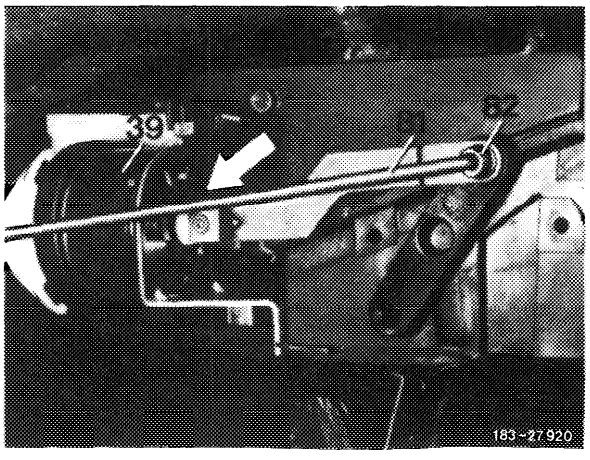
3 Push off cover (84).



4 Pull connecting rod (81) and clip (82) from lever for legroom flaps.

5 Push down detent (arrow) of bayonet lock while simultaneously turning vacuum element (39) to the left.

Install in vice-versa sequence.

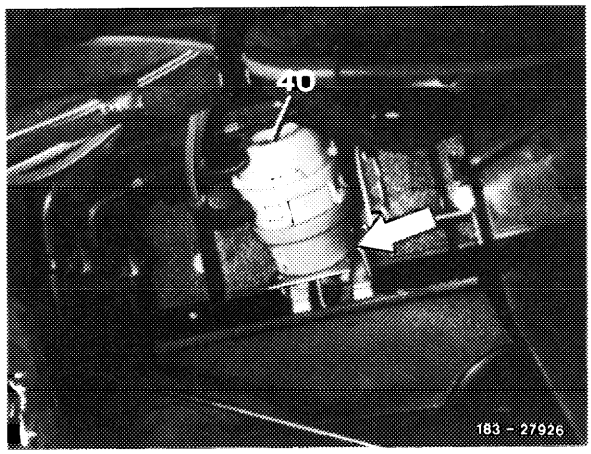


D. Vacuum element (40) for fresh air/recirculating air flap

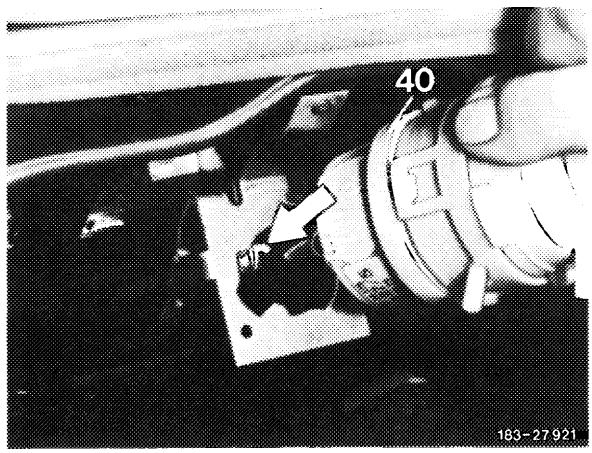
1 Remove vacuum element (39) for legroom flaps (refer to 83-I 65, section C).

2 Pull both vacuum lines from vacuum element (40).

3 Turn vacuum element (40) to the left while slightly lifting vacuum element with a screwdriver (arrow).



4 Push connecting rod of vacuum element from clip (arrow).



5 Connect vacuum lines (medium green/yellow) top and (medium green/light blue) in center to vacuum element (40).

6 Continue installation in vice-versa sequence.

Data

Resistance of rpm sensor	590 ± 60 Ω

Conventional tool

Pliers for locking ring J2 (inside lock)	e.g. Hazet D-5630 Remscheid

1 Remove refrigerant compressor (83-522).

2 Loosen line and plug housing on refrigerant compressor.

3 Open plug housing and remove both plug pins for rpm sensor.

4 Remove locking ring (arrow) and pull out rpm sensor (144).

5 Install in vice-versa sequence, while checking sealing ring on refrigerant compressor for rpm sensor. Renew, if required. Moisten sealing ring with cold-flowing oil.

6 Let refrigerant vapor flow into refrigerant compressor on service valve (arrow). A bottle or filling cylinder pressure of above 4 bar gauge pressure is required.

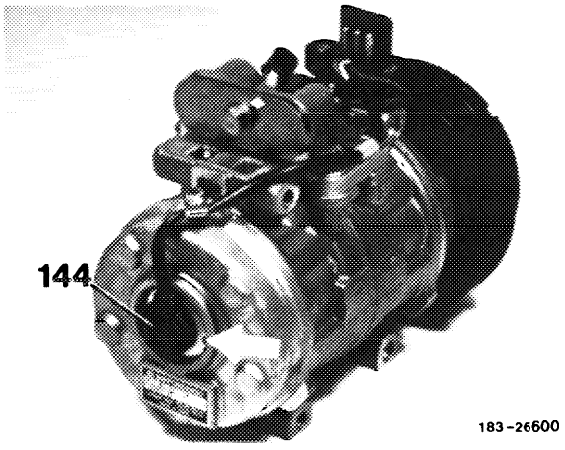
7 In installation position of refrigerant compressor, rotate compressor shaft several times manually in direction of rotation.

8 Check refrigerant compressor for leaks by means of leak test.

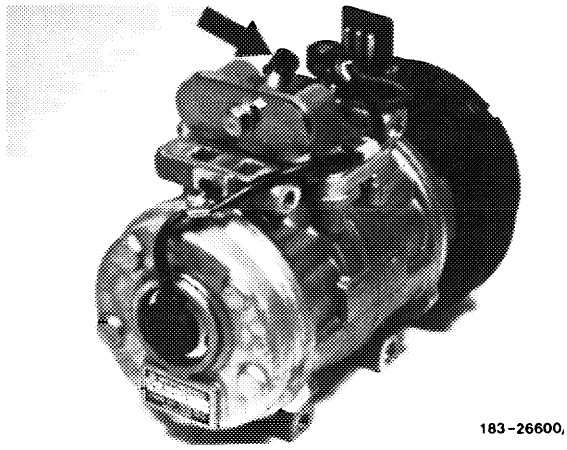
9 Connect valve on service unit or on filling cylinder again and remove hose line on service valve.

10 Install refrigerant compressor (83-522).

11 Evacuate air conditioning system, fill again, and check for function and leaks (83–036).



183-26600


183-26600,

83-517 Removal and installation of rpm sensor on starter ring gear (model 201.122)

Data

Resistance of rpm sensor	1.8 ± 0.2 kΩ

Conventional tool

Hex. socket wrench 5 mm

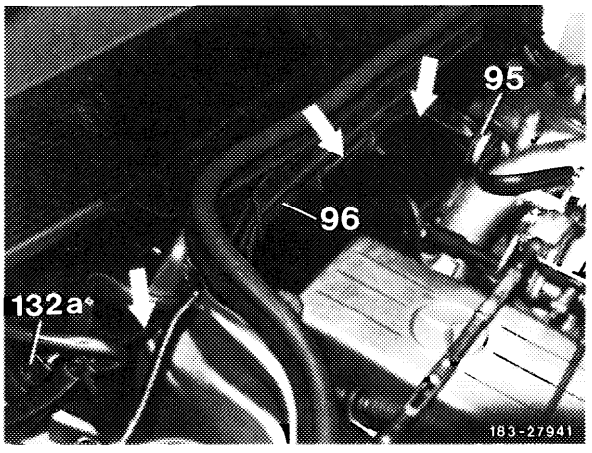
1 Remove air cleaner housing.

2 Remove rear engine compartment panelling, below.

3 Separate 2-pin plug connection (132a).

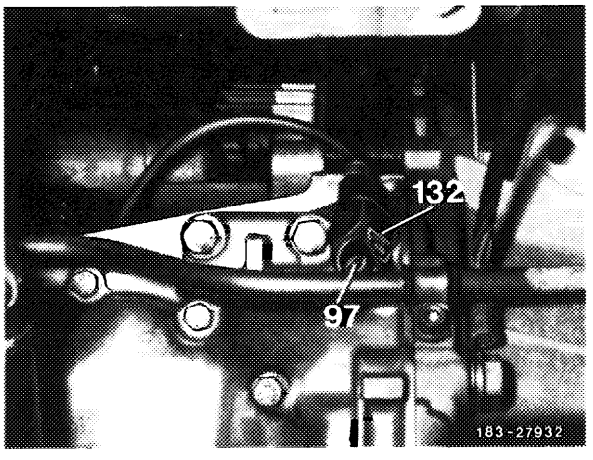
4 Remove clamp (95).

5 Open line cover (96) and expose line of rpm sensor (arrows).



6 Unscrew screw (97) and pull rpm sensor (132) out of oil pan.

Install in vice-versa sequence.



83–520 Checking oil level in refrigerant compressor

Oil filling capacity

Oil type cold-flowing oil (for approved refrigerant compressor oil types refer to Specifications for Service Products, page No. 362)

Oil capacity, fresh oil, in refrigerant compressor	Delco refrigerant compressor	170 cc
	Nippondenso refrigerant compressor	120 cc

Jobs on refrigerant system

During each repair job on refrigerant system renew container of receiverdrier on principle.

Procedure	Quantity of compressor oil to be filled in, including 10 cc oil for receiverdrier
1. Repair or slow loss of refrigerant	
Refilling refrigerant:	
Up to 400 g (no leak showing up)	Do not fill in compressor oil.
Completely fill system owing to leaks and renew receiver-drier.	20 cc fresh oil
Renew refrigerant compressor and receiver-drier. Drain oil from removed compressor and measure quantity. Also drain oil from new compressor.	Same quantity as from removed compressor and fill an additional 10 cc (for receiverdrier) into new compressor, drained oil of new compressor can be used.
Recondition refrigerant compressor (e.g. front shaft seal) and renew container of receiver-drier. For this purpose, drain refrigerant slowly (suction end).	Fill 20 cc of fresh oil into compressor.
2. **Sudden discharge of system (e.g. broken line or accident)**	
Renew defective part and receiver-drier as described under 1. and 3., including specified quantity of oil.	Fill in additional 40 cc compressor oil.

Note

Upon evacuation (approx. 30 minutes) fill air conditioning system with approx. 200 g refrigerant R 12 and check for leaks. Then drain refrigerant again and evacuate again (approx. 15 minutes).
Then fill system with specified quantity of refrigerant and test air conditioning system for function.

3. Replacing components	
Renew condenser	20 cc of fresh oil
Renew evaporator	40 cc of fresh oi l
Renew receiver-drier	10 cc of fresh oil
Suction line from evaporator to compressor and pressure line from compressor to condenser	10 cc of fresh oil each

Note

If the refrigerant compressor is reconditioned or renewed, pay attention to quantity of cold-flowing oil to be filled in.
For details refer to oil capacity while working on refrigerant system. But be sure to install a new receiver-drier each time.

If up to 400 g refrigerant are lost over a longer period, no cold-flowing oil need be added. If more than 400 g of fresh refrigerant are filled in, check air conditioning system for leaks. If refilling is required, add approx. 20 cc of cold-flowing oil into system prior to evacuating.

Checking and correcting oil capacity of refrigerant compressor

1 Remove refrigerant compressor (83-522).

2 If the refrigerant compressor is renewed, drain oil from refrigerant compressor while holding refrigerant compressor Delco R 4 with shaft end in upward direction and holding refrigerant compressor Nippondenso with pressure and suction hole in downward direction and letting the oil run out through pressure and suction hole for approx. 10 minutes. Accelerate draining of the oil by rotating drive shaft (coupling) several times.

3 Drain oil from new refrigerant compressor as described under item 2.

4 Check how much oil has run out of original refrigerant compressor and out of pipe line.

5 Fill similar quantity of fresh oil into new refrigerant compressor through suction hole, plus an additional 10 cc for new receiver-drier.

6 When reconditioning refrigerant compressor (e.g. front shaft seal) renew receiver-drier and add an additional 20 cc of fresh oil into compressor.

7 Install refrigerant compressor (83–522).

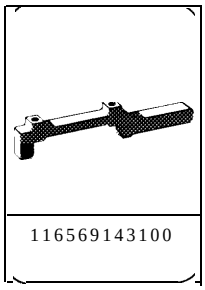
A. Delco refrigerant compressor engine 102

Oil filling capacity

Oil type cold-flowing oil (for approved refrigerant compressor oil types refer to Specifications for Service Products, page No. 362)	
Oil capacity, fresh oil, in refrigerant compressor	170 cc

Tightening torques	Nm
Screws M 12 refrigerant compressor on carrier	60 + 10
Screw pipe line on refrigerant compressor	50 ± 3
Hose line from evaporator to pipe line 7/8''	29–37
Hose line from pipe line to condenser 7/8''	29–37

Special tools



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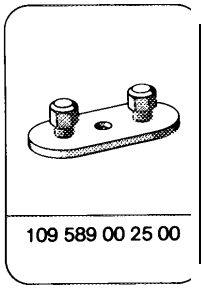

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Conventional tools

Double open-end wrench 1/2'' x 9/16'', 5/8'' x 3/4'', 7/8'' x 15/16'', 1'' x 11/8''	
Socket 14 mm, 3/8'' square	
Assembly tester with 3 filling hoses or evacuating and filling equipment for air conditioning system	e.g. Christof Fischer Augsburger Str. 289, D-7000 Stuttgart 60

Note

If the refrigerant compressor must be renewed or reconditioned, fill in oil according to job No. 83–520.

If the refrigerant compressor is renewed owing to inside damage (e.g. blocking or damage on valve plates), additionally renew pipe line on compressor, expansion valve and receiver-drier. In addition, check function and direction of rotation of auxiliary fan (clockwise) by means of 20 bar and 100 °C switch.

Removal

1 Mask both front fenders.

2 Disconnect battery.

3 Remove engine compartment panelling, below.

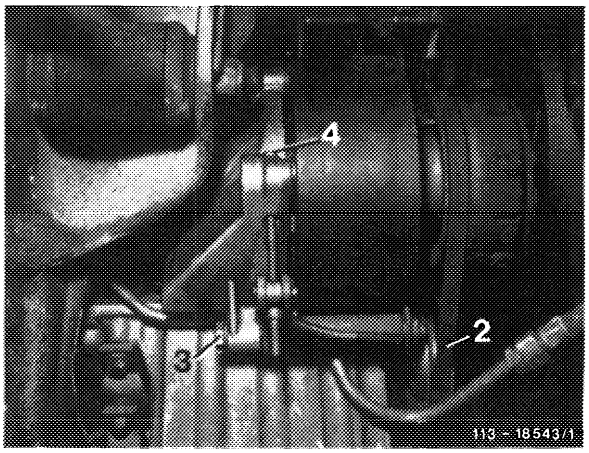
4 Remove alternator.

5 Drain air conditioning system.

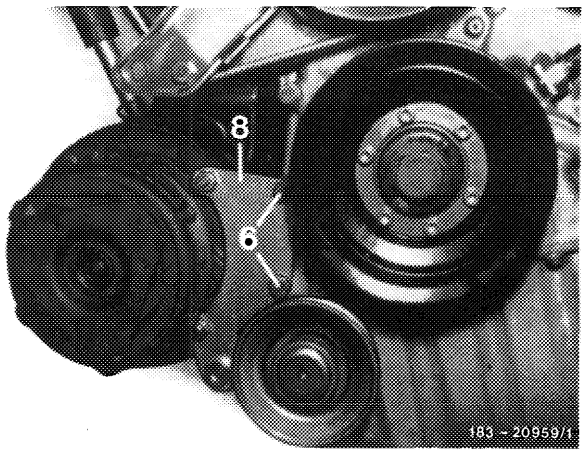
6 Pull plug from electromagnetic clutch.

7 Loosen screw (3).

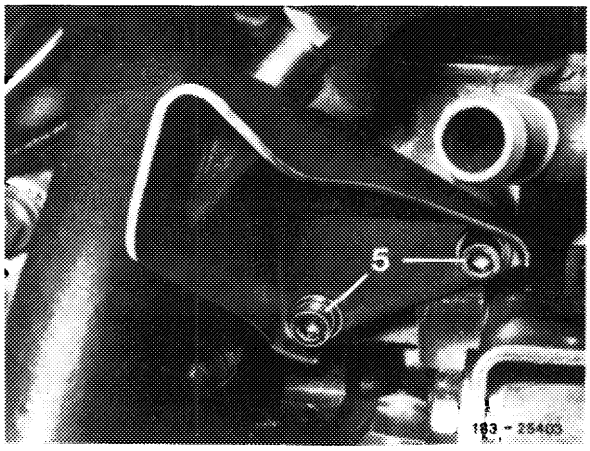
8 Loosen tensioning screw (7) and remove V-belt (2).



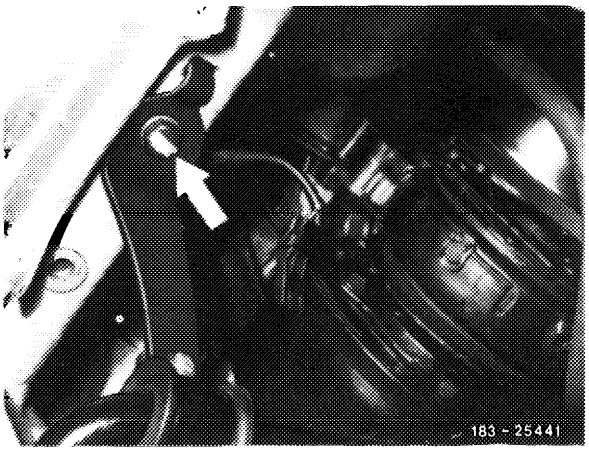
9 Unscrew screws (6) on holder (8).



10 Unscrew screws (5) on holder of pipe line.



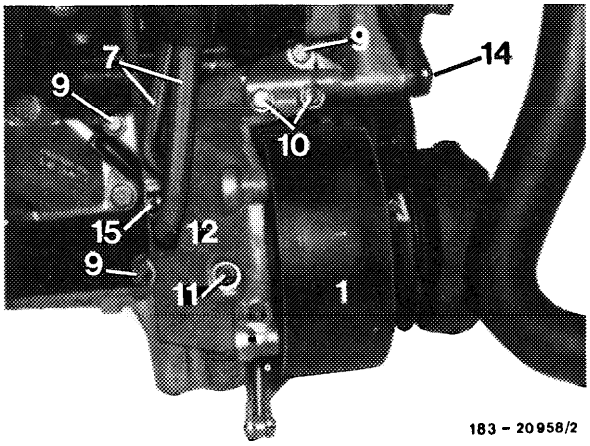
11 Unscrew screw (arrow) left and right on **torsion** bar and pull torsion bar in downward direction.



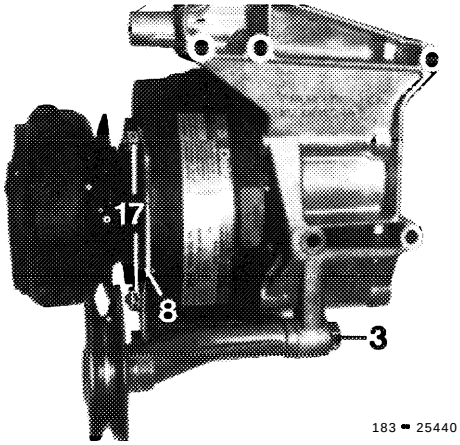
12 Unscrew screw (15) from pipeline.

13 Unscrew screws (9 to 11 and 14) on carrier for refrigerant compressor.

14 Remove refrigerant compressor (11) with carrier (12) in downward direction.



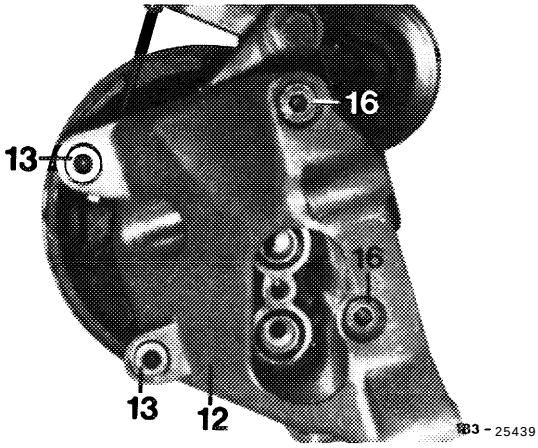
15 Unscrew nuts (17) and screw (3) on holder (8).



16 Unscrew screws (13 and 16) and **remove refrigerant compressor from carrier (12).**

17 If the refrigerant compressor is renewed, refer to section "Testing oil level in refrigerant **compressor" (83-520).**

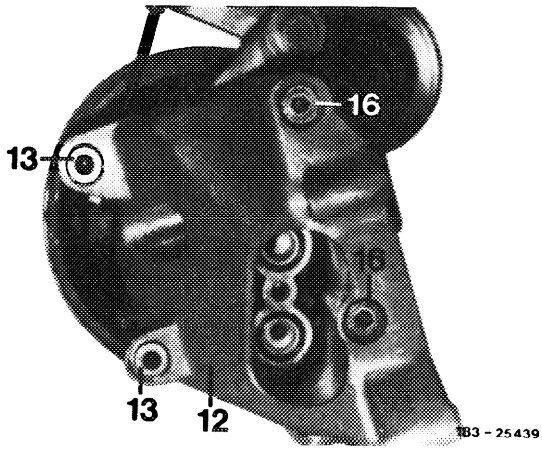
18 When working on electromagnetic clutch or on shaft seal, close connections on refrigerant compressor with pressure-testing plate.



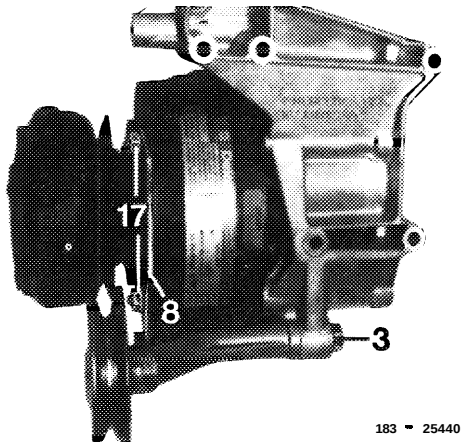
Installation

19 Check O-rings on refrigerant compressor and renew, if required.

20 Screw carrier (12) to refrigerant compressor by means of screws (13 and 16).

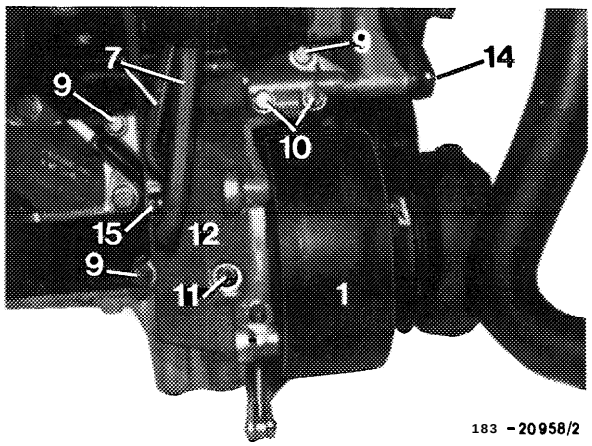


21 Mount holder (8) on carrier with screw (3) and nuts (17).

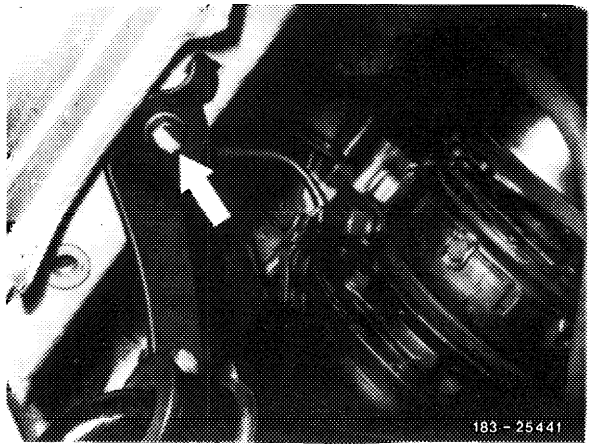


22 Install refrigerant compressor with carrier from below and mount to engine block by means of screws (9 to 11 and 14).

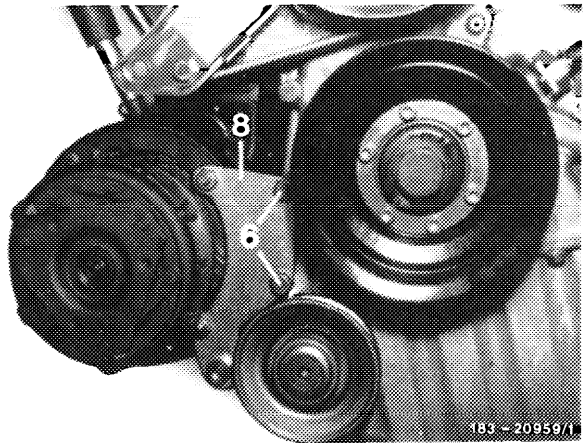
23 Mount pipe line with screw (15).



24 Mount torsion bar, top, with screws (arrow).

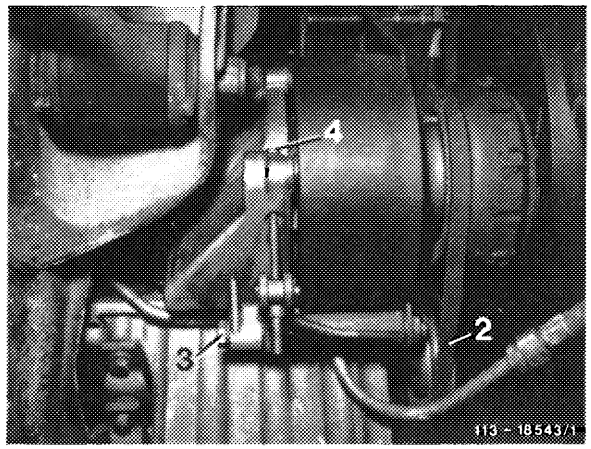


25 Mount holder (8) with screws (6).



26 Mount V-belt (2) and tension with tensioning screw (4).

27 Tighten screw (3).



28 Screw screws (5) to holder for pipe line.

29 Insert plug on electromagnetic clutch.

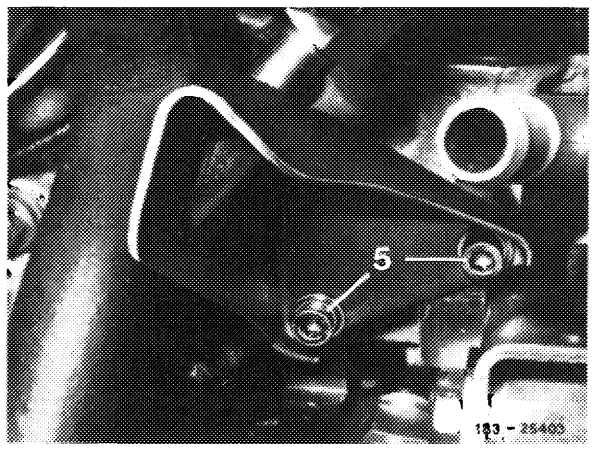
30 Install alternator.

31 Renew receiver-drier (83–530).

32 Connect battery.

33 Evacuate air conditioning system and refill.

34 Install engine compartment panelling, below.



Attention!
When filling oil into refrigerant compressor, handle like a new refrigerant compressor, i.e. during initial operation of engine, run for min. 4 minutes at **idle speed** only.

35 Check air conditioning system for function and leaks (83–036).

B. Nippondenso refrigerant compressor engine 601

Oil filling capacity

Oil type cold-flowing oil (for approved refrigerant compressor oil types refer to Specifications for Service Products, page No. 362)	
Oil capacity in new refrigerant compressor in cc	120

Tightening torques	Nm
Screw, carrier to crankcase M 8 x 40 / M 8 x 60	23 ± 2.3
Screw, compressor to carrier M 8 x 95	23 ± 2.3
Suction or pressure hoses on refrigerant compressor	23 ± 2.3

Spare part

Closing plate for refrigerant compressor	601 131 00 21

Conventional tools

Open-end wrench
Socket 10 mm, 13 mm (3/8'' square)

Note

Bores and screws with metric threads, hose connections as before with inch threads.

If the refrigerant compressor must be renewed or reconditioned, fill in oil according to job No. 83-520.

If the refrigerant compressor is renewed owing to inside damage (e.g. blocking or damage on valve plates), additionally renew pipe line on compressor, expansion valve and receiver-drier. In addition, check function and direction of rotation of auxiliary fan (clockwise) by means of 20 bar and 100 °C switch.

Removal

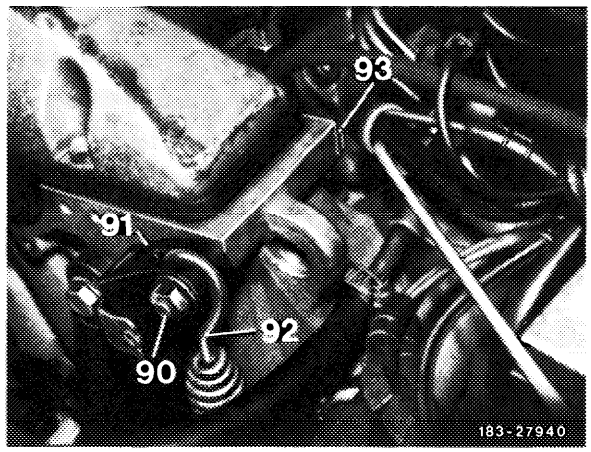
1 Mask both front fenders.

2 Drain air conditioning system.

3 Remove air cleaner and air scoop.

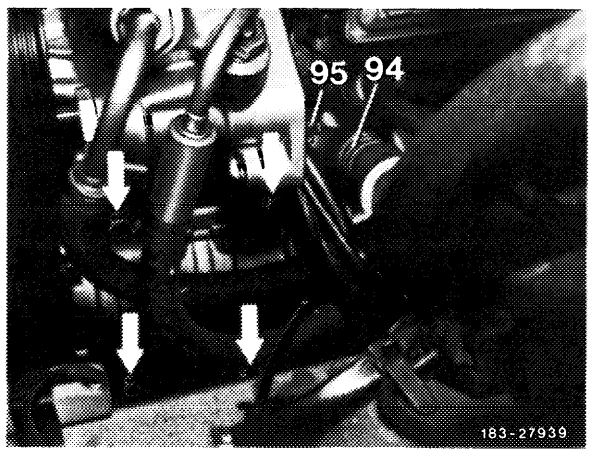
4 Slacken V-belt and remove. For this purpose, unscrew flange nut (90). Insert a mandrel into spring tensioning lever (91) and push against force of draw spring (92), while pulling back screw (93). Load spring tensioning lever and remove V-belt.

5 Pull plug from refrigerant compressor.



6 Disconnect hose line (94) from refrigerant compressor, unscrewing screw (95) for this purpose. Then mount connections to refrigerant compressor with closing plate (refer to special tools) and available screw (95).

7 Unscrew four screws (arrow) on refrigerant compressor and remove refrigerant compressor in upward direction.



Installation

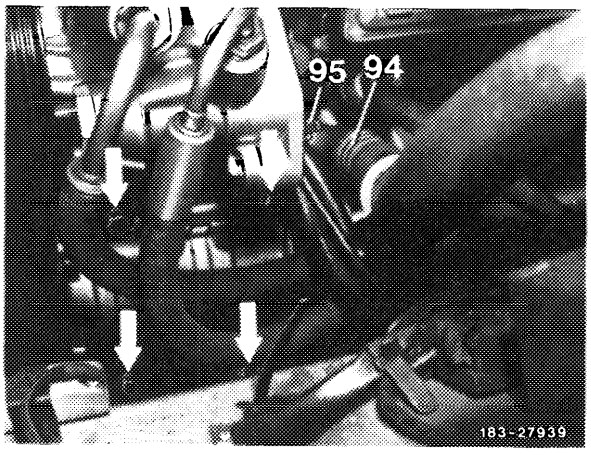
Attention!
New refrigerant compressors are filled with refrigerant. Slowly drain refrigerant at service valve prior to installing new refrigerant compressor.

8 Correct oil level (83–520).

9 If refrigerant compressor is not renewed, check O-rings at connections and renew, if required.

10 Screw refrigerant compressor to carrier (arrows).

11 Connect hose line (94) to refrigerant compressor.



12 Insert plug on refrigera nt compressor.

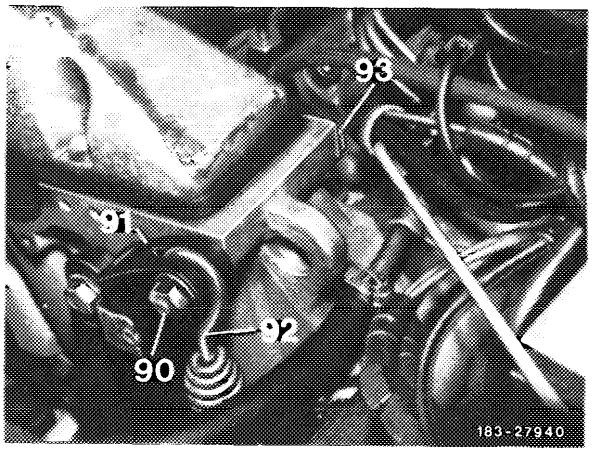
13 Mount V-belt. Push spring tensioning lever (91) back with a mandrel, slip screw (93) through spring tensioning lever and screw on nut (90).

14 Install air scoop and air cleaner.

15 Renew receiver-drier (83–530).

16 Evacuate air conditioning system and refill.

17 Check air conditioning system for function and leaks (83–036).

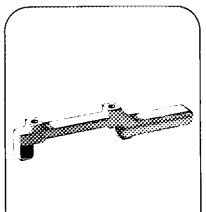


A. Delco refrigerant compressor engine 102

Data

Designation	Delco radial 4-cylinder
Max. speed rpm (l/min)	7000
Power input at max. compressor speed kW (HP)	approx. 6.3 (8.5)
Cylinder capacity	164 cc
Oil filling capacity	
Oil type cold-flowing oil (for approved refrigerant compressor oil types refer to Specifications for Service Products, page No. 362)	
Oil capacity, fresh oil, in refrigerant compressor	170 cc
Tightening torques	Nm
Screws (8) pulley clutch body	11
Screw M 10 x 30 pipe line to refrigerant compressor	50 ± 3
Nut (1) to drive shaft	13
Screws (5 and 6) M 12 refrigerant compressor to carrier	60 + 10
Hose line (14) from evaporator to pipe line 7/8''	29-37
Hose **line** (15) from pipe line to condenser 3/4''	24-28

Special tools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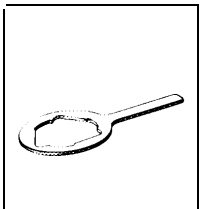
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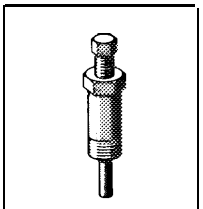
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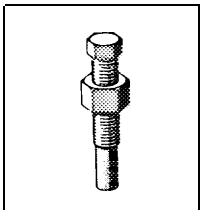
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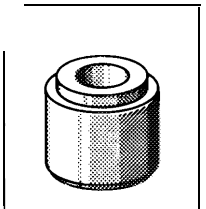
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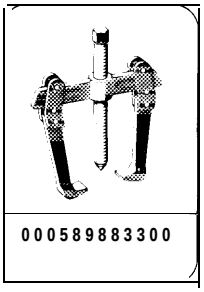

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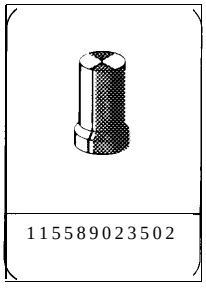

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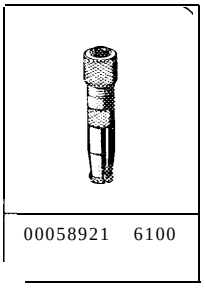

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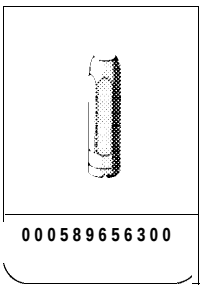

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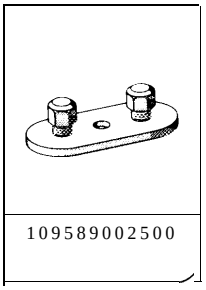

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Conventional tools

Socket **14** mm, 3/8'' square	e.g. Hazet, D-5630 Remscheid
Slip gauge (set)	e.g. Hazet, D-5630 Remscheid Order No. 2147
Langbeck pliers 72 J (internal lock)	e.g. Hazet, D-5630 Remscheid Order No. 1846a-1
Pliers for locking ring A 2 (outside lock)	e.g. Hazet, D-5630 Remscheid Order No. 1846 c-2
Double open-end wrench 1/2'' x 9/16'', 5/8'' x 3/4'', 7/8'' x 15/16'', 1" x 1 1/8''	

Self-made tool

Remover for O-ring

a) Renewing shaft seal of refrigerant compressor

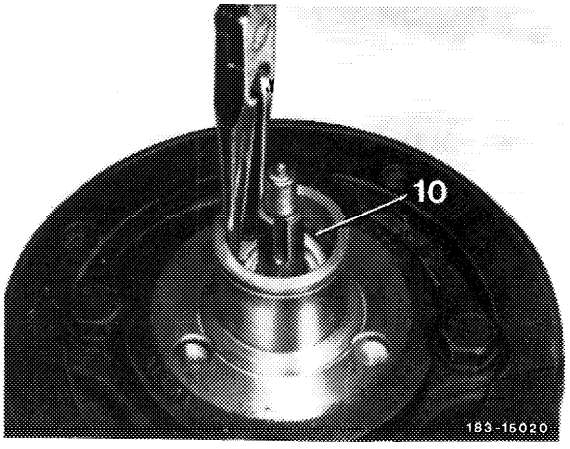
Removal

1 Drain air conditioning system.

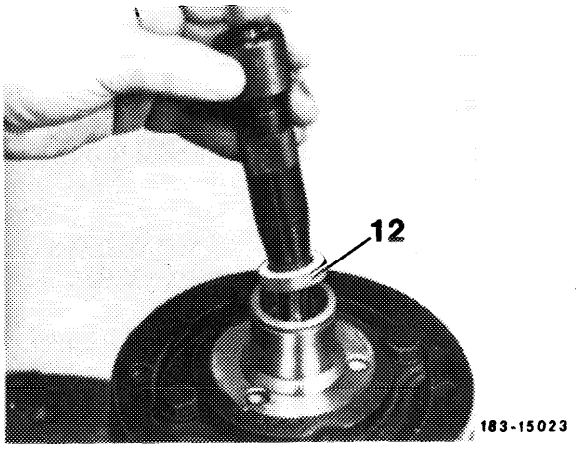
2 Remove refrigerant compressor (83-522).

3 Remove spring plate (83-526).

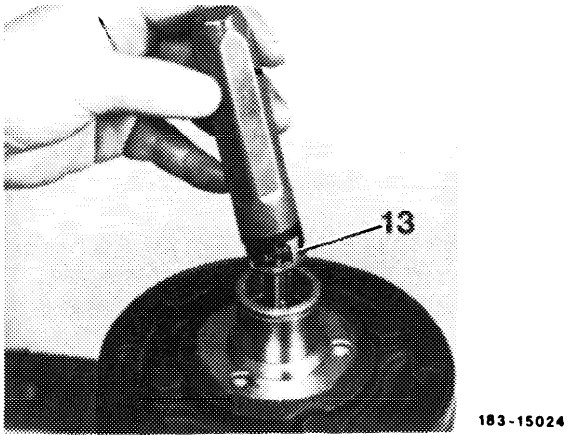
4 Remove locking ring (10) for shaft seal.



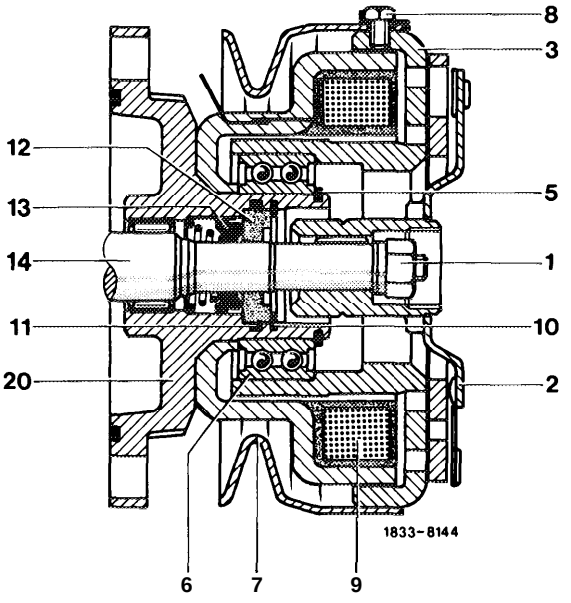
5 Remove slip ring (12) by means of remover and installer.



6 Remove shaft seal (13) by means of remover and installer. Keep pushing against tool, turn tool to the right to contact lug of shaft seal with detents on tool. Remove complete shaft seal from shaft by straight pulling.



7 Remove O-ring (11) from inside bore in housing cover. A wire, bent to a hook, can be used for this purpose.



1 Nut on drive shaft
2 Spring plate
3 Coupling member
5 Locking ring
6 Bearing for coupling member
7 Pulley
8 Screw with lock
9 Magnetic coil
10 Locking ring
11 O-ring
12 Slip ring
13 Shaft seal
14 Drive shaft
20 Housing cover

8 Check whether parts of the old shaft seal are still in bore of housing cover. Clean bore prior to inserting new seal.

9 Dip new sealing parts into clean cold-f lowing oil. Insert O-ring (11) into groove of housing cover.

10 Insert shaft seal (13) into tool and slip on shaft. Keep turning tool to the right until shaft seal engages in shaft. Only then turn the tool to the left for disengagement on lugs of shaft seal and remove.

11 Introduce slip ring (12) into bore by means of tool until ring touches shaft seal. Make sure that the O-ring **(11)** is not pushed out of groove.

Attention!
Sealing surface of slip ring (12) must be protected against any kind of damage, e.g. scratches.

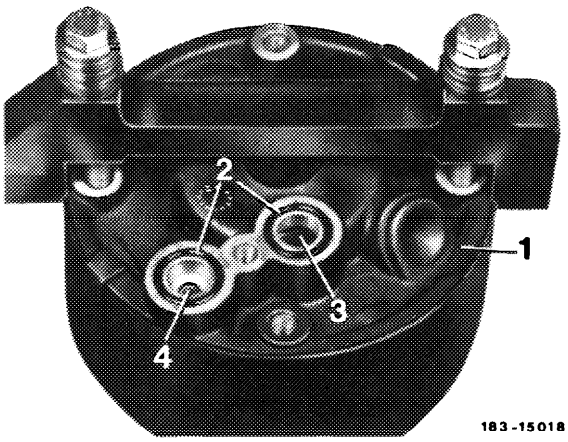
12 Introduce locking ring (10) with flat side facing downwards until the locking ring rests on slip ring. Then push against locking ring with lock pliers or a screwdriver until locking ring snaps into groove.

13 Install spring plate (83-526).

b) Checking refrigerant compressor for external leaks

Note: When working on shaft seal it wi II be of advantage to drain all the cold-flowing oil from refrigerant compressor. Determine drained quantity of cold-flowing oil and fill same quantity of fresh oil into refrigerant compressor. For details refer to Checking oil level in refrigerant compressor (83–520).

14 Check installed sealing rings (2) on refrigerant compressor (1) for condition, renew if required and provide with cold-f lowing oil.



1 Refrigerant compressor
2 Sealing ring
3 Suction connection
4 Pressure connection

15 Screw pressure-testing plate (3) with available hex. screw to refrigerant compressor (1).

16 Connect inner connection of pressure-testing plate with hose line (4) of service unit.

17 Let refrigerant vapor flow into refrigerant compressor. A bottle or filling cylinder pressure of above 4 bar gauge pressure is required.

18 In installation position of refrigerant compressor, rotate compressor shaft in direction of rotation manually several times.

19 Check refrigerant compressor with leak tester for leaks.

20 Close valve on service unit or on filling cylinder again and remove hose line from pressure-testing plate.

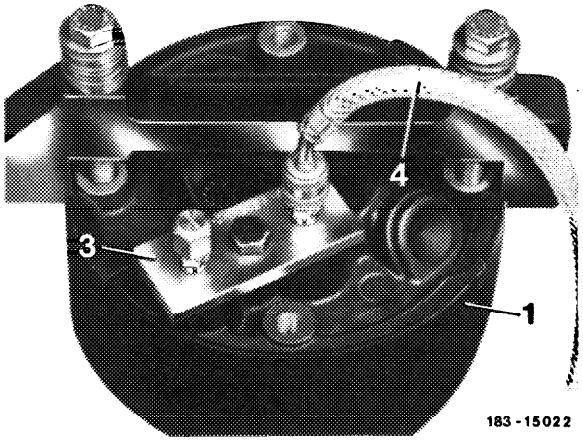
21 Remove pressure-testing plate again, but only directly before attachment of pipe line.

22 For details concerning oil filling capacity of refrigerant compressor refer to “Checking oil level in refrigerant compressor” (83-520).

23 Renew receiver-drier (83-530).

24 Install refrigerant compressor (refer to 83-522).

25 Evacuate air conditioning system and fill again, also check for function (83-036).



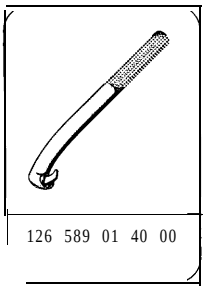
B. Nippondenso refrigerant compressor engine 601

Data, test values

Designation 10 P 15 G, 5 double piston swash plate compressor	
Displacement cc	153
Nominal output kcal/h	5200 at 14.7 bar
Power input kW	3.1
Max. rpm 1/min	8000
Nominal rpm 1/min	7000
Oil filling capacity (fresh oil) cc	120

Tightening torques	Nm
Screw carrier to cylinder head M 10 x 30	30 ± 3.0
Screw compressor to holder M 8 x 90	20 ± 2.5
Nut M 8 to compressor shaft	16 ± 1.0

Special tools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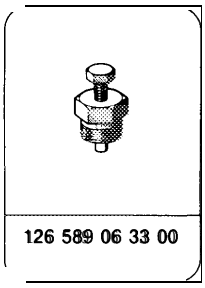
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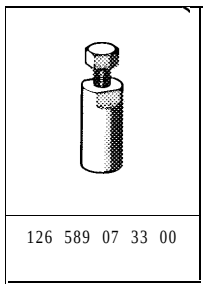
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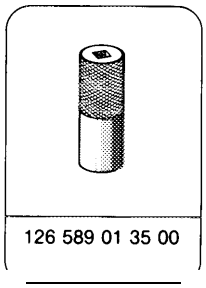
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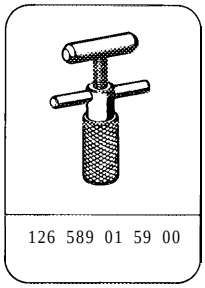
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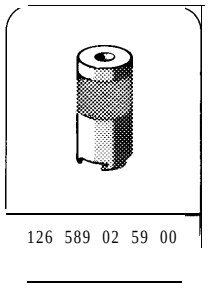
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Spare part

Closing plate for refrigerant compressor	601 131 00 21

Conventional tools

Pliers for locking ring J 3 (inner)	e.g. Hazet, D-5630 Remscheid

Slip gauge (set)	e.g. Hazet, D-5630 Remscheid
Socket 12 mm, 13 mm (3/8'' square)	e.g. Hazet, D-5630 Remscheid
Double open-end wrench 12 x 14, 17 x 19, 24 x 26	e.g. Hazet, D-5630 Remscheid

Note

Bores and screws with metric threads, hose connections as before with inch threads.

Renewing shaft seal of refrigerant compressor

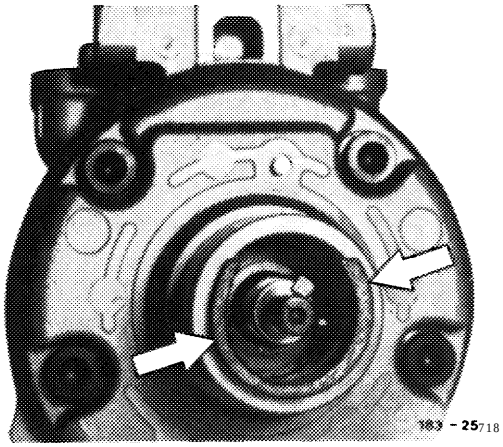
Removal

1 Drain air conditioning system.

2 Remove refrigerant compressor (83-522).

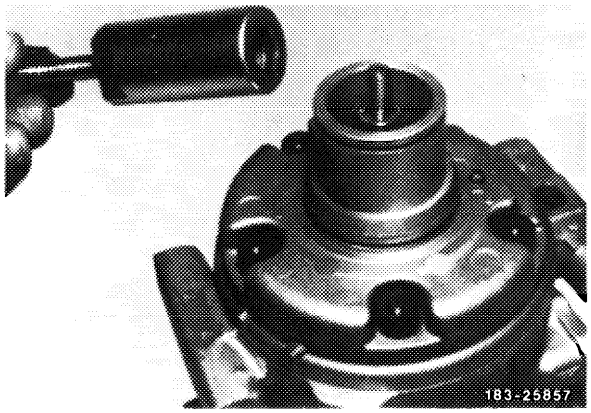
3 Remove spring plate (83-526).

4 Push out dust seal (arrow) with a screwdriver.



5 Plug key puller on compressor shaft and rotate by half a turn.

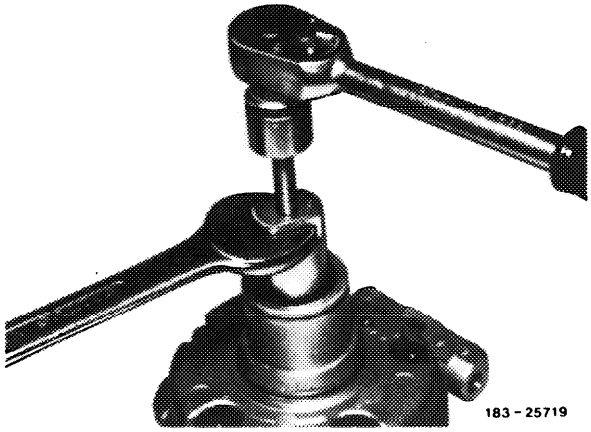
Attention!
Pay attention to inclination of refrigerant compressor to prevent loss of oil.



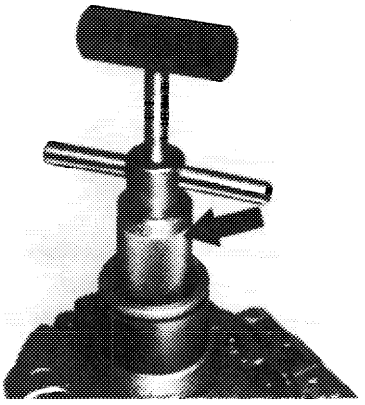
6 Pull out key and remove.

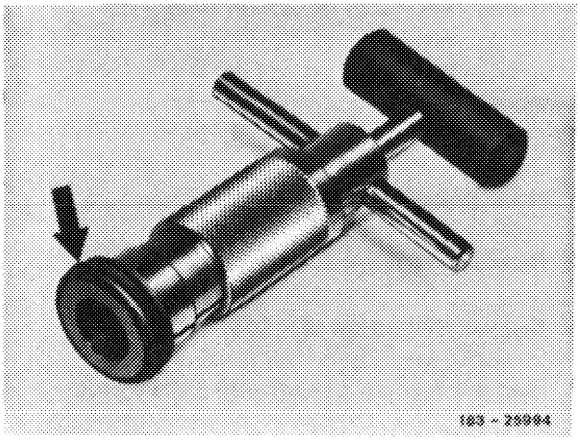
7 Remove locking ring by means of circlip pliers (J 3).

8 Apply cold-flowing oil to inner bore of refrigerant compressor.

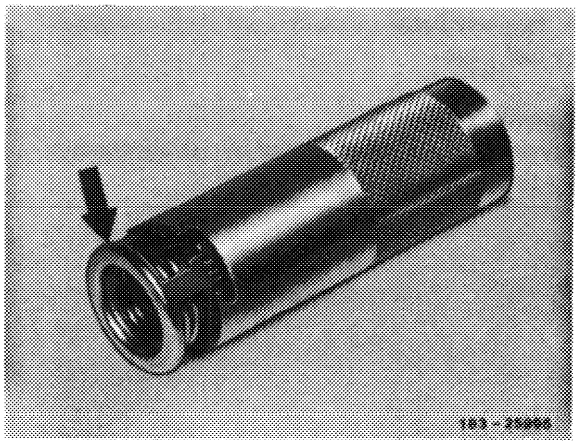


9 **Insert sealing plate-assembly tool against shaft and push holding ring (arrow) down up to mark. Pull out sealing plate and remove from tool.**



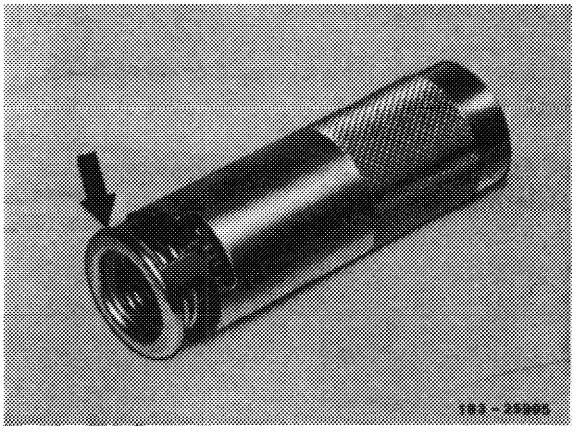


10 **Introduce assembly tool for shaft seal against shaft, push in, turn to the right and remove shaft seal.**



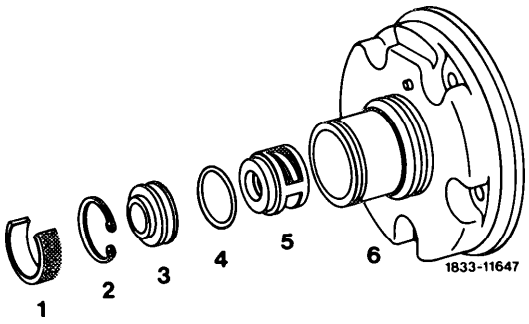
Installation

Attention!
The crankshaft seal on coupling side of refrigerant compressor is available as a complete unit only and must also be installed as such. Never install new and used parts together.
Newly installed shaft sealing sets need not be removed again immediately owing to a slight leak. The carbon ring is lapped together with the inside of the sealing plate. Its fit is getting better during running-in time of shaft seal.



11 Fasten shaft seal on assembly tool and moisten with cold-flowing oil.

12 Insert shaft seal and loosen special tool by turning to the left.

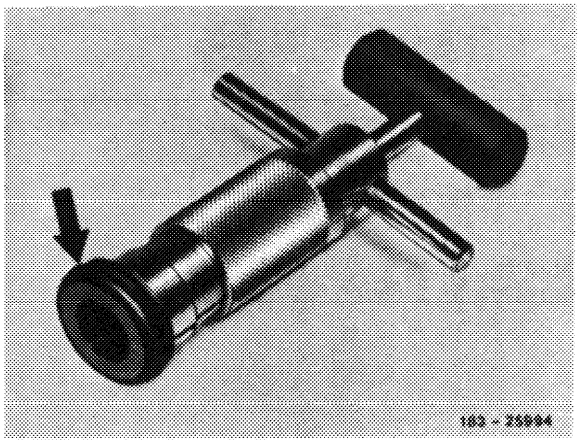


1 Dust seal
2 Locking ring
3 Sealing plate
4 O-ring
5 Shaft seal
6 Head part, front

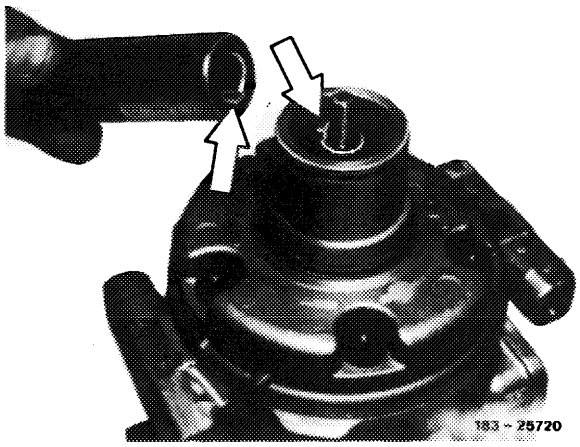
13 Fasten sealing plate to assembly tool (Fig.) and lubricate with cold-flowing oil.

14 Insert sealing plate and mount locking ring.

Attention!
Tapered surface of locking rings must be front end.

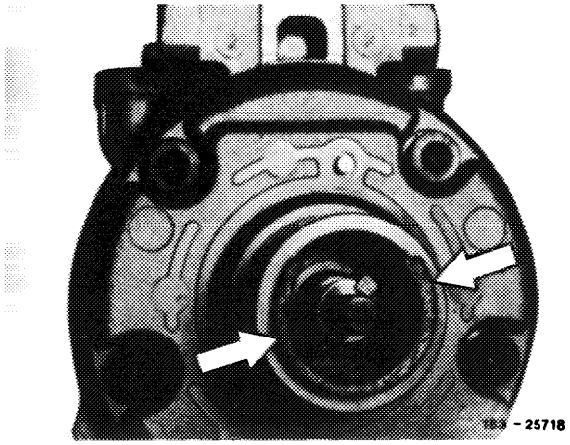


15 Mount key and push in (arrows).



16 Push in dust seal (arrows).

17 Install spring plate (83–526).



18 Let refrigerant vapor flow into refrigerant compressor at service valve (arrow). A bottle or filling cylinder pressure of above 4 bar gauge pressure is required.

19 In installation position of refrigerant compressor rotate compressor shaft several times manually in direction of rotation.

20 Test refrigerant compressor with leak tester for leaks.

21 Close valve on service unit or on filling cylinder again and remove hose line on service valve.

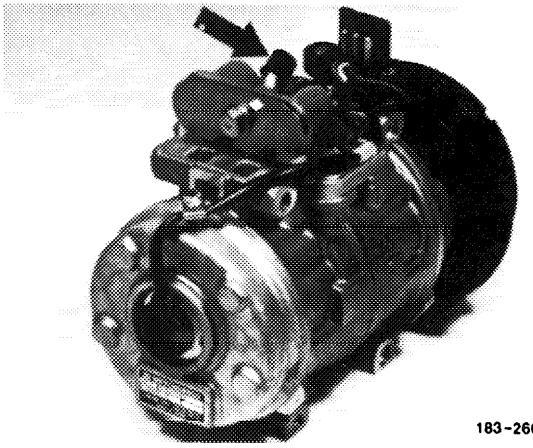
22 Install refrigerant compressor (83-522).

23 Renew receiver-drier (83-530).

24 Correct oil quantity (83–520), while adding an additional 10 cc of fresh oil into compressor.

25 Leak test and evacuate.

26 Evacuate air conditioning system and refill, also check for function (83-036).



183-26600/1

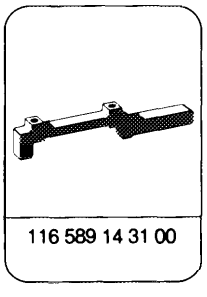
A. Delco refrigerant compressor engine 102

Data, test values

Electromagnetic clutch 12 V	Delco 4.9 inch
Power input in amps at 13.5 V	cold 3.9 warm 3.4

Tightening torques	Nm
Screws (8) pulley-clutch body	11
Screw M 10 x 30 pipe line on refrigerant compressor	50 ± 3
Nut (1) on drive shaft	13
Screws (5 and 6) M 12 refrigerant compressor on carrier	60 + 10
Hose line (14) from evaporator to pipe line 7/8''	29-37
Hose line (15) from pipe line to condenser 7/8''	29-37

Special tools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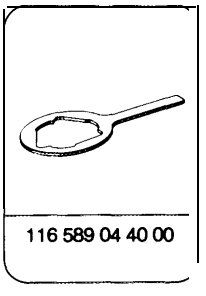
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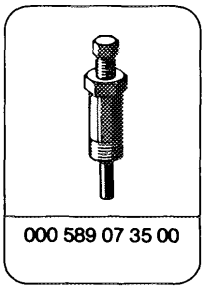
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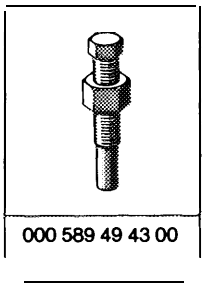
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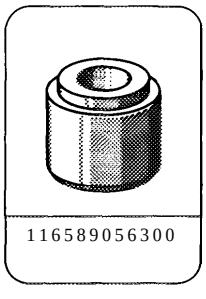
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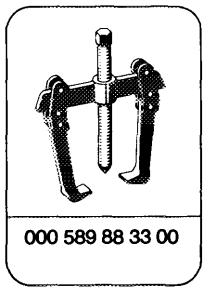
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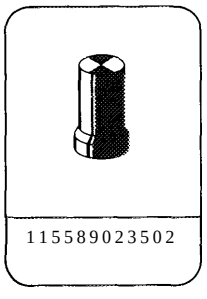
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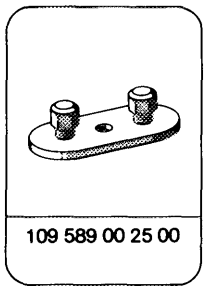
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Conventional tools

Socket **14** mm, 3/8'' square	e.g. Hazet, D-5630 Remscheid
Slip gauge (set)	e.g. Hazet, D-5630 Remscheid Order No. 2147
Langbeck pliers 72 A (inner lock)	e.g. Hazet, D-5630 Remscheid Order No. 1846 a-l
Pliers for locking ring J 2 (outer lock)	e.g. Hazet, D-5630 Remscheid Order No. 1846 c-2

Self -made tool

Remover for O-ring

Note

Removal and installation of spring plate, of coupling member with pulley and magnetic coil, as well as of shaft seal can be performed only with refrigerant compressor removed.

The coupling member with bearing, the pulley and the magnetic coil are together one assembly group. If a part of this assembly group must be renewed, remove entire group (refer to 83-526, section b).

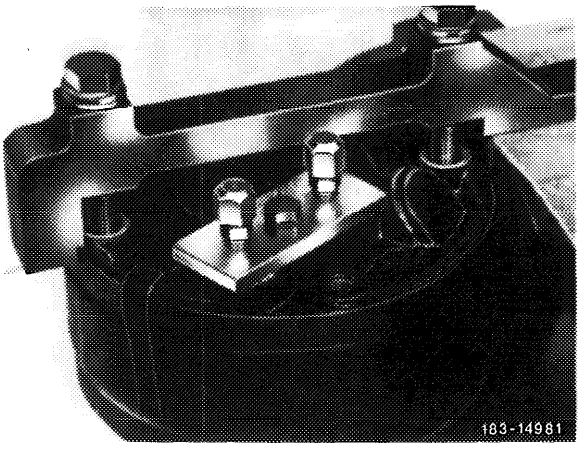
a) Spring plate

Removal

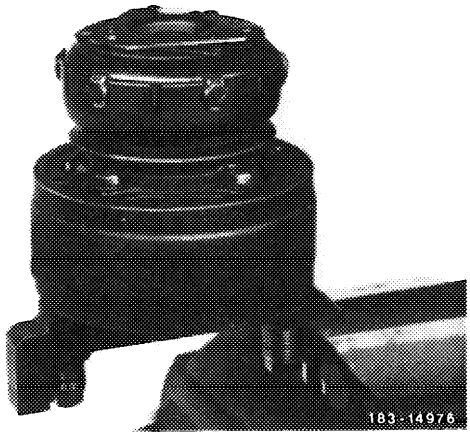
1 Drain air conditioning system.

2 Remove refrigerant compressor (83-522).

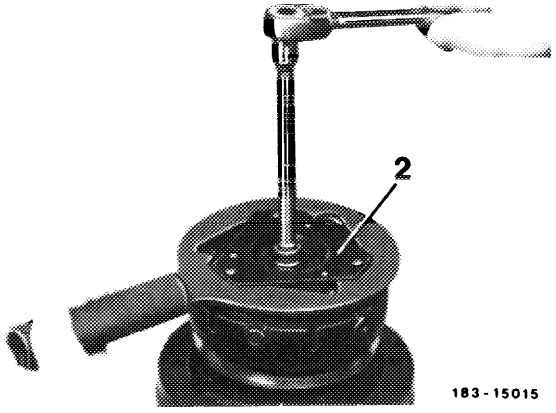
3 Close openings by means of pressure-testing plate. Then fasten holding device on refrigerant compressor and clamp into vise.



4 Loosen refrigerant compressor from holding device and fasten again with drive shaft in upward direction.

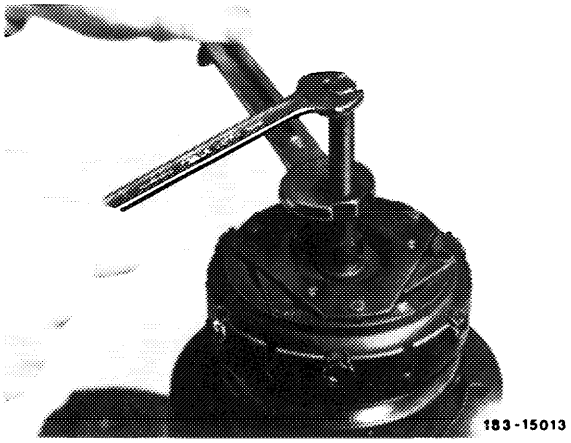


5 Prevent turning of spring plate (2) with holding wrench, unscrew nut from shaft, using socket 14 mm for this purpose.



6 Screw remover into hub, hold tool with wrench and tighten central screw.

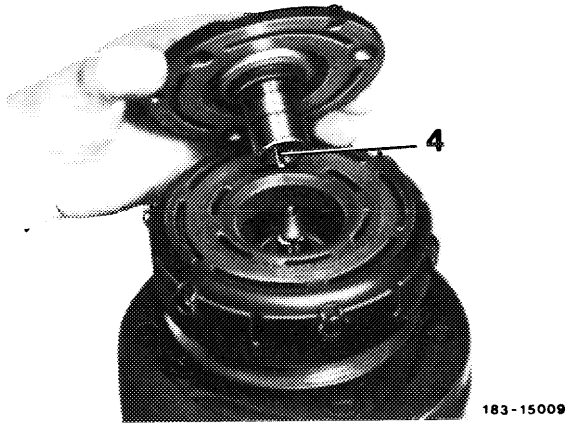
7 Remove key from shaft.



Installation

8 Clean friction surface of spring plate and of coupling member.

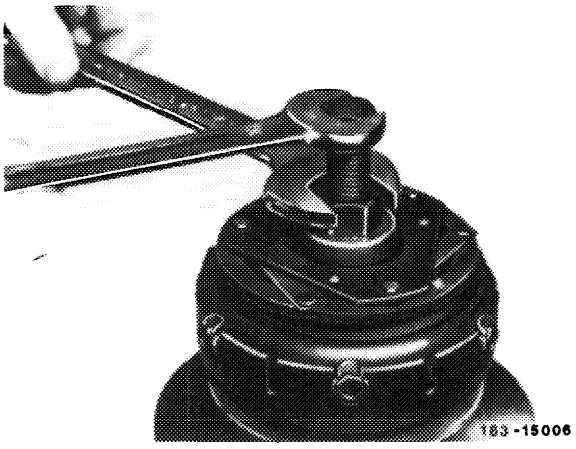
9 Insert key (4) into groove of hub with approx. 5 mm projection.



10 Place spring plate on shaft in such a manner that key and key groove are in alignment.

11 Place spacer on spring plate. Insert installer through spacer and screw installation tool on shaft end.

12 Hold hex. head of tool in place and screw in center screw, until a clearance of approx. 0.5-l mm is obtained between the friction surfaces of the spring plate and the coupling member.



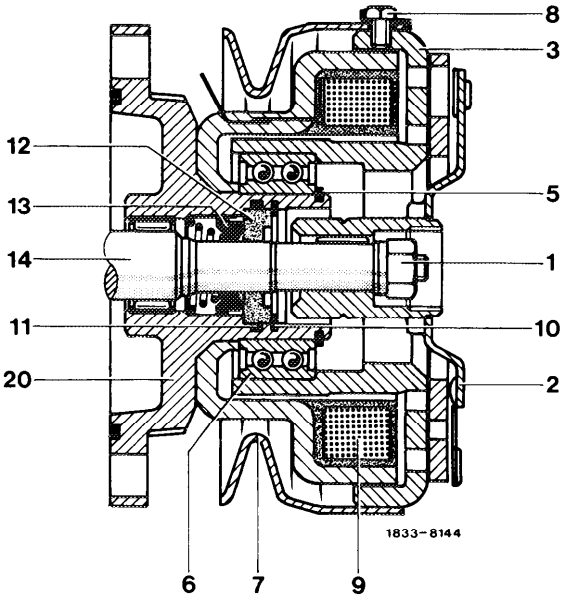
13 Remove installer and spacer.

14 Screw new nut on shaft (smaller diameter of nut in direction of shaft shoulder) and tighten. Check clearance once again.

15 Renew receiver-drier (83–530).

16 Install refrigerant compressor (83-522).

1 Nut on drive shaft
2 Spring plate
3 Coupling member
5 Locking ring
6 Bearing for coupling member
7 Pulley
8 Screw with lock
9 Magnetic coil
10 Locking ring
11 O-ring
12 Slip ring
13 Shaft seal
14 Drive shaft
20 Housing cover

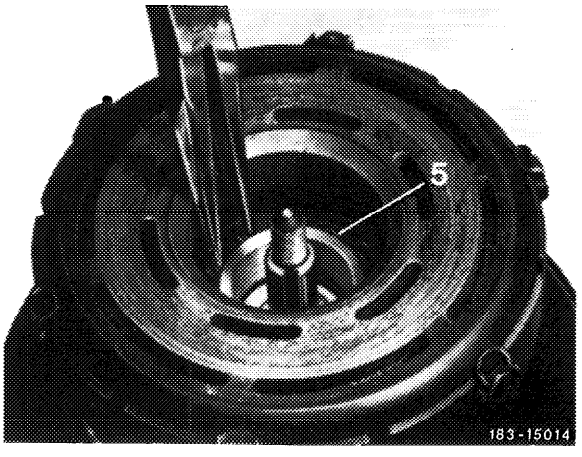


b) Removal and installation of coupling member with pulley, magnetic coil and bearing

Removal

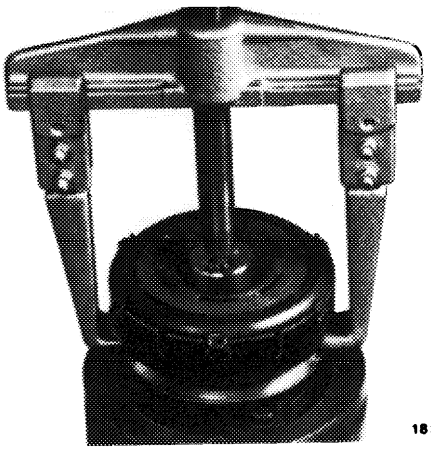
17 Remove spring plate (83-526, section a, item 1 to 7).

18 Remove lock (5). Mark location of magnetic coil terminals.



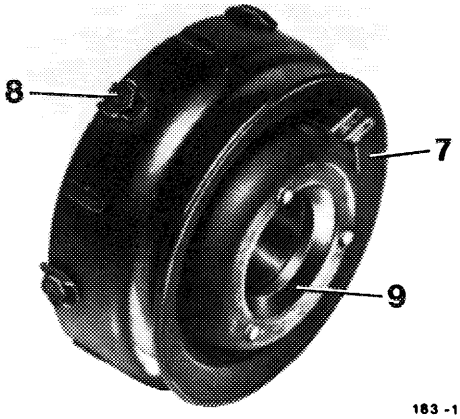
19 Insert guide piece over shaft on head part of refrigerant compressor.

20 Pull off assembly group with puller.



183-15007

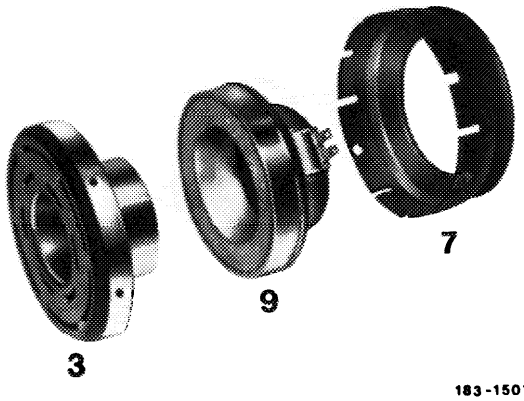
21 Bend away locks on hex. head screws and remove the 6 screws (8) with locks.



183-15012

22 Remove pulley from coupling member and take magnetic coil out of pulley.

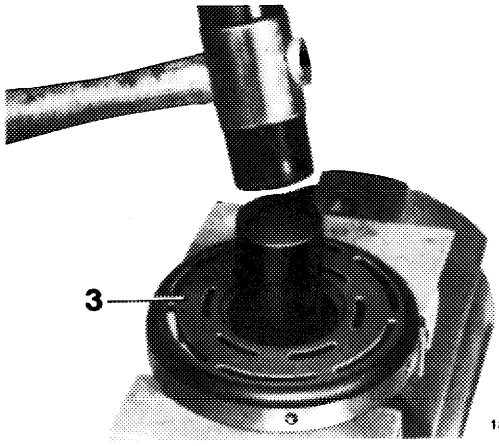
Note: If bearing (6) of magnetic body (3) must be renewed, perform items 22 to 24.



183-15011

Removal of bearing

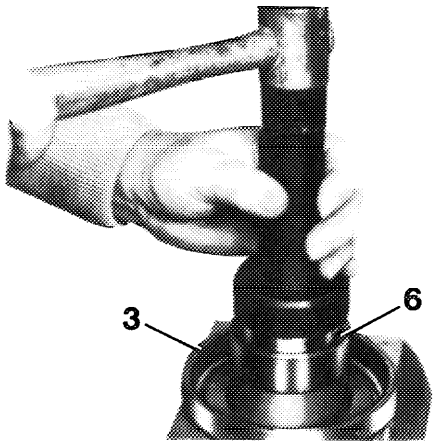
23 Place coupling member (3) on wooden support and press out bearing (6). Removal of bearing does not require elimination of notches.



183-15008

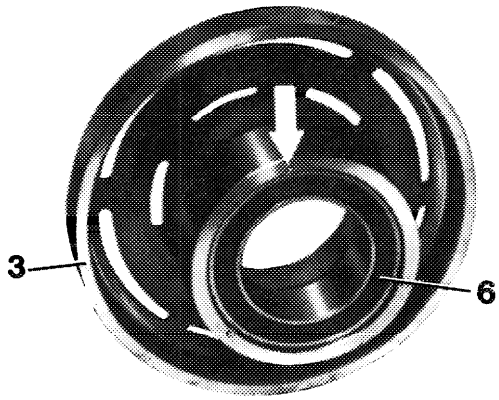
Installation of bearing

24 Align new bearing (6) accurately on bore and then press in.



183-15010

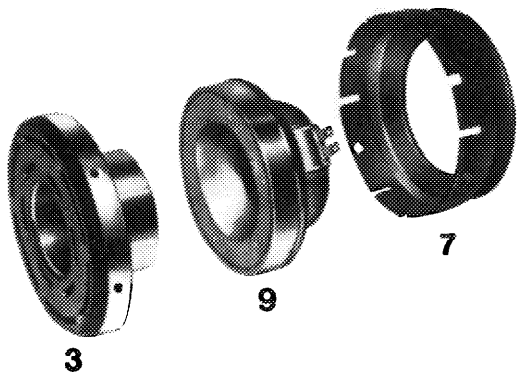
25 Punch-mark bearing at three points 120° away from each other as a safety measure. Do not punch too deeply, since this may distort outer race of bearing. Do not use old notches again!



183-15019

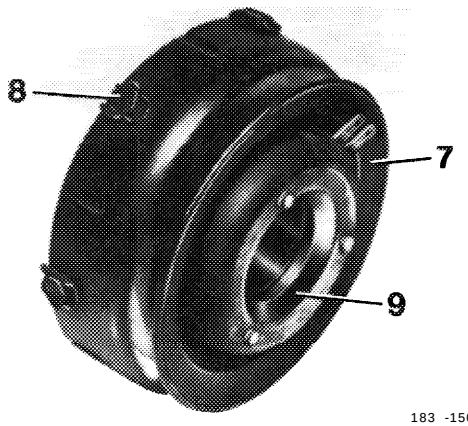
Installation

26 Insert magnetic coil (9) into pulley (7).



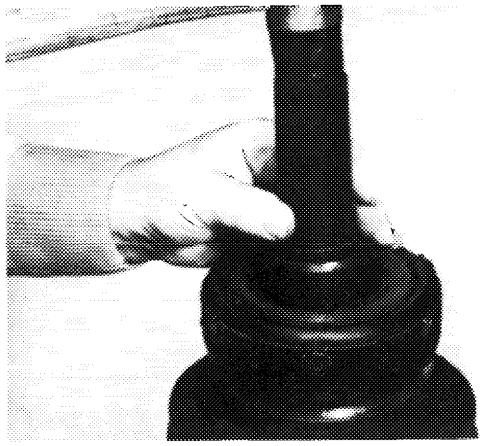
183-15011

27 Slip coupling member (3) into pulley (7) and screw on provisionally with new locks and screws (8). Provide threads of screws with Loctite.



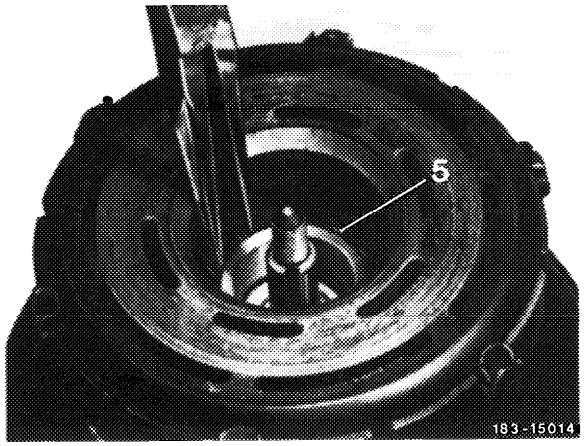
183-15012

28 Place complete assembly group on front housing cover. Before pressing on completely, make sure that the terminals of the magnetic coil are in correct position in relation to refrigerant compressor and that the three projections on back of magnetic coil are in alignment with the three depressions in housing cover.



29 Insert locking ring (5) for assembly group.

30 Clean friction surface of spring plate and of coupling member.

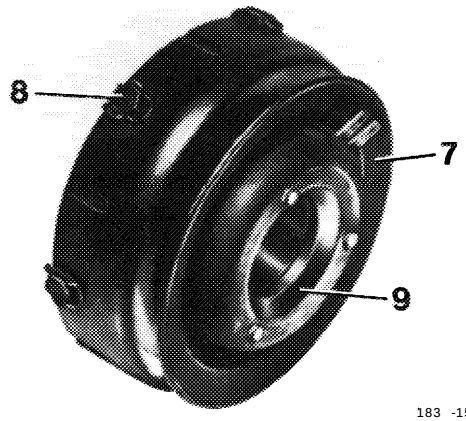


31 Rotate pulley with coupling member to check pulley for alignment. Slightly readjust pulley, if required.

32 Tighten screws (8) of pulley – coupling member. Secure screw heads in the same manner as the screws were secured prior to removal.

33 Renew receiver-drier (83–530).

34 Install refrigerant compressor (83-522).



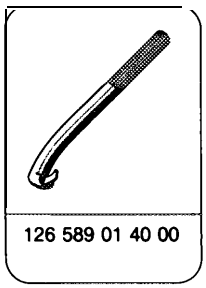
B. Nippondenso refrigerant compressor (engine 601)

Data, test values

Designation	Electromagnetic clutch 12 V
Power input In amps at 13.5 V	cold 4.2 warm 3.75

Tightening torques	Nm
Screw carrier to crankcase M 8 x 60 and M 8 x 40	23 ± 2.3
Screw compressor to carrier M 8 x 95	23 ± 2.3
Nut M 8 to compressor shaft	16 4 1.0

Special tools



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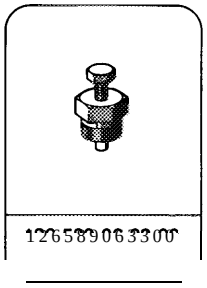

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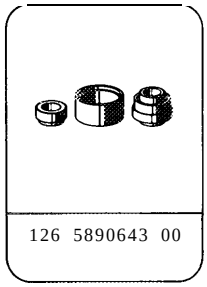

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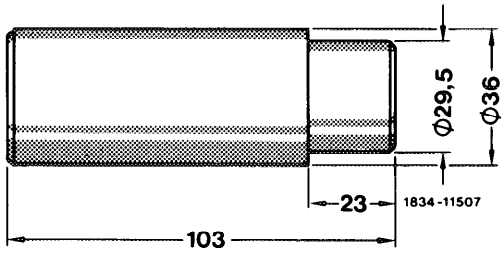
Conventional tools

Pliers for locking ring A 2 (outer)	e.g. Hazet, D-5630 Remscheid
Slip gauge (set)	e.g. Hazet, D-5630 Remscheid
Socket 12 mm, 13 mm (3/8'' square)	e.g. Hazet, D-5630 Remscheid
Double open-end wrench 12 x 14, 17 x 19, 24 x 26	e.g. Hazet, D-5630 Remscheid

Self -made tool

Bearing mandrel (rotating part), not required for assembly with hand lever press



Note

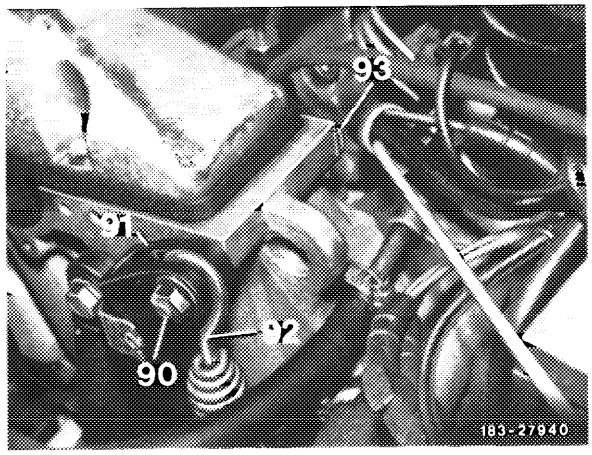
Bores and screws with metric threads, hose connections as before with inch threads.

a) Spring plate

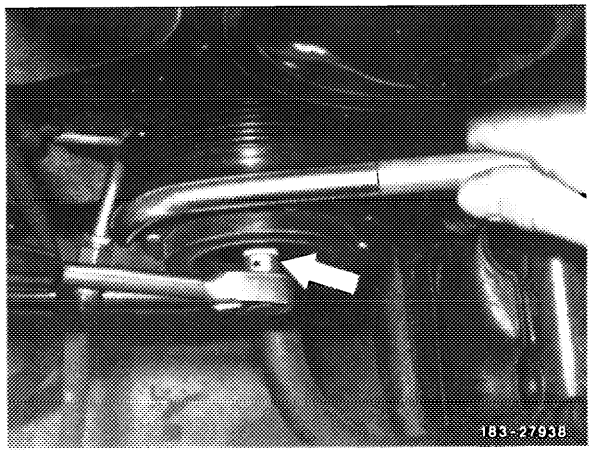
Removal

1 Remove fan and fan cover.

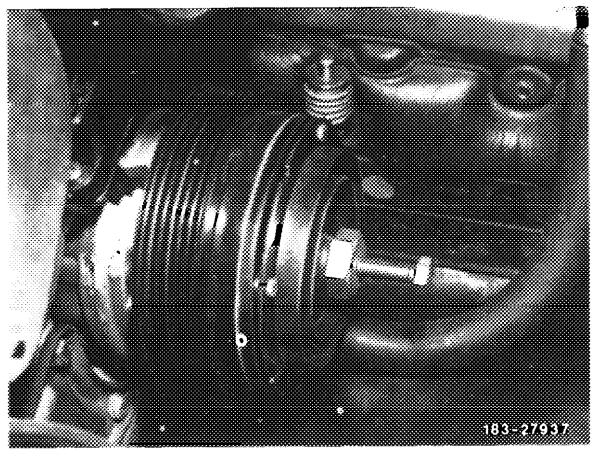
2 Slacken V-belt and remove, as follows:
Unscrew collar nut (90). Place a mandrel into spring tensioning lever (91) and pull back against force of draw spring (92).
Release spring tensioning lever and remove V-belt.



3 Position holding rod for spring plate and unscrew nut (arrow).



4 Screw puller (arrow) into spring plate and pull off spring plate.



Installation

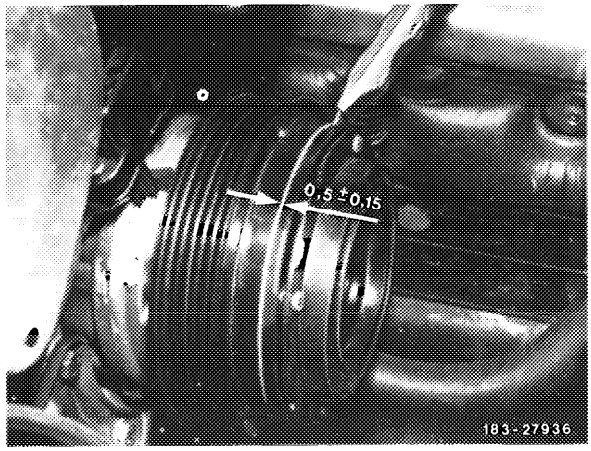
5 Plug spring plate on compressor shaft and tighten with nut.

6 Check gap dimension with valve gauge and correct with spacing washer, if required.

7 Install V-belt.

8 Install fan cover and fan.

9 Check air conditioning system for function (83-036).

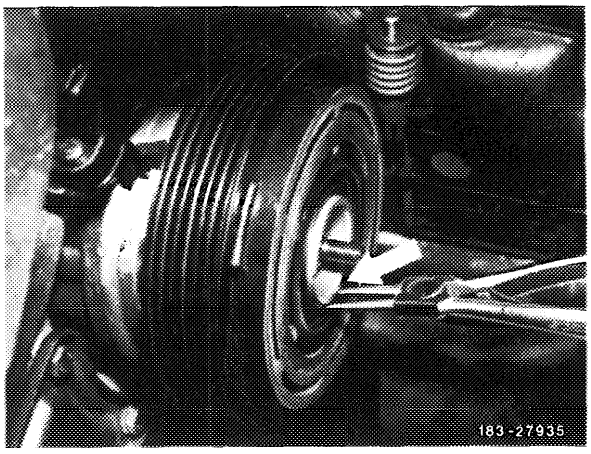


b) V-belt pulley

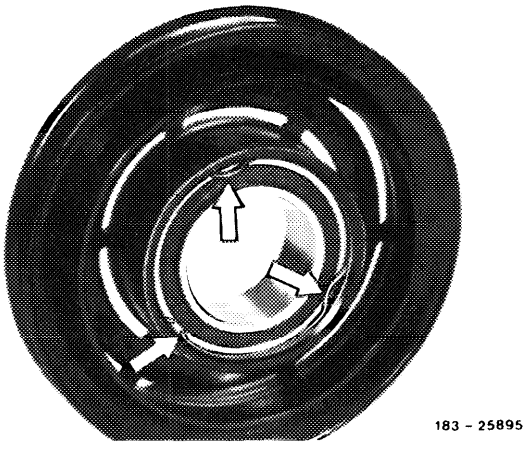
Removal

1 Remove spring plate (refer to section a).

2 Remove locking ring in front of V-belt pulley (arrow) and knock off V-belt pulley with plastic hammer.

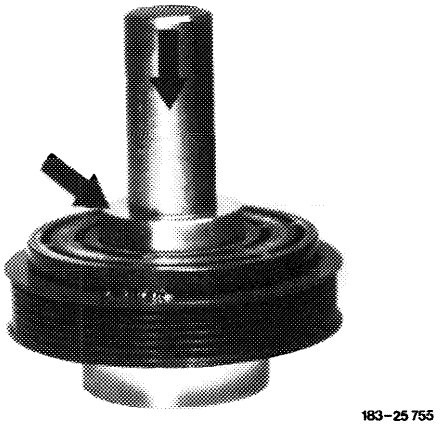


3 Renew antifriction bearing according to condition. Remove locking ring from antifriction bearing (arrow).



4 Force out antifriction bearing with special tools (arrows).

5 Force in new antifriction bearing with special tools.



Installation

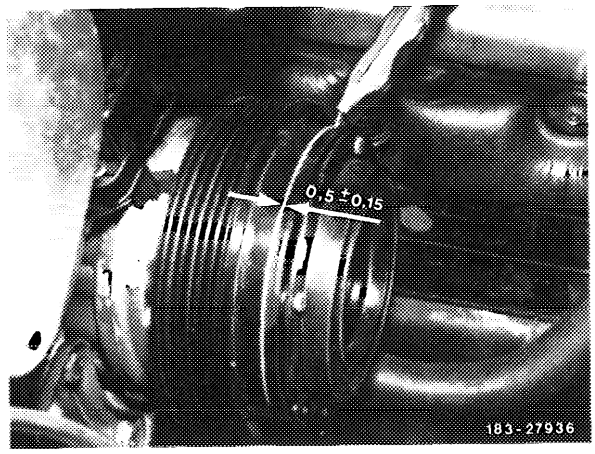
Attention!
If the same pulley is installed again, clean friction surface of pulley. In the event of damage on friction surface (e.g. caused by overheating) renew pulley together with spring plate.

6 Mount V-belt **pulley and install locking ring.**

7 Mount spacing washer and spring plate on compressor shaft. Tighten nut (arrow).

8 Check gap dimension with valve gauge or correct with spacing washer, if required.

9 Check air conditioning system for function (83–036).



c) Magnetic coil

Data

Nominal value approx.	warm	3.75 A
	cold	4.2 A

For testing magnetic coil, refer to 83-040.

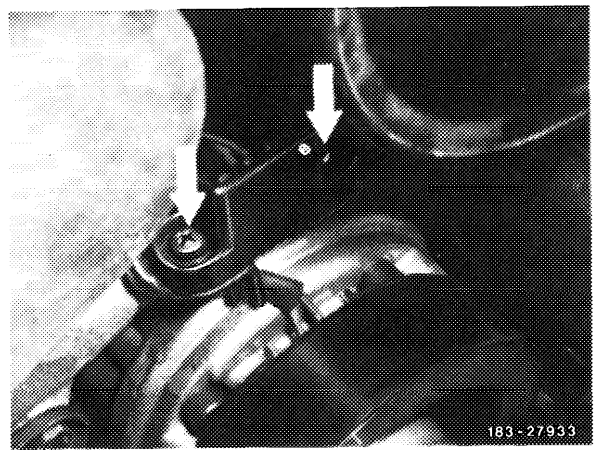
Removal

1 Remove spring plate and V-belt pulley (refer to section a and b).

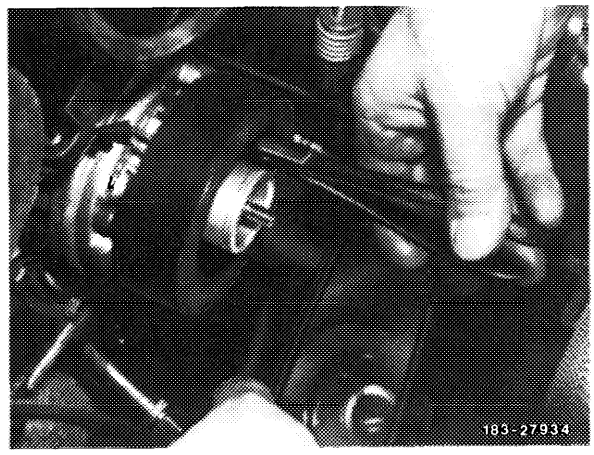
2 Pull plug from refrigerant compressor.

3 Unscrew both screws (arrow) from plug housing, open plug housing and remove line (blue).

4 Disconnect grounding cable of magnetic coil from refrigerant compressor.



5 Remove locking ring of magnetic coil and remove coi I.



Installation

Attention!
Tapered surface of locking rings must be front end.

6 Mount magnetic coil (pay attention to fitted pin) and install locking ring (arrow).

7 Install V-belt pulley (refer to section b).

8 Slip spacing washer on compressor shaft and mount spring plate (refer to section a).

9 Test air conditioning system for function (83-040).

83-528 Removal and installation of condenser

Data

Version	Aluminum pipe and aluminum fins

Tightening torques	Nm
Hose line (101) to condenser	29-37
Hose line (102) to condenser	15-18

Conventional tool

Inch wrench

Note

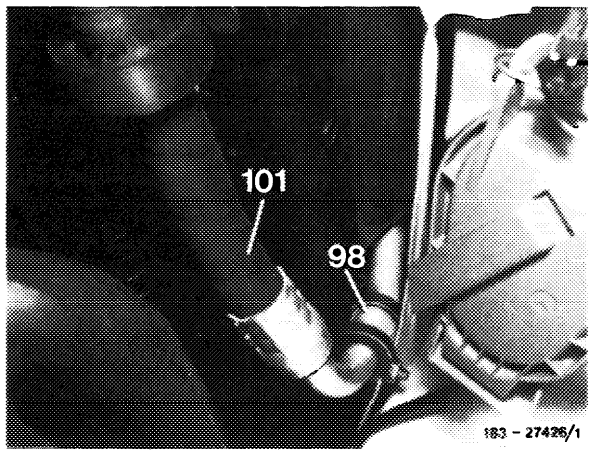
If the condenser is not reinstalled immediately, blow through condenser with refrigerant R 12 or nitrogen. Then close connections with plug. When renewing condenser, fill 20 cc of new compressor oil into condenser.

Removal

1 Drain air conditioning system.

2 On model 201.024, drain coolant and remove radiator.

3 On model 201.024, remove clamp (98) from hose line (101).

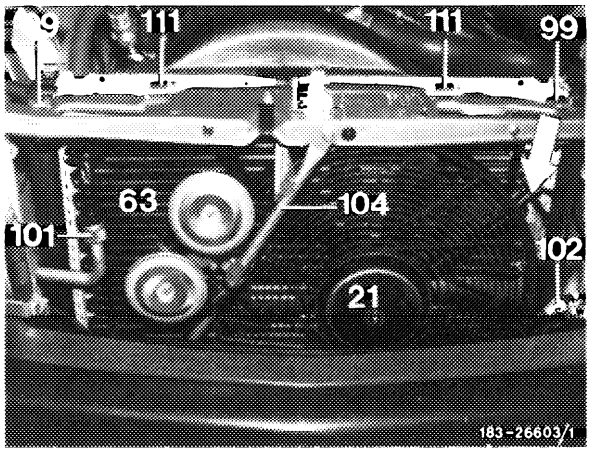


4 Unscrew hose lines (101 and 102) from condenser (63).

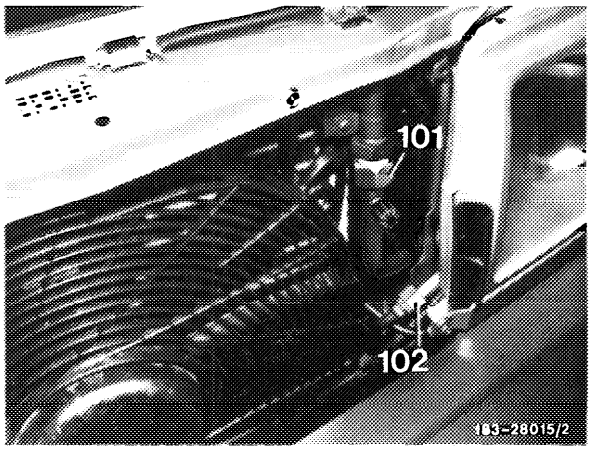
5 On model 201 .122, remove clamps (111), lift radiator out of lower support and put radiator aside in direction of engine.

6 Remove cable strap (arrow).

7 Unclip both clamps (99) on radiator supporting frame and lift out condenser (63) in upward direction.



Condenser model 201.024



Condenser model 201.122

Installation

8 Insert condenser (63) into grommets on front cross member. Continue installation in vice-versa sequence, while moistening threads for hose lines (101 and 102) with cold-flowing oil.

9 Renew receiver-drier (83–530).

10 Evacuate air conditioning system and refill, check for leaks and function (83–036).

83-530 Removal and installation of receiver-drier

Data

Version	Steel housing with sight-glass
Pressure relief valve (a)	Lets refrigerant blow off at 40 ± 5 bar. Closes at max. 5 bar below opening pressure
Pressure switch (19) in receiver-drier for auxiliary fan and electromagnetic clutch of engine fan	Cutout pressure: 15 ± 0.5 bar Cut-in pressure: 20 ± 0.5 bar
Pressure switch (22) in receiver-drier for refrigerant compressor	Cutout pressure: 2 ± 0.2 bar gauge pressure Cut-in pressure: max. 0.6 bar above cutout pressure

Tightening torque	Nm
Hose lines to receiver-drier	15-18

Note

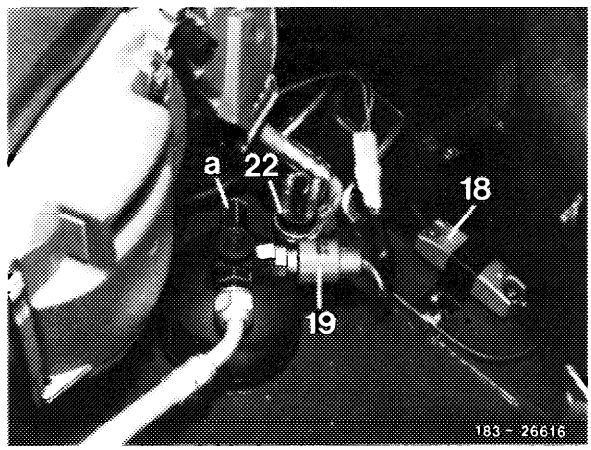
In the event of trouble on air conditioning system as the result of leaks, contamination or icing-up, when exchanging or reconditioning refrigerant compressor, as well as on air conditioning systems which are without refrigerant, a new receiver-drier must be generally installed. In accordance with extent of contamination, blow out air conditioning system prior to installing new receiver-drier with refrigerant R 12 or nitrogen.

Removal

1 Drain air conditioning system.

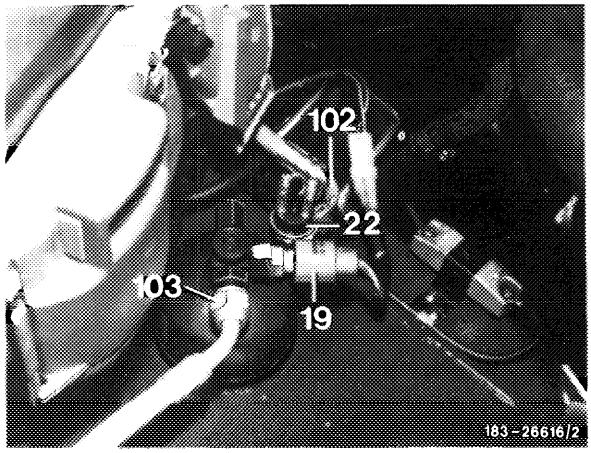
2 Pull plug from pressure switches (22 and 19).

3 Unscrew both pressure switches from receiver-drier.



4 Unscrew hose lines (102 and 103 from receiver-drier. Close connections blind.

5 Unscrew two screws on receiver-drier and lift out receiver-drier.



Installation

6 Prior to installation of new receiver-drier, fill 10 cc of fresh compressor oil into lateral connection (83–520).

7 For installation proceed vice versa, while moistening threads for hose lines (102 and 103) with cold-flowing oil.

8 Evacuate air conditioning system and fill up again, check for leaks and function (83-036).

83-53 1 Checking or removing and installing pressure switch for refrigerant compressor in receiverdrier

Data

Pressure switch (22) in receiver-drier	Cutout pressure: Cut-in pressure:	2 + 0.2 bar gauge pressure max. 0.6 bar above cutout pressure

Tightening torque	Nm
Pressure switch	20 ± 4

Note

To remove pressure switch (22), drain refrigerant of air conditioning system.

Testing pressure switch (22)

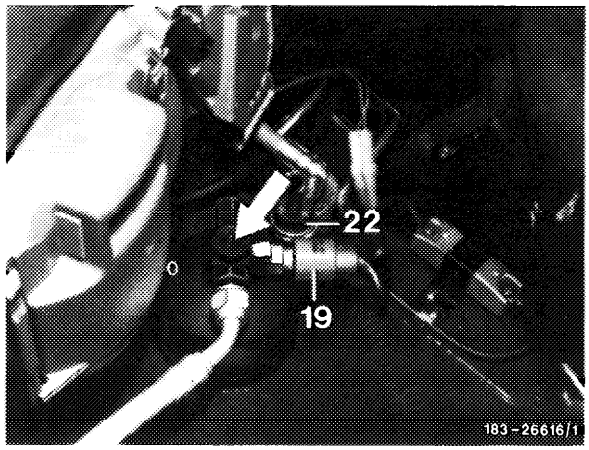
Test cut-in pressure (air conditioning system filled with refrigerant).

1 Run engine and switch on air conditioning system.

2 If the electromagnetic clutch of refrigerant compressor is not attracting, test the two flat plugs on pressure switch for voltage (do not pull plug from pressure switch [22]).

3 If the two plugs of pressure switch are connected to voltage and the electromagnetic clutch of refrigerant compressor is not attracting, there is a fault on model 201.024 on coil of electromagnetic clutch or on electric line between pressure switch and magnetic coil. On model 201 .122 and on model 201.024 starting model year 1985 there may also be a fault on compressor cutout (for checking, refer to 83–040).

4 If only flat plug of pressure switch is connected to voltage, there is not enough refrigerant in air conditioning system (refer to sight-glass, arrow) or the pressure switch (22) is defective.



5 To check refrigerant level, pull the two electric plugs from pressure switch and connect to each other (bypass). Run air conditioning system for approx. 2-3 minutes at 1000 rpm, then shortly after adding electromagnetic clutch, check whether refrigerant flows free of bubbles past sight-glass of receiver-drier.

6 The pressure switch is defective while quantity of refrigerant is adequate (high pressure $>$ 3 bar).

7 Switch off ignition.

Testing **cutout pressure**

8 Connect pressure gauge (service unit or pertinent tool) to service valve (pressure end).

9 Pull both electric plugs from pressure switch and connect ohmmeter to pressure switch.

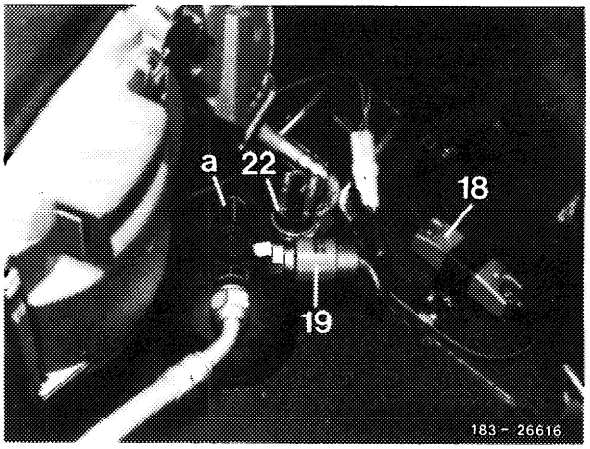
10 Drain refrigerant, at approx. 2 $\pm$ 0.2 bar gauge pressure the cutout point of pressure switch must be indicated by ohm meter (ohm meter to infinite).

Removing pressure switch

11 Drain air conditioning system.

12 Pull off electric lines and unscrew pressure switch (22) from receiver-drier.

13 Close connection on receiver-drier with plug.



Installing pressure switch

14 Moisten O-ring and threads of pressure switch with cold-flowing oil.

15 Screw pressure switch (22) into receiver-drier and plug on electric lines.

16 Evacuate air conditioning system, fill again and check for function and leaks (83-036).

83-532 Testing or removing and installing pressure switch for auxiliary fan in receiver-drier

Data

Pressure switch (19) in receiver-drier	Cutout pressure:	15 ± 0.5 bar
	Cut-in pressure:	20 ± 0.5 bar

Tightening torque	Nm
Pressure switch (19)	10 ± 2

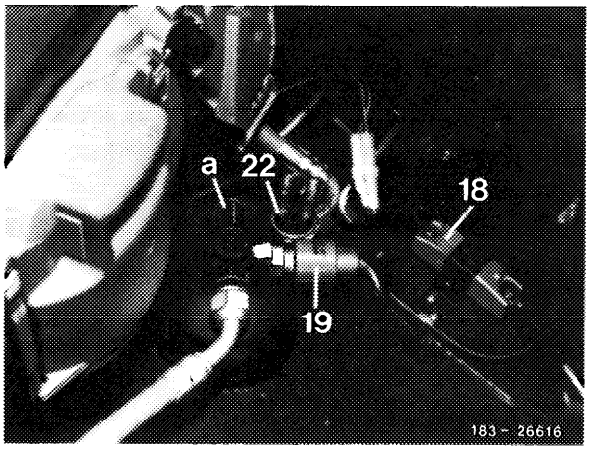
Note

To remove pressure switch (19), drain refrigerant of air conditioning system.

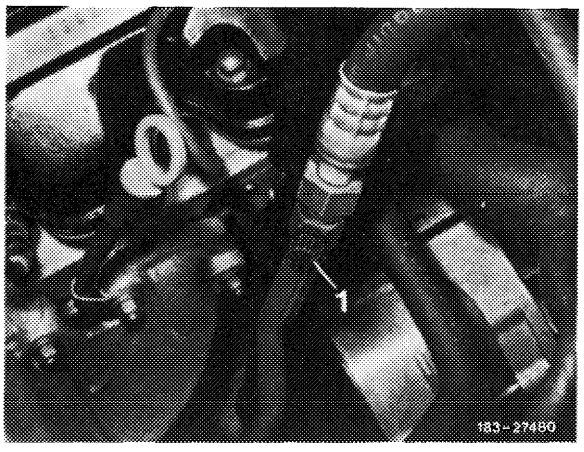
Testing pressure switch (19)

Switch on ignition and connect the two plugs of pressure switch (19) with each other (bypass). If the auxiliary fan prior to condenser is not switching on, the fault is outside pressure switch (19) – refer to circuit diagram 83-028.

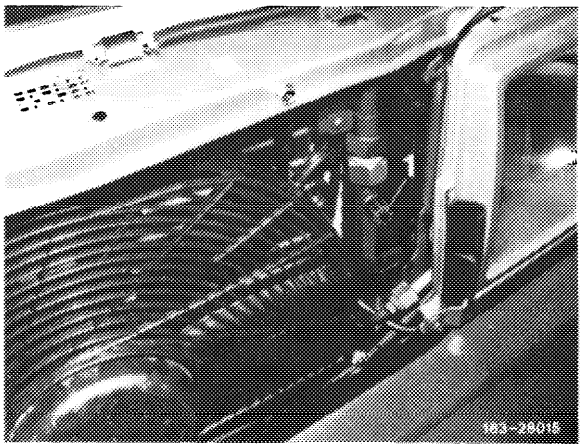
Testing **cut-in pressure** (air conditioning system filled with refrigerant).



1 Unscrew closing cap (1) from pressure line. Then connect hose line of high-pressure gauge to service valve. Make sure that the connecting nipple of hose line has a pressure pin in center.



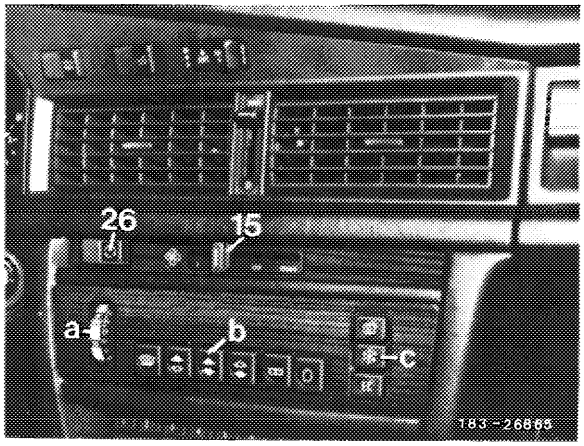
1 Closing **cap on pressure line**
Engine 102 up to model year 84



1 Closing cap on pressure line
Engine 601 and engine 102 starting model year 85

2 Engage temperature wheel (a) at "MI N".

3 Switch on mode selection of pushbutton switch (b) and mode selection of switch for air conditioning (c).

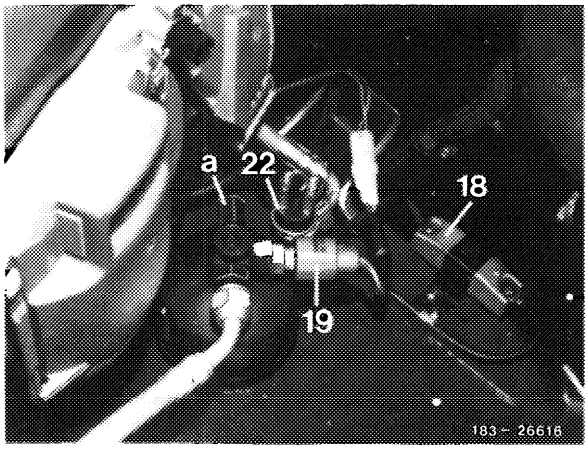


4 Set blower switch (15) to 4th blower stage.

5 Let engine run at idle until pressure of refrigerant has attained 18 ± 0.5 bar (corresponds with a pressure on pressure switch (19) of 20 ± 0.5 bar), let engine speed increase slowly, if required. If the auxiliary fan is not switching on, the pressure switch (19) is defective.

Testing cutout pressure

6 Run engine at idle speed until pressure of refrigerant has attained 12 ± 0.5 bar (corresponds with a pressure on pressure switch (19) of 15 ± 0.5 bar), pull a plug from pressure switch (22), if required. If the auxiliary fan is not switching off, the pressure switch (19) is defective.

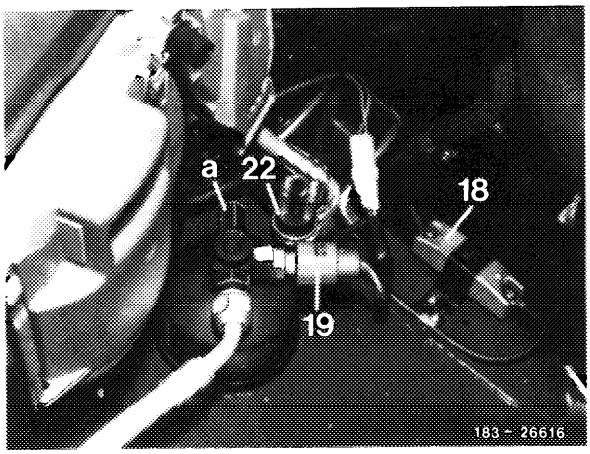


Removing pressure switch (19)

5 Drain air conditioning system.

6 Pull off electric lines and unscrew pressure switch (19) from receiver-drier.

7 Close connection on receiver-drier with plug.



installing pressure switch

8 Moisten O-ring and threads of pressure switch with cold-flowing oil.

9 Screw pressure switch (19) into receiver-drier and plug on electric lines.

10 Evacuate air conditioning system, fill again and check for function (83–036).

83-534 Removal and installation of expansion valve

Data

Version	Thermostatic valve with outer pressure compensation

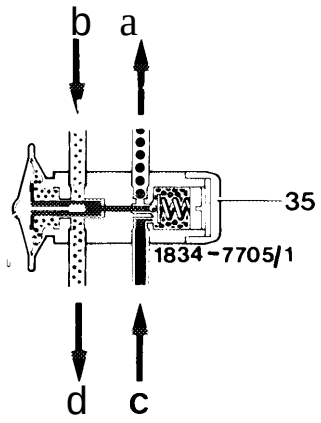
Tightening torques	Nm
Screws M 5 expansion valve to evaporator	6 - 10
Screw M 6 hose lines to expansion valve	7 - 13

Conventional tools

Hex. socket wrench 3 and 4 mm

Note

If expansion valve is heavily contaminated, renew receiver-drier and expansion valve (83-530 and 83-534).



Injection valve (diagram)

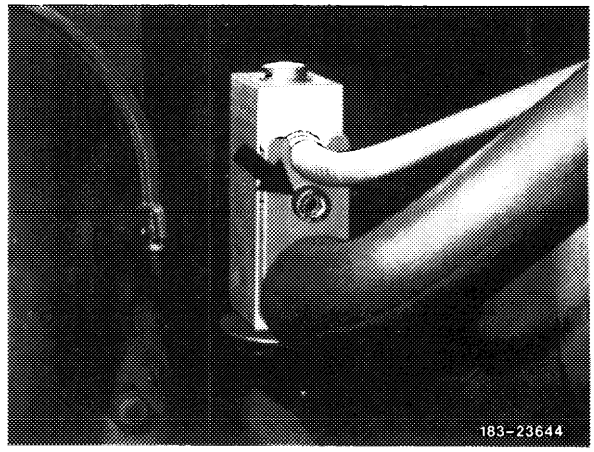
a To evaporator
b From evaporator
c From receiver-drier
d To compressor
35 Expansion valve

Removal

1 Drain air conditioning system.

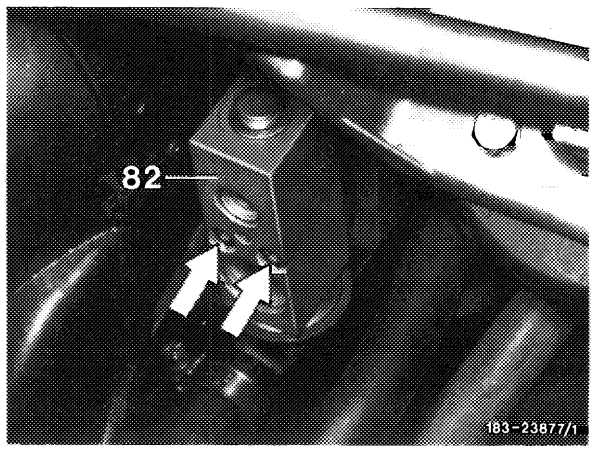
2 Remove cover on air inlet (83–140).

3 Unscrew screw (arrow) and pull lines out of expansion valve.



4 Unscrew both screws (arrows) and remove expansion valve (82).

5 Close connections with plugs.



Installation

6 Install in vice-versa sequence, while testing O-rings on evaporator pipes, as well as on pipe lines, and moisten with cold-flowing oil.

7 Renew receiver-drier (83–530).

8 Evacuate air conditioning system, fill again, and check for function and leaks (83-036).

Data

Version	Pipes and fins made of aluminum
Face/depth	6.0 dm^2/96 mm

Note

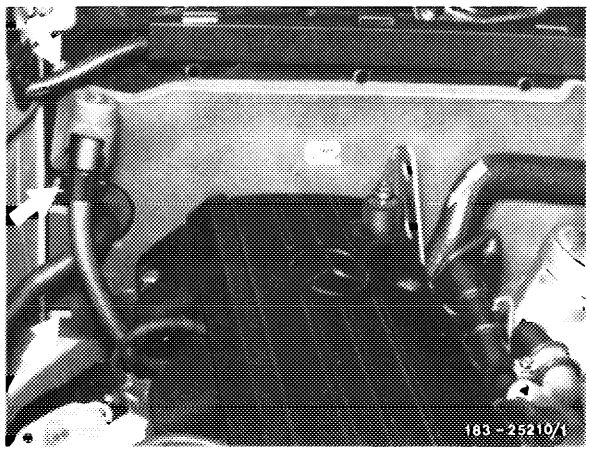
If expansion valve shows heavy contamination, renew receiver-drier and expansion valve (83-530 and 534). When renewing evaporator, add 40 cc of fresh compressor oil into evaporator.

Removal

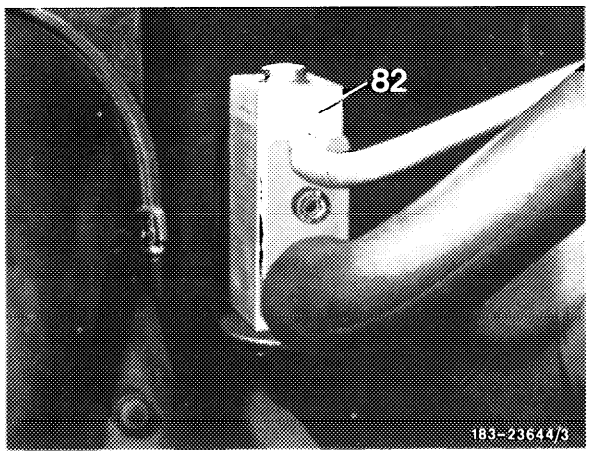
1 Drain air conditioning system.

2 Remove cover on air intake (83-l 40).

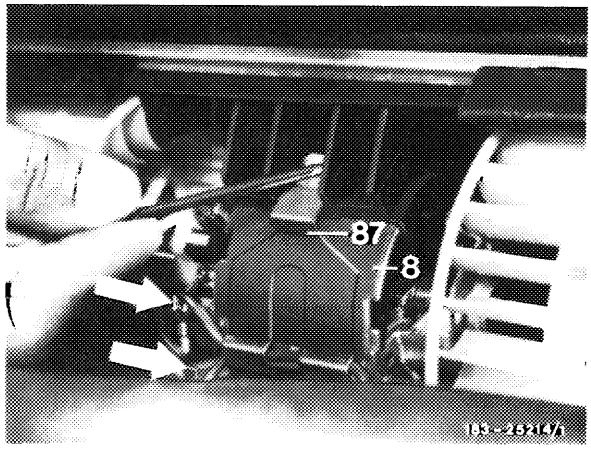
3 Loosen bulkhead (62), while pulling screws (arrow) at left and right on bulkhead forward up to engine for this purpose.



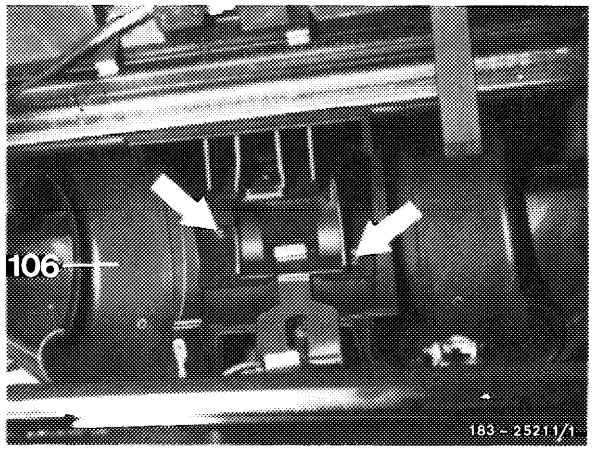
4 Remove expansion valve (82) (83-534).



5 Remove blower motor (8) (83-120).

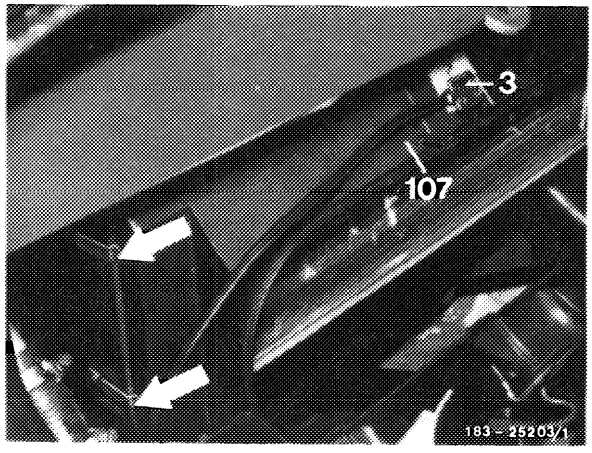


6 Unscrew screws (arrow) and lift out lower part of housing (106).

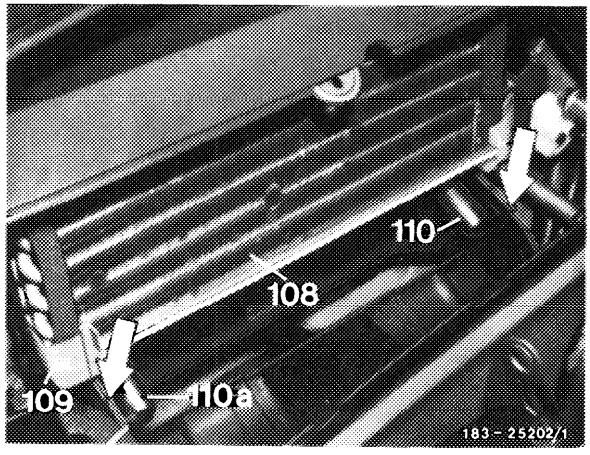


7 Pull temperature sensor (3) out of guide tube.

8 Unclip clamps (arrow) laterally left and right from frame (107) and remove frame.



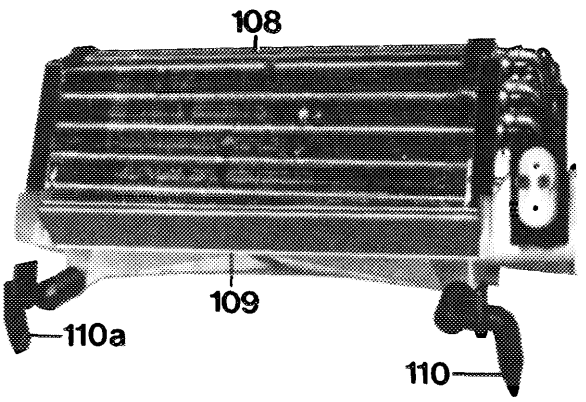
9 Lift evaporator (108) with pan (109) and condensate water drain hoses (110 and 110a) out of evaporator housing.



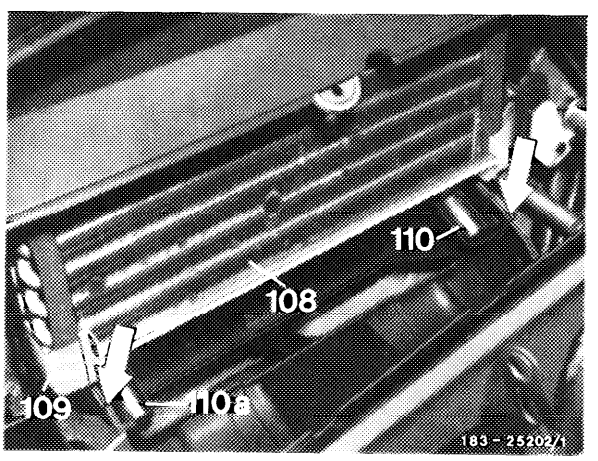
Installation

10 **Clean** pan (109) inside while checking **whether condensate water drain hoses (110 and 110a) have perfect passage.**

11 insert evaporator (108) into pan (109).

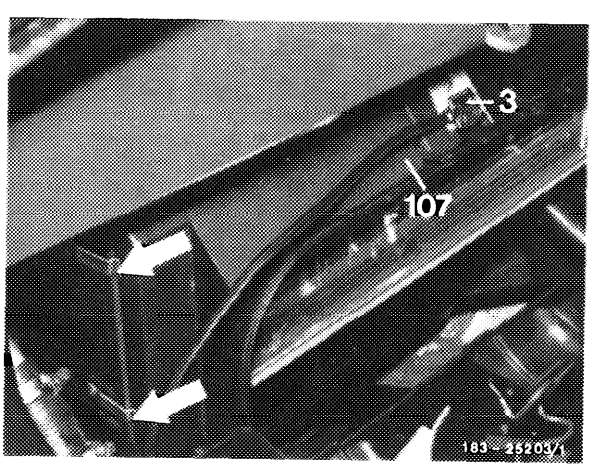


12 **Insert evaporator with pan into evaporator housing. Then mount rubber grommets (arrow) of condensate water drain hoses (110 and 110a).**



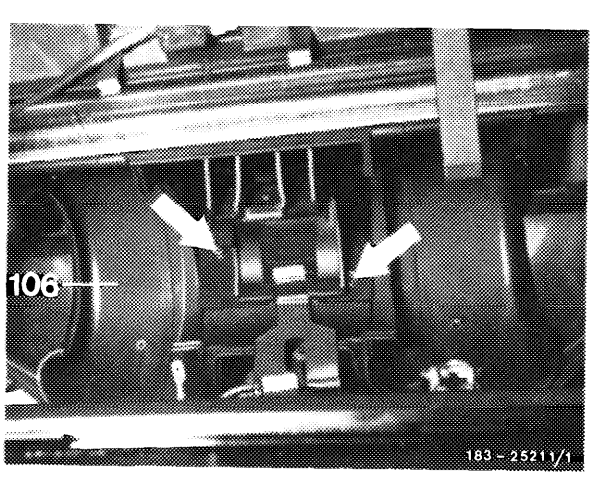
13 Flange frame (107) to evaporator housing and fasten with clips (arrow).

14 Insert temperature sensor (3) into guide tube up to stop.



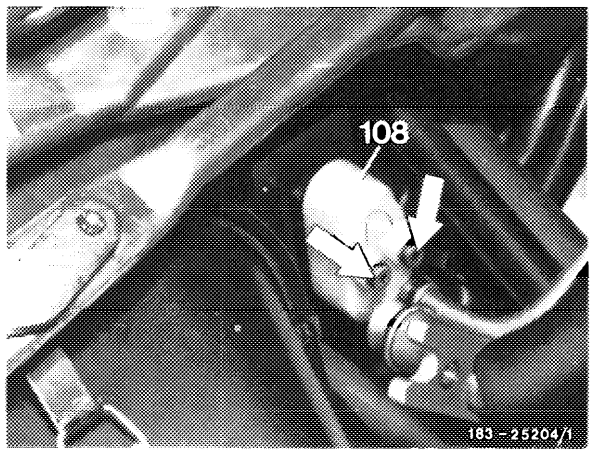
15 Mount lower part of housing (106) by means of screws (arrow).

16 Install blower motor (83-I 20).



17 Remove closing cap (108) of new evaporator from evaporator pipes unscrewing both screws (arrow) for this purpose.

18 Install expansion valve (83-543).

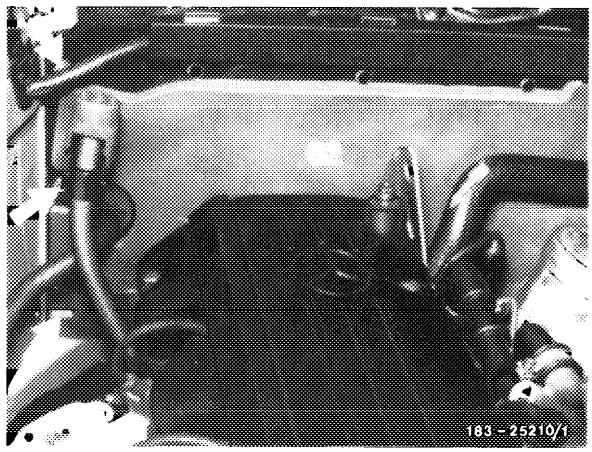


19 Mount bulkhead (62) and fasten with screws (arrow).

20 Install cover at air inlet (83–140).

21 Renew receiver-drier (83–530).

22 Evacuate air conditioning system, fill again and check for function and leaks (83–036).

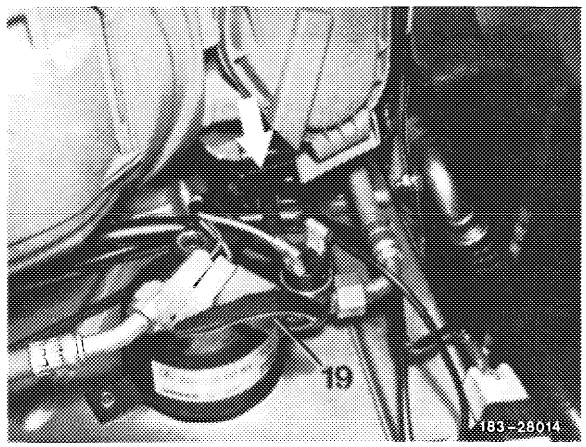


Data

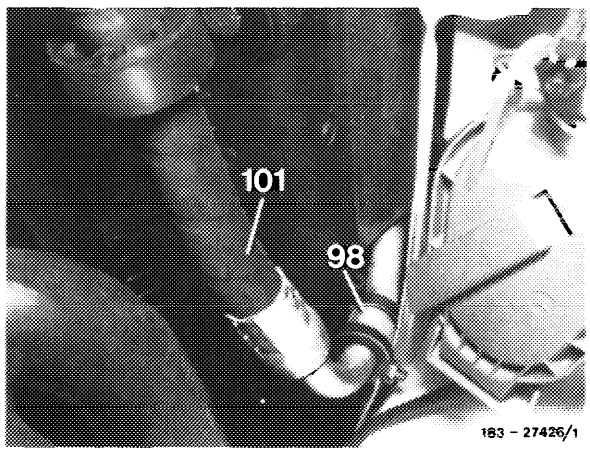
Power input at 13 V ± 0.2 V	**17.5 A**
Fan speed at 13 V ± 0.2 V	**2300 rpm**

Removal

1 Separate 2-pin connector (arrow).



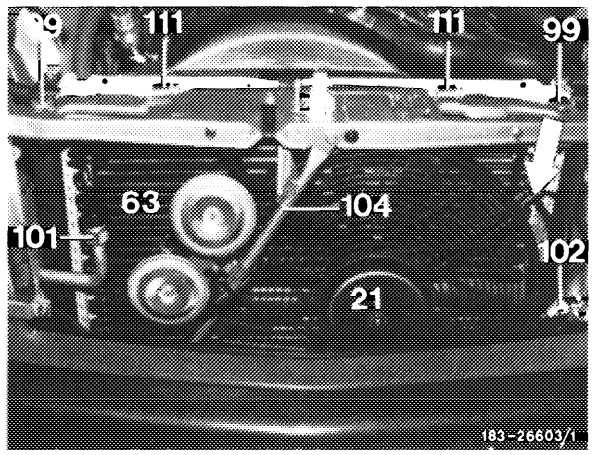
2 Remove clamp (98) on model 201.024.



3 Disconnect both horns and remove strut (104).

4 Loosen radiator and condenser, removing clips (99 and 111) for this purpose. Pull out radiator and condenser at lower holder and put aside as far as possible in direction of engine.

Attention!
Hoses of radiator and condenser remain connected.

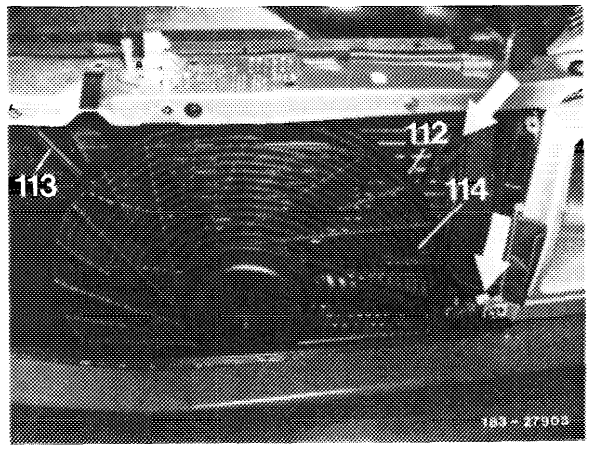


6 Loosen both cable straps (arrow) from condenser.

7 Unscrew screw (112) and remove holder (113).

8 Remove auxiliary fan to the right and then in forward direction.

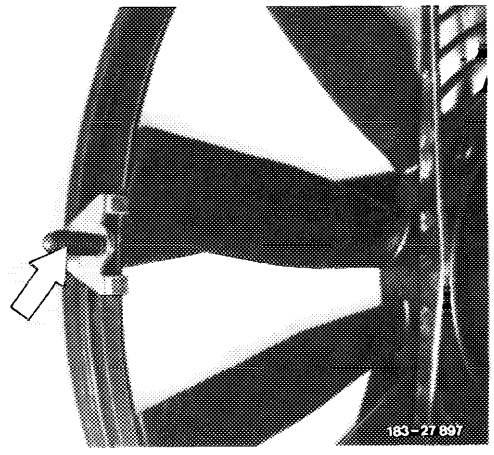
9 Unclip protective grille (114) from auxiliary fan and remove lower holder.



Installation

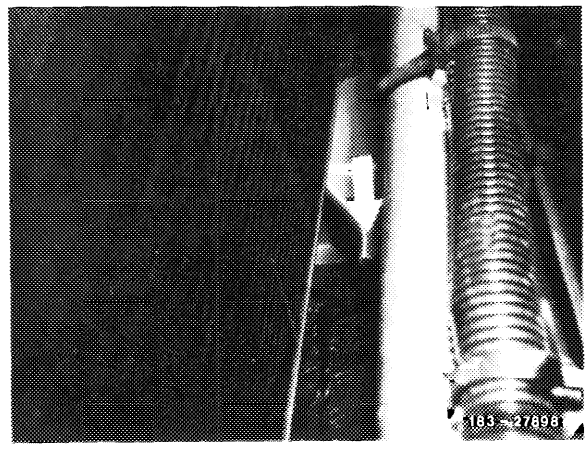
10 Pull rubber mount from lower holder of auxiliary fan and wind approx. 5 layers of insulating tape around bolt (arrow). Then slip rubber mount on holder.

Note: The insulating tape makes sure that the rubber mount will not fall off when mounting auxiliary fan.



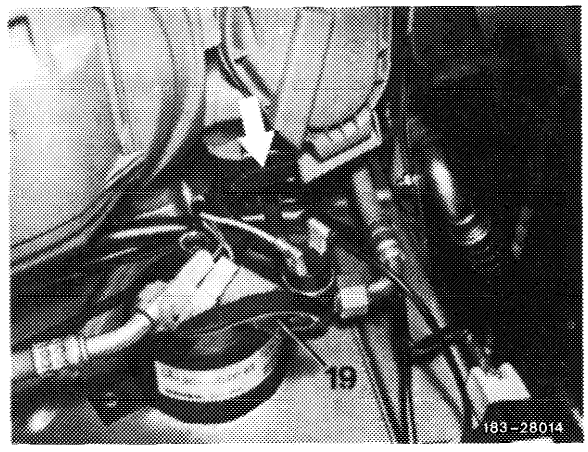
11 Insert auxiliary fan and slip rubber mount into holder on cross member (arrow).

12 For further installation proceed vice versa.



13 Check auxiliary fan for function, switching on ignition for this purpose and bridging both connections of pressure switch (19), but do not separate connections of pressure switch and harness.

14 Check direction of rotation of auxiliary fan. Fan rotates clockwise. If direction of rotation is wrong, interchange sockets in 2-pin connector (arrow).



Tempmatic climate control, model 201, model year 1985

Differences from model year 1984:

1. Air conditioning compressor, model 201.024

Model 201.024 now has the swash plate compressor (Nippondenso) used on model 201.122. Due to the installation of the single belt drive on engine 102, the same compressor cut-out (as on engine 601) is used to prevent belt damage in case the compressor jams.

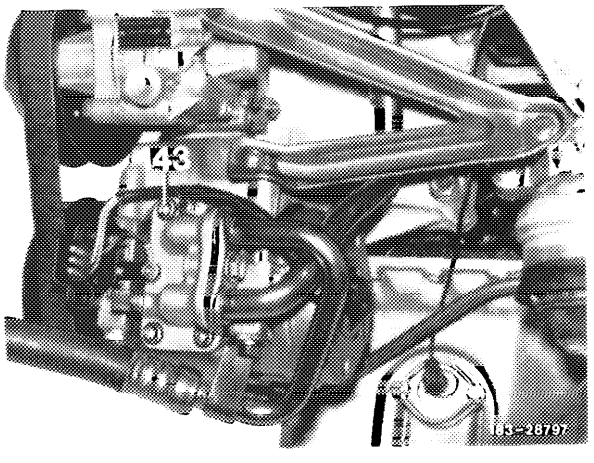


Fig. 207 Air conditioning compressor (143), model 201.024

2. Air conditioning compressor cut-out

A similar control unit as used on model 201.024 is installed in model 201.122. Both control units are designed for a delayed compressor cut-in. The compressor is activated 10 seconds after an engine speed of 600 rpm is reached. This improves engine speed stabilization after start-up.

To prevent the 102 engine from overheating, the control unit has an additional integrated cut-out circuit. At a coolant temperature of 1 10 °C, this circuit is grounded through temperature switch (23) and the compressor stops working. At approx. 103 °C, the temperature switch opens and the compressor comes on again.

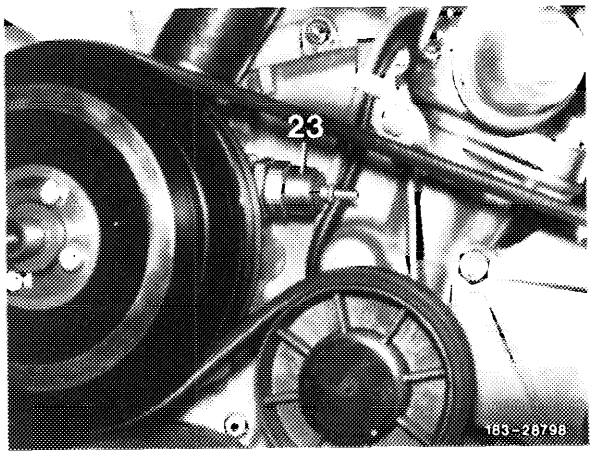


Fig. **208** Location of temperature switch 110 °C (23)

3. Temperature switch for engine fan clutch (100 °C) and auxiliary fan (110 °C)

This temperature switch (16) has three connections and two switch functions. One switches the fan clutch on at 100 °C, the other switches the auxiliary fan on at 110 “C.

On model 201.024, the engine fan clutch control and the relay for the auxiliary fan are now switched through the positive side of the electrical circuit (see wiring diagrams).

The previous temperature switch for the auxiliary fan in 201 models was therefore eliminated.

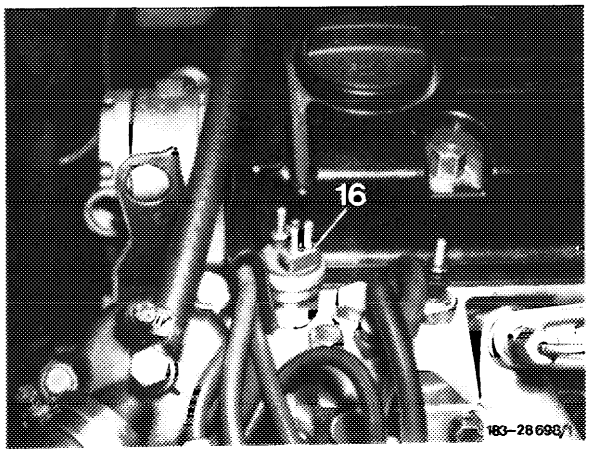


Fig. 209 Location of coolant temperature switch 1001110 °C (16), model 201.024

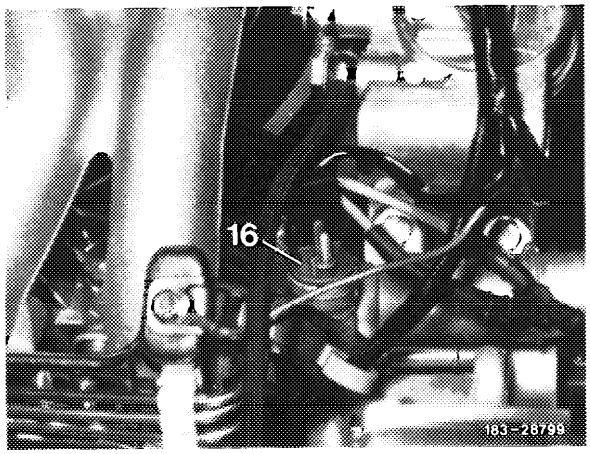


Fig. 210 Location of coolant temperature switch 1001110°C (16), model 201.122

Important:

Air conditioning compressor switching was changed from the positive to the negative side of the electrical circuit.

This means that with the ignition and tempmatic climate control switched on, the low pressure switch and the control unit are connected to ground (M 10).

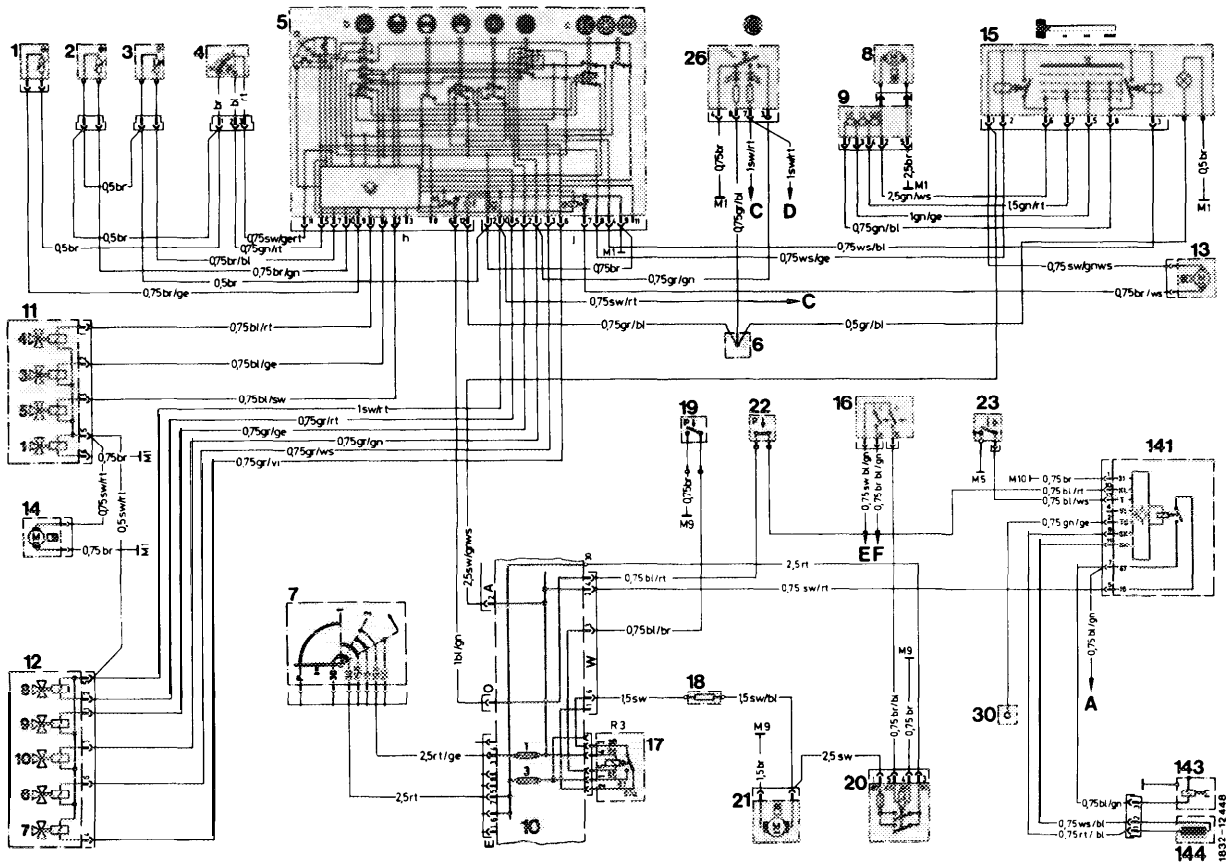


Fig. 211 Wiring diagram, tempmatic climate control, model 201.024

1 In-car temperature sensor
2 Ambient sensor, outside air temperature
3 Temperature sensor, air conditioning evaporator
4 Feedback potentiometer
5 Pushbutton switch unit, consisting of:
- a Temperature wheel
- b Pushbutton switch with six buttons
- c Mode switch for air conditioning compressor with three buttons
  air conditioning on, controlled via temperature sensor (3) to 0 °C evaporator temperature
  air conditioning, controlled via pushbutton switch unit (electronic system)
  air conditioning off
- d Relay for air conditioning compressor
- e Relay for auxiliary coolant pump
- f Lights
- g Fuse: 2 amps
- h 12-pin connector, at left side of pushbutton switch unit
- j 12-pin connector, at right side of pushbutton switch unit

6 Terminal block, circuit 58d
8 Blower motor
9 Pre-resistor, blower motor
10 Electrical center with fuses
Fuse 1 = 16 A
Fuse 3 = 16 A
11 Switchover valve unit, 4 connections
11.4 Switchover valve for blend air flaps (“cold”)
11.3 Switchover valve for blend air flaps (“warm”)
11.5 Switchover valve for heater valve (“closed”)
11.1 Switchover valve for heater valve (“open”)
12 Switchover valve unit, 5 connections
12.8 Switchover valve for legroom flaps
12.9 Switchover valve for fresh air/ recirculating air flap (short stroke)
12.10 Switchover valve for fresh air/ recirculating air flap (long stroke)
12.6 Switchover valve for defroster nozzle flaps (short stroke)
12.7 Switchover valve for defroster nozzle flaps (long stroke)
13 Auxiliary coolant pump
14 Aspirator blower for in-car temperature sensor
15 Blower switch
16 a Coolant temperature switch (100°C) for engine fan clutch
b Coolant temperature switch (110%) for auxiliary fan (high speed)
17 Relay, auxiliary fan pre-resistor
18 Pre-resistor, auxiliary fan
19 High pressure switch, auxiliary fan (low speed): On 20 bar/Off 15 bar
20 Relay, auxiliary fan
21 Auxiliary fan
22 Low pressure switch, air conditioning compressor cut-out: On 2.6 bar/Off 2.0 bar
23 Coolant temperature switch (110°C) for compressor (high temperature cut-out)
26 Switch, fresh air/recirculating air
A To electronic control unit C-IS-E, terminal 19
C To hazard warning switch, terminal 15
D To seat belt Indicator, terminal 8 circuit 15
E To heated windshield washer nozzle (circuit 15)
F To engine fan clutch
30 Terminal block for circuit TD (by diagnostic socket)
141 Control unit for compressor protective cut-out
143 Electromagnetic clutch, compressor
144 RPM sensor, compressor shaft
M 1 Common ground connection (behind instrument cluster)
M 5 Ground connection, engine (unit screwed into engine)
M 9 Ground connectron, front left (near headlight)
M 10 Ground connectron, battery

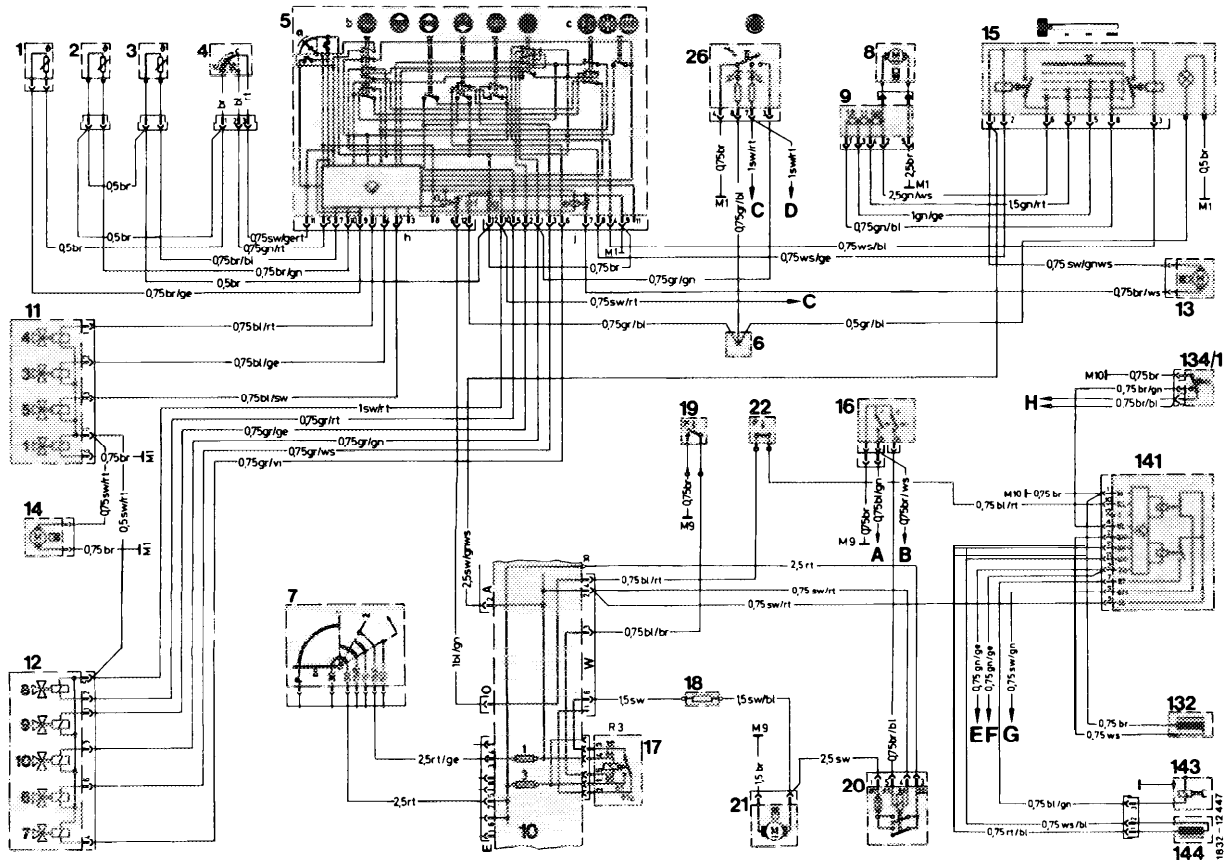


Fig. 212 Wiring diagram, tempmatic climate control, model 201.122

1 In-car temperature sensor
2 Ambient sensor, outside air temperature
3 Temperature sensor, air conditioning evaporator
4 Feedback potentiometer
5 Pushbutton switch unit, consisting of:
a Temperature wheel
b Pushbutton switch with six buttons
c Mode switch for air conditioning compressor with three buttons
air conditioning on, controlled via temperature sensor (3) to 0 °C evaporator temperature
air conditioning, controlled via pushbutton switch unit (electronic system)
air conditioning off
d Relay for air conditioning compressor
e Relay for auxiliary coolant pump
f Lights
g Fuse: 2 amps
h 12-pin connector, at left side of pushbutton switch unit
j 12-pin connector, at right side of pushbutton switch unit
6 Terminal block, circuit 58d
7 Preglow starter switch
6 Blower motor
9 Pm-resistor, blower motor
10 Electrical center with fuses
Fuse 1 = 16 A
Fuse 3 = 16 A
11 Switchover valve unit, 4 connections
11.4 Switchover valve for blend air flaps ("cold")
11.3 Switchover valve for blend air flaps ("warm")
11.5 Switchover valve for heater valve ("closed")
11.1 Switchover valve for heater valve ("open")
12 Switchover valve unit, 5 connections
12.6 Switchover valve for legroom flaps
12.9 Switchover valve for fresh air/ recirculating air flap (short stroke)
12.10 Switchover valve for fresh air/ recirculating air flap (long stroke)
12.6 Switchover valve for defroster nozzle flaps (short stroke)
12.7 Switchover valve for defroster nozzle flaps (long stroke)
13 Auxiliary coolant pump
14 Aspirator blower for in-car temperature sensor
15 Blower switch
16 a Coolant temperature switch (100 °C) for engine fan clutch
b Coolant temperature switch (110 °C) for auxiliary fan (hlgh speed)
17 Relay, auxiliary fan pre-resistor
16 Pre-resistor, auxiliary fan
19 Hlgh pressure switch, auxiliary fan (low speed): On 20 bar/Off 15 bar
20 Relay, auxiliary fan
21 Auxiliary fan
22 Low pressure switch, air conditioning compressor cut-out: On 2.6 bar/Off 2.0 bar
26 Switch, fresh air/recirculating air
132 Rpm sensor, ring gear
13411 Microswitch for compressor cut-out at full load (only connected on vehicles with automatic transmission)
141 Control unit for compressor protective cutout
143 Electromagnetic clutch, compressor
144 Rpm sensor, compressor shaft
A Coolant temperature switch (100%) for engine fan clutch
B To control unit, EGR, terminal 6
C To hazard warning switch, circuit 15
D To seat belt indicator, terminal 6 (circuit 15)
E To control unit, EGR, terminal 4
F To control unit, electronic idle speed, terminal 10
G To klckdown switch
H To switchover valves, EGR
M I Common ground connectlon (behind Instrument cluster)
M 5 Ground connectlon, engine (unit screwed Into engine)
M 9 Ground connectlon, front left (near headlight)
M 10 Ground connectlon, battery

Tempmatic climate control, model year 1986

Modifications as compared with model year 1985

Model 201.024

Activation of electromagnetic clutch for engine fan

At a refrigerant pressure of 20 bar the pressure switch (S 32) activates the low speed of the auxiliary fan **and** the electromagnetic clutch for engine fan via double contact relay (K 8).

Formerly only the auxiliary fan was activated by the refrigerant high pressure switch (S 32).

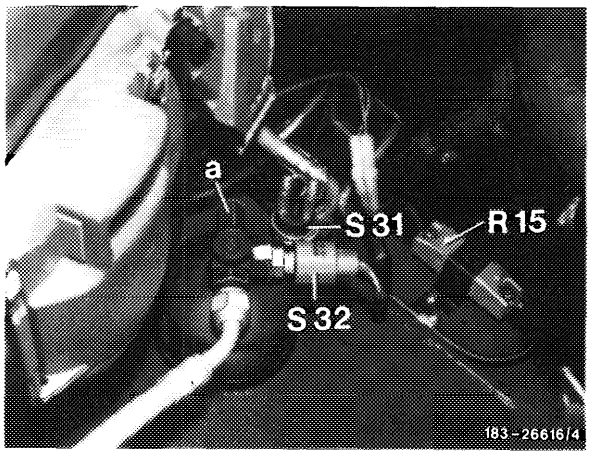


Fig. 83/27

S 32 Refrigeranthigh pressure switch (aux fan low and enginefan)

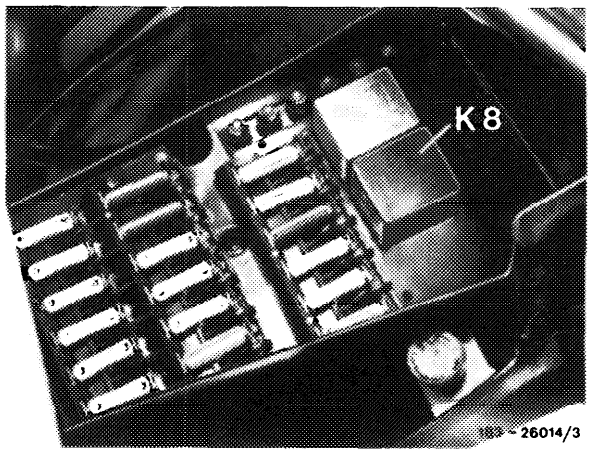


Fig. 83/28

K 8 Double contact relay

Model 201 .126

Layout and function are similar to A/C compressor protective cutout of model 201.122 model year 1985.

The switch (S 32) activates only the aux. fan low (engine has visco-fan).

A/C compressor overheating cut-out, models 201.024/.126

To prevent overheating of the engine, a cutout has been integrated in control unit (N6). At approx. 115°C (engine 602), 110°C (engine 102) coolant temperature the temperature switch (S 25/5 or S 25/3) will switch to ground so that the A/C compressor is switched off via the control unit. The temperature switch opens at approx. 108°C (engine 602), 103°C (engine 102) and the A/C compressor switches on again via control unit (N6).

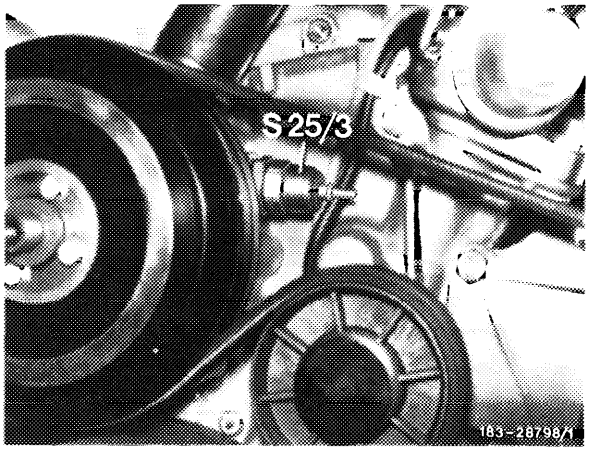


Fig. 83/29 Engine 102

S 25/3 Coolant temperature switch 110 C (A/C compressor cut-out)

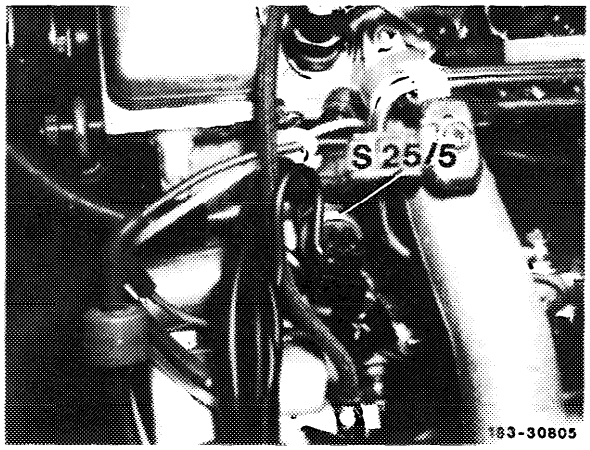


Fig. 83/30 Engine 602

S 25/5 Coolant temperature switch 105/115 °C
a 105 C, aux fan (high speed)
b 115 °C, A/C compressor cut-out

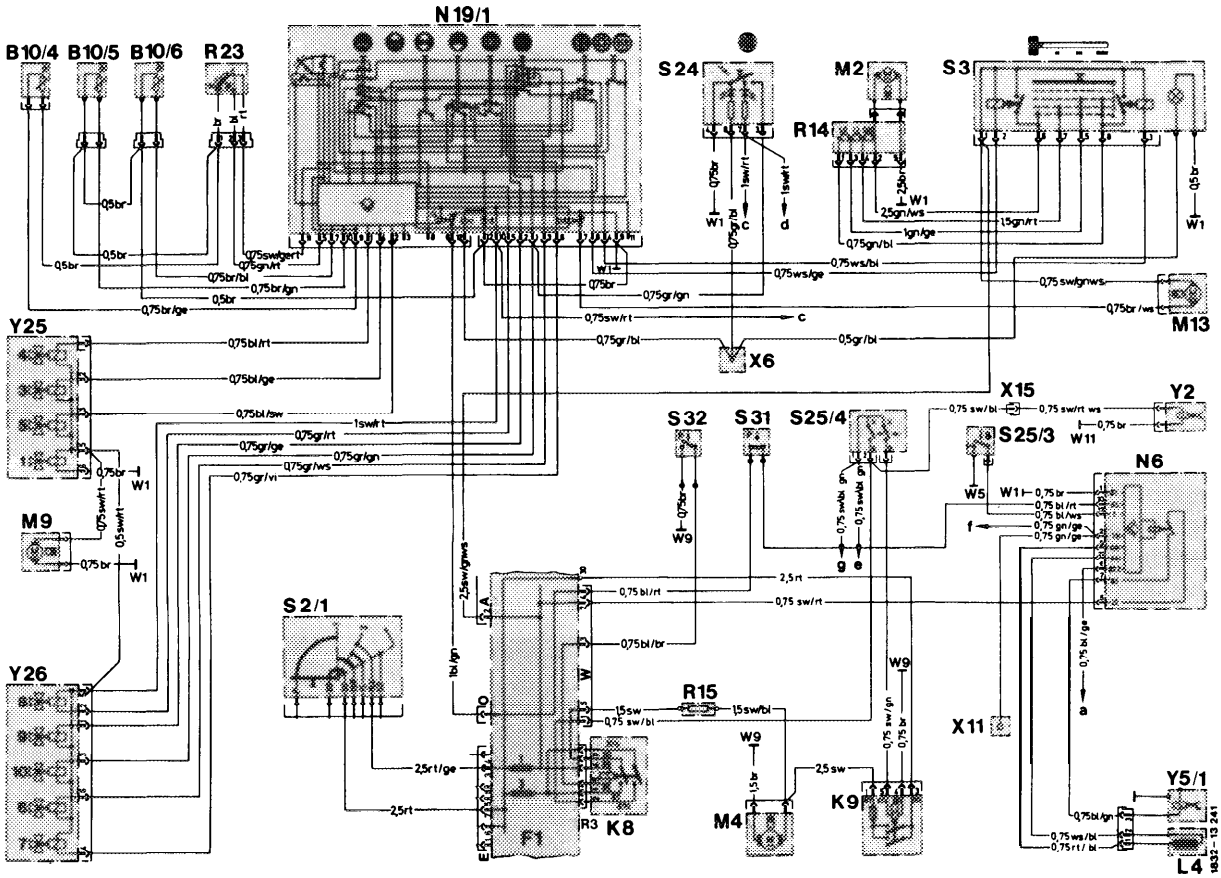


Fig. 83/31 Wiring diagram, tempmatic climate control, Model 201.024

B 10/4 In-car temperature sensor
B 10/5 Outside air temperature sensor
B 10/6 Evaporator temperature sensor
F 1 Electrical center Fuse 1 = 16 A
Fuse 3 = 16 A
K 8 Double contact relay, auxiliary fan low and engine fan clutch
K 9 Relay, auxiliary fan high
L 4 Rpm sensor, A/C compressor
M 2 Blower motor
M 4 Auxiliary fan
M 9 Aspirator blower for in-car sensor
M 13 Auxiliary coolant pump
N 6 Compressor cut-out control unit
N 19/1 Pushbutton switch unit
a Relay for A/C compressor
b Relay for aux coolant pump
c Illumination
d Fuse = 2 A
R 14 Pre-resistor for blower motor
R 15 Pre-resistor for aux fan
R 23 Feedback potentiometer
S 2/1 Ignition-starter switch
s 3 Blower switch
S 24 Fresh/recirculation switch
S 25/3 Coolant temperature, engine overheat (1 1 0°C), A/C compressor cut-out
S 25/4 Coolant temperature switch100/110°C
a 100°C for engine fan clutch
b 1 10°C for aux fan (Hi)
s 31 Refrigerant low pressure switch (compressor)
Closed 2 6 bar/Open 2 0 bar
S 32 Refrigerant high pressure switch (aux fan low and engine fan clutch)
Closed 20 bar/open 15 bar
W 1 Common ground (behind Instrument cluster)
W 5 Engine qround
w 9 Ground, at front headlamp
w 11 Ground, engine (electric wire connection)
X 6 Terminal block 58 d
x 11 Diagnostic plug
x 15 Connector plug, engine fan to coolant temperature switch (S 25/4)
Y 2 Engine fan clutch
Y 5/1 Electromagnetic clutch for A/C compressor
Y 25 Switchover valve unit, 4 connections
4 Switchover valve for blend air flaps ("cold")
3 Switchover valve for blend air flaps ("warm")
5 Switchover valve for heater valve ("opens")
1 Switchover valve for heater valve ("open")
Y 26 Switchover valve unit, 5 connections
8 Switchover valve for legroom flaps
9 Switchover valve for fresh/ recirculating air flap (short stroke)
10 Switchover valve for fresh/ recirculating air flap (long stroke)
6 Switchover valve for defroster flaps (short stroke)
7 Switchover valve for defroster flaps (long stroke)
a To control unit for CIS-E system pm socket 19
c To hazard warning switch terminal 15
d From fasten seat belt Indicator, terminal 8 (connection terminal 15)
e To heated windshield washer nozzle (terminal 15)
f To fuel pump relay pm socket 10
g To tachometer

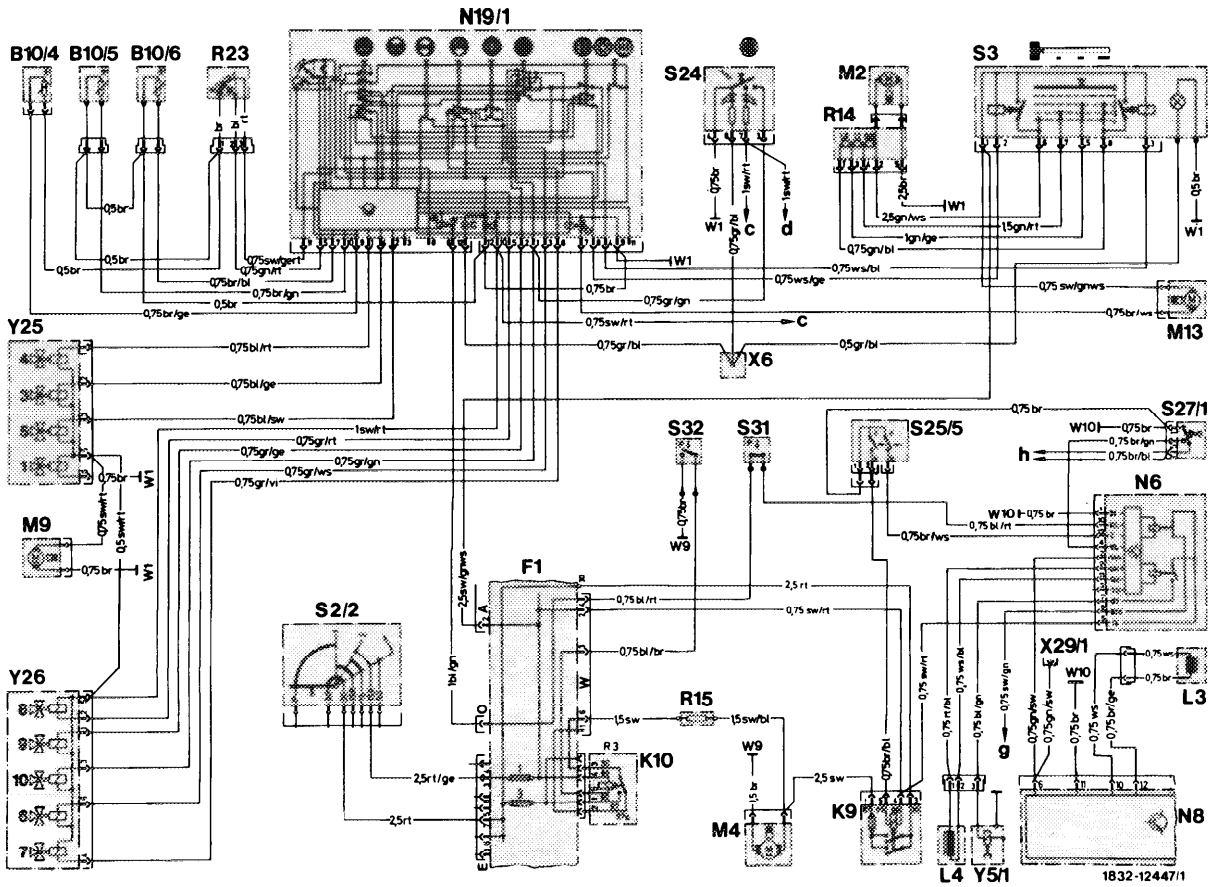


Fig. 83/32 Wiring diagram, tempmatic climate control, Model 201.126

B 10/4 In-car temperature sensor
B 10/5 Outside air temperature sensor
B 10/6 Evaporator temperature sensor
F 1 Electrical center Fuse 1 = 16 A
Fuse 3 = 16A
K 9 Relay, auxiliary fan
K 10 Relay, auxiliary fan pre-resistor
L 3 Rpm sensor, flywheel ring gear
L 4 Rpm sensor, A/C compressor
M 2 Blower motor
M 4 Auxiliary fan
M 9 Aspirator blower for m-car sensor
M 13 Auxiliary coolant pump
N 6 Compressor cut-out control unit
N 8 Idle rpm control unit
N 19/1 Push button switch unit
a Relay for A/C compressor
b Relay for aux coolant pump
c Illumination
d Fuse = 2 A
R 14 Pre-resistor for blower motor
R 15 Pre-resistor for aux fan
R 23 Feedback potentiometer
S 2/2 Pre-glow starter switch
s 3 Blower switch
S 24 Fresh/recirculation switch
s 25/5 Coolant temperature switch 105/115°C
a 105°C for aux fan (Hi)
b 115°C engine overheat
A/C compressor cut-out
s 27/1 Microswitch for A/C compressor cut-out at full throttle
(only connected with auto trans)
s 31 Refrigerant low pressure switch
(A/C compressor cut-out)
Closed 2 6 bar/Open 2 0 bar
S 32 Refrigerant high pressure switch
(aux fan low)
Closed 20 bar/Open 15 bar
W 1 Common ground
(behind Instrument cluster)
w 9 Ground, at front headlamp
w 10 Battery ground
X 6 Terminal block 58 d
x 29/1 Test connection for rpm signal
Y 5/1 Electromagnetic clutch
for A/C compressor
Y 25 Swrtchover valve unit, 4 connections
4 Swrtchover valve for blend air flaps (“cold”)
3 Swrtchover valve for blend air flaps (“warm”)
5 Switchover valve for heater valve (“closed”)
1 Switchover valve for heater valve (“open”)
Y 26 Swrtchover valve unit, 5 connections
8 Switchover valve for legroom flaps
9 Swrtchover valve for fresh/ recirculating air flap (short stroke)
10 Swrtchover valve for fresh/ recirculating air flap (long stroke)
6 Switchover valve for defroster flaps (short stroke)
7 Switchover valve for defroster flaps (long stroke)
c To hazard warning switch terminal 15
d From fasten seat belt indicator, terminal 8 (connectron terminal 15)
g To kickdown switch
h To switchover valves for EGR

Tempmatic climate control, model year 1987

Tempmatic climate control, model 201

Modifications as compared to Model Year 1986:

Fresh/recirculated air switch and tempmatic pushbutton control unit

The fresh/recirculated air switch has been integrated into the tempmatic pushbutton control unit, in place of the previous "EC" pushbutton. In addition, the operation of the A/C mode pushbuttons, as well as the symbol for the center button, have been modified (Fig. 83/1). Both A/C mode pushbuttons can be switched on and off individually. If one pushbutton is depressed, it will automatically cancel the other. With both A/C mode pushbuttons switched off, the climate control operates as before in the economy ("EC") setting (no A/C).

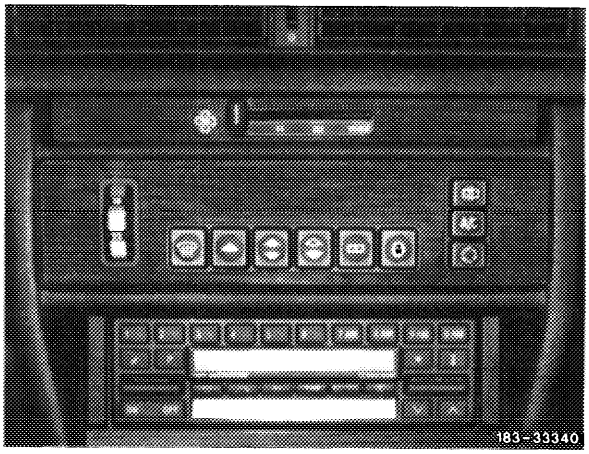


Fig. 83/1

Function of recirculated air mode

The function of the recirculated air mode is identical to model 124, however, when depressing the recirculated air switch, the outside temperature must exceed 15 °C for the system to remain in the recirculated air mode for 30 minutes (in model 124, exceeding 7 °C).

Function of dehumidifying mode

Pushing this button switches the compressor on to operate until the evaporator reaches i-5 °C. The interior temperature sensor has no influence.

Pushbutton control unit

- Short-circuit proof design.
- Override function during failure of a temperature sensor or the feedback potentiometer.
- Malfunction indication using light emitting diode (LED) blink code.

Short-circuit proof design

The circuit board in the tempmatic pushbutton control unit is protected against shorts from any of its externally connected circuits. The respective output signal, i.e. blower and A/C compressor, is switched off, and the blend air flap remains in its present position. The respective output signals are switched on again after the short-circuit has been eliminated.

Due to this modification, the two ampere fuse in the tempmatic pushbutton control unit is no longer required.

Override function during failure of a temperature sensor or feedback potentiometer

Then tempmatic pushbutton control unit switches to an override function if one of the following components fails:

- In-car temperature sensor
- Outside temperature sensor
- Evaporator temperature sensor
- Coolant temperature gauge sensor
- Feedback potentiometer

In this case, the blend air flap remains in its present position. The heater valve remains open or opens. The blower continues to blow at the previously set speed, and the legroom flaps open. All other functions are non-operational.

Malfunction indication using light emitting diode (LED) blink code

A defective temperature sensor or feedback potentiometer is detected by the tempmatic pushbutton control unit. The malfunction indication is conveyed in the form of voltage impulses (battery voltage) at terminal 9 of the right connector on the tempmatic pushbutton control unit. These impulses can be “read” through the use of a LED (not a light bulb). The malfunctioning component or respective wiring can be pinpointed according to the number of voltage impulses indicated by the blinking LED. The LED will blink once for each impulse. The voltage impulses have a **frequency** of ½ Hz. (two seconds).

Defective component with wiring	Number of voltage impulses (blinks)	Time of impulse sequences in seconds
In-car temp. sensor	5	10
Outside temp. sensor	10	20
Feed back potentiometer	15	30
Evaporator temp. sensor	20	40
Coolant temp. gauge sensor	25	50

The malfunction indication repeats until the defect is no longer detected. There is a pause of four seconds between each sequence of impulses, at which point the opening and closing of the relay in the blower switch is audible (clicking noise), momentarily switching the blower off. This provides an additional method for diagnosing the defective component by listening to the relay and timing the impulse sequences.

The test procedure for diagnosis using the LED blink code is on page 246.

Model 201.0291128

Auxiliary fan

These models are equipped with dual electric auxiliary fans. They are switched on simultaneously in the first speed at a refrigerant pressure of 20 bar and in the second speed at an engine temperature of 105° C. At maximum speed, both auxiliary fans draw approx. 26 Amps at 13 Volts battery voltage.

The auxiliary fans are attached to the condenser and can only be removed after first removing the front center reinforcement (arrow).

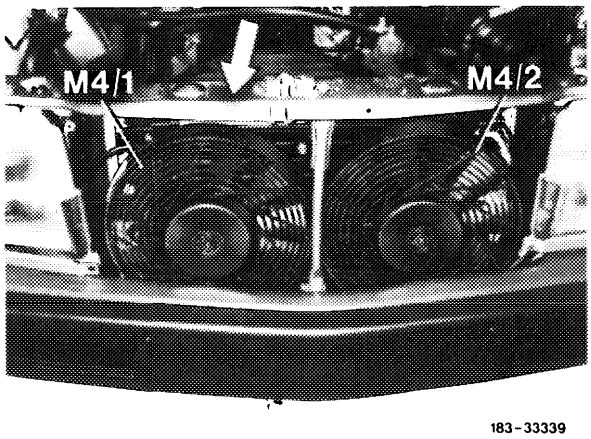


Fig. 83/2

M 4/1 Left auxiliary fan
M 4/2 Right auxiliary fan

Models 107, 124, 126, 201

2-Function refrigerant pressure switch

To prevent damage to the A/C compressor, a 2-function refrigerant pressure switch (S 31 /1) is installed in the receiver/dryer replacing the previous switch.

1. Function 1 (low pressure) activates if the refrigerant level is too low or with no refrigerant in system.

   Cut-out pressure is approx. 2.0 bar.
   Cut-in pressure is approx. 2.6 bar.

2. Function 2 (high pressure) activates if the expansion valve becomes clogged or if the auxiliary fan fails to operate.

   Cut-out pressure is approx. 30.0 bar.
   Cut-in pressure is approx. 22.0 bar.

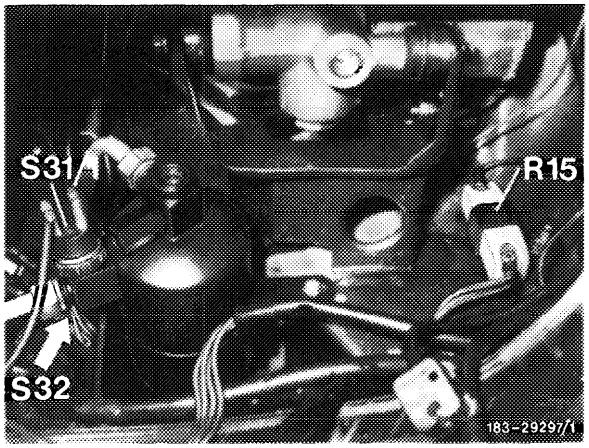


Fig. 83/3

S 3 111 2-Function refrigerant pressure switch

Model 201

Testing the temperature sensors and the feedback potentiometer

Complaints resulting from a defective temperature sensor or feedback potentiometer causing the blower to switch off momentarily or the blower relay to make a clicking noise, can be more easily diagnosed using a light emitting diode (LED) blink code.

Further test procedures are performed as before.

Diagnosis using LED blink code

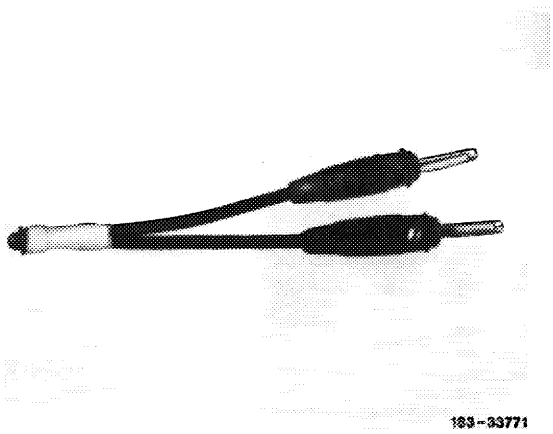
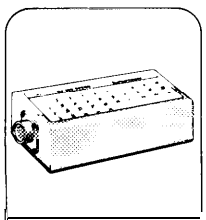


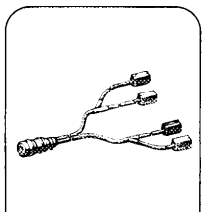
Fig. 83/4 LED blink code tester

Defective component and/or wiring	Number of voltage impulses (blinks)	Time of impulse sequences in seconds
In-car temp. sensor	5	10
Outside temp. sensor	10	20
Feed back potentiometer	15	30
Evaporator temp. sensor	20	40
Coolant temp. gauge sensor	25	50

Special tools



124 589 00 21 00



201 589 09 63 00

LED blink code tester

900 589 00 21 00

Test procedure

1. Remove pushbutton control unit. Connect socket box tester cable to tempmatic pushbutton control unit and unit wiring plugs.
2. Connect red wire of LED blink code tester to socket 10 and brown wire of LED blink code tester to socket 9 of the socket box.
3. Turn ignition on and set temperature wheel to 22° C. Pushbuttons can be in any position.
4. Count number of voltage impulses by counting the blinking LED in the switch of the LED blink code tester.
5. Replace defective part or check respective wiring.
6. Repeat test procedure until no defects are detected.

Modified test value for checking the feedback potentiometer

Due to modifications to the pushbutton switch, the required voltage for adjustment of the feedback potentiometer, with the temperature selector in position "MIN", is changed from 3.9-4.4 V to 2.4-2.7 V.

Note: We recommend to make the above change in test step 20 of your test chart "Tempmatic, Model 201".

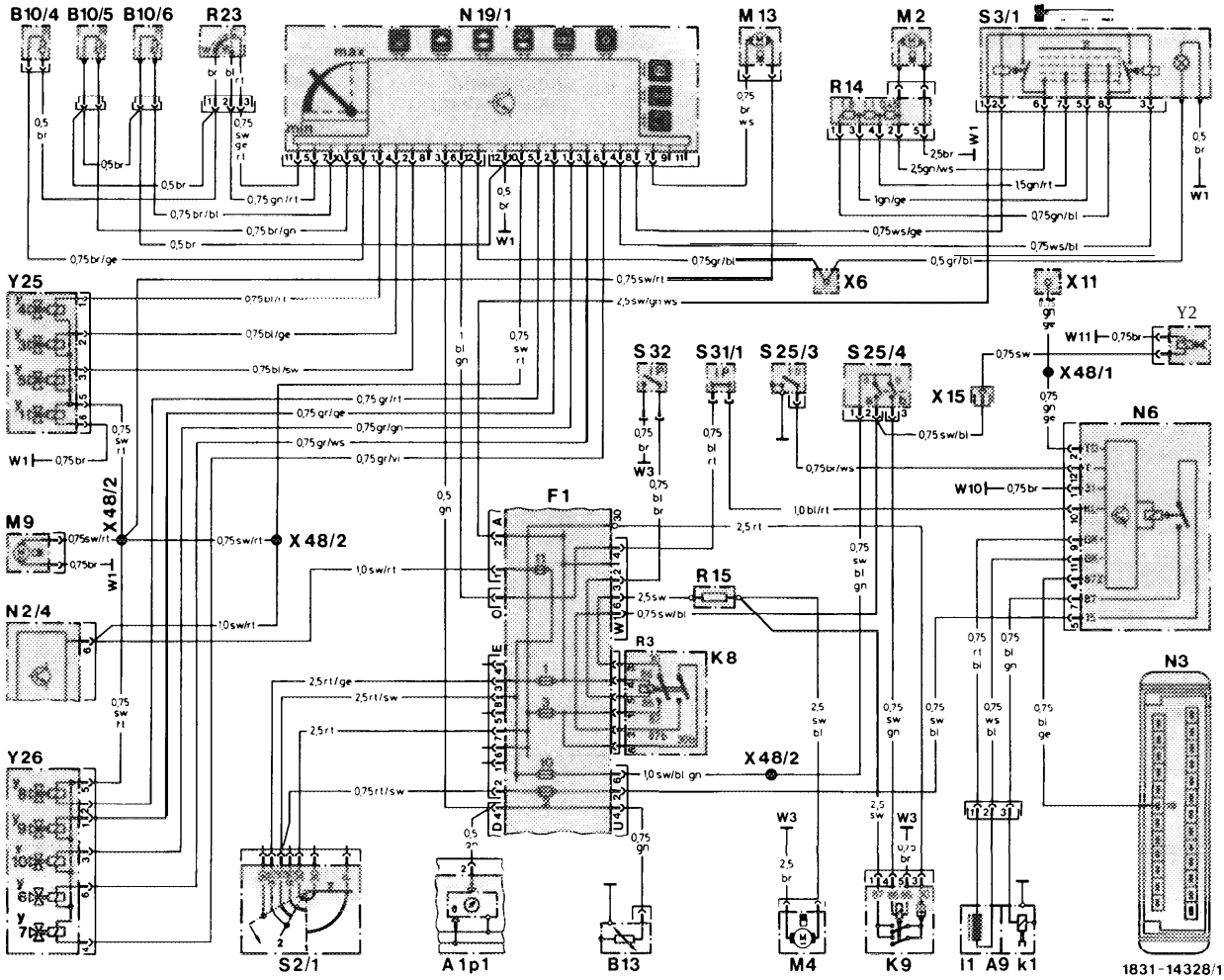


Fig. 83/5 Wiring diagram, Tempmatic climate control, model 201.028

A lpl	Coolant temperature gauge
A 9	A/C compressor
A 9k1	Electro-magnetic clutch
A 911	RPM sensor
B 10/4	In-car temperature sensor
B 10/5	Outside temperature sensor
B 10/6	Evaporator temperature sensor
B 13	Coolant temperature gauge sensor
F 1	Electrical center.
	Fuse 1 16A
	Fuse 2 8A
	Fuse 3 16A
	Fuse 10 8A
	Fuse 11 8A
K 8	Double contact relay for auxiliary fan, low, and magnetic clutch for engine fan
K 9	Auxiliary fan relay. high
M2	Blower motor
M4	Auxiliary fan
M9	Aspirator blower
M13	Auxiliary coolant pump
N 2/4	Warnmg module (seat belts, keys, lights)
N3	CIS-E control unit
N6	A/C compressor control unit
N 19/1	Tempmatic pushbutton control unit
R 14	Blower motor prereslstor group
R 15	Auxiliary fan prereslstor
R23	Feedback potentiometer
S 2/1	Ignition/starter switch
s 3/1	Blower switch, Tempmatic
S 25/3	110° C temperature switch
S 25/4	100/1 10" C temperature switch
a	100' C for engine fan clutch
b	110° C for auxiliary fan
S 31/1	Refrigerant pressure switch, 2-function (off 2 0/30 0 bar, on 2 6/22 0 bar)
S 32	Refrigeranthigh pressure switch (auxiliary fan) (off 15 0 bar, on 20 0 bar)
W1	Mam ground, behind instrument cluster
W3	Ground, left front wheelhousing (at ignition coil)
W5	Ground, engine
X 6	Terminal block, circuit 58d
x 11	Diagnostic socket/terminal block
x 15	Connector, engine fan/ 100" C temp switch (S 25/4)
X 48/1	Connector sleeve, circuit TD (solder jointin harness)
X 48/2	Connector sleeve, circuit 15 (solder jointin harness)
Y 2	Electro-magnetic engine fan clutch
Y 25	Switch-over valve unit, 4 connections
	4 Switch-over valve for blend air flaps (“cold”)
	3 Switch-over valve for blend air flaps (“warm”)
	5 Switch-over valve for heater valve (“closes”)
	1 Switch-over valve for heater valve (“opens”)
Y 26	Switch-over valve unit, 5 connecttons
	8 Switch-over valve for legroom flaps
	9 Switch-over valve for fresh/recirculated air flap (short stroke)
	10 Switch-over valve for fresh/recirculated air flap (long stroke)
	6 Switch-over valve for defroster flaps (short stroke)
	7 Swatch-over valve for defroster flaps (long stroke)

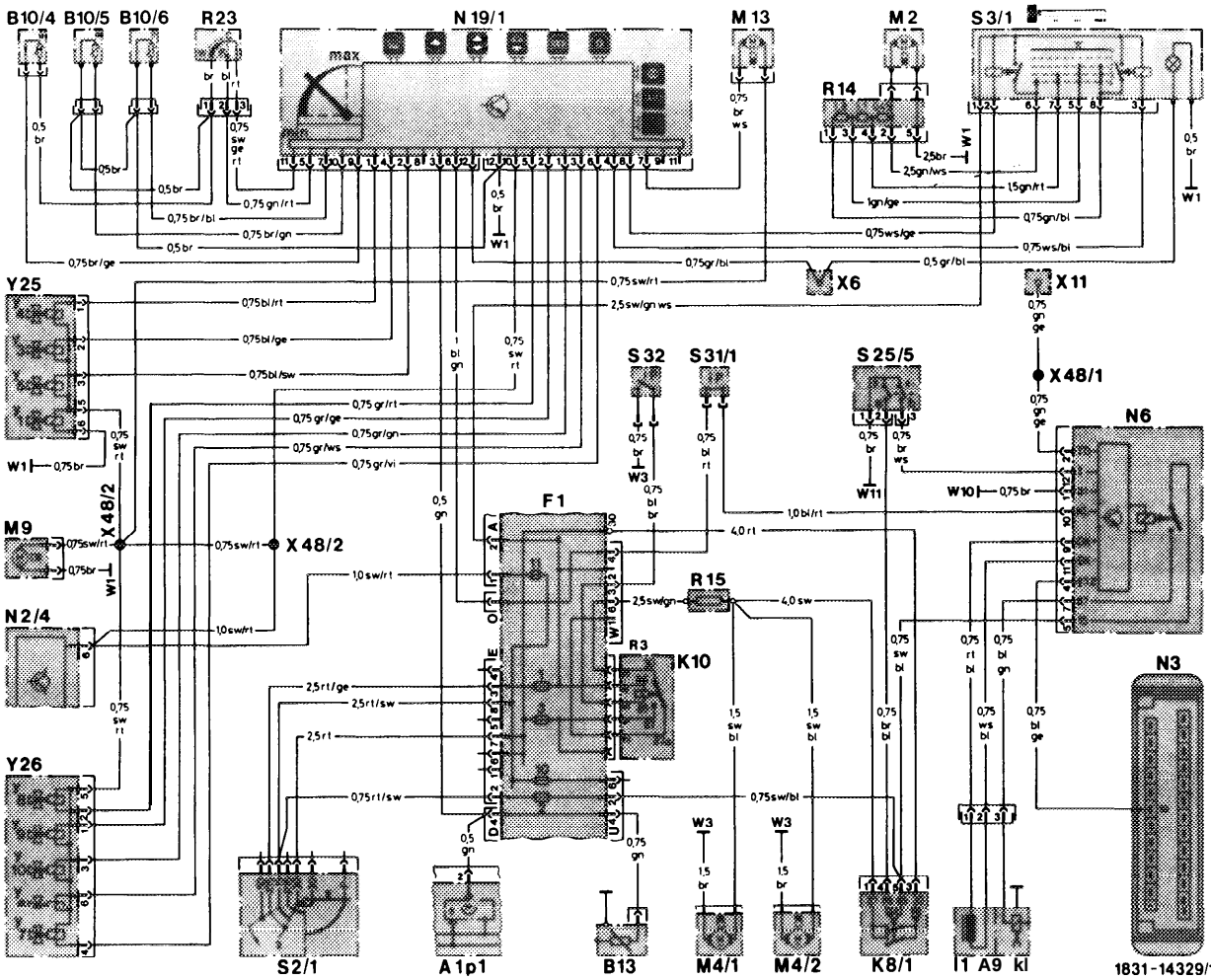


Fig. 83/6 Wiring diagram, Tempmatic climate control, model 201.029

A lpl	Coolant temperature gauge	N 19/1	Tempmatic pushbutton control unit	Y 25	Switch-over valve unit.
A 9	A/C compressor	R14	Blower motor preresrstor group		4 connections
A 9k1	Electro-magnetic clutch	R 15	Auxiliary fan preresrstor		4 Switch-over valve for blend air flaps (“cold”)
A911	RPM sensor	R 23	Feedback potentiometer		3 Switch-over valve for blend air flaps (“warm”)
B 10/4	in-car temperature sensor	S 2/1	Ignition/starter switch		5 Switch-over valve for heater valve (“closes”)
B 10/5	Outside temperature sensor	s 3/1	Blower switch		1 Switch-over valve for heater valve (“opens”)
B 10/6	Evaporator temperature sensor	s 25/5	105/115° C temperature switch	Y 26	Switch-over valve unit,
B 13	Coolant temperature gauge sensor	a	105° C for auxiliary fan		5 connections
F 1	Electrical center,	b	115° C for A/C compressor		Et Switch-over valve for legroom flaps
	Fuse 1 16A		emergency cut-out		9 Switch-over valve
	Fuse 2 8A	S 31/1	Refrigerant pressure switch,		for fresh/recirculated air flap (short stroke)
	Fuse 3 16A		2-function (off 2.0130 0 bar,		10 Switch-over valve
	Fuse 10 8A		on 2 6/22 0 bar)		for fresh/recirculated air flap (long stroke)
	Fuse 11 8A	S 32	Refrigerant high pressure switch		6 Switch-over valve for defroster flaps (short stroke)
K 8	Double contact relay for auxrlrary fan, low, and magnetic clutch		(auxiliary fan)		7 Switch-over valve for defroster flaps (long stroke)
	for engine fan		(off 15 0 bar, on 20 0 bar)		
K 8/1	Relay for dual auxiliary fan, high	W1	Main ground, behind instrument		
M2	Blower motor		cluster		
M4/1	Left auxrlrary fan	w 3	Ground, left front wheelhousmg		
M4/2	Right auxrlrary fan		(at ignition coil)		
M9	Aspirator blower	W5	Ground, engine		
M13	Auxiliary coolant pump	X 6	Terminal block, circuit 58d		
N 2/4	Warning module	x 11	Diagnostic socket/terminal block		
	(seat belts, keys, lights)		(circuit TD)		
N3	CIS-E control unit	X 48/1	Connector sleeve, circuit TD		
N6	A/C compressor control unit		(solder joint in harness)		
		X 48/2	Connector sleeve, circuit 15		
			(solder jointin harness)		

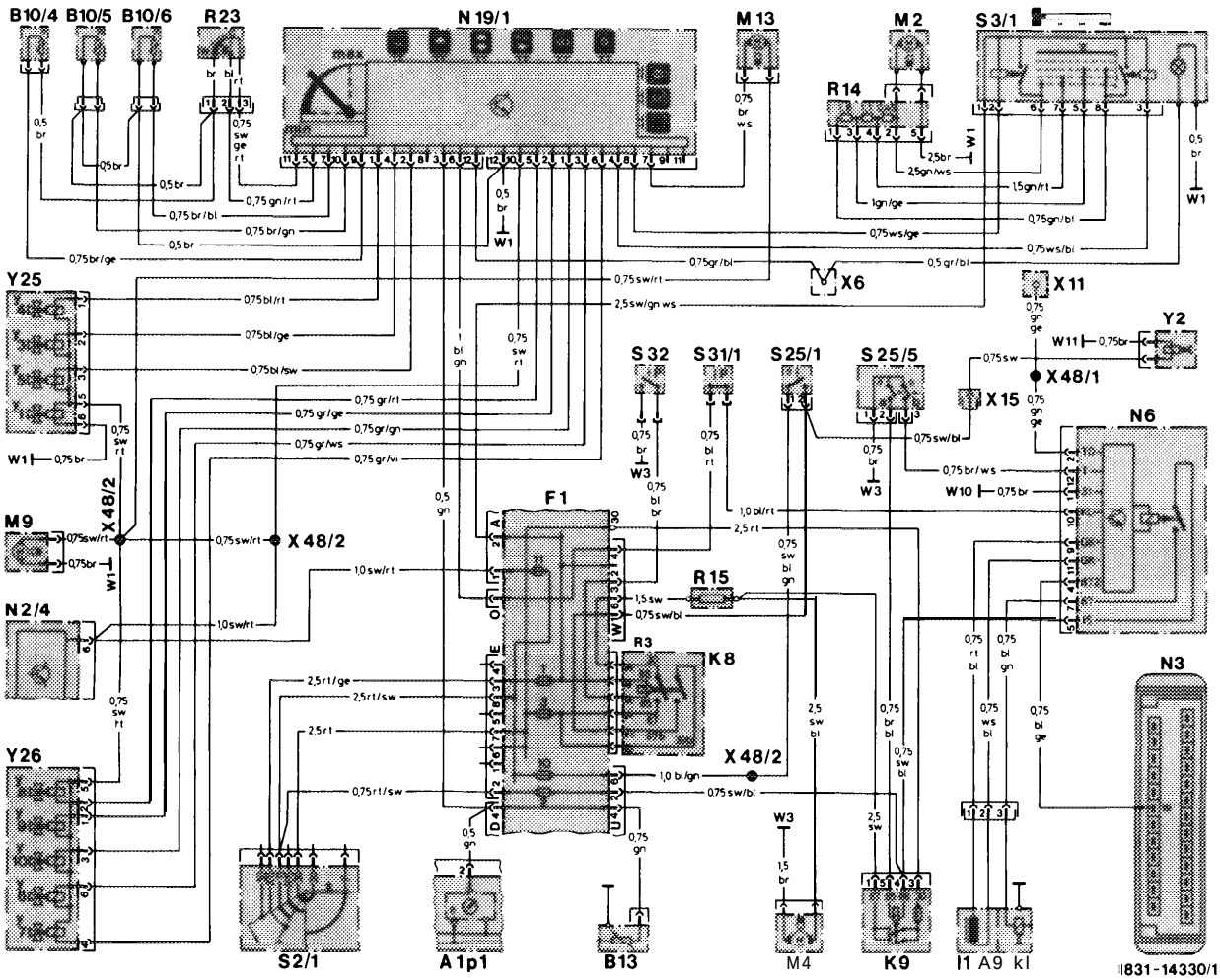


Fig. 83/7 Wiring diagram, Tempmatic climate control, model 201.034

A Ipl Coolant temperature gauge
A 9 A/C compressor
A 9k1 Electra-magnetic clutch
A911 RPM sensor
B 10/4 In-car temperature sensor
B 10/5 Outside temperature sensor
B 10/6 Evaporator temperature sensor
B 13 Coolant temperature gauge sensor
F 1 Electrical center,
Fuse 1: 16A
Fuse 2 8A
Fuse 3. 16A
Fuse 10: 8A
Fuse 11: 8A
K 8 Double contact relay for auxiliary fan, low, and magnetic clutch for engine fan
K 9 Relay for auxiliary fan, high
M2 Blower motor
M4 Auxiliary fan
M9 Aspirator blower
M I 3 Auxiliary coolant pump
N 2/4 Warnmg module (seat belts, keys, lights)
N 3 CIS-E control unit
N 6 A/C compressor control unit
N 19/1 Tempmatic pushbutton control unit

R14 Blower motor preresistor group
R 15 Auxiliary fan preresistor
R 23 Feedback potentiometer
s 2/1 Ignition/starter switch
s 3/1 Blower switch
s 25/1 100° C temperature switch
S 25/5 105/115° C temperature switch
a 105" C for auxiliary fan
b 115° C for A/C compressor emergency cut-out
S 31/1 Refrigerant pressure switch, P-function (off 2.0/30.0 bar, on 2.6/22 0 bar)
S 32 Refrigerant high pressure switch (off 15.0 bar, on 20.0 bar)
W1 Main ground, behind instrument cluster
w 3 Ground, left front wheelhousing (at ignition coil)
w 5 Ground, engine
X 6 Terminal block, circuit 58d
x 11 Diagnostic socket/terminal block (circuit TD)
x 1 5 Connector, engine fan/l 00° C temperature switch
X48/1 Connector sleeve, circuit TD (solder joint in harness)
X 48/2 Connector sleeve, circuit 15 (solder joint in harness)

Y 2 Electro-magnetic engine fan clutch
Y 25 Switch-over valve unit, 4 connections
4 Switch-over valve for blend air flaps (“cold”)
3 Switch-over valve for blend air flaps (“warm”)
5 Switch-over valve for heater valve (“closes”)
1 Switch-over valve for heater valve (“opens”)
Y 26 Switch-over valve unit, 5 connections
8 Switch-over valve for legroom flaps
9 Switch-over valve for fresh/recirculated air flap (short stroke)
10 Switch-over valve for fresh/recirculated air flap (long stroke)
6 Switch-over valve for defroster flaps (short stroke)
7 Switch-over valve for defroster flaps (long stroke)

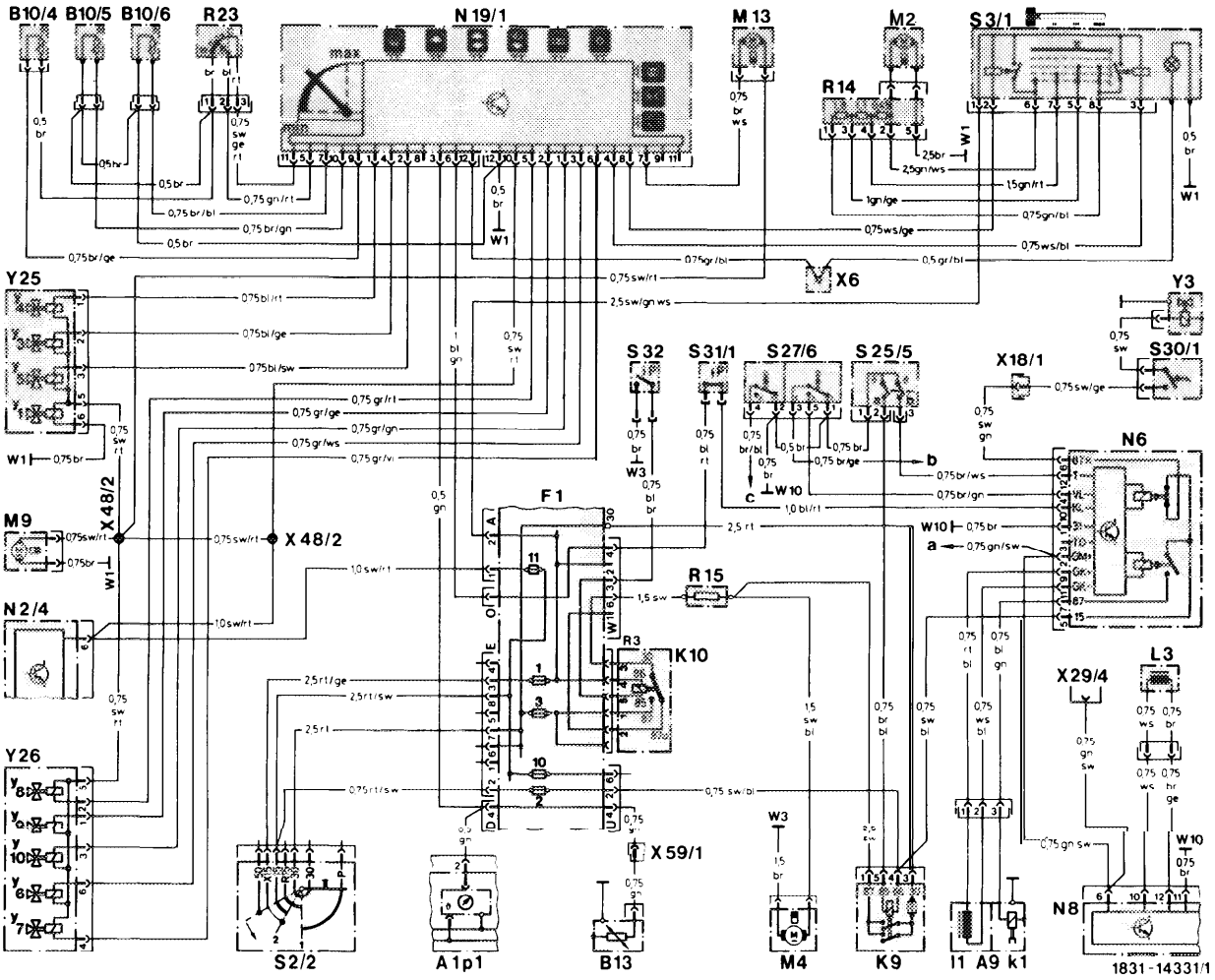


Fig. 83/8 Wiring diagram, Tempmatic climate control, model 201.126

A lpl	Coolant temperature gauge
A 9	A/C compressor
A 9k1	Electro-magnetic clutch
A911	RPM sensor
B 10/4	In-car temperature sensor
B10/5	Outside temperature sensor
B 10/6	Evaporator temperature sensor
813	Coolant temperature gauge sensor
F 1	Electrical center,
	Fuse 1 16A
	Fuse 2 8A
	Fuse 3 16A
	Fuse 10 8A
	Fuse 11 8A
K 9	Relay for auxiliary fan, high
K 10	Auxrlrary fan pre-resistor relay
L 3	Ring gear speed sensor
M2	Blower motor
M4	Auxrlrary fan
M9	Aspirator blower
MI3	Auxrlrary coolant pump
N 2/4	Warning module
	(seat belts, keys, lights)
N6	A/C compressor control unit
N 8	Idle speed control unit
N 19/1	Tempmatrc pushbutton control unit
R14	Blower motor preresistor group
R 15	Auxrlrary fan preresrstor
R23	Feedback potentiometer
s 2/2	Glow/starter switch
S 3/1	Blower switch
S 25/5	105/115° C temperature switch
a	105' C for auxiliary fan
b	115° C for A/C compressor emergency cut-out
S 27/6	A/C compressor and EGR cut-out microswitch (vehicles with automatic transmission only)
s 30/1	Kick-down switch
S 31/1	Refrigerant pressure switch, 2-function (off 2 0/30 0 bar. on 2 6/22 0 bar)
S32	Refrigerant high pressure switch (auxiliary fan) (off 15 0 bar, on 20 0 bar)
W1	Main ground, behind instrument cluster
w3	Ground, left front wheelhousmg (at ignition coil)
W10	Ground, battery
X 6	Terminal block, circuit 58d
x 18/1	Connector, taillamp harness/ A/C compressor harness
X 29/1	Test connectton, engine speed signal (EDS)
X 48/2	Connector sleeve, circuit 15 (solder jointin harness)
X 59/1	Connector, engine fan/coolant temperature sensor
Y 3	Kick-down solenoid (automatic transmission)
Y 25	Swatch-over valve unit, 4 connections
	4 Swatch-over valve for blend air flaps (“cold”)
	3 Swatch-over valve for blend air flaps (“warm”)
	5 Swatch-over valve for heater valve (“closes”)
	1 Switch-over valve for heater valve (“opens”)
Y 26	Swatch-over valve unit, 5 connections
	8 Switch-over valve for legroom flaps
	9 Switch-over valve for fresh/recirculated air flap (short stroke)
	10 Swatch-over valve for fresh/recirculated air flap (long stroke)
	6 Swatch-over valve for defroster flaps (short stroke)
	7 Switch-over valve for defroster flaps (long stroke)
a	to EGR (II) control unit N37/2, terminal 2
b	to EGR (II) control unit N37/2, terminal 5

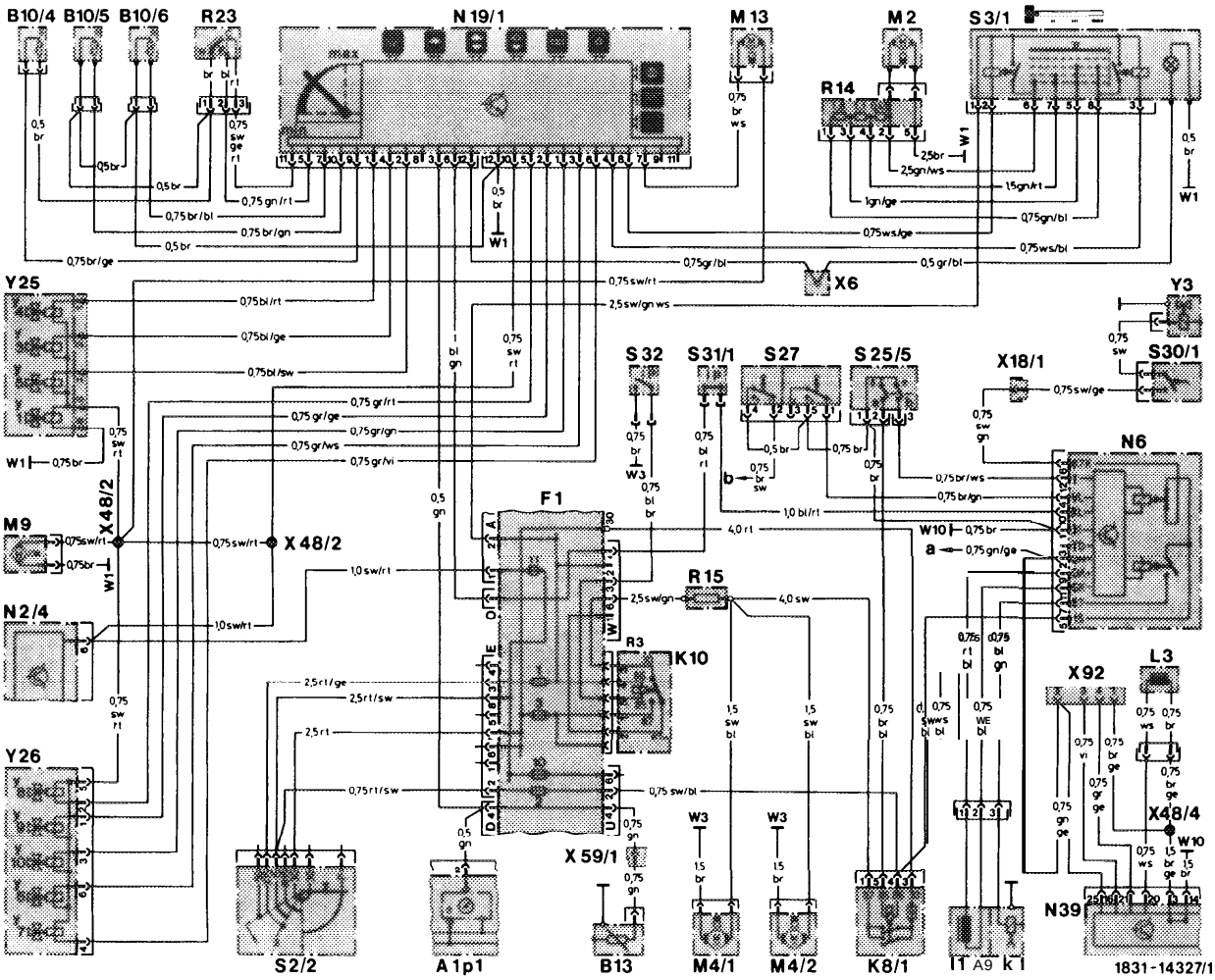


Fig. 83/9 Wiring diagram Tempmatic climate control, model 201 .128

A lpl	Coolant temperature gauge
A 9	A/C compressor
A 9k1	Electro-magnetic clutch
A911	RPM sensor
B 10/4	In-car temperature sensor
B 10/5	Outside temperature sensor
B 10/6	Evaporator temperature sensor
B 13	Coolant temperature gauge sensor
F 1	Electrical center,
	Fuse 1 16A
	Fuse 2 8A
	Fuse 3 16A
	Fuse 10 16A
	Fuse 11 8A
K 8/1	Relay for dual auxrliary fan, high
K 10	Auxiliary fan pre-resistor relay
L 3	Ring gear speed sensor
M2	Blower motor
M4/1	Left auxiliary fan
M4/2	Right auxiliary fan
M9	Aspirator blower
M13	Auxiliary coolant pump
N 2/4	Warning module
	(seat belts, keys, lights)
N 6	A/C compressor control unit
N 19/1	Tempmatic pushbutton control unit
N39	Control unit (EDS)
R 14	Blower motor preresrstor group
R 15	Auxiliary fan preresrstor
R 23	Feedback potentiometer
S 2/2	Glow/starter switch
s 3/1	Blower switch
S 25/5	105/115° C temperature switch
a	105° C for auxiliary fan
b	115° C for A/C compressor emergency cut-out
S 27	A/C compressor/boost pressure, cut-out microswitch
S 30/1	Kick-down switch
S 31/1	Refrigerant pressure switch. 2-function (off 2 0/30 0 bar, on 2 6/22 0 bar)
S 32	Refrtgerant high pressure switch (auxiliary fan) (off 15 0 bar, on 20 0 bar)
W1	Main ground, behind instrument cluster
w 3	Ground, left front wheelhousmg (at ignition coil)
W10	Ground, battery
X 6	Terminal block, circuit 58d
X 18/1	Connector, taillamp harness/ A/C compressor harness
X 48/2	Connector sleeve, circuit 15 (solder joint in harness) ,
X 48/4	Connector sleeve, rpm sensor signal (solder jointin harness)
X 59/1	Connector, engine fan/coolant temperature sensor
x 92	Test plug (EDS) 8-pole
Y 3	Kick-down solenoid (automatic transmission)
Y 25	Switch-over valve unit, 4 connections
	4 Switch-over valve for blend air flaps (“cold”)
	3 Switch-over valve for blend air flaps (“warm”)
	5 Switch-over valve for heater valve (“closes”)
	1 Switch-over valve for heater valve (“opens”)
Y 26	Switch-over valve unit, 5 connections
	8 Switch-over valve for legroom flaps
	9 Switch-over valve for fresh/recirculated air flap (short stroke)
	10 Switch-over valve for fresh/recirculated air flap (long stroke)
	6 Switch-over valve for defroster flaps (short stroke)
	7 Switch-over valve for defroster flaps (long stroke)
a	to clock/tachometer Al p7
b	to engine overload protection pressure switch

Mercedes-Benz

Service

Service Manual
Engine 102

Mercedes-Benz of North America, Inc. · Montvale, NJ 07645

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Introduction

This service manual is the product of existing technical publications. Special care has been taken to provide accurate information on removal, disassembly, inspection, installation, and adjustment procedures, together with the necessary technical data for the particular job.

The material in this manual is divided according to the Mercedes-Benz Component Group System as outlined on the GROUP INDEX page. This page will quickly direct the reader to the Major Component Group. Each Major Component Group begins with a JOB INDEX listing all jobs within that group.

Mercedes-Benz of North America, Inc. recommends that repairs to, and maintenance of Mercedes-Benz automobiles be performed by **trained Mercedes-Benz personnel** at authorized Mercedes-Benz dealerships.

The information contained in this special publication is ordinarily issued by Mercedes-Benz of North America, Inc., in conjunction with supplementary service literature and special tools supplied **only to** its authorized dealers. The repair and maintenance procedures outlined herein are intended for use by **trained Mercedes-Benz service and dealership personnel. This** manual can also be useful for Mercedes-Benz owners in diagnosing vehicle systems and performing repairs. Supplementary service literature will not be provided with this publication, but may be contained in reprints of this service manual.

Please note that this manual has been compiled from various sources, some of which cover models other than the subject of this book. Always refer to the engine and vehicle identification table for model and component information.

Special tools required in performing certain service jobs are identified in the manual and are recommended for use. Any part numbers given are only used for identification and easier differentiation between individual components, and are not intended for ordering purposes.

If your Mercedes-Benz model differs from the specifications contained in the manual you select, consult your authorized Mercedes-Benz dealer.

All procedures, illustrations and specifications contained in this manual were based on the latest information available at the time of publication. All rights are reserved to make production, design and specification changes at any time, without notice and without obligation to give notice. Any such changes will not be contained in this manual.

Caution!

The proper performance of service and repair procedures is essential for both the safety of the mechanic and the safe and efficient operation of the vehicle. The use of incorrect service procedures and tools may greatly increase the risk of personal injury and render the vehicle unsafe. The procedures in this manual are described in such a manner that the service may be performed safely and accurately.

However, it is a general assumption that the reader is familiar with basic automotive repair procedures and Mercedes-Benz vehicles. You should not attempt to use this manual if this is not the case.

Mercedes-Benz of North America, Inc. assumes no liability for any damage to person or property caused by the utilization of this publication to effect maintenance or repair work on Mercedes-Benz automobiles.

MERCEDES-BENZ OF NORTH AMERICA, INC.
Service and Parts Literature

General, Technical Data	00
Crankcase and cylinder head	01
Crankshaft assembly	03
Engine timing, valvetrain	05
Continuous Fuel Injection System (CFI)	07.3
Air filter	09
Belt drive	13
Intake and exhaust manifolds, emission control system	14
Electrical system, engine	15
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Engine cooling system	20
Engine suspension	22
Accelerator control, cruise control, electronic accelerator	30
Fuel system	47
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Job No.

Instructions for use of service manual . . . . . 00 – 005
Engine and vehicle identification . . . . . – 010
Vehicle identification number locations . . . . . – 015
Technical data . . . . . – 020

Complete Service Manual coverage for late model year Mercedes-Benz vehicles requires four individual manuals:

Service Manual, Engine
Service Manual, Chassis and Body
Service Manual, Automatic Climate Control
Electrical Troubleshooting Manual

Throughout these manuals, the vehicles are identified by their chassis and engine numbers. These numbers are made up of the first six digits of the respective serial number. For the actual location of chassis and engine numbers, see page 00-015/1. In cases where the repair instructions apply to all versions, only the first three digits of the respective number are referenced.

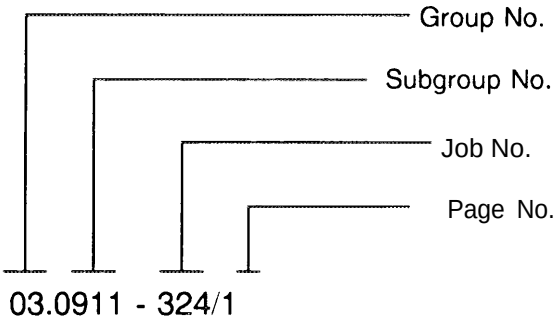
For example, chassis 124 applies to all 124 models. However, chassis 124.051 would apply only to model 300CE with engine 104.

Location of specific repair instructions

First locate the Group No. in the Group Index. Individual groups are separated by an easily visible dividing page, which is followed by the job index page. The exact job required is found in the job index. The initial page of a typical job description appears as follows:

03-324 Replacement of front crankshaft radial seal

Job Title appears on same line as Group No.



Technical data, tightening torques and tools are listed at the beginning of each job.

All dimensions are in metric units unless otherwise indicated. Any part numbers given are only used for identification and differentiation between individual components, and are not intended for ordering purposes.

Special Instructions

⚠Warning Appears throughout service instructions indicating the possiblity of personal injury if procedures are not followed.

Caution! Indicates possible equipment or vehicle damage if procedures are not followed.

Note Provides helpful information for the described procedure.

Installation note Provides detailed information during assembly.

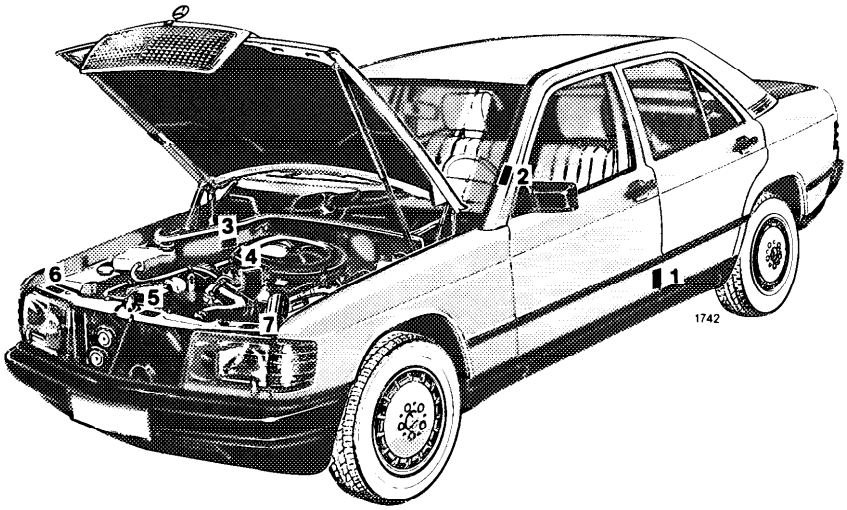
This manual applies to the following passenger cars, starting model year 1984.

Gasoline engines

Model Year	Model	Sales Designation	Engine
1984	201.024	190 E 2.3	102.961
1985	201.024	190 E 2.3	102.985
1986	201.024	190 E 2.3	102.985
1987	201.028	190 E 2.3	102.985
1988	201.028	190 E 2.3	102.985
1989	–	–	–
1990	–	–	–
1991	201.028	190 E 2.3	102.985
1992	201.028	190 E 2.3	102.985
1993	201.028	190 E 2.3	102.985

Model 201

When ordering spare parts, please specify chassis and engine numbers.



Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Informatron Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag
a Emission Control Tag
Catalyst Information
(from model year 1964 up to 1966)

Gasoline engines

Model	20 1.024	201.024	201.028
Sales designation	190 E 2.3 (Model year 1984)	190 E 2.3 (Model years 1985 - 86)	190 E 2.3 (Model years 1987-8, 1991-3)
Engine	102.961	102.985	102.985
Operation	4-stroke spark ignition, mechanically/electronically controlled continuous fuel injection system with airflow sensor (CIS-E)	4-stroke spark ignition, mechanically/electronically controlled continuous fuel injection system with airflow sensor (CIS-E)	4-stroke spark ignition, mechanically/electronically controlled continuous fuel injection system with airflow sensor (CIS-E)
Aspiration	Normal	Normal	Normal
Number of cylinders	4	4	4
Cylinder arrangement	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination
Bore, stroke mm	95580.25	95.5/80.25	95.5/80.25
Total effective piston displacement cc	2299	2299	2299
Compression ratio	8.0:1	8.0 : 1	9.0 : 1
Firing order	I-3-4-2	I-3-4-2	I-3-4-2
Maximum speed rpm	5700 ± 50	6200 ± 50	6200 ± 50
Engine output (SAE)kW/rpm net bhp/rpm	84/5000 11315000	90/5000 120/5000	97/5100 130/5100
Maximum torque Nm/rpm net lb-ft./rpm	18113500 13313500	184/3500 1361'3500,	198/3500 14613500
Crankshaft bearings	5(multi-component, anti-friction bearings)	5(multi-component, anti-friction bearings)	5 (multi-component, anti-friction bearings)
Valve arrangement	Overhead, 2 per cylinder	Overhead, 2 per cylinder	Overhead, 2 per cylinder
Camshaft arrangement	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft
Oil cooling	-	-	-
Cooling	Coolant circulation pump, thermostat with bypass line, fan with electromagnetic clutch, finned tube radiator	Coolant circulation pump, thermostat with bypass line, fan with electromagnetic clutch, finned tube radiator	Coolant circulation pump, thermostat with bypass line, fan with electromagnetic clutch, finned tube radiator
Lubrication	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump
Oil filter	Full flow filter	Full flow filter	Full flow filter
Air filter	Dry air filter with paper cartridge	Dry air filter with paper cartridge	Dry air filter with paper cartridge

Filling capacities

Model	201.024	201.024	201.028
Sales designation	190 E 2.3 (Model Year 1984)	190 E 2.3 (Model Years 1985 - 6)	190 E 2.3 (Model Years 1987-8, 1991-3)
Engine	102.961	102.985	102.985
Fuel tank/reserve approx. l	55/7.5	55/7.5	55/7.0 (6.0 l reserve from 1991)
During initial oil filling approx. l	5.0	5.0	5.0
During oil and filter change approx. l	4.5	4.8	4.5
Marks on dipstick max./min. approx. l	4.3/2.8	4.3/2.8	4.3/2.8
Cooling system with heater approx. l	8.5	8.5	8.5

Electrical system

Model	201.024	201.024	201.028
Sales designation	190 E 2.3	190 E 2.3	190 E 2.3
Engine	102.961	102.985	102.985
Battery Voltage Capacity	 12 V 55 Ah	 12 V 55 Ah	 12 V 62 Ah
Starter Bosch	12 V 1.5 kW	12 V 1.5 kW	12 V 1.4 kW
Alternator	14 V 65 A	14 V 70 A	14 V 70 A

Job No.

Engine and model survey . . . . . 01 – 001
Overview - Engines . . . . . 01 – 005
Removal and installation of bottom engine compartment cover . . . . . 01 – 006
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Testing cylinder leaktightness . . . . . – 015
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Enlarging camshaft bearing bores (repair size) . . . . . – 419
Pressure-testing cylinder head . . . . . – 420

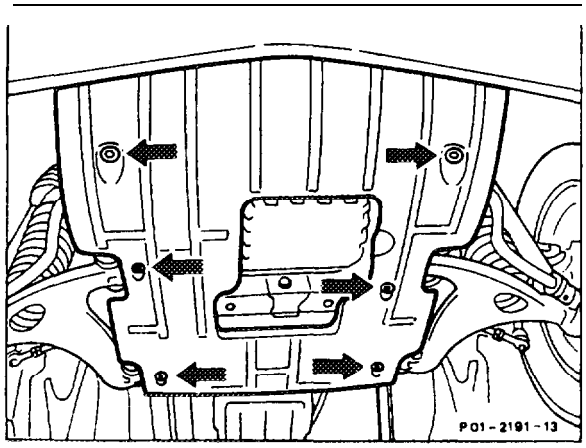
01-001 Engine and Model Survey

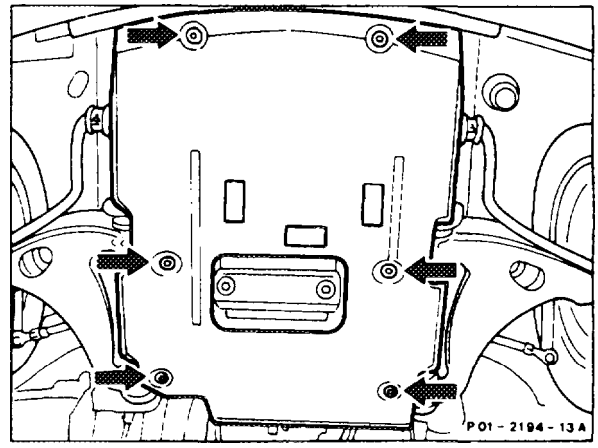
Engine	Model	Model Year	Sales designation	Power in kW at rprn	Compression ratio
102.961	201.024	1984	190 E 2.3	84/5000	8.0:1
102.985	201.024	1985 - 86	1190E2.3	90/5000	9.0:1
102.985	1201.028	1987 - 88 1991 - 93	119OE2.3	97/5100	9.0:1

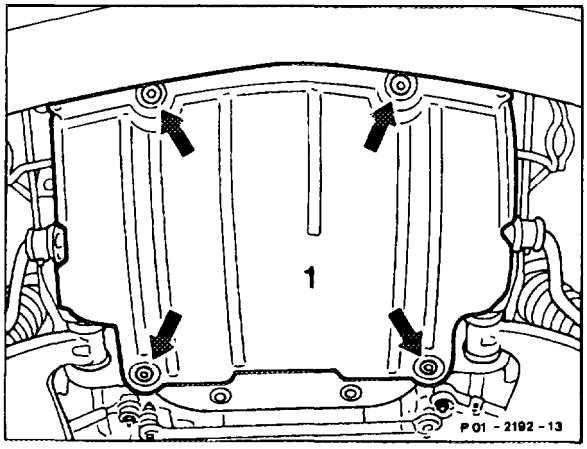
01-005 Overview – Engines, Models, Output and Compression Ratio

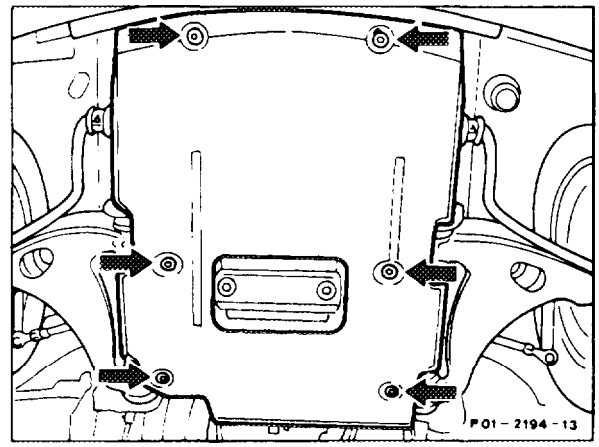
Engine	Model	Sales designation	Output in KW at rpm net bhpirpm	Compression ratio ε : 1
102.961 (USA) as of 1984	201.024	190 E 2.3	84/5000 113/5000	8.0
102.985 (USA) as of 1985	201.024	190 E 2.3	90/5000 12015000	8.0
102.985 (USA) as of 1987	201.028	190 E 2.3	97/5100 130/5100	9.0

01-006 Removal and installation of bottom engine compartment cover









Model 201

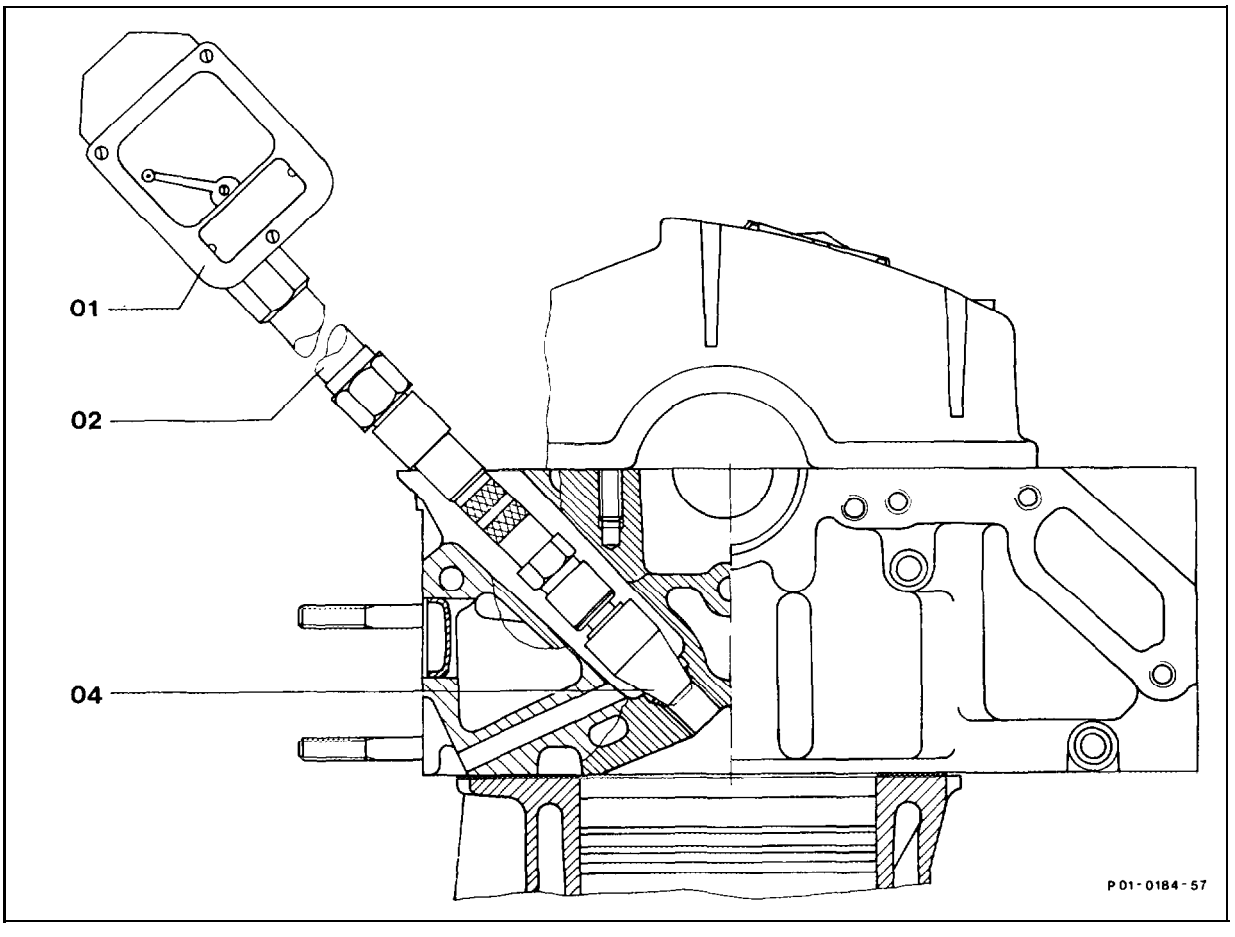
Self-tapping screws (arrows)	remove, screw in and remove, install engine compartment cover.

Note

On Model 201.028 (USA) install engine compartment cover so that the edge of the side parts grips above the bottom part.

01-010 Testing compression pressure

Preceding work:
Removing spark plug (15-018).

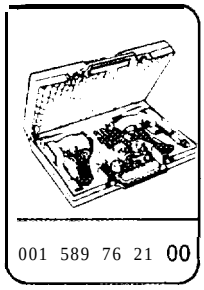


01 Compression pressure recorder, special tool 001 589 76 '21 00
02 Adapter piece
04 Sealing cone with check valve

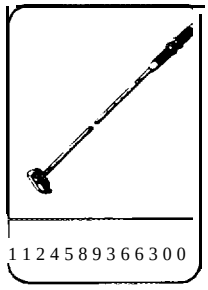
Test data with engine at normal operating temperature (80°C) in bar

Subject		When new	Limit value
Compression ratio	ε = 9.0 – 9.4	10 – 12	approx. 8.5
	ε = 10.0	13.5 – 15.5	approx. 12
	ε = 7.5 – 8.3	9 - 10	approx. 7.5
	ε = 7.2 (102.92)	8 - 9	approx. 6.5
Permissible difference between individual cylinders max. 3			

Special tools



001 589 76 21 00



1124589366300

Notes

Test compression pressure at normal operating temperature.

If the minimum compression pressure is not reached, test cylinder leaktightness (01-015).

Unscrew all the spark plugs for testing.

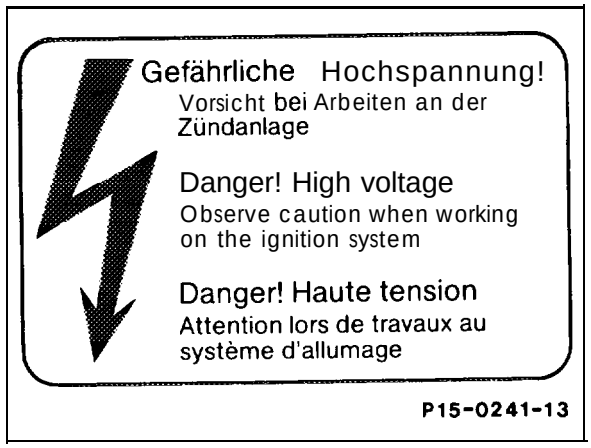
Turn crankshaft with starter and compression pressure recorder.

Warning!

The engines are equipped with an ignition system with variable ignition characteristics (EZL).

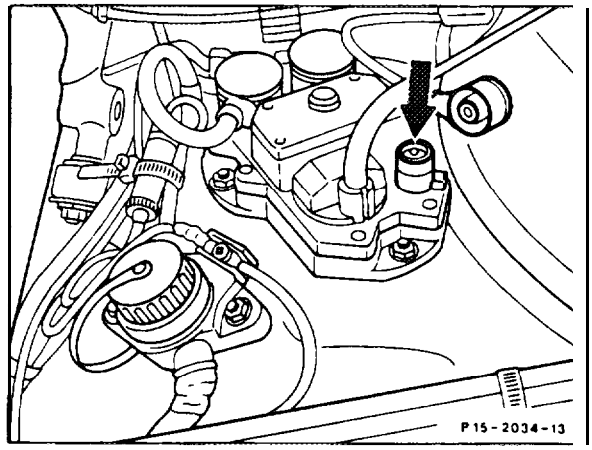
Because of high ignition voltage, it is very dangerous to touch components of the ignition system (ignition coil, ignition cables, spark plug connector, plug-on unit) when

- the engine is running,
- the engine is started,
- the key in the steering lock is in position 2 and the engine is cranked by hand.

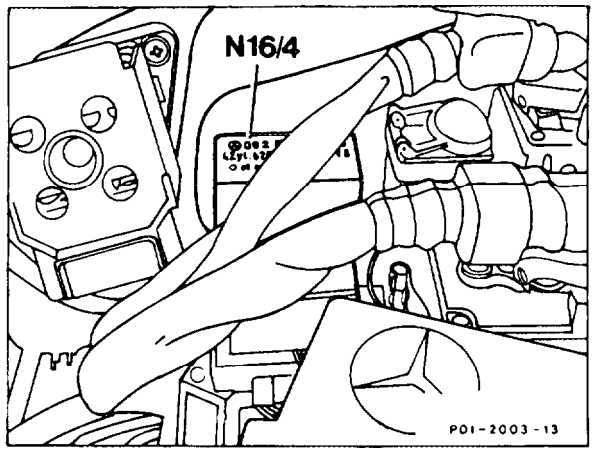


Testing

1 Switch off ignition. Detach connector from ignition distributor pickup (green cable on control module) (arrow).

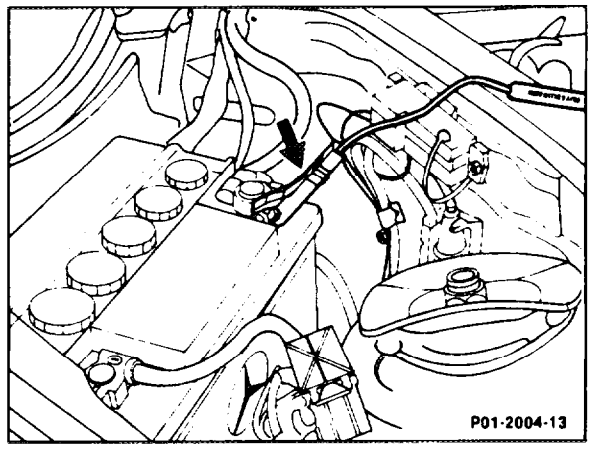


Caution!
On injection engines, detach the fuel pump relay module (N1614) before turning the crankshaft to ensure that no fuel is injected.



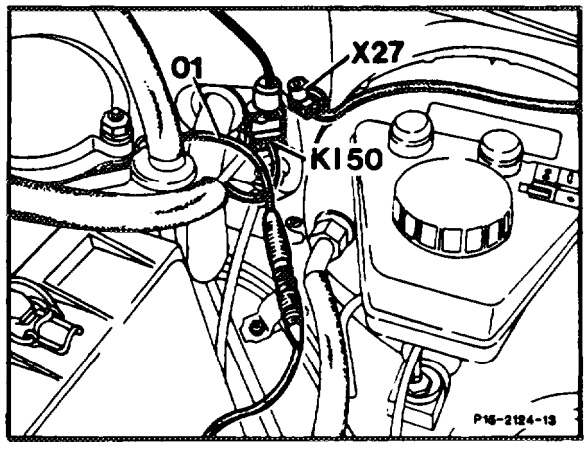
Model 201

2 Connect compression pressure recorder. This is done by clamping one of the two alligator clamps (arrow) of the compression pressure recorder, Part No. 001 589 76 21 00, to the positive terminal post of the battery.



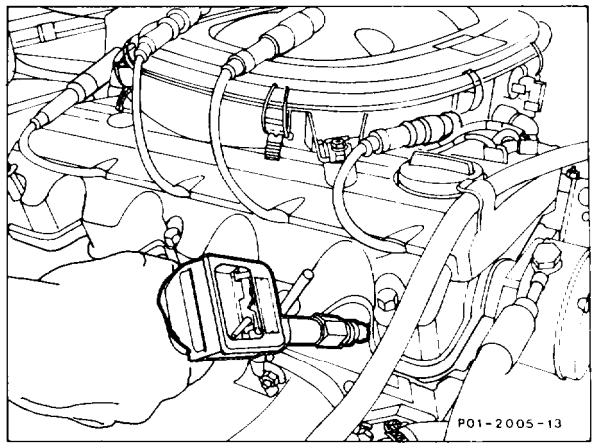
3 Detach connector (X27) from plug connection (terminal 50).

4 Plug in connector of adapter cable (01), Part No. 124 589 36 63 00.



Model 201

5 Crank engine several times with starter motor, in idle position, selector lever in position "P", and parking brake applied so that residues and soot are ejected.



6 To test each cylinder, press the compression pressure recorder into the spark plug hole of the particular cylinder and, with the throttle valve fully opened, crank engine approx. 8 revolutions. Test all the cylinders in this way.

7 Blow out spark plug recesses with compressed air. Remove any residues on the tapered sealing seat.

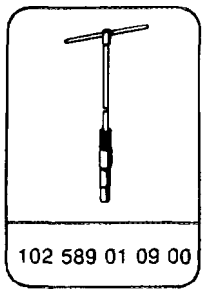
01-015 Testing cylinder leaktightness

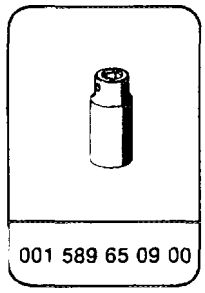
Data

Total pressure loss	max. 25%
At valves and cylinder head gasket	max. 10%
At pistons and piston rings	max. 20%

Tightening torque	Nm
Spark plugs	20

Special tools





Commercial tool

Cylinder leaktightness tester	e. g. Bosch, EFAW 210 A Sun, CLT 228

Testlng

1 Run engine until at normal operating temperature.

2 Blow out spark plug recesses with compressed air.

3 Remove spark plugs.

4 Top off coolant and leave filler opening at coolant expansion tank open.

5 Remove oil filler cap.

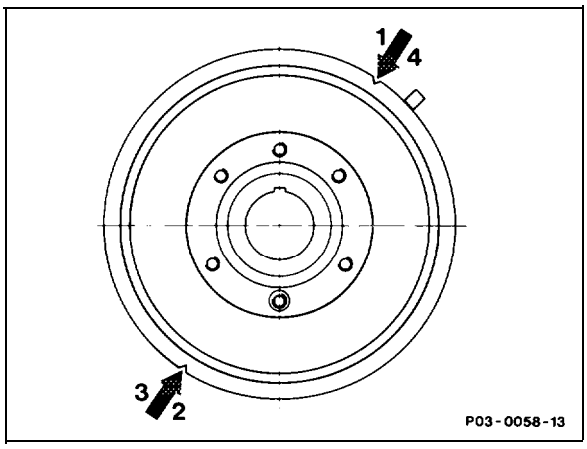
6 Remove air filter (09-400 or 09-410).

7 Connect cylinder leaktightness tester to a compressed air system and calibrate tester.

8 Position piston of No. 1 cylinder to ignition TDC. This is done by turning the crankshaft with a tool combination consisting of wrench socket (27 mm, 1/2" square) and reversible ratchet handle, at the central bolt (front of crankshaft).

Note

The respective pistons are in the TDC position when the markings shown in the drawing opposite on the vibration damper or on the belt pulley are below the TDC pointer.



9 Open throttle fully.

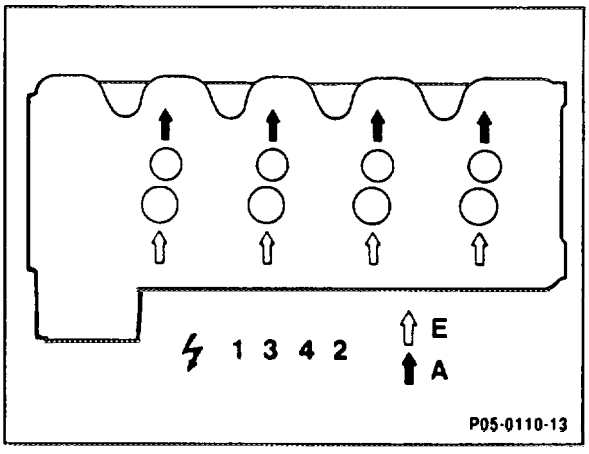
10 Screw connection hose into the 1 st spark plug bore and attach to the connecting hose of the tester.

The crankshaft must not turn when performing this step.

11 Read off pressure loss at tester.

12 Determine by listening whether the pressure escapes through intake manifold, exhaust, oil filler opening, spark plug bore of adjacent cylinder or coolant filler opening.

13 Test all the cylinders in the firing order.



Notes

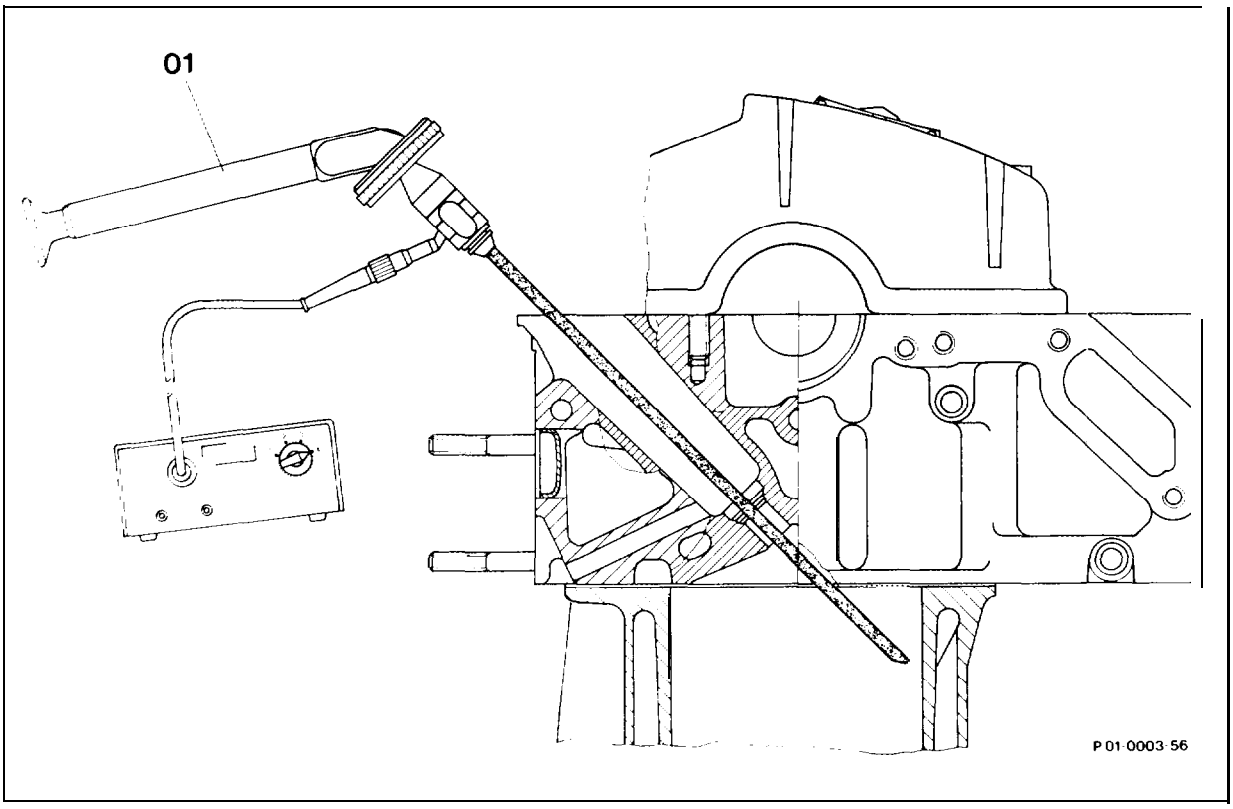
It is possible that the piston ring gaps of individual pistons are directly above each other which falsifies the test result.

In cases of doubt, allow vehicle to run and test cylinder leaktightness once again after some time.

After spraying oil onto the piston crown, it is possible to determine whether the leak exists at the piston rings or at the valves or the cylinder head gasket.

01-020 Illuminating cylinders

Preceding work:
Removing spark plugs (15-018).



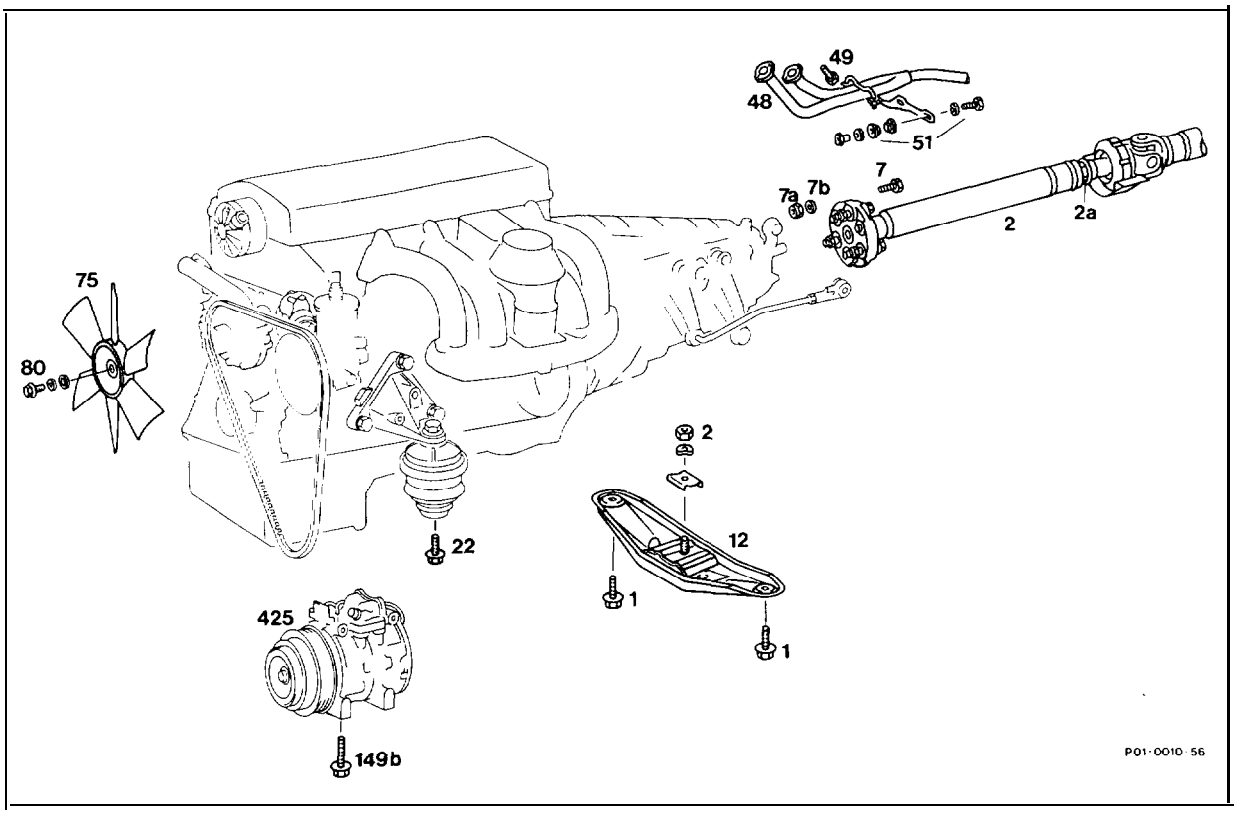
Cylinder (01)	illuminate with cylinder inspection lamp (01), distinguish between “optical rub marks and seizing rub marks”. “Optical rub marks” may result from the ring gap. Traces of honing are still visible, engine in order. “Seizing rub marks”; honing marks no longer visible, recondition engine.

Commercial tool

Cylinder inspection lamp	e. g. Karl Storz GmbH, D-7200 Tuttlingen Motoskop TW (cold light) with lens probes 103 26 CW (570 mm) and 103 26 CT (210)

01-030 Removal and installation of englne

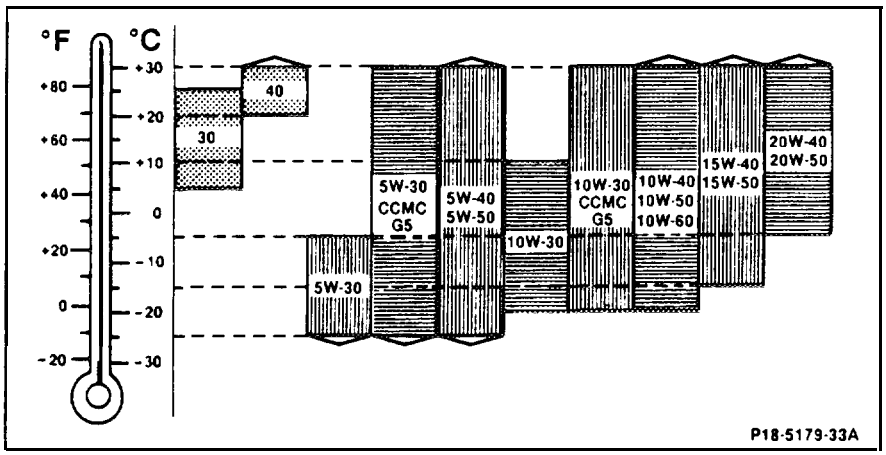
Preceding work:
Removal and installation of bottom engine compartment fairing (01-006).
Removal and installation of air filter (09-400 or 09-410).
Removal and installation of radiator (20-420).



Battery positive cable	disconnect, connect.
Fan (75)	remove, install, 25 Nm.
Alternator cable connector	detach (step 3).
Lines for pressure oil pump	detach, attach (step 4).
Cover for evaporator	insert (step 5).
Cover for engine wiring harness	remove at component partition wall (steps 6 and 7).
Starter wiring harness	remove, install (step 8).
Terminal block terminal 50	disconnect, connect (step 9).
Terminal 30	disconnect, connect at terminal block (step 10).
Engine wiring harness	disconnect, connect at the individual connections (steps 11 to 18).

Fuel evaporation system	detach, attach (step 19).
Ground cable	unbolt, bolt on at intake manifold (step 20).
Accelerator control	disconnect, connect Bowden cable, adjust (step 21).
Fuel lines	detach, attach (step 22).
Coolant hose, heater supply line	detach, attach (step 23).
Vacuum line, brake booster	detach, attach (step 24).
Air conditioning compressor (425)	Note On vehicles with air conditioning, the A/C compressor can be unbolted with the lines connected and without draining the system (steps 25 to 34).
Engine hoist	attach to suspension lugs, detach (step 35).
Guard plate	insert between component compartment and engine, remove (step 37).
Exhaust system (48)	unbolt at exhaust manifold and transmission mount (51), bolt on (steps 38 and 39), 25 Nm.
Lambda sensor	remove, install (step 40).
Engine supporting bracket (12)	unbolt, bolt on (step 42). Tightening torques: Bolt (1) 25 Nm, Nut (2) 70 Nm.
Drive shaft to transmission (2)	detach, attach, replace self-locking nuts (7a) (step 44).
Clamping nut (2a)	loosen, tighten (step 45), 45 Nm.
Speedometer shaft	disconnect, connect to transmission (step 46).
Ground cable at transmission	disconnect, connect (step 47).
Shift rods at transmission	detach, attach (step 48).
Cable connector for starter lockout, backup light switch	unplug, plug in (step 49).
Cable for kickdown solenoid valve	disconnect, connect (step 50).
Front engine mounting (22)	unbolt, bolt on at bottom (step 51), 40 Nm.

Engine with transmission	.....	lift out, insert (step 52).
Lines, hoses and engine mounts	. . . . .	examine for signs of wear, replace if necessary. Examine antifreeze protection, adjust to correct level if necessary. Test leaktightness.



Viscosity grades for engine oils according to SAE

Adhering to the SAE grades in accordance with ambient temperatures would result in frequent oil changes. Consequently, the temperature ranges are merely guidelines, which can be exceeded in the upper or lower limits for brief periods.

In moderate climatic zones SAE 30 may be used from the spring on for all engine models. SAE 10W-40 or SAE 10W-50 may be used as an all-seasons oil for all gasoline engines.

Refer to the most current “Factory Approved Service Products” for further information regarding specified viscosity grades and approved engine oils.

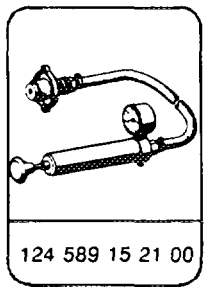
Oil capacity in liters

(refer to Factory Approved Service Products for approved engine oils)

Engine (total capacity when refilling)	5.5
Engine capacity when changing oil and filter	5.0

Tightening torques	Nm
Fan to engine coolant pump	**25**
Exhaust pipe to exhaust manifold	25
Exhaust bracket to transmission	25
Hexagon bolt of belt pulley to power steering pump	25
Bracket for A/C compressor to oil sump	10
Bracket for AC compressor to AC compressor	25
V bracket servo pump – engine supporting bracket – A/C compressor	25
Servo pump to supporting bracket	25
A/C compressor to supporting bracket	30
Propeller shaft to transmission	45
Clamping nut to spline end of propeller shaft	45
Ground cable to transmission	45
Engine mount to axle carrier	40

Special tools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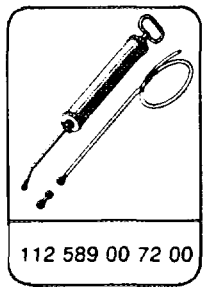
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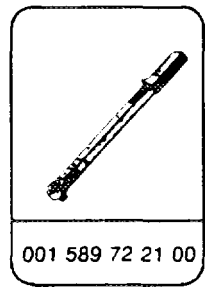
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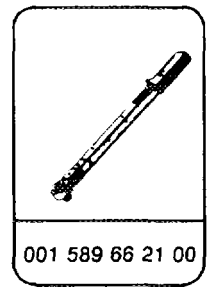
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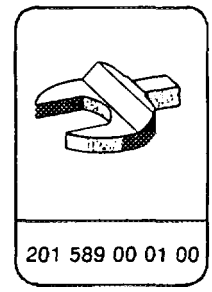

201 589 00 01 00

Commercial tool

Engine hoist No. 3188 self-locking	e. g. Messrs. Backer Herderstraße D-5630 Remscheid

Shop-made tools

Guard plate for radiator/evaporator	Dimensions approx. 480 x 600 x 1
Metal panel for component compartment wall	Dimensions approx. 320 x 380 x 1

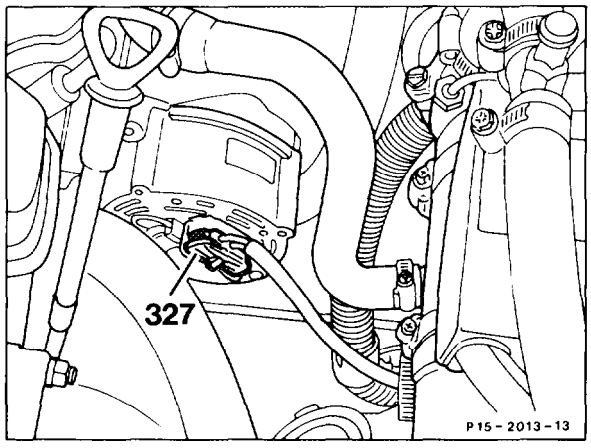
Note
Remove and install engine together with transmission.

Removal and installation

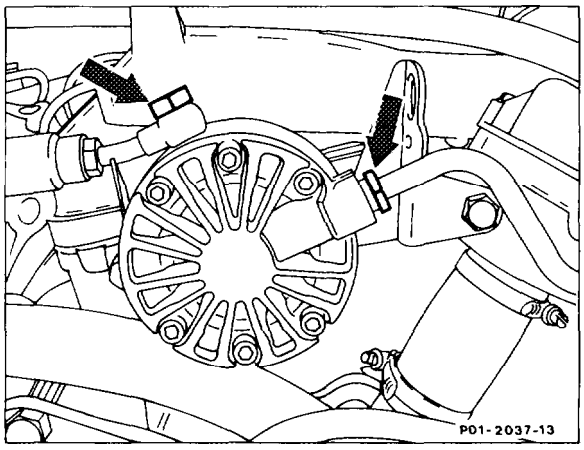
1 Disconnect battery negative terminal, connect.

2 Remove fan. install.

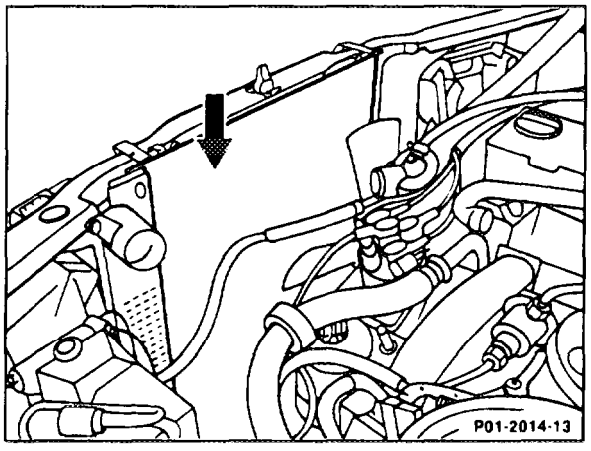
3 Unplug cable connector (327) at alternator, plug in.



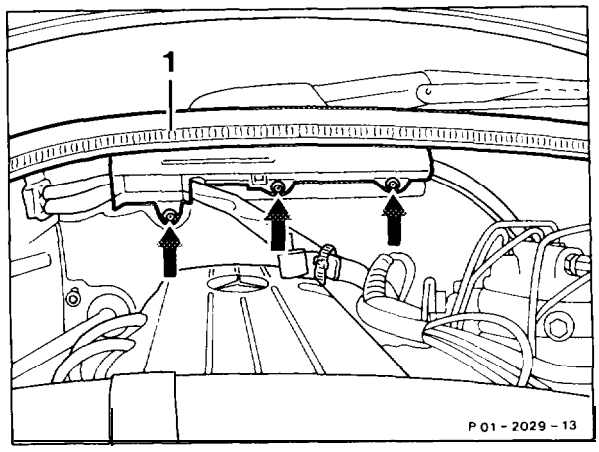
4 Detach lines for pressure oil pump at cylinder head, connect (arrows).



5 If equipped with air conditioning: install guard plate (arrow) to evaporator of air conditioning system.

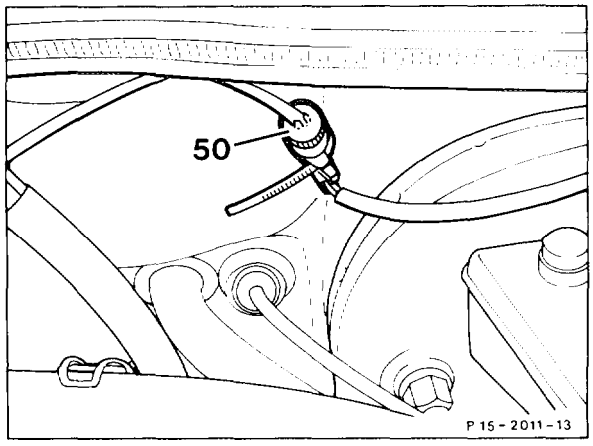


7 On Model 201, pull off rubber strip (1) above fire wall.
Take out clips (arrows), fold fixture upwards.



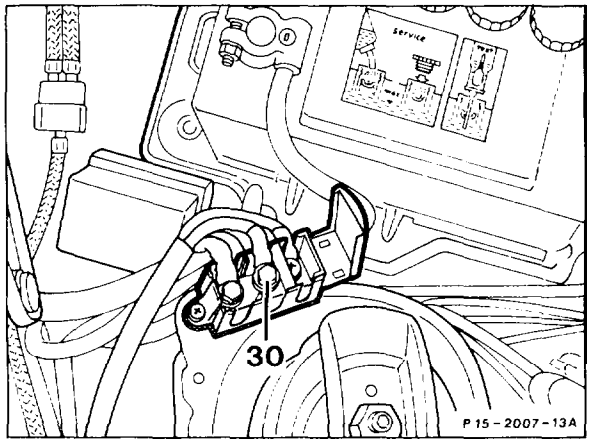
Model 201

9 On Model 201, unplug cable connector (50) at the plug connection, plug in.



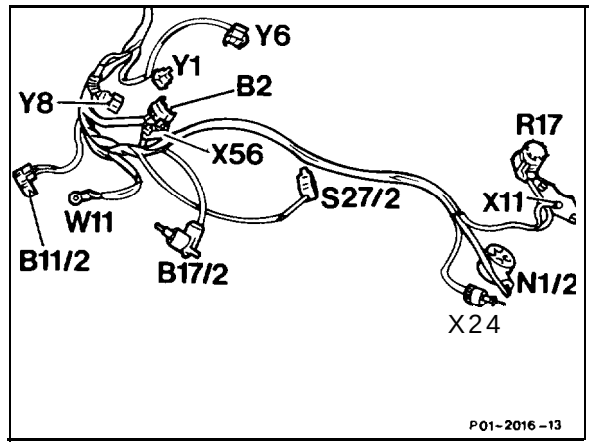
Model 201

10 Unbolt battery positive terminal. Disconnect terminal (30) at cable connector and pull cable through component compartment wall and place over engine.



Model 201 terminal 30

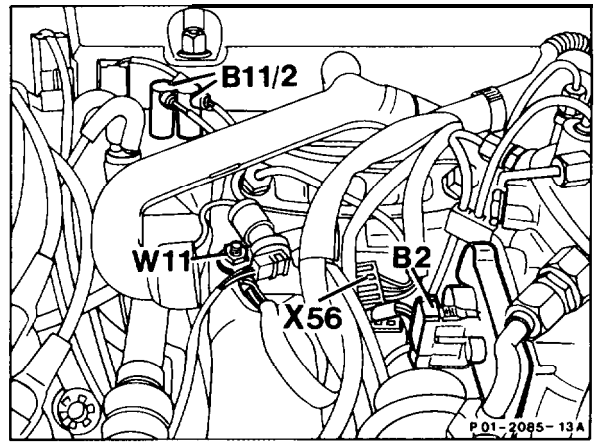
11 Disconnect engine wiring harness at the individual connections and place over the component compartment wall.



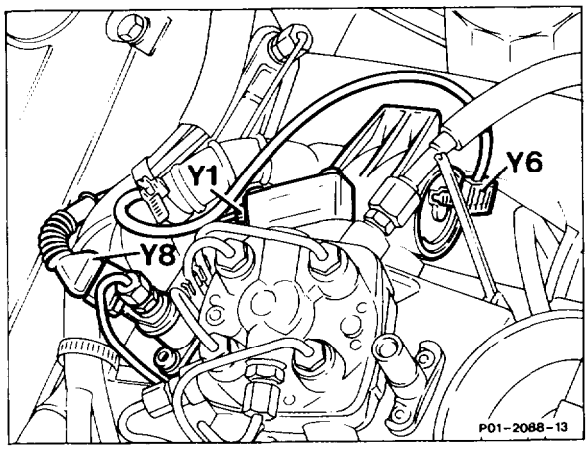
Engine wiring harness, shown on Model 201

B2	Volume air flow sensor position Indicator
B1 1/2	Engine coolant temperature sensor (CFI), 2-pin
B17/2	Intake air temperature sensor, CFI injection system
N1/2	Ignition control module
R17	Reference resistor, CFI injection system
S27/2	Deceleration shutoff microswitch
W11	Engine ground (electric lead bolted on)
x11	Diagnostic connector/terminal block terminal TD
X24	Connector, headlamp wiring harness
X56	Throttle body switch connector
Y1	Electrohydraulic actuator
Y6	Idle air control valve
Y8	Start valve

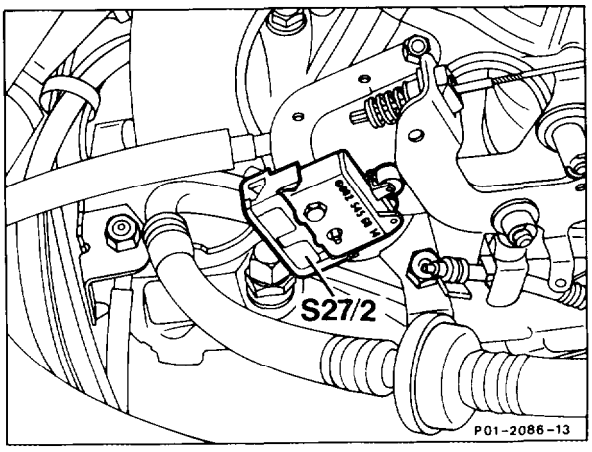
12 Detach twin connector (B1112) for engine coolant temperature sensor (CFI), plug in.
Unbolt engine ground (W11), bolt on.
Unplug throttle body switch connector (X56), plug in.
Unplug volume air flow sensor position indicator (B2), plug in.



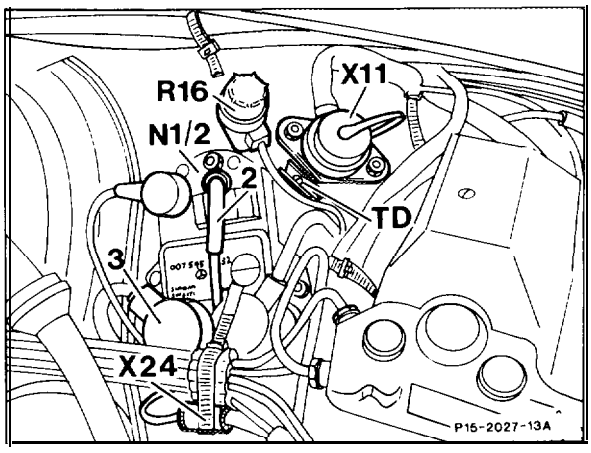
13 Unplug start valve (Y8), plug in.
Unplug electrohydraulic actuator (Y1), plug in.
Unplug idle air control valve (Y6), plug in.



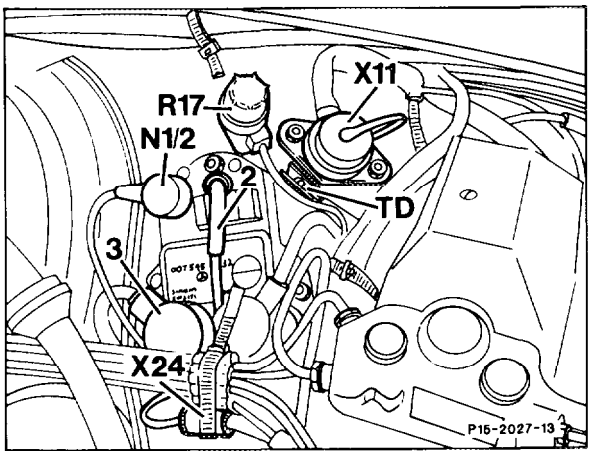
14 Unplug deceleration shutoff microswitch (S27/2), plug in.



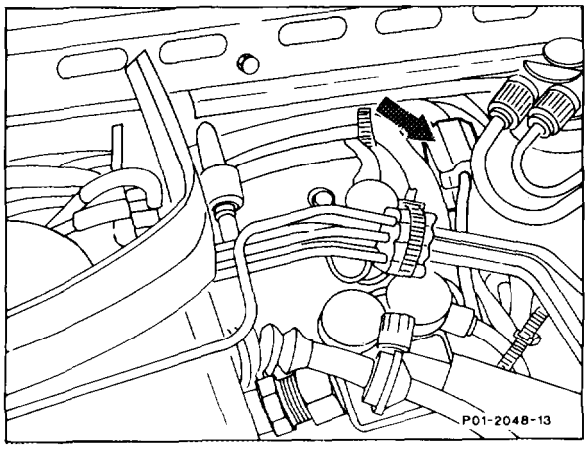
15 Unplug connector for crankshaft position sensor on ignition control module (N1/2), plug in.
Unplug vacuum line (2) and 4-pin connector (3), plug in.



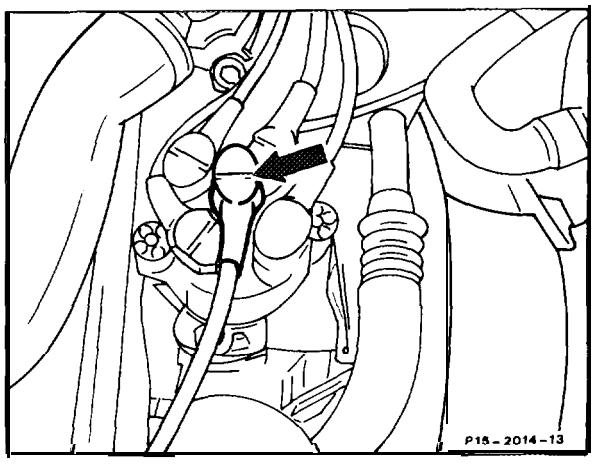
16 Unbolt terminal TD at terminal block of diagnostic connector (Xl 1), bolt on. Unscrew diagnostic connector (Xl 1) and unplug on the bottom the grey cable for TDC pulse generator, plug in.



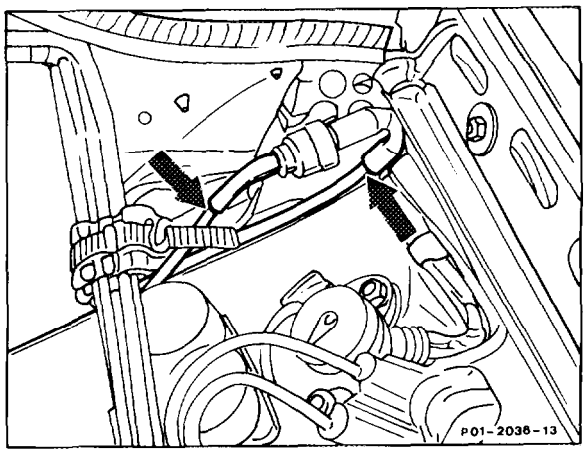
17 On models equipped with cruise control, unplug connector (arrow), plug in.



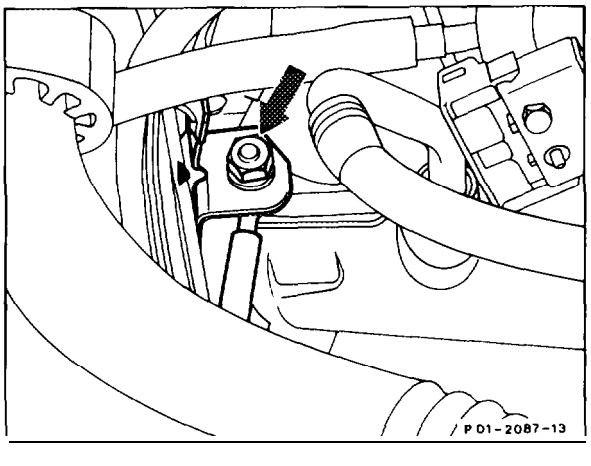
18 Unplug ignition cable 4 (arrow) at ignition distributor, plug in.



19 Detach vacuum lines (arrows) for fuel evaporative emission control system, attach.



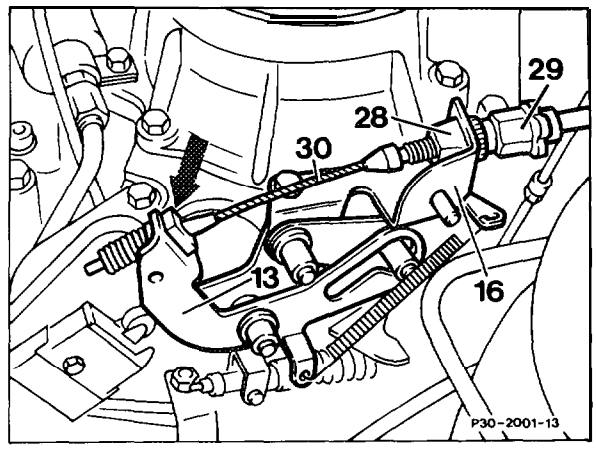
20 Unbolt ground cable at intake manifold, screw on (arrow).



21 Detach Bowden cable (30) for accelerator control, attach. Press plastic guide (arrow) out of its seat in the fulcrum lever (13) to perform this step, and take Bowden cable (30) out of the slot in the fulcrum lever.

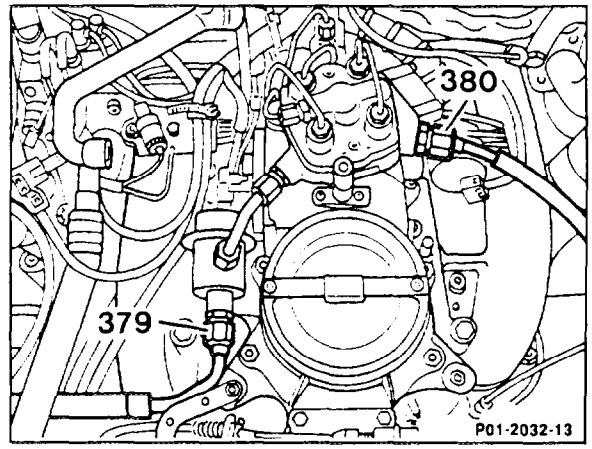
Installation instruction

Adjust Bowden cable (30) (30-325).



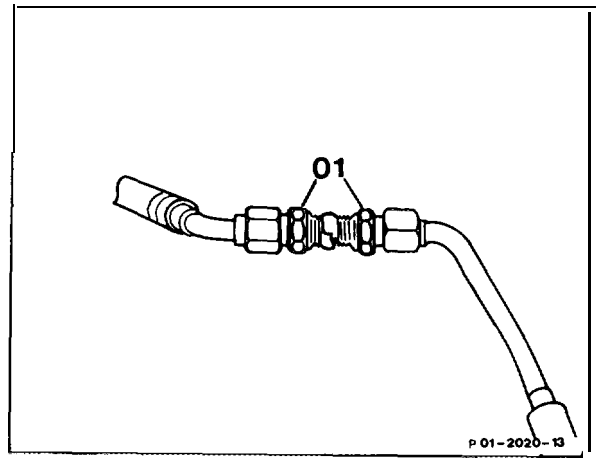
22 Reduce fuel pressure in the fuel lines by briefly opening fuel tank cap.

Unbolt fuel lines (379 and 380), bolt on.

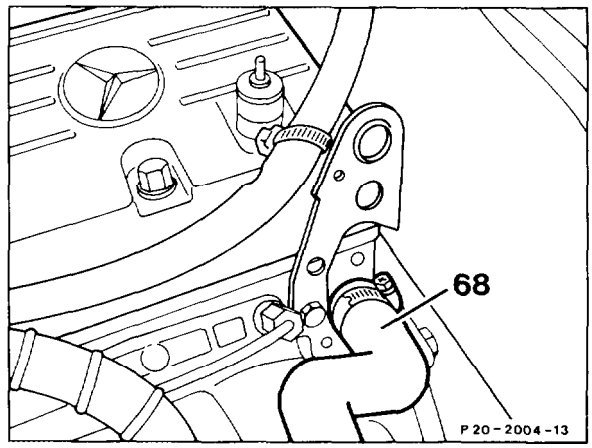


Note

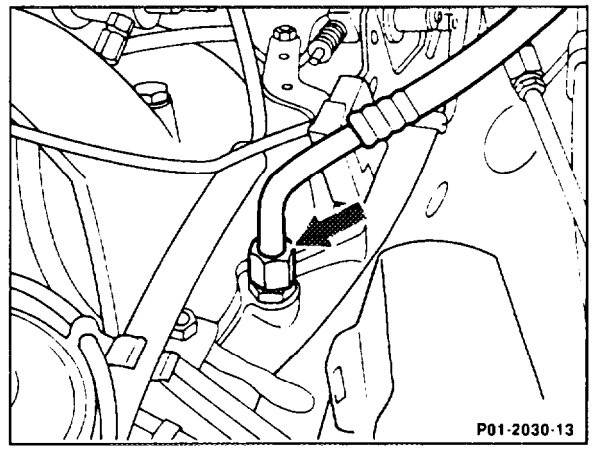
To prevent fuel flowing out of the disconnected fuel lines, both fuel lines can be plugged with a fitting (01, shop-made).



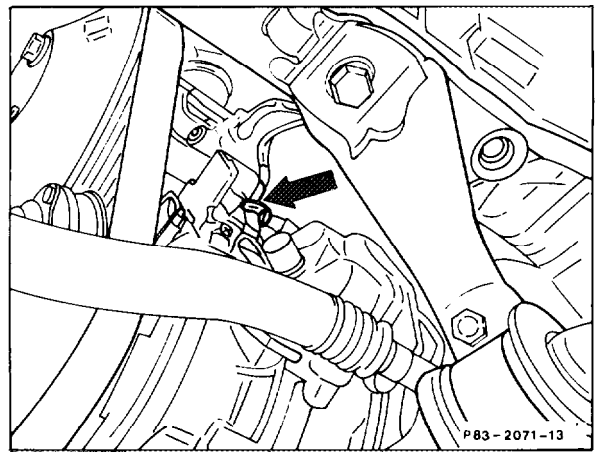
23 Disconnect engine coolant hose (68) for heater supply line at the cylinder head, connect.



24 Disconnect vacuum line for brake booster at intake manifold (arrow), connect.



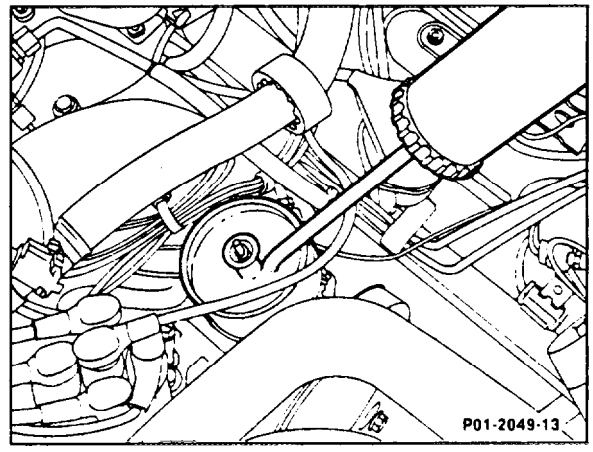
25 On models with A/C compressor, disconnect electric lead at A/C compressor, connect (arrow).



26 Disconnect piping group (170) at the cylinder head, connect (arrows).

27 Extract oil from the reservoir for power steering.

28 Disconnect oil lines at power steering pump, connect.



Installation instruction

Adjust oil level of power steering to correct level. When engine is running, top off oil to the marking. Turn steering several times from full left to full right lock.

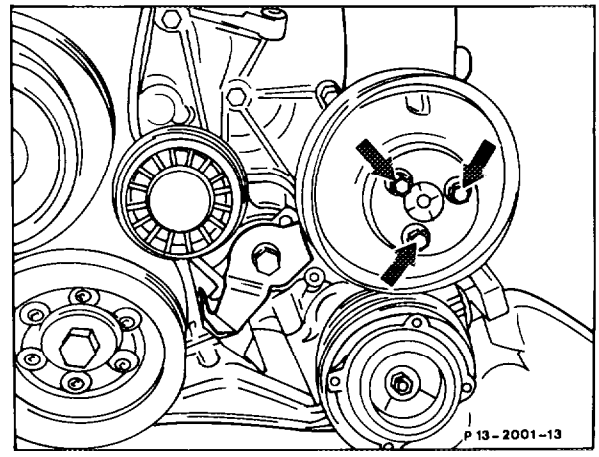
Oil level when oil at normal operating temperature (approx. 80 °C) 18 – 26 mm below the top edge of reservoir.

Oil level when oil cold (room temperature, approx. 20 “C) between Min. and Max. markings.

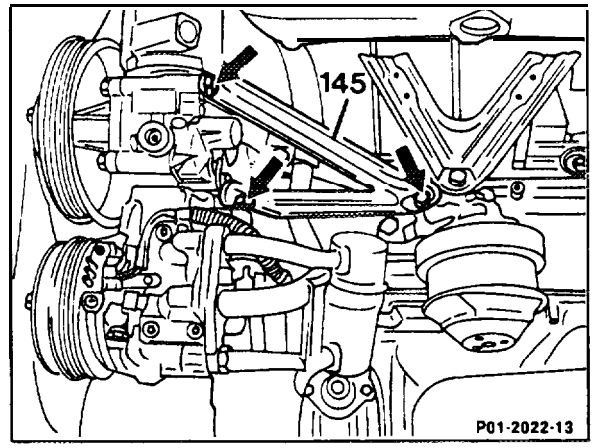
29 On models with AC compressor, remove poly V-belt, install (13-342).

30 Remove and install tensioning device for V-belt (13-345).

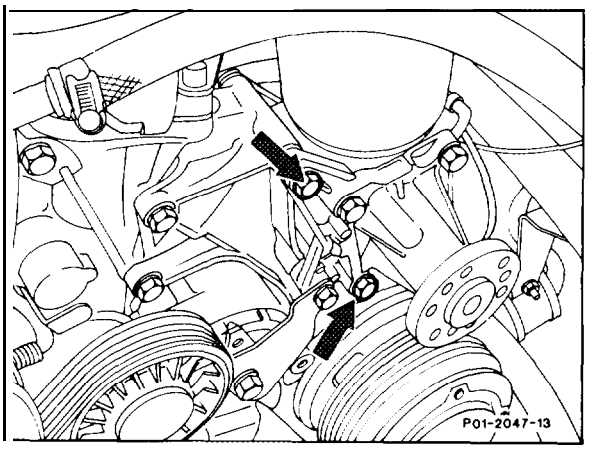
31 Unbolt belt pulley for high pressure pump of power steering, bolt on (arrows).



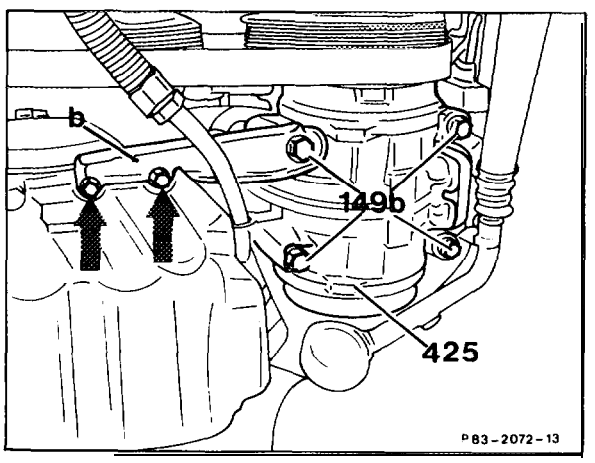
32 Unbolt strut (145) for high pressure oil pump and AC compressor (arrows), bolt on. Tightening torque 25 Nm.



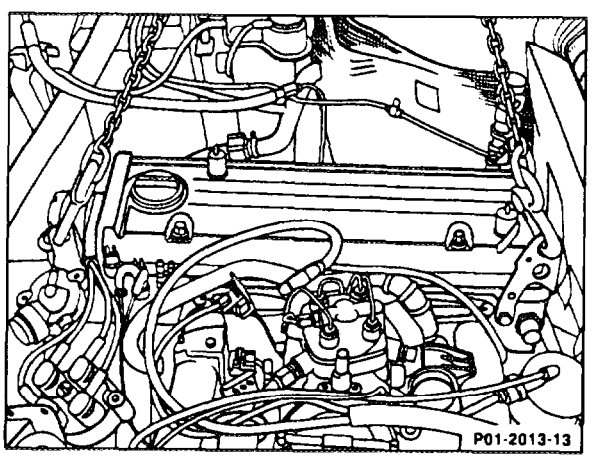
33 Unbolt high pressure oil pump, bolt on (arrows) and place to the side with the lines connected, tightening torque 25 Nm.



34 Unbolt AC compressor (425) at the supporting bracket, bolt on, and place to the side with lines connected. Bolts (149b), tightening torque 25 Nm.
Unbolt bracket (b), bolt on.

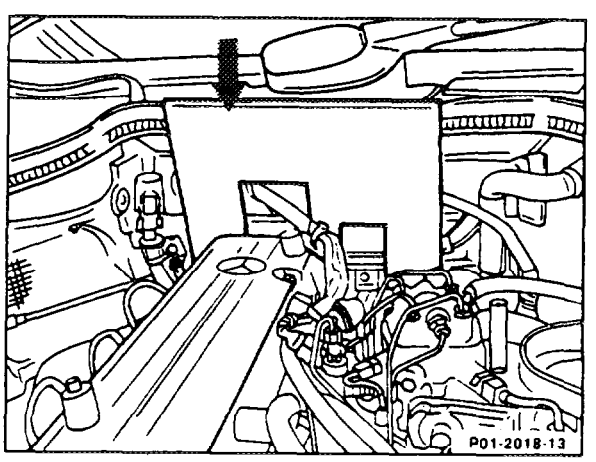


35 Attach engine hoist into the suspension lug of the engine.
Adjust engine hoist so that the engine can be raised horizontally.

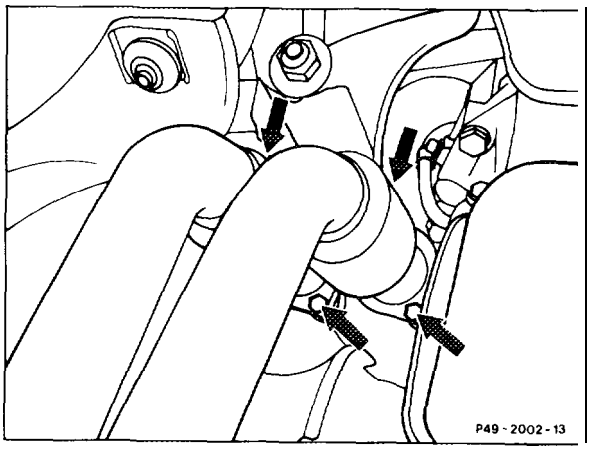


36 Disconnect all remaining lines, e. g. vacuum, oil, fuel lines and electric cables, running to the engine; connect.

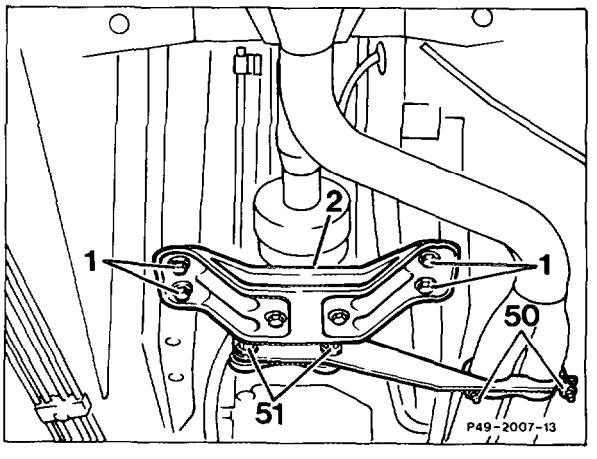
37 Insert guard plate (arrow) between component compartment and engine, remove.



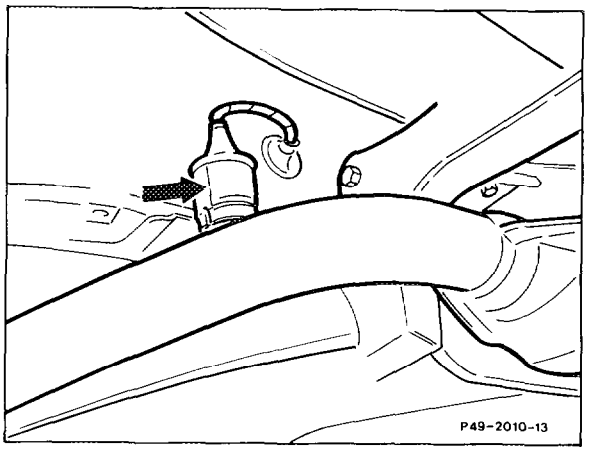
38 Unbolt exhaust at the exhaust manifold, bolt on (arrows), tightening torque 25 *Nm.*



39 Unbolt exhaust holder (50 and 51) at the exhaust and transmission, bolt on, tightening torque 25 Nm.

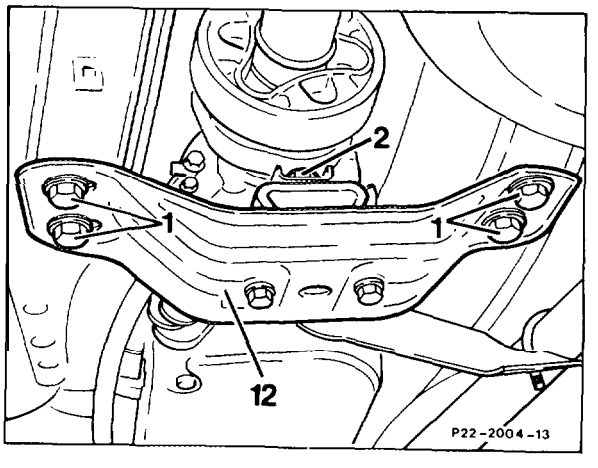


40 Remove lambda sensor at exhaust pipe, install. Remove cover (arrow) to perform this step.

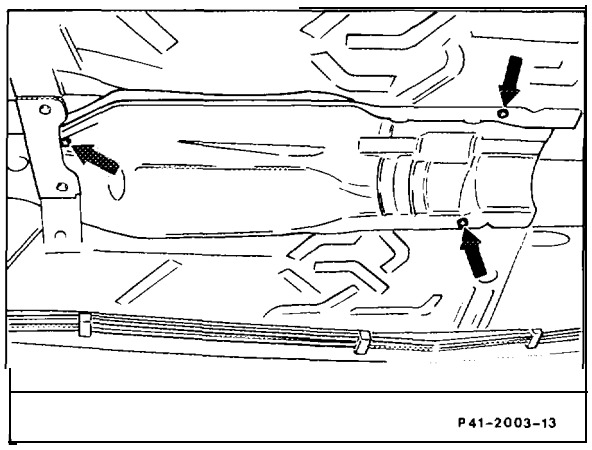


41 Remove and install exhaust system (49-100).

42 Unbolt engine supporting bracket (12), bolt on.
Tightening torques:
Bolt (1) 25 Nm,
Nut (2) 70 Nm.



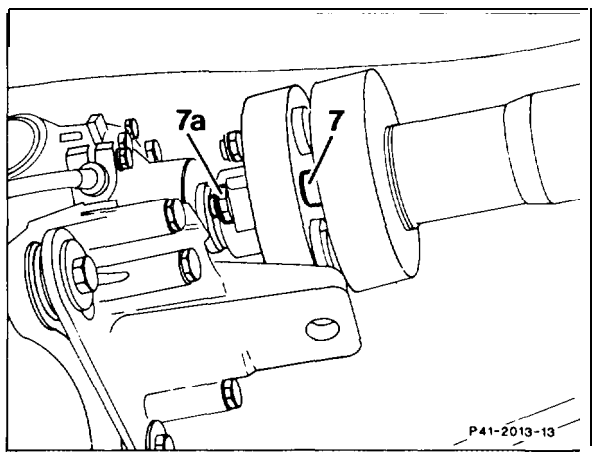
43 Unbolt shield, bolt on (arrows).



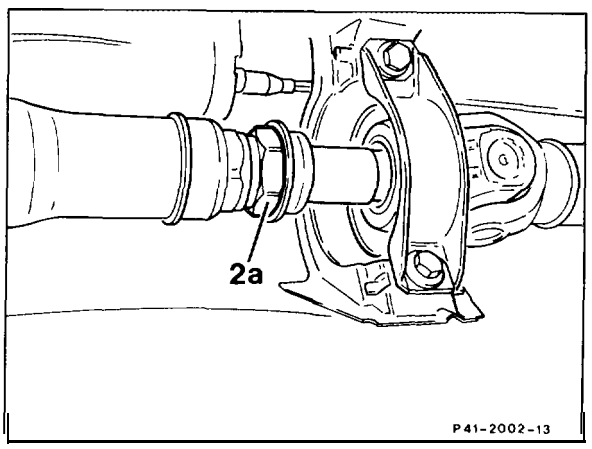
44 Unbolt drive shaft, bolt on. Loosen the bolts (7) and nut (7a) to perform this step. Tightening torque 45 Nm.

Note

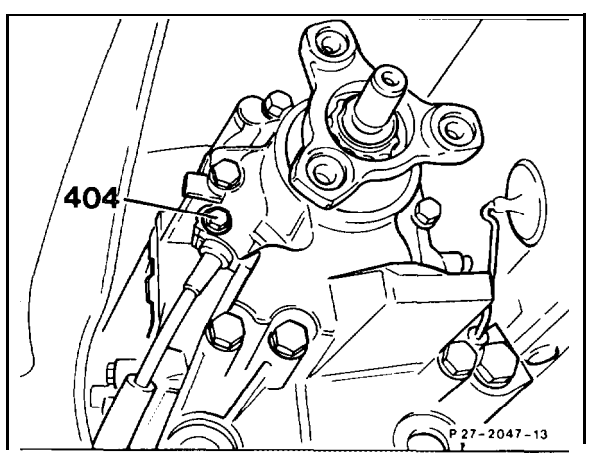
Flexible coupling remains on drive shaft.



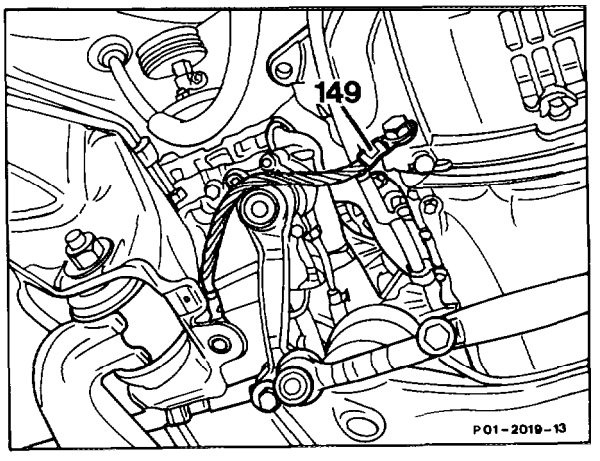
45 Loosen clamping nut (2a), tighten (wrench waf 41/46). Push drive shaft back as far as possible. Tightening torque 45 Nm.



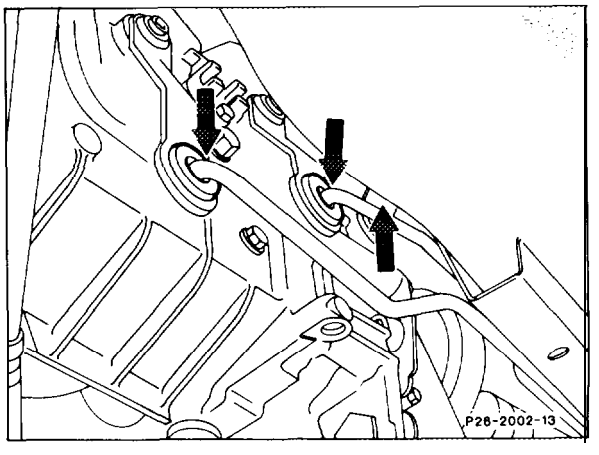
46 Detach speedometer shaft at transmission, attach. Remove bolt (404) to perform this step.



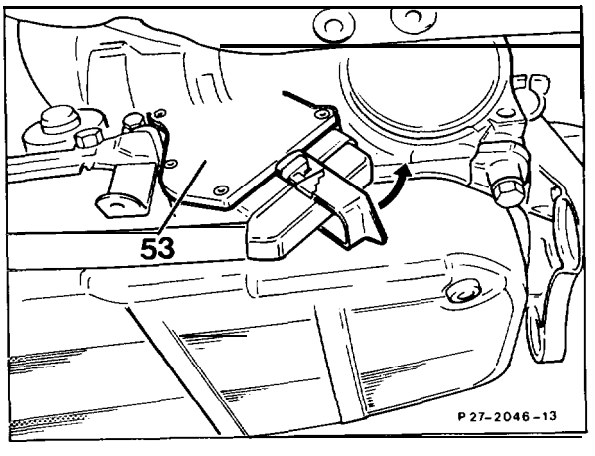
47 Unbolt ground cable (149) at transmission, bolt on. Tightening torque 45 Nm.



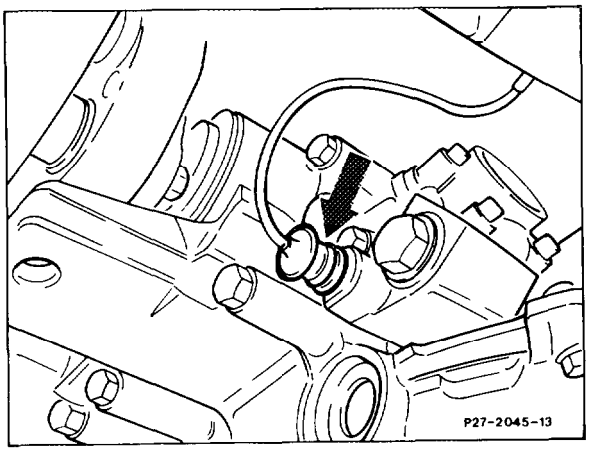
48 Detach shift rods at transmission, attach (arrows). Take the clip locks off the transmission shift levers to perform this step.



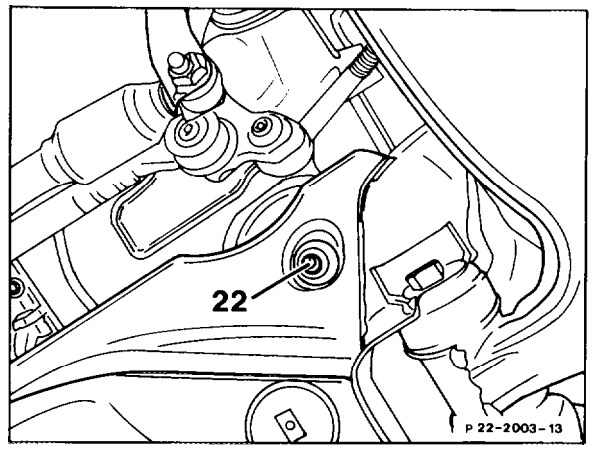
49 If equipped with automatic transmission, turn white plastic lock on starter lockout, backup light switch (53) approx. 45° to the right and unplug cable connector, plug in.



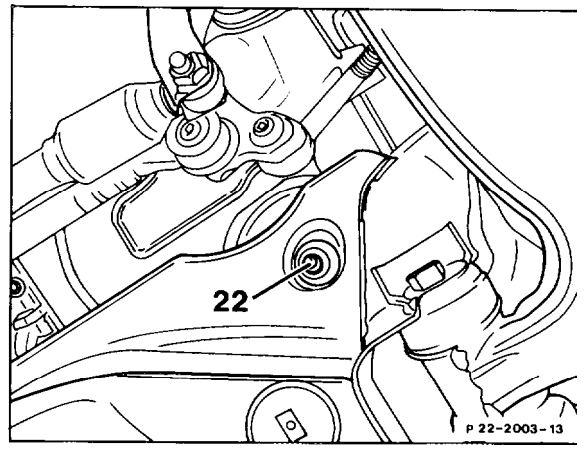
50 Unplug cable (arrow) at the kickdown solenoid valve, plug in.



51 Remove both bolts (22) for engine mounting. Tightening torque 40 Nm.



52 Lift out engine together with transmission at an angle of approx. 45°.

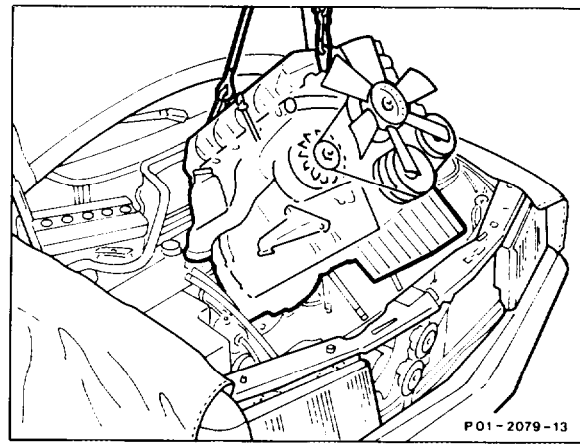


53 Install in the reverse order.

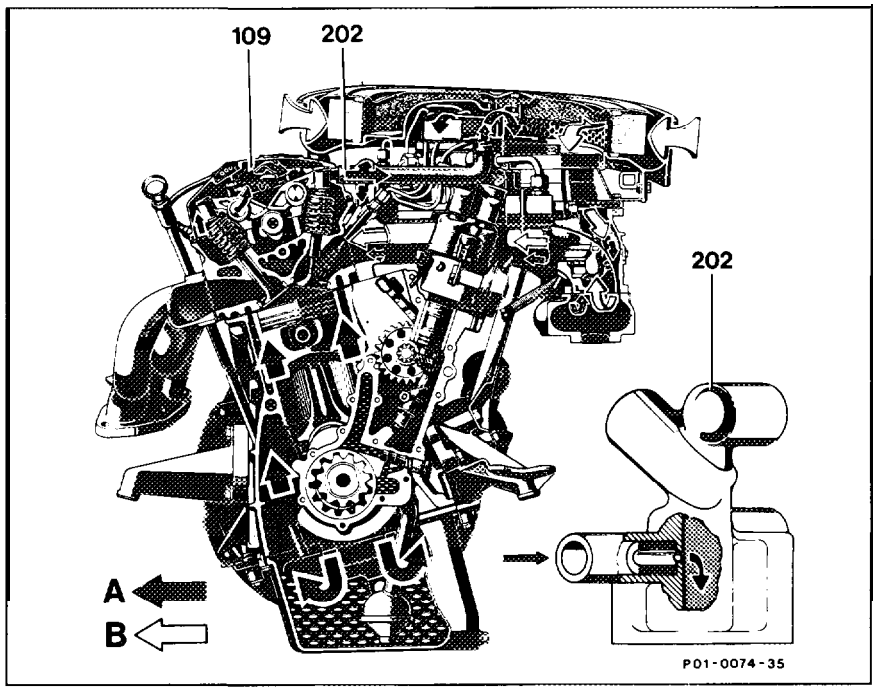
54 Check front and rear engine mounts.

55 Check fluid levels, adjust to correct levels if necessary.

56 Check leaktightness with engine running.



Englne 102.985 (CFI system)



109 Oil separator
202 Idle air distributor (bypass passage dia. 1.5 mm)
A Fresh air
B Blowby gases

Function

The engine blowby gases flow through the oil separator (109) at the cylinder head cover and through a pipeline to the idle air distributor (202) or to the air filter (clean air side).

The oil separated out in the oil separator (109) flows back through a passage (dia. 3 mm) to the cylinder head.

At a high intake manifold vacuum, the blowby gases are drawn through the bypass passage (dia. 1.5 mm) in the idle air distributor (202) and the idle air passage in the intake manifold and flow to the combustion chambers. At the same time, a small quantity of clean air from the air filter is drawn in as well through the bypass passage.
At a low or no intake manifold vacuum. the blowby gases flow to the clean air side in the air filter and pass together with the intake air to the combustion chambers.

01-I 10 Measuring, boring and honing cylinders

Data

Engine	Gr. No.	1 st version	Gr. code letter	2nd version
		102.985		102.985
Standard	0	95.498 – 95.508	A	195.500 – 95.506
	1	95.509 – 95.518	X	95.507 – 95.512
	2	95.519 – 95.528	B	95.513 – 95.518
1st repair size (+0.5)	0	95.998 – 96.008	A	96.000 – 96.006
	1	96.009 – 96.018	X	96.007 – 96.012
	2	95.519 – 96.028	B	96.013 – 96.018
2nd repair size (+1.0)	0	96.498 – 96.508	A	96.500 – 96.506
	1	96.509 – 96.518	X	96.507 – 96.512
	2	96.519 – 96.528	B	96.513 – 96.518

Wear limit in direction of travel or transverse direction		0.10
Permissible variation of cylinder shape	when new	0.007
	wear limit	0.05
Permissible variation from rectangularity related to cylinder height		0.05
Averaged peak-to-valley height (Rz) after ceramic finish honing		0.002 – 0.004
Permissible height of unevenness (Wt)		50 % of PTV height
Chamfer of cylinder bores		see instruction
Honing angle		50° ± 10°

Commercial tool

Snap gauge for internal measurements, Ø 80 – 100 mm	e. g. Hahn und Kolb Borsigstraße 50 D-7000 Stuttgart 30 Order No. G422K

Note
Since 04/88 the tolerance stages of piston and cylinder bore dia. have been identified with letters (hitherto figures, refer to data). As previously in the figures, the letters are also stamped in the mating face of the crankcase and in the piston crowns.

Identification of tolerance stages

previous	current
0	A
1	X
2	B

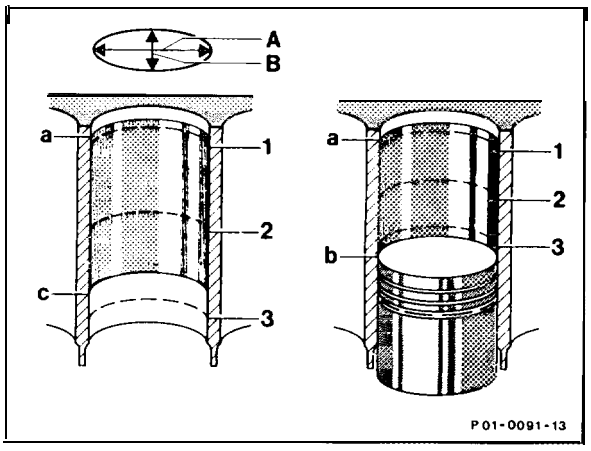
Standard **implementation:** 041'88

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	024336	072359

When performing repairs, ensure that the tolerance stage identification of piston and cylinder bore agrees. It is possible to install pistons with a code letter identification in cylinder bores with a digit identification if this tolerance stage identification agrees according to the table. If, when performing repairs, no identical pairing is possible, reference can be made to the piston installation play of 0.016 – 0.040 mm to determine a suitable piston.

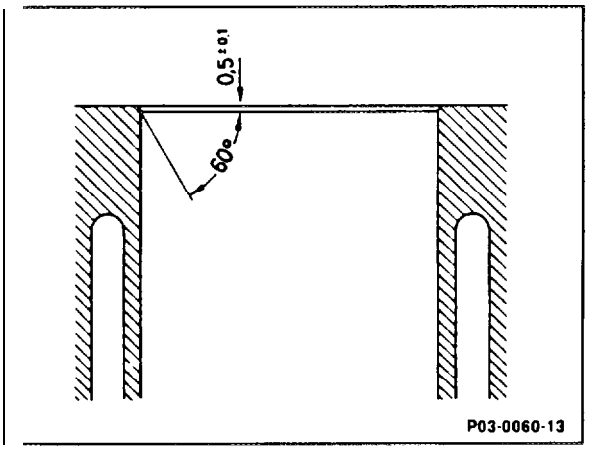
Measuring

Measure the cleaned cylinder bores with an internal measuring device at measuring points 1, 2 and 3 in longitudinal direction A (piston pin axis) and in transverse direction B.
With pistons installed, measuring point 3 is just above the piston, which must be at bottom dead center.

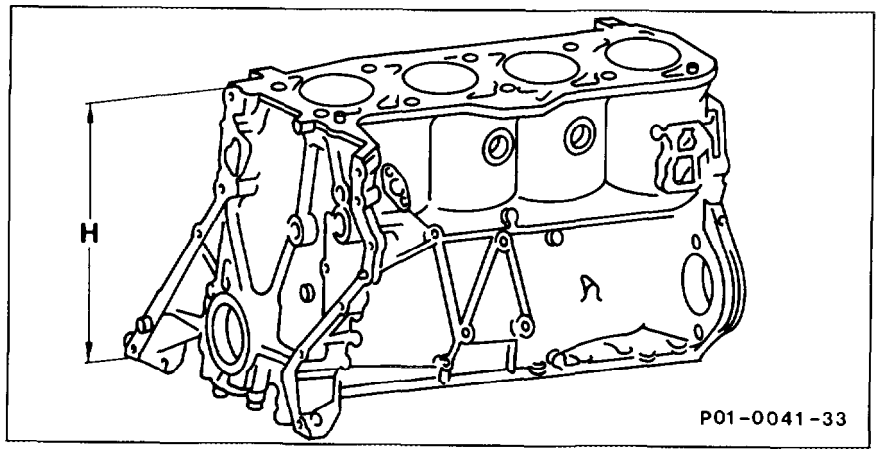


Measuring points 1 – 3
A Longitudinal direction
B Transverse direction
a Top reversal point of 1st piston ring
b Bottom dead center of piston
c Bottom reversal point of oil scraper ring

Chamfer the cylinder bores after boring.
The material allowance for honing should be not more than 0.05 mm.



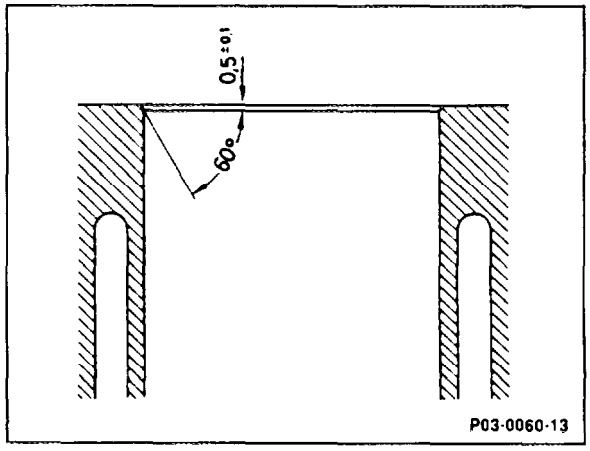
01-120 Facing crankcase parting surface



Data

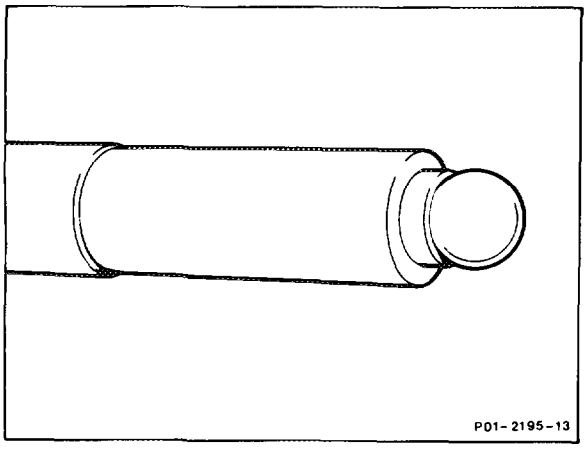
Height "H" of crankcase when new		292.45 ± 0.05
Minimum height after necessary stock removal		292.35
Permissible unevenness	top crankcase mating face	0.03
	bottom crankcase mating face	0.04
Permissible variation of parallelism of top to bottom crankcase mating face in longitudinal direction		0.1
Peak-to-valley height (Rz)	top crankcase mating face	0.005 – 0.020
	bottom crankcase mating face	0.025
Test pressure with air under water in bar gauge pressure		1.5
Chamfer of cylinder bores		0.5 ± 0.1 × 60°

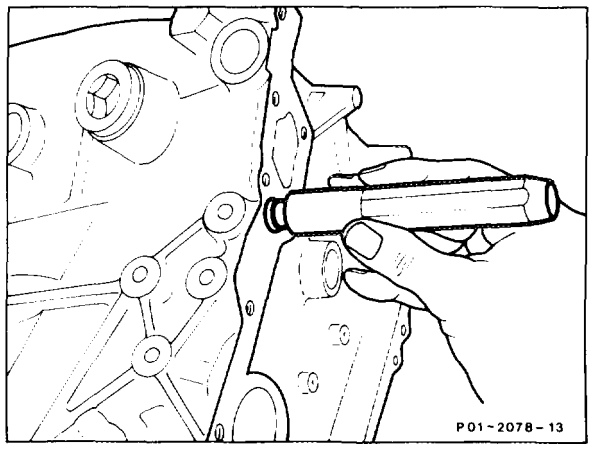
Note
Chamfer the cylinder bores after completing machine work.
If the crankcase mating face has been remachined, the timing must be reset (05215).
The timing case cover must be bolted tight to the crankcase and also be machined when machining the top or bottom crankcase mating faces.



01-130 Removal and installation of steel balls in main oil gallery

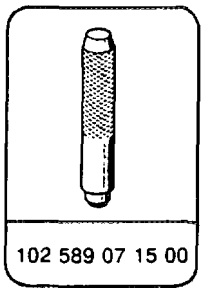
Preceding work:
Removal of engine coolant pump (20-210).
Removal of flywheel (03-410).





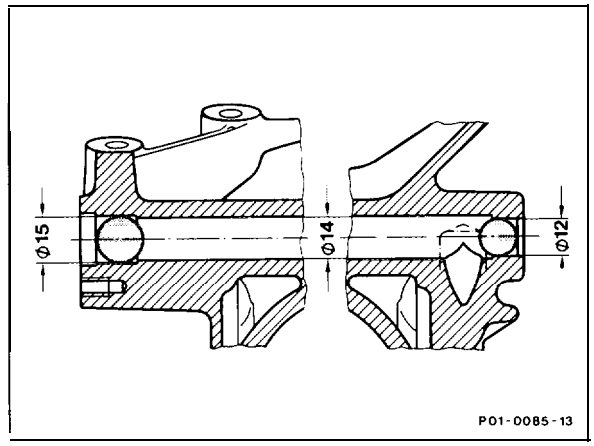
Both steel balls	knock out together from back to front with a round steel bar (dia. 11 mm, approx. 500 mm long). If the rear ball moves into the cross passage to the oil filter, remove the oil filter to enable the ball to be removed.
Bores	thoroughly clean in the area in which the steel balls are pressed in.
Cup on fitting mandrel	coat with grease and install steel ball into the cup.
Steel ball	position with the installation mandrel and knock in each at front and rear as far as the stop on the mandrel.

Special tool



Notes

The main oil gallery is closed with steel balls, dia. 15 mm at the front, dia. 12 mm at the rear.

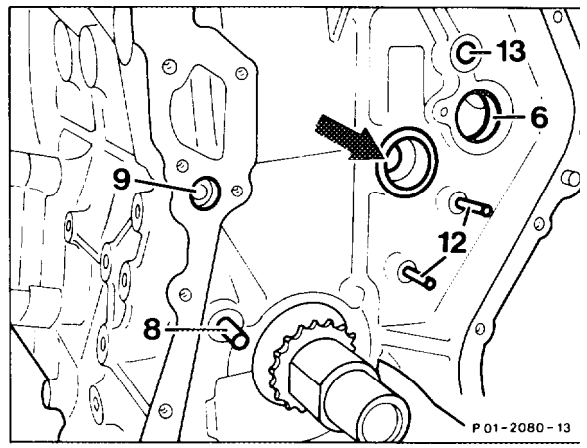


When reconditioning the engine, the steel bails must be knocked out from the rear in order to clean the main oil galleries.

Undamaged steel balls may be reused several times without machining the ball seat.

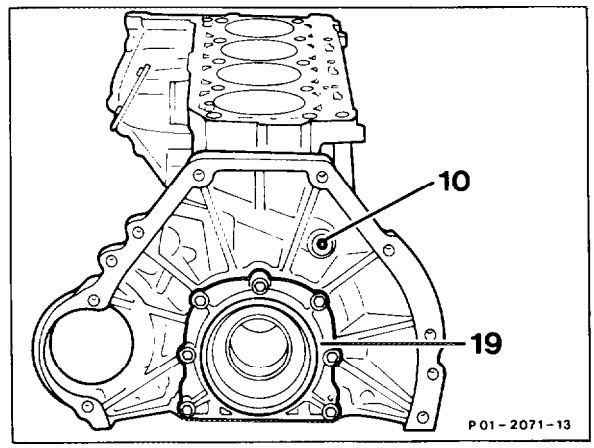
Replace damaged steel balls.

If a leak exists, reset steel balls approx. 1 mm (size is fixed on installation mandrel). Special tool 102 589 07 15 00.



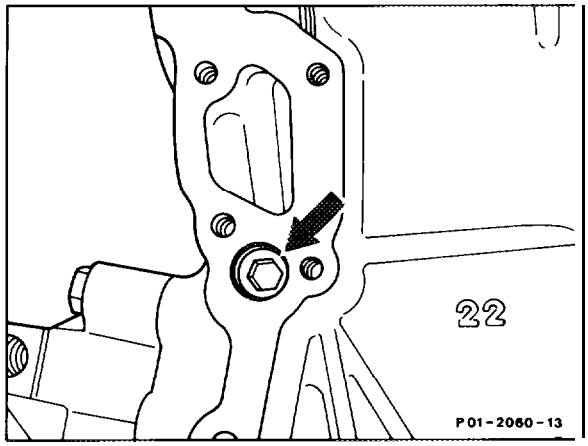
9 Front steel ball (Ø 15 mm)

Should the leaks not be repaired after this, knock out both steel balls and seal the main oil passage end in question with a screw plug.

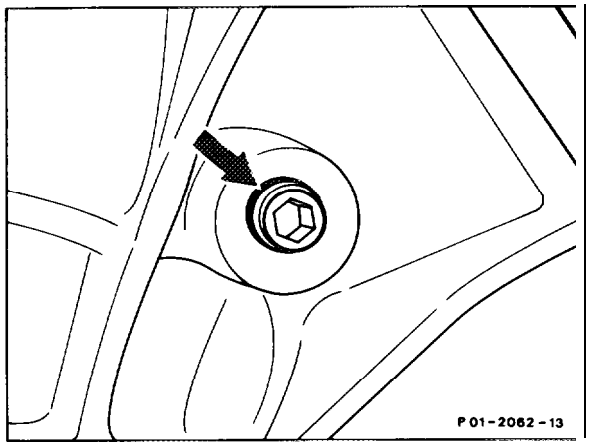


10 Rear steel ball (Ø 12 mm)

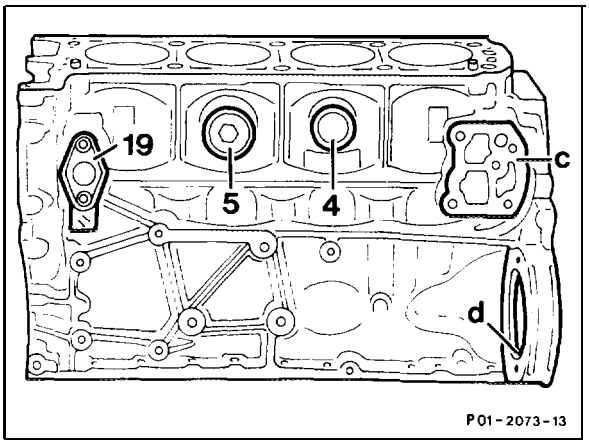
This is done by tapping an Ml 6 × 1.5 thread approx. 10 mm deep at the front of the main oil gallery. Thoroughly remove chips from the oil gallery.
Coat Ml6 × 1.5 screw plug Part No. 000 906 016 002 with sealing adhesive 002 989 94 71 and screw in (arrow).

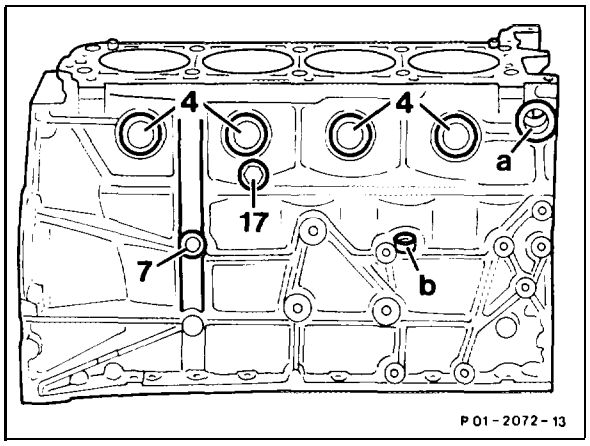


Tap an Ml 4 × 1.5 thread approx. 12 mm deep into the rear of the main oil gallery. Thoroughly remove chips from the main oil gallery.
Coat Ml 4 x 1.5 screw plug, Part No. 000 906 014 000, with sealing adhesive 002 989 94 71 and screw in (arrow).



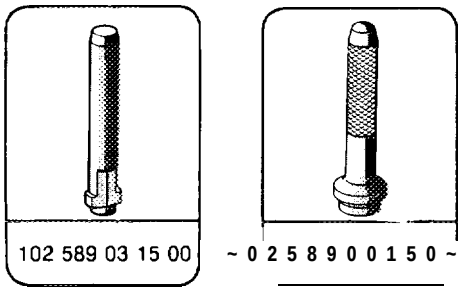
01-140 Replacing core plug in crankcase





Coolant	drain completely, pour in (20-010).
Components which restrict access	remove, install.
Core plug (4)	remove.
	Position a chisel with narrow blade or a screwdriver in the deep-drawn edge of the plug (step 3).
	Carefully knock in plug on one side far enough for it to turn through its own longitudinal axis (approx. 90°), and pull out with the pliers (step 4).
Sealing surface in crankcase	Thoroughly clean of residues. The sealing surface must be free of grease.
New core plug	install.
	Coat sealing surface with the sealant Loctite 241, 002 989 94 71. Note curing time of approx. 45 minutes (step 6).
	Knock in core plug with the matching mandrel (step 7).
Engine	run until warm and check leaktightness.

Special tools

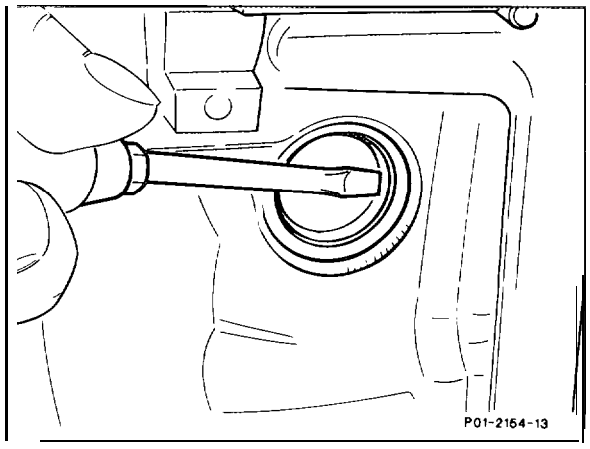


Replacement

1 Completely drain engine coolant (20-010).

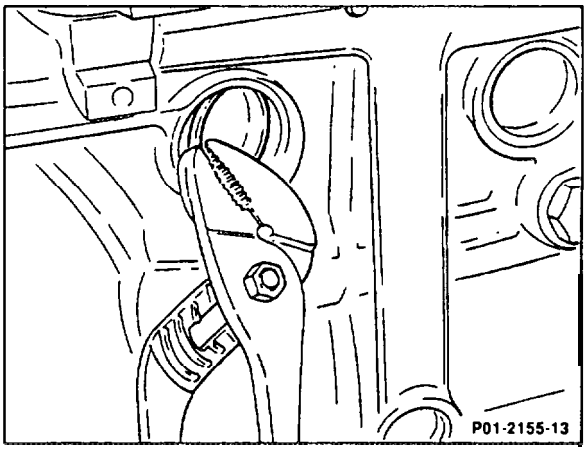
2 Remove components which restrict access.

3 Position a chisel with narrow blade or a screwdriver into the deep-drawn edge of the plug.



4 Carefully knock in plug on one side far enough for it to turn through its own longitudinal axis (approx. 90°) and withdraw with pliers.

5 Thoroughly clean sealing surface of residues. The sealing surface must be free of grease.

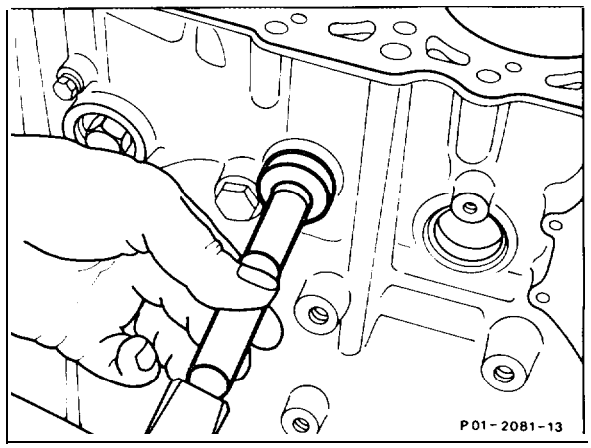


6 Coat sealing surface with sealant Loctite 241, 002 989 94 71.

Note

The sealant must cure for approx. 45 minutes before adding the engine coolant.

7 Knock in new core plug with the matching mandrel.



mm 0	Special tool
34	102 589 00 15 00
20	102 589 03 15 00

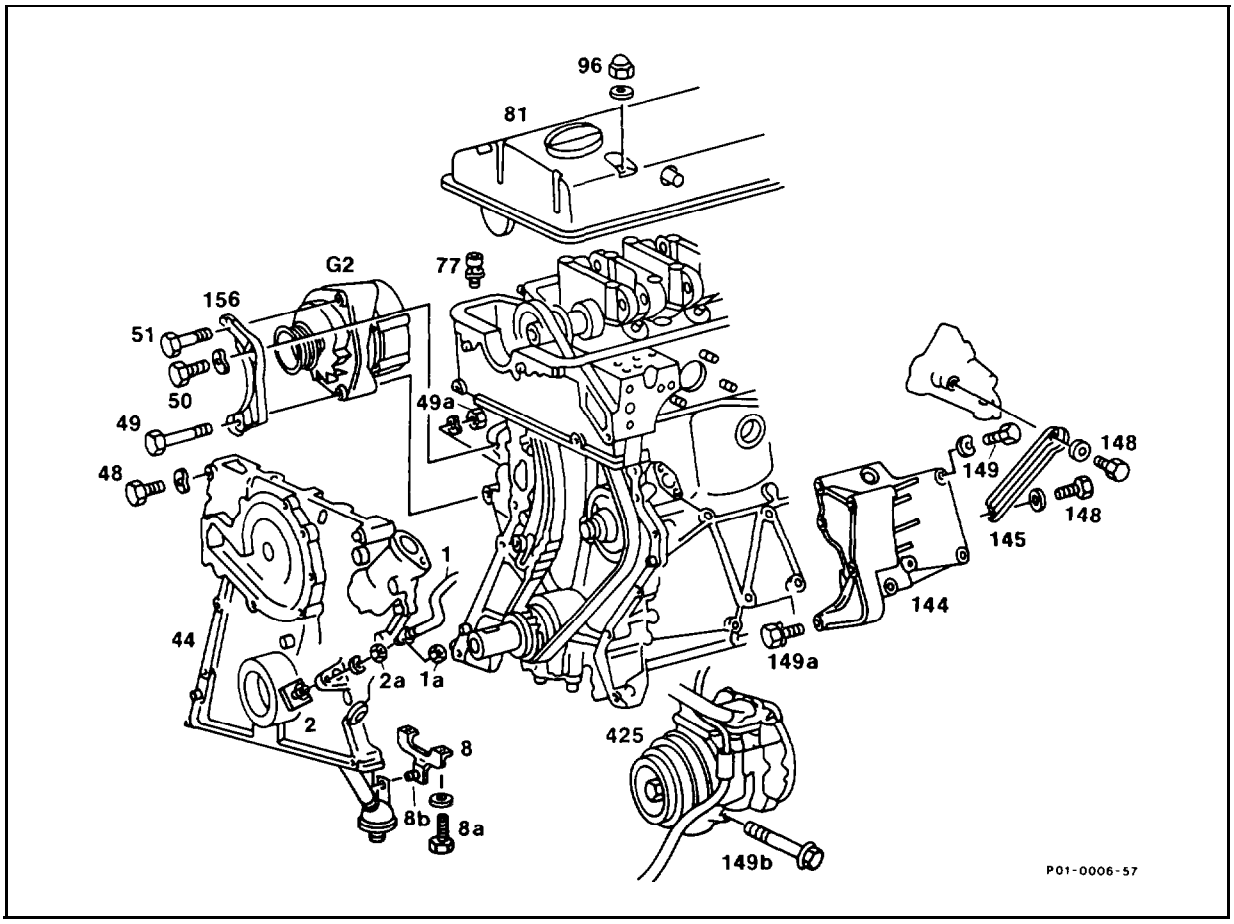
8 Install removed components.

9 Add engine coolant (20-010).

10 Run engine until warm and check leaktightness.

01-210 Removal and installation of timing case cover

Preceding work:
Removal of radiator (20-420).
Removal of power steering pump (46-710).
Removal of torsion bar (32-300).
Removal of oil sump (01-310).
Removal of V-belt tensioning device (13345).
Removal of vibration damper or hub and belt pulley (03-342)
Removal of engine coolant pump (20-210).
Removal of air filter (09-400, or 09-410).
Removal of ignition distributor (15-l 10).
Removal of pressure oil pump for level control (32640).

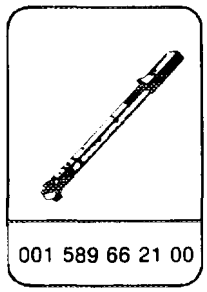


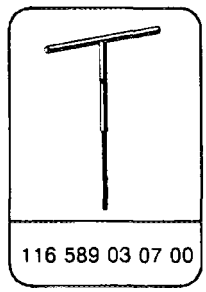
Cylinder head cover (81)	remove, install, together with ignition cable and distributor cover (01-406).
Hexagon socket bolts (77)	3 off, remove and install, 25 Nm (reference value, step 2).
Strut (145)	unbolt, bolt on, 25 Nm (step 3).
A/C compressor (425)	unscrew, screw on and place to the side with connected lines, 25 Nm. Unbolt, bolt on bracket (b), 10 Nm (step 4).

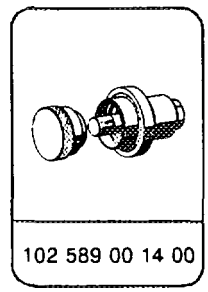
Connector (327)	unplug at alternator, plug in (step 5).
Alternator (G2)	unscrew, screw on, 30 Nm (step 6).
Bracket (156)	for alternator, unbolt, bolt on, 25 Nm (step 7).
TDC pulse generator cable (1)	unbolt, bolt on (step 8). If timing case cover has been replaced, the TDC pulse generator bracket must be adjusted (03345).
Bracket (8)	for oil pump strainer basket, unbolt, bolt on, 25 Nm, (step 9).
Timing case cover	remove remaining bolts, take off timing case cover (steps 10 and 11). Do not damage cylinder head gasket: replace cylinder head gasket if damaged.
Mating surfaces	clean (step 12).
Timing case cover	coat with sealant 001 989 25 20 and install timing case cover (steps 13 and 14). Use fitting tool 102 589 00 14 00 and spacer ring 102 589 01 14 00 for replacement of radial seal.

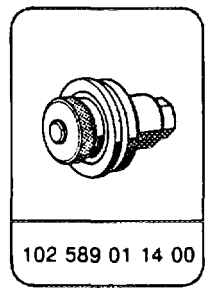
Special tools

001 589 72 21 00


001 589 66 21 00


116 589 03 07 00


102 589 00 14 00


102 589 01 14 00

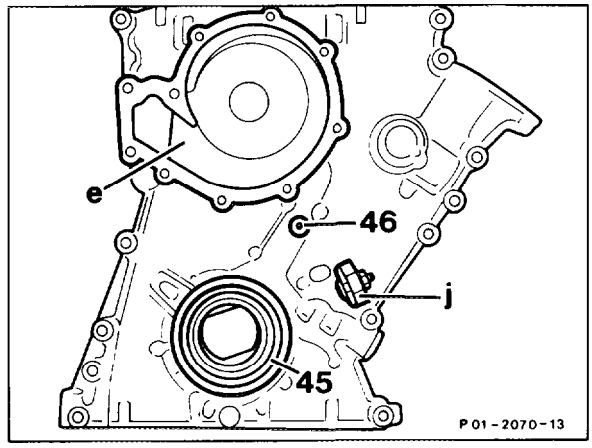
Notes

The timing case cover closes off the crankcase at the front. It is fixed in position with 2 straight pins 10 × 14 and attached to the crankcase with 15 hexagon bolts.

The timing case cover is sealed to the crankcase with the sealant Loctite 573, Part No. 001 989 25 20.

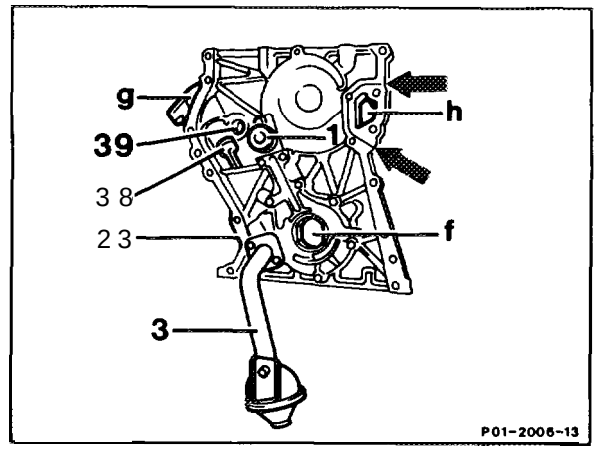
The timing case cover also acts as a support or housing for the following components or component parts:

Engine coolant pump
Ignition distributor
Oil pump
Oil overpressure valve
Radial seal for sealing crankshaft at front
Setting pointer
TDC pulse generator



Front side of timing case cover
45 Crankshaft radial seal
46 Setting pointer for TDC
e Coolant pump chamber with inlet
j Bracket for TDC pulse generator

To avoid any engine coolant mixing with the engine oil should a leak occur between crankcase and timing case cover, a groove (arrows) has been provided around the coolant inlet (h) to allow the coolant to flow to the outside.



Rear side of timing case cover
1 O-ring
23 Oil overpressure valve plug
38 Thrust piece
39 Bearing bush for Intermediate gear shaft
f Oil pump
g Mount for ignition distributor
h Coolant inlet

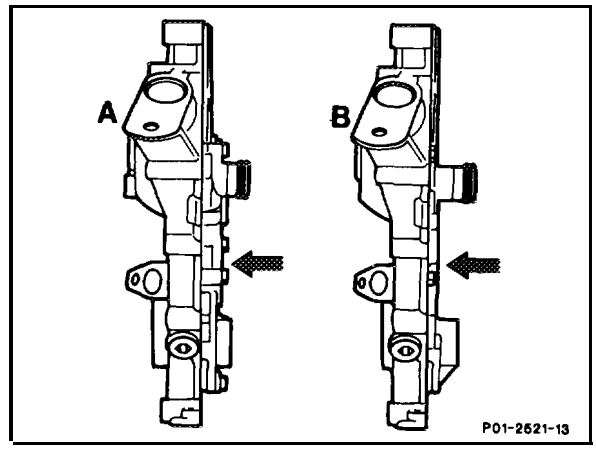
The timing case cover is always supplied as a replacement part with the oil pump installed, but without radial seal for the front of the crankshaft and without oil suction pipe with oil strainer.

Note

A gasket for sealing the timing case must not be installed on these engines (with single belt drive).

The timing case cover was modified effective 11/87.

The contours on the rear side have been lowered. This is detectible from the cast Part No. 102 015 11 01 on the front side of the cover. This timing case cover can also be installed on engines manufactured prior to this date.



A Previous version
B Present version

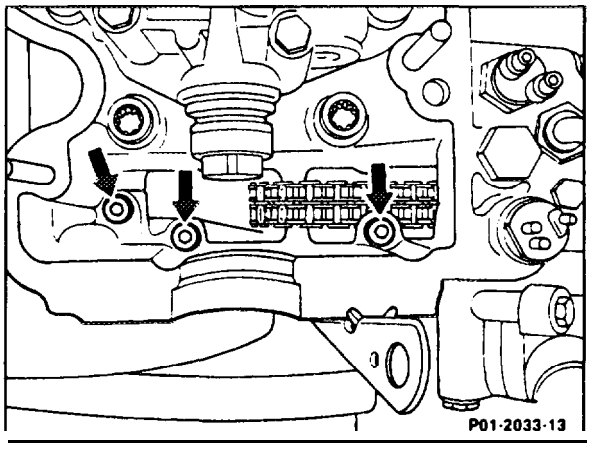
Standard implementation: 11/87

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	020073	063591

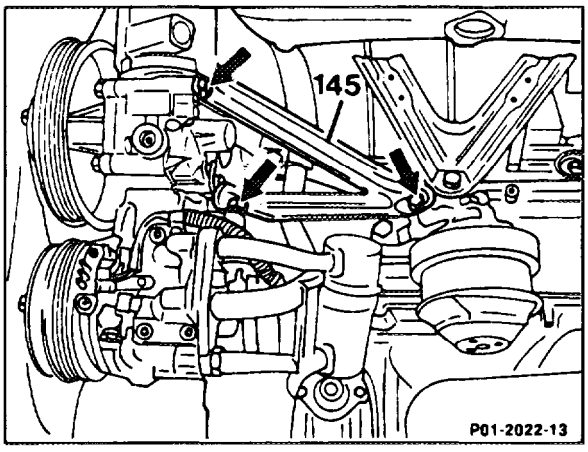
Removal

1 Remove cylinder head cover (01-406).

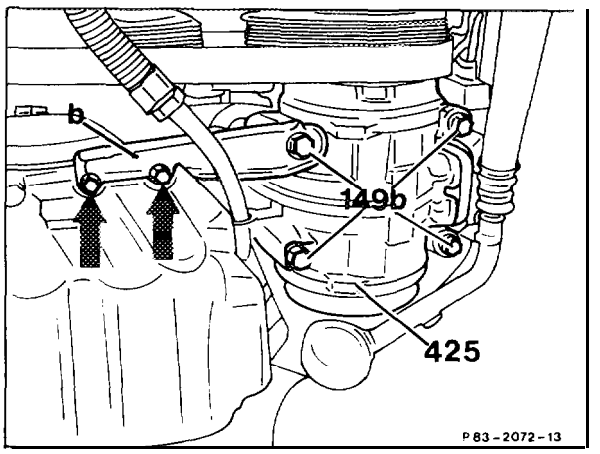
2 Remove hexagon socket bolts (3 off M8, arrows) in the chain box with a stud wrench 116 589 03 07 00. Tightening torque 25 Nm (reference value).



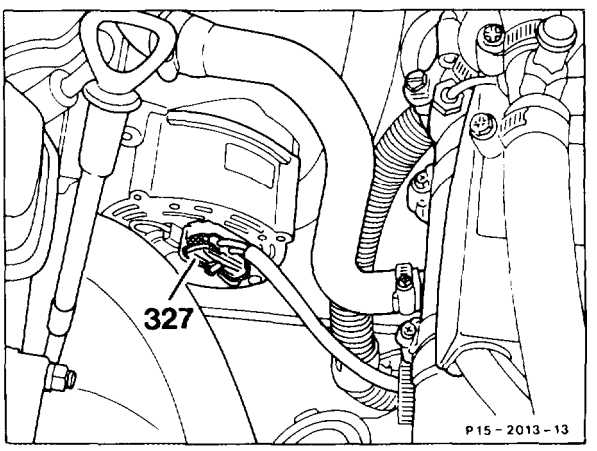
3 Remove strut (145) for power steering pump and A/C compressor (arrows). Tightening torque 45 Nm.



4 On models equipped with A/C compressor, unbolt compressor. Unbolt bracket (b) to perform this step.
Place A/C compressor to the side with the pipe group connected.

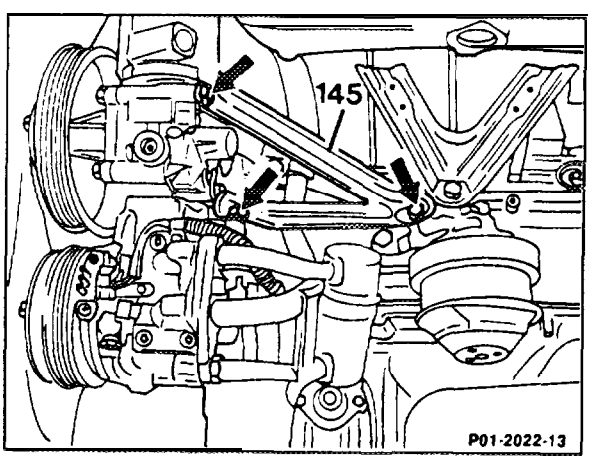


5 Unplug connector (327) at the alternator, plug in.

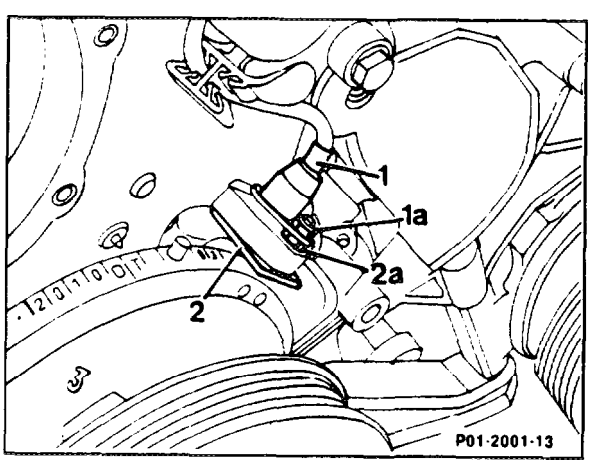


6 Remove bolts (49 and 51), bolt on; remove alternator, insert. Tightening torque 30 Nm.

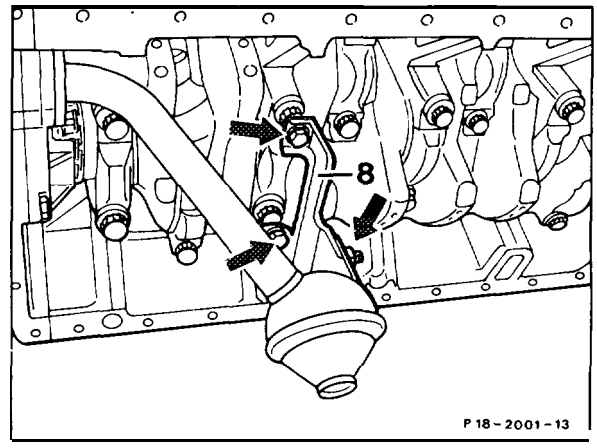
7 Unbolt bracket (156), bolt on. Tightening torque 25 Nm.



8 Unbolt TDC pulse generator cable (1) at the holder (2), screw on.



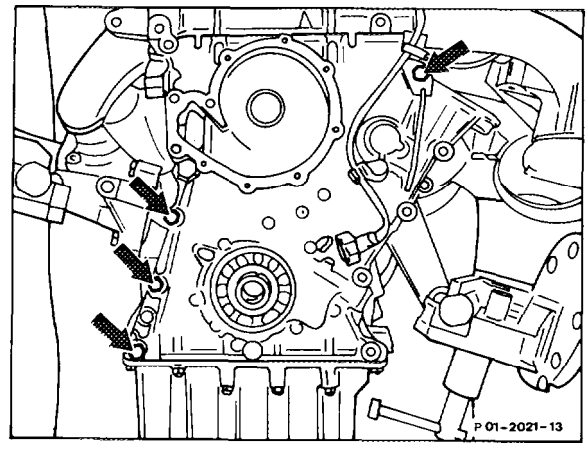
9 Unbolt bracket (8) for oil pump strainer basket, bolt on (arrows).



10 Remove remaining bolts (arrows) for timing case cover.

11 Remove timing case cover.

Caution!
Do not damage cylinder head gasket. Replace cylinder head gasket if damaged.



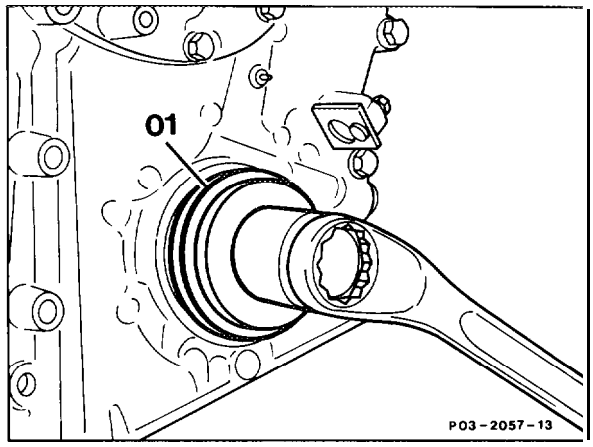
Installation

12 Clean mating faces.

13 Coat mating face of timing case cover with the sealant, Part No. 001 989 25 20.

14 Carefully install timing case cover, paying attention to the cylinder head gasket, and bolt tight.
Note bolt lengths.

15 If the radial seal has been removed, insert new radial seal with the sleeve 102 589 00 14 00.
Install spacer ring (01) 102 589 01 14 00 for the timing case cover with double roller chain.



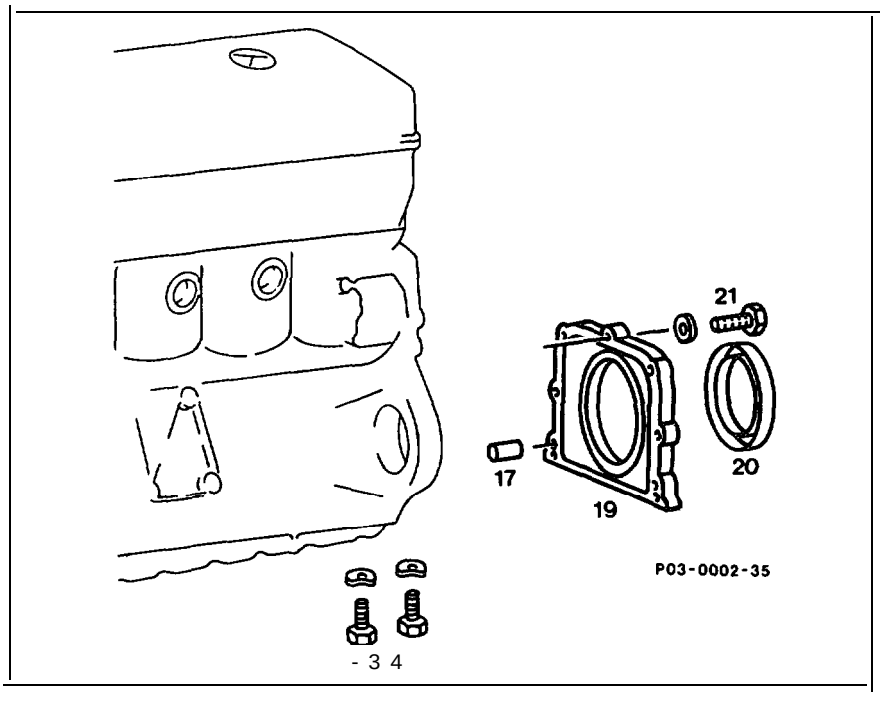
Note
If the timing case cover has been replaced, the TDC pulse generator holder must be adjusted (03-345).

16 The remaining parts are installed in the reverse order.

17 Run engine and check for leaks.

01-222 Removal and installation of end cover

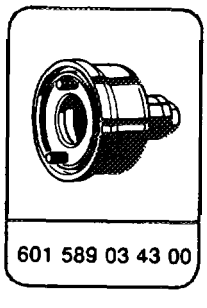
Preceding work:
Removal of transmission **(26-020** or **27-600).**
Removal of flywheel **(03-410).**

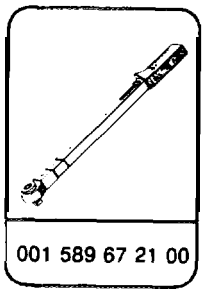


End cover (19) . . . . . remove, install (pay attention to instructions). Clean mating face, insert roll pins (17). Coat mating face and bolts (21 and 34) with sealant 001 989 45 20 10, 10 Nm.

Radial seal (20) . . . . . replace, use special tool 601 589 03 43 00.

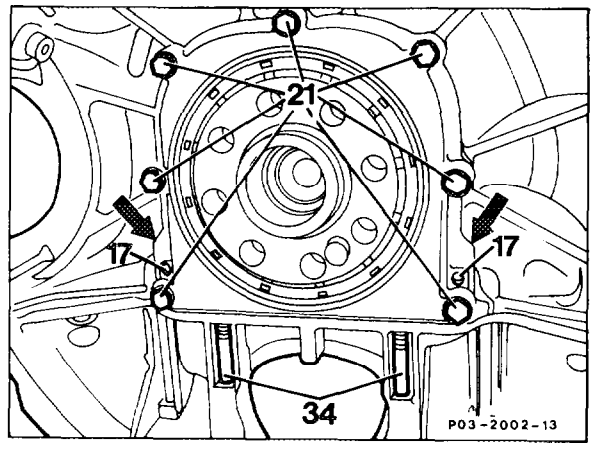
Special tools


601 589 03 43 00


001 589 67 21 00

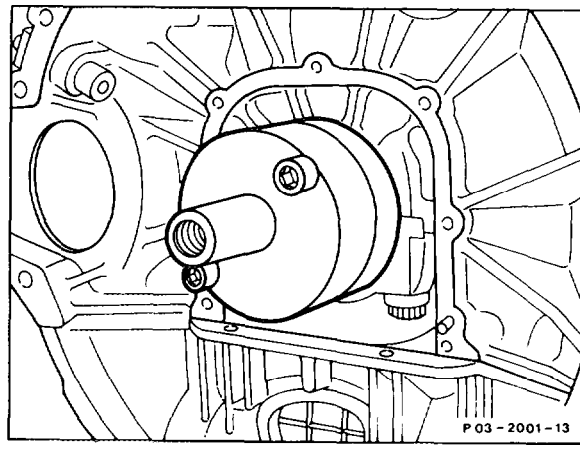
Notes

The center installation position relative to crankshaft center is fixed with two roll pins (17). Press end cover off at both side plates (arrows).



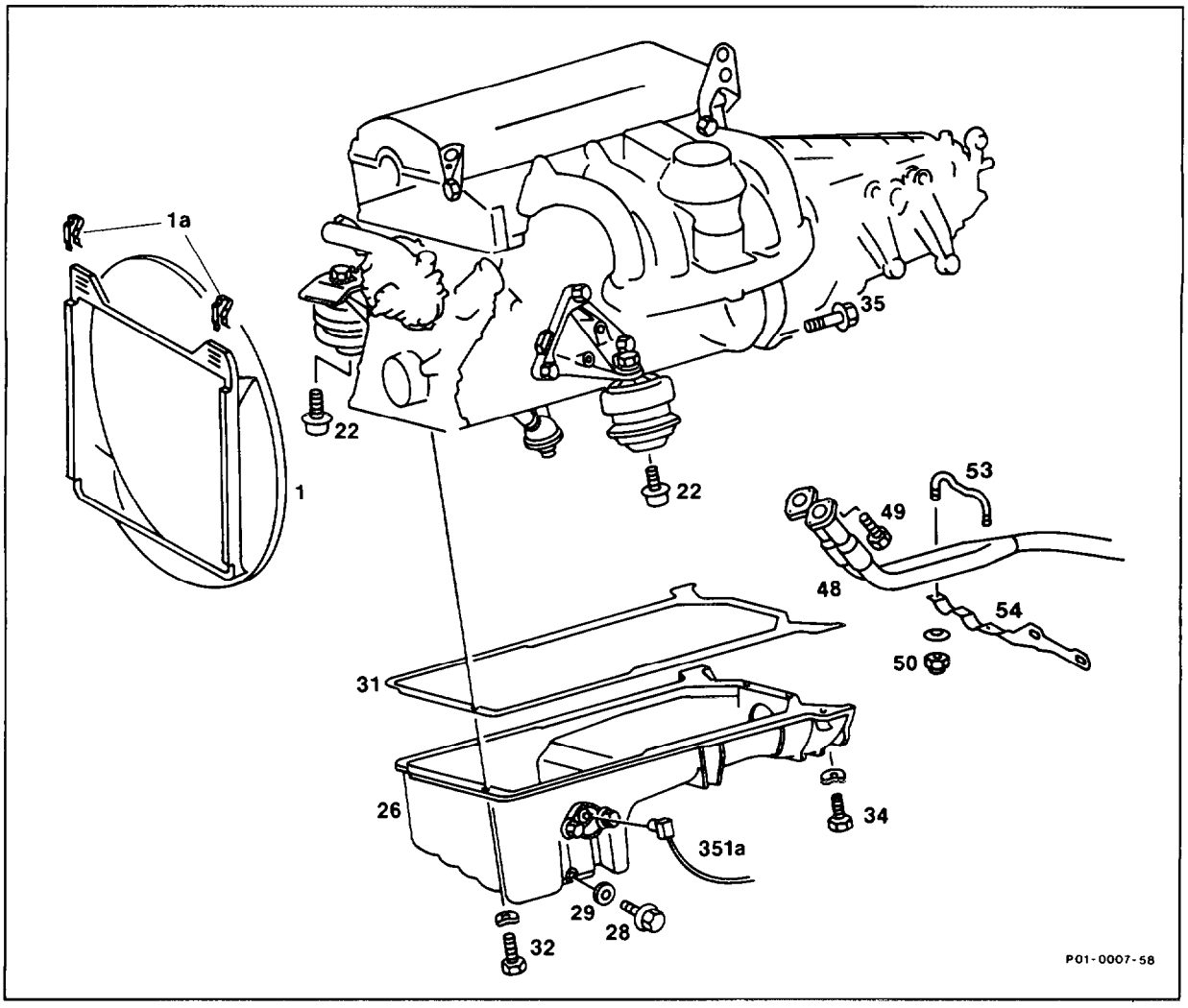
17 Roll pin
21 Bolt-washer assy (M6 x 22)
34 Bolt-washer assy (M6 x 65)

Push end cover with radial seal installed in place over the bolted-on assembly sleeve.



01-310 Removal and installation of oil pan

Preceding work:
Removal of air filter (09-400 or 09-410).
Removal of bottom engine compartment cover (01-006).
Removal of torsion bar (32-300).



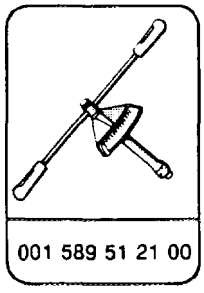
Engineoil	drain, add. Unscrew oil drain plug (28) to perform this step, screw in, 25 Nm. Replace sealing ring (29).
Cable (351a)	unplug, plug in.
Clips (la)	pull off, detach, attach fan shroud (1), place over fan.
Exhaust pipes (48)	unbolt at exhaust manifold, bolt on, 25 Nm (step 4).

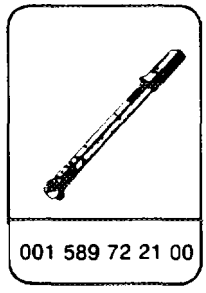
Pipe clip (53)	unbolt, bolt on, 25 Nm (step 5). Replace nuts (50).
Bolts (35)	2 off M10, unbolt, bolt on, 45 Nm (step 6).
Bolts (22)	unbolt, bolt on, 45 Nm, attach engine hoist to suspension lugs and raise (steps 7 and 8).
Oil pan (26)	remove, install. Remove bolts (32, 34) for this step, bolt on. Clean sealing surface. Replace gasket (31) (step 9). Tightening torque: M6 10 Nm, M8 25 Nm.

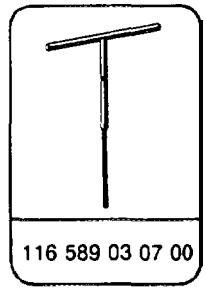
Oil capacity in litres

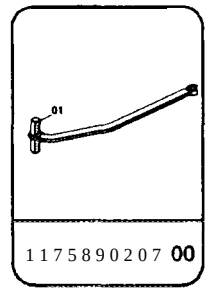
Total capacity for oil and filter change	5.5
Oil pan max. / min.	4.8 12.8

Special tools


001 589 51 21 00


001 589 72 21 00


116 589 03 07 00



1175890207 00

Commercial tool

Engine hoist No. 3180	e. g. Messrs. Backer Herderstraße D-5630 Remscheid

Shop-made tools

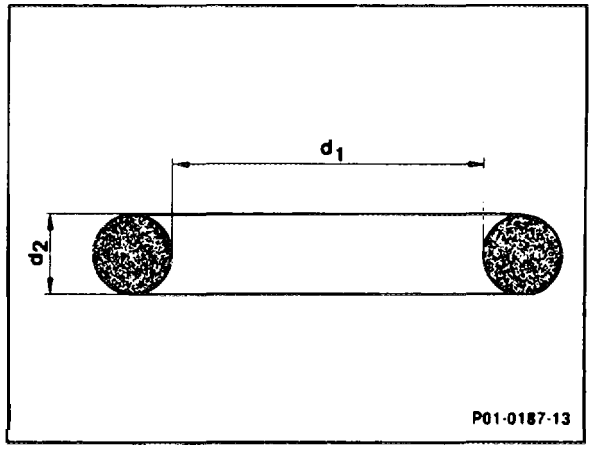
Metal panel for component compartment wall	Dimensions: approx.320 × 380 × 1
Guard plate for radiator/evaporator	Dimensions: approx. 480 × 600 × 1

Note
The O-ring for sealing the oil level pickup to the oil pan has been improved. In addition, the diameter has been increased from 3 mm to 3.15 mm. Color: green (previously black).

Standard implementation: 09/86

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.024 (USA)	102.985	004381	040652

In June 1987 the O-ring of the oil level pickup was once again modified.



Modification

Size	Previous version mm	Present version mm
d_1	40.20	37.20
d_2	3.15	3.2

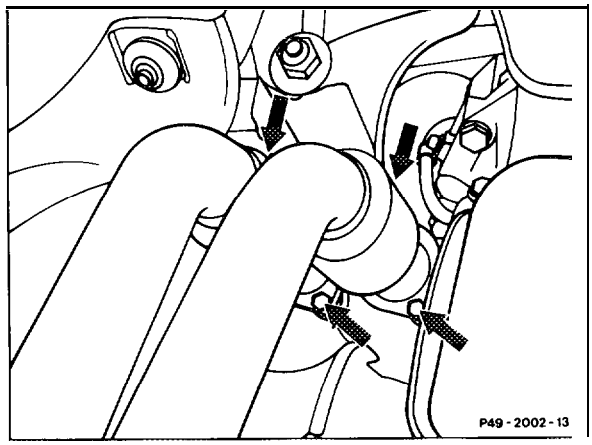
Removal and installation

1 Drain engine oil.

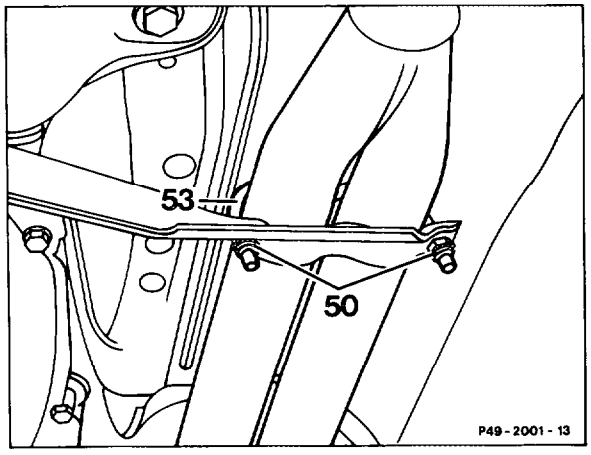
2 Unplug cable (351a) at the oil level pickup, plug in.

3 Detach clips (la) for fan shroud, detach, attach fan shroud (1), place over fan.

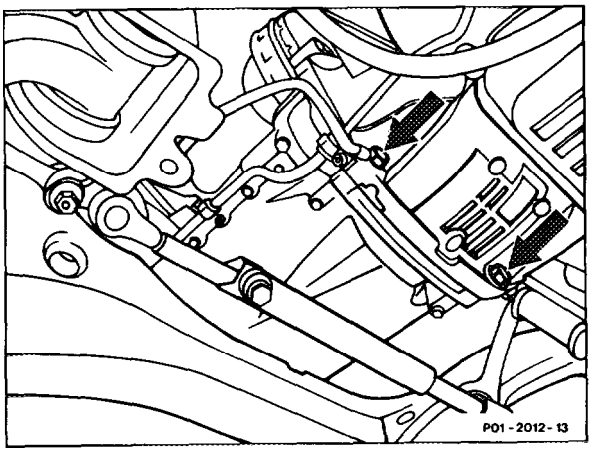
4 Unbolt exhaust pipes at exhaust manifold, bolt on (arrows).



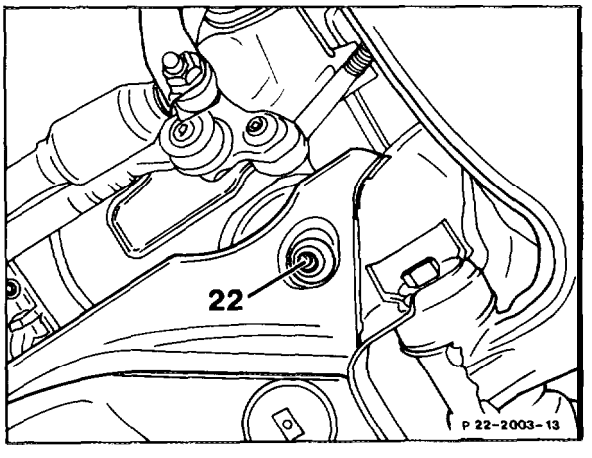
5 Unscrew pipe clip (53) at the front exhaust bracket to the transmission. Replace nuts (50). Tightening torque 25 Nm.



6 Remove two bolts at the transmission – engine joint (M10, arrows), bolt on. Tightening torque 45 Nm.



7 Remove both bottom bolts (22) for engine mounting fixture, bolt on. Tightening torque 45 Nm.

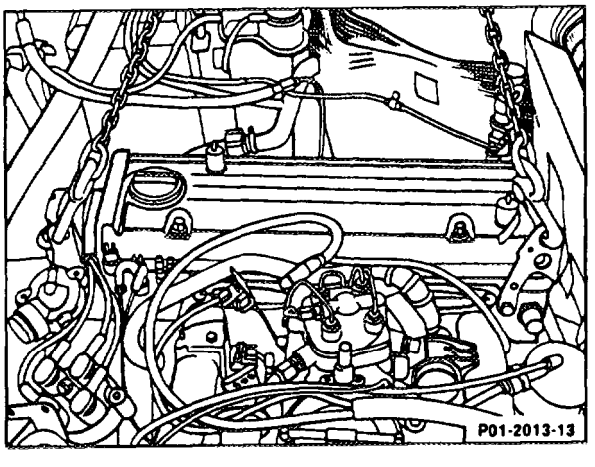


Len side shown

8 Raise engine with the engine hoist.

9 Remove remaining bolts (32, 34) for attaching oil pan, bolt on and remove oil pan. Tightening torque:
M6 10 Nm,
M8 25 Nm.

10 Carefully clean mating face at oil pan and on crankcase.



11 install oil pan with new gasket. Pay attention to bolt lengths and tightening torques.

12 Lower engine and attach engine mounts.

13 Add engine oil and adjust to correct level.

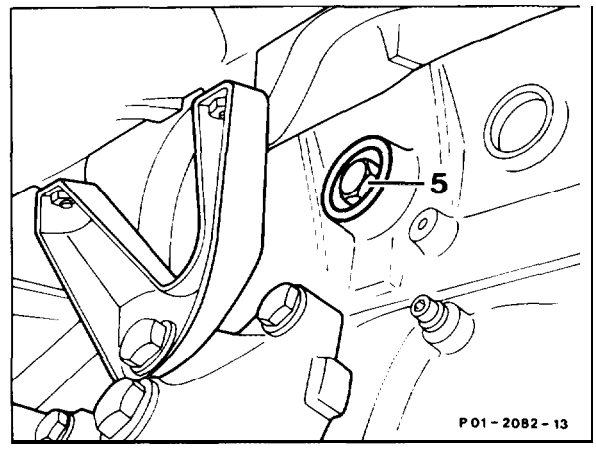
14 Check for leaks with engine running.

01-403 Repair instructions for crankcase, cylinder heads and cylinder head gaskets

Crankcase

The tapped hole for attaching the power steering pump carrier (compared to engines with multi-belt drive) have been converted from M8 to M10.

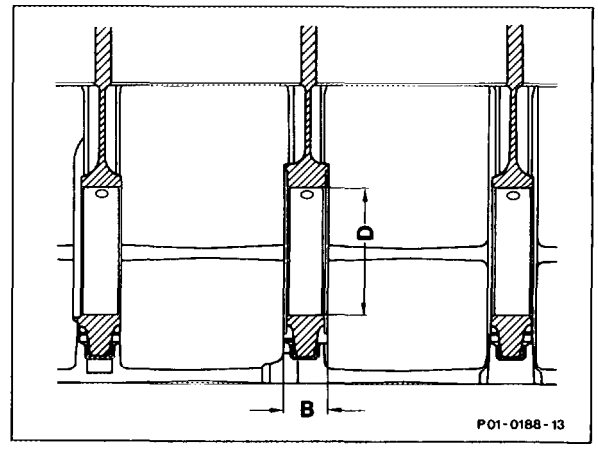
The M 38 × 1.5 tapped hole for mounting the coolant preheater on the left side is shorter. It is sealed with a screw plug (5) and an O-ring from engines 116/117 and 601.



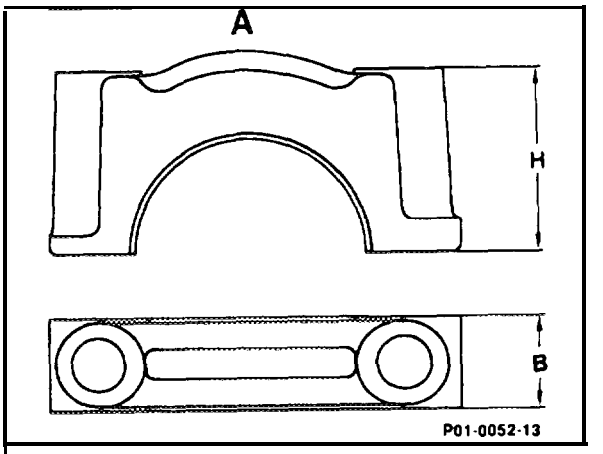
The crankshaft bearings in the crankcase have been modified (size "B").

Multi-belt drive = 24 mm

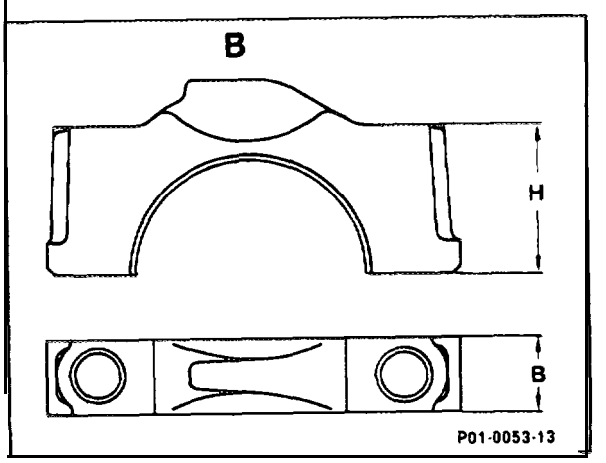
Single-belt drive = 20 mm



At the same time, the crankshaft bearing covers are 8 mm lower (H = 40 mm).

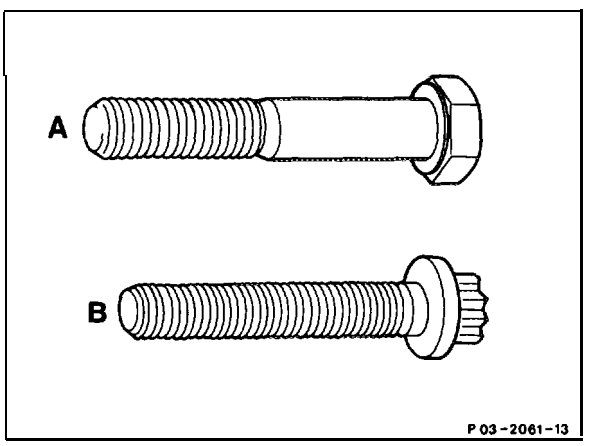


Engines with multi-belt drive (102.985)
H = 48 mm



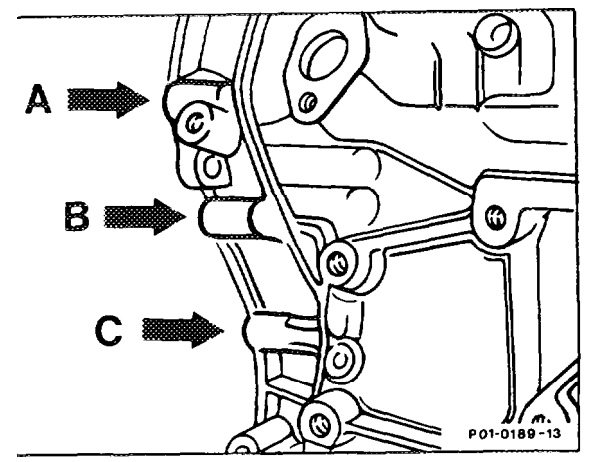
Engines with single-belt drive (102.961)
H = 40 mm

Fastening bolts of the crankshaft bearing covers converted to Ml 1 x 62 twelve-side stretch bolts with collar. Previously, Ml 2 x 70 hexagon bolts.

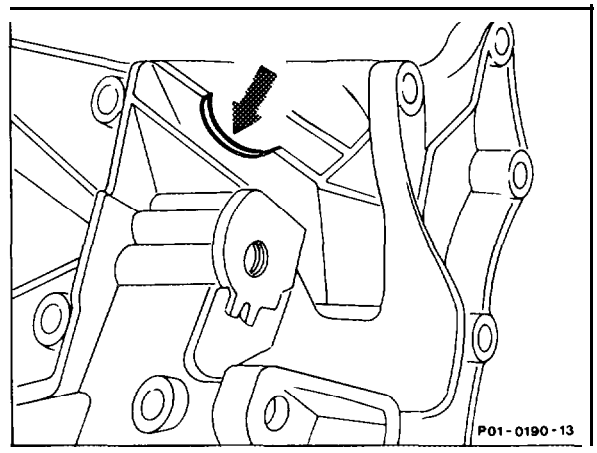


A M 12 x 70 hexagon bolts
B Mt 1 x 62 twelve-side stretch bolt

Bolt projections (A, 6, C) on crankcase for fastening bolts of timing case cover lengthened.



Because of the lengthened bolt extensions, the power steering pump carrier has been provided with a semi-circular cutout at the second reinforcing rib (arrow).



Standard Implementation: 06186

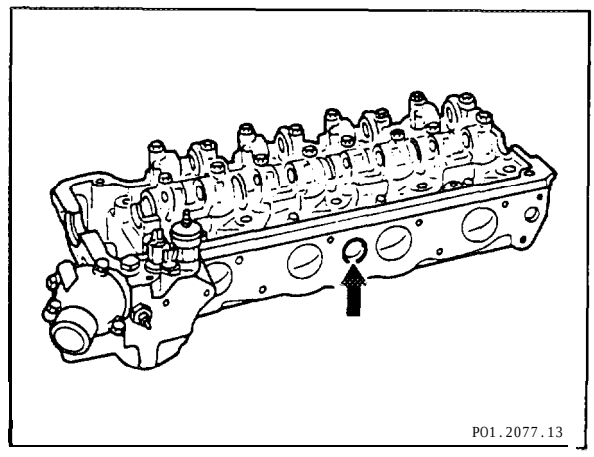
Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.024 (USA)	102.985	003938	036445	313424	246820

Cylinder head

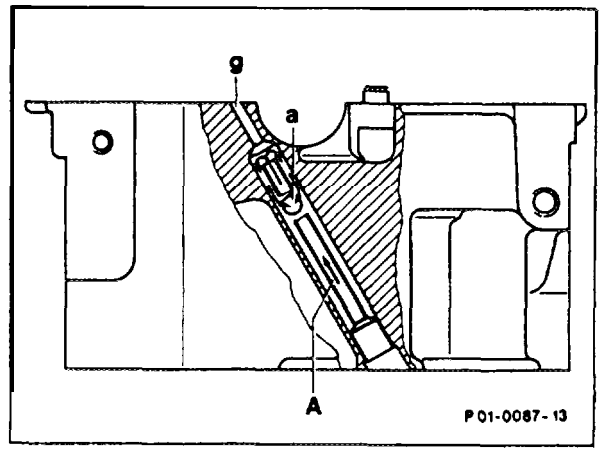
The same cylinder head is installed on engines 102.9221924 as on engines 102.962/982/985.
Only one cylinder head version is supplied as a replacement part.
This cylinder head must not be installed on the previous engine 102.961.

A core plug, Part No. 000 443 025 003 should be inserted with MB sealant 002 989 94 71 and the installation mandrel 102 589 02 15 00 for engine 102.985.

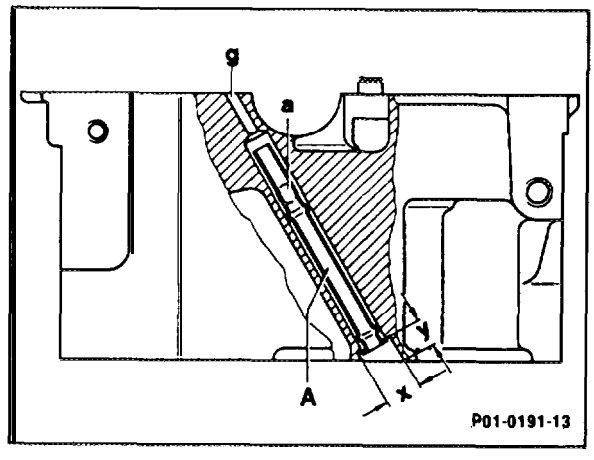
Caution!
If the core hole is not closed (arrow), coolant may get into the cylinders on engine 102.985.



An oil pipe (A) is inserted in the oil feed passage at the rear of the cylinder head to prevent the oil passages running empty when the engine is off.

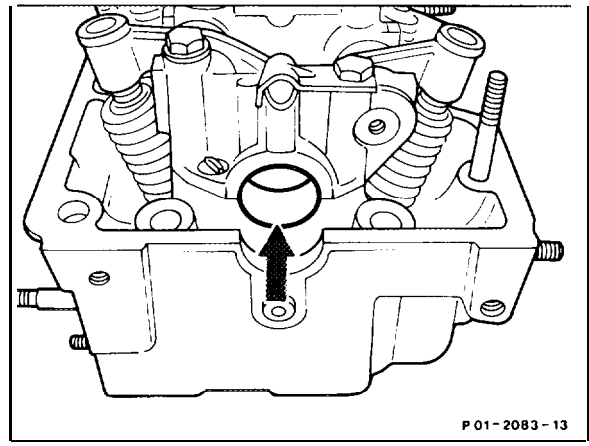


Since 071'87 the oil pipe (A) has a stop collar (arrow). This prevents the oil pipe "migrating upward" in the cylinder head. At the same time, the recess in the cylinder head has been modified.



Dimension	Previous version	Present version
X	9.0 mm	9.5 mm
Y	7.0 mm	7.0 mm

No oil passage is provided at the 4th bearing point for camshaft lubrication (arrow).



Cylinder head gasket

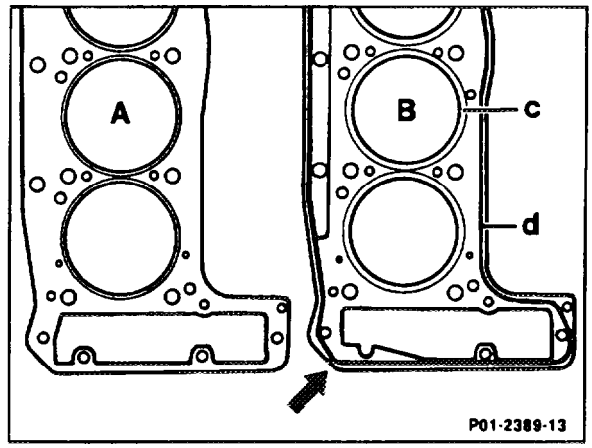
Cylinder head gaskets of asbestos-free material were installed for a certain period on engines 102.985.

Standard implementation: February – March 1988 (manufacturer Elring)

Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.028	102.985	022847 – 023481	068903 – 070235	437591 – 441023	*

* not covered

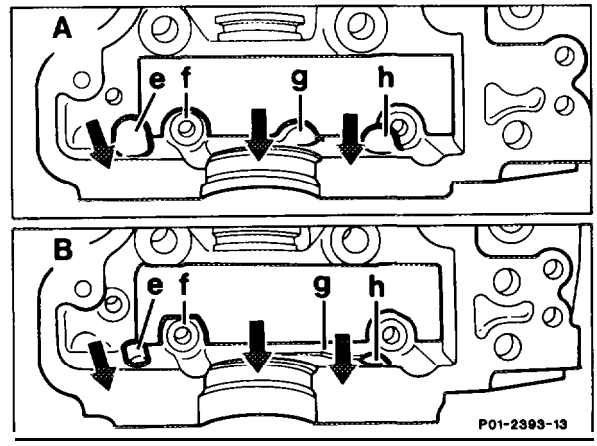
The cylinder head gasket in the chain box area was modified with implementation of the double roller chain (B, arrow).
In addition, sealing surfaces with modified coating and widened combustion chamber chamfered faces (c) as well as silicone strips (d) running all round the outer edge.



Standard implementation: 01/88

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	021822	066697

To achieve greater clearance for the double roller chain, the front wall at the cylinder head was lengthened. In addition, the bolt extensions were flattened off at the radius (f).



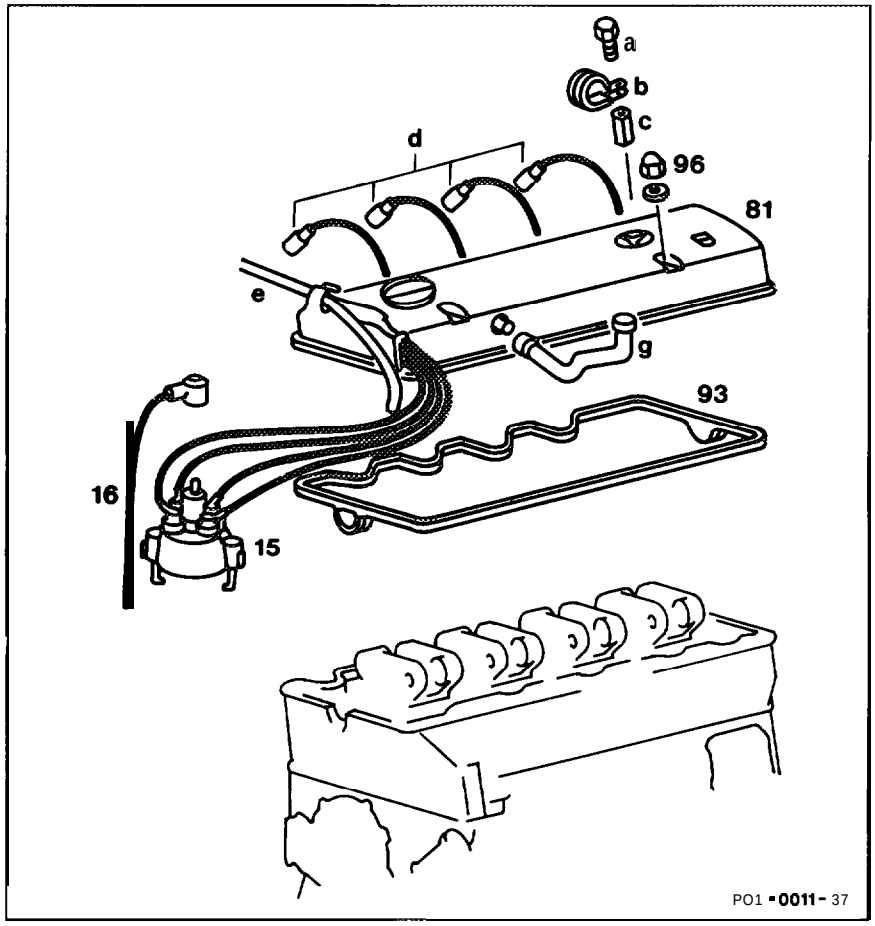
A Single roller chain
B Double roller chain

Standard implementation: 01188

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	022013	067143

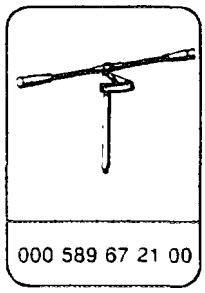
01-406 Removal and installation of cylinder head cover

Preceding work:
Removing air filter (09-400 or 09-410).



Ignition cable (16)	unplug at distributor cover, plug in.
Ignition distributor cover (15)	unbolt at distributor, bolt on.
Spark plug connector (d)	detach from spark plugs, fit on.
Vent line (e)	detach, attach.
Holder (b)	unbolt, bolt on if equipped with automatic transmission.
Cap nut (96) or hexagon nut (c)	unbolt, bolt on, 15 Nm.
Cylinder head cover (81)	remove with ignition cables, refit. Pay attention to instructions.
Gasket (93)	check, replace if necessary.

Special tool

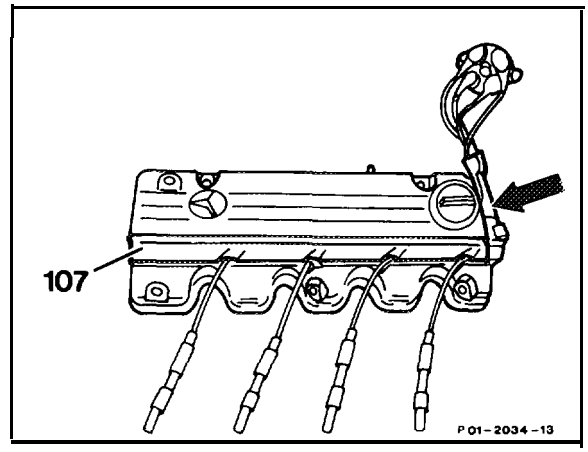


Notes

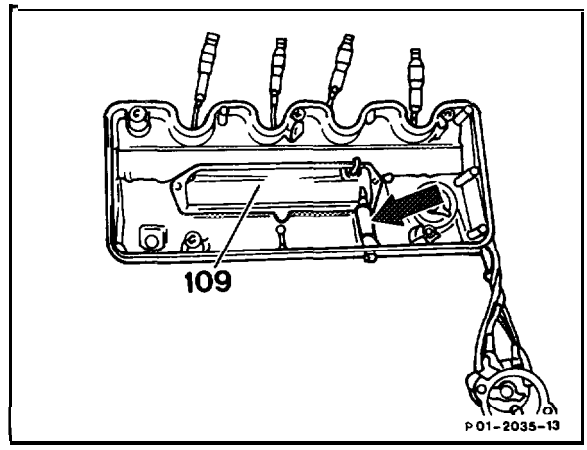
The cylinder head cover is manufactured from a magnesium alloy and is coated on the outside with a black colored plastic.

A two-part, glass fibre reinforced polyamide rectangular tube (107) in which the ignition cables run is inserted in a longitudinal groove of the cylinder head cover.

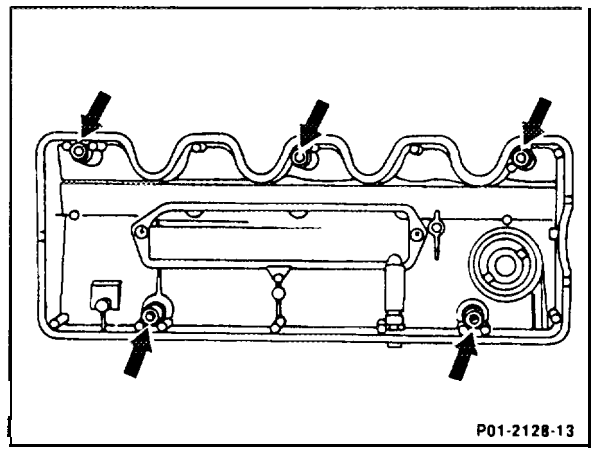
In addition, the ignition cables and the vent line at the face end of the cylinder head cover run through a plastic holder (arrow).



On the inside, the oil separator (109) and the related outlet pipe are fixed in place with the hose piece (arrow) of the crankcase ventilation (function description 01-140).



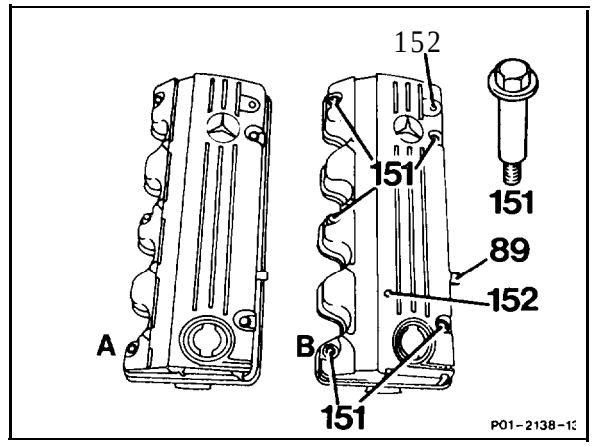
The spacer sleeves (arrows) prevent the gasket being squeezed when tightened.



In January 1986 a cylinder head cover made of plastic was fitted (on engines without pressure oil pump for level control).

Distinguishing features:

- Collar bolt (151)
- Hose connection for crankcase ventilation with larger OD.

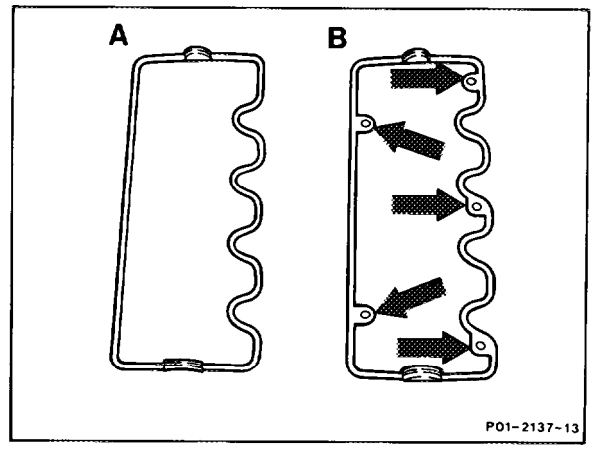


A Cylinder head cover (magnesium)
B Plastic cylinder head cover

The cylinder head gasket has wider plates (arrows) for sealing the bolt guides.

Caution!

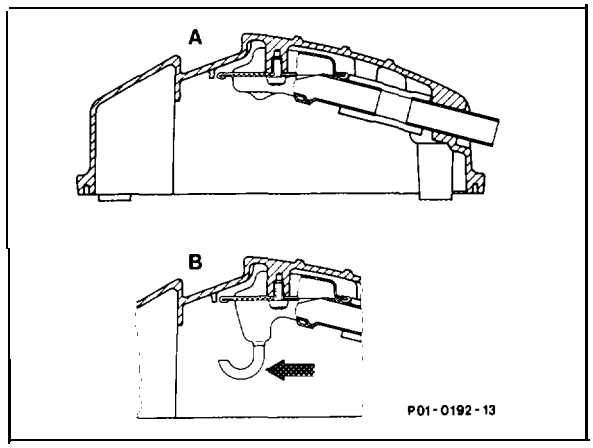
If the cylinder head cover has to be replaced, e. g. because of cracking, install the previous magnesium cylinder head cover.



Model affected

Model	Vehicle Ident End No.	
	from	to
201.024	A 277147 F 159163	280307 192314

As of February/March 1985 the oil separator is installed in the cylinder head cover with a vent pipe.



A 1 st version
B 2nd version

Standard implementation: 02/85

On models with level control

Model	Engine	Engine End No.		Chassis End No.
		Manual transmission	Automatic transmission	
201.024 (USA)	102.985	001321	011371	A 198009 / F 084320

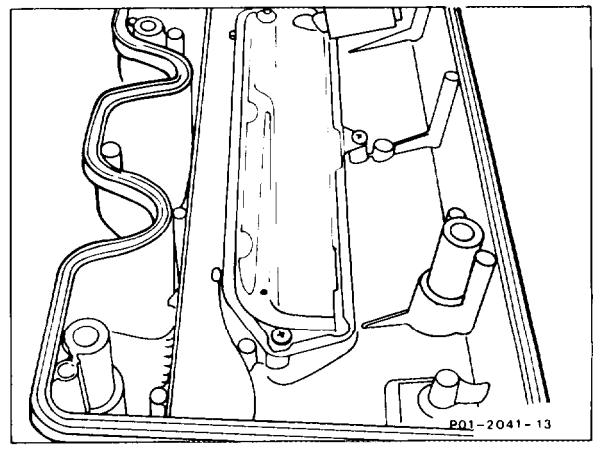
Standard implementation: 03/815

Model	Engine	Engine End No.		Chassis End No.
		Manual transmission	Automatic transmission	
201.024 (USA)	102.985	001460	012597	

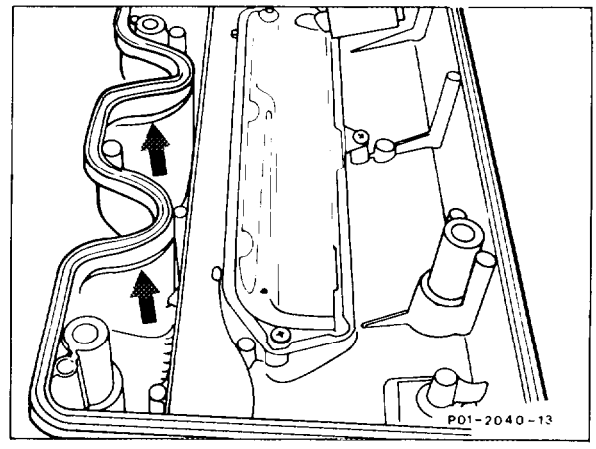
Since 12/88 **a** cylinder head cover has been installed which has a recessed wall (arrows) in the area of the spark plug recesses.

This prevents the valve spring or the valve spring plate rubbing the cylinder head cover and causing noises.

The modified cylinder head cover can also be installed on previous engines in the event of complaints.



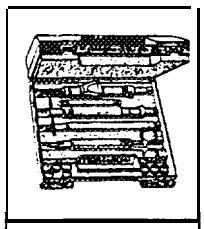
Cylinder head cover **1st** version



Cylinder head cover 2nd version

01-407 Reconditioning spark plug thread In cylinder head

Special tool

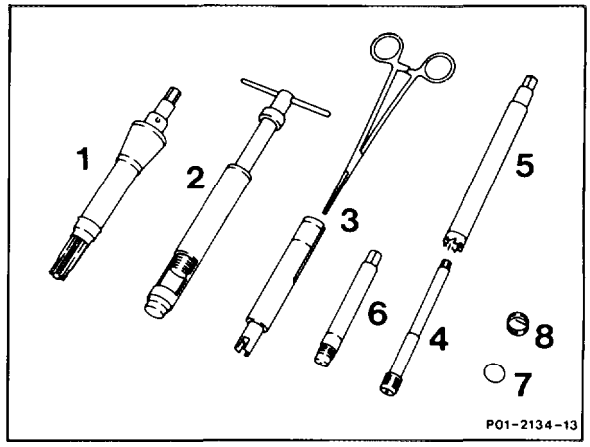


102 589 00 99 00

Note

The spark plug threads in the cylinder head can be reconditioned on all gasoline engines with the HELI-COIL repair set.

The cylinder head should only be removed for reconditioning the spark plug thread if the spark plug bore in question is not accessible for the tool.

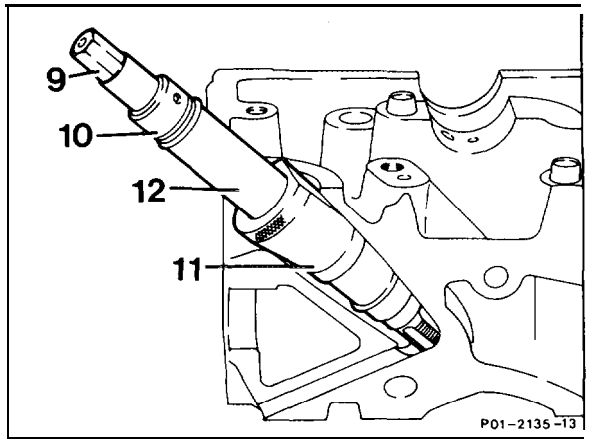


Recondltionina

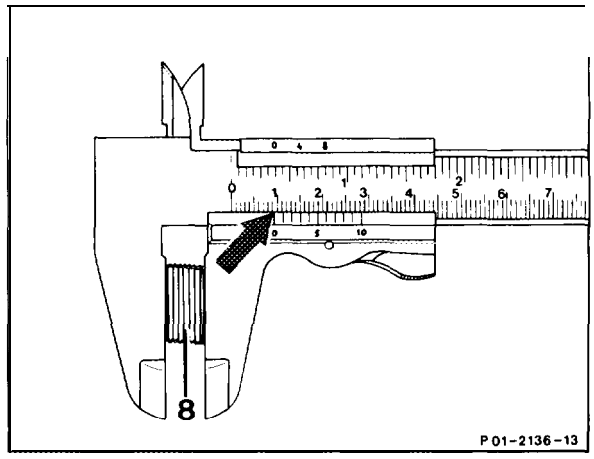
1 Set piston at the cylinder in question to 20° – 30° before TDC.

2 Pack grooves of the combination tap (9) of the tapping unit (1, ill. note) with grease and screw combination tap into the damaged thread. At the same time, press the guide bush (11) into the spark plug recess. Screw in combination tap far enough for the guide tube (12) to move up and be touching the stop ring (10).

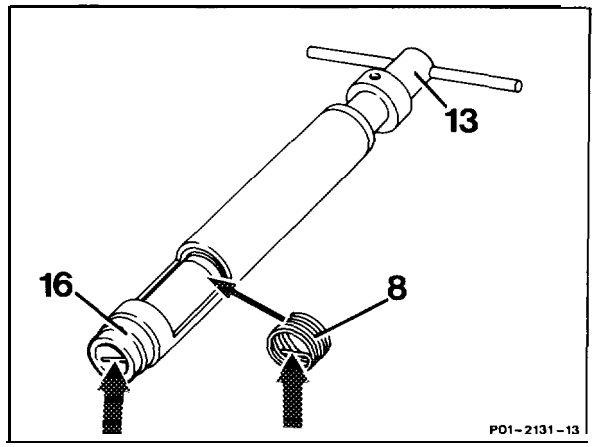
Caution!
If the cylinder head is installed, unbolt combination tap after approx. each five turns, clean grooves of swarf and grease and again pack with grease.



3 Check length of the HELI-COIL thread insert (8).
Use only the HELI-COIL inset-t with 9.1 mm block length.



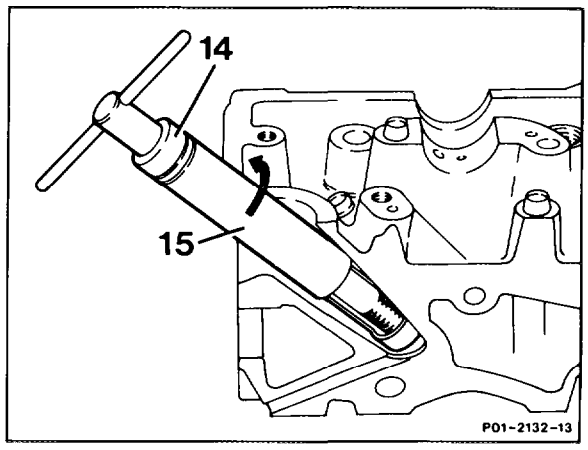
4 Install HELI-COIL thread insert. To perform this step, insert HELI-COIL insert (8) into the tool (2, ill. note) so that the bar (arrow) of the insert is facing the preload cartridge (16).
Turn HELI-COIL insert with the turning spindle (13) far enough through the preload cartridge until the bar (arrow) is flush with the face of the preload cartridge.



Install installation tool onto the tapped hole, hold jacket sleeve (15) tight and turn spindle for long enough until the stop ring (14) is touching the jacket sleeve.

Note

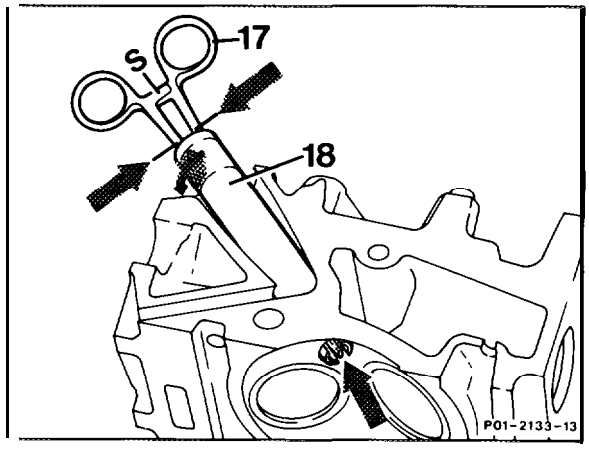
When installing the HELI-COIL thread insert, turn back jacket sleeve slightly (15) if it is jamming.



5 Break off bar (arrow) of the HELI-COIL thread insert.

This is done by installing the sleeve (18) of the bar breaking unit (3, ill. note) over the bar, introducing the opened pliers (17) as far as the mark (arrow) into the sleeve and closing pliers. The serrated tooth lock (s) must engage.

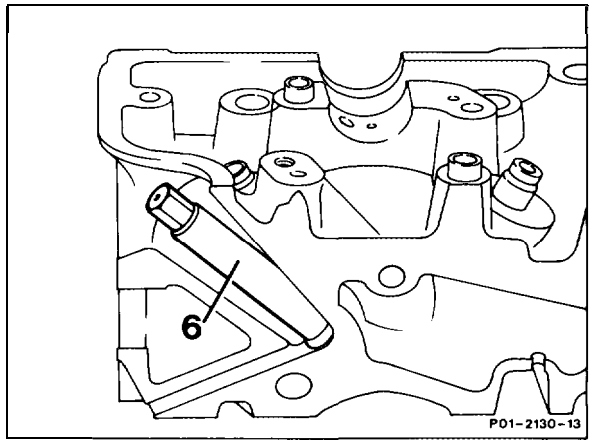
Turn sleeve to the left as far as the stop and hold tight. Move pliers slightly up and down and break off bar.



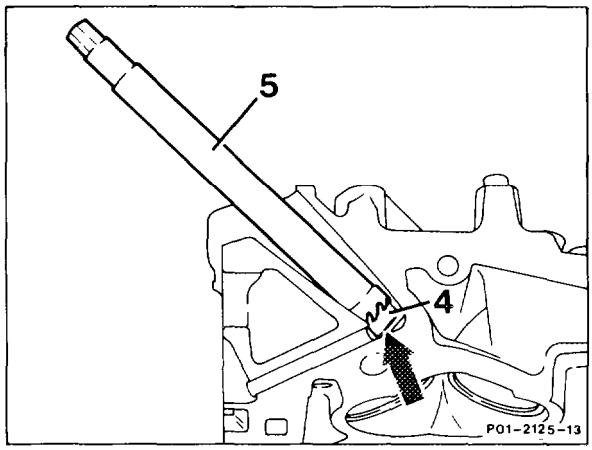
Caution!

It is essential to remove a bar which may have dropped on the piston crown with a magnet.

6 Caulk HELI-COIL thread insert. This is done by greasing the conical thread of the caulking tool (6), screwing caulking tool into the fitted HELI-COIL insert, tightening to 25 Nm and removing the caulking tool.



7 Mill mounting seat for the copper seal (7). This is done by screwing in the guide mandrel (4) far enough for the stop collar (arrow) to be touching the tapped hole.
Push milling cutter (5) over guide mandrel and mill the seat for the sealing ring. Always blow out the chips from time to time.
Once the milling cutter is seated on the stop collar of the guide mandrel, the required milling depth is reached (no further cutting resistance).



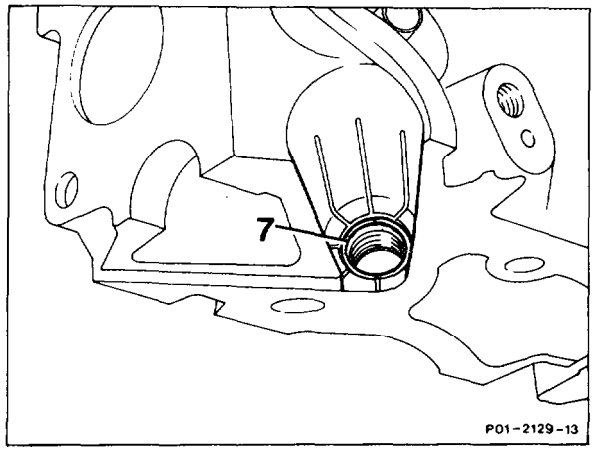
Once again thoroughly blow out spark plug recess before then removing the guide mandrel. Turn crankshaft several times with starter motor and contact handle in order to remove any chips which may have dropped onto the piston crown.

8 Place copper seal (7) into the milled mounting seat, screw in spark plug and tighten to 30 Nm.

Note

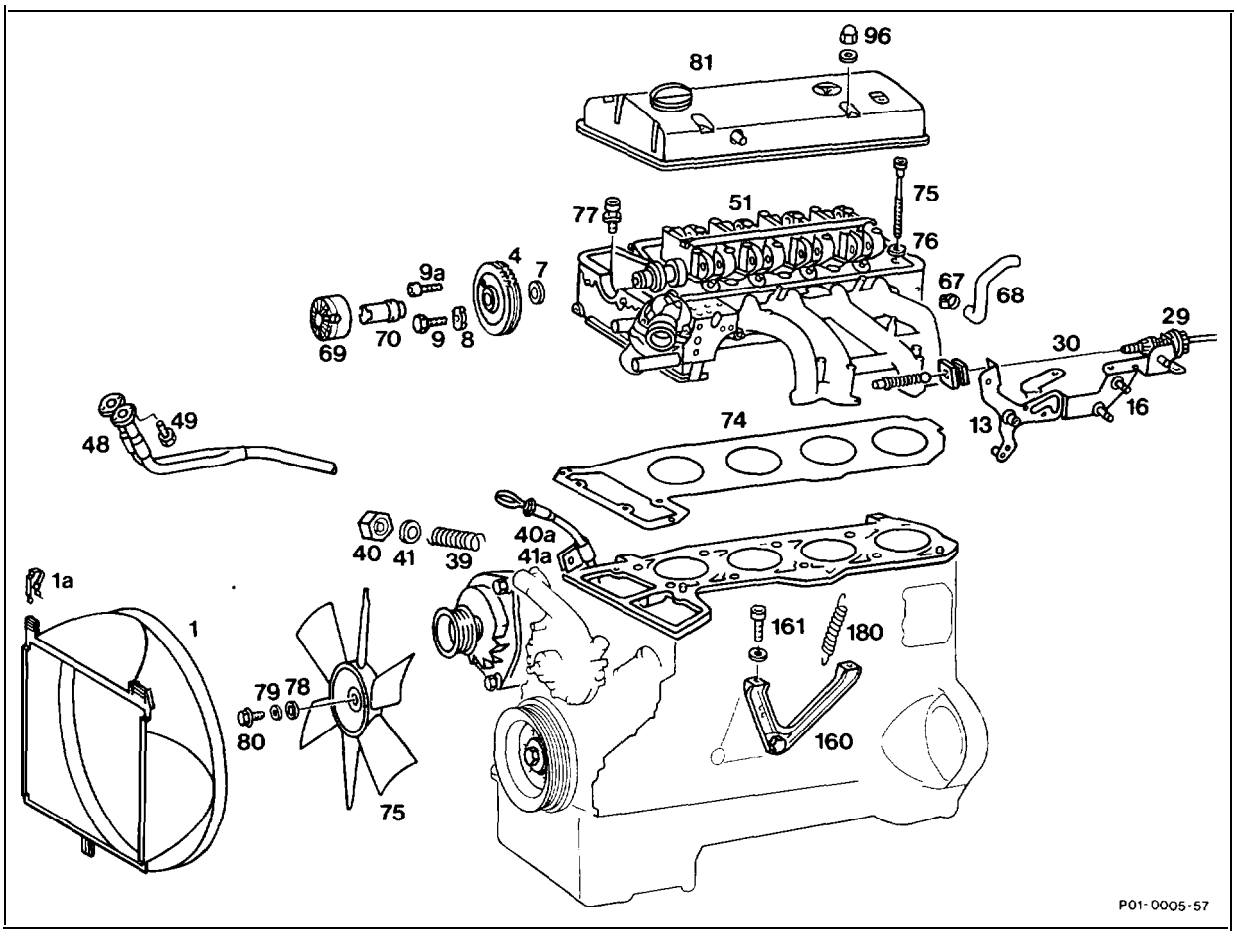
When performing this step, the tapered seat of the spark plug is pressed into the copper seal.

9 Loosen spark plug fully and tighten to 15 Nm.



01-415 Removal and installation of cylinder head

Preceding work:
Removal of air filter (09-400).
Draining engine coolant (20-010).
Removal of guide rail in cylinder head (05-340).
Removing poly V-belt (13-342).



Fan shroud (1) and fan (75)	remove, install, 25 Nm (steps 1 and 2).
Cylinder head cover (81)	remove, install, with ignition cable and distributor cover (01-406).
Exhaust pipes (48)	unbolt at exhaust manifold, bolt on, 25 Nm (step 4).
Dipstick guide tube (40a)	unbolt, bolt on (step 5).
Bowden cable (30)	detach, attach, adjust (30-325, step 6).
Intake manifold strut (160) and return spring (180)	at intake manifold, unbolt, bolt on, return spring, detach, attach (steps 7 and 8).

Engine coolant hose (68) supply line for heater	disconnect, connect (step 9).
Engine wiring harness	disconnect, connect (steps 10 to 14).
Brake booster vacuum line	disconnect, connect (step 15).
Fuel lines	disconnect, connect, dump overpressure (step 16).
Air conditioning pipe group holder	disconnect, connect (step 17).
Piston of No. 1 cylinder	set to ignition TDC (step 18).
Alternator	swing away to the outside (steps 19 and 20).
Closing nut (40)	for chain tensioner, remove and install, replace sealing ring (41) (05310, step 21).
Camshaft gear (4)	mark relative to timing chain (step 22).
Pressure oil pump (69)	unbolt, bolt on, place to the side with lines connected (step 23).
Camshaft gear (4)	unbolt, bolt on, 80 Nm, check TDC marking (steps 24 and 25).
Hexagon socket bolts (77)	unbolt, bolt on with pin wrench 116 589 03 07 00, 25 Nm (reference value), (step 26).
Cylinder head bolts (75)	unbolt, bolt in, check, tighten (steps 27, 31 to 33). Refer to table for tightening torques.
Cylinder head (51)	remove, refit, clean mating surfaces, replace cylinder head gasket (74) (steps 28 to 30).

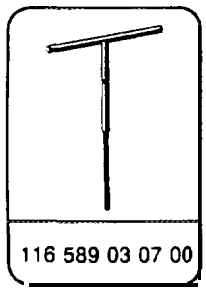
Tightening torques in Nm and angle of rotation torque

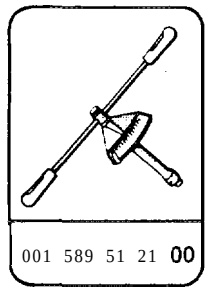
Diagram for step-by-step tightening: refer to step 31 for order:

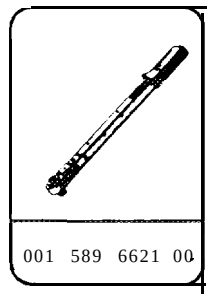
Step-by-step tightening **angle of rotatlon torque** when engine cold

	1st stage	2nd stage	3rd stage
M12 cylinder head bolts	55 Nm	90°	90°
Hexagon socket bolts	25 Nm (reference value)	–	

Special tools


116 589 03 07 00


001 589 51 21 00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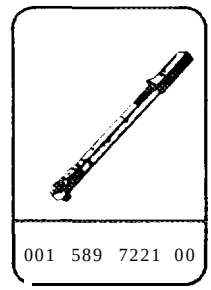
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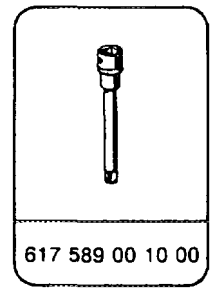

617 589 00 10 00

Note

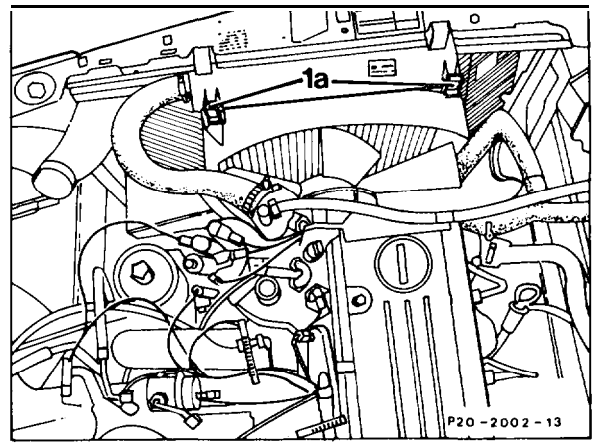
Remove cylinder head together with camshaft, intake manifold and exhaust manifold once engine has cooled down.

Removal and installation

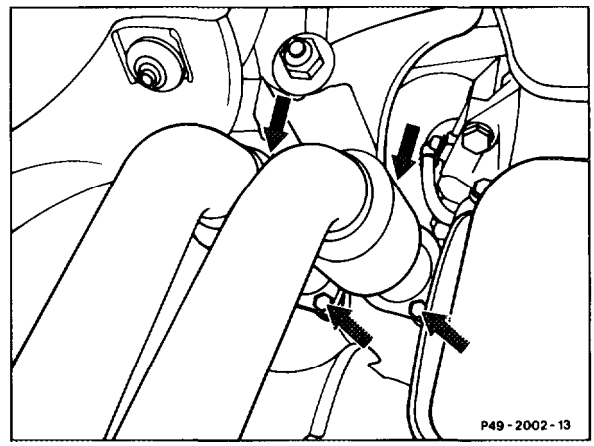
1 Detach fan shroud (1) and place over fan. When installing, ensure clearance to fan.

2 Unbolt fan (75), remove together with fan shroud, bolt on.

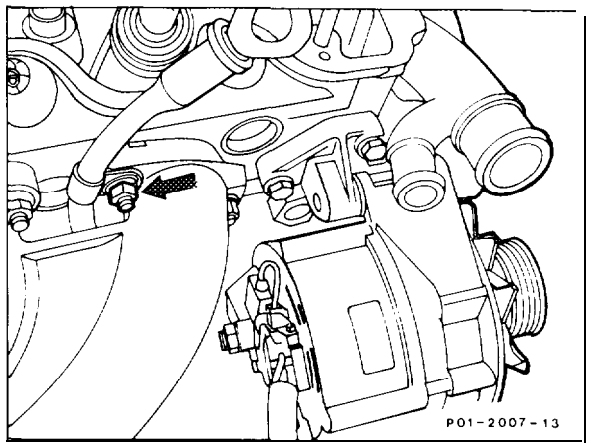
3 Remove cylinder head cover together with spark plug connector and distributor cover (01-406).



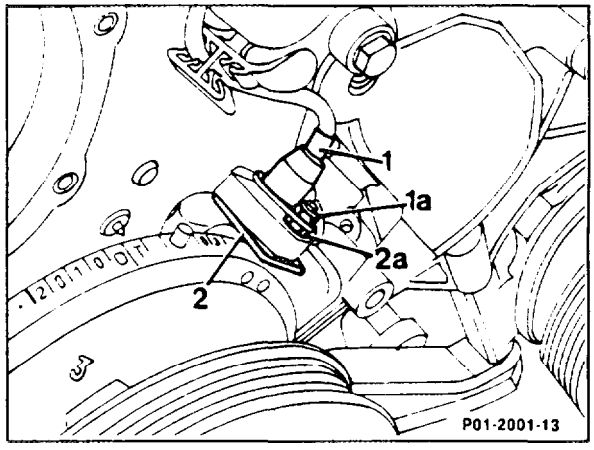
4 Unbolt exhaust pipes at exhaust manifold, bolt on.



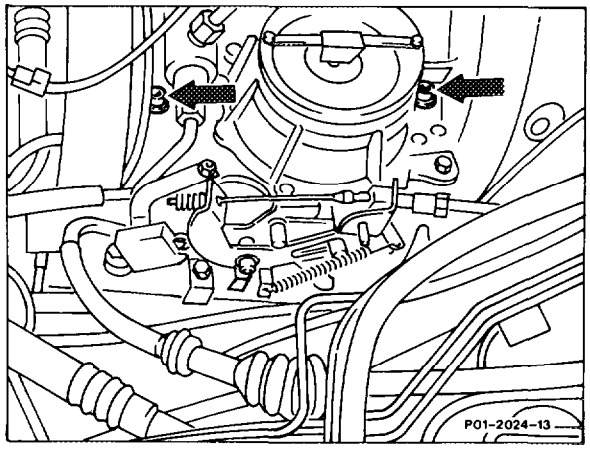
5 Unscrew dipstick guide tube at exhaust manifold, screw in (arrow).



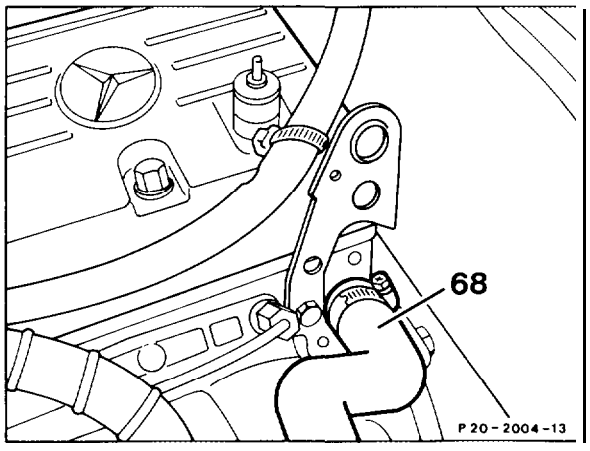
6 Detach Bowden cable (30) for accelerator control, attach, press plastic guide (arrow) out of its seat in the fulcrum lever (13) to perform this step, and take Bowden cable (30) out of the slot in the fulcrum lever.
Compress plastic clip (28) and push clip together with Bowden cable to the rear through the holder (16).
Adjust Bowden cable (30) (30-325).



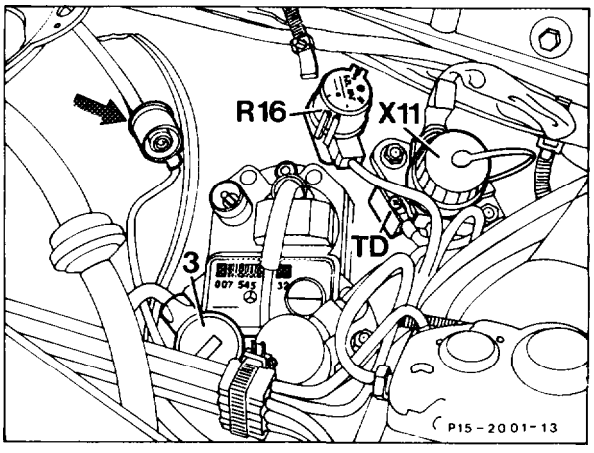
7 Unbolt strut at intake manifold. To perform this step, unbolt 2 hexagon socket bolts (arrows) on injection engine, bolt on.
Detach return spring for throttle body assembly (below intake manifold), attach.



8 Detach coolant hose (68) of supply line for heater, attach.



9 Detach connector pickup of control cable (arrow) and 4-pin connector pickup (3) at ignition control module, plug in.



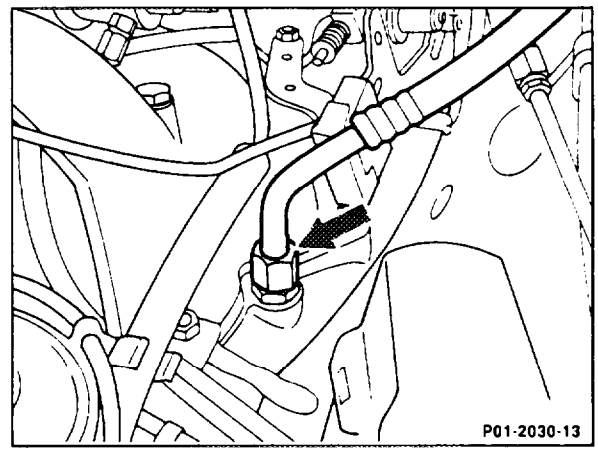
10 Detach cable from reference resistor (R16) (Model 201 only).

11 Unbolt terminal TD at the diagnostic connector (Xl 1), bolt on.

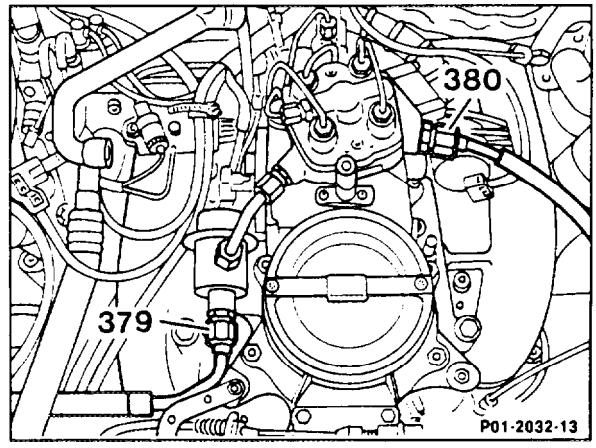
12 Unbolt diagnostic connector (Xl 1), unplug grey cable from the TDC pulse generator at the rear of the diagnostic connector, plug in.

13 Unplug all connectors and vacuum lines at thermo valves and temperature switches, plug in.

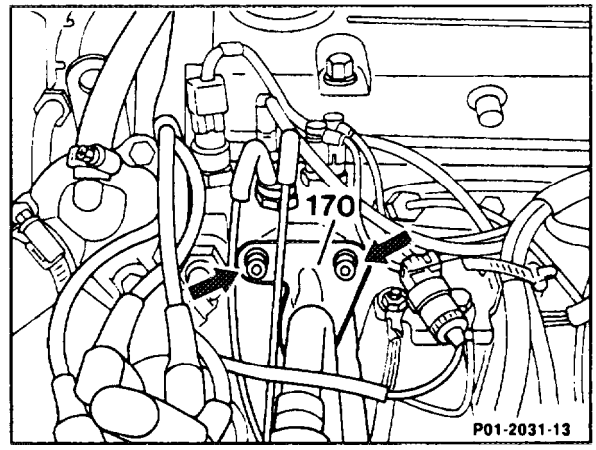
14 Disconnect vacuum line for brake booster, connect (arrow).



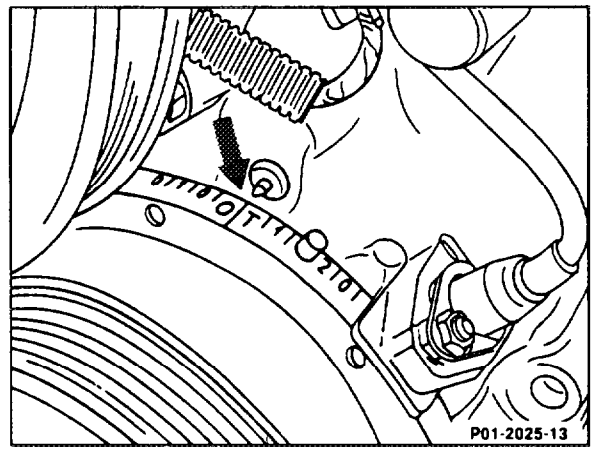
15 Lower fuel pressure in the fuel lines by briefly opening fuel filler cap.
Unbolt fuel lines (379, 380), bolt on. When detaching the fuel line (380), hold connection to prevent it from turning.



16 On models equipped with air conditioning, unbolt bracket for pipe group (170) of A/C compressor at cylinder head, bolt on.

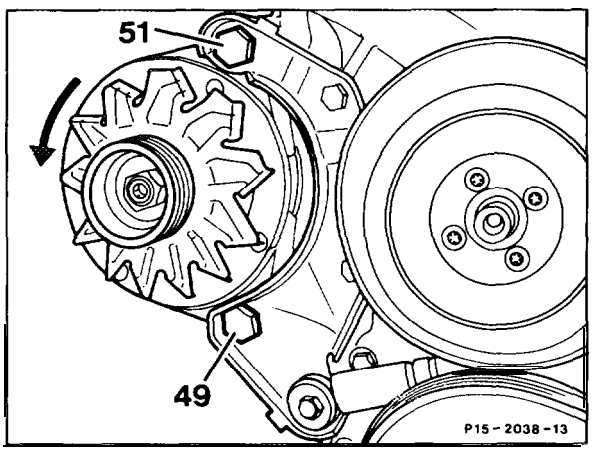


17 Set engine to ignition TDC of No. 1 cylinder.

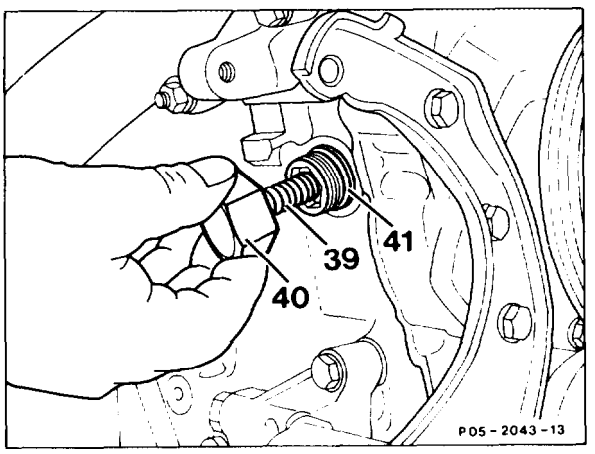


18 Loosen bottom bolt (49) for alternator fixture, tighten.

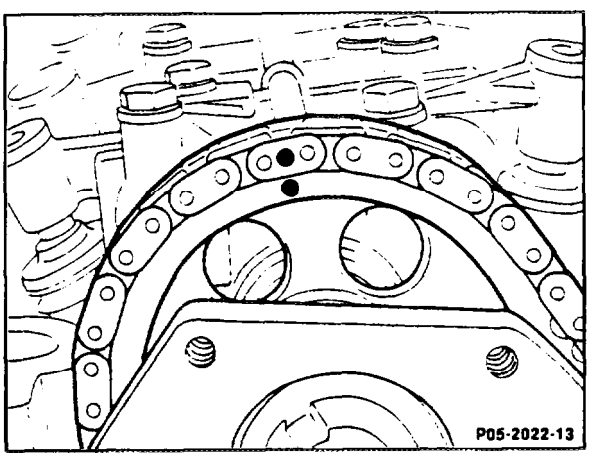
19 Remove top bolt (51), swivel alternator out of the way to the outside (arrow).



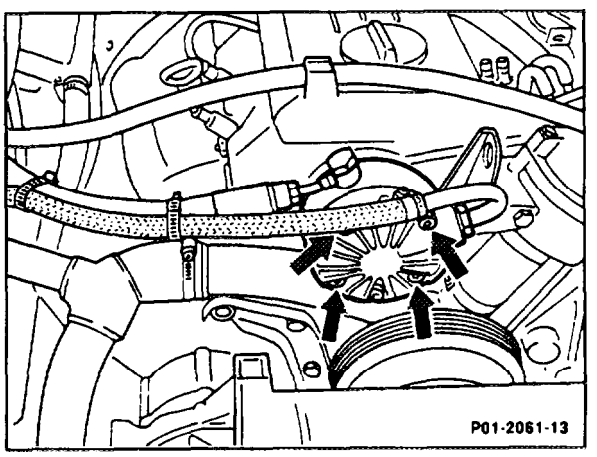
20 Unscrew locking nut (40) of the chain tensioner, bolt on. Replace seal (41). Tightening torque 70 Nm.



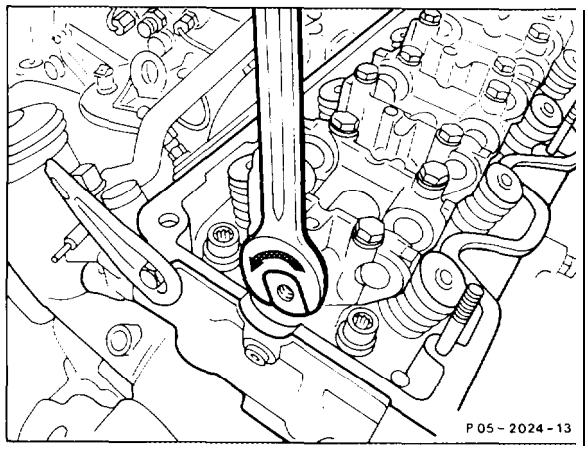
21 Mark camshaft gear and timing chain relative to each other.



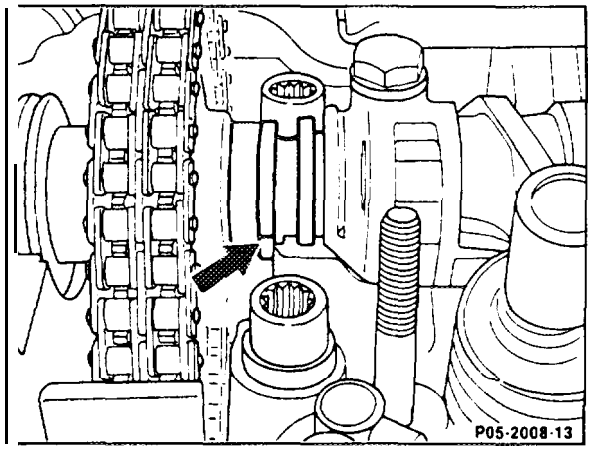
22 Unbolt pressure oil pump, place to the side with lines connected, bolt on (arrows).



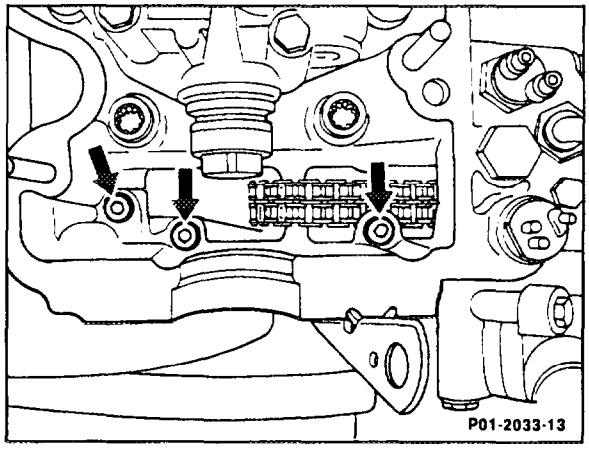
23 Unbolt camshaft gear, remove and bolt on. Place timing chain in chain box. Tightening torque 80 Nm.
Hold camshaft gear tight with an open-end wrench (waf 24 mm) for loosening or tightening the camshaft bolt.



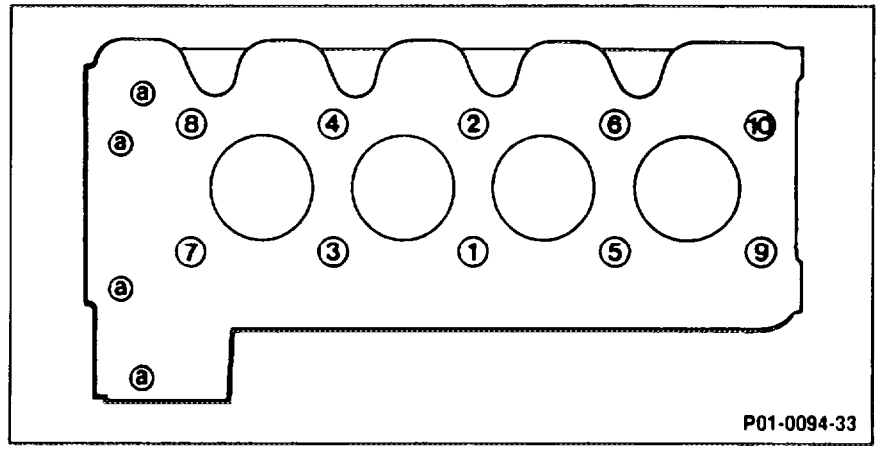
24 Check setting marking on camshaft (arrow).



25 Unscrew hexagon socket bolts (arrows) with the pin wrench 116 589 03 07 00, screw on. Tightening torque 25 Nm (reference value).



26 Remove cylinder head bolts in stages in the reverse order of the tightening diagram with the torque wrench insert 617 589 00 10 00 with engine cold.



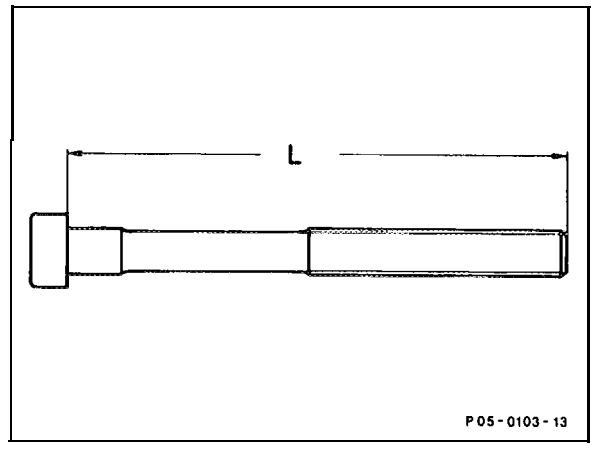
27 Remove cylinder head (51).

28 Clean mating faces on cylinder head and crankcase.

29 Replace cylinder head gasket.

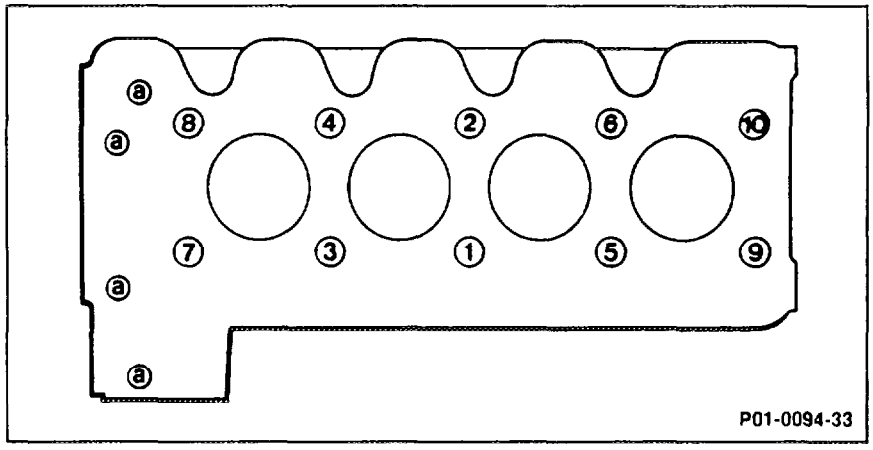
30 Check the shaft length of the cylinder head bolts.
If the maximum length (L) of 122 mm is exceeded, the bolts should be replaced with new ones.

31 Oil thread and head contact face of cylinder head bolts and insert.



32 Tighten cylinder head bolts in stages in the order of the tightening diagram, beginning with 1.

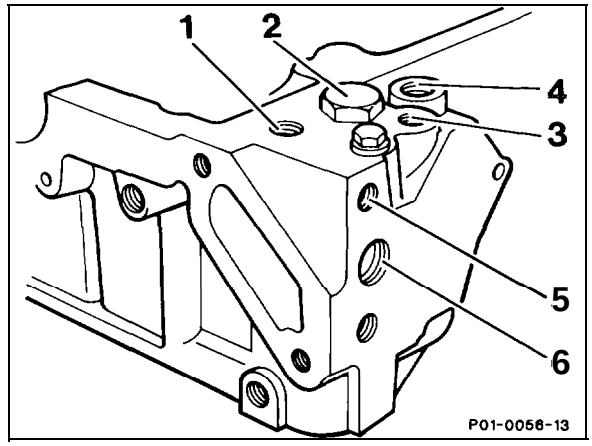
1st tightening stage 55 Nm
2nd tightening stage 90° angle of rotation
3rd tightening stage 90” angle of rotation
Hexagon socket bolts (a), 25 Nm.



33 Check for leaks with engine running.

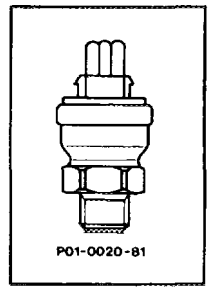
01-416 Matching measuring sensors to cylinder head

Note
Different temperature switches, thermo-time switches or thermovalves are installed in the measuring sensor box on the cylinder head depending on the engine version.

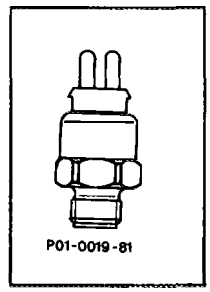


Items on cylinder head

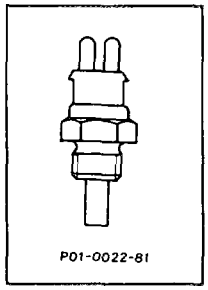
Item 1
Temperature switch for magnetic fan coupling and 2nd stage auxiliary fan red 100 °C.



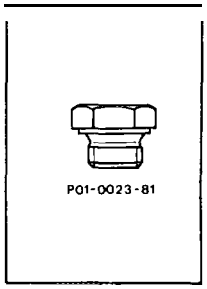
Temperature switch for magnetic fan coupling red 100 °C.



Item 2
Temperature sensor for A/C compressor blue.

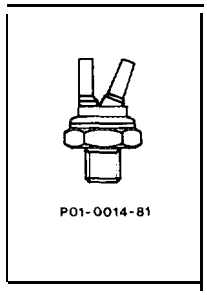


Item 2 **and 5**
Screw plug Ml4 x 1.5

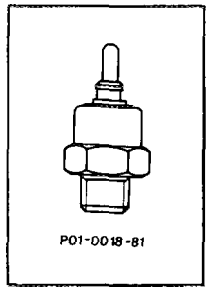


Item 3
Thermovalve for:

Ignition switchover	white	60 °C
Purge	red	50 °C
	black	40 °C

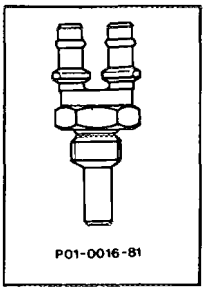


Item 4
Temperature switch for intake manifold heater black 110 °C.

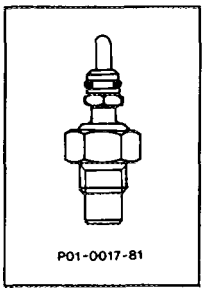


Temperature sensor for:

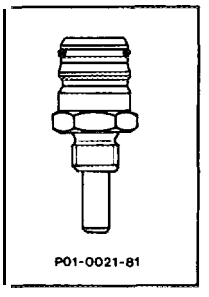
CFI control	black
Ignition control and CFI control module	green



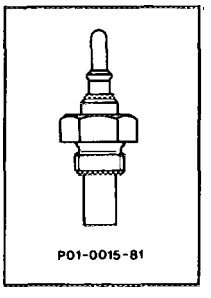
Temperature sensor for CFI injection system black.



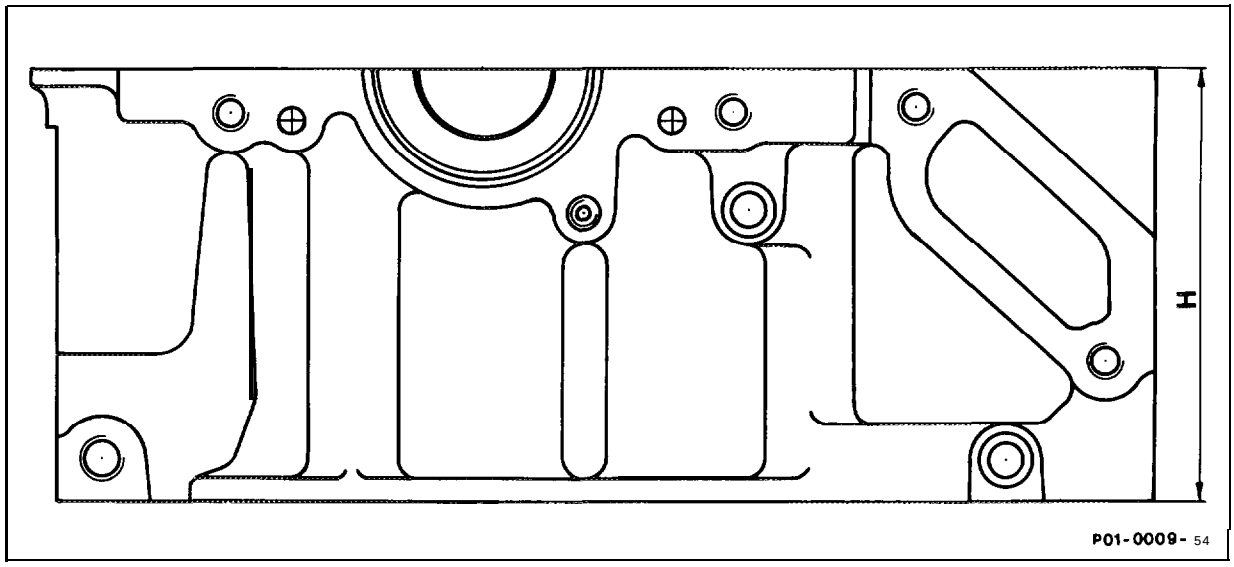
Double temperature sensor for ON board, CFI control and ignition control black.



Item 6
Temperature sensor for instrument cluster.



01-418 Facing cylinder head mating face



Data

Total height "H" of cylinder head		98.4 – 98.5
Minimum height after machining		97.8
Permissible variation of evenness of mating face	in longitudinal direction	0.15
	in transverse direction	0.05
Permissible variation of parallelism of top to bottom mating face in longitudinal direction		0.1
Peak-to-valley height		0.003 – 0.010
Test pressure with air under water in bar gauge pressure		2

Valve clearance to cylinder head mating face

Engines		102.961 (USA) as of 1984
Minimum clearance “A” with new valve seats and valves	Inlet (172)	1.2
	Exhaust (173)	0.5
Maximum clearance “A” with machined valve seats and reground valves	Inlet (172)	2.1
	Exhaust (173)	1.4

Commercial tools

Surface grinding machine with milling device for light alloy surfaces.	e. g. Sceledum, Type RTY Messrs. Roaro u. Fi. Schioiltaly
Knife-edge straightedge approx. 500 mm long	e. g. Messrs. Roaro u. Fi. Schioiltaly

Note
Only machine cylinder head mating face if there are porous or damaged areas.

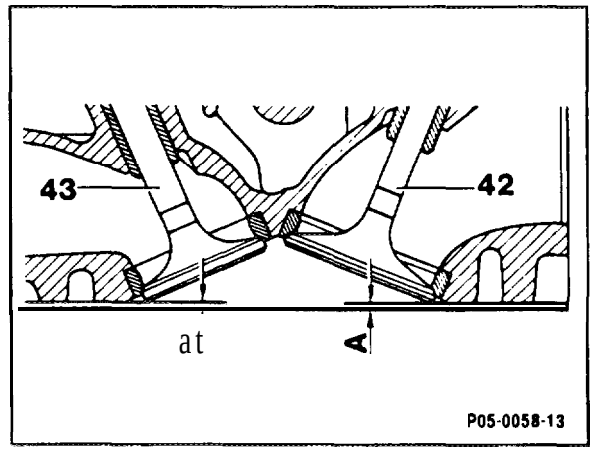
Caution!
Clamp cylinder head absolutely flat for facing. Failure to observe this instruction may result in the camshaft jamming when the cylinder head is reinstalled. In this case, the cylinder head must be replaced.

Facing

1 Face cylinder head mating face.

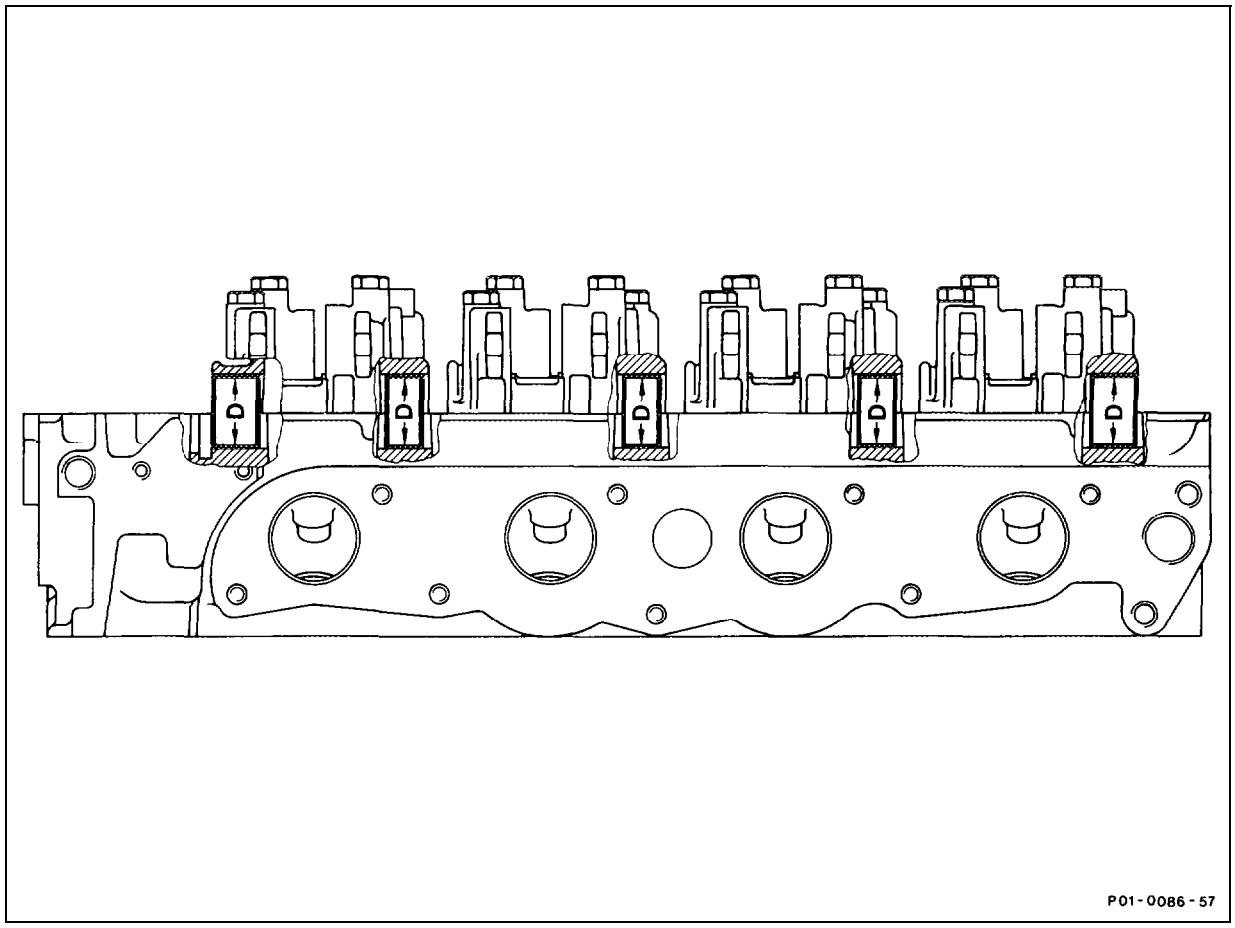
2 Remachine valve seats far enough for the minimum distance “A” to be achieved (05-291).

3 Check timing (05-215).



01-419 Enlarging camshaft bearing bores (repalr size)

Preceding work:
Removal and installation of cylinder head (01-415).
Removal and installation of camshaft (05-220).
Disassembling cylinder head.



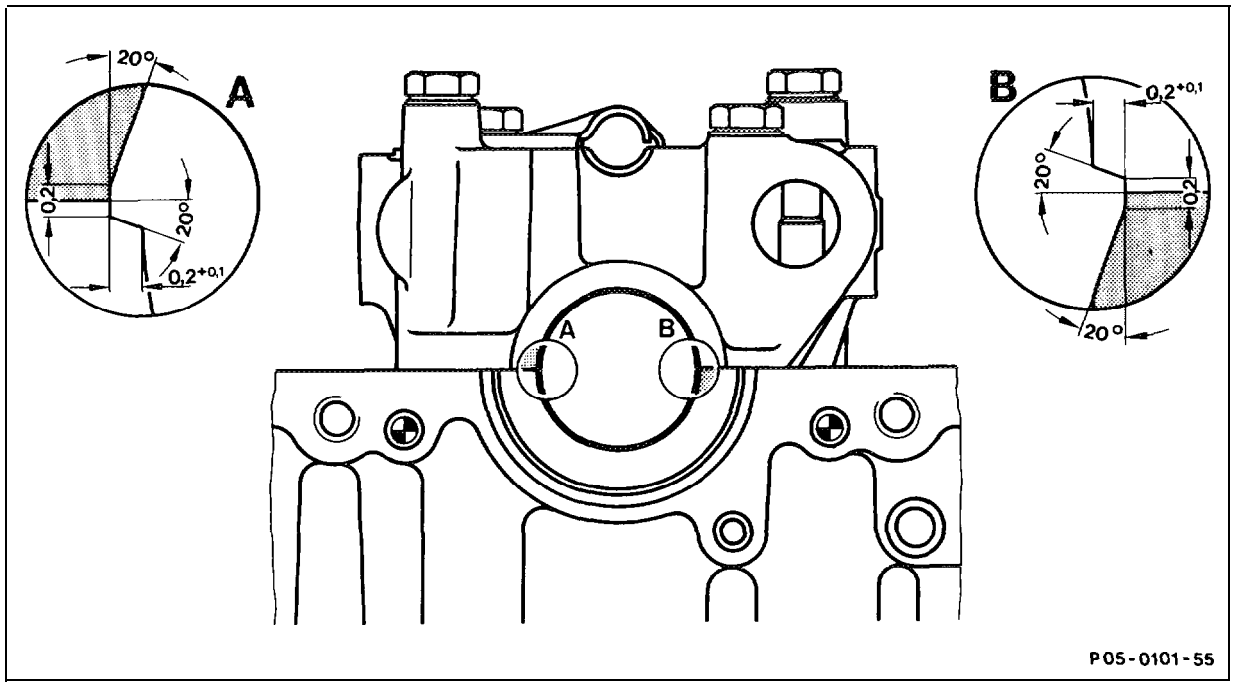
P01-0086-57

Camshaft bearing data

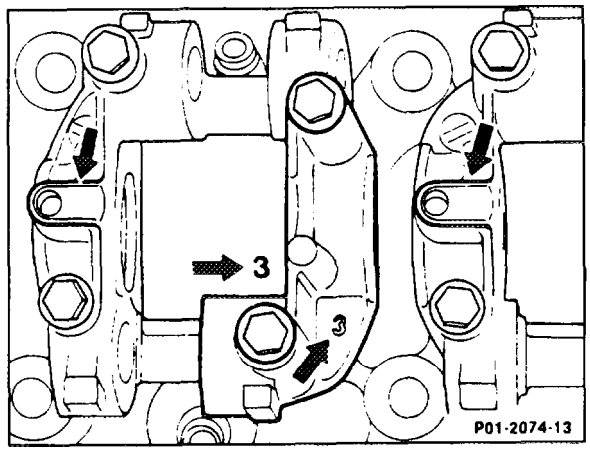
Normal size	Camshaft bearing dia. D	32.000 32.025
	Journal dia. D1	31.934 31.950
Repair size	Camshaft bearing dia. D	32.500 32.525
	Journal dia. D1	32.434 32.450
Camshaft bearing bores	Peak-to-valley height	0.003 – 0.006
	Permissible variation from cylindrical shape	0.012

		When new	Wear limit
Bearing play	radial	0.050 – 0.091	0.11
	axial	0.07 – 0.15	0.18

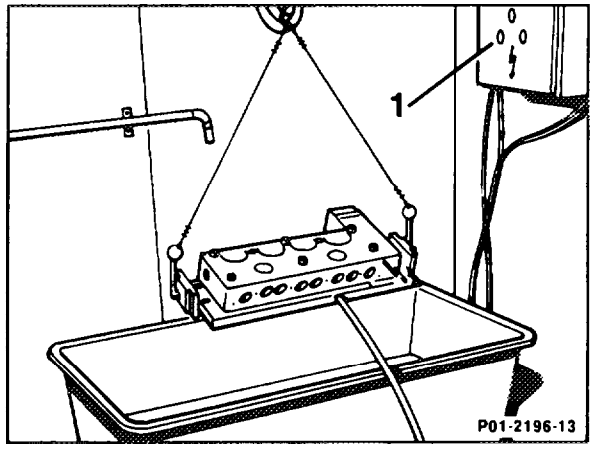
Note
If bearing seizure or severe scoring is present, the camshaft bearings in the cylinder head can be enlarged by 0.5 mm and camshafts with oversize bearing journals installed.
These camshafts have different code numbers (05-215 and 220).
If the rocker arm bearing brackets are equipped for enlarging without the rocker arm shafts, the fastening bolts of the bearing brackets must be tightened to max. 15 Nm otherwise the bores for the rocker arm shafts will be distorted. When machining the basic bores, ensure that the half-bores for mounting the cylinder head cover gasket or the sealing disc at front and rear on the cylinder head are not widened. After widening the basic bores, the edges at the mating face of the cylinder head bracket (A) or at the mating face of the cylinder head (B) on the camshaft bearings 1 to 4 must be machined in accordance with the specified dimensions. If the edges are not machined, the lubrication film will tear at these points, causing damage (seizure) to the camshaft bearings.



The bearing brackets differ. Each bearing bracket has a number stamped to identify it. This number must agree with the number stamped on the cylinder head (arrows). If correctly installed, the contact faces for the oil pump are facing to the rear and the code numbers are on the righthand side (direction of travel) (arrows).

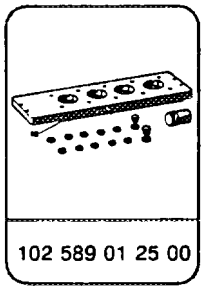


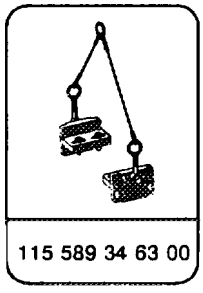
01-420 Pressure-testing cylinder head



Pressure-testing plate	bolt onto cleaned cylinder head.
Bores and connections	plug.
Compressed air hose	connect and adjust compressed air to 2 bar gauge pressure.
Cylinder head	Attach to suspension device and immerse into the heated water (approx. 80 “C). If air bubbles rise up, determine leak point and mark.

Special tools


102 589 01 25 00


115 589 34 63 00

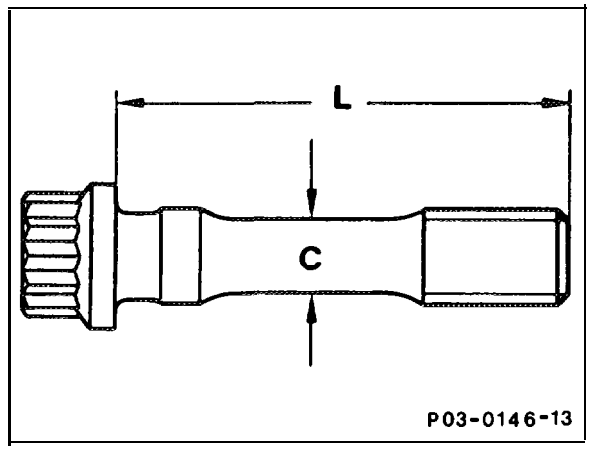
Commercial tool

Electrically heated water bath	e. g. Messrs. Otto Dürr D-71 23 Sachsenheim-Ochsenbach

Job No.

Checking, replacing and torquing conrod bolts . . . . . 03 – 310
Reconditioning and checking angles on bearing bores 03-313
Removal and installation of pistons . . . . . -316
Checking and reconditioning crankshaft . . . . . -318
Installation of crankshaft bearings . . . . . – 320
Replacing front crankshaft radial seal . . . . . – 324
Replacing rear crankshaft radial seal . . . . . – 327
Removal and installation of grooved ball bearing in crankshaft . . . . . – 330
Removal and installation of vibration damper . . . . . – 342
Checking and correcting setting of TDC pulse generator . . . . . – 345
Removal and installation of crankshaft gear . . . . . – 350
Removal and installation of flywheel or flex plate . . . . . -410
Remachining flywheel . . . . . – 420
Replacing ring gear on flywheel . . . . . – 430

03-310 Checking, replacing and torquing conrod bolts



Conrod bolts ..... before reuse, measure the smallest bolt shaft dia. If the dia. reaches or is less than the minimum shaft dia. of 7.1 mm, replace the conrod bolt.

Thread and bolt head contact surface ..... oil before installing.

Conrod bolt initial and angle of rotation torque ..... initial torque 30 Nm.
Angle of rotation torque 90 – 1 00°,
use special tool 001 589 66 21 00.
Pay **attention** to note.

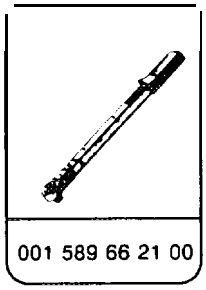
Dimensions of conrod bolts

Part No.	Thread dia.	Stretch shaft dia. when new	Minimum stretch shaft dia. "c"
102 038 00 71	M9 × 1	7.4 – 0.1	7.1

Torque of conrod bolt

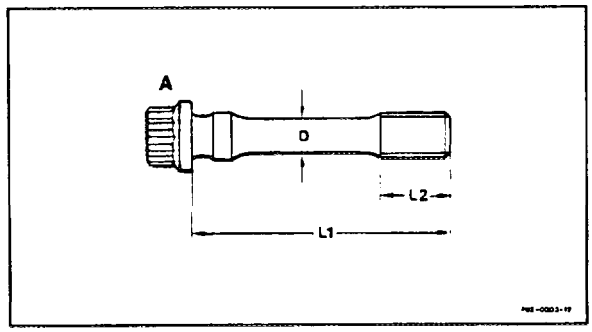
Initial tightening torque	30 Nm
Angle of rotation torque	90" – 100"

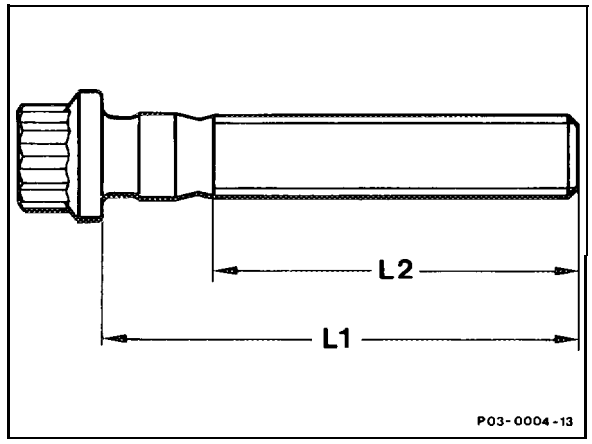
Special tool



Note

In September 1988 conrod bolts with a longer thread were installed.
These conrod bolts are not supplied as replacement parts.



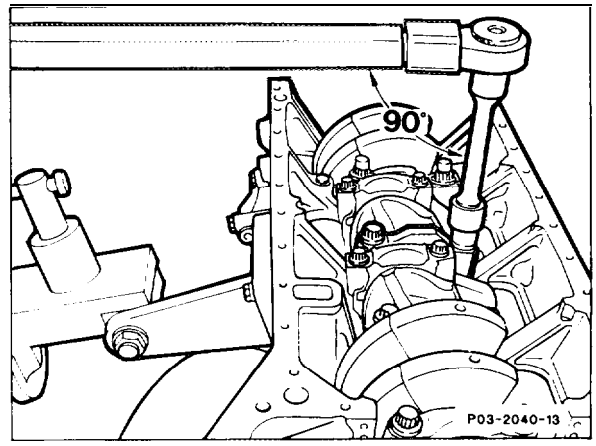


A 1st version
B 2nd **version**

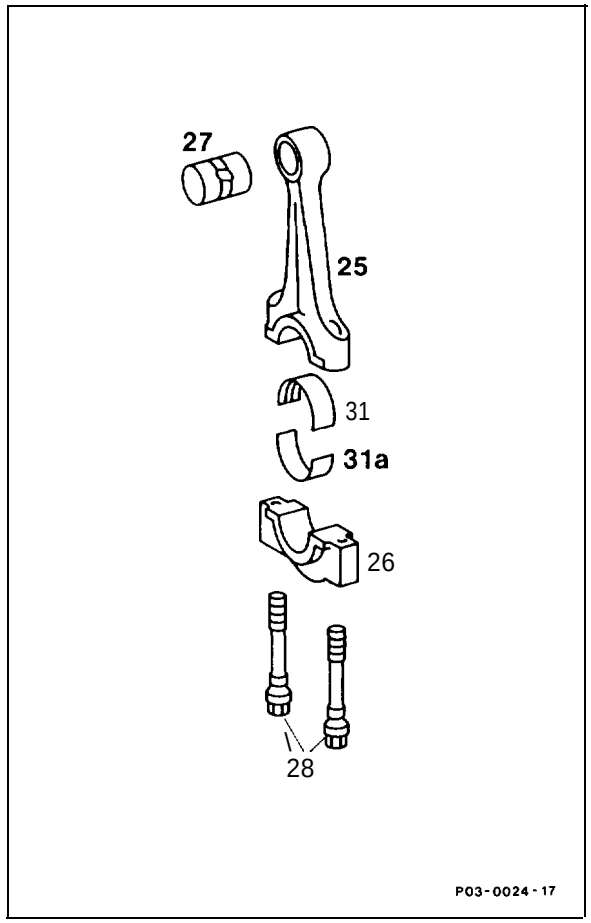
Standard **implementation:** 09/86

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	027063 – 028449	076715 – 077418

If no torque wrench is available, the conrod bolt can be tightened according to the specified torquing angle with a socket wrench in a single operation. To prevent any angular errors, do not use a bending rod torque wrench for tightening according to angle degrees.



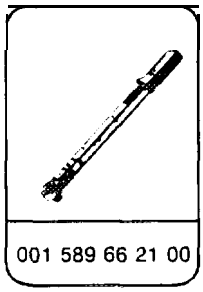
03-313 Reconditlonlng and checking angles of bearing bores



Conrod bolt (28)	check (03-310).
Conrod bearing cover (26)	install without bearing shells (31 and 31a), oil thread and bolt head contact surface, 30 Nm.
Basic bore	measure; if the value of 51.619 mm is exceeded, or if it is conical, dress bearing cover up to max. 0.02 mm (step 3).
Conrod bushing (27)	press in, pay attention to oil holes. Insertion pressure approx. 2500 N. Hollow out conrod bushing by turning or reaming. Dress side contact surfaces on dressing plate (steps 4 to 6).

Conrod (25)	check angles of bearing bores with conrod tester. Align conrod bearing bore to small end bushing bore (steps 7 and 8).
Axial twist	to small end bushing bore, check (step 9).

Special tool



Commercial tool

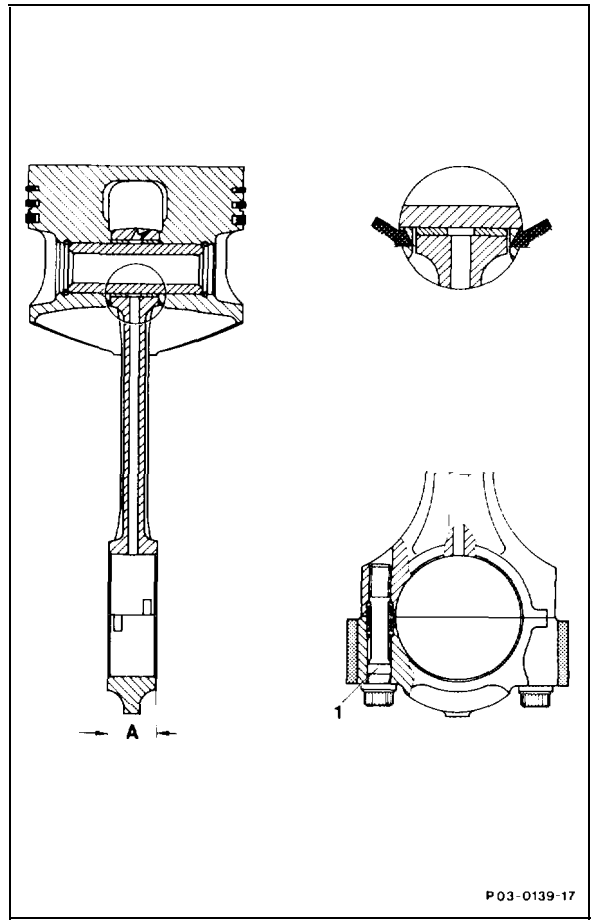
Conrod aligning tool	e. g. Hahn & Kolb D-7000 Stuttgart Model BC 503

Data

Centre of conrod bearing bore to center of small end bushing bore (L, Fig. para 4)	144 95 145.05
Width of conrod at conrod bearing bore and at small end bushing bore (B, Fig. para 4)	22 000 21.948
Basic bore for conrod bearing shells	51 600 51.619
Basic bore for small end bushing (D1, Fig. para 4)	24 521 24.500
Small end bushing OD	24 590 24.550
Small end bushing ID (D2, Fig. para 4)	22.007 22.013
Peak-to-valley height of small end bushing on inside	0.005
Permissible axial twist of conrod bearing bore to small end bushing bore related to 100 mm length	0.1
Permissible variation of axial parallelism: conrod bearing bore to small end bushing bore related to 100 mm length	0.045
Permissible variation of conrod bearing bore from roughness	0.02
Permissible difference in weight of complete conrod within an engine	5 grams

Note

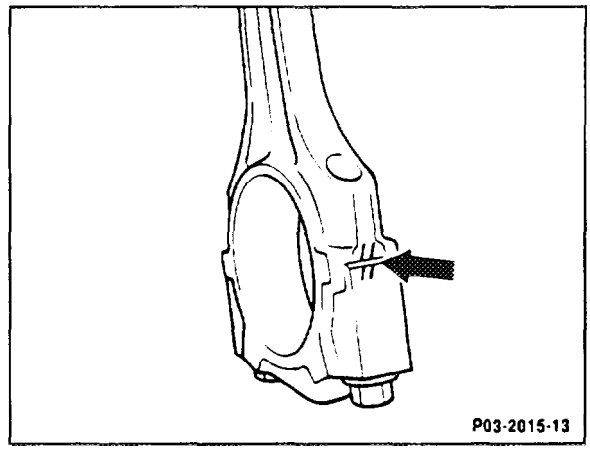
The end play of the conrod is limited not at the crankshaft journals but at the piston pin bosses (piston-guided conrod, arrows).



Conrods which have been overheated as a result of a bearing damage (blue discolouration), must not be reused.

Conrod and conrod bearing cover are marked together. The conrod shaft must not show any cross scoring and notches.

Conrods are supplied as replacement parts with a machined small end bushing.



To reduce the distortion tendency, conrods with a modified material were installed from June through September 1985 and are installed effective February 1987.

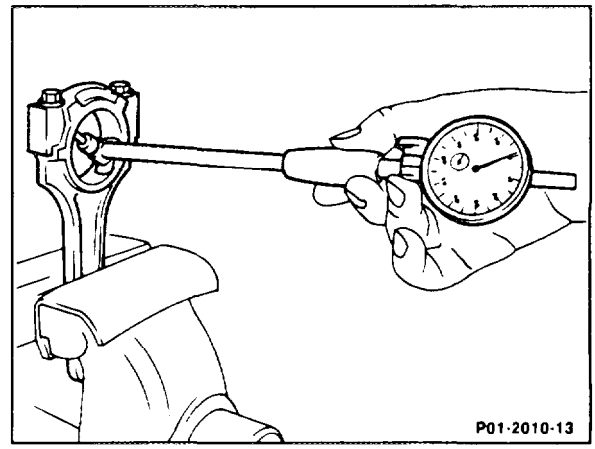
Standard implementation: June through September 1985

Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.024	102.961	–	056261 – 056430		124773 – 135776
201.024 (USA)	102.985	002118 – 002665	018026 – 023402	–	120052 – 153013

* not covered

Effective 09/89 all conrods are subject to additonal heat treatment to prevent conrod distortion resulting in noises when the engine is operating at normal temperature.

Reconditioning



1 Check conrod bolts, replace if necessary (03-310).

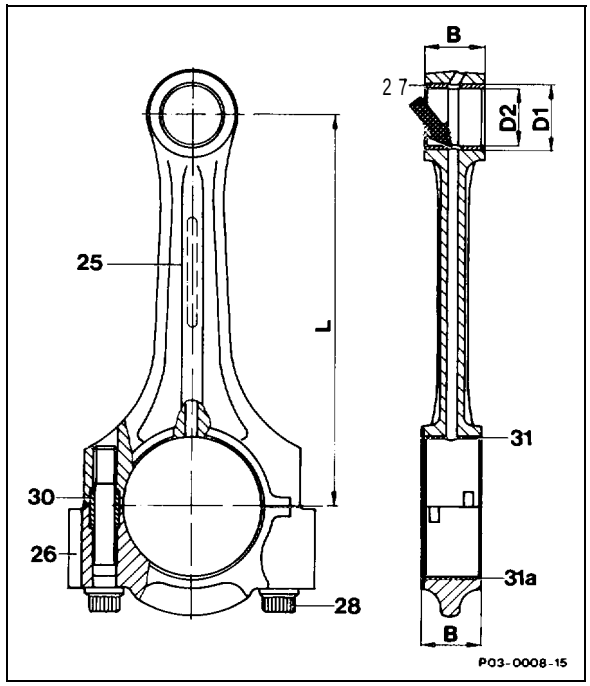
2 Install conrod bearing cover. To perform the step, oil thread and bolt head contact surface and tighten to 30 + 5 Nm.

3 Measure conrod bearing basic bore. If the basic bore exceeds the value of 51.619 mm or is conical, dress contact face of bearing cover on a surface plate to max. 0.02 mm.

4 Press in new small end bushing so that the oil bores are aligned (arrow).
Press-fitting pressure 2500 N.

5 Hollow out small end bushing by turning or reaming.

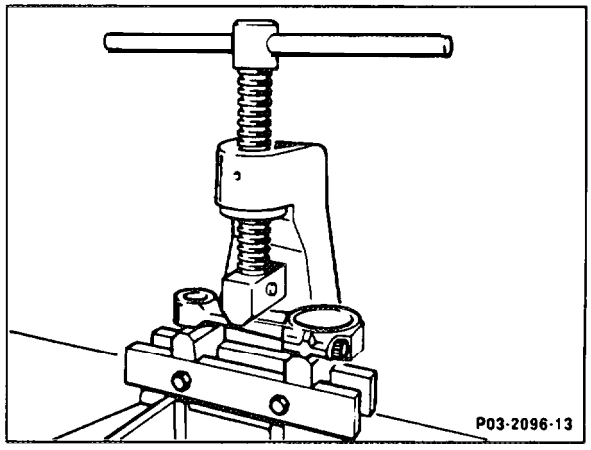
6 Dress side contact faces of conrod on the surface plate.



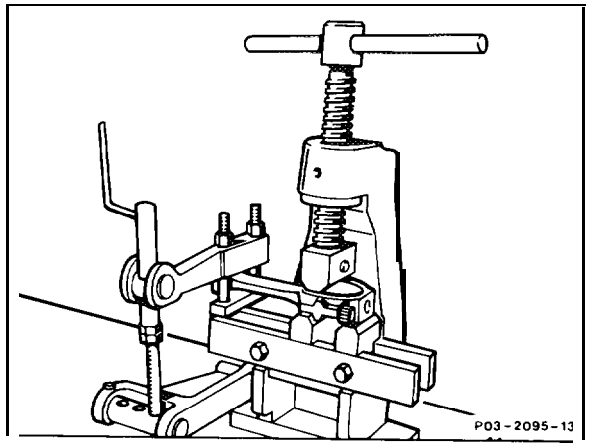
Checking angles

7 Check angles of bearing bores with a conrod tester.

8 Align conrod bearing bore to small end bushing bore (parallelism).

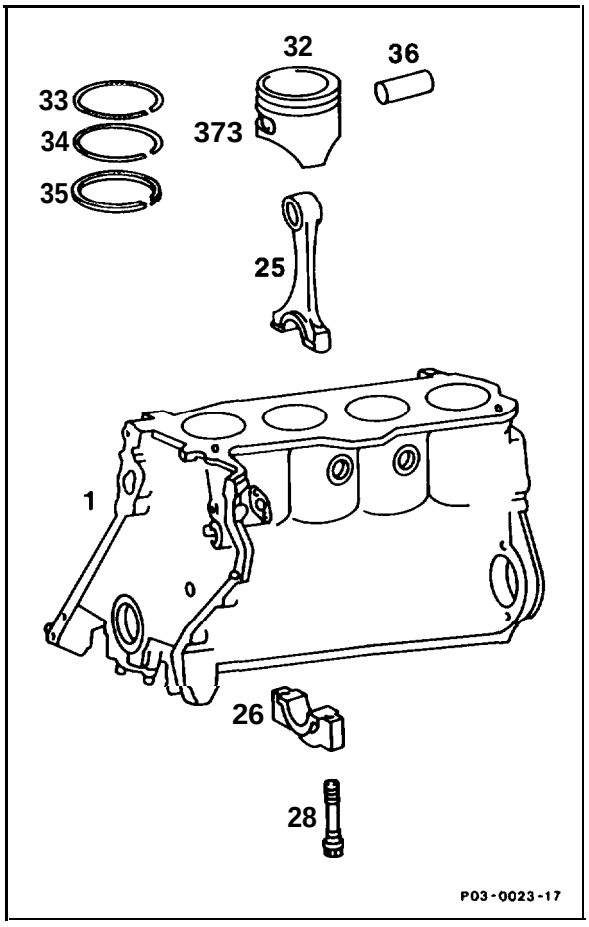


9 Check axial twist of conrod bearing bore relative to small end bushing bore and correct, if necessary.



03-316 Removal and installation of pistons

Preceding work:
Removal of engine (01-030).
Removal of cylinder head (01-415).
Removal of oil pan (01-310).



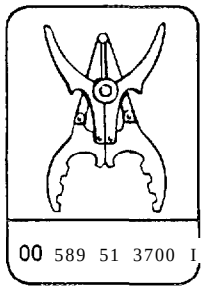
Conrod bearing cover (26)	unbolt, bolt on, 30 Nm and 90” angle of rotation torque. Do not mix up top and bottom bearing shells. Pay attention to matching of conrod and bearing cap (step 12).
Conrod bolt (28)	check (03-310).
Piston (32) and conrod (25)	push out of crankcase upwards.
Locking ring (37)	remove (step 3) and insert (step 9).
Piston pin (36)	press out and press in by hand (step 8).

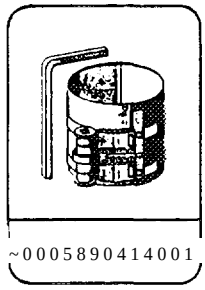
Installation Instructlon

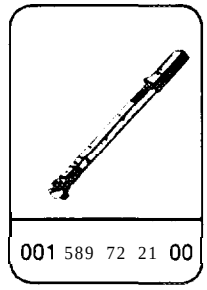
Insert conrod into piston so that the chamfered splash bore in the small end bearing with the arrow in the piston crown are pointing in direction of travel; **do not** heat piston.

Piston (32)	.....	check condition, pay attention to installation position.
Piston rings (33, 34 and 35)	..	check condition, pay attention to installation position, “Top” must face upwards. Position ring gaps evenly around circumference of piston.
Piston (32) with conrod (25)	...	install with tensioning strap 000 589 04 14 00, oil piston beforehand and clean cylinder bores (steps 10 and 11).
Piston projection	.....	check in TDC position (step 14).

Special tools







Matching pistons and cylinders

Engine	Group No.	Piston dia.	Cylinder dia.	Group code letter	Piston dia.	Cylinder dia.
102.922/924 102.962963 Standard (normal size)	0	88.968 88.982	88.998 89.008	A	88.973 88.979	89.000 89.006
	1	88.978 88.992	89.009 89.018	X	88.978 88.986	89.007 89.012
	2	88.988 89.002	89.019 89.028	B	88.985 88.991	89.013 89.018
Repair size 1 (+0.5)	0	89.468 89.482	89.498 89.508	A	89.473 89.479	89.500 89.506
	1	89 478 89.492	89.509 89.518	X	89.478 89.486	89.507 89.512
	2	89.488 89.502	89 519 89.528	B	89.485 89.491	89.513 89.518

Engine	Group No.	Piston dia.	Cylinder dia.	Group code letter	Piston dia.	Cylinder dia.
Repair size 2 (+ 1.0)	0	89.968 89.982	89.998 90.008	A	89.973 89.979	90.000 90.006
	1	89.978 89.992	90.009 90.018	X	89.978 89.986	90.007 90.012
	2	89.988 90.002	90.019 90.028	B	89.985 89.991	90.013 90.018
102.982/985 Standard (normal size)	0	95.469 95.481	95.498 95.508	A	95.473 95.479	95.500 95.506
	1	95.479 95.491	95.509 95.518	X	95.478 95.486	95.507 95.512
	2	95.489 95.501	95.519 95.528	B	95.485 95.491	95.513 95.518
Repair size 1 (+0.5)	0	95.969 95.981	95.998 96.008	A	95.973 95.979	96.000 96.006
	1	95979 95.991	9696.018 009	X	95.978 95.986	96.007 96.012
	2	95.989 96.001	96.019 96.028	B	95.985 95.991	96.013 96.018
Repair size 2 (+1.0)	0	96.469 96.481	96.498 96.508	A	96.473 96.479	96.500 96.506
	1	96.479 96.491	96.509 96.518	X	95.478 96.486	96.507 96.512
	2	96.489 96.501	96.519 96.528	B	96.485 96.491	96.513 96.518

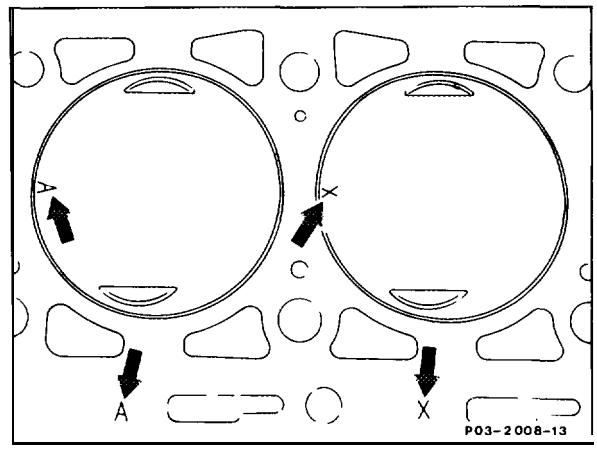
Test data

		When new	Wear limit
Piston play	with Group No. 0, 1 or 2	0.016 – 0.040	–
	with Group code letter A, X or B	0.020 – 0.034	–
Difference in weight of pistons in an engine			10 g
Piston pin dia.		21.995 – 22.000	–
Piston pin play	in small end bush	0.007 – 0.018	–
	in piston	0.002 – 0.012	–
End gap of piston rings	groove 1	0.30 – 0.55	1.0
	groove 2	0.30 – 0.55	0.8
	groove 3	0.25 – 0.50	0.8
Vertical play of piston rings	groove 1	0.050 – 0.085	0.15
	groove 2	0.010 – 0.030	0.1
	groove 3	0.010 – 0.045	0.1
Conrod in piston (end play)		0.050 – 0.450	–
Piston projection		0.60 – 1.0	–

Note

The pistons and cylinder bores are arranged into three diameter groups within the tolerance and were previously identified with the figures 0, 1 and 2.

As of April 1988 the tolerance stages are identified with the Group code letters A, X and B. The identification is given as before in the mating face of the crankcase and in the piston crown.



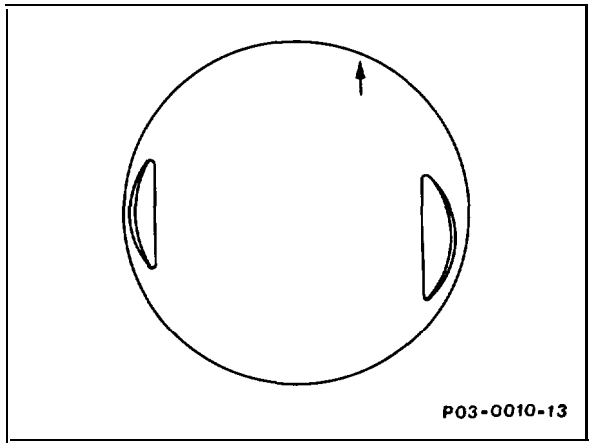
previously	now
0	A
1	X
2	B

Only pistons with the Group code letter “X” are supplied for repair purposes. These pistons should also be installed in the cylinder bores with the Group code letters “A” or "B".
Only pistons with Group code letters are also supplied for the previous engines with Group numbers 0, 1 and 2, namely piston "X" for Group No. 0 and 1. Piston “B” for Group No. 2.
When performing repairs, the cylinder bores should be honed according to the dimensions of the existing pistons plus piston play.

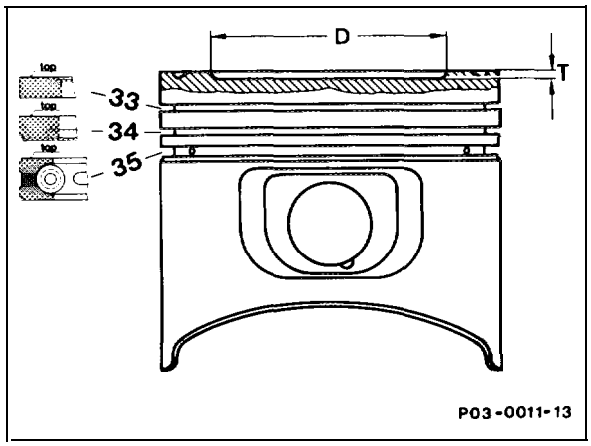
The piston crown is designed differently in the individual engines. The piston crown of normal compression engines is either smooth or provided with a recess. In addition, there are two valve niches each in the piston crown.

Caution!

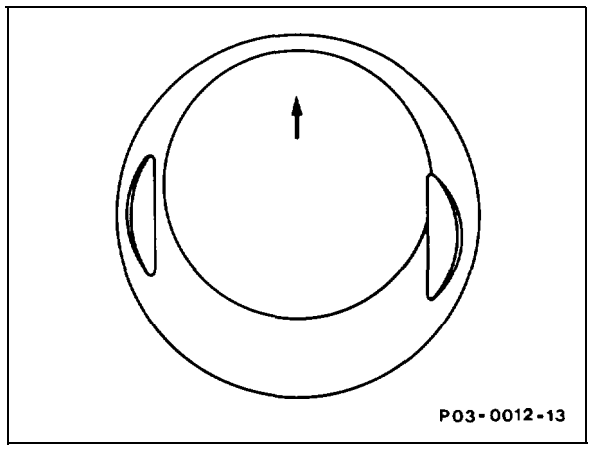
A recess with a diameter of 50 mm appears on the piston crown of pistons in repair size version.



Piston crown smooth, two valve niches

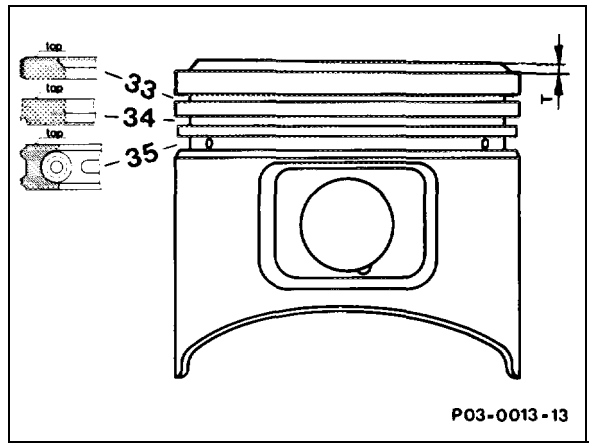


Engine 102.985

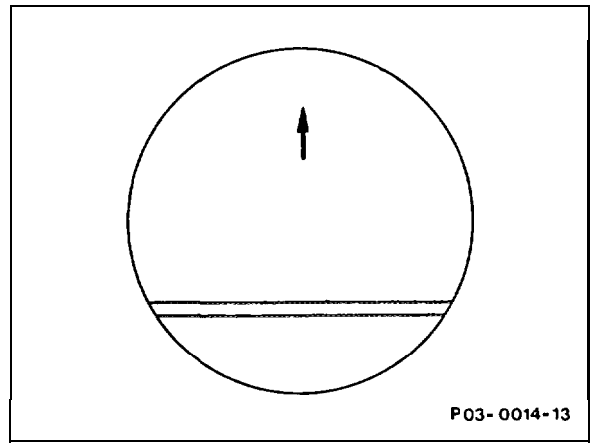


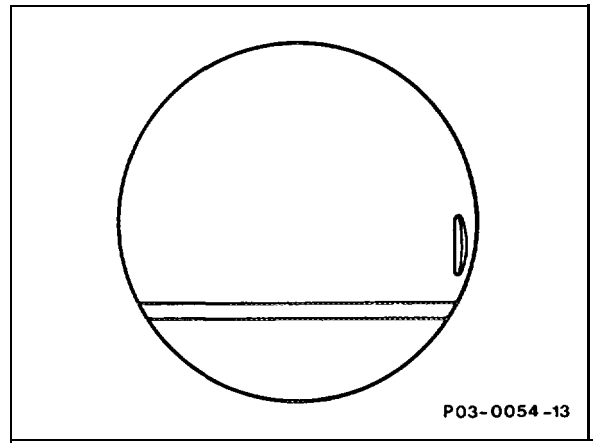
Recess in piston crown, two valve niches
D 70 mm dia.
T vanes according to piston (normal size, repair sizes)

All low compression engines have a step on the piston crown (except 102.985 (USA), 1985 additionally one valve niche).



33 Rectangular ring with Internal chamfer, running surface chrome-plated
34 Taper face oil scraper ring, running surface precision-turned
35 Chamferred oil control ring with garter spring, running surfaces chrome-plated
T Height of size 2.0 mm





Engine 102.985 (USA)

As the design of the piston crown (flat, recess or step) has an influence on the compression, the pistons are not interchangeable.
Two repair sizes (each step + 0.5 mm dia.) are approved for the pistons of all engines.

The shape of the piston and the roughness of the grinding pattern of the pistons has been modified from 0.8 mm to 1.2 mm on Engine 102.982 as a noise-reducing measure.

On engine 102.985 (USA) the rectangular ring manufactured by Götze is installed in groove I of the piston manufactured by Mahle and KS. The running surface of this piston ring is chrome-plated, asymmetrically crowned and sharp-edged at the bottom to reduce oil consumption.

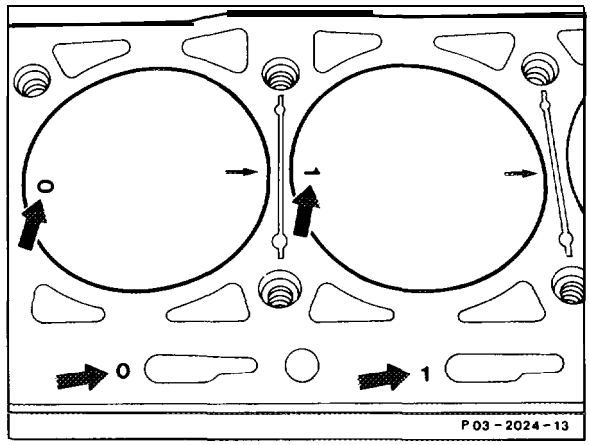
Standard Implementatlon: 03/88 (Mahle)

Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.028 (USA)	1102.985	023341	069631		484718

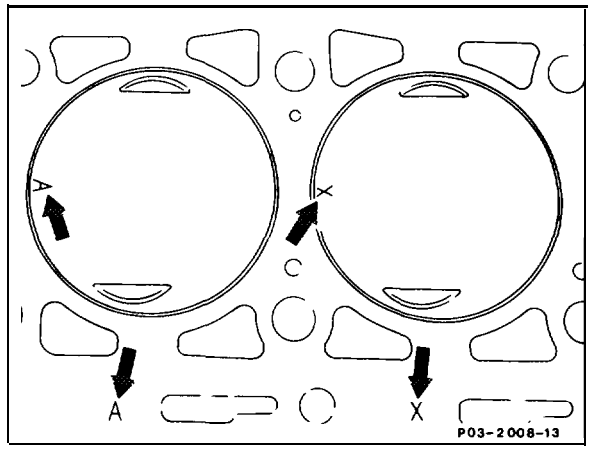
Standard Implementation:03/88 (KS)

Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.028 (USA)	102.985	023788	070989		492527

The Group code numbers on the pistons and on the mating face of the crankcase have been replaced by Group code letters.
As a result, the cylinder diameters and matching of pistons and cylinders have also been modified (refer to data).

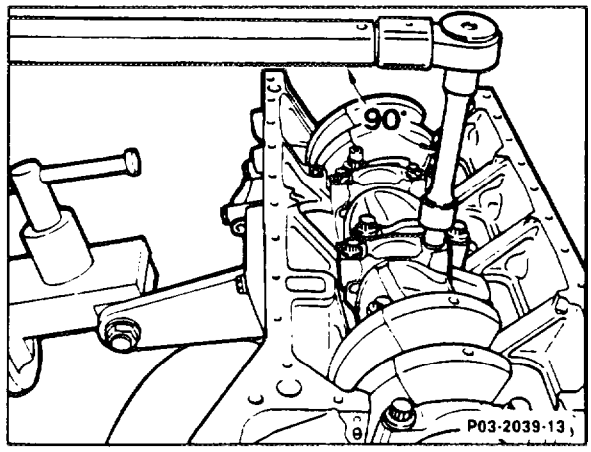


Crankcase with Group numbers



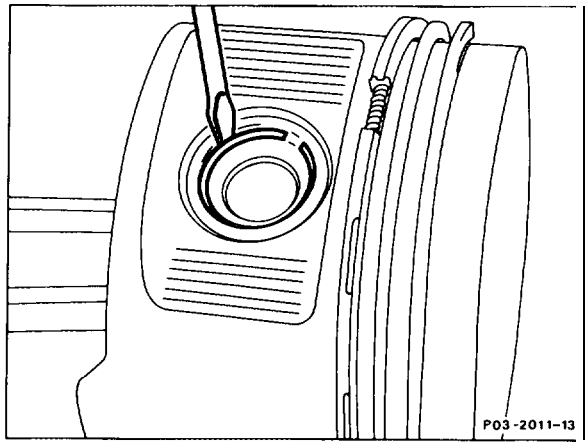
Crankcase with Group code letters

Removal and installation



1 Unbolt conrod bearing cover and remove conrod together with piston upwards.

2 Check conrod bolts (03310).

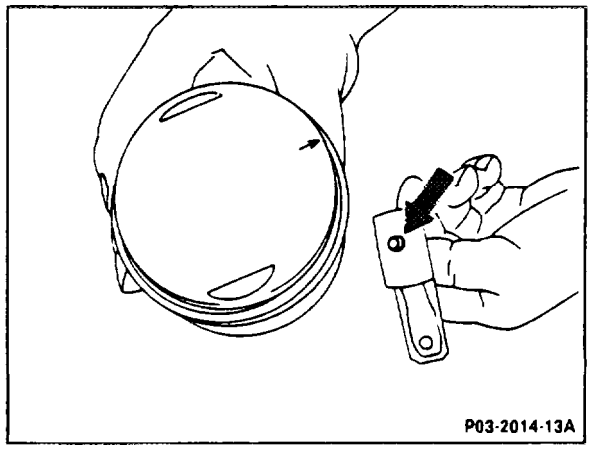


3 Remove piston pin locking element with screwdriver and press out piston pin.

4 Recondition conrod and check angles of bearing bores, if necessary (03-313).

5 If the pistons are worn, check the gap clearance and end play of the piston rings (refer to table). Check that the piston rings move easily. Pay attention to installation position: “Top” must be facing upwards. Distribute the ring gaps evenly around the circumference of the piston.

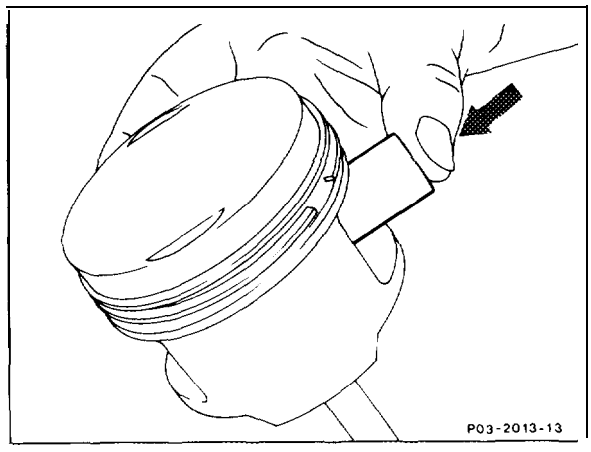
6 Oil piston pin and small end bushes.



7 Install piston so that the chamfered splash bore in the small end bearing (arrow) and the arrow in the piston crown are facing in direction of travel.

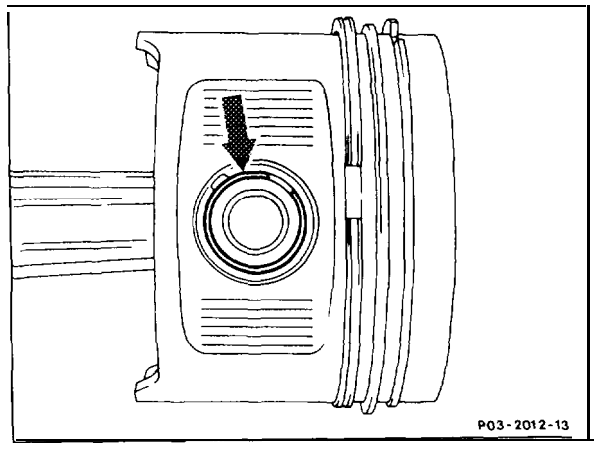
Caution!
Do not heat piston.

8 Press in piston pin by hand.

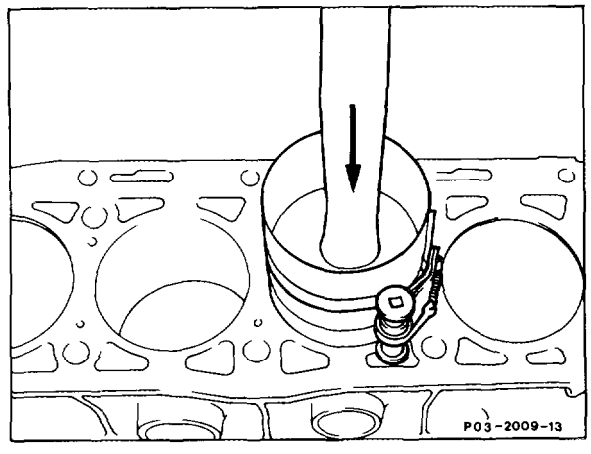


9 Insert piston pin locking element into the groove.

10 Oil cleaned cylinder bores, conrod bearing journals, conrod bearing shells and pistons.

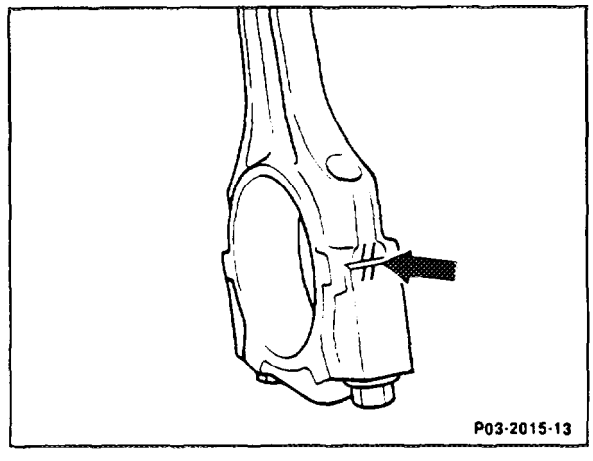


11 Install tensioning strap for piston rings and install piston into cylinder bore with arrow facing in direction of travel.

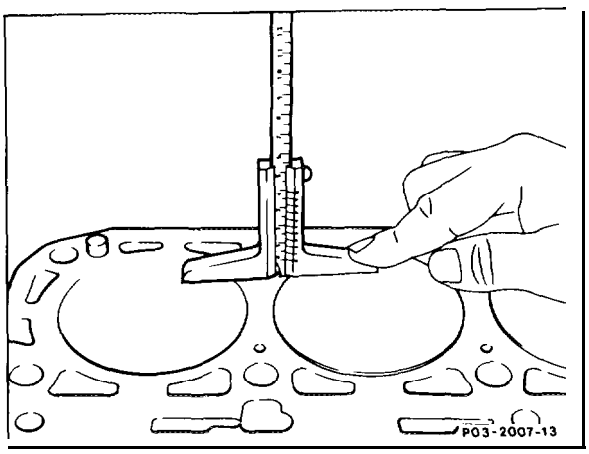


12 Mount conrod bearing cover onto the conrod with the code marks (arrows) aligned with each other and torque conrod bolts to an initial torque of 30 Nm and angle of rotation torque of 90".

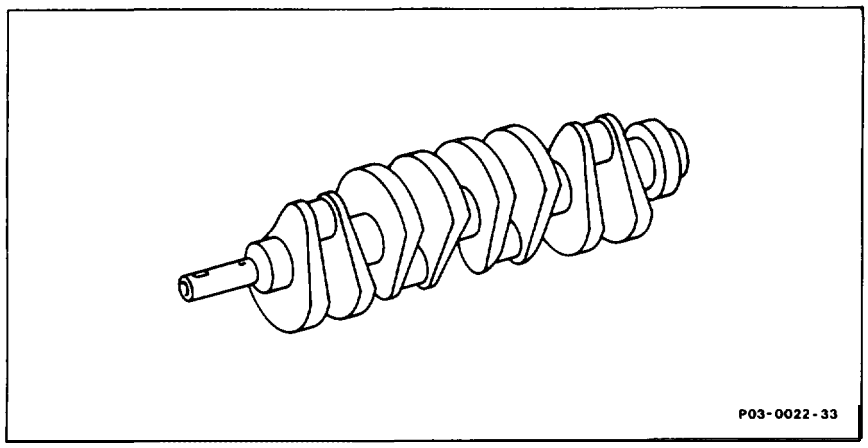
13 Turn crankshaft and check clearance between piston pin boss and conrod.



14 Measure the distance between piston crown and crankcase mating face with the pistons in the TDC postion (refer to table).



03-318 Checking and reconditioning crankshaft



Data

Crankshaft normal size and repair sizes	Crankshaft journal dia.	Crankshaft journal width at thrust bearing	Crankpin dia.	Crankpin width
Normal size	57.950 57.965	28.500 28.533 or 28.600 28.633	47.955 47.965	28 000 28.084
Normal size II	57.935 57.950			
1st repair size	57.705 57.715	28.700 28.721 or 28.900 28.921 or 29.000 29.021	47.705 47.715	up to 28.30
2nd repair size	57.455 57.465		47.455 47.465	
3rd repair size	57.205 57.215		47.205 47.215	
4th repair size	56.955 56.965		46.955 46.965	

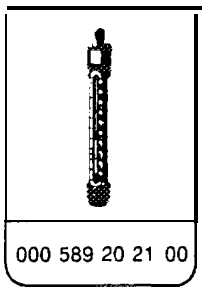
Permissible out-of-roundness of crankshaft journals and crankpins		0.0025
Permissible conicity	crankpins	0.010
	crankshaft journals	0.010
Permissible axial runout of fit bearing		0.02
Fillet radii at the	crankshaft bearing journals	2.0 – 2.2
	crankpins	2.8 – 3.0
Bearing journals ground and fine-lapped, max peak-to-valley height R_z (pm)		0.15
Crankshaft journall dia. front		29.987 – 30.000
Permissible variation of front crankshaft journal from concentricity [1)] [2)]		0.030
Running surface dia. for rear radial seal		92.874 – 92.928
Permissible variation of rear crankshaft flange	from concentricity [1)]	0.02
	from axial runout [1)]	0.012
Permissible variation of crankshaft journals from concentricity [1)]	journal II, IV	0.07
	journal III	0.10
Scleroscopic hardness of crankshaft journals and crankpins	when new	74 – 82
	limit value	60 [3)]
Permissible unbalance of crankshaft		14.5 cmg

1) When crankshaft mounted on outer crankshaft journals I and V and one full rotation.
2) If measurement performed when crankshaft installed, eliminate radial bearing play by pressing against crankshaft journal.
3) The limit value must exist at least at 2/3 of the circumference of the journal.

Note

Maximum wear limit of crankshaft journals and crankpins 0.02 mmm. The repair sizes listed in the table must be strictly adhered to. In addition, it is essential to adhere to the fillet radii at the crankshaft journals and crankpins when regrinding.

Special tool



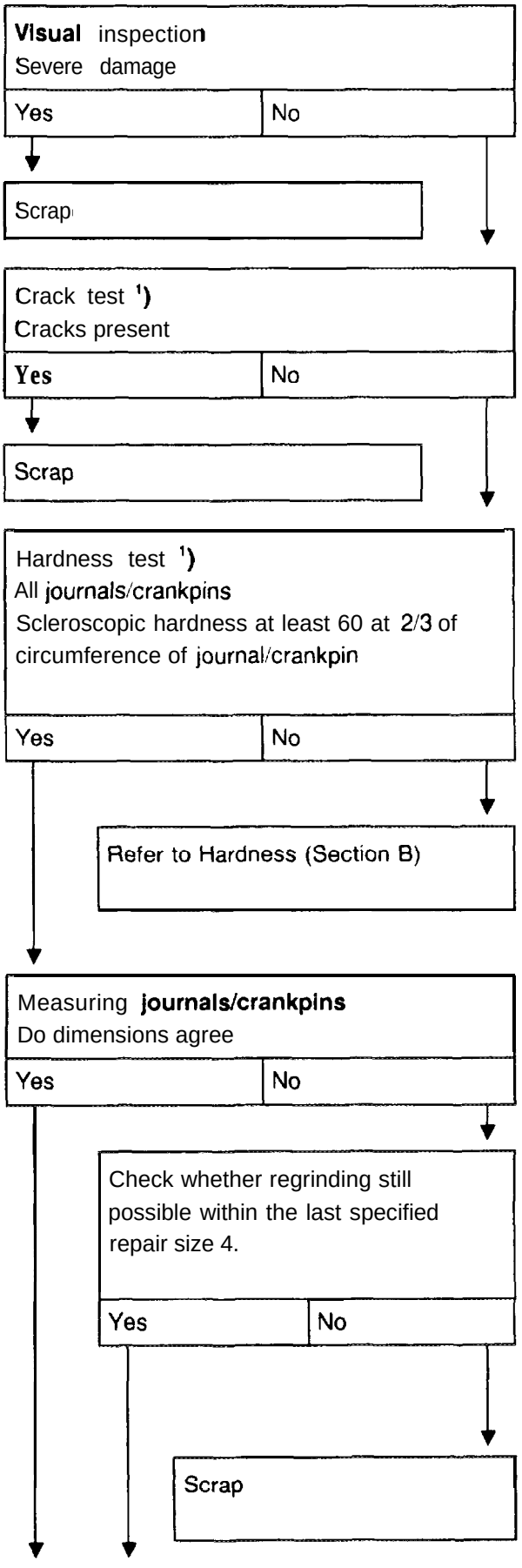
Note

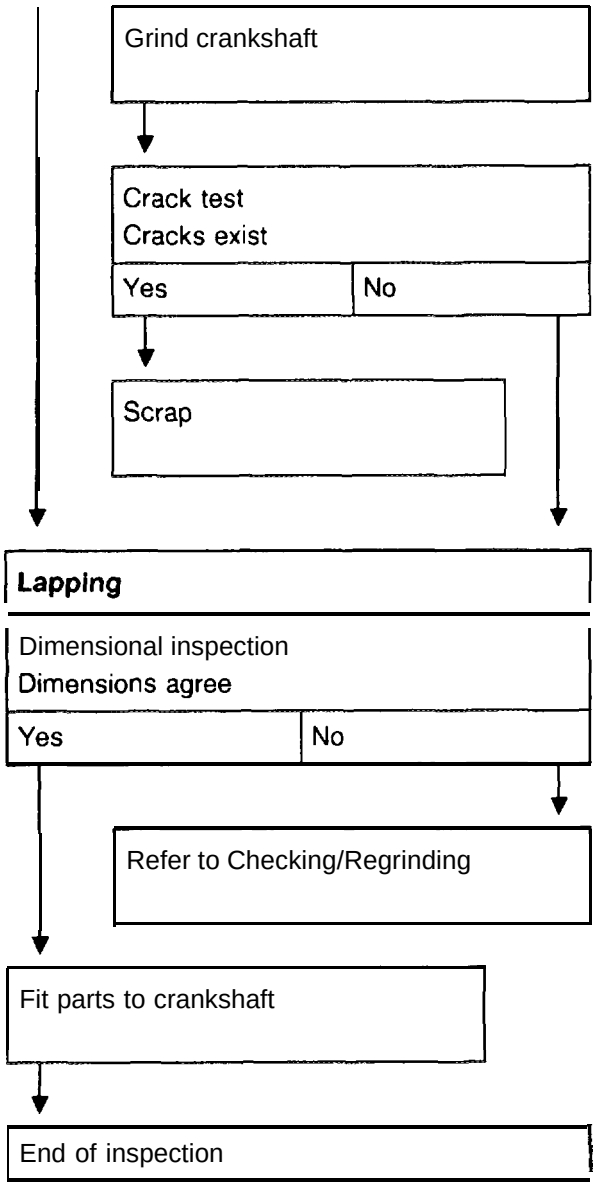
Adhere to the sequence of operations of the diagram below when checking and reconditioning crankshafts.

Dianram

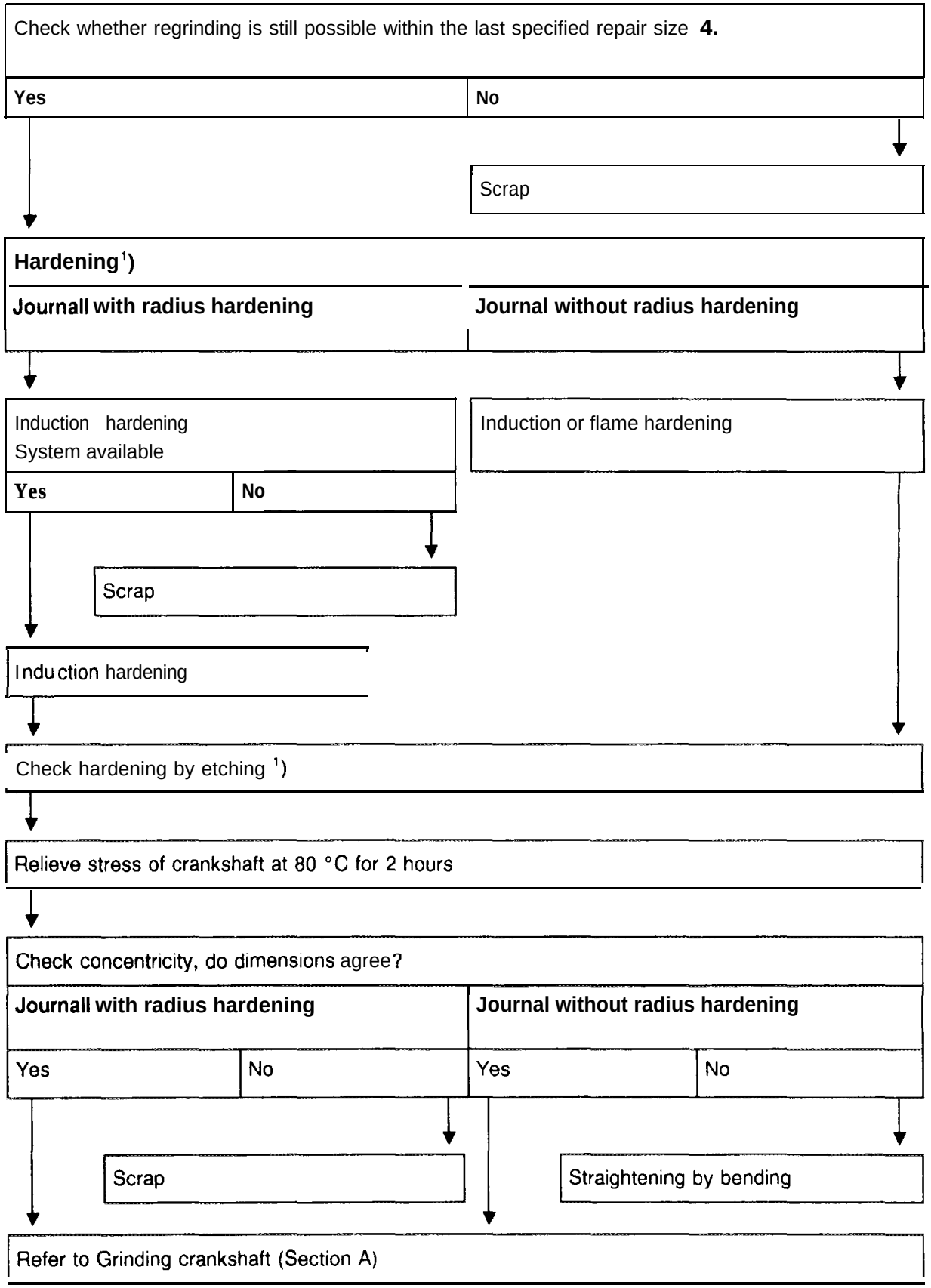
[1]) Refer to Section “Explanatory notes regarding diagram”.

A. Checking, grinding




Grind crankshaft
Crack test
Cracks exist
Yes
No
Scrap
Lapping
Dimensional inspection
Dimensions agree
Yes
No
Refer to Checking/Regrinding
Fit parts to crankshaft
End of inspection

B. Hardening


Check whether regrinding is still possible within the last specified repair size 4.
Yes
No
Scrap
Hardening 1)
Journall with radius hardening
Journal without radius hardening
Induction hardening
System available
Yes
No
Scrap
Induction or flame hardening
Induction hardening
Check hardening by etching 1)
Relieve stress of crankshaft at 80 °C for 2 hours
Check concentricity, do dimensions agree?
Journall with radius hardening
Journal without radius hardening
Yes
No
Yes
No
Scrap
Straightening by bending
Refer to Grinding crankshaft (Section A)

Explanatory notes regarding diagram

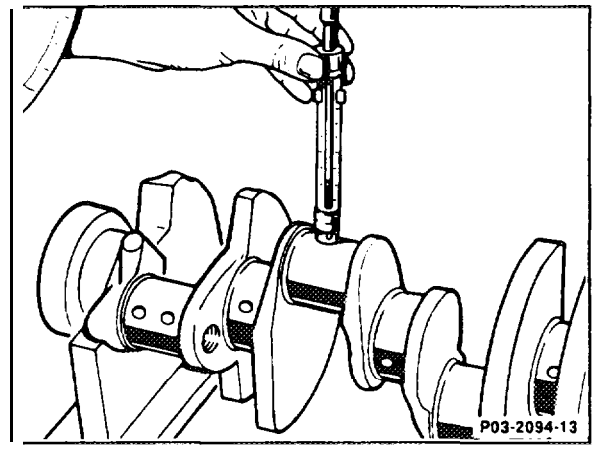
Crack test

Clean crankshaft. The bearing journals must be free of oil and grease.
Magnetize crankshaft and apply fluorescent powder (flux).
A dye penetration method (immersing in bath or with spray can) may also be used.

Helpful tools: die, UV oil or fluorescent powder,
cleaning agent,
developer

Hardness test

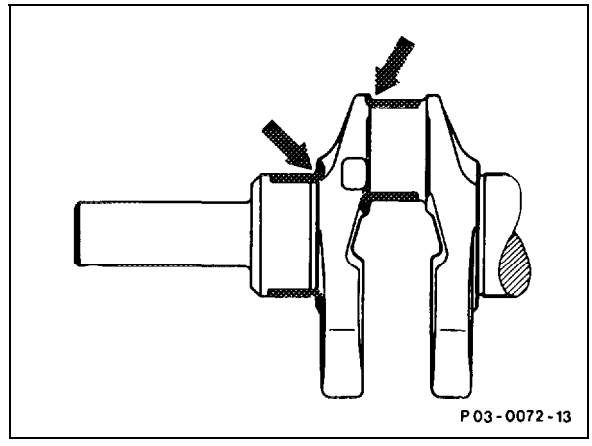
Test hardness with the drop hardness tester (scleroscopic hardness).
The minimum hardness of 60 must exist at 2/3 of the circumference of the journal.



Hardening

The journals without hardened radii may be hardened inductively or with a flame. By contrast, the journals with hardened radii (arrows) must always be hardened inductively. If this is not possible, scrap crankshaft.

When hardening the journals without hardened radii, it is important to adhere to the distance A between hardening runout and radius (4 – 5 mm).



Inspection of hardening

To achieve proper hardening, check the setting of the hardening system by metallographic ground surfaces.

These can be removed from test hardening operations on scrapped crankshafts.

Check hardening by etching the surface of the journal with a 2 % alcoholic nitric acid (HNO_3).

No dark spots should appear on the surface of the journal.

Non-hardened radii change to a dark colour.

By contrast, the hardened radii must be just as bright as the surface of the journal.

As a comparison, it is recommended to perform etching on a metallographically tested journal.

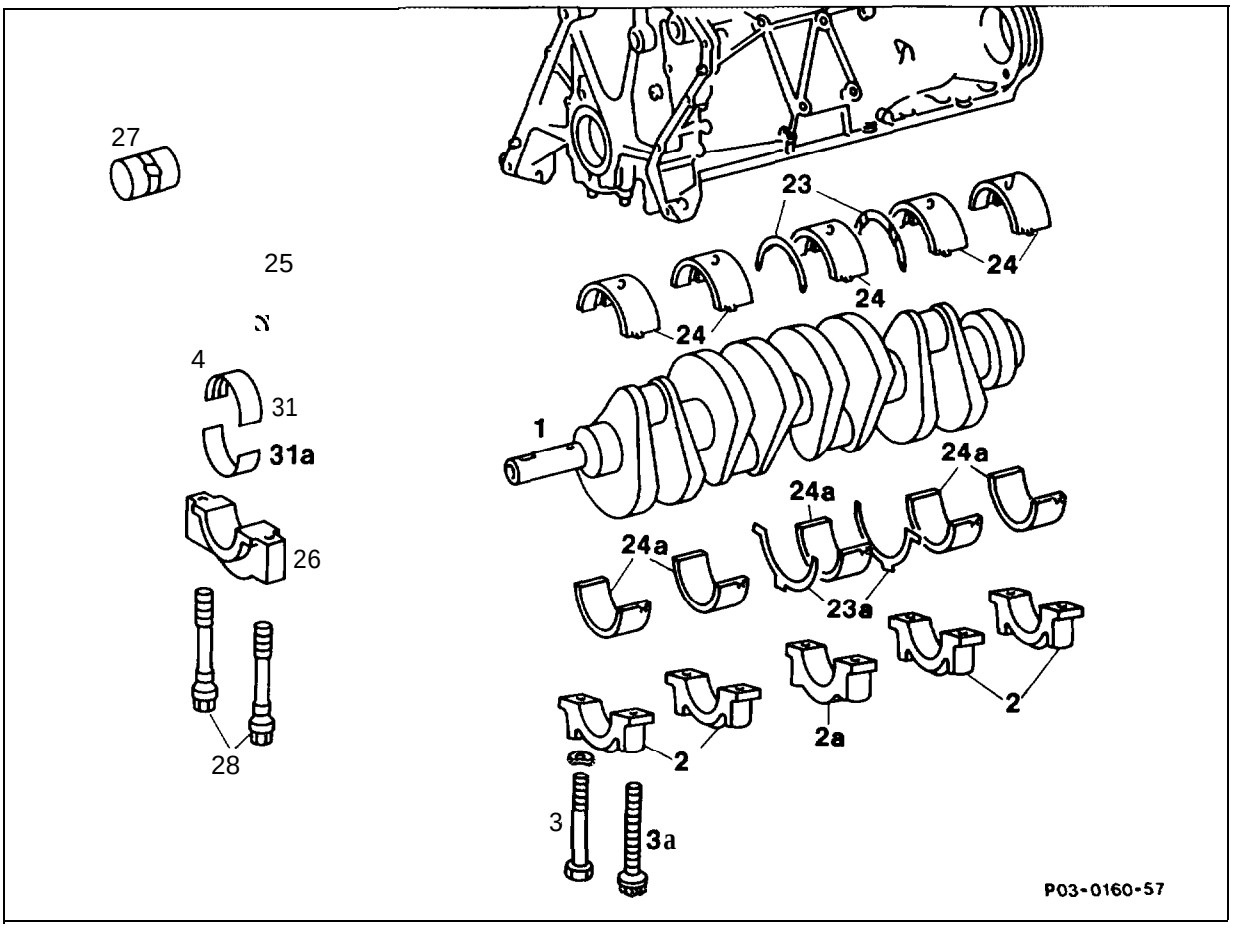
Following this, carefully wash off the nitric acid with alcohol.

Corrosion protection

Crankshafts which are not immediately re-installed, must be oiled with initial operation engine oil (SAE 30).

03-320 Installation of crankshafts bearings

Preceding work:
Engine removed and disassembled.
Main oil **passage** in crankcase open (01-130).
Clean oil passages in crankcase and in crankshaft.
Check crankshaft for cracks, dimensional tolerance, hardness and concentricity (03-318).



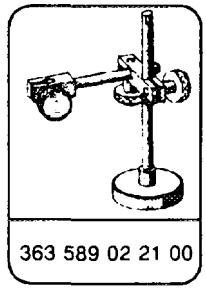
Crankshaft bearing covers (2 and 2 a)	.....	install without bearing shells, pay attention to markings, tighten. Hex. bolt 90 Nm, stretch bolt, initial torque 55 Nm, angle of rotation torque 90” (steps 1 and 2).
Basic bore	.....	measure conicity in direction A, B and C (step 3).

Crankshaft bearing shells (24 and 24 a)	insert, adhere to tightening torques (step 4).
Bearing diameters	measure and note values (step 5).
Crankshaft (1)	measure crankshaft bearing journals, determine bearing play (step 6).
Thrust bearing journals	measure width and match appropriate thrust washers (step 7).
Bearing shells (24)	oil with engine oil and insert crankshaft (step 8).
Thrust washers (23)	oil and fit into grooves of thrust bearings, pay attention to oil grooves (step 9).
Thrust bearing cover (2a)	oil together with thrust washers (23 a) and install (step 10).
Crankshaft bearing cover (2)	install, hexagon bolt, 90 Nm, stretch bolt (3 a), initial torque 55 Nm, angle of rotation torque 90° (steps 11 and 12).
Crankshaft bearing end play	measure. Check ease of movement of crankshaft (steps 13 and 14).
Conrod	recondition and check angles (03-313).
Conrod bearing shells (31 and 31 a)	insert, initial torque 30 Nm, angle of rotation torque 90” (step 16).
Bearing diameter	measure and note value (step 17).
Wrist pins	measure, determine bearing play (step 18).
Piston	install on conrod (pay attention to installation position and install (03-316).
Conrod bearing cover (26)	install, initial torque 30 Nm, angle of rotation torque 90” (step 20). **Caution!** Note step 20.

Special tools

001 589 72 21 00

001 589 66 21 00


363 589 02 21 00

Commercial tools

Quick caliper for internal measurements, dia. 40 – 60 mm	e. g. Hahn und Kolb Borsigstraße 50 D-7000 Stuttgart 30 Order No. G 222 K
Quick caliper for internal measurements, dia. 60 – 80 mm	Order No. G 322 K
Bow-type measuring bolt 25 – 50 mm	Order No. 31346 025
Bow-type measuring bolt 50 – 75 mm	Order No. 31346 050

Data

Crankshaft normal size and repair sizes	Crankshaft bearing journal dia.	Thrust bearings Matched thickness of thrust washers	Crankshaft journal width at thrust bearing	Wrist pin dia.	Wrist pin width
Normal size	57.960 [1] 57.965 57.955 57.960 57.950 [1] 57.955	4.15 or 4.20	28 500 28.521 or 28.600 28.621	47 955 47.965	28 000 28.084
Normal size I	57.945 [1] 57.950 57.940 57.945 57.935 [1] 57.940				
1st repair size	57.705 57.715	4.25 or 4.35 or 4.40	28. 700 28.721 or 28.900 28.921 or 29.000 29.021	47 705 47.715	up to 28.30
2nd repair size	57.455 57.465			47.455 47.465	
3rd repair size	57 205 57.215			47 205 47.215	
4th repair size	56.955 56.965			46 955 46.965	

[1]) Colored dots on the crank webs or counterweights next to the crankshaft journals: blue, yellow, red.

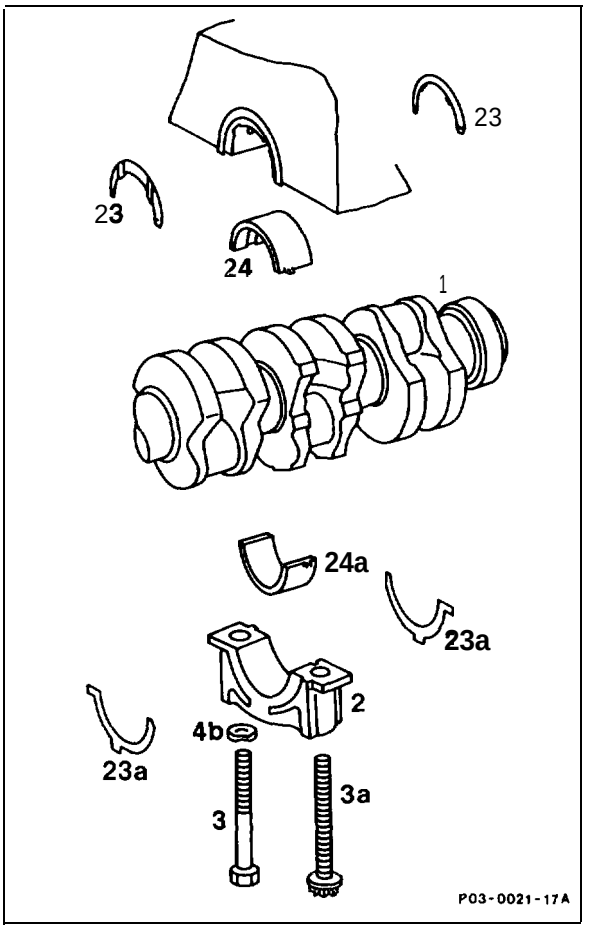
Basic bore and bearing play

		Crankshaft bearings	Conrod bearings
Basic bore dia.		62.500 62.519	62.500 62.519
Basic bore width at thrust bearing		23.979 24.000	–
Conrod width		–	22.000 21.948
Permissible out-of-roundness and conicity of basic bore		0.02	0.02
Radial bearing play	when new	0.025 – 0.045	0.030 – 0.050
	wear limit	0.070	0.070
Axial bearing play	when new	0.06 – 0.22	–
	wear limit	0.30	–

Notes

Engine removed and disassembled.
Main oil passage in crankcase open (01-130).
Oil passages in crankcase and in crankshaft carefully cleaned.
Crankshaft checked for cracks, hardness, dimensional tolerance and concentricity (03-318).
Normal bearing shells and **thrust washers** are installed on the 3rd crankshaft bearing (thrust bearing).
The thrust washers absorb the axial forces of the crankshaft.

The thrust washers (23 and 23a) inserted in the crankcase and in the bearing cover on both sides are each identical.
The thrust washers each have two retaining lugs in the bearing cover as an anti-twist lock and to avoid assembly errors, the bottom lugs being fitted off-center. In addition, all the thrust washers are chamfered at one end.
When repairing crankshafts, the thrust bearing journals must be reground in the width to one of the dimensions stated in the table (Section "Data").



1 Crankshaft
2 Bearing cover
3 M 12 x 60 bolts (1 S version)
3a Ml 1 x 62 collar bolts (2nd version)
4b Washer
23 Thrust washer in crankcase
23a Thrust washer in bearing cover
24 Bearing shell in crankcase
24a Bearing shell in bearing cover

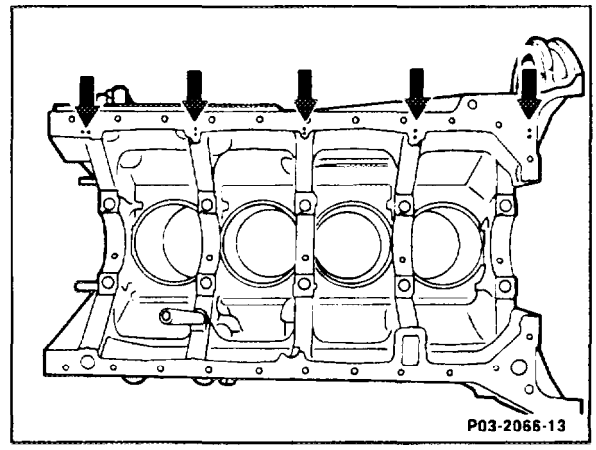
Thrust washers of the same thickness must always be installed on both sides.
It is not permitted to regrind thrust washers.
The thrust washers are available only as sets as replacement parts. A set consists of one top and one bottom thrust washer (23 and 23a).

Matching crankshaft bearing shells to crankcase

Crankshaft journal bearing [1]	Basic bores in crankcase		
	1 chisel marks	2 chisel marks	3 chisel marks[2]
	Matching bearing shells with color coding		
blue	blue	yellow	yellow
yellow	blue	yellow	red
red	yellow	yellow	red

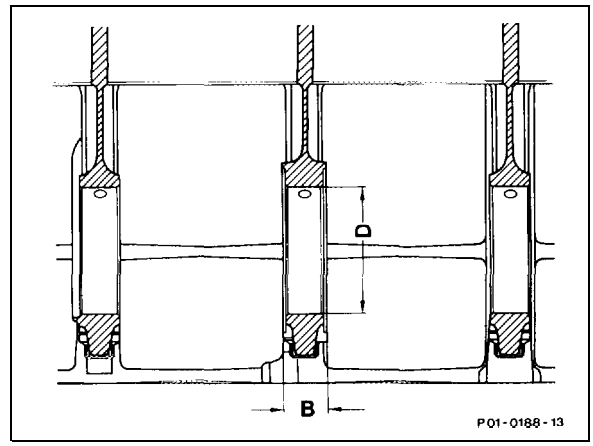
[1] Colored dots on the crank webs or counterweights next to the crankshaft journals.
[2] Chisel marks in mating face of crankcase at oil sump end next to basic bore.

The normal size crankshaft bearing shells with the color coding blue, yellow and red are supplied as replacement parts.
They should be matched according to the table.
The bearing plays do not therefore need to be measured.

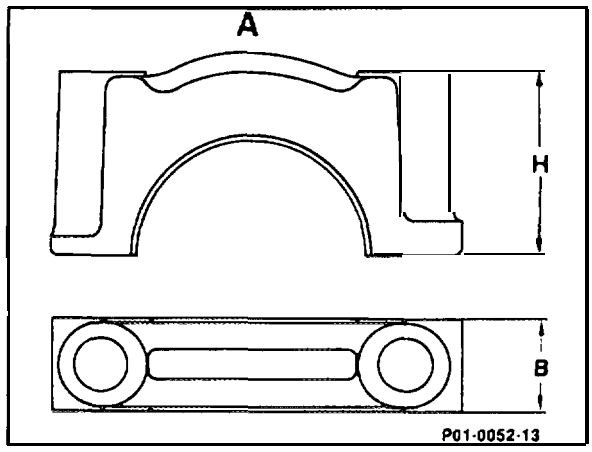


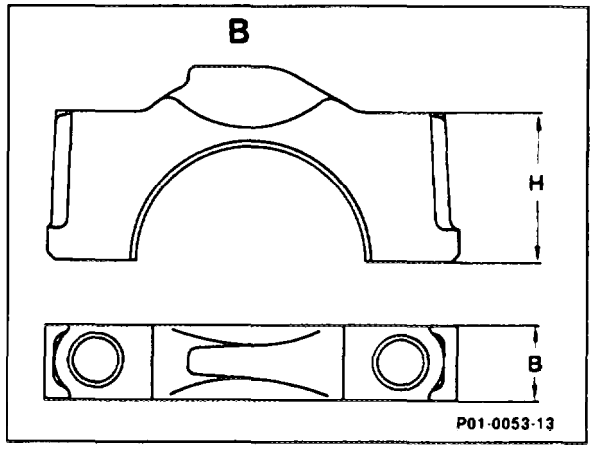
Chisel marks for matching crankshaft bearing shells

In June 1986 the crankshaft bearings were modified from 24 mm to 20 mm (size "B").



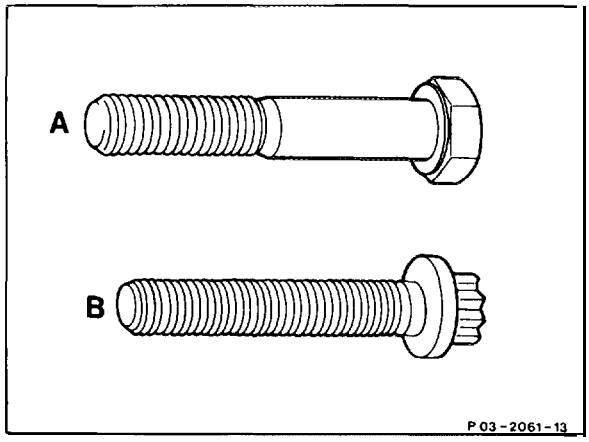
At the same time, the crankshaft bearing covers were reduced in height by 8 mm (H = 40 mm).





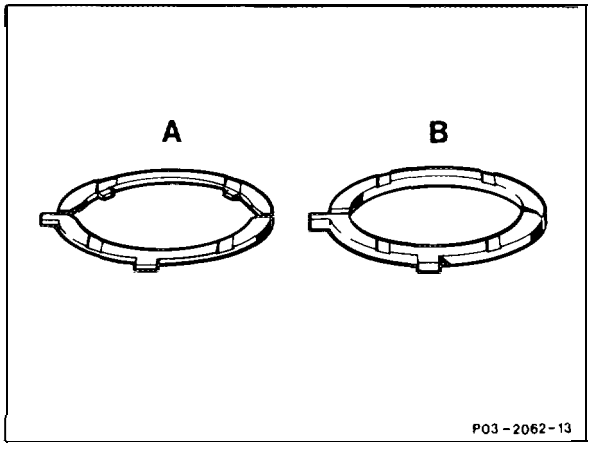
A 1 st version H 48 mm
B 24 mm
B 2nd version H 40 mm
B 20 mm

Likewise, the bolts of the crankshaft bearing covers were converted to M 11 × 62 twelve-sided stretch bolts with collar.
Previously, Ml 2 × 70 hexagon bolts.



A Ml 2 x 70 hexagon bolts
B M11 x62 twelve-sided stretch bolt

In view of the narrower crankshaft bearings, 4.15 mm thick thrust washers are installed on crankshaft bearing 3 (thrust bearing).

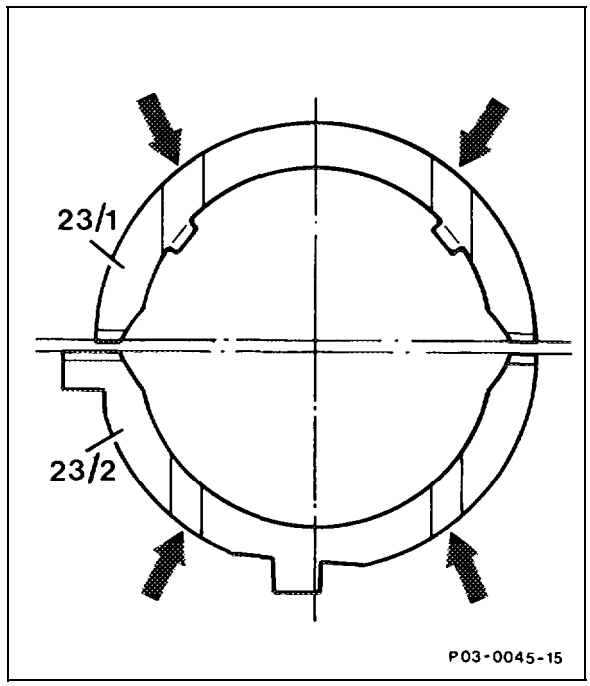


A 2.15 mm thick thrust washers
B 4.15 mm thick thrust washers

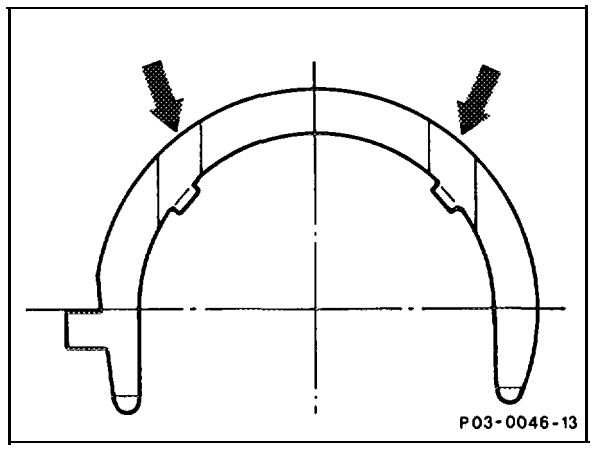
Standard implementation: 06186

Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.024 (USA)	102.985	003938	036445		246820

During the period November through December 1987 and December 1987 through January 1988, single-section thrust washers from two different suppliers were installed.



A Two-section thrust washers



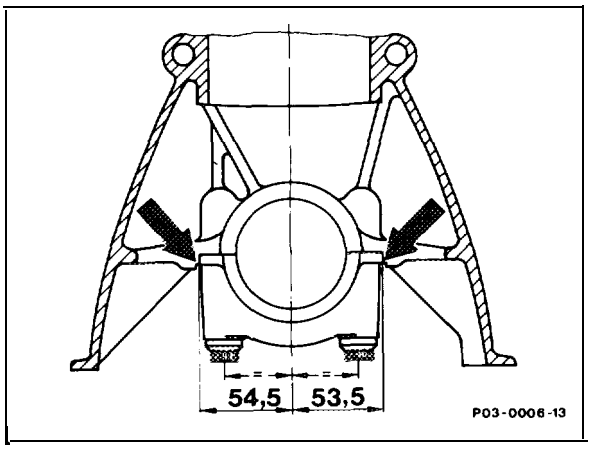
B Single-section thrust washers

Matching crankshaft bearings, installing crankshaft

Note

These operations should be performed if the dimensions of the crankshaft journals or of the basic bearing bores in the crankcase and at the conrod are not known, e.g. if the crankshafts have been remachined.

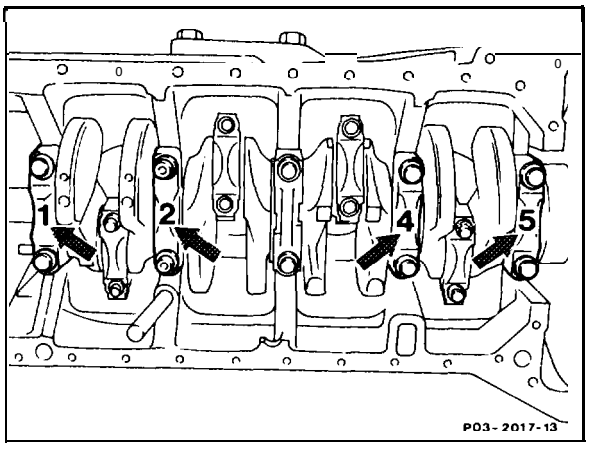
All the bearing covers fit into the side of the crankcase (arrows) and are attached each with 2 bolts.
The fit (arrows) is offset from the center so that the bearing covers can only be installed in one position.



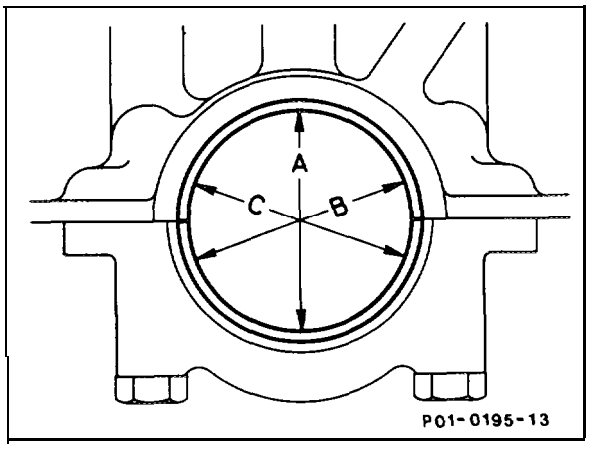
In addition, they are marked from front to rear with the code numbers 1, 2, 4 and 5 (arrows), with the exception of the thrust bearing covers,, and must not be interchanged or replaced.

1 Install crankshaft bearing covers without bearing shells.

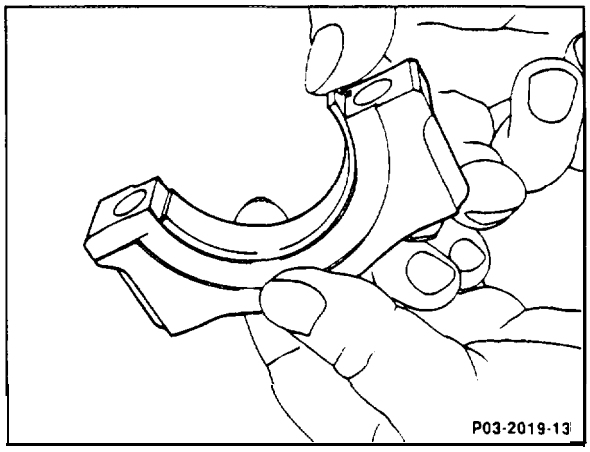
2 Oil fastening bolts for crankshaft bearing covers and tighten to 90 Nm (hexagon bolts) or 55 Nm initial torque and 90° angle of rotation torque (stretch bolts), respectively.

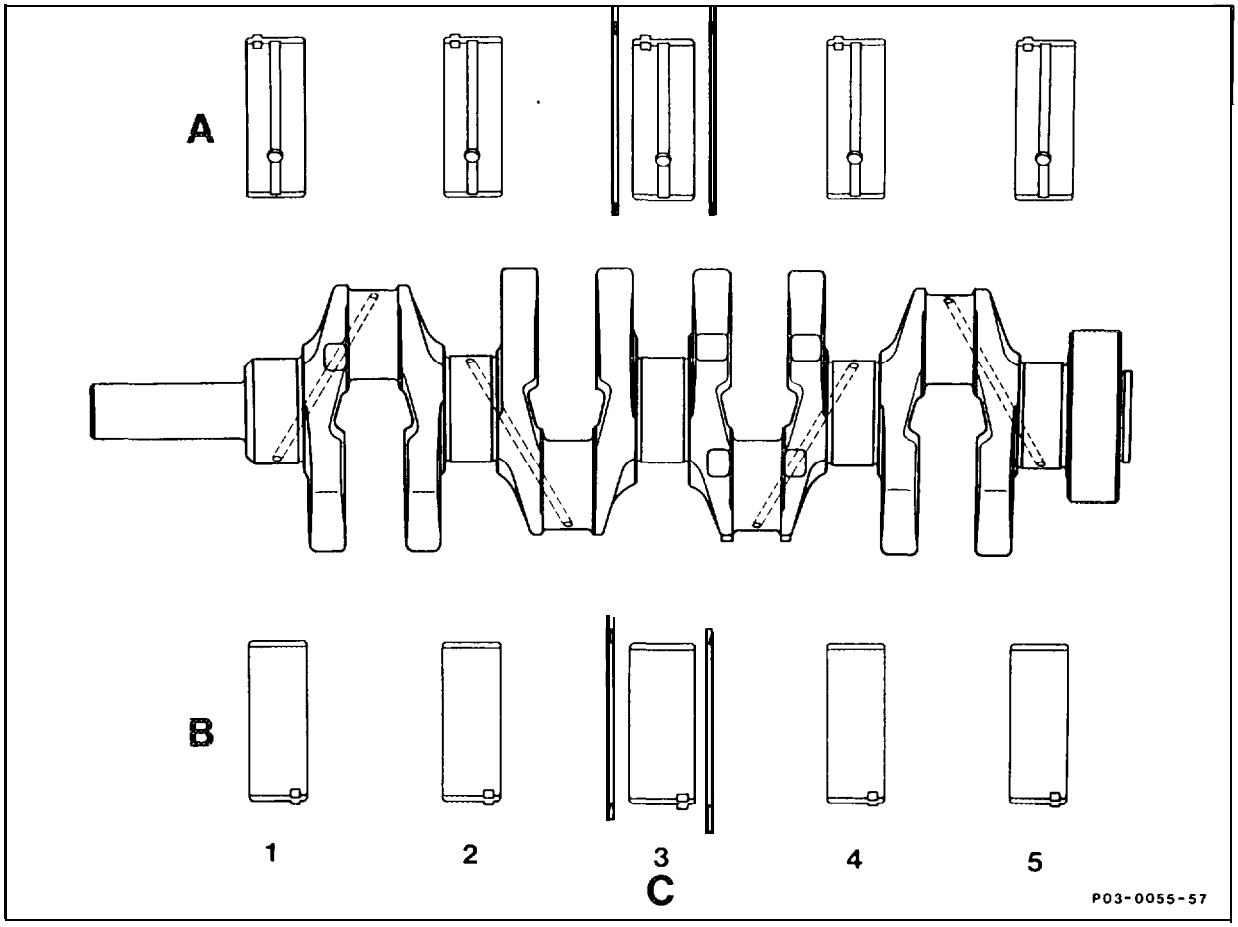


3 Measure basic bore in two planes in the direction A, B and C (conicity).
If a basic bore exceeds the specified value or is conical, dress the mating face of the bearing cover on a surface plate to max. 0.02 mm.



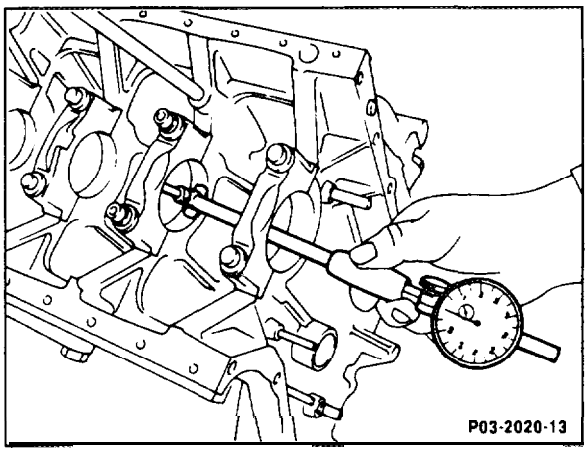
4 Insert crankshaft bearing shells, install bearing covers, screw in fastening bolts and tighten to 90 Nm (hexagon bolts) or 55 Nm initial torque and 90” angle of rotation torque (stretch bolts), respectively.





A Bearing shells in crankcase
B Bearing shells in bearing covers
C Thrust bearings with thrust washers

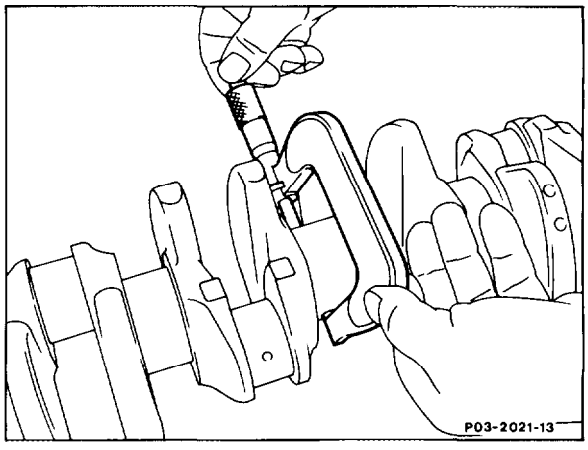
5 Measure and note bearing diameters.



6 Measure crankshaft bearing journals, determine radial play of crankshaft bearings.

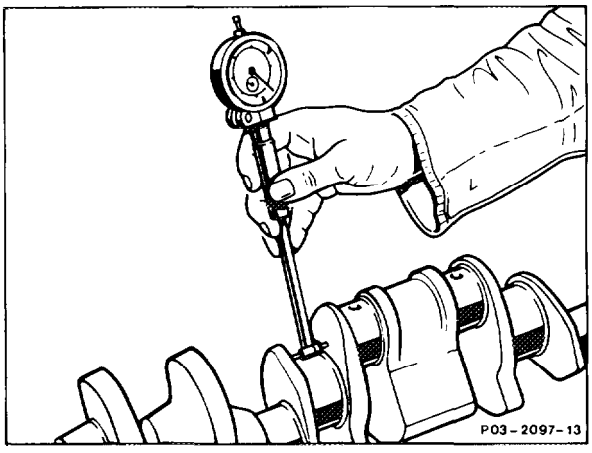
Note

Bearing play can be corrected by replacing the bearing shells (refer to table for matching crankshaft bearing shells to crankcase).

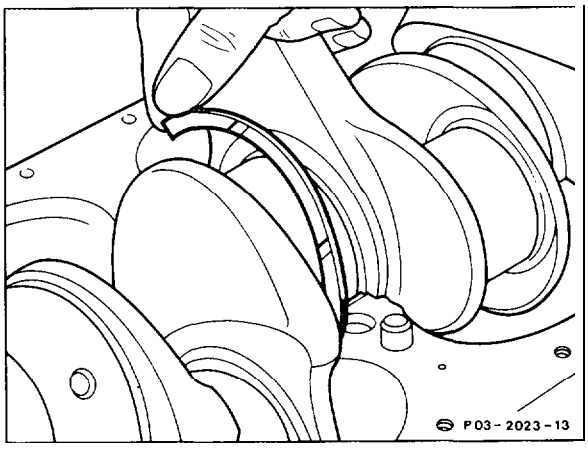


7 Measure width of thrust bearing journal and match appropriate thrust washers (refer to table, Section " Data").

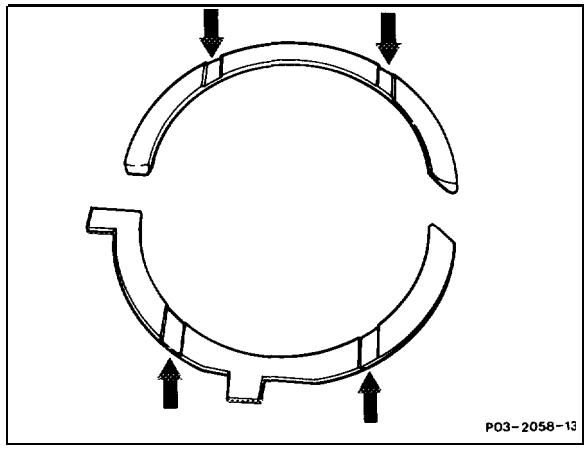
8 Oil bearing shells and crankshaft with engine oil and insert crankshaft.



9 Oil thrust washers with engine oil and fit the grooves on the thrust bearing (crankcase).

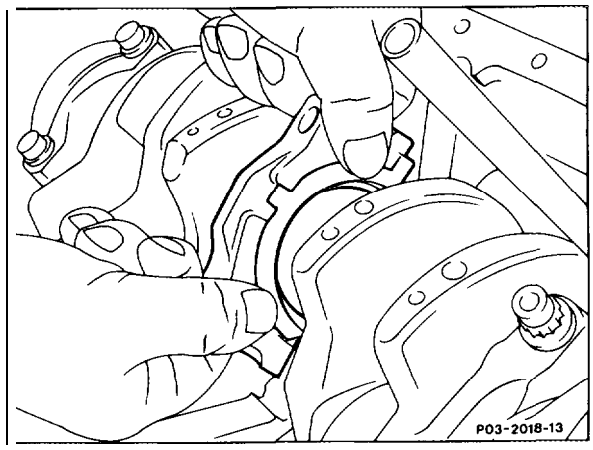


Caution!
The two oil grooves (arrows) in the thrust washers must be facing the crankshaft webs.



10 Install thrust bearing cover.

Caution!
Oil thrust washers with engine oil and place into the grooves on the thrust bearing cover. The two oil grooves in the thrust washers must be facing the crankshaft webs.
When installing the thrust bearing cover, hold both thrust washers tight.

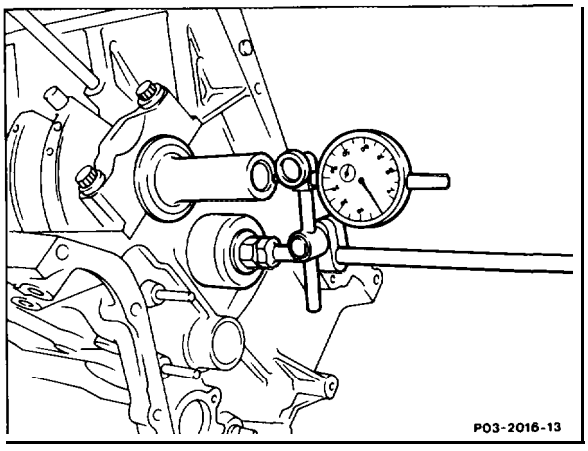


11 Install crankshaft bearing cover.

12 Tighten fastening bolts of bearing covers to 90 Nm (hexagon bolts) or 55 Nm initial torque and 90° angle of rotation torque (stretch bolts), respectively.

13 Measure end play of crankshaft bearings.

14 Rotate crankshaft by hand and check whether it runs freely.



Matching conrod bearings and installing conrod

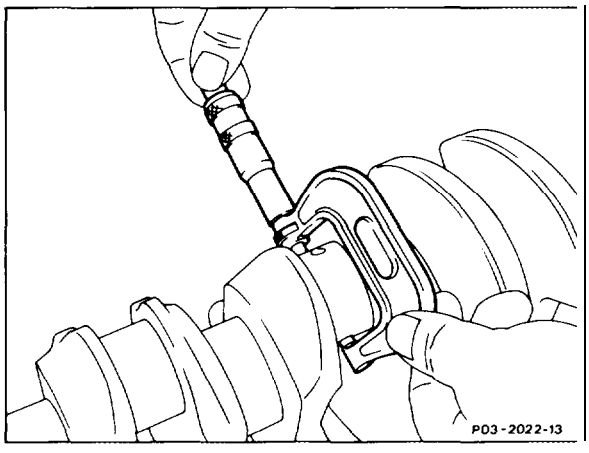
15 Recondition conrod and check angles of bearing bores relative to each other (03-313).

16 Insert conrod bearing shells. Install conrod bearing cover with bearing shell and tighten conrod bolts to an initial torque of 30 Nm and angle of rotation torque of 90".

Note

Conrod bearing shells are supplied only in the yellow version.

17 Measure bearing diameter and note.



18 Measure wrist pins, determine radial play of conrod bearings.

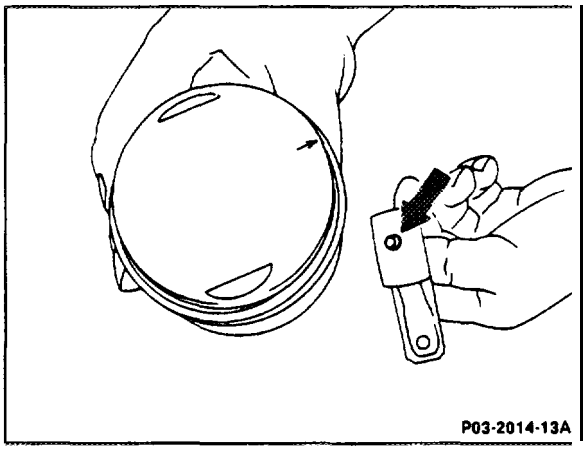
Note

If the conrod bearing play exceeds the specified value, dress mating face of conrod bearing cover on a surface plate to max. 0.02 mm.

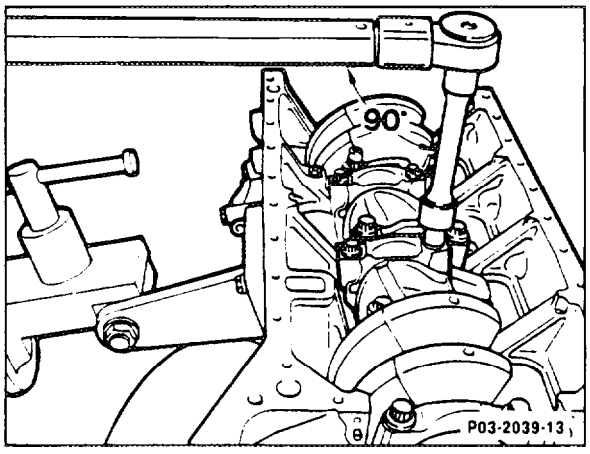
19 Fit pistons to conrod and install (03-316).

Note

The conrod must be installed on the pistons so that the **chamfered** splash bore in the small end bearing (arrow) and the arrow in the piston crown are facing the direction of travel.



20 Tighten conrod bolts to an initial torque of 30 Nm and angle of rotation torque of 90”.

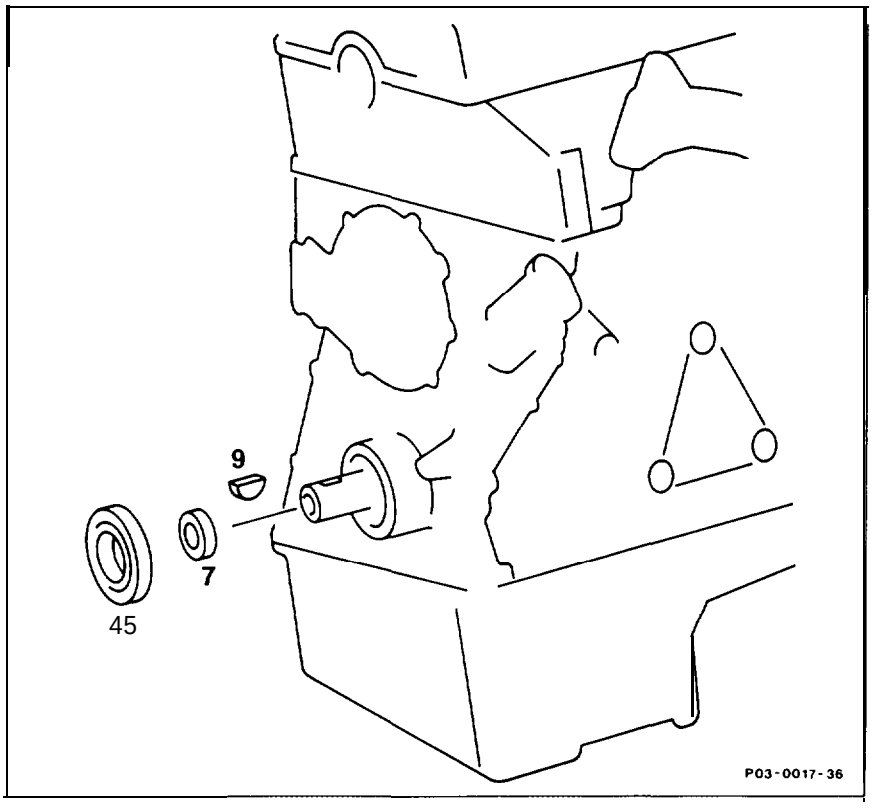


Caution!
Remove oil pump, clean, replace, if necessary, oil pump gears and drive sleeve (18-210). Remove oil pressure relief valve and check ease of movement of pistons (18-215). Remove oil filter (18-l 10), disassemble and clean.

Install initial operation oil filter element. After 1000 – 1500 km, change engine oil and oil filter element.

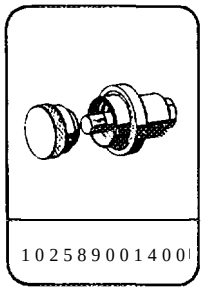
03-324 Replacing front crankshaft radial seal

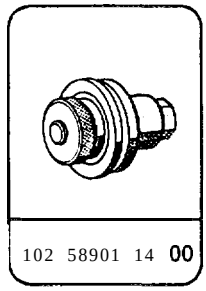
Preceding work:
Drain coolant (20-010).
Remove radiator (20-420).
Remove poly V-Belt (13-342).
Remove belt pulley and vibration damper (03342).

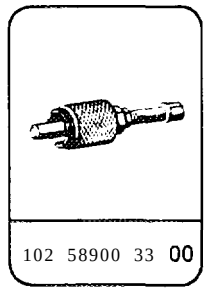


Radial seal (45)	. . . . .	remove, replace and install (steps 1, 3 and 4)
Spacer ring (7)	. . . . .	check, replace if necessary (step 2).
Mounting hole	. . . . .	clean, check.

Special tools

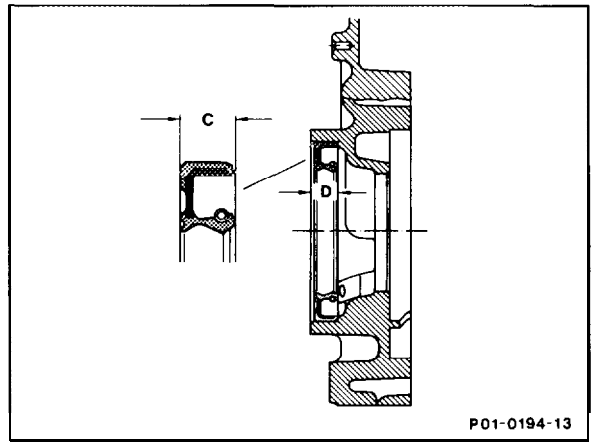






Notes

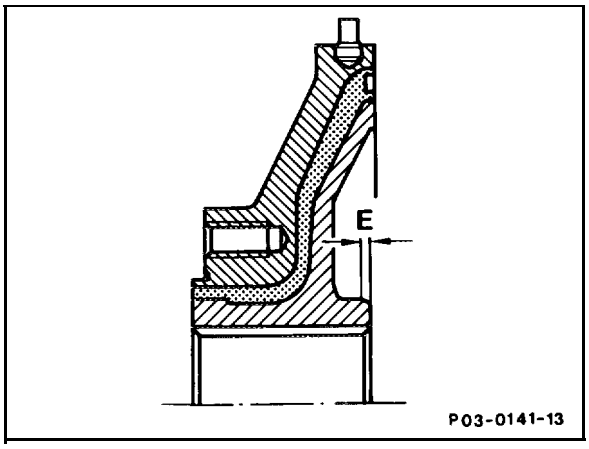
Since August 1986 (implementation of use of double roller chain) a 4 mm narrower radial seal has been installed.
Size "C" 8 mm (previously 12 mm).
For the same reason, the mounting in the timing case cover (D) was made 3.4 mm flatter.
Size "D" 9.8 mm (previously 13.2 mm).



Standard implementation: 08/86 radial seal

Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.024 (USA)	102.985	004069	038196		261571

As a result of the modified installation position of the dust lip on the narrower radial seal, the chamfer on the vibration damper is shorter. Size "E" 0.8 mm (previously 2 mm).



Standard implementation: 08/86 vibration damper

Model	Engine	Engine End No.		Vehicle Ident End No.	
		Manual transmission	Automatic transmission	A	F
201.024 (USA)	102.985	004202	039381		267452

A radial seal of a further manufacturer was installed for a certain period.

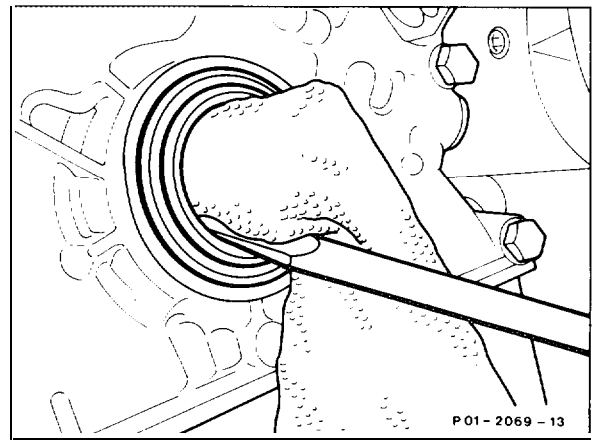
Identification: outer ring black
inner ring red

Removal and installation

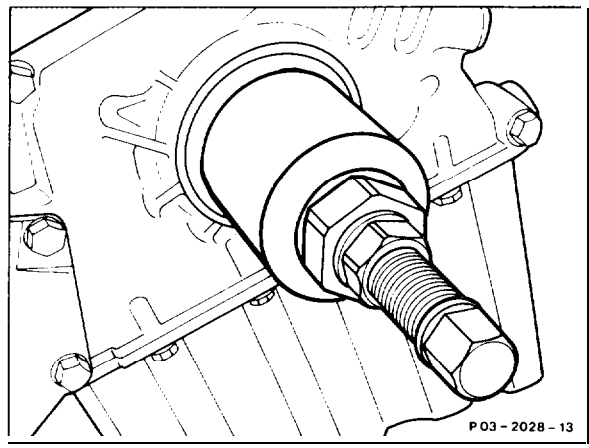
Note

Before replacing the front crankshaft radial seal, it is necessary to determine whether the leak is occurring at the timing case cover itself (shrink holes, cracks).
This is done by cleaning the bottom area of the timing case cover free of oil, drying and spraying it with “MB contrast spray white”,
Part No. 009 989 03 59. Run engine and pinpoint oil leak after 2 – 5 minutes.

1 Pry radial seal (45) out of the timing case cover with a screwdriver.
When performing the step, ensure that the crankshaft journal and the mounting hole in the timing case are not damaged. Cover over crankshaft journal with a rag.
Deburr mounting hole, if necessary.



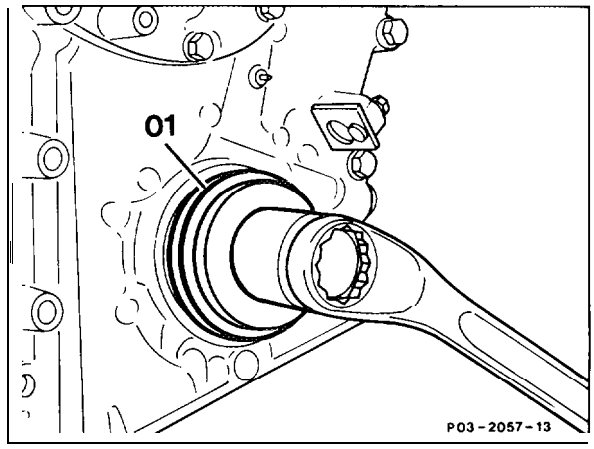
2 Check whether the sealing lip of the radial seal has worn at the spacer ring (7) (groove). If necessary, remove spacer ring with the puller 102 589 00 33 00.
If necessary, install new spacer ring.



3 Oil the sealing lip of radial seal (45).

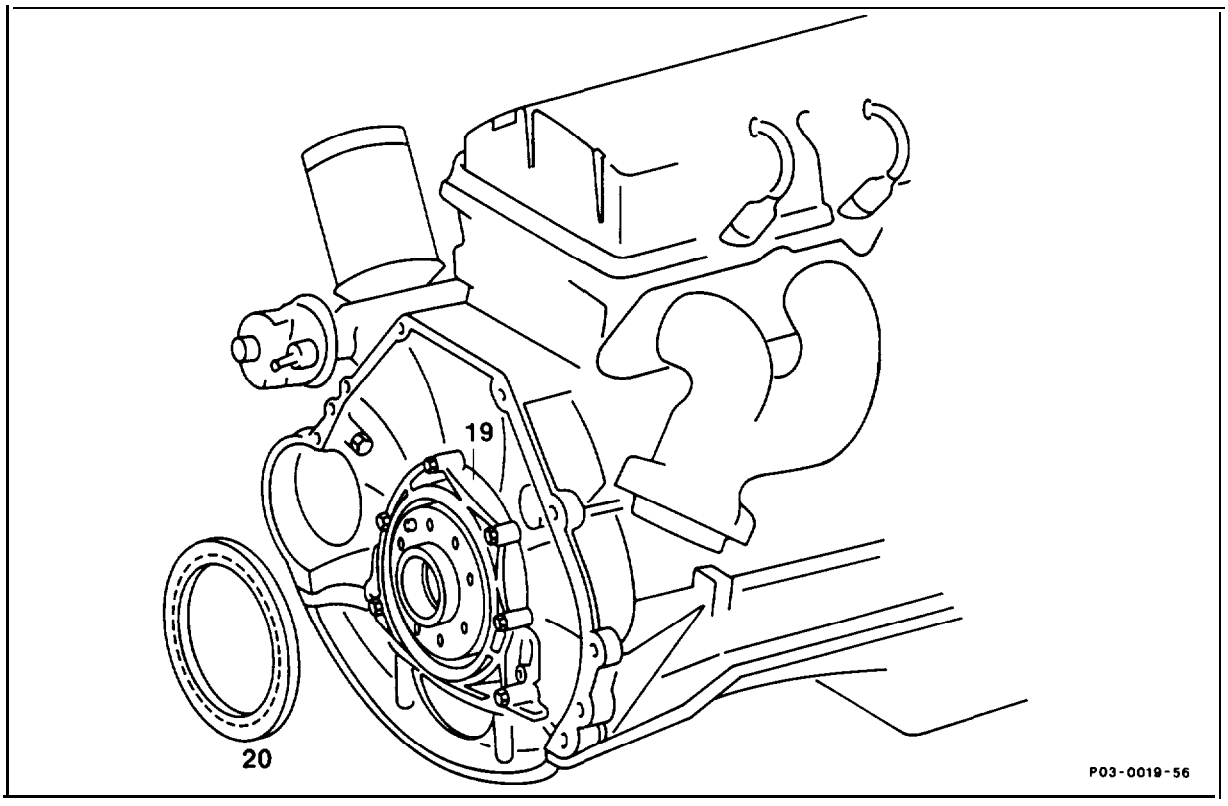
Caution!
Do not use any grease. Grease prevents the inclined webs on the sealing lip from positioning.

4 Pull in radial seal with an installation tool.
Installation instruction
Use **special** tool 102 589 00 14 00 on engines with single roller chain, use additionally the 'spacer ring 102 589 01 14 00 (01) on engines with double roller chain.



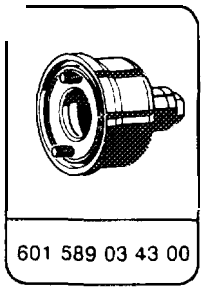
03-327 Replacing rear crankshaft radial seal

Preceding work:
Removing transmission (26-020 or 27-600).
Removing flywheel or driven member (03-410).

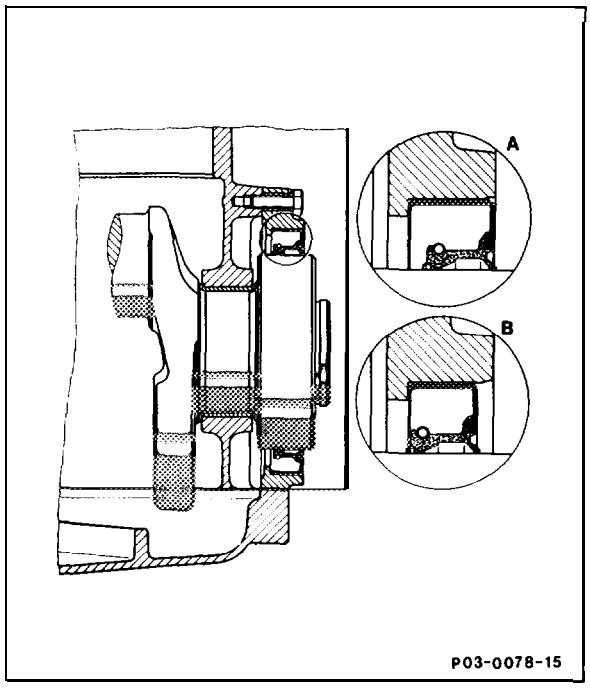


Radial seal (20)	remove, replace and install.
Mounting hole	clean, check.
Sealing lip	oil.
Leaks when engine running	check.

Special tool



Notes
The sealing lip of the replacement radial seal is offset to the inside by 3 mm so that it does not run in a groove which may have been produced on the running surface on the crankshaft by the standard radial seal.

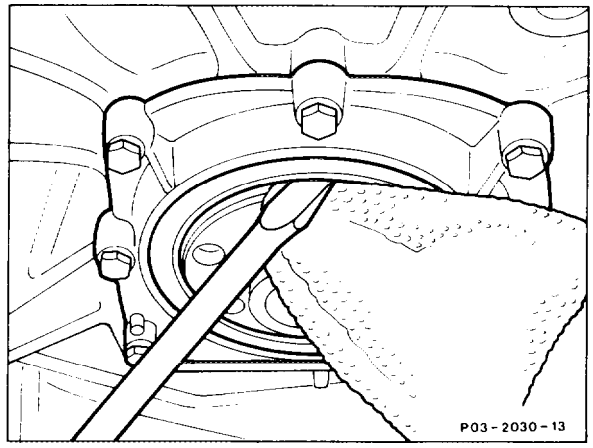


A Standard radial seal
B Repair radial seal

The radial seall is installed into the end cover flush without any sealant.
Oil leaks can be determined after spraying the cleaned and dried surrounding area with Mercedes-Benz contrast spray white, Part No. 000 989 03 59.

Removal and installation

1 Press radial seal out of the end cover with a screwdriver.
When performing this step, ensure that the crankshaft flange and the mounting hole in the end cover are not damaged. Cover over crankshaft flange with a rag.

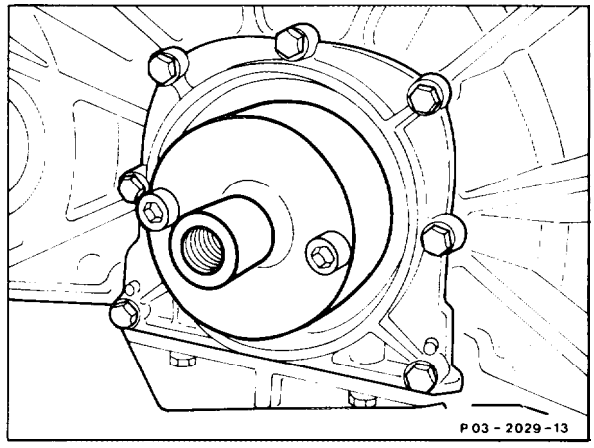


2 Check running surface for radial seal on the crankshaft for signs of damage.

3 Clean mounting hole in the end cover for the radial seal, deburr if necessary.

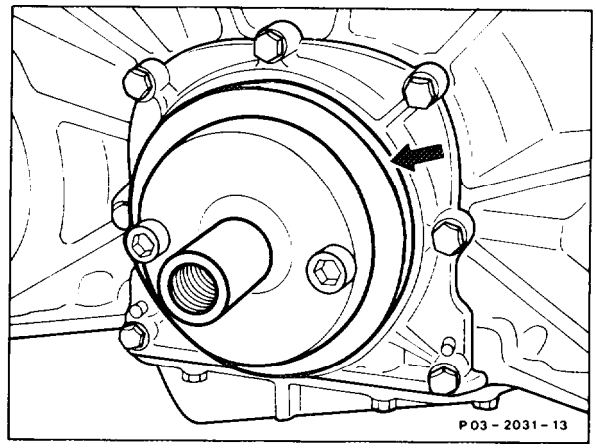
4 Screw inner part of installation tool onto crankshaft flange.

5 Oil sealing lip of radial seal.

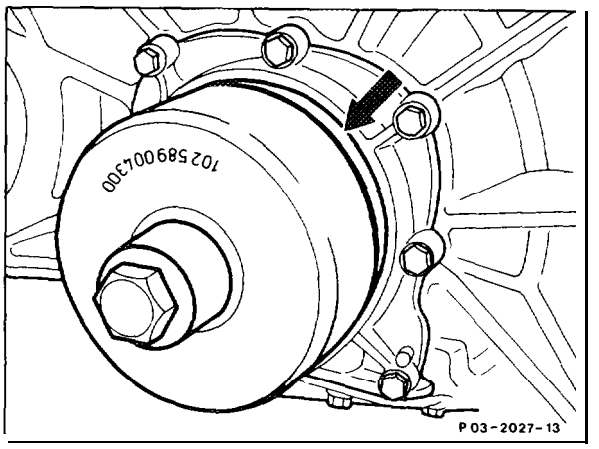


Caution!
Do not use any grease. Grease prevents the inclined webs on the sealing lip from repositioning.

6 Install radial seal (arrow) over the inner part of the Installation tool.



7 Press the radial seal (arrow) into the end cover as far as the stop with the outer part of the installation tool.

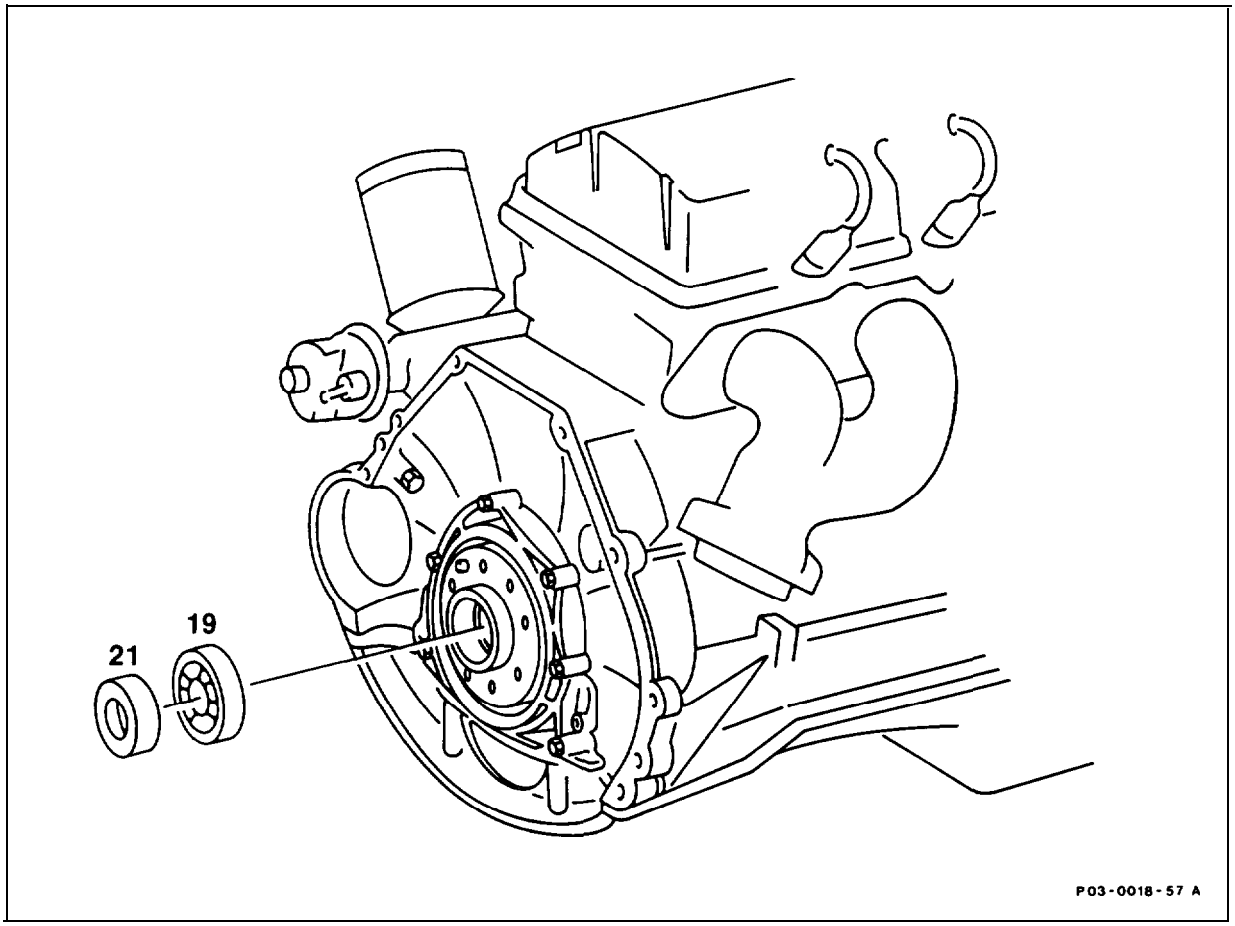


Caution!
The radial seal must be positioned exactly at right angles to the crankshaft flange or inner part of the installation tool to ensure that it provides a proper seal.

8 Check for leaks with engine running.

03-330 Removal and installation of grooved ball bearlng in crankshaft

Preceding work:
Removing transmission (26-020 or 27-600).
Removing clutch (25050).

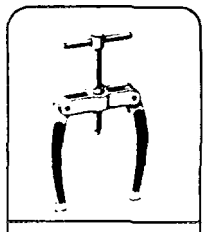


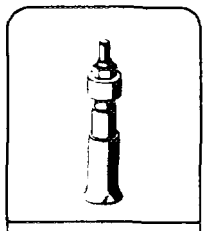
Grooved ball bearing (19) and locking ring (21) . . withdraw, special tool 000 589 33 33 00 and 000 589 25 33 00.

Before installation, coat outer race of grooved ball bearing with adhesive 002 989 94 71.

Knock in grooved ball bearing as far as the stop, outer race flush.

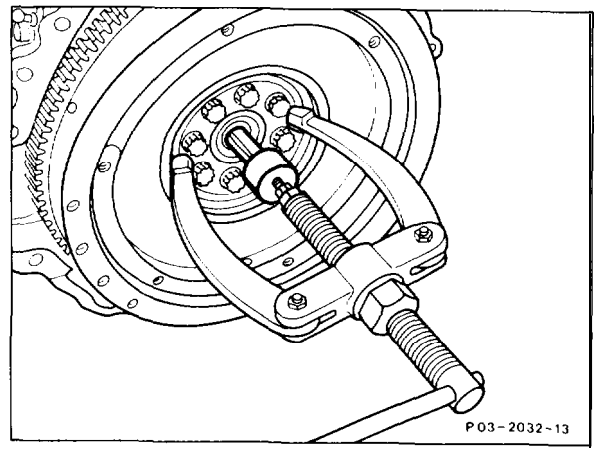
Special tools





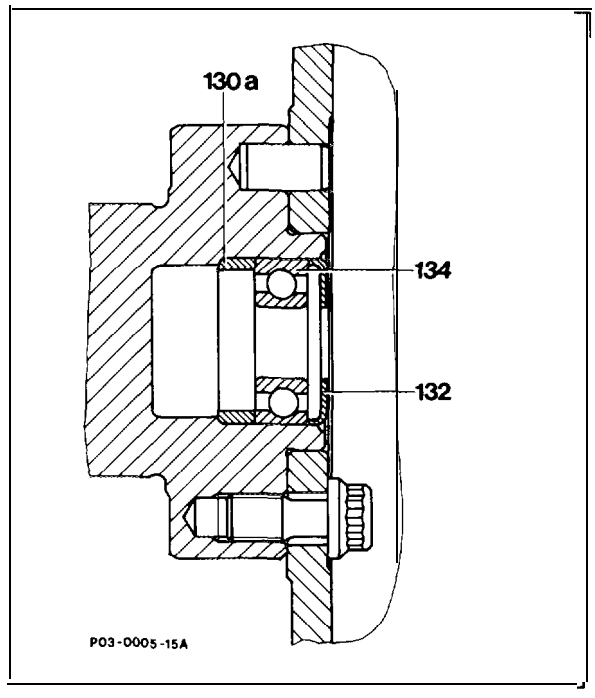
Removal and installation

1 Withdraw grooved ball bearing with locking ring from the crankshaft, special tool 000 589 33 33 00 and 000 589 25 33 00.



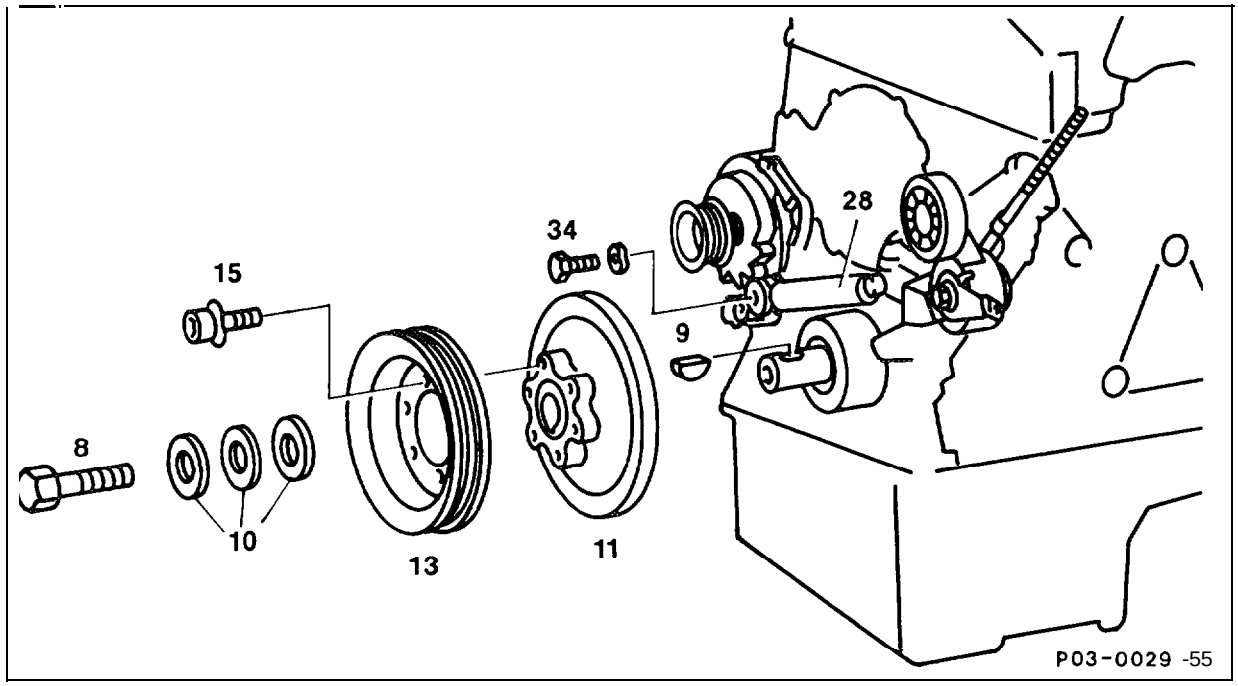
2 Coat the new grooved ball bearing with the adhesive 002 989 94 71 and knock the outer race with a suitable drift to insert it into the crankshaft as far as the stop.

3 Knock in locking ring (132) flush.



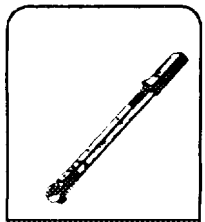
03-342 Removal and installation of vibration damper or hub and belt pulley

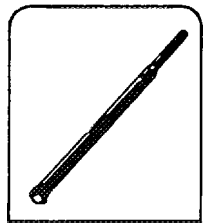
Preceding work:
Draining coolant (20-010).
Removing radiator (20-420).
Removing poly V-belt (13-340).

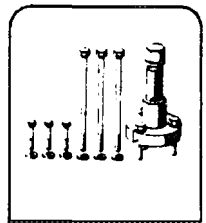


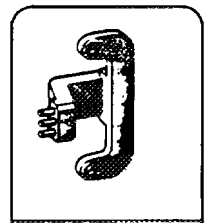
Retaining lock on starter ring gear	remove and install, special tool 601 589 02 40 00.
Belt pulley (13)	unbolt, bolt on, 25 Nm.
Hexagon bolt (8)	unscrew, bolt on, 300 Nm.
Shock absorber (28)	Unbolt at bottom, bolt on (step 4) and press up, 25 Nm.
Vibration damper (11)	pull off, special tool 601 589 08 33 00, fit on.

Special tools


001 589 72 21 00


001 589 74 21 00


103 589 00 33 00

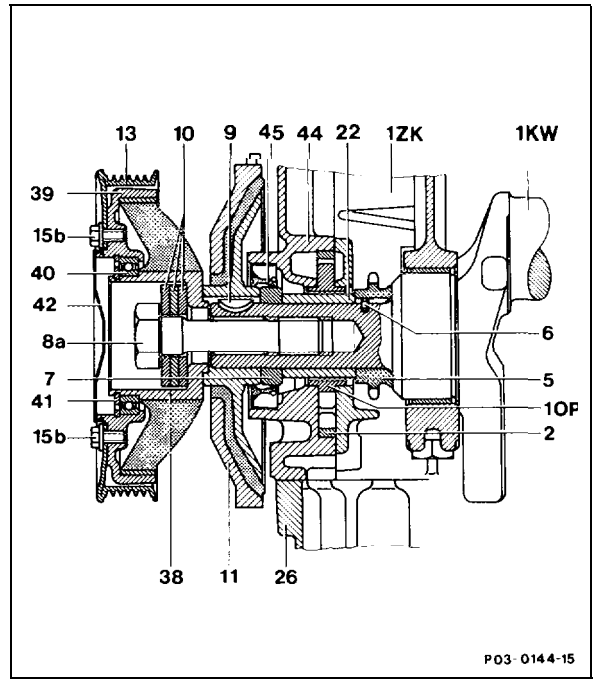

601 589 02 40 00

Commercial tool

3/4" square socket to 1/2" square driver coupler	e. g. Hazet D-5630 Remscheid Order No. 1058 R-I

On vehicles with air conditioning/automatic climate control, the belt pulley (13) was installed with a hub with rubber part (38, damping part) with ball bearing (40) up to December 1984.

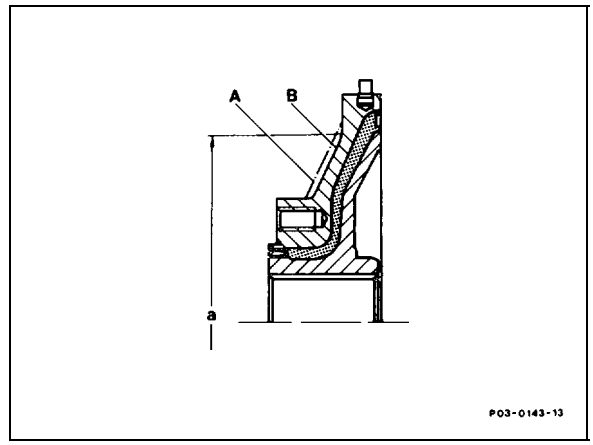
The uneven running of the crankshaft, particularly at low engine speeds and during cutin surges of the A/C compressor, are damped by the coupling so that the V-belt runs practically slip-free on the belt pulley.



1 KW Crankshaft
1ZK Crankcase
2 Oil pump outer gear
5 Crankshaft gear
6 Straight pin 3 × 5 mm
7 Spacer ring
8a M18 x 1.5 x 75 stretch bolt
9 Woodruff key
10 Belleville spring washer
10P Oil pump inner gear
11 Vibration damper
13 Belt pulley
15b M6 × 13 bolts
22 Oil pump drive sleeve
26 Oil sump
38 Hub with rubber part and steel ring
39 Flange
40 Ball bearing
41 Locking ring
42 End cover
44 Timing case cover
45 Radial seal

In order to provide greater clearance for the top shock absorber of the poly V-belt tensioning device, the shape of the vibration damper has been modified.

Size "a" = 133.1 **mm dia., previously** 145 mm dia.



A 1st version
B 2nd version

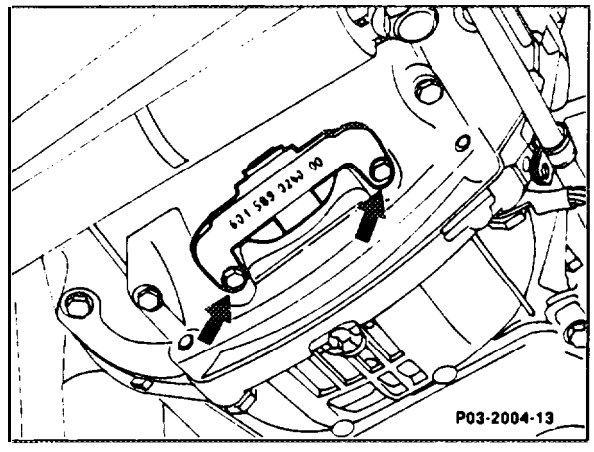
Standard implementation: 10/87

Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985	018810	061766

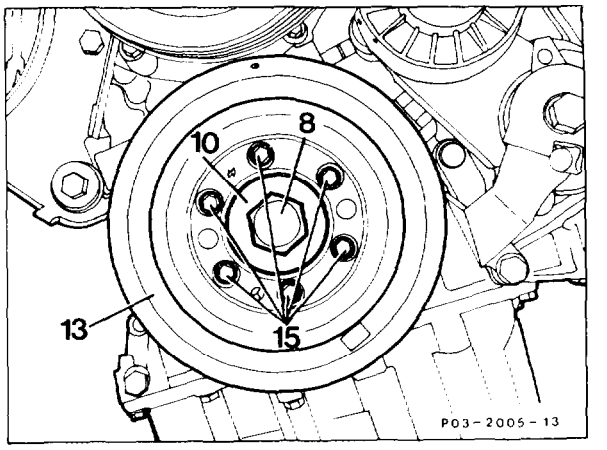
The spacer ring on the crankshaft was made 3.65 mm narrower with implementation of the double roller chain.

Removal and installation

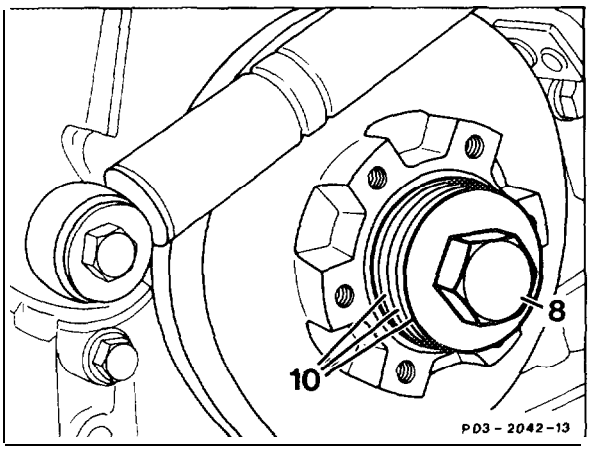
1 Attach retaining lock 601 589 02 40 00 with two bolts to the oil pan (arrows).



2 Remove bolts (15) and take off belt pulley (13). Tightening torque 25 Nm.

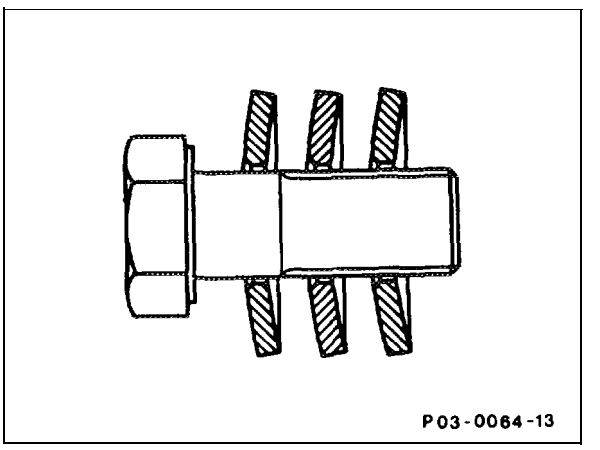


3 Remove bolt (8) and take off Belleville spring washers (10).

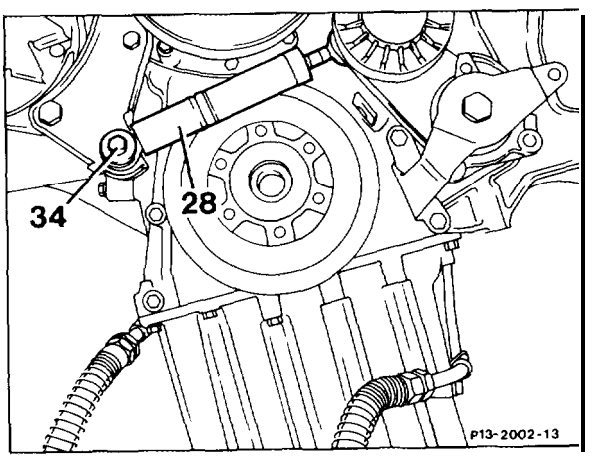


Installation Instruction

Oil bolt threads and Belleville spring washers. Install Belleville spring washers with curved side facing bolt head.



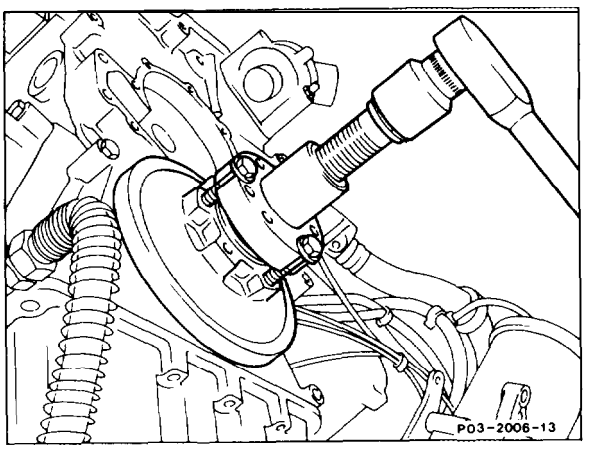
4 Remove bolt (34) for bottom shock absorber mounting and swing shock abosrber (28) upwards. Tightening torque 25 Nm.



5 Pull off vibration damper (11) with the puller 103 589 00 33 00.

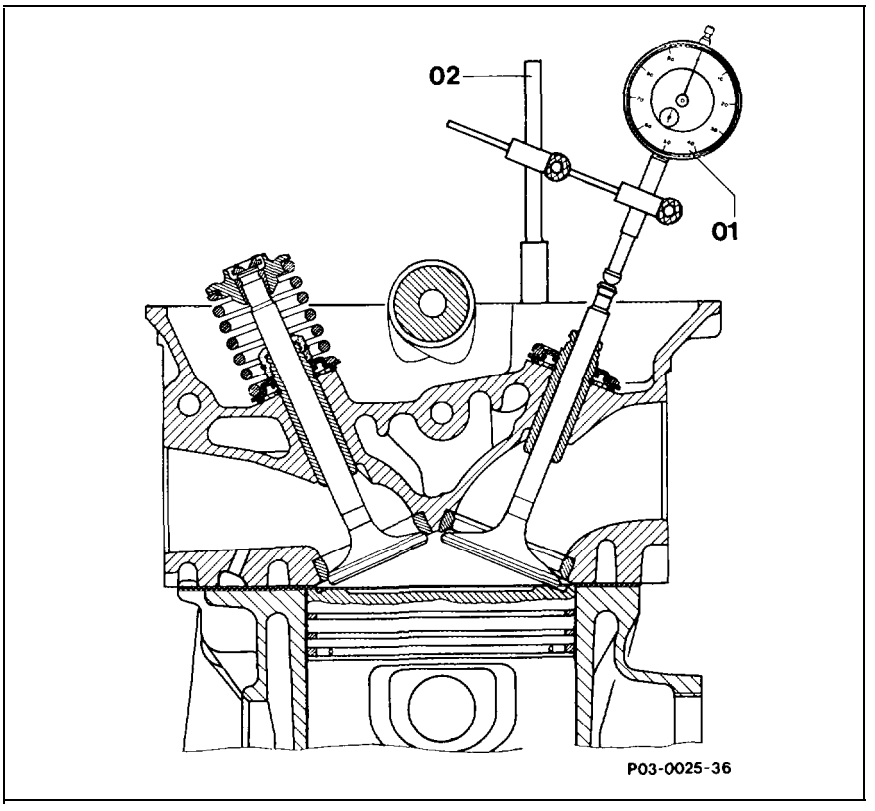
Installation instruction

When installing the vibration damper, check whether the groove in the hub is aligned with the Belleville spring washer in the crankshaft.



03-345 Checking and correcting setting of TDC pulse generator

Preceding work:
Removing poly V-belt (13-342).
Removing cylinder head cover (01-406).
Removing spark plugs (15-018).



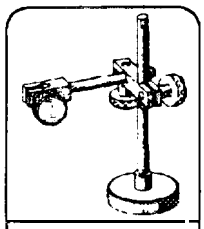
Fan and fan coupling	remove and install (step 1).
No. 1 cylinder piston	set to ignition TDC (step 2).
No. 1 cylinder rocker arm bearing bracket	remove and install, 20 Nm (step 3).
Valve spring	remove from 1st intake valve, install (05-250).
Valve stem seal	remove from 1st intake valve, install (step 5 and 05-270).

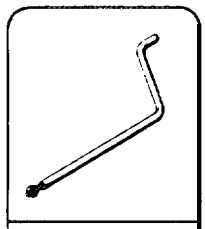
TDC setting	measure by attaching dial gauge holder 363 589 02 21 00 to cylinder head. Mount valve on piston crown. Turn back crankshaft to approx. 10° before TDC of No 1 cylinder. Inset-t dial gauge in holder. Fit tracer pin of dial gauge onto valve stem with preload of 2 mm. Slowly turn crankshaft in direction of rotation of engine until the large pointer stops (TDC setting, steps 6 through 11).
Hexagon nut	unbolt at TDC pulse generator, withdraw TDC pulse generator (step 12).
Dial gauge	loosen and set preload of 5 mm, position scale of gauge to "0" (step 13).
Turn crankshaft	until dial gauge has moved back by 2.85 mm or 3.07 mm, respectively (step 14).
Fixing device	Insert special tool 119 589 00 21 00 into setting slide. The pin in the vibration damper must engage in the groove of the fixing device; correct setting slide, if necessary (steps 14 through 19).

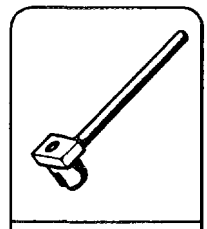
Data

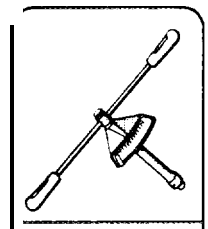
Piston travel at crankshaft setting 20° after TDC	measured over intake valve	2.85 mm
	measured directly at piston crown	3.07 mm

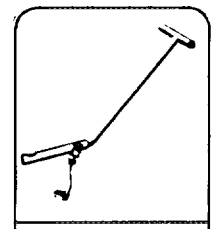
Special tools

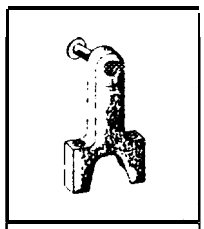

363 589 02 21 00

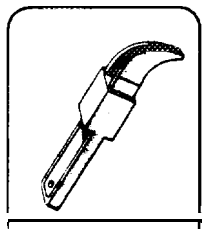

123 589 09 63 00

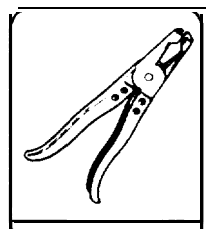

119 589 00 21 00


001 589 51 21 00


102 589 00 61 00


1102589 01 61 00


116 589 06 63 00

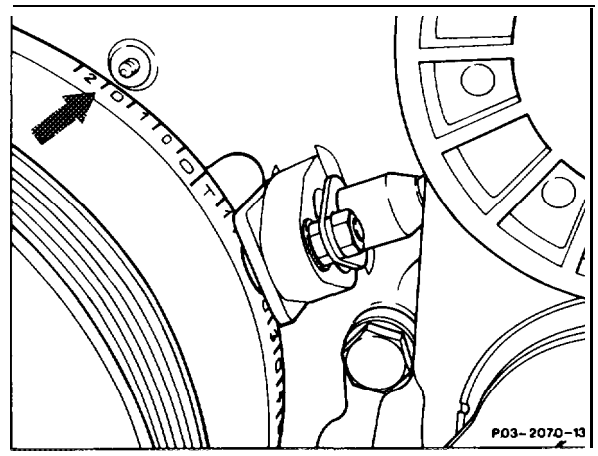

104 58900 3700

Commercial tool

Dial gauge A 1 DIN 878	e. g.	Mahr D-7300 Esslingen Order No. 311000

Notes

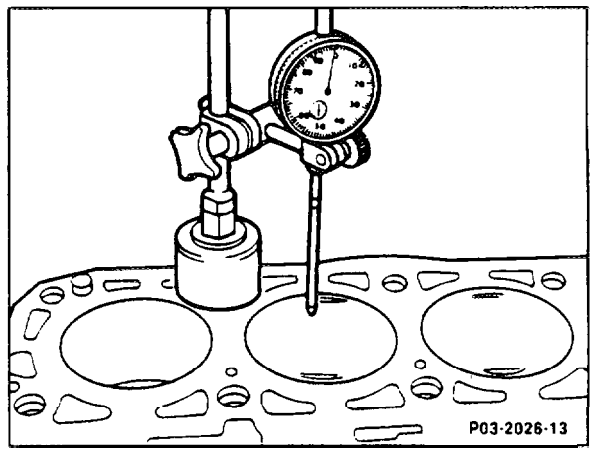
The TDS pulse generator with holder (1) is attached to the timing case cover.
The pin in the vibration damper or on the belt pulley must be positioned exactly below the TDC pulse generator at a crankshaft setting of 20” after TDC.



The adjustment of the TDC pulse generator must be checked or corrected:

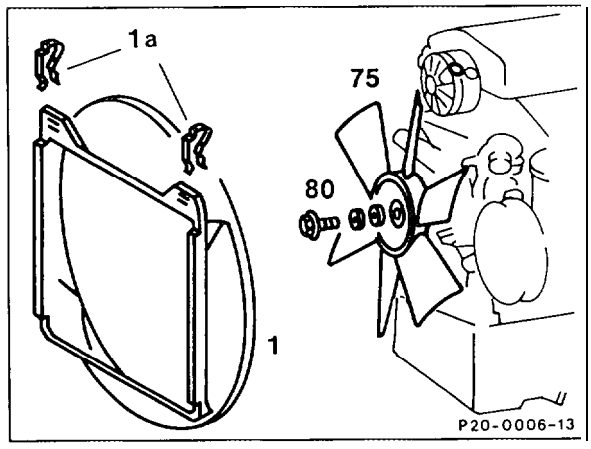
- When replacing the crankshaft or the vibration damper.
- When replacing the timing case cover.
- When installing parts to reconditioned engines.

The crankshaft setting 20” after TDC is determined from the piston travel, starting from ignition TDC of No. 1 piston.
The piston travel is measured either with the intake valve of No. 1 cylinder mounted on the piston crown and dial gauge or, if the cylinder head is removed, directly by mounting the dial gauge pin on the piston crown.

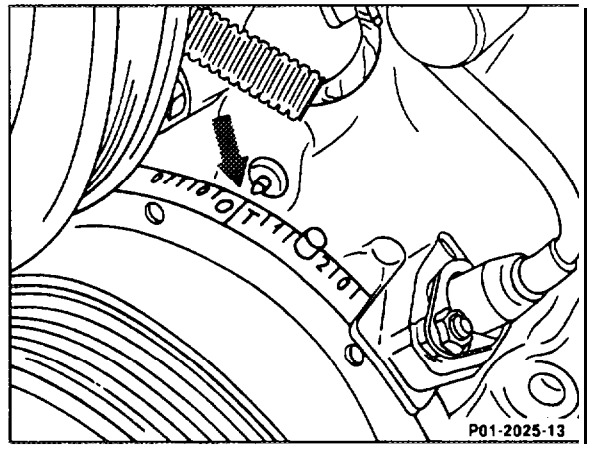


Checking

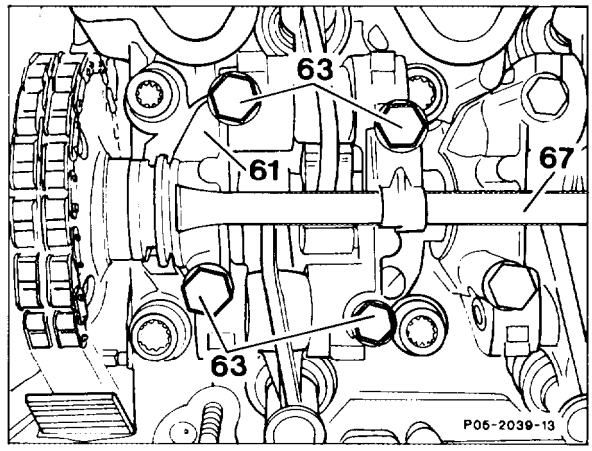
1 Remove and install fan shroud (1) and fan (75), tightening torque of bolt (80), 25 Nm.



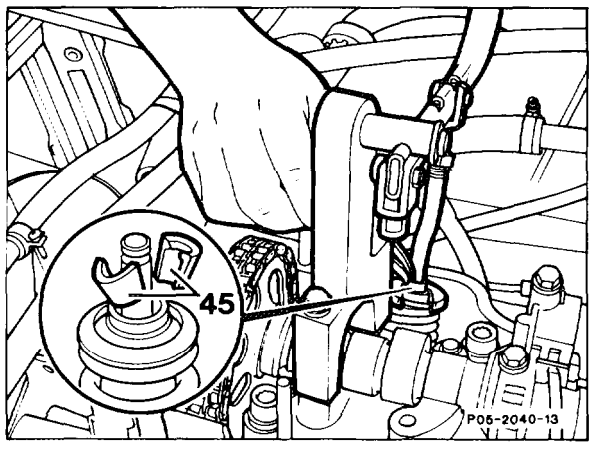
2 Set engine to ignition TDC of No. 1 cylinder.



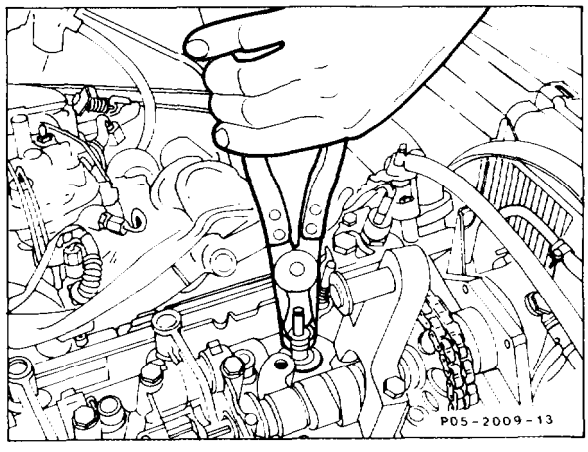
3 Remove and install rocker arm bearing bracket (61) by unscrewing oil pipe. Tightening torque of bolts (63), 21 Nm.



4 Remove and install valve spring at No. 1 intake valve (05-250).



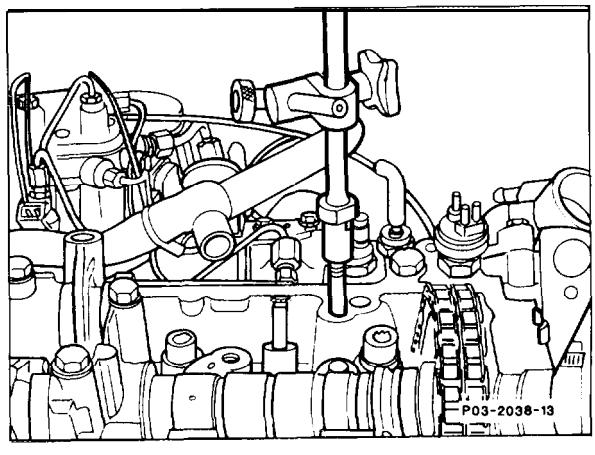
5 Remove and install valve stem seal of No. 1 intake valve. Oil new valve stem seal and press on by hand. Mount assembly sleeve on the valve stem for performing this step (05-270).



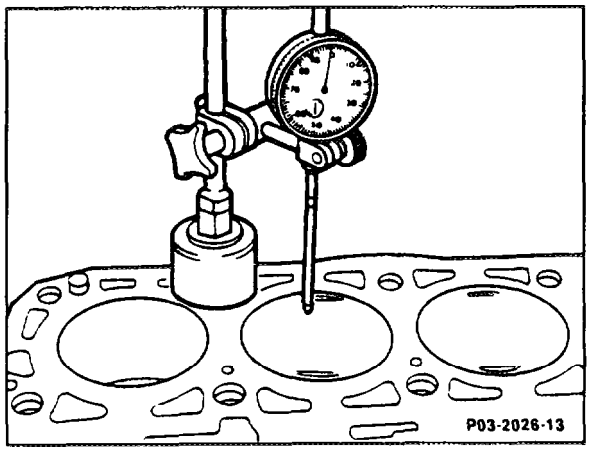
6 Mount valve on piston crown.

7 Turn back crankshaft to approx. 10° before TDC of No. 1 cylinder.

8 Bolt dial gauge holder 363 589 02 21 00 with threaded sleeve onto cylinder head set bolt at front left.



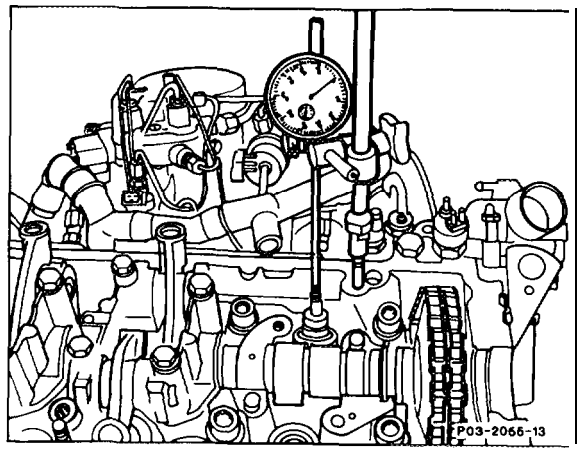
Note
With cylinder head removed, mount a magnetic dial gauge holder onto the mating face of the crankcase.



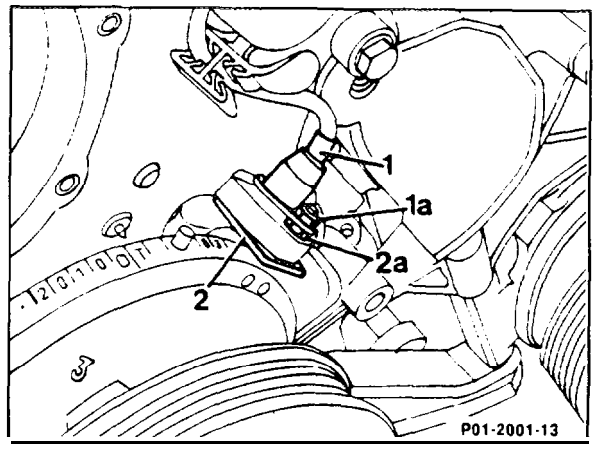
9 Insert dial gauge with extension.

10 Mount dial gauge with 2 mm preload onto the valve stem or piston crown.

11 Slowly turn crankshaft in direction of rotattion of *engine* until the larger pointer of the dial gauge stops (TDC setting).

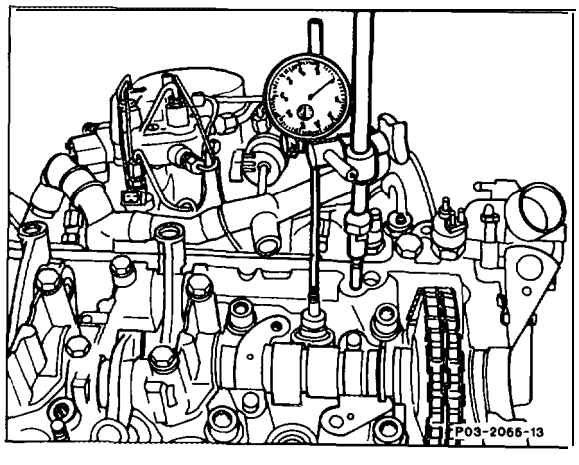


12 Unscrew hexagon nut (la) and withdraw TDC pulse generator (1).



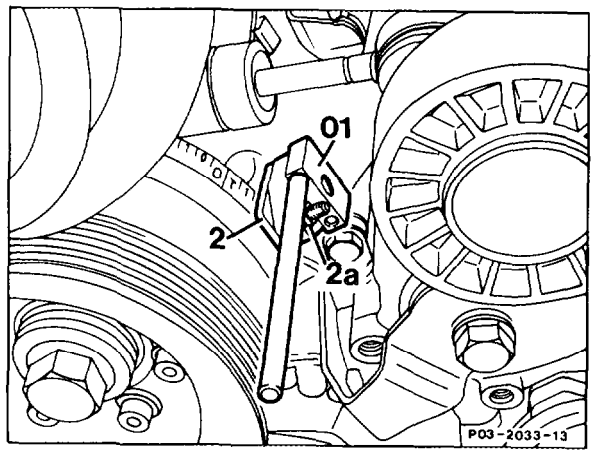
13 Loosen dial gauge and mount extension with 5 mm preload onto the valve stem or piston crown. Turn scale of gauge until the large pointer is at zero.

14 Turn on crankshaft in direction of rotation until the dial gauge has moved back by the appropriate value (data in table).



15 Position fixing device 119 589 00 21 00 into the setting slide (2).
The pin on the vibration damper must engage in the groove of the fixing device (1).

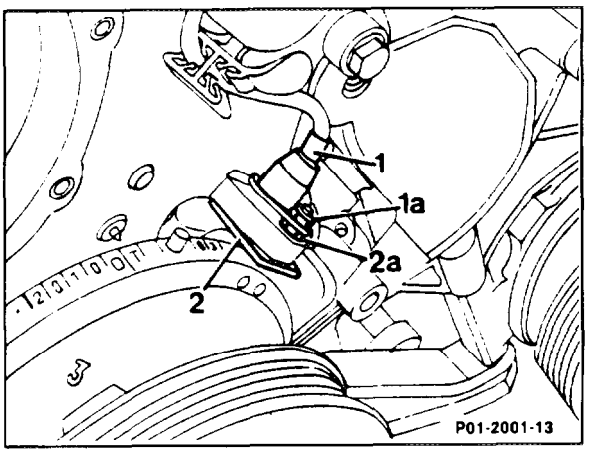
If the pin does not engage, adjust position of setting slide.



Adjustment

16 Loosen nut (2a) and move setting slide (2) far enough for the pin on the vibration damper to engage in the groove of the fixing device.

17 Tighten nut (2a) and withdraw fixina device.

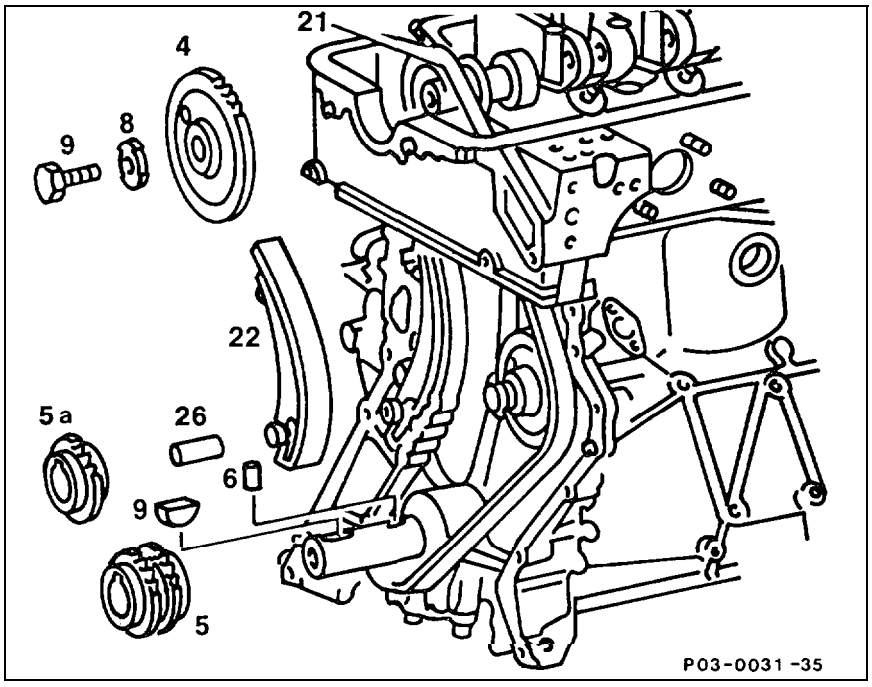


18 Insert TDC pulse generator and bolt on.

19 Remove dial gauge and dial gauge holder.

03-350 Removal and installation of crankshaft gear

Preceding work:
Removing liming case cover (01-210).
Removing chain tensioner (05-310).



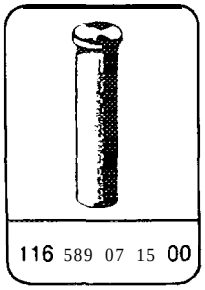
Timing chain (21), camshaft gear (4) and crankshaft gear (5 or 5a)	mark relative to each other (steps 1 and 2).
Camshaft gear (4)	remove and place timing chain in chain box (step 3). Install (step 10), 80 Nm.
Tensioning rail (22)	pull off and insert.

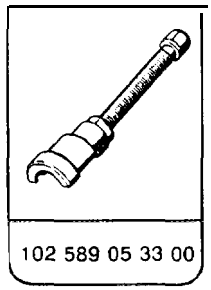
Note

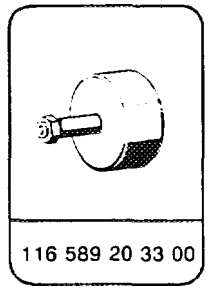
Drill bearing pin (26) of engines with double roller chain, tap M6 thread and knock out with impact extractor 115 589 12 33 00 and extension 100 589 00 43 00.
When installing tensioning rail, insert new bearing pin together with tensioning rail (steps 4 and 9).

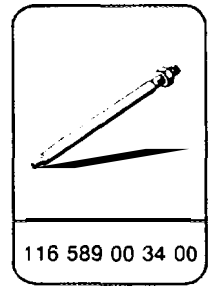
Crankshaft gear (5 or 5a)	. . . . .	pull off with puller 102 589 05 33 00 together with oil pump drive sleeve. Transfer colour marking to new crankshaft gear. Knock in crankshaft gear, if necessary, with drift 116 589 07 15 00, pay attention to straight pin (6) (steps 5 through 8).

Special tools







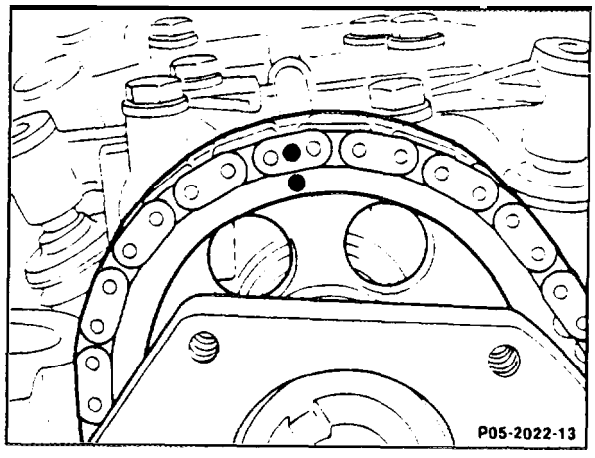


Note

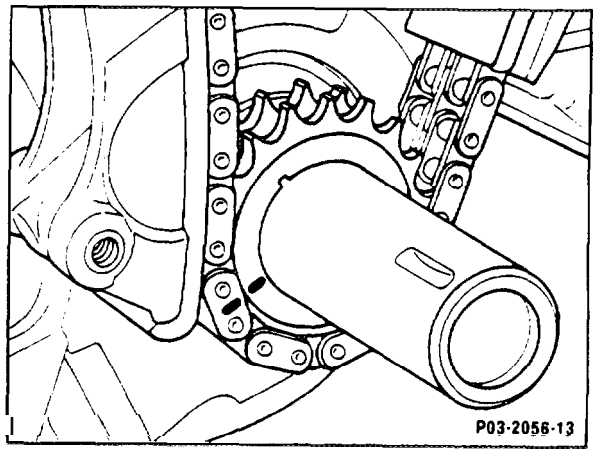
As of January 1988 a double roller timing chain has been installed.

Removal and installation

1 Mark timing chain and camshaft gear rerlative to each other.

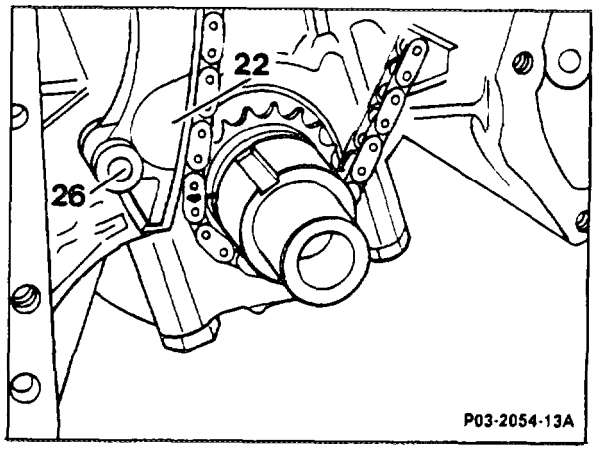


2 Mark timing chain and crankshaft gear relative to each other.



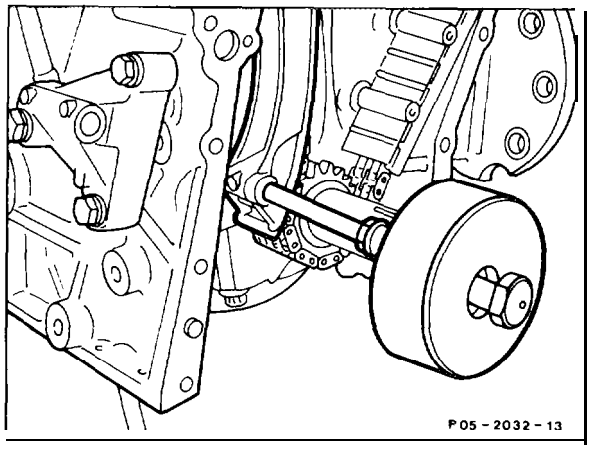
3 Unbolt camshaft gear and place timing chain in chain box.

4 Pull tensioning rail (22) off bearing pin (26) .

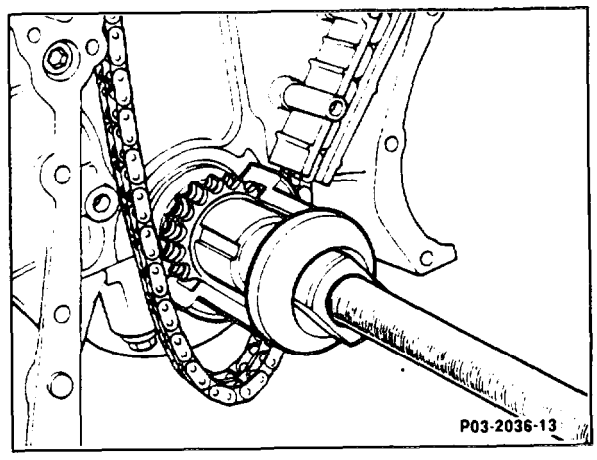


Note

On engines with double roller chain, knock out bearing pin of tensioning rail with the impact extractor 115 589 12 33 00 and the extension 100 589 00 43 00.
To perform the step, tap an M6 thread approx. 10 mm deep into the bearing pin.

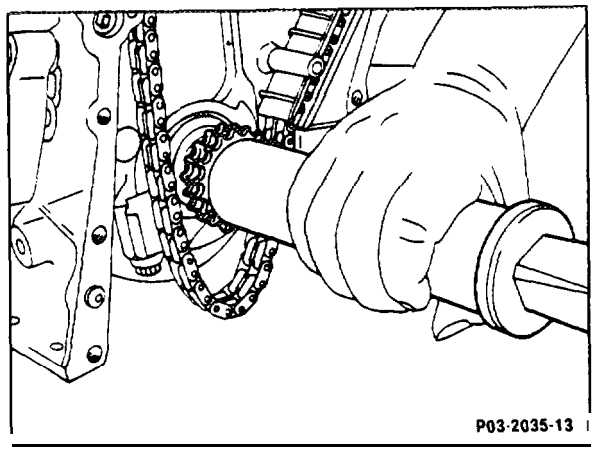


5 Pull off crankshaft gear and oil pump drive sleeve with the puller 102 589 05 33 00.



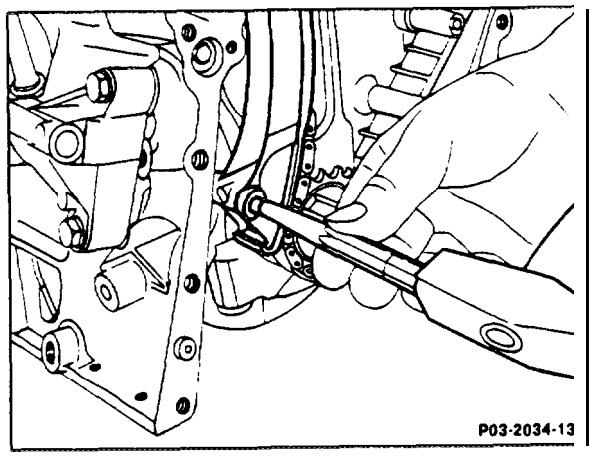
6 If the crankshaft gear is replaced, transfer color marking from the old to the new crankshaft gear.

7 Install crankshaft gear onto crankshaft. If this proves difficult, knock in with the impact drift 116 589 07 15 00.
Pay attention to the straight pin for locating, when performing this step.



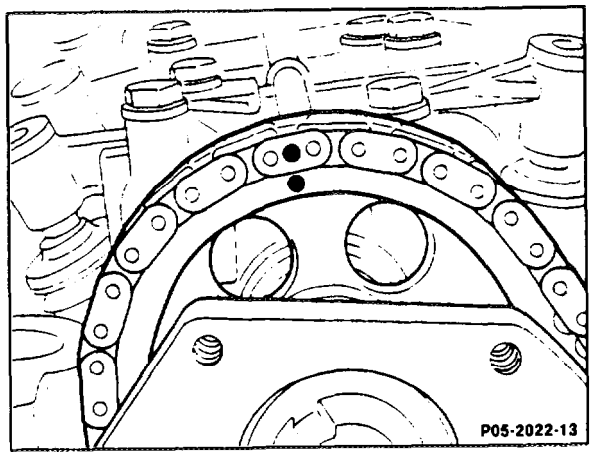
8 Insert drive sleeve.

9 Insert tensioning rail.
On engines with double roller chain, insert tensioning rail and knock in new bearing pin as far as the stop.



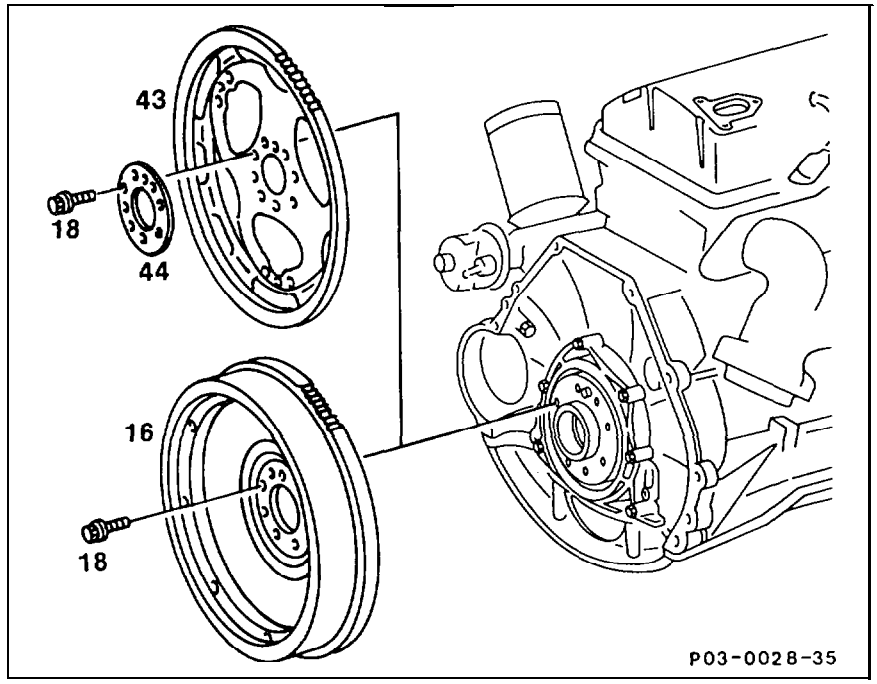
10 Install camshaft gear (pay attention to color marking), tightening torque 80 Nm.

11 Check for leaks with engine running.



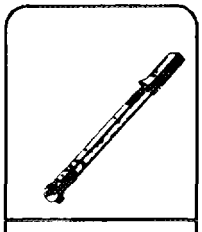
03-410 Removal and Installation of flywheel or flex plate

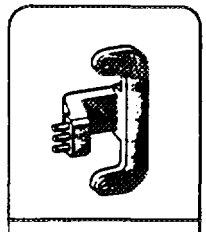
Preceding work:
Removing transmission (26-020 or 27-600).
Removing **clutch (25-050).**



Retaining lock on starter ring gear	remove and install, special tool 601 589 02 40 00 (step 2).
Stretch bolt (18)	unbolt, bolt in, check length/stretch shaft dia., initial torque 30 Nm, angle of rotation torque 90°, with two-mass flywheel 50 Nm, angle of rotation torque 90° (steps 6 and 7).
Flywheel (16) or flex plate (43) with spacer disc (44)	detach, attach (step 5).

Special tools

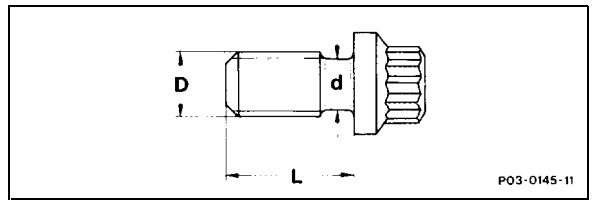

001 569 66 21 00


601 569 02 40 00

Stretch bolt

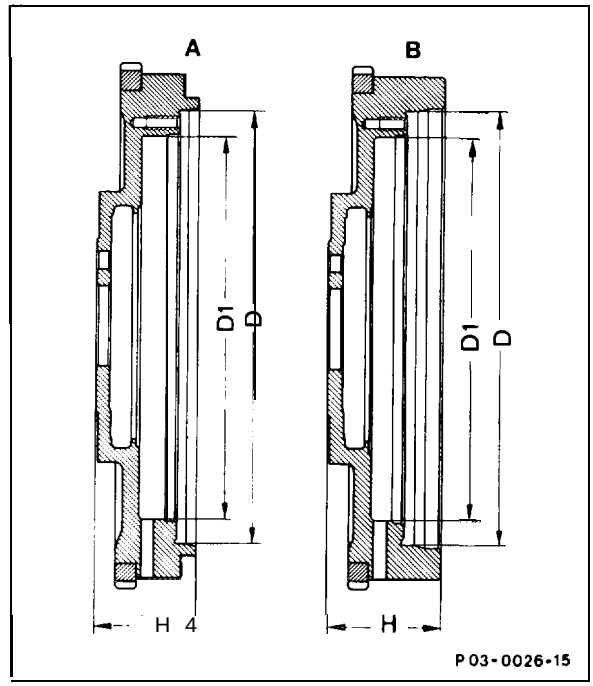
Part No.		102 **032 00** 71	103 032 00 71 [1])
Thread dia. D		M10 × 1	M10 × 1
Thread shaft dia. d	when new	8.5 -0.2	8.5 -0.2
	minimum dia.	8.0	8.1
Length L	when new	22 ±0.2	57 ±0.2
	maximum length	22.5	

[1]) Stretch bolt with two-mass flywheel



Notes

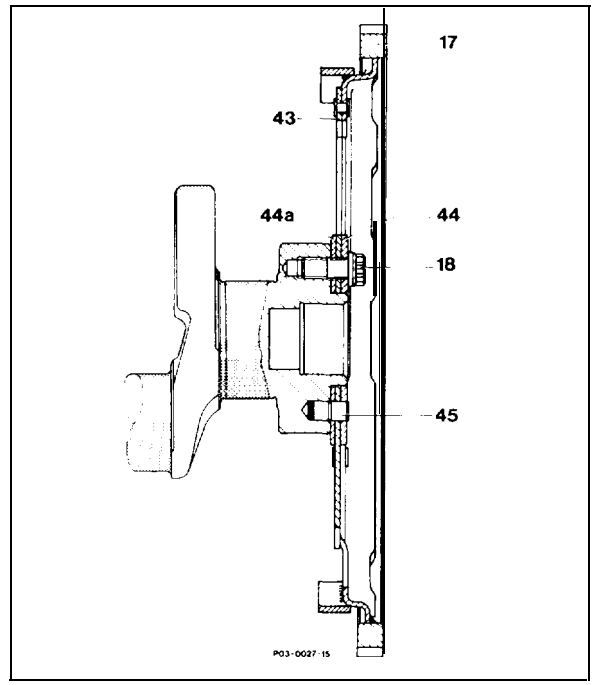
The engines 102.922/924/962/963 have the same flywheels (standard flywheel). Compared to this standard flywheel, the flywheel of engine 102.985 is lighter and the hole circle for the tapped holes for mounting the clutch are larger. The flywheels must not be interchanged and can be replaced without the need for static or dynamic balancing.



A Engines **102.922/924/962/963**
D 253 mm
D1 223 mm
H 58.6 mm

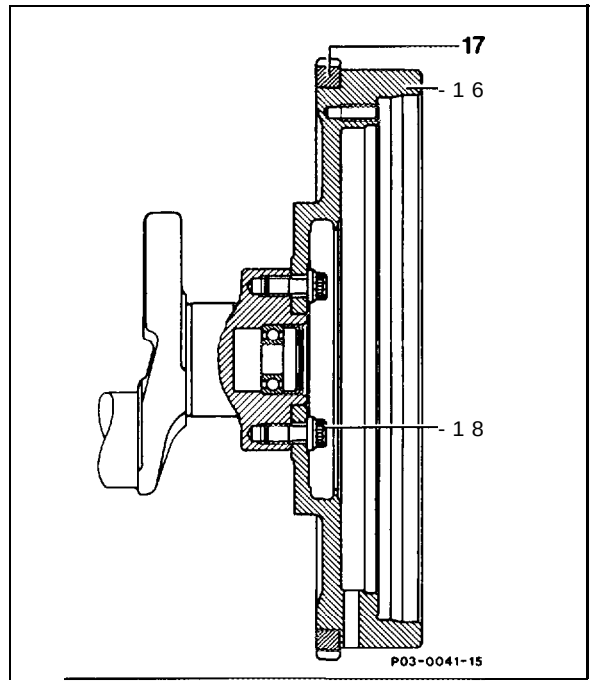
B Engine 102.985
D 265 mm
D1 237 m m
H **57** mm

The flex plate of the engines with automatic transmission is identical on all engines. Flywheel and flex plate with ring gear can be replaced without the need for static or dynamic balancing.



Arrangement of flex plate on crankshaft of engines with automatic transmission.

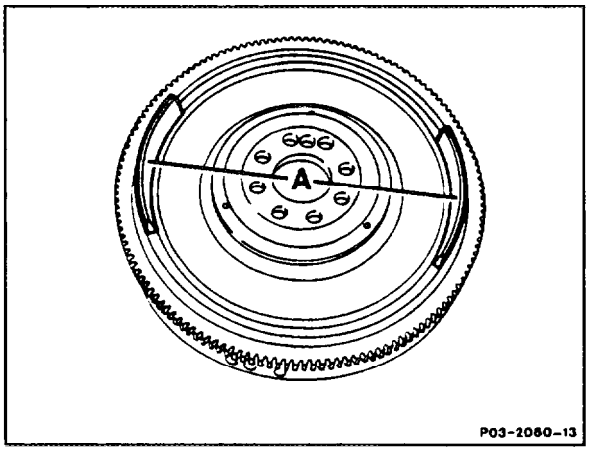
17 Ring gear
18 Ml0 x 1 x22 stretch bolt
43 Flex plate
44 Spacer disc
44a Spacer disc (bonded on)



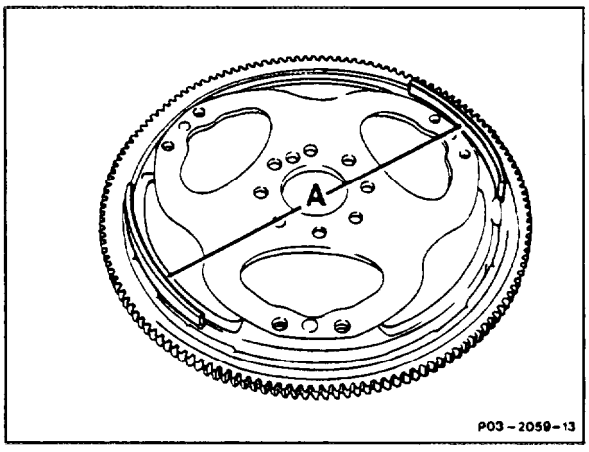
Arrangement of flywheel on crankshaft of engines with manual transmission.

16 Flywheel
17 Ring gear
1a M10×1 x22 stretch bolt

With the distributor ignition (DI - formerly EZL), the flywheel or the flex plate was provided with two segments (A) offset by 180".
As the segments rotate past the position sensor this produces an alternating voltage as a result of induction.
If the segments are damaged, replace the flywheel or the flex plate.



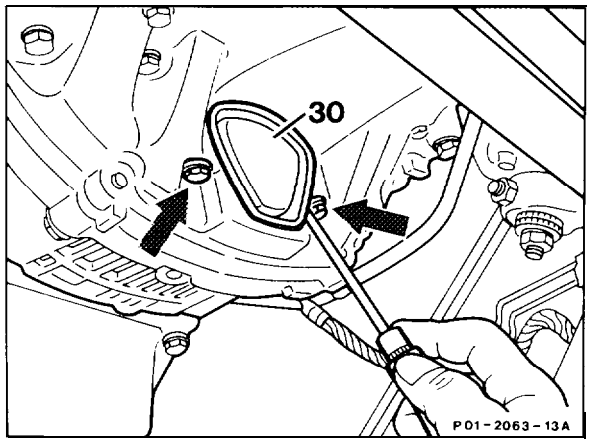
Flywheel of manual transmission



Flex plate of automatic transmission

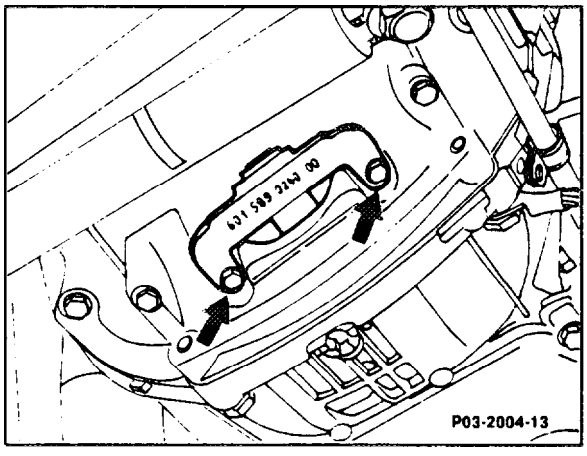
Removal and installation

1 Remove end cover (30) from the rear of the oil pan. Remove bolts (arrows), bolt in, tightening torque 10 Nm.
Press off end cover with screwdriver, fit on.



2 Attach retaining lock 601 589 02 40 00 with both bolts (arrows). The pins on the retaining lock must mesh into the ring gear teeth.

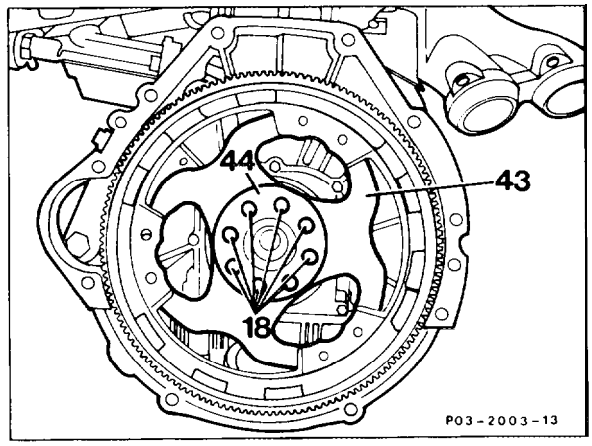
3 Unscrew stretch bolts (18).
Take off flywheel or driven member with bonded spacer disc (44a) and spacer disc (44).



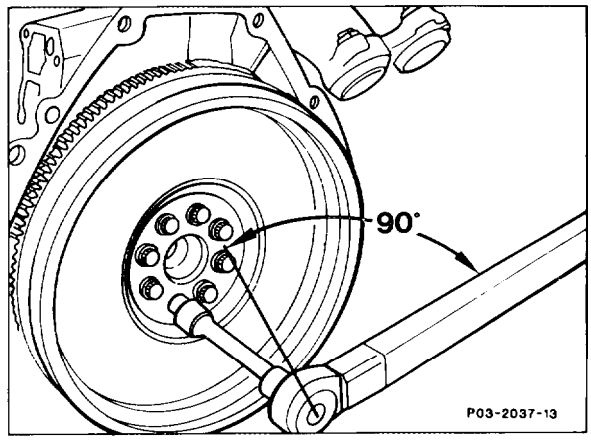
4 Check stretch bolts (see table).

5 install flywheel or flex plate (43) with bonded disc and disc (44), pay attention to centering of installation pin.

6 Bolt in stretch bolts (18) and tighten to an initial torque of 30 Nm or 50 Nm, respectively, for the two-mass flywheel.

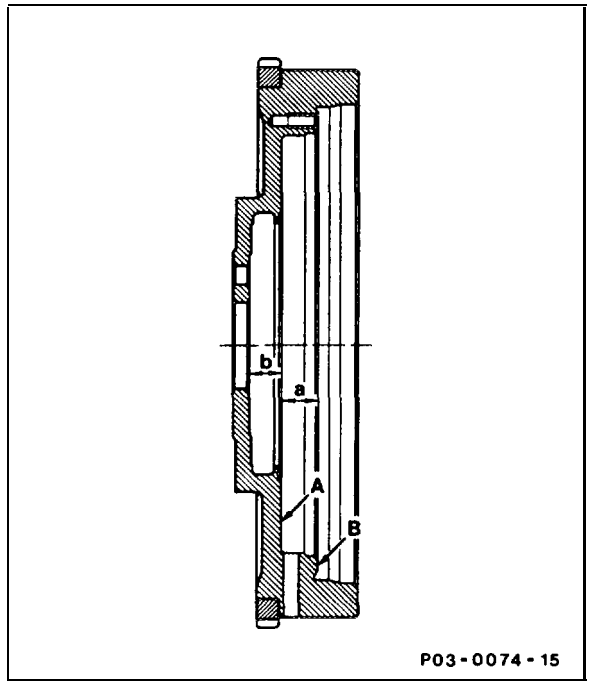


7 Torque stretch bolts (18) in a single operation by the specified angle of rotation torque of 90”.



03-420 Remachining flywheel

Preceding work:
Removing flywheel (03410).



Data

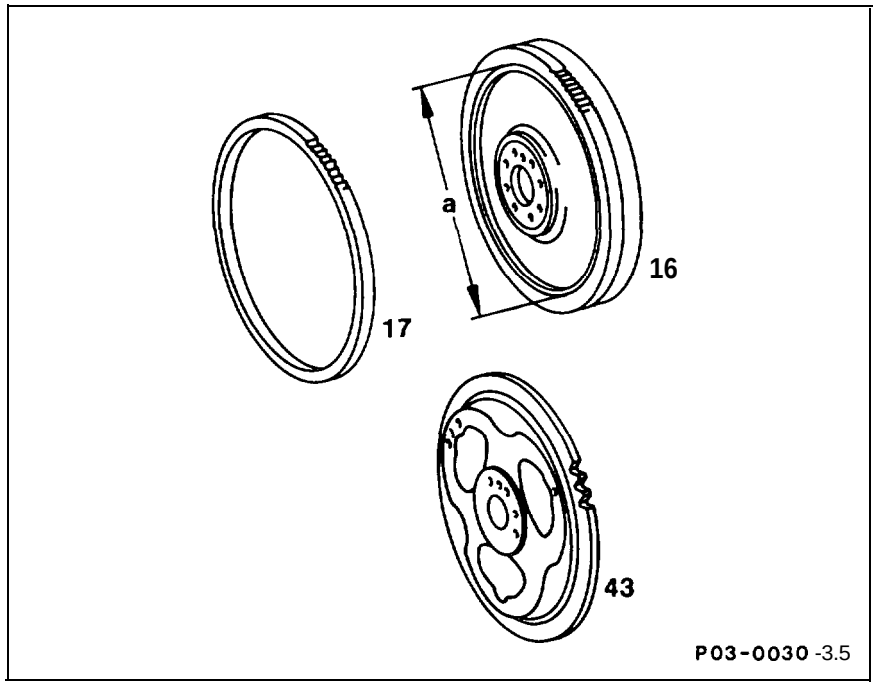
Engine		102.985
Distance a		19.4 – 19.5 mm
Distance b	when new	16.6 mm
	up to for repairs	15.5 mm
Permissible axial runout at clutch face or clutch flange face		0.05 mm

Notes
The two-mass flywheel cannot be machined and is only available as a complete replacement part.
Flywheels for manual transmissions which have scorch marks, scoring or cracks in the clutch face, should be machined by precision turning.

If grooves or cracks are deeper than the maximum permissible material removal, the flywheel must be replaced.
If the clutch face A is machined, the mounting face B must be machined by the same amount in order to maintain the distance a.
The size b must be maintained as a minimum when performing repairs.
The flywheel must be properly clamped for machining to ensure that the permissible axial runout of 0.05 mm is not exceeded.
After machining, the clutch face must not show any shrink holes or chatter marks.

03-430 Replacing ring gear on flywheel

Preceding work:
Removing flywheel (03-410).



Ring gear (17)	Drill old ring gear and snap open with a chisel or heat rapidly and then remove immediately. Heat new ring gear to 220 °C and fit onto the flywheel immediately. Pay attention to instruction. Lateral runout at ring gear max. 0.4 mm.
Flywheel (16)	Centering collar dia. (a) for ring gear 275,31–275,39 mm. Clean contact surface of ring gear at flywheel before installation on ring gear.
Flex plate (43)	This ring gear is welded on and cannot be replaced. Replace driven member complete.

Commercial accessories

Temperature measuring chalk Colour No. 2815/220 (white) Thermochrom	e. g. AW Faber-Castell D-8504 Stein bei Nürnberg

Notes

The ring gear is hardened. For this reason, do not exceed a temperature of 220 °C (yellow annealing colour) at any point when heating. This is only reliably possible by using a heating plate or heating oven.
Use a temperature measuring chalk corresponding to the instructions if possible.
Only use a flame in exceptional cases.
Coat only the inside of the ring gear for this purpose.
After replacing a ring gear, the flywheel does not need to be balanced.

To avoid damage to the ring gear, a ring gear with axially chamferred teeth was installed for a brief period to vehicles with automatic transmission.

Standard implementation: April – July 1986 standard

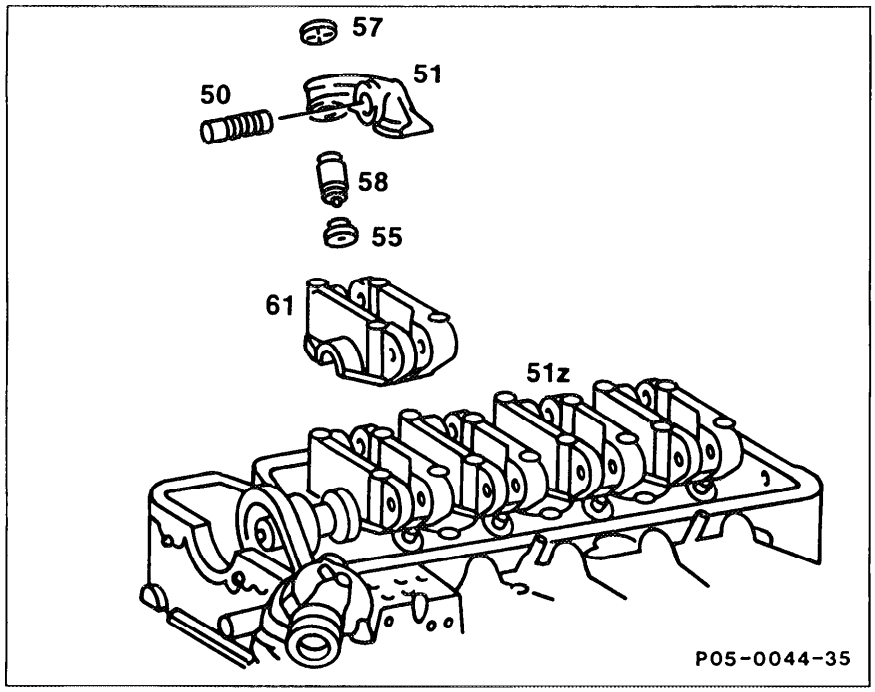
Model	Engine	Engine End No.	
		Manual transmission	Automatic transmission
201.028	102.985		033406 – 038268

Job No.

Checking and replacement of hydraulic valve clearance compensating element . . . . . 05 - 211
Checking and correcting the installation position of hydraulic valve clearance . . . . . 05 - 214
Checking and adjusting camshaft timing . . . . . -215
Removal and installation of camshaft . . . . . -220
Removal and installation of rocker arm bearing supports with rocker arms . . . . . -235
Replacement of rocker arms and rocker arm bearing supports . . . . . -240
Removal and installation of valve springs . . . . . -250
Checking valve springs . . . . . -260
Replacement of valve stem seals . . . . . - 270
Checking and machining valves . . . . . -280
Checking and replacing valve guides . . . . . - 285
Replacing valve seat ring . . . . . -290
Machining valve seats . . . . . -291
Removal and installation of chain tensioner . . . . . -310
Replacement of timing chain . . . . . -320
Installation of oil spray nozzle retroactively . . . . . -328
Removal and installation of tensioning blade . . . . . -330
Removal and installation of guide rails . . . . . -340
Removal and installation of idler gear shaft . . . . . -412
Removal and installation of oil pressure pump drive . . . . . -437

05-211 Checking and replacement of hydraulic valve clearance compensation element

Preceding work:
Air cleaner removed (09-400 and 09-410).
Cylinder head cover removed (01-406).



Check

Cam . . . . . position hydraulic element under test on the base circle. Load hydraulic element for approx. 5 to 10 seconds. If the element drops, remove it. To do this remove corresponding rocker arm bearing support (OS- 235). If a leaking hydraulic element is not found, check fitting position (05-214).

Note

When pressure testing the compensating elements, do not press valves against the piston crown (Numbers 1 and 2).

Valve clearance compensating element (58) . . . .

Fill up reservoir chamber of valve clearance compensating element on test with engine oil. Press on ball valve with a suitable pin and vent working chamber by pumping set bolt up and down. Close ball valve, if necessary replenish oil. After this no oil shall escape at ball valve when compressed and set bolt may not drop. If this is not the case, replace compensating element (Number 3).

Note

If compensating element is satisfactory, check oil bores in cylinder head, rocker shaft and rocker arm for passage, and clean if required. If several compensating elements are soft, replace oil pipe in cylinder head (01-415), for this purpose remove cylinder head (01- 415).

Replacement

Valve clearance compensating element (58) . . . .

With oil reservoir chamber full and original washer (57) push into the rocker arm up to the stop on the snap ring (56) (Number 4).

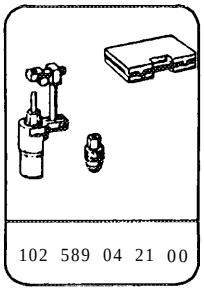
Rocker arm bearing support (61) . . . . . .

Install (05-235), at the same time fit original ball socket (55).

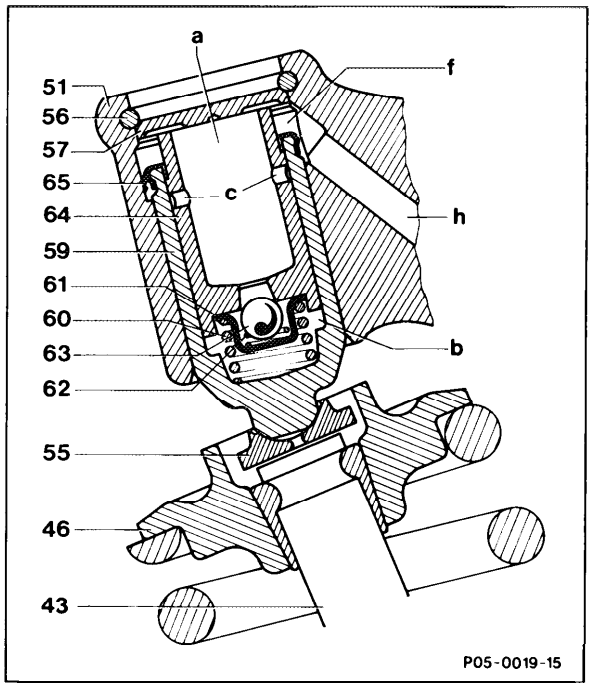
Note

Use ball socket 103 055 00 24, if a new ball socket is to be installed. Check and if required correct fitting position (05-214, Numbers 5 and 6).

Special tool



Hydraulic valve clearance compensation



43 Valve
46 Valve spring retainer
51 Rocker arm
55 Ball socket
56 Snap ring
57 Washer
59 Guide sleeve
60 Compression spring
61 Telescopic type ball bearing traveler
62 Compression spnng
63 Ball (5 mm 0)
64 Set bolt
65 Sealing cap
a Oil reservoir chamber
b Working chamber
c Return and venting bores

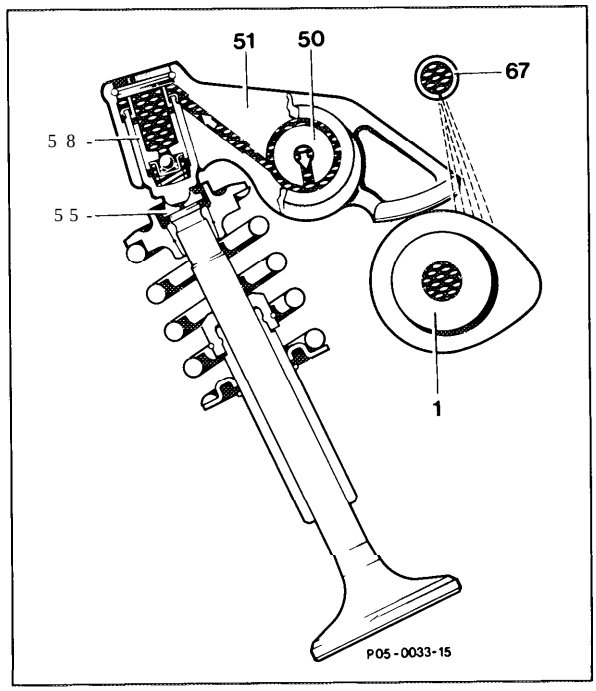
Valve adjustment Is no longer required when equipped with hydraulic valve clearance adjusters

The maintenance-free hydraulic valve clearance compensating elements located in the rocker arms eliminate valve clearance, i.e. dimensional changes in the valve train due to thermal expansion and wear are compensated by the elements. Valve train noise is low, because rocker arm is in continuous contact with the cam.

The hydraulic valve clearance compensating elements consist of the following components:

- Set bolt (64) with oil reservoir chamber (a) as well as return and venting bores (c) and a ball valve, consisting of a 5 mm Ø ball (63), telescopic type ball bearing traveler (61) and compression spring (62).

- Guide sleeve (59) with working chamber (b), compression spring (60) and sealing cap (65).



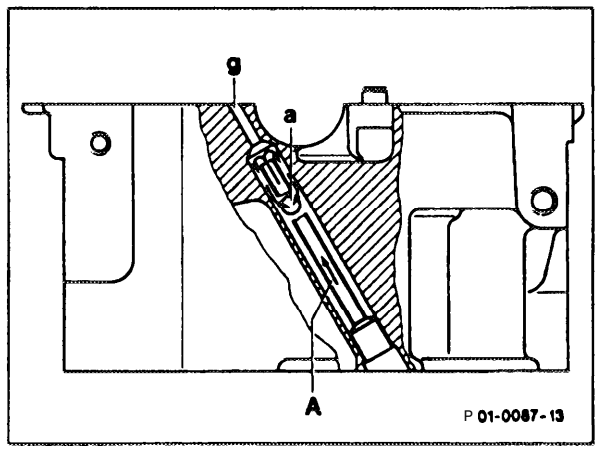
The element can drop completely when the engine is not running and the cam tip presses against the rocker arm and thus also against the element. Oil expelled from the working chamber (b) flows via the annular gap (built-in clearance between guide sleeve and set bolt) to the reservoir chamber (a).
When the cam tip moves away from the rocker arm, the set bolt (64) is relieved of load and the compression spring (60) presses the set bolt upwards until the rocker arm contacts the cam.

The vacuum, arising from the upward movement of the set bolt, opens the ball valve, and oil flows out of the reservoir chamber (a) into the working chamber (b).
As soon as the cam presses against the rocker arm and thus loads the set bolt, the ball valve closes. The oil in the working chamber acts as an “hydraulically rigid connection” and the respective valve is opened.
When the engine is running, depending on engine speed and cam position, the set bolt is only pressed slightly downwards.

The oil needed for operating the hydraulic valve clearance compensating elements, flows from the longitudinal channel and the transverse bores in the cylinder head to the rocker arm bearing points. From here it reaches the ring channel (f) through the bore (h) in the rocker arm and the reservoir chamber (a) via grooves in the washer (57).
Any air in the reservoir chamber can separate from the oil (solid oil), with the result that, if necessary, defoamed oil is led to the working chamber.

The oil quantity in the reservoir chamber is sufficient to fill the working chamber under all engine operating conditions. Any air in the reservoir chamber can escape to the ring channel (f) via the grooves in the washer (57) and from there via the annular gap between washer and rocker arm and the joint gap of the snap ring (56).

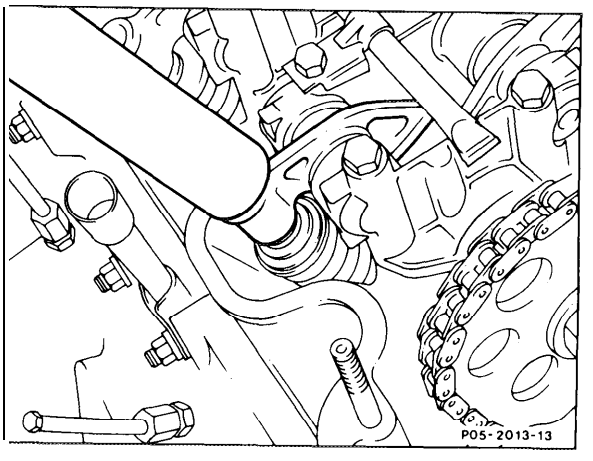
In order that the hydraulic valve clearance compensating elements can be supplied with oil pressure corresponding to the respective engine speed, oil flows unrestricted via nozzle (A) into the longitudinal channel (a) in the cylinder head (pressure-orientated oil feed). The nozzle simultaneously blocks off the oil return, preventing the channels up to the hydraulic elements emptying when the engine is not running.



The sealing cap (65) is shaped so that it secures the hydraulic valve clearance compensating element captive in the rocker arm.
Only store the compensating elements upright, and do not dismantle them. It is essential that rocker arm, compensating element, washer (57) and ball socket (55) are installed in their original position.

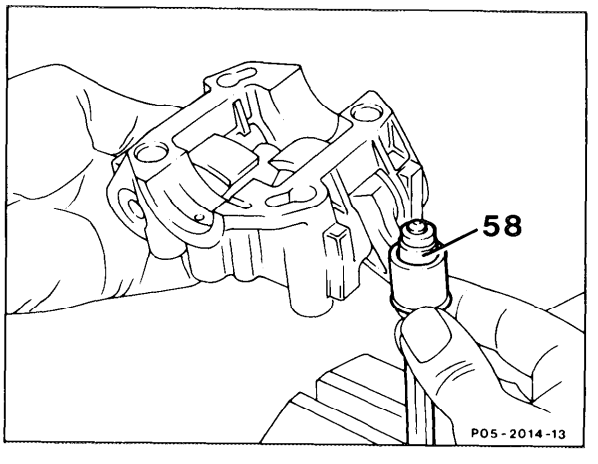
Checking

1 Position camshaft on the hydraulic element under test so that the rocker arms contact the cam base circle.



2 Press on the rocker arm with a hammer butt or similar above the hydraulic valve clearance compensating element for 5 - 10 seconds.

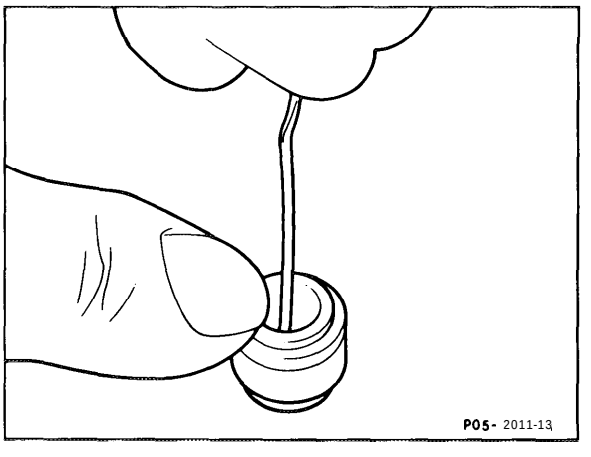
If one compensating element drops noticeably compared to others, compensating element should be removed. To do this, remove rocker arm bearing support (05-235) and press the compensating element (58) together with the washer carefully out of the rocker arm with an aluminium or brass mandrel.



If a leaking compensating element cannot be detected, try to move the rocker arm by hand. If play is detected when doing this, check and correct fitting position of the hydraulic valve clearance compensating elements (05-214).

Caution!
When testing compensating elements, do not press valves against the piston crown.

3 Fill reservoir chamber of the hydraulic valve clearance compensating element with engine oil, carefully press on ball valve in the setbolt with a wire (approx. 1.5 mm Ø) and press setbolt downwards as far as the stop and release. Repeat process two or three times.



After this, press compensating element setbolt heavily downwards for about 5 - 10 seconds with hammer butt or similar. If the setbolt drops noticeably when doing this, replace the compensating element.

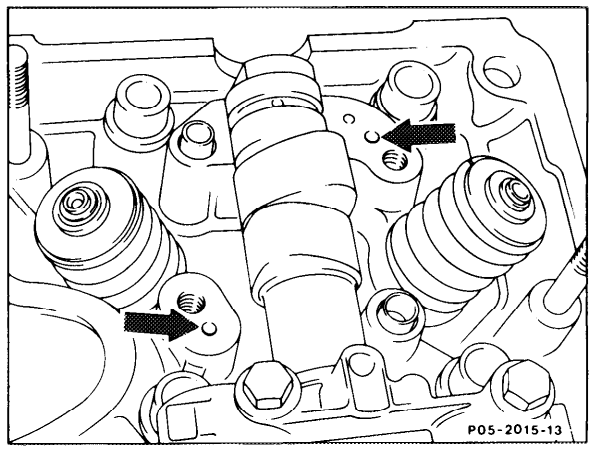
Note

Compensating element must be vertical when filling the working chamber as well as during the test.

If compensating element does not drop noticeably, check the respective oil bore in the cylinder head (arrow) as well as the oil bores in the rocker shaft and in the rocker arm for free passage, and clean if required.

To do this remove rocker arm (05240).

If several compensating elements are loud or soft the oil nozzle in the cylinder head should be checked for firm seating and replaced if required.



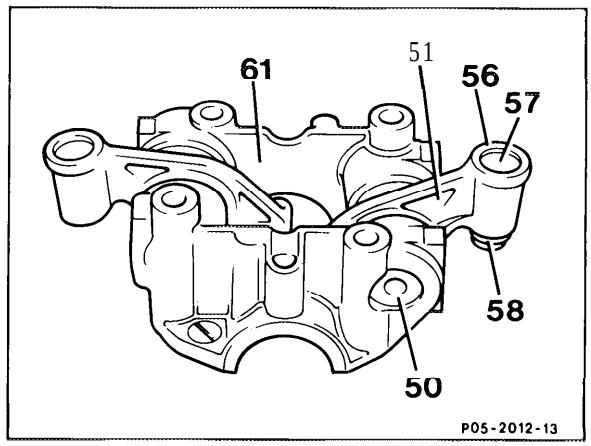
Replacement

4 Slide new valve clearance compensating element (58) with the original washer (57) into the rocker arm (51) as far as the stop on the snap ring (56).

Note

Install new compensating element with the working chamber and reservoir chamber filled with oil. (See Figure 3 for filling the hydraulic valve clearance compensating element).

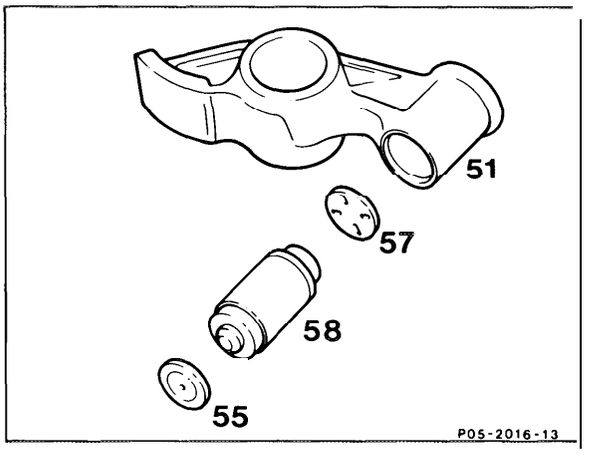
The grooves in the washer (57) must point to the compensating element (58) (Figure 5).



5 Install rocker arm bearing support (05-235). In so doing install the original ball socket (55).

Note

Use ball socket Part No. 103 055 00 24 if a new ball socket is installed.

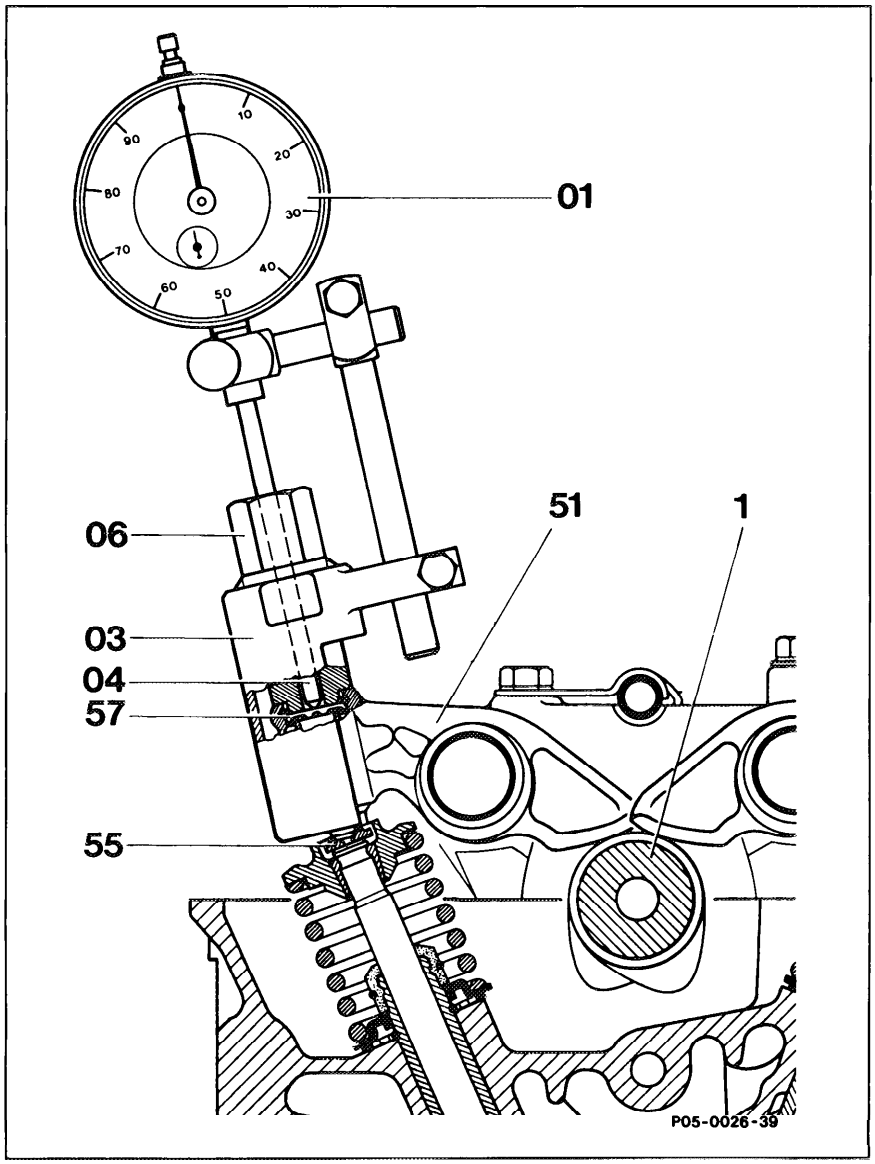


6 Check the installation position of the new valve clearance compensating element, correct if necessary (05-2 14).

7 Install in the reverse sequence.

05-214 Checking and correcting the installation position of hydraulic valve clearance compensating elements

Preceding work:
Air cleaner removed (09-400 and 09-410).
Cylinder head cover removed (01-406).



Camshaft (1)	position the cylinder under test so that rocker arm (51) contacts the cam base circle (Number 1).
Measuring fixture	mount, set dial gauge with 5 mm pretension, set dial gauge pointer to "0".

Checking	Turn pressure pad (06) to the right until a detectable pressure point is reached. Read setting range (residual stroke) on the dial gauge. Reference value 0.5 - 2.4 mm. Correct the fitting position if the residual stroke is larger or smaller (Number 2).
Adjusting the residual stroke	Remove and install rocker arm bearing support (05235). Remove hydraulic valve clearance compensating element and slide into the rocker arm again up to the snap ring stop. If residual stroke is too small use a thinner washer (57), or a thicker washer if residual stroke is too large. Measure residual stroke again. If the specified residual stroke has still not been achieved, a thinner or thicker ball socket (55) can be fitted (Numbers 3 to 6), if necessary. **Note** Before installation of the hydraulic valve clearance compensating element fill reservoir chamber with engine oil.
Rocker arm bearing support	Install, repeat test (Numbers 7 and 8). Prior to this, turn the engine with the starter and contact handle a few times.

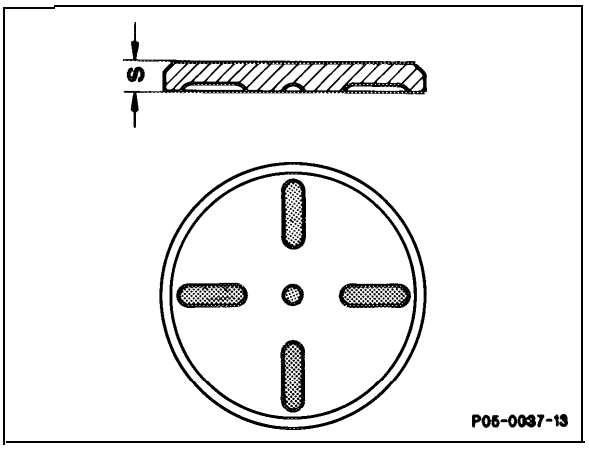
Installation specification of washer and ball socket

Assembly condition	Washer		Ball socket	
	Dimension "s" mm	Part No.	Dimension "a"	Part No.
Standard [1])	1.5	103 055 07 76	3.0	103 055 00 24
Standard[2])	1.8	103 055 06 76	3.5	103 055 02 24
Repair [3])	2.2	103 055 09 76		

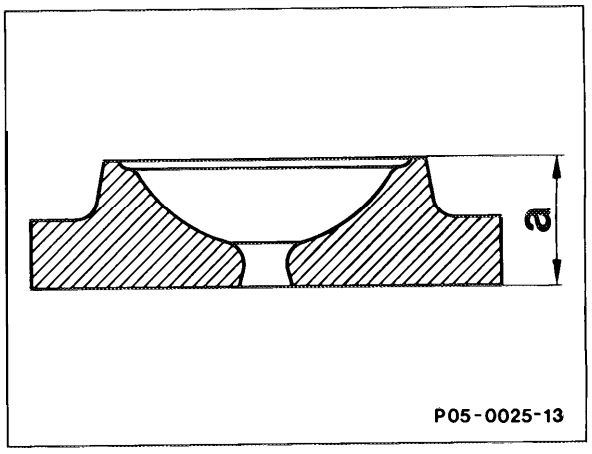
[1]) Production: install in the case of repair, when valve timing parts (rocker arm beanng supports, rocker arms, camshaft, etc.) are renewed. Camshaft with normal cam base circle without identification letter next to the camshaft identification number.

[2]) Production: Install in the case of repair, when valve timing parts (rocker arm beanng supports, rocker arms, camshaft, etc.) are renewed. Camshaft with small cam base circle and identification letter "E" next to the camshaft identification number.

3) Install in the case of repair, when valves and/or valve seat inserts have been resunk by machining.

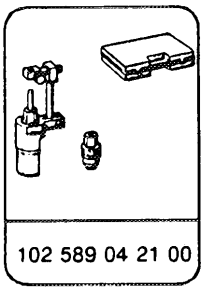


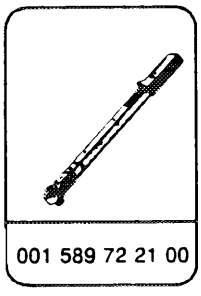
Washer

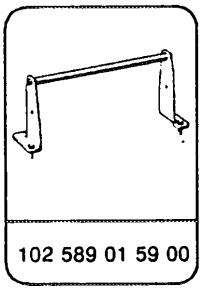


Ball socket

Special tools







Conventional tool

Dial gauge Al DIN 878	e.g. Mahr, D-7300 Esslingen Part No. 311000

Note

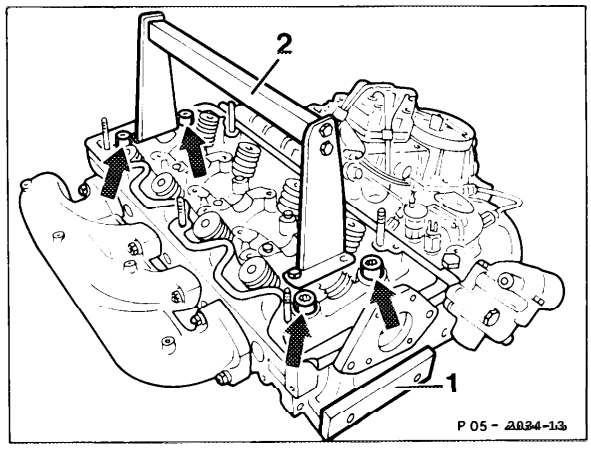
The fitting position of the hydraulic valve clearance compensating elements must be checked

a) If there have been complaints of valve train noise and no malfunctions have been established when checking the compensating element in accordance with 05211.

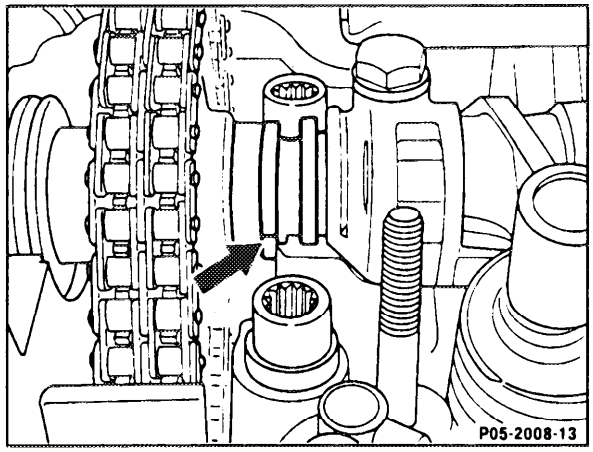
b) If valve timing parts, which are installed or mounted on the cylinder head (apart from the camshaft timing gear, valve guides, valve stem seals) have been renewed, or when valves and/or valve seat inserts have been machined.

For testing, all timing parts located on the cylinder head must be installed correctly and working chamber of valve clearance compensating elements must be filled with engine oil.

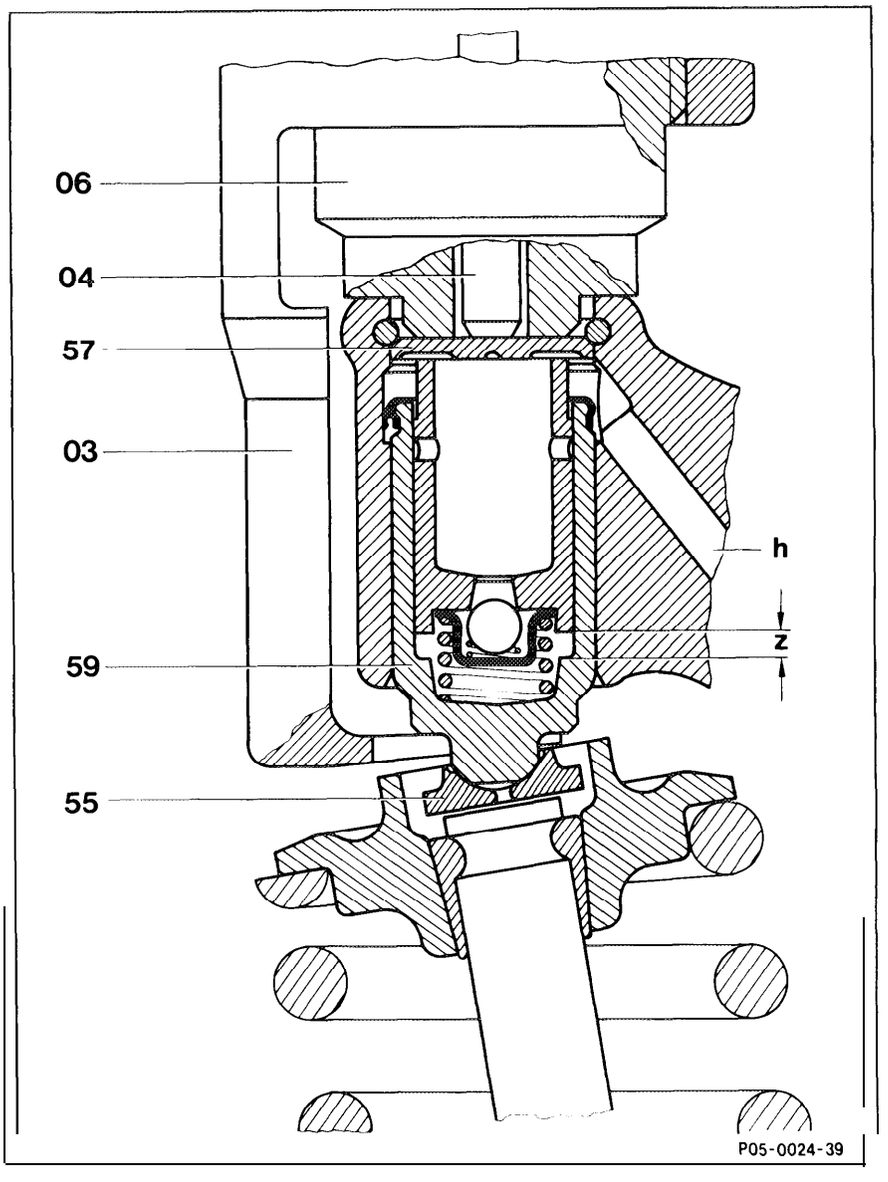
The tests can also be carried out when the cylinder head is removed. To do this clamp cylinder head with four cylinder head bolts (arrows) on assembly board 102 589 00 59 00 (1). In this case turn the camshaft on rear flats with a fork wrench (24 mm).



After the test, position camshaft so that indentation on the collar agrees with the edge on the cylinder head (arrow).



In order to determine the specified fitting position of the hydraulic valve clearance compensating element, the residual stroke "Z" of the compensating elements must be measured. The permitted **residual stroke** is 0.5 **to** 2.4 mm. If a residual stroke smaller than 0.5 mm or larger than 2.0 mm is measured despite installing a washer and a ball socket in accordance with the "installation specification" table, compensation is to be carried out with the next thinnest or thickest washer or ball socket.



Checking

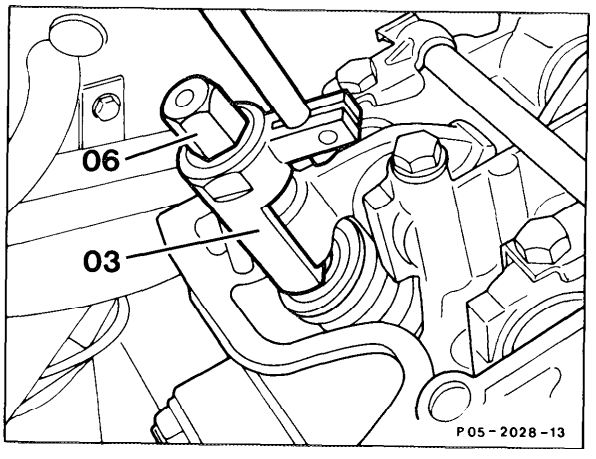
1 Position camshaft by turning the crankshaft so that the rocker arms contact the cam base circle on cylinder under test.

2 Place measuring fixture 102 589 04 21 00 so that the claws of the claw sleeve (03) contact the ring shaped area around the hemispherical mushroom pad of the guide sleeve (59).

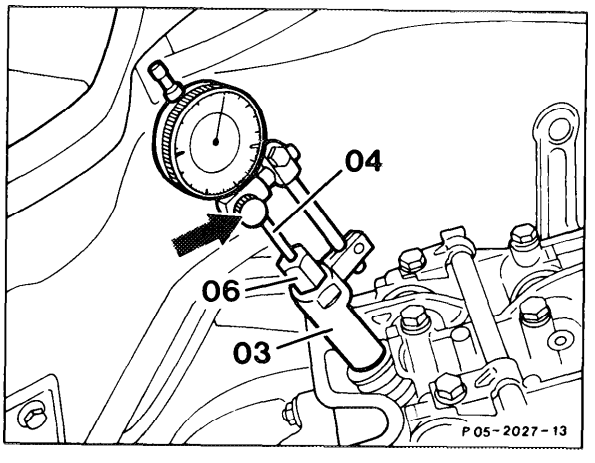
Turn the pressure pad (06) by hand to the right sufficiently until it contacts the washer (57, previous picture), and a clearly detectable pressure point is reached.

Note

The pressure pad must contact the washer and not the rocker arm.



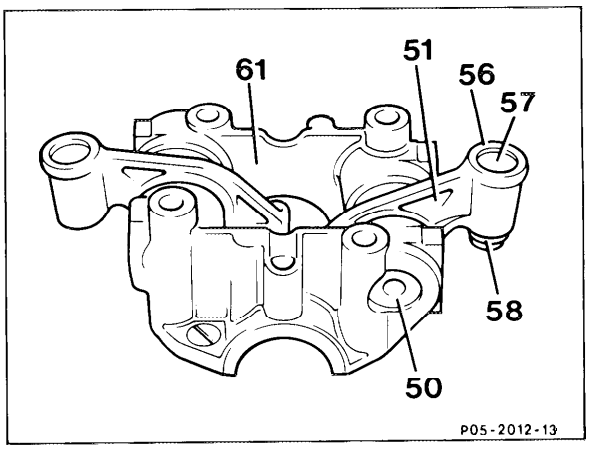
3 Insert measuring pin adapter (04) in the central bore of the pressure pad (06), set dial gauge measuring pin on the measuring pin adapter with 5 mm pretension (small pointer) and attach the dial gauge to claw sleeve bracket (arrow). Position large dial gauge pointer on zero by turning the dial gauge scale.



4 Turn pressure pad (06) slowly to the right with a fork wrench (17 mm) on the hexagon until a clearly detectable pressure point is reached. Read off setting range (residual stroke) on dial gauge. It must be 0.5 - 2.4 mm. In event of smaller or larger residual stroke, correct installation position of the hydraulic valve clearance compensating element.

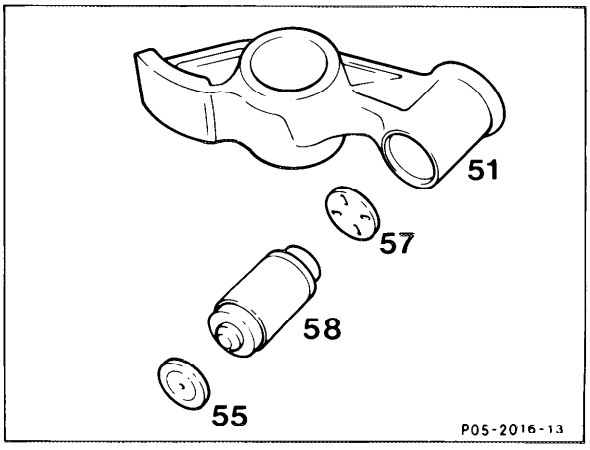
Corrections

5 Remove rocker arm bearing support **(05235).**



6 Press hydraulic valve clearance compensating element (58), together with the washer (57), carefully out of the rocker arm with an aluminum or brass mandrel, and finally slide into the rocker arm up to the snap ring stop (56) again. Use a thinner washer (residual stroke too small) or a thicker washer (residual stroke too large).

If specified residual stroke cannot be achieved with the washers available (57), depending on residual stroke measured, use a thinner or thicker ball socket (55) (see note, on the washer and ball socket tables).



Caution!
Before carrying out the installation fill reservoir chamber of the hydraulic valve clearance compensating element with engine oil (05- 211, Number 3).

The grooves in the washer (57) must point in the direction of the compensating element setbolt.

7 Install rocker arm bearing support (05-235).

8 Repeat tests, Numbers 1 to 3.

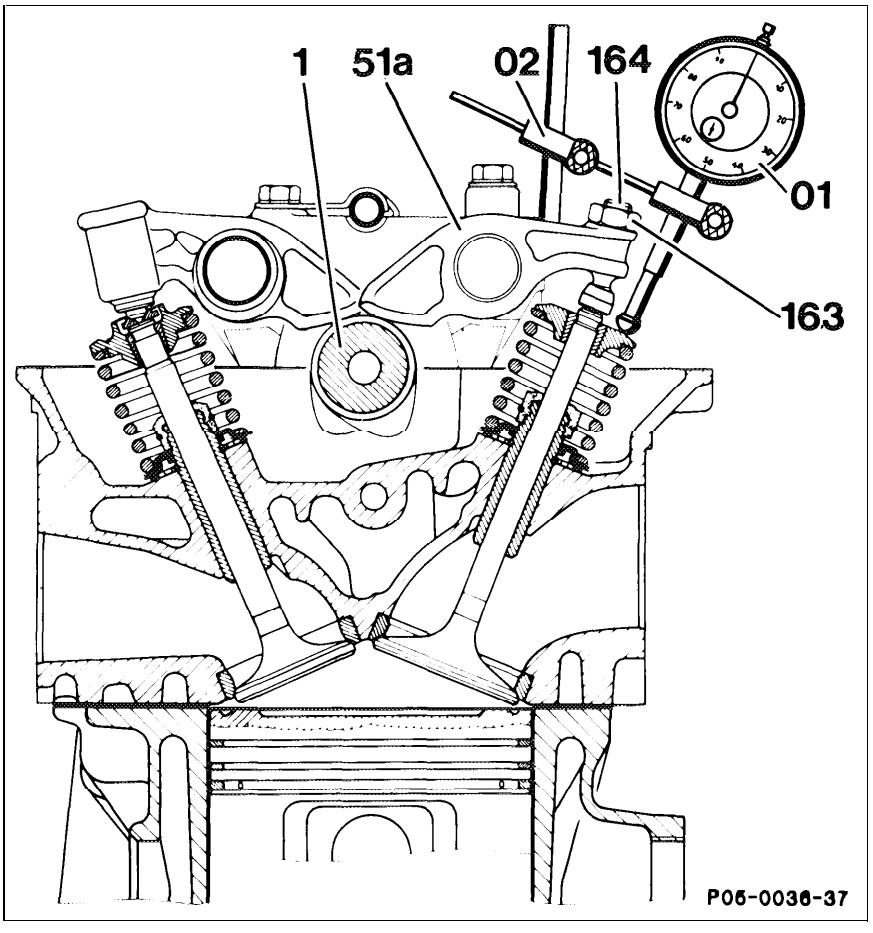
Note
Before carrying out the test turn the crankshaft a few times by using the starter.

9 The installation is carried out in the reverse sequence of the removal.

10 Check for leaks when engine is running.

05-215 Checking and adjusting camshaft timing

Preceding work:
Air cleaner removed (09-400 and 09-410).
Cylinder head cover removed (01-406).



Checking ..... Position the No. 1 cylinder camshaft so that the rocker arm (51a) contacts the cam base circle. Remove No. 1 cylinder rocker arm bearing support (05-235). Remove rocker arm and hydraulic valve clearance compensating element and adjustable rocker arm 102 055 00 01 together with adjusting screw 102 050 0220 (164) and fit locknut (163). Eliminate valve clearance by turning the adjustment screw (164) (Numbers 1 to 4).

Dial gauge bracket (02) ..... Screw onto stud bolt at front left part of cylinder head (Number 5).

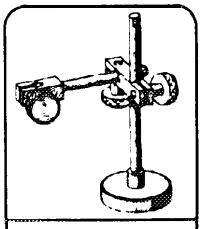
Dial gauge (01)	Insert and put tip vertically on valve spring retainer with 3 mm pretension (small pointer) (Number 6).
Crankshaft	Turn in the direction of rotation of the engine until the small pointer on the dial gauge has travelled back by 2 mm (valve stroke). The value now read off on the vibration damper must agree with the value in the table “Intake valve open” (Number 7).
Adjustment	Put engine on ignition TDC of No.1 cylinder (Number 8).
Chain tensioner locknut (40)	Unbolt and bolt up, replace sealing ring (41), 70 Nm (Numbers 9 and 19).
Oil pressure pump	Unbolt, set to one side with lines connected (Number 10).
Camshaft timing gear	Align with timing chain. Unbolt camshaft timing gear (Numbers 11 to 13 and 15).
Woodruff key (6)	Select from table and insert (Numbers 14 and 15).
Camshaft timing gear	Assemble, note color marking, only install set bolt. Repeat tests (Numbers 6 and 7). Tighten set bolt (9). 80 Nm (Numbers 16 to 18).
Dial gauge (01) and dial gauge (02)	Detach.
Rocker arm bearing support and rocker arm with hydraulic valve clearance compensating element	Install (Number 20). Proceed with installation in reverse sequence

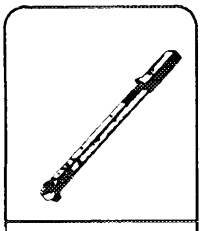
Valve timing with 2 mm valve stroke

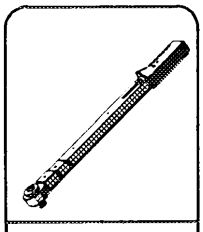
Engine	Identification number of camshaft stamped at the rear of the camshaft	Intake valve		Exhaust valve	
		Opens after TDC	Closes after BDC	Opens before BDC	Closes before TDC
102.96 102.985	27/28 [1]) 35 [3])/36 [1])/44 [4])	11" (12°)	17"	32"	13°

Value for used chain in brackets.
[1]) Repair camshaft with 0.5 mm larger bearing diameter.
[2]) Camshaft with wider cam (19 mm) and tin-plated.
[3]) Chilled cast iron camshaft.
[4]) Chilled cast iron camshaft (with crowned cams) from 09/89.

. Special tools


363 589 02 21 00


001 589 66 21 00

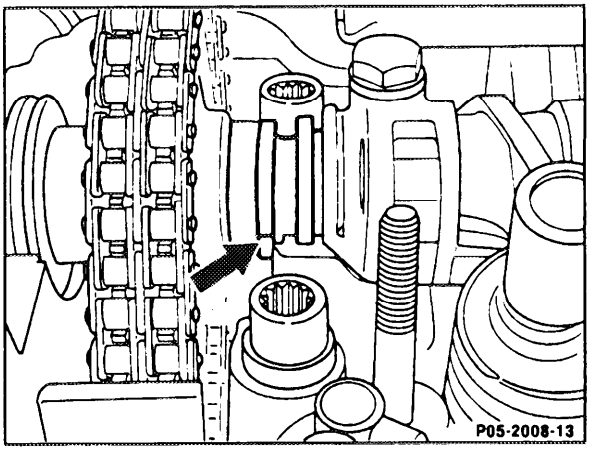

001 589 67 21 00

Conventional tool

Dial gauge A 1 DIN 878	e.g.	Mahr, D-7300 Esslingen Bestell-Nr. 311000

Note

It is sufficient during assembly work, if the marking on the camshaft agrees with the cylinder head edge in the ignition TDC position of the No 1. cylinder (arrow). In special cases, for example when there are performance problems, the start of opening of No. 1 cylinder intake valve is to be checked as described in the following, and to be adjusted, if required. The valve timings are measured at
2 mm valve stroke. Valve clearance must be eliminated for this purpose.



Checking

1 Turn crankshaft until cam tips of No. 1 cylinder intake valve point downwards (valve closed).

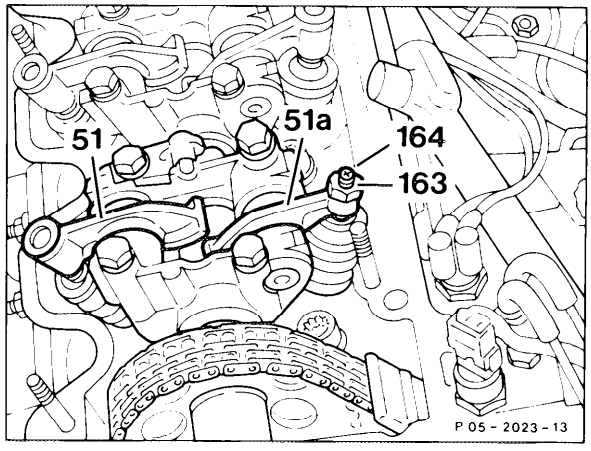
Caution!
The engine must not be turned at the camshaft timing gear fixing bolt.

Under no circumstances turn engine backwards during the measurement, otherwise considerable measuring errors result, and chain tensioner lock setbolt can spring forwards.

2 Remove rocker arm bearing support of No. 1 cylinder (05-235).

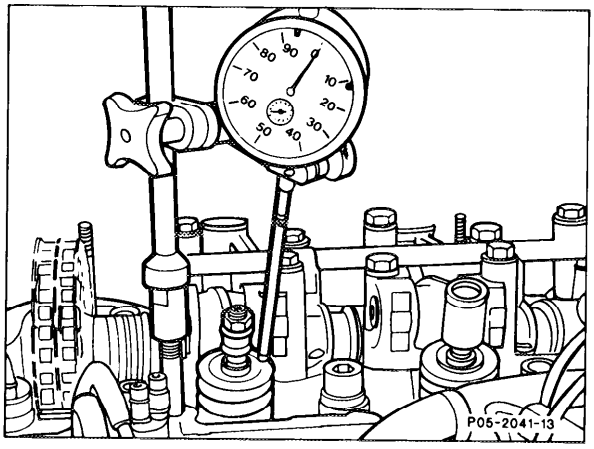
3 Install intake valve rocker arm against the rigid rocker arm (51a) Part No. 102 055 00 01 together with the adjustment bolt (164) Part No. 102 050 02 20 and the locknut (163) Part No. 000936 008009 (05-240).

4 Install rocker arm bearing support, 21 Nm.



5 Install the dial gauge bracket with threaded sleeve onto the stud on the front left part of the cylinder head.

6 Insert dial gauge and attach so that tip is **exactly vertical** on valve spring retainer with a pretension of 3 mm (small pointer on the dial gauge). Turn dial gauge clockface until large pointer is on "0".



7 Turn crankshaft in direction of rotation of the engine until dial gauge small pointer has returned by 2 mm (valve stroke). In this position the value on the vibration damper must agree with the value “intake valve opens after TDC” in the valve timing table.

Adjustment

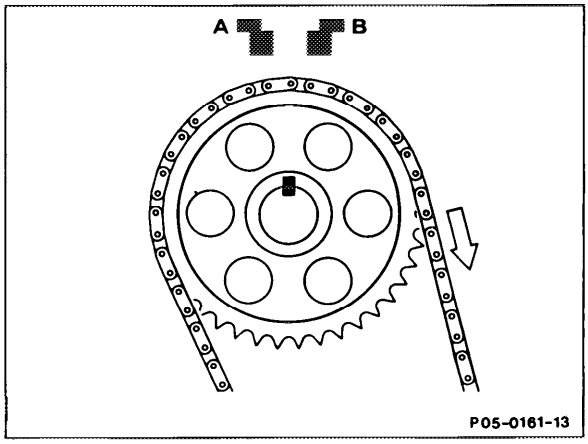
If valve timing settings have to be corrected, an offset Woodruff key has to be installed, and a new timing chain when chain length is excessive.

Woodruff keys are available in the following stages:

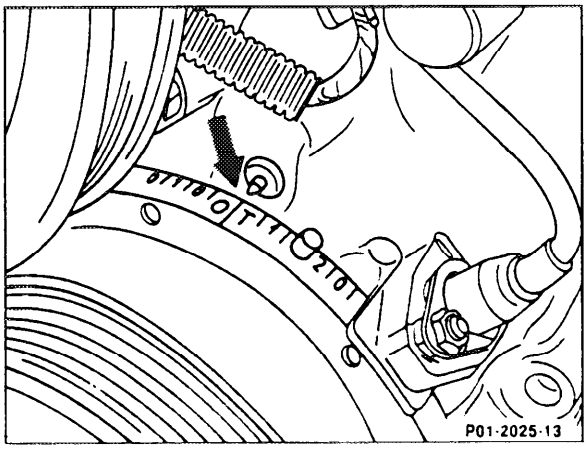
Offset mm	Part No.	for a correction of approx.
0.7	621 991 04 67	6” CKA
0.9	621 991 02 67	8” CKA
1.1	621 991 01 67	9.5” CKA
1.3	621 991 00 67	11.5” CKA

CKA = CranK Angle

An offset of one tooth on the camshaft timing gear produces approx. 20 at the crankshaft. Offsetting the Woodruff keys to the right (in direction of travel A) causes the valves to open earlier and an offset to the left (B) causes the valves to open later.

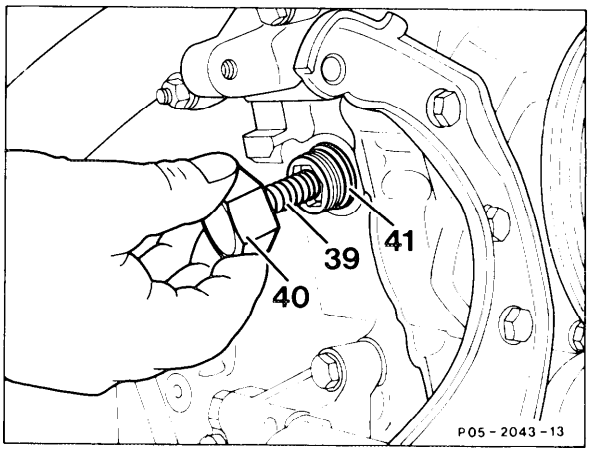


8 Position engine on ignition TDC of No. 1 cylinder.

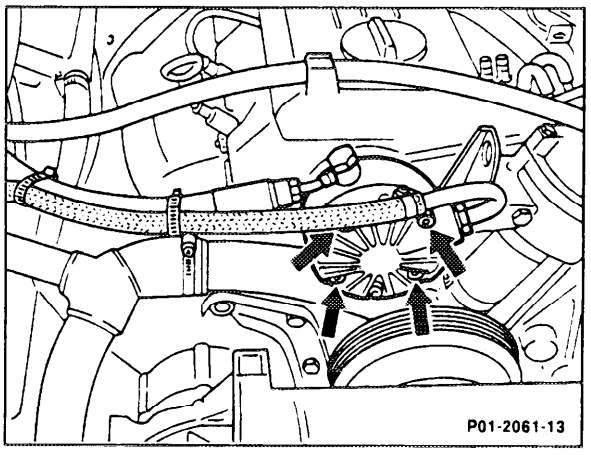


9 Unscrew hexagon cap nut (40) for chain tensioner and remove sealing ring (41) as well as compression spring (39) (see 05310).

Caution!
The chain tensioner hexagon cap nut is under pressure from the compression spring.

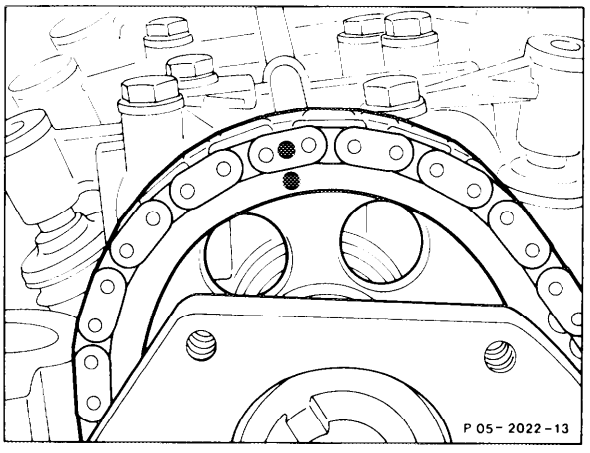


10 Unscrew oil pressure pump (arrows) and set to one side with the lines connected.



11 Align camshaft timing gear and timing chain.

12 Remove camshaft timing gear set bolt.

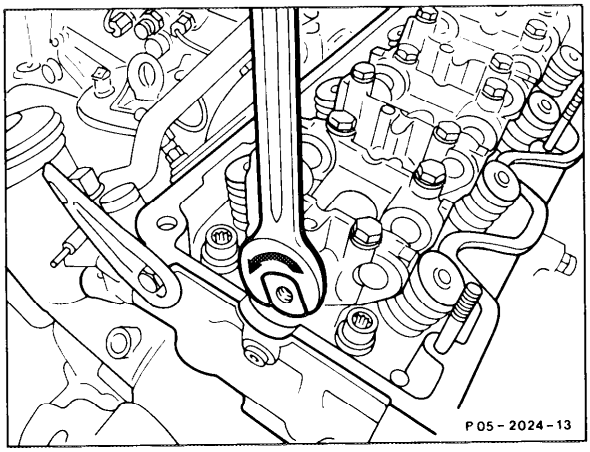


To do this hold in position with a fork wrench (24 mm) on flats at the rear end of the camshaft.

Note

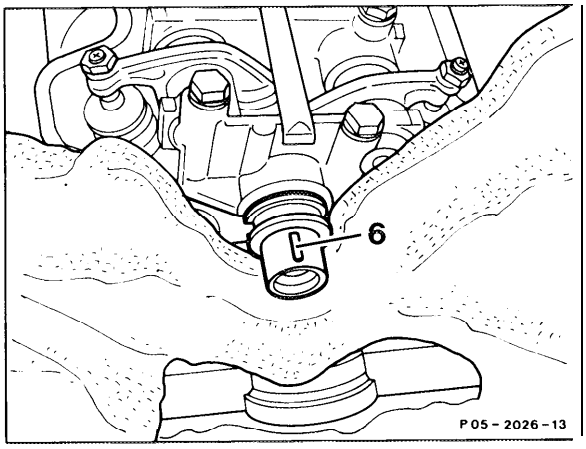
On vehicles with self-levelling suspension the camshaft timing gear and driving sleeve are attached by a bolt with hexagon recessed hole. Take out the driving sleeve.

13 Remove camshaft timing gear.



14 Place cleaning rag over the timing case and remove Woodruff key (6).

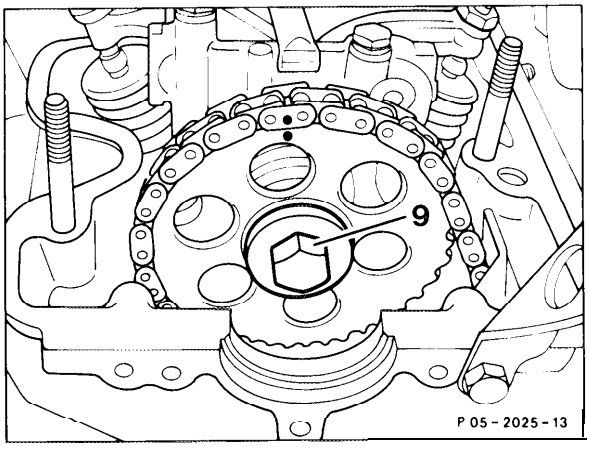
15 Insert selected Woodruff key.



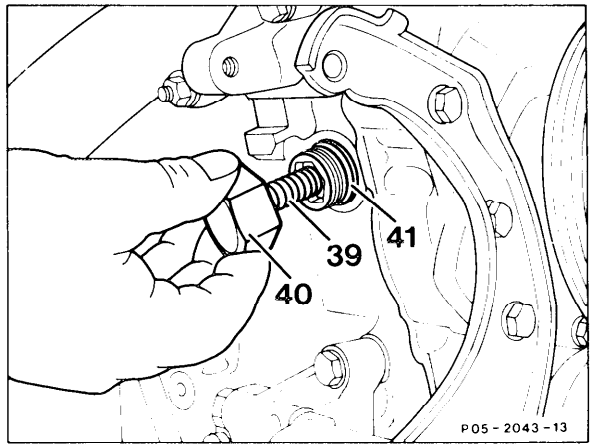
16 Put on camshaft timing gear. In the process note that the colour markings on the camshaft timing gear and the timing chain align.
Do not torque the set bolt (9) yet.

17 Repeat test Numbers 6 and 7.

18 Torque camshaft timing gear set bolt (9) to 80 Nm. For this hold in position with a fork wrench (24mm) on flats at the rear of the camshaft.

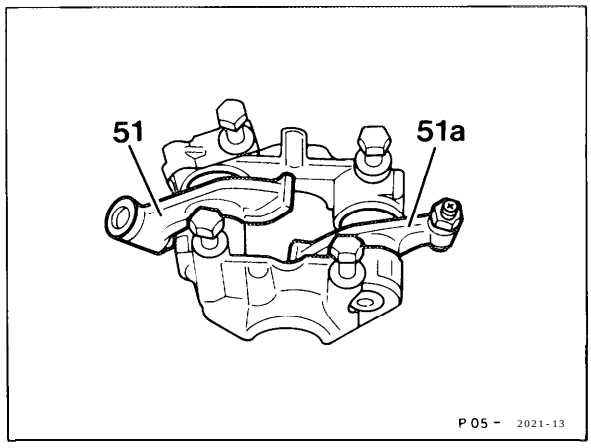


19 Insert compression spring (39), replace sealing ring (41), bolt in screw plug (40) and tighten to 70 Nm.



20 Unbolt rocker arm bearing support from **No.1** cylinder and withdraw rocker arm (51a) for hydraulic valve clearance compensation.

21 Install rocker arm bearing support, tightening torque 20 Nm (05- 235).



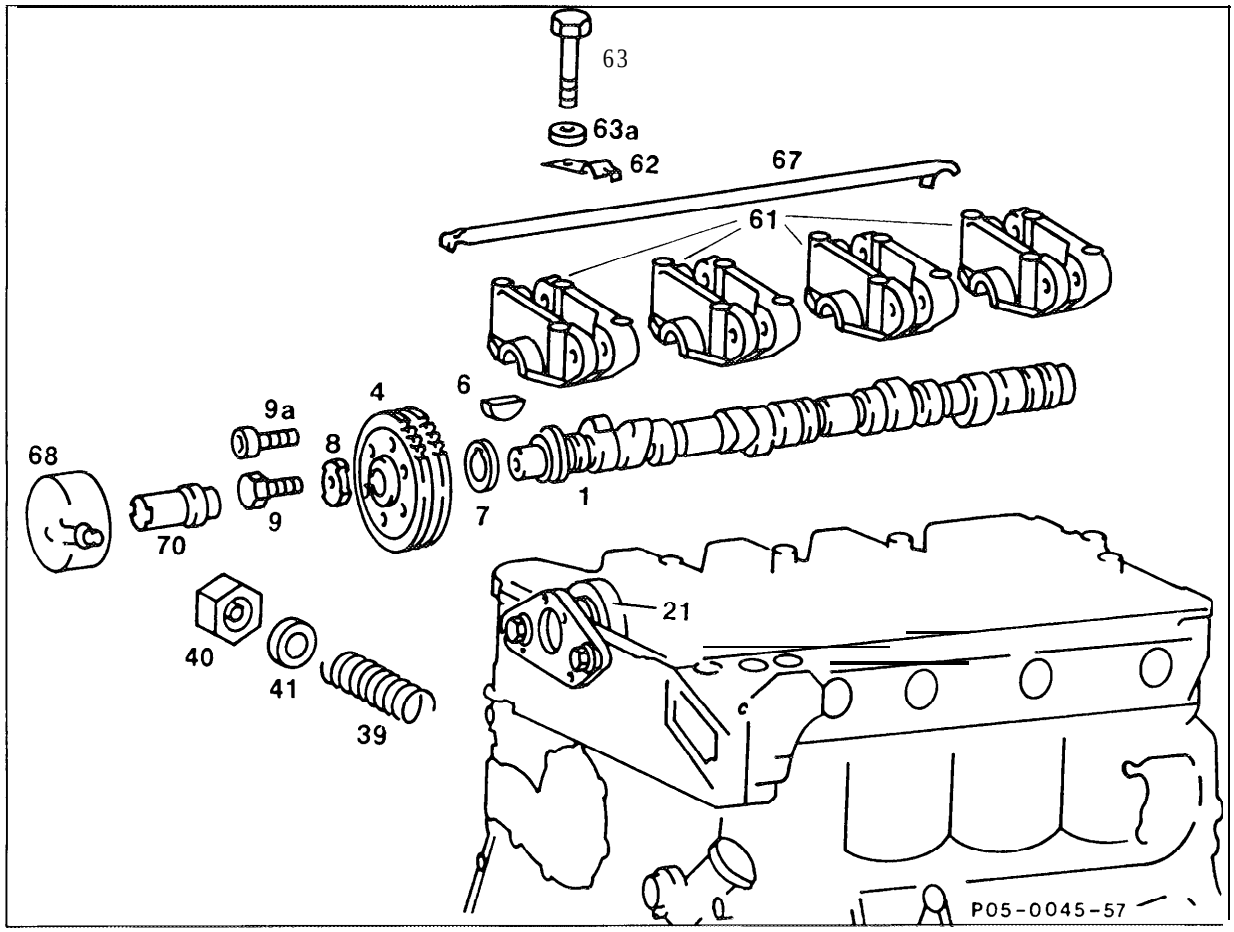
22 Remove dial gauge and dial gauge bracket.

23 The remaining installation takes place in the reverse sequence.

24 Check for leaks when engine is running.

05-220 Removal and installation of camshaft

Preceding work:
Air cleaner removed (09-400 and 09-410).
Cylinder head cover removed (01-406).

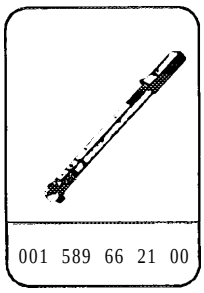


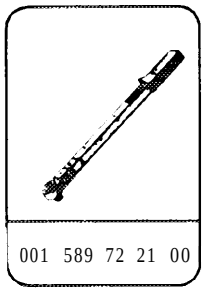
Piston of No. 1 cylinder	position on ignition TDC, note markings (Numbers 1 and 2).
Screw plug (40)	of the chain tensioner, unbolt, bolt in, 70 Nm.
	Warning! Screw plug is under pressure. Remove compression spring (39), replace sealing ring (41)(Numbers 3 and 11).
Oil pressure pump (68)	unbolt, bolt in, set to one side with lines connected (Number 4).
Camshaft timing gear (4) and timing chain	align. When installing note markings. Screw (9 and 9a), 80 Nm (Numbers 5 to 8).

All rocker arm bearing supports (61) with rocker arms and oil pipe (67) . . . . . unbolt, bolt on, 20 Nm. Note oil pipe designs (Number 9).

Camshaft (1) . . . . . remove, replace, oil bearing points with engine oil. Check condition of camshaft, note identification number. Position engine on ignition TDC and check markings on camshaft and vibration damper (Number 10).

Special tools





Test values

		New value	Wear limit
Permitted deviation from true running when locating camshaft in bearing positions 1 and 5	At the seat of camshaft timing gear	0.025	
	At the bearing points 2, 3 and 4	0.030	–
Camshaft bearing play	radial	0.050 – 0.091	0.11
	axial	0.070 – 0.150	0.18
Camshaft journals Ø	Normal dimension	32.000 – 32.025	–
	Repair stage	32.500 – 32.525	–
Scleroscope hardness of the cams		70 – 82	63

Camshaft identification numbers and valve timings with 2 mm valve stroke

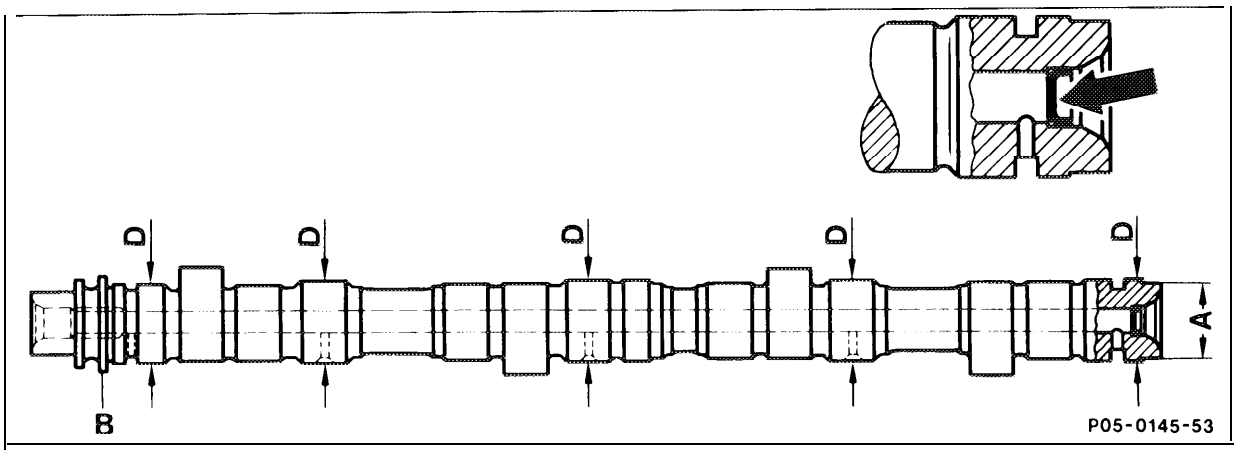
Engine	Camshaft identification number stamped at rear of camshaft	Intake valve		Exhaust valve	
		Opens after TDC	Closes after BDC	Opens before BDC	Closes before TDC
102.96 102.985	27128 [1]) 35 [3])/6 [1])/44[4])	11° (12°)	17°	32"	13°

Value for used chains in brackets.
[1]) Repair camshaft with 0.5 mm larger bearing diameter.
[2]) Camshaft with wider cams (19 mm) and tin-plated.
[3]) Chilled cast iron camshaft.
[4]) Chilled cast iron camshaft (with crowned cams) from 09/89.

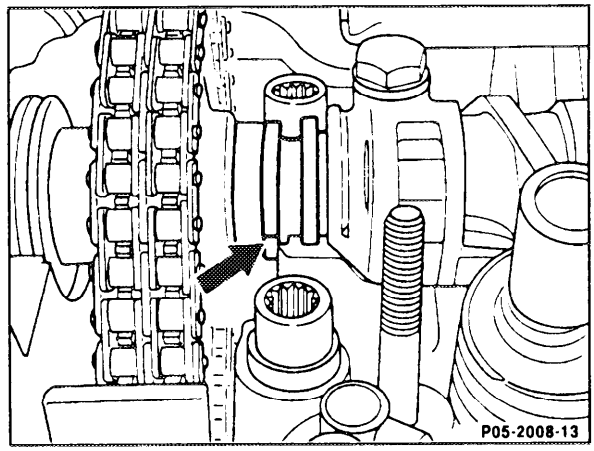
Note

The camshaft supported on 5 bearings is drilled hollow. The bearing points are supplied with oil via the longitudinal bore (10.5 mm Ø), which is sealed at the front with the camshaft timing gear set bolt and at the rear with a pressed cover (arrow). The oil feed takes place via a groove (360°) and a transverse bore (3.5 mm Ø) in the rear journals.
The diameter (D) of all 5 bearing points is 32 mm (repair stage 32.5 mm).

A fork wrench can be put on flats (A, 24 mm) at the rear end of the camshaft for turning the camshaft when camshaft timing gear is removed and for holding in position when loosening and tightening camshaft timing gear set bolt. The collar (B), which runs in a groove in the cylinder head, locates the camshaft axially.



The marking for the ignition TDC position of the No. 1 piston is placed on this collar. It must match up with the edge on the cylinder head (arrow).



The camshaft can be removed from above. The rocker arm bearing supports and the camshaft timing gear have to be removed for this.

If the camshaft is to be replaced, all the rocker arms have to be replaced as well.

In the event of scored bearings or pronounced striation, the camshaft bearings in the cylinder head and in the rocker arm bearing supports can be bored out by 0.5 mm and a camshaft with over dimensioned bearing spigots installed (01-419).

The running in and wear characteristics have been improved by short- stroke honed camshafts (formerly tin-plated).

Introduced in production: January 1986

Model	Engine	Engine end number		Vehicle identification end number	
		Manual transmission	Automatic transmission	A	F
201.024 (USA)	102.985	003326	030324		193767

Since October 1987 camshafts have been fitted with 19 mm wide tinplated cams (formerly 18 mm).
Identification number: 39

Note

As a temporary measure this camshaft has been given the identification number "3".

Introduced in production: October 1987

Model	Engine	Engine end number		Vehicle identification end number	
		Manual transmission	Automatic transmission	A	F
201.028	102.985	019320	062484	416851	435608

Since 1988, in order to avoid camshaft wear, chilled cast iron camshafts and rocker arms with soldered on hard metal pads have been equipped.
If the chilled cast iron camshaft has been installed on previous engines, rocker arms with hard metal cam follower must also be installed.
As a temporary measure this camshaft has been given the identification number “5”.

Introduced in production: October 1988

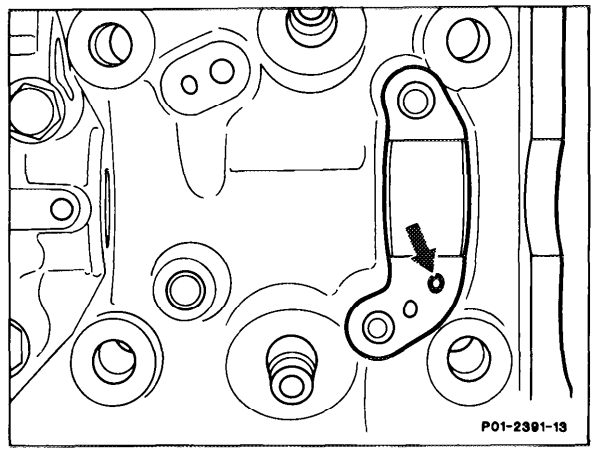
Model	Engine	Engine end number Manual transmission	Engine end number Automatic transmission
201.028	102.985	027671	077053

From 09/89 a chilled cast iron camshaft with crowned cams has been installed. This camshaft is also supplied as a replacement part.
Identification number: 44

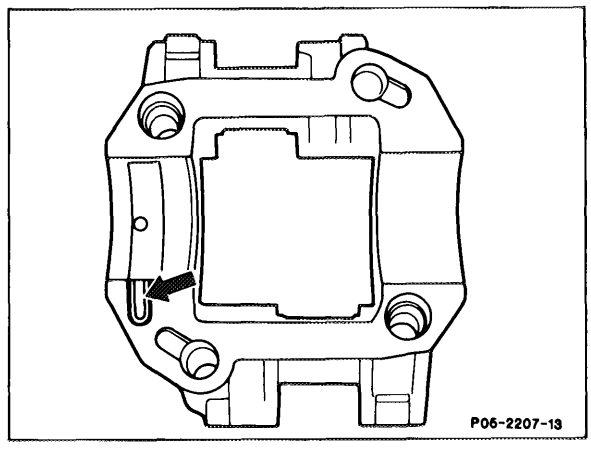
Introduced in production: September 1989

Model	Engine	Engine end number		Vehicle identification end number	
		Manual transmission	Automatic transmission	A/B	F
201.028	102.985	033962	080108	B 525380	–

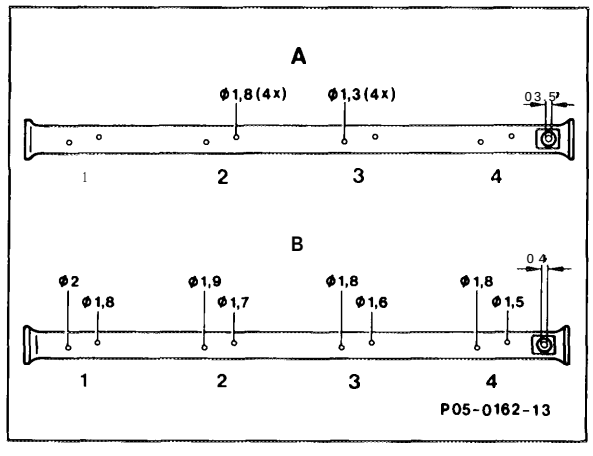
In order to improve camshaft lubrication the oil feed bore in the cylinder head has been enlarged from 3 mm to 4 mm Ø (arrow).



The oil groove in the rocker arm bearing support has also been widened from 4 mm to 5.5 mm (arrow).



The injection bores in the oil pipe for camshaft lubrication have a different diameter depending on position.



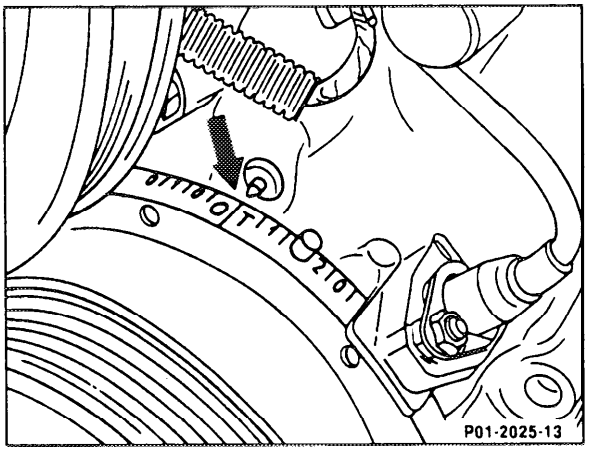
A Oil pipe - first design
B Oil pipe - second design

Introduced in production: January 1988

Model	Engine	Engine end number Manual transmission	Engine end number Automatic transmission
201.028	102.985	022013	067143

Removal and installation

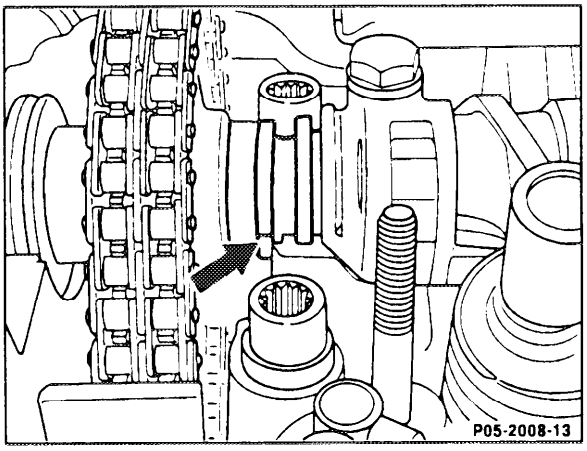
1 Position piston of No. 1 cylinder on ignition TDC.



2 Marking on camshaft collar must align with the edge on the cylinder head (arrow).
Before turning the crankshaft, switch off the ignition and remove the plug for the inductive sensor at the switching unit.

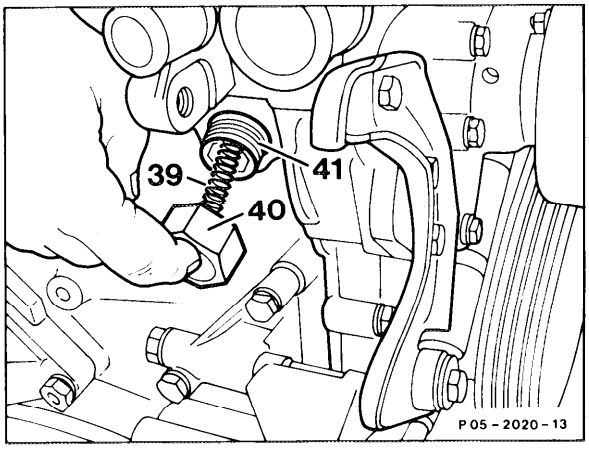
Caution!

Do not turn the engine by the camshaft timing gear set bolt.
Do not turn the crankshaft backwards.

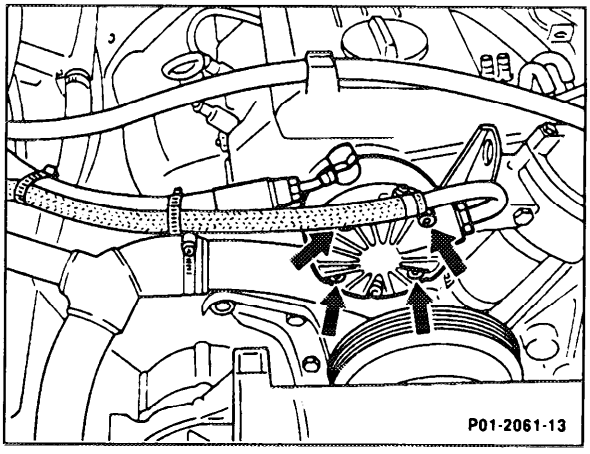


3 Unscrew the chain tensioner hexagon cap nut (40) and remove sealing ring (41) as well as compression spring, tightening torque 70 Nm (05-310).

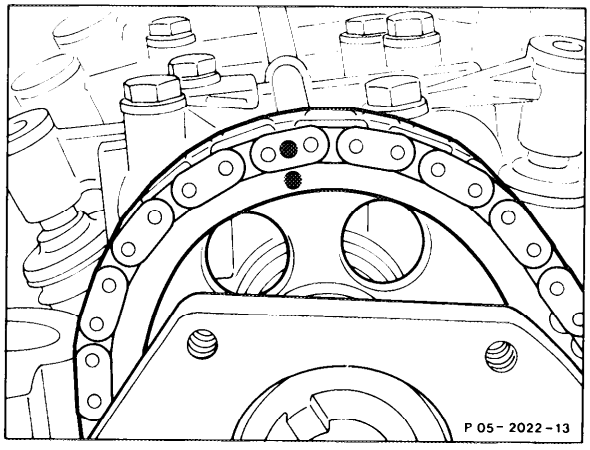
Caution!
The chain tensioner hexagon cap nut is pressurized by the compression spring.



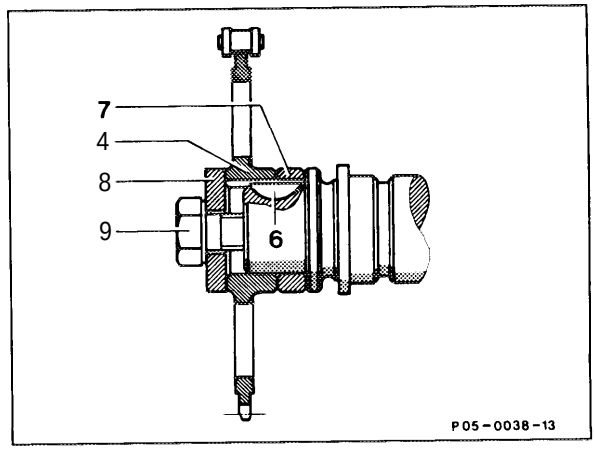
4 Unbolt, bolt on oil pressure pump (68) (arrows) and put to one side with the lines connected.



5 Align camshaft timing gear and timing chain.



6 Remove camshaft timing gear, remove timing chain and place in the timing case, tightening torque 80 Nm.



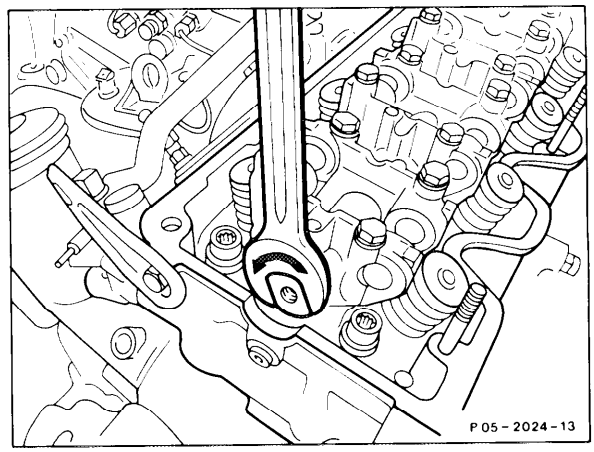
7 Remove and install Woodruff key (6) and spacer washer (7).

Installation note

Note color markings on camshaft timing gear and timing chain.

Assemble camshaft timing gear so that on the single roller chain the wide collar points to the camshaft and on the dual roller chain the curvature points to the camshaft.

8 In order to loosen or tighten up camshaft timing gear hold in position with flats at the rear of camshaft with a fork wrench (24 mm).

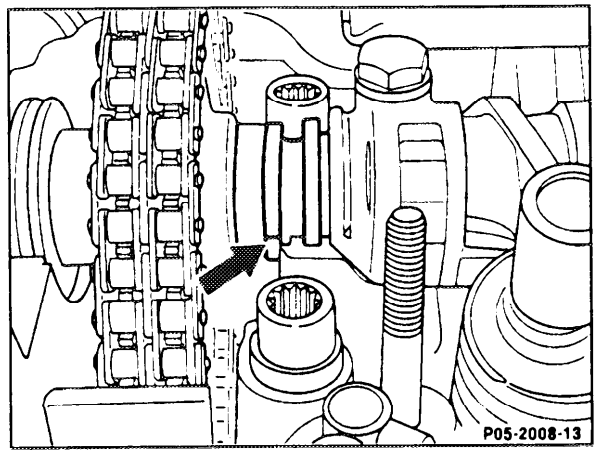


9 Remove and install rocker arm bearing supports (61) (05-235), tightening torque 20 Nm.

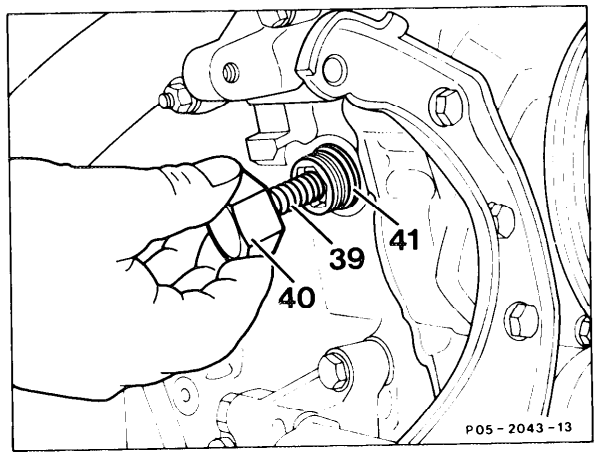
10 Remove camshaft. Before installing lubricate all bearing points with engine oil. Check, whether the marking on set collar aligns with edge on the cylinder head.

Installation note

If camshaft is to be replaced, all rocker arms and rocker shafts have to be replaced as a set.



11 Install hexagon cap nut (40) and compression spring (39) with new sealing ring (41), tightening torque 70 Nm.

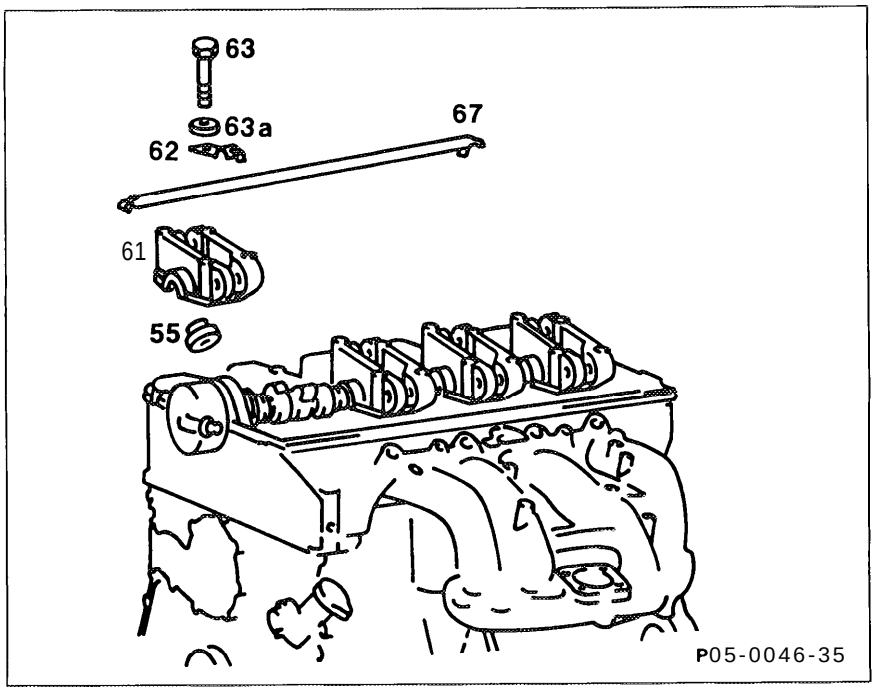


12 The installation proceeds in reverse sequence.

13 Check for leaks when engine is running.

05-235 Removal and installation of rocker arm bearing supports with rocker arms

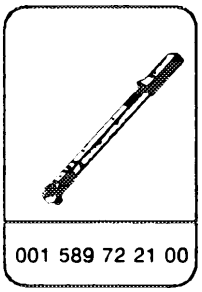
Preceding work:
Air cleaner removed (09-400 and 09-410).
Cylinder head cover removed (01-406).



Engine	turn, so that rocker arm of bearing support being removed is on base circle of cam (cam tips pointing downwards).
Oil pipe (67)	remove, install (Number 2).
Rocker arm bearing support (61)	remove, install, 20 Nm (Number 3).

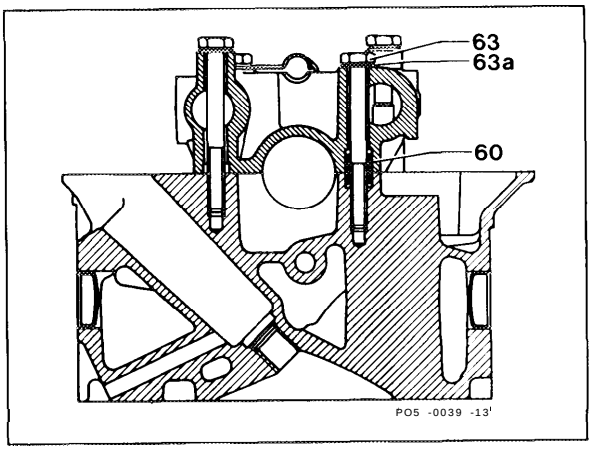
Installation note
Install ball socket (55) in original position.
Note identification number on cylinder head and camshaft bearing cap.

Special tool



Note
The five bearing bores for camshaft support are each located half in the cylinder head and on top in the four rocker arm bearing supports. The front rocker arm bearing support has two half bearing bores.

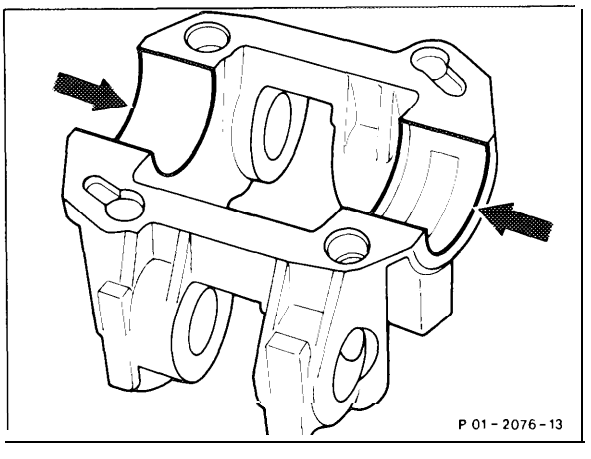
Each of the four bearing supports is attached with four bolts (63) and with two installation sleeves (60). Each bearing support simultaneously acts as a rocker arm carrier.



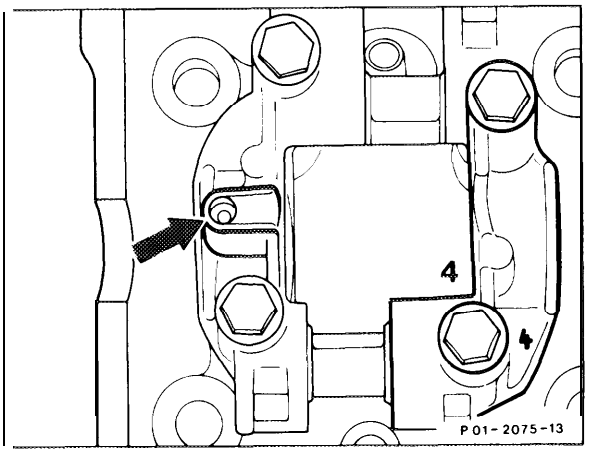
The rocker arm bearing supports can be distinguished by the following features.

Front bearing support
Code No. 1. Two bearing positions (arrows).

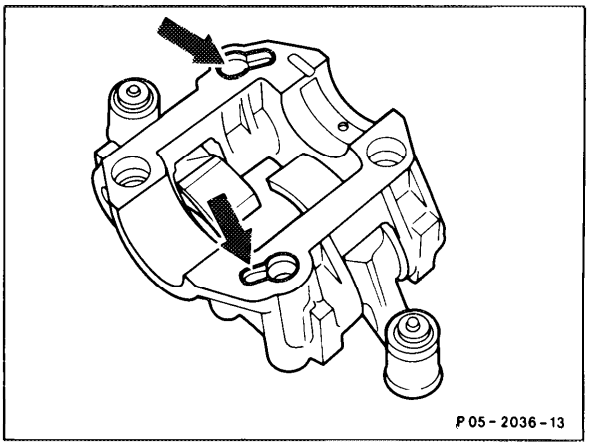
Center bearing supports
Code No. 2 and 3. These two bearing supports are the same apart from the identification numbers.



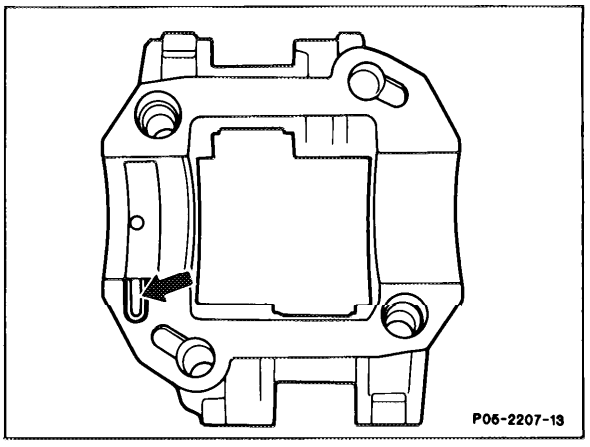
Rear bearing support
Code No. 4. Connection bore for oil pipe (arrow).



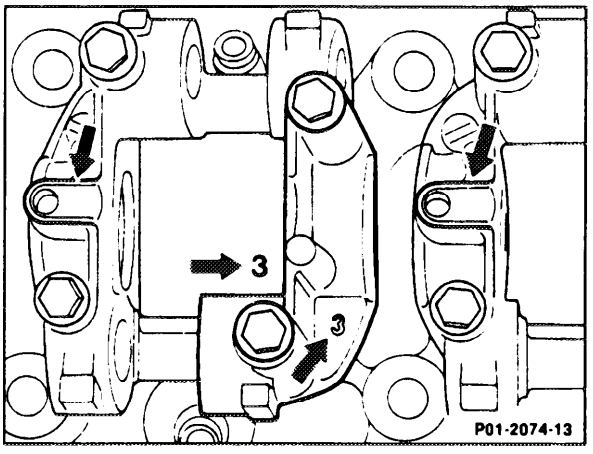
The two oil grooves (arrows) act as oil supply to the hydraulic valve clearance compensating elements.



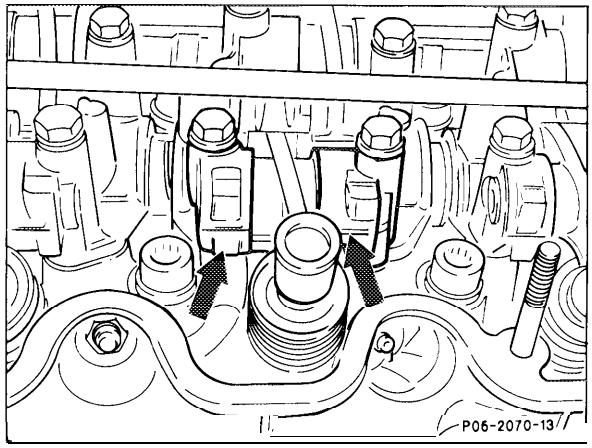
The oil pipe for camshaft lubrication is supplied with oil via the groove (arrow) on the rocker arm bearing support.



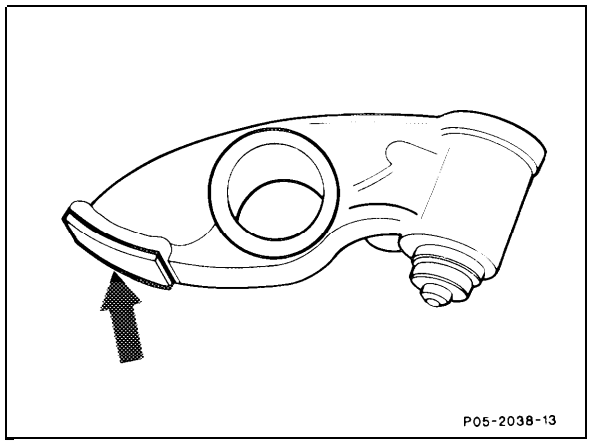
The rocker arm bearing supports should not be confused with each other. They are therefore identified on the right-hand side with the Numbers 1, 2, 3 and 4 from the front to the back. The identification of the bearing support must agree with the number, which is cast in the cylinder head (arrows).
In the replacement parts area the bearing supports are made individually and without code numbers stamped on. The corresponding code number is to be applied after installation.



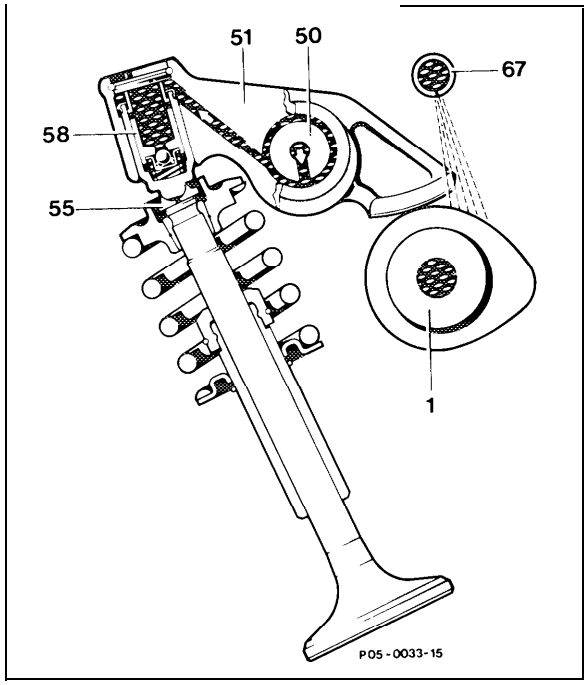
The rocker arms for operating the valves are supported individually on a rocker shaft fitted in a bearing support on both sides (arrows).



Rocker arms with soldered on cemented carbide tips have been installed since October 1988 (arrow).

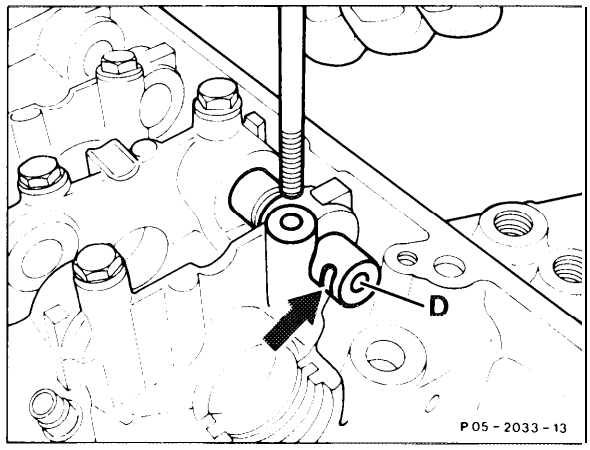


The oil required for lubricating the rocker arm bearings reaches the rocker arm bearing shaft (50) and hydraulic valve clearance compensating element via a longitudinal channel in the cylinder head and a feed bore in the bearing support (which is also the set bolt bore).



1 Camshaft
50 Rocker shaft
51 Rocker arm
55 Ball socket
58 Hydraulic valve clearance compensating element
68 Oil pipe

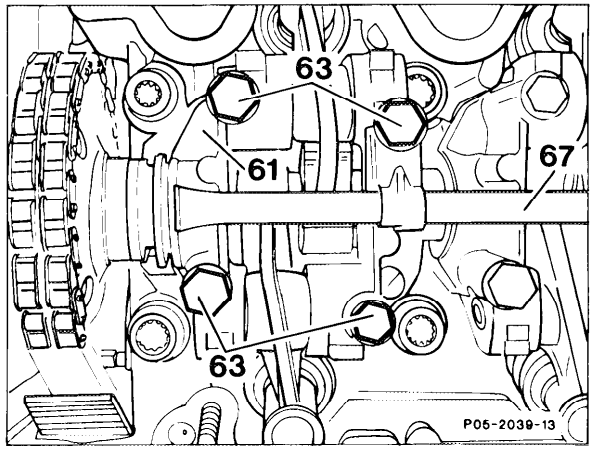
The rocker shaft is secured in the axial and rotary direction by a bearing support set bolt. For this a half bore is attached to the shaft, in which one half of the screw shaft is located (arrow).
An M8 thread (D) has been incorporated in the front face for installation and removal of the rocker shaft.



Removal, installation

1 Turn engine so that the camshaft tips of the bearing support being removed point downwards and rocker arms are on the base circle.

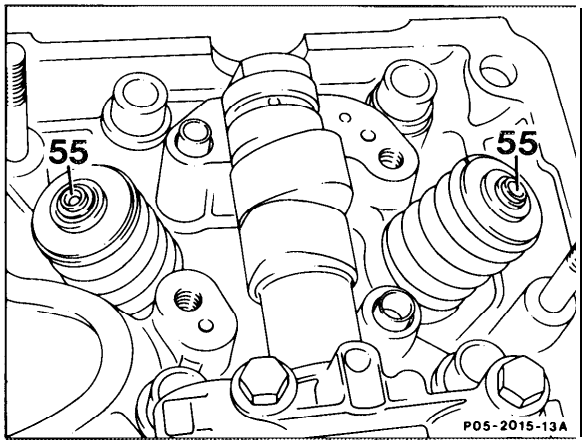
2 Remove oil pipe (67), to do this unbolt, bolt up the two bolts (63) on the pipe clamps, tightening torque 20 Nm.



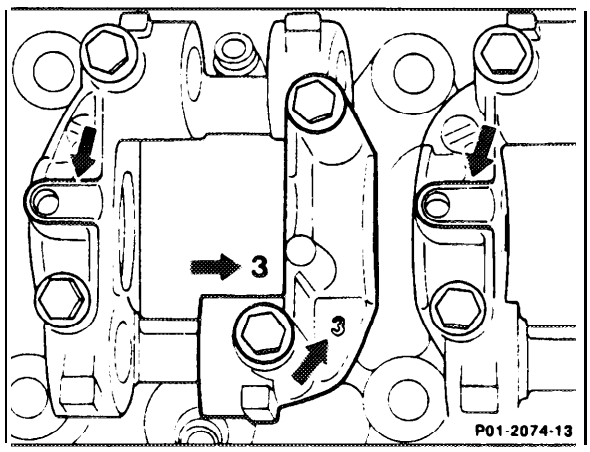
3 Remove, install relevant rocker arm bearing support, tightening torque 20 Nm.

Note

Loosen seized bearing supports using light blows with a plastic hammer.
The ball sockets (55) on the hydraulic elements can stick or fall down when removing the bearing support. Install ball sockets in their original positions.

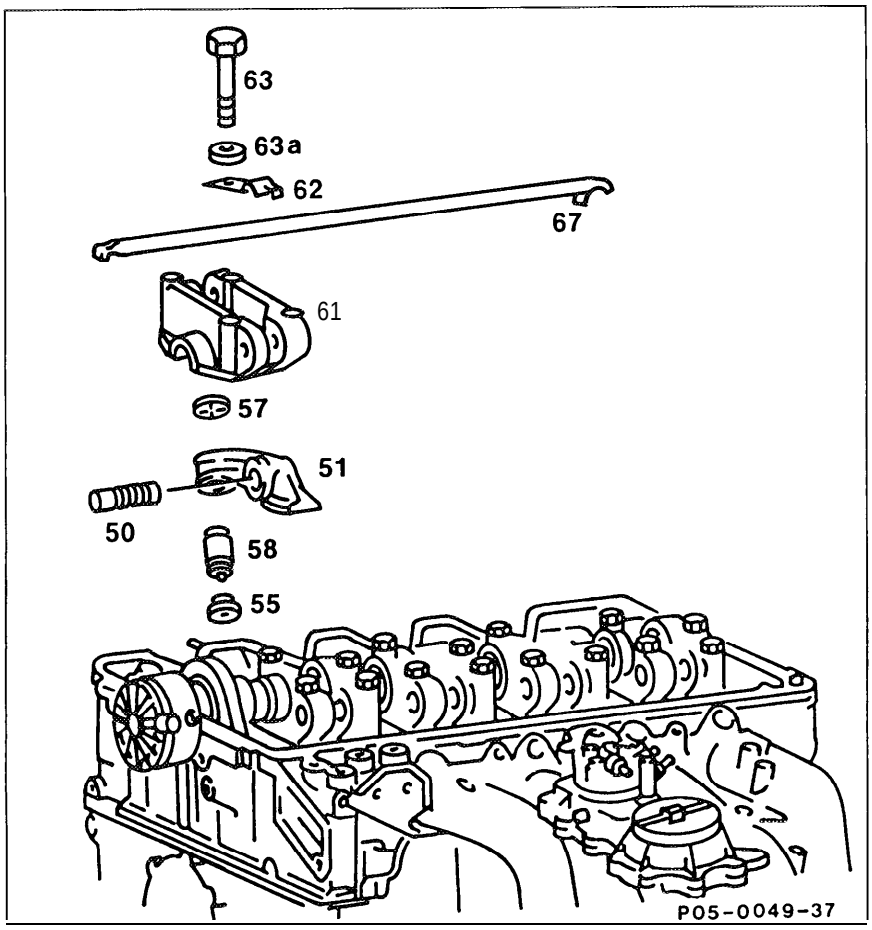


install the rocker arm bearing support so that the support areas for the oil pipe point rear-wards, the code numbers of the bearing supports are on the right-hand side (direction of travel) and correspond to the number cast on the cylinder head (arrows).



05-240 **Replacement** of rocker arms and rocker arm bearing supports

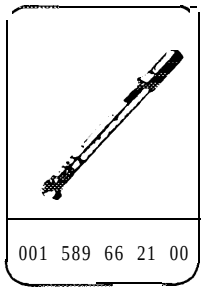
Preceding work:
Air cleaner removed (09-400 and 09-410)
Cylinder head cover removed (01-406).



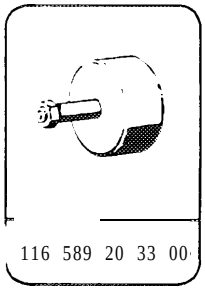
Camshaft	position so that rocker arms of bearing support being removed is on base circle of the cam (Number 1).
Oil pipe (67)	remove, install (Number 2)
Bearing support (61)	remove.
Rocker shaft (50)	pull out with impact extractor 116 589 20 33 00 and extension 616 589 00 34 00. Lubricate new rocker arm and rocker shaft and install. Prior to this rebuild hydraulic valve clearance compensating element (05-211, Numbers 4 and 5).
New bearing support (61)	install with rocker shaft without rocker arm, 20 Nm (Numbers 6 and 7).

Camshaft	turn and check for smooth running, possibly fit new bearing support (Number 8).
Bearing support (61)	remove, complete with rocker arm (51) and install rocker shaft (50) and bearing support (Numbers 9 and 10), 20 Nm.

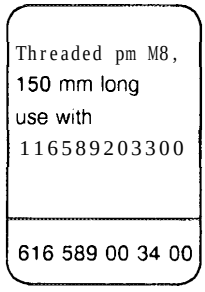
Special tools



001 589 66 21 00



116 589 20 33 00



616 589 00 34 00

Data

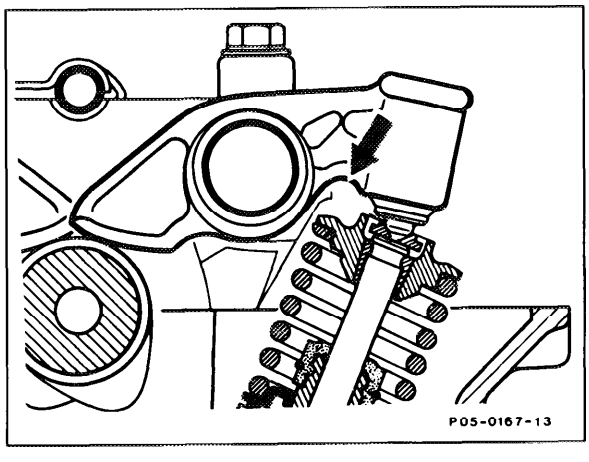
Rocker arm bore	18.016 18.027
Rocker shaft diameter	17.089 18.000
Radial clearance between rocker arm and rocker shaft	0.016 0.038
Rocker arm bearing support bore	18.000 18.018

Note

Only one bearing support can be replaced on an engine, otherwise camshaft binding will result.

Only rocker arm bearing supports where camshaft bearing half bore is 0.05 mm larger than on production parts are supplied as spare parts. This prevents the camshaft binding when replacing a bearing support.
In the event of bearing seizure or pronounced striation the camshaft bearings can be bored out by 0.5 mm and a camshaft with oversized journals installed (01-419). These camshafts have different code numbers
(05-215 and 05-220).
If the bearing supports are put together without rocker shafts, tighten the set bolts to max. 15 Nm, otherwise the shaft bores distort.

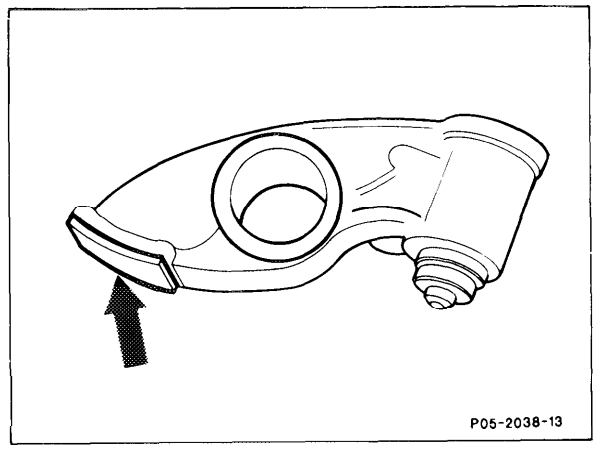
The radius on the rocker arm has been changed in order to increase the clearance between the rocker arm and the valve spring retainer (arrow).



Introduced in production: December 1984

Model	Engine	Engine end number		Vehicle identification end number	
		Manual transmission	Automatic transmission	A	F
201.024	102.985	000871	007129	172188	063323

In order to avoid camshaft wear, rocker arms with soldered on cemented carbide tips have been installed (arrow).
Only this rocker arm is still supplied as a replacement part.
These rocker arms may only be installed together with the chilled cast iron camshaft.



Introduced in production: October 1988

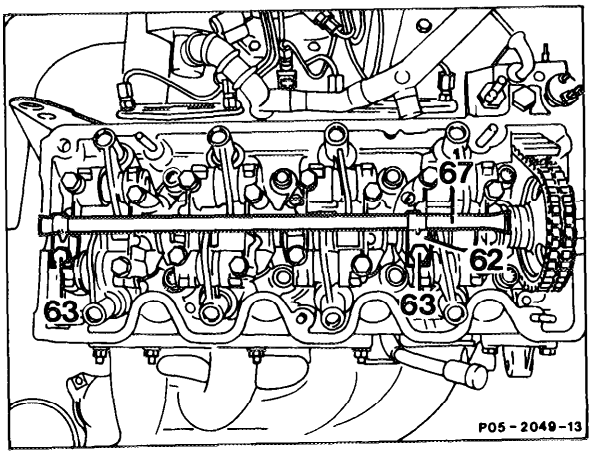
Model	Engine	Engine end number Manual transmission	Engine end number Autom. transmission
201.028	102.985	027671	077053

Replacement

a) Rocker arms and rocker shafts

1 Turn the engine so that the cam tips of the bearing support being removed point downwards and the rocker arms are on the base circle.

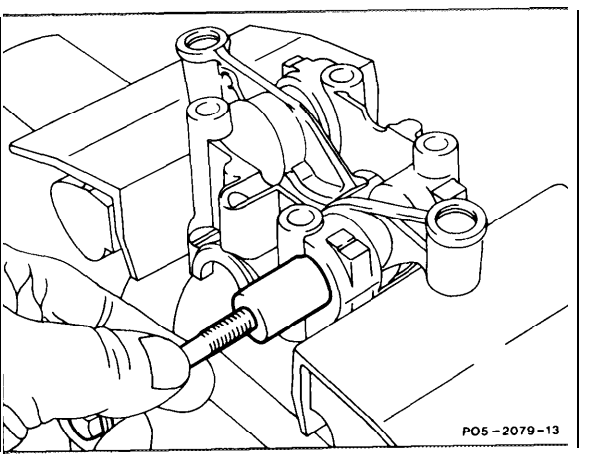
2 Remove, install oil pipe (67).



3 Remove bearing support.

4 Pull out rocker shaft with the impact extractor 116 589 20 33 00 and extension 616 589 00 34 00 or with an M8 bolt.

5 Lubricate new rocker arm and rocker shaft and install.

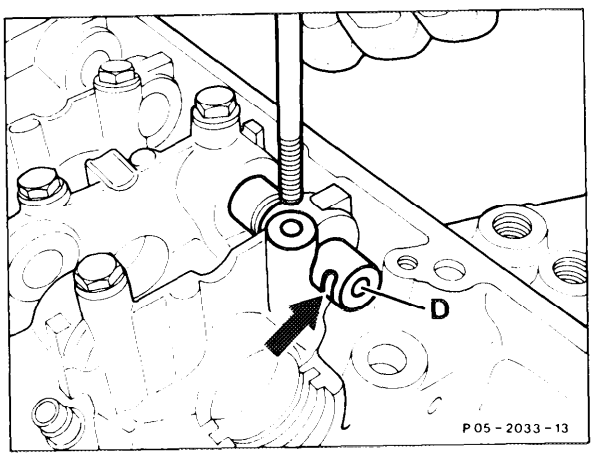


b) Bearing support

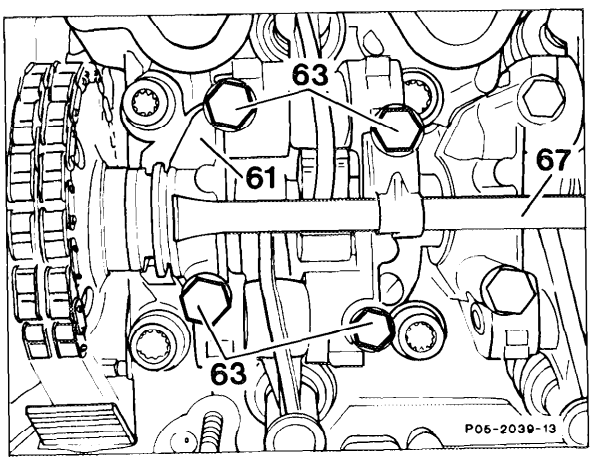
6 Lubricate new rocker shaft and install without rocker arm in the new bearing support.

Note

Insert the rocker shaft so that the half-bore (arrow) is located in one half of the screw shaft.



7 Put on bearing support, tighten set bolts (63) to 20 Nm, install oil pipe (67).

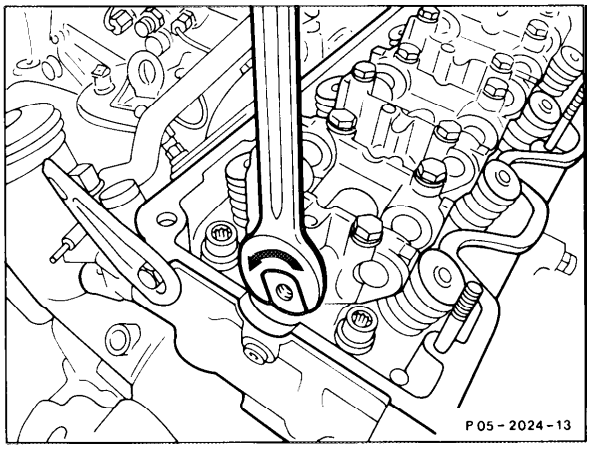


8 Turn camshaft by the fiats with a fork wrench (24 mm) and check for ease of movement. If binding occurs, remove the bearing support again and replace with another.

9 Remove new rocker arm bearing support and pull out rocker shafts (Figure Number 4).

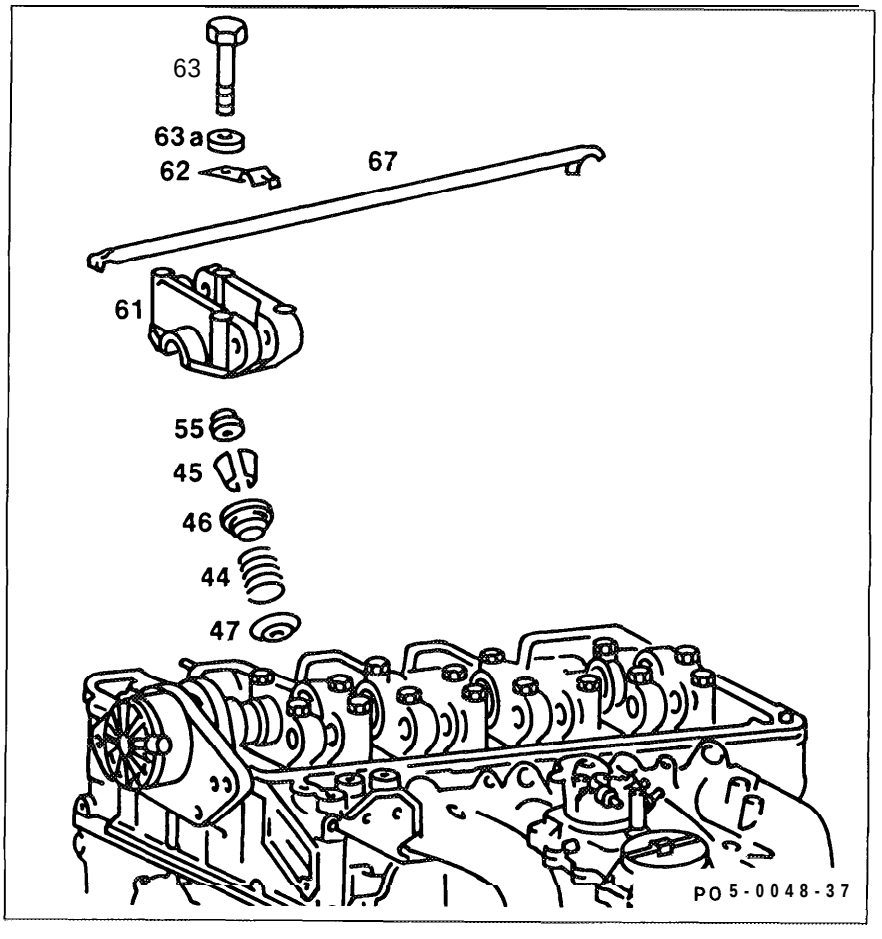
10 Lubricate rocker arms and rocker shafts and install in bearing support.

11 The installation proceeds in the reverse sequence.



05-250 Removal and installation of valve springs

Preceding work:
Air cleaner removed (09-400 and 09-410).
Cylinder head cover removed **(01-406).**
Spark plugs removed **(15-018).**



A. Cylinder head removed

Cylinder head ..... clamp on assembly board 102 589 00 59 00. Remove, install rocker arm bearing supports. Attach support bridge 102 589 01 59 00 to cylinder head. Remove, install valve springs with the lever compressor 601 589 02 61 00.

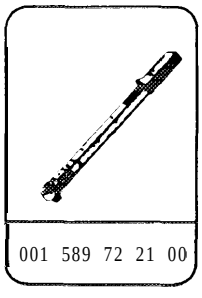
B. Cylinder head installed

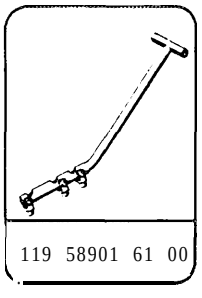
Piston of the relevant cylinder ..... position on ignition TDC (Number 1).

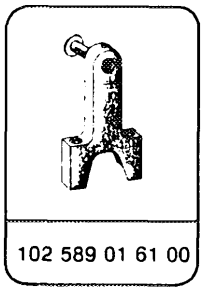
Oil pipe (67) ..... remove, install (Number 2).

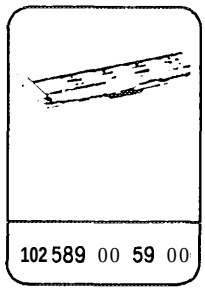
Rocker arm bearing support (61)	remove, install, 20 Nm (Number 3).
	Repair note Lubricate camshaft journals. Ball sockets (55) must be installed in the same position again. Note installation position of the rocker arm bearing bolt.
support	install 102 589 01 61 00 (Number 4).
Cylinder leakage tester	Disconnect, connect to the relevant cylinder (Number 5). Pressurize cylinder.
Valve cotters (45)	remove and install with the lever compressor 601 589 02 61 00 and magnet 116 589 06 63 00. Remove, insert valve springs (Numbers 7 to **9).**
	Installation note Install valve spring so that the color marking and the narrower coil point downwards.

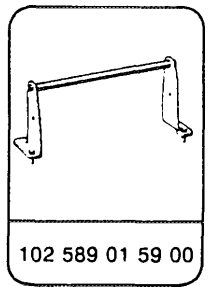
Special tools

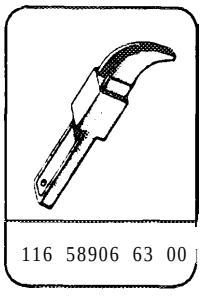

001 589 72 21 00


119 58901 61 00


102 589 01 61 00


102 589 00 59 00


102 589 01 59 00

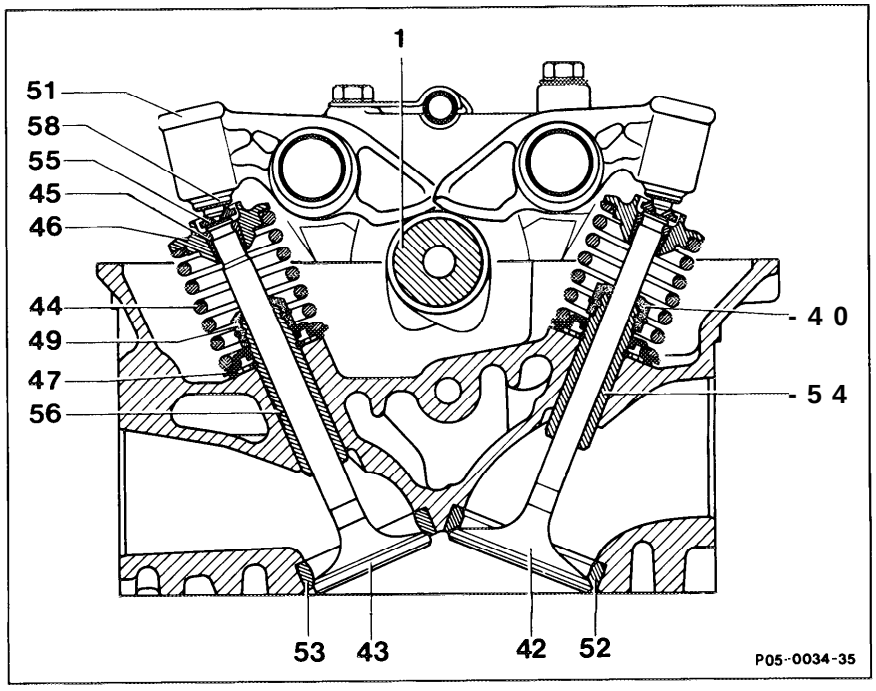

116 58906 63 00

Conventional tool

Cylinder leakage tester	e. g.	Bosch, E F A W **210** A **Sun,** CLT 228

Note

Valve springs and valve spring retainers with scoring on the mounting surfaces must be replaced.



The valve springs act progressively and must be installed so that the color marking (narrow coil) points towards the thrust collar (47).

Color marking : yellow/red or
violet/red

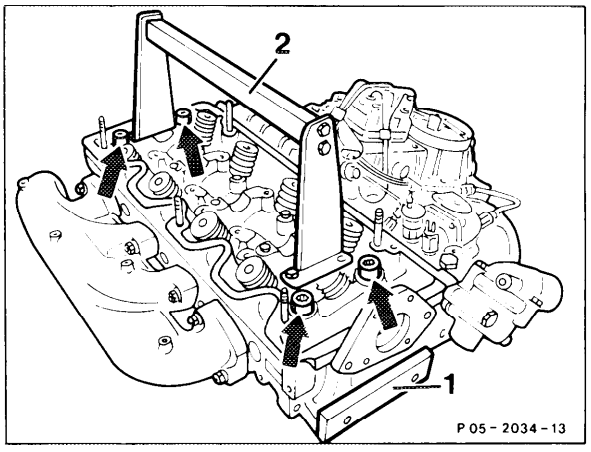
A thrust collar (47) is inserted under the valve springs, which is supported on the cylinder head via anti-rotation lugs.

As on all other engines, the valve spring thrust bearing at the top forms valve spring retainers (46), which are attached to the valves with valve cone halves (45).

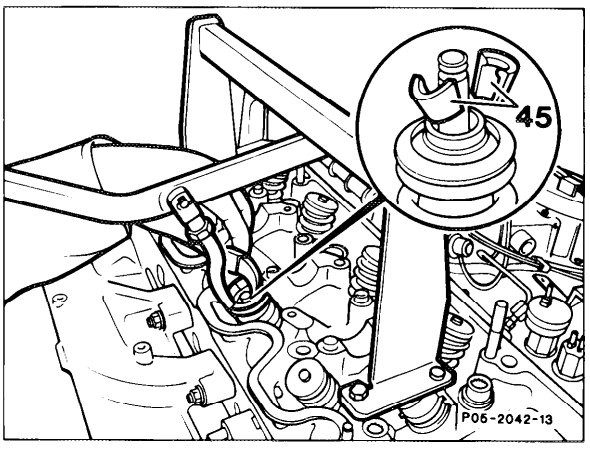
A. Cylinder head removed

When the cylinder head is removed the valve springs can be removed as follows:

Clamp cylinder head with four cylinder head bolts (arrows) on assembly board 102 589 00 59 00 (1). Remove rocker arm bearing supports with rocker arms and camshaft.

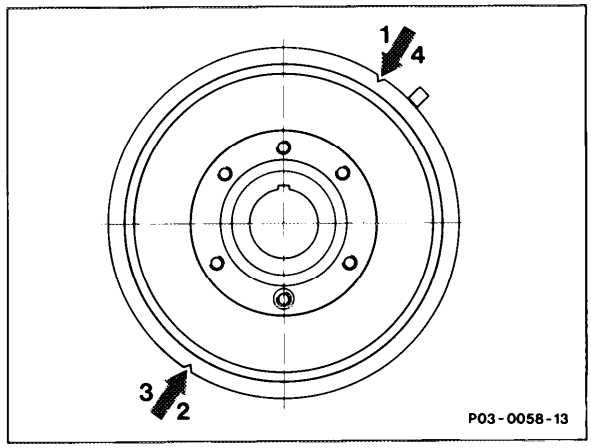


Attach support bridge 102 589 01 59 00 to the cylinder head and remove the valve springs with the lever compressor.



B. Cylinder headl installed

Removal, installation

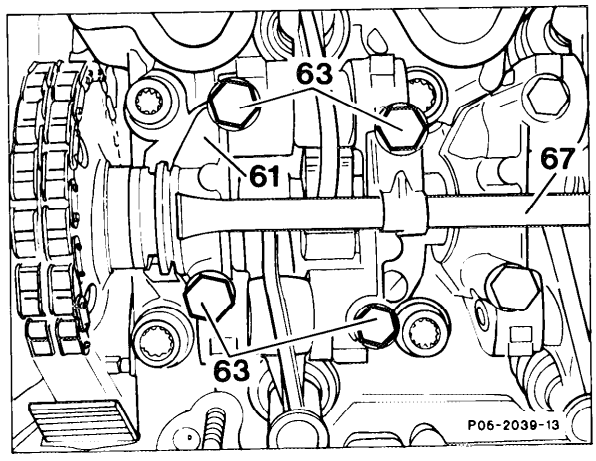


1 Put piston of the relevant cylinder on ignition TDC.

Note

The respective pistons are in the ignition TDC position, when the markings on vibration damper shown in the adjacent drawing are beneath the TDC pointer.

Marking	TDC	180"
Piston at TDC on cylinder	1 and 4	2 and 3



2 Removal and installation of oil pipe (67).

3 Remove and install the required rocker arm bearing support (61), tightening torque 20 Nm.

Installation note

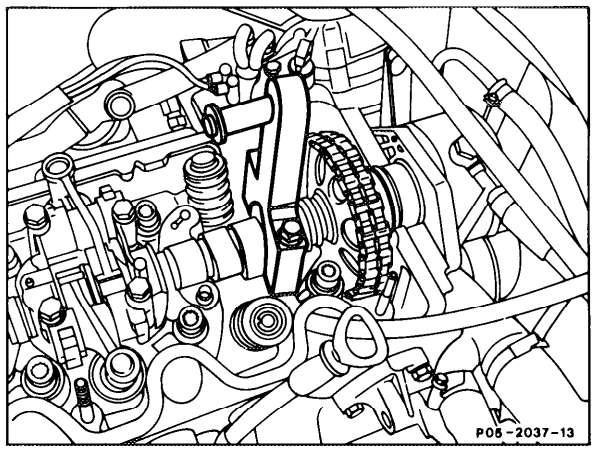
Before installing rocker arm bearing support lubricate camshaft journals.

Install the rocker arm bearing support so that the support area for the oil pipe points rearwards and the code number is on the right (in the direction of travel).

The ball sockets (55) must be installed in the same position again.

4 Bolt up, unbolt support for lever compressor,

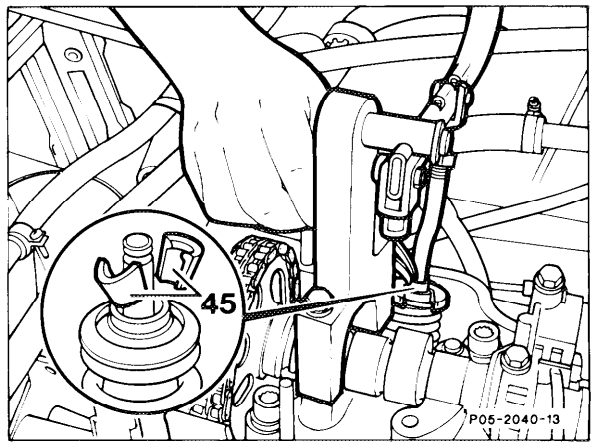
5 Connect cylinder leakage tester and pressurize cylinder.



6 Mount lever compressor on the support and install the valve spring retainer.

7 Compress valve spring and take out valve cone halves with the magnetic lever.

Caution!
Do not remove the valve springs without compressed air in the cylinder, otherwise damage can occur due to contact between the valves and the piston.

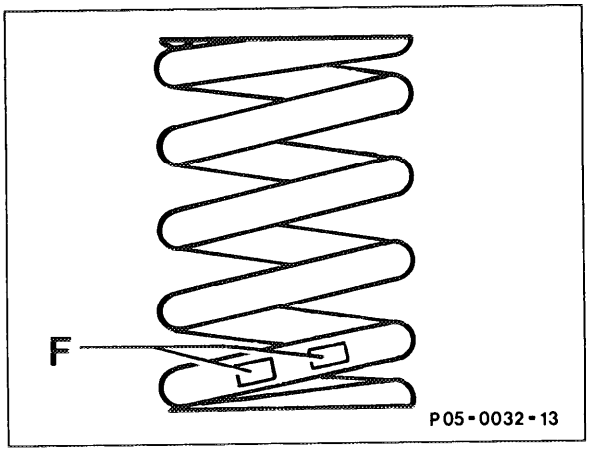


8 Remove, install valve spring retainers and valve spring.

9 Check valve spring (05-260) and valve spring retainers, replace as necessary.

10 Installation is the reverse of removal.

05-260 Checking valve springs



Data

	Valve spring Part no.	Colour identification (F)	Out-side Ø mm	Wire Ø mm	Free length mm	Spring force at the pre-loaded length		
						mm	New value N	Limit value N
1st design	102 053 02 20	yellow-red or violet-red	34.7	5.0	49	30.4	1084 + 30 - 50	−760
2nd design	102 053 11 20	violet-yellow orange or yellow-yellow orange						

Note

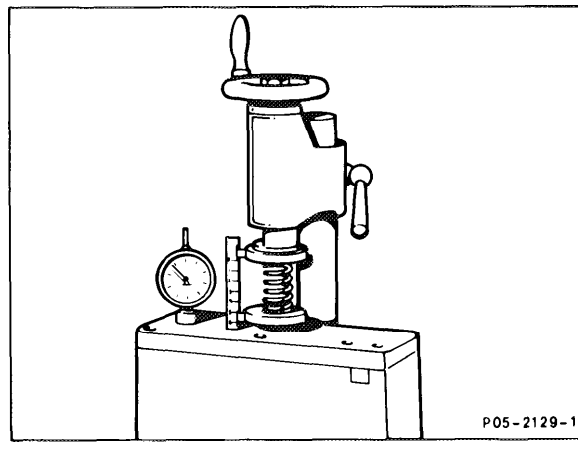
When carrying out repairs valve springs are to be checked for corrosion before re-use and to be replaced as necessary.

Checking

1 Check valve springs with a valve spring tester or with a spring test scale.

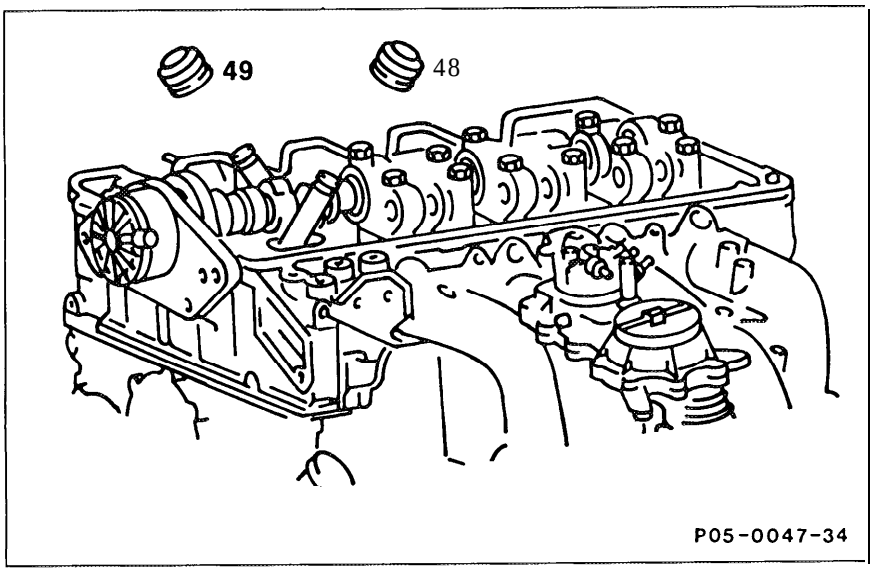
2 Check spring force at the specified length.

3 If the limit value is not achieved, replace valve springs.



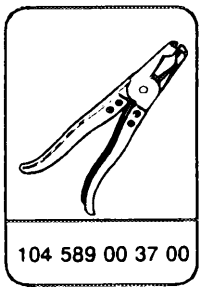
05-270 Replacement of valve stem seals

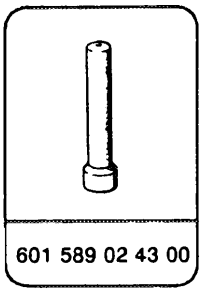
Preceding work:
Air cleaner removed (09-400 and 09-410).
Cylinder head cover removed (01-406).
Spark plugs removed (15-018).
Valve springs removed (05-250).



Valve stem seal (48 and 49) . . . . . extract with special tool 104 589 00 37 00.
Deburr valve stem at the groove. Replace hammered valve cone halves, spring seats and thrust collars.
Lubricate valve stem seal and insert.
Special tool 601 589 02 43 00. Note color marking, use assembly sleeve.

Special tools

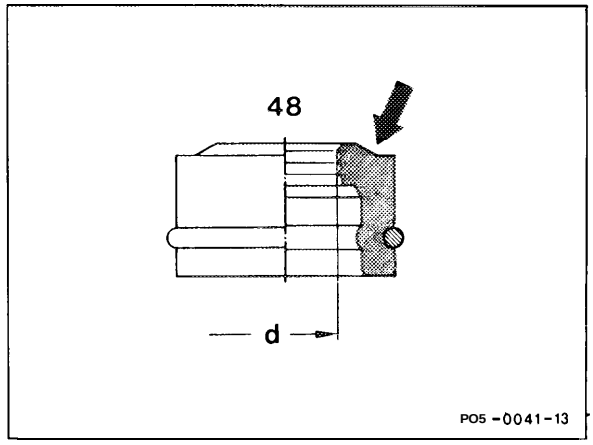

104 589 00 37 00


601 589 02 43 00

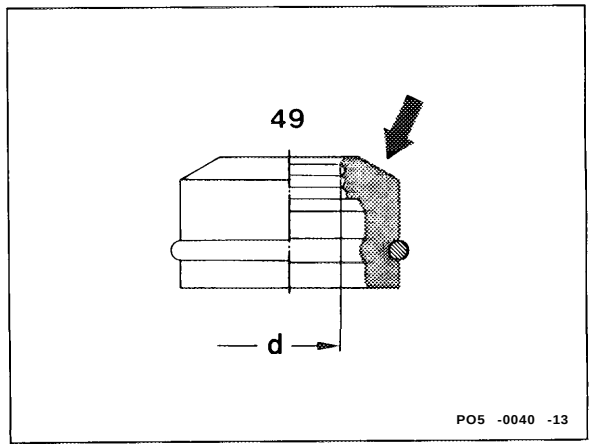
Note
The valve stem seals including assembly sleeves are supplied in the repair set. Since September 1988 standardized valve stem seals in Viton (formerly Polyacrylic) are installed for intake and exhaust valves. The valve stem seals must not be interchanged due to the different inside Ø.

Distinguishing features:

Intake valve stem seal **(48)**
Chamfer (arrow) relieved
d = 7.3 mm
Wire ring : phosphated (black)
Color: brown



Exhaust valve stem seal (49)
Chamfer (arrow) inclined
d = **8.2** mm
Wire ring **:** bright galvanized (yellow)
Color: brown

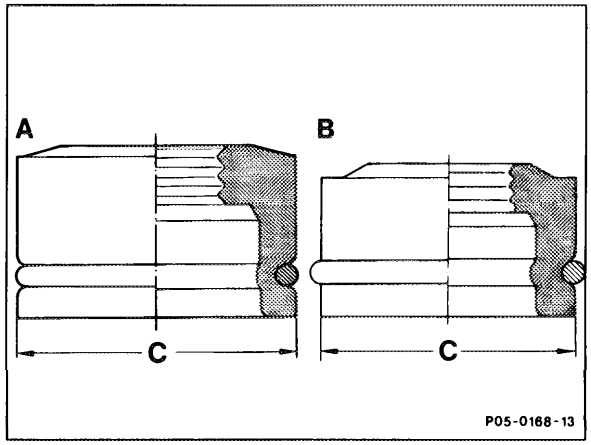


Valve guides, which are opened out at the retaining groove for the valve stem seal, must be replaced.
When installing the valve stem seal on the intake valves it is absolutely essential that the plastic sleeve, which is enclosed in the repair set, is placed on the valve stem, because without the sleeve damage to the sealing lip of the valve stem seal is unavoidable.

As a temporary measure valve stem seals with a smaller inlet Ø c = 16 mm (previously 17.5 mm) have been installed.

Identification: revised outside contour

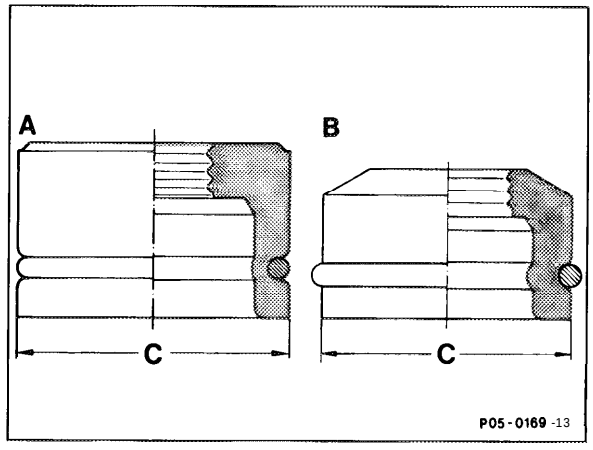
A Temporary design
B Production design



Intake valve stem seal

Introduced in production: January to February 1986

Model	Engine	Engine end number Manual transmission	Engine end number Automatic transmission
201.024	102.985	003217 – 003513	029482 – 031994



Exhaust valve stem seal

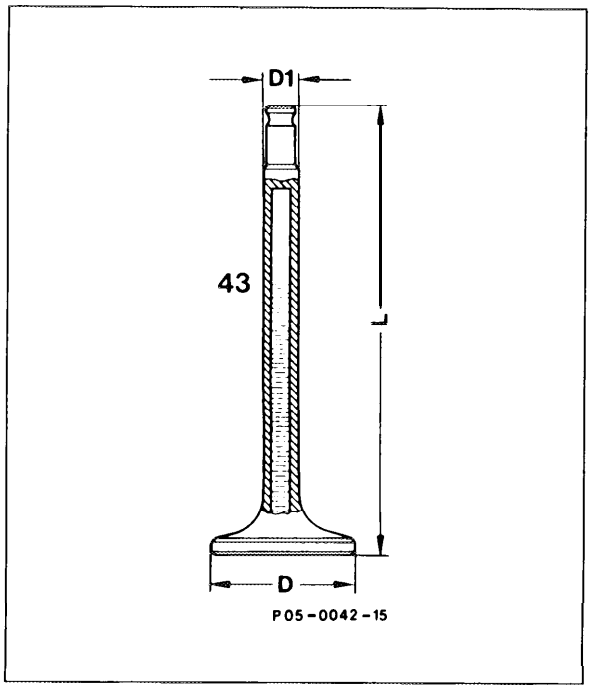
Introduction of Viton valve stem seal

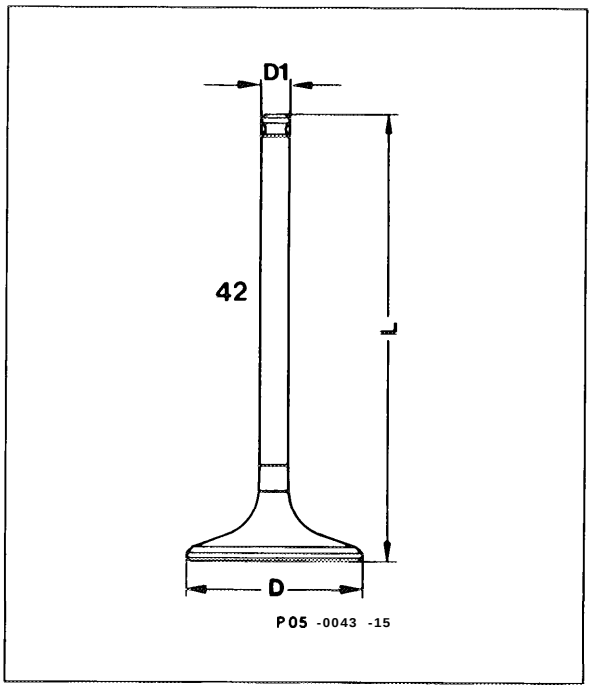
Color identification: brown

Introduced in production: June 1988

Model	Engine	Engine end number Manual transmission	Engine end number Automatic transmission
201.028 (USA)	102.985	025442	074595

05-280 Checking and machining valves





Checking	clean valves. Visual inspection: Valves with burnt valve heads, insufficent valve head height (h) worn or grooved valve stem must be replaced (Number 1).
Checking	Measure valve stem eccentricity. Replace valve when eccentricity is more than 0.03 mm (Number 2).
Machining valve seat	Note operating instructions for machining equipment. Note adjustment angle “a” 45 + 15°. Replace valve when maximum tolerances are reached (Numbers 3 and 4).

Conventional tools

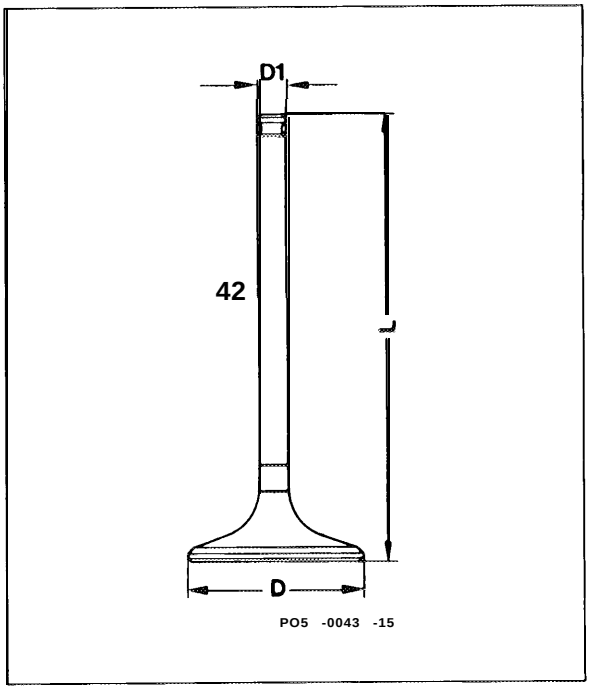
Valve cone grinding machine or	e.g.	Krupp, D-5309 Meckenheim VS Model
Valve cone turning equipment	e.g.	Hunger, D-8000 München 70 Type VKDR1, Part Number 203.00.200

Data

		Intake valve (42)	Exhaust valve (43)
Engine		102.985	102.985
Valve head Ø D		45.90 46.10	38.90 39.10
Height "h" of the valve head (Figure Number 1):	New value	1.6	2.7
	Limit Value	1.0	2.0
Adjusting angle „∝" for machining the valve (Figure Number 1)		45° + 15'	45° + 15'
Valve stem Ø D1		7.970 7.950	8.960 8.938
Valve seat reinforcement		without	with
Sodium filled		without	with
Valve length		114.70 115.10	115.60 116.00
Width of valve seat		1.8 – 2.5	1.5 – 2.5
Permitted eccentricity on valve stemand valve seat max.		0.03	0.03

Identification on end of stem

Engine	Inlet valve	Exhaust valve
102.985	E 102 08	A 102 03 27

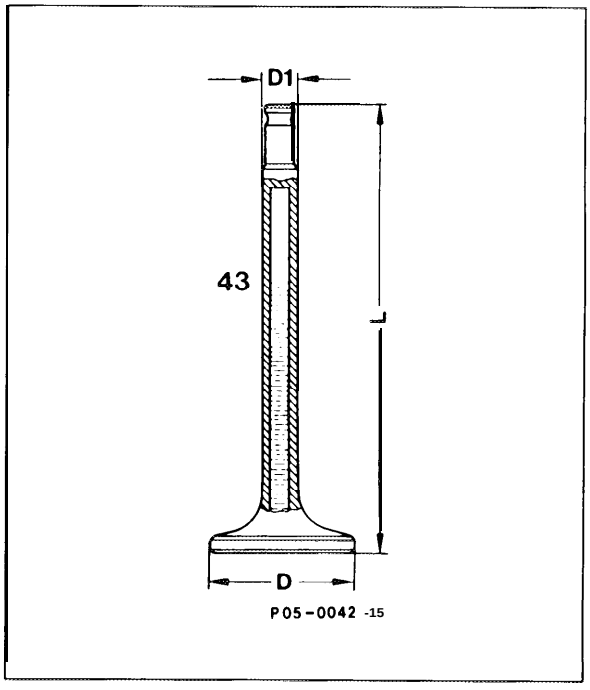


42 Intake valve

Note
The exhaust valve stem is chrome-plated on these engines and filled with sodium due to high temperatures in the combustion chamber.

Warning!
Unserviceable sodium filled valves must be neutralised before scrapping. They must therefore be collected and sent to:

Mercedes Benz AG
Werk Marienfelde
Daimlerstraße 145
Anlieferstelle KST 3153
Arbeitsvorbereitung TAI

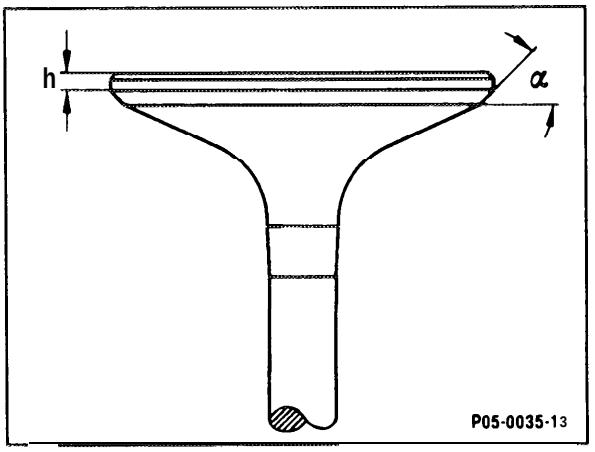


43 Exhaust valve

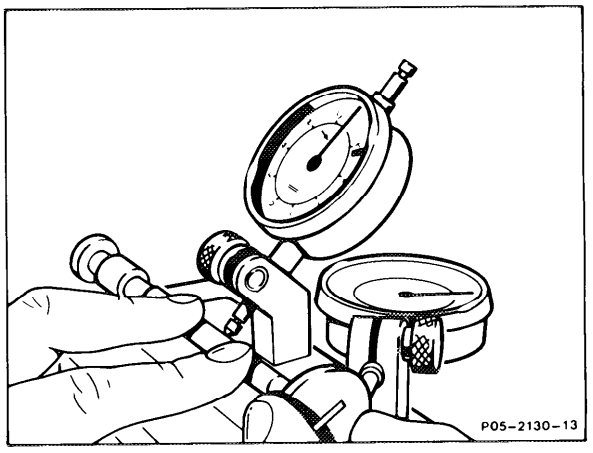
After machining or replacing valves, the installed length of hydraulic valve clearance compensating elements must be checked and corrected if necessary (05214).

Checking and machining

1 Clean valves and carry out visual inspection. Valves with burnt valve heads with insufficient valve head height "h" and with worn or scored valve stem are to be replaced.

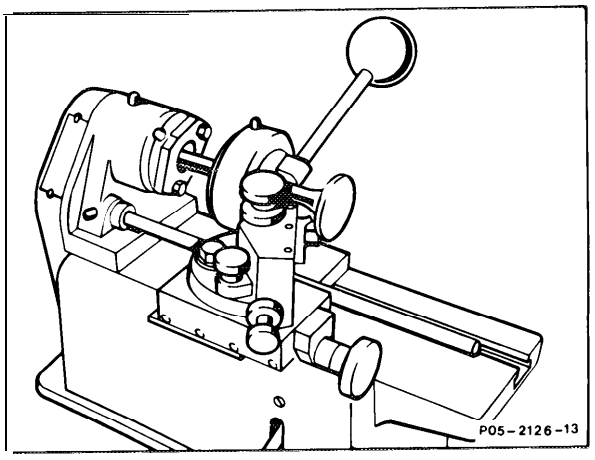


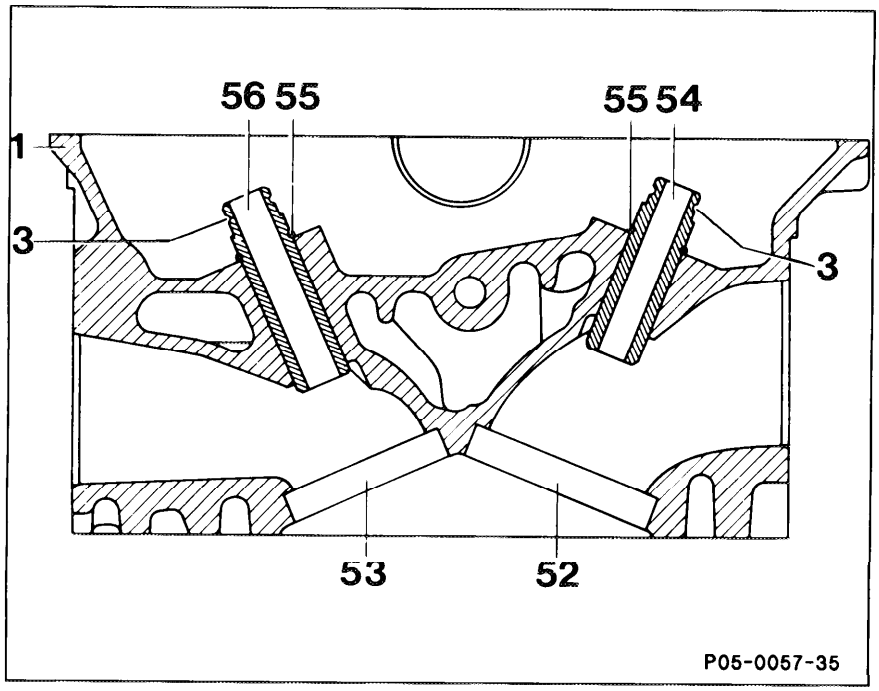
2 Measure valve stem eccentricity. Replace valve when an eccentricity of more than 0.03 mm is measured.



3 Machine valve seat. Note operating instructions of the machining equipment and adjustment angle "α" 45 + 15'.

4 Measure valve seat eccentricity and valve head height "h". Replace valve if the limit values are reached.

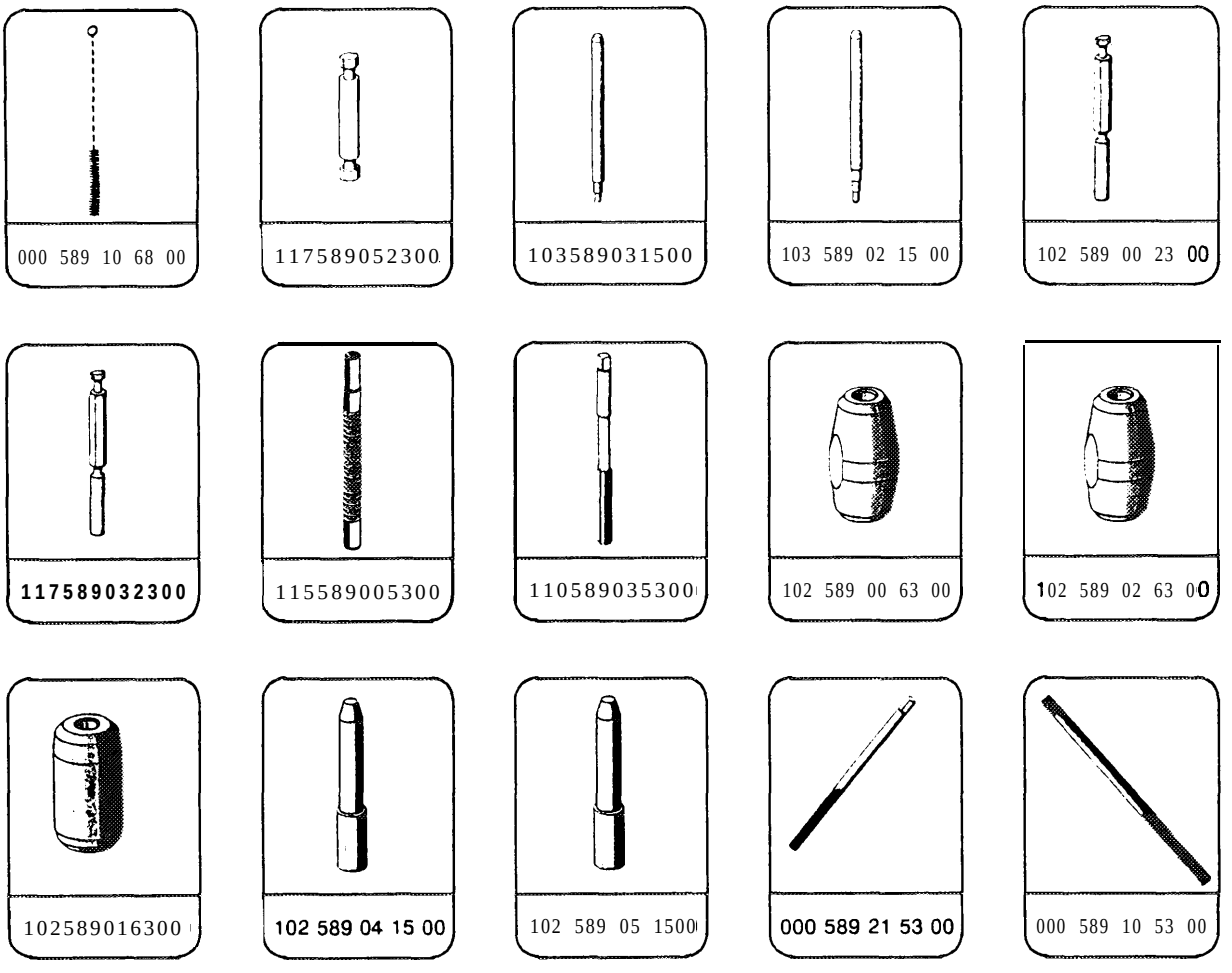




Valve stem seal seat (3)	check for wear. If the valve stem seal is no longer firmly seated, replace valve guide, special tools 103 589 02 15 00, 103 589 03 15 00.
Valve guide (54 and. 56)	clean, check, special tools 000 589 10 68 00, 102 589 00 23 00 and 117 589 03 23 00. If the go pin of the checking mandrel can be slid in longitudinally or laterally to the full extent (6.5 mm), replace valve guide. Special tools 103 589 02 15 00 and 103 589 03 15 00. Insert: Super cool in liquid nitrogen approx. (3 minutes), special tools 102 589 04 15 00 and 102 589 05 15 00. See repair note. After insertion check inside Ø with testing mandrel, special tools 102 589 00 23 00 and 117 589 03 23 00; if required, ream, special tools 000 589 21 53 00 and 000 589 10 53 00.

Base bore for valve guide in the cylinder head (1)	check before inserting a valve guide. Special tool 117 589 05 23 00. If normal dimension valve guide can be used; Ream base bore with reamer 14.035 mm Ø, 1105890300 When the checking pin can be inserted to the full extent, broach base bore to 14.2 mm Ø. Special tools 115 589 00 53 00, 102 589 00 63 00, 102 589 01 63 00 and 102 589 02 63 00. See repair note.
Valve seat ring (53 and 54)	after installing a new valve guide check for eccentricity, if necessary machine (05-291).

Special tools



Conventional tool

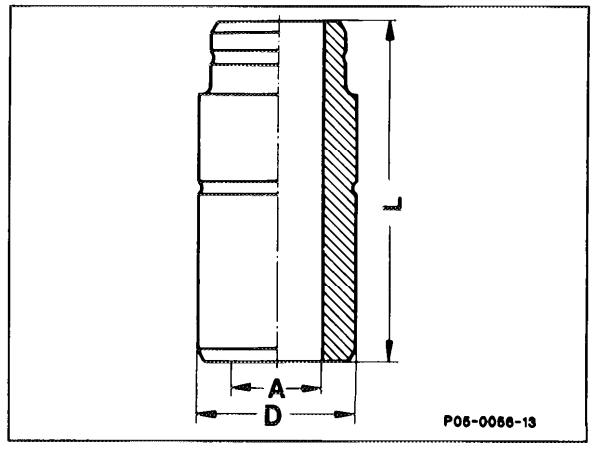
Cylinder head clamping fixture	e.g.	f-lunger, D-8000 München 70 Part Number 221.60.000

Valve guides

	Intake valve		Exhaust valve	
	Normal dimension	Repair stage	Normal dimension	Repair stage
Part Number	11020501724	11020501024	11020501824	11020501324
Outside Ø (D)	114.044 – 14.051	114.214 – 14.222	114.044 – 14.051	14.214 – 14.222
Color identification	grey-brown	red	grey-brown	red
Base bore in cylinder head	14.030 – 14.035	114.198 – 14.203	114.030 – 14.035	114.198 – 14.203
Overlap	0.009 – 0.021	0.011 – 0.024	0.009 – 0.021	0.011 – 0.024
Valve guide inside Ø (A)	8.000 – 8.015	8.000 – 8.015	9.000 – 9.015	9.000 – 9.015
Length (L)	46.0	46.0	51.0	51.0

Note

Valve guides are made of different materials on the intake and exhaust side.
Intake valve guide (54): copper olours
Exhaust valve guide (56): brass colors



Valve guides produced by another manufacturer have been installed between June and September 1986.

Introduced in production: June - September 1986

Model	Engine	Engine end number		Vehicle identification end number	
		Man. transmission	Auto. transmission	A	F
201.024 (USA)	102.985	003910 – 004391	036130 – 040796	–	262533 – 277581

[1]) not recorded

Broach base bore in cylinder head (repair stage)

Remove rust and clean the cylinder head thoroughly, particularly the inside of valve seat rings.

Select correct guide sleeve (2) and remove swarf from the cutting edge of broach (1) with a stiff plastic brush or similar.

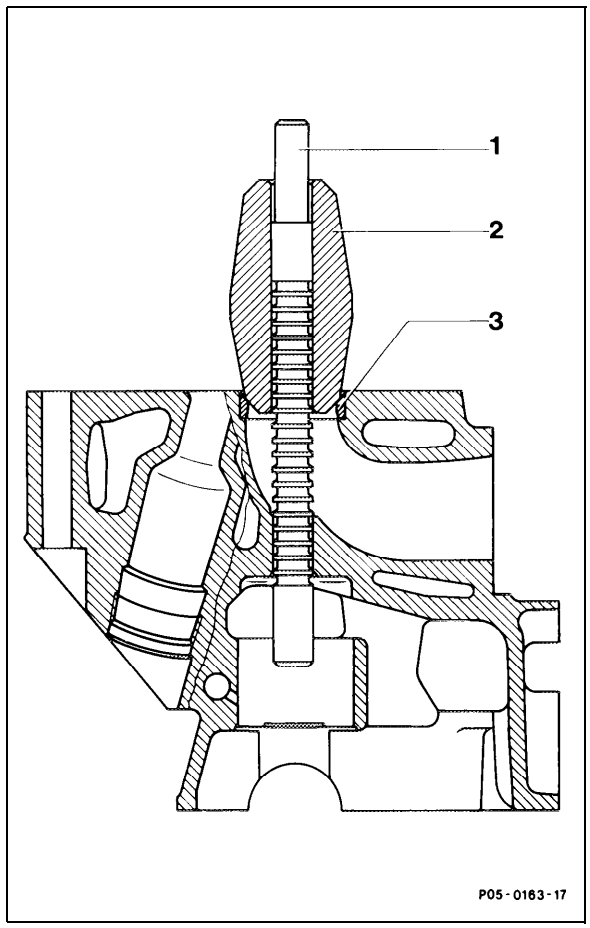
Note

The broaching tool cutting edges must be cleaned before every broaching process. Provide guide sleeve, base bore and complete broach with ample supply of kerosene.

Slide broaching tool in direction of broaching into the guide sleeve, so that when putting the guide sleeve on the valve seat ring (3) the first broach cutter is inserted in the base bore. When doing this, note that the correct side (A or B) of the guide sleeve is placed on the valve seat. Center guide sleeve by rotary movements in valve seat ring.

Note

Drive home the broach briskly with an aluminium mandrel, approx. 130 mm long, and a plastic hammer of approx. 250 g.



1 Broach
2 Guide sleeve
3 Valve seat ring

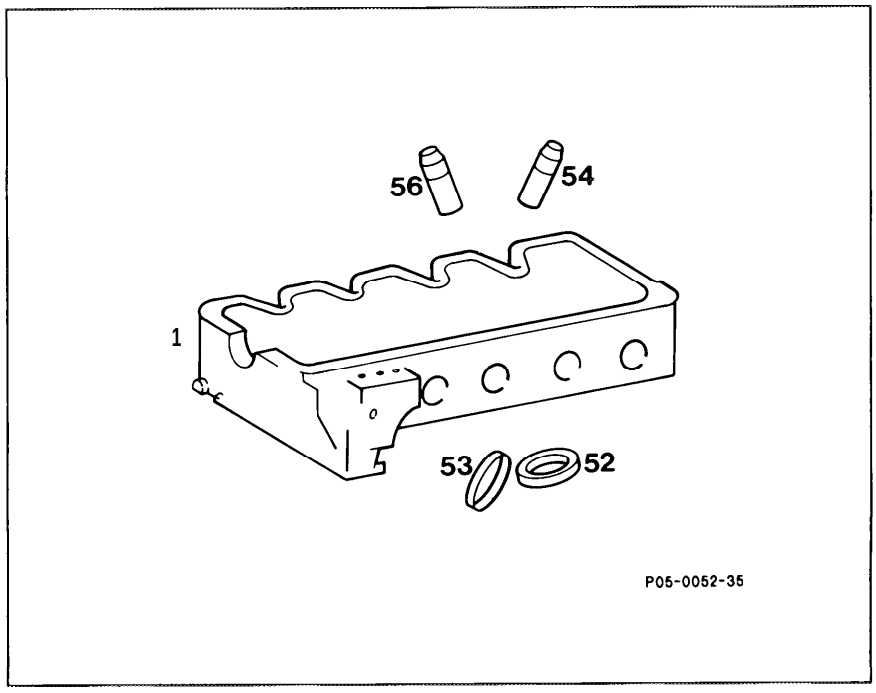
Inserting valve guide

Drive in the valve guides with impact mandrel and hammer, when the valve guides are not super cooled and cylinder head is not heated up. Coat valve guides with wax or oil before driving in.

Guide sleeve - valve seat allocation to enaine

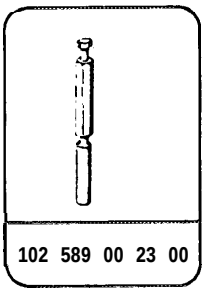
Valve seat	Engine	Guide sleeve Part No.	Base bore Ø in cylinder head
Intake	102.922/924 102.962.963	102 589 01 63 00	14. 2 mm
	102.985	102 589 02 63 00	
Exhaust	102.985	102 589 00 63 00	

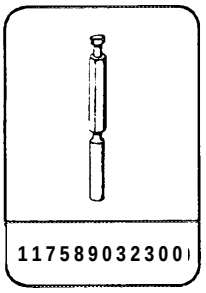
05-290 Replacing valve seat ring



Valve seat ring (52 and 53)	unscrew with seat ring turning tool Note turning tool operating instructions.
Valve guides (54 and 56)	check, replace if necessary (05-285).
Base bore (D2)	measure.
	Note A new valve seat ring with normal dimensions can be used, when specified overlap is present. If minimum overlap is not achieved, machine base bore for valve seat ring.
Machined base bore	measure.
Valve seat ring repair stage	skim, so that the specified overlap is achieved.
Cylinder head (1)	heat up in water bath.
Valve seat ring	Super cool with liquid nitrogen and stamp with a suitable mandrel. Machine valve seat (05-291).

Special tools



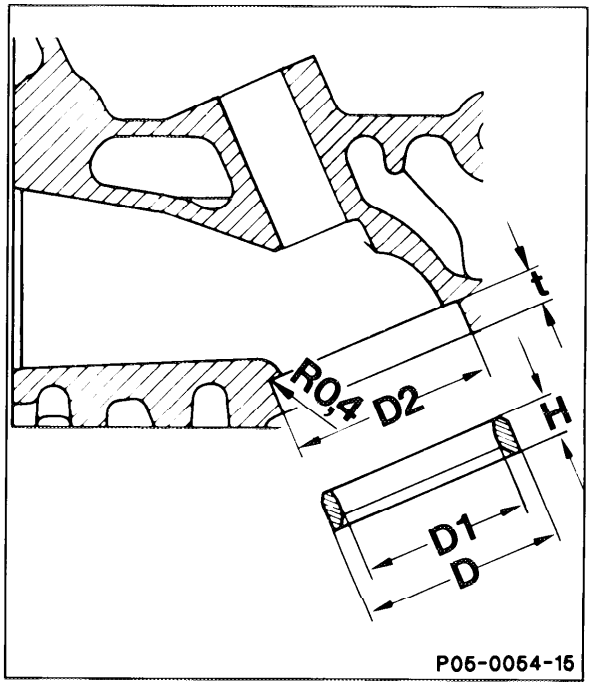


Conventional tools

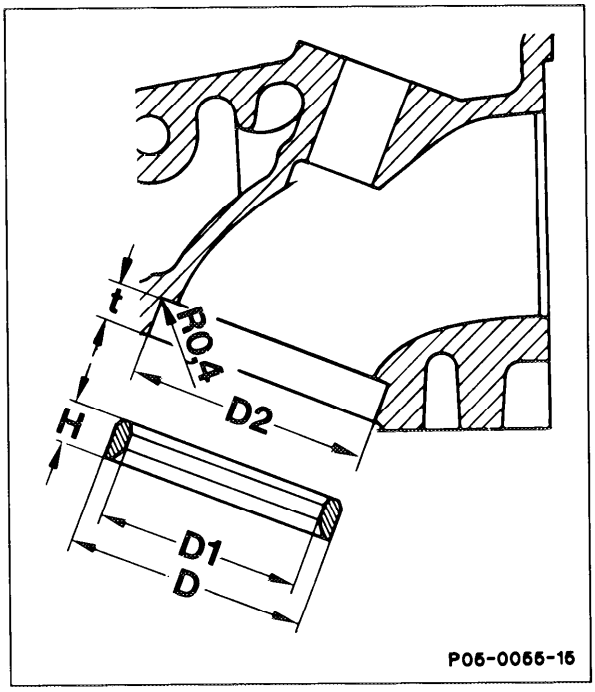
Cylinder head clamping fixture	e.g.	Hunger, D-8000 München 70 Part No. 221.60.000
Ring seat turning tool	e.g.	Hunger, D-8000 München 70 Size 2, Part No. 220.03.110
Valve seat turning device	e.g.	Hunger, D-8000 München 70 Type VDSN 1/45/30, Part No. 236.03308
Test set for valve seats	e.g.	Hunger, D-8000 München 70 Part No. 216.93.300
Internal measuring instrument (measuring range 35 - 100 mm)	e.g.	Mahr, D-7300 Esslingen Part No. 844 N
External micrometer (measuring range 25 - 50 mm)	e.g.	Mahr, D-7300 Esslingen Part No. 40 S H

Data

		Intake		Exhaust
Engines		102.922/924 102.962/963	102.982/985	102.922/924 102.962/963 102.982/985
Overlap of valve seat rings in cylinder head		+ 0.074 to + 0.100	+ 0.074 to + 0.100	+ 0.074 to + 0.100
D2	Normal dimension	46.000 46.016	49.000 49.016	42.000 42.016
	Repair stage max. to	47.0	50.0	43.0
D	Normal dimension	46.090 46.100	49.090 49.100	42.090 42.100
	Pre-turning dimension	47.3	50.3	43.3
D1		38	42.0	35.0
H	Normal dimension and repair stages	7.910 8.000	7.910 8.000	7.910 8.000
t	(New value)	8.0	8.0	8.0



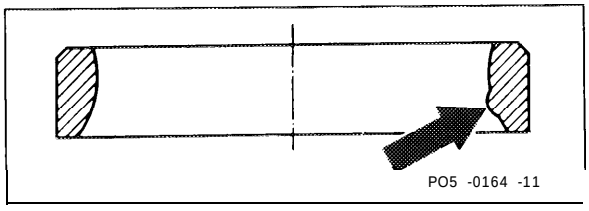
Exhaust



Intake

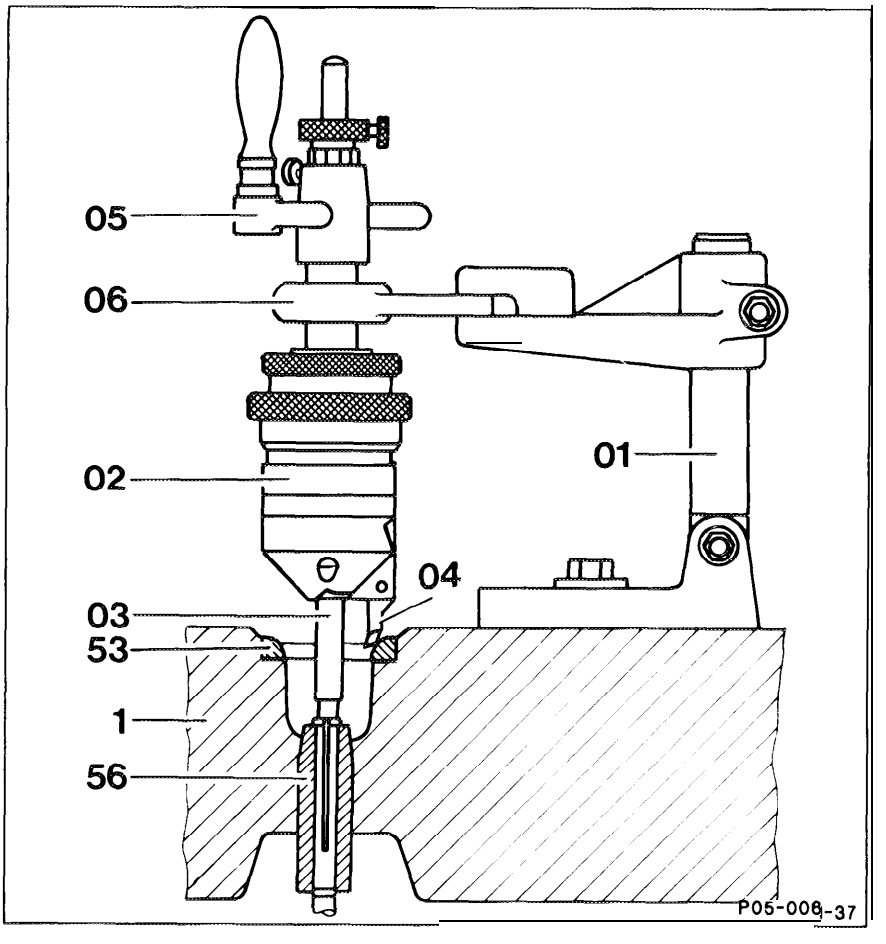
Note
The valve seat rings are sintered metal on account of lead free fuel.

These hardened valve seat rings temporarily had a step (arrow) on the inside of the ring.



This step must be turned off in order to machine the valve seat ring. There is a repair valve seat ring with larger outside diameter as a replacement part for all valve seat ring designs. After renewing valve seat rings, the fitting condition of the hydraulic valve clearance compensating elements must be checked and corrected if necessary (05-214).

05-291 Machining valve seats

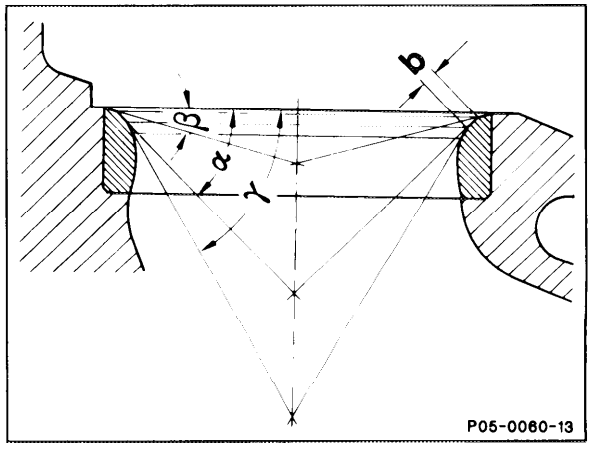


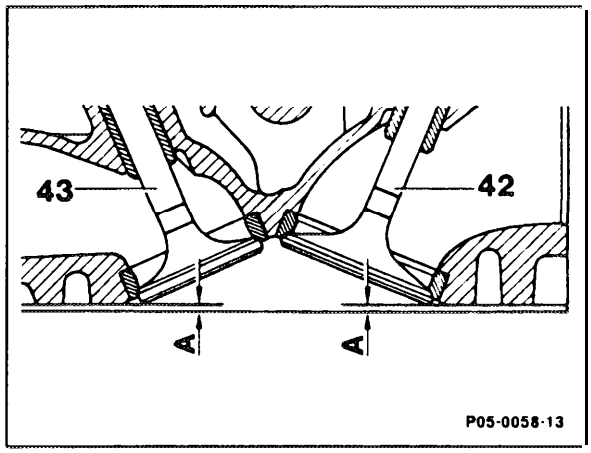
Valve guides (56)	check (05285).
Valve seats (53)	machine in accordance with manufacturer's operating instructions. See data for adjustment. **Note** Only loosen pilot, when eccentricity of valve seat ring has been checked.
Valve seat eccentricity	check (Number 3).
Valve seat width (b)	measure, correct if required (Number 4).
Valves	insert and measure, stand off (A).

Conventional tools

Cylinder head clamping fixture	e.g.	Hunger, D-8000 München 70 Part No. 221.60.000
Valve seat turning equipment	e.g.	Hunger, D-8000 München 70 Type VDSN 1/45/30, Part No. 236.03.308
Test set for valve seats	e.g.	Hunger, D-8000 München 70 Part No. 216.93.300
60" correction steel No. 13 for correction angle below(y)	e.g.	Hunger, D-8000 München 70 Part No. 216.64.622

Data	Inlet	Exhaust
Valve seat width b	1.8 – 2.5	1.5 – 2.5
Valve seat angle α	45° –15'	45° –15'
Correction angle upper β	15°	15°
Correction angle lower γ	60°	60°
Permitted deviation in valve seat concentricity	0.05	0.05





Valve distance to cylinder head parting surface

Engines		102.922/924 102.9621963	102.982/985
Minimum distance A with new valve seats and new valves	Intake (42)	1.7	1.2
	Exhaust (43)	0.5	0.5
Largest distance A with reworked valve seats and reground valves	Intake (42)	2.6	2.1
	Exhaust (43)	1.4	1.4

Largest distance A reduces by the same dimension, by which the cylinder head parting surface has been reworked.

Note

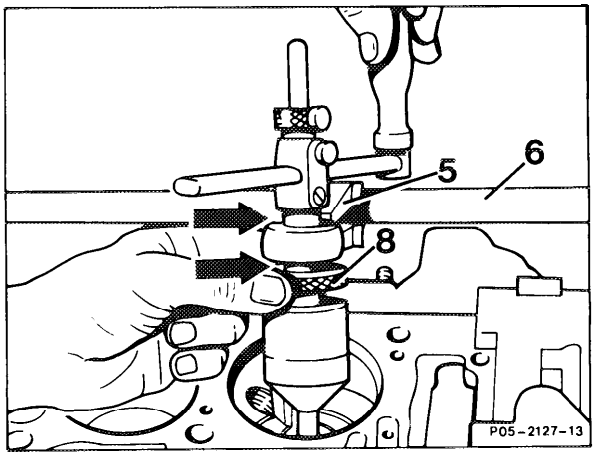
Clamp cylinder head in clamping fixture for stripping down and machining.
Machine valve seats with valve seat turning equipment, with valve seat grinding machine or with valve seat miller. After machining the valve seat rings the installation position of the hydraulic valve clearance compensating elements must be checked and corrected if necessary (05214).

Machining valve seats

1 Check valve guide, replace if necessary (05-285).

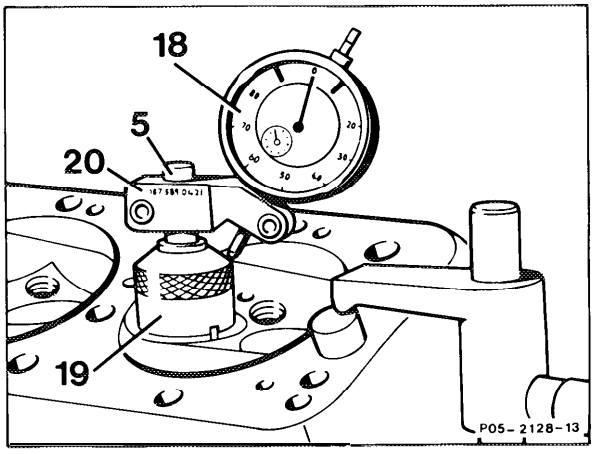
2 Machine valve seats (see manufacturer's operating instructions).

Caution!
Only loosen pilot, when eccentricity of valve seat has been checked (Number 3).

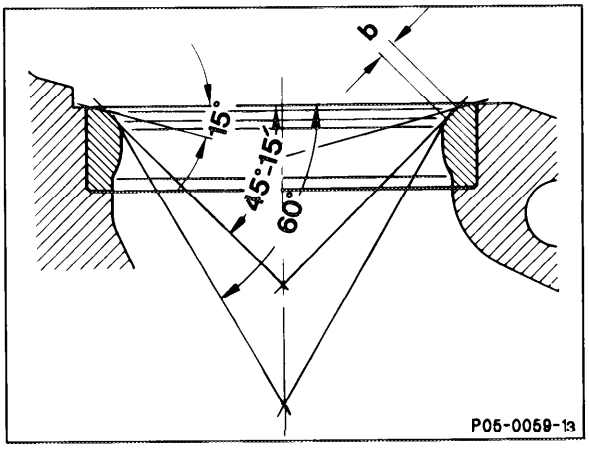


3 Check valve seat eccentricity. For this push test sleeve (19) with dial gauge bracket (20) and dial gauge on the pilot (5).

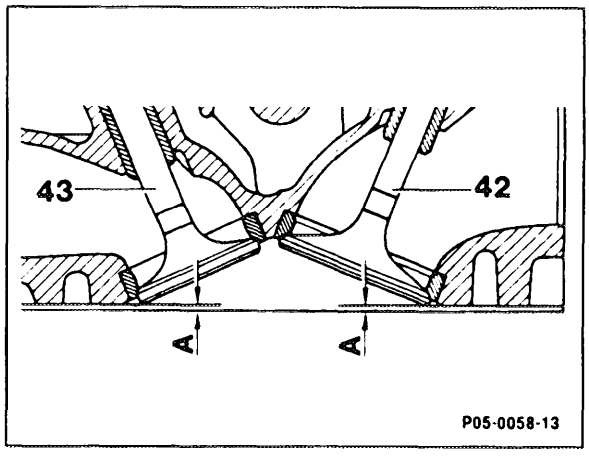
5 Pilot
18 Dial gauge
19 Test sleeve
20 Dial gauge bracket



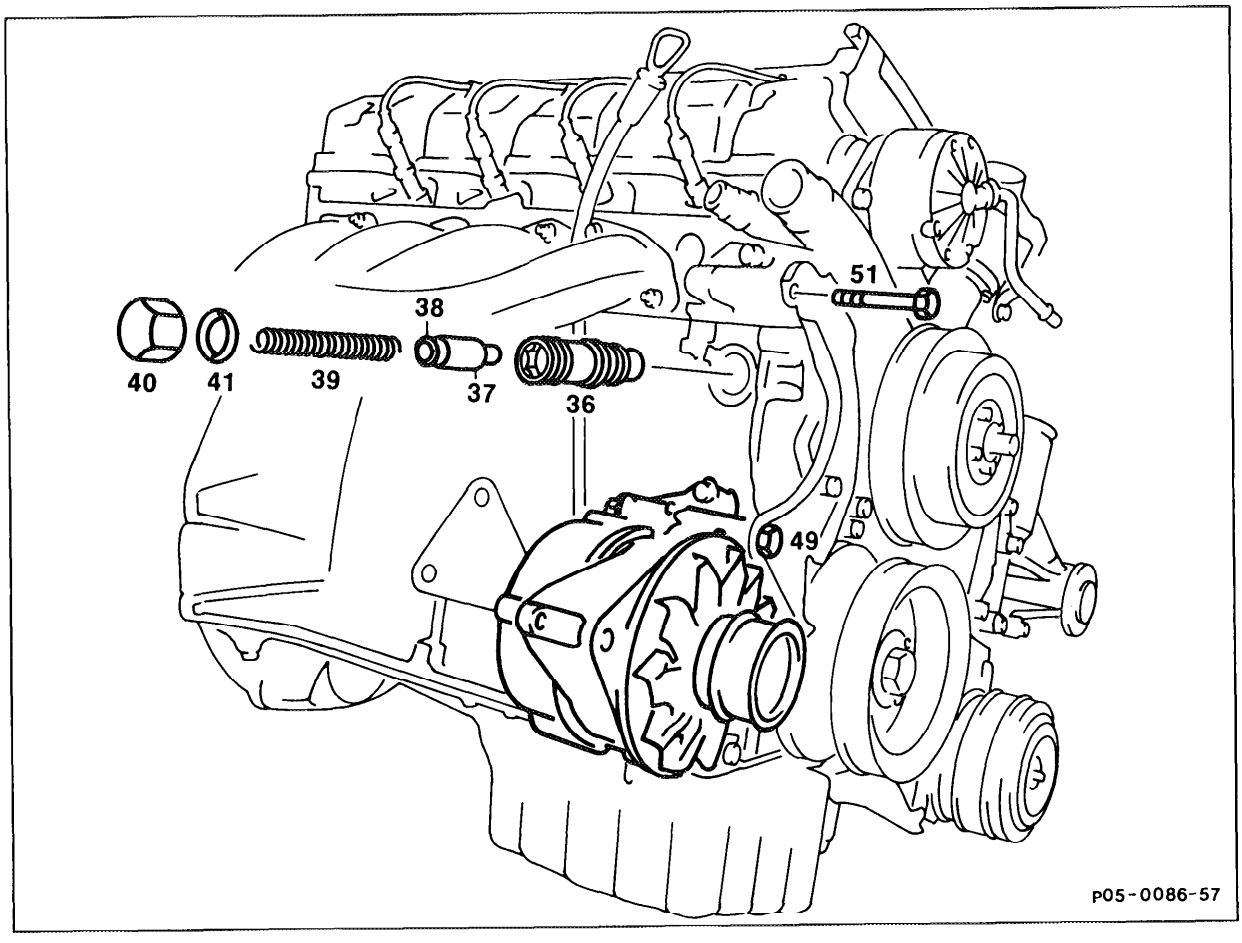
4 Measure valve seat width (b), and if required correct top(P) 15° angle and the bottom (y) 60° angle.



5 Insert valves and measure distance A.



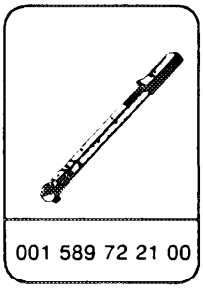
05-310 Removal and installation of chain tensioner

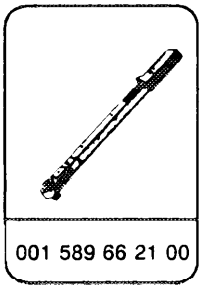


V-ribbed belt	detach, assemble (13-342).
Bolt (49)	loosen (Number 2).
Bolt (51)	unbolt (Number 3).
Alternator	swing outwards.
Sealing plug (40)	unbolt.
	Note The sealing plug is under pressure (Number 4).
Sealing ring (41)	replace.
Compression spring (39)	remove, install.
Chain tensioner casing (36) with setbolt (37)	unbolt (Number 5).

Setbolt (37) with locking spring (38)	press out of chain tensioning casing in the direction of pressure. Check individual parts for wear (Number 6).
Chain tensioner casing (36)	screw into cylinder crankcase, 15 Nm (Number 7).
Setbolt (37) with locking spring (38)	push in (Number 8).
Sealing plug (40) with compression spring (39) and new sealing ring (41)	screw in, 70 Nm (Number 9).
Alternator	mount (Number 10).
V belt	assemble (13-342).
When engine is running	check for leakage.

Special tools



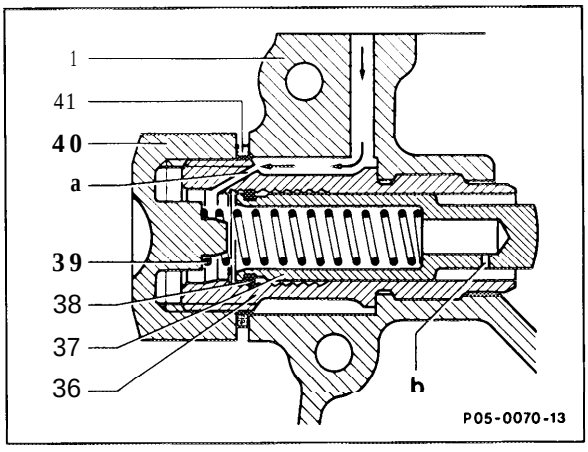


Conventional tool

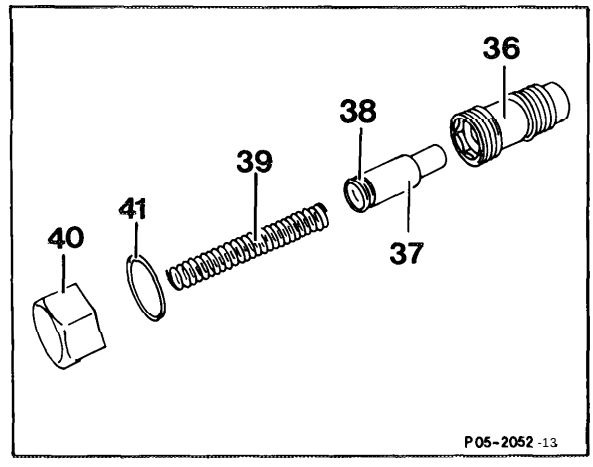
Stud driver insert 17 mm, 1/2" square	e.g.	Hazet, D-5630 Remscheid Part No. 985/1 7

Note

The housing (36) of valveless, hydraulic lock chain tensioner is bolted to the crank case (1). The application force required to tension the chain is comprised of the force from compression spring (39) and oil pressure in the chain tensioner, depending on engine oil pressure.



In the event of sudden load the oil feed bore with 1.1 mm Ø (a) and an orifice bore (b) in the setbolt of 1.2 mm Ø prevents the oil escaping rapidly and thus has a damping effect. An embossing is provided in the chain tensioner casing (36) and a locking spring (38) on the setbolt.

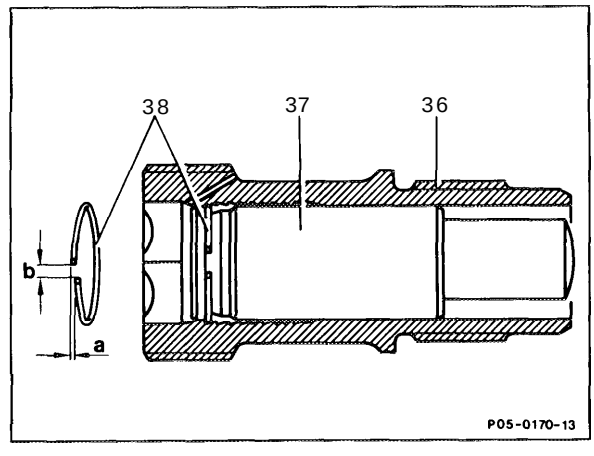


36 Chain tensioner casing
37 Setbolt
38 Locking spring
39 Compression spring
40 Cap nut
41 Sealing ring

The locking spring (38) has been modified in order to improve the function of the chain tensioner.

Changes:

- Ends free from burrs
- Smaller twist
  (dimension "a" = 0.1 mm, was 0.5 mm)
- Improved material
- Dimension "b" = 3.5 mm, was 4.0 mm.



Introduced in production: December 1985

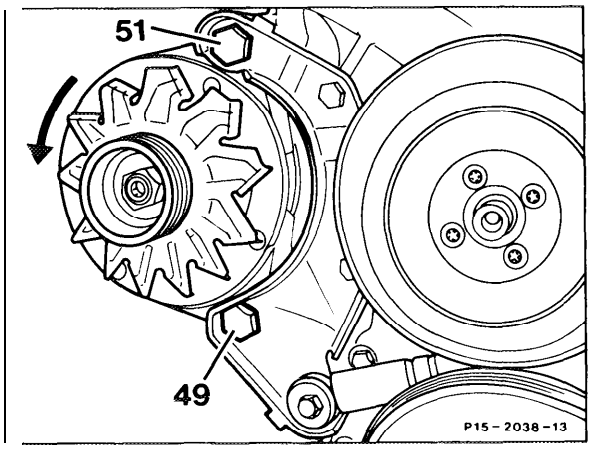
Model	Engine	Engine end number Manual transmission	Engine end number Automatic transmission
201.024 (USA)	102.985	003199	**029429**

Removal and installation

1 Removal and installation of Poly V- belt (13-342).

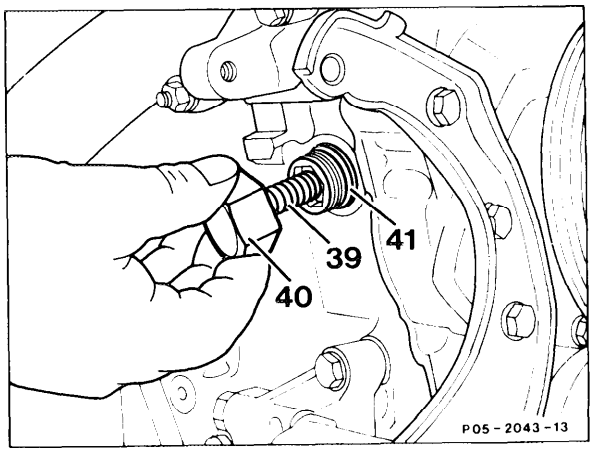
2 Loosen lower bolt (49) for alternator positioning.

3 Remove upper bolt (51), swing alternator outwards (arrow).

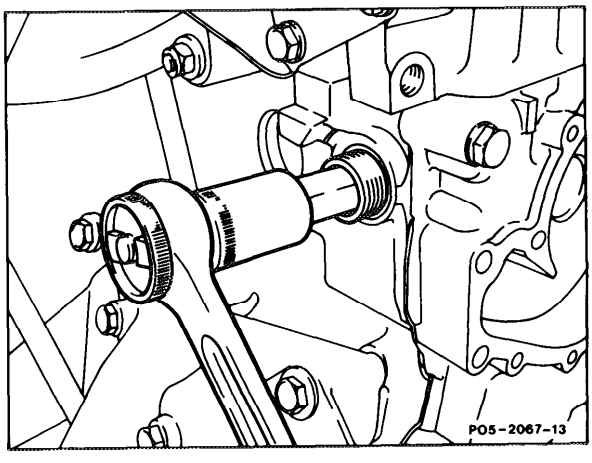


4 Unscrew sealing plug (40) and sealing ring (41) and remove compression spring (39).

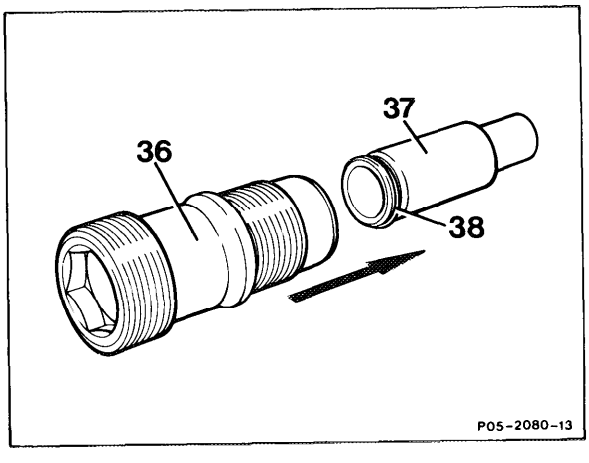
Caution!
Sealing plug is pressurized by the compression spring.



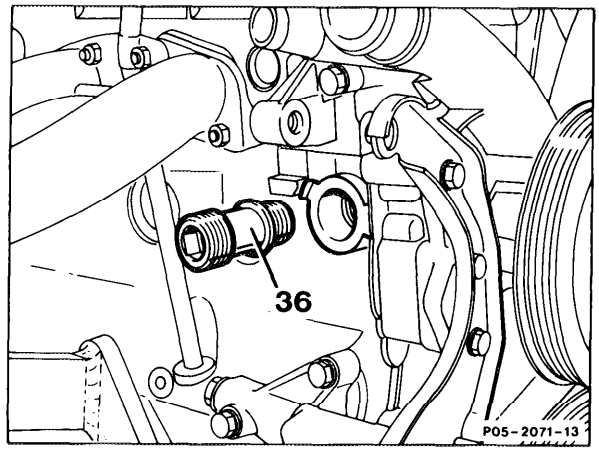
5 Unbolt chain tensioner case (36) from the cylinder crankcase with the stud driver insert.



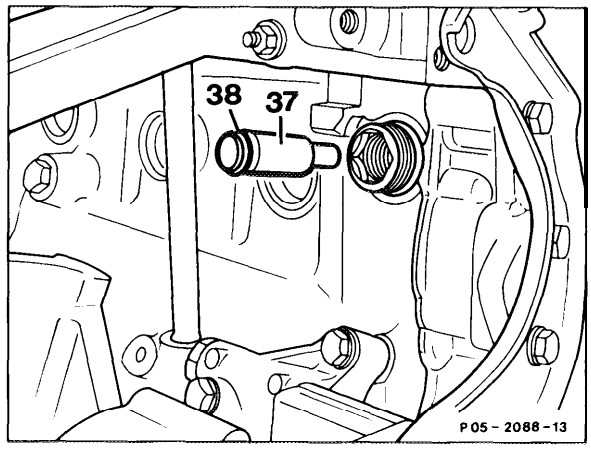
6 The chain tensioner must be stripped down before assembly. To do this press the setbolt (37) and locking spring (38) out of chain tensioner casing (36) in the direction of the arrow. Clean parts and check for wear.



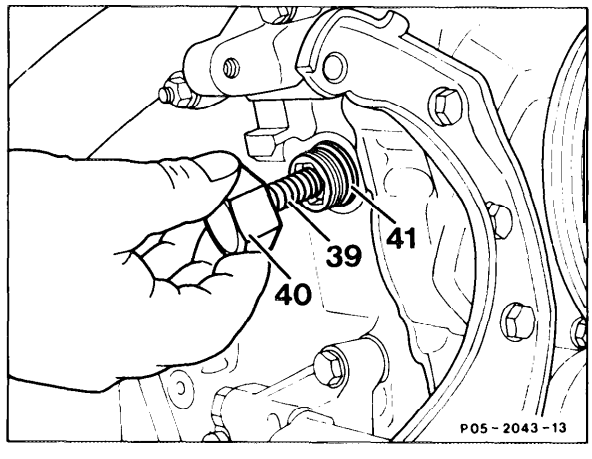
7 Bolt chain tensioner casing (36) onto crankcase, tightening torque 15 Nm.



8 Push setbolt (37) and locking spring (38) into the assembled chain tensioner casing.



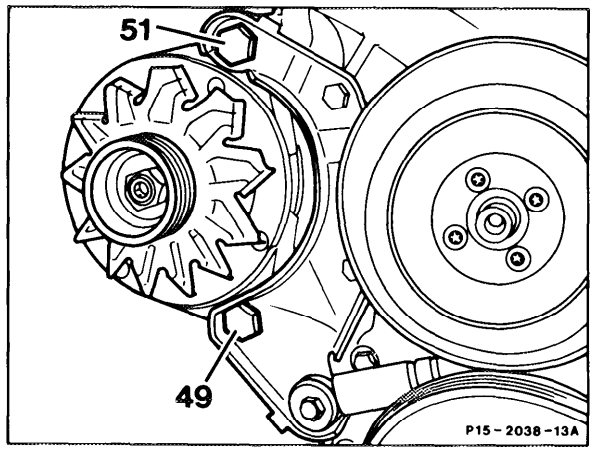
9 Mount compression spring (39) and sealing plug (40) with new sealing ring (41), tightening torque 70 Nm.



10 Mount alternator, tightening torque of the bolts (49 and 51), 25 Nm.

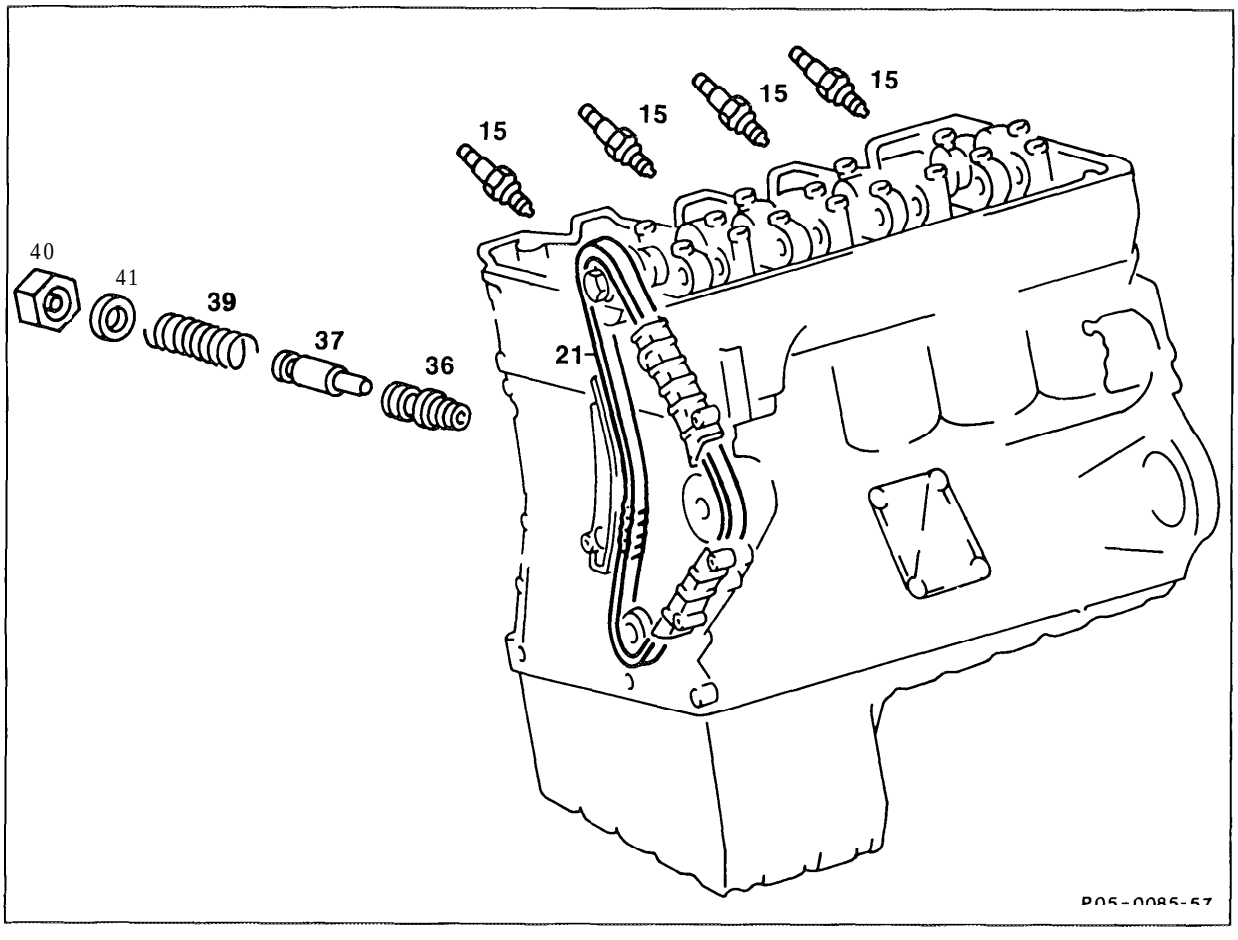
11 Install Poly V- belt (13-342).

12 Check for leaks when engine is running.



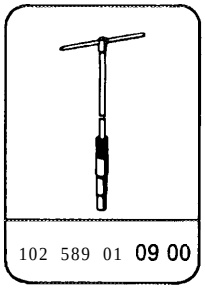
05-320 Replacement of timing chain

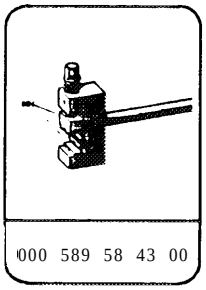
Preceding work:
Air cleaner removed (09-400 and 09-410).
Cylinder head cover removed (01-406).

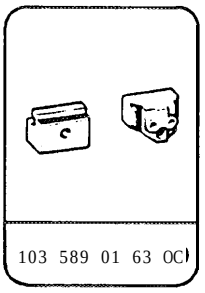


Spark plugs (15)	remove, install (15-318).
Chain tensioner (36 to 41)	remove and install (05-310).
Chain bolt	grind off (Number 3).
New timing chain with old timing chain (21)	connect, pull in (Numbers 4 to 7).
Exterior bracket	press on with riveting tool 000 589 58 43 00, rivet set 103 589 01 63 00 for single roller chain, conversion set 000 589 53 43 for double roller chain (Numbers 8 to 10).
Riveting tool	remove, convert (Number 11).
Connector link bolt	rivet individually (Numbers 12 and 13).

Special tools



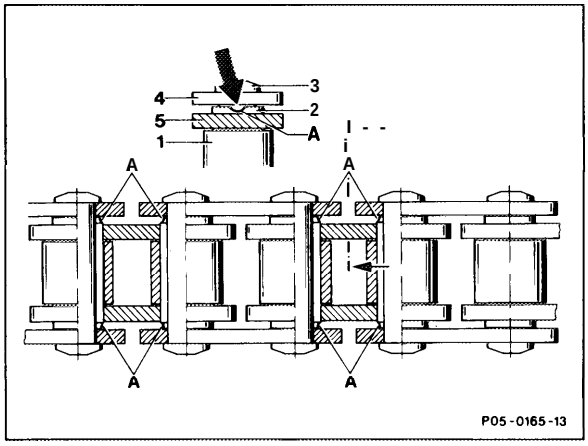




Note
An open timing chain with connector link is supplied for repairs. The sprockets are to be checked for scores and pitting as well as the chain tensioner for perfect function before installing a new timing chain.

Improved timing chains have been installed since November 1985.

Changes:
Sleeves (2) with recesses (notches, arrow and A). Hence improved oil supply to bolts (3) and sleeves (2).



Introduced in production: November 1985 - May 1986

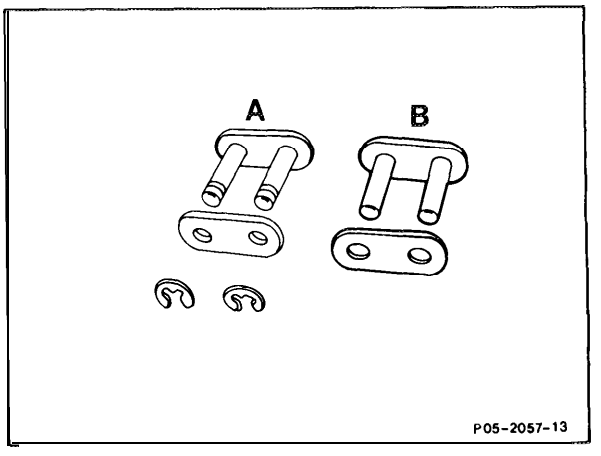
Model	Engine	Engine end number Manual transmission	Engine end number Automatic transmission
201.024 (USA)	102.985	003057-003893	027366-036001

Introduced in production: June 1986

Model	Engine	Engine end No. Manual transmission	Engine end No. Automatic transmission	Vehicle chassis end No.	
				A	F
201.024 (USA)	102.985	003925	036289	312513	Not recorded

Double roller timing chains have been installed since January 1988.

The former connector link with locking devices (A) has been deleted. Only the connector link (B) is still supplied for riveting.



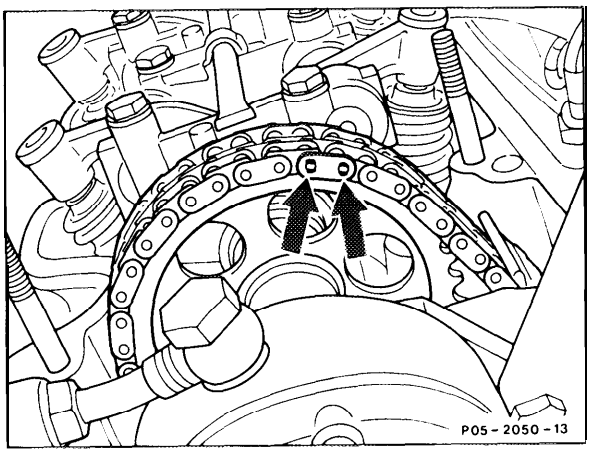
A Former connecting link with locking devices
B Modified connecting link - can be riveted

Replacement

1 Remove, install spark plugs (15018).

2 Remove, install chain tensioner (05-310).

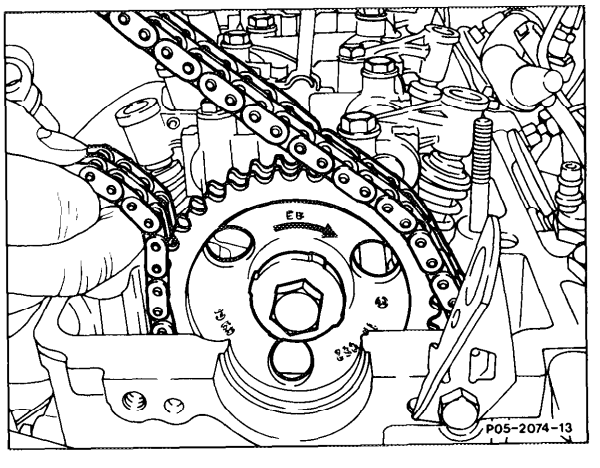
3 Cover the open part of the chain casing with a rag, grind off both chain bolts (arrows) at a double link in the timing chain.



4 Attach new timing chain and the connector link onto the old timing chain. To do this press out ground off double link.

5 Put the new timing chain connected with the old timing chain onto the camshaft timing gear. Rotate crankshaft.

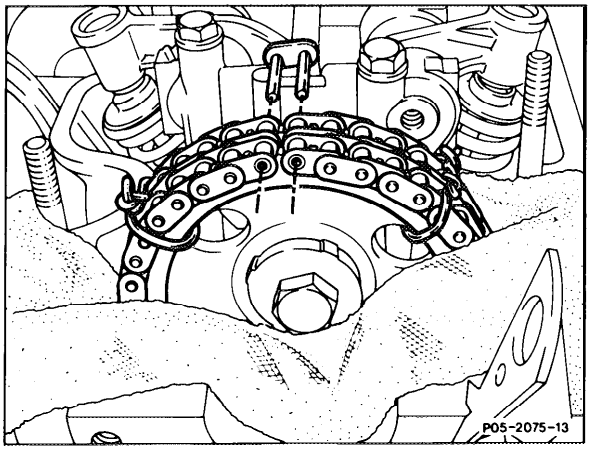
Caution!
The timing chain must remain engaged while rotating the camshaft timing gear.



6 Pull out the released end of the old timing chain evenly, to correspond with drawing on the new timing chain.

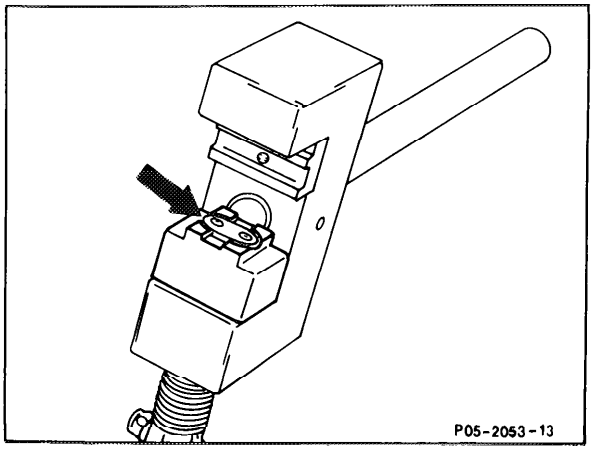
Caution!
The timing chain must remain engaged while turning the camshaft timing gear and crankshaft gear.

7 Secure the ends of the chain to the camshaft timing gear with wire. Detach old timing chain and connect the ends of the new timing chain with the repair connector link.
Note
Connector link must be inserted from behind.

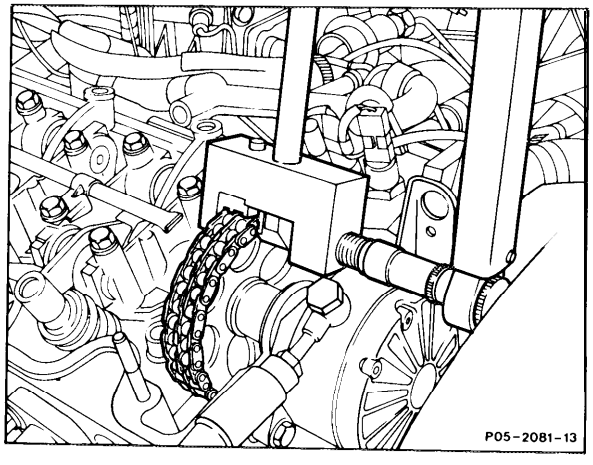


8 Fit riveting set 103 589 01 63 00 to the basic tool 000 589 43 00 corresponding to the timing chain design (single or double roller chain).

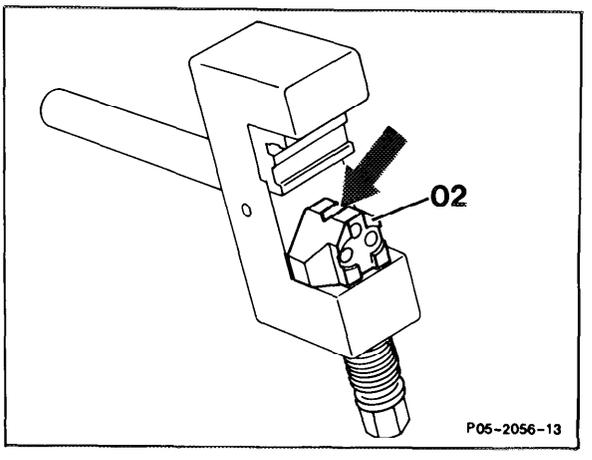
9 Put loosely attached exterior bracket of the connector link in the press tool (arrow).
The exterior bracket is held magnetically.



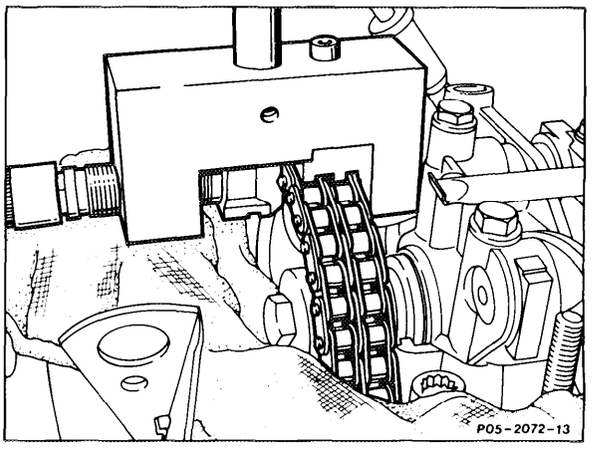
10 Put press tool on the connector link and press on bracket up to the stop.
Note
Put on clip so that both rivet pins engage.



11 Remove assembly tool and turn punch (02) so that the notch (arrow) points forward.

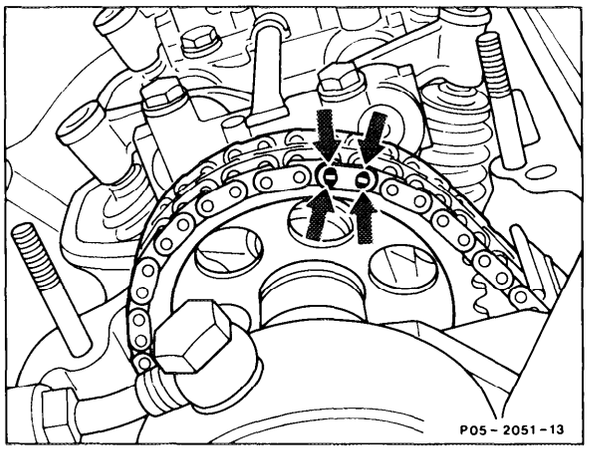


12 Install assembly tool exactly over the center bolt. Rivet bolts of the connector links individually, tightening up spindle to approx. 30 - 35 Nm (reference value).



13 Check riveting (arrows), re-rivet if required.

14 Install chain tensioner (05310).

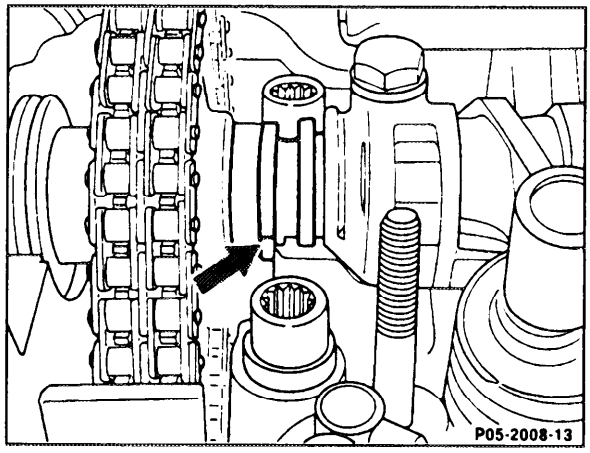


15 Turn crankshaft and check adjustment markings at engine TDC position.

Note

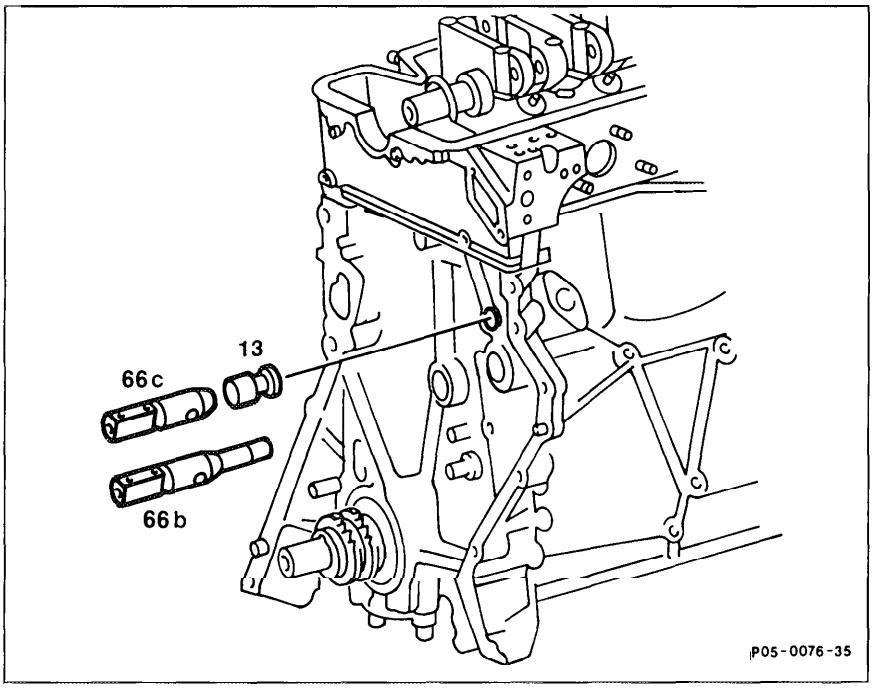
If the adjustment markings do not align, the valve timing settings of the camshaft must be checked (05215).

16 Assembly is completed in the reverse order.



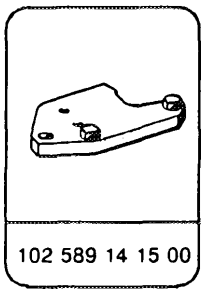
05328 Installation of oil spray nozzle retroactively

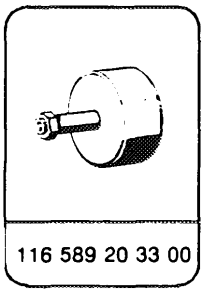
Preceding work:
Timing case cover removed (01-210).
idler gear shaft removed (05-412).

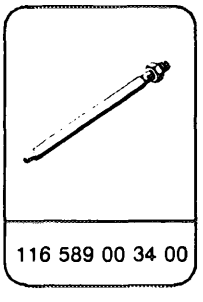


Sealing plug (13)	remove (Numbers 1 and 2).
Joggle plate	Part No. 102 589 14 15 00 bolt up, unbolt (Number 3).
Oil spray nozzle (66b and 66c).	drive home up to stop (Number 4).
Idler gear shaft	install (05-412).
Timing case cover	install (01-210).
On engine	change oil and filter.
When engine is running	check for leaks.

Special tools

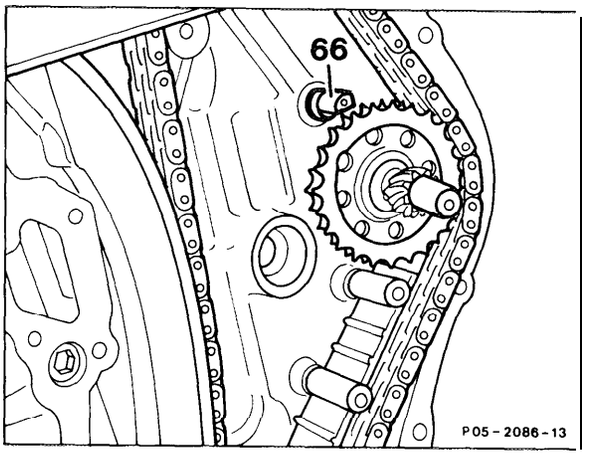

102 589 14 15 00


116 589 20 33 00


116 589 00 34 00

Note

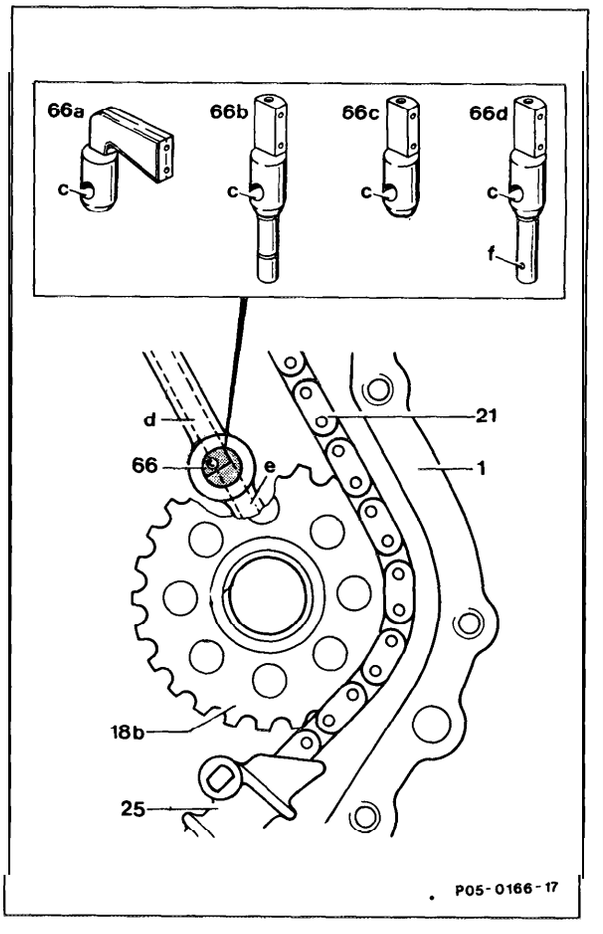
In order to achieve better lubrication of the timing chain, an additional oil spray nozzle (66) has been fitted in the front face of the main oil channel. This oil spray nozzle, can be installed retroactively. The retroactive installation should only be carried out, when for example the timing case cover has already been removed for other work.



Production breakpoint of the various designs

Injection engines

66a 1st design March to April and May 1986
66b 2nd design November 1986 to July 1987
66c 3rd design July 1987



Production breakpoint: March - April 1986
(Injection engines 1st design)

Model	Engine	Engine end No. Man. transm.	Engine end No. Autom. transm.
201.024 (USA)	102.985	003626-003670	**033140-033543**

Production breakpoint: May 1986
(Injection engines 1st design)

Model	Engine	Engine end No. Man. transm.	Engine end No. Autom. transm.
201.024 (USA)	102.985	00381 **I-003828**	**03521 o-035424**

Production breakpoint: November 1986
(Injection engines 2nd Design)

Model	Engine	Engine end No. Man. transm.	Engine end No. Autom. transm.
201.028	102.985	007099	045782

Production breakpoint: July 1987
(Injection engines 3rd Design)

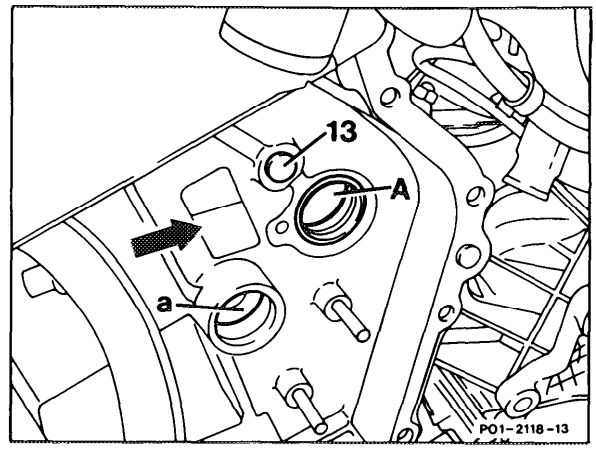
Model	Engine	Engine end No. Man. transm.	Engine end No. Autom. transm.
201.028	102.985	015733	057671

Installation

1 Remove sealing plug (13), to do this drill a core hole (5 mm Ø, 10 mm deep).

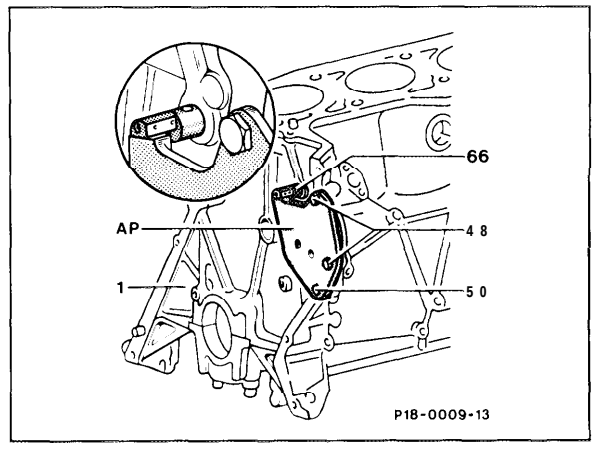
Note

Carefully cover oil channel (a), bearing bore (A) and window (arrow).



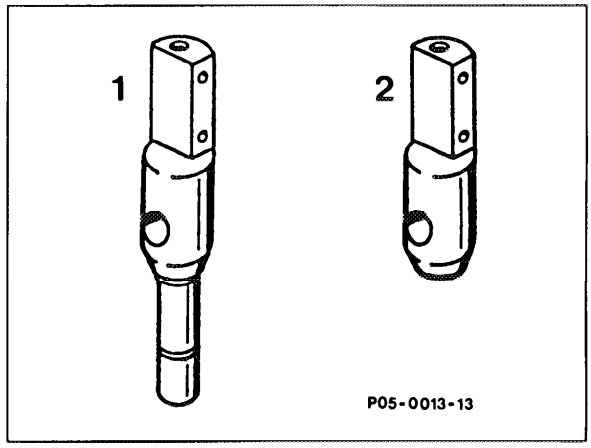
2 Unscrew sealing plug with impact extractor 116 589 20 33 00 and stud 116 589 00 34 00

3 Attach joggle plate (AP) 102 589 14 15 00 with two hexagon bolts M8 x 15 (48).



1 Cylinder crankcase
48 Fixing bolts
50 Straight pin (guide for timing case cover)
66 Oil spray nozzle
AP Joggle plate

4 Select correct oil spray nozzle (carburettor or injection engine) and drive home the cylinder crankcase up to the stop. The correct fitting position of the oil spray nozzle is achieved when this is laid on the joggle plate, as shown in Figure (Number 3).



1 Carburettor engines (non-US)
2 Injection engines

5 Detach joggle plate.

6 Install idler gear shaft (05412).

7 Install timing case cover (01-210).

8 Change engine oil and filter.

9 Check for leaks when engine is running.

Parts required	Part No.
Oil spray nozzle	102 180 09 43 (Carburettor engine) 102 180 08 43 (Injection engine)

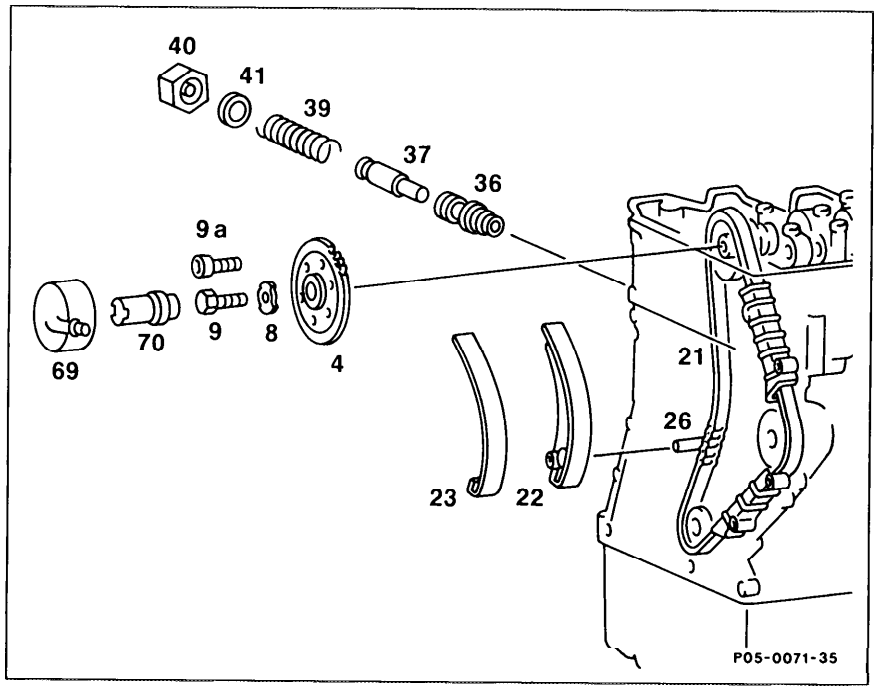
Standard Text and flat rates

Install oil spray nozzle for timing chain (Idler gear shaft removed)	02-0367/01	Related work, 5 flat rates or 0.4 hours

The operation number is t'o be placed in front of the book/column number.

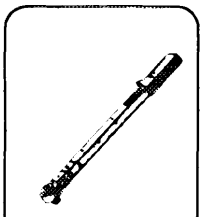
05-330 Removal and installation of tensioner blade

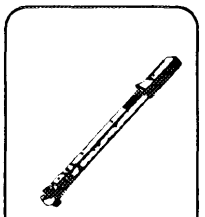
Preceding work:
Timing case cover removed (01-210).

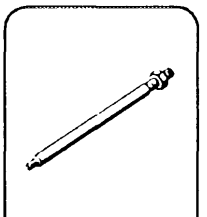


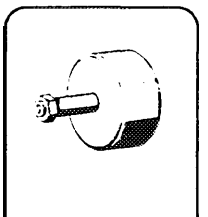
Timing chain (21) and crankshaft gear	mark (Number 1).
Timing chain and camshaft timing gear (4)	mark (Number 2).
Chain tensioner (36 to 41)	remove, install (05310).
Oil pressure pump (69)	unbolt, bolt up, put to one side with lines connected (Number 4).
Camshaft timing gear (4)	unbolt, bolt up, 80 Nm (Number 5).
Tensioner blade (22)	remove from bearing bolt, put on.
	Note On double roller chain, spot drill bearing pin (26) and drive out with the impact extractor 115 589 12 33 00. Install new tensioner blade with bearing pin (Numbers 7 and 9).
Plastic support (23)	check, possibly renew (Number 8).
Camshaft adjustment	check (Number 11).

Special tools


001 589 66 21 00


001 589 72 21 00

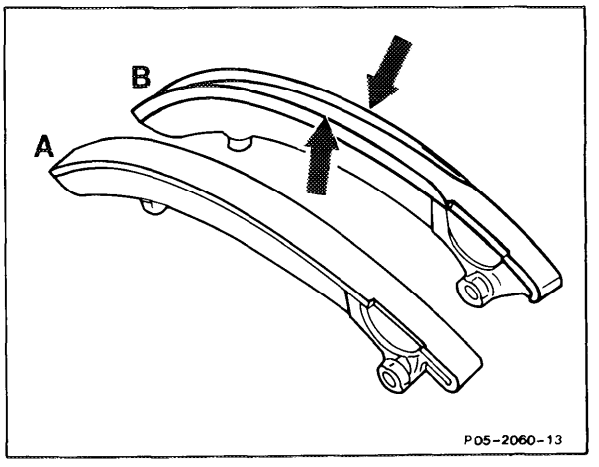

116 589 03 34 00


116 589 20 33 00

Note

In order to achieve better guidance of the timing chain, the plastic support has lateral guide bars (arrows). The plastic support is also fixed differently; in this way the support is prevented from slipping off the tensioner blade.

A Former design
B Current design

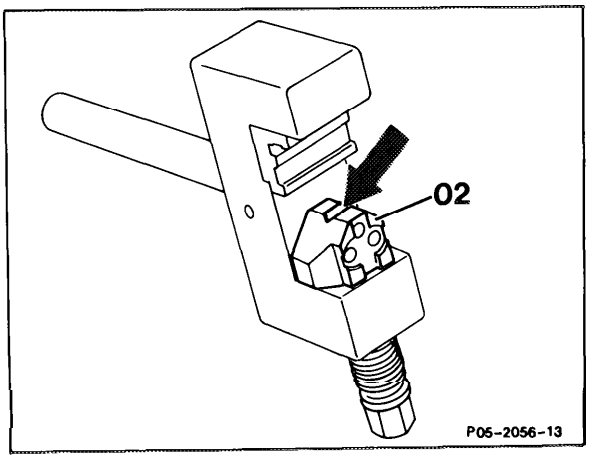


Production breakpoint: August 1986

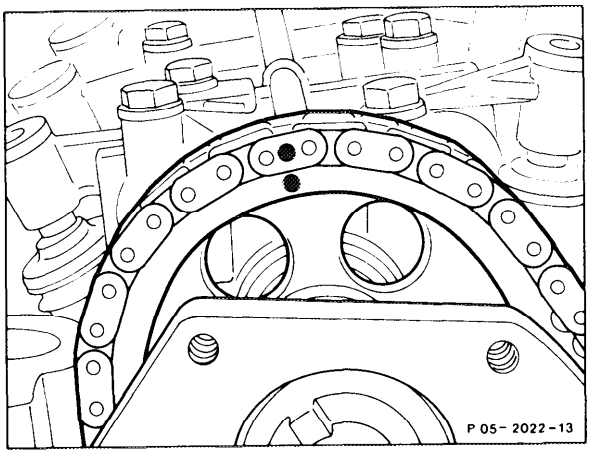
Model	Engine	Engine end No. Man. transmission	Engine end No. Auto. transmission	Vehicle chassis end No.	
				A	F
201.023	102.924	026699	006810	325157	268097
201.024	102.962	102052	051653		268146
201.024 (USA)	102.985	004185	039295		266691

Removal and installation

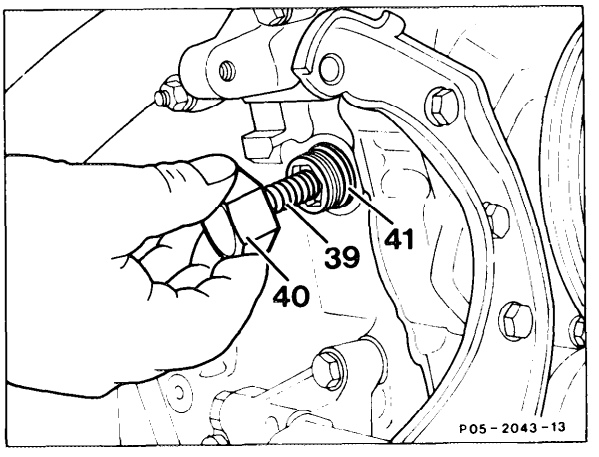
1 Align timing chain and crankshaft gear.



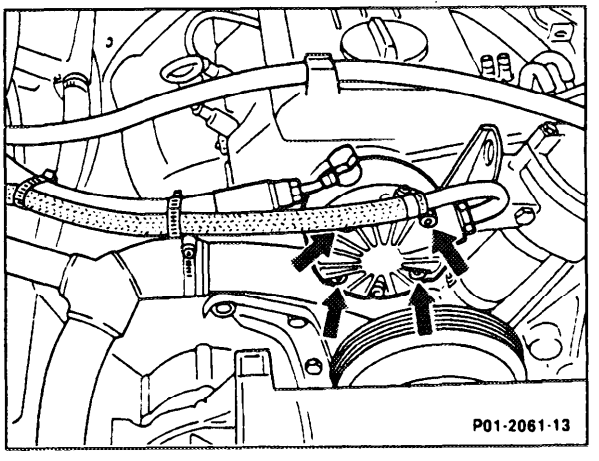
2 Align timing chain and camshaft timing gear.



3 Remove chain tensioner (05-310).



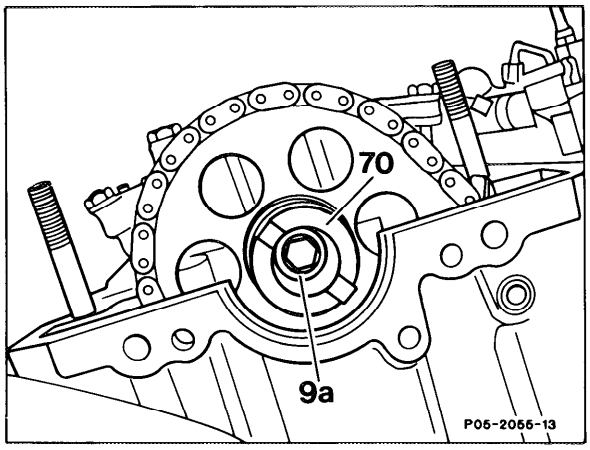
4 Unbolt oil pressure pump with lines connected (arrows) and put to one side.



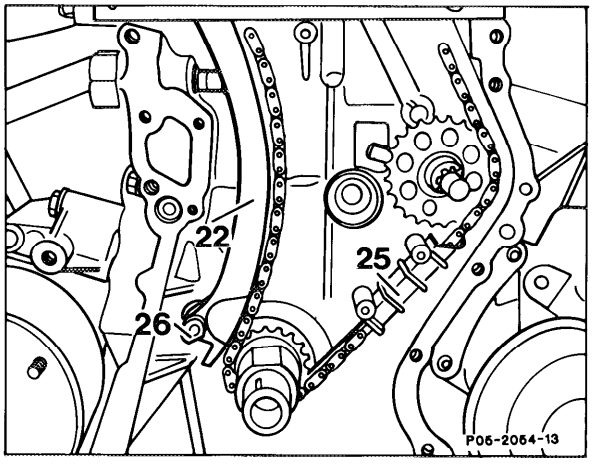
5 Unbolt, bolt up camshaft timing gear, bolt (9a), tightening torque 80 Nm. Note color markings on camshaft timing gear and crankshaft gear.

Note

On vehicles with oil pressure pump remove driving disc sleeve (70).

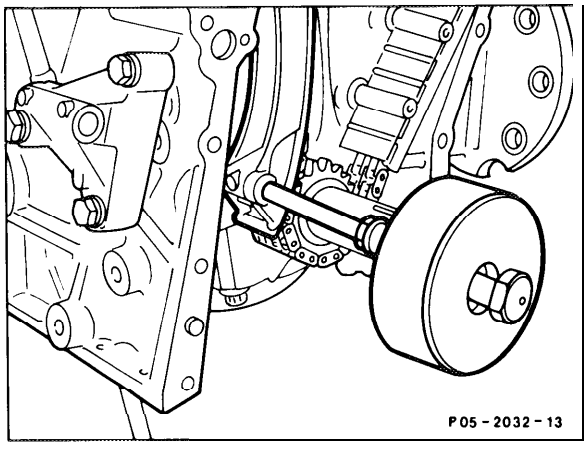


6 Swing tensioner blade (22) for single roller chain inwards and remove from bearing pin (26), install.

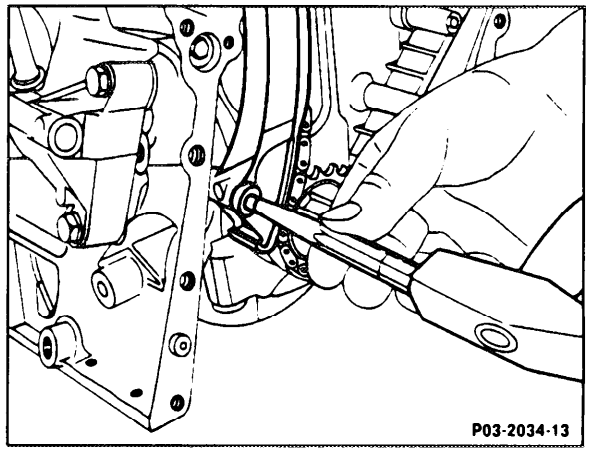


7 On engines with double roller chain, drive out bearing pin (26) of the tensioner blade with the impact extractor 116 589 20 33 00 and extension 116 589 03 34 00. To do this cut an M6 thread approx. 10 mm deep on the bearing pin. Remove tensioner blade.

8 Check plastic support for wear, replace if necessary.



9 Insert new tensioner blade and drive home bearing pin up to stop.

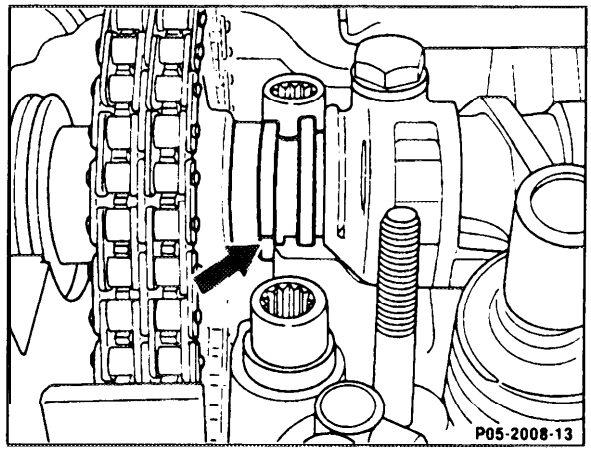


10 Install chain tensioner (05-310).

11 Turn crankshaft and check adjusting marking at TDC position of engine.

12 The installation proceeds in the reverse sequenceas removal.

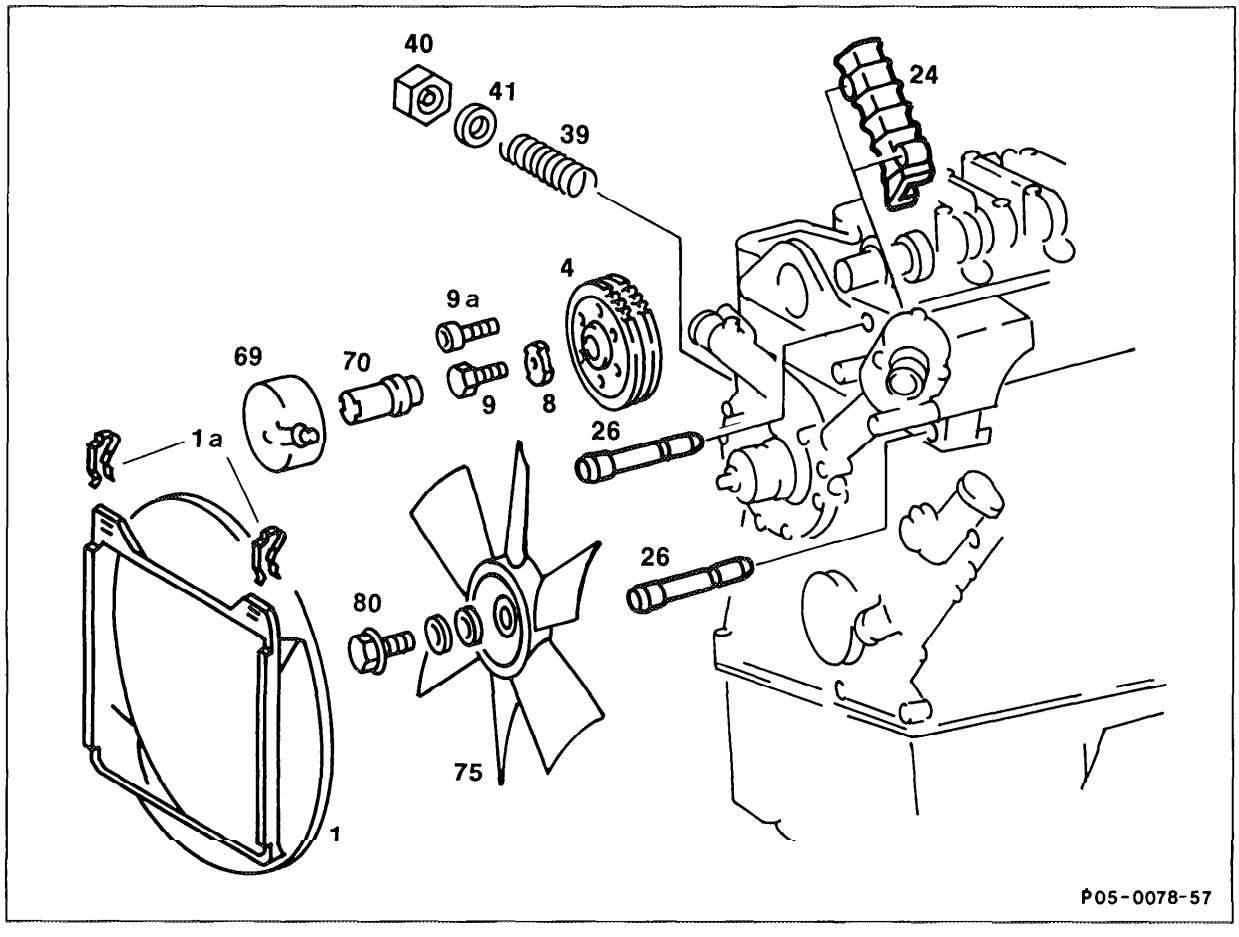
13 Run engine, check for leaks.



05-340 Removal and installation of guide rails

A. Guide rail (24) in cylinder head

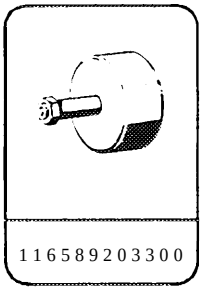
Preceding work:
Air cleaner removed (09-400 and 09-410).
Cylinder head cover removed (01-460).

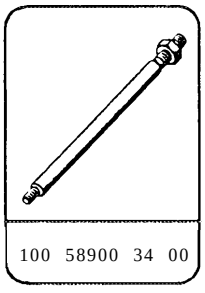


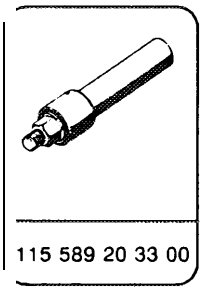
Chain tensioner (39 to 41)	remove, install 70 Nm (Number 1).
Fan shroud (1) and fan (75)	remove, install, bolt (80), 25 Nm (Number 2).
Piston of No. 1 cylinder	position on ignition TDC (Number 3).

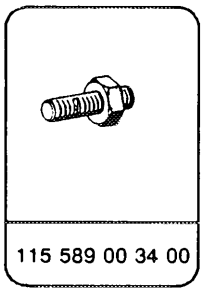
Oil pressure pump (69)	unbolt, bolt up, put to one side with lines connected (Number 4).
Timing chain and camshaft timing gear (4)	align and unbolt, bolt (9 and 9a), 80 Nm (Number 5).
Guide rail bolt (26)	extract, with impact extractor 116 589 20 33 00 and stud 100 589 00 34 00, drive home **Note** Insert guide rail bolt with sealant 001 989 25 20. Note that the fixing nose on the guide rail engages in the guide rail bolt (Numbers 6 and 7).
When engine is running	check for leaks.

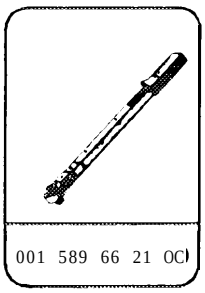
Special tools

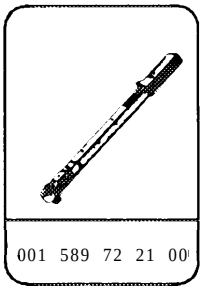






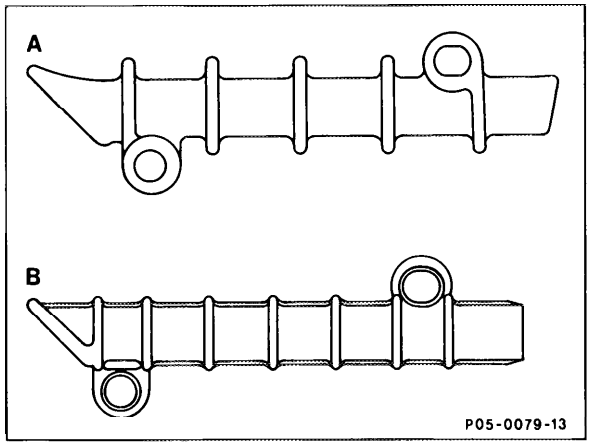






Note

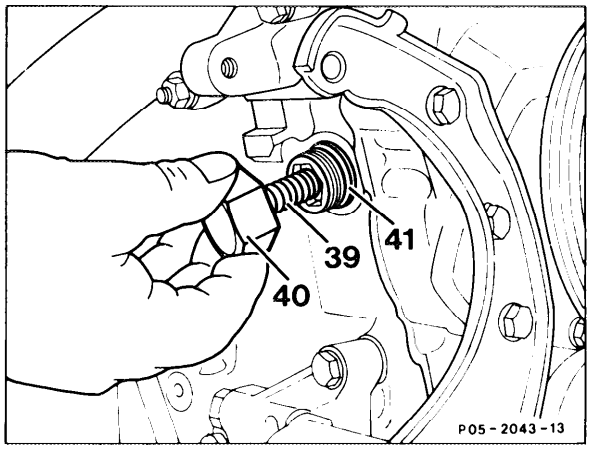
The guide rails have been changed with the introduction of the double roller chain.



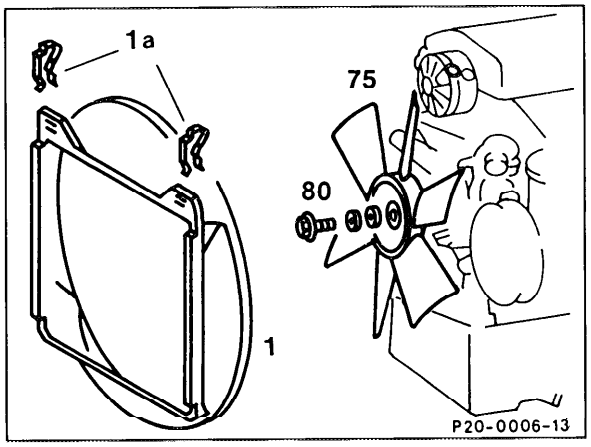
A Guide rail for single roller chain
B Guide rail for double roller chain

Removal and installation

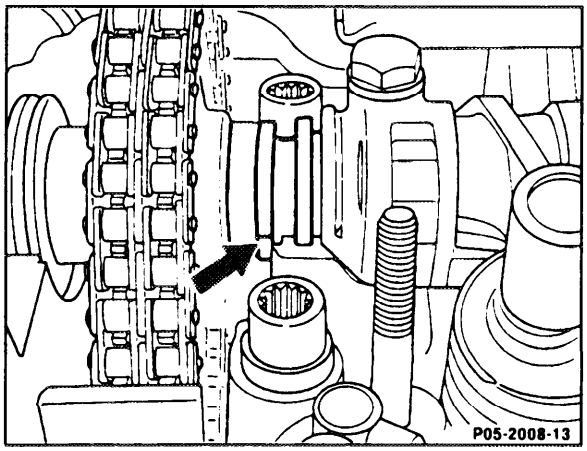
1 Removal and installation of chain tensioner (05310). Tightening torque of hexagon cap nut (40) 70 Nm.



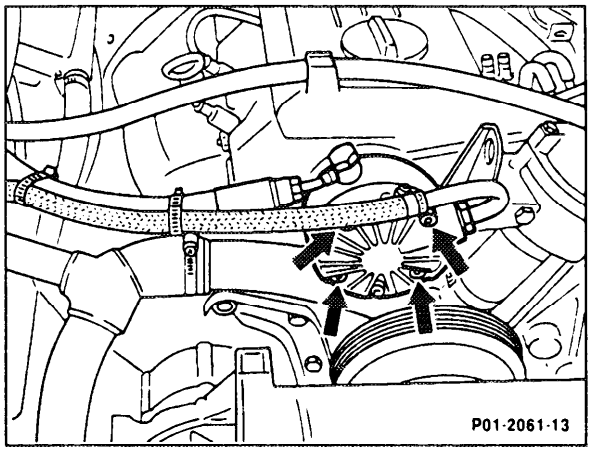
2 Remove fan shroud (1) and fan (75). Tightening torque of bolt (80) 25 Nm.



3 Position piston of No. 1 cylinder on ignition TDC.



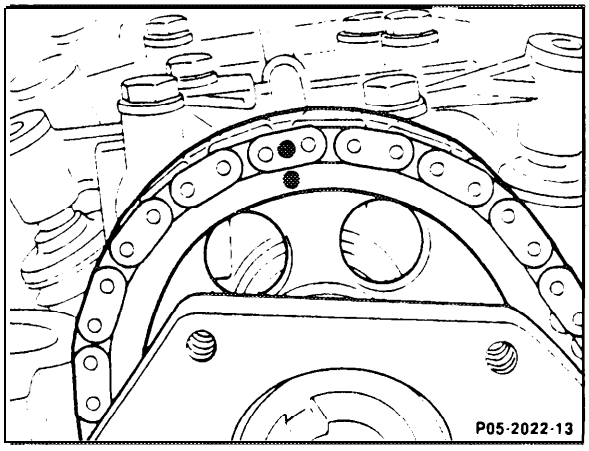
4 Unbolt oil pressure pump with lines connected (arrows) and set to one side.



5 Align timing chain and camshaft timing gear. Unbolt camshaft timing gear and remove sprocket.

Note

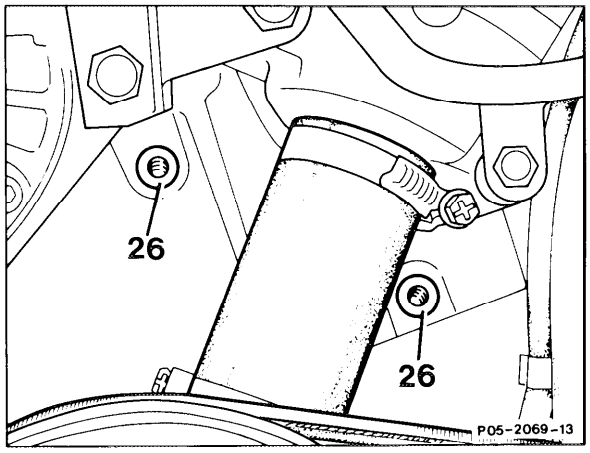
When installing the sprocket note color markings. Tightening torque of set bolt 80 Nm.

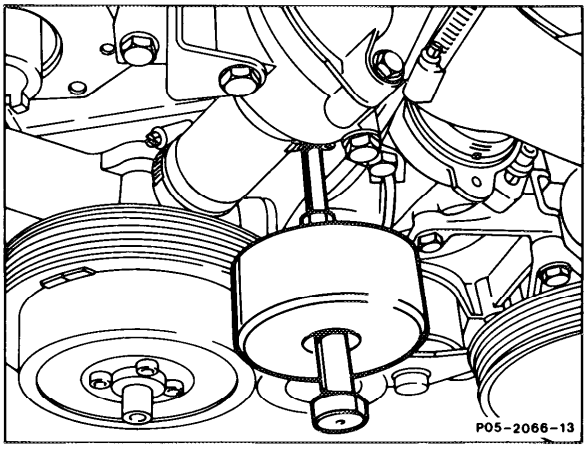


6 Withdraw both guide rail bolts (26) with impact extractor 116 589 20 33 00 and stud 100 589 00 34 00.

Note

If the guide rail bolts are too tight, the extractor 115 589 20 33 00 with stud 115 589 00 34 00 can also be used.





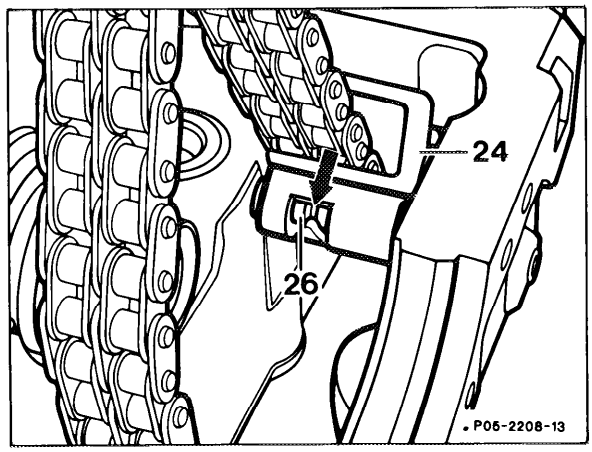
Impact extractor in place

7 Install guide rail (24) so that the locating lug (arrow) engages in the groove of the upper guide rail bolt.

Note

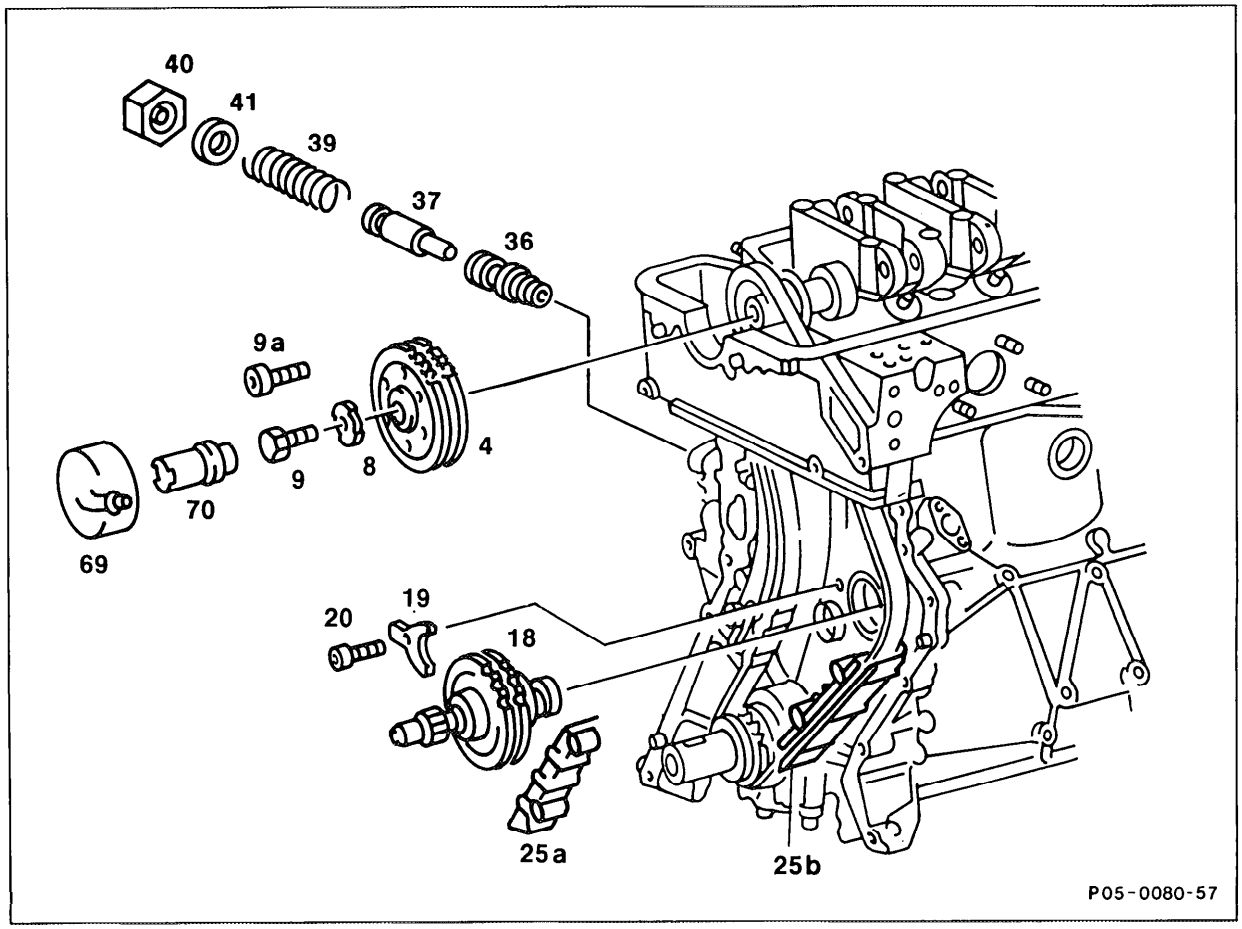
Apply sealant 001 989 25 20 at collar of guide rail bolts.

8 Check for leaks when engine is running.



B. Guide rail in cylinder crankcase

Preceding work:
Timing case cover removed (01-210).



a. With single roller chain

Guide rail (25a, single roller chain)	remove, put on (Number 1).

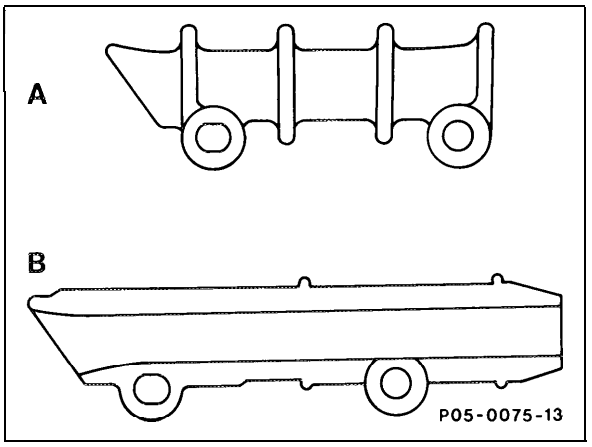
b. With double roller chain

Piston of No. 1 cylinder	position on ignition TDC (Number 2).
Oil pressure pump (69)	unbolt, bolt up, put to one side with lines connected (Number 3).
Chain tensioner	remove, install (05310).

Timing chain and camshaft timing gear (4)	align and unbolt, (9 and 9a), 80 Nm (Number 5).
Timing chain and crankshaft gear	align (Number 6).
Bolt (20)	unscrew, remove clip (19) and idler gear shaft (18) (Numbers 7 and 8).
Timing chain with crankshaft gear	pull forward as far as possible, remove and fit guide rail (25b) (Number 9).
	Note When pushing back the crankshaft gear, and the timing chain, note the positioning pin in the camshaft flange and alignment of timing chain to tension lever.
Idler gear shaft (18)	install, bolt (20), 5 Nm (Number 10).
Further installation	in reverse sequence.
When engine is running	check for leaks.

Special tool

Note
The guide rails have changed with the introduction of the double roller chain.

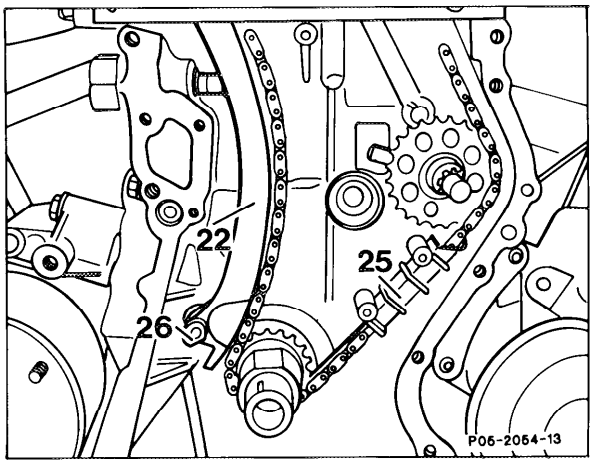


A Guide rail for single roller chain
B Guide rail for double roller chain

Removal and installation

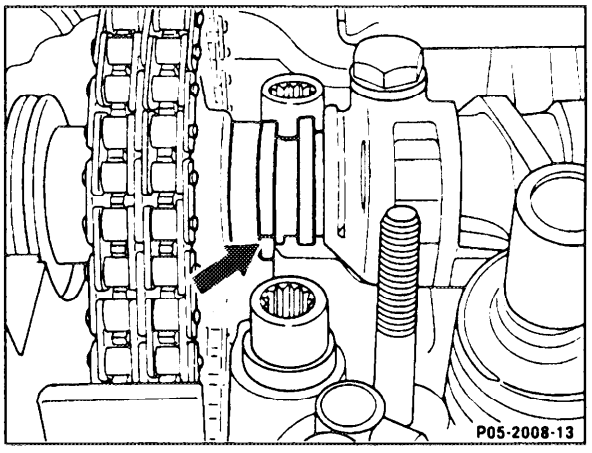
a. With single roller chain

1 Pull off guide rail (25), install.

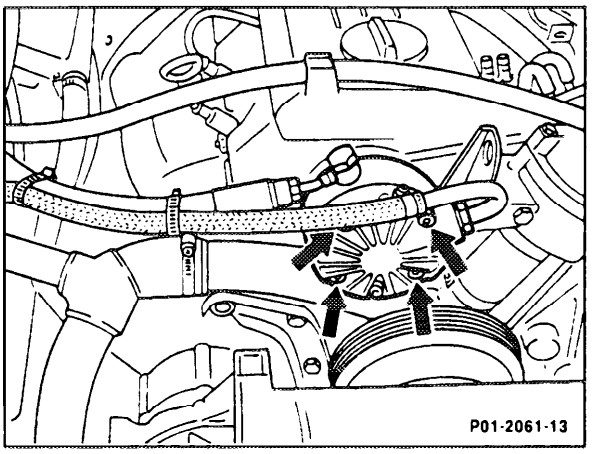


b. With double roller chain

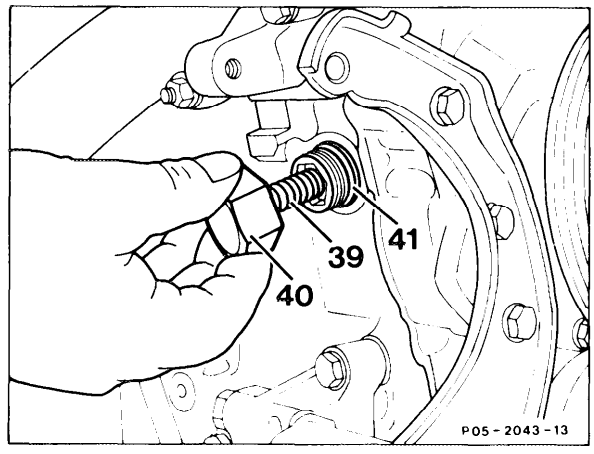
2 Position piston of No. 1 cylinder on ignition TDC.



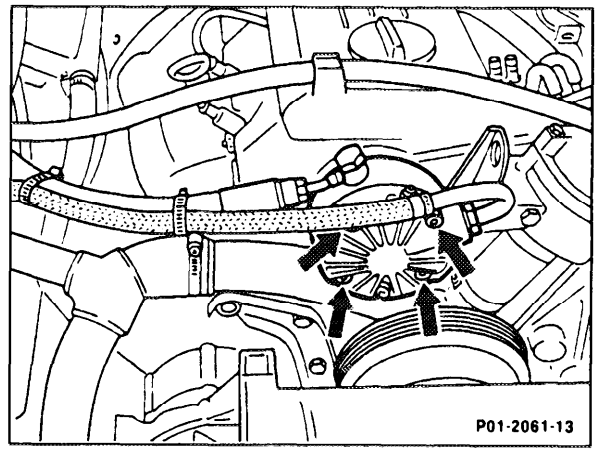
3 Unbolt, bolt up oil pressure pump (arrows) and put to one side with lines connected.



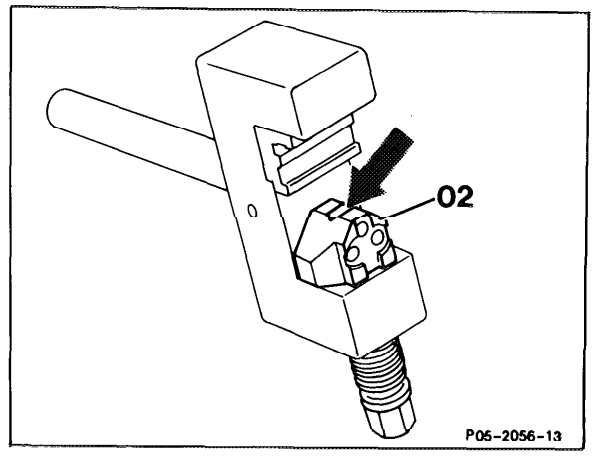
4 Remove chain tensioner (05-310).



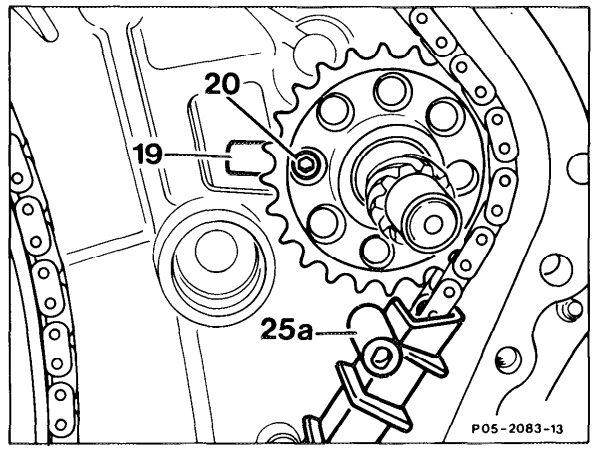
5 Align timing chain and camshaft timing gear and unbolt camshaft timing gear. Put timing chain in timing case.



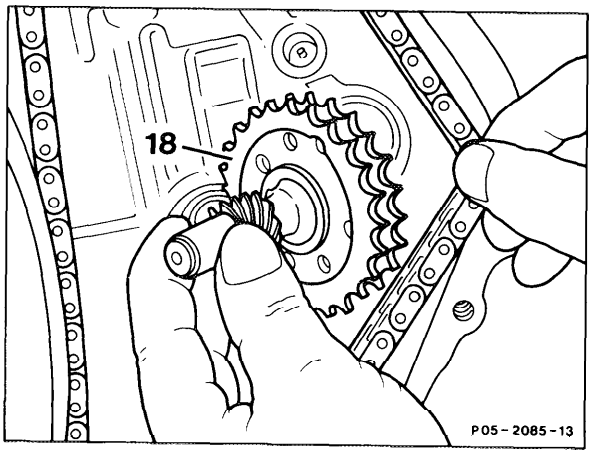
6 Align timing chain and crankshaft gear.



7 Unscrew bolt (20) and remove retaining clip (19).



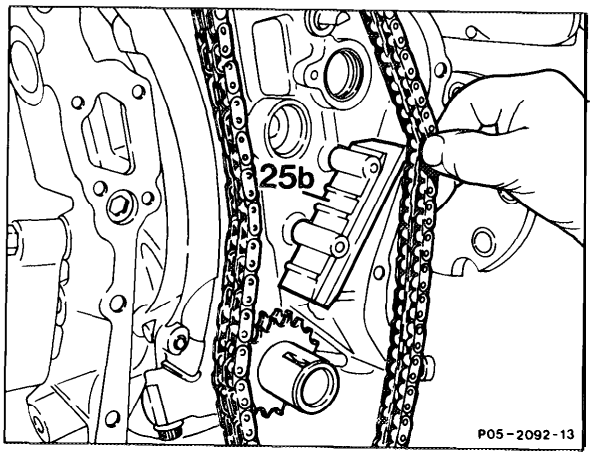
8 **Pull** out idler gear shaft (18) and remove timing chain.



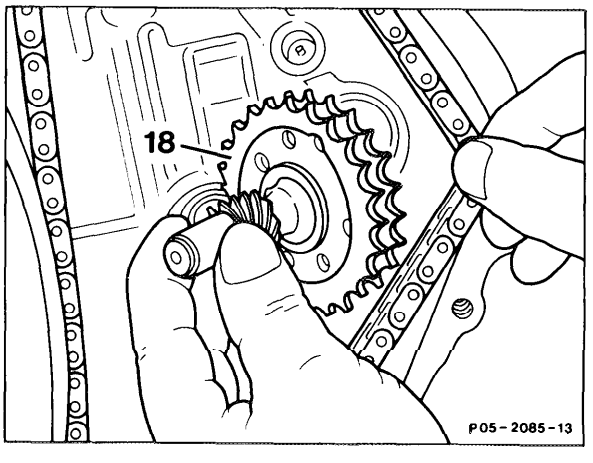
9 Remove, install, pull timing chain and crankshaft gear forward as far as possible and remove guide rail (25b). Put on timing chain and push back crankshaft gear together with timing chain.

Note

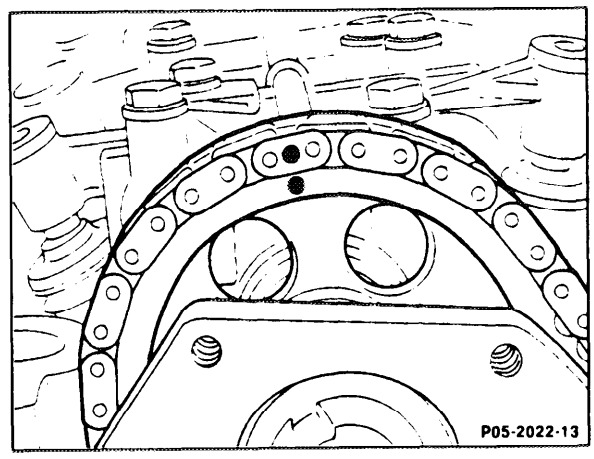
When pushing back the crankshaft gear, note the positioning pin in the camshaft timing gear flange and the color marking.



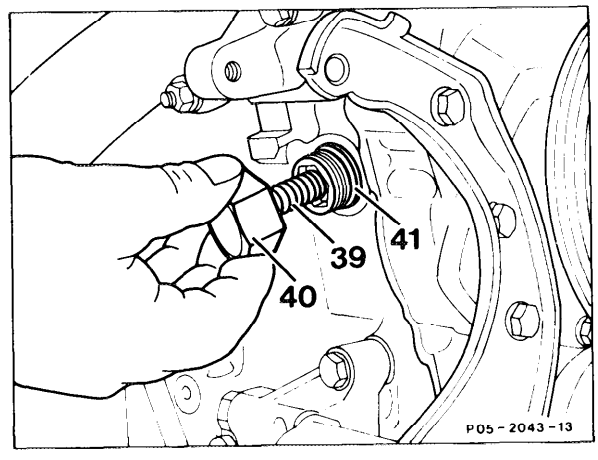
10 Install idler gear shaft, tightening torque of the hexagonal socket screw (20) 5 Nm (reference value).



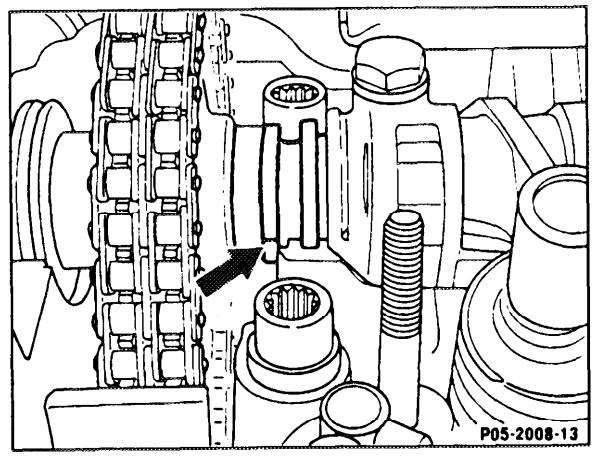
11 Install timing chain and camshaft timing gear, note marking. Tightening torque of camshaft timing gear set bolt 80 Nm.



12 Install chain tensioner (05-310). Tightening torque of sealing plug (40), 70 Nm.



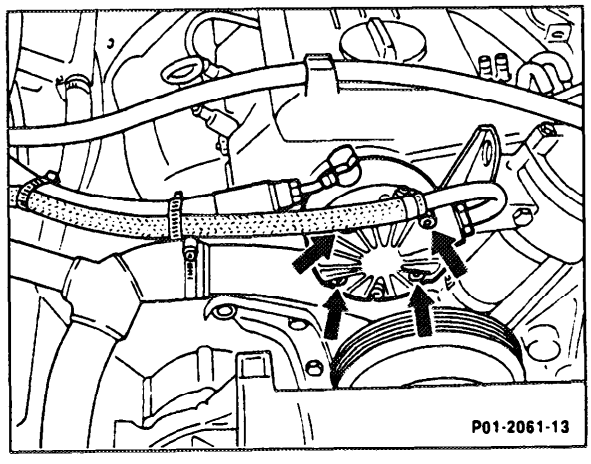
13 Check adjustment marking of camshaft (arrow) at ignition TDC position of engine, correct if necessary.



14 Install oil pressure pump, in so doing note driving disc.

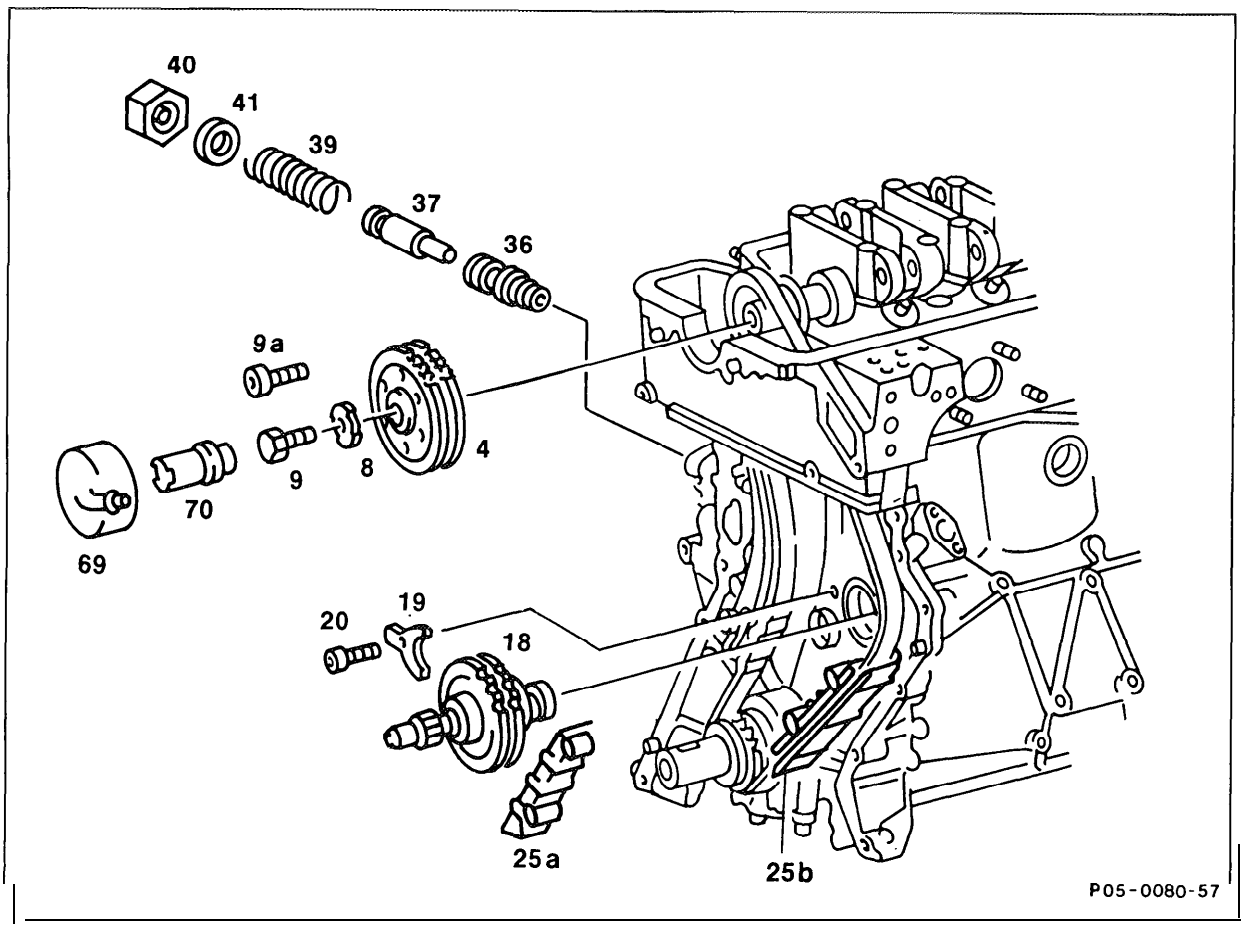
15 The installation is the reverse of removal.

16 Check for leaks when engine is running.



05-412 Removal and installation of idler gear shaft

Preceding work:
Timing case cover removed (01-210).
Fuel pump removed (07.2-212, only carburettor engines).



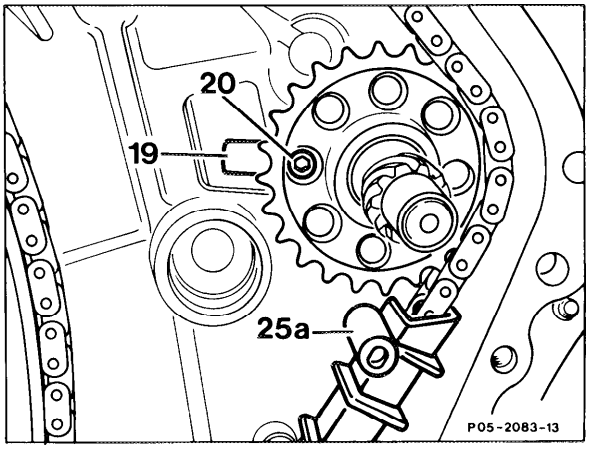
Chain tensioner (36 to 41)	remove, install (05-310).
Oil pressure pump (69)	unbolt, bolt up, set to one side with lines connected (Number 2).
Camshaft timing gear (4)	align with timing chain (Number 3).
Crankshaft gear	align with timing chain (Number 4).
Bolt (9 and 9a)	unbolt, bolt up and remove camshaft timing gear, 80 Nm. Note marking (Number 5).
Guide rail (25a)	remove, install (only on single roller chain, Number 6).

Hexagon socket bolt (20)	unbolt, bolt up, 5 Nm. Remove, install retaining clip (19) (Number 7).
Idler gear shaft (18)	withdraw from rear bearing and remove from timing chain, insert (Numbers 8 and 9).
When engine is running	check for leaks.

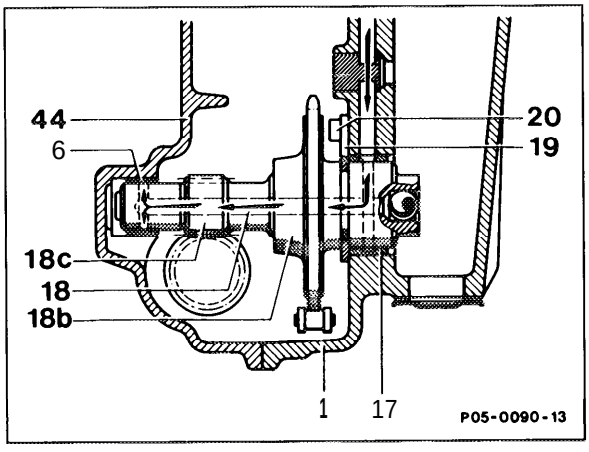
Special tool

Note

The idler gear (18b) is pressed on the idler gear shaft (18) supported on bearings in timing case cover and cylinder crankcase. It is fixed axially by a retaining clip (19) bolted on the cylinder crankcase, which engages in a groove on the idler gear shaft. The teeth for driving the ignition distributor (18c) are located behind the front bearing position.



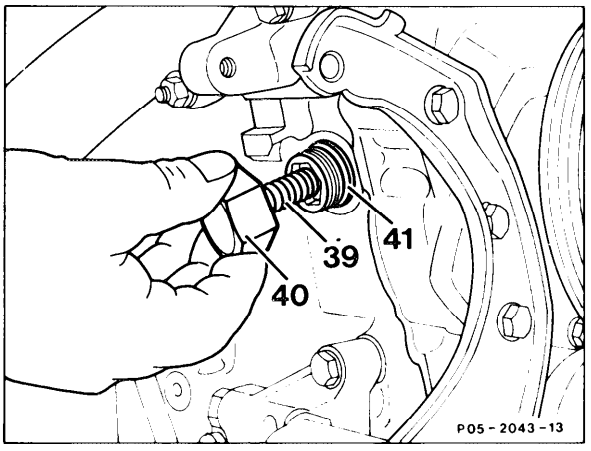
Arrangement of idler gear shaft Engines 102.985



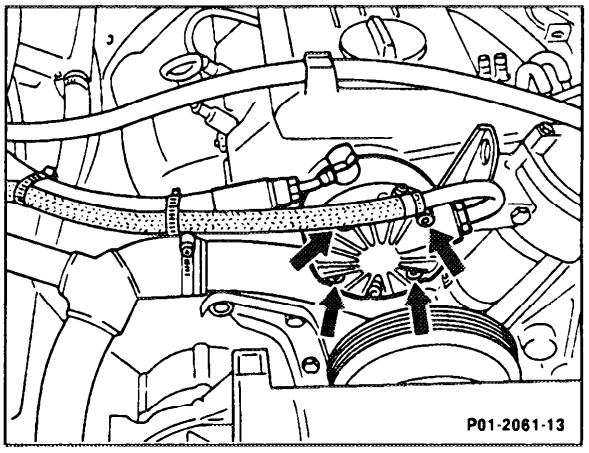
1 Cylinder crankcase
6 Bearing bush in timing case cover
17 Bearing bush in cylinder crankcase
18 Idler gear shaft
18b Idler gear
18c Teeth for ignition distributor drive
19 Retaining clip
20 Bolt M5 × 18 mm
44 Timing case cover

Removal and installation

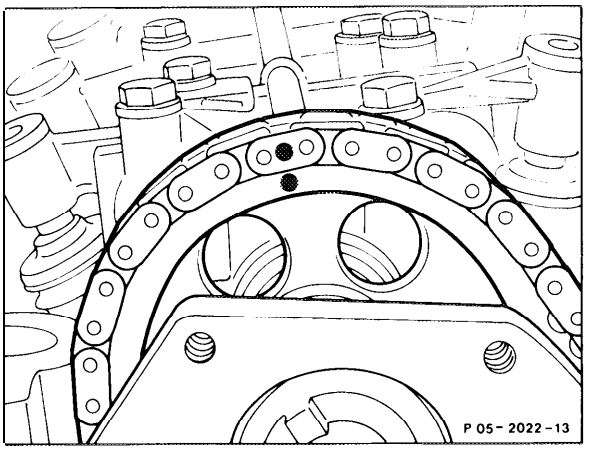
1 Remove chain tensioner (05-310).



2 Unbolt, bolt up oil pressure pump (arrows) and put to one side with lines connected.

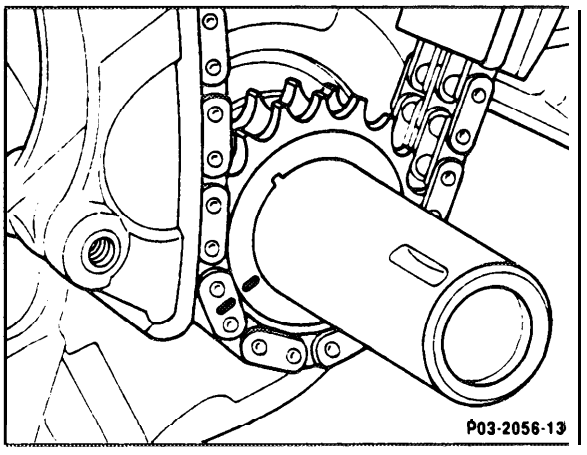


3 Align camshaft timing gear and timing chain.



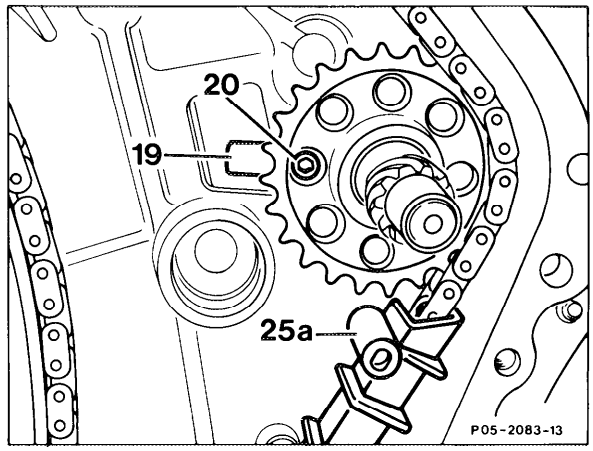
4 Align crankshaft gear and timing chain.

5 Unbolt camshaft timing gear and remove, put timing chain in timing case.



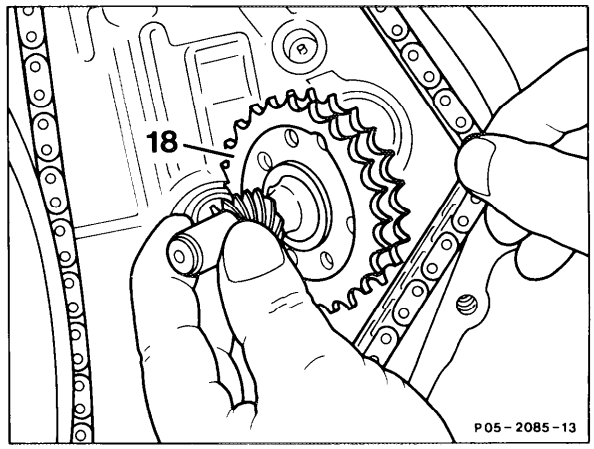
6 Remove guide rail (25a) (only on single roller chain).

7 Unbolt hexagon socket bolt (20) and remove retaining clip (19).



8 Remove idler gear shaft (18), install, in so doing raise timing chain somewhat.

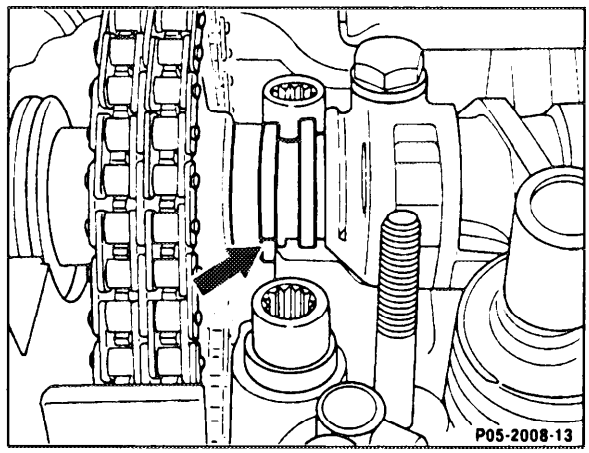
9 Install retaining clip (19) and secure with bolt (20), tightening torque 5 Nm (reference value).



10 Install guide rail (25a).

11 Assemble camshaft timing gear, at the same time noting colored markings, tightening torque 80 Nm.

12 Check adjustment marking of the camshaft (arrow) at ignition TDC position of engine, correct if necessary.



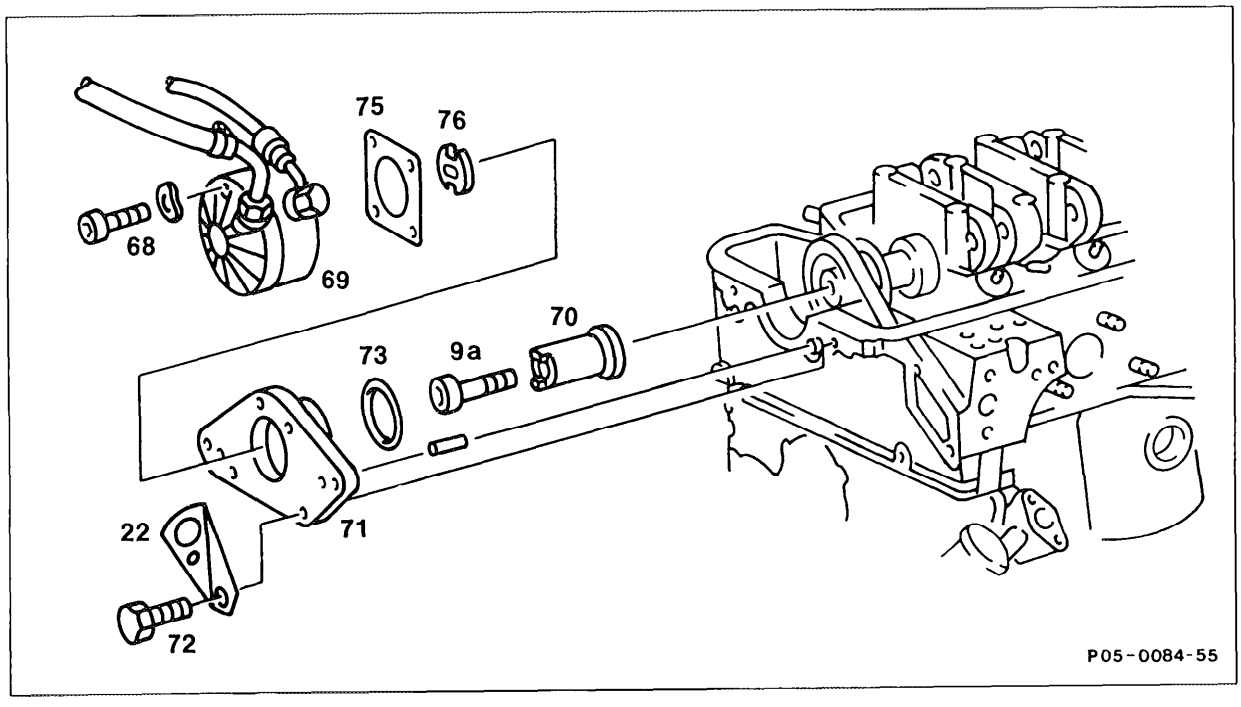
13 Install chain tensioner (05310).

14 The installation is the reverse of removal.

15 Check for leaks when engine is running.

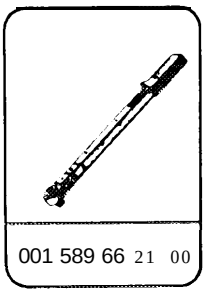
05-437 Removal and installation of oil pressure pump drive

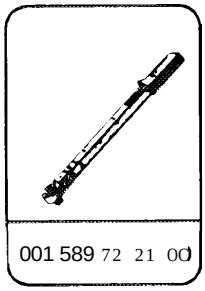
Preceding work:
Cylinder head cover removed (01-406).



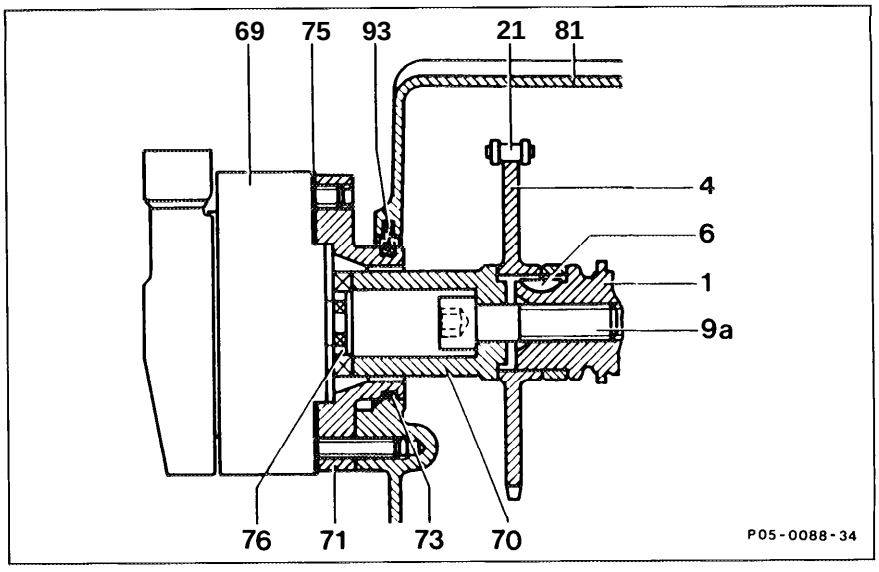
Set bolts (68)	unbolt, bolt up, 15 Nm (Numbers 1 and 2).
Oil pressure pump (69)	remove together with driving disc (76). On Model 201 set oil pressure pump with lines connected to one side.
Gasket (75)	renew.
Driving disc (76)	remove, install.
Flange (71)	unbolt, bolt up, with attachment eye (22), 25 Nm (Number 4).
O-Ring (73)	replace.
Hexagon socket bolt (9a)	unbolt, bolt up, 80 Nm. Remove, install driving disc sleeve (70) (Number 5).

Special tools



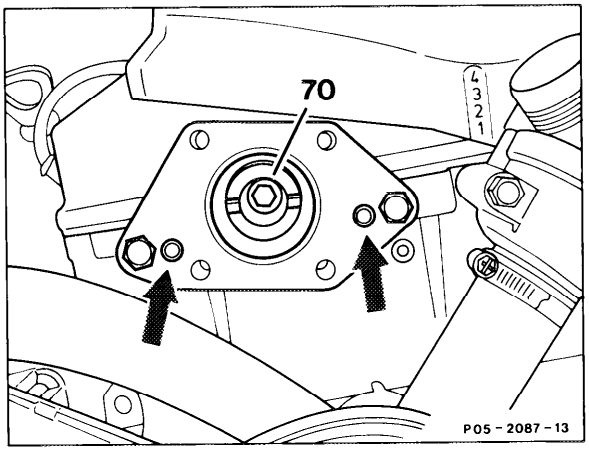


1 Camshaft
4 Camshaft timing gear
6 Woodruff key
9a Hexagon socket bolt
21 Timing chain
69 Oil pressure pump
70 Driving disc sleeve
71 Flange
73 O-Ring
75 Gasket
76 Driving disc
81 Cylinder head cover
93 Cylinder head cover gasket



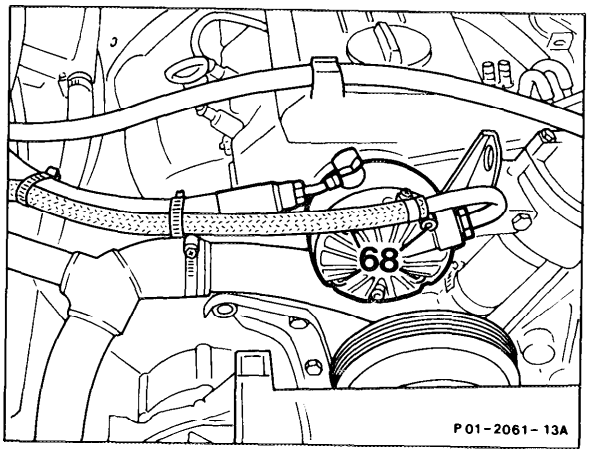
Note

The oil pressure pump (69) is driven directly by the camshaft **(1)** via the driving disc sleeve **(70)** and the driving disc (76) and is attached to the cylinder head by a flange **(71).** The fitting position of the flange on the cylinder head is fixed by two straight pins (arrows). The camshaft timing gear (4) is attached to the camshaft with the driving disc sleeve (70) and the hexagon socket screw **(9a).** The O-Ring (73) on the flange **(71)** seals the front semicircular bore in the cylinder head and in the cylinder head cover (81).



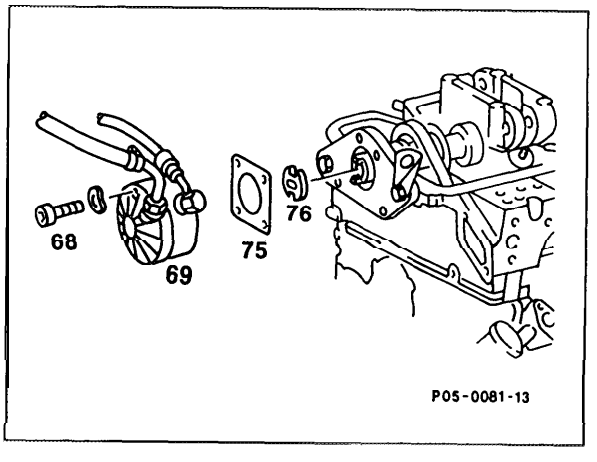
Removal and installation

1 On Model 201 remove bolts (68), remove oil pressure pump and set to one side with lines connected.

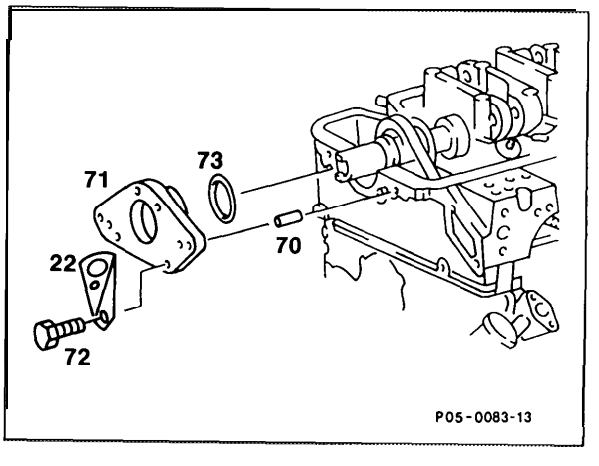


Model 201

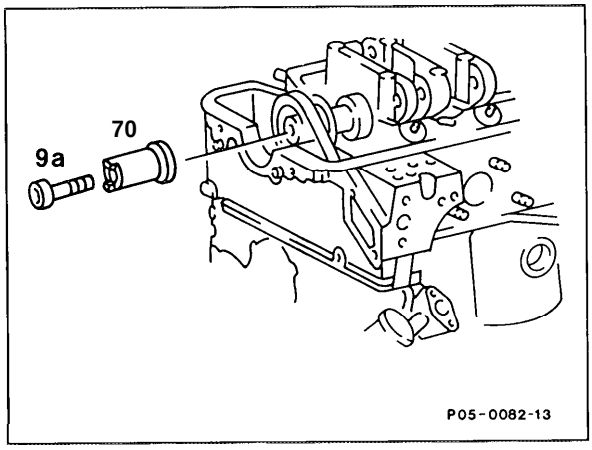
2 Remove, install driver (76). Replace gasket (75).



3 Unbolt, bolt up flange (71) together with the attachment eye (22), renew O-Ring (73). Tightening torque of bolts (72) 25 Nm. Note both dowels (70).



4 Unscrew hexagon socket bolt (9a) and remove, insert driver sleeve (70), tightening torque 80 Nm.



Job No.

Model designation survey ..... 07.3 - 001
Vehicle features ..... 07.3 - 004
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Testing, adjusting engine ..... -110
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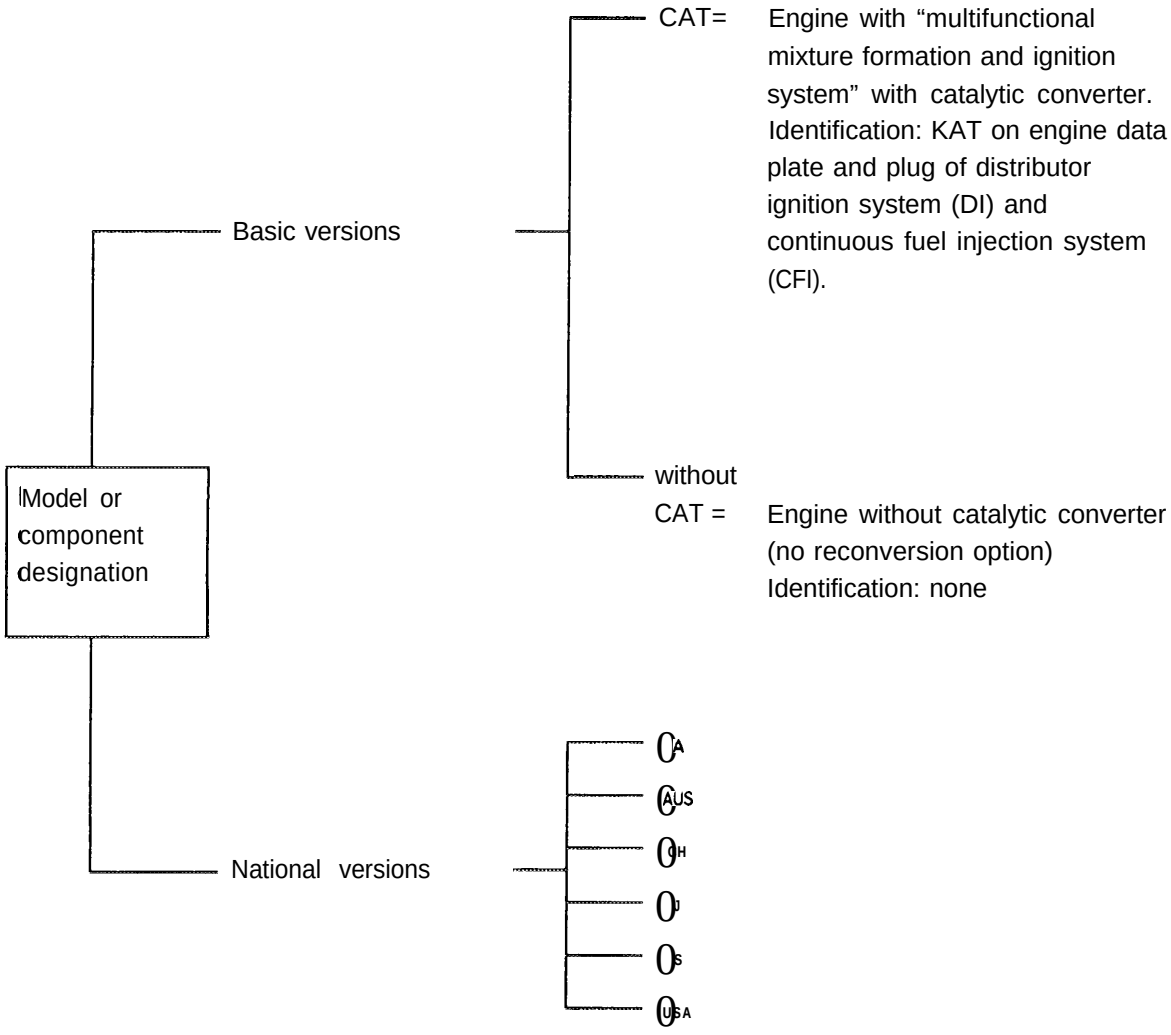
07.3–0001 Model designation survey

Model designation

The models and components with their 3- to 6-digit designation (e. g. 201 or 201.028) may have different versions, data and operations. These differences are identified by the following suffixes:



If there are no suffixes following the designation of models or components, the respective data apply to all the models or components listed in each case.

Model survey

Sales designation	Model	Model year	Engine
190 E 2.3	201.024	1984	102.961
190 E 2.3	201.028	1985-1993	102.985

National version (USA)

Engine	102.961 (2.3)
Version	(USA) 1983, 1984
Model	201.024
CFI designation	CFI (KE) II
Compression ratio ε	8
Ignition system	TSZ
Distributor ignition system resistance trimming plug	–
CFI system resistance trimming plug	–
Coolant temperature sensor	one-pin connection for CFI control module
Starting valve control	via thermo-time switch up to +5 °C
Idle speed device	Electronic idle speed control

Continuation

Engine	102.961 (2.3)
Version	(USA) 1983, 1984
Model	201.024
CFI designation	CFI (KE) II
Idle speed air valve	3-pin connection
Fault detection	
Further features	Fuel pump relay in front of electrical centre. Multi-belt drive. AC compressor cut-in signal from pressure switch. Altitude correction sensor

Engine	102.985	102.985
Version	(USA) up to 1986	(USA) 1987
Model	201.024	201.028
CFI designation	CFI (KE) II	CFI (KE) III
Compression ratio ε	8	9
Ignition system	TSZ	Distributor (DI - formerly EZL)
Distributor ignition system resistance trimming plug	-	750 Ω reference resistor incorporated in cable set
CFI system resistance trimming plug	-	0 Ω reference resistor incorporated in cable set
Coolant temperature sensor	two one-pin connections for CFI control module/fuel pump relay	two one-pin connections for CFI control module/distributor ignition system
Starting valve control	via fuel pump relay up to + 60 °C	via fuel pump relay up to + 60 °C
Idle speed device	Electronic idle speed control	Electronic idle speed control
Idle speed air valve	3-pin connection	2-pin connection
Fault detection		as of 08/86 fault diagnosis via on/off ratio

Continuation

Engine	102.985	102.985
Version	(USA) up to 1986	(USA) 1987
Model	201.024	201.028
CFI designation	CFI (KE) II	CFI (KE) III
Further features	Altitude correction sensor. Oxygen sensor warning lamp.	Altitude correction sensor. Oxygen sensor warning lamp.

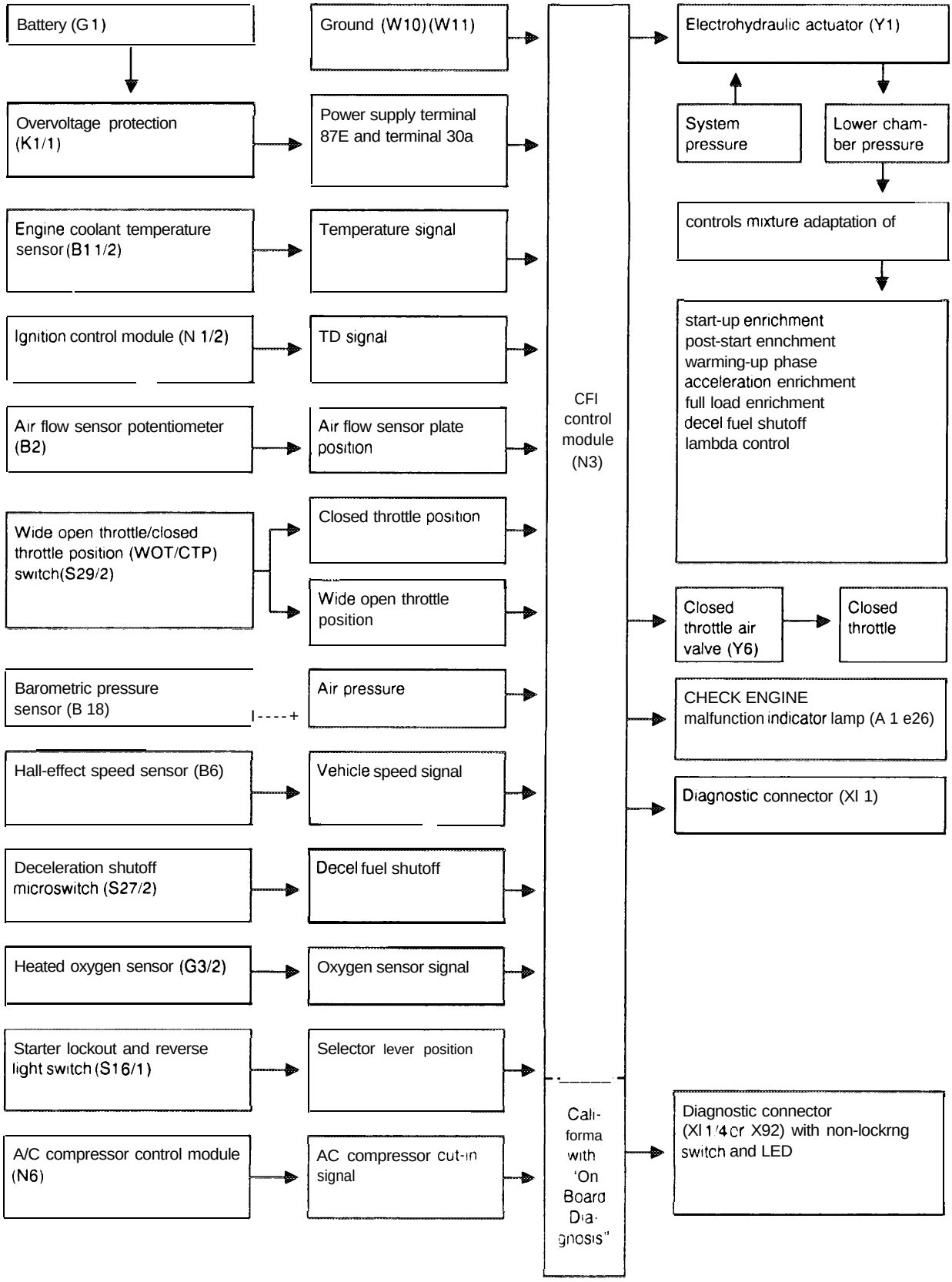
Engine	102.985	102.985	102.985
Version	(USA) 1988 Federal	(USA) 1988 California	(USA) 1991
Model	201.028	201.028	201.028
CFI designation	CFI (KE) III	CFI (KE) III	CFI (KE) III
Compression ratio ε	9	9	9
Ignition system	DI	DI	DI
Distributor ignition system resistance trimming plug	750 Ω reference resistor	750 Ω reference resistor	1.3 kΩ reference resistor (manual transmission), 2.4 kΩ reference resistor (automatic transmission) incorporated in cable set
CFI system resistance trimming plug	Fixed resistor integrated in CFI control unit	Fixed resistor integrated in KE control unit	Fixed resistor integrated in CFI control unit
Coolant temperature sensor	two one-pin connections for CFI control module/distributor ignition system	four one-pin connections, 2 for CFI control module, 2 for distributor ignition system	four one-pin connections, 2 for CFI control module, 2 for distributor ignition system
Starting valve control	via fuel pump relay up to +60 °C	via fuel pump relay up to +60 °C	via fuel pump relay up to +60 °C
Idle speed device	Electronic idle speed control with road speed signal	Electronic idle speed control with road speed signal	Electronic idle speed control with road speed signal
Idle speed air valve	2-pin connection	2-pin connection	2-pin connection

Continuation

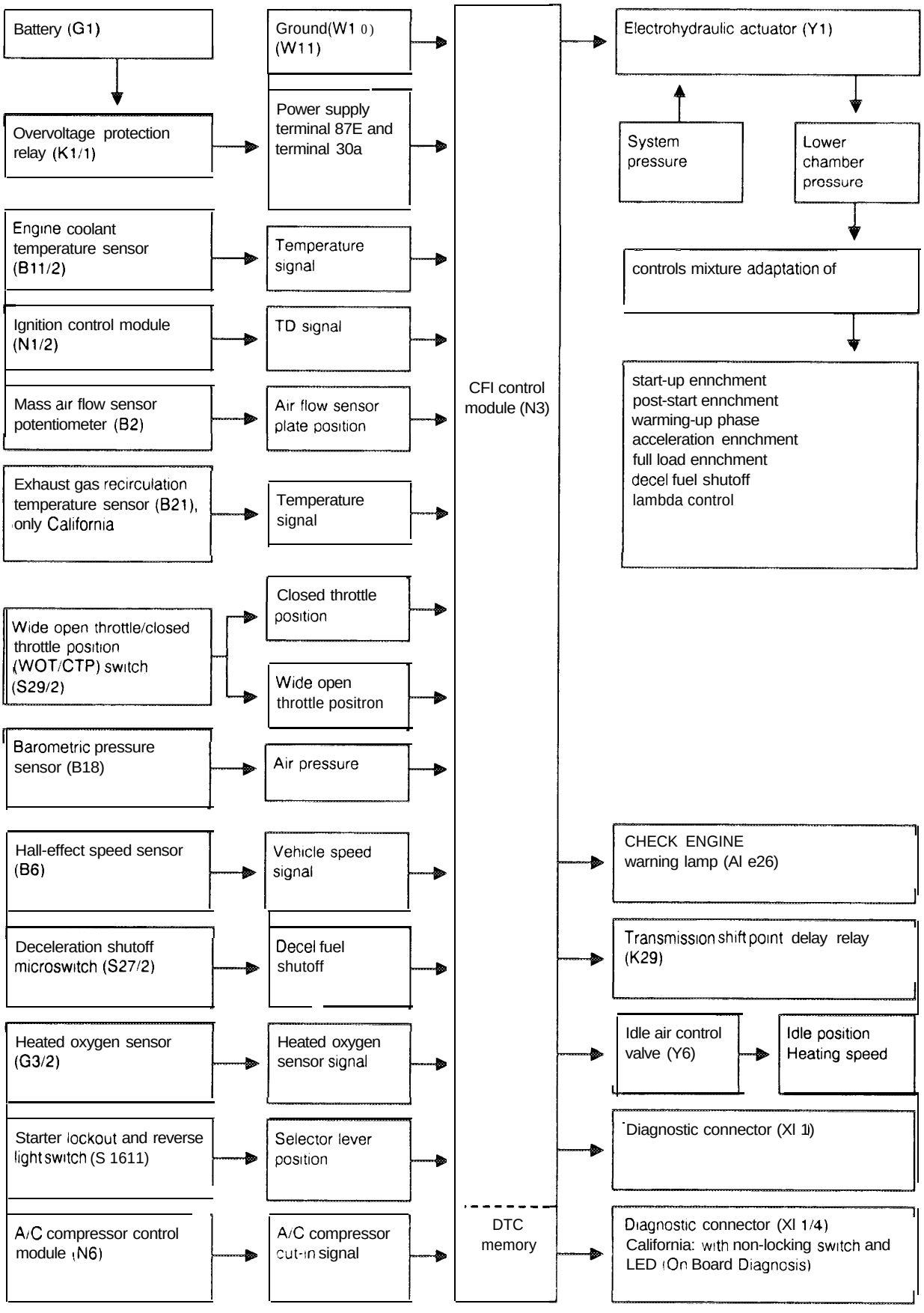
Engine	102.985	102.985	102.985
Version	(USA) 1988 Federal	(USA) 1988 California	(USA) 1991
Model	201.028	201.028	201.028
CFI designation	CFI (KE) III	CFI (KE) III	CFI (KE) III
Fault detection	Fault diagnosis via on off ratio	Fault diagnosis via on/off ratio. "On Board Diagnosis" fault storage.	Fault diagnosis via on/off ratio. Fault storage.
Further features	Altitude correction sensor. CHECK ENGINE warning lamp.	Altitude correction sensor. CHECK ENGINE warning lamp. Non-locking switch with LED at test coupling.	Altitude correction sensor. CHECK ENGINE warning lamp. Oxygen sensor at exhaust manifold. Oxygen sensor heated as of +20 °C. Transmission shift point delay (automatic transmission). Intake air temperature sensor for CFI eliminated (now DI). Decel fuel shutoff as of +40 °C. Intake air preheating. Without pre-catalytic converters. Exhaust gas recirculation. California: exhaust gas recirculation temperature sensor (621). California: Non-locking switch with LED at test coupling ("On Board Diagnosis").

07.3–005 Parameters of mixture adaptation

A. National version (USA) 1988 Engine 102.985

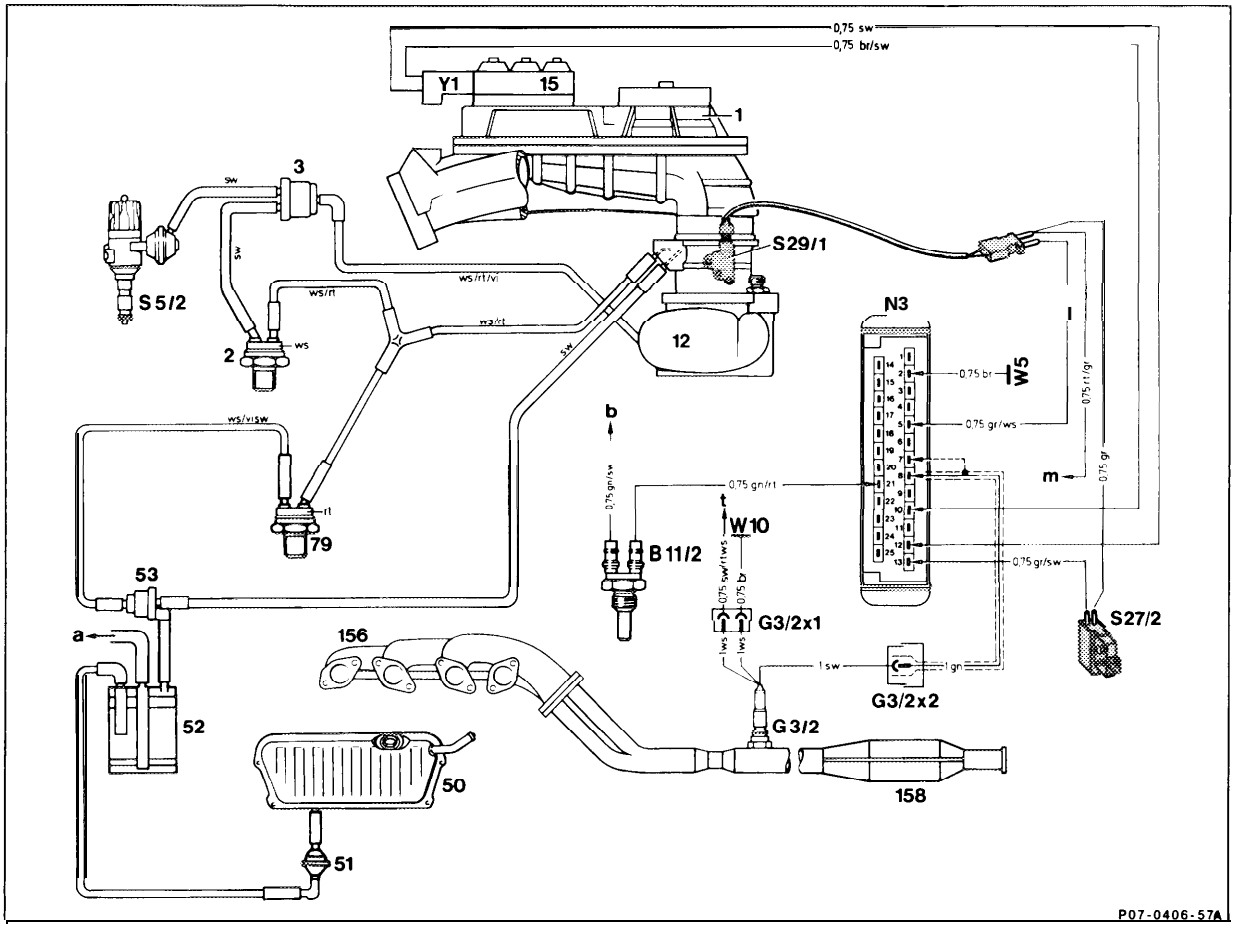


B. National version (USA) 1991 Engine 102.985



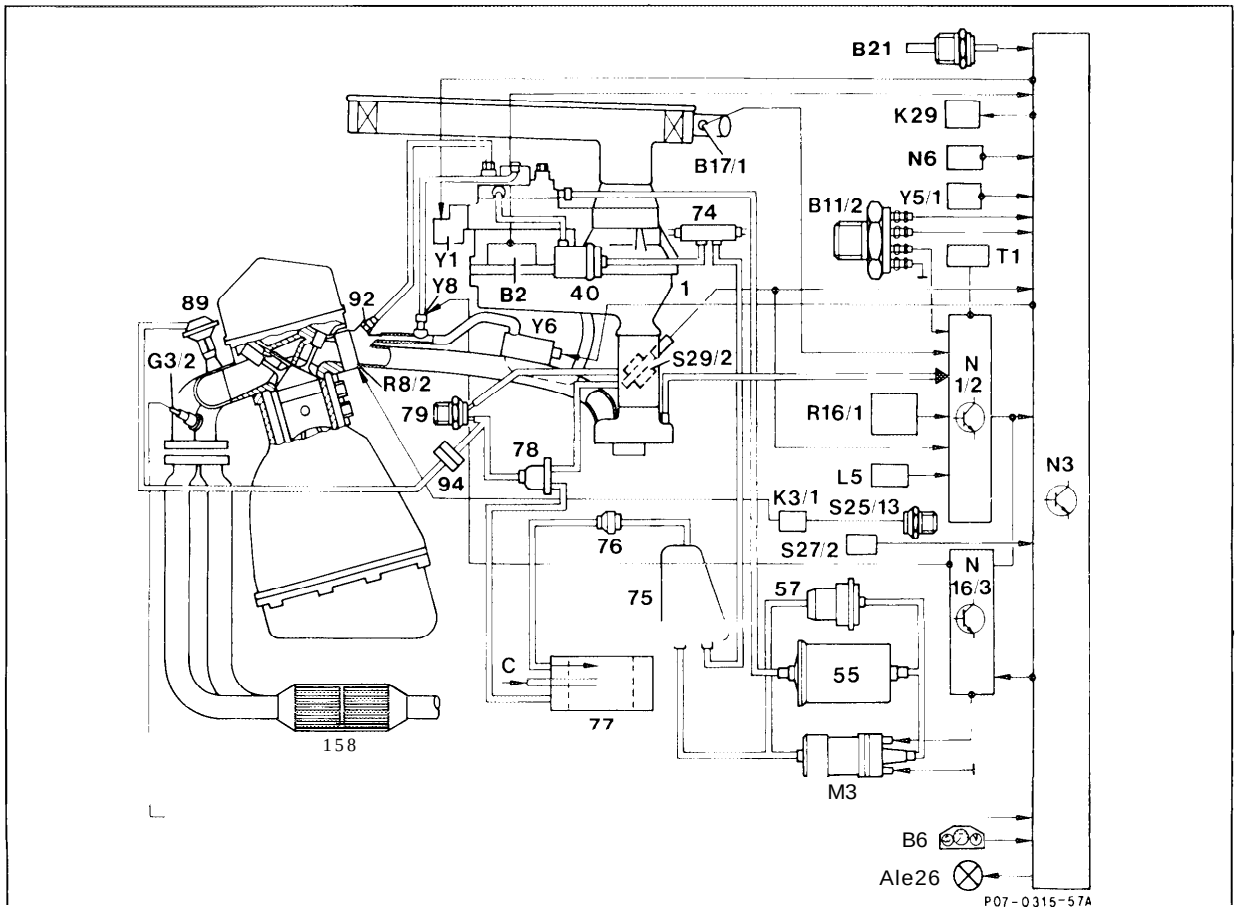
07.3–013 Function diagram of KE injection system

F. (USA) 1984 Engine 102.961 (2.3), (USA) 1985186 Engine 102.985



1	Mixture control unit	G3/2	Heated oxygen sensor
2	60 °C thermovalve (white)	G3/2x1	Oxygen sensor heating coil plug connection
3	Check valve with Integrated restrictor	G3/2x2	Oxygen sensor signal plug connection
12	Intake manifold	N3	CFI control module
15	Fuel distributor	S5/2	Distributor (breakerless)
33b	Underfloor catalytic converter	S27/2	Decel fuel shutoff microswitch
50	Fuel tank	S29/1	WOT/CTP switch
51	Vent valve	W5	Engine ground
52	Charcoal canister	W10	Battery ground
53	Purge valve	Y1	Electrohydraulic actuator
79	50 °C thermovalve (red)		
156	Exhaust manifold	a	Air admissions line (engine compartment)
158	Under-floor catalytic converter	b	Fuel pump relay, contact 2
B11/3	Engine coolant temperature sensor	m	Idle speed air valve, contact 2 Fuel pump relay module, contact 7, terminal **87**

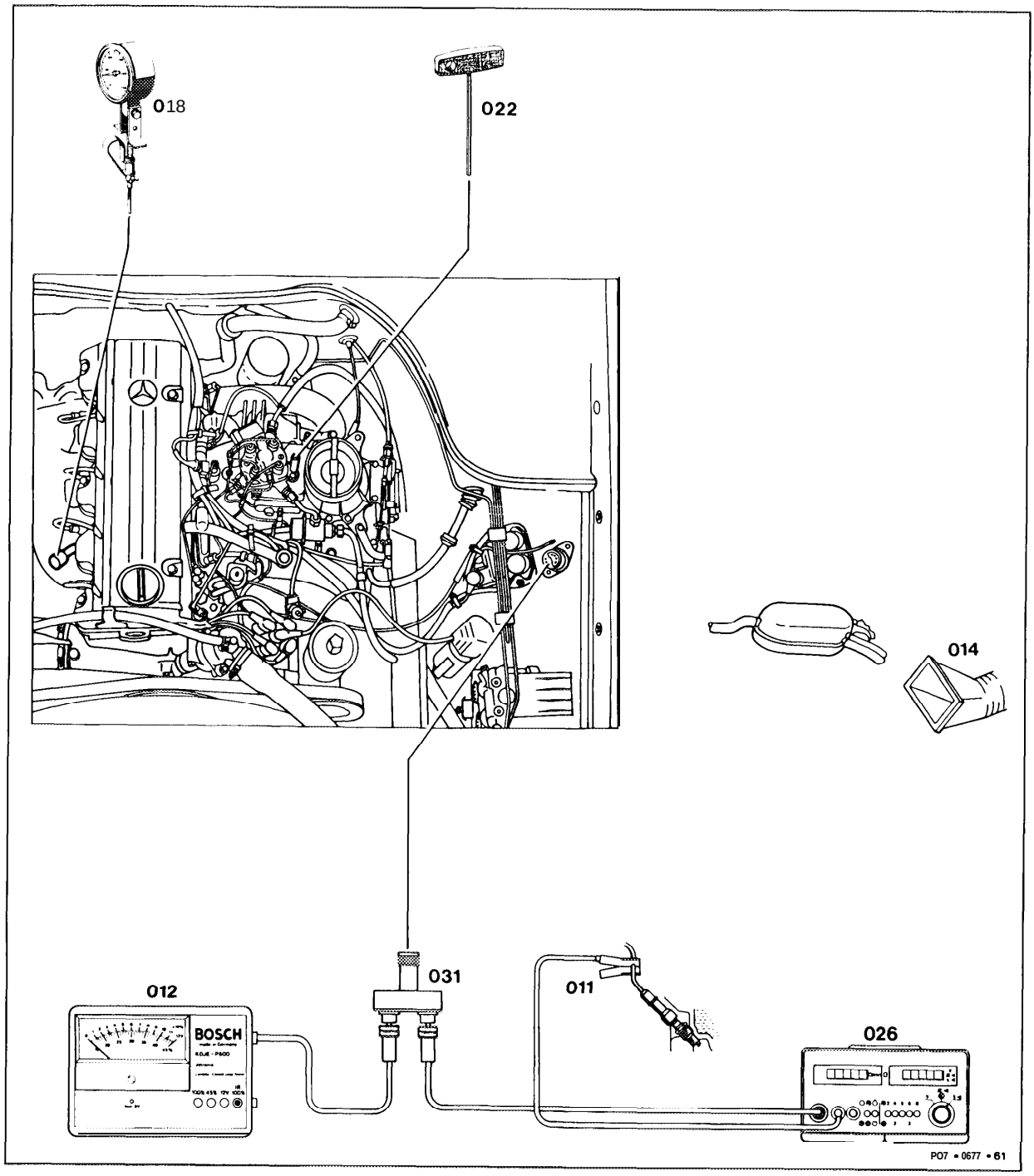
(USA) 1991 Engine 102.985



I	Mixture control unit
I0	Diaphragm pressure regulator
55	Fuel filter
57	Fuel accumulator
75	Fuel tank
76	Vent valve
77	Charcoal canister
78	Purge valve
79	70 °C thermovalve
89	Exhaust gas recirculation valve
92	Injector
94	Deceleration valve (manual transmission only)
158	Under-floor catalytic converter
Ale26	CHECK ENGINE malfunction indicator lamp
B2	Air flow sensor potentiometer
B6	Hall-effect speed sensor
B11/2	Engine coolant temperature sensor, 4-pin
B17/1	Intake arr temperature sensor
B21	Exhaust gas recirculation temperature sensor (EGR) (California only)
G3/2	Heated oxygen sensor
K3/1	Intake air preheating (PSV) relay
K29	Transmission upshift delay relay
L5	Crankshaft position sensor
M3	Fuel pump
N1/2	Ignition control module
N3	CFI control module
N6	A/C compressor control module
N16/3	Fuel pump relay module
R8/2	Intake air preheater (PSV)
R16/1	Reference resistor (DI)
S25/13	60 °C temperature switch (PSV)
S27/2	Decel fuel shutoff microswitch
S29/2	WOT/CTP switch
T1	Ignition coil
Y1	Electrohydraulic actuator
Y5/1	A/C compressor electromagnetic clutch
Y6	Idle air control valve
Y8	Start valve
c	Air admission

07.3–105 Testing on/off ratio (USA)

Preceding work:



Air conditioning or automatic air conditioning .... switch off.

Selector lever ..... in park position "P".

Testers ..... connect.
Engine oil remote thermometer (018)
124 589 07 21 00,
Lambda control tester (012),
Twin socket (031),
Engine tester (026),
Trigger clamp (011).

Extraction device (014) ..... position at exhaust tail pipe.

Throttle control ..... check for ease of movement and condition.

Ignition point ..... test (see table).

Engine oil temperature ..... approx. 80 °C.

Idle speed ..... test (see table).

Lambda control ..... test (see table).

Caution!
All adjustments may only be performed when replacing **a** component of the injection system or performing engine repairs.
Pay attention to note.
Install repair kit 102 070 01 74.

Smooth engine running ..... check by switching on all ancillary components.

Idle speed, lambda control

Engine	Model year	Idle speed 1/min	Idle speed Control range	Lambda control Control range
102.961 (2.3)	1983/1984	720 ± 50	2531%	2.1-4.8 volts [1])
102.983	1986-1989	900 ± 50	35–45%	50 ± 10%
102.985	1985/1986	720 ± 50	25–31%	2.1-4.8 volts [1])
102.985	1987/1988 [2])	750 ± 50	36-50%	50 ± 10%
102.985	1991 [2])	700-800	580 ± 50mA [3])	50 ± 10%

[1]) Adjust. Detach heated oxygen sensor couplmg. Take reading of control value (volts). Readout must not fluctuate. Plug together heated oxygen sensor coupling – readout fluctuates. Test value must not vary more than ± 0.8 volts from reference value.

[2]) California 1988 and (USA) 1991 with diagnostic trouble code (DTC) memory: "CHECK ENGINE" malfunction Indicator lamp must not light up. First, switch over CFI control module (N3) to on/off ratio output.

[3]) Current measurement at idle speed air valve with multimeter (wait at least 28 seconds after starting, heating speed).

TSZ ignition point

Engine	Model year	Type of fuel	Distributor Bosch No.	**Setting [1])** of ignition point in °CKA before TDC ± 1 ° with vacuum at idle speed	**Test value** Ignition point adjustment in °CKA before TDC without vacuum at 3500/min
102.961 (2.3)	198311984	unleaded	0 237 002 094	5	19–25
102.961 102.985	1985/1986		0 237 002 098		22-26

1) If normal-compression engines are operated with fuel of less than 98 RON (min. 88 MON) or low-compression engines with fuel of less than 92 RON (min. 82 MON), the ignition point should be retarded and adapted to the octane number of the fuel used. The rule of thumb for this adjustment is: retard ignition point by 1 – 2° CKA per 1 RON. The ignition point must not be retarded more than 6° CKA.
This results in reduced engine power output and Increased fuel consumption. In addition, the engine must not be operated at full load. Full ignition advance should be re-set as soon as fuel of the specified octane number is available.

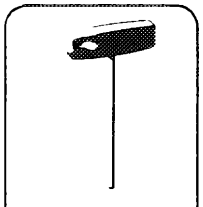
Distributor ignition point

Engine	Model year	Distributor ignition control unit Part No. alternatively	Resistance trimming plug	Engine speed in 1/min	**Ignition point** in °CKA BTDC **without** vacuum	**Ignition point** in °CKA BTDC **with** vacuum
102.983	1986/1987	004 545 57 32 004 545 59 32	Reference resistor 750 Ω	4000	18–22 [1])	29–33 [1])
				Idling	14–18	14–18
102.985	198711988	005 545 30 32 005 545 32 32		3200	25–29	39–43
				Idling	8–12	8–12
102.985	1989	007 545 47 32 [2])[3]) 007 545 48 32 [2])[3])		3200	23–27	39-43
				Idling	8-12	8-12
102.985	1991	010 545 59 32 010 545 60 32	Reference resistor 1.3 kΩ (manual transmission) 2.4 kΩ (automatic transmission)	3200	22–26 [4])	39–43 [4])
				Idling	8–12	8–12

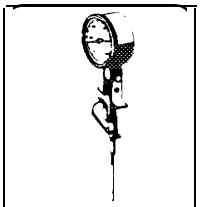
1) Intake air temperature sensor connector unplugged.
2) These ignition control modules may also be Installed in vehicles prior to 1988. In this case, the ignition point values alter as shown in the table.
3) Test ignition point at 80 °C engine coolant temperature by unplugging the temperature sensor connector B11/2 and feeding in 320 Ω with resistance decade between green/black cable and engine ground.
4) For testing, unplug the intake air temperature sensor and engine coolant temperature sensor connectors. Test ignition point at 80 °C coolant temperature by feeding in 320 Ω with resistance decade between contact 1 at 4-pin connector and engine ground.

Note
Ignition control module with ignition mao for manual and automatic transmission (activated by different DI resistance trimming plugs), boiling protection correction (max. 5 ° CKA), intake air correction (max. 7 ° CKA) and safety retarded adlustment (6° CKA) in the event of open circuit to reference resistor

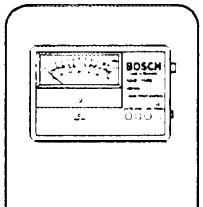
Special tools



000 589 14 11 00



124 589 07 21 00



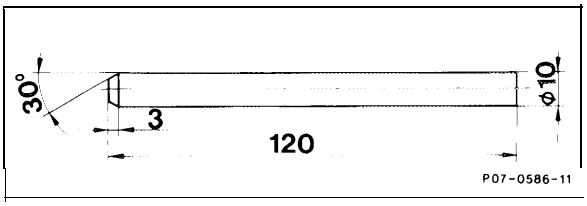
909 589 00 21 OCII

Commercially available testers

Engine tester (rpm, dwell angle, ignition angle)	e. g.	Bosch, MOT 001.03 Sun, Hermann
Twin socket	e. g.	Hermann, ECD 53

Shop-made tool

Drift for inserting steel anti-tamper lock

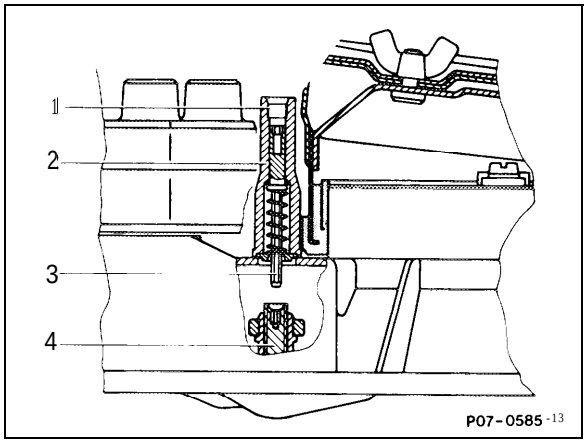


Note

The adjustment device (2) for the fuel/air mixture setting is secured with a steel anti-tamper lock (1) to prevent any unauthorized alteration of the setting.

This anti-tamper lock is factory-installed with a special tool after the fuel/air mixture is set and must not be removed in the workshops.

The fuel/air mixture setting may only be corrected when replacing a component of the injection system (e. g. fuel distributor) or when performing engine repairs.
In such cases, the adjustment device (2) must be replaced.

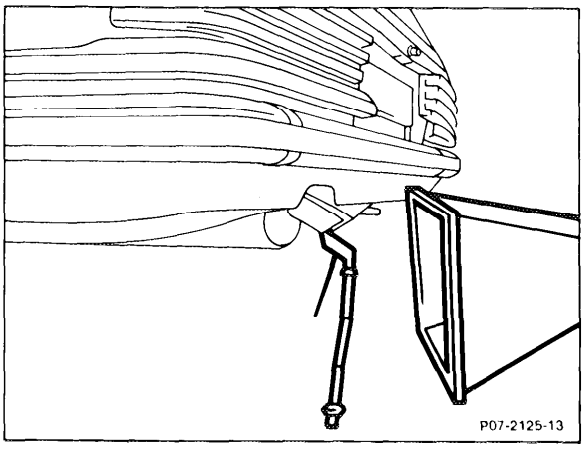


1 Steel anti-tamper lock
2 Adjustment device
3 Hexagon head
4 Mixture regulating screw

The lambda control must not be tested when the engine is very hot, e. g. immediately after a long drive or after measuring engine output on the dynamometer.

1 Switch off air conditioning. Move selector lever into park position "P".

2 Connect testers:
Oil remote thermometer (018) 124 589 07 21 00
Lambda control tester (012)
Twin socket (031)
Engine tester (026)
Trigger clamp (011)



3 Position extraction device (014) at exhaust pipe.

4 Check throttle control for ease of movement and condition.

5 Test ignition point (see table).

6 Run engine to warm up oil to 80 °C.

7 Test idle speed (see table).

Note
If idle speed varies, test electronic idle speed control (07.3-I 12).

8 Test lambda control (see table).

Note
The readout must fluctuate during the measurement. If a constant readout is indicated, there is a fault in the lambda control, e. g. oxygen sensor faulty. See "Testing electrical components of CFI system" (07.3-I 21) for trouble diagnosis table.

a) Measuring on/off ratio with lambda control tester at diagnostic connector.

Engine 102.983
Engine 102.985 as of 1987

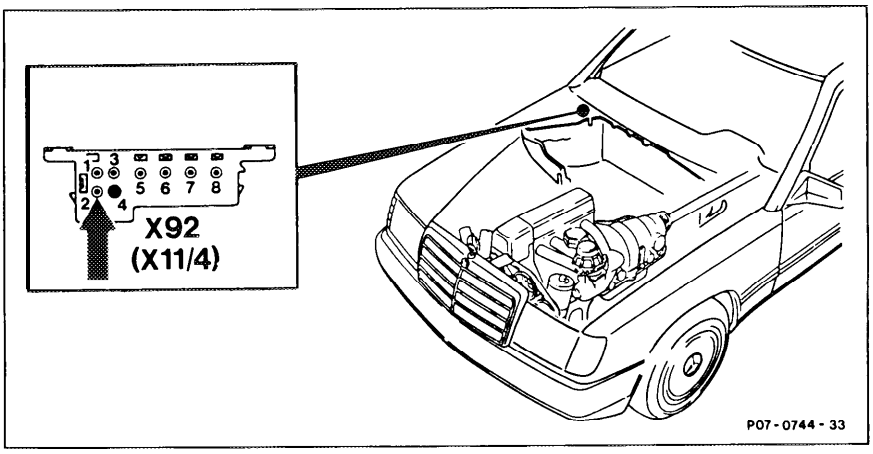
Test value: 50 ± 10%

Press 100 % IR button on Bosch lambda control tester.

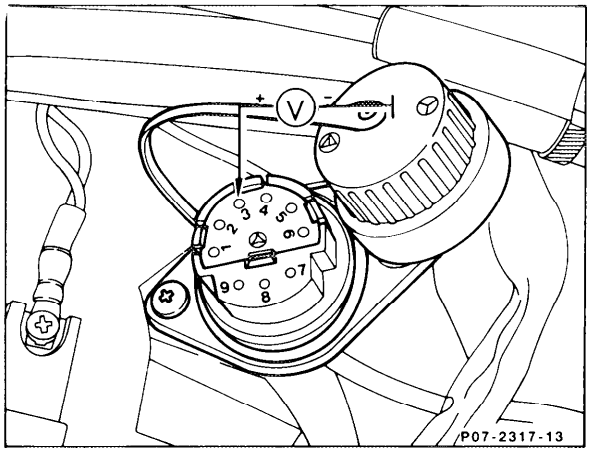
(USA) California 1988 and (USA) 1991 Engine 102.985 with diagnostic trouble code memory: The CFI control module must be switched over to on/off ratio output with the impulse counter scan tool or with the pushbutton switch (California only) at the diagnostic connector X92 or Xl 1'4 (see also 07.3-121, Section F).

California versions:
Press switch (2, arrow) at diagnostic connector (X92 or Xl 1/4) for between 2 and 4 seconds. LED (4) flashes once (no DTC stored in system). Again press switch (2) for between 2 and 4 seconds, CFI control module is switched over to on/off ratio output. LED shows steady light.

Requirement:
"CHECK ENGINE" malfunction indicator lamp does not light up.



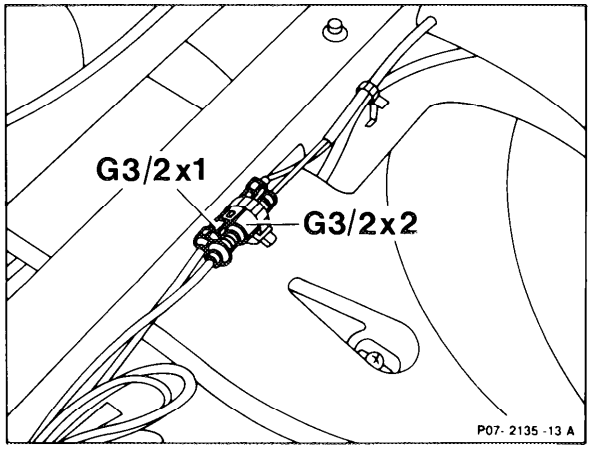
b) Voltage measurement with multimeter or lambda control tester (12 volt position) at contact 3 of diagnostic connector to ground.



Engine 102.961 (2.3) 198311984
Engine 102.985 up to 1986

Test value: 2.1–4.8 volts

Switch off all ancillary components.
Detach heated oxygen sensor signal plug connection (G3/2x2). Take reading of control value (e. g. 3.3 volts). Readout must not fluctuate.

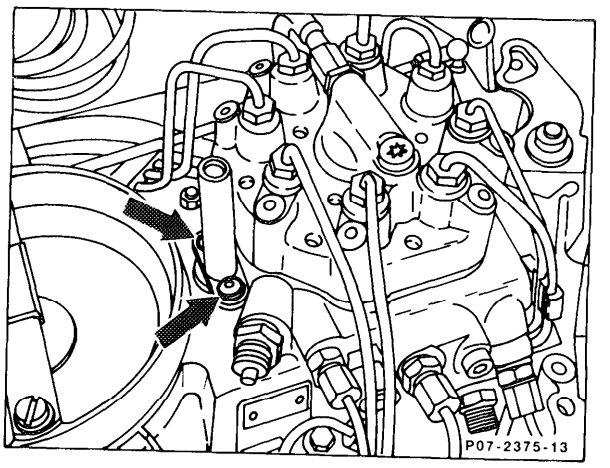


Plug together heated oxygen sensor signal plug connection (G3/2x2) – readout fluctuates. Test value must vary not more than ± 0.8 volts from control value. Variation > 0.8 volts, set control value.

9 Adjust lambda control.
Should it be necessary to set the on/off ratio after performing engine repairs or replacing a part of the CFI system, procede as follows:

Remove air cleaner.

Strike shear-off screws (arrow) in the middle with a chisel and drill approx. 6 – 8 mm deep with a 2.5 mm twist drill.



Caution!
Do not drill through screws as the metal chips may cause engine damage. Thoroughly remove metal chips with a cloth.

Unscrew shear-off screws with left-hand drill.

Install new repair kit, Part No. 102 070 01 74.
Tighten screws until head shears off.

Install air cleaner.

Start engine.

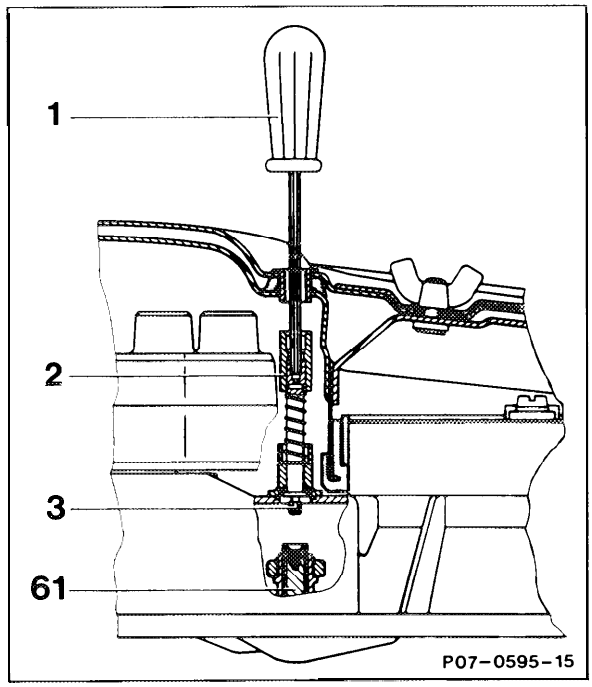
Push the screwdriver (1) through the recess in the top of the air cleaner onto the adjusting device (2).

Press the adjusting device down with the screwdriver against the spring force, turn it slightly until the hexagon head (3) engages in the mixture regulating screw (61).

Turning to the left = leaner – on/off ratio or voltage rises

Turning to the right = richer – on/off ratio or voltage drops

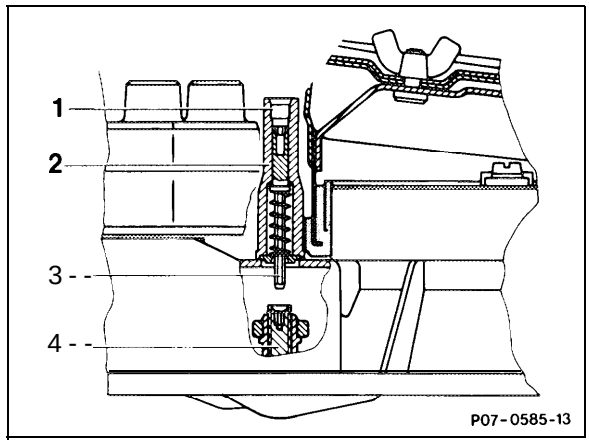
After each adjustment, briefly blip throttle and test lambda control; re-set if necessary.



Switch off engine.

Take off air cleaner.

Knock in steel anti-tamper lock (1) with shop-made drift at the chamfered side far enough for the surface of the anti-tamper lock to be flush with, or slightly lower than, the bottom edge of the taper of the adjusting device (2).



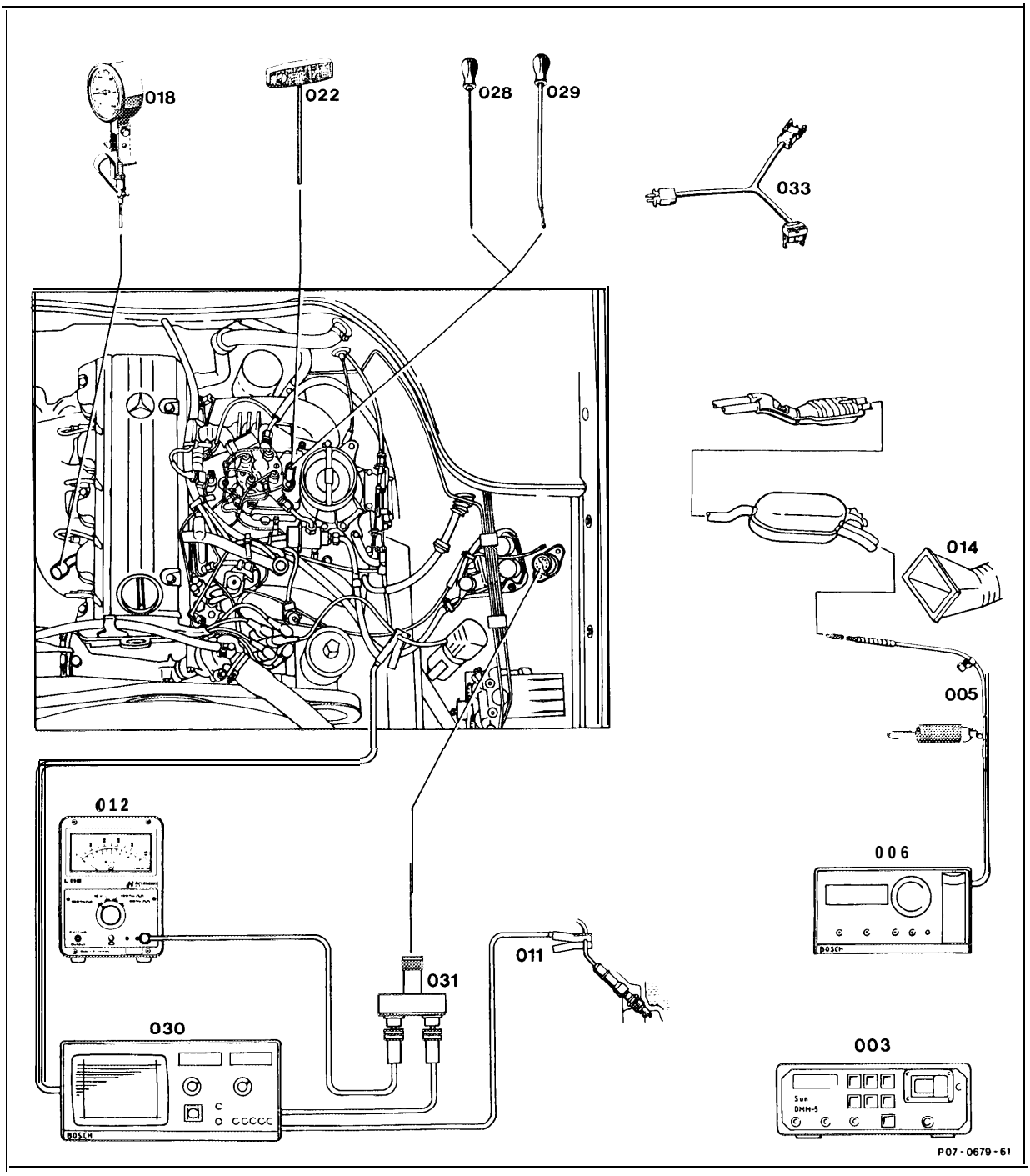
1 Steel anti-tamper lock
2 Adjusting device
3 Hexagon head
4 Mixture regulating screw

Install air cleaner.

Check smooth engine running by moving selector lever into Drive mode, switching on air conditioning/automatic climate control, turning power steering to full lock. The engine must continue to run smoothly. Test electronic idle speed control, if necessary (07.3-l 12).

07.3–110 Engine testing, adjustment

Preceding work:



Air conditioning or automatic climate control	switch off.
Selector lever	in park position "P".
Diagnostic trouble code (DTC) memory	read out and note DTCs (engines with DTC memory).
Testers	connect: oil remote thermometer (018) 124 589 07 21 00, lambda control tester (012), twin socket (031), trigger clamp (011), exhaust probe (005) 126 589 11 63 00, CO measuring instrument (006), engine tester with oscilloscope (030), multimeter (003), test cable (033) 102 589 04 63 00.
Extraction device (0 14)	position at exhaust tail pipe.
Engine coolant level	check, adjust to correct level.
Engine oil level	check, pay attention to condition of oil (visual inspection).
Air cleaner	remove, install.
Throttle control linkage (7)	check ease of movement and condition of throttle valve. Grease mounting points, relay levers, ball sockets.
Fulcrum lever	check, adjust.
Idle stop	check.
Wide open throttle stop	check from accelerator pedal, adjust.
Voltage	test at battery and ignition coil, terminals 1 and 15.
Current at actuator	test with ignition switched on.
Ignition point	test, adjust (see table).
Centrifugal advance (TSZ)	test (see table).
Vacuum advance	test (see table).
Oil level in automatic transmission	check, adjust to correct level.
Deceleration shutoff	check.
Engine oil temperature	approx. 80 °C.
Oscilloscope image	analyze.
Intake system	check for leaks by pressure-testing.

Exhaust gas recirculation valve	check.
Idle speed	check (see table).
Lambda control	see 07.3- 105.
Smooth engine running	check by switching on all ancillary components.
DTC memory	erase. (Engines with DTC memory).

Test and adjustment data

(USA) black information plate

Engine	Version	Model year	Idle speed 1/min	Idle speed Control range	Lambda control Control range
102.961 (2.3)	(USA)	198311984	720 ± 50	25–31%	2.1-4.8 volts [5]
102.983		1986-1989	900 ± 50	35–45%	50 ± 10%
102.985		19851'1986	720 ± 50	25–31%	2.1-4.8 volts [5]
102.985		198711988 [7]	750 ± 50	36-50%	50 ± 10%
102.985		1991 [7]	700-800	580 ± 50 mA [8]	50 ± 10%

1) With self aspiration system.
2) 700–800/min with A/C compressor (electronically controlled).
3) Without idle speed control.
4) Without air injection. Detach shaped hose and plug.
5) Adjust. Detach heated oxygen sensor connector. Take reading of control value (volts). Readout must not fluctuate. Plug together heated oxygen sensor connector – readout fluctuates. Test value must vary not more than ± 0.8 volts from control value.
6) Current measurement at idle speed air valve with multimeter (wart at least 28 seconds after starting, heating speed).
7) California 1988 and (USA) 1991 with DTC memory: "CHECK ENGINE" malfunction indicator lamp must not light up. First of all switch over CFI control module (N3) to on/off ratio output.
8) Control measurement at idle speed air valve with multimeter (wait at least 28 seconds after starting, heating speed).

Current at actuator with ignition switched on

National version (USA)

Engine	Version	Current at actuator with ignition switched on mA
102.961	(USA)	75–85 [7]
102.985	(USA) up to 1986 (USA) as of 1987	75–85 [7] 20

1) 100 mA with CFI control module 004 545 12 32.
2) Manual transmission.
3) As of 01.87 for manual and automatic transmission.
4) Automatic transmission.
5) CFI control module 004 545 93 32 (1986/87).
6) CFI control module 004 545 94 32 (as of 1988).
7) Connector at engine coolant temperature sensor disconnected.

Ignition point (TSZ) US version

Engine	Type of fuel[3])	Distributor Bosch No.	Test value and setting [1]) of ignition point in °CKA BTDC ± 1 without/with vacuum		Ignition point adjustment in °CKA before TDC without vacuum			Vacuum advance of ignition point in °CKA BTDC at	Installed ignition point value in °CKA BTDC at starting speed without vacuum
			4500/ min	Idling	Idling	1500/ min	3000/ min	4500/ min	
USA 102.961 1984	unleaded	0 237 002 094	–	5 with	–	5–11	19–25[2])	24–28[2])	5
102.961 102.985 as of 1983		0 237 002 098				10–14	22–26[2])	14–18[2])	5

1) If normal-compression engines are operated with fuel of less than 98 RON (min. 88 MON) or low-compression engines with fuel of less than 92 RON (min. 82 MON), the ignition point should be retarded and adapted to the octane number of the fuel used. The rule of thumb for this adjustment is: retard ignition point by 1 – 2° CKA per 1 RON. The ignition point must not be retarded more than 6° CKA.
The ignition correction should be entered by hand on the "engine setting data" information plate.
This results in reduction in power output and increased fuel consumption. In addition, the engine must not be operated at full load. Full ignition advance should be re-set as soon as fuel of the specified octane number is available.

2) Test at 3500/min

3) Vehicles with catalytic converter must be operated with unleaded fuel.

4) This value must be identical with and wrthout vacuum when engine is at normal operating temperature; test ignition advance in warm-up phase if necessary (15-543).

National version (USA)

Engine	Version	Production breakpoint/ Model year	Distributor ignition control module Part No. alternatively	Engine speed in 1 imin	Resistance trimming plug setting type of fuel [7])	**Ignition point** in °CKA BTDC **without** vacuum	**Ignition point** in °CKA BTDC **with** vacuum
102.985	(AUS)	1991	010 **545 93 32** alternatively 010 **545 94 32**	**3200**	Reference resistor 1.3 kΩ (manual transmission) **2.4** kΩ (automatic transmission)	16-21 [9])	39-43 [9])
				At idle		8-12	8-12

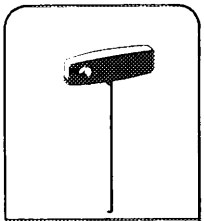
CKA = CranK Angle

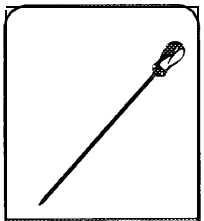
Engine	Version	Production breakpoint/ Model year	Distributor ignition control module Part No. alternatively	Engine speed in 1 min	Resistance trimming plug setting type of fuel [7]	**Ignition point** in °CKA BTDC **without** vacuum	**Ignition point** in °CKA BTDC **with** vacuum
102.985	0 (USA)	1987/1988	005 545 30 32 005 545 32 32	at idle	Reference resistor 750 Ω	14-18	14-18
				3200		25–29	39-43
102.985		1989	007 545 47 32 [5][6] 007 545 48 32 [5][6]	at idle		18-12	18-12
				3200		23-27	39–43
102.985		1991	010 545 59 32 010 545 60 32	at idle		8-12	8-12
				3200		22-26 [9]	39–43 [9]
				at idle	Reference resistor 1.3 kΩ (manual transmission) 2.4 kΩ (automatic transmission)	8-12	8-12

1) Manual transmission.
2) Automatic transmisison.
3) Intake air temperature sensor connector unplugged.
4) Resistance trimming plug setting results from adjustment.
5) These ignition control modules may also be Installed in vehicles prior to 08188. In this case, the ignition point values alter as shown in the table. Resistance trimming plug setting "7" is no longer permitted with these ignition control modules.
6) Test ignition point at 80 °C engine coolant temperature by unplugging the temperature sensor connector B11/2 and feeding in 320 Ω with resistance decade between green/black cable (4-pin coolant temperature sensor coupling, contact 1) and engine ground.
7) Vehicles fitted with catalytic converter must be operated with unleaded fuel. S = premium grade fuel; N = regular grade fuel.
8) Reference resistor (∞ Ω resistance) not fitted to vehicles with ignition control module 003 545 70 32.
9) For testing, unplug the intake air temperature sensor and engine coolant temperature sensor connectors. Test ignition point at 80 °C engine coolant temperature by feeding in 320 Ω with resistance decade between contact 1 at 4-pin connector and engine ground.

Note
Ignition control module with ignition map for manual and automatic transmission (activated by different resistance trimming plugs), boiling protectton correction (max. 5° CKA), intake air correction (max. 7° CKA) and safety retarded setting (6° CKA) in event of open circuit to resistance trimming plug.

Special tools


000 589 14 11 00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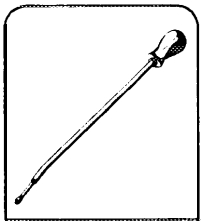
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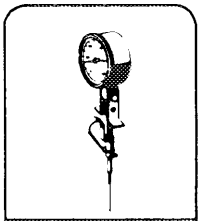
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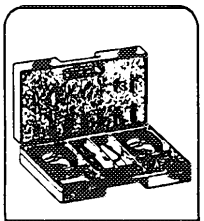
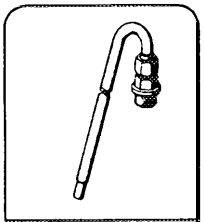

201 589 00 99 00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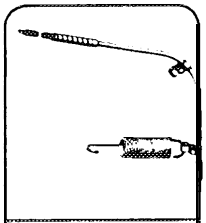
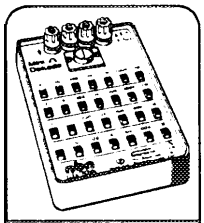

126 589 11 63 00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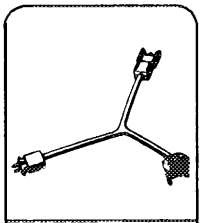
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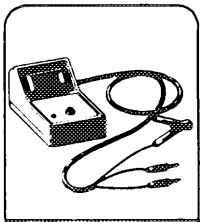

124 589 19 21 00

Commercially available testers

CO measuring instrument		
Engine tester (rpm, dwell angle, ignition angle, oscilloscope, voltmeter)	e. g.	Bosch, MOT 002.02 Sun, 1019
Lambda control tester	e. g.	Hermann, L 115
Multimeter	e. g.	Sun, DMM-5
Twin socket	e. g.	Hermann, ECD 53

Shop-made tool

Intake pipe DIN 19534 DN 100 for volume air flow sensor	length approx. 500 mm
Seal	e. g. from air cleaner

Note

Test and adjust lambda control with a lambda control tester.

The lambda control and the idle speed emissions level must not be tested when the engine is very hot, e. g. immediately after driving sharply or after measuring engine output on the dynamometer.

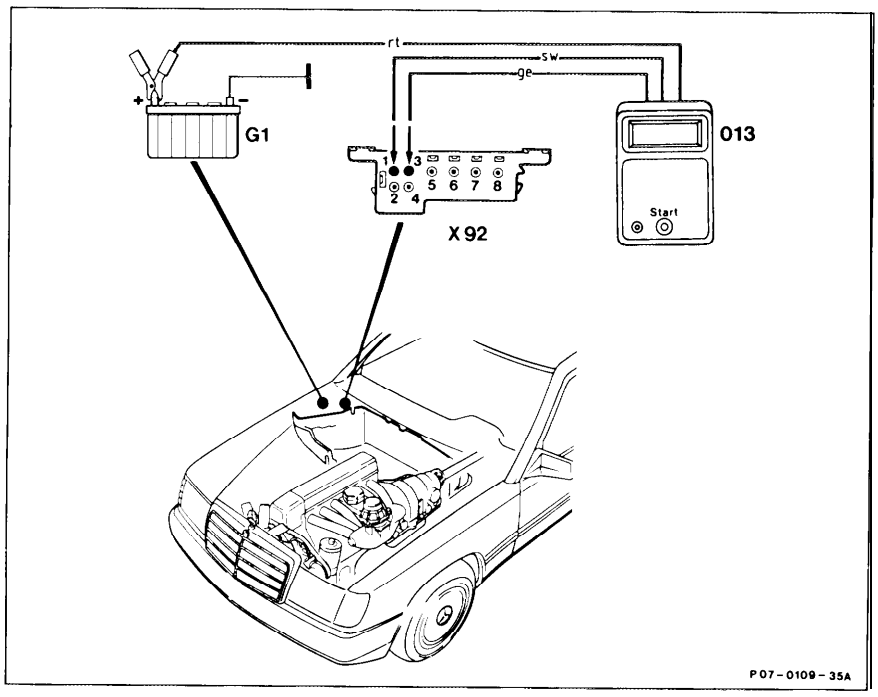
CAUTION!

Engines 102.96/98 as of 09/89 or model year 1990 with DTC memory

If an engine running problem exists, read out the DTC memory as part of Op. No. 07-1 100 and note the DTCs (see 07.3-1 21, section D) before performing any repairs.

This ensures that a distinction is made between real DTCs and "simulated DTCs" as DTCs are stored when performing test work with the engine running, which may result from a simulation or from wiring being disconnected.

The DTC memory must be erased after completing the test work.



Testing, adjusting

1 Complete measurement sheet.

2 Switch off air conditioning or automatic climate control. Move selector lever into position "P".

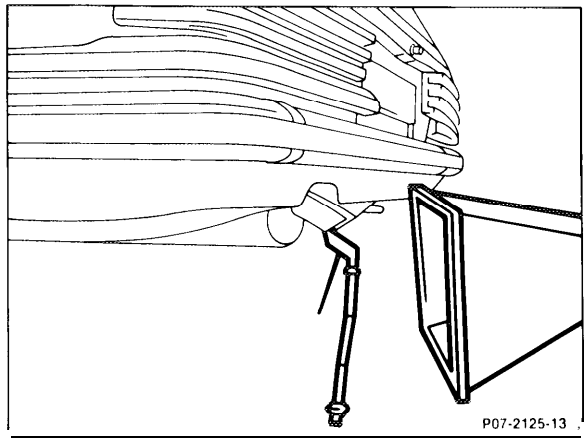
3 Read out DTC memory, note DTCs. Connect impulse counter scan tool (013) to diagnostic connector (Xl 1/4) and battery (G1) for this step. Ignition: **ON.** Press start button for 2 – 4 seconds.

Pulse readout 1: no malfunction.
Other DTC readouts: see 07.3-l 21, section " D".
(USA) California 1988 and (USA) 1991, see 07.3-l 21, section "F".

Again press start button for 2 – 4 seconds to display any further DTCs.
No readout: no further DTC stored.

4 Connect testers:
oil remote thermometer (018) 124 589 07 21 00
lambda control tester (012)
twin socket (031)
trigger clamp (011)
exhaust probe (005) 126 589 11 63 00
CO measuring instrument (006)
engine tester with oscilloscope (030)
multimeter (003)
test cable (033) 102 589 04 63 00.

5 Position extraction device (014) at exhaust tail pipe.



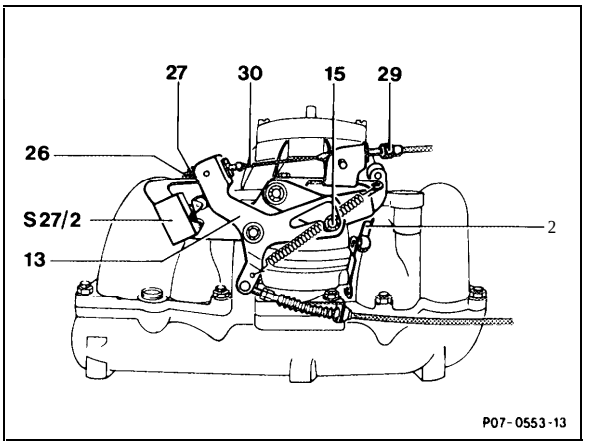
6 Check engine coolant level, adjust to correct level.

7 Check engine oil level, pay attention to condition of oil (visual inspection).

8 Take off air cleaner.

9 Check ease of movement and condition of throttle control linkage and throttle valve. Grease all bearing points and ball sockets (30-335).

10 Check fulcrum lever, adjust.
Check whether the roller (15) in the fulcrum lever (13) is resting free of tension against end stop. Adjust fulcrum lever (13) with the connecting rod (2), if necessary, so that the roller (15) is resting free of tension against end stop.



Engine 102.96/985

11 Idle stop.
Check whether the throttle valve is resting against idle stop. Disconnect connecting rod (2) for this step. Adjust throttle control (30-300).

Engines with cruise control only.
Check whether the actuator is resting against idle stop of cruise control by pressing the lever of the actuator clockwise against idle stop at cruise control. When attaching the connecting rod (21), ensure that the lever of the actuator is lifted approx. 1 mm off the idle stop at the cruise control. Adjust tie rod, if necessary. Adjust throttle control (30-300).

12 Check wide open throttle stop from the accelerator pedal, adjust (30-300).

13 Voltages
Test (battery and ignition coil):

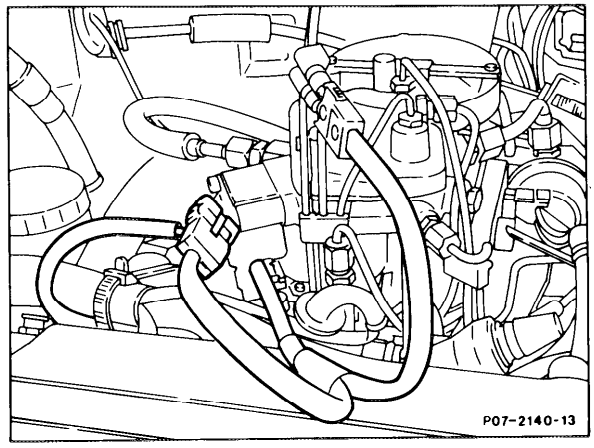
No-load voltage

Connect voltmeter to the battery, paying attention to the polarity, and take reading of voltage. Specification: 12.2 volts.

Ignition coil

Switch on ignition with engine not running. Test the voltage terminal 15 to ground at contact 5 of diagnostic connector.
Specification: battery voltage
Test difference in voltage between terminal 15 and terminal 1 at contacts 5 and 4 of diagnostic connector.
Specification: 0 volts
If the specified values are not reached, test ignition system (15-540 or 15-542).

. 14 Test current at actuator with ignition switched on by detaching coupling at actuator and inserting test cable 102 589 004 63 00 into the circuit. Connect multimeter, set to mA (see table).
On Std. version, detach connector at engine coolant temperature sensor.
If the specified values are not reached, test electrical components (07.3-I 21).



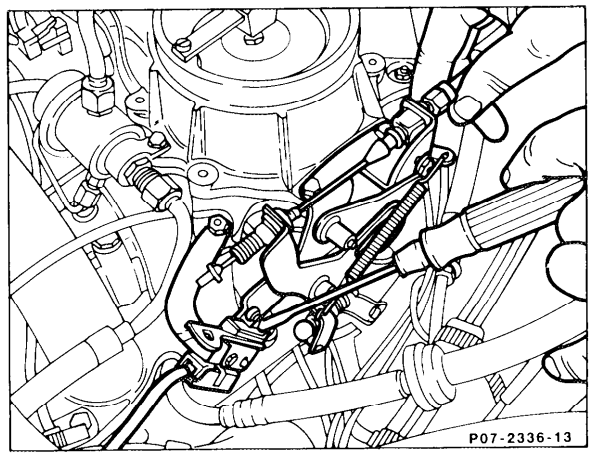
15 Test ignition point and vacuum advance (see table). For TSZ version, test centrifugal advance.

If the specified values are not reached, test ignition system (15–540/542).

16 Check oil level in automatic transmission.

17 Test deceleration shut-off (engine coolant temperature > 50 °C).

Hold engine speed at a constant > 3000/min. Operate microswitch by hand; this must cause the engine to saw.



Electrical test of deceleration shutoff, see 07.3-I 21.

Check fuel pressures and internal leaktightness if necessary, see 07.3-I 20, section "C".

18 Run engine to raise oil temperature to approx. 80 °C.

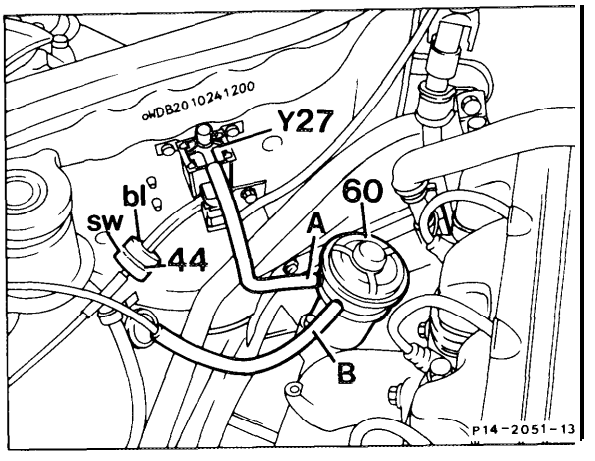
19 Analyze oscilloscope image (15–525).

20 Check intake system for leaks. Fit "shop-made intake pipe" to fuel distributor before spraying. Spray all sealing points with ISO octane DIN 51 756 or cleaning petroleum. CO rise < 2%.

⚠WARNING!
Do not use commercially available fuel for spraying (risk of harmful vapors). Pay attention to fire hazard and do not spray onto glowing parts or parts of the ignition system.

21 Check function of exhaust gas recirculation valve.

Detach both vacuum lines at the exhaust gas recirculation valve (60). Connect tester to EGR valve (connection A, red) and pressurize with vacuum. If there is not a clear deterioration in engine running, replace exhaust gas recirculation valve. Check valve actuation, if necessary (14-100).
(USA) 1991: check exhaust gas recirculation, see 14-475.

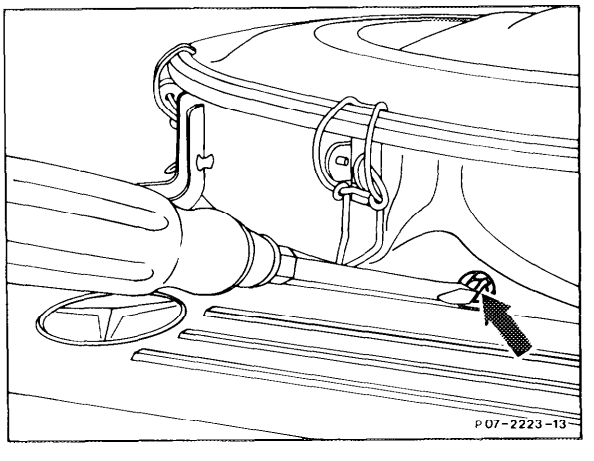


22 Install air cleaner.

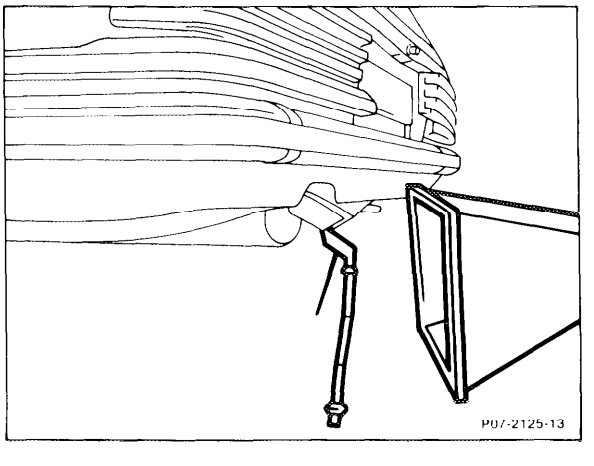
23 Test idle speed (see table).

Note
The idle speed of engines fitted with electronic idle speed control cannot be adjusted. If the idle speed varies, test electronic idle speed control (07.3-I 12).

Engine 102.961 without idle speed control:
Adjust engine speed with the idle air screw (arrow).
Check idle stop at throttle body assembly when performing this step.



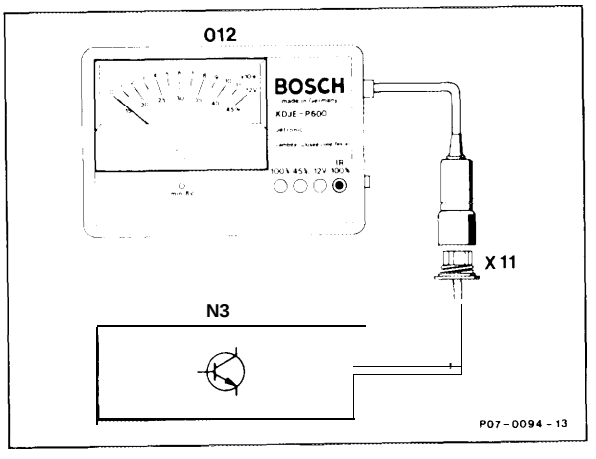
24 Test idle emissions level (see table).
Measured at exhaust tail pipe. Setting idle emissions level, see step 25.



25 Test lambda control (see table).

Note
The readout must fluctuate during the measurement. If a constant value is indicated, there is a fault in the lambda control, e. g. exhaust sensor disconnected.

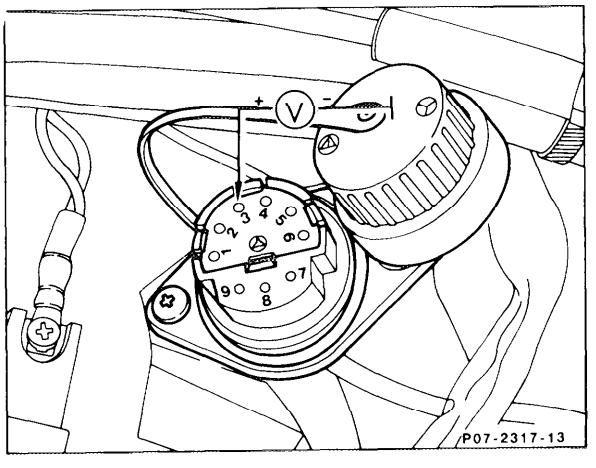
See “Testing electrical components of CFI system” (07.3-I 21) for trouble diagnosis.



b) Measuring voltage with multimeter or lambda control tester (12 **volt position) at contact** 3 **of diagnosis socket to ground.**

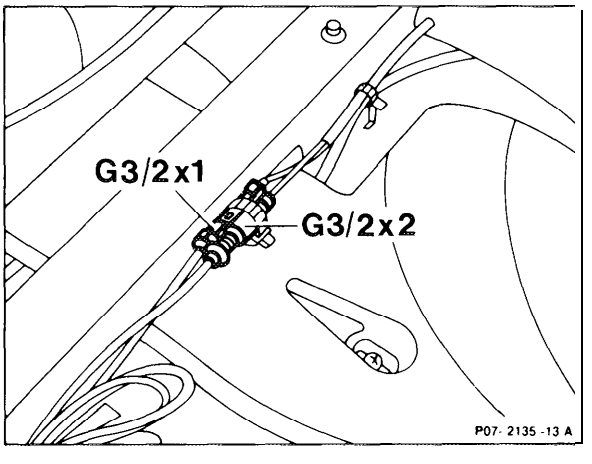
Engine 102.961 (USA) 1984
Engine 102.985 (USA) 19851986

Test value: 2.1-4.8 **volts**



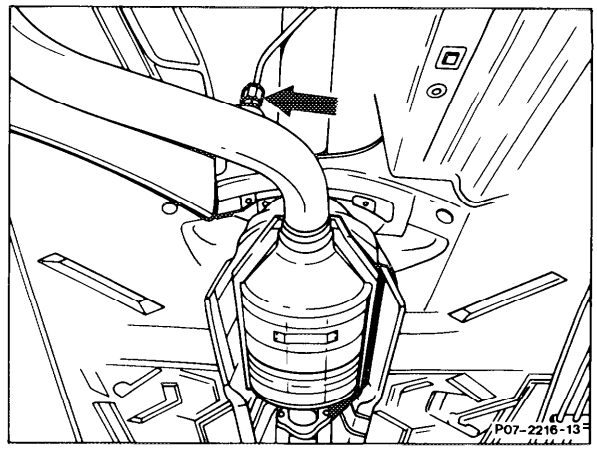
Switch off all auxiliary components.
Detach oxygen sensor signal plug connection (G3/2x2). Take reading of control value (e. g. 3.3 volts). Readout must not fluctuate.

Plug together heatedoxygen sensor signal plug connection (G3/2x2) – readout fluctuates. Test value must vary not more than ± 0.8 volts from the control value. Variation > 0.8 volts, set control value.



26 Adjust idle emissions level and lambda control (see table).

Measuring point (arrow) for Std. KAT (open-loop), upstream of catalytic converter.



Remove anti-tamper plug (4) with the extractor.

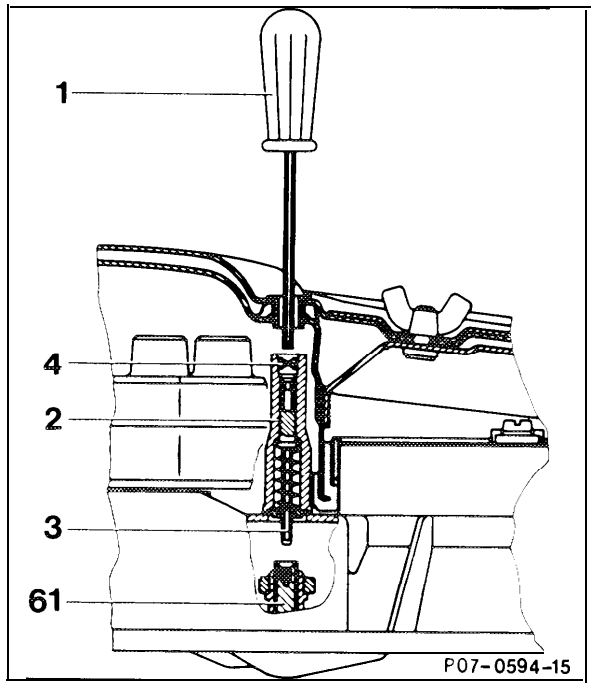
Insert a screwdriver (1) through the recess on the top of the air cleaner onto the adjusting device (2). Press the adjusting device down with the screwdriver against the spring force, turn it slightly until the hexagon head (3) engages in the mixture regulating screw (61).

Turning to the left = leaner – on/off ratio/ voltage rises.

Turning to the right = richer – on/off ratio/ voltage drops.

After each adjustment, blip throttle slightly; re-adjust if necessary.

After adjusting, insert a blue anti-tamper plug (4), Part No. 000 997 59 86, with the inserting drift.



1 Screwdriver
2 Adjusting device
3 Hexagon head
4 Anti-tamper plug
61 Mixture regulating screw

27 Check smooth engine running by moving selector lever into Drive mode, switching on air conditioning/automatic climate control, turning power steering to full lock. The engine must continue to run smoothly.

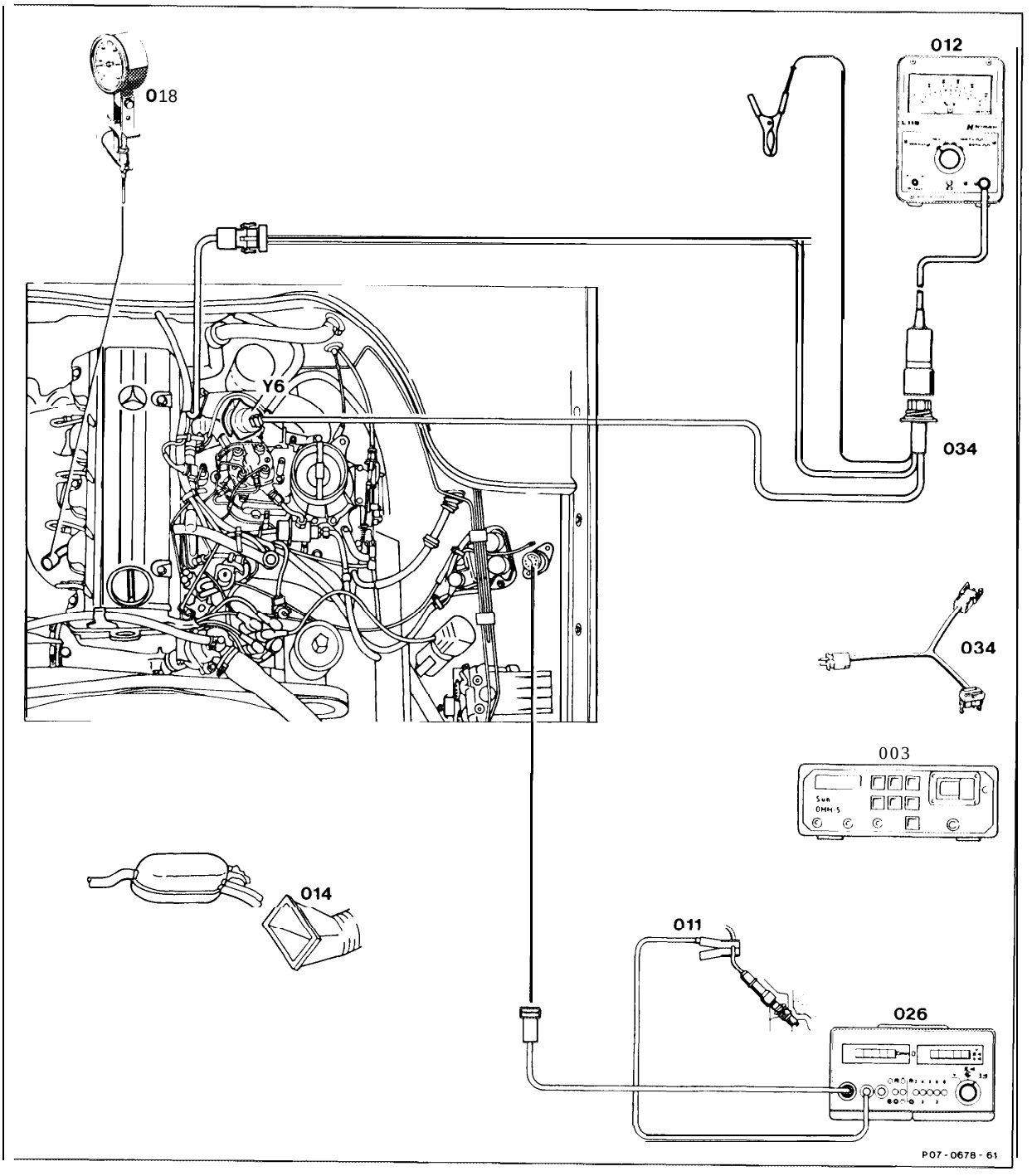
28 Erase fault memory (engines 102.96198 as of 09189).

Press start button on pulse counter when pulse indicated for 6 – 8 seconds. If a number (greater than 1) then continues to be displayed, a further fault is stored. Press start button again for 6 – 8 seconds to erase.

Note
Each pulse indicated must be erased **individually.**

07.3-l 12 Testing electronic idle speed control

Preceding work:
Testing, adjusting engine (07.3-l 10)



Air conditioning or automatic climate control	switch off.
Selector lever	in position "P" or "N".
Testers	connect: oil remote thermometer (018) trigger clamp (011), engine tester (026).
	Vehicles up to 09/89 and model year 1990: Connect test cable (034) to idle speed air valve (Y6). 2-pin: test cable 103 589 00 63 00 3-pin: test cable 102 589 14 63 00 Fit on ground clamp. Connect lambda control tester (012).
	Vehicles as of 09/89 and model year 1990: Connect multimeter (003) to idle speed air valve (Y6) via test cable (033) 102 589 04 63 00.
Extraction device (014)	position at exhaust tail pipe.
Engine oil temperature	approx. 80 °C.
Electronic idle speed control	test (see table). As of 09/89 and model year 1990: wait at least 28 seconds after start before measuring (heating speed).
Control range	test at idle speed (see table).
Smooth engine running	test by switching on all ancillary components.

Test and adjustment data

National version

(USA) black information plate

Engine	Version	Model year	Idle speed 1/min	Idle speed Control range	Idle speed air valve connection	Test programme, see section

Engine	Version	Model year	Idle speed 1/min	Idle speed Control range	Idle speed air valve connection	Test programme, see section
102.961	(USA)	1983/84	**720 ± 50**	25-3 1%	3-pin	"a"
102.983		1986-I 989	900 ± **50**	35–45%	2-pin	" b"
102.985		198511986	720 ± 50	25-3 1 %	3-pin	" a"
102.985		1987/1988	750 ± 50	36–50%	2-pin	"b"
		1991	700–800	580 ± 50mA [2])		

[1]) With A/C compressor.

[2]) Current measurement at idle speed air valve with multimeter (wait at least 28 seconds after start before measuring, heating speed).

[3]) All national versions with KAT. National versions without KAT, see basic version.

Special tools

Test cable for Lambda control tester				
102 589 14 63 00	201 589009900)	103 589 00 63 00	124 589 07 21 00	102 589 04 63 00

Commercially available testers

Engine tester (rpm, dwell angle, ignition angle)	e. g.	Bosch, MOT 001.03 Sun, Hermann
Lambda control tester	e. g.	Hermann, L 115
Multimeter	e. g.	Sun, DMM-5

a) Idle speed air valve with 3-pin connection

Key to symbols

Socket box

Lambda control tester

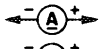
Battery

Multimeter

Contact

Connector

Voltage measurement (volts, direct voltage)


Current measurement (amperes, direct current)

Resistance measurement (ohms)

Note

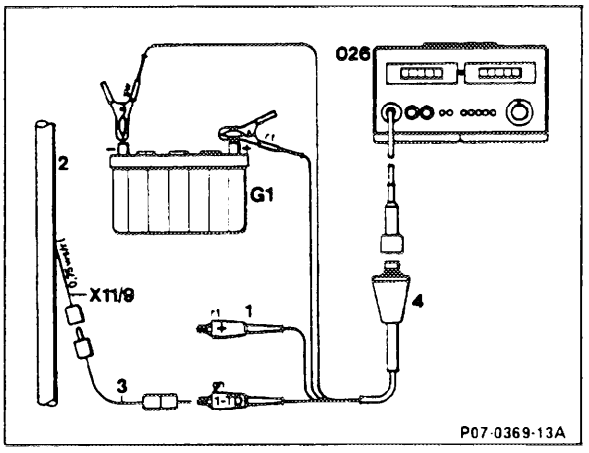
- Wiring diagrams 07.3-128.
- If the specified value of a test step, e. g. step 4.0, is in order, it is not necessary to perform test step 4.1. Different component designations are possible depending on the wiring diagram or vehicles with optional equipment. These designations are given in parentheses. This has no effect on the test (connections, specified value).
- Idle speed control is independent of the air flow sensor potentiometer.
- Engine speed increases when the coupling is disconnected from the decel fuel shutoff microswitch.
- Test TD signal if readout on tester fluctuates and engine surges.

Pest conditions:

- Intake system without leaks.
- Slide in idle speed air valve operates freely.
- Engine oil temperature approx. 80 °C.
- Coolant temperature sensor, decel fuel shutoff microswitch and idle speed detection throttle valve switch (RÜF, KAT) in order (07.3-I 21).

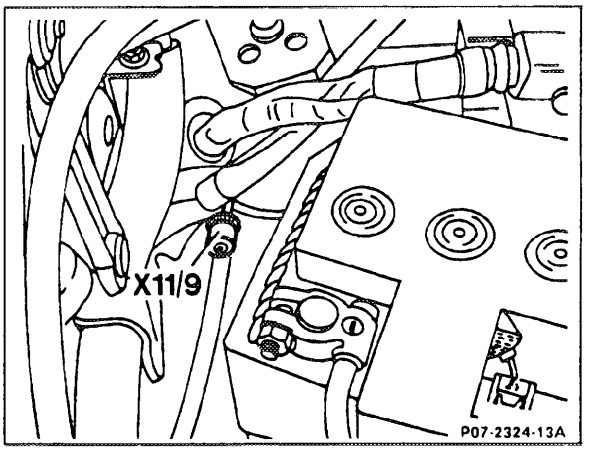
- **Engine 102.983 Std.**

  Connect engine tester test cable (4) to test connection of idle air control valve Xl 1 9.



1 is not connected
2 Engine wiring harness
3 Test cable from set 201 589 00 99 00
4 Engine tester test cable
026 Engine tester
G1 Battery
Xl 1/9 Idle air control valve test connection

The idle air control valve test connection Xl 1/9 is located on the right in the component compartment.



On/off ratio display	Test step/ Test scope	Equipment/ Test connection	Operation/ Requirement	Specification Function	Possible cause/ Remedy
–	1.0 Idle air control valve (Y6) control range	Connect test cable to idle speed air valve. Connect lambda control tester or engine tester.	Engine at idle.	see table	Set specified value at bypass screw. Idle speed air valve Open circuit to idle air control valve. Closed throttle contact (see 07.3-l 21). Deceleration shutoff microswitch (see 07.3–121). TD signal (test step 3.0) CFI control module
	1.1 Idle air control valve voltage supply	Y6 ⊥ (V) 2	Coupling at Y6 detached. Ignition: **ON**	11–14 V	Fuse in overvoltage protection relay faulty or not inserted. Lead to contact 1 (terminal 30) has open circuit. Overvoltage protection control at contact 6 (terminal 15) has open circuit. Lead from overvoltage protection, contact 5 (terminal 31, ground) has open circuit. Lead from overvoltage protection, contact 2 to idle air control valve coupling, contact 2 has open circuit.
	1.2 Idle air control valve control	Y6 1 (V) 2 Y6 3 (V) 2	Coupling at Y6 detached. Ignition: ON	11–14 V 11–14 V	Test cable between CFI control module, terminal 20 and battery ground.
	1.3 Cable	Y6 1 (Ω) 4 Y6 3 (Ω) 3	Coupling at Y6 detached. Ignition: OFF	< 1 Ω < 1 Ω	Cable has open circuit. Cable has open circuit.

On/off ratio display	Test step/ Test scope	Equipment/' Test connection	Operation/ Requirement	Specifi-cation Function	Possible cause/Remedy
–	2.0 Idle air control valve resistance	Y6 3 — Ω — 2 Y6 1 — Ω — 2	Ignition: **OFF** Coupling Y6 disconnected.	12 ± 3 Ω 12 ± 3 Ω	Replace idle air control valve.
–	3.0 TD signal	2 — V — 25	Engine at idle. CFI control module connected.	6-12 V	Ignition control module. Wiring.
–	4.0 Selector lever position (for automatic transmis-sion)	16 — V — 1	Engine at idle. Selector lever in position "P". Parking brake applied. Selector lever in position "D".	11–14 V Voltage drops [1]	Starter lockout and reverse light switch (S16/1, 27-130). Test cable open circuit according to wiring diagram.
–	5.0 A/C compressor cut-in signal	2 — V — 19	Ignition: **ON** **AC** compressor switched on	11-14 v	A/C compressor control module (N6). Cable.
	5.1 Cable	N6 4 — Ω — 19	Ignition: OFF N6 detached.	< 1 Ω	Cable has open circuit.

[1]) Voltage may drop to 0 volts on analog Instruments.

b) Idle air control valve with 2-pin connection

Key to symbols

Socket box

Lambda control tester

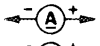
Battery

Multimeter

Contact

Connector

Voltage measurement (volts, direct voltage)


Current measurement (amperes, direct current)

Resistance measurement (ohms)

Note

- Wiring diagrams 07.3–128.

- If the specified value of a test step, e. g. step 4.0, is in order, it is not necessary to perform test step 4.1. Different component designations are possible depending on wiring diagram and vehicles with optional equipment. These designations are given in parentheses. This has no effect on the test (connections, specified value).

- Engine speed increases when the coupling is disconnected from the deceleration shutoff microswitch.

- As of 09/88 and model year 1989: idle speed control with road speed signal. The idle speed is deactivated from approx. 1.4 km/h.
  If the complaint “jerking when car moving with throttle valve closed” is indicated, test the road speed signal (07.3-121).

- As of 09/89 and model year 1990: idle speed control with heating speed. This is activated for not more than 28 seconds after each start (conditions: closed throttle position contact closed and selector lever in position "P" or "N").

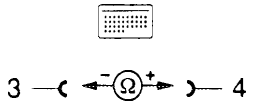
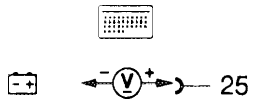
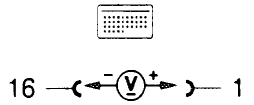
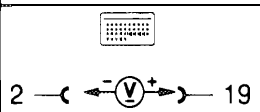
Test conditions

- Engine coolant temperature sensor, decel fuel shutoff microswitch and idle speed detection throttle valve switch (RÜFKAT) in order (07.3-l 21).

- Intake system not leaking.

- Engine oil temperature approx. 80 °C.

On off ratio display	Test step/ Test scope	Equipment/ Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
	1.0 Idle air control valve (Y6) control range	Connect test cable 102 589 14 63 00 to idle speed air valve (Y6). Connect lambda control tester. As of 09/89 connect test cable 102 589 04 63 00 and multimeter (current measurement).	Engine at idle.	see table	Readout 0% or 100% or 0 mA: Voltage supply, see test step 1.1. Open circuit to idle air control valve, idle speed contact (see 07.3-I 21). Decel fuel shutoff microswitch (see 07.3-I 21). TD signal (see test step 4.0). Air flow sensor potentiometer (see 07.3-I 21). CFI control module.
	1.1 Idle air control valve (Y6) voltage supply	Y6 ⊥ V 2	Coupling at Y6 disconnected Ignition: **ON**	11–14 V	Fuse in overvoltage protection faulty or not inserted. Cable to contact 1 (terminal 30) has open circuit. Overvoltage protection control at contact 6 (terminal 15) has open circuit. Cable from overvoltage protection contact 2 (terminal 87) to idle speed air valve has open circuit. Cable from overvoltage protection contact 5 (terminal 31) to ground has open circuit.
	1.2 Cable	Y6 3 Ω 3	Y6 disconnected.	< 1 Ω	Cable has open circuit.
	1.3 Cable	Y6 4 Ω 4	Y6 disconnected.	< 1 Ω	Cable has open circuit.
	1.4 Ground	20 V +		11-14 v	Battery ground (W10) loose, cable has open circuit.

On/off ratio display	Test step/ Test scope	Equipment/ Test connection	Operation/ Requirement	Specification/ Function	Possible cause/ Remedy
–	2.0 Idle air control valve (Y6)		Coupling at Y6 disconnected. Briefly apply battery voltage to Y6.	Idle air control valve switches audibly.	Idle air control valve.
–	3.0 Idle air control valve (Y6)		Ignition: OFF	20-30 Ω	Idle air control valve. Wiring.
–	4.0 TD signal		Engine at idle.	6-12 V	Wiring has open circuit.
–	5.0 Selector lever position (with automatic transmission)		Engine at idle. Selector lever position "P". Parking brake applied. Selector lever position "D".	11-14 v Voltage drops [1]	Starter lockout and reversing light switch (S16/1, 27–130). Test open circuit according to wiring diagram.
–	6.0 A/C compressor cut-in signal		Engine at idle. A/C compressor switched on.	11-14 v	AC compressor control module (N6) Cable (USA) pressure switch compressor cutoff (S3 1). Test open circuit according to wiring diagram.

1) Voltage may drop to 0 volts on analog instruments.

07.3-l 17 Determining fuel consumption by test drive

1 Park vehicle on level ground and fill fuel tank fully in the presence of the customer.

2 Driving distance approx. 100 km (60 miles.), of which approx. 40 km (25 miles.) on highway and approx. 60 km (37.5 miles.) on main roads and in town.

3 After test drive, fill fuel tank again full and calculate fuel consumption.

Example

Fuel consumption in liters/l 00 km

$$= \frac{\text{Fuel consumed in liters}}{\text{km driven}} \times 100$$

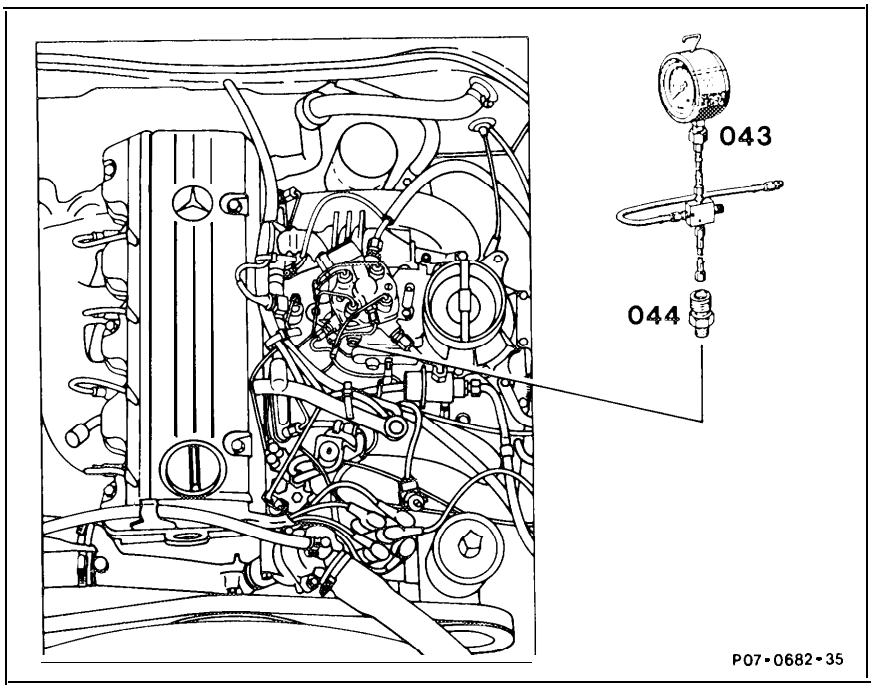
Fuel consumption in miles/gallon

$$= \frac{\text{miles driven}}{\text{fuel consumed in gallons}}$$

07.3-I 20 Testing fuel pressure and internal leaktightness

Preceding work:
Testing, adjusting engine (07.3-1 10)

Basic and national versions



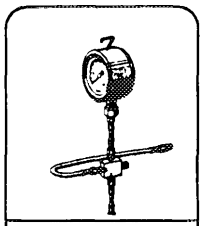
All fuel connections	check for leaks.
Ease of operation of air flow sensor plate and control plunger	check.
Pressure gauge (043)	connect. Special tool 103 589 00 21 01.
Double fitting (044)	connect. Special tool 102 589 06 63 00.
System pressure	test.
Lower chamber pressure	test.
Deceleration shut-off	test.
Acceleration enrichment	test.
Fuel distributor and fuel pump	test for leaks.

Fuel pressures in bar gauge

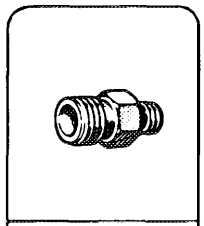
Engine			102.961
Version			I USA
System pressure when engine cold or engine at normal operating temperature			5.3–5.5
Lower chamber pressure	when engine at normal operating temperature	approx.	0.4 [1])
	with connector of engine coolant temperature sensor disconnected		1.0-1.3 [1])
	at engine coolant temperature of + 20 °C, engine stationary or idling	approx.	0.5 [3]) 0.4 [2])
	at engine coolant temperature of + 20 °C and acceleration enrichment		≥ 3.8
	at wide open throttle enrichment and engine at normal operating temperature	approx.	0.05 [3])
	with deceleration shut-off		5.3–5.5 [4])

[1]) Below previously measured system pressure.
[3]) Below previously measured lower chamber pressure.
[4]) Lower chamber pressure equal to system pressure

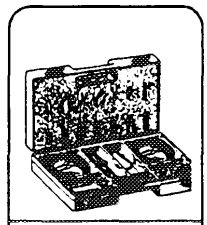
Special tools



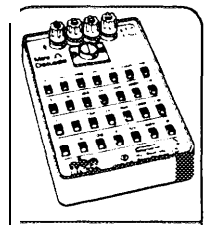
103 589 00 21 00



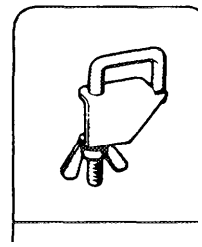
102 589 06 63 00



201 589 00 99 00



124 589 09 63 00



000 589 40 37 00

Commercially available tester	
Multimeter	e. g. Sun, DMM-5

Note

The leak test should only be performed if there exists a problem regarding starting when engine warm.

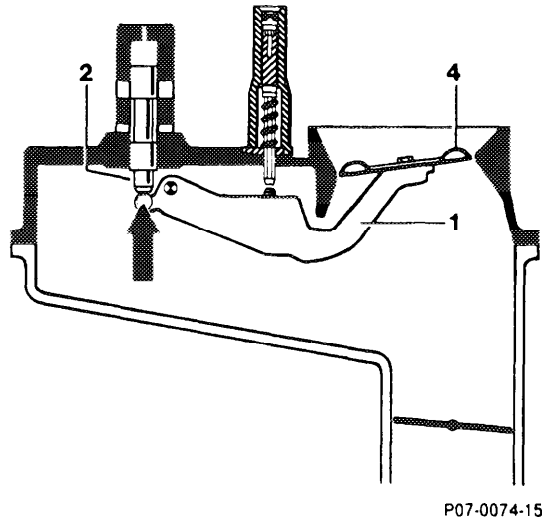
After switching off the engine, the fuel pressure after 30 minutes must still be 3.0 bar.

Visual inspection

1 Remove air cleaner.

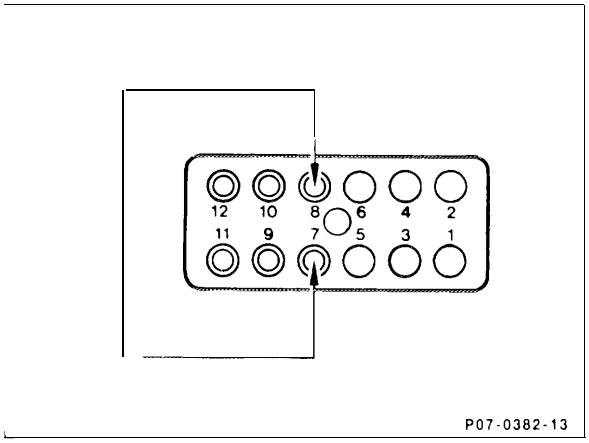
2 Check all fuel connections for leaks.

3 Check ease of operation of control lever (1) together with air flow sensor plate (4) in the air distributor and of the control plunger (2) in the fuel distributor.

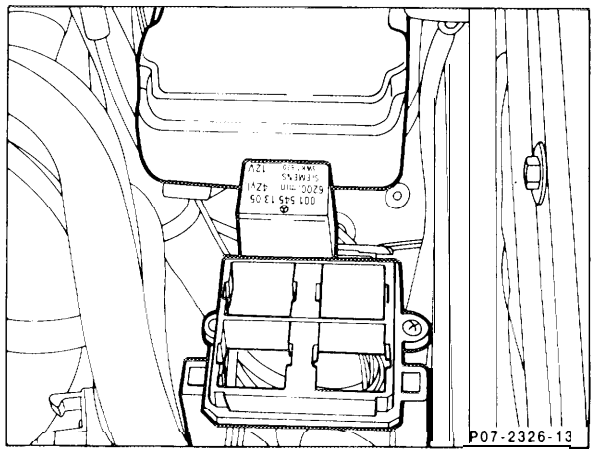


P07-0074-15

This is done by detaching the fuel pump relay module in the right of the component compartment and bridging the two contacts 7 and 8 briefly to build up pressure.



Engine 102.961 in Model 201
The fuel pump relay module is located in front of the electrical center.

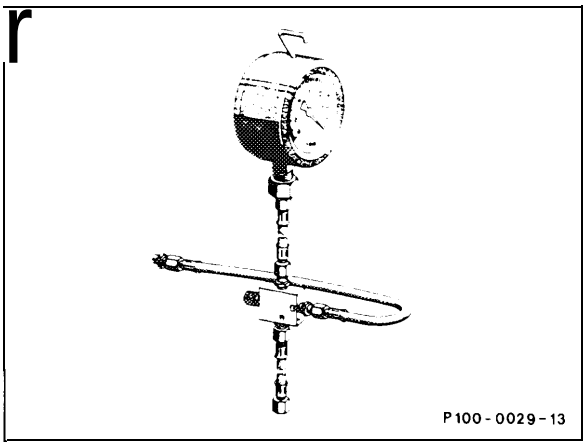


Press air flow sensor plate (4) down by hand. The resistance which is felt must be even over the entire travel. No resistance must be felt when the plate is moved rapidly upward as the slow-moving control plunger lifts away from the control lever (1). During a slow upward movement, the control plunger (2) must follow, maintaining a positive contact.

4 Check control plunger in fuel distributor for leaks.

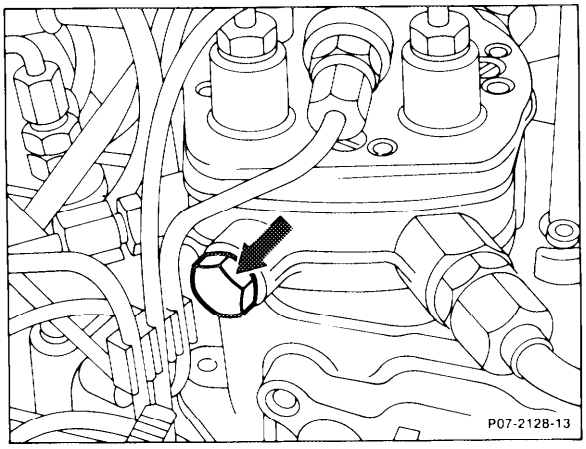
Briefly fully depress air flow sensor plate and hold in this position; a slight leak quantity is permissible (illuminate with endoscope lamp, if necessary).

Connecting pressure measuring device.

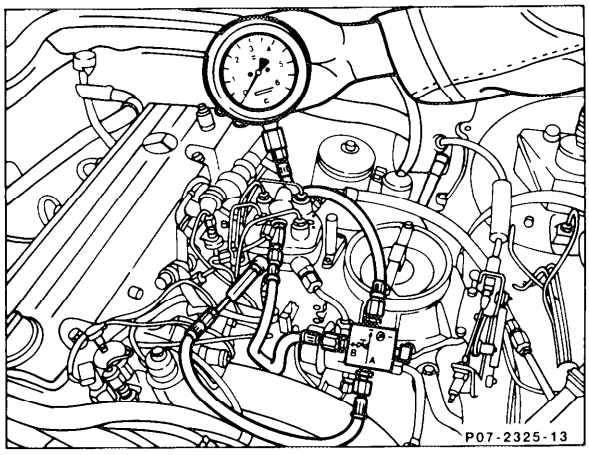


Connection A = Hose line to lower chamber of fuel distributor
Connection B = Hose line to upper chamber of fuel distributor at starting valve

1 Remove screw plug (arrow) on the lower chamber of the fuel distributor.

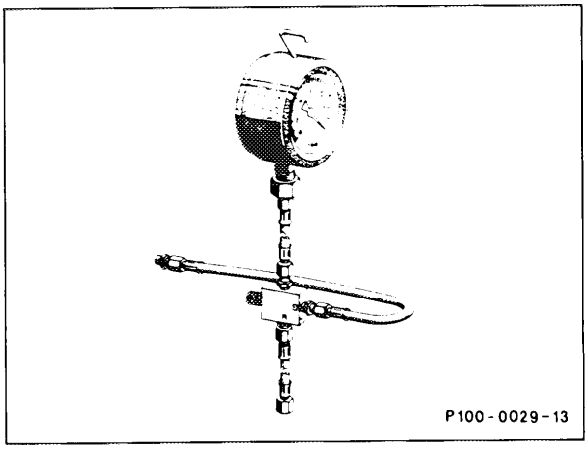


2 Connect hose line from connection “A” on lower chamber.
Use double fitting M8 ×1/M12 ×1.5, special tool 102 589 06 63 00 for this step.



3 Unscrew fuel line for start valve at fuel distributor.

4 Connect hose line from connection "B" at fuel distributor.



5 Position of valve screws:

a) System pressure

Pressure measuring device = open valve screw.

b) Lower chamber pressure

Pressure measuring device = close valve screw.

Testing

The test of the system and of the lower chamber pressure must be performed with the engine running.

Place pressure measuring device on cylinder head cover.

a) System pressure when engine cold or at normal operating temperature

1 Engine at idle.

2 Take reading of system pressure.

Specification:

Engine 102.96/98 5.3-5.5 bar pressure

3 If the specified value is not reached or is exceeded:

Test fuel pump (07.3-130).

Replace diaphragm pressure regulator.

Check that fuel return line is not blocked.

b) Lower chamber pressure with engine at normal operating temperature

4 Take reading of lower chamber pressure.

Specified pressure **at** operating temperature approx. **0.4** bar below system pressure.

If the specified values are not reached:

Test electrohydraulic actuator **(07.3-l** 21).

c) Deceleration shut-off

Engine at normal operating temperature.

5 Valve screw closed.

6 Run engine at idle speed. Briefly increase engine speed to approx. 3500/min. As the engine speed drops, the pressure in the lower chamber must rise to system pressure.

Combustion is restored at approx. 1200 – 1600/min.

If the specified value is not reached:

Test microswitch **(07.3-l** 21).

Test current at actuator **(07.3-121).**

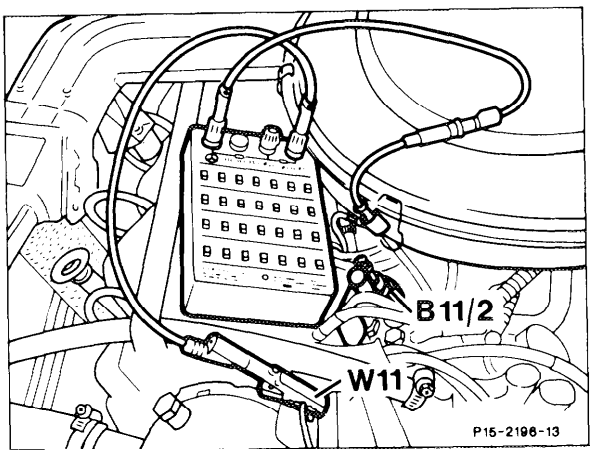
Vehicles up to 09/88 and model year 1989 with cruise control:
Test signal for cruise control operation (Group **54).**

d) Acceleration enrichment

"Engine cold" must be simulated for testing acceleration enrichment.

7 Valve screw closed.

8 Simulate "engine cold" by feeding in 2.5 kΩ with Ω decade, corresponds to approx. + 20 °C, between engine coolant temperature sensor connection cable and vehicle ground.



B11/2 Engine coolant temperature sensor
W11 Engine ground

9 Start engine. Specified value at + 20 °C approx. 0.5 bar below the previously measured system pressure. Increase engine speed sharply to approx. 2500/min. Lower chamber pressure must drop as engine speed increases.

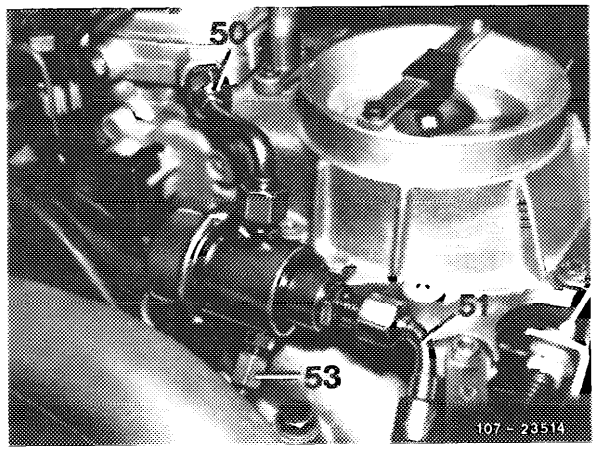
If the specified value is not reached:
Test volume air flow sensor potentiometer (07.3421).
Test current at actuator (07.3421).

Checking fuel system for leaks

1 Switch off engine. The pressure in the system drops below the opening pressure of the injectors (approx. 3.0 or as from 09188 approx. 3.2 bar gauge pressure).

2 If the pressure drops immediately to 0 bar, replace check valve at the fuel pump.

3 If the pressure drops slowly, unscrew fuel return line (51) at the diaphragm pressure regulator. No fuel must flow out subsequently from the diaphragm pressure regulator **(a** slight leak quantity is permissible).



Caution!
If fuel flows out in the fuel return line (51), seal line with a dummy plug.

4 Pinch leak line at the fuel accumulator with a clamp. If the pressure does not drop, replace fuel accumulator (07.3-270).

5 If no leak is found after performing the leak test, check start valve for leaks by removing start valve (07.3-l 24, test step 2.0 and 2.1). Replace fuel distributor (07.3-205).

6 Disconnect pressure measuring device, collect fuel with a cloth.

7 Connect fuel lines, once again run engine and check all fuel connections for leaks.

8 Install air cleaner.

07.3-l 21 Testing electrical components

Preceding work:
Testing, adjusting engine (07.3-1 10)

The individual test steps (e. g. coolant temperature sensor, intake air temperature sensor etc.) are combined in a test program. If a fault is found during the engine diagnosis which relates to an individual test step, it is not necessary to perform the complete test program but only the individual test step.

The test program is divided into the following sections depending on engine version, model year and CFI designation:

A. National version (USA)
(CFI designation: CFI (KE) II)

(USA) Engine 102.961 and engine 102.985 up to model year 1986

B. National version (USA)
(CFI designation: CFI (KE) Ill)

(USA) model year 1987/88 engine 102.985
(USA) model year 1991 engine 102.985

A. National version (USA)
(CFI designation: CFI (KE) II)

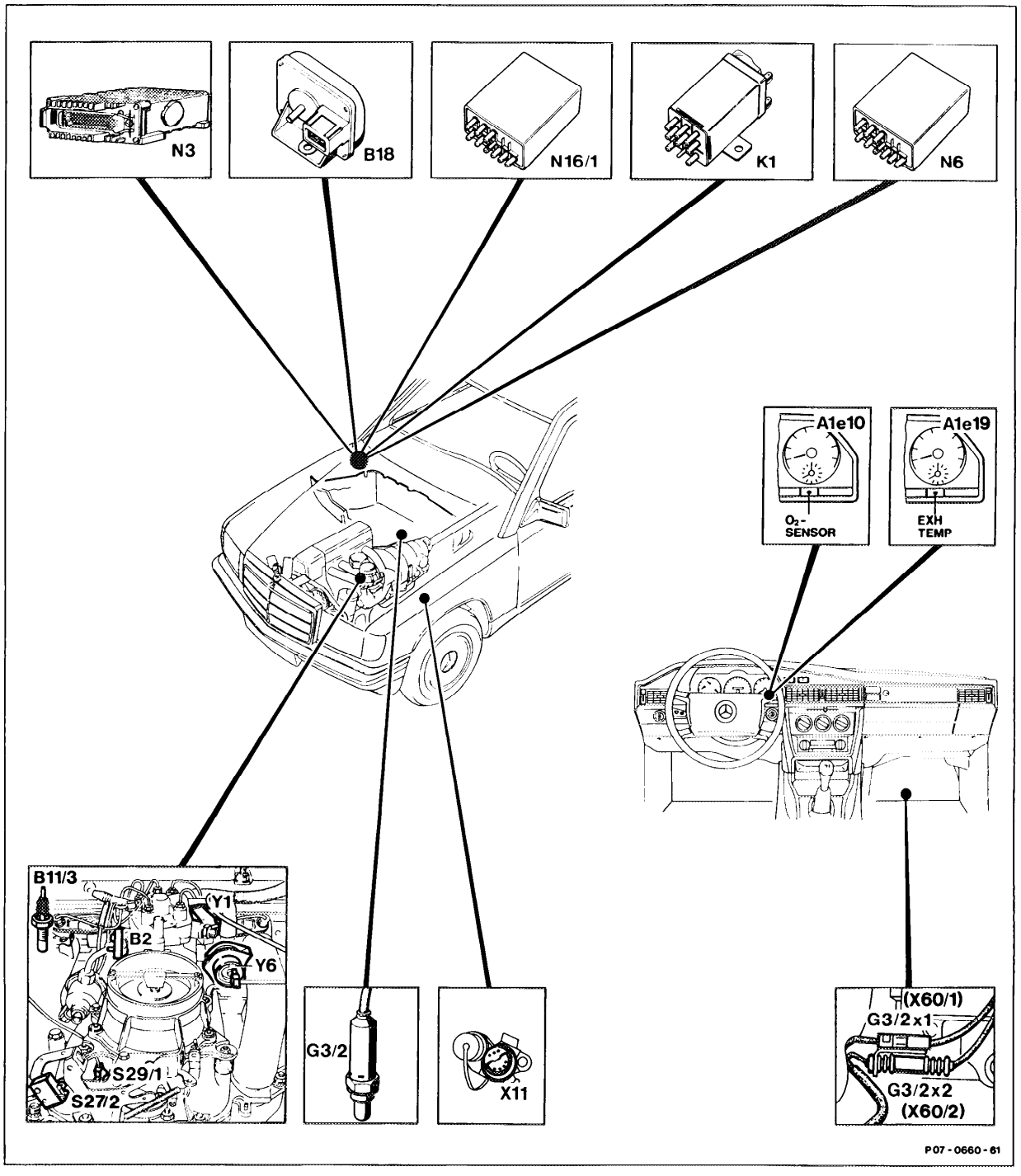
(USA) Engine 102.961 and engine 102.985 up to model year 1986

a) Model survey
b) Arrangement of components
c) Electrical test data
d) Wiring diagrams
e) Pin assignment of CFI control module (N3) coupling
f) Special tools, commercially available tools
g) Connecting testers according to connection diagram
h) Test program with socket box
i) Table of voltage values for engine coolant temperature sensor (B113)
j) Table of barometric pressure sensor (B18)
k) Testing deceleration shut-off

a) Model survey

Model	Engine	Version	Model year
201.024	102.961	(USA)	1984
	102.985	(USA)	1985
	102.985	(USA)	1986

b) Arrangement of components



Ale10	"heated oxygen sensor" malfunction indicator lamp 1984/85: alternating display 1986/87: failure display	N3	CFI control module
		N6	A/C compressor control module
B2	Volume air flow sensor position Indicator	N16/1	Fuel pump relay module ((USA) 1984: (N5/1) in front of electrical center)
B11/3	Engine coolant temperature sensor	S27/2	Deceleration shut-off microswitch
B18	Barometnc pressure sensor	S29/1	Wide open throttle throttle position switch
G3/2	Heated oxygen sensor	Xl 1	Diagnosis connector/terminal block terminal TD
G3/2x1	Heated oxygen sensor connector	Y1	Electrohydraulic actuator
G3/2x2	Oxygen sensor signal connector (1 -pole)	Y6	Idle air control valve
K1	Overvoltage protection relay ((USA) 1984: in electrical center)		

c) Electrical test data (current at actuator in mA)

Engine	National version model year	Ignition: ON	Engine coolant temperature sensor		Post-start enrich-ment	Accelera-tion enrich,-ment	Wide open throttle correction at approx. 2000/min	Partial load mixture adapta-tion
			Engine coolant tempera-ture +20 °C (warm-up base value) Resist-ance 2.3-2.8 kΩ	Engine coolant tempera-ture +80 °C Resist-ance 290-370 Ω	Post-start at +20 °C	Engine coolant tempera-ture +20 °C and blipping throttle		
102.961	(USA) 1984	–	9–14	7–9	20-28	> 15	7–9[1])	Readout fluctu-ates
102.985	(USA) 1985186	–			1–4		8-11	

)eceleration shut-off: current at actuator approx. –60 mA

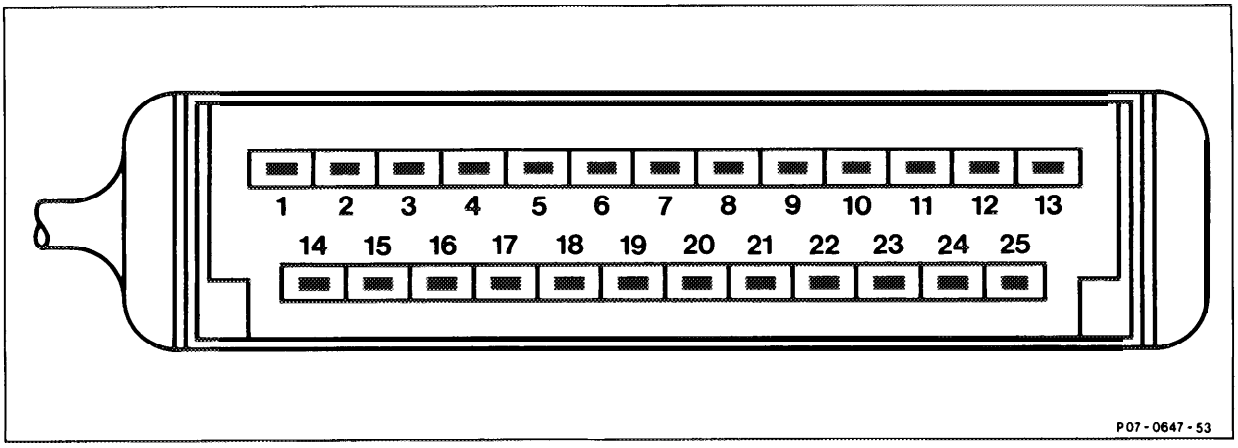
[1]) independent of engine speed

d) Wiring diagrams

The wiring diagrams are assigned to the relevant electrical troubleshooting manual according to the model.

Electrical Troubleshooting Manual Model 201

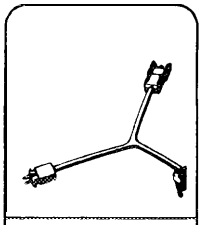
e) Pin assignment of CFI control module coupling (N3)



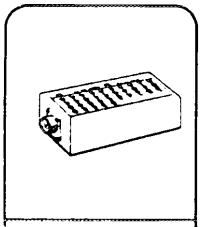
1 Overvoltage protection relay (K1) contact 2, terminal 87
2 Engine ground (W1 1)
(USA) 1984: battery ground (WI 0)
3 Idle air control valve (Y6), contact 3
4 Idle air control valve (Y6), contact 1
5 Wide open throttle/closed throttle position switch (S29/1 or S29/2)
6 Cruise control plug connection
7 Ground of connector 7 is linked internally to ground of connector 2
8 Heated oxygen sensor (G3/2), sensor signal
9 not assigned
10 Electrohydraulic actuator (Y 1)
11 Barometric pressure sensor
12 Electrohydraulic actuator (Y 1)
13 Deceleration shut-off microswitch (S27/2), idle speed detection
14 Air flow sensor potentiometer (B2), contact 1 and Barometric pressure sensor (B18), connector 3
15 not assigned
16 Model 201 **with manual transmission:**
Battery ground (W10)
(USA) 1984 engine 102.961: not assigned
Model 201 with automatic transmission:
(USA) fuel pump wiring harness plug connection (X36/1) contact 3
17 Air flow sensor potentiometer (B2), contact 2
18 Air flow sensor potentiometer (B2), contact 3 looped via Barometric pressure sensor (B18)
19 Compressor cutoff control module (N6)
(USA) A/C compressor pressure switch plug connection (X78)
20 Battery ground (W 10)
21 Engine coolant temperature sensor
22 not assigned
23 Diagnosis connector (XI 1), contact 3 via headlamp wiring harness plug connection (lambda control)
24 Fuel pump relay (N5/1, N5/2, N16/1, N16/2) contact 12, terminal 50
25 Fuel pump relay (N5/1, N5/2, N16/1, N16/2) contact 10, TD signal

f) Special tools, commercially available tools

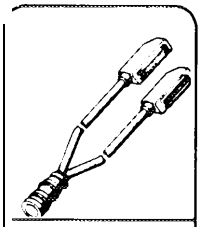
Special tools



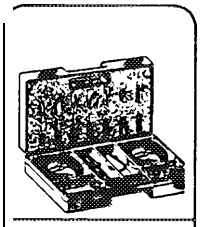
102 589 04 63 00



124 589 00 21 00



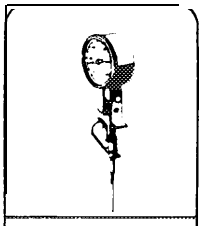
124 589 33 63 00



201 589 00 99 00

Test resistance for testing electrcial components of CFI

102 589 05 63 00



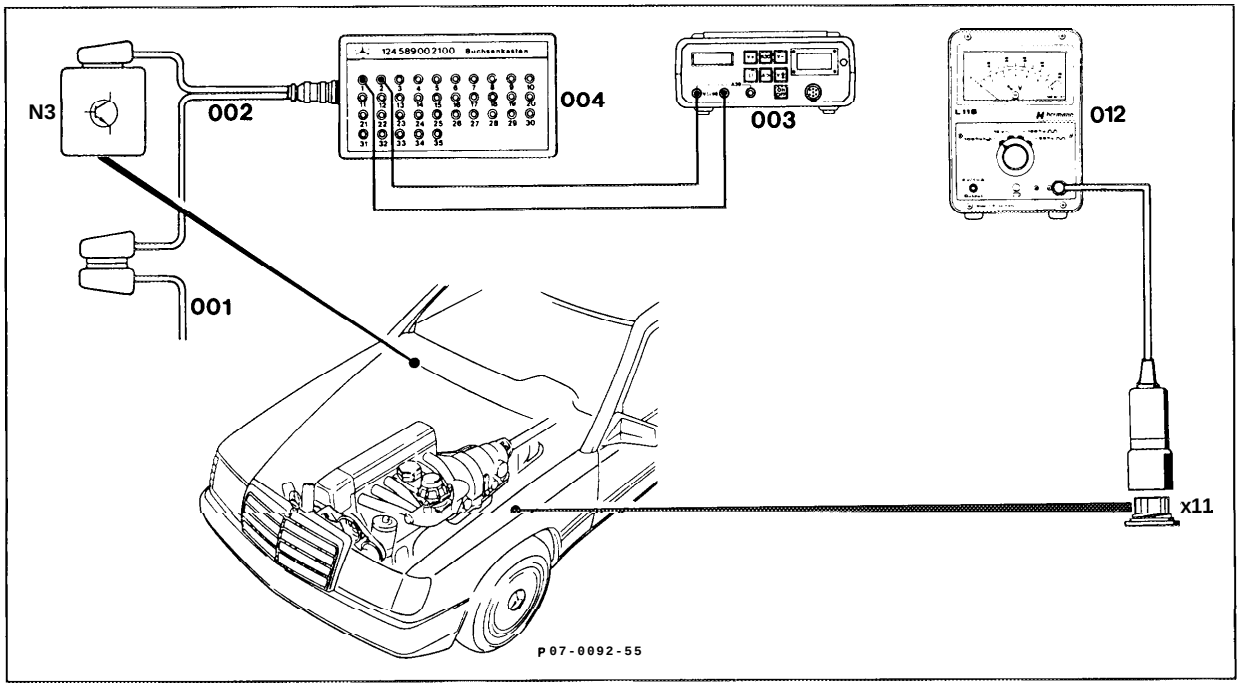
124 589 07 21 00

Commercially available tools

Multimeter	e. g. Sun, DMM-5
Twin socket	e. g. Hermann, ECD 53
Lambda control tester	e. g. Hermann, L 115 e. g. Bosch, KDJE-P 600 [1])
Engine tester	e. g. Bosch, MOT 002.02

[1]) Special tool in USA

g) Connecting testers according to connection diagram



001	CFI control module coupling	033	Test cable 102 589 04 63 00
002	Test cable		
003	Multimeter	N3	CFI control module
004	Socket box	x11	Diagnostic connector
012	Lambda control tester		

h) Test program with contact box

Key to symbols

Socket box

Battery

Multimeter

Contact

 Connector

Voltage measurement (volts, direct voltage)

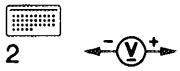
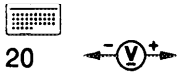
Voltage measurement (amperes, direct voltage)

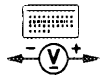
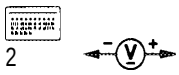
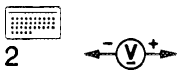
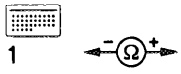
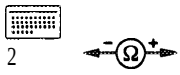
Resistance measurement (ohms)

Note

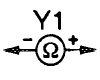
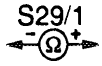
If the specified value of a test step, e. g. step **4.0,** is in order, it is not necessary to perform test step 4.1.

Different component designations are possible depending on the wiring diagram or in the case of vehicles with optional equipment. These designations are given in parentheses.

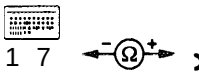
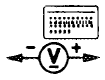
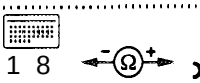
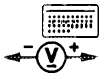
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	1.0 Ground	 2 +	Ignition: ON	11-14 V	Ground connection **W11** loose, cable has open circuit
–	2.0 Ground	 7 +		11-14 V	CFI control module defective
–	3.0 Ground	 20 +		11-14 V	Ground connection **W10** loose, cable has open circuit

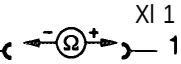
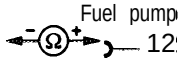
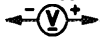
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi-cation	Possible cause/ Remedy
	4.0 Supply voltage from (N3), terminal 15	 2 1	Ignition: ON	11-14v	Fuse in overvoltage protection, overvoltage protection defective or not connected. Cable to contact 1 (terminal 30) has open circuit. Actuation of contact 3 (terminal 15) has open circuit. Cable from contact 2 (terminal 87 or 87E) to (N3) contact 1 has open circuit
	4.1 Cable terminal 30	 K1 (K1/1) 2 1	Ignition: **OFF** Overvoltage protection disconnected	11-14v	Cable has open circuit
	4.2 Cable terminal 15	 K1 (K1/1) 2 6 (3)	Ignition: ON Overvoltage protection disconnected	11-14v	Cable has open circuit
	4.3 Cable terminal 87 or 87E	 K1 (K1/1) 1 2	Ignition: **OFF** Overvoltage protection disconnected	< 1 Ω	Cable has open circuit
	4.4 Cable terminal 31 (ground)	 K1 (K1/1) 2 5	Ignition: **OFF** Overvoltage protection disconnected	< 1 Ω	Cable has open circuit

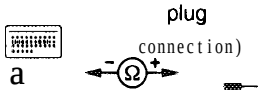
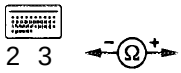
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	5.0 Current at actuator	 set to A	Connect test cable 102 545 04 63 00 to actuator. Ignition: **ON**		Electrohydraulic actuator Wiring CFI control module
			Coupling at engine coolant temperature sensor disconnected	75-105 mA	
			20 °C simulated with test resistance	see table section c), warm-up base value	
			Additionally coupling of Deceleration shut-off microswitch (S27/2) disconnected. Start engine and blip throttle	see table, acceleration enrichment	Volume air flow sensor potentiometer, see test step 9.0
			Coupling of Wide open throttle/closed throttle position switch (wide open throttle contact) bridged. Coupling of Deceleration shut-off microswitch (S27/2) disconnected. Start engine	see table, wide open throttle correction at 2000/min	

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	possible cause/Remedy
–	6.0 Electro-hydraulic actuator	10 — 12	Ignition: QFF Disconnect test cable. Coupling at CFI control module disconnected	19.5 ± 1 Ω	Electrohydraulic actuator Wiring
	6.1 Electro-hydraulic actuator	 Y1 1 — 2	Coupling at (Yl) dis-connected	19.5 ± 1 Ω	Replace electrohydraulic actuator
	6.2 Cable	1 0 — Y1 — 2		< 1 Ω	Cable has open circuit
	6.3 Cable	1 2 — Y1 — 1		< 1 Ω	Cable has open circuit
–	7.0 Wide open throttle contact	1 — 5	Ignition: **OFF** Coupling at CFI control module disconnected Accelerator in wide open throttle position	∞ < 1 Ω	Wide open throttle contact Wiring (to terminal 15)
	7.1 Wide open throttle contact	 S29/1	Coupling of Wide open throttle/closed throttle position switch plug connection disconnected Accelerator in wide open throttle position	00 < 1 Ω	Set or replace throttle position switch
–	8.0 Engine coolant temperature sensor	2 — 2 1	Engine at idle (operating temperature). CFI control module connected	At + 80 °C 0.29– 8.35 v other values see table section 1)	Engine coolant temperature sensor Wiring

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	A 8.1 Engine coolant temperature sensor 1 -pin	B11/3	Coupling at temperature sensor disconnected	Ω value see table section i)	Replace engine coolant temperature sensor
	B 8.1 Engine coolant temperature sensor 2-pin	B11/2	Both couplings at temperature sensor disconnected (measure both contacts)	Ω value see table section i)	Replace engine coolant temperature sensor
	8.2 Cable	2 1 B11/2 (B11/3) Cable gn/rt		< 1 Ω	Cable has open circuit
	9.0 Volume air flow sensor potentiometer	14 18 14 17	Ignition: OFF CFI control module disconnected. Air flow sensor plate in zero position Volume air flow sensor plate in zero position Volume air flow sensor plate deflected	3.2-4.8 kΩ 560-840 Ω 3.8–5.6 kΩ	Replace or set volume air flow sensor potentiometer Wiring CFI control module Barometric pressure sensor, see test step 10.0
	9.1 Cable	1 4 B2 1	Ignition: OFF measure at coupling (B2)	< 1 Ω	Cable has open circuit
	9.2 Cable	1 8 B2 3		< 1 Ω	Cable has open circuit

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi-cation	Possible cause/Remedy
–	9.3 Cable	 1 7 B2 2		< 1 Ω	Cable has open circuit
	9.4 CFI control module	 2 18	Ignition: **ON** CFI control module connected	7.4- 8.6 v	Replace CFI control module
	10.0 Barometric pressure sensor	 7 1 1	Ignition: OFF CFI control module coupling and coupling at volume air flow sensor potentiometer disconnected	Values, see table section j	Wiring Replace Barometric pressure sensor
	10.1 Cable	 1 1 B18 3	Ignition: OFF Coupling at (B18) dis-connected	< 1 Ω	Cable has open circuit
	10.2 Cable	 1 8 B18 2		< 1 Ω	Cable has open circuit
	10.3 Cable	 1 1 B18 1		< 1 Ω	Cable has open circuit
	11.0 TD signal	 2 25	Engine at idle (operating temperature). CFI control module connected	6-12 V	Ignition control module Wiring
	11.1 Cable	 2 5 x11 1	Ignition: OFF	< 1 Ω	Cable has open circuit

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	11.2 Cable	N1/2 TD —  — Xl 1 — 1	Coupling (TD signal) at ignition control module disconnected	< 1 Ω	Cable has open circuit
	12.0 Terminal 50 (start detection)	2 — — 2 4	Starter: **ON** Selector lever of automatic transmission in position "P" or "N"	11–14 V	Cable
	12.1 Cable	Relay Fuel pump 24 —  — 12	Ignition: **OFF**	< 1 Ω	Cable has open circuit
	13.0 Lambda control	— — Xl 1 — 3	Engine at idle (operating temperature). CFI control module connected	2.1-4.8 V Readout fluctuates	Heated oxygen sensor Wiring
	13.1 Heated oxygen sensor	7 — — 8	Engine at idle (operating temperature). CFI control module connected	fluctuates between 0.1–0.9 v	Heated oxygen sensor Wiring
	13.2 Heated oxygen sensor	G3/2x2 (X60/2) (one-pin plug connection) 7 —  —	Engine at idle (operating temperature). Separate plug connection (G3/2x2) and place connector to ground (lean simulation)	> 450 mV	Replace heated oxygen sensor

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	13.3 Cable	7 8	Ignition: QFF Coupling at CFI control module disconnected	∞	Cable defective
	13.4 Cable	G3/2x2 (X6012) (one-pin plug connection)  a		< 1 Ω	Cable has open circuit
	13.5 Cable	 2 3 x11 3		< 1 Ω	Cable has open circuit

i) Table of voltage values for engine coolant temperature sensor

Temperature in °C	Resistance	Voltage at contact 21 coolant (volts)
-20	**15.7 kΩ**	**3.24-3.94**
-10	**9.2 kΩ**	2.04-3.47
0	**5.9 kΩ**	**2.39-2.93**
10	3.7 kΩ	1.94-2.37
20	2.5 kΩ	1.51-l .84
30	1.7 kΩ	1.16-l .42
40	1.18 kΩ	0.88-l .08
50	840 Ω	0.66-0.80
60	600 Ω	0.50-0.61
70	435 Ω	0.38-0.46
80	325 Ω	**0.29-0.35**
90	247 Ω	0.22-0.26

Note

For engine 102.961 only the engine coolant temperature sensor (B11/3) with the Ml4 × 1.5 thread is supplied for parts requirements. When performing repairs, fit the temperature sensor in place of the Ml4 × 1.5 plug.

The previous installation point should be sealed with the Ml 0 × 1 plug,
Part No. 007 604 01 01 02, and seal,
Part No. 007 603 01 01 01.

j) fable of Barometric pressure sensor (B18)

Altitude above sea level/meters	Barometric pressure p absolute/mbar	Voltage at contact 14 (to ground) volts
0	1013	4 ± 1
1000	899	3 ± 1
2000	795	2 ± 1

k) Testing deceleration shut-off

Connection diagram of socket box, see section g)

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	1.0 Deceleration shut-off		Engine speed > 3000 (engine at operating temperature). CFI control module connected Operate deceleration shut-off microswitch (S27/2) by hand	Engine surges	Deceleration shut-off microswitch Wiring CFI control module Check throttle control (30-300)
	1.1 Deceleration shut-off microswitch (S27/2)	S27/2	Coupling at microswitch disconnected	< 1 Ω	Replace microswitch
			Depress accelerator	∞	
		1 — 13	Ignition: **OFF**	< 1 Ω	Wiring
			Depress accelerator	∞	
	1.2 Cable	13 — S27/2 gr/sw		< 1 Ω	Cable has open circuit
	1.3 Cable	1 — S27/2 gr		< 1 Ω	Cable has open circuit to terminal 15

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	2.0 Current at actuator	set to A	Connect test cable 102 545 04 63 00 to actuator. Engine speed > 3000/min. Operate deceleration shut-off microswitch (S27/2) by hand	-60 mA	Wiring TD signal CFI control module
	2.1 Cable	10 — Ω — Y1 — 2		< 1 Ω	Cable has open circuit
	2.2 Cable	1 2 — Ω — Y1 — 1		< 1 Ω	Cable has open circuit
	2.3 TD signal	2 — V — 2 5	Engine at idle (operating temperature). CFI control module connected	6-12 V	Wiring
	2.4 Cable	2 5 — Ω — X1 1 — 1	Ignition: OFF	< 1 Ω	Cable has open circuit
	2.5 Cable	N1/2 TD — Ω — x11 — 1	Coupling (TD signal) at ignition control module disconnected	< 1 Ω	Cable has open circuit

B. National version (USA)
(CFI designation: CFI (KE) III)

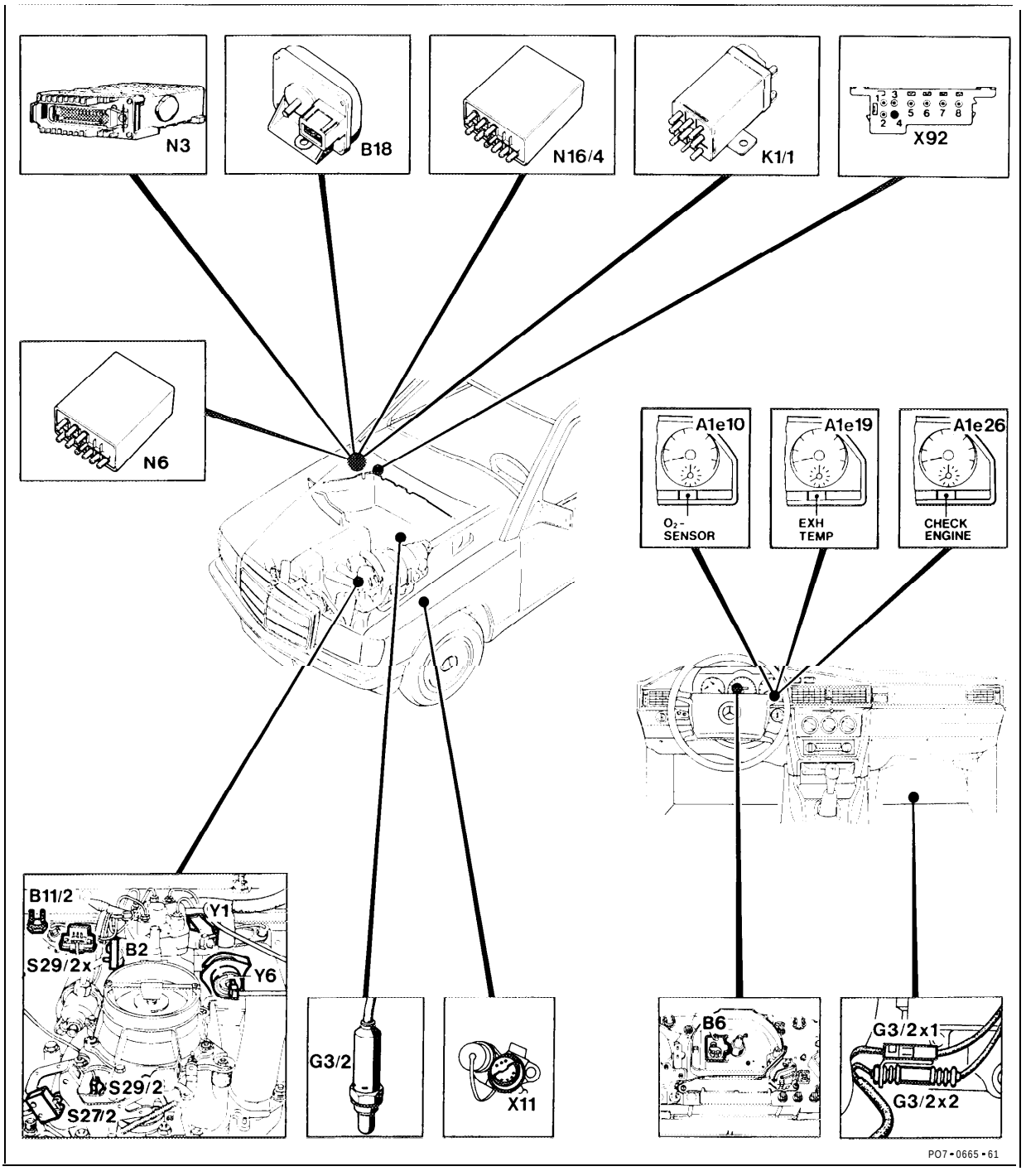
(USA) model years 1987/88 engine 102.985
(USA) model year 1991 engine 102.985

a) Model survey
b) Arrangement of components
   (USA) up to model year 1988
c) Electrical test data
d) Wiring diagrams
e) Pin assignment of CFI control module (N3) coupling
f) Without fault diagnosis by measuring on/off ratio
g) Fault diagnosis by measuring on/off ratio
h) Special tools, commercially available tools
i) Trouble diagnosis diagram
j) Test program with socket box
k) Table of voltage values of engine coolant temperature sensor (B11/2)
   and of intake air temperature sensor (B17/2)
l) Barometric pressure sensor (B18)
m) DTC output at diagnosis test coupling
   On Board Diagnosis System (USA) California model year 198811991
n) Testing deceleration shut-off
o) Testing road speed signal (USA) model year 1988
P) Testing post-start enrichment and warm-up base value (USA) 1991
q) Testing transmission upshift delay relay module (USA) 1991
r) Testing exhaust gas recirculation temperature sensor (B21) (USA) 1991 California

a) Model survey

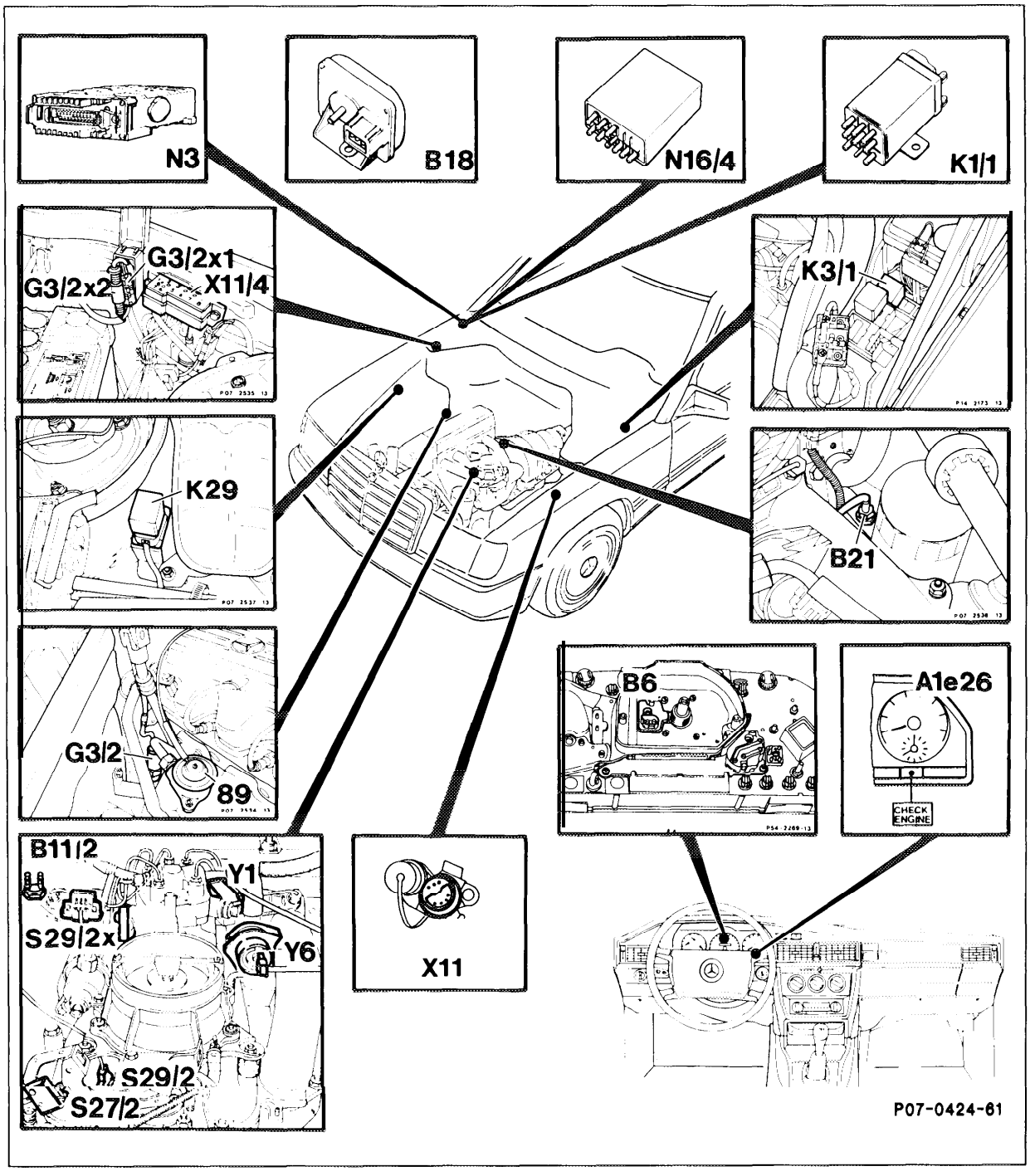
Model	Engine	Version	Model year
201.028	102.985	(USA)	1988
		(USA) Federal	1988/1991
		(USA) California	

b) Arrangement of components
(USA) up to model year 1988



Ale10	(USA) "heated oxygen sensor" malfunction indicator lamp (1986/87: failure Indicator)
Ale26	(USA) 1988 "CHECK ENGINE" malfunction indicator lamp
B2	Volume air flow sensor position Indicator
B6	Hall-effect speed sensor (USA) 1988
B11/2	Engine coolant temperature sensor
B18	Barometric pressure sensor
G3/2	Heated oxygen sensor
G3/2x1	Heated oxygen sensor heating coil plug connectron
G3/2x2	Heated oxygen sensor signal plug connectron
K1/1	Overvoltage protection relay
N3	CFI control module
N6	A/C compressor control module
N16/4	Fuel pump relay
S27/2	Deceleration shut-off microswitch
S29/2	Wide open throttle/closed throttle position switch
S29/2x	Throttle position switch plug connection
x11	Diagnosis socket/terminal block, terminal TD
x92	(USA) California 1988: Diagnostic connector
Y1	Electrohydraulic actuator
Y6	Idle air control valve

Arrangement of components
(USA) 1991 Engine 102.985



A1e26	CHECK ENGINE malfunction Indicator lamp
B2	Volume air flow sensor position indicator
B6	Hall-effect speed sensor
B11/2	Engine coolant temperature sensor 4-pin
B18	Barometric pressure sensor
B21	Exhaust gas recirculation (EGR) temperature sensor (California only)
G3/2	Heated oxygen sensor
G3/2x1	Heated oxygen sensor heating coil plug connection
G3/2x2	Heated oxygen sensor signal plug connection
K1/1	Overvoltage protection relay
K29	Transmission shift point retard relay

N3	CFI control module
N16/4	Fuel pump and kickdown shutoff relay
S27 2	Deceleration shut-off microswitch
S29/2	Wide open throttle/closed throttle position switch
S29/2x1	Wide open throttle/closed throttle position switch plug connection
x11	Diagnosis socket/terminal block, terminal TD
X11/4	Diagnostic connector, 8-pin (pulse signal)
Y1	Electrohydraulic actuator
Y6	Idle air control valve

c) Electrical test data (current at actuator in mA)

Engine	National version Model year	Ignition: **ON**	Engine coolant temperature sensor		Post-start enrichment	Acceleration enrichment	Wide open throttle correction at approx. 2000/min	Part load mixture adaptation
			Engine coolant temperature +20 °C (warming-up base value) Resistance 2.3–2.8 kΩ	Engine coolant temperature +80 °C Resistance 290–370 Ω	Post-start at +20 °C	Coolant temperature +20 °C and blipping throttle		
102.985	(USA) 1985/86	20	0 ± 1[2]) 40 s after start	0 ± 3	8–14	> 15	3–6	Readout fluctuates
102.985	(USA) 1987/88	20	1–5[1])[2])[4])	0 ± 3	7–13[1])[2])[3])	> 8	2–5	Readout fluctuates
102.985	(USA) 1991	50	-6 to ± 0	0 ± 3	-3 to +3	> 15	4–6	Readout fluctuates

Deceleration shut-off: current at actuator approx. -60 mA

1) Must be greater by the indicated current value than that at 80° C engine coolant temperature.

2) Test with plug connectton G3/2x2 (heated oxygen sensor signal plug connection) separated

3) Take reading of current value at multimeter 1 – 2 seconds after end of start

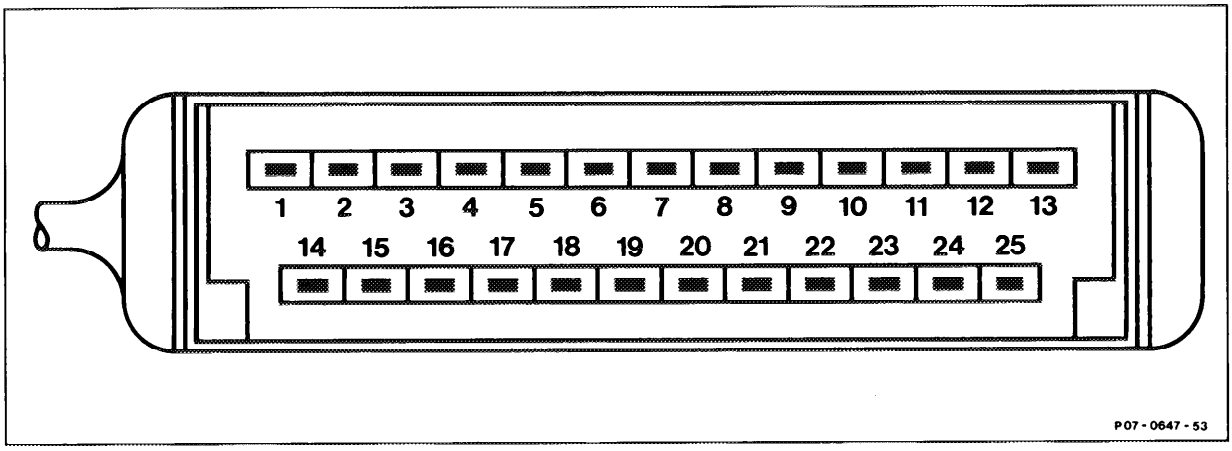
4) Take reading of current value at multimeter 5 seconds after end of start

d) Wiring diagrams

The wiring diagrams are assigned to the relevant electrical troubleshooting manual according to the model.

Electrical Troubleshooting Manual Model 201

e) Pin assignment of CFI control module (N3) connector
(USA) model year 1987/88



Overvoltage protection relay
up to 08/88: (K1) contact 2, terminal 87
as of 09/88: (K1 /1) contact 2, terminal 87E

2 Engine ground (W 11)

3 Idle air control valve (Y6), contact 1

4 not assigned

5 Throttle positron switch (S29/2), contact 3, wide open throttle detection

6 USA up to 1987:
Cruise control injection system plug connection (X33)
USA 1988:
Hall-effect speed sensor signal
Ground of connector 7 is linked internally to ground of connector 2

8 Heated heated oxygen sensor (G3/2), sensor signal

9 Fuel pump relay (N16/1, N16/2, N16/3, N16/4) contact 2, TF signal

10 Electrohydraulic actuator (Y1), contact 2(10)

11 **Engines 102.96/985:**
Barometric pressure sensor (B18), contact 1

12 Electrohydraulic actuator (Y1), contact 1 (12)

13 Throttle position switch (S29/2), contact 1, closed throttle position detection

14 not assigned

15 USA Federal up to 1987: heated oxygen sensor malfunction indicator lamp (Al e10)
USA Federal 1988: "CHECK ENGINE" malfunction Indicator lamp (Al e26)
USA California 1988 (with DTC memory):
Terminal 30a, of overvoltage protection relay (K1/1), contact 4

16 Gear detection with automatic transmission via terminal 50 (in selector lever position "P" or "N", ground at connector 16 via starter)
Model 201 **manual transmission:**
Battery ground (W 10)
Model 201 automatic transmission:
Engine wiring harness/taillamp harness plug connection, 2-pin (Xl 8, X26/3)

17 Volume air flow sensor position indicator (B2), contact 2

18 Volume air flow sensor position indicator (B2), contact 3

19 A/C compressor control module (N6), contact 4 (terminal 87z)

20 Battery ground (W 10)

21 Engine coolant temperature sensor (B 11/2)

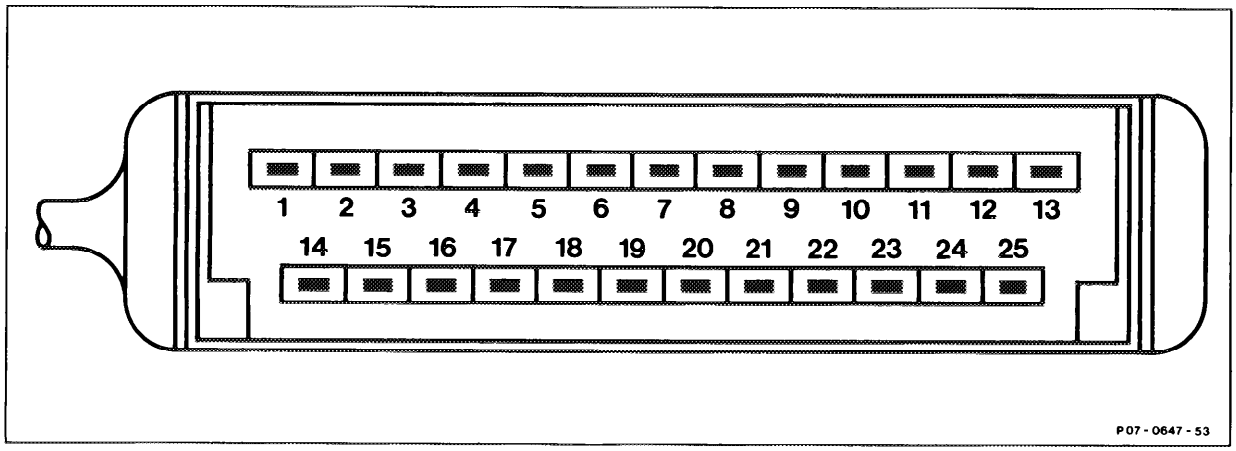
22 CFI reference resistor (R17/1)
Jumper (0 Ω) incorporated in cable set
USA 1988: not assigned
(fixed resistor in CFI control module)

23 Diagnosis socket (Xl 1), contact 3 (on/off ratio)
Model 201: via headlamp wiring harness plug connection (X24, X26/1)
USA California 1988: "CHECK ENGINE" malfunction Indicator lamp

24 Deceleration shut-off microswitch (S27/2), contact 1

25 Fuel pump relay (N16/1, N16/2, N16/3, N16/4), contact 10, TD signal

(USA) Model year 1991 engine 102.985

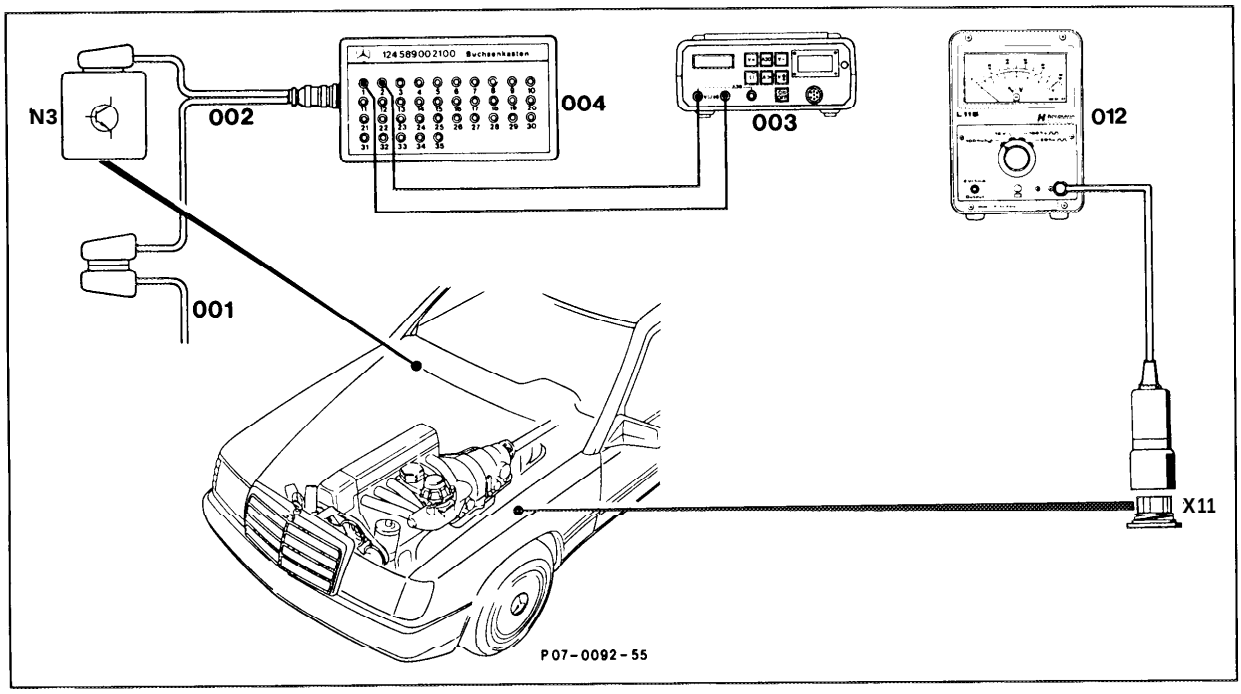


	Battery voltage, terminal 67 L (K1/1)
2	Engine ground (W11)
3	Idle air control valve
4	not assigned
5	Full throttle contact
6	Road speed signal (Hall-effect sensor)
7	Looped ground from contact 2
8	Heated oxygen sensor signal
9	TF signal at pump relay
10	Electrohydraulic actuator
11	Barometric pressure sensor signal
12	Electrohydraulic actuator
13	Closed throttle position contact
14	Transmission shift point retard
15	Terminal 30 of overvoltage protection relay (K1/1)
16	Gear detection
17	Air flow sensor signal
18	Supply voltage of barometric pressure sensor, volume air flow sensor
19	A/C compressor signal
20	Battery ground
21	Engine coolant temperature sensor
22	Exhaust gas recirculation temperature sensor (California only)
23	Output signal for lambda control on/off ratio, fault pulse display, CHECK ENGINE malfunction indicator lamp
24	Deceleration shut-off microswitch
25	TD signal

f) Without fault diagnosis by measuring on/off ratio

Up to approx. 1986 no diagnostic trouble code detection is integrated in the CFI control module (see table, 07.3-250).
On these vehicles it is not possible to specifically start the test program by measuring the on/off ratio.
In such cases the “Test program with socket box” without % display should be performed in turn.

g) Fault diagnosis by measuring on/off ratio



Testers	connect to CFI control module (N3), CFI control module coupling (001) and diagnostic connector (Xl 1): test cable (002) multimeter (003) contact box (004) lambda control tester (012) test cable (033).
Engine	at idle.
Battery voltage	11 – 14 volts.
Engine oil temperature	approx. 80 °C.
On/off ratio	measure. Rectify faults according to “Fault diagnosis table” or “Test program with socket box”.

(USA) 1988 California and
(USA) 1991 with diagnostic trouble code storage:

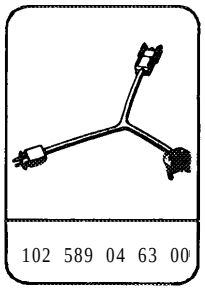
The CFI control module must be switched over to output of on/off ratio because the signal for the diagnostic trouble code (DTC) display is output as priority.

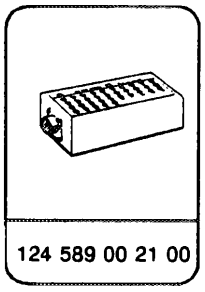
The output of the on/off ratio is performed once all the DTCs have been read out and the start button of the impulse counter scan tool or the non-locking switch on the diagnostic connector (California version only) is then once again pressed (see section m).

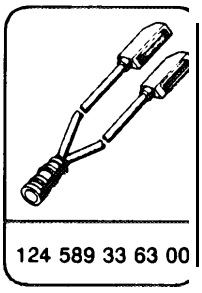
The % readout now fluctuates when the engine is running at normal operating temperature and there are no DTCs.

h) Special tools, commercially available tools

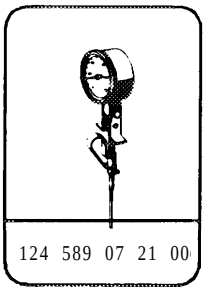
Special tools


102 589 04 63 00


124 589 00 21 00


124 589 33 63 00

201 589 00 99 00


124 589 07 21 00

Commercially available tools

Multimeter	e. g. Sun, DMM-5
Twin socket	e. g. Hermann, ECD 53
Lambda control tester	e. g. Bosch KDJE-P 600 e. g Hermann, L 1 1 5
Engine tester	e. q. Bosch, MOT 002.02

i) Trouble diagnosis table

The CFI control module monitors various components of the CFI injection system since approx. 1986 (see Op. No. 07.3–250). If a fault is detected, a certain on/off ratio is output to the diagnostic connector (contact 3) and can be measured there with the lambda control tester. The relation of on/off ratio and possible cause of fault is presented in the table below.

On/off ratio in %	Possible causes of fault
0	– No voltage or ground at diagnostic connector (Xl 1) – Cable from diagnostic connector (Xl 1) to CFI control module (N3) has open circuit – Lambda control tester defective – Mixture setting too "rich" (on/off ratio 0 – 8 % also possible) – (USA) California model year 1988 and (USA) 1991: CFI control module not switched over to on/off ratio output.
10	– Volume air flow sensor position indicator (B2) has incorrect polarity or is defective (possibly fast idle speed) – Pin assignment of throttle position switch coupling, closed throttle position and wide open throttle contact, has incorrect polarity or closed throttle position contact defective (ignition point at idle speed advanced approx. 10°)
20	– Wide open throttle contact has incorrect polarity or is defective Readout 20 % only when deceleration shut-off microswitch actuated
30	– Short circuit or open circuit between CFI control module and engine coolant temperature sensor (B11/2) – Engine coolant temperature sensor defective
40	– Short circuit or open circuit between CFI control module and volume air flow sensor position indicator (B2) – Volume air flow sensor position indicator defective (possible fast closed throttle position)
50	– Heated oxygen sensor (G3/2) not operational or defective – Cable to heated oxygen sensor has open circuit

On/off ratio in %	Possible causes of fault
60	(USA) up to model year 1988: not assigned No road speed signal (speedometer)[1])
70	- No engine speed signal (TD signal)
80	Up to 09/89 or model year 1989: - Short circuit or open circuit between CFI control module and barometric pressure sensor (B18) - Barometric pressure sensor defective
90	not assigned
100	- No voltage or ground at diagnostic connector (Xl 1) - Cable from diagnostic connector (Xl 1) to CFI control module (N3) has open circuit - Lambda control tester defective - No voltage or ground at CFI control module (N3) (overvoltage protection fuse or overvoltage protection defective) - CFI control module defective - Mixture setting too "lean" (on/off ratio approx. 95 – 100 % also possible) - Heated oxygen sensor (G3/2) defective (signal line has short circuit to ground)
Readout fluctuates	All monitored signals are in order.

[1]) The road speed signal can be checked by the CFI control module only when driving (dynamometer/road). If an incorrect road speed signal is detected, the on/off ratio 60 % is output. This on/off ratio remains stored until the ignition is switched off. Without a road speed signal this leads e. g. to the complaint: jerking when vehicle moving and throttle valve closed.

j) 'Test programme with contact box

Key to symbols

Contact box

Lambda control tester

Battery

Multimeter

Jumper (Bridge)

Contact

Connector

Voltage measurement (volts, direct voltage)

Current measurement (amperes, direct voltage)

Resistance measurement (ohms)

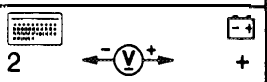
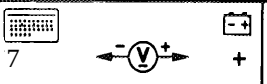
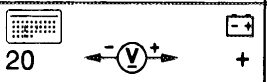
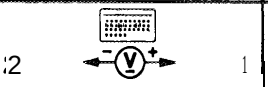
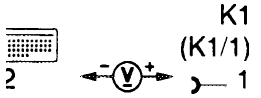
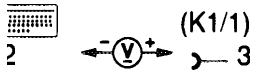
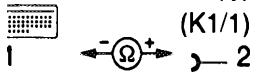
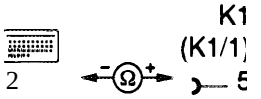
Note

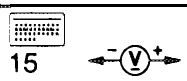
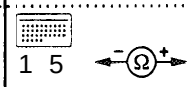
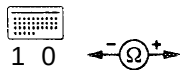
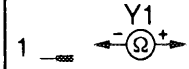
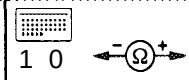
If no on/off ratio is output, or if the readout is constant (0 % or 100 %), first of all perform test steps 1 – 3.

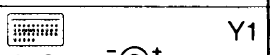
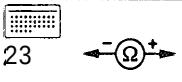
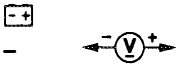
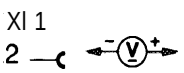
If the specified value of a test step, e. g. step 4.0, is in order, it is not necessary to perform test step 4.1.

Different component designations are possible depending on wiring diagram or in the case of vehicles with optional equipment. These designations are given in parentheses. This has no effect on the test (connections, specified value).

The on/off ratio readout must be constant. If the readout constantly changes, no fault diagnosis is possible by measuring the on/off ratio.

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi-cation	Possible cause/Remedy
–	1.0 Ground		Ignition: ON	11–14 V	Ground connection W11 loose, cable has open circuit
–	2.0 Ground			11–14 V	CFI control module defective
–	3.0 Ground			11–14 V	Ground connection W10 loose, cable has open circuit
–	4.0 Supply voltage from (N3), terminal 15		Ignition: ON	11–14 V	Fuse in overvoltage protection, overvoltage protection defective or not connected. Cable to contact 1 (terminal 30) has open circuit. Actuation of contact 3 (terminal 15) has open circuit Cable from contact 2 (terminal 87/87E) to (N3), contact 1 has open circuit
	4.1 Cable terminal 30		Ignition: OFF Overvoltage protection disconnected	11-14v	Cable has open circuit
	4.2 Cable terminal 15		Ignition: ON Overvoltage protection disconnected	11-14v	Cable has open circuit
	4.3 Cable terminal 87E		Ignition: OFF Overvoltage protection disconnected	< 1 Ω	Cable has open circuit
	4.4 Cable terminal 31 (ground)		Ignition: OFF Overvoltage protection disconnected	< 1 Ω	Cable has open circuit

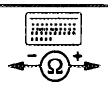
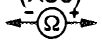
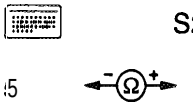
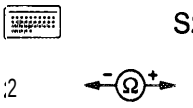
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	4.5 Cable terminal 30a (fault memory)		Ignition: OFF Overvoltage protection disconnected	11-14 v	Overvoltage protection defective, second fuse in overvoltage protection may be defective Cable has open circuit
	4.6 Cable		Ignition:OFF Overvoltage protection disconnected	< 1 Ω	Cable has open circuit
	5.0 Current at actuator	 set to A	Connect test cable 102 545 04 63 00 at actuator. Ignition: ON	see test data section c)	Electrohydraulic actuator Wiring CFI control module CFI resistance trimming plug
	6.0 Electro-hydraulic actuator		Ignition: OFF Disconnect test cable. Coupling at CFI control module disconnected	19.5 ± 1 Ω	Electrohydraulic actuator Wiring
	6.1 Electro-hydraulic actuator		Coupling at (Y1) disconnected	19.5 ± 1 Ω	Replace electrohydraulic actuator
	6.2 Cable			< 1 Ω	Cable has open circuit

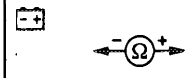
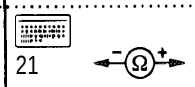
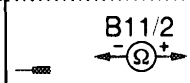
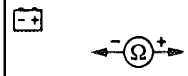
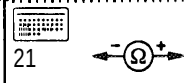
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	6.3 Cable			< 1 Ω	Cable has open circuit
	6.4" CFI reference resistor (R17/1)		Ignition: OFF	< 1 Ω	Jumper in wiring harness has open circuit
0 % 2)	7.0 Cable		Ignition: **OFF** Coupling at CFI control module disconnected	< 1 Ω	Cable has open circuit
0 % 2)	8.0 Cable (terminal 30 protected)		Ignition: OFF	11-14 v	Test fuse Model 201: fuse 9 Cable has open circuit
0 % 2)	9.0 Cable (ground)		Ignition: OFF	11-14 v	Cable has open circuit to ground Model 201: (W9)
0 % 2)	10.0 Lambda control	connected to XI 1	Engine at idle (operating temperature) CFI control module connected	50 ± 10 %	Set lambda control ([on/off ratio), see (17.3-I 10

1) not for USA 1988, fixed resistor in CFI control module

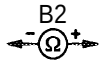
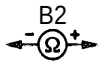
2) If an on/off ratio between 10 – 90 % is indicated with ignition ON (engine not running), test steps, 7.0, 8.0 and 9.0 need not be performed.

On/off ratio readout	Test step/ Pest scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
10 %	11.0 Closed throttle position contact	connected to x11	Ignition: ON Open microswitch (throttle valve must not be opened)		Readout 20 %: see test step wide open throttle contact (S29/2) Readout 40 %: see test step volume air flow sensor potentiometer Readout 70 %: see test step closed throttle position contact (S29/2)
10 %	12.0 Closed throttle position contact	2 — Ω — 13	Ignition: OFF Coupling at CFI control module and coupling of ignition control module (code number 1 – 4) disconnected	< 1 Ω	Pin assignment of coupling (S29/2x, X56) has incorrect polarity Closed throttle position contact Wiring
			Depress accelerator	∞	Pin assignment of coupling (S29/2x, X56) has incorrect polarity Closed throttle position contact Wiring
	12.1 Closed throttle position contact	S29/2x (X56) 1 — Ω — 2	Coupling (S29/2x) disconnected	< 1 Ω	Set or replace throttle position switch Wiring
			Depress accelerator	∞	Set or replace throttle position switch Wiring
	12.2 Cable	S29/2x (X56) 13 — Ω — 1		< 1 Ω	Cable has open circuit
	12.3 Cabie	S29/2x (X56) 2 — Ω — 2		< 1 Ω	Cable has open circuit

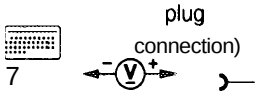
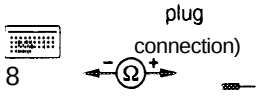
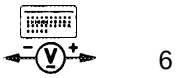
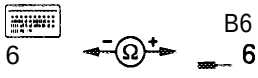
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
20 %	13.0 Wide open throttle contact	 2 — 5	Ignition: **OFF** Coupling at CFI control module disconnected	∞	Coupling (S29/2x, X56) has incorrect polarity Wide open throttle contact Wiring
			Accelerator in wide open throttle position	< 1 Ω	Coupling (S29/2x, X56) has incorrect polarity Wide open throttle contact Wiring
	13.1 Wide open throttle contact	S29/2x (X56)  2 — 3	Coupling (S29/2x) disconnected	∞	Set or replace throttle position switch
			Accelerator in wide open throttle position	< 1 Ω	Set or replace throttle position switch
	13.2 Cable	 S29/2x (X56) 5 — 3		< 1 Ω	Cable has open circuit
	13.3 Cable	 S29/2x (X56) 2 — 2		< 1 Ω	Cable has open circuit
30 %	14.0 Coolant temperature sensor (B11/2)	 7 — 2 1	Engine at idle (operating temperature) CFI control module connected	At + 80° C 0.29–0.35 V other values see table section 10	Engine coolant temperature sensor Wiring

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
30 %	A 14.1 Engine coolant temperature sensor 2-pin	 B11/2	Both couplings at temperature sensor disconnected (measure both contacts)	Ω value, see diagram/ table section k)	Replace engine coolant temperature sensor
	A 14.2 Cable	 21 B11/2 Cable gn/rt		< 1 Ω	Cable has open circuit
	B 14.1 Engine coolant temperature sensor 4-pin	 B11/2	Ignition: QFF Temperature sensor coupling disconnected. Measure 2 × diagonally	Ω value, see diagram/ table section k)	Replace engine coolant temperature sensor
	B 14.2 Cable	 B11/2 4[1])		< 1 Ω	Cable has open circuit
	B 14.3 Cable	 21 B11/2 2		< 1 Ω	Cable has open circuit
40 %	15.0 Air flow sensor potentiometer signal	7 17	Engine at idle (operating temperature) CFI control module connected	0.55–0.95 V	Air flow sensor potentiometer

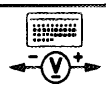
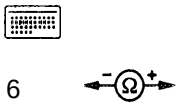
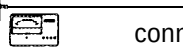
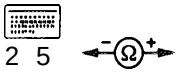
[1]) (USA) 1988 California without contact designation, see section k).

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
40 %	15.1 Supply voltage of volume air flow sensor potentiometer	7 18		4.6-5.1 v	CFI control module
	15.2 Cable	7 B2 1	Ignition: OFF measure at coupling (B2)	< 1 Ω	Cable has open circuit
	15.3 Cable	18 B2 3		< 1 Ω	Cable has open circuit
	15.4 Cable	1 7 B2 2		< 1 Ω	Cable has open circuit
	15.5 Air flow sensor potentiometer	 1 B2 3	Ignition: OFF coupling at (B2) disconnected	3.6-4.4 kΩ	Replace volume air flow sensor
	15.6 Air flow sensor potentiometer	 1 B2 2	Slowly deflect volume air flow sensor plate by hand	Ω value [1]	Replace volume air flow sensor
50 %	16.0 Oxygen sensor	7 8	Engine at idle (operating temperature) CFI control module connected	fluctuates between 0.1-0.9 v	Oxygen sensor Wiring Test CFI resistance trimming plug

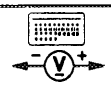
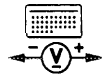
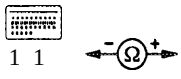
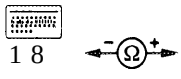
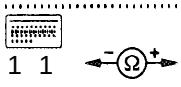
[1]) Ω value increases continuously up to 2/3 of deflection, and then drops off again.

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
50 %	16.1 Heated oxygen sensor	G3/2x2 (X6012) (one-pin plug connection)  7	Engine at idle (operating temperature). Separate plug connection (G3/2x2) and lay connector to ground (lean simulation)	> 450 mV	Replace heated oxygen sensor
	16.2 Cable	7 8	Ignition: **OFF** Coupling at CFI control module disconnected	∞	Cable defective
	16.3 Cable	G3/2x2 (X6012) (one-pin plug connection)  8		< 1Ω	Cable has open circuit
60 %[1])	A 17.0 Road speed signal **Model 201**	 2 6	Ignition: **ON** Move vehicle approx. 1 m	Readout fluctuates o - 12 v (0 – 9 V with ancillaries)	Cable Hall-effect sensor
	A 17.1 Cable	 6 B6 6	Coupling at (B6) disconnected	< 1 Ω	Cable has open circuit

[1]) not assigned on vehicles without road speed signal and (USA) 1988

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
60 %[1])	B 17.0 Road speed signal	 2 6	Drive vehicle on dynamometer (approx. 40 km/h)	> 1 v	Cable Electronic speedometer
	B 17.1 Cable	 Alp8 (A2) 6 1	Connector at (Al p8) disconnected	< 1 Ω	Cable has open circuit
60 %[1])	18.0 CFI control module	 connected to x11	Drive vehicle in 3rd gear/ drive mode 3 on road/dynamometer; accelerate fully at approx. 2000/min (approx. 6 seconds)	Readout fluctuates after accelerator pedal eased off	If readout 60 %: replace CFI control module
70 %	19.0 TD signal	 2 2 5	Engine at idle (operating temperature) CFI control module connected	6-12 V	Ignition control module Wiring
	19.1 Cable	 x11 2 5 1	Ignition: OFF	< 1 Ω	Cable has open circuit
	19.2	N1/2 TD x11 1	Coupling (TD signal) at ignition control module disconnected	< 1 Ω	Cable has open circuit

[1]) not assigned on vehicles without road speed signal and (USA) 1988

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
80 %[1])	20.0 Barometric pressure sensor (B18)	 7 — 18	Ignition: **ON** CFI control module connected	4.6-5.1 v	Barometric pressure sensor Wiring
	20.1 Altitude correction sensor	 7 — 11		see table section I)	Replace barometric pressure sensor
	20.2 Cable	 11 — B18 — 3	Ignition: OFF Coupling at (B18) disconnected	< 1 Ω	Cable has open circuit
	20.3 Cable	 18 — B18 — 2		< 1 Ω	Cable has open circuit
	20.4 Cable	 11 — B18 — 1		< 1 Ω	Cable has open circuit
90 %	not assigned				
100% [2])	21.0				see on/off ratio 0 % and 50 %

[1]) not assigned on vehicles without barometric pressure sensor

[2]) Idle speed too high

k) Voltage values of engine coolant temperature sensor (B11/2) and CFI intake air temperature sensor (B17/2)

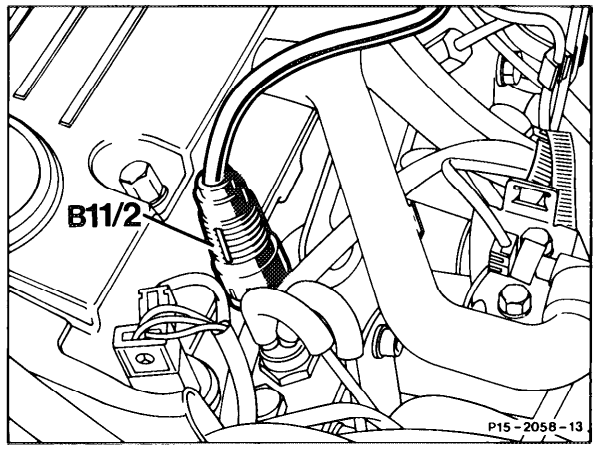
Temperature in °C	Resistance	Voltage at contact 11 intake air (volts)	Voltage at contact 21 coolant (volts)
–20	15.7 kΩ	2.85–3.49	3.24–3.94
–10	9.2 kΩ	2.50–3.06	2.84–3.47
0	5.9 kΩ	2.10–2.56	2.39–2.93
10	3.7 kΩ	1.69–2.07	1.94–2.37
20	2.5 kΩ	1.32–1.62	1.51–1.84
30	1.7 kΩ	1.03–1.25	1.16–1.42
40	1.18 kΩ	0.77–0.94	0.88–1.08
50	840 Ω	0.57–0.69	0.66–0.80
60	600 Ω	0.42–0.52	0.50–0.61
70	435 Ω	0.32–0.40	0.38–0.46
80	325 Ω	0.25–0.31	0.29–0.35
90	247 Ω	0.18–0.22	0.22–0.26

Note

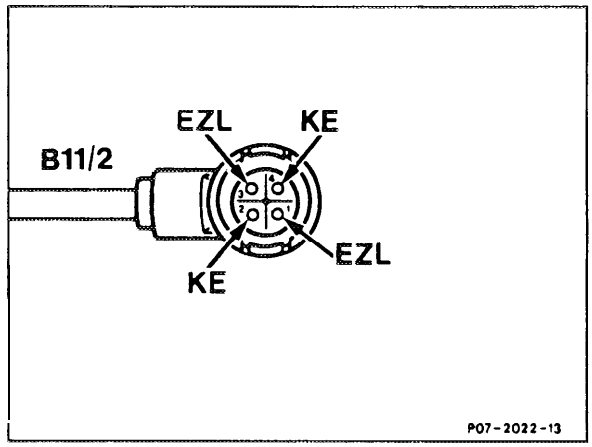
Testing engine coolant temperature sensor (B11/2)

The engine coolant temperature sensor is a 4-pin design. It integrates two separate temperature sensors (NTC), which do not have any electrical connection to the housing of the engine coolant temperature sensor. One temperature sensor (NTC) is for the distributor ignition system and one for the CFI injection system.

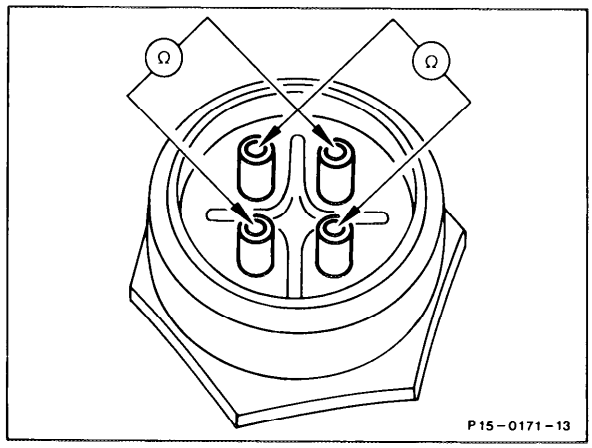
The connector of the engine coolant temperature sensor is designed so that it can be plugged in in any position.



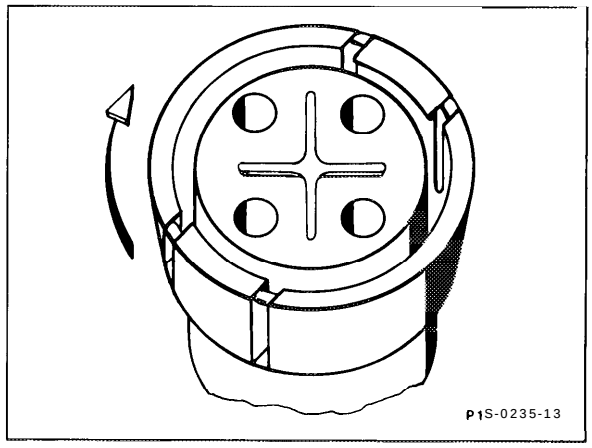
Pin assignment:
1 = Distributor ignition temperature sensor
2 = CFI temperature sensor
3 = Engine ground at intake manifold for ignition
4 = CFI control module ground



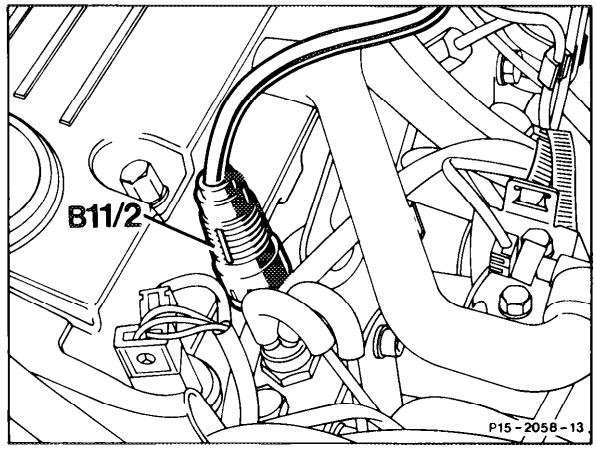
When testing the engine coolant temperature sensor, measure the resistances 2 × diagonally and compare. The resistances of the maps are Identical to those of the previous version.



(USA) 1988 California (without contact designation on coupling B11/2):
When testing the wiring from the CFI control module (contacts 7 or 21) to the connector (B11/2), the contacts on the connector should be tested clockwise; only one cable may have continuity (< 1 Ω) in each case.



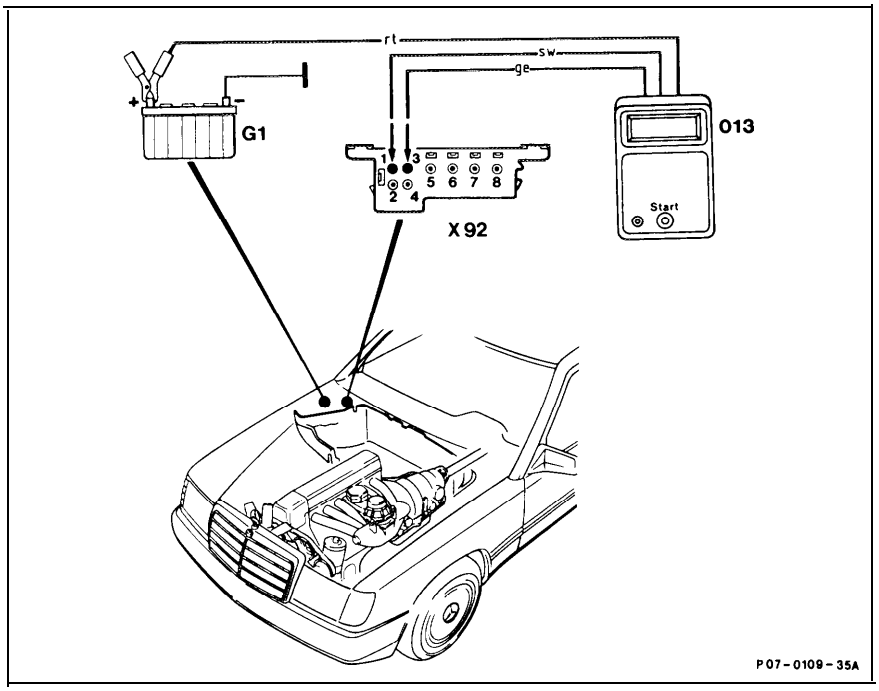
Arrangement of engine coolant temperature sensor (B11/2)



I) fable of altitude correction sensor (818)

Height above sea level (m)	Atmospheric pressure p absolute (mbar)	Voltage at contact 14 (to ground) (volts)
0	1013	4 ± 1
1000	899	3 ± 1
2000	795	2 ± 1

m) Diagnostic Trouble Code (DTC) readout at diagnostic connector



Impulse counter scan tool (013)	connect to positive pole of battery (G1) and to diagnostic connector (X92) or (Xl 114) according to connection diagram. LED U Bat-t must light UP-
Ignition	**ON.**
Start button	press for 2 to 4 seconds. Note readout. DTC readout 1 indicates: no fault in system. Other readouts: see fault table.
Start button	again press for 2 to 4 seconds. Note any furtherDTCs. If no more faults are stored, no further readout appears. (USA) CFI control module switches over to on/off ratio output.
Noted codess	rectify according to DTC table.
Ignition	**OFF** (pulse output completed).
Ignition	**ON** (pulse output can once again be read out).

Erasing diagnostic trouble code(DTC) memory

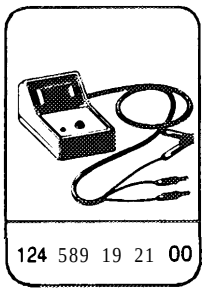
Once a fault has been rectified without having disconnected the CFI control module or the battery, the DTC displayed must be erased as follows:

- When the DTC is displayed, wait 2 seconds before pressing start button for 6 – 8 seconds.
- No display; stored DTC is erased.
- A number (greater than 1) is displayed; further DTC in system.

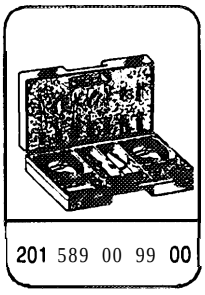
Note

Each displayed DTC must be erased **individually.**

Special tools



124 589 19 21 00



201 589 00 99 00

Notes regarding impulse counter scan tool display

The number 1 indicates that no fault is stored in the system. All other numbers are assigned a particular DTC. If there are several DTCs in the system, the malfunction with the lowest DTC number is output first.

Numbers from 1 to 12 appear in the display of the impulse counter scan tool.

- If the LED U Batt appears after connecting the impulse counter scan tool, the impulse counter scan tool and power supply for impulse counter scan tool are in order.
- If no display appears during the test after one or several DTCs (numbers), no further DTC is stored.

If the LED U Batt does not light up:

a) Test contact 1 at diagnostic connector (X92) to battery positive (11 – 14 V).
b) Test contact 3 at diagnostic connector (X92) to contact 1 (0.7 – 2.5 V).

Fault table

Diagnostic trouble code DTC	Possible cause	Remedy
1	no malfunction in system	–
2	Throttle position switch, wide open throttle contact	13.0
3	Engine coolant temperature sensor (B11/2)	14.0
4	Air flow sensor potentiometer	15.0
5	Heated oxygen sensor (G3/2)	16.0
6	not assigned	–
7	TD signal	19.0
8	Barometric pressure sensor	20.0
9	Electrohydraulic actuator	5.0
10	Throttle position switch, closed throttle position contact	11.0, 12.0
12 [1])	Exhaust gas recirculation temperature sensor	Section r)

only (USA) 1991 California

On Board Diagnosis System(DTC) (USA) California Model Year1988/1991

The CFI control module monitors all the exhaust components of the CFI injection system and the exhaust gas recirculation. Malfunctions caused by an open circuit or failure of one of these components are indicated by the malfunction indicator lamp in the “CHECK ENGINE” instrument cluster and simultaneously stored in the CFI control module.

A diagnostic connector (X92) with non-locking switch (2) and LED (4) is provided for this purpose on the right of the component compartment partition wall. When the non-locking switch is pressed (ignition: ON) for between 2 and 4 seconds, the flashing DTC output is initiated and the fault path indicated by the number of flashes.

After completion of the flashing DTC output, the LED shows a steady light. If the non-locking switch is again pressed for between 2 and 4 seconds, a further fault path can be indicated if it exists. If no further fault code is detected, the CFI control module switches over to on/off ratio output.

Erasing flashing DTCs

Once a fault has been rectified without having disconnected the CFI control module, the flashing DTC output displayed must be erased as follows:

- When the flashing DTC output is displayed, wait 2 seconds before pressing the non-locking switch for 6 – 8 seconds.

Note

Each flashing DTC output displayed must be erased individually.

- LED flashes once, stored DTC is erased.

Note

The non-locking switch and LED have been developed to enable customers and non-MB dealers to specifically pinpoint the fault path with “on board means” in conformity with legal requirements. An impulse counter scan tool which indicates the stored fault(s) on a digital display has been developed for MB workshop personnel (see DTC output to diagnostic connector).

On/off ratio output

The on/off ratio is not output until the CFI control module has been programmed for on/off ratio output. Otherwise, when the engine is running, the readout shows 0 % or 85 % if the “CHECK ENGINE” malfunction indicator lamp lights up.

The control module is switched over to on/off ratio output for testing the lambda control by operating the non-locking switch (see 07.3-105 or 07.3-l 10).

⚠

In the event of an engine running problem, the DTC memory should be read out and the DTCs noted before performing any repairs as part of 07–1 100. This ensures that a distinction can be made between genuine and simulated DTCs as DTCs are stored when performing test work with the engine running, which may originate from a simulation or a disconnected cable.
The DTC memory must be erased after completing the test work.

n) Testing deceleration shut-off

Connection diagram of contact box, see section g)

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/remedy
–	1.0 Deceleration shut-off	13 — 2	Engine speed >3000/min (engine at operating temperature) CFI control module connected		Decel fuel shutoff microswitch Throttle position switch closed throttle position contact, test, see "Test programme with contact box" test step **12.0** Wiring CFI control module
			Operate deceleration shut-off microswitch (S27/2) by hand	Engine surges	
		13 remove jumper 2		Engine running un-changed	
	2.0 Deceleration shut-off microswitch (S27/2)	S27/2 —	Ignition: **OFF** Coupling at microswitch disconnected	< 1 Ω	Check throttle control (30300) Replace microswitch
			Depress accelerator	∞	
	2.1 Cable	24 — S27/2 gr/sw		< 1 Ω	Cable has open circuit
	2.2 Cable	2 — S27/2 br		< 1 Ω	Cable has open circuit to ground (W1 1)

o) Testing road speed signal (USA) model year 1988

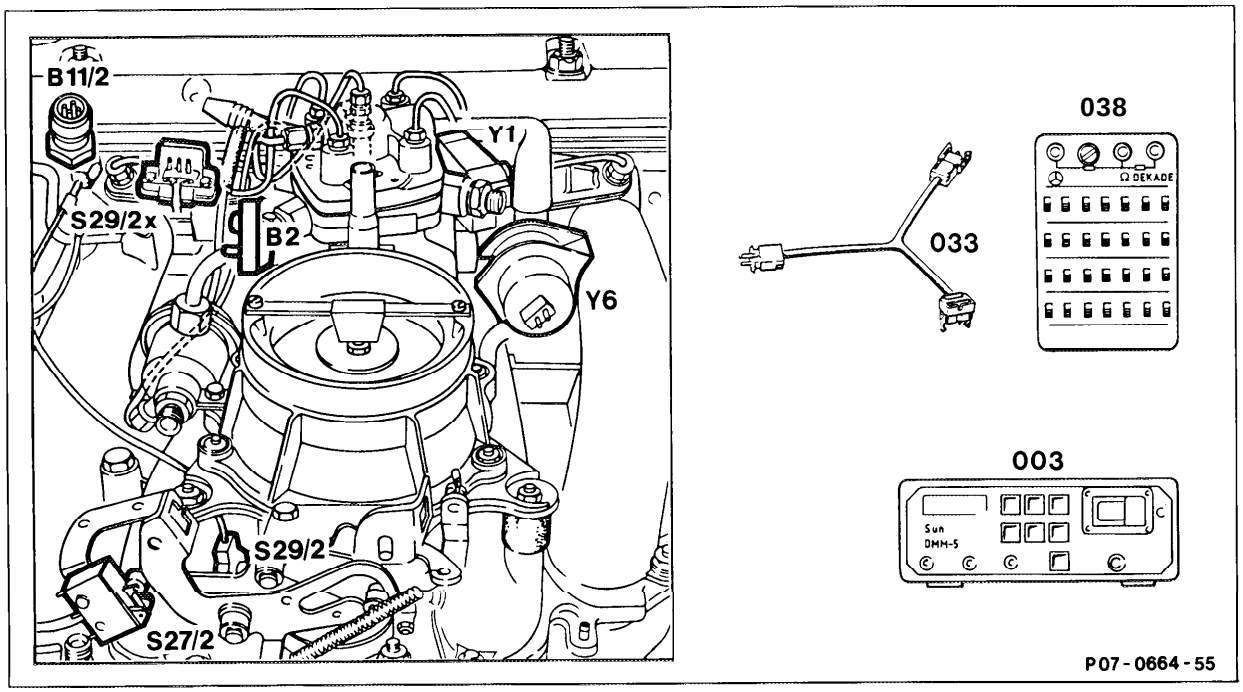
Note

The test should only be performed if the following complaint exists:

- Jerking when vehicle moving with throttle closed.

For testing see “Pest program with socket box”, test steps A17.0 and 18.0 (initiating with on/off ratio not yet possible in model year 1988).

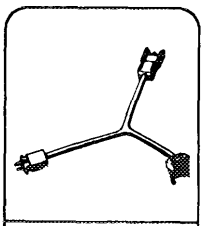
p) Testing post-start enrichment and warm-up base value



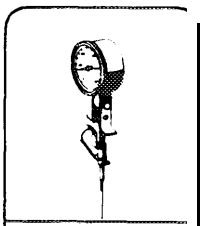
Engine oil temperature	approx. 80 °C.
Plug connection (G3/2x2) (oxygen sensor signal) .	separate on right of component compartment.
Resistance decade (038)	connect to engine coolant temperature sensor coupling (B17/2), contact 2 and contact 4 (coupling disconnected). Set 320 Ω (approx. 80 °C engine coolant temperature).
Multimeter (003)	connect to electrohydraulic actuator (Y1) with test cable (033). Measuring range amperes.
Engine	start.
Current level	read and note no sooner than 5 seconds after end of start.
Ignition	**OFF**
Resistance decade (038)	switch over to 2.5 kΩ (approx. 20 °C engine coolant temperature).
Engine	start.
Post-start enrichment current value	take reading 1– 2 seconds after end of start. **Specification: 7 – 13 mA** greater than the value noted at approx. 80 °C engine coolant temperature.

Warm-up base value	**Specification: 1 – 5 mA** greater than the value noted at approx. 80 °C engine coolant temperature. Take reading of current value no sooner than 28 seconds (after elapse of heating speed).

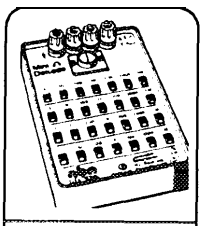
Special tools



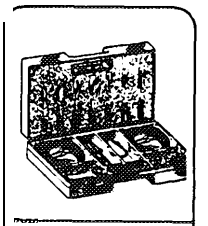
102 589 04 63 00



124 589 07 21 00



124 589 09 63 00

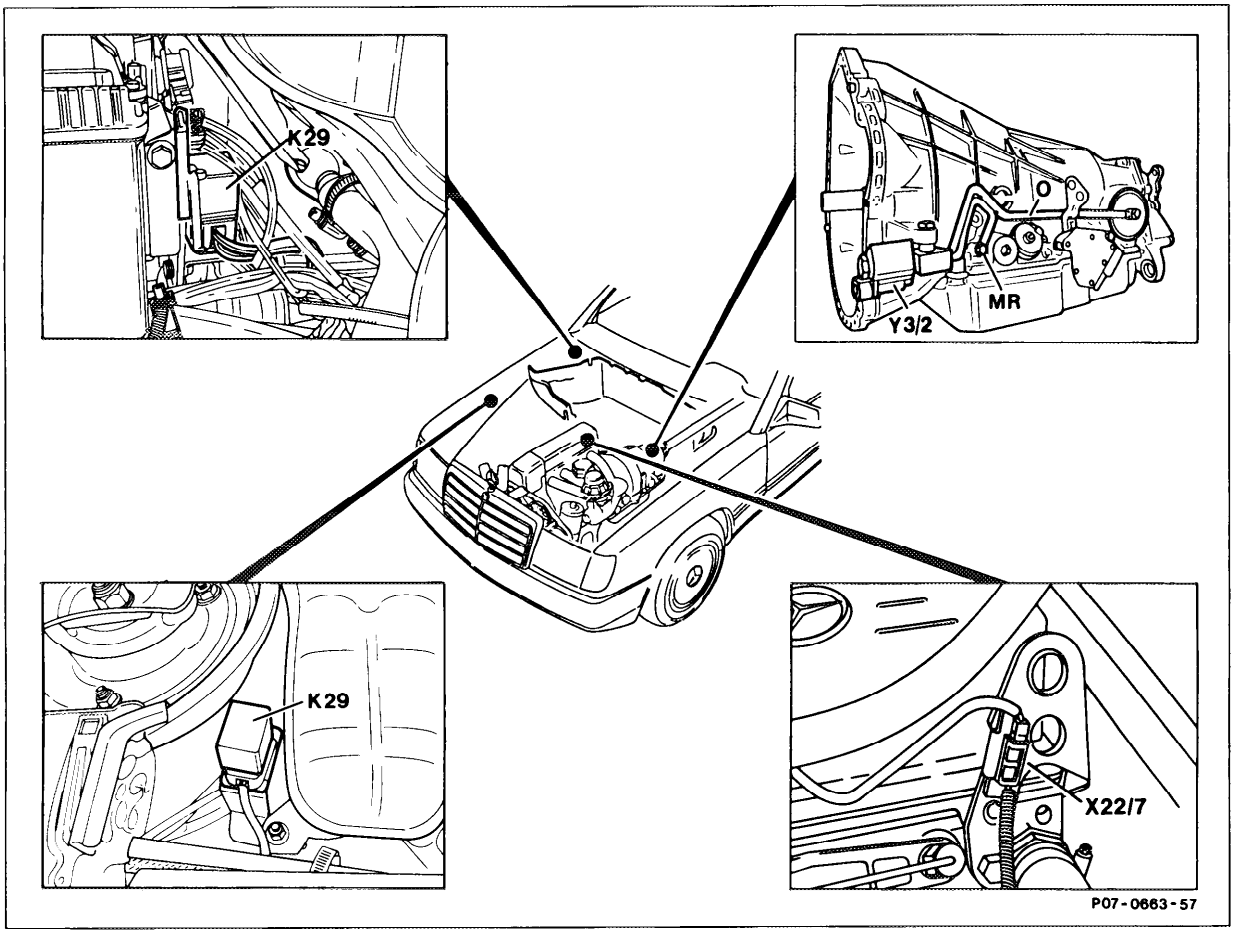


201 589 00 99 00

Commercially available tools or testers

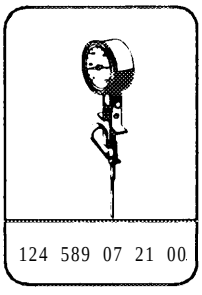
Multimeter	e. g. Sun, **DMM-5**

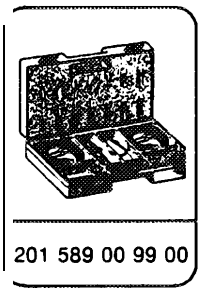
q) Testing transmission upshift delay (automatic transmission only)



K29	Transmission upshift delay relay module Model 201 right wheelhouse	X22/7	Transmission upshift delay valve plug connection, 1 -pin
		Y3/2	Transmission upshift delay solenoid valve

Special tools


124 589 07 21 00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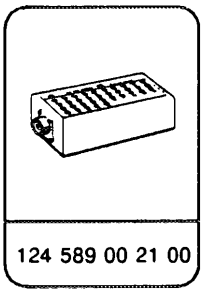
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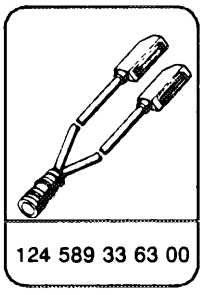

124 589 33 63 00

Commercially available tools or testers

Multimeter	e. g. Sun, DMM-5

Test conditions

- Engine oil temperature approx. **80 °C**
- All electrical ancillaries switched off
- Battery voltage 11 - 14 V

Symbols for measuring instruments:

Multimeter

Contact

Connector

Jumper (Bridge)

Symbols for type of measurement with multimeter:

Voltage measurement (volts, direct voltage)

Resistance measurement (ohms)

Connection diagram of contact box, see section g)

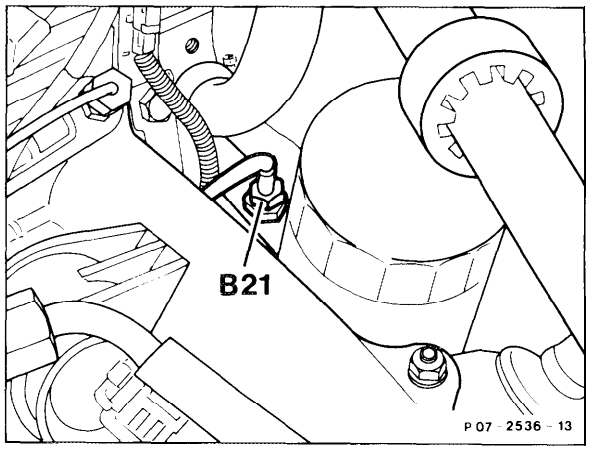
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	1.0 Function of transmission upshift delay relay module (K29)	N3 2 — 14 W11 — Y3/2	Engine at idle	11–14V	Voltage and ground supply for transmission upshift delay relay module (K29), relay (K29) defective. No road speed signal. No engine coolant temperature signal. CFI control module (N3) defective.
–	**2.0** Voltage supply of transmission upshift delay relay module (K29)	W11 — K29 — 4	Transmission upshift delay relay module (K29) disconnected. Run engine	11–14V	**Model 201:** Fuse No. 2, open circuit transmission upshift delay relay module (K29) ▮ intake manifold preheating relay (K3/1) ▮ ignition starter switch (S2/1).

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	2.1	W11 ⊥ — (V) — K29 3	Transmission upshift delay relay module (K29) disconnected. Ignition: ON	11–14V	Overvoltage protection relay (K1/1). Open circuit transmission upshift delay relay module (K29) ▮ overvoltage protection relay (K1/1).
–	3.0 Ground supply of transmission upshift delay relay module (K29).	K29 5 — (V) — + N3 2 — 14	Transmission upshift delay relay module (K29) disconnected. Ignition: OFF	11–14V	Open circuit transmission upshift delay relay module (K29) ▮ CFI control module (N3).
–	4.0 Cable	W11 ⊥ — (V) — Y3/2 K29 1 — 3	Transmission upshift delay relay module (K29) disconnected. Ignition: ON	11–14V	Open circuit transmission upshift delay relay module (K29) ▮ plug connection (X22/7) ▮ shift point retard solenoid valve coupling (Y3/2) ▮
–	4.1 Shift point upshift delay solenoid valve (Y3/2)	W11 J_ — (Ω) — Y3/2		10–18Ω	Replace upshift delay relay solenoid valve.

r) Testing exhaust gas recirculation temperature sensor 821

(USA) 1991 California

Test resistances of the EGR temperature sensor (B21) according to diagram. The temperature sensor is installed in the exhaust gas recirculation line.
Tightening torque **23 – 28** Nm.



The temperature of the recirculated exhaust gases is detected by the temperature sensor. If the exhaust gas temperature drops below approx. 120 °C when driving, "no exhaust gas recirculation" is performed. The CFI control module detects this as a DTC which is stored and the CHECK ENGINE malfunction indicator lamp is activated.

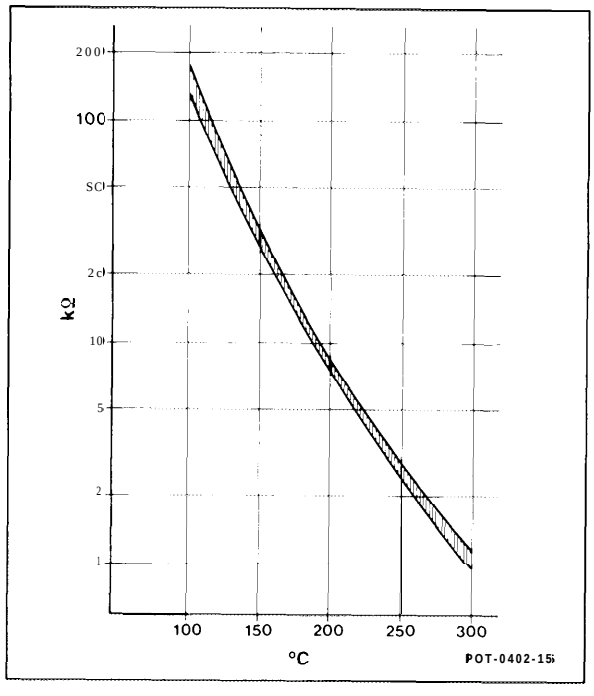
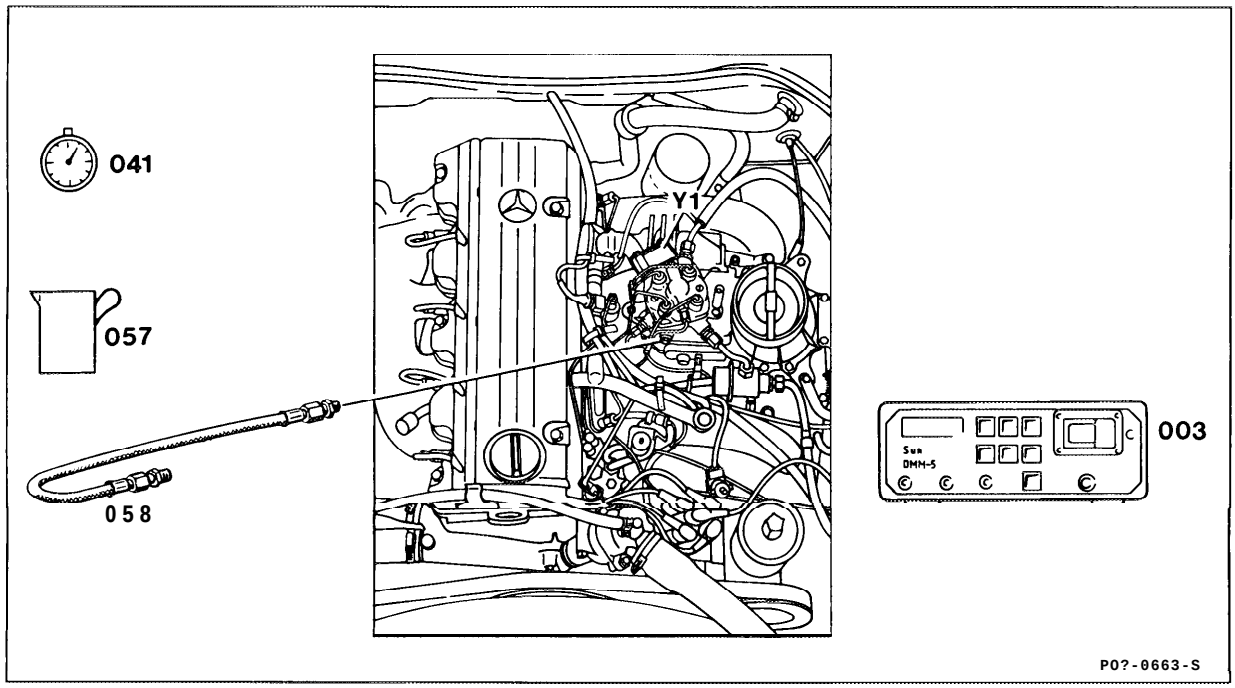


Diagram
Exhaust temperature resistance at exhaust gas recirculation temperature sensor

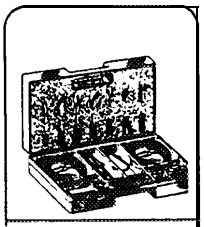
07.3–122 Testing continuity of inductor in fuel distributor

Preceding work:
Testing fuel pressures and internal leaktightness (07.3-I 20)



Connector at electrohydraulic actuator (Y1).....	detach. With lambda control: switch on ignition. Detach oxygen sensor signal plug connection.
Fuel line	unscrew at fuel distributor and seal with M10×1 plug.
Pressure hose (058)	connect to fuel distributor and hold into measuring beaker. Special tool 103 589 00 21 05.
Fuel pump relay module	detach and bridge contacts 7 and 8. (Fuel pump running) Special tool 201 589 00 99 00.
Inductor	test continuity Specification: 130 – 150 cm^3/min at minimum voltage of 11.5 V at fuel pump. If specification is not reached, replace fuel distributor.

Special tools

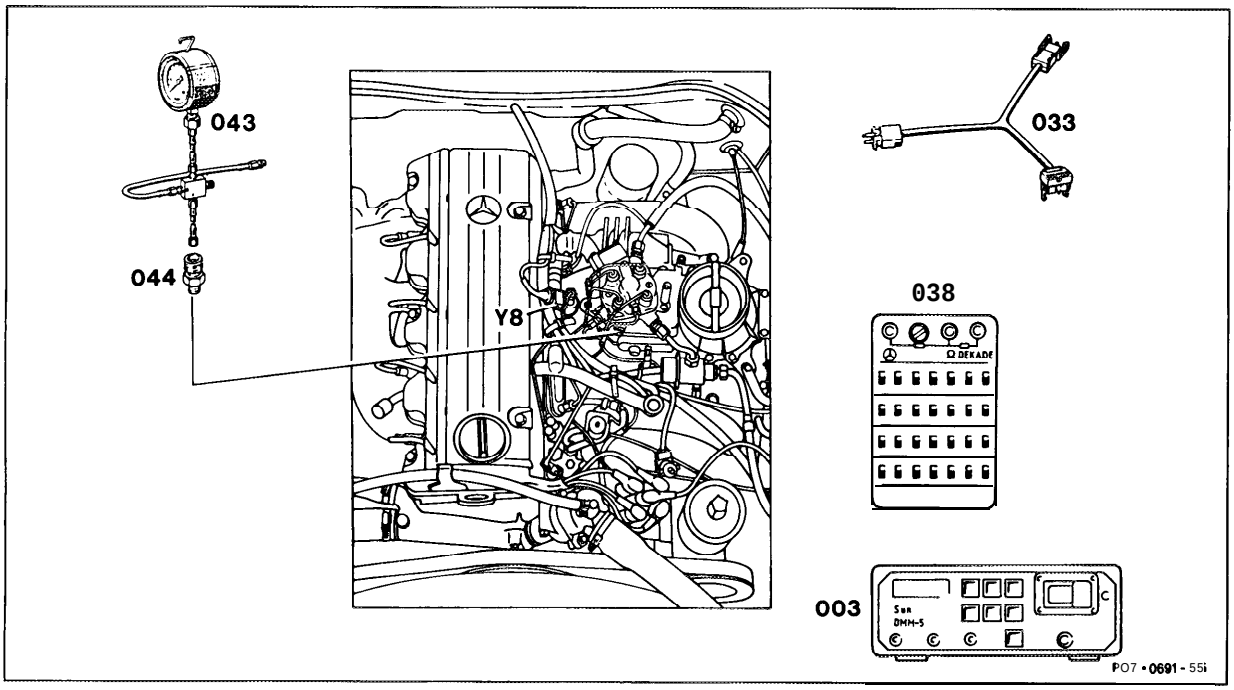
Pressure hose	
103 589 00 21 05	201 589 00 99 00

Commercially available testers

Multimeter, measuring glass or measuring beaker, stopwatch

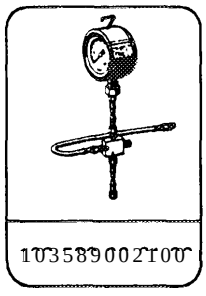
07.3424 Testing start device

Preceding work:
Testing **fuel pressure and internal leaktightness (07.3-I 20)**

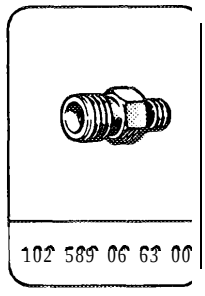


Testers	connect: pressure gauge (043) 103 589 00 21 00, double fitting (044) 102 589 06 63 00, multimeter **(003),** Ω decade (038) 124 589 09 63 00, test cable (033) 102 589 04 63 00.
Fuel pressures and internal leaktightness	test (07.3-I 20).
Start valve	check operation and for leaks.
Post-stat-t enrichment	**test.**

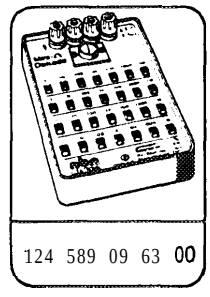
Special tools



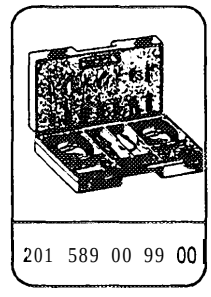
1035890021 00



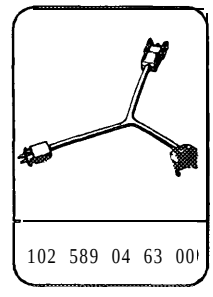
102 589 06 63 00



124 589 09 63 00



201 589 00 99 00



102 589 04 63 00

Commercially available tester

Multimeter	e. g.	Sun, DMM-5

Note

Wiring diagrams (07.3-1 28).

Engine 102.961 version (USA):
Start valve control by thermo-time switch (S26).

a) If engine speed is too low after the cold start

Compress shaped hose (arrow).
If engine speed does not change, the idle air control valve is jamming and must be replaced.

b) Engine speed too high at normal operating temperature

Compress formed hose (arrow).
If there is a significant change in engine speed, the idle air control valve is jamming or is not electrically heated.

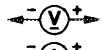
Key to symbols

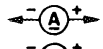
Battery

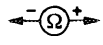
Multimeter

Contact

Connector


Voltage measurement (volts, direct voltage)


Current measurement (amperes, direct current)


Resistance measurement (ohms)

Notes

- If the specified value of **a** test step, e. g. step **4.0,** is in order, it is not necessary to perform test step **4.1.**
- Different component designations are possible depending on wiring diagram or in the case of vehicles with optional equipment. These designations are given in parentheses.

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
–	1.0 Test idle air control valve		Start cold engine	up to approx. 70°C engine coolant temperature	Idle air control valve jamming.
				900 – 1200/min	
			Start engine at normal operating temperature	750 – 850/min	Idle air control valve jamming. Heating coil Voltage supply of heating coil
–	1.1 Idle air control valve heating coil (R21)	R21	Ignition: QFF Connector at idle air control valve disconnected	approx. 40 Ω	Replace auxiliary air fan
–	1.2 Voltage supply of heating coil (R21)	R21	Engine closed throttle position connector at idle air control valve disconnected	11-14 v	Wiring Fuel pump relay module (07.3-l 65).
–	1.3 Wiring	R21 — N5/1 (N5/2) (N16/1) (N16/2) — 7	Ignition: **OFF**	< 1 Ω	Cable has open circuit.

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
–	1.3 Wiring	W9 R21 (W11)	Ignition: **OFF**	**< 1 Ω**	Cable has open circuit.
–	2.0 [1])	Disconnect fuel line at start valve, remove start valve, reconnect fuel line	Detach connector at thermo-time switch, connect terminal **"W"** on connector to ground (not necessary below + 5 °C). Hold start valve in vessel. Start engine.	Start valve must eject finely atomized spray.	Test start valve actuation via thermo-time switch (07.34 26).
–	3.0 [2])	Disconnect fuel line at start valve, remove start valve, re-connect fuel line	Connector of engine coolant temperature sensor disconnected. Feed in 10 **kΩ** at connector of engine coolant temperature sensor with **Ω** decade (simulate approx. -15 °C). Pay attention to **Ω** decade connection! **1-pin temperature sensor (B11/3):** **Ω** decade to ground and detached cable.	Start valve must eject finely atomized spray.	Test start valve actuation via fuel pump relay (07.3-126).

[1]) Start valve actuation via thermo-time switch: only engine 102.961 Std. and national version (USA).
[2]) Start valve actuation via fuel pump relay module.

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
–	3.0 [2])		**2-pin engine coolant temperature sensor (B11/2) and ignition system CFI (KE I and KE II):** Ω decade to ground and detached cable (gn/sw) to fuel pump relay module (terminal **TF).** **2-pin temperature sensor (B11/2) and DI ignition system CFI (KE III):** Ω decade to ground and detached cable (gn/rt) to **KE** control unit (connector 21). **4-pin temperature sensor (B11/2):** Ω decade diagonally to contacts 2 and 4. Hold start valve in vessel. Start engine.		
–	**4.0** Test start valve for leaks.		Ignition: **OFF** Dry off start valve at nozzle	Start valve must not leak	Replace start valve.

[2]) Start valve actuation via fuel pump relay module.

Note
Plastic connector at start valve colored green
(previously blue).

Production breakpoint: 08/88

Model	Engine	Engine End No. manual transmission	Engine End No. automatic transmission
201.028	102.985	026332	076393

Testing post-start enrichment

National version (USA)

Engine	Version	CFI control module Part No.	Post-start [1] at +20°C mA	Warm-up base value mA	Pest acc. to section
102.961	(USA) 1983/84	003 545 38 32		9–14	"a"
102.985	(USA)	004 545 26 32	–	5–15	
	(USA) 1985186	003 545 38 32	1–4	3–9	
	(USA) 1987188	005 545 94 32 006 545 80 32 006 545 55 32	13–19		

[1] After end of start current value drops to the temperature-dependent warm-up base value.

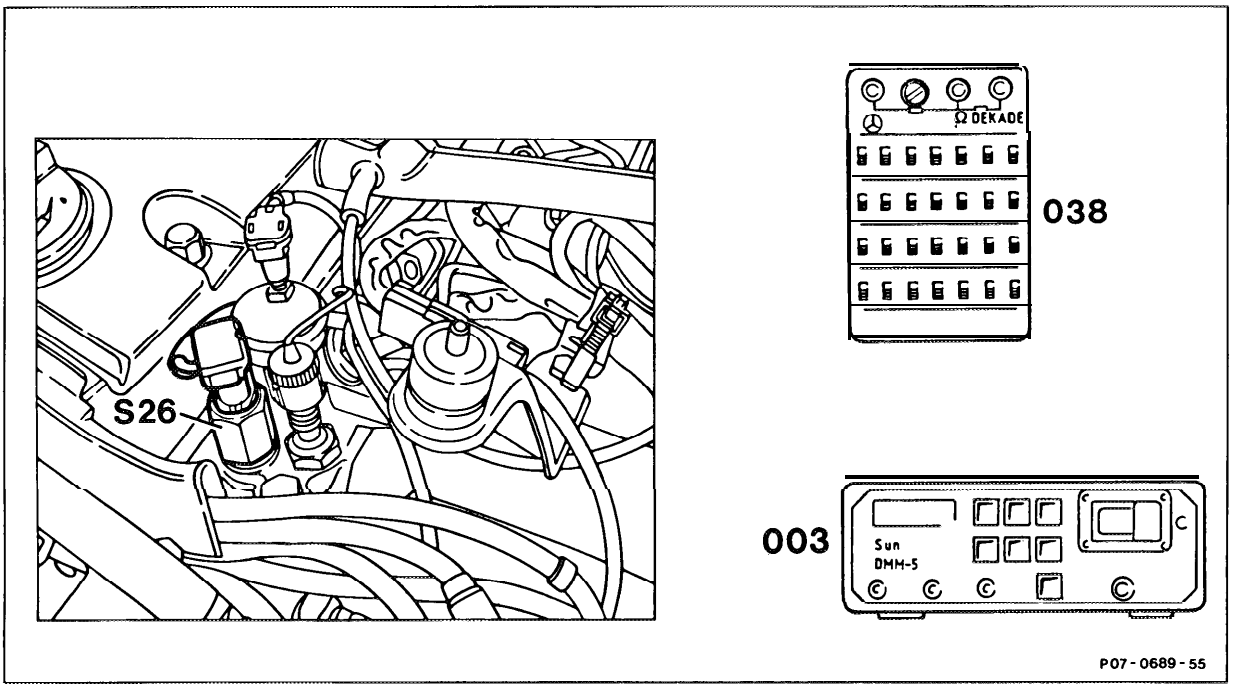
a) USA national version

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specification/ Function.	Possible cause/Remedy
	1.0 Test current at electro-hydraulic actuator (Y1)		Connect test cable (033) 102 589 04 63 00 to electrohydraulic actuator (Y1) and multimeter. Feed in 2.5 kΩ at engine coolant temperature sensor connector with Ω decade. Pay attention to Ω decade connection! **1 -pin temperature sensor (B11/3):** Ω decade to ground and detached cable. **2-pin temperature sensor (B11/2) and TSZ ignition system (KE I and KE II):** Ω decade to ground and detached cable (gn/sw) to fuel pump relay module (terminal TF). **2-pin temperature sensor (B11/2) and DI ignition system (KE III):** Ω decade to ground and detached cable (gnlrt) to CFI control module (connector 21)		

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
			4-pin temperature sensor (B11/2): Ω decade diagonally to contacts 2 and 4 Start engine	 See table for values	 Supply voltage CFI control module Engine coolant temperature sensor Volume air flow sensor potentiometer TD signal Start detection (terminal 50) at CFI control module (connector 24), only for KE I and KE II **Note** Tests, see 07.3-I 21.

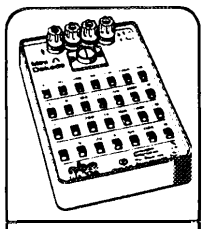
07.3–126 Testing start valve actuation

Preceding work:
Testing starting device (07.3-l 24)

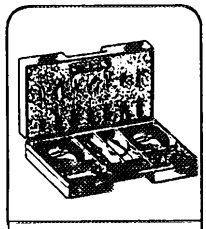


Testers	connect: multimeter (003) ohms decade (038) 124 589 09 63 00.
Starting voltage	test. At least 10 V in approx. 5 seconds.
Electric wiring between starting valve and fuel pump relay	test for continuity. Resistance approx. 0 Ω.
a) Vehicles with actuation via thermo-time switch (S26)	
Thermo-time switch (S26)	test (102.961 (USA)).
b) Vehicles with actuation via fuel pump relay module	
Voltage at fuel pump relay module	test. Contact **12** (terminal 50) at least 10 V, contact 2 (terminal TF).

Special tools



124 58909 63 00



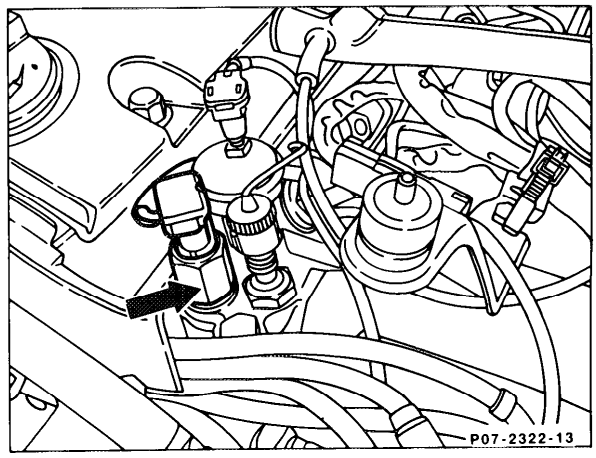
201 589 00 99 00

Commercially available tester

Multimeter	e. g. Sun, DMM-5

Note
Wiring diagrams (07.3-I 28).

a) Vehicles with actuation via thermo-time switch (arrow)



The start valve is operated by the closed thermo-time switch only when the engine coolant temperature is below + 5°C.

The actuation time increases as the temperature drops and reaches approx. 12 seconds at -20°C.

Test below + 5°C engine coolant temperature

Remove thermo-time switch and cool with commercially available refrigerant.

Connect voltmeter to terminal of start valve (Y8).

Operate starter. Depending on the engine coolant temperature, the voltmeter must then indicate ≥ 10 volts over a certain period.

The switching time increases as the temperature drops by approx. 1.5 seconds per 5°C.

e.g. + 5°C = 0 seconds
0°C = 1.5 seconds

It is recommended to still test the thermo-time switch (S26) with an ohmmeter for this test.

Test value below + 5°C:

Terminal W-G approx. 93 Ω
(contacts in switch closed).

Test above + 5°C engine coolant temperature

Above an engine coolant temperature of + 5°C the test of the thermo-time switch (S26) can only be performed with an ohmmeter. Unplug the connector at the thermo-time switch for this step.

Test value above + 5°C:

Terminal W-G ∞Ω
(contacts in switch open).

b) Vehicles with actuation via fuel pump relay

Depending on the engine coolant temperature the start valve is actuated by the coolant pump relay.

Example:
-20°C = 10 seconds.
No further actuation occurs above + 60°C or + 15°C, respectively (see 07.3-004).

Key to symbols

Battery

Multimeter

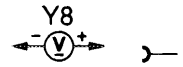
Contact

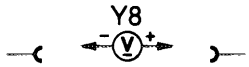
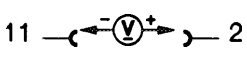
Connector

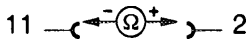
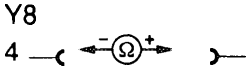
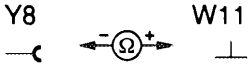
Voltage measurement (volts, direct voltage)

Current measurement (amperes, direct current)

Resistance measurement (ohms)

On/off ratio readout	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
–	1.0 Test start valve actuation	Y8 	Feed in 10 kΩ at engine coolant temperature sensor coupling with Ω decade (approx. –15°C). Pay attention to Ω decade terminal! **1-pin temperature sensor (B11/3):** Ω decade to ground and detached cable. **2-pin temperature sensor (B11/3) and TSZ ignition system (KE I and KE III):** Ω decade to ground and detached cable (gn/sw) to fuel pump relay (terminal PF).		

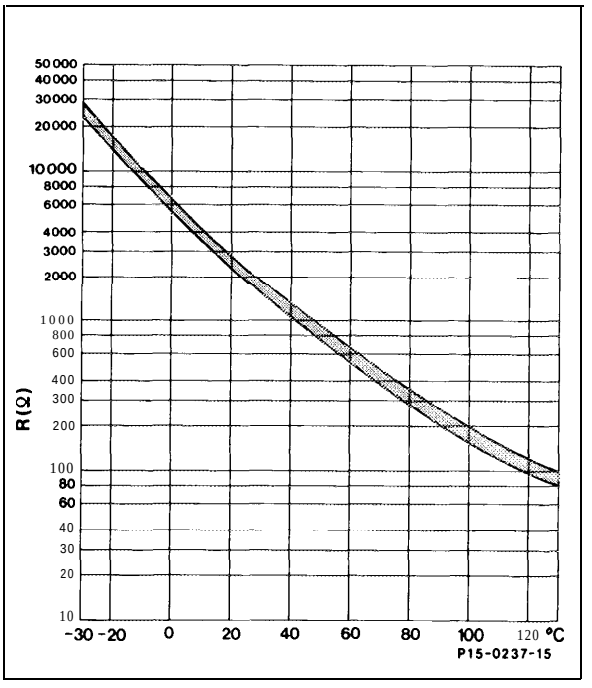
On/off ratio readout:	Test step/ Test scope	Tester/ Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
	1.0 Test start valve actuation	Y8 	**2-pin temperature sensor (B11/2) and EZL ignition system (KE III):** Ω decade to ground and detached cable (gn/rt) to KE control unit (connector 2 1) **4-pin temperature sensor (B11/2):** Ω decade diagonally to contacts 2 and 4 Plug protective connector Part No. 102 589 02 21 00 into diagnosis socket. Start engine	>10 V approx. 5 s	Fuel pump relay module (07.3-165) TF signal Voltage Terminal 50 Wiring
–	2.0 [1]) Test TF signal	Fuel pump relay module 	Fuel pump relay module disconnected. Contacts 7 and 8 bridged. Engine at idle.	3-5 v	Engine coolant temperature sensor (07.3-l 21). Open circuit CFI control module (contact 9) ▮ fuel pump relay module (contact 2). CFI control module

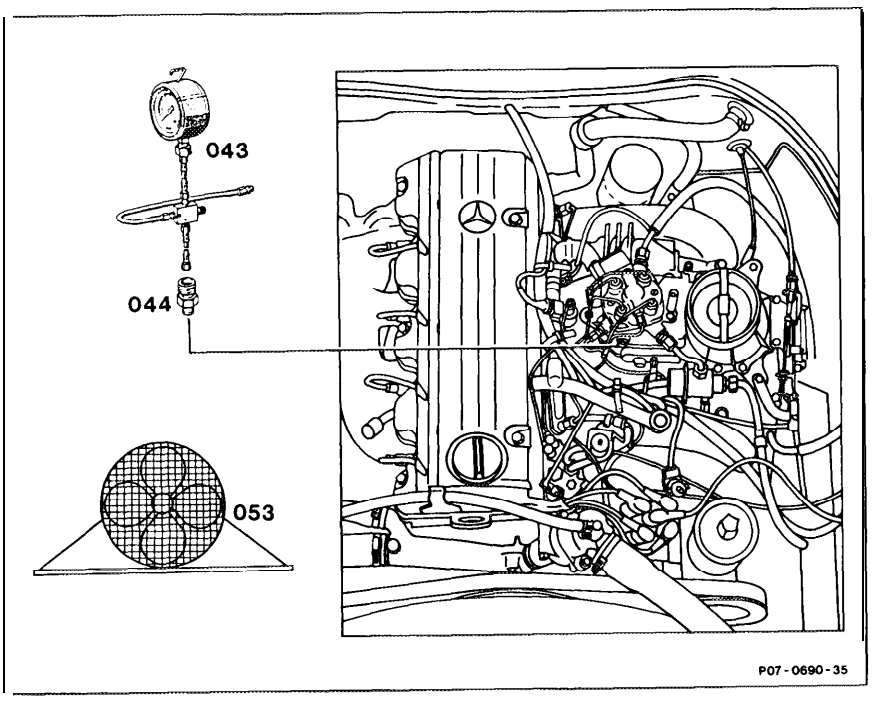
On/off ratio readout	Test step/ Test scope	Tester/ Pest connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
–	3.0 [2]) Test TF signal	Fuel pump relay module  	Fuel pump relay module disconnected.	Ω value e. g. + 80°C approx. 320 Ω + 20°C approx. 2.5 kΩ, other values see diagram	Engine coolant temperature sensor. Open circuit engine coolant temperature sensor ▮ fuel pump relay module (contact 2).
–	4.0 Voltage of terminal 50	Fuel pump relay module 	Fuel pump relay module disconnected. Starter: ON	> 9 v	Open circuit starter (M1) ▮ fuel pump relay module.
–	5.0 Wiring	Fuel pump relay module Y8  	Fuel pump relay module and start valve coupling (Y8) disconnected.	< 1 Ω	Cable has open circuit.
		 	Coupling at start valve (Y8) disconnected.	< 1 Ω	Cable has open circuit.

1) Vehicles with wiring routed from CFI control module (contact 9) to fuel pump relay module (contact 2).
2) Vehicles with wiring routed from engine coolant temperature sensor (B11/2) to fuel pump relay module (contact 2).

Diagram

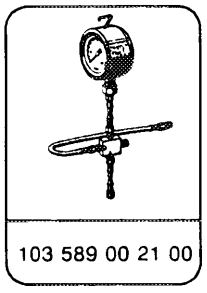
Resistances of engine coolant temperature sensor (B11/2).



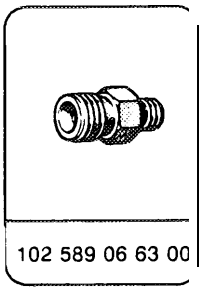


Pressure measuring device, double fitting (043, 044)	connect (07.3-l 20). Special tools 103 589 00 21 00, 102 589 06 63 00. Run engine to build up pressure.
Cooling fan (053)	for cooling engine (or leave to stand overnight).
Cold start	perform, paying attention to pressure gauge: test fuel pressures (07.3-120) or electronic components of CFI injection system (07.3–121), if necessary.

Special tools



103 589 00 21 00



102 589 06 63 00

Fuel pressures in bar gauge

Engine		102.961 102.985
System pressure when idling and engine cold or at normal operating temperature		5.3–5.5
Lower chamber pressure	Engine oil temperature approx. 80°C	approx. 0.4 [1])
	Engine not running or idling at engine coolant temperature of +20°C	approx. 0.5 [1])
	with deceleration shut-off	5.3-5.5

[1]) Below previously measured system pressure

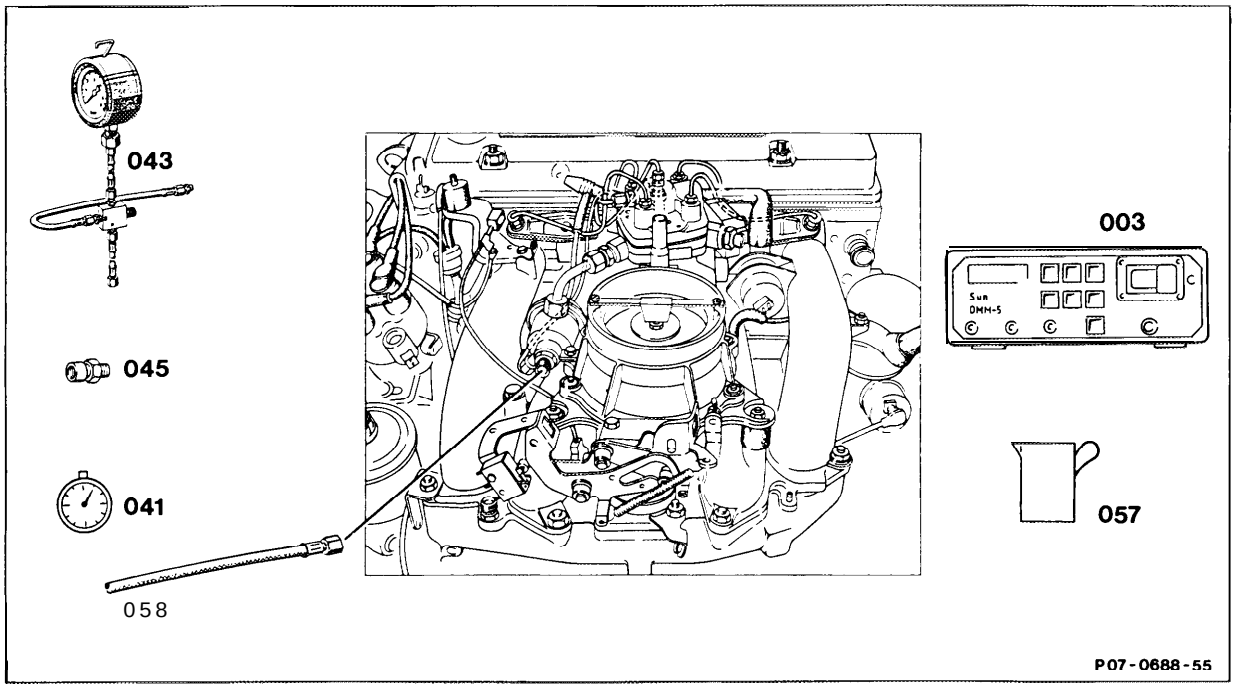
The wiring diagrams are assigned to the relevant electrical troubleshooting manual depending on the model.

Electrical Troubleshooting Manual, Model 201

07.3430 Testing fuel pump

Operation No. of operation texts and work units or standard texts and flat rates: 07-5701, 07-5702

Versions as of 1986



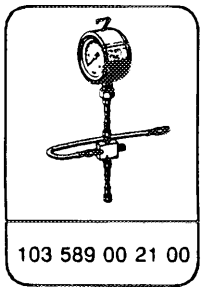
Current consumption	test. Specification 6 – **10** amperes (step **1).** Use multimeter (003) for this test.
Fuel pressure in fuel tank	**release by removing filler cap.**
Fuel return line **(51)**	unscrew.
Fuel hose (058)	make in-shop and connect to diaphragm pressure regulator.
Delivery	test. Specification **1** litre in maximum 40 seconds: use measuring beaker **(057),** stopwatch (041) for this test.
Fuel pressure	test on vehicles with double pump version. Specification 2 – 4 bar gauge. Use pressure measuring device (043) **103 589 00 21 00,** connection fitting (045) 103 589 02 63 00 for this test.

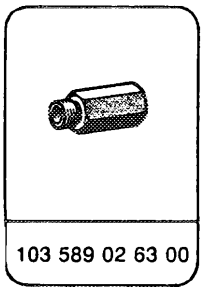
Test data

Fuel pump (qty.)		1 pump	1 pump
Designation		EKP 6	EKP 4
Engine		102 up to approx. 02/86	102 as of approx. 03/86
MB Part No.		002 091 59 01 [2])	002 091 97 01
		0 580 254 951	0 580 254 943
Test specification		with engine running and voltage of min. 11.5 volts at delivery pump	
Delivery [1])	Test point	Fuel return line downstream of diaphragm pressure regulator	
	min. 1 liter in	40 seconds	
Current consumption		6–10 amperes [3])	

1) The fuel tank must be at least half full for measuring delivery.
2) If replacing, Install Part No. 002 091 88 01.
3) KAT version up to 01/90 with oxygen sensor heater connection at terminal 87 at fuel pump relay: detach oxygen sensor heating coil plug connection (G3/2x1).

Special tools


103 589 00 21 00


103 589 02 63 00

201 589 00 99 00

Commercially available testers

Measuring glass or beaker (at least 1 litre), stopwatch	
Multimeter	e. g. Sun, DMM-5

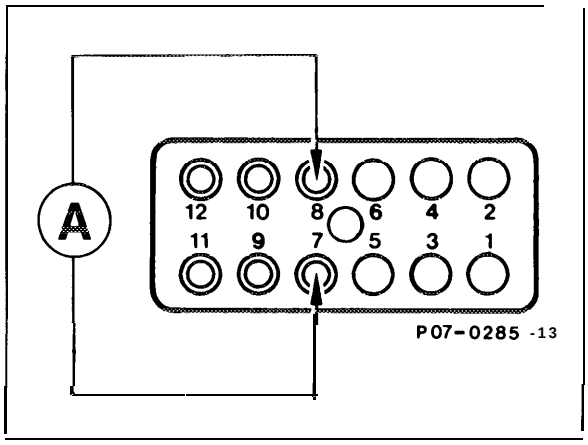
Shop-made tools

Fuel hose	500 mm long
Tube with sealing cone	
Union nut	M14x1.5

Note
For wiring diagrams see Electrical troubleshooting Manual, Model 201.
The fuel pump must run audibly for a short time (approx. 1 second) when the ignition is switched on.

A. Delivery

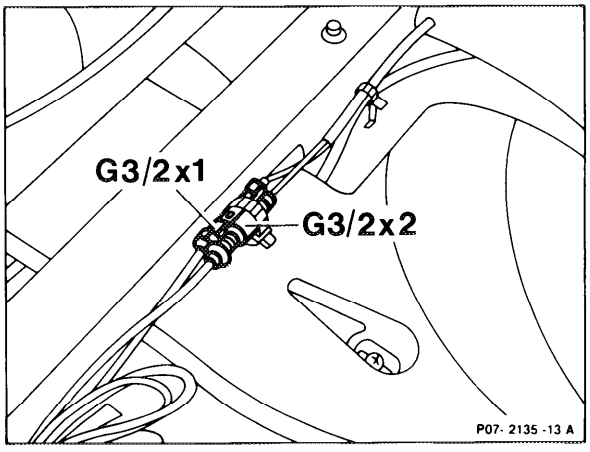
1 Detach fuel pump relay module. Multimeter set to amperes. Test current consumption at contact 7 (terminal 87) and contact 8 (terminal 30).



Current consumption 6 – 10 amperes.

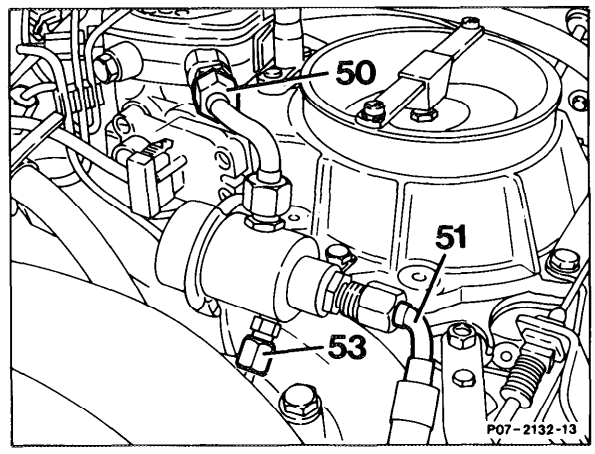
If the readout is greater than 10 amperes, proceed as follows:

a) Vehicle with Catalytic Converter (up to 01/90)
Detach heated oxygen sensor heating coil plug connection (G3/2x 1) and repeat measurement. Located in right footwell (arrow), as of 09/89 next to battery.



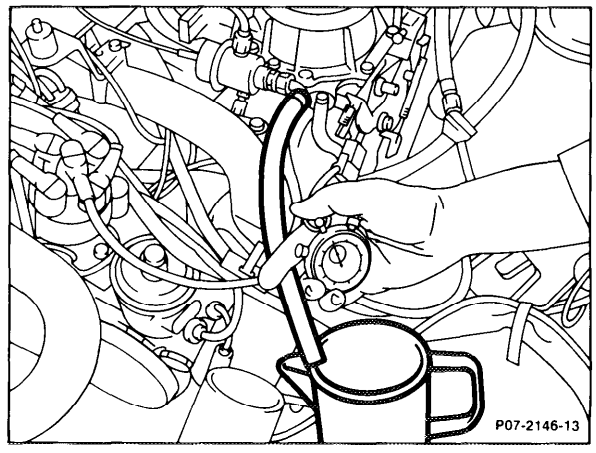
Test current consumption of heated oxygen sensor, 0.5 – 1.3 A; test heated oxygen sensor if necessary (see 07.3-l 21, test program with contact box, on/off ratio 50%).

2 Detach wiring from multimeter. The delivery of the fuel pump should be tested in the fuel return. Release fuel pressure in fuel tank by removing filler cap. Unscrew fuel return line (51) at the diaphragm pressure regulator and plug.



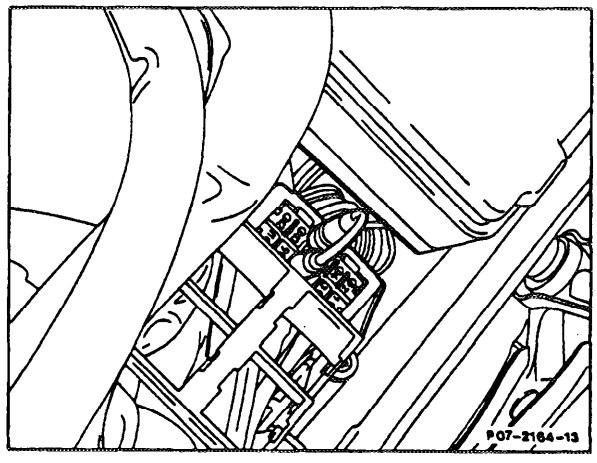
50 System pressure feed
51 Fuel return
53 Fuel distributor return

3 Screw shop-made fuel hose onto diaphragm pressure regulator and hold in measuring glass or beaker.



4 Bridge contacts 7 and at fuel pump relay module. This supplies voltage to the fuel pump.

Arrangement of fuel pump relay module in right of component compartment.
Engine 102.961: in front of electrical center (see ill.).



Detach bridge after 40 seconds or before measuring glass/beaker runs over.

Specification:
1 liter in maximum 40 seconds at a minimum voltage of 11.5 volts at the fuel pump.

5 If the delivery is less than 1 liter in 40 seconds, test the following points:

a) Test voltage at the fuel pump. Specification at least 11.5 volts.

b) Check that strainer in supply line fitting of fuel distributor is not blocked.

c) Check fuel lines for restriction points (pinched lines).

d) Clamp off leak line between fuel accumulator and fuel suction hose. Re-check fuel delivery. If the specified delivery quantity is reached, replace fuel accumulator.

e) Replace fuel filter.

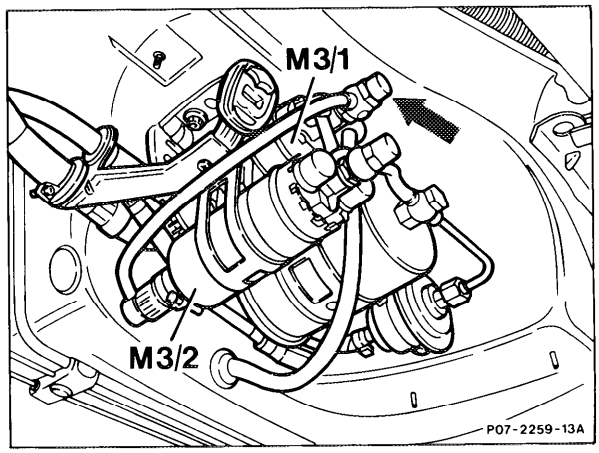
6 If the delivery is still insufficient, replace fuel pump.

7 Connect fuel return hose, install fuel pump relay module.

B. Fuel pressure

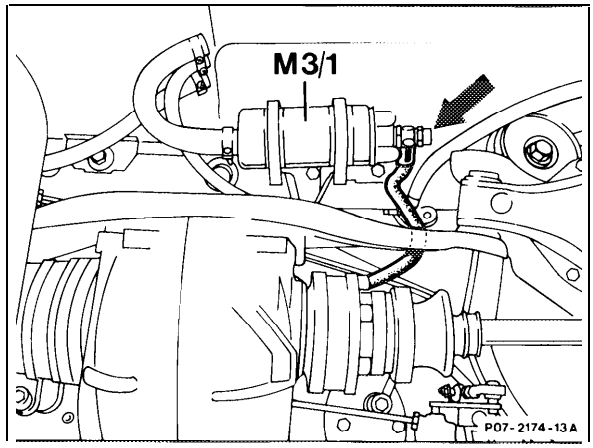
1 Take off protective box.

2 Unscrew cap nut (arrow) at fuel pump (M3/1). Connect fitting, Part No. 103 589 02 63 00 and pressure gauge, Part No. 103 589 00 21 00.



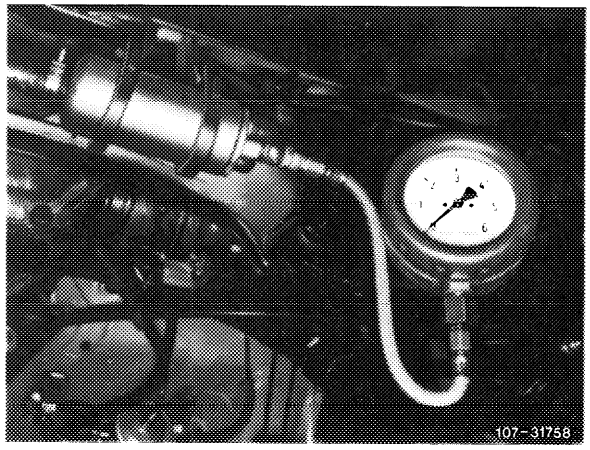
3 Detach fuel pump relay module and bridge contacts 7 and 8 (terminals 30 and 87).

4 Take reading on pressure gauge. The pressure must be between 2 – 4 bar. If it is below 2 bar, the fuel pump (M3/1) is defective. If it is above 4 bar, the fuel pump (M3/2) is defective.



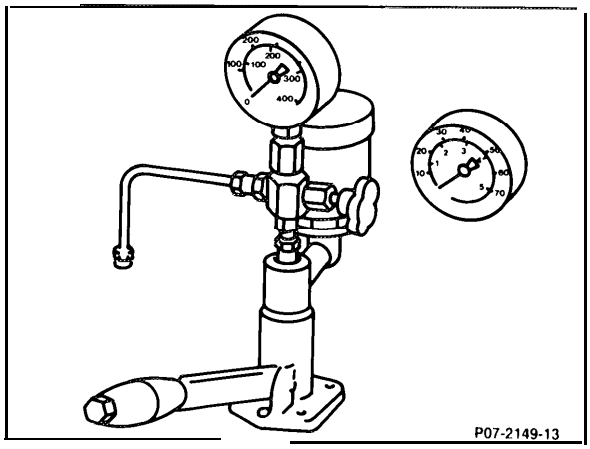
5 Disconnect pressure measuring device, connect cap nut, install fuel pump relay module and check for leaks.

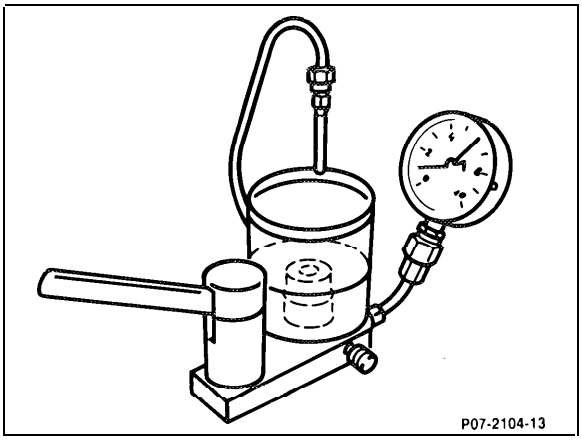
6 Install protective box.



07.34 35 Testing fuel injectors

Preceding work:
Removal and installation of injectors (07.3-215)





Fuel injectors	test.
Rough leak test	a) Connect removed injectors to tester. Bleed pressure line with shutoff cock open and union nut open. Following this, tighten union nut.
	b) Shutoff cock open; slowly operate hand lever (4 sec./stroke) and build up pressure to max. 1.5 bar gauge. If a leak is detected at the injector, the injector must be replaced.
Test opening pressure	See test data for new injectors. See test data for used injectors. Close shutoff cock. Flush through injector by operating hand lever rapidly several times. Open shutoff cock and test opening pressure with slow movement of hand lever.

Precision leak test	Close shutoff cock. Flush through injector by opening hand lever rapidly several times, open shutoff cock and increase pressure slowly up to 0.5 bar gauge pressure below the previously determined opening pressure, and hold. No drop must form at the injector within 15 seconds.
Chatter test, assessing spray pattern	Close shutoff cock and flush injector by operating hand lever several times (0.5 sec./stroke). Following this, reduce lever speed to approx. 1 sec./stroke. This must cause the injector to chatter. No drop should form at the mouth of the injector. No string jet should form. Unilateral, atomized jet formation within a total spray angle of approx. 35 ° is permissible. See illustrations for assessing spray jet.

Test data

Engine		MB Part No. (Bosch No.)	Opening pressure (bar gauge 1)) new injectors	Opening pressure (bar gauge 1)) min. for used injectors
102	up to 08/88	000 078 40 23 (0 437 502 010)	3.5 - 4.1	3.0
	as of 09/88	000 078 56 23 2) (0 437 502 047)	3.7 - 4.3	3.2

1) Fuel injectors which are found to be out of tolerance must be replaced. Injectors may be replaced individually within a set.
2) Brass fuel Injectors.

Tightening torques in Nm

Injection lines to fuel distributor (reference value)	10 - 12
Injection lines to injectors (reference. value)	10 - 15

Commercially available tools and testers

Designation	e. g. Make, Order No.
Injector tester EFEP 60 H 1)	Bosch No. 0 684 200 700
0 – 6 bar pressure gauge, housing Ø100 mm, quality class 1 .O	Bosch No. 1 687 231 000
Pipe line	Bosch No. 1 680 750 001
Adaptor 2)	Bosch No. KDJE-P 400/7

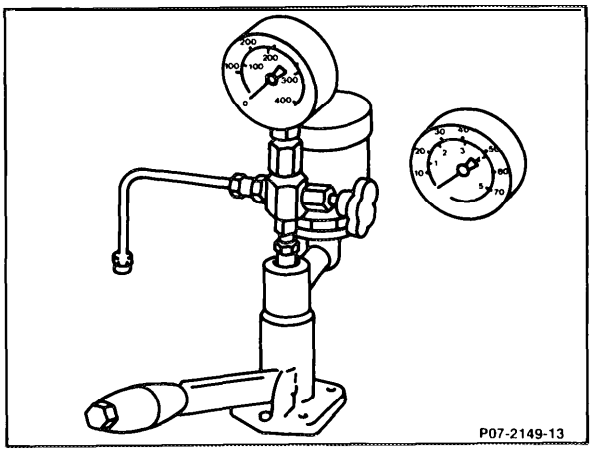
1) Similar to previous injector tester The pressure gauge listed or the pressure gauge of the pressure measuring device 100 589 13 21 00 is required for testing the Injectors.

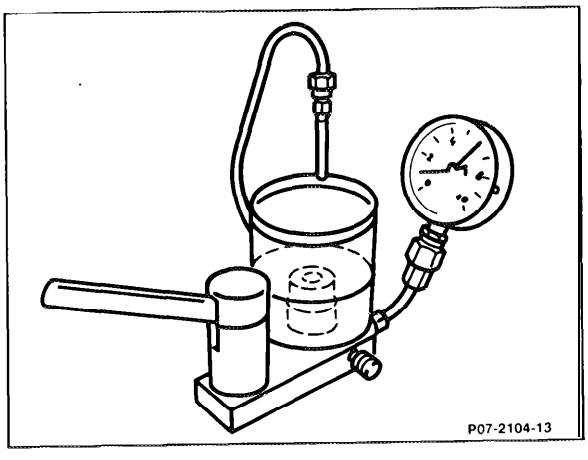
2) An adaptor must be used due to the modified M1 0 x 1 connection thread of the Injectors.

Note

The opening pressure, chatter, the jet and the leaktightness of the fuel injectors must be tested using an injector tester.

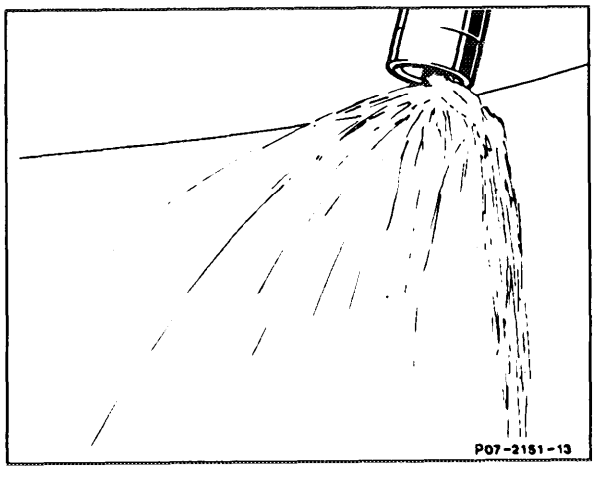
Before it is possible to begin testing the injectors, the reservoir tester must be filled and the tester bled. Only clean test fluid (i.e. Shell mineral spirits 135) should be used for testing.





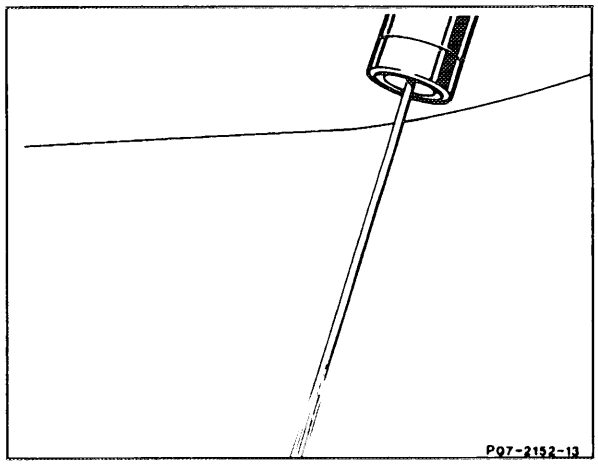
Assessing jet

Damaged fuel injectors

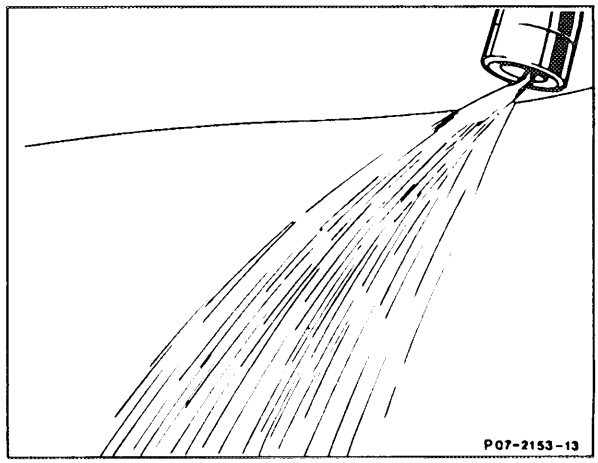


Formation of drops

Pencil shaped jet

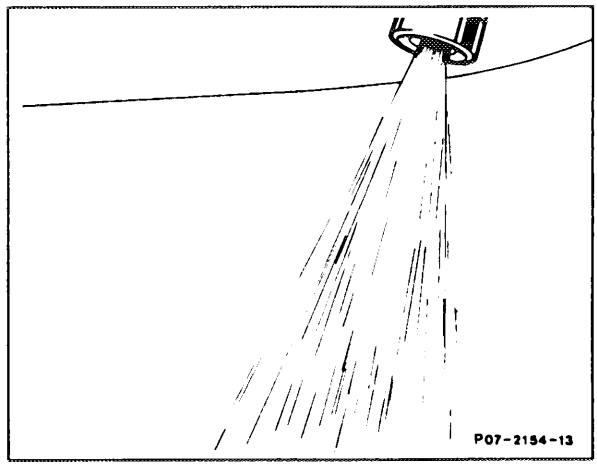


Stringy jet

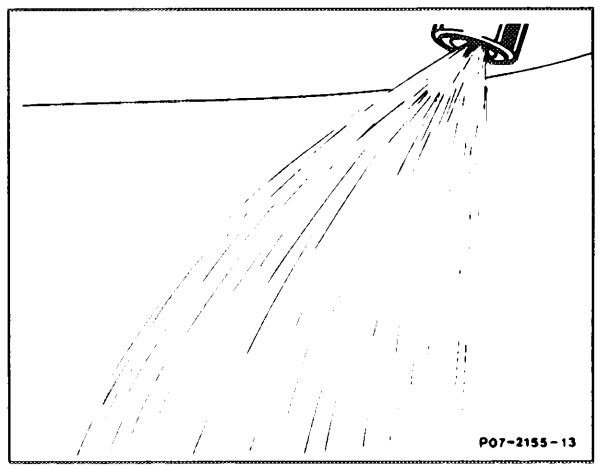


Good fuel injectors

Good spray formation

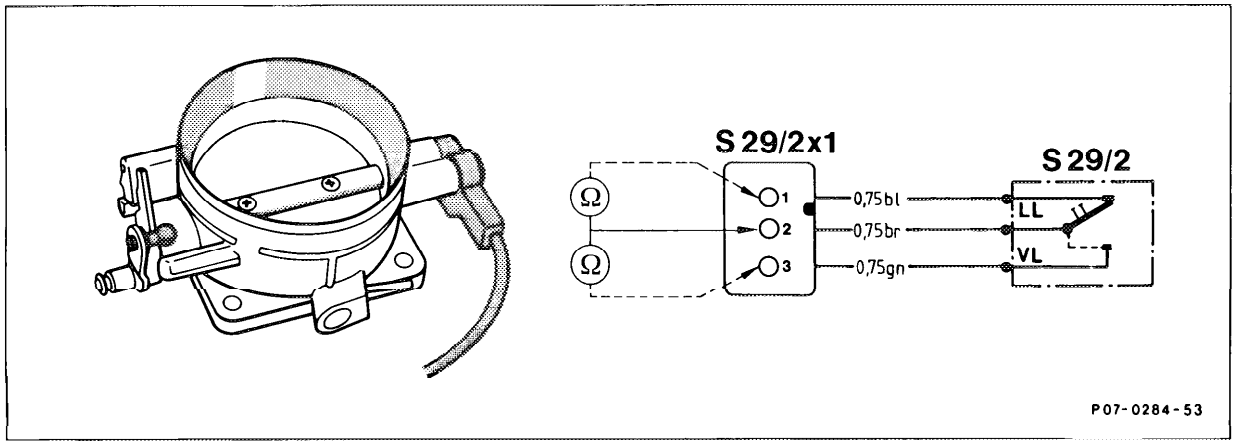


Slightly unilateral atomization



07.3–152 Testing, replacement of wide open throttle/closed throttle position switch

Preceding work:
Removal and Installation of throttle valve assembly
(07.3-230)



S29/2 Wide open throttle/closed throttle position switch
S29/2x1 Wide open throttle/closed throttle position switch connector

Note
Check closed throttle position stop only in the case of wide open throttle/closed throttle position switch with wide open throttle/closed throttle speed detection.

Ohmmeter	set to measuring range 0 – ∞.
Full throttle stop	check by pressing switch against wide open throttle stop. The readout should be 0 Ω. Turn throttle valve slightly towards closed throttle position: this must cause the readout to show ∞Ω.
Closed throttle position stop	check by pressing throttle switch against closed throttle position stop. Turn throttle switch far enough to obtain a readout of 0Ω. Raise throttle switch 0.2 mm; this must cause readout to show ∞Ω.

Closed throttle position contact:

closed throttle position	approx. 0Ω
wide open throttle position	approx. ∞Ω

Wide open throttle position contact:

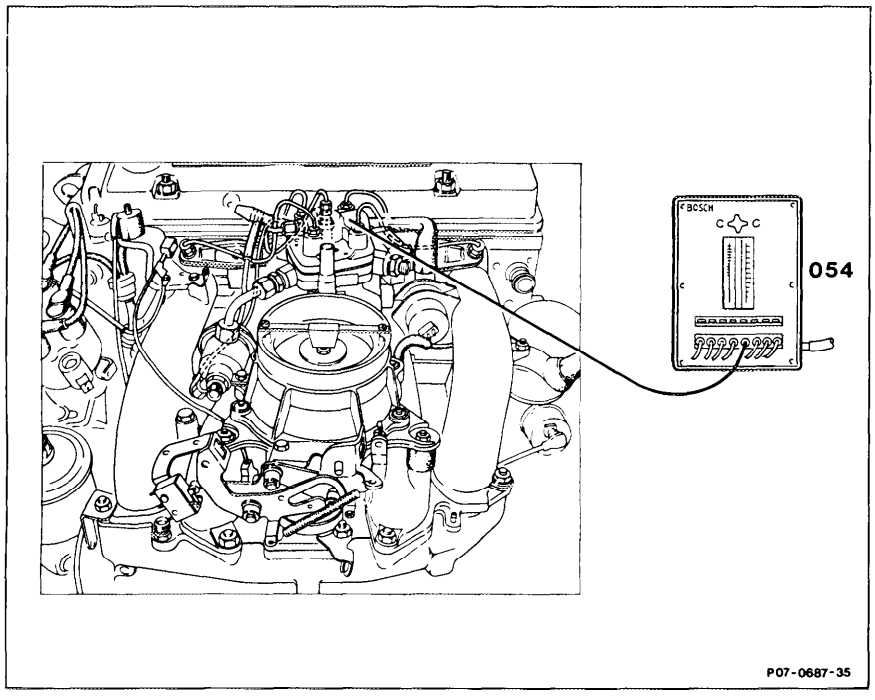
closed throttle position	approx. ∞Ω
wide open throttle position	approx. 0Ω
partial throttle position	approx. ∞Ω

Commercially available tester		
Multimeter	e.g.	Sun, DMM-5

WOT/CTP switch (S29/2 and S29/1).....	replace by removing both fastening bolts and bolting on.

Performing fuel quantity comparison measurement

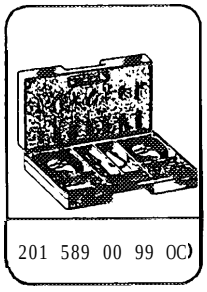
Precedmg work:
Testing, adjusting engine (07.3-110)



Quantity comparison tester	unscrew, screw in.
Injection lines	Remove at fuel distributor and at injectors, bolt on. Clean connection points before reinstallation.
Quantity comparison tester (054)	connect to fuel distributor (see ill. for sequence).
Fuel return line	insert into filler neck of fuel tank.
Adjusting device for setting air flow sensor plate	clamp to stop bar of air flow sensor plate (see ill.).
Fuel pump relay	disconnect and bridge contacts 7 and 8 (fuel pump runs).
Air flow sensor plate	deflect and press button 1 to 4 in sequence for bleeding tester.
Tester button 1	press and hold. Deflect air flow sensor plate by means of adjusting device far enough to obtain a reading of 4 cc/min. (idle quantity). Fix air flow sensor plate in position.

Tester buttons 2 to 4	press in sequence and measure flow quantities and enter on sheet B 20 800 99 472 00 (or note on paper). Maximum permissible variation between cylinders 0.4 cc/min (at idle). Following this, identical procedure as before. Test part and wide open throttle flow quantities by deflecting air flow sensor plate. a) Part throttle 30 cc/min b) Wide open throttle 100 cc/min Maximum permissible variation between cylinders: Part throttle 4 cc/min Wide open throttle 10 cc/min If the variation is out of tolerance, replace fuel distributor (07.3-205).
Engine	run; check all fuel connections for leaks.
Idle speed	set (07.3-l 05).

Special tool



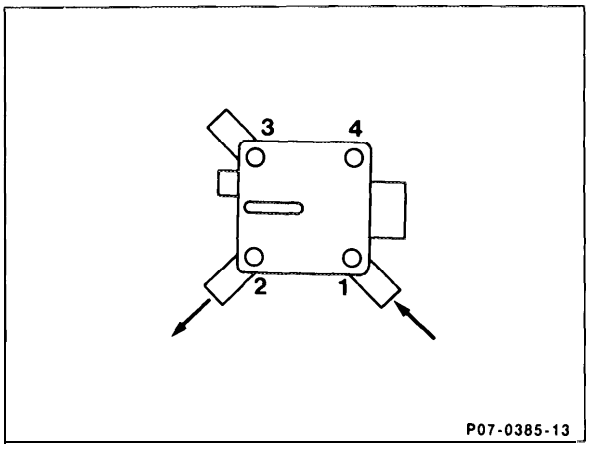
Commercially available Bosch testers and accessories

Designation	Order designation
Quantity comparison tester	KDJE-P 300
Tester trolley [1]	M 200/2 or KDJE-W 100

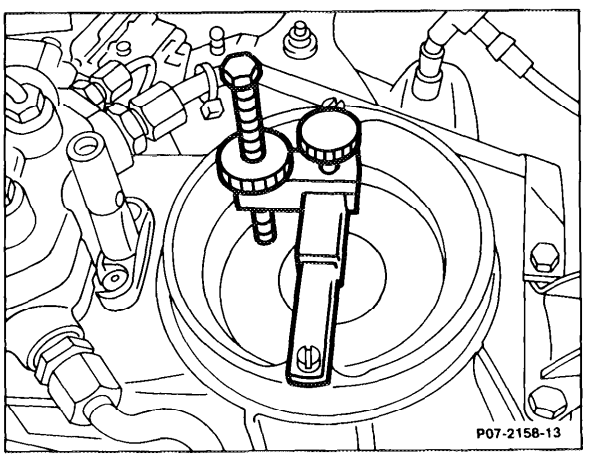
[1] If the tester trolley is used for the quantity comparison tester, an additional angle plate is required. This can be shop-made or obtained through a Bosch distributor.

Note

The measurement is performed with the engine not running. The operating condition (idle speed, part or full load) is simulated and set at the air flow sensor plate using an adjusting device.



Arrangement of fuel lines at fuel distributor

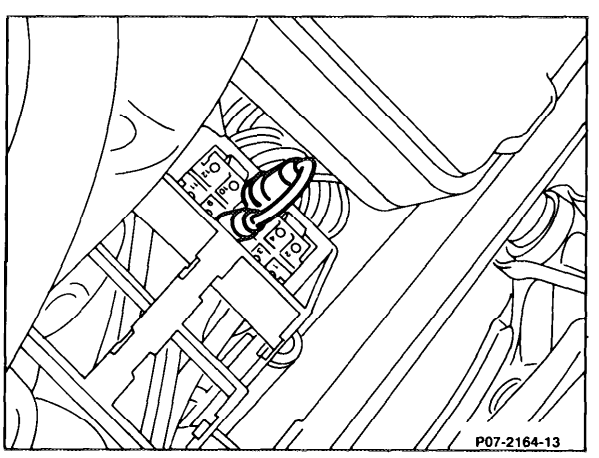


Fix air flow sensor plate with adjusting device

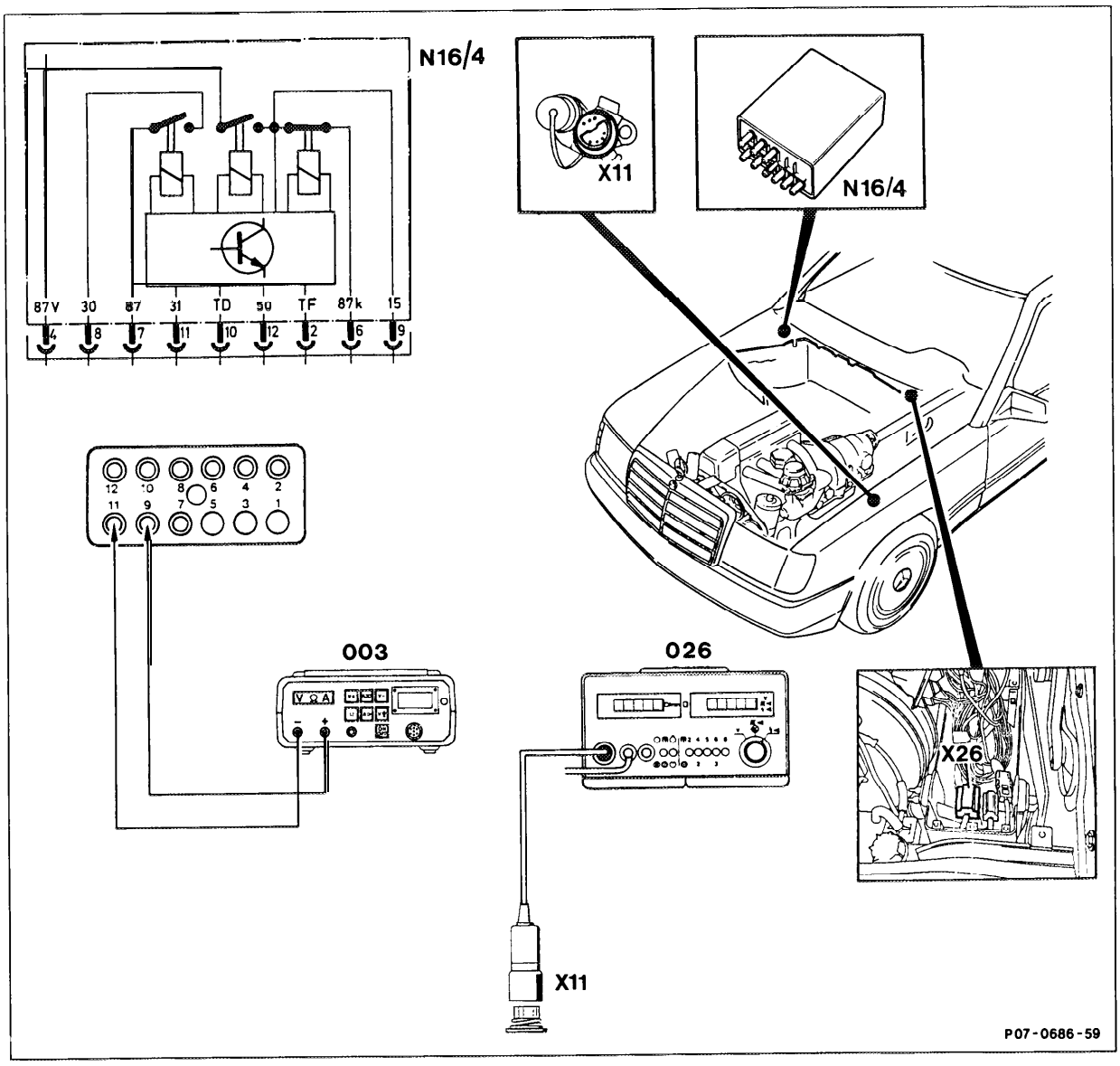
Detach fuel pump relay and bridge contacts 7 and 8 (terminals 30 and 87).

This supplies voltage to the fuel pump. The fuel pump relay is located on the right of the component compartment.

On engine 102.961 it is located in front of electrical center.



07.3-165 Testing fuel pump relay module



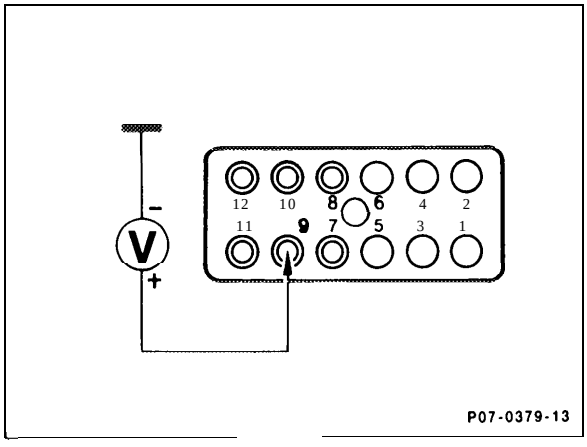
N16/4	Fuel pump relay module	X26	Interior/engine connector
x11	Diagnostic connector/terminal block	003	Multimeter
		026	Engine tester

Wiring diagrams (07.3428).
Check current draw of fuel pump (07.3430).

Engine	Version	Fuel pump relay module MB Part No.	Governed speed 1/min	Kick-down shutoff	Starting valve actuation	Remarks
102.961	USA	001 545 93 05 1) 001 545 94 05 2)	5700 ± 50	5500 ± 50	--	up to 09/84
102.985	USA	001 545 93 05 1)	5700 ± 50	--	--	06/83-08/84
		001 545 94 05 2)	5700 ± 50	5500 ± 50	--	06/83-08/84
		001 545 77 05 1)	3)	--	60°C/ Coolant temperature sensor	09/84-07/86
		001 545 78 05 2)	3)	5900 ± 50	60°C/ Coolant temperature sensor	09/84-07/86
		002 545 20 05 1) 002 545 21 05 2)	6200 ± 50	6000 ± 50	60°C/ KE voltage signal	as of 08/86
		003 545 20 05	6200 ± 50	6000 ± 50	60°C/ KE voltage signal	1991

1) Manual transmission, replacement part as for automatic transmission.
2) Automatic transmission.
3) Without engine speed limiter

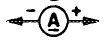
Pin assignment for fuel pump relay module connector



1 not assigned
2 with start valve actuation (terminal TF):
CFI control module
3 not assigned
4 with start valve actuation (terminal 67V).
start valve (Y8)
5 as of approx. 01/90 (terminal 67H):
heated oxygen sensor heater from + 20°C
6 with automatic transmission (terminal 67k):
kick-down valve (Y3)
7 fuel pump,
oxygen sensor heater (up to 12/89),
auxiliary air fan heating coil (without idle speed control)
(terminal 87)
8 Terminal 30
9 Terminal 15
10 engine speed signal (terminal TD)
11 ground (terminal 31)
12 start signal (terminal 50)

Test

Key to symbols

	Battery
	Multimeter
	Socket
	Pin
	Ground
	Bridge
	Voltage measurement (volts, direct voltage)
	Current measurement (amps, direct current)
	Resistance measurement (ohms)

Notes

If the specified value of a test step, e. g. step 4.0, is in order, it is not necessary to perform test step 4.1.

Different component designations are possible depending on wiring diagram or in the case of vehicles with optional equipment. These designations are given in parentheses. The fuel pump relay module has been designated uniformly with N16/4 (N5/1, N5/2, N16/1, N16/2, N16/3 also possible in the wiring diagrams).

On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
–	1.0 Voltages at fuel pump relay module (N16/4)	–	Ignition: ON Fuel pump in order.	Fuel pump starts briefly when ignition switched on.	Fuel pump voltage. Fuel pump relay module.
	1.1 Voltage terminal 30	N16/4 11 — V — 8	Fuel pump relay module disconnected.	11-14v	Open circuit to terminal block, terminal 30. Open circuit to ground.
	1.2 Voltage terminal 15	N16/4 11 — V — 9	Ignition: ON Fuel pump relay module disconnected.	11-14v	Cable has open circuit.
	1.3 Cable	N11 W9) W10) N16/4 ⊥ — Ω — 11	Ignition: OFF Fuel pump relay module disconnected.	< 1Ω	Cable has open circuit.
	1.4 Cable	N16/4 + — Ω — 8	gnition: OFF Fuel pump relay module disconnected.	< 1Ω	Cable has open circuit.

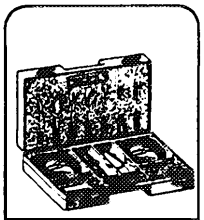
On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
	1.5	F1 N16/4 5 — Ω — 9 (Coupling U	Ignition: OFF Fuel pump relay module disconnected. Electrical center coupling U disconnected.	< 1Ω	(Cable has open circuit.
	2.0 Start signal terminal 50	N16/4 11 — V — 12	Starter: ON Selector lever in position "P" or "N".	10-14 v	(Cable has open circuit.
	2.1 Cable	X14 (X35) 1) N16/4 50 — Ω — 12	Ignition: OFF Fuel pump relay module and Xl4 disconnected.	< 1Ω	(Cable has open circuit.
	3.0 Engine speed signal terminal TD	N16/4 10 — V — 11 7 — ⊏ — 8	Fuel pump relay module disconnected. Start engine.	6–12 v	(Cable has open circuit.
	3.1 Cable	N16/4 x11 10 — Ω — 1	Ignition: OFF	< 1Ω	(Cable has open circuit.
–	4.0 Kickdown shutoff 2)	N16/4 ⊥ — V — 6	Disconnect fuel pump relay far enough to make connection to connector 6. Start engine Increase engine speed up to approx. 200/min less than governed speed. See table for engine speed.	 11–14 v Voltage drops	(Cable has open circuit. ((07.3-l 67). Fuel pump relay.

1) Model 201.024 vehicle identification end no. 000 001 • 045 803

2) with automatic transmission, test if engine is governed before upshift.

On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
–	5.0 Governed speed		Start engine increase speed	Governed speed and version with speed limiter, see table	Test TD signal (test step 3.0). Fuel pump relay.

Special tool



201 589 00 99 00

Commercially available testers

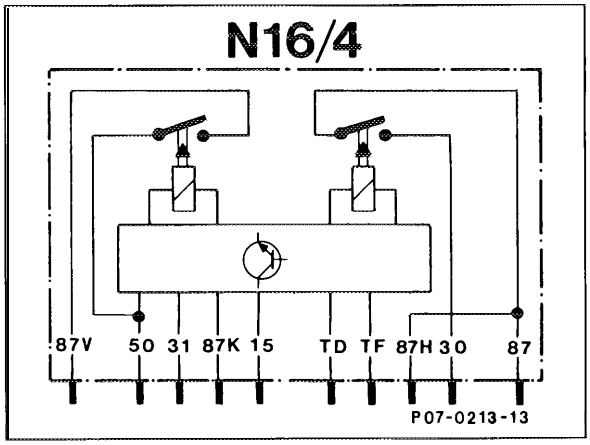
Multimeter	e. g.	Sun, DMM-5
Engine analyzer	e. g.	Bosch, MOT 001.03

Function

The fuel pump relay performs the following functions:

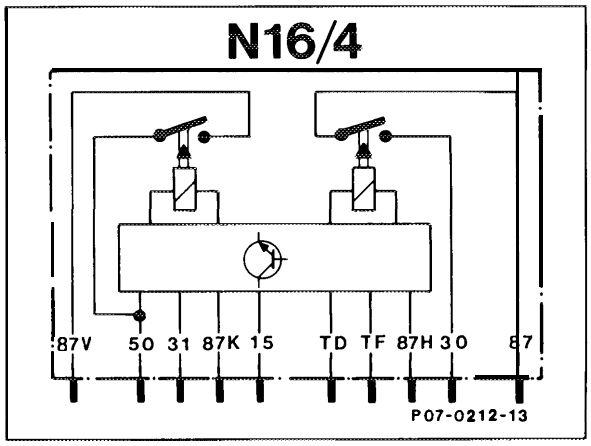
- Brief supply of voltage to fuel pump when ignition is on.
- Voltage supply to fuel pumps when engine started and when running.
  With KAT, additionally voltage supply of oxygen sensor heater.
  Voltage supply of auxiliary air valve (only vehicles without idle speed control).
- Shuts off fuel pumps when maximum engine speed is reached (speed limiter, versions see table).
- Switches off fuel pump as soon as no further pulses supplied vie terminal TD of ignition control module.
- Kick down shutoff (for test see 07.3467).
- Starting valve actuation (for test see 07.3-l 26).

- As of 09/89 the function in the fuel pump relay module is partially supplemented in two stages by a separate oxygen sensor heater:



1st version up to approx.12/89

The fuel pump relay module is fitted with an additional connector for the oxygen sensor heater with the designation 87H. This also results in a modification to the cable assignment at the relay module.
The actuation is performed as before as the additional connector 87H is linked by a bridge to the connector with the designation 87.



2nd version as of 01/90

From this date on the fuel pump relay module is no longer equippedwith a bridge between terminals 87 and 87H. The electronic circuitry in the relay is modified as a result. The cut-in temperature for the oxygen sensor heater is + 20°C and is determined by the coolant temperature sensor.

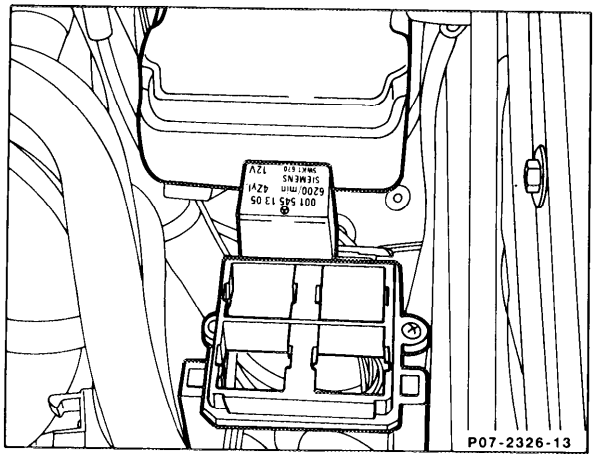
Note

Only the new fuel pump relay modules are available through replacement parts. This means that in vehicles prior to 09/89, the actuation of the fuel pump and oxygen sensor heater continues to be performed by connector 87. Connector 87H on these vehicles does not perform any function.

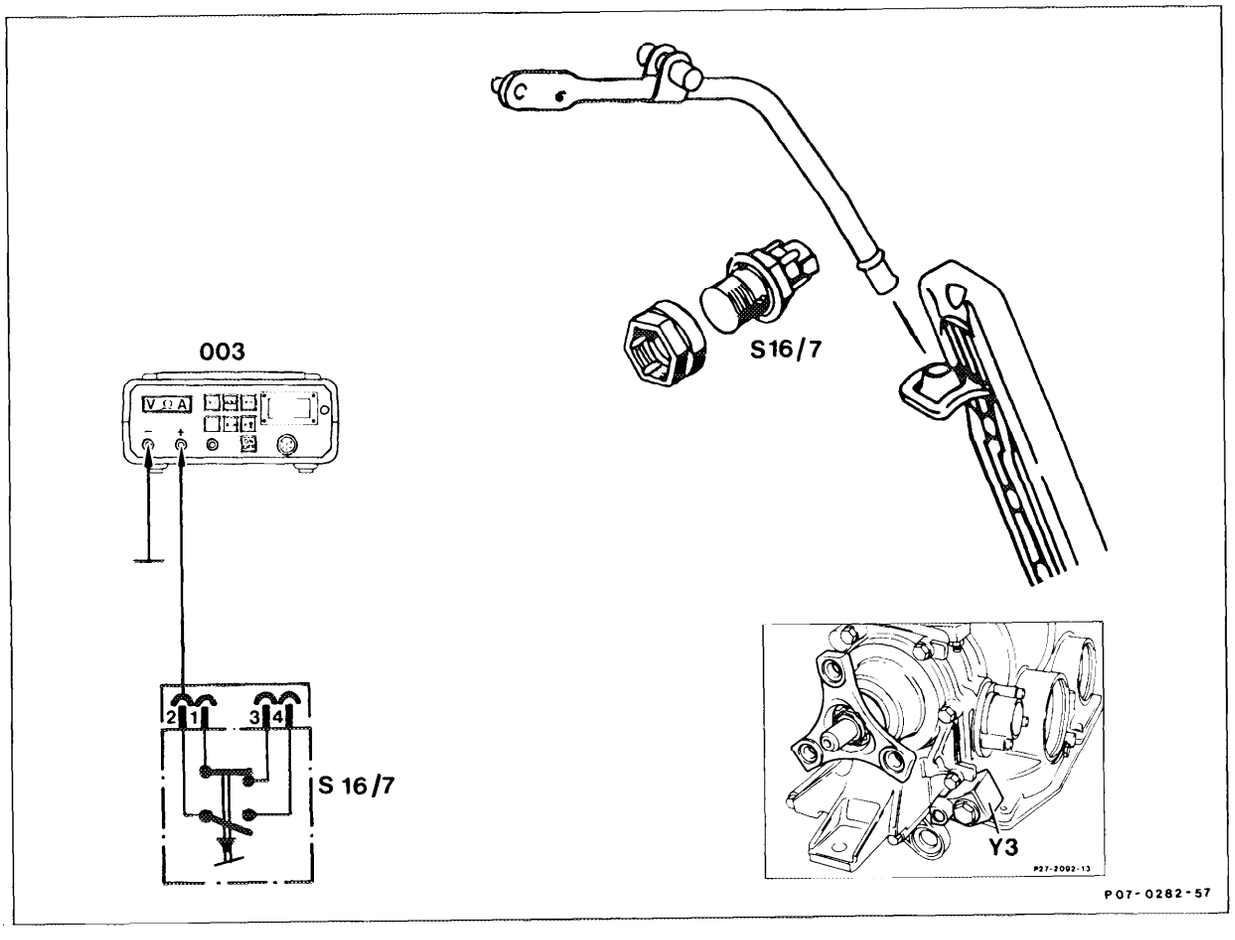
Arrangement of fuel pump relay module

The fuel pump relay module is located on the right of the component compartment.

Exception: engine 102.961 in model 201.
Fuel pump relay in front of electrical center (see ill.).



Testing kick-down switch



S16/7	Economy mode kickdown switch	003	Multimeter
Y3	Kickdown valve		

Test

Key to symbols

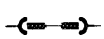
Battery

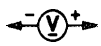
Multimeter

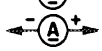
Socket

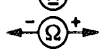
Pin

Ground


Bridge


Voltage measurement (volts, direct voltage)


Current measurement (amps, direct current)


Resistance measurement (ohms)

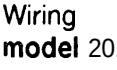
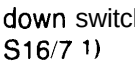
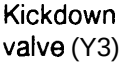
Notes

If the specified value of a test step, e. g. step 4.0, is in order, it is not necessary to perform test step 4.1.

- Different component designations are possible depending on wiring diagram or in the case of vehicles with optional equipment. These designations are given in parentheses.

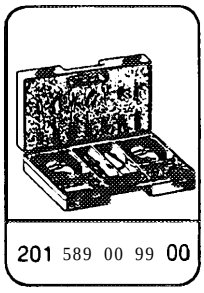
On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
–	1.0 Test kick-down shut-off 1)	S16/7 (S30/2) __/_+-++--- 2	Ignition: ON Coupling at kickdown switch disconnected.	11–14 V	Wiring.
		S16/7 (S30/2) 4—(-V+)— 2		11–14 V	Wiring.

1) Vehicles without economy mode with 2-pin kickdown switch S16/6 (or S30/1), coupling has no contact designaion (note coloring of wiring).

On/off ratio readout	Test step/ Test scope	Tester Test connection	Operation/ Requirement	Specification/ Function	Possible cause/Remedy
–	1.1 Wiring model 201	N16/4 (X18) 1 — 6  X26/3 2)	Ignition: OFF Fuel pump relay module and connectors X26, S16/7 and Y3 disconnected.	< 1Ω	Open circuit.
		X26/3 2) (X18) 1 — 2 S16/7 (S30/2)		< 1Ω	Open circuit.
		S16/7 (S30/2) 4 — Y3		< 1Ω	Open circuit.
–	2.0 Test kick-down switch S16/7 1)	S16/7 (S30/2) 4 — 2 	Ignition: OFF Kickdown switch connector disconnected.		Kickdown switch.
			Operate kick-down switch.	< 1Ω	
			Do not operate kick-down switch.	∞Ω	
–	3.0 Kickdown valve (Y3) (automatic transmission)	Y3 	Ignition: ON Operate kick-down switch.	11–14 V	• Cable. • Kickdown valve.

1) Vehicles without economy mode with 2-pin kickdown switch S16/6 (or S30/1), coupling has no contact designation (note color of wring).

Special tool

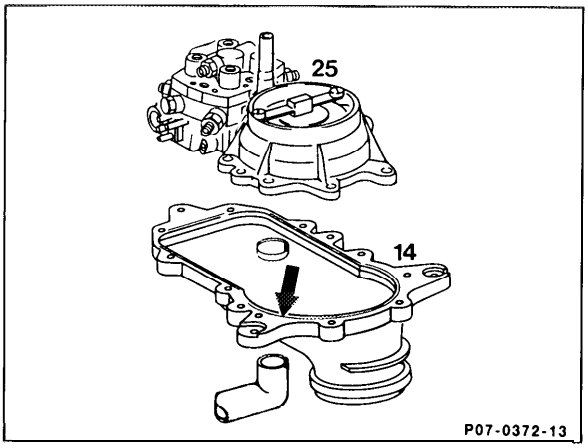


Commercially available tester

Multimeter	e. g.	Sun, DMM-5

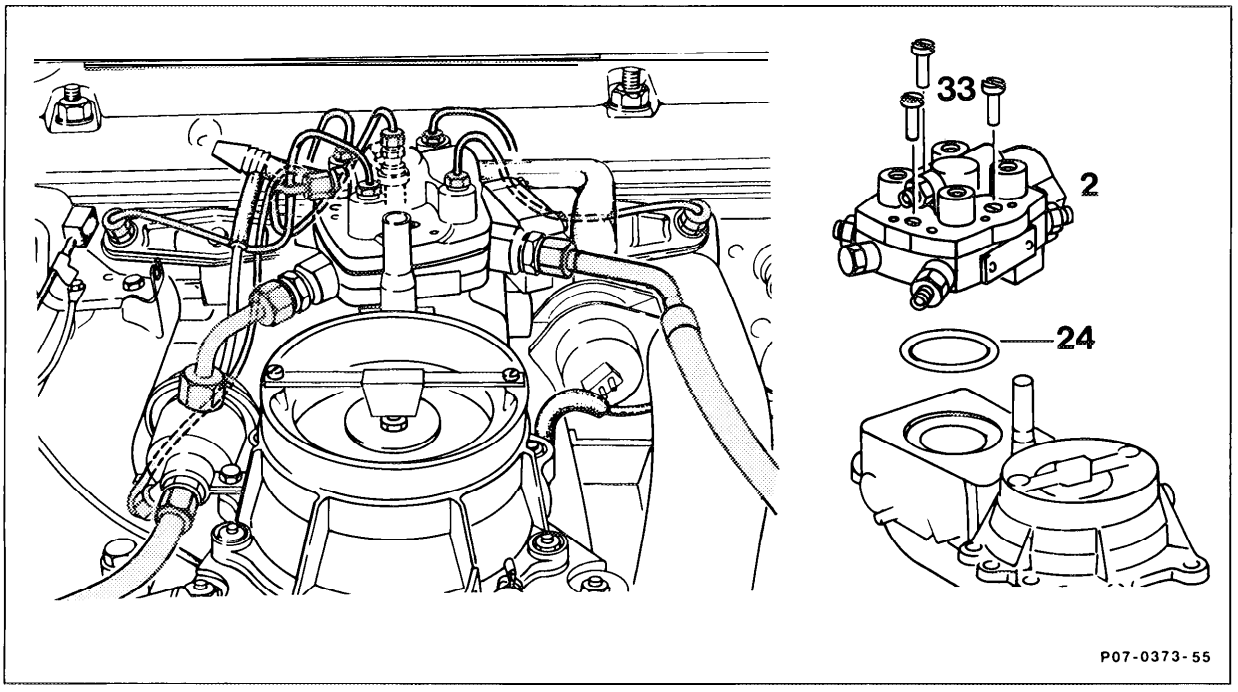
07.3–200 Removal and installation of mixture control unit

Preceding work:



Mixture control unit (25)	remove together with air guide housing (14), install (07.3-225).
Air guide housing (14)	unbolt from mixture control unit (25). Replace damaged parts. During installation, do not use sealing compound. Seal is provided by sealing lip (arrow). The air guide housing is made of rubber. It is inserted into the light alloy frame for fixing in place.

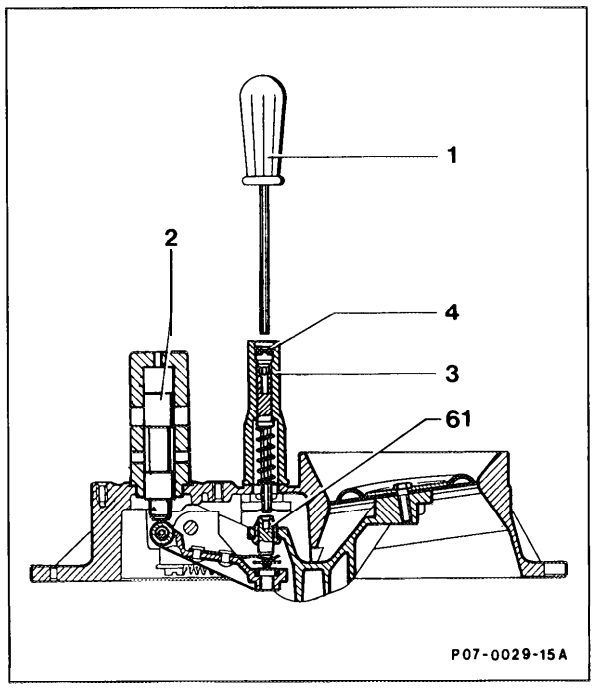
07.3–205 Removal and installation of fuel distributor



Fuel supply and return lines	disconnect, connect
Injection lines	disconnect at fuel distributor and at injectors, connect, 10-15 Nm (reference value).
bolts (33)	remove, bolt in.
Fuel distributor (2)	detach by turning back and forward.
Rubber seal (24)	replace, install dry. Carefully fit on fuel distributor, ensuring that rubber seal (24) does not slip.
Basic position of control plunger relative to air flow sensor plate	check, adjust if necessary. Detach fuel pump relay module for this step and bridge contacts 7 and 8. The fuel must at this point stop or begin to flow from the outlet nozzles for the injection lines; adjust assignment if necessary with the idle mixture regulating screw.
Engine	run, check all fuel connections for leaks.
Idle speed	set (07.3-l 00).

Note

Perform basic setting of control plunger (2) by altering the position of the idle mixture adjusting screw (61).



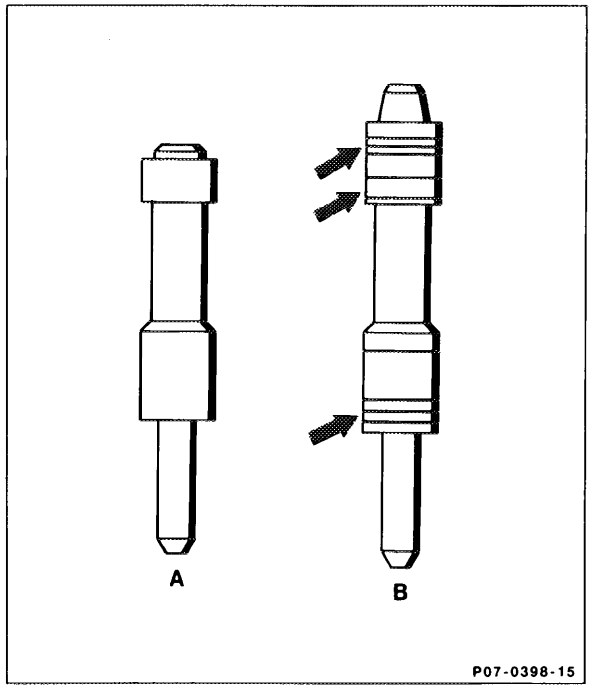
1 Screwdriver
2 Control plunger
3 Adjusting device for lambda control/idle emissions level
4 Anti-tamper plug
61 Adjusting screw

Note

The control plunger in the fuel distributor has been lengthened. At the same time, grooves have been machined on the circumference of the control plunger and a finish (arrows) embossed on the surface.

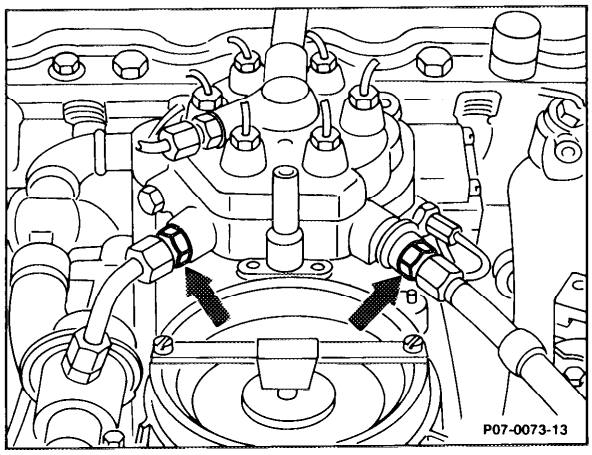
Production breakpoint:

As of 01/85 (production date 541) unspecified.
As of 02/85 (production date 43 T2) general.



A Previous version
B Current version

Screw fitting (arrows) for fuel supply and return made of brass (previously steel).

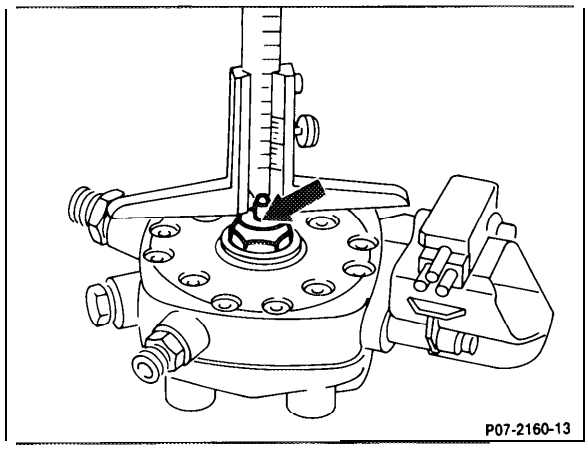


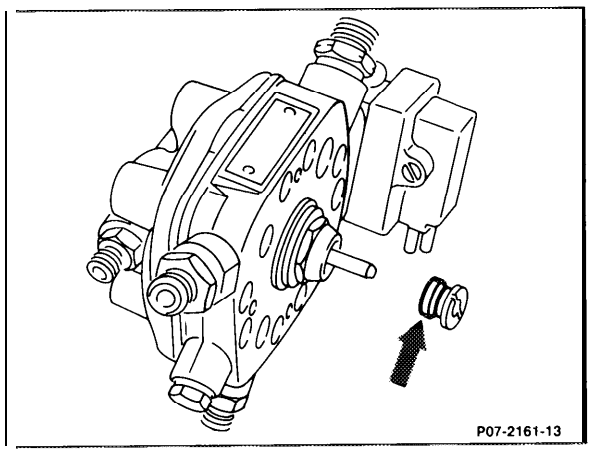
Production breakpoint: March 1989

Model	Engine	Engine End No. manual transmission	Engine End No. automatic transmission
201.024	102.96	217465	112399
201.028	102.985	030864	078604

07.3–207 **Replacing** seal for control plunger

Preceding work:
Removal and installation of fuel distributor (07.3–205)



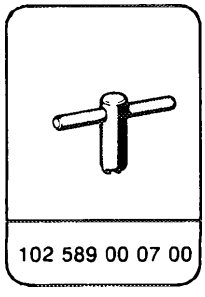


Position (arrow) of screw plug	measure with depth gauge and note. Mark position with marking tool as a safeguard.
Screw plug (arrow)	remove with pronged wrench special tool (102 589 00 07 00).
Seal of screw plug	replace, ensure seal is correctly seated.
Screw plug (arrow)	screw in to the value or marking measured prior to removal.

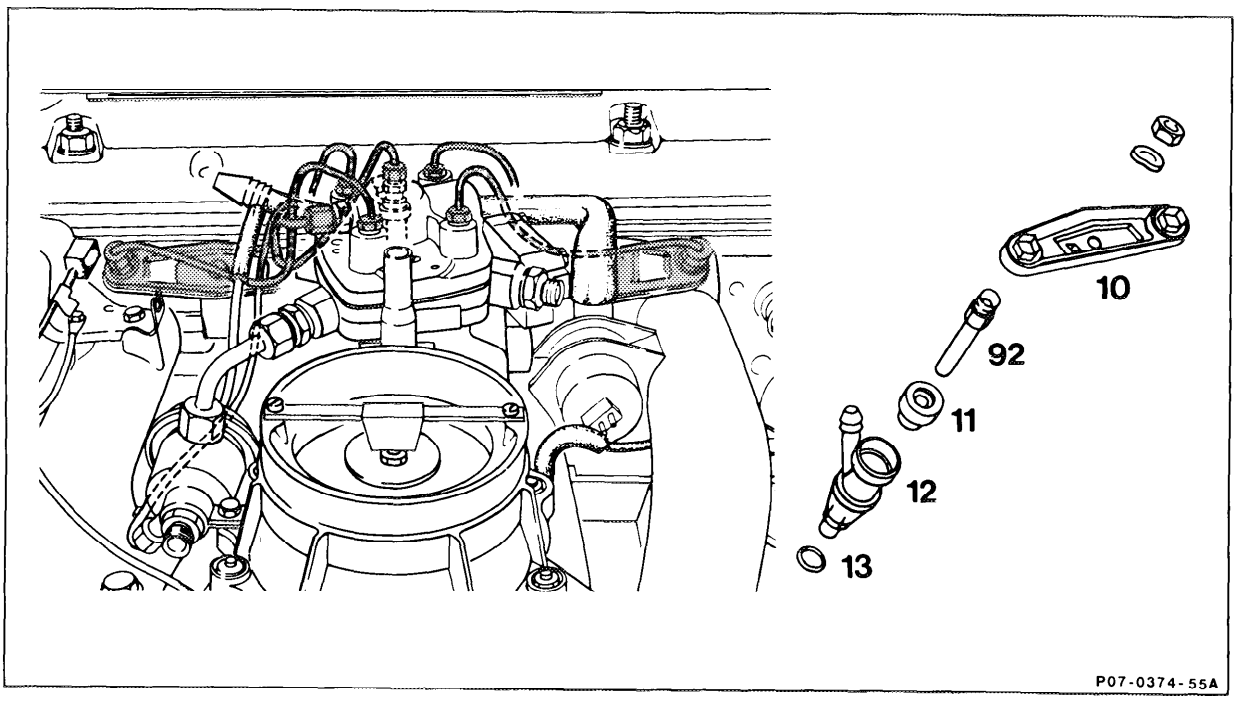
Caution!
Failure to do this means control plunger selects incorrect basic setting.

Idle speed	set (07.34 00).

Special tools



07.3–215 Removal and installation of fuel injectors



Fuel and injection lines	remove, install, holding injectors tight. Clean connection points. Tighten to 10–15 Nm as approx. value.
Mounting bracket (10)	unscrew, screw on.
Injectors (92)	remove, insert.
Rubber seal (11)	replace.

Notes

Mounting bracket (10) installed with M8 X 20 combination bolt plus washer (previously M8 X 12 stud).

Production breakpoint: 11/86

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.028	102.985	007459	046500

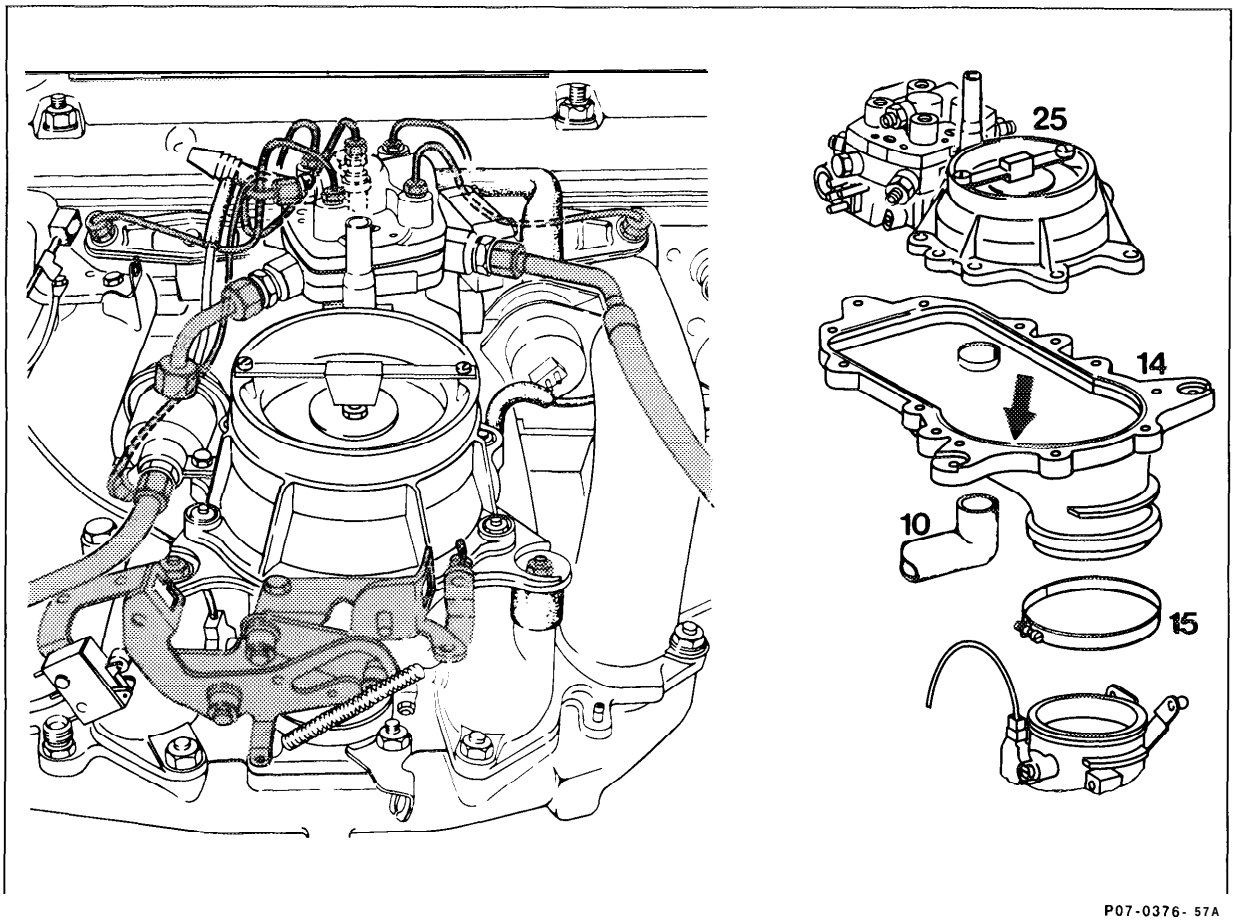
To improve leaktightness, fuel injectors made of brass with higher pressure ratings have been installed (07.3-I 35). Identification located on shaft 000 078 56 23.

Production breakpoint: 03/89

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.028	102.985	027063	076715

07.3–220 Replacement of air flow sensor

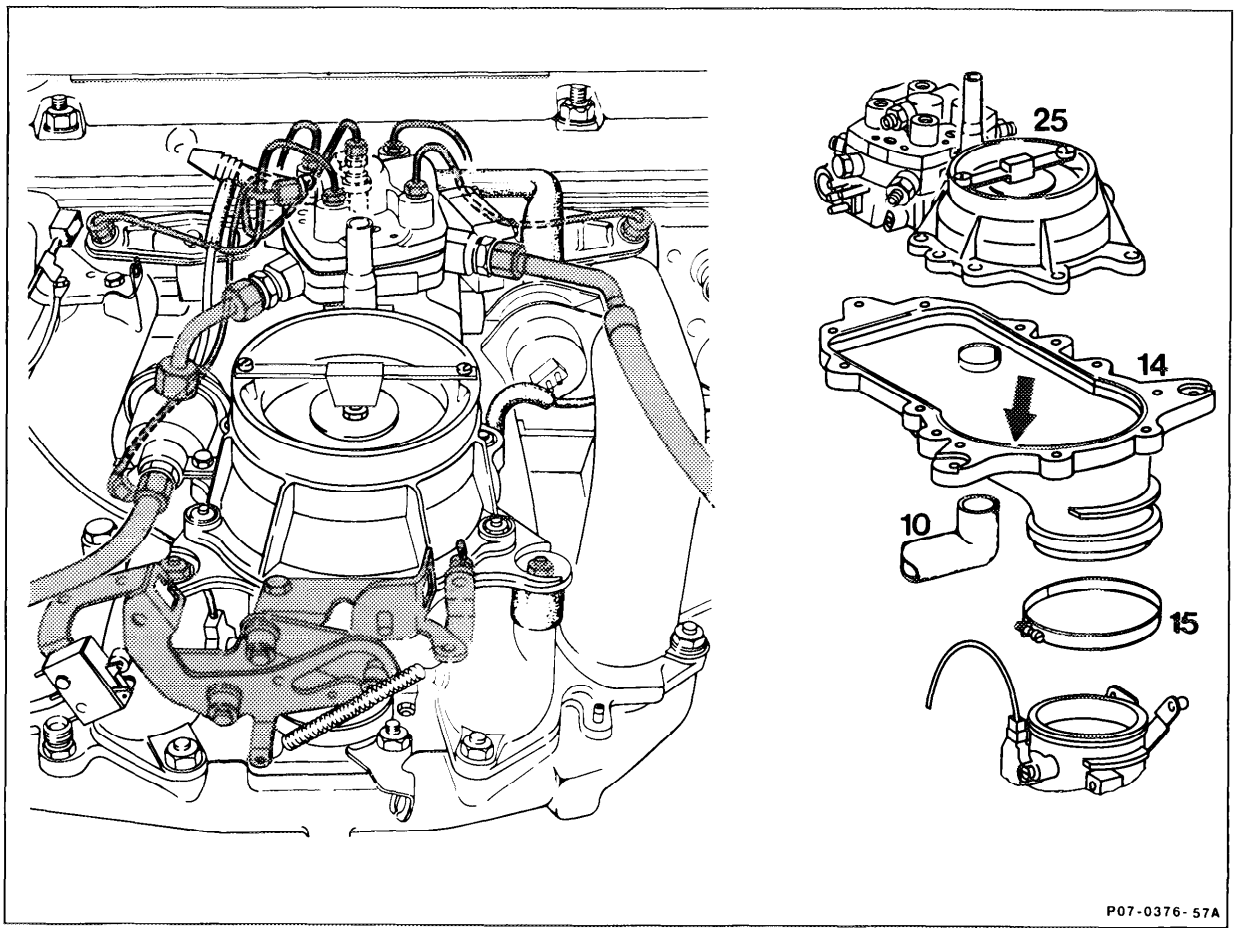
Preceding work:
Removing and installing mixture control unit with air guide housing (07.3-225)



Air guide housing (14)	remove from mixture control unit (25). Replace damaged parts. During installation, do not use sealing compound. Sealing is provided by sealing lip (arrow). The air guide housing is made of rubber. It is located in position by the light alloy frame.
Fuel distributor	remove, install (07.3-205).

07.3–225 Removal and installation of mixture control unit with air guide housing

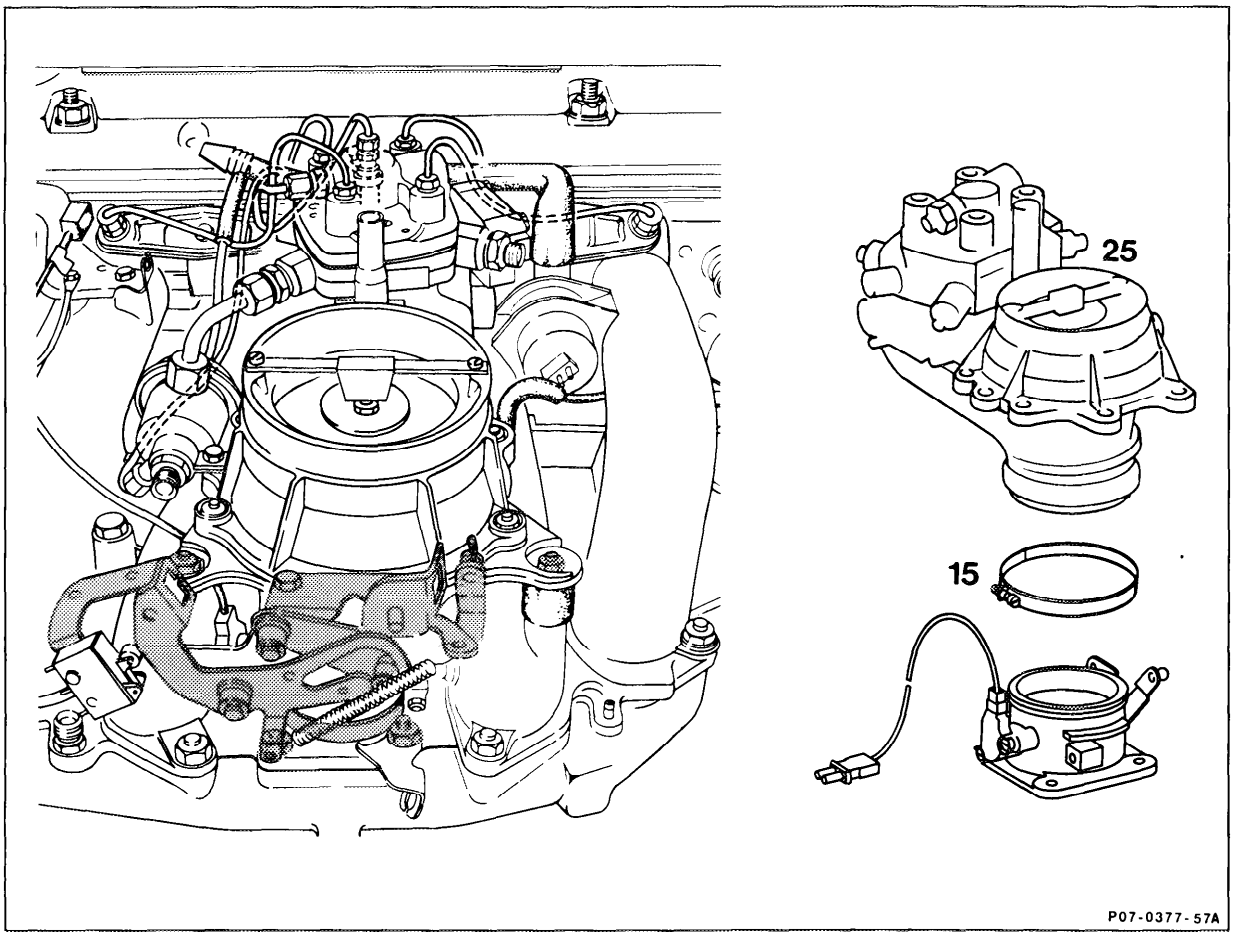
Preceding work:



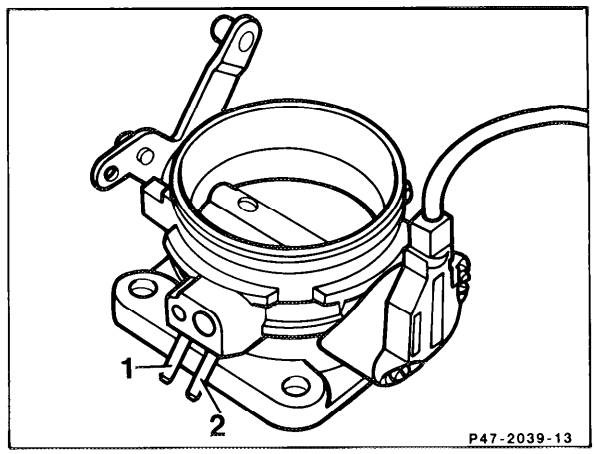
Fuel and injection lines	unscrew, screw on, 10-15 Nm tightening torque (reference value).
Electric wiring	disconnect, connect.
Diaphragm pressure regulator	unbolt, bolt on.
Four fastening nuts for mixture control unit mounting at rubber pads	unscrew, screw on, 9-10 Nm (reference value).
l-lose clip (15) at throttle valve assembly	loosen, tighten.
Mixture control unit (25) complete with air guide housing	lift off, fit on.
Formed hose (10)	pull off, fit on.
Rubber pad for mounting of air guide housing	check, replace according to condition.
Engine	run, check all fuel connections for leaks.
Idle speed	set (07.3-100).

07.3–230 Removal and installation of throttle body

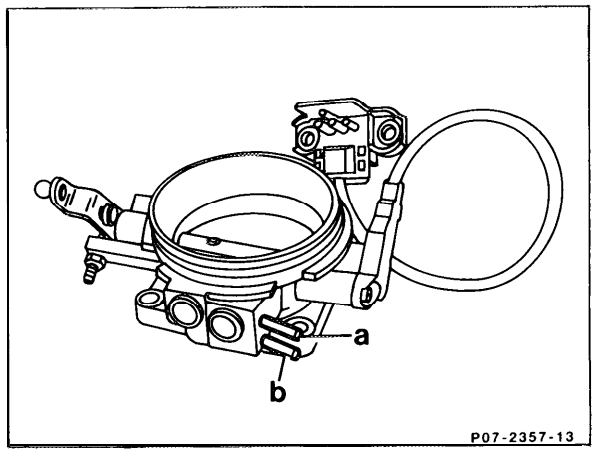
Preceding work:
Removal and installation of mixture control unit with air guide housing (07.3-225).



Hose clip (15)	loosen, tighten.
Throttle control linkage and return spring	detach, attach; adjust if necessary.
Throttle body switch plug connection	unbolt, remove and bolt on.
Vacuum connections	pull off, fit on. Ensure that all connections are correct.
Fastening bolts	unbolt. Remove throttle body. Install with new gasket. Tightening torque 21-25 Nm.
Idle speed	set (07.34 00).



1 Ignition advance connection
2 Extraction line connection to regeneration line for fuel evaporation control system

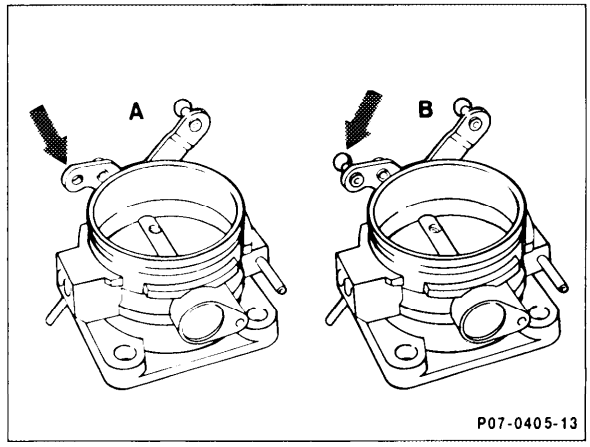


a To thermal vacuum valve
b Vacuum line connection to evaporative emission canister purge valve

Vehicles with cruise control

The cruise control linkage now pivots on a ball connection. This replaces the previous angled rod.

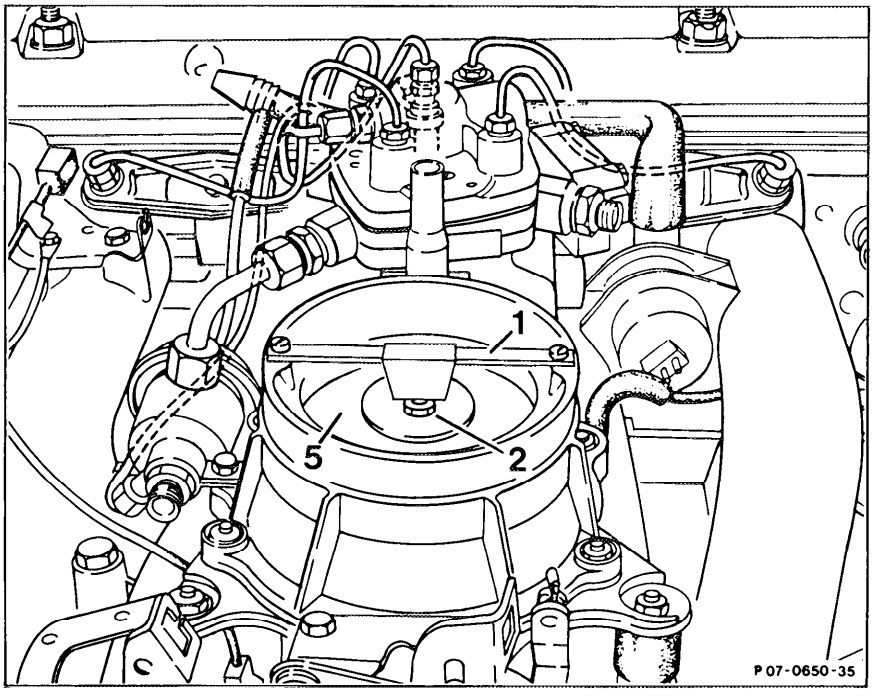
Production breakpoint 12/84



A Previous version
B Present version

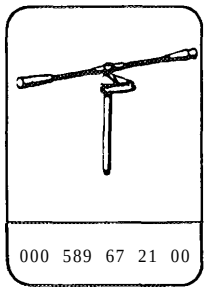
07.3–245 Replacement, centering air flow sensor plate and checking and adjustment of zero position of air flow sensor plate

Preceding work:



Stop bar (1) for sensor plate	unscrew, screw on.
Fastening bolt (arrow)	heat with hot air fan and carefully unscrew (there is a risk of shearing the bolt off), bolt in 5.0-5.5 Nm.
Air flow sensor plate (5)	remove, install, center and check zero position (pay attention to installation notes). Proceed following to this method for mixture control units with shaped sensor plate.
Hole for mounting sensor plate	clean with M6 tap.
Idle speed	set (07.34 00).

Special tool

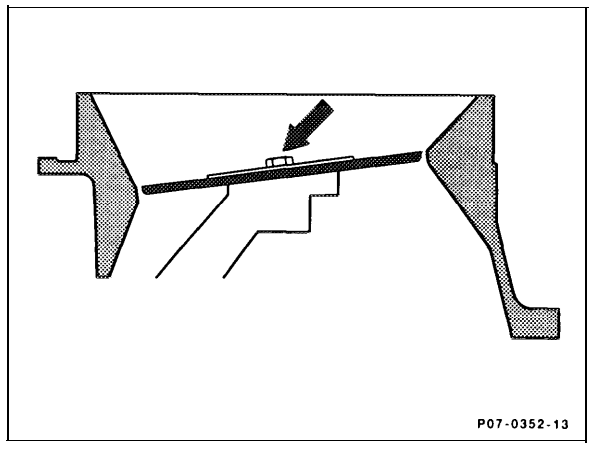


Commercially available equipment and tools

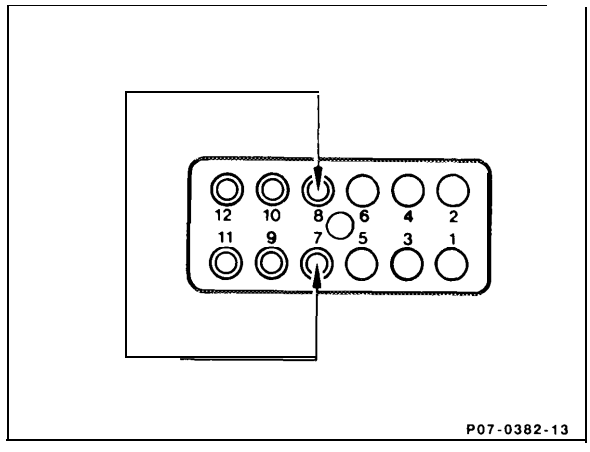
Hot air fan, M6 tap

Installation notes

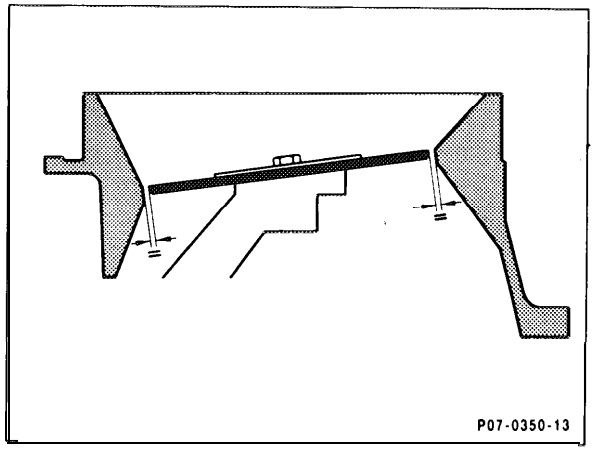
1 Install parts of the repair kit. Insert sensor plate with the inscription “top” facing up and shim. Slightly tighten microencapsulated mounting bolt (arrow, self-locking).



2 Center air flow sensor plate by detaching fuel pump relay and briefly bridging the two contacts 7 and 8 (terminals 30 and 87) to build up pressure.



Use a feeler gauge approx. 0.05 mm to ensure that the air flow sensor plate is precisely centered. The sensor plate must not jam even when slight pressure is applied to the side (bearing clearance eliminated).

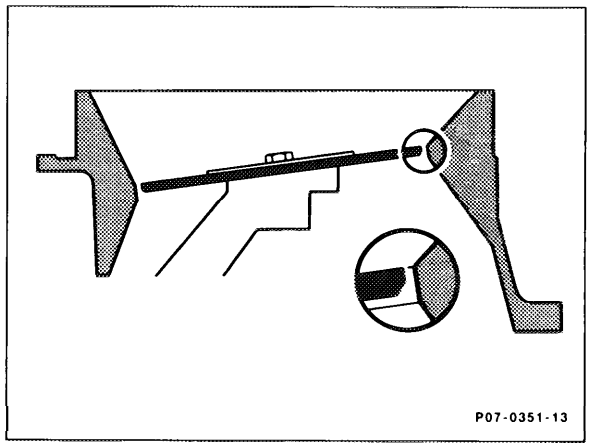


3 Tighten fastening bolt to 5.0-5.5 Nm and install stop bar.

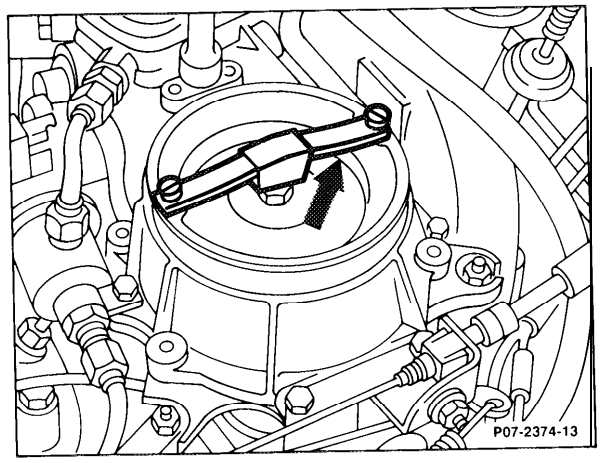
4 Check that sensor plate operates freely by pressing sensor plate down by hand. The plate must not jam. Release sensor plate. It must also not jam as it moves back. It must audibly strike against the resilient stop. Re-center air flow sensor plate if necessary.

5 Check zero position (rest position) of air flow sensor plate. The top edge of the sensor plate must be level with the top edge of the cylindrical part of the air funnel. A position up to 0.2 mm higher is permissible.

In this position, a clearance of 1-2 mm must exist when the air flow sensor plate is pressed as far as the control plunger.



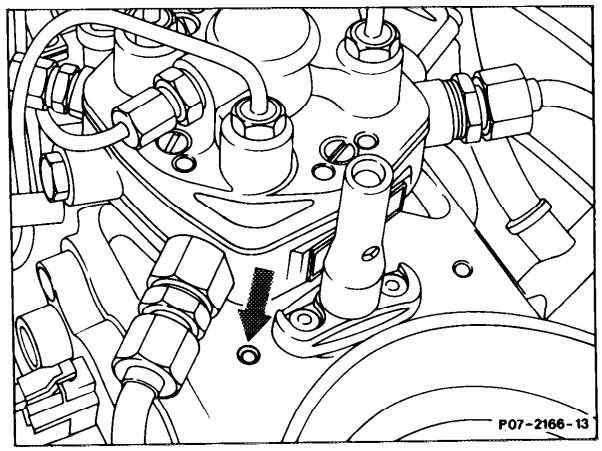
The measurement point is located directly below the stop bar (arrow).



6 Set zero position of air flow sensor plate.

a) If position is too high, knock guide pin (arrow) deeper with a drift.

b) If position is too low, remove mixture control unit and knock out guide pin from below (07.3-200).



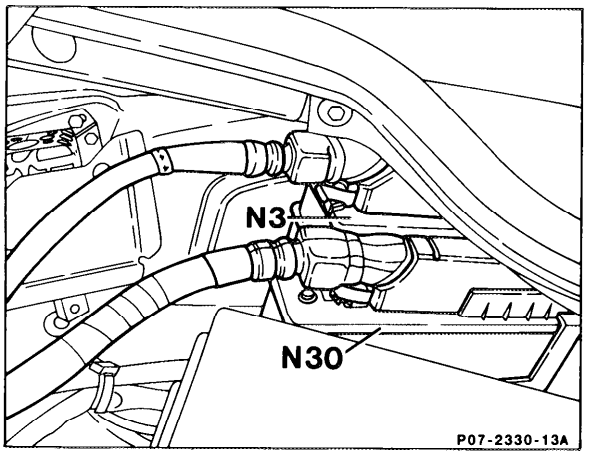
Caution!
Do not knock guide pin in too deep. Avoid repositioning several times in both directions as the interference fit seal will become too loose.

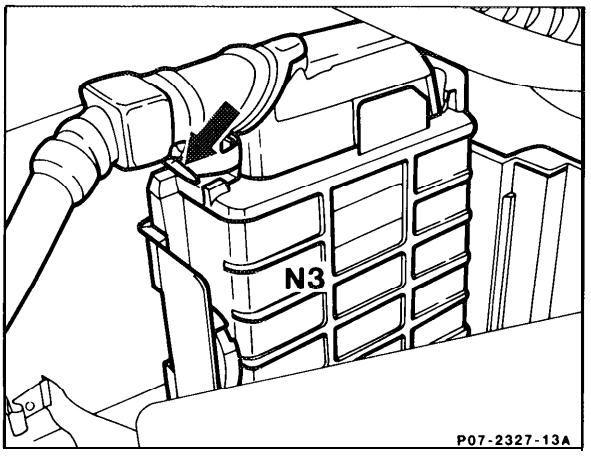
7 Install fuel pump relay module.

8 Set idle speed (07.3400).

07.3–250 Removal and installation of CFI control module

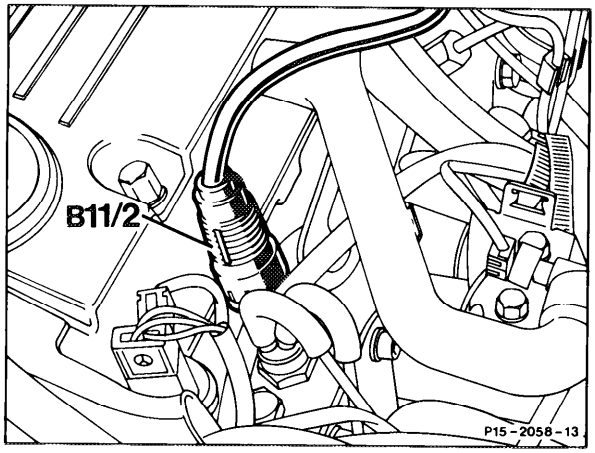
Preceding work:
Removal and installation of fuel distributor (07.3-205)





Plastic cover behind battery	remove, install.
Vehicles equipped with ABS	remove ABS control module (N30). Install by unclipping metal strap, clipping in place.
Vehicles equipped with 64 Ah battery	remove, install battery.
Coupling of CFI control module (N3)	pull off by pressing down clip (arrow).
CFI control module (N30	remove, install.

Engine	Version	CFI control module MB Part No.	Remarks
102.961	1983 – 1984	003 545 38 32	with deceleration fuel shutoff and engine speed limitation
102.985	1985 – 1986	003 545 38 32	with deceleration fuel shutoff and engine speed limitation
	1987	005 545 94 32	as of 08/86: with fault diagnosis by measuring on-off ratio %
	1988 Federal	006 545 94 32	with Diagnostic Trouble Code (DTC) storage and On-board diagnosis, CHECK ENGINE malfunction indicator lamp, resistance trimming plug integrated into CFI control module.
	1988 Calif.	006 545 55 32	with Diagnostic Trouble Code (DTC) storage and On-board diagnosis, CHECK ENGINE malfunction indicator lamp, resistance trimming plug integrated into CFI control module.
	1991 Federal	010 545 54 32	with Diagnostic Trouble Code (DTC) storage, activation of CHECK ENGINE malfunction indicator lamp if heated oxygen sensor (G3/2) fails, resistance trimming plug integrated into CFI control module (N3).
	1991 Calif.	010 545 55 32	with Diagnostic Trouble Code (DTC) storage and expanded On-board diagnostics (EGR temperature sensor added), activation of CHECK ENGINE malfunction indicator lamp if exhaust related components fail, resistance trimming plug integrated into CFI control module (N3).

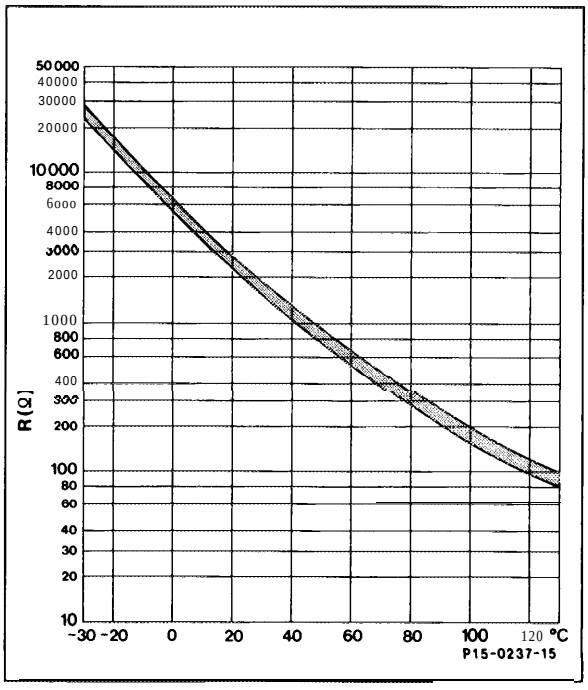


Engine coolant temperature sensor connector ...	detach, fit on.
Engine coolant temperature sensor	unscrew, screw in.
	Caution!
	Pay attention to position and notes!
Diagnostic memory	read out and erase, if necessary, on engines 102.961/985 as of 09/89 (see 07.3-121, section "D").

Engine coolant temperature sensor (NTC)
The engine coolant temperature is detected by a temperature sensor.

This is actuated by the electronic CFI control module. The resistance of the current temperature sensor varies as a function of engine temperature (see characteristic curve). The characteristic curves of all versions are identical.

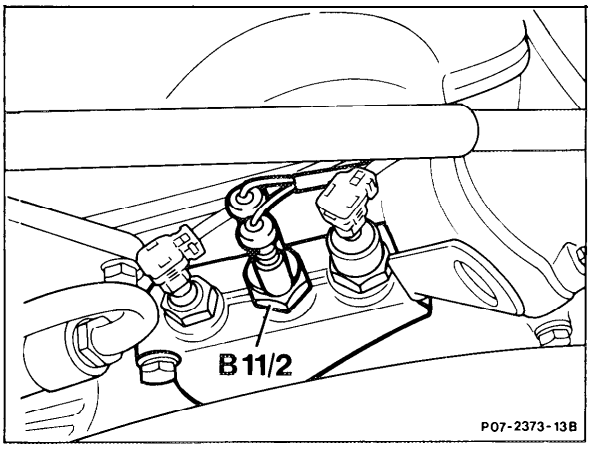
Note
NTC = negative temperature coefficient, i.e. the resistance becomes less as the temperature increases.



2-pin engine coolant temperature sensor (B11/2)

The engine coolant temperature is detected by a double temperature sensor with two l-pin connections. The temperature signal is fed into the CFI control module and into the fuel pump relay module (CFI I, II) or into the ignition control module (CFI Ill).

Engine 102.961985

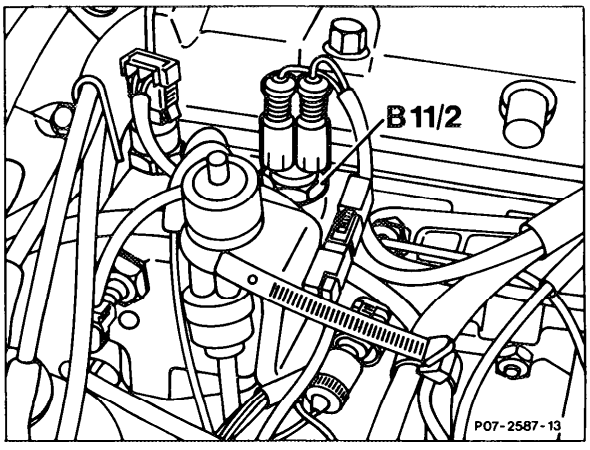


I-pin engine coolant temperature sensor (B11/3)

Note

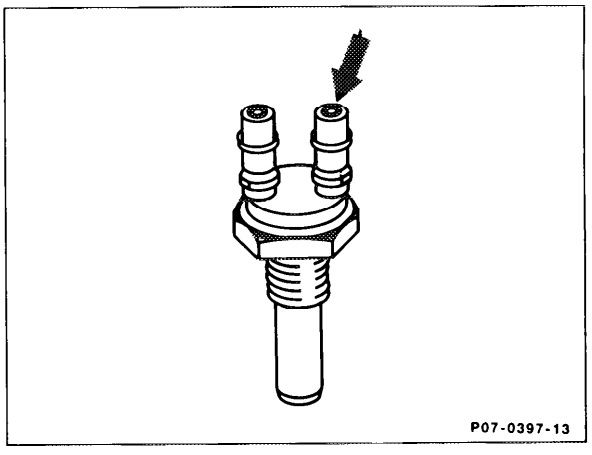
On engine 102.961 only the engine coolant temperature sensor (B11/3) with the Ml 4 X 1.5 thread is supplied as a replacement part. When performing repairs, the engine coolant temperature sensor should be installed in place of the Ml 4 X 1.5 plug next to the thermal time switch.

The previous installation point should be sealed with the Ml 0 X1 plug, Part no. 007 604 010 102, and gasket, Part No. 007 603 010 101.

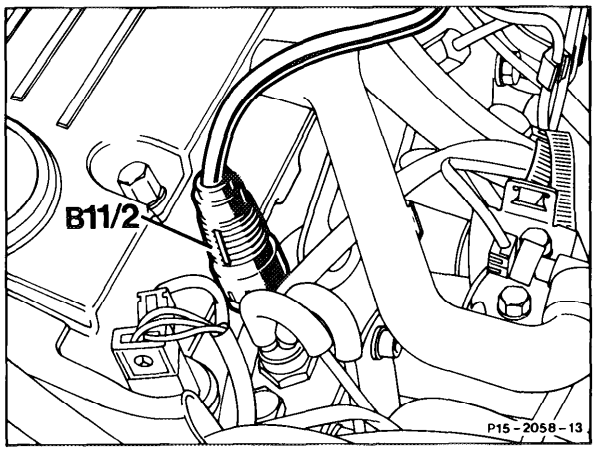


Note

As of a production date 1 1/84, the engine coolant temperature sensor was equipped with reinforced pins (arrow). Part number remains unchanged.



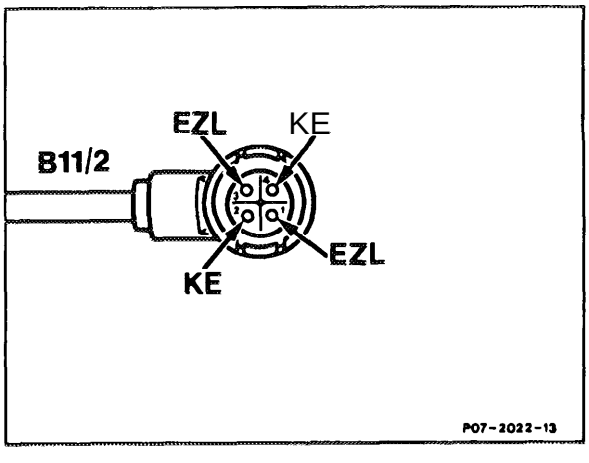
Note
As of 03/90 engine 102 has been equipped with a 4-pin engine coolant temperature sensor.



Engine 102.96/98

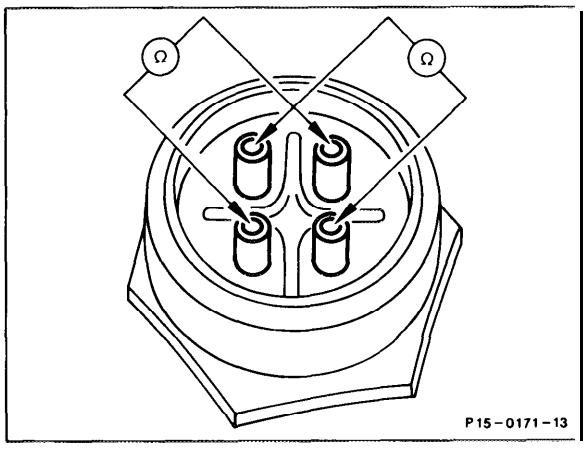
4-pin engine coolant temperature sensor (B11/2)
The engine coolant temperature sensor is a 4-pin design. It integrates two separate temperature sensors (NTC), which do not have any electrical connection to the housing of the engine coolant temperature sensor. One temperature sensor is used for the distributor ignition system and one for the CFI injection system. The connector of the engine coolant temperature sensor is designed so that it can be plugged-in in any position.

Pin assignment:
1 = Distributor ignition temperature sensor.
2 = CFI temperature sensor
3 = Engine ground at intake manifold for distributor ignition system.
4 = CFI control module ground

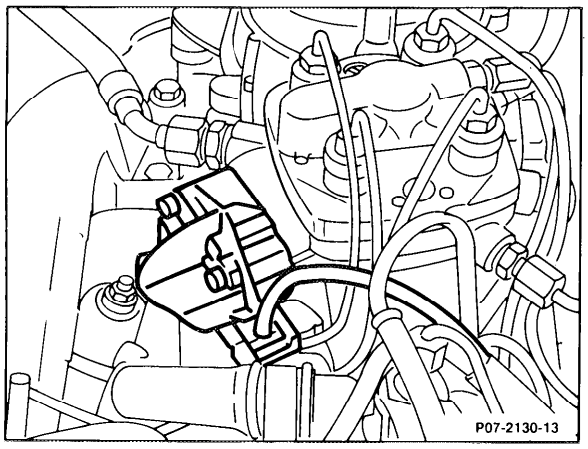


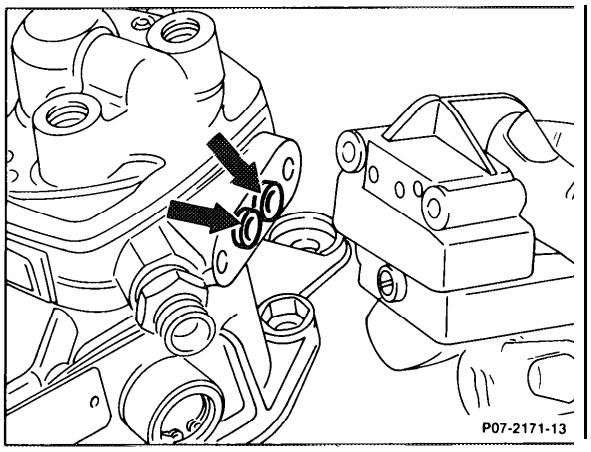
Note
1988 version does not have coupling designations.

Notes for testing engine coolant temperature sensor (B11/2)
When testing the engine coolant temperature sensor, measure the resistance 2 x diagonally and compare.



07.3–255 Replacement of electrohydraulic actuator



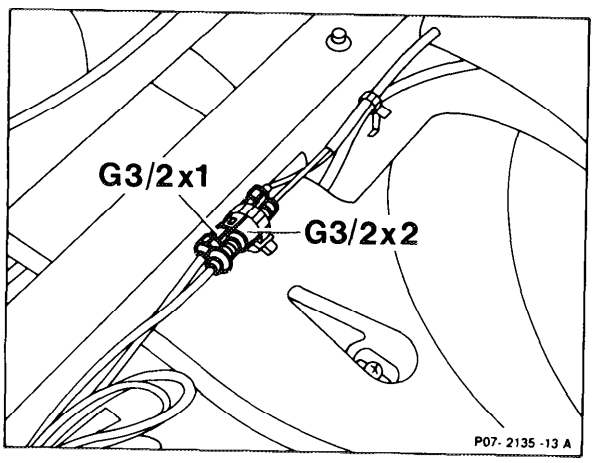


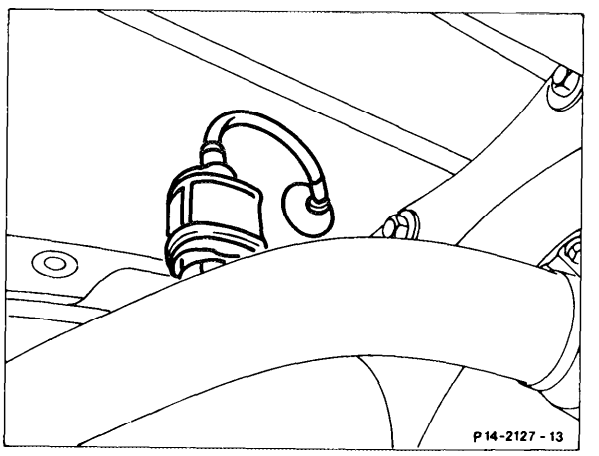
Electrical coupling	disconnect, connect.
Fuel pressure	release by detaching fuel line between fuel distributor and start valve. Collect fuel overflow with a cloth.
Both fastening bolts	unscrew, screw in. Replace O-rings (arrows). Ensure sealing surface is clean; clean surfaces with cleaning petroleum and lint-free cloth, if necessary. Tighten fastening bolts to 3.0 ± 0.5 Nm.
Pressure test of O-rings (arrows)	check that no fuel flows out with the engine running.
Idle speed	set (07.34 00).

Commercially available tool

Screwdriver	e. g. Hazet, D-5630 Remscheid

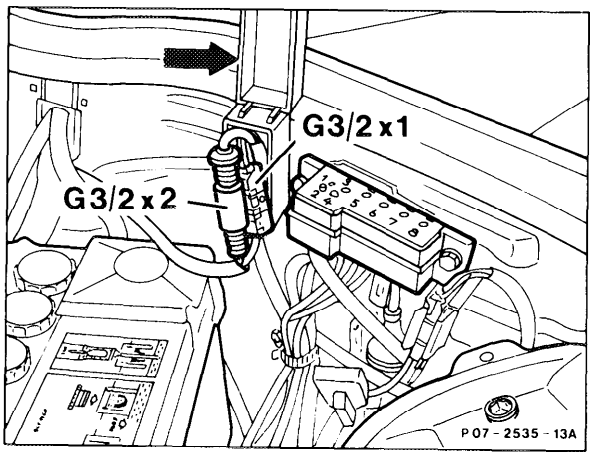
A. Heated oxygen sensor upstream of catalytic converter

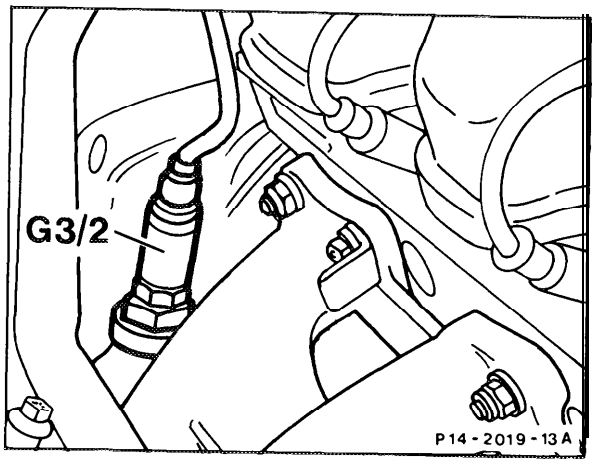




Floor mat, right front floor plate	remove, install.
Covering on center tunnel	partially remove.
Connectors (G3/2x1 and G3/2x2)	for heated oxygen sensor signal (coaxial connector) and oxygen sensor heater (2-pin), disconnect.
Wiring with rubber grommet	push to outside.
Shield	pull off, fit on. Note installation position: open side to the rear.
Heated oxygen sensor (G3/2)	unscrew, screw in. Coat threads of heated oxygen sensor with hot lubricating paste, Part No. 000 989 88 51. Tighten heated oxygen sensor (50-60 Nm).
Lambda control	check (07.3-I 00 or 07.3-I 05).

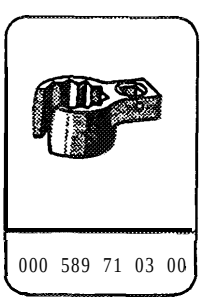
B. Oxygen sensor in exhaust manifold





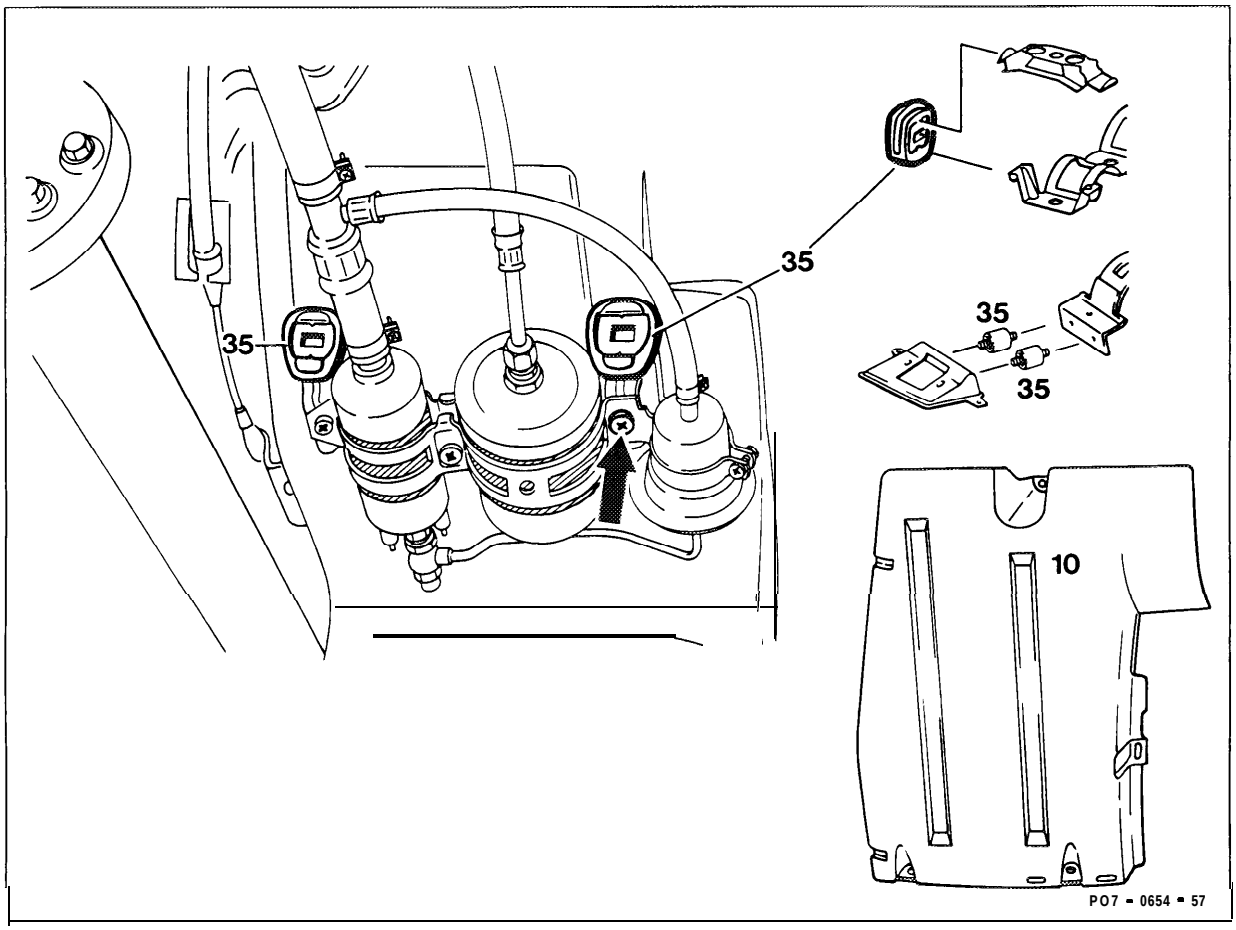
Cover (arrow)	over plug connector, raise.
Connector (G3/2x1 and G3/2x2)	for oxygen sensor signal (coaxial connector) and oxygen sensor heater (2-pin), separate.
Wiring with rubber grommet	press through partition wall.
Heated oxygen sensor (G3/2)	unscrew, screw **in. Special tool 000 589 71 03 00.** Coat threads of heated oxygen sensor with hot lubricating paste, Part No. 000 989 88 51. Torque heated oxygen sensor (SO-SO Nm).
Lambda control	check (07.3-I 00 or 07.3-I 05).

Special tool



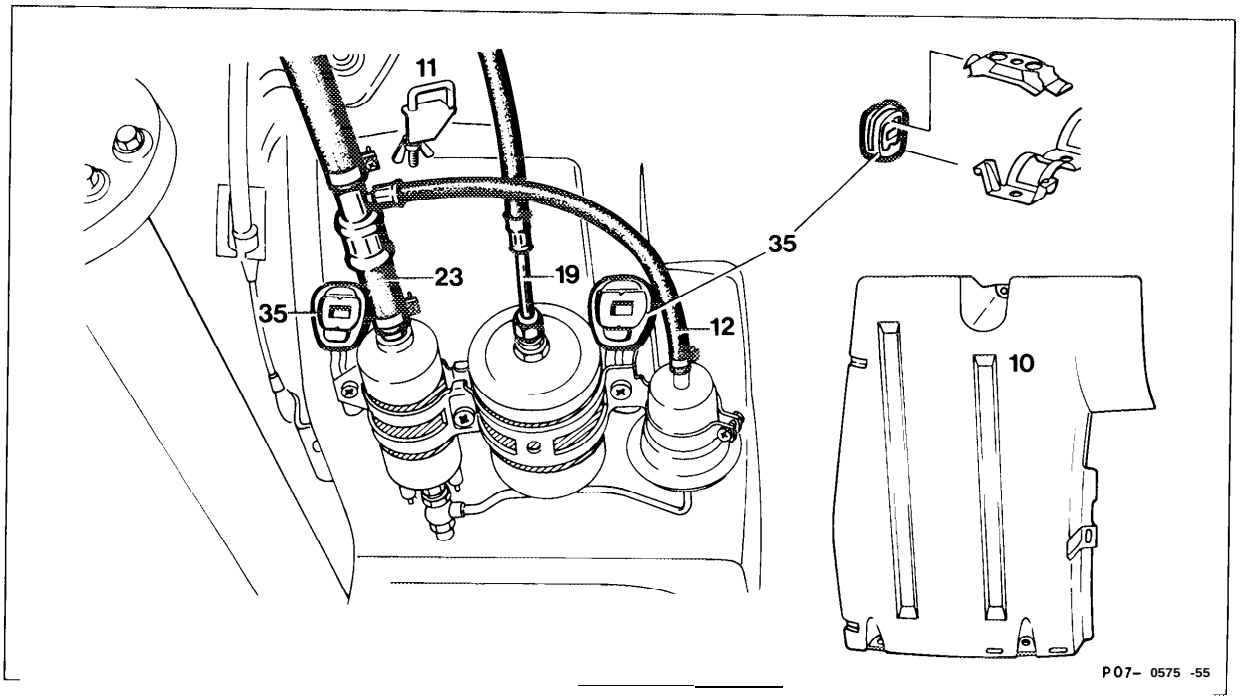
07.3–268 Replacement of rubber rings or pads for fuel pump set

Preceding work:



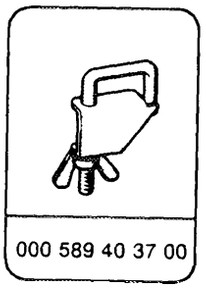
Protective box (10) depending on version ..... unscrew, screw on.
Rubber rings/pads (35) depending on version ... remove, install.

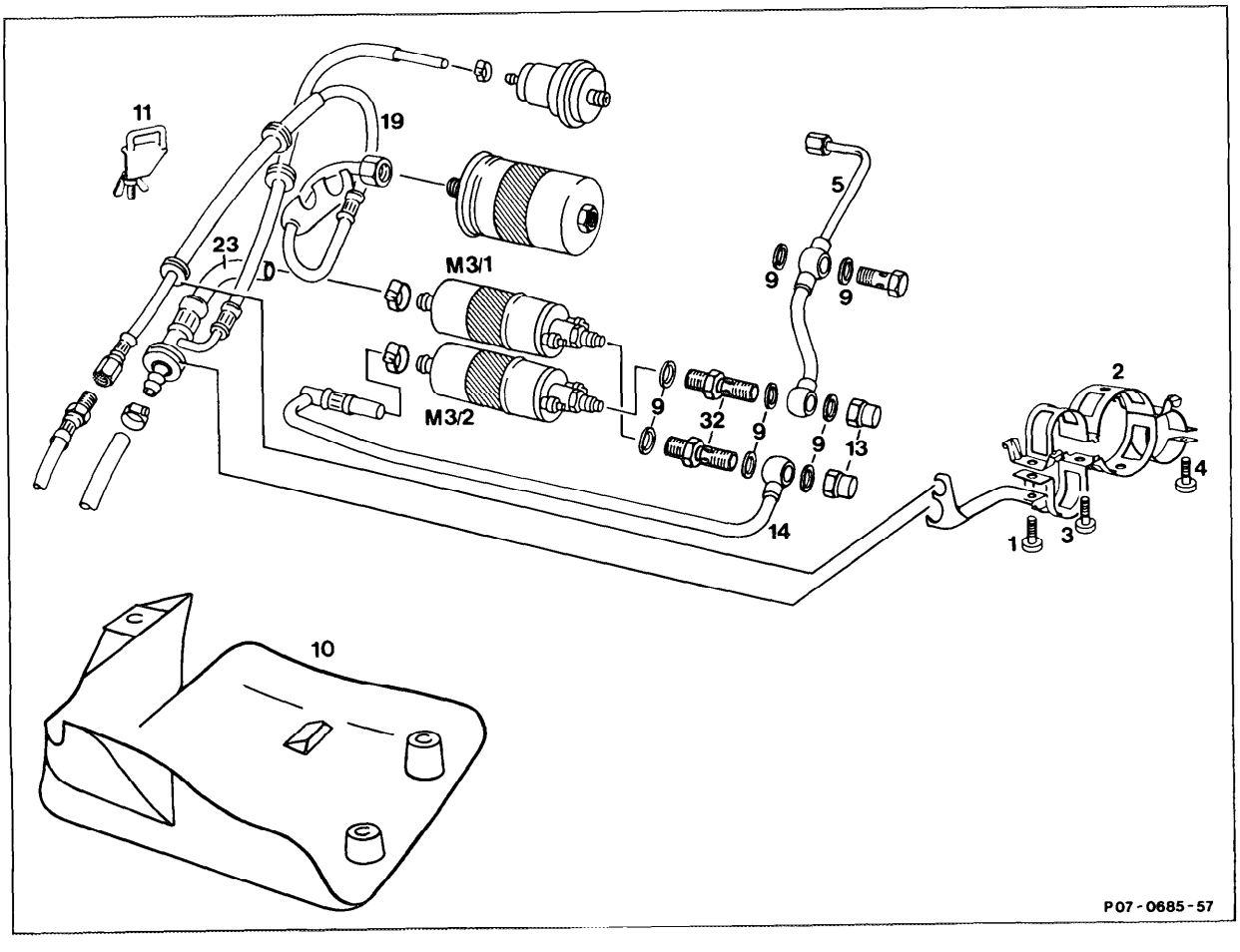
Note
Arrangement of further fuel pump sets
(see 07.3-290).



Battery	disconnect, connect.
Protective cover (10)	unscrew, screw on.
Electric wiring	disconnect, connect.
Fuel suction hose (23) and pressure hose (19)	pinch with clamp (11) and remove. Special tool 000 589 40 37 00
Fuel suction hose (23), bleed hose (12) and pressure hose (19)	unbolt, bolt on.
Rubber rings/pads (35)	remove, install.

Special tool





Overpressure in fuel tank	release by opening filler cap
Battery	disconnect, connect.
Protective cover (10)	unscrew, screw on.
Fuel suction hose (23) and pressure hose (19)	pinch with clamp (11) and remove. Loosen fuel suction hose and detach. Special tool 000 589 40 37 00

Replacing check valve on fuel pump 1 (M3/1):

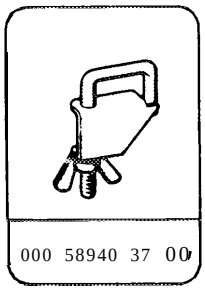
Fastening bolt (1, 3, 4)	at bracket (2) for fuel pump, loosen.
Fuel line (14)	unbolt, bolt on.

Cap nut(13)	unbolt, bolt on.
Fuel pump 1 (M3/1)	push to the left
Check valve (32)	remove, install. Tightening torque 22 Nm as a reference value.
Copper seals (9)	replace.
Run engine	check for leaks.

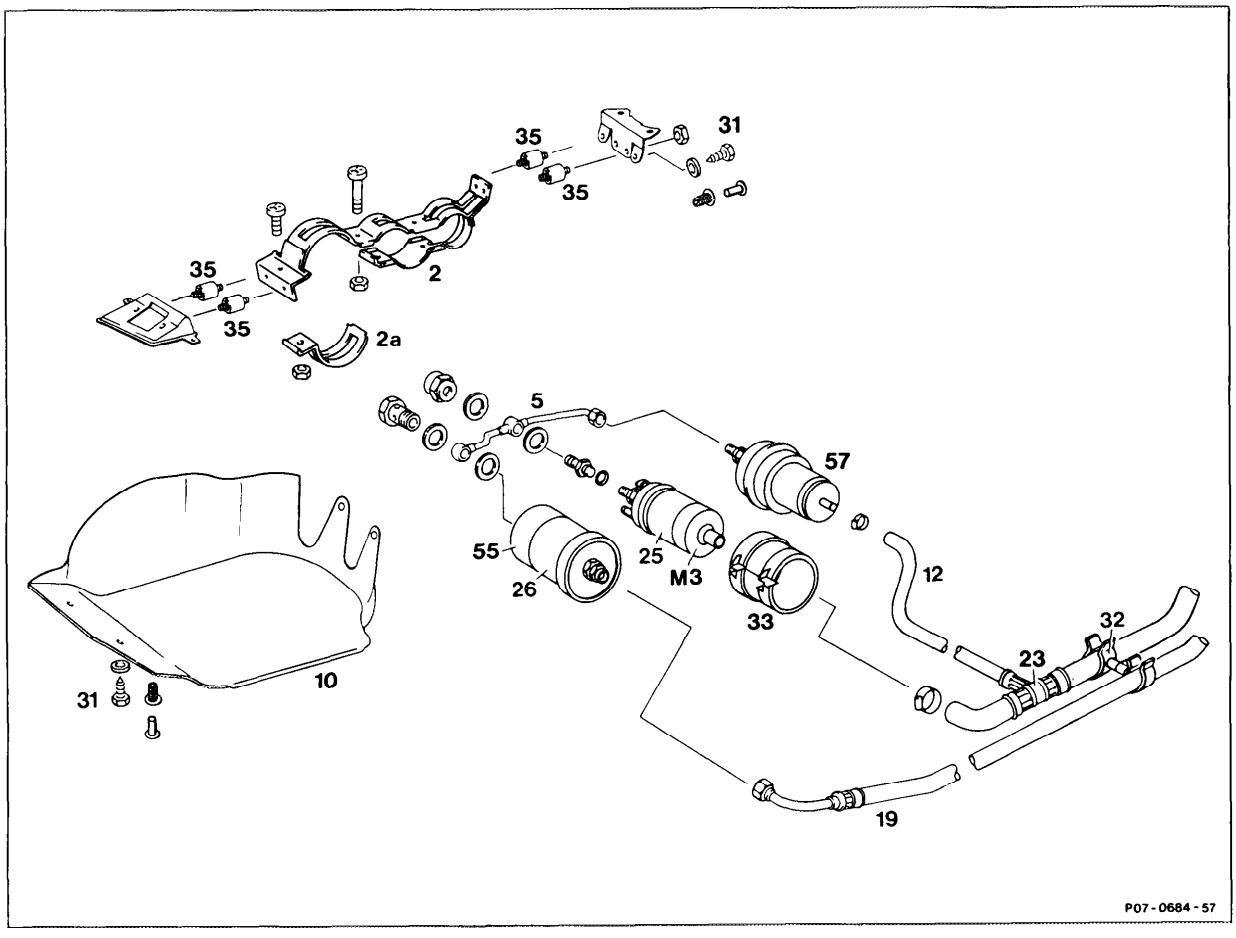
Replacing check valve on fuel pump 2 (M3/2):

Fuel line (5)	between fuel pump, filter, accumulator, unbolt, bolt on.
Cap nut (13)	unbolt, bolt on.
Check valve (32)	remove, install. Tightening torque 22 Nm as a reference value.
Copper seals (9)	replace.
Run engine	check for leaks.

Special tool



A. Model 201



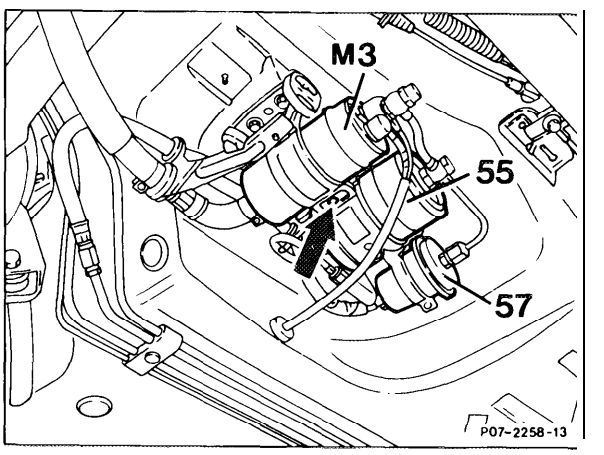
2	Bracket	31	Self-tapping screw (as of 01/85 plastic expanding rivets)
2a	Fuel filter bracket		
5	Fuel line	32	Clip (as of 10/83 rubber ring)
10	Protective cover	33	Spacer sleeve (as of 08/84)
12	Leak line	35	Rubber-bonded to metal pad
19	Fuel pressure hose	55	Fuel filter
23	Fuel suction hose	57	Fuel accumulator
25	Plastic sleeve	M3	Fuel pump
26	Plastic sleeve		

Note

The fuel pump set can be converted to mounting with rubber rings in the event of noise problems (07.3-265).

Note

As of 08/84 the fuel pump has been attached using a modified bracket (for standardization purposes). The diameter for fuel pump mounting is larger. For this reason, the fuel pump is installed with a spacer sleeve (33).

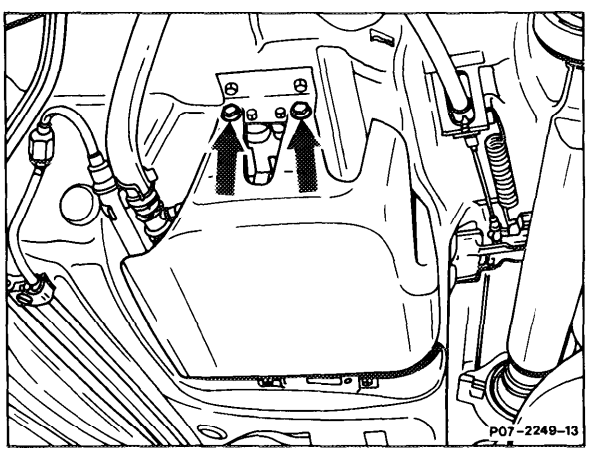


2nd version

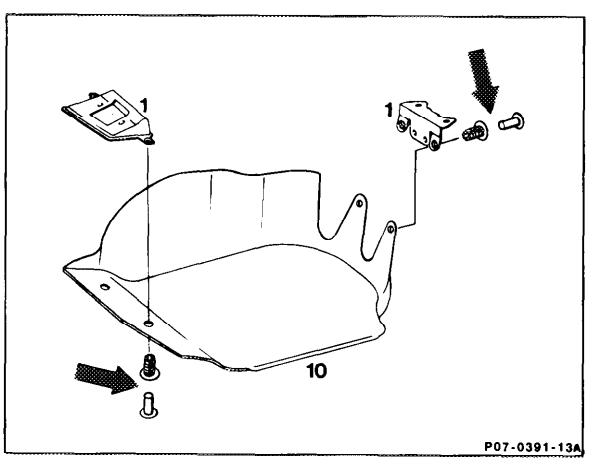
As of 07/85 modified fuel pump attachment brackets are equipped with rubber rings.

Model 201

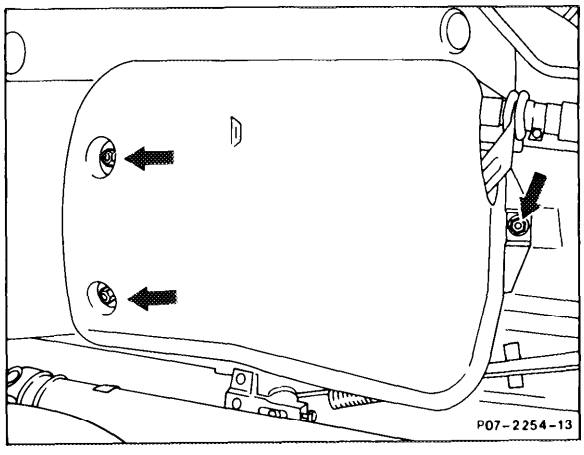
1st version of protective cover attached with self-tapping screws (arrows).



As of 01/84 the protective cover (10) for the fuel pump set is attached to the brackets (1) with plastic expanding rivets (arrows).



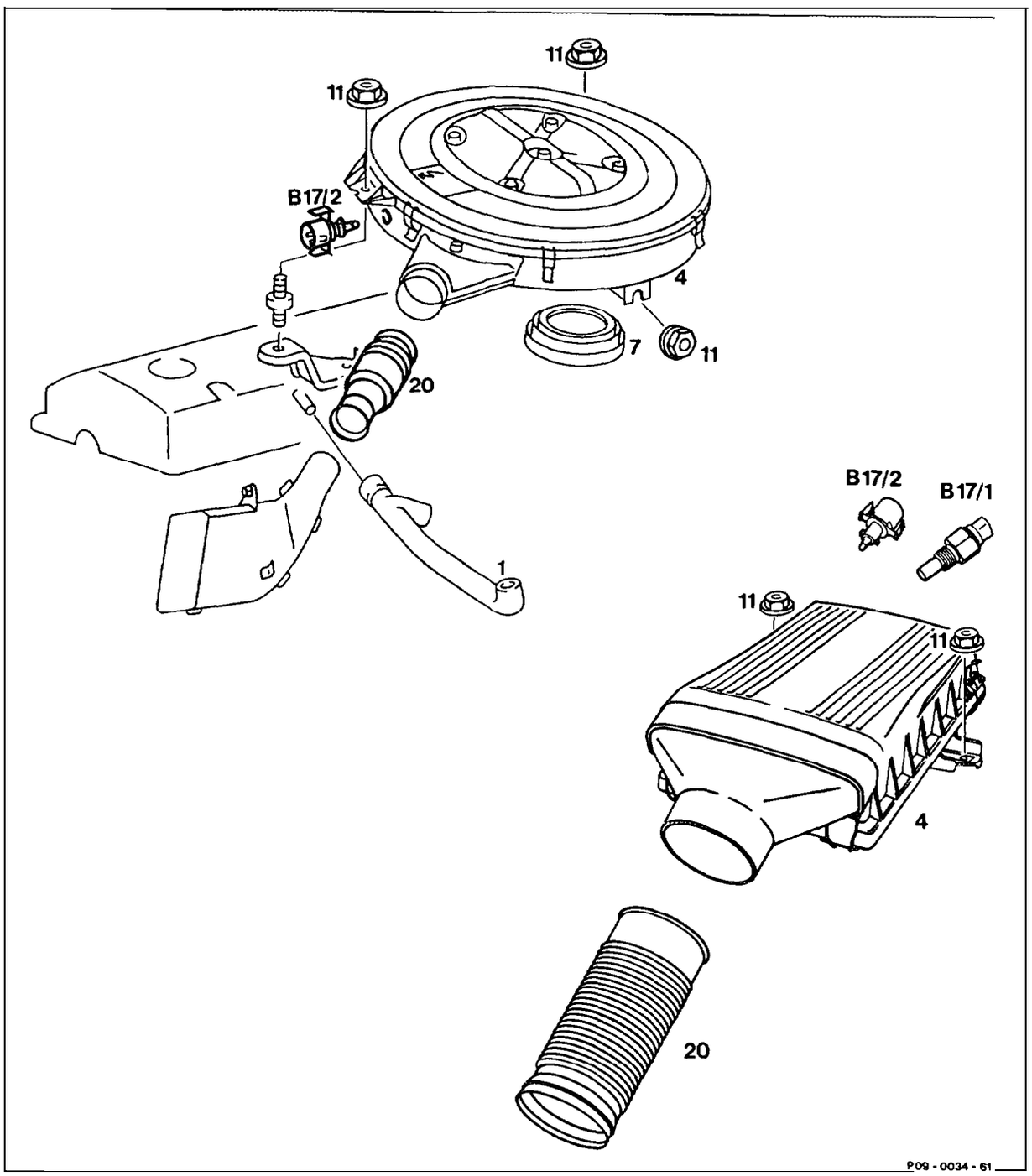
As of 08/85 the shape of the protective cover has been modified and is attached with plastic nuts.



Job No.

Removal and installation of air cleaner . . . . . 09 – 400
Replacing intake scoop . . . . . 09 – 402
Replacing idle air distributor . . . . . 09 – 410

09–400 Removal and installation of alr cleaner



Plastic hose (20)	pull off, fit on.
Intake air temperature sensor (B17/1, B17/2)	pull off connector, fit on.
Fastening nuts (11)	unscrew, screw on.
Shaped hose (1)	for crankcase breather, pull off, fit on.
Air cleaner (4)	remove, install. Ensure seal (7) between air flow sensor and air cleaner is correctly seated.

Note
The air cleaner is made of plastic (except engine 102.961 up to 09/84: sheet metal).

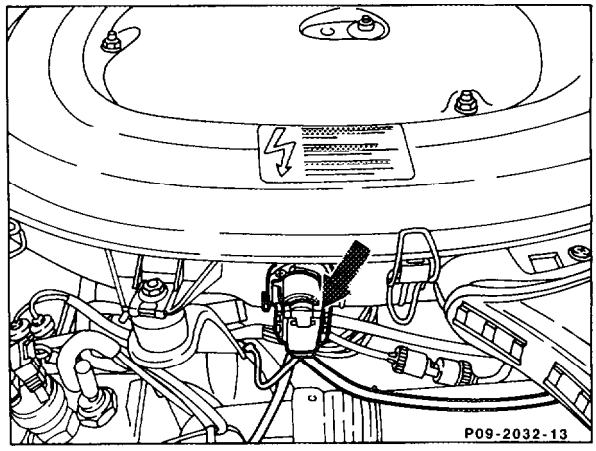
Since 09/84 the air cleaner top is fitted with 4 fastening nuts and tensioning bars.

A recess is provided in the air filter top for adjusting the idle mixture.

In the case of vehicles in KAT version, an intake air temperature sensor is positioned in the air filter housing (arrow).

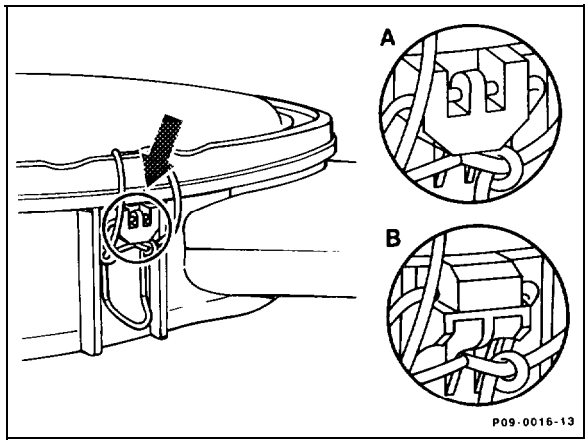
During removal and installation, compress catch and remove by turning.

This influences the CFI system or the distributor ignition system (as of 09/89).



Engine 102.96/98

Air cleaner housing with modified mounting for tensioning bars
As of 03/85 air filter housings with modified mounting for the tensioning bars on the bottom part of the filter have been installed. On filter housings on which the mounting is damaged, the filter bottom part may be replaced separately. Previously, it was only possible to replace the complete air cleaner.

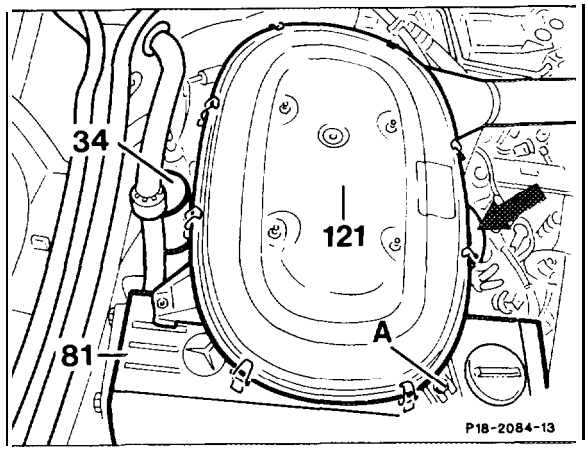


A Mounting, 1 st version
Et Mounting, 2nd version

Air cleaner housing with modified installation position

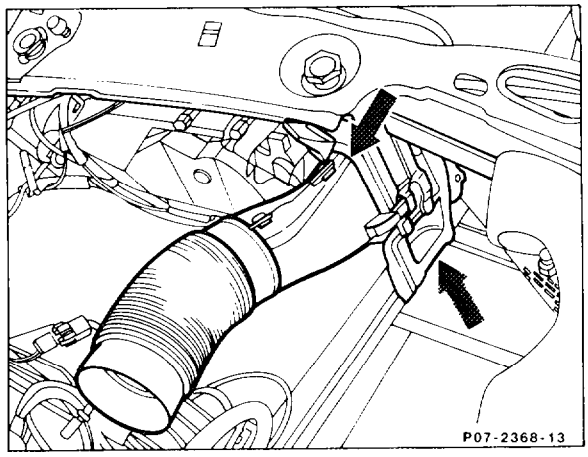
Engines 102.962/963/982/985 RÜF/KAT

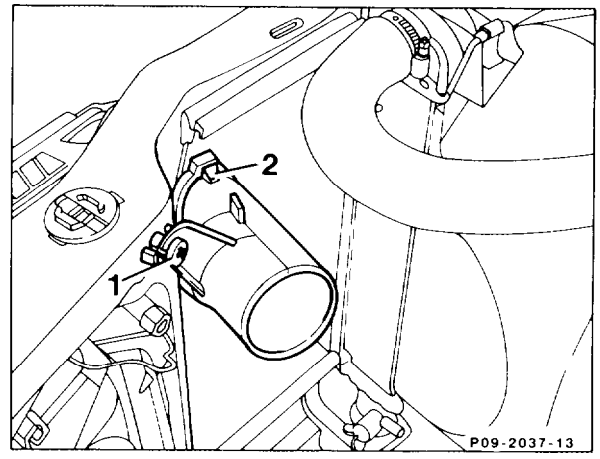
Modified air cleaner with new mounting point (A) on cylinder head cover (81, previously intake manifold) and different shaped hose (arrows) for crankcase ventilation because of modified installation position of hose connection at air cleaner. This provides improved access to the oil filter (34).



Model	Engine	Engine end No. manual transmission	Engine end No. automatic trans.	Vehicle ident end No. A	F
201.028	102.985	025135	074068	451656	516354

09–402 Replacing intake scoop



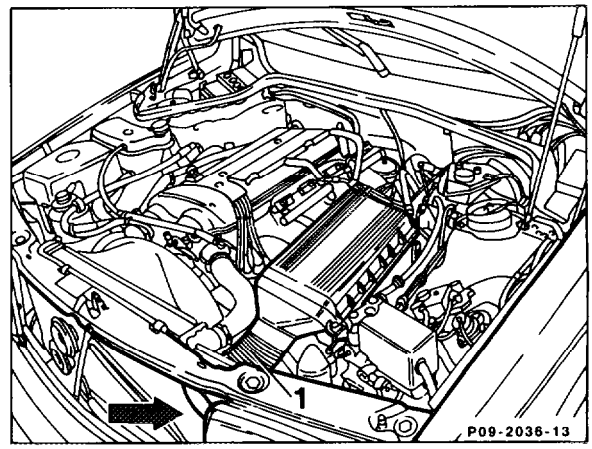


Model 201

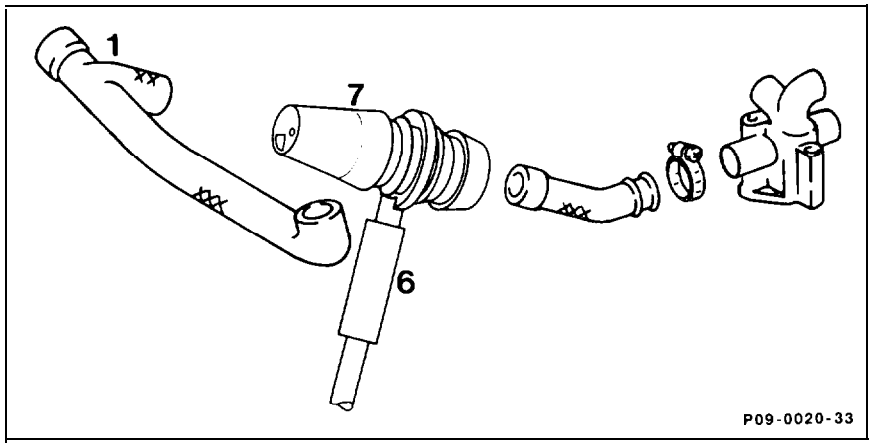
The intake scoop is attached with 2 plastic clips
(arrows) . . . . . remove plastic clips, insert.

Note

The air is drawn in outside of the engine compartment (arrow) through the plastic scoop.

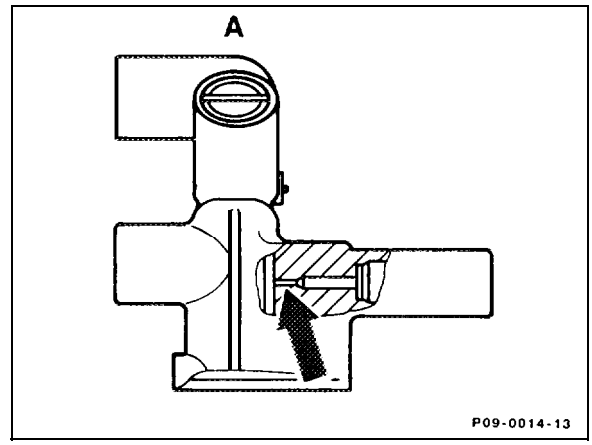


Engine 102.983 model 201.034 (shown as example)

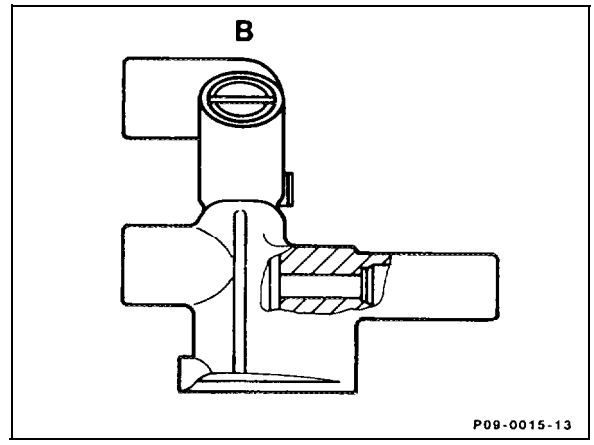


Hose connection fitting (7)	replace.
Shaped hose (1) with vent connection	replace.
Vent line (6)	connect to diaphragm pressure regulator.
Idle air distributor	replace.

Note
Since 04184 the nozzle (arrow) in the hose connection fitting (7) has been repositioned. For this reason, the hose connection fitting (7) must also be replaced when replacing the idle air valve on vehicles manufactured prior to this date.



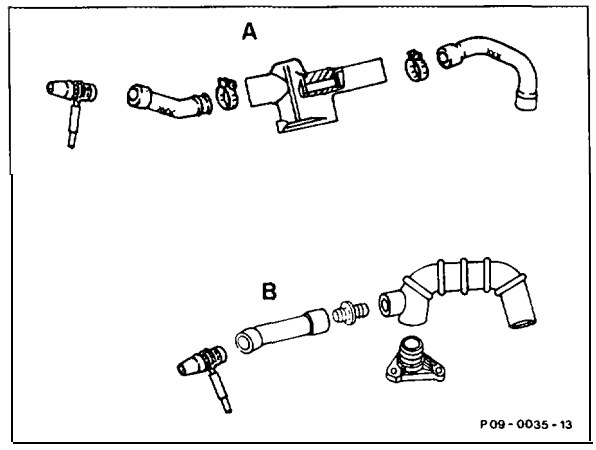
A Version up to 03/84



B Version as of 04/84

Engine 102.985

Restriction orifice and hose clips are no longer installed. Modified housing with gasket and shaped hoses.



A Previous version
B Present version

Production breakooint:08/87

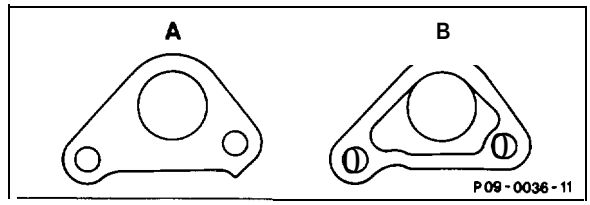
Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.028	102.985	017190	059588

Flange at idle air distributor housing increased to 8 mm (previously 3 mm).

Production breakpoint: 11187

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.028	102.985	019774	063164

Shape of gasket and sealing surface on housing modified. Improved sealing.



A Previous version
B Present version

Production breakpoint: 03/88

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.028	102.985	023710	070984

Job No.

Instructions concerning replacement and tensioning of V-belts (Engine 102.961) ..... 13 – 335
Replacing and tensioning V-belts (Engine 102.961) ..... 13 – 340
Checking condition and replacement of poly V-belt ..... 13 – 342
CheckingconditionofpolyV-belt 13-343
Removal and installation of tensioning device ..... 13 – 345
Changes to the Poly V-belt tensioning device ..... 13 – 346

13-335 Instructions concerning replacement and tensioning of V-belts

Adjusting data

V-belts (profile width in mm)	New V-belts (KG-scale on measuring instrument)	Used V-belts (KG-scale on measuring instrument)
9.5.	30	20-25
12.5	50	40-45

Special tool

Measuring instrument (Krikit) for measuring V-belt tension		001 589 69 21 00

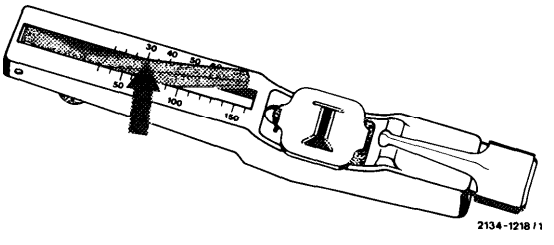
Checking condition of V-belts

Cracked, porous, burned or worn belts should be replaced.

Checking tension

For handling of instrument (Krikit) refer to operating instructions and renewing and tensioning V-belt (13–340).

The respective adjusting data refer to KG-scale (arrow) of measuring instrument.



2134-1218/1

Used V-belts

Check tension of V-belts and compare with the values named in table for used V-belts (e.g. V-belts with profile width of 9.5 mm = adjusting value 20-25). Retension V-belt, if required.

Mounting and tensioning of new V-belts

Perfect mounting of a V-belt requires loosening of respective auxiliary unit or of tensioning device of V-belt to the extent that the belt can be easily mounted. In addition, the running surfaces for the V-belt on pulleys must be free of burr, rust and dirt.

Keep free of oil, grease, chemicals. Do not use belt wax or similar agents. Subsequent optimal adjustment of belt tension (for adjusting values refer to Table) serves to prevent complaints such as squeaking V-belts and low life.

In scope of maintenance jobs, mount V-belts prior to engine checkup and tension to value for new V-belts named in Table (e.g. V-belt. profile width 9.5 mm = adjusting value 30).

If the V-belt tension is checked during final acceptance or following a test drive, the value measured in such a case should be in agreement with the value named in Table for used V-belts (e.g. V-belt, with profile width 9.5 mm = adjusting value 20–25). If required, retension V-belt.

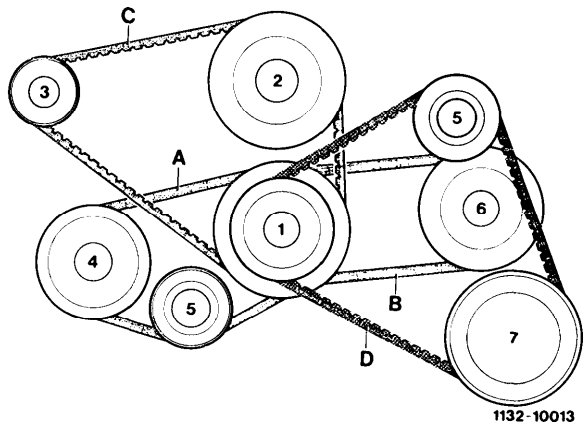
V-belt dimensions and adjusting values

V-belt	A Refrigerant compressor	B Power steering pump	C Alternator Coolant pump	D Air pump')
Dimensions	12.5 x 875	12.5 x 750	9.5 x 1005	9.5 x 1050[2)] 9.5 x 1055[3)]
Adjusting value KG-scale (measuring instrument)	new	50		30
	used	40-45		20-25

1) Model 123 (AUS) (CH) (S)
3) Model 123 (AUS) (S) 1981/1982 (up to January 1982).
Model 123 (AUS) (S) starting January 1982, @starting 1983.

Special tool

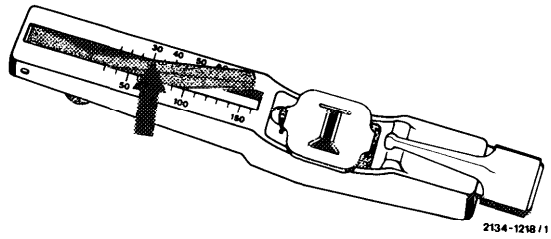
Measuring instrument (Krikit) for measuring V-belt tension		001 589 69 21 00



1 Crankshaft
2 Coolant pump
3 Alternator
4 Refrigerant compressor
5 Tensioning roller
6 Power steering pump
7 Air pump

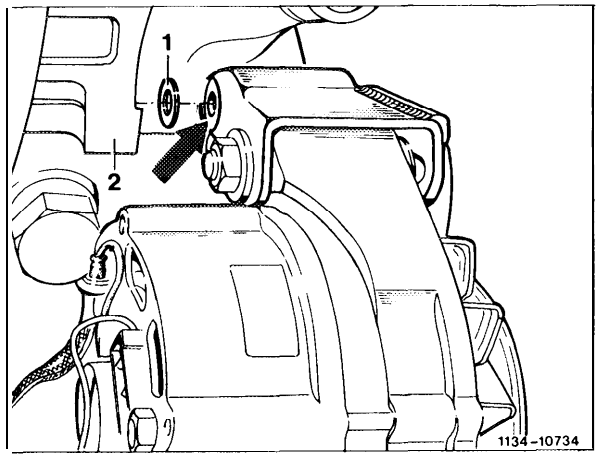
Note

The adjusting values of V-belt tension named in Table refer to KG-scale (arrow) of measuring instrument.



To improve level location of holder (clamping bridge) on cylinder head (2) and to prevent alignment faults, a washer (1) 0.85 mm thick has been temporarily installed between holder and cylinder head. The washer is located in a recess of required depth (arrow) of holder.

Washer and holder with recess are not available as a spare part. In the event of repairs, install the holder (clamping bridge) used up to now without washer.



On engines 102.920 and 102.980 (model 123) in national versions (AUS) (S) since December 1981 and in national version (CH) since start of series, the tensioning wheel with fastening screw and holder (B, arrows) is installed instead of the tensioning screw with nut (A, arrows).

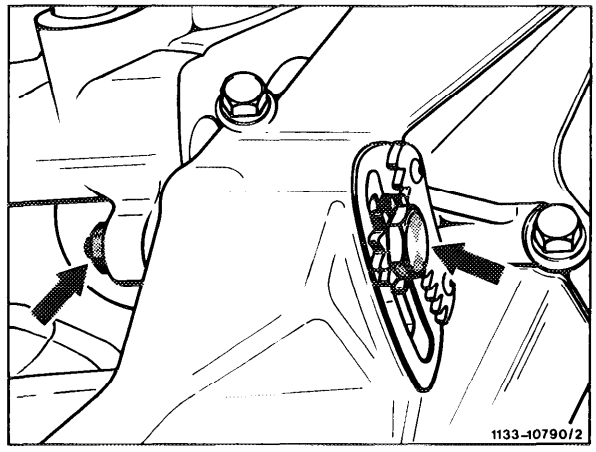
The modified tensioning components

Tensioning wheel	part no. 102 234 00 25
Holder	part no. 102 230 02 40
Hex. head screw	part no. 000931 008257

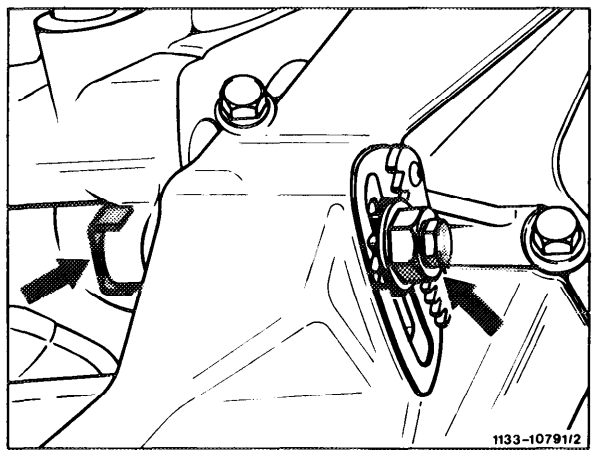
can be installed in older engines also in the event of repairs.

A = tensioning components 1st version up to December 1981
B = tensioning components 2nd version starting December 1981

A



B



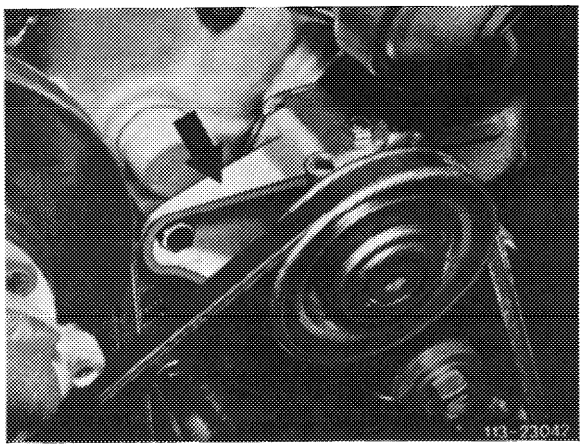
Start of series: December 1981

Model	Engine	Engine end no. transmission mech.	autom.	Chassis end no.
123.220	102.920	054 079	015664	071207
123.223 123.243	102.980	064759	043267	085725 011893

To simplify mounting of V-belt for power steering pump drive the holder for tensioning holder of air pump V-belt on engines 102.920 and 102.980 (model 123) in national version (AUS) (S) has been modified.

The modified tensioning roller holder requires a longer V-belt of 9.5 x 1055 (formerly 9.5 x 1050) for air pump drive.

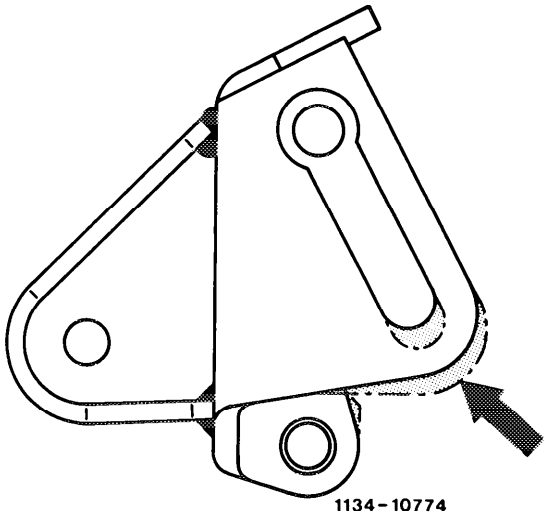
Together with V-belt 9.5 x 1055 part no. 007 997 00 92 the modified tensioning roller holder can also be installed in older engines in the event of repairs.



Start of series: January 1982

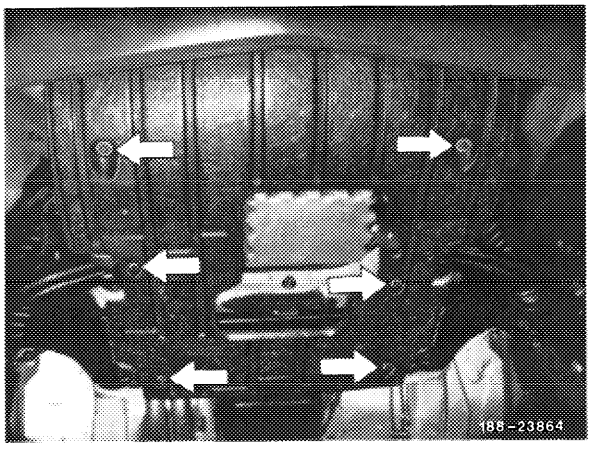
Model	Engine	Engine end no. transmission mech.	autom.	Chassis end no.
123.220	102.920	055058	015922	073682
123.223	102.980	065989	044251	088477
123.243				012147

Tensioning roller holder
Interrupted lines, dotted = 1st version
Continuous lines = 2nd version



Attention!
On model 201.024 the engine compartment lining below must be removed for tensioning V-belts.

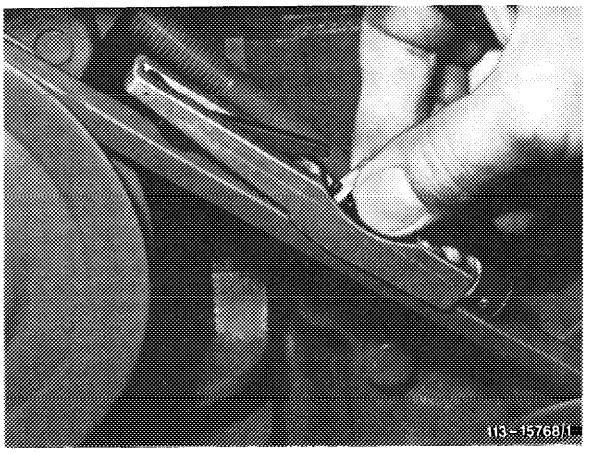
For this purpose, unscrew six sheet metal screws (arrows).



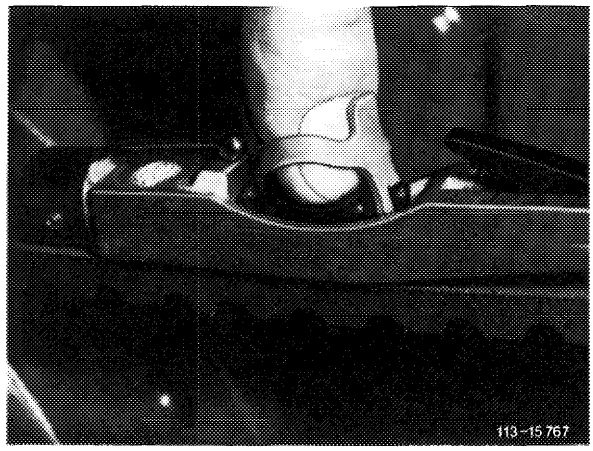
Handling of measuring instrument

For checking V-belt tension the measuring instrument can be held in various ways:

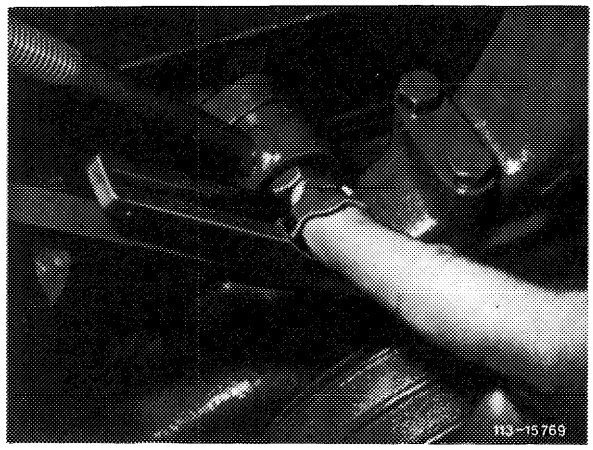
a) With thumb and forefinger against rubber loop, with the finger tips resting on push-button.



b) With forefinger from above in rubber loop.



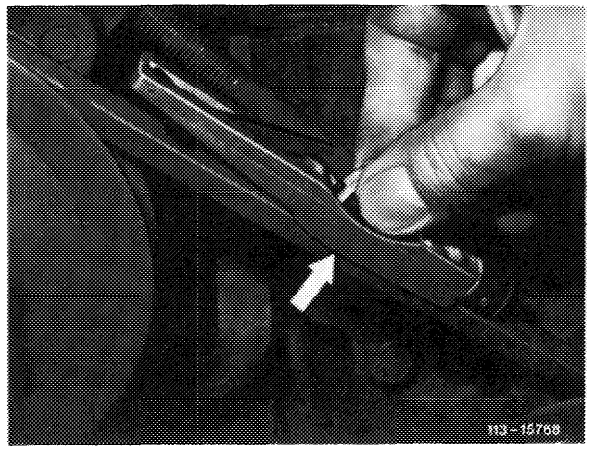
c) With forefinger laterally between rubber loop and push-button.



Testing

1 Lower indicator arm on measuring instrument.

2 Place measuring instrument on V-belt in center between pulleys. The lateral stop of the measuring instrument should rest laterally against V-belt (arrow).

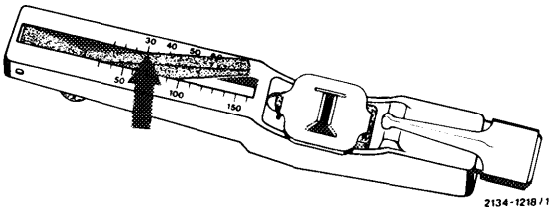


3 Exert a uniform, vertical pressure of V-belt upper surface by means of push-button, until click spring is audibly (or noticeably) disengaging.

Note: Upon disengagement of click spring, do not continue pushing on measuring instrument, since otherwise a wrong measuring value will be indicated.

4 Carefully lift measuring instrument from V-belt. Avoid knocking against instrument and do not change position of indicator arm.

5 Read adjusting value at point of intersection of indicator arm and upper scale (KG-scale, arrow), to which the indicated adjusting values are also referring.



Renewing

Check condition of V-belt.

Replace cracked, burned or worn V-belts.

1 Loosen tensioning device or units.

2 Mount V-belt without using force.

3 Tension V-belt.

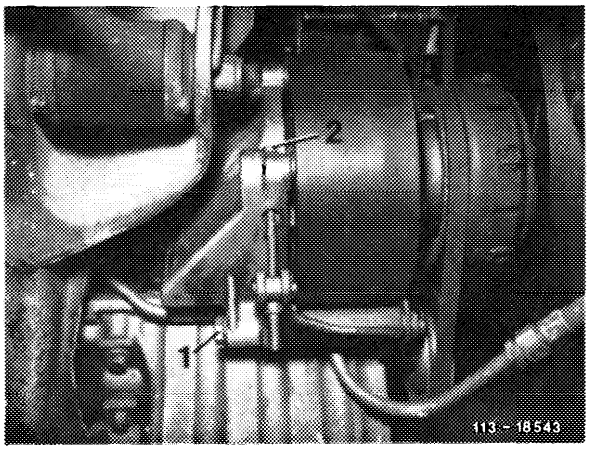
Tensioning

V-belt A refrigerant compressor

1 Loosen fastening screw (1).

2 Tension V-belt with tensioning screw (2).

3 Tighten fastening screw (1).

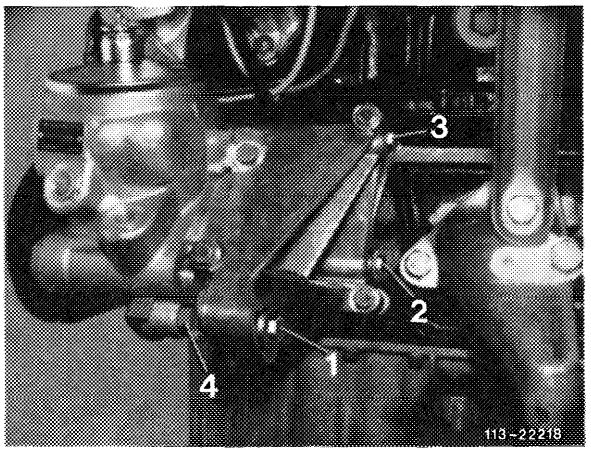


V-belt B power steering pump
standard version and (J) starting 1981

1 Loosen fastening screws (1, 2 and 3).

2 Tension V-belt with tensioning wheel (4).

3 Tighten fastening screws (1, 2 and 3).

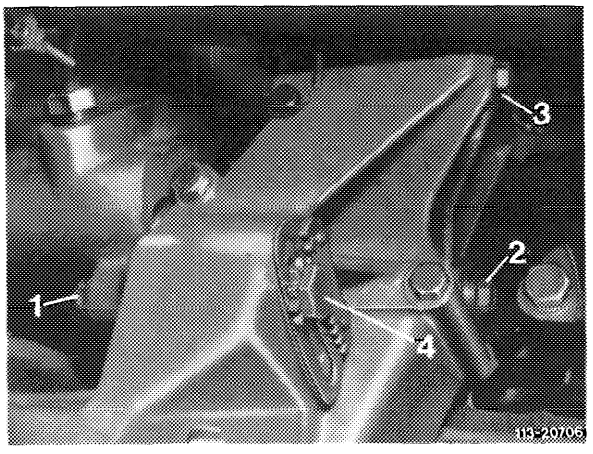


V-belt B power steering pump
(AUS) (S) 198111982
(1st version of tensioning components up to January 1982)

1 Loosen nut (1) and fastening screws (2 and 3).

2 Tension V-belt with tensioning screw (4).

3 Tighten nut (1) and fastening screws (2 and 3).

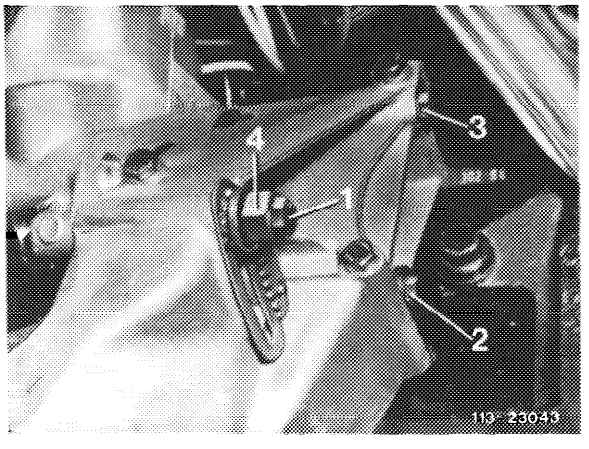


V-belt B power steering pump
(AUS) (S) starting 1982
(2nd version of tensioning components starting January 1982)
(CH) starting 1983

1 Loosen fastening screws (1, 2 and 3).

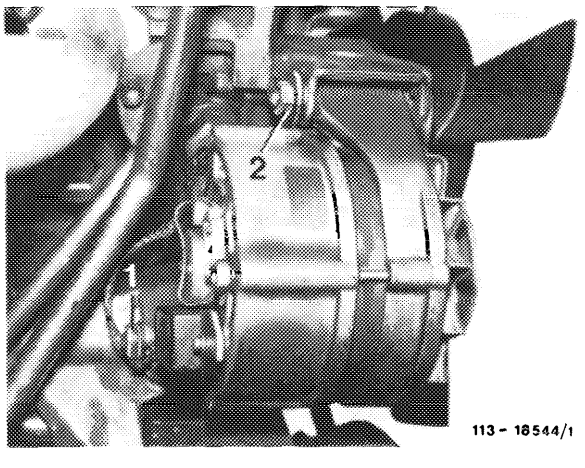
2 Tension V-belt with tensioning wheel (4).

3 Tighten fastening screws (1, **2** and 3).



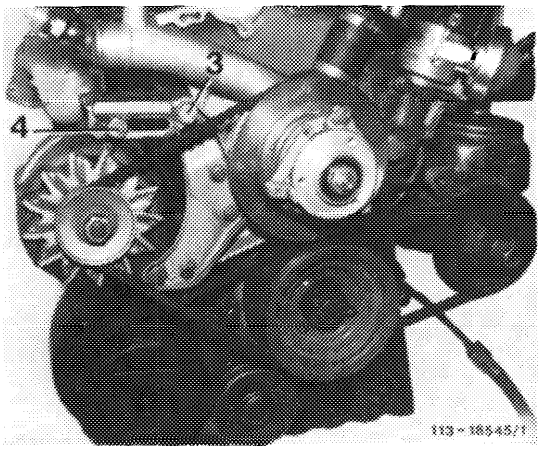
V-belt C alternator-coolant pump

1 Loosen nuts (1 and 2) and fastening screw (3).



2 Tension V-belt with tensioning screw (4).

3 Tighten nuts (2 and 1) and fastening screw (3).

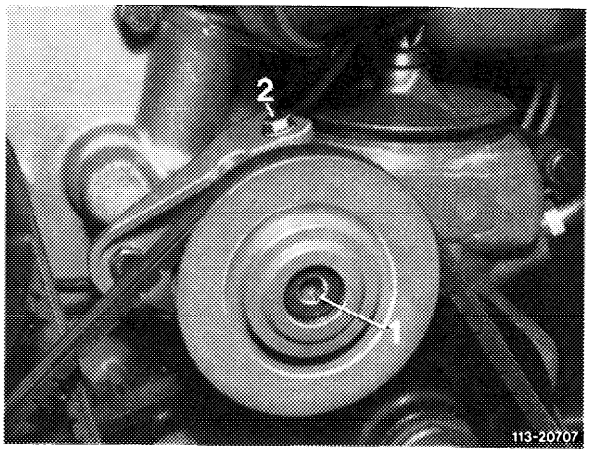


V-belt D air pump
(AUS) (S) starting 1981, (CH) starting 1983

1 Loosen necked-down screw (1).

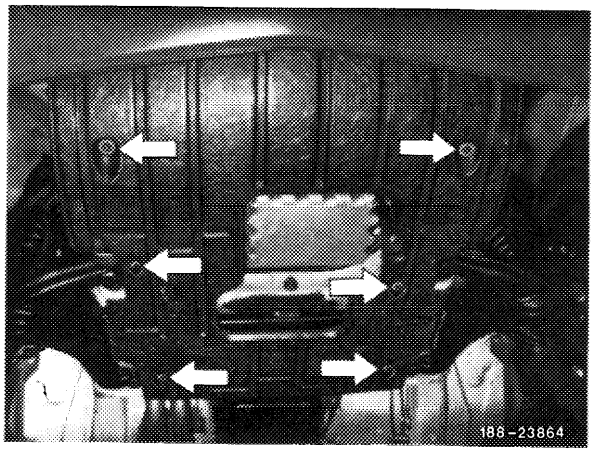
2 Tension V-belt with tensioning screw (2).

3 Tighten necked-down screw (1) to 25 Nm.

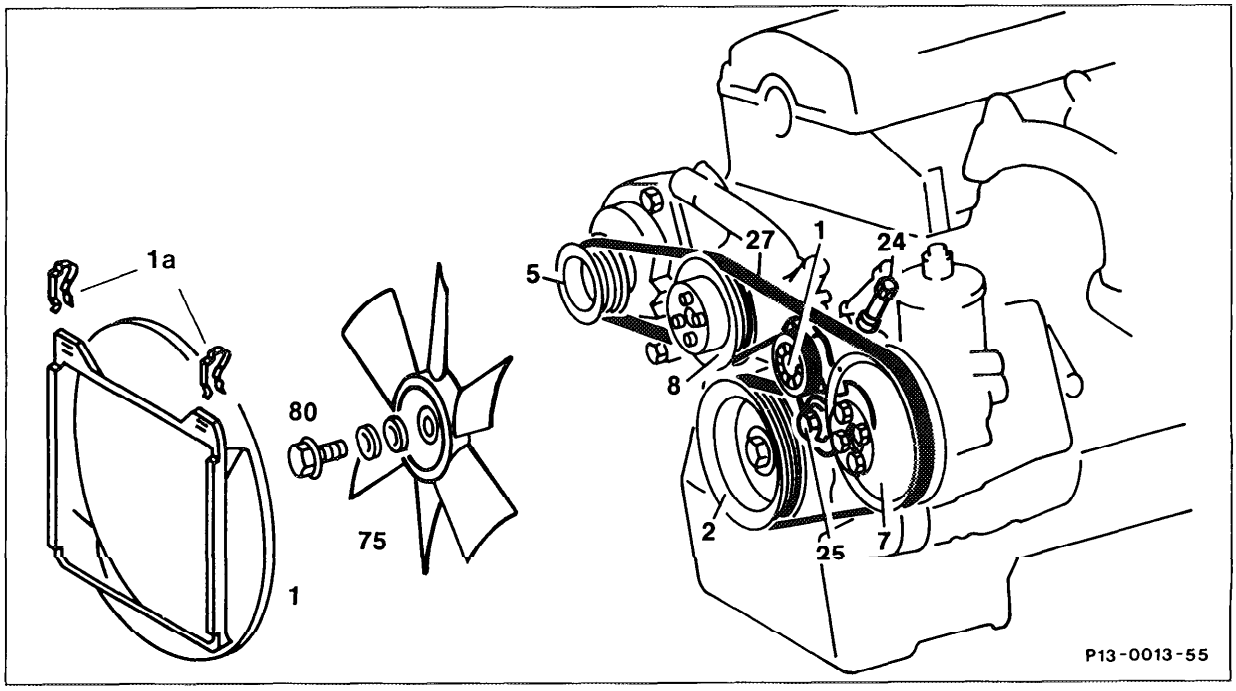


Attention!
On model 201.024 install engine compartment lining after tensioning V-belts.

For this purpose, screw in the six sheet metal screws (arrows) and tighten to 3 Nm.



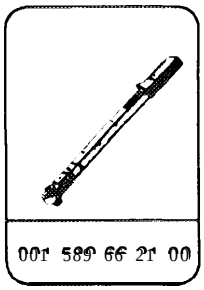
13-342 Removal and installation of Poly V-belt drive

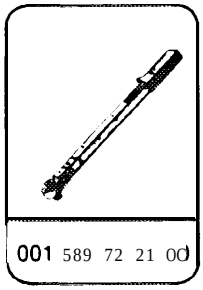


Fan shroud (1)	remove, install, to do so remove, put on clamps (1a).
Fan (75)	unbolt, bolt up, 25 Nm (Number 1).
Bolt (25)	slacken 1/4 - 1/2 turn (Number 2).
Adjusting nut (24)	slacken sufficiently until Poly V-belt (27) can be removed (Number 3).
	Note Check Poly V-belt profile and tensioning device for wear (Number 4).
Poly V-belt (27)	put on, beginning with idler pulley (1) in the numerical sequence of the layout diagram (Number 5).
	Note Do not use any belt wax, etc. Check seating of the Poly V-belt.

Adjusting nut (24)	on vehicles up to the mid-October 1986, turn to the right until the tip of the adjusting pointer is positioned as follows: without power steering above 5th marker, with power steering and air conditioning between the 8th and 9th graduation mark. On vehicles from October 1986 turn the adjusting nut to the right until the adjusting pointer is directly over the thick marker of the scale (Number 7).
Bolt (25)	tighten up. With across flats width 19 mm, 75 Nm. With across flats width 17 mm, 80 Nm.

Special tools





Note

Since June/July 1986 the material of Poly V-belts has been changed.

Production breakpoint: June 1986
on vehicles with air conditioning and automatic air conditioning

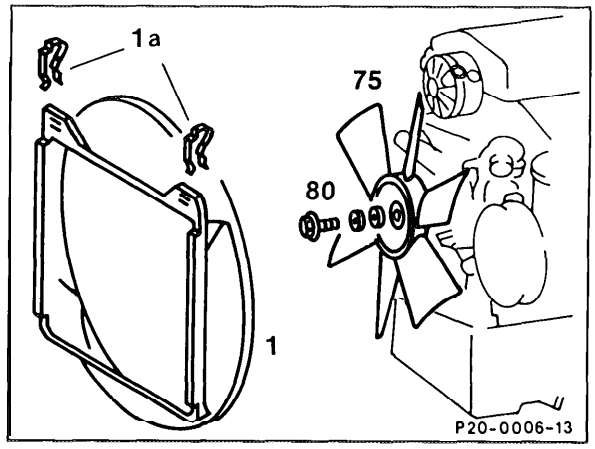
Model	Engine	Engine end No. Manual transmission	Engine End No. Automatic transmission	Vehicle chassis end No.	
				A	F
201.024 (USA)	102.985	003835	035535	307566	238297

Production breakpoint: October 1988

Model	Engine	Engine end No. Manual transmission	Engine end No. Automatic transmission	Vehicle chassis end No.	
				A	F
201.028	102.985	005673	043064	not recorded	289390

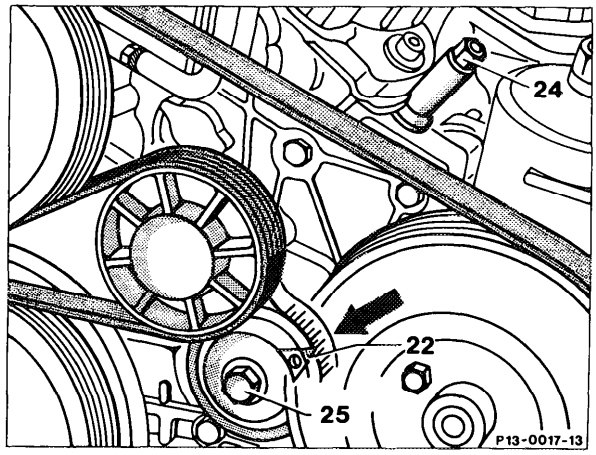
Removal and installation

1 Remove, install fan and fan shroud, tightening torque of the bolt (80), 25 Nm.



2 Loosen bolt (25) 1/4 - 1/2 turn.

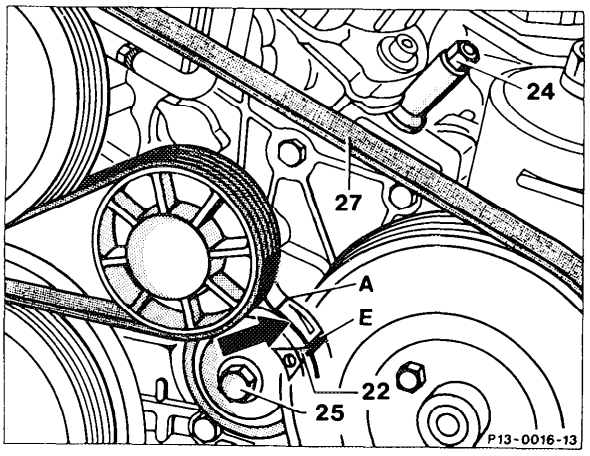
3 Release tension on the tensioning device with adjusting nut (24) (turn to the left), until the Poly V-belt (27) can be removed.



4 Check Poly V-belt profile and tensioning device for damage and contamination, replace if necessary (e.g. flattened bearing points, dents or other damaged points on the Poly V-belts etc.).

Note

On vehicles built up to mid-October 1986, slide the adjustment pointer (22) to the left, until the tip of the pointer is over the first graduation mark of the adjusting scale (arrow). On vehicles built since mid-October 1986, push the adjustment pointer to the left, until the tip of the pointer is over the thin line (A) of the adjusting scale.



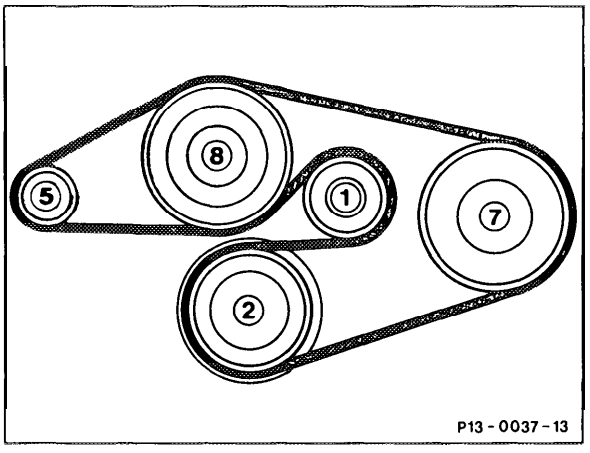
5 Install Poly V-belt: Begin at the idler pulley (1) in the numerical sequence of the layout diagram.

Note

Do not use any belt wax or similar products

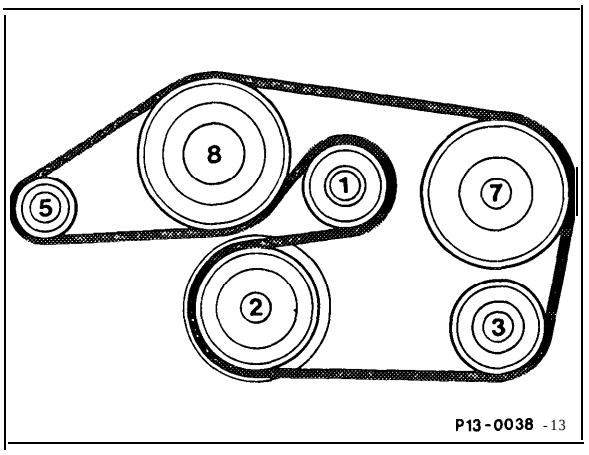
6 Check seating of the Poly V-belt on the pulley.

Layout diagram on vehicles with power steering
Belt length: 1885 mm



1 Idler pulley
2 Crankshaft
5 Alternator
7 Power steering pump
8 Engine coolant pump

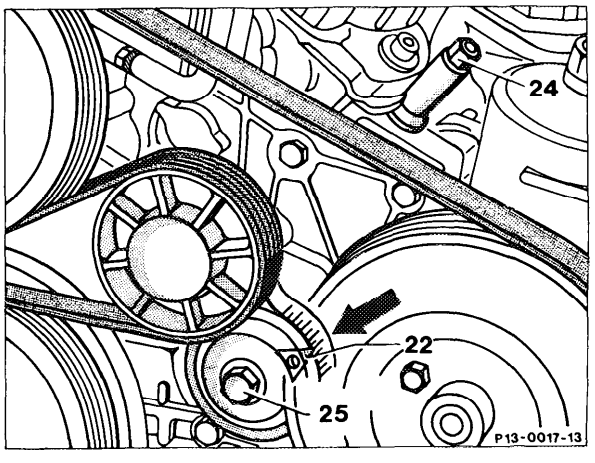
Layout diagram on vehicles with power steering and air conditioning/automatic climate control
Belt length: 1980 mm



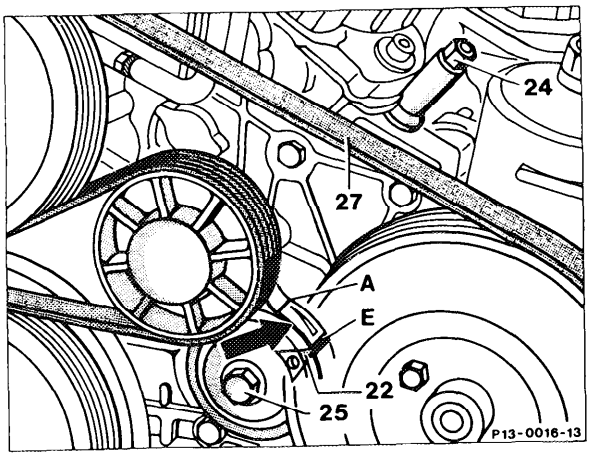
1 Idler pulley
2 Crankshaft
3 A/C compressor
5 Alternator
7 Power steering pump
8 Engine coolant pump

7 Tension Poly V-belt, to do this on vehicles built until mid-October 1986 turn the adjusting nut (24) to the right until the tip of the adjusting pointer (22) is located as follows:

- on vehicles with power steering or with power steering and air conditioning/automatic climate control between the 8th and 9th graduation mark.



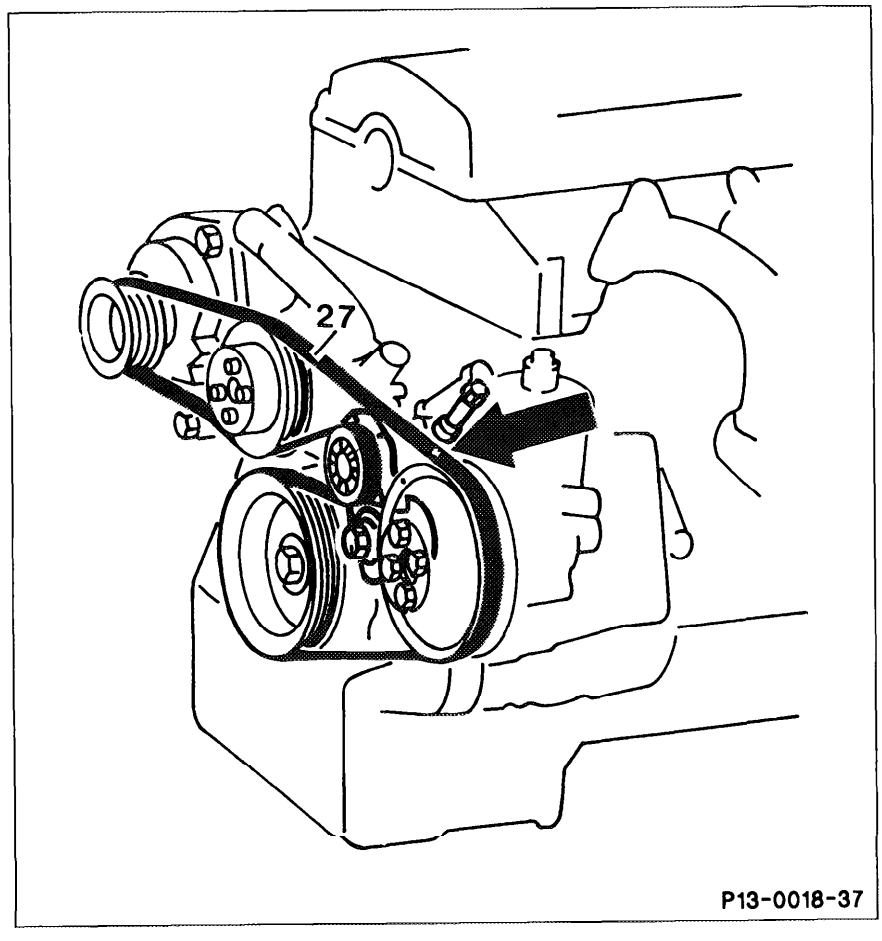
On vehicles built since mid-October 1986 turn the adjusting nut to the right until tip of the adjustment pointer is located directly over the thick line (E) on the adjusting scale.



8 Torque bolt (25).
Tightening torque:

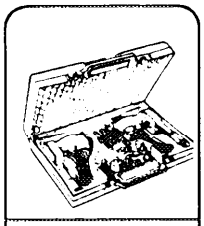
Across flats width	19 mm	75 Nm
Across flats width	17 mm	80 Nm

13-343 Checking condition of Poly V-belt

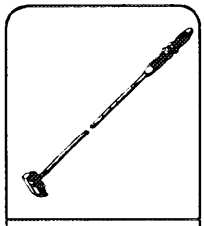


Ignition	turn off, pull off, refit cable 4 on switching unit. On injection engines remove, install the fuel pump relay module (Number 1).
Compression pressure recorder	connect 001 589 76 21 00 with adaptor 124 589 36 63 00 to positive battery terminal and terminal 50 (Numbers 2, 3 and 4).
Poly V-belt (27)	mark with chalk at a clearly visible point (arrow). Partly turn engine, check belt for damage (Numbers 5 and 6).

Special tools



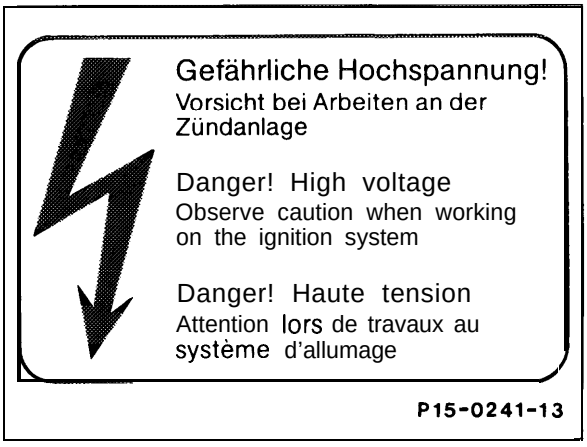
001 589 76 21 00



124 589 36 63 00

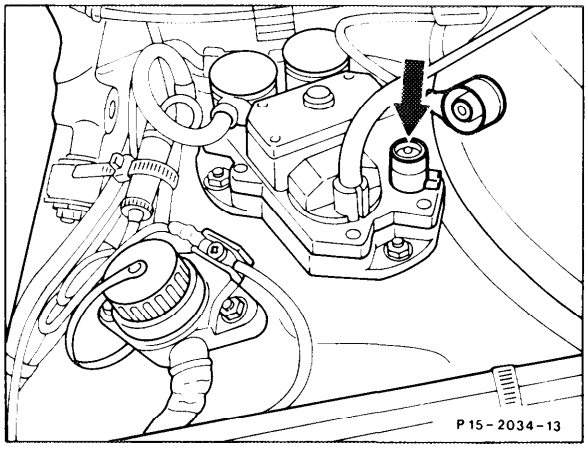
The engines are equipped with a distributor ignition system. Due to the high ignition voltage it is very dangerous to touch ignition system components (ignition coil, ignition cables, spark plug connectors, diagnostic connector), when:

- the engine is running
- the engine is being started
- the key in the ignition switch is in position 2 and the engine is turned by hand



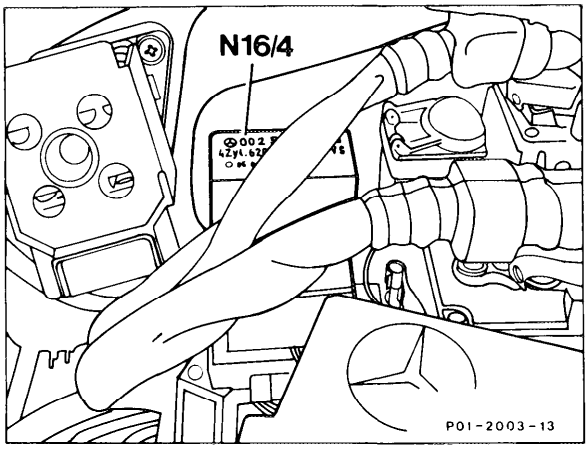
Testing

1 Switch off ignition. Pull off plug from ignition distributor sensor (green and black cable on the switching unit) (arrow).



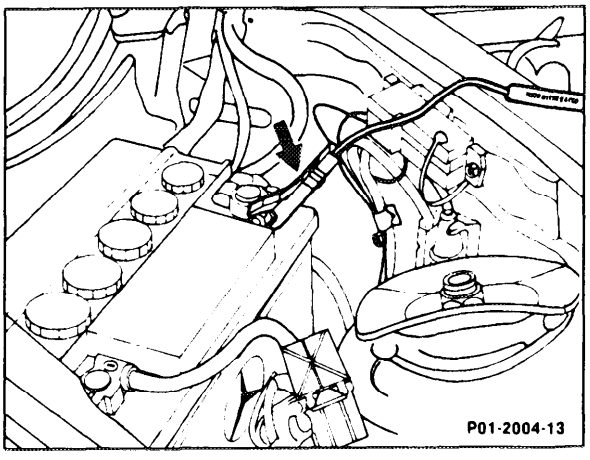
Note

On injection engines pull off fuel pump relay module (N16/4) before turning the engine, so that no fuel is injected.



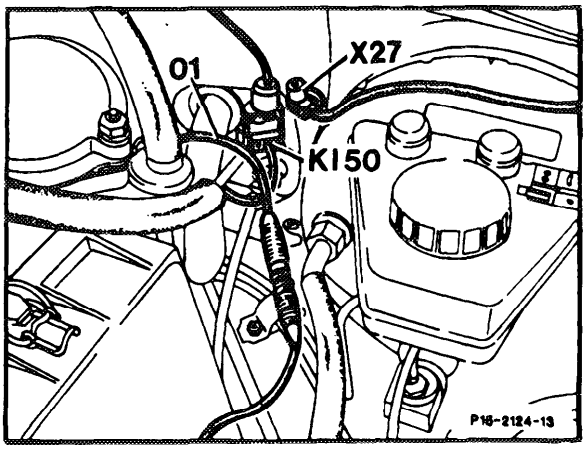
Shown on model 201

2 When connecting compression pressure recorder, connect one of the two crocodile clips (arrow) of the compression pressure recorder Part No. 001 589 76 21 00 to the positive battery terminal.



3 Pull off plug (X 27) from plug connector (terminal 50).

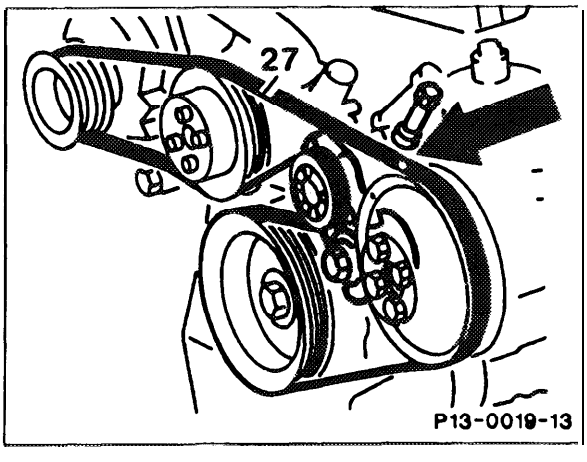
4 Connect plug of the adaptor lead (01), Part No. 124 589 36 63 00.



201 model

5 Mark Poly V-belt with chalk in a clearly visible position.

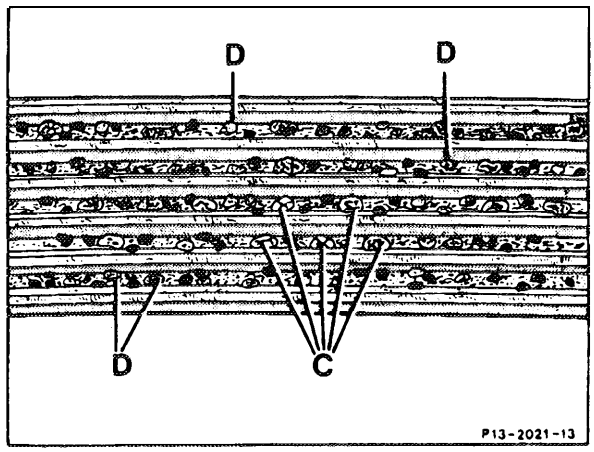
6 Turn engine partly with the compression pressure recorder Part No. 001 589 76 21 00 and the adaptor cable Part No. 124 589 36 63 00 and at the same time check Poly V-belt for damage. Terminate the process, when the marking is visible again (one full belt rotation).



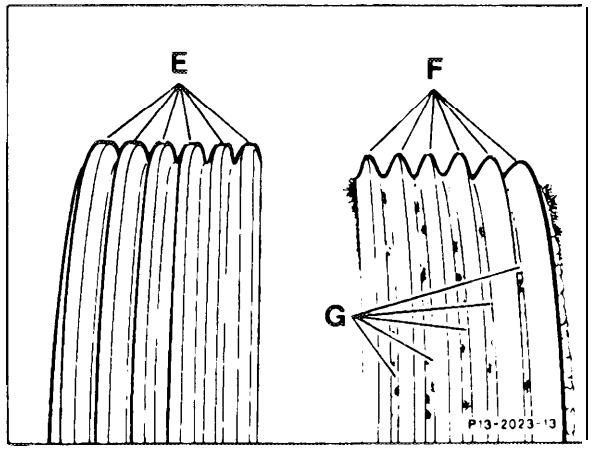
The Poly V-belt must be replaced, when the following forms of damage occur:

Forms of damage

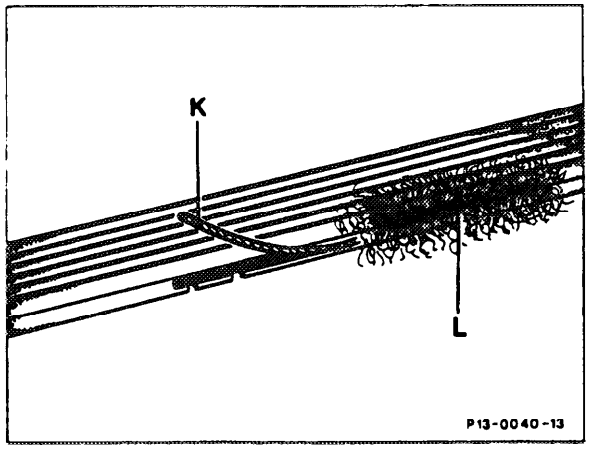
- Rubber nodules in the base of the ribs (C).
- Deposits of dirt or stones (D).



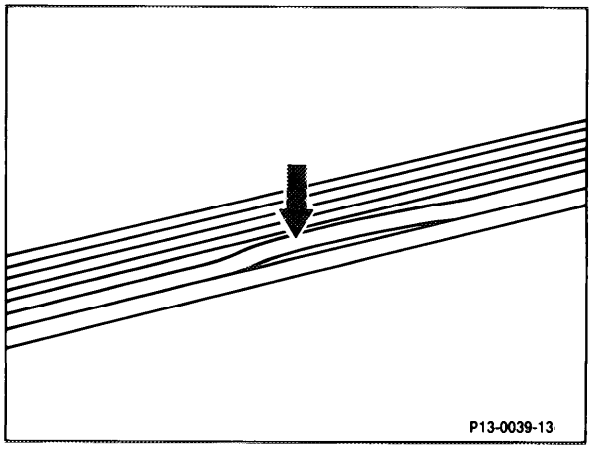
- Wear on flanks (F, ribs are triangular, when worn; ribs are trapezoidal when brand new E) and pulled strands are visible in the base of the ribs (G, brighter points).



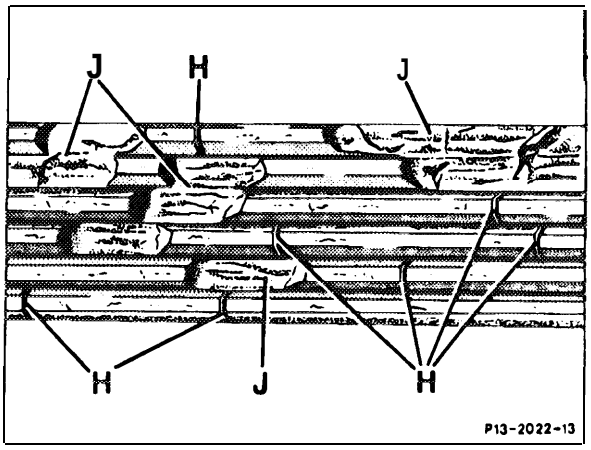
- Strands pulled out at the side (K) or frayed outer strands (L).



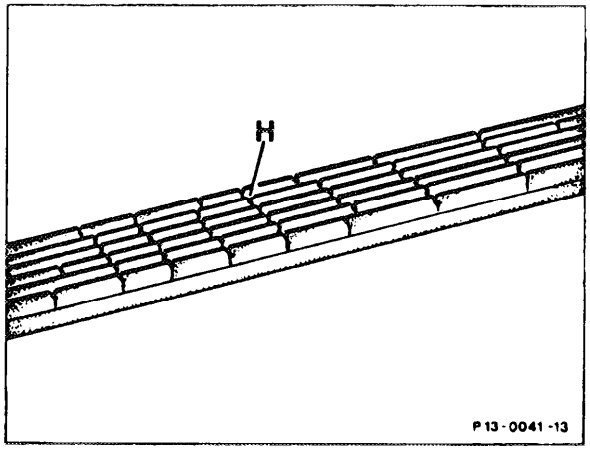
- Rib loosened from rib base (arrow).



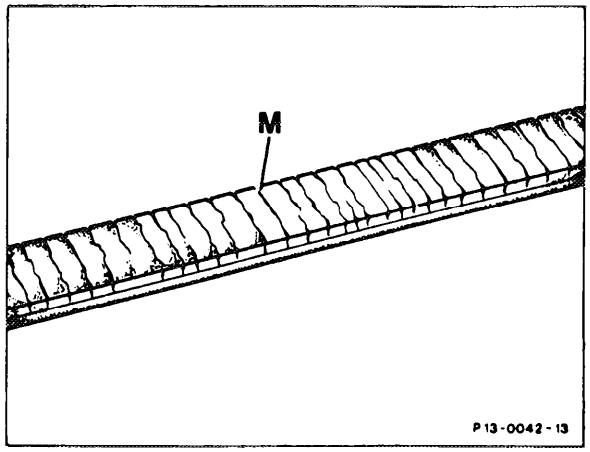
- Transverse cracks in the ribs (H) and/or ribs broken away (J).



- Transverse cracks (H) in several ribs.

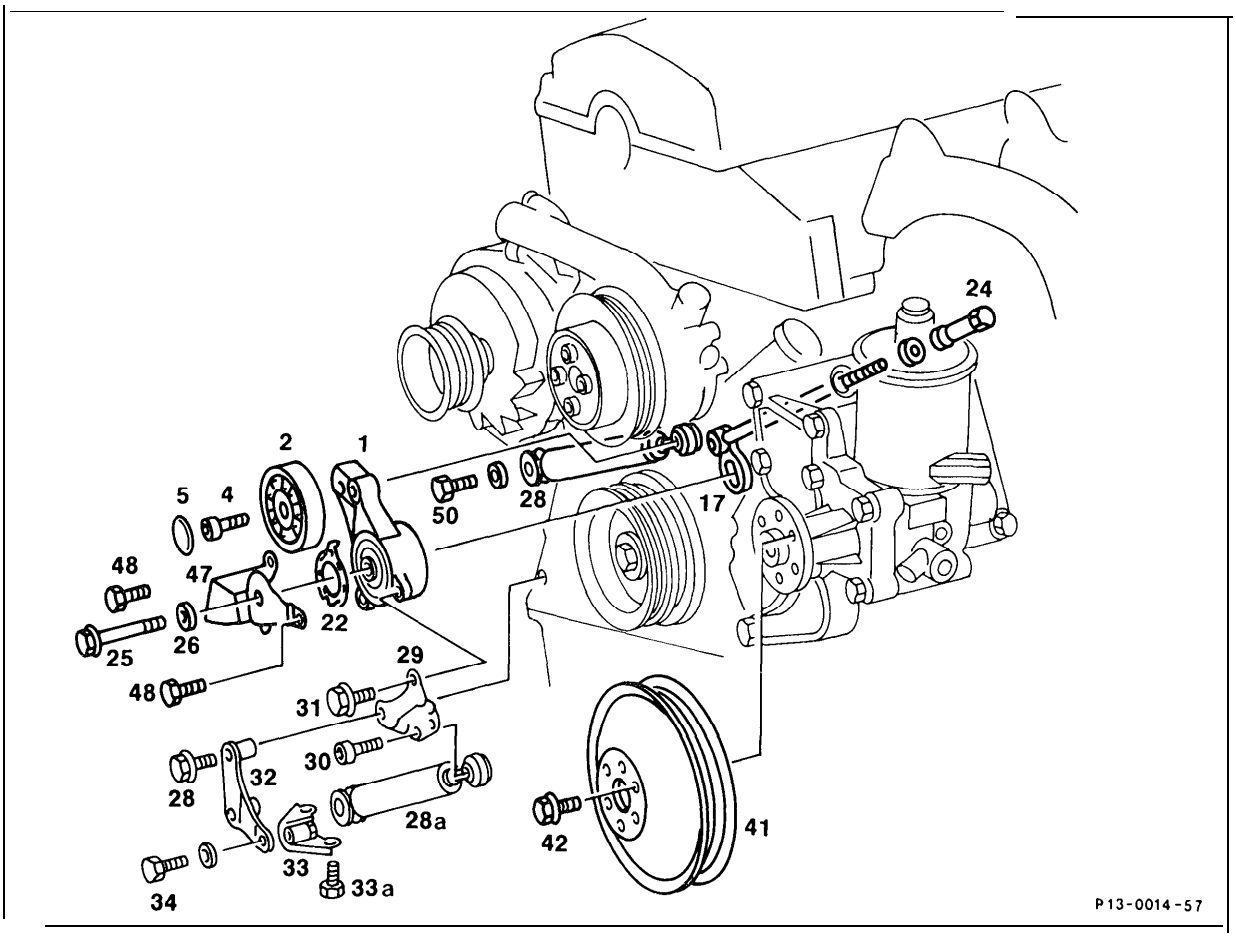


- Transverse cracks (M) on the back.



13-345 Installation and removal of Poly V-belt tensioning fixture

Preceding work:
Poly V-belt removed (13-342).



Without shock absorber .....

Adjusting screw (25) ..... unbolt, bolt up, remove, insert tensioning element (1) (Number 1).

Idler pulley (2) ..... unbolt, bolt up, to do this remove, install cover (5), 25 **Nm.**

With shock absorber strut of lower damping posltion

Shock absorber (28a) ..... unbolt, bolt up, together with the bracket (29). Bolts (31 and **34),** 25 Nm (Number 3).

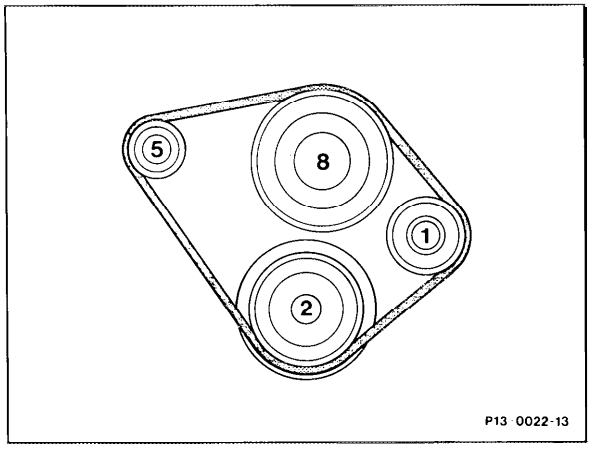
Bolt (25) ..... unbolt, bolt up, remove, install tensioning fixture (1).

With shock absorber strut of upper damping position

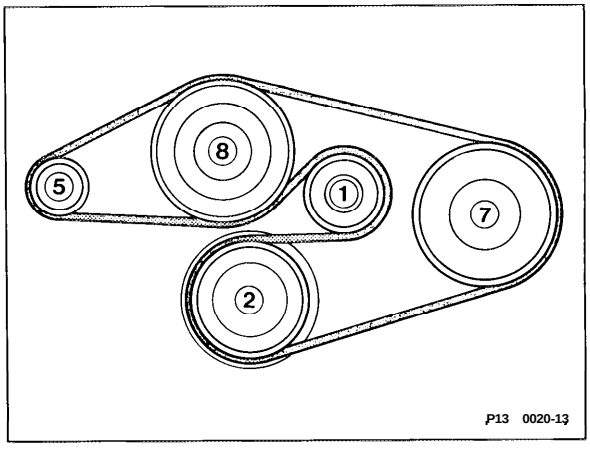
Pulley (41)	unbolt, bolt up, 30 Nm (Number 6).
Idler pulley (2)	unbolt, bolt up, 25 Nm.
Shock absorber (28)	unbolt, bolt up on the tension lever (1) and on the alternator bracket. Special tool 102 589 01 07 00 (Numbers 8 and 9).
Bracket (47)	unbolt, bolt up, 25 Nm (Numbers 10 and 11).
Bolt (25)	unbolt, bolt up, remove, install bracket (47) and tensioning fixture (1), (Number 12).

Dimensions

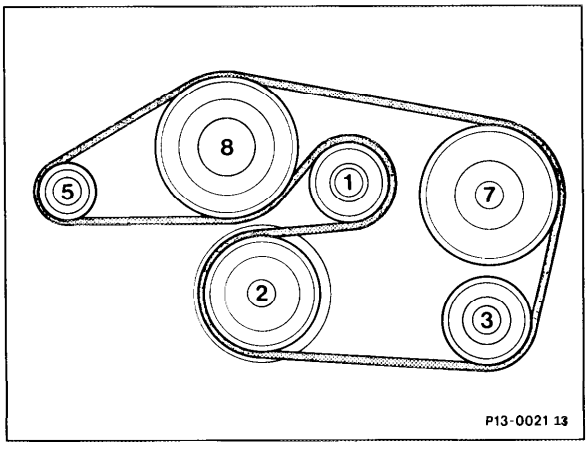
Belt layout	A	B	C
Belt length in mm	1020	1885	1980



P13 0022-13



P13 0020-13



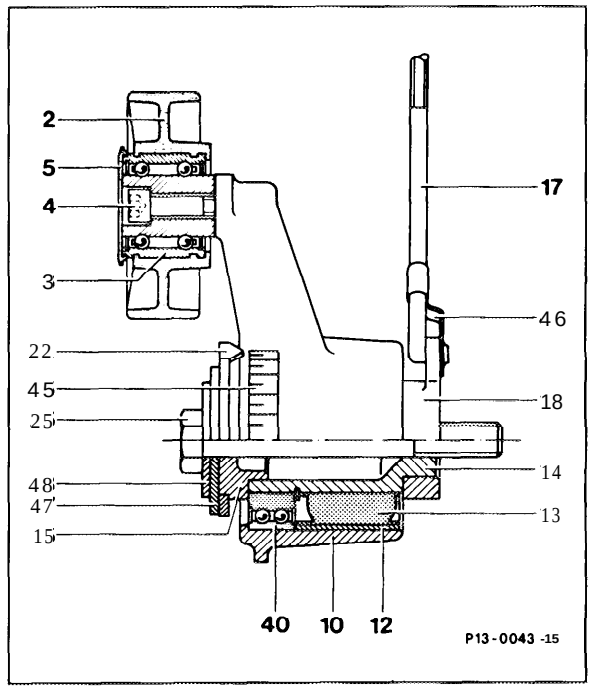
P13-0021 13

1 Idler pulley
2 Crankshaft
3 Refrigeration A/C compressor
5 Alternator
7 Power steering pump
8 Engine coolant pump

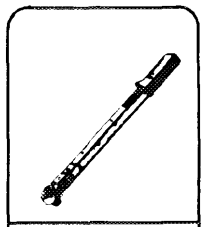
Note

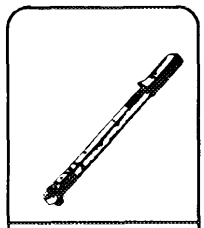
The V-belt is tensioned by an automatic tensioning fixture. Through its construction and operation it guarantees an even belt tension over the whole engine speed range. This is achieved by a rubber element in the tensioning fixture, which has to be pre-tensioned by hand when installing a new Poly V-belt.

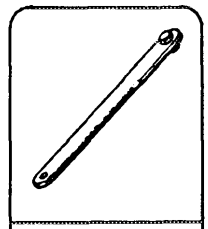
2 Idler pulley
3 Deep groove ball bearing
4 Hexagon socket screw
5 Sealing cover
10 Bracket-rubber bearing
12 Outer sleeve
13 Rubber bearing
14 Inner sleeve
15 Front sleeve
17 Connecting rod
18 Lever
22 Adjustment pointer
25 Bolt M12 x 115
40 Double roller bearing
45 Adjustment scale
46 Locking device
47 Bracket
48 Washer



Special tools

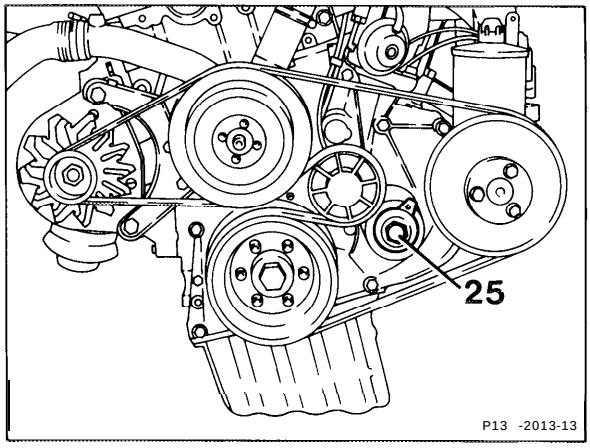

001 589 66 21 00


001 589 72 21 00

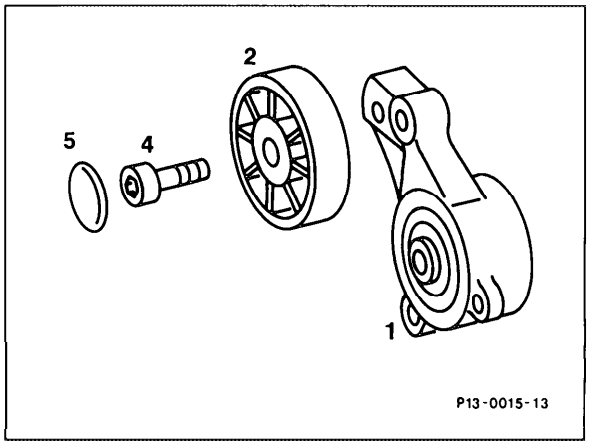

102 589 01 07 00

Removing and installing

1 On tensioning devices without shock absorber (1st design) unbolt, bolt up fixing bolt (25), remove belt tensioner.



2 Remove, press on sealing cover (5). Unbolt, bolt up hexagon socket screw (4) and remove idler pulley, tightening torque 25 Nm.

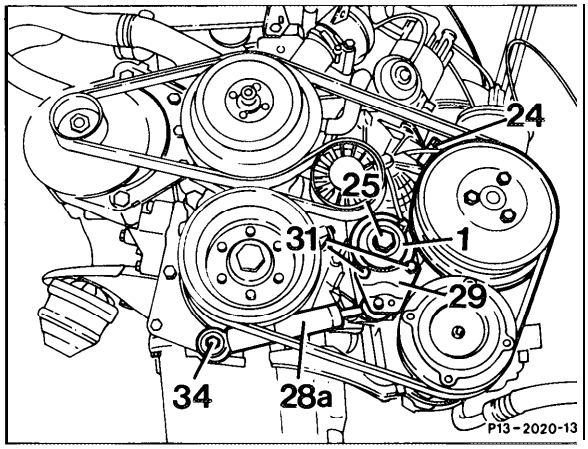


3 **On tensioning devices with lower damping position**

Unbolt shock absorber (28a) and bracket (29), to do this remove bolts (31 and 34).

4 Remove bolt (25) and remove tensioning fixture (1).

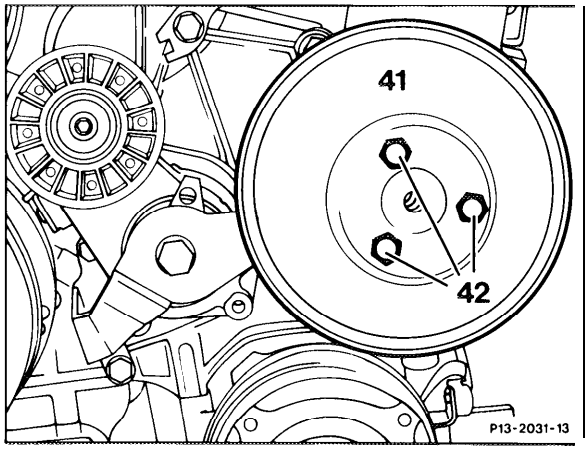
5 Unbolt idler pulley.



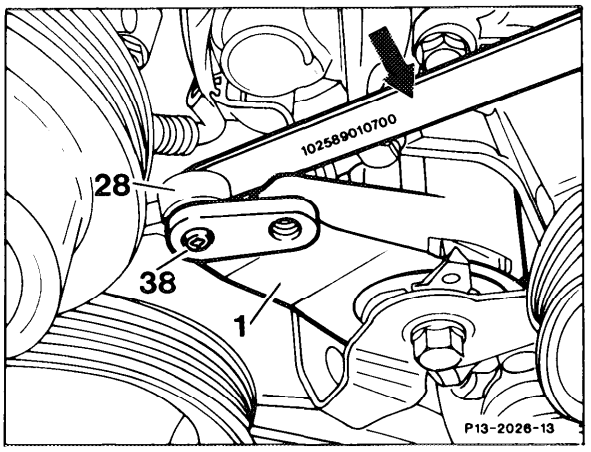
6 **On tensioning devices with upper damper position**

Unbolt, bolt up pulley (41) for oil pressure pump power steering, tightening torque 30 Nm.

7 Unbolt, bolt up, idler pulley (2), tightening torque 25 Nm.



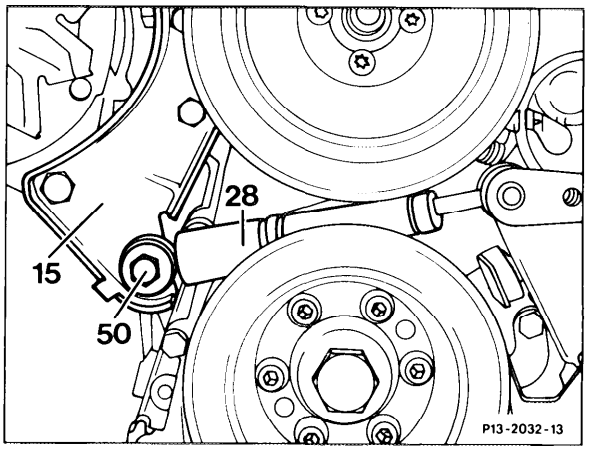
8 Unbolt shock absorber (28) at the tension lever (1), to do this hold in position with screwdriver 102 589 01 07 00 (arrow).



9 Unbolt, bolt up shock absorber (28) at the bracket (15) for alternator. Tightening torque 25 Nm.

Note

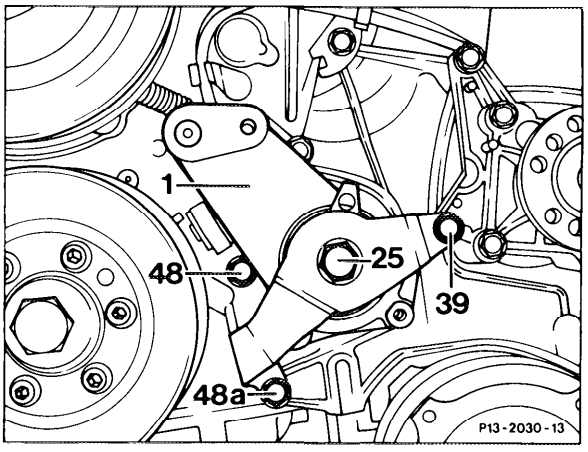
If a washer has been installed between the tensioning element (1) and shock absorber (28), refit this during assembly.



10 Unbolt nut from bolt (39) behind the power steering pump carrier.

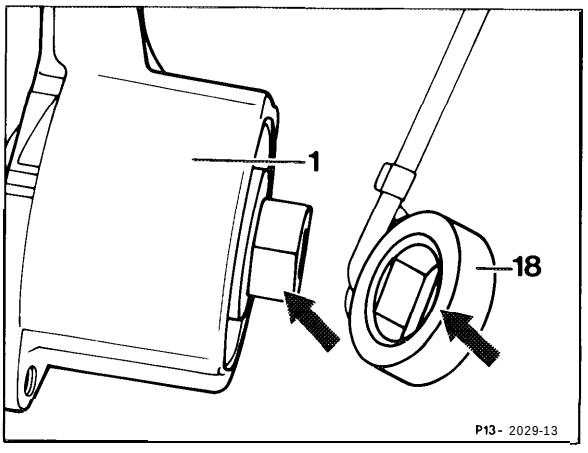
11 Unscrew bolts (48 and 48a).

12 Unscrew bolt (25), remove tensioning device (1) together with the pressed bracket (47).



Note

When installing tensioning fixture (1) put on lever (18) with the connecting rod to suit the tensioning element (arrows). Only fit the fixing bolt (25) loosely, do not tighten up. Tightening torque of M8 bolt 25 Nm.



13-346 Changes to the Poly V-belt tensioning device

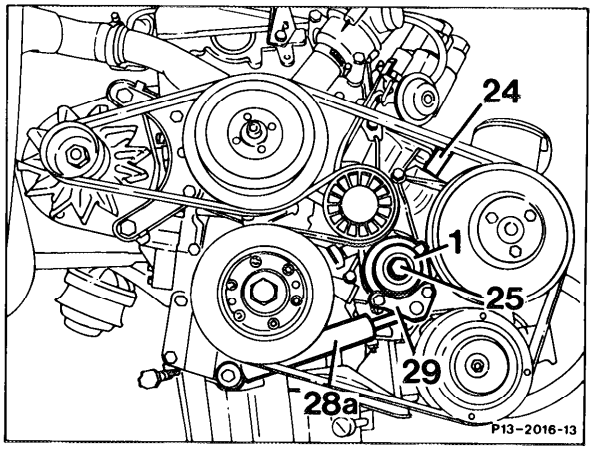
From December 1984 all 102 engines with automatic transmission and engines with manual transmission and air conditioning and automatic climate control have a revised tensioning device with an additional shock absorber. The revised design can also be installed on vehicles manufactured prior to this date.

Production breakpoint

Model	From chassis end No. A	From chassis end No. F
201.024	178818	068273*

* 201.024 model with automatic transmission from chassis end No. A174443/F 065148

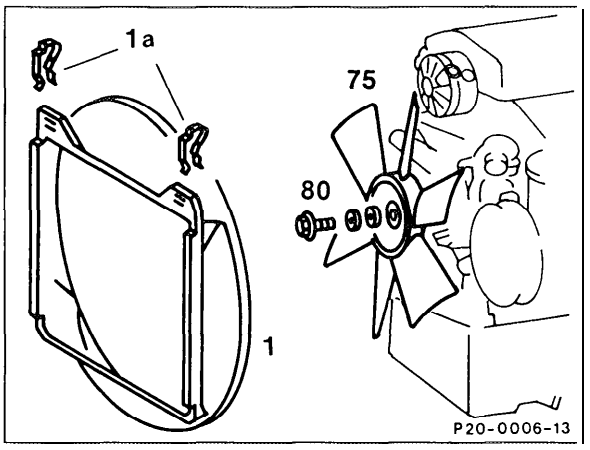
Lay out of shock absorber for Poly V-belt tensioning device



28a Shock absorber
1 Tensioning device

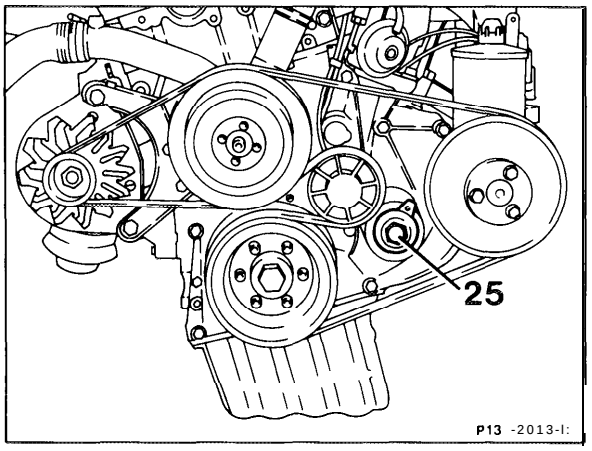
Scope of work for retroactive installation

1 Remove, install fan shroud (1) and fan (75), bolt tightening torque (80), 25 Nm.



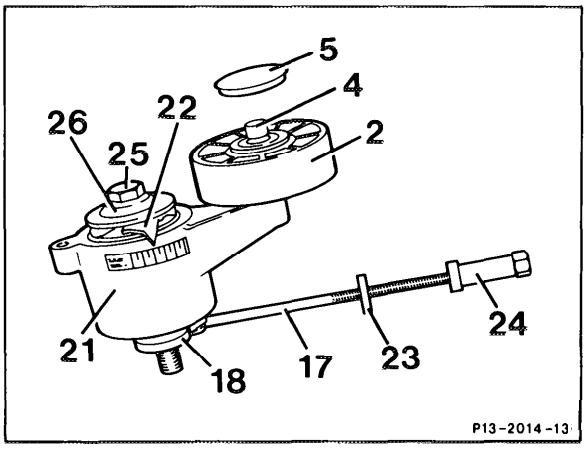
2 Remove, install Poly V-belt (13-342).

3 Unscrew fixing bolt (25) and remove belt tensioner (1).

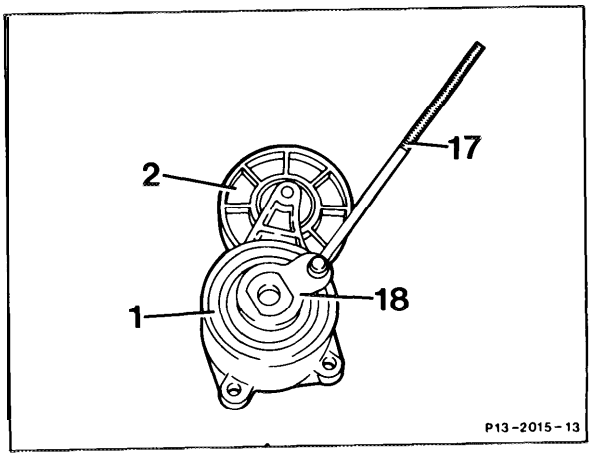


The following parts can be used again:

- Idler pulley (2)
- Bolt (4), tightening torque 30 Nm
- Sealing cover (5)
- Distance sleeve (21)
- Connecting rod (17)
- Lever (18)
- Ball socket (23)
- Adjusting nut (24)
- Adjustment pointer (22)
- Distance washer (26)
- Bolt (25)



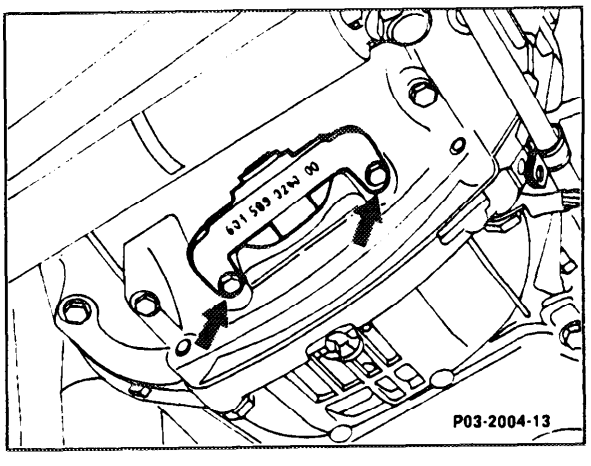
4 Complete revised tensioning device with the adopted parts. In so doing put lever (18) of the connecting rod (17) to suit the tensioning element.



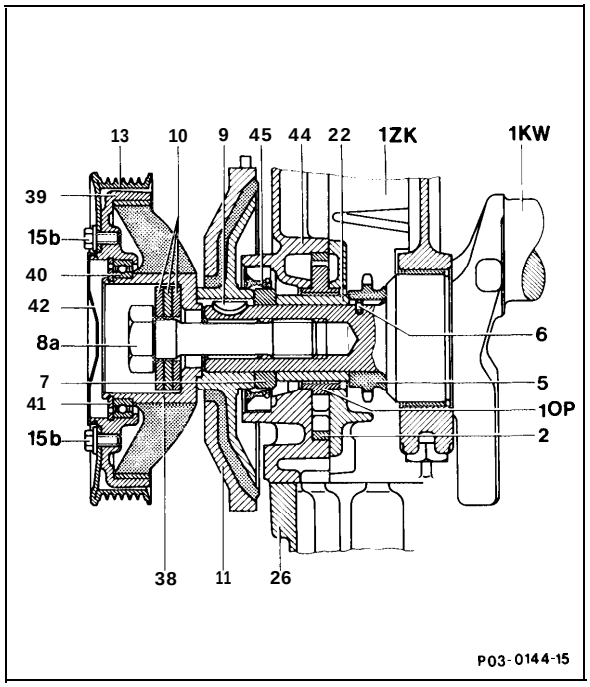
5 Install revised tensioning device. When doing this only do up the fixing bolt (25) loosely. Fit ball socket (23) under the adjusting nut (24). Bolt the adjusting nut to the connecting rod (17).

Before carrying out the work (Numbers 6 to 10), check whether the crankshaft pulley, rigidly connected with the vibration damper, has already been installed. If need be proceed with the work from (Number 11).

6 Fit holding interlock Part No. 601 589 02 40 00.



7 Unscrew bolt (8a). Remove pulley (13) and vibration damper (11).



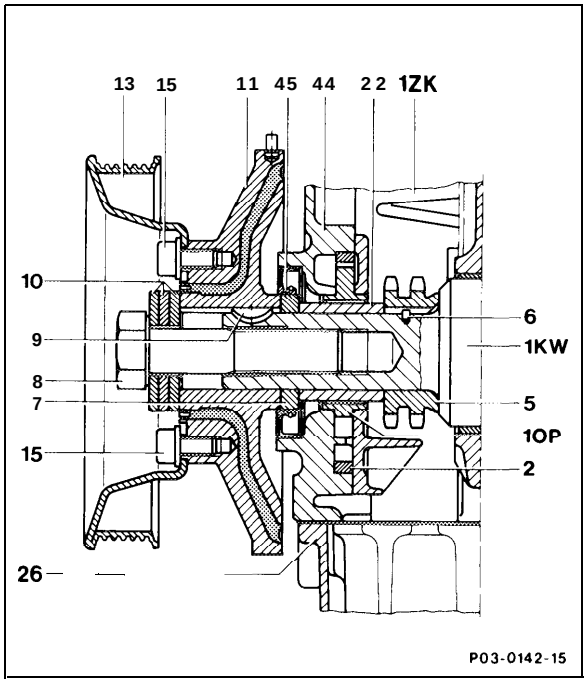
8 Install new vibration damper (11). Tighten up hexagon bolt (8) to 300 Nm.

Note

Replace the necked-down bolt (8a) Ml8 x 1.5 x 75 by the hexagon bolt (8).

9 Install new pulley (13). Tighten up combination screw (15) to 20 Nm.

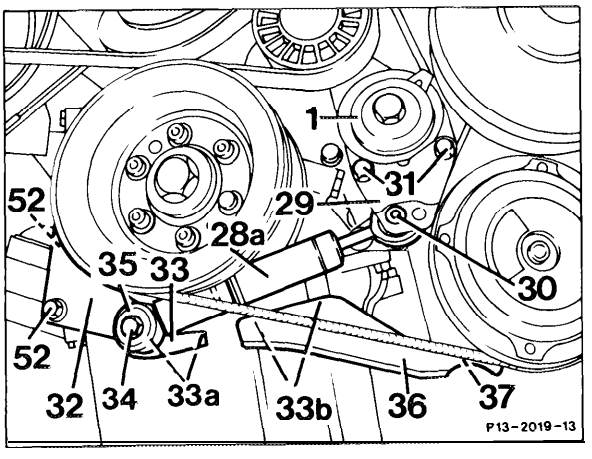
10 Remove holding interlock.



11 On vehicles with air conditioning and automatic climate control install a shorter bracket (36).
Tightening torque:

Bolt (37)	20 Nm
Bolts (33b)	8 Nm

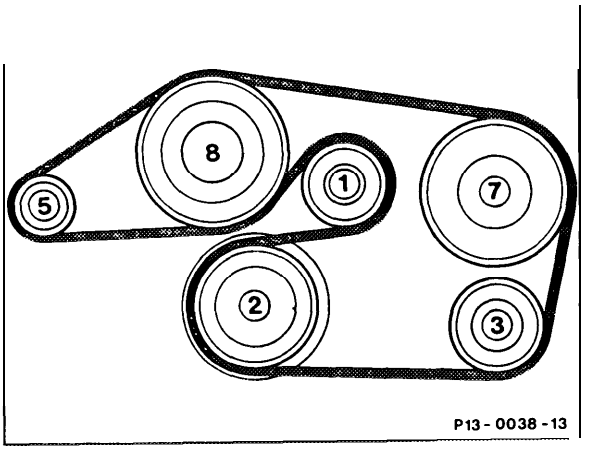
12 Attach bracket (33) to oil pan. Use fixing bolts M6 X 25 (33a), tightening torque 8 Nm.



13 Install bracket (32) to timing case cover. Use fixing bolt M8 X 70 (52), tightening torque 20 Nm.

14 Install shock absorber (28a) with fixing bolt M8 X 50 (30 and 34) to the brackets (29 and 32), tightening torque 20 Nm.

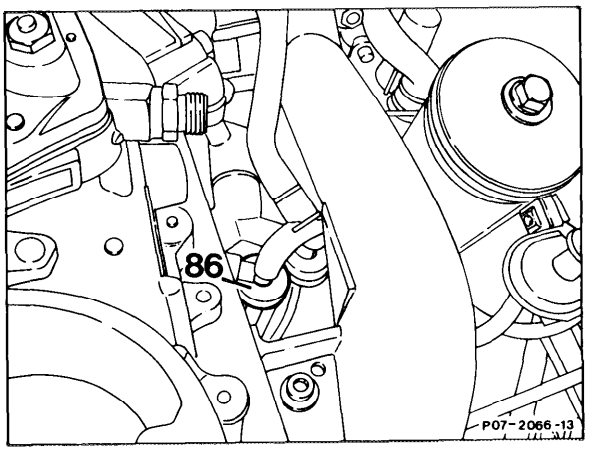
15 Put on Poly V-belt, beginning with the idler pulley (1) in numerical sequence.



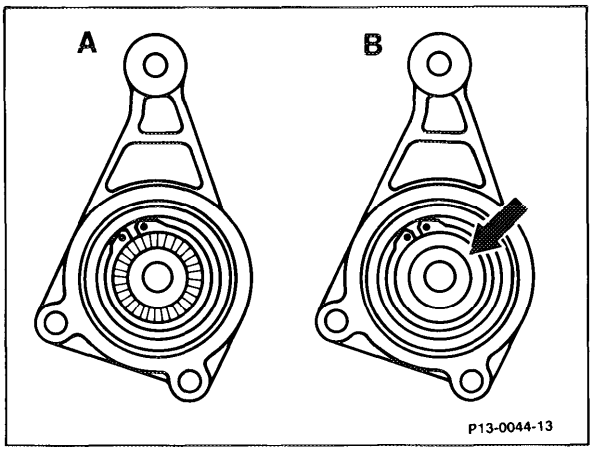
1 Idler pulley
2 Crankshaft
3 A/C compressor
5 Alternator
7 Power steering pump
8 Engine coolant pump

16 Tension Poly V-belt (13-342).

17 Install fan and fan shroud.



The teeth on the inner sleeve (arrow) have been deleted in order to achieve a high security against loosening or breakage of the fixing bolt.



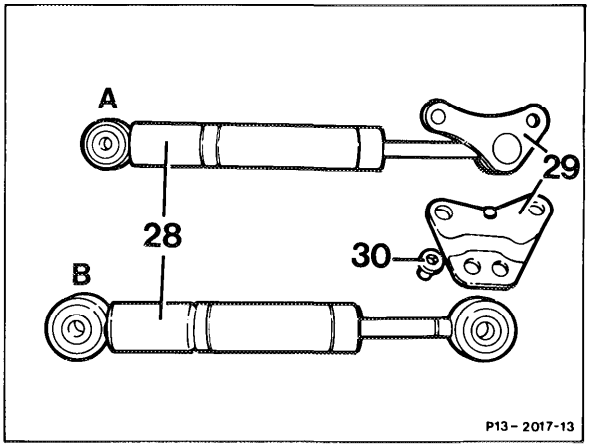
A 1st design
B 2nd design

Production breakpoint: May 1985

Model	Engine	Engine end No. Manual transmission	Engine end No. Automatic transmission	Vehicle chassis end No.	
				A	F
201.024 (USA)	102.985	002015	017298	221198	115103

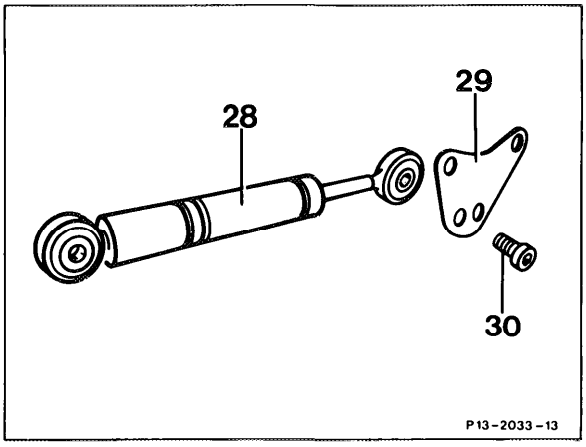
As of June 1985 model 201.02 has a revised shock absorber. The differences are the outside diameter of the attachment eye, the length of the shock absorber housing and the bracket (29), which is no longer welded to the shock absorber. The revised shock absorber can also be installed on vehicles produced prior to this date.

A 1st design
B 2nd design



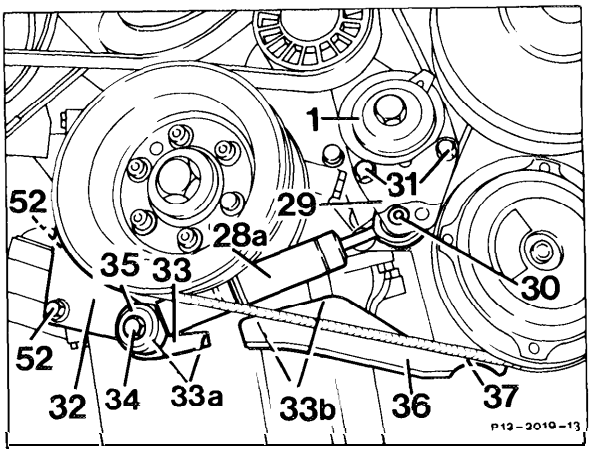
Repair note

The bracket (29) is to be attached to the shock absorber with the hexagon socket screw M6 x 25 (30) in accordance with the table.



Engine	Manual transm.	Automatic transm.	Up to engine end No.	From engine end No.	Bracket on shock absorber bore	
					A	B
102.985	X		002293			X
	X			002294	X	
		X	019688			X
		X		019689	X	

Parts		Part No.
All engines	Shock absorber (28a)	1022000714
	Bracket (29)	102 202 21 40
	Hexagon socket screw M8 × 14 (30)	007984 008063



Production breakpoint

Model	Chassis or vehicle identification end No.	
	A	F
201.024	227434	124444

The fixing bolt for the belt tensioning device Ml2 x 115 has a longer thread (100 mm, previously 30 mm).

Production breakpoint: April 1986

Model	Engine	Engine end No. Manual transm.	Engine end No. Autom. transm.	Vehicle chassis end No.	
				A	F
201.024 (USA)	102.985	003644	033262		218169

Since June 1986 Poly V-belts with revised material (as on engine 601, 602 and 603) have been installed.

Production breakpoint: June 1986
on vehicles with air conditioning or automatic climate control

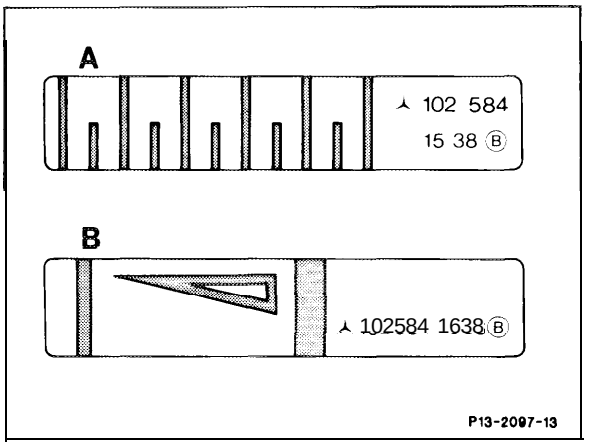
Model	Engine	Engine end No. Manual transm.	Engine end No. Autom. transm.	Vehicle chassis end No.	
				A	F
201.024 (USA)	102.985	003835	035535		238297

Production breakpoint: July 1986
On vehicles without air conditioning or automatic climate control

Model	Engine	Engine end No. Manual transmission	Engine end No. Automatic transmission
201.024 (USA)	102.985	004020	037758

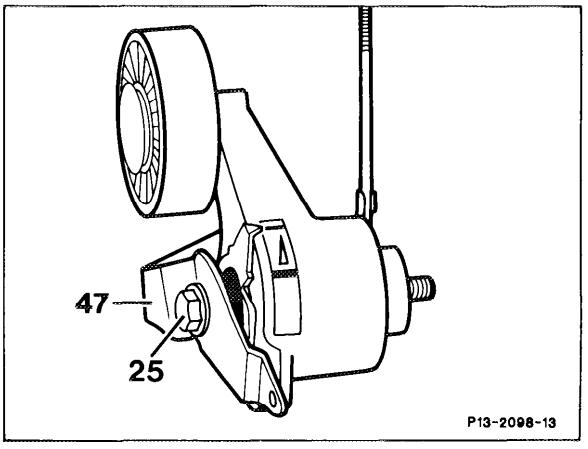
From April to July 1986 a Poly V-belt produced by the Conti Company has been installed (only on vehicles without air conditioning/automatic climate control).

Since October 1986 an adhesive plate with revised adjustment scale for tensioning the Poly V-belt has been progressively introduced on the tensioning device.



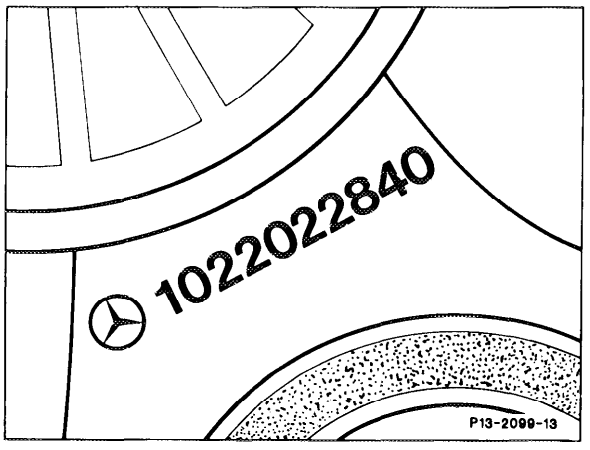
A Adhesive plate 1st design
B Adhesive plate 2nd design

As of January 1987 a revised tensioning fixture has been installed (102.985 engine as of July 1986). This tensioning fixture has an additional pressed bracket (47), a collar screw (25), previously hexagon bolt, and a reinforced bracket for the tensioning device.



25 Collar screw
47 Pressed bracket

This reinforced bracket is to be identified by the cast-in Part No. 102 202 28 40.

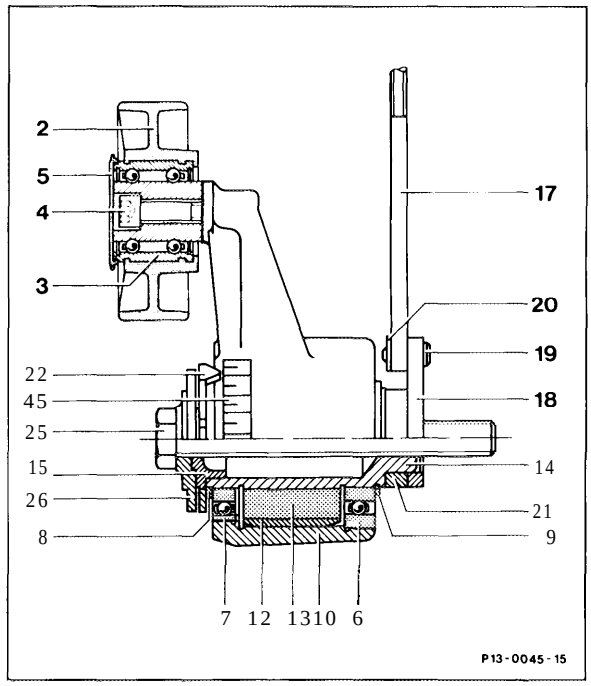


Remforced bracket

Changes to the tension lever

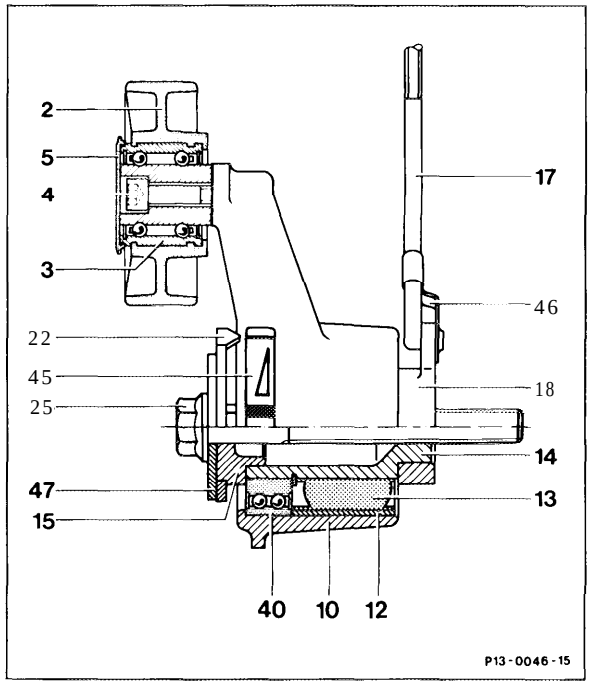
1st design

Two single row ball bearings (6 and 7),
wide rubber bearing (13),
hexagon bolt (25) 12 x 115 mm,
tension lever (18) and distance sleeve (21),
tie rod (17), attached to the tension lever (18)
with bolt (19) and secured with clips (20).



2nd design

A double row angular ball bearing (40),
narrower rubber bearing (13),
collar screw (25) Ml 2 x 110 mm,
one piece tension lever (18),
tie rod (17), attached to the tension lever (18)
with sheet metal locking device (46).



Production breakpoint: July 1986

Model	Engine	Engine end No. Man. transmission	Engine end No. Autom. transm.	Vehicle chassis end No.	
				A	F
201.028	102.985	004036	037882	322007	257172

Production breakpoint: November 1986

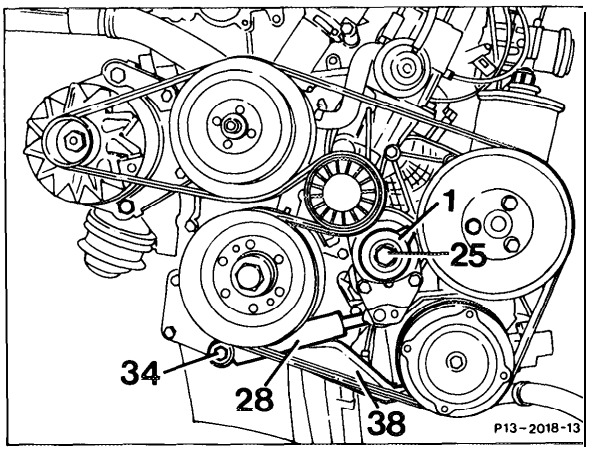
Model	Engine	Engine end No. Man. transmission	Engine end No. Autom. transm.	Vehicle chassis end No.	
				A	F
201.024 (USA)	102.985	007271	046061	-	**304297**

Fit revised tensioning device retroactively

1 Remove Poly V-belt (13-342).

2 Remove lower engine compartment panelling.

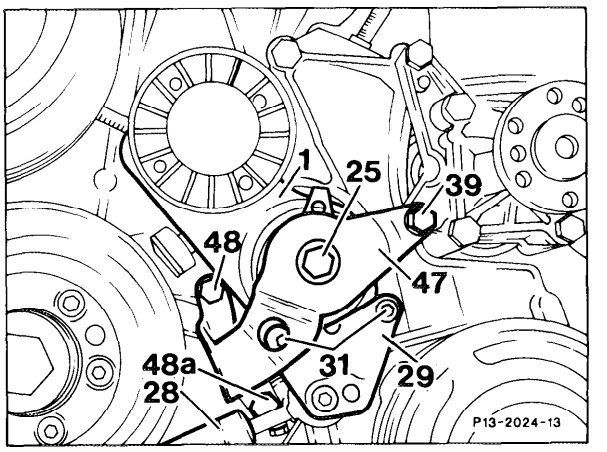
3 Loosen bolt (34) and swing shock absorber (28) downwards. Completely unscrew bolt (25) and remove tensioning fixture (1).



4 Remove pulley for power steering pump.

5 Undo nut from bolt (39) behind power steering pump/A/C compressor support.

6 Remove bolts (48 and 48a).



7 Install revised tensioning device with pressed bracket (47). Grease collar screw (25) Ml2 x 110 on the thread and the support area and screw in. Assemble adjusting nut.

8 Attach pressed bracket (47) with longer bolts.

Bolt (39) M8 × 95
(48) M8 × 45
(48a) M8 × 55

Torque the nut of bolt (39) and bolts (48 and 48a), tightening torque 25 Nm.

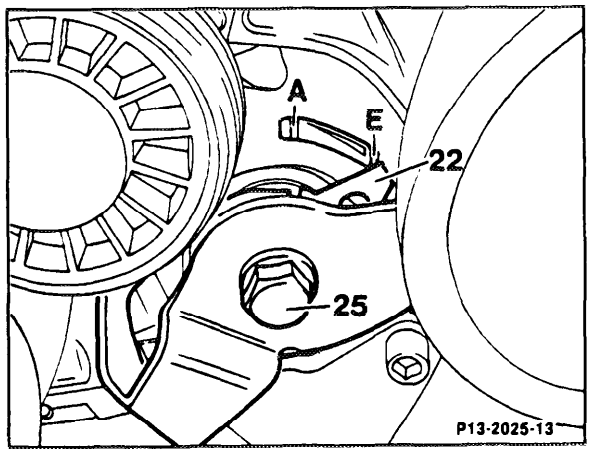
9 Install power steering pump pulley, tightening torque 30 Nm.

10 Attach bracket (29) and shock absorber (28) to tensioning fixture. Torque bolts (37 and 34), tightening torque 20 Nm.

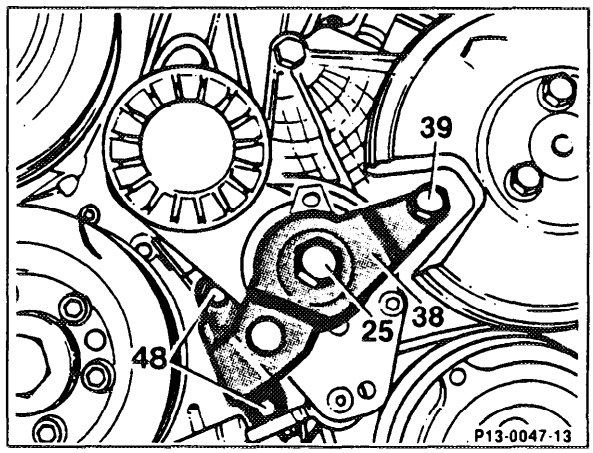
11 Install Poly V-belt (13-342).

12 Install engine compartment panelling.

13 Push adjustment pointer (22) to the left until the tip is directly over the scale marking (A). Then turn the adjusting nut (24) to the right until the tip of the adjustment pointer is directly over the scale marking (E). Tighten up collar screw (25), tightening torque 80 Nm.



As of January 1987 the collar screw (25) Ml2 x 110 has been changed to a hexagon bolt with washer Ml 2 x 115.

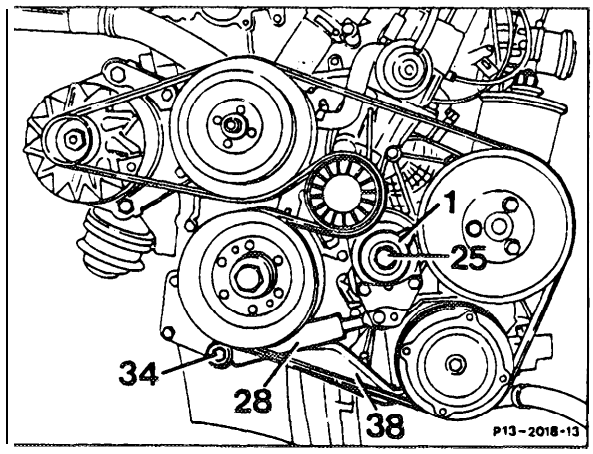


Production breakpoint: January 1987

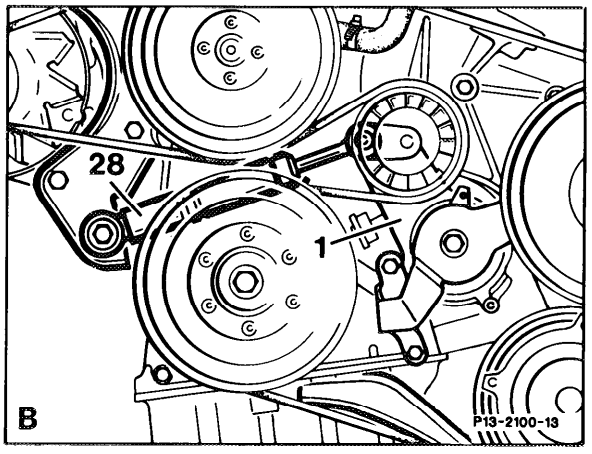
Model	Engine	Engine end No. Manual transmission	Engine end No. Automatic transmission
201.028	102.985	**009464**	**049226**

Revised fitting position of the shock absorber

As of November 1987 the shock absorber has beeninstalled overhead (previously underneath).



A Lower fitting position (1st design).



A Upper fitting position (2nd design)

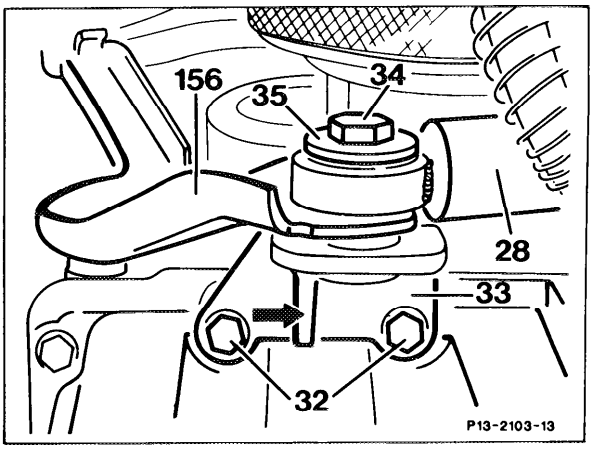
The following parts have been changed:

- Shock absorbers;

Note

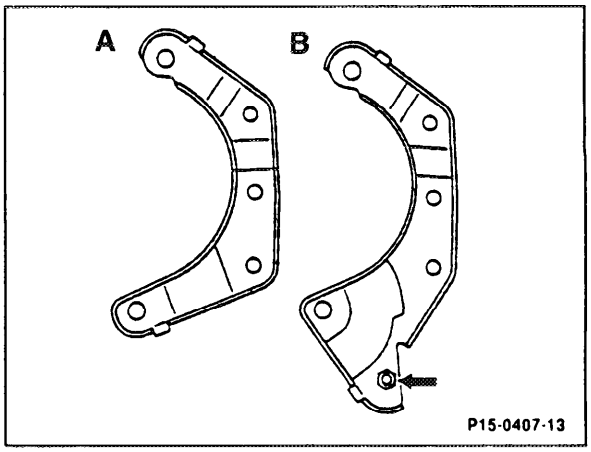
In the event of repair **do not confuse** the shock absorbers for the upper and lower fitting position. The shock absorber Part No. 102 200 12 14 (overhead) can be fitted for the shock absorber Part No. 102 200 08 14 (underneath). On engines prior to November 1987 the overhead shock absorber cannot be installed retroactively.

- Tensioning device with additional cast eye (B) for fixing the shock absorber.



A 1 st design
B 2nd design

- Coolant pump (see group 20)
- Vibration damper (see group 03)
- Pressed bracket (B) for attaching alternator with M8 welded nut for attaching the shock absorber (arrow).

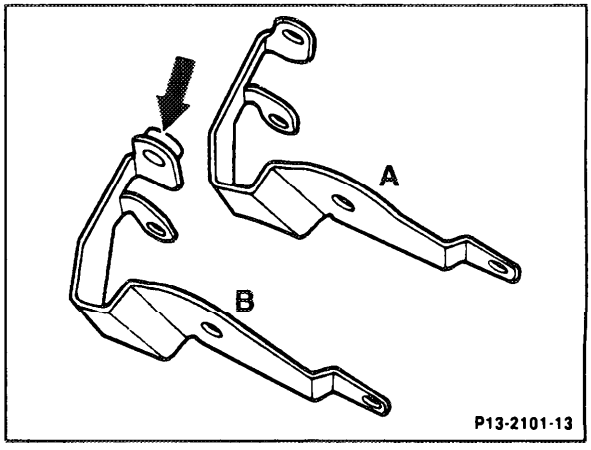


A 1st design
B 2nd design

Production breakpoint: November 1987

Model	Engine	Engine end No. Man. transm.	Engine end No. Autom. transm.	Vehicle chassis end No.	
				A	F
201.028	102.985	020298	064022	421492	445940

As of January 1988 the bracket (B) for supporting the tensioning device has been fitted with a welded-on eye (arrow).



Production breakpoint: January 1988

Model	Engine	Engine end No. Man. transm.	Engine end No. Autom. transm.
201.028	103.985	022013	067143

Intake and exhaust, manifolds, emission control system 14

Job No.

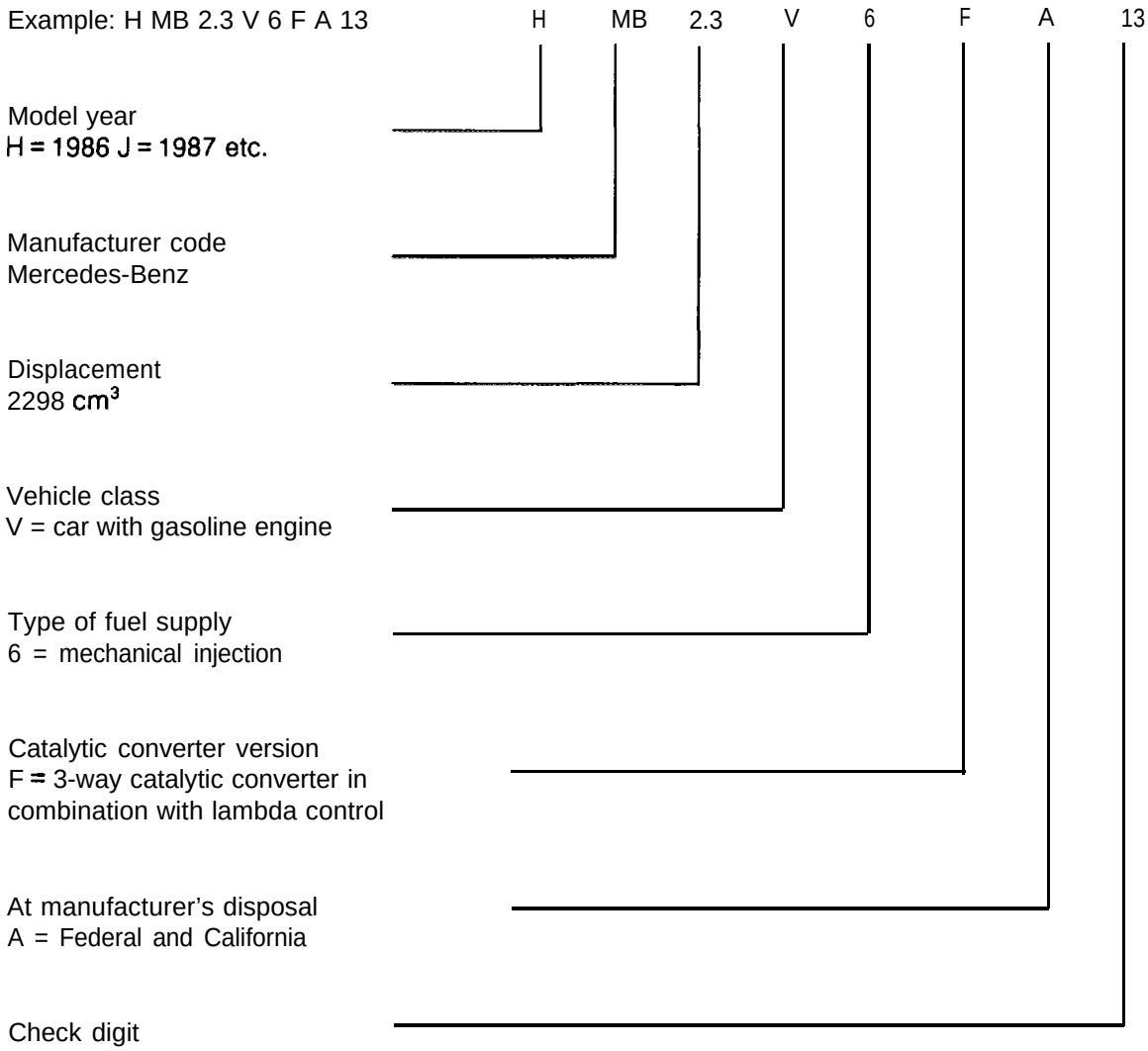
Recognition features in vehicles in national version (USA) . . . . . 14 – 001
Function of emission control system 14-050
Testing heated oxygen sensor malfunction indicator lamp . . . . . – 116
Removal and Installation of catalytic converter . . . . . – 200
Removal and installation of intake manifold and replacing gasket . . . . . – 450
Replacement of preheating flange . . . . . – 452
Replacement of intake manifold . . . . . – 455
Testing partial Intake manrfold heating (PMP) . . . . . – 456
Removal and installation of intake manifold bottom section, replacing gasket . . . . . – 460
Removal and installation of exhaust manifold . . . . . – 470
Testing exhaust gas recirculation (EGR) (USA) 1991 . . . . . – 475
General instructions for vehicles with catalytic converter (KAT) . . . . . – 487
Disposing of catalytic converters . . . . . – 489

Recognition features of vehicles in national version USA

(USA)

Information plate for emissions control system on cross member in front of radiator. This plate lists the engine code data as well as the principal engine setting data.

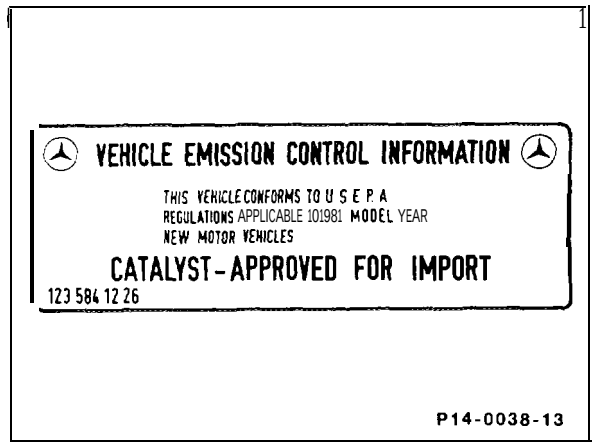
The engine code data are given in a lo-position code.



Tourist version
Vehicles in tourist version are equipped with a factory installed catalytic converter as of approximately 05 88.

Color code of information plate:
Background color red. lettering silver.

Vehicles must be equipped with catalytic converters for Importation into the USA.



14-050 Function of emission control system

A. National version (USA) with catalytic converter

a) General
b) Function dlagrams
c) CFI control module
d) Lambda control
e) Oxygen sensor
9 Catalytic converters

a) General

The function of the emissions control system for the basic and national versions is described in the sections below (b to f). Specific national variations are listed in the respective section. The vehicle features are listed in the Op. No. 07.3-004 .

Note

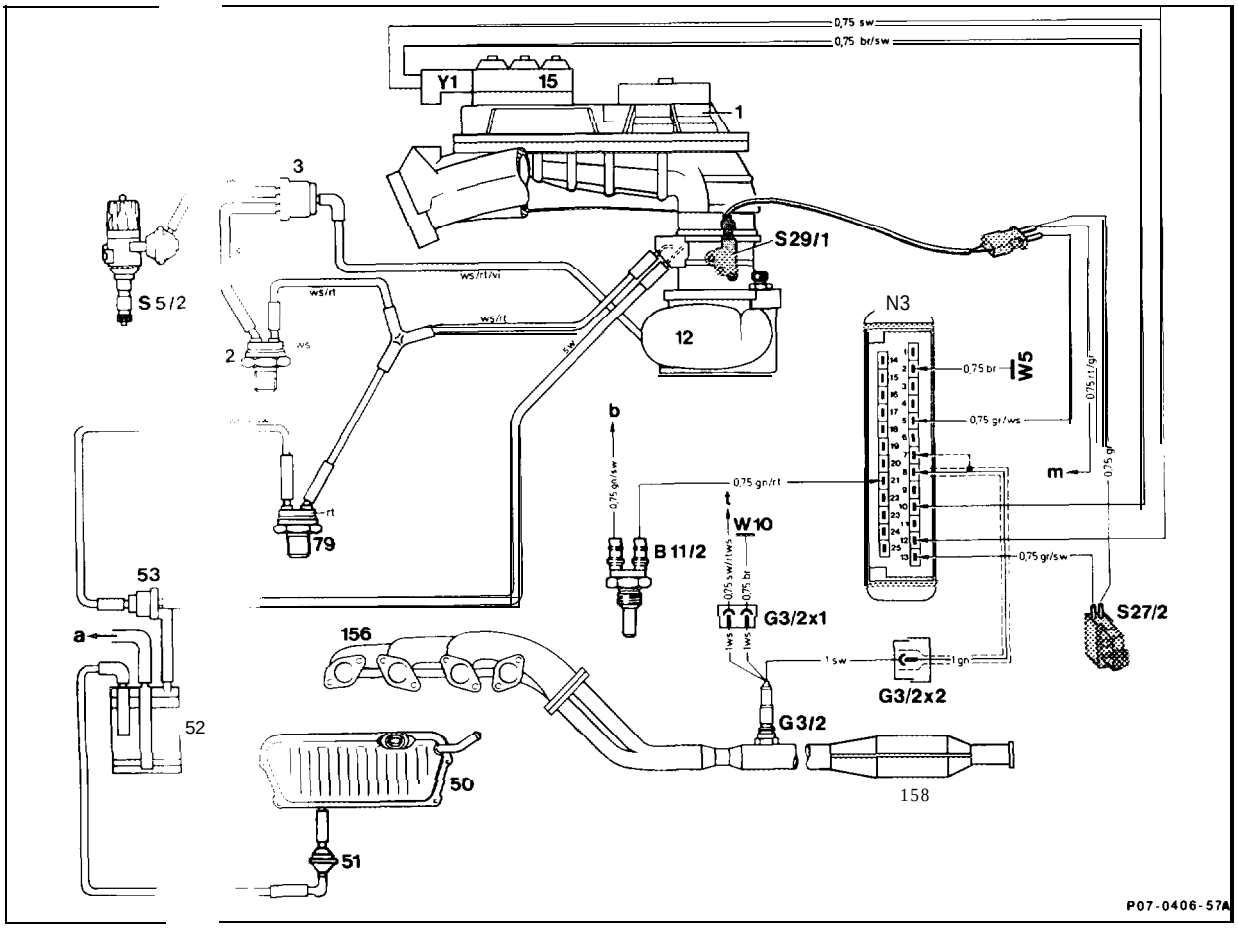
- Vehicles with engines in Standard version can be converted to open-loop catalytic converter (Op No. 14480). An exception to this are vehicles with engine 102.983 Standard.
- Vehicles in the basic version RÜF can be converted to KAT (closed-loop). See installation instructions for optional equipment for conversion measures.

Model 201 Volume 2 Group 14

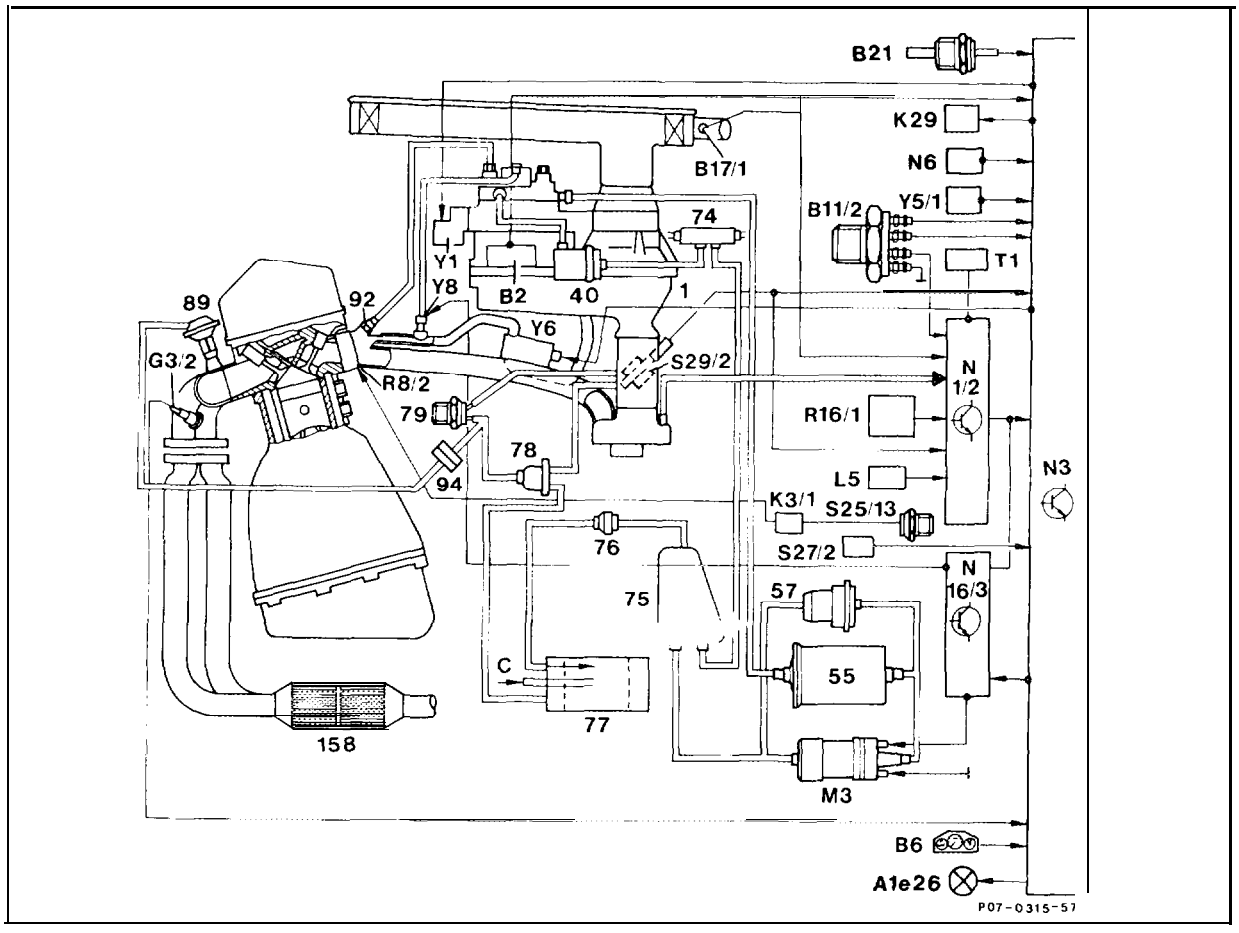
- In the case of vehicles in the basic version KAT with engines 102.96198 as of 09/89, RÜF mode is no longer possible.

b) Function diagrams

Engines 102 962 NV KAT RÜF 09/83–09/85
@engine 102.961 (2.3) (USA) 1985/86 engine 102.985



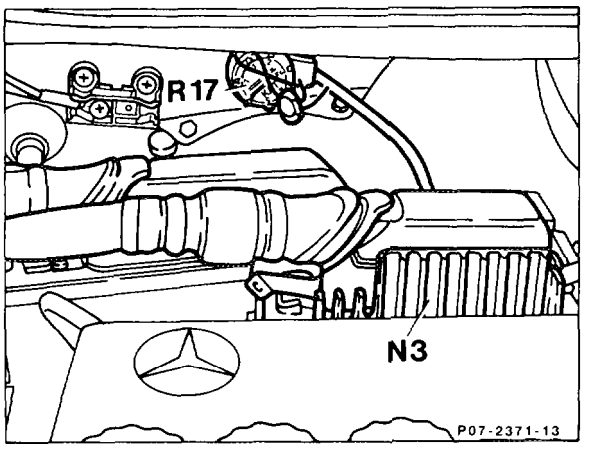
1	Mixture control unit
2	60 °C thermalvalve (white)
3	Check valve with integrated restrictor
12	Intake manifold
15	Fuel distributor
50	Fuel tank
51	Vent valve
52	Charcoal canister
53	Regeneration valve
79	50 °C thermovalve (red)
156	Exhaust manifold
156	Underfloor catalytic converter
B11/3	Coolant temperature sensor
G3/2	Heated oxygen sensor
G3/2x1	Ox. generating coil plug connection
G3/2x2	Oxygen sensor signal plug connection
N3	CFI control module
S5/2	Distributor (breakerless)
S27/2	Deceleration fuel shutoff microswitch
S29/1	Full load detection throttle valve switch
W5	Engine ground
W10	Battery ground
Y1	Electrohydraulic actuator
a	Air admission line (engine compartment)
b	Fuel pump relay, contact 2
m	Idle speed air valve, contact 2
t	Fuel pump relay, contact 7, terminal 87



1	Mixture control unit
40	Diaphragm pressure regulator
55	Fuel filter
57	Fuel accumulator
75	Fuel tank
76	Vent valve
77	Charcoal canister
78	Regeneration valve
79	70°C thermovalve
89	Exhaust gas recirculation valve
92	Injection valve
94	Deceleration valve (only with manual transmission)
158	Underfloor catalytic converter
A1e26	CHECK ENGINE malfunction Indicator lamp
B2	Air flow sensor potentiometer
B6	Hall-effect speed sensor
B11/2	Engine coolant temperature sensor (DI/CFI/2 E-E), 4-pin
B17/1	Intake air temperature sensor
B21	Exhaust gas recirculation (EGR) temperature sensor (California only)
G3/2	Heated oxygen sensor
K3/1	Intake air preheating (PMP) relay
K29	Transmission shift point retard relay
L5	Crankshaft position sensor
M3	Fuel pump
N1/2	Ignition control module
N3	CFI injection system control module
N6	Compressor shutoff control module
N16/3	Fuel pump relay module
R8/2	intake manifold preheating (PMP)
R16/1	Reference resistor
S25/13	60°C temperature switch (PMP)
S27'2	Deceleratron fuel shutoff microswitch
S29/2	Full load/idle speed detection throttle valve switch
T1	Ignition coil
Y1	Electrohydraulrc actuator
Y5/1	Air conditioning compressor electromagnetic clutch
Y6	Idle speed arr valve
Y8	Start valve
C	Air admission

c) CFI control module (N3)

The CFI control module is installed on the right of the component compartment behind the battery.



Caution!
When ignition is on or when the engine is running, do not detach coupling at CFI control module as the CFI control module may be damaged by voltage or current peaks.

N3 CFI control module
R 17 Reference resistor

Note
Survey of CFI control modules, see 07.3-250 and 07.3–004.

CFI control module version
When the ignition is switched on, a certain current exists at the electrohydraulic actuator and a certain on off ratio is output at the lambda test output (see 07.3–121). The CFI control module has two injection programs (with/without lambda control). The respective program is activated by the resistance trimming plug. For (USA) reference resistors are installed . For (USA) 1988 and 1991 the reference resistor is integrated in the CFI control module.

Version	Injection program	Resistance trimming plug
KAT	With lambda control	KAT

CFI control module KAT/RÜF version with diagnosis by measuring on/off ratio

The CFI control module detects faulty input signals and passes a fault message to the lambda test output. The fault message can be read at the diagnostic connector with the lambda tester. The faults detected are short circuit and open circuit.

A certain on/off ratio is assigned to each fault. The output of fault messages has priority over output of the lambda control signal. If the lambda control is not operational (e.g. heated oxygen sensor temperature too low), the readout is 50% (control mode/constant readout). If the lambda is switched on, the readout fluctuates around a mean value. If several faults occur simultaneously, the fault which corresponds to the lowest on/off ratio is always displayed. This continues until all the faults have been rectified. An assignment of on/off ratio and possible cause of fault is summarized in the respective test program (07.3-I 21).

Plausibility circuitry

The signals which the peripheral components feed into the CFI control module are continuously monitored. If the composition of the signals is not longer logical, the electronic control automatically forms a substitute value (emergency running property) for the implausible signal.

CFI control module KAT **version with fault diagnosis by** measuring **on/off ratio and fault storage**

The injection program for the RÜF mode is no longer provided in the CFI control module.

Two possibilities exist in the CFI control unit for detecting and outputting faults which occur in the system.

The fault tables with the listing of the individual faults are described in the test program 07.3-121, Section "E" and "F" respectively.

On/off ratio with engine running

The faults which exist at that moment and are detected are displayed by measuring the on/off ratio. The faults are not stored and can only be displayed immediately by measuring the on/off ratio at the diagnosis socket (Xl 1).

Diagnostic trouble code (DTC) memory

Faults which occur and are detected when driving are stored in the CFI control module and **can be** output at the diagnostic connector (Xl 1/4) with the impulse counter scan tool.

The battery must not be disconnected in the meantime, otherwise the stored DTCs are erased. Loose contacts are also recognized as codes and stored. The CFI control module cannot be replaced by other versions.

Note (USA) 1988/1 991 California

On Board diagnosis system (see 07.3-121, Section "F").

d) Lambda control

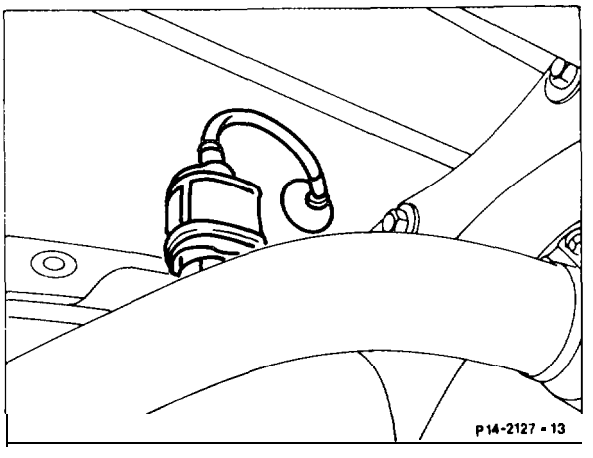
The CFI control module performs the following functions: monitoring heated oxygen sensor, signal amplification and calculation from the input signals the output signal for the electrohydraulic actuator. The current level with lambda control fluctuates between approx. -10 to + 10 mA.

The lambda control is not operative during the following operating conditions, i.e. control mode:

- heated oxygen sensor not operational or defective
- deceleration with decel fuel shutoff
- wide open throttle operation
- acceleration enrichment
- starting at below + 15 °C up to approx. + 40°C – 70°C engine coolant temperature (depending on version).

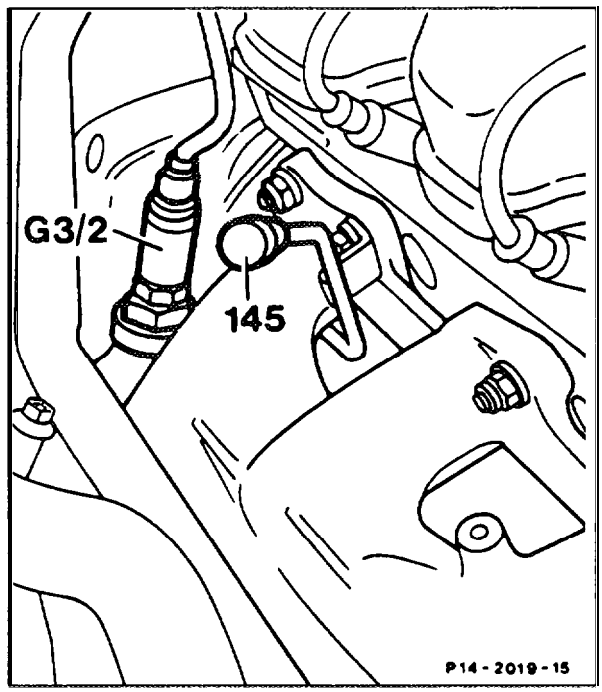
e) Heated oxygen sensor (G3/2)

The heated oxygen sensor is installed in the front exhaust pipe or in the exhaust manifold (engine 102.96/98 as of 09/89). The oxygen sensor is heated in order to create a constant operating temperature. The heating element of the oxygen sensor is energized via terminal 87 of the fuel pump relay module and is heated so long as the fuel pump is running.



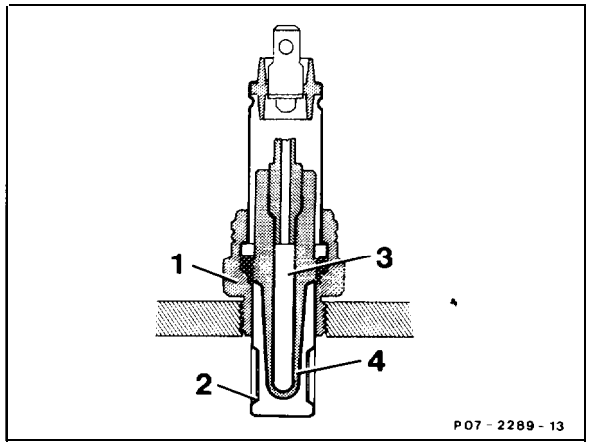
Arrangement in front exhaust pipe

Note: **fuel** pump relay **module as of 01/90**
Fuel pump and kick-down shutoff relay (N16/4) with additional connector for oxygen sensor heater. Oxygen sensor (G3/2) is heated only from +20°C engine coolant temperature (07.3–165).



Arrangement in exhaust manifold

The outer electrode is exposed to the exhaust emissions, the inner electrode is exposed to atmosphere. The active part of the heated oxygen sensor is a ceramic body which consists primarily of zirconium dioxide. It is coated on the surface with a gas-permeable platinum layer, as well as with an additional protective layer on the exhaust side.

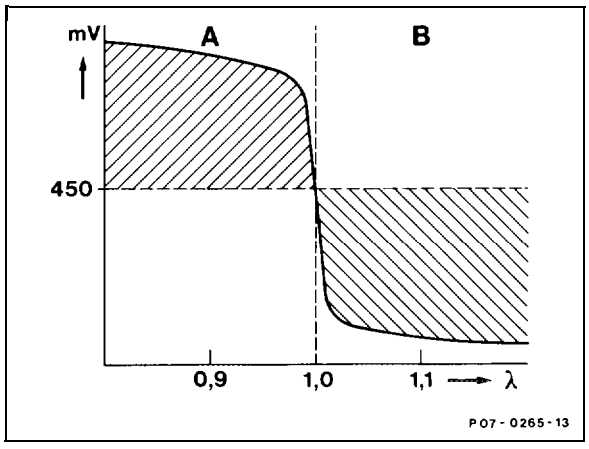


1 Sensor housing
2 Protective tube slot
3 Heating element
4 Sensor ceramic

At operating temperature the ceramic material conducts the oxygen ions. The different oxygen portion between exhaust gas and atmosphere produces a voltage in the heated oxygen sensor.

At operating temperature (>300°C) the oxygen sensor supplies a voltage signal to the control module.
Voltage >450 mV rich mixture
Voltage <450 mV lean mixture

As a result of the rapid voltage jump with lambda (A) = 1, the exhaust composition can be rapidly monitored and the fuel/air mixture corrected within a narrow control range.



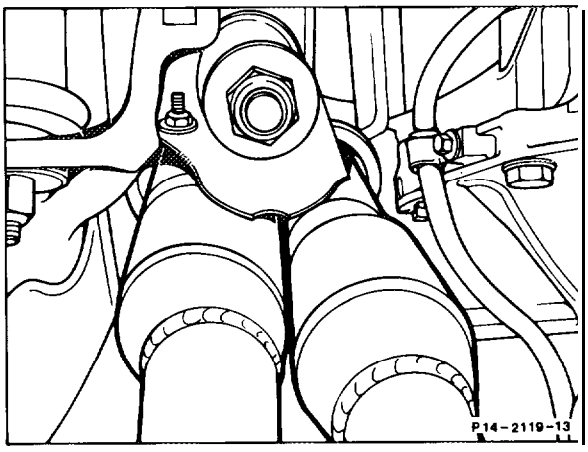
A Rich fuel/air mixture
B Lean fuel/air mixture

e) Catalytic converters

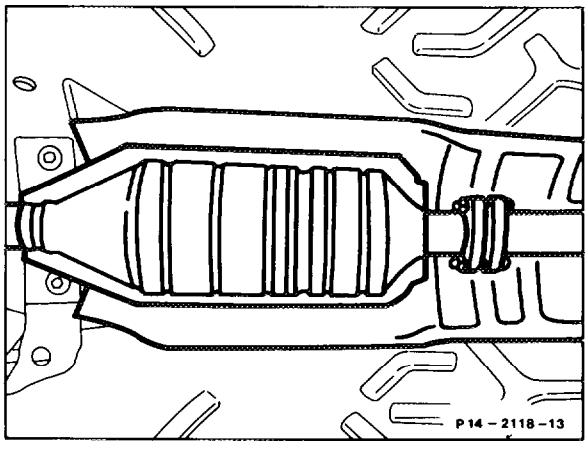
The 3-way catalytic converters are installed in the exhaust system upstream of the mufflers. The following versions are installed:

Up to 08189
Pre- and underfloor catalytic converter.

As of 09189 underfloor catalytic converter (pre-catalytic converters no longer installed).

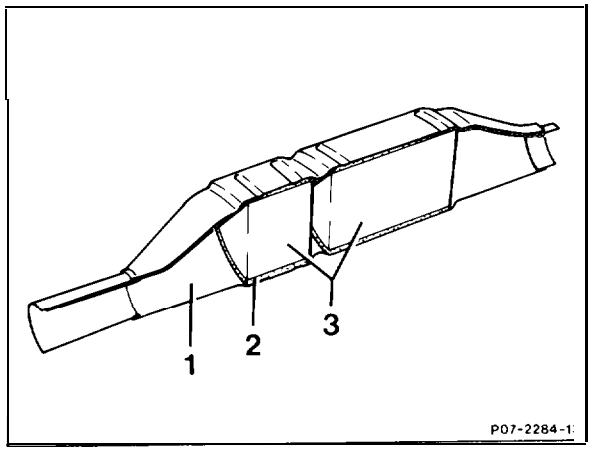


Pre-catalytic converter



Underfloor catalytic converter

The catalytic converters consist primarily of three main parts:
Carrier material of high-strength ceramic or high temperature-resistant stainless steel, also known as the monolith (ceramic flexibly mounted on wire mesh). Intermediate layer for enlarging the surface. Catalytically active layer of platinum/rhodium.



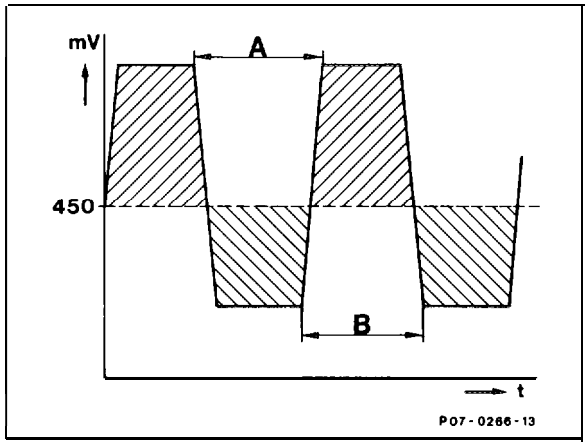
1 Fabric
2 Wire mesh
3 Monolith

Function

The exhaust gases flow through the catalytic converter and come into contact with the noble metals. Oxidation converts carbon monoxide (CO) into carbon dioxide (CO_2) and hydrocarbons (HC) into water (H_2O) and reduction converts the oxides of nitrogen (NO,) into nitrogen (N_2). The critical factors for this process are the temperature and the residual oxygen content in the exhaust gas. The catalytic process, i.e. the chemical reaction, commences from approx. 250 °C. Excessively high temperatures result in thermal overload.

Oxygen is required for the oxidation of CO and HC. The reduction of the oxides of nitrogen occurs in an oxygen-deficient atmosphere.

The fluctuation between oxygen-low and oxygen-rich exhaust gas is achieved by altering the fuel/air mixture. The ratio of the fuel/air mixture is designated with lambda (A), in which $\lambda < 1$ indicates a rich mixture, $A > 1$ a lean mixture.



A Rich fuel/air mixture
B Lean fuel/air mixture

The fluctuation of the oxygen portion of the exhaust gas is controlled by the oxygen sensor. The three exhaust elements stated can only be chemically converted in the catalytic converter by means of these oxygen fluctuations.

Vehicles fitted with the catalytic converter and oxygen sensor must only be operated with unleaded fuel. Lead additives in the fuel are deposited on the chemically reacting surface of the catalyst and the oxygen sensor, rendering the system ineffective.

B. National version (USA) with exhaust gas recirculation

a) General
b) Function diagrams
- **Engine 102.961**
  - (AUS) **1984/85**
- **Engine 102.96**
  - (CH) **1984-1986**
  - (S) **1984-1987**
- **Engine 102.982**
  - (CH) **1985/86**
  - (S) **1985-1987**

c) Function of exhaust gas recirculation
d) Function of components
h) (USA) 1991

a) General

Exhaust gas recirculation (EGR) reduces the oxides of nitrogen (NOx).

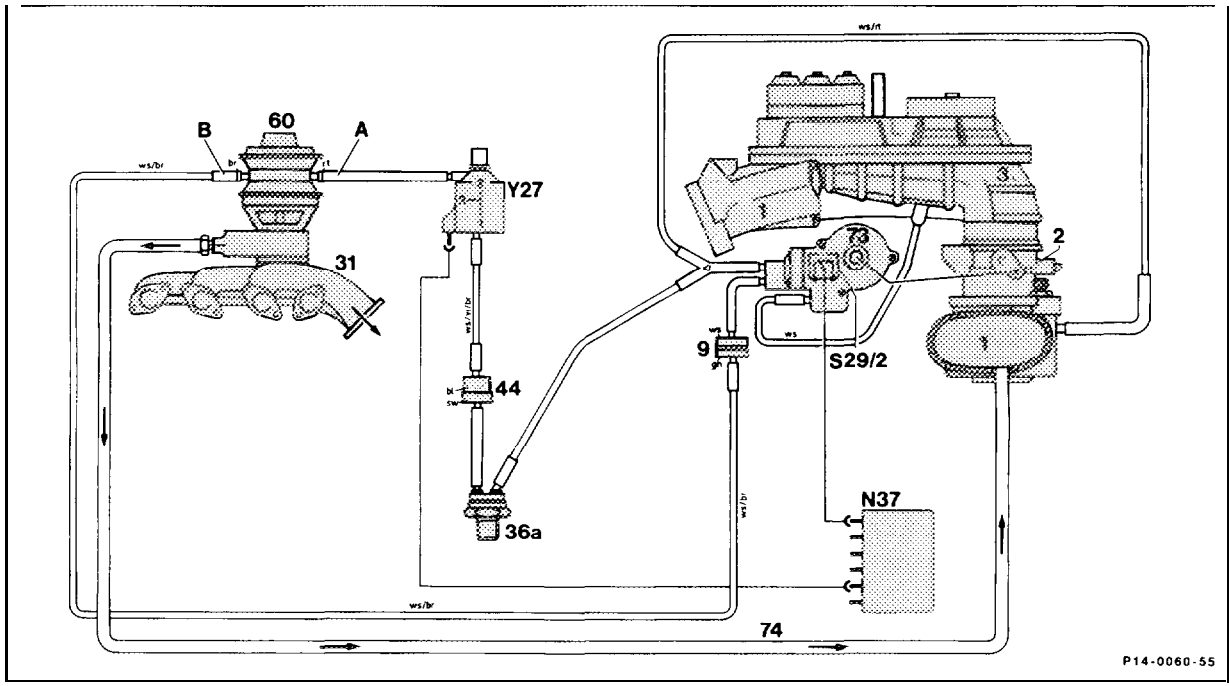
Fuel evaporation control system (USA) reduces the emission of fuel vapors to atmosphere (47-200).

Exhaust gas recirculation
Part of the exhaust gases is returned through the exhaust gas recirculation valve to the intake manifold during certain engine operating states in order to reduce the oxides of nitrogen in the exhaust gas.

The low-oxygen exhaust gases are mixed in the intake manifold with the fresh, oxygen-rich mixture. The portion of fresh mixture is reduced as a consequence and less oxygen is thus available in the combustion process. The quantity of recirculated exhaust gases is dependent on the throttle position and on the engine coolant temperature. The driving characteristics of the vehicles are not influenced by exhaust gas recirculation.

(USA) 1991 engine 102.985: testing exhaust gas recirculation, see 14-475.

c) Function of exhaust gas recirculation (EGR)



The exhaust gases are recirculated at an engine coolant temperature above approx. 40°C and with the throttle contacting the closed throttle position stop or wide open throttle stop.

When the throttle is contacting the closed throttle or wide open throttle position stop, the control module (N37) switches voltage to the switchover valve (Y27). The signal for this is passed to the control module (N37) by the WOT/CTP switch (S29/2).

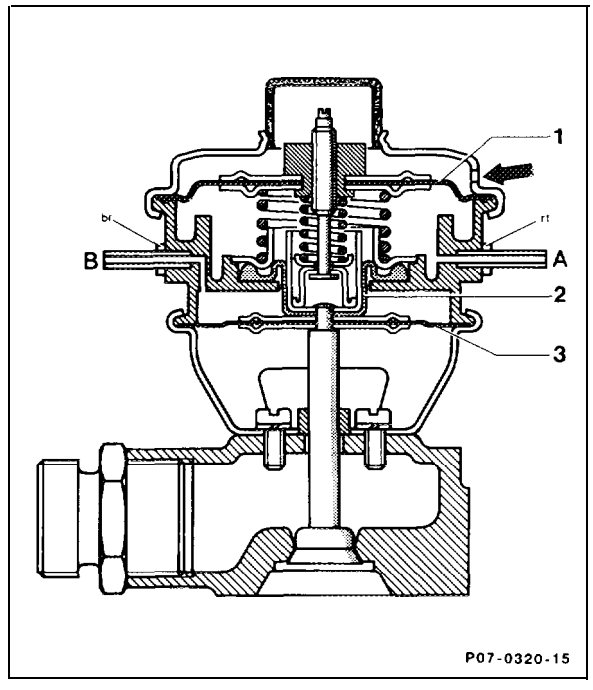
The switchover valve (Y27) switches over and admits air to the EGR valve (60, connection A), which causes the latter to close.

If the throttle is moved into a position between closed and wide open throttle, the signal from the WOT/CTP (S29/2) to the control module (N37) is switched off. This interrupts the voltage supplied to the switchover valve (Y27).

As a result, the switchover valve (Y27) switches intake manifold vacuum to the EGR valve (60, connection A). At the same time, more or less air is admitted through the vacuum control valve (73) to the EGR valve (60, connection B), depending on the throttle position. The EGR valve (60) opens partially or fully.

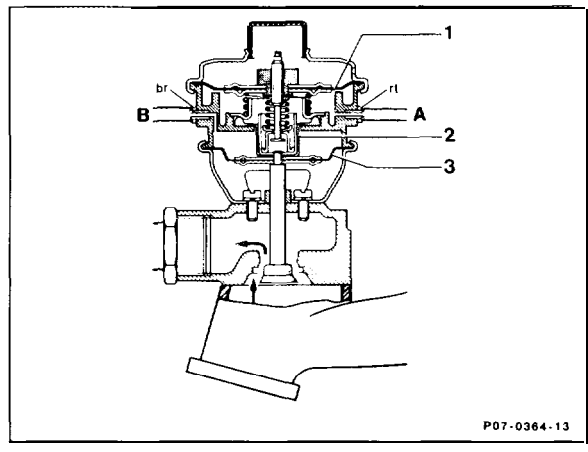
d) Function of components

Exhaust gas recirculation valve (60)
Atmospheric pressure which is admitted through a orifice (arrow) constantly acts via the shutoff diaphragm (1 j in the diaphragm chamber.



1 Shutoff diaphragm
2 Pc? diaphragm
3 Work ng diaphragm
A Connection (red), to switchover valve
B Connection (brown), to switchover valve

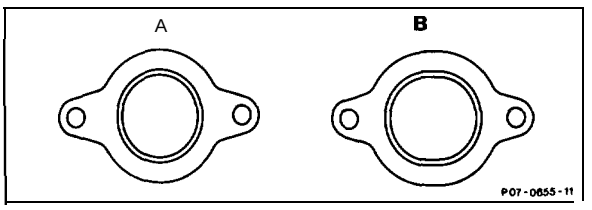
If intake manifold vacuum is acting through connection A (red) in the diaphragm chamber below the shutoff diaphragm (1), the latter is pressed down against the spring force. The EGR valve opens if air is admitted at the same time to the diaphragm chamber through the working diaphragm (3).



Note

inner diameter of gasket for exhaust gas recirculation valve **at** exhaust manifold enlarged as a result of modification of shape.

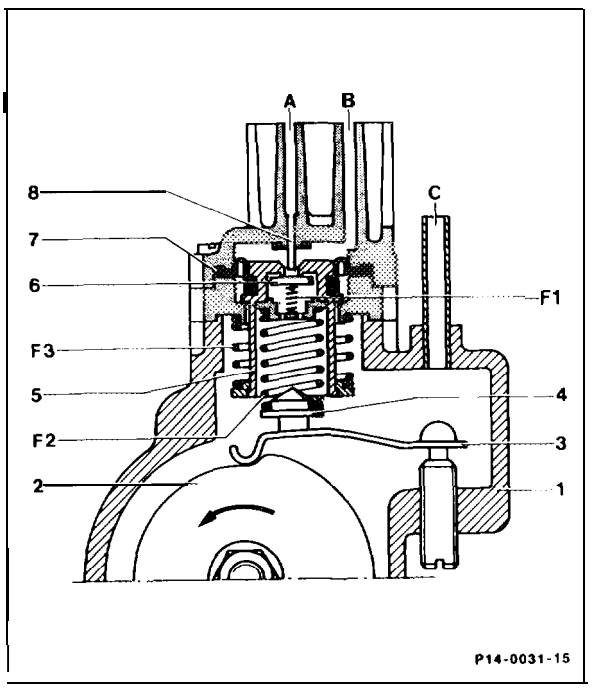
A Previous version
B Present version



Vacuum control valve (73)

When the engine is at idle, the vacuum control valve reduces the intake manifold vacuum to a constant level. If the throttle is opened, the cam disk (2) is moved in the direction of the arrow. The reduced vacuum at connection (B) is further reduced, as a result of which the EGR valve opens.

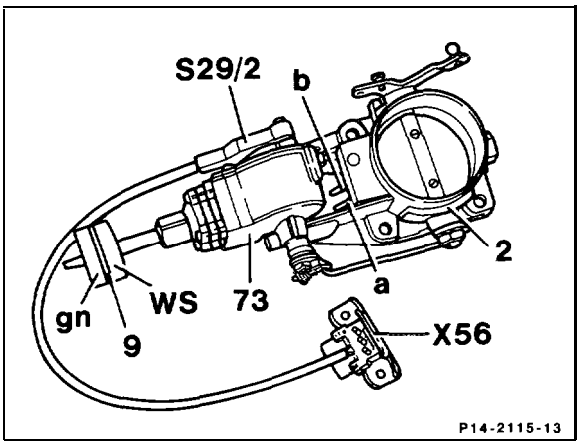
1 Housing
2 Cam disk
3 Lever
4 Spring retainer
5 Sleeve
6 Sealing disks
7 Diaphragm
8 Tube
A Intake manifold connection
B Damper connection, exhaust gas recirculation valve
C Air guide housing connection
F1 Conical spring
F2 Pre-tensioning spring
F3 Compression spring



Vacuum damper (9) with restrictor

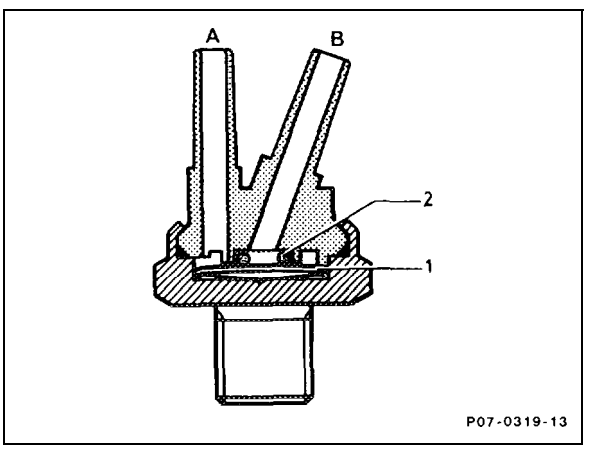
This prevents the EGR valve opening or closing suddenly. A restrictor is fitted in the connection (gn).

Wide open throttle/closed throttle position switch (WOT/CTP) (S29/2)
It **switches** the control **signal for switching off the EGR** when the throttle is **in the closed throttle and wide** open throttle position.



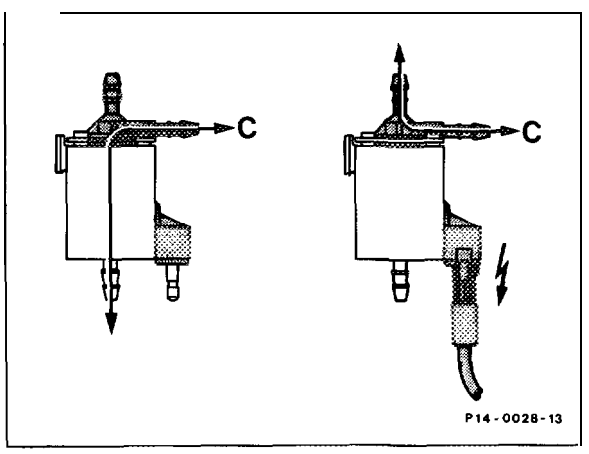
X56 Throttle **body switch plug connection**
gn = green
ws = white

40°C thermovalve (36a, color code black)
It opens from a coolant temperature of approx 40°C and then allows the intake manifold vacuum to pass.



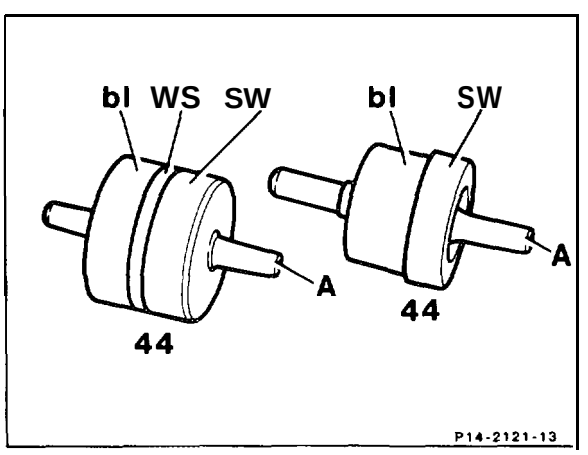
1 Bimetal **plate**
2 O-ring
A to check **valve**
B to intake manifold

Switchover valve (Y27)
Fitted to the bulkhead in the engine compartment. The swttchover valve is energized when the throttle valve **is** in the idle and full throttle position and switches over to atmospheric air admission.



Check valve (44)
It prevents the intake manifold vacuum at the exhaust gas recirculation **valve** dropping as the throttle valve increasingly **opens further.**

Cylindrical or stepped version possible.



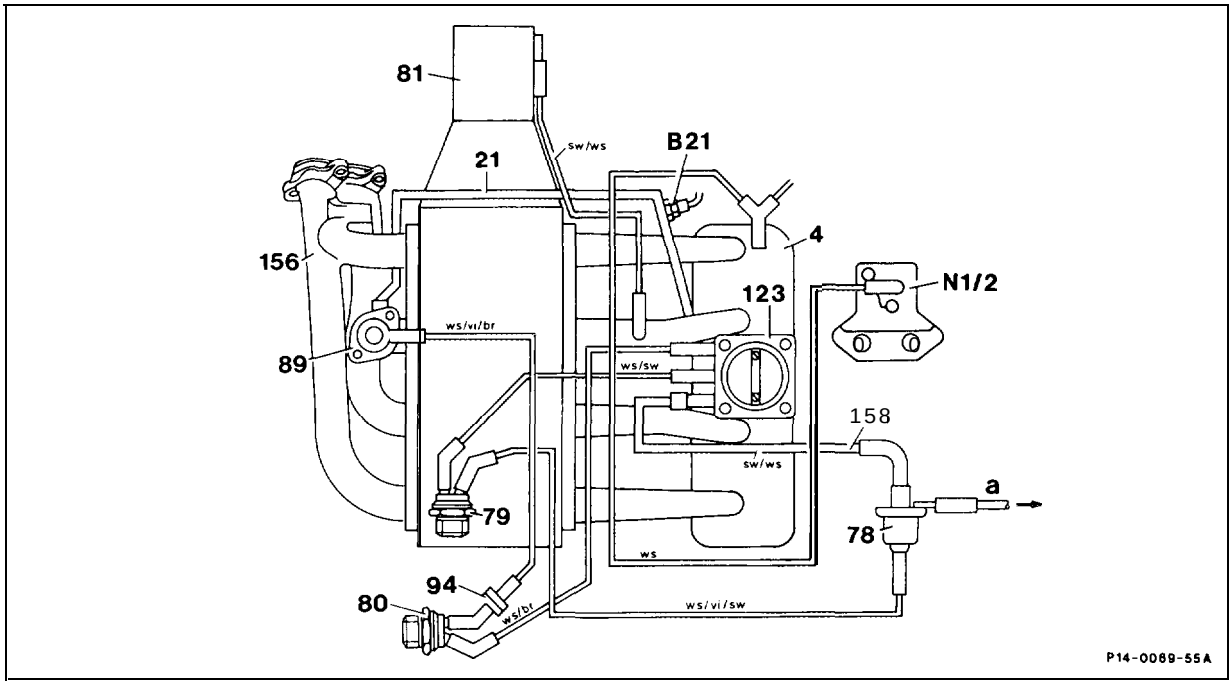
A = **Vacuum inlet**

Control module (N37)

It switches through or switches off the voltage for the switchover valve depending on the control signal from the throttle valve switch.

Model 124

h) (USA) 1991 engine 102.985



Function diagram of exhaust gas recirculation

4	Intake manifold	156	Exhaust manifold
21	Exhaust gas recirculation line	158	Purge line
78	Purge valve for fuel evaporatron control system	a	Purge line to charcoal canister
79	Thermovalve for fuel evaporation control system, opens at 70°C, closes at 35°C	B21	Exhaust gas recirculation temperature sensor
		N1/2	ignition control module
80	Thermovalve for exhaust gas recirculation, opens at 70°C, closes at 60°C		Line color code
81	Automatic transmission		br brown
89	Exhaust gas recirculation valve		sw black
94	Time-delay valve (manual transmission only)		ws white
123	Throttle body assembly		vi violet

Note
Testing exhaust gas recirculation, see 14-475.

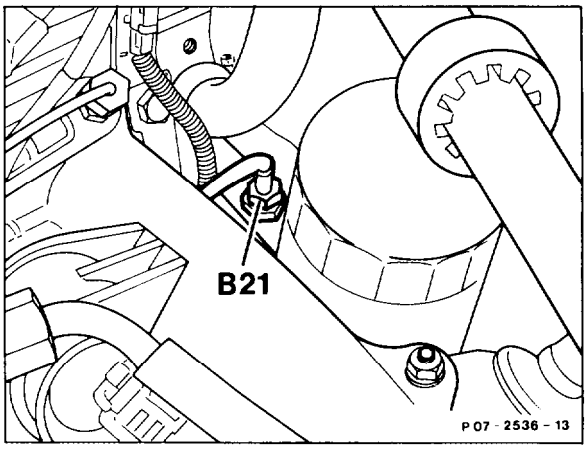
The vacuum which exists at the exhaust gas recirculation valve (89) differs according to the throttle position.
With the thermovalve (80) open, the vacuum controls the exhaust gas recirculation valve (89), as a result of which the exhaust gas recirculation valve opens partially or fully and exhaust gases are thus passed through the exhaust **gas** recirculation line (21) into the intake manifold (4).

The time-delay valve (94) on vehicles with manual transmission prevents the exhaust gas recirculation valve (89) opening too rapidly.

Exhaust gas recirculation is performed
- in partial load mode:
  a) with rising engine coolant temperature above +70° C
  b) with dropping engine coolant temperature up to +60°C

No exhaust gas recirculation is performed
- when idling and at wide open throttle
- at engine coolant temperature below + 60°C

Exhaust gas recirculation temperature **sensor (B21), California only**
Installed in the exhaust gas recirculation only. Tightening torque 23-28 Nm. The temperature of the recirculated exhaust gases is registered by the temperature sensor. See diagram for resistances.



If the exhaust temperature drops below approx. 120°C during operation, no exhaust gas recirculation is performed. This is detected as a fault by the CFI control module and stored.
In addition, the CHECK ENGINE malfunction indicator lamp lights up
(see 07.3-121, Section F).

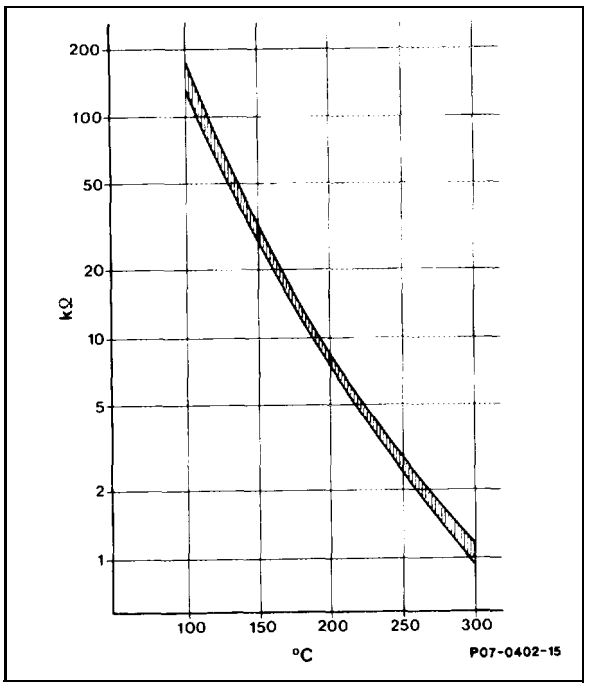
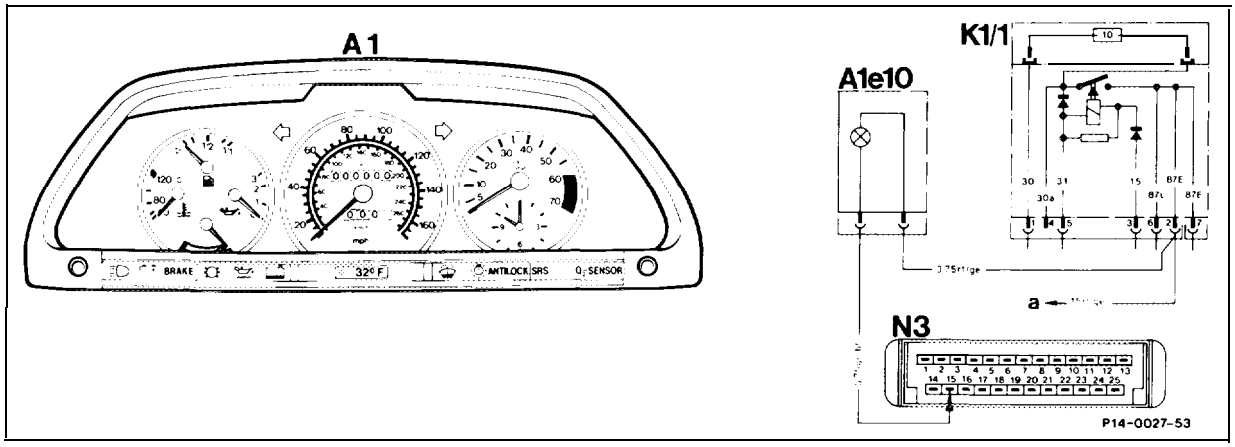


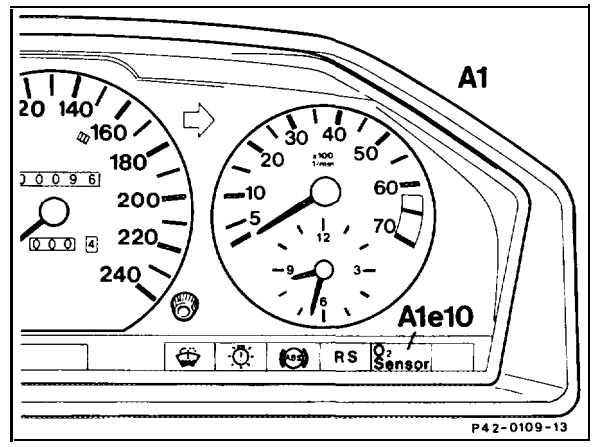
Diagram
Exhaust gas temperature resistance
at exhaust gas recirculation temperature sensor



A1	Instrument cluster	N3	CFI control module
A1e10	Heated oxygen sensor malfunction indicator lamp	a	To CFI control module (N3)
A1e26	CHECK ENGINE malfunction indicator lamp		contact 1
K1/1	Overvoltage protection relay		

Oxygen sensor change malfunction indicator lamp, model 201.024, model year 1984/85

Legislation prescribes that the oxygen sensor must be replaced once after 30 000 miles or, in the case of Canada vehicles, after 50 000 km. This is indicated by an "O_2 sensor" malfunction indicator lamp (A1e10) in the instrument cluster (A1) lighting up.



Description of function

The odometer of the speedometer produces a voltage via a magnetic field when 30 000 miles or 50 000 km, respectively, is reached. The downstream electronics detects this voltage and switches on the malfunction indicator lamp in the instrument cluster.

After the heated oxygen sensor has been replaced, the malfunction indication device should be deactivated by removing the bulb. Partially remove instrument cluster and install for this purpose.

Heated oxygen **sensor malfunction indicator lamp, model years 1986, 1967, 1968 and 1991 Federal version**

A failure of the oxygen sensor is indicated by the "O_2 sensor" malfunction indicator lamp (Al) in the instrument cluster (A1e10) lighting up (1988 and 1991 Federal: Inscription: "CHECK ENGINE" (Ale26).

The malfunction indicator lamp is actuated by the CFI control module, contact 15 (1991 Federal : **CFI** control module, contact 23).

"CHECK ENGINE" malfunction indicator lamp Model year 1988, 1991 California version

The "CHECK ENGINE" malfunction indicator lamp (Ale26) lights up if an exhaust component fails (On Board Diagnostic System, see 07.3-121, Section F). The malfunction indicator lamp is actuated by the CFI control module, contact 23.

Test condition

- Battery voltage 11-14 **V**

Wiring diagrams (07.3-I 28).

Key to symbols

Multimeter

Contact

Connector

Ground

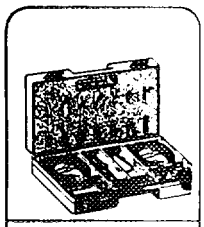
Multimeter direct voltage measuring mode

Multimeter **resistance measuring** mode

Test step/ Test scope	Tester/ Test connection	Operation Requirement	Specification	Possible cause/Remedy
1.0 Test malfunction indicator lamp (A1e10) (Al e26)	Visual inspection	Ignition: ON Engine: **start**	Malfunction indicator lamp (A1e10) or (Al e26) lights up **briefly**	Malfunction indicator lamp defective. Remove malfunction indicator lamp, test, replace if necessary Open circuit malfunction indicator lamp lover-voltage protection relay (K1/1) Open circuit malfunction indicator lamp I CFI control module (N3)
2.0 Voltage supply of malfunction indicator lamp				
A. 1986/87/88 Federal	Ale10 Ale26 cable rt/ge ⊥	Ignition: ON Cable disconnected	11-14 v	Open circuit cable (A1e10) → (K1/1) contact 2. Open circuit cable (K1/1) contact 2 → (N3) contact 1
B. 1988 California 1991	Ale26 cable rt/bl _I_ rt/ge) [1]	Ignition: ON Cable disconnected	11-14 v	Open circuit cable (Ale26) → (K1/1) contact 6. cable (Ale26) → CFI control module (N3) contact1
3.0 CFI control module (N3) cable to malfunction indicator lamp				
A. 1986/87/88 Federal	Ale10 cable N3 gr/bl 15	Ignition: **OFF** Cable disconnected	< 1 a	Open circuit
B. 1988 California 1991	Al e26 cable N3 bl/ws 23 (gr/gn) [1]	Ignition: **OFF** Cable disconnected	< 1 Ω	Open circuit

[1]) 1988 California

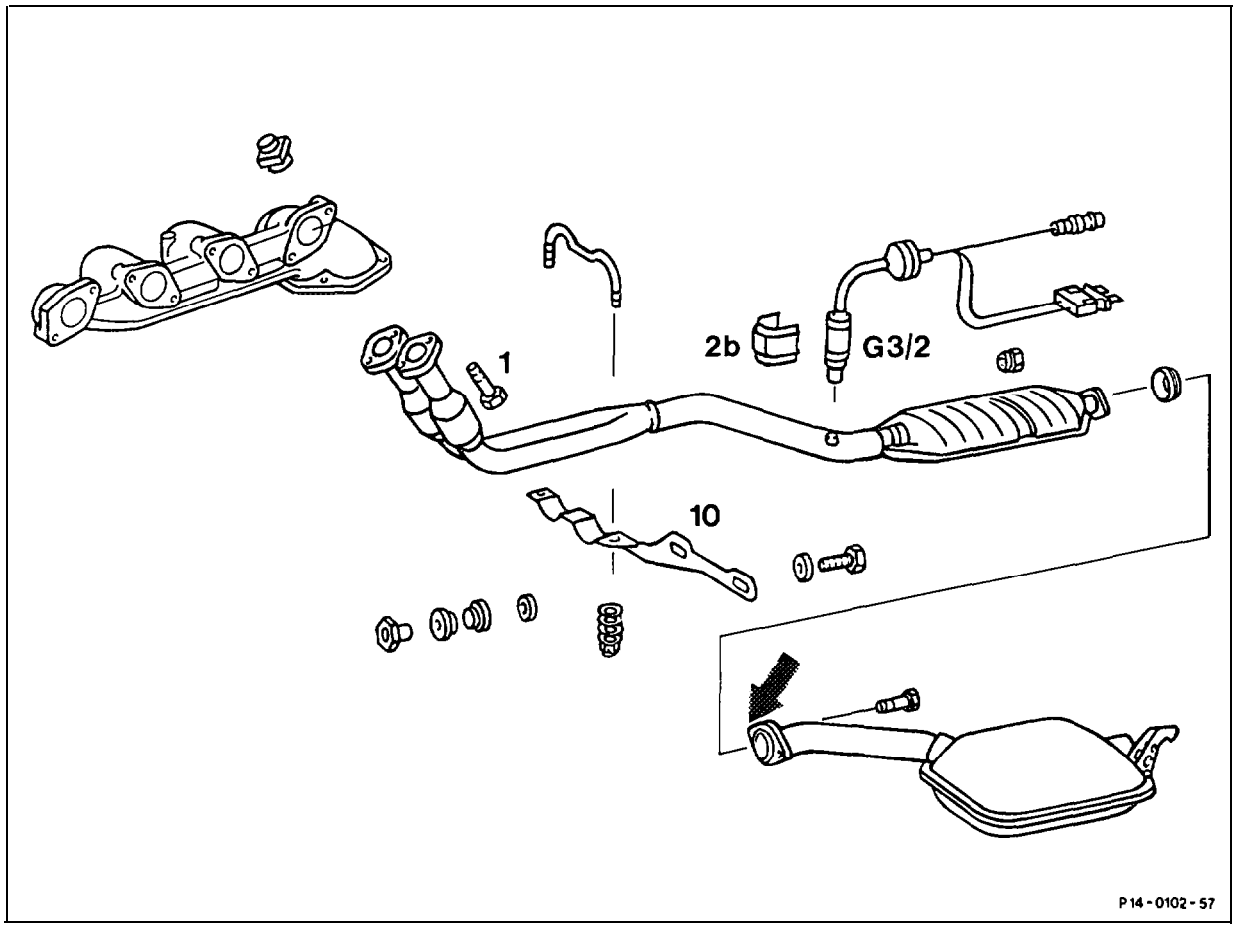
Special tool



201 589 00 99 00

Commercially available tester

Multimeter	e.g.	**Sun, DMM-5**



Cover (2b)	remove, install. Pay attention to install position.
Heated oxygen sensor (G3/2)	remove, install (07.3–258), not on vehicles with heated oxygen sensor in exhaust manifold.

Note

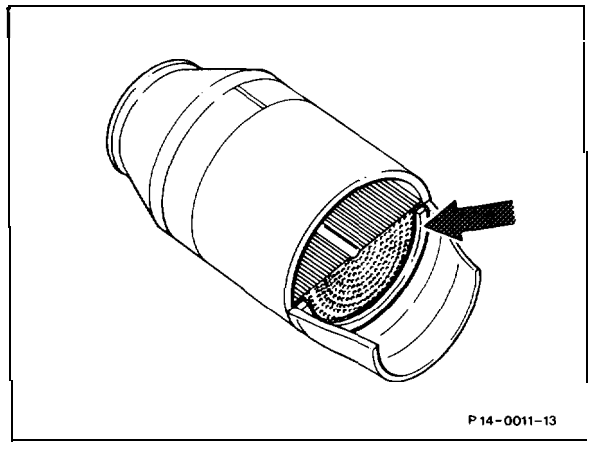
Before installing oxygen sensor, the thread must be coated with hot lubricating paste, Part No. 000 989 88 51.

Bolts (1) of flanged joint at exhaust manifolds	unscrew, screw on.
Side support (10) at transmission	remove, install.
Rubber rings for exhaust system	detach, attach.
Exhaust system	remove, install complete (49-l 00).
Flanged joints (arrow)	detach and remove catalytic converter.

Note

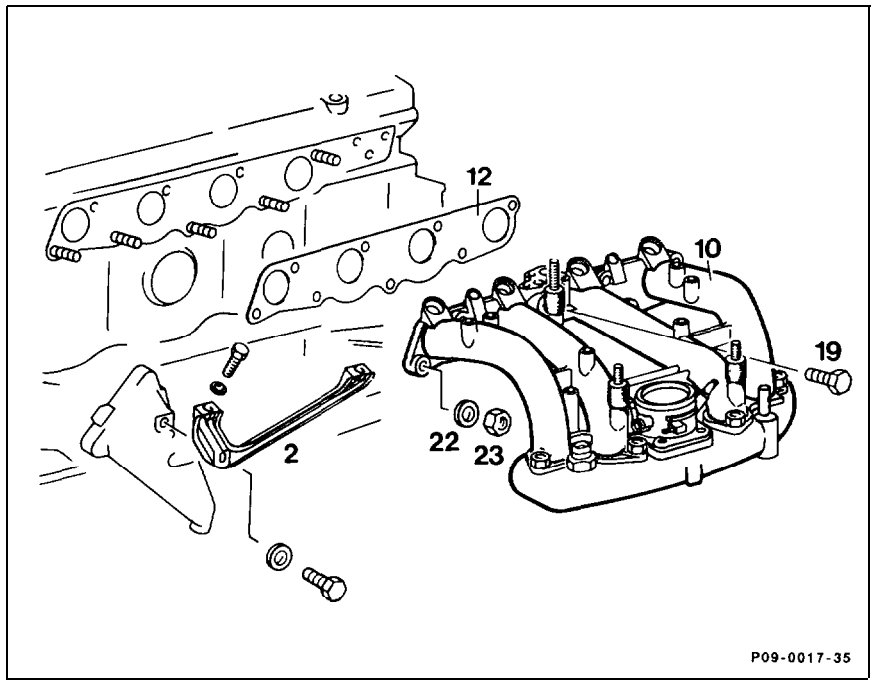
Engine 102.96 985: A deflector ring (arrow) has been installed for Improved support of the pre-catalytic converter (monolith) (noise reduction).

Production breakpoint: 05/86



14-450 Removal and installation of intake manifold and replacing gasket

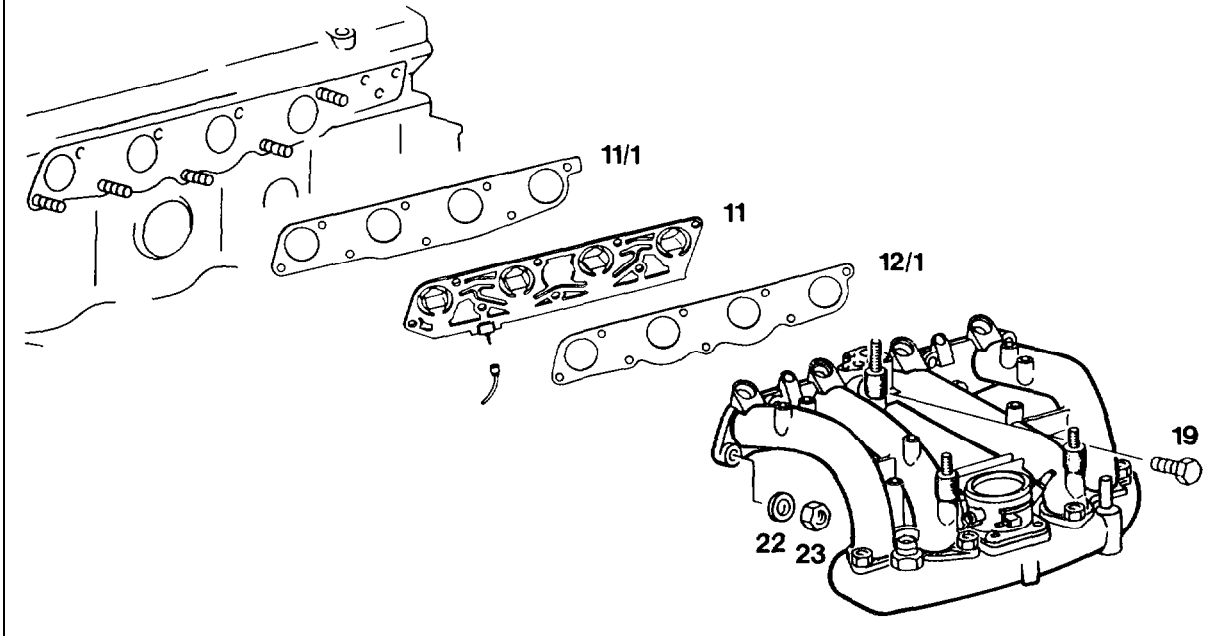
Preceding work:
Removal and installation of mixture control unit with air guide housing (07.3-225).



Fuel lines	unscrew, screw on.
Bracket for starter cable	unscrew, screw on.
Electric wiring, vacuum lines	take off, fit on.
Supporting bracket (2) for intake manifold	unscrew, screw on.
Engine lifting lug	unscrew, screw on.
Fastening nuts (23) and bolt (19)	unscrew, screw on. Use washer (22).
Intake manifold (10)	take off, clean. Check flange surfaces with straightedge; dress on dressing plate if necessary.
Intake manifold gasket (12)	replace. Replace light alloy gasket for preheating flange on engines with partial intake manifold preheating (14-452).
Throttle control linkage	install, check, adjust if necessary (30-300).
Idlespeed	set (07.3-I 00).

14-452 Replacement of preheating flange

Preceding work:
Removal and installation of intake manifold and replacing gasket (14450).



Intake manifold gasket (12/1)	. . . . .	replace.
Electric coupling for intake manifold preheating	. .	unplug, plug in.
Preheating flange (11)	. . . . .	take off, replace.
Light alloy gasket (11/1)	. . . . .	replace.

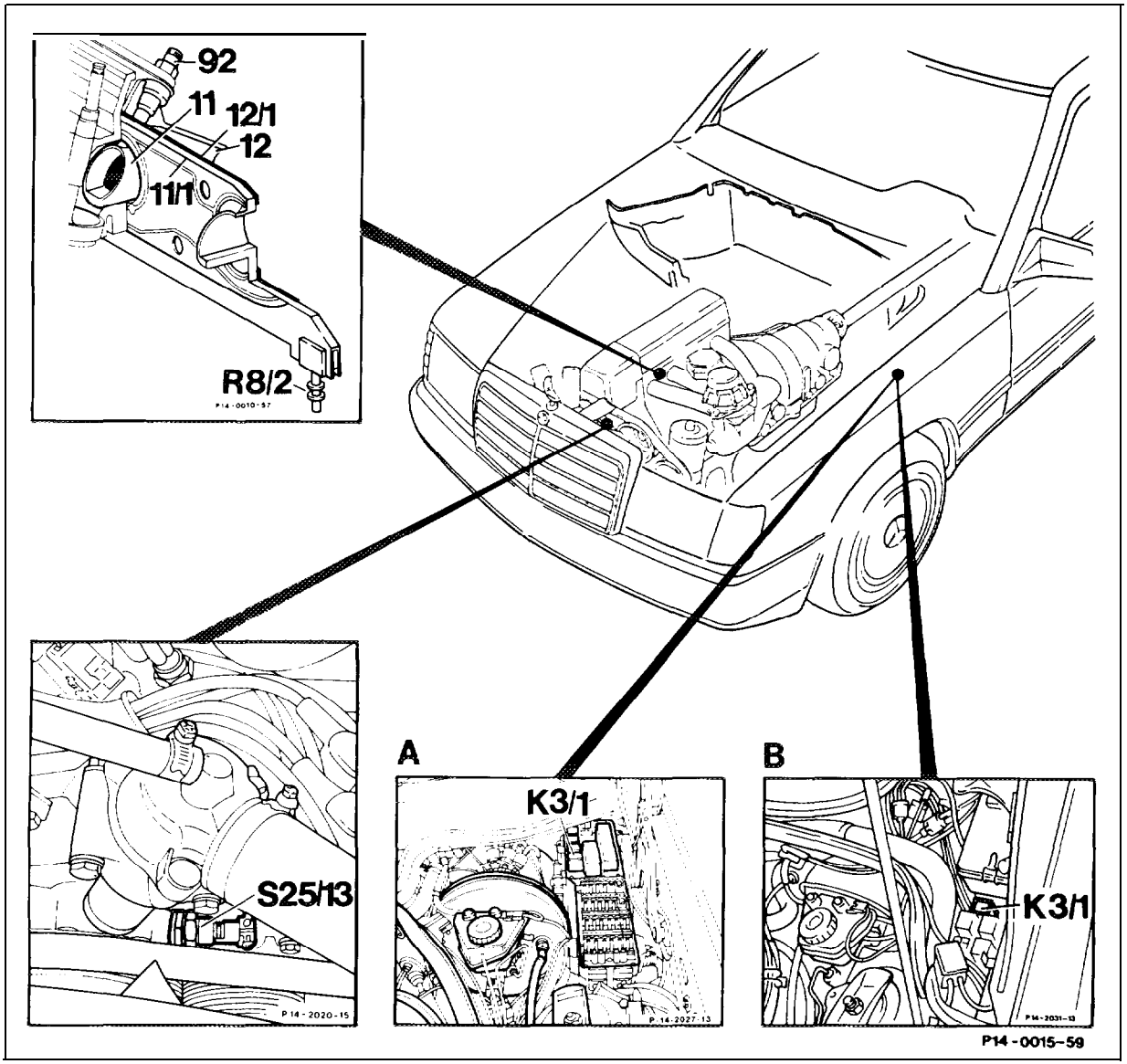
14–455 Replacement of intake manifold

Preceding work:
Removal and installation of intake manifold (14450)

Replacement

Unbolt all parts on the removed intake manifold which are able to be unbolted and install onto new intake manifold with new gasket.

Engine 102.96/98 KAT as of 09/89

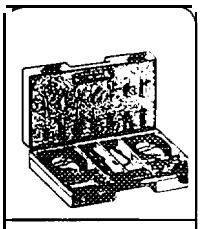


K3/1	Intake mamfold preheater relay module	12	Intake manifold
R8/2	Intake mamfold preheater	12/1	PSV-Intake mamfold gasket
S25/13	60 °C temperature switch	92	injector
11	Preheating flange	A	Model 124 (non-USA)
11/1	Cylinder head-PMP gasket	B	Model 201

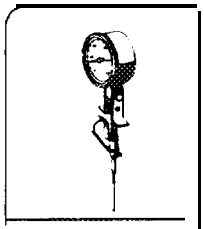
Test . . . . . perform only in the case of engine running faults, e.g. engine bucks up to 60°C engine coolant temperature.

All electrical accessories	switched off.
Battery voltage	11-14 v.
Multimeter (range “A”)	connect with current clamp to intake manifold preheating cable (R8/2) at preheating flange.

Special tool



201 589 00 99 00



124 589 07 21 0(

Commercially available tester

Multimeter	e.g. Sun, DMM-5

Key to symbols

- Multimeter
- Contact
- Connector
- Ground
- Multimeter direct voltage measuring mode
- Multimeter resistance measuring mode

Note

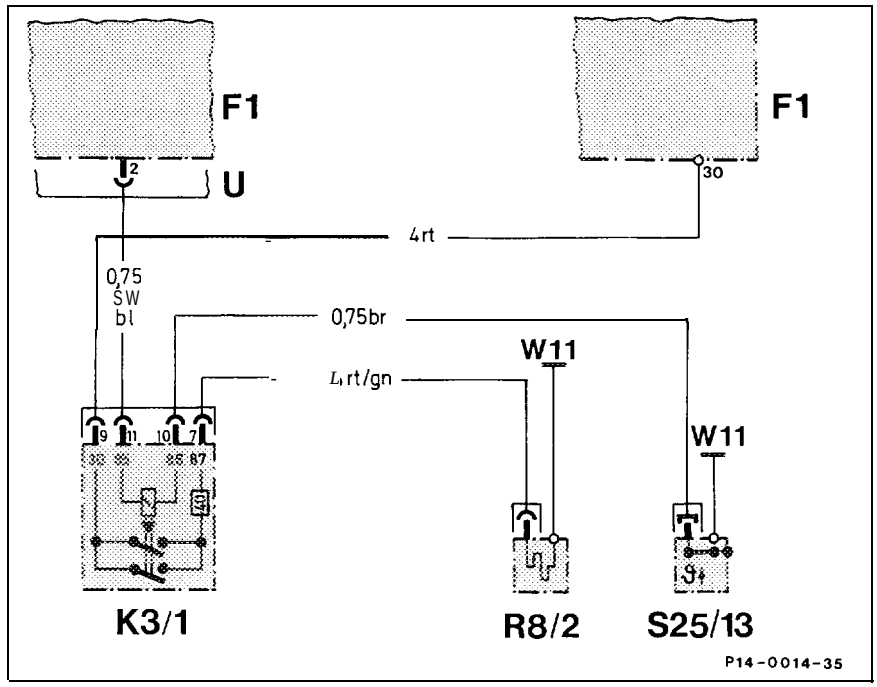
If the specified value of a test step, e.g. step 2, is in order, it is not necessary to perform test step 2.1.

Test step: Test scope	Tester/ Test connection	Operation Requirement	Specification	Possible cause/Remedy
1.0 Cable	Connect multimeter (range “A”) with current clamp to intake manifold preheater cable (R8/2) at preheating flange	Detach connector at engine coolant temperature sensor (S25/13) and connect to ground. Start engine.	I-2 s after end of start > 21 A	1. Current consumption > 5 < 21 A: replace preheating flange (11) (14-452) 2. Current consumption < 5 A: intake manifold preheater relay module (K3/1), wiring

Test step/ Test scope	Tester/ Test connection	Operation Requirement	Specification	Possible cause/Remedy
1.1	W11 ⊥ — (V) — K3/1 terminal 3 (9) [1]	Ignition: ON Relay module (K3/1) disconnected	11-14 v	Model 201: Open circuit from (F1) terminal 30 → (K3/1) contact 3
1.2	W11 ⊥ — (V) — K3/1 terminal 4 (10) [1]	ignition: ON Relay (K3/1) disconnected	11-14 v	Model 201: Open circuit from (F1) coupling U, contact 2 → (K3/1) contact 4
1.3	K3/1 terminal 1 (7) [1] — (Ω) — R8/2	Ignition: OFF Relay module (K3/1) disconnected, coupling at (R8/2) disconnected	< 1 Ω	Open circuit
1.4	K3/1 terminal 5 (11) [1] — (Ω) — S25/13	Ignition: OFF Relay module (K3/1) disconnected, coupling at (S25/13) disconnected	< 1 Ω	Open circuit

[1]) **Contact assignment for engine 102.96/98**

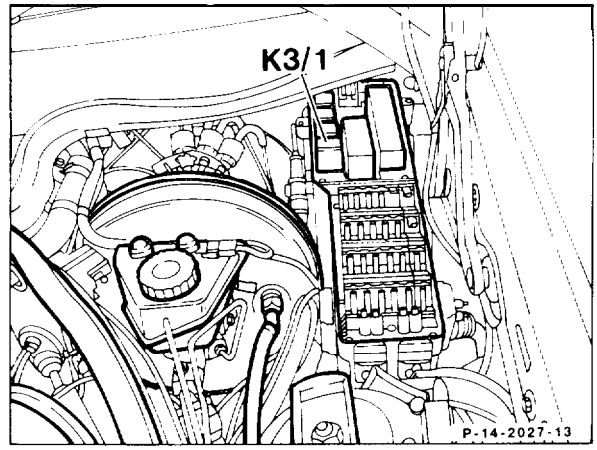
Model 201
Engine 102.96 98



F1	Electrical centre
K3/1	Intake manifold preheating (PMP) relay
R8/2	Intake manifold preheating (PMP)
S25/13	60°C temperature switch
W11	Engine ground

Operating principle

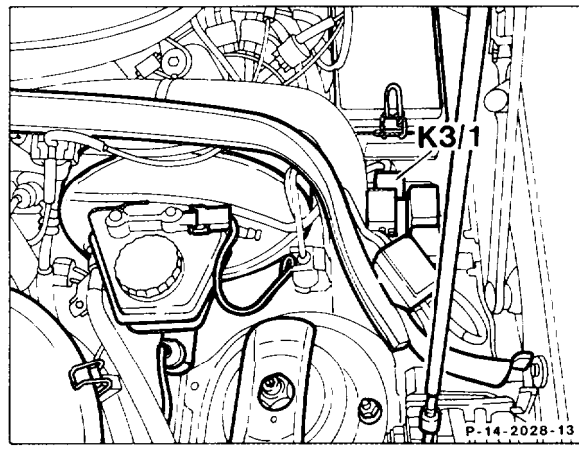
A preheating flange (PTC element) is fitted between intake manifold and cylinder head in order to achieve preheating of the mixture during the warming-tip phase. A relay module (K3/1) and a 60°C engine coolant temperature switch (S25/13) are required for heating the preheating flange.



Model 124 shown

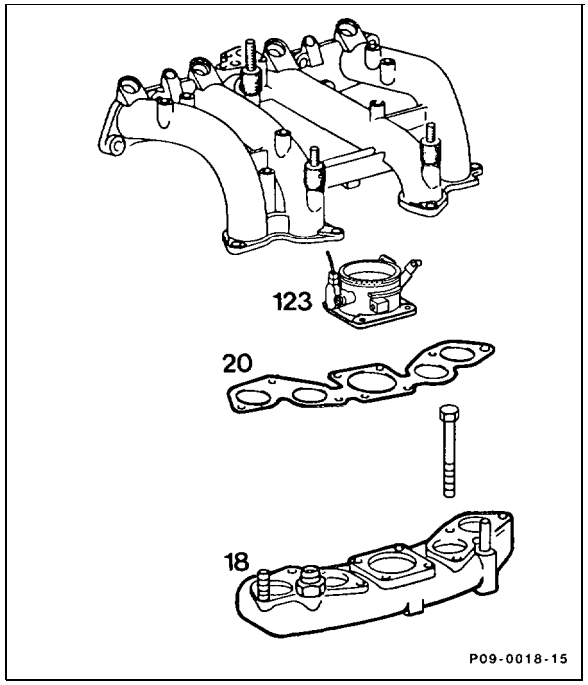
If the engine is started at an engine coolant temperature <60°C, the preheating flange is energized by the relay module (K3/1).

As the temperature at the preheating flange rises, the current flow is reduced constantly (PTC element) until the temperature switch (S25/13) interrupts the ground connection to the relay module (K3/1) at an engine coolant temperature of approx. 60°C.



Model 201

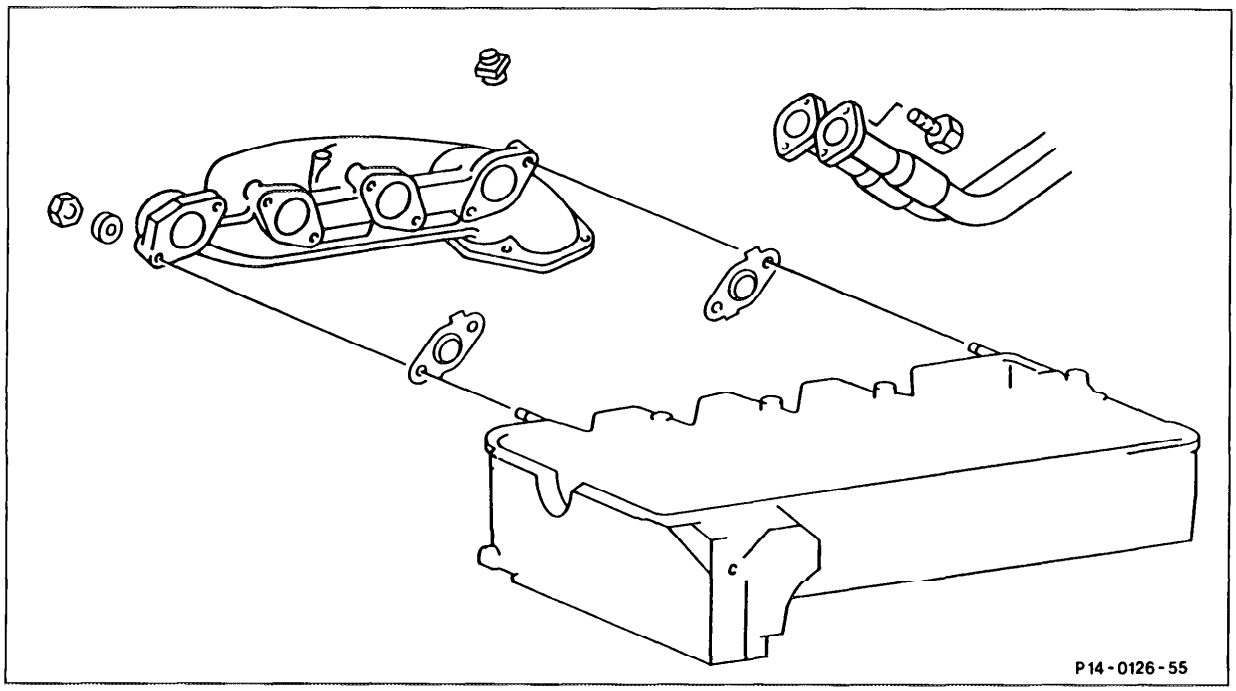
1 4–460 Removal and installation of intake manifold bottom section, replacing gasket



Throttle control linkage	unbolt, bolt on, adjust (30-300).
Vacuum lines	take off, refit.
Return hose for power steering	model 201, loosen, tighten.
Coolant hose for thermostat housing	model 201, remove, fit on. Check coolant level.
Throttle body assembly (123)	unscrew fastening nuts, screw on.
Engine mounts	loosen both and raise engine with inspection pit lift.
Intake manifold bottom section (18)	unscrew fastening nuts, screw on, press down and remove.
Intake manifold gasket (20)	replace.

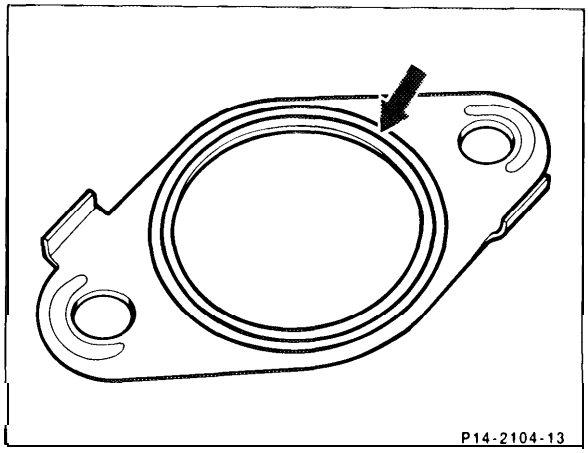
Caution!
When replacing the intake manifold bottom section, unscrew all the parts which can be unscrewed on the removed bottom section and fit to the new bottom section. The M8 × 22 stud bolts in the intake manifold bottom section as well as the two M8 × 85 hexagon bolts must be installed with sealing compound.

Idle speed	set (07.3-l 00).



Exhaust system	. . . . .	partially remove, install (49-l 00).
Exhaust nuts	. . . . .	at exhaust manifold, unbolt, bolt on.
Exhaust manifold	. . . . .	take out.
Exhaust manifold	. . . . .	install with new gaskets.

Caution!
The angled metal tabs or the beads (arrow) must be facing the exhaust manifold.



Notes

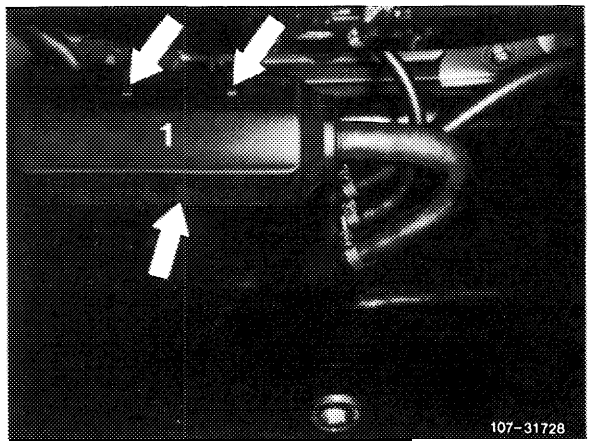
Exhaust manifold studs
Studs of a higher quality (10.9) (previously 8.8) are used for attaching the exhaust manifold to the cylinder head.

Identification: black bonderized (was yellow chromatized).

Production breakpoint: 04/84

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.024	102.961	068090	040901

Engine 102.96/98
Stability increased by strengthening ribs (arrows) on exhaust manifold between cylinders 2 and 3, 3 and 4.



Production breakpoint:
Engine 102.985 approx. 05/86

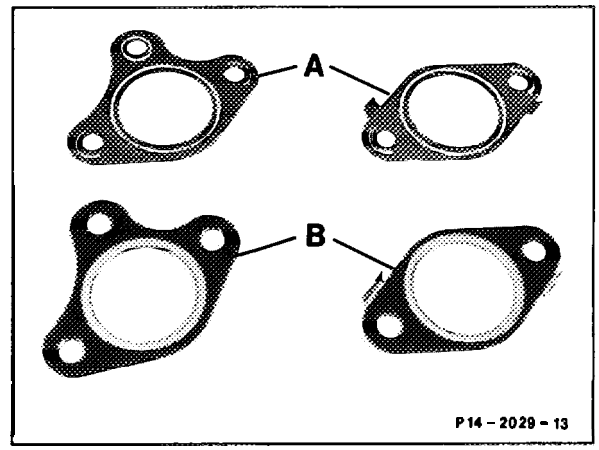
Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.024 (USA)	102.985	003769	034688

Engine 102.985
Exhaust manifold made of modified material
Reason: crack prevention

Production breakpoint: 09/88

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.028	102.985	027063	076715

Exhaust manifold gaskets at cylinder head
Engine 102.985
Installation of asbestos-free soft material gasket to provide better sealing.



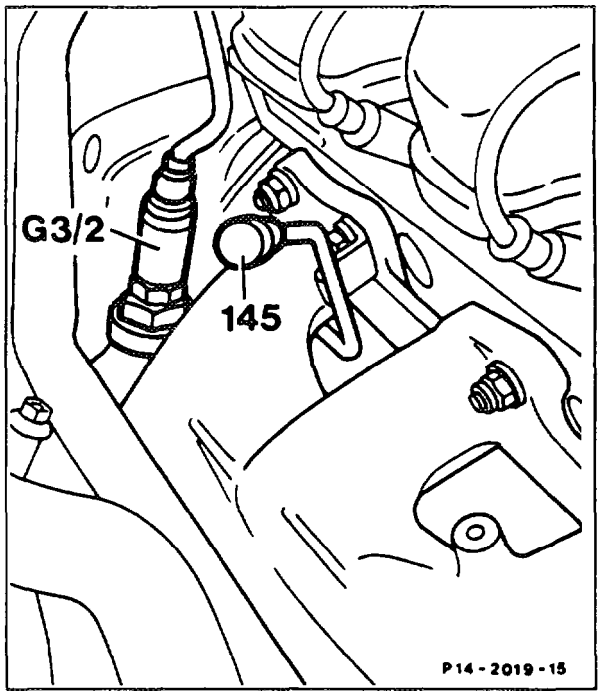
Exhaust manifold/cylinder head gasket
A Previous version
B Modified version (soft material)

Production breakpoint: 05/89

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.028	102.985	031907	079148

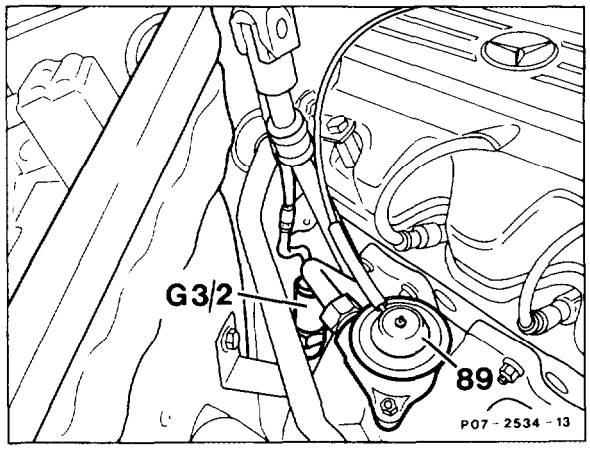
Engine 102.96/98 KAT as of 09/89
Heated oxygen sensor (G3/2) installed in rear section of exhaust manifold.

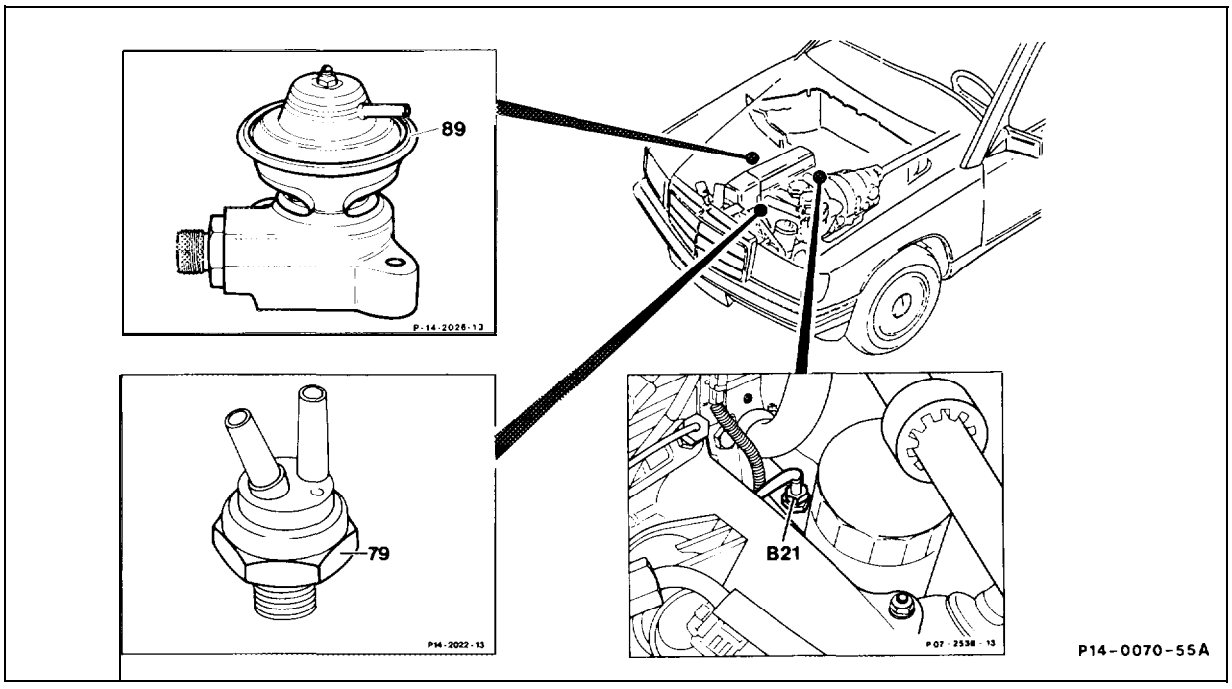
Remove, install heated oxygen sensor (see 07.3–258).



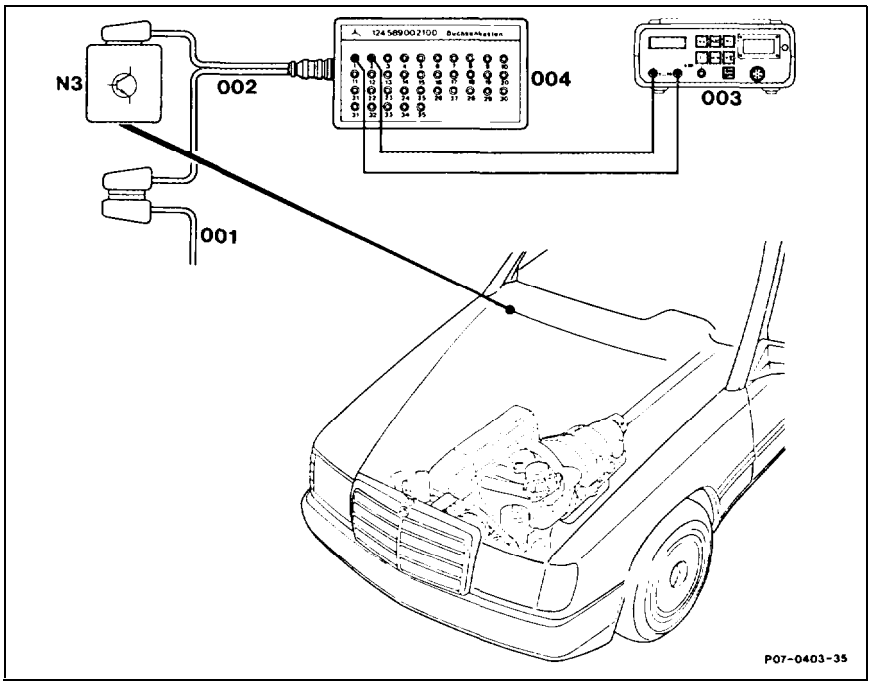
G3/2 Heated oxygen sensor

(USA) 1991 engine 102.985
The heated oxygen sensor (G3/2) is located close to the engine in the exhaust manifold. This enables it to reach its operating temperature sooner.
The exhaust gas recirculation valve (89) is positioned at the rear part of the exhaust manifold.



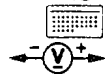


79	Thermovalve, opens at + 70°C, closes at + 60°C	B21	Exhaust gas recirculation temperature sensor (California only)
89	Exhaust gas recirculation valve		

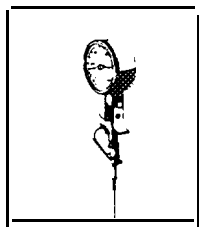


Connection diagram (California only)

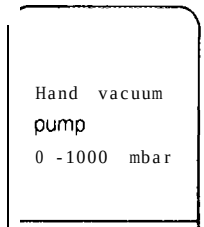
001 CFI control module connector
002 Test cable
003 Multimeter
004 Contact box
N3 CFI control module

Test step	Test scope	Tester/ Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
1.0	Function of monitoring signal **(California only)**	N3 7  22	Engine at operating temperature, 4000/min approx. 1 minute	< 4,7 V	No exhaust gas recirculation Temperature sensor faulty Wiring.
2.0	EGR valve (69) (static)	Ignition: **OFF** Vacuum tester connected to EGR valve	Apply 500 mbar vacuum Detach vacuum tester at EGR valve	 EGR valve should close audibly	 Replace EGR valve.
2.1	EGR valve (69) (dynamic)	Engine idling	Apply 500 mbar vacuum at EGR valve	Engine should run roughly	Replace EGR valve.
2.2	Vacuum supply for EGR valve	Vacuum tester connected to detached vacuum line	Engine sppeed >4000/min	approx. 500 mbar	Check arrangement of vacuum lines (see function diagram), replace thermovalve.
3.0	Thermo-valve (79) a) shift points	Connect vacuum tester to angle connection, apply vacuum	Engine coolant temperature >70 °C <60 °C	 Passage **No** passage	 Replace thermovalve. Replace thermovalve.
	b) Leak-tightness	Connect vacuum tester straight connection	Apply 500 mbar vacuum	Vacuum must not drop	Replace thermovalve.

Special tools



124 58907 21 oc



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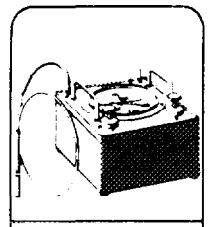
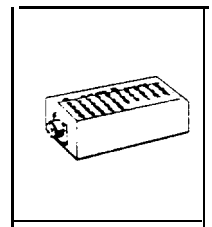


201 589 13 21 00



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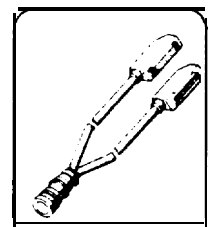
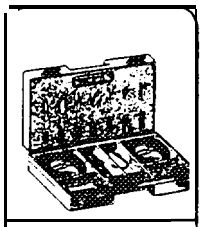


124 509 33 63 00



201 589 00 99 00

Commercially available tools or testers

Designation	e.g., Make, Order No.
Multimeter	Sun, DMM-5
Engine tester	Bosch, MOT 002.02

14-487 General instructions for vehicles with catalytic converter (KAT)

Tow-starting or jump-starting

Tow-starting or jump-starting with another battery can be performed when the engine is cold and the catalytic converter system has cooled down. Repeated attempts at starting should be avoided, however. If the engine is at normal operating temperature and does not start **immediately,** do not make any further attempts to start the engine in order to protect the catalytic converter system.

Misfiring

If misfiring occurs, the pre-catalytic converters are particularly at risk as fuel/air mixture is converted in the hot catalytic converter. The pre-catalytic converters may thus be subjected to excessive thermal stresses. If misfiring occurs frequently, the engine may only be operated for a short time at low load. The cause of the problem should be immediately repaired. In cases of doubt, the catalytic converter should be examined for thermal damage after rectifying the problem at the ignition system.

Checking the catalytic converter system for thermal damage

If excessive thermal stresses occur, the pre-catalytic converters sustain damage first. This can be checked by visual inspection with the exhaust system removed. Complaints regarding performance after engine running problems indicate excessive thermal stress of the catalytic converter. Residues of the molten catalytic **converter** block the exhaust pipe.

Driving on the roller dynamometer

The pre-catalytic converter becomes red-hot more rapidly at high loads because of the greater heat dissipation. This is no reason for concern.

Fuel additives

These are not recommended for vehicles fitted with catalytic converters. Only the specified quality of fuel may be used.

Use of leaded fuel

If leaded fuel has been inadvertently used, the function of the lambda control should be checked. If the sensor is damaged, it must be replaced. If the emission level exceeds **< 0,5%** CO, the complete catalytic converter system should be replaced.

Engins oils

The same oil recommendations (approved products, oil change intervals, etc.) as for vehicles without catalytic converter apply to vehicles fitted with catalytic converter.

Obnoxious odors

Deposits of sulfur elements from the fuel in the catalytic converter **may** result in the formation of hydrogen sulfide. Even minute concentrations of hydrogen sulfide are extremely obnoxious, although not harmful to health.

Risk of fire (parking on premises)

The surfaces of the under-floor catalytic converters in our vehicles fitted with closed-loop catalysts are thermally insulated to ensure effective cleaning of the exhaust gases in all operating conditions. Provided the engine is operating correctly, no higher temperatures therefore occur than with conventional muffler systems. Excessive temperatures occur only if (e.g. as a result of faults in the ignition or injection system) uncombusted fuel/air mixture passes into the catalytic converter.

Catalytic converters must not be disposed of as scrap. The catalytic converter contains valuable noble metals which can be recycled.

Details regarding return addresses and exchange prices are available at an authorized Mercedes-Benz dealer.

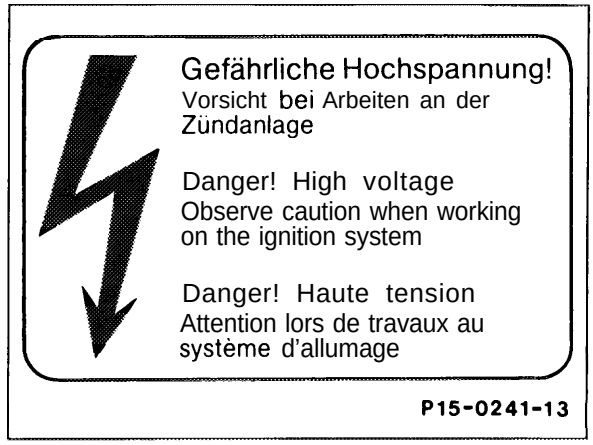
Job No.

Notes regarding work on transistorized ignition system . . . . . 15 – 505
Function of distributor ignition system (DI) . . . . . 15 – 510
Function of the breakerless transistorized ignition system (TSZ) . . . . . – 512
Testing ignition point . . . . . – 515
Analyzing oscilloscope images . . . . . – 525
Replacing spark plugs . . . . . – 530
Removal and installation of ignition or high voltage distributor . . . . . – 535
Testing distributor ignition system (DI) . . . . . – 540
Testing breakerless transistorized ignition (TSZ) . . . . . – 542
Testing ignition advance in warm-up phase (only TSZ) . . . . . – 543
Retrofitting corrugated hoses for ignition cables . . . . . – 547

A. Safety precautions

increased requirements of modern engines in respect of the ignition systems and the desire for freedom from maintenance have led to the standard use of electronic ignition systems.

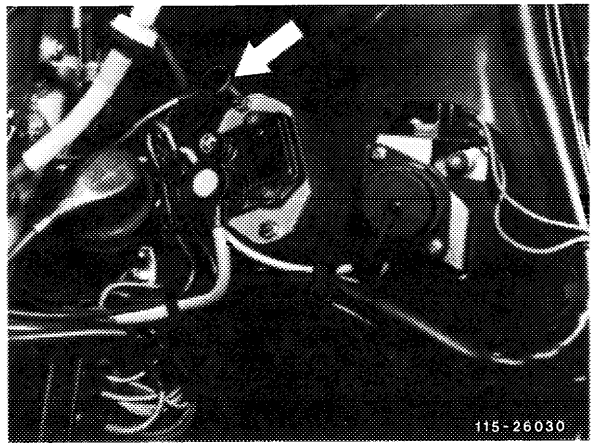
As a rule, the ignition capacities of electronic systems are higher than those of conventional systems; further increases in capacity are likely. Consequently, electronic ignition systems operate in a power range which may be hazardous if contact is made with live parts or terminals (see warning plate).



Warning plate in engine compartment

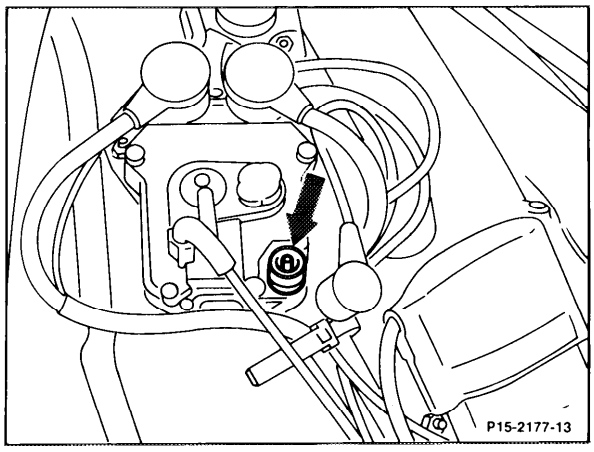
For this reason, the following safety precautions should always be observed when performing work on electronic ignition systems (distributor ignition, TSZ):

- Before performing work at cranking speed, e.g. testing compression or adjusting valve clearance, switch off ignition and detach control lead (arrow) at control module or plug protective connector Part No. 102 589 02 21 00 into the diagnostic connector.



TSZ ignition control module

- Persons with heart pacemakers should not work on such ignition systems.
- Do not grasp or detach any components of the ignition system at cranking speed or when the engine is running.



ignition control module

- Perform removal and installation work on the ignition system or connection and disconnection of sensors at ignition cables only when the engine is not running and the ignition is switched off.
- No adapters or plug-in sensors which are metallically blank to the outside may be installed in the ignition cables (e.g. cylinder 1).

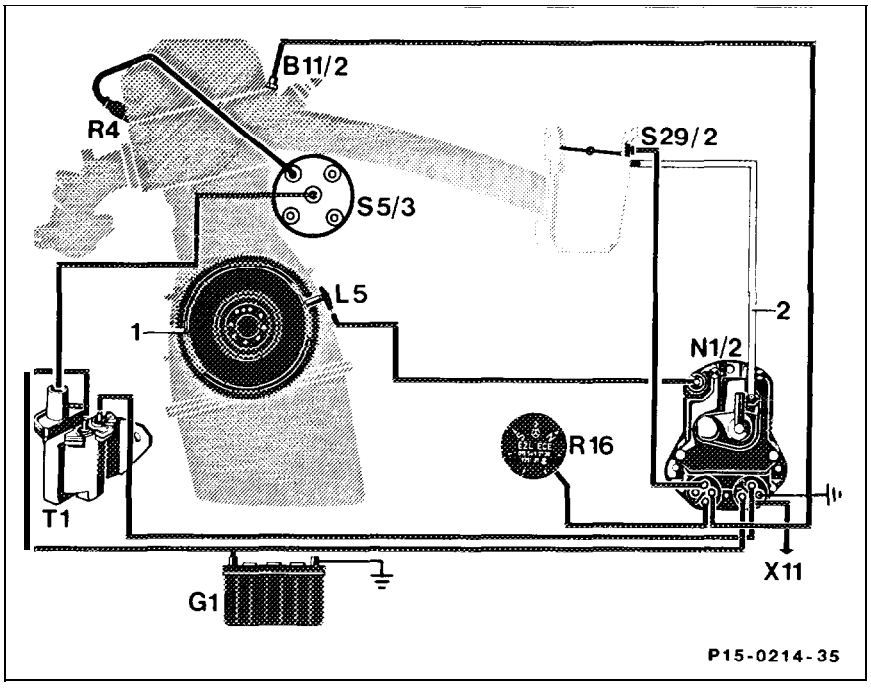
B. Instructions for avoiding damage to ignition system

- **The control module connectors may only be unplugged and plugged in when the ignition is switched off in order to avoid damage to the ignition and TSZ control modules.**
- Do not connect a test lamp to terminal 1 of the ignition coil.
- Terminals 1 and 15 of the ignition coil must not be short circuited to ground, e.g. as an anti-theft protection.
- The threaded pins of the ignition coil have different diameters (M5 and M6) to eliminate the risk of incorrect polarity.
- Install only genuine ignition system parts.
- Do not operate ignition system at starting speed unless all the ignition cables are fully connected.

- The high voltage side of the ignition system must have a load of at least 2 kΩ (distributor rotor 1 kΩ, distributor cap per terminal 1 kΩ) to avoid damage to the ignition and/or TSZ control modules. Do not install 5 kΩ distributor rotors for interference suppression.
- The following work must not be performed at starting speed or when the engine is running:
  - holding ignition cable 4 at a distance to ground
  - unplugging spark plug connector
  - unplugging ignition cable 4 at ignition coil.
- The ignition control module is coated on the rear with heat-conducting paste to improve heat dissipation and covered with a heat-conducting protective film. The protective film must not be removed.
- If the short-circuit protection (cylinder comparison) is operated and the engine stops, the test cannot be performed with this tester.
- A load of not more than 28 kV may be applied to the ignition coil when performing the separate ignition coil test in order to avoid damaging the coil.
- If it is necessary to test the ignition spark when rendering roadside assistance, this must only be done with a spark plug at a cylinder ignition lead. Ensure a good contact to ground of the spark plug.
  WARNING! Risk of shock!

C. Instructlons for use of engine testers

- Connect and disconnect voltage clamp to ignition cable 4 and trigger clamp to ignition cable of cylinder 1 only when the engine is not running and the ignition is switched off.



Function diagram of distributor ignition system (DI)
Engine 102.985

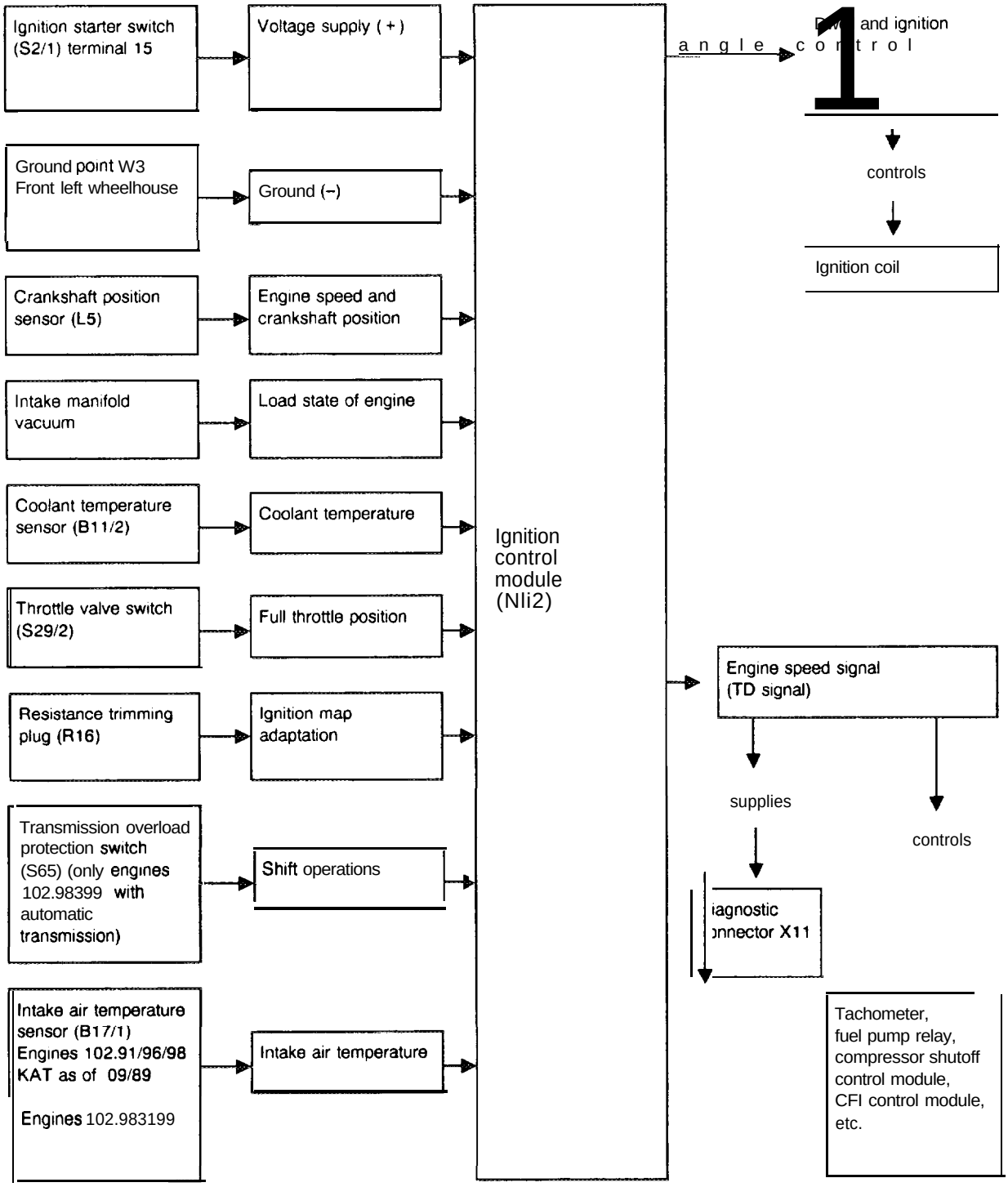
B11/2	Engine coolant temperature sensor	S29/2	Full throttle/idle speed detection throttle valve switch
G1	Battery		
L5	Crankshaft position sensor	T1	Ignition coil
N1/2	Ignition control module	Xl 1	Diagnostic connector/terminal block terminal TD
R4	Spark plugs		
R16	Reference resistor	1	Segments on driver disk
S5/3	High voltage distributor	2	Vacuum line

Engines 102.96/98 as of 09/89

The intake air temperature sensor (B17/1) supplies its temperature values to the ignition control module (intake air temperature sensor for CFI system no longer equipped).

Components and function

ignition control module (N1/2)



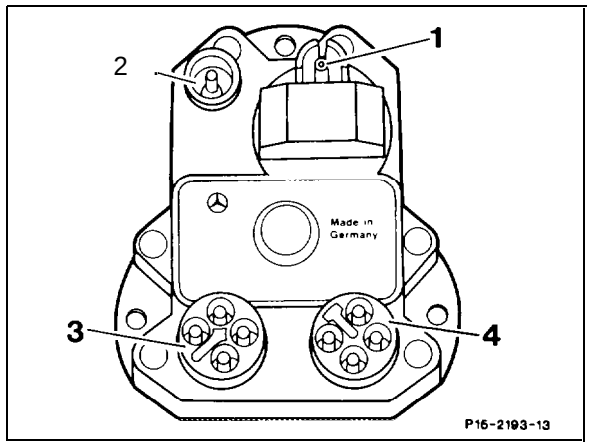
The ignition control module is located on the left wheelhouse panel.

It is installed with heat conducting paste to improve heat dissipation. When exchanging this part, the protective film must not be removed. The film does not impair heat dissipation. The ignition control module contains a microcomputer, a pressure sensor and the power output stage.

The ignition maps for typical load/engine speed ranges and a fixed idle speed ignition map are stored in the microprocessor of the ignition control module.

The ignition control module detects the momentary operating state of the engine from various input signals. Engine speed and crankshaft position are sensed by the position sensor.

The optimal ignition point for this operating state is output from the stored ignition maps by analyzing all the input signals.



1 Vacuum connection
2 Coaxial connector for control lead from position sensor
3 Sensor connector 4-pin
  1 Engine coolant temperature sensor
  2 Wide open throttle/closed throttle position switch
  3 Reference resistor
  4 Vacant (lead ends in wiring harness)
    or intake air temperature sensor
4 Supply connector 4-pin
  15 = Terminal 15
  16 = Ignition coil terminal 1
  TD = TD signal
  31 = Ground

The output end stage actuated by the micro-computer switches the primary current of the ignition coil between terminals 16 and 31 (4-pin supply connector).

The familiar functions of dwell angle control, primary current cutoff and primary current limiting are still contained in the ignition control module.

The speed-dependent TD signal is generated in the ignition control module (15-512).

When the engine is started and up to approx. 450/min the ignition point is controlled only via the segment edges of the flywheel. Only when a certain engine speed is reached (approx. 460/min) is a transition made from the fixed ignition point to the ignition point calculated for the momentary operating state.

In the warming-up range, various ignition maps are inhibited depending on coolant temperature in order to reach the operating temperature as rapidly as possible.

At idling speed and when decelerating a fixed ignition map is specified when the idle contact of a throttle valve switch is closed. This is influenced neither by the temperature sensor, the intake manifold vacuum nor by the reference resistor.

Note
If an interruption of the engine coolant temperature sensor occurs (resistance $\infty\Omega$) Bosch ignition control modules depart from the fixed idle speed curve and select a certain ignition point in the map, i.e. the ignition point is advanced.

At full load, the ignition point is determined by the full load ignition curve. The ignition control module detects full load from the intake manifold vacuum and engine speed input signals.

At full load, the ignition point is advanced (higher engine torque), taking into account the knock limit.

On engines 102.983199 two full load ignition characteristic curves are stored. The ignition point is determined as follows depending on the switch position of the intake air temperature sensor:

- By the advanced ignition characteristic curve below +25 °C intake air temperature.
- By the retarded ignition characteristic curve above +25 °C intake air temperature.

On engines 102.96/98 as of 09/89 with intake air temperature sensor, the ignition point is retarded as the intake air temperature rises. In addition, an ignition map is stored both for automatic and manual transmission. These maps are activated by the reference resistor.

The ignition points of certain ignition characteristic curves can be altered with the reference resistors. depending on the operating state.

Two maps for the following operating modes are stored in the ignition control module:

- For operation **with** catalytic converter (is activated via reference resistor).

The national version (USA) has a fixed resistance reference resistor.

Note
The ignition control module for engine 102.983 Standard has only one map. The ignition point IS altered for leaded and unleaded premium grade fuel with a special resistance trimming plug (inscription EZL and digits l-7).

Safety measures at control module
A safety retardation is automatically performed in the event that one or several sensors of the ignition system fail in order to protect the engine.

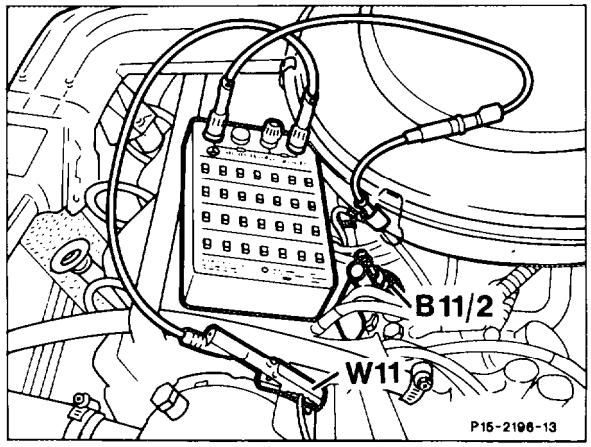
If the engine coolant temperature exceeds 90 °C or 100 °C (depending on version), certain ignition characteristic curves are retarded to counteract a further temperature rise (boiling protection correctton).

On engines 102.96/98 as of 09/88 up to 08/89 the use of the boiling protection correction has been advanced from 100 °C to 90 °C engine coolant temperature. From a coolant temperature of 90 °C the ignition point is retarded. The maximum retardation of 5" CKA is already reached at a coolant temperature of 100 °C.

Engines **102.996/98** as of **09/89**
The use of the boiling protection correction begins from 100 "C.
The retardation correction is:
100 °C → retarded 2" CKA (crank angle)
110 °C → retarded 4" CKA
120 °C → retarded 5" CKA

⚠
The correction of the boiling protection and of the intake air are added, i.e. 120 °C coolant temperature and 50 °C intake air temperature produce a maximum retardation of 12" CKA.

The Ignition point test must be performed at an engine coolant temperature between 75 °C and 90 °C because of 'he boiling protection correction as the ignition point is altered outside of this temperature range. To avoid an incorrect measurement of the ignition point, unplug connector for the engine coolant temperature sensor and feed in 320 Ω (= 80 °C engine coolant temperature) with the resistance decade.

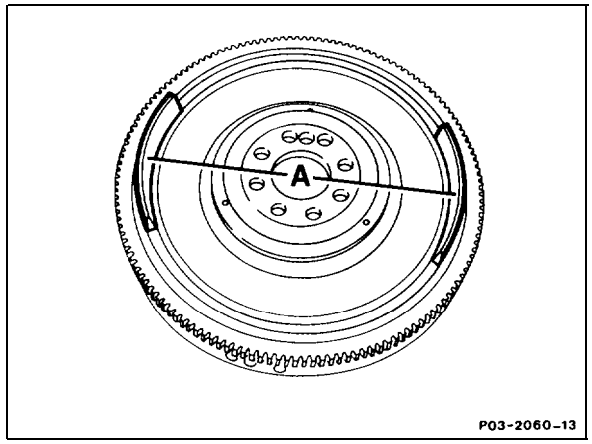


Engines 102.96/98
B11/2 Engine coolant temperature sensor
W1 1 Engine ground

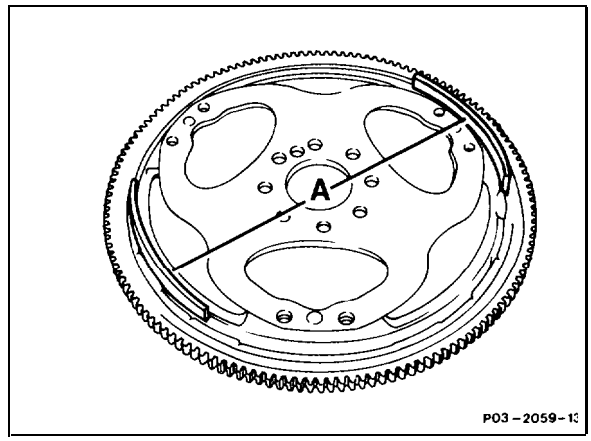
Flywheel disk with segments

Two segments offset 180" (A) are installed to the flywheel or to the flexplate.

As the segments pass the position sensor they produce an alternating voltage as a result of Induction.



Flywheel (manual transmission)



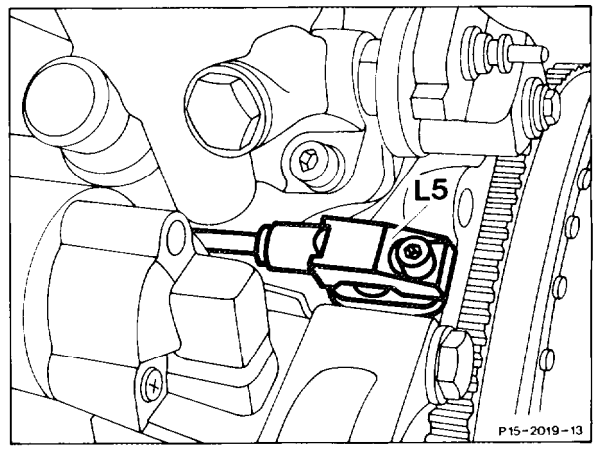
Flexplate with ring gear
(automatic transmission)

Position sensor (L5)

To activate the ignition control module, the position sensor (L5) detects the crankshaft position and the engine speed.

The position sensor is installed on the crankcase above the starter flange.

The coil body projects to just before the segments at the driver plate. Segment position and engine speed are sensed without contacts.

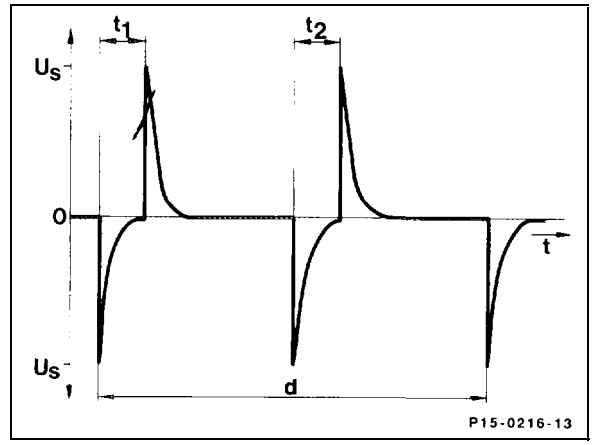


When the engine is rotating an alternating voltage is produced in the position sensor as a result of induction. The peak value of the voltage (U,) is approx. 1.5 volts at starter speed. As engine speed increases, the voltage rises (U, approx. 3 volts at 1200/min.).

Note
Measure peak value of voltage (U,) with the oscilloscope.

The crankshaft setting is detected from the voltage as follows:

The front edge of the segment produces a negative voltage signal.
The rear edge of the segment produces a positive voltage signal.

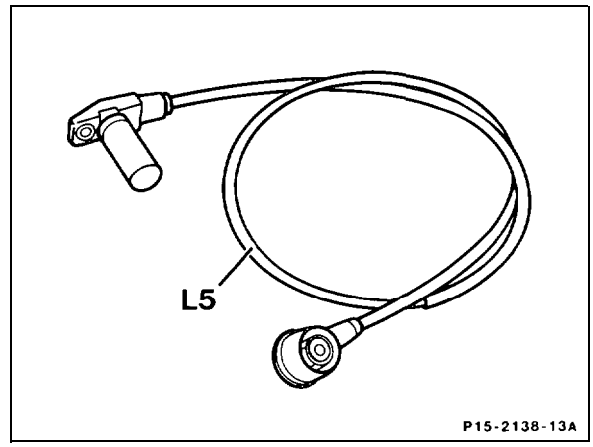


Position sensor voltage signal
t1 1 st segment
t2 2nd segment
d Period for one crankshaft revolution

The engine speed is determined by measuring the period.

The alternating voltage of the position sensor is passed along the control lead (coaxial lead) to terminal 7 at the ignition control module. The lead is a single-core cable and the screening is used as a second lead.

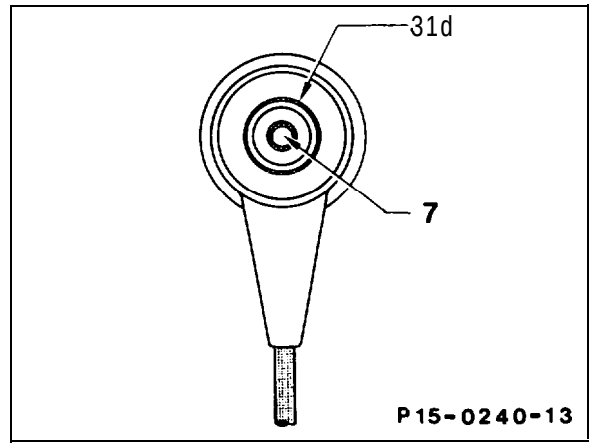
If the ignition control module does not receive a signal from the position sensor, the complete ignition system is inoperative, e.g. an interruption of the sensor coil can cause this.



The resistance of the position sensor between terminal (7) and (31d) is 680-1200 Ω.

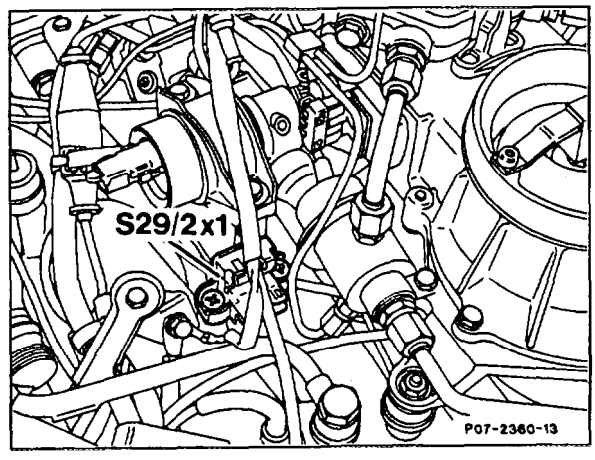
Notes regarding damage segments or mechanical damage to position sensor:

- Alternating voltage of position sensor below specification.
- Alternating voltage signals of individual segments vary greatly.
- No alternating voltage signal.



Wide open throttle/closed throttle position (WOT/CTP) switch (S29/2)

When the closed throttle **contact of** a WOT/CTP switch is closed (accelerator not depressed), the fixed idle speed/deceleration ignition characteristic curve is activated. The switching signal passes through the WOT/CTP switch connector (S29/2x1) and the 4-pin sensor connector (contact 2) to the ignition control module.



Engine coolant temperature sensor (B11/2)

Temperature sensors are equipped with 2-pin or 4-pin (from approx. 09/89) connections.

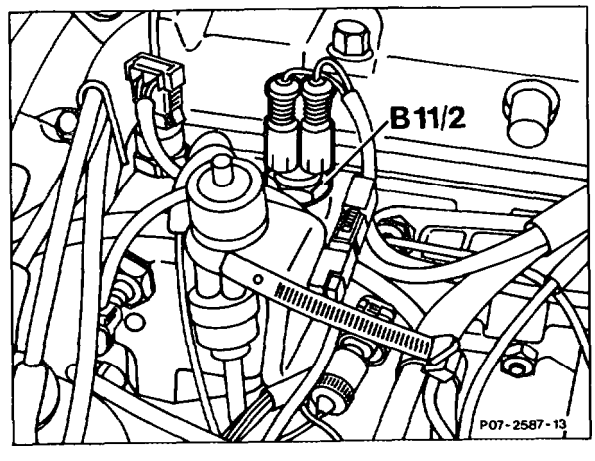
The temperature signal passes along the green/black cable at the 4-pin sensor connector (contact 1) to the ignition control module.
The engine coolant temperature sensor is positioned at the front at the cylinder head.

Note

NTC = resistor with negative temperature coefficient, i.e. the resistance is less in the warm state.

2-pin engine coolant temperature sensor (B11/2)

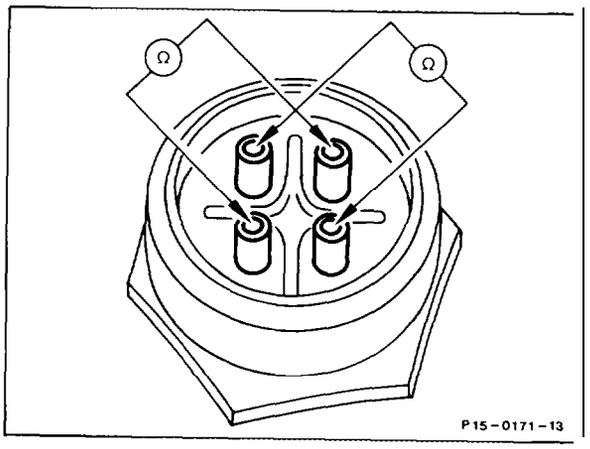
The engine coolant temperature sensor has two NTC resistors, each with **a** single-pin connection. One NTC for CFI and one NTC for the distributor ignition system.



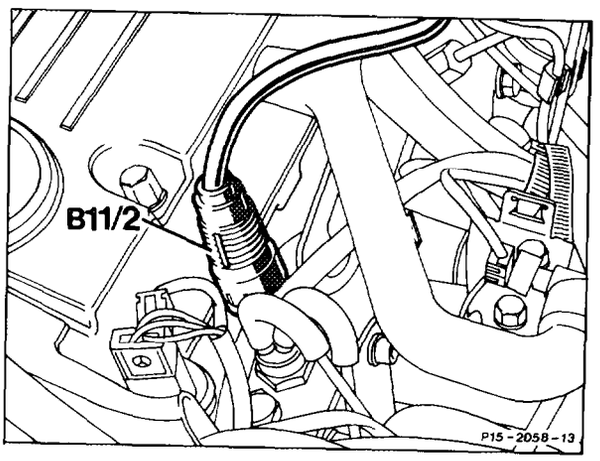
Engines 102.961985
B11/2 Engine coolant temperature sensor

4-pin engine coolant temperature sensor (B11/2)

It integrates two separate temperature sensors (NTC) which do *not* have any electrical connection to the housing of the engine coolant temperature sensor.

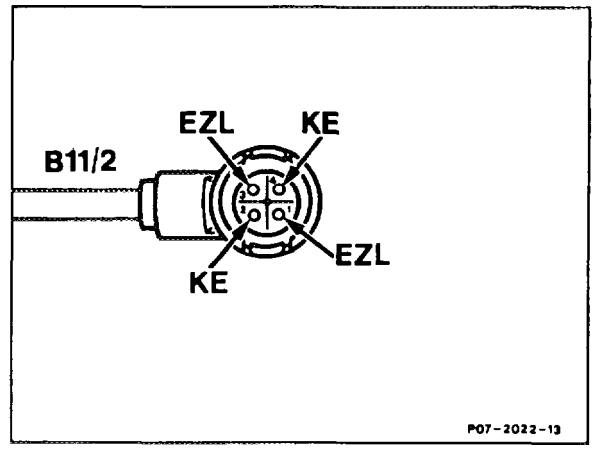


One temperature sensor is for the distributor ignition system (contacts **1** and 3) and one for the injection system (contacts 2 and 4).
The connector of the engine coolant temperature sensor is designed so that it can be plugged in in any position. The two temperature sensors are arranged diagonally.



Engines 102.96/98
B11/2 Engine coolant temperature sensor

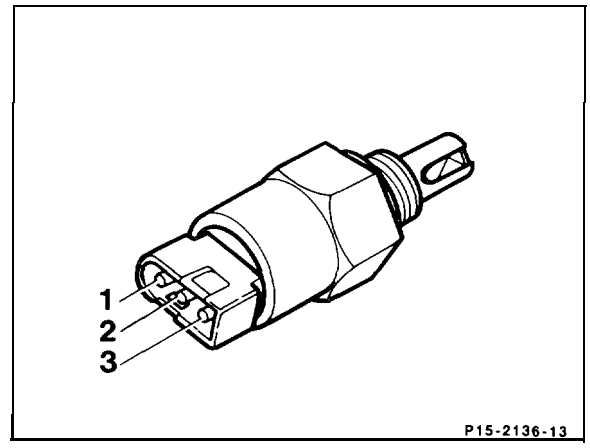
Pin assignment of coupling:
1 = Ignition temperature sensor
2 = CFI temperature sensor
3 = Ground W3, front left wheelhouse
4 = CFI control module ground



Notes regarding test
Engine coolant temperature sensor (B11/2)
When testing the engine coolant temperature sensor, measure the resistances 2 x diagonally and compare. The resistances of the characteristic curves are identical with those of the previous version.

An electronic switch is incorporated in the intake air temperature sensor which interrupts the connection between terminal 2 and terminal 3 (ground) at temperatures ≥ 25 °C. Continuity exists between the two terminals below this temperature.

At terminal 1 the voltage for the electronic switch is supplied from terminal 15 via fuse 10.

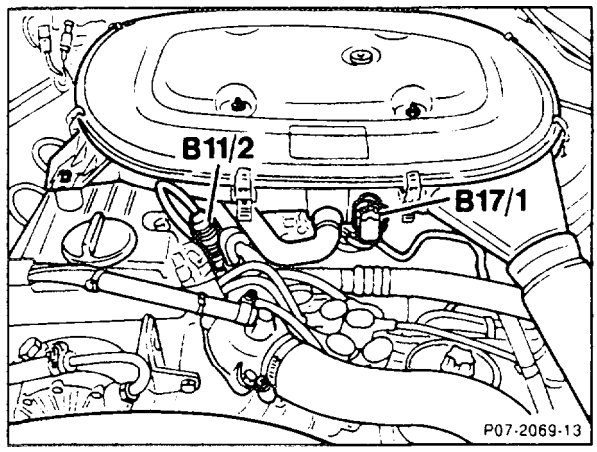


1 **Voltage supply**
2 **Ignition control module**
3 **Ground**

b) **Engines 102.96/98 KAT as of 09/89**
The intake air temperature sensor installed on CFI now supplies its temperature values through the sensor connector contact 4 to the ignition control module. The resistance of the temperature sensor (NTC) becomes smaller as the temperature rises.

From an intake air temperature of 32 °C the ignition point is retarded and reaches its maximum at 50 “C.

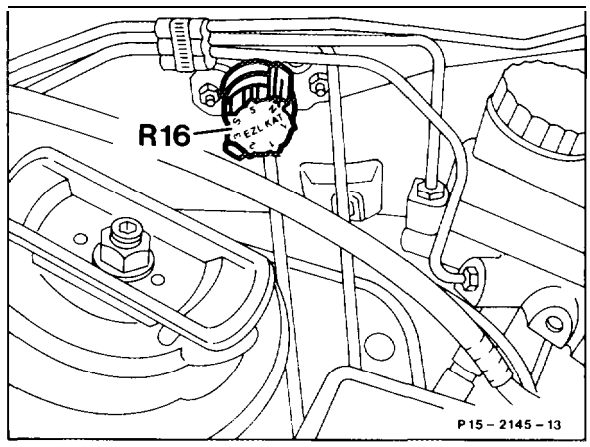
e. g.: 32 °C → retarded 1° CKA
40 °C → retarded 5” CKA
50 °C → retarded 7° CKA



Engines 102.96/98
B17/1 Intake air temperature sensor

Reference resistor
Two different types of reference resistors are installed:

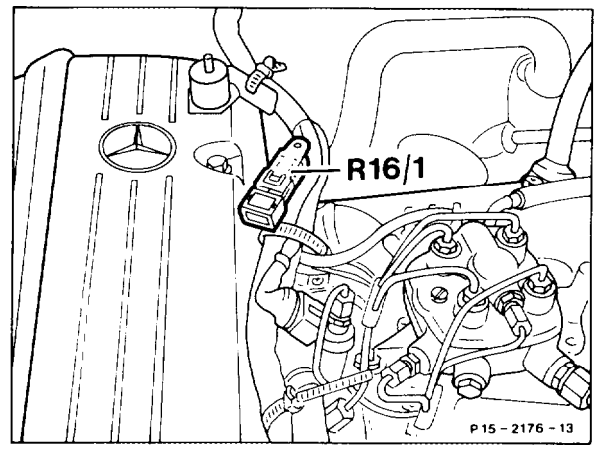
a) Variable resistance trimming plug (R16).
b) Reference resistor (R16/1) with fixed resistance (USA).



Model 124 shown
R 16 Reference resistor

b) Reference resistor (R16/1)

The reference resistor (R16/1) has a fixed resistance. The fixed resistances differ depending on Part No. as follows (see 15-515 for assignment):



Model 201

Part No.	Resistance
000 540 22 81	220 Ω
000 540 23 81	470 Ω
000 540 24 81	750 Ω
000 540 25 81	1300 Ω
000 540 26 81	2400 Ω

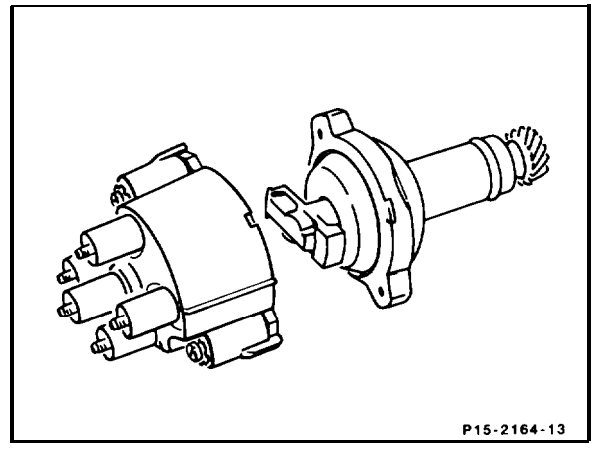
A certain ignition map is activated in the ignition control module with the reference resistor (R16/1).

Perform resistance measurement for testing the reference resistor (R16/1) at the ignition control module between sensor connector (contact 3) and ground.

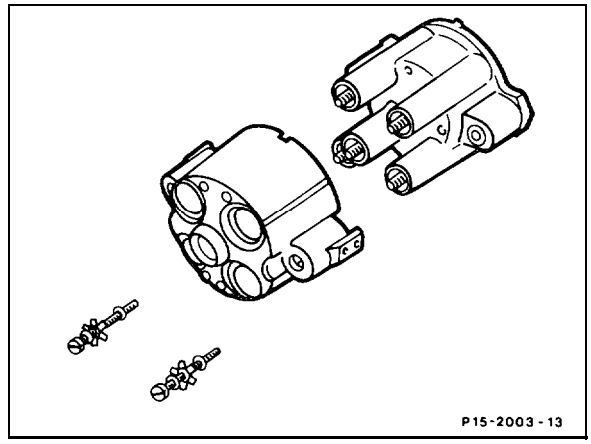
High voltage distributor (S5/3)

The singular task of the high voltage distributor is to distribute the ignition voltage. It is therefore no longer possible to set the ignition point. Activation and adjustment of the ignition point are performed by the position sensor and the ignition control module.

Interference suppression resistors: At distributor cap per terminal 1 kΩ, spark plug connector 1 kΩ, distributor rotor 1kΩ.

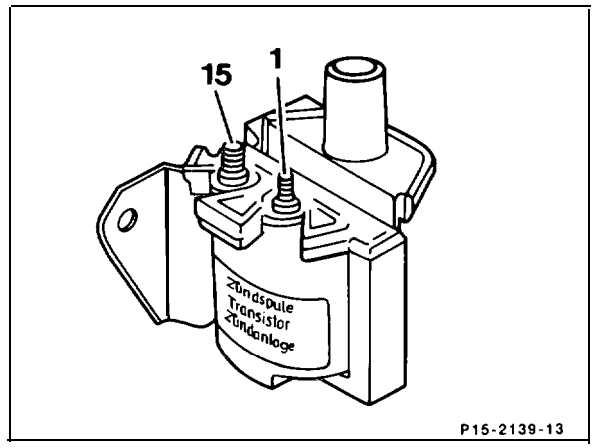


The distributor cap is attached to the high voltage distributor with M-6 special bolts.
The special cap for long-range interference suppression is mounted on the cap and attached with two metal stars.



Ignition coil(T1)

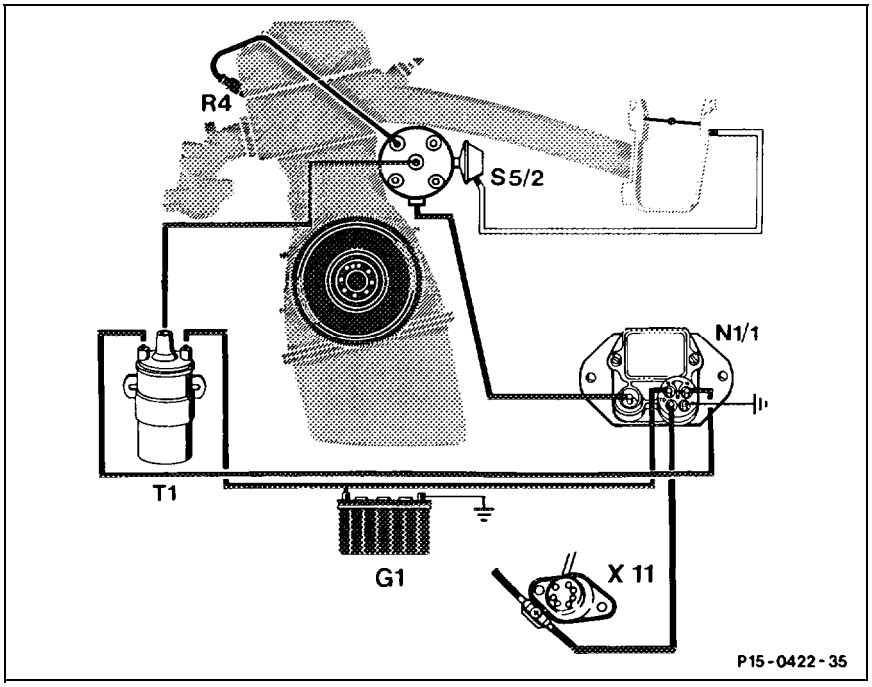
The ignition coil is matched to the ignition control module to achieve a higher ignition energy. The primary current can be further boosted as a result of the high switching capacity of the ignition control module. The primary winding is designed as a very low impedance (0,3–0,6Ω) for this purpose.
Stall current cutoff and primary current limiting enable the ignition coil to be operated without ballast resistor. Consequently, current limiting by the ballast resistor is eliminated. If the maximum primary current flows without limit in the ignition coil (e.g. stall current cutoff defective), the ignition coil is damaged after a short time by the high level of heat developed.



For distinguishing:

The ignition coils of 4- and 6-cylinder engines with distributor ignition systems are identical
Identification: yellow type plate.
The ignition coils cannot be interchanged with ignition coils for a-cylinder engines (identification: green type plate).
Pay attention to Part No. when exchanging.

Pay attention to instructions regarding work on electronic ignition systems (15–505).



G1	Battery	S5/2	Breakerless distributor
N1/1	Transistorized ignition (TSZ) control module	T1	Ignition coil
R4	Spark plugs	x11	Diagnostic connector/terminal block terminal TD

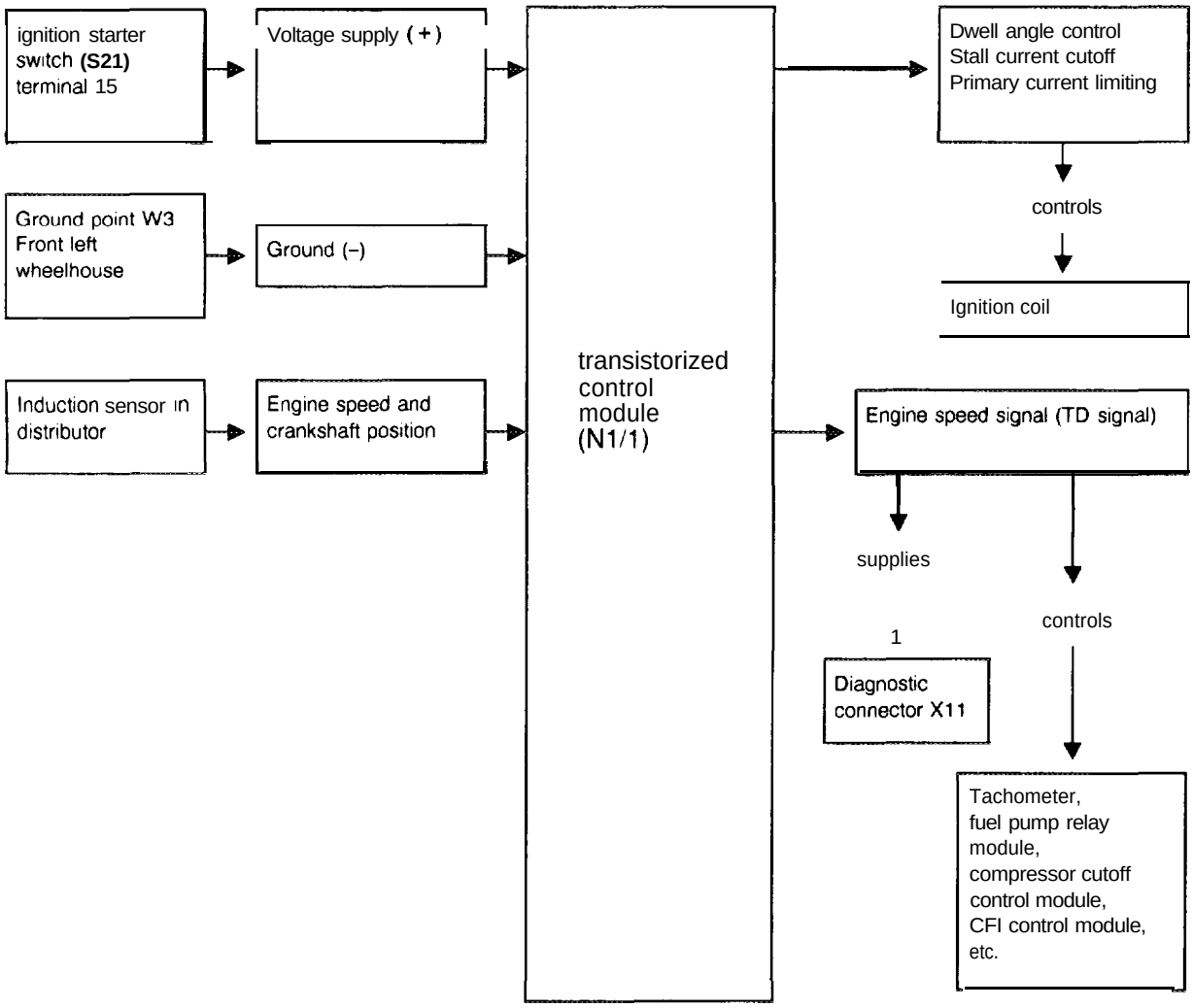
Note

Installation survey of engines with breakerless transistorized ignition system (TSZ), see 07.3-004.

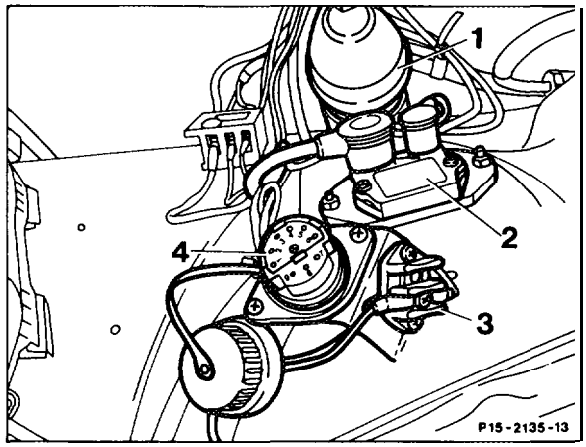
Only a 4-pin connector is plugged in at the small transistorized control module (distinguishing feature to ignition control module).

Components and function

transistorized control module **(N1/1)**



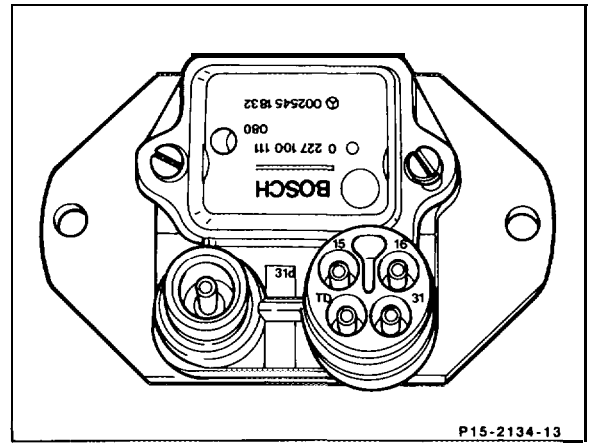
The transistorized control module is located on the left wheelhouse panel. It is designed in space-saving hybrid technology.



1 Ignition coil
2 transistorized control module
3 Terminal block terminal TD
4 Diagnostic connector

Pin assignment at transistorized control module

- Green control lead from induction sensor in distributor (coaxial connector).
- 4-pin round connector with terminals 15, 31, 16 and TD.



The electronic functions of primary current limitation and stall current cutoff in the transistorized control module enable the series resistors in the primary current circuit to be eliminated. Consequently, a higher ignition coil primary current and higher ignition capacity are possible.

The transistorized control module is activated by induction sensor in the distributor.

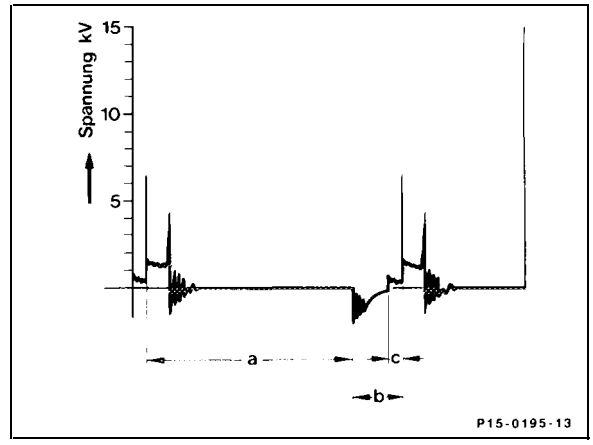
The optimal capacity of the ignition system is achieved by the dwell angle control in the transistorized control module. The dwell angle is controlled within the control range so that the same primary current is always achieved approximately in every operating state, i.e. at different battery voltages and engine speeds.

As a result of the elimination of the series resistors, the primary current is cut off by the transistorized control module (stall current cutoff) when the engine is not running and the ignition is switched on. The primary current is connected only once a certain pulse sequence is generated by the induction sensor in the distributor.

The maximum primary current of the ignition coil is determined by a current limiter in the transistorized control module.

The current limitation (c) can be recognized on the oscilloscope when the engine is at idle. Current limitation is no longer visible from an engine speed of approx. 2000imin.

The power output stage switches the primary current of the ignition coil between terminals 16 and 31. In addition, the power output stage performs the task of limiting the primary current.



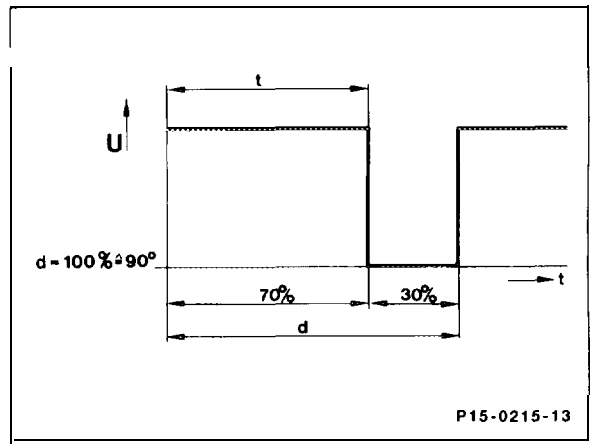
a Opening angle
b Dwell angle
c Current limiting

TD signal

The transistor engine speed (TD) signal is produced in the transistorized control module. This is an engine speed-dependent square-wave signal.

The engine speed is detected by the number of square-wave signals per minute.

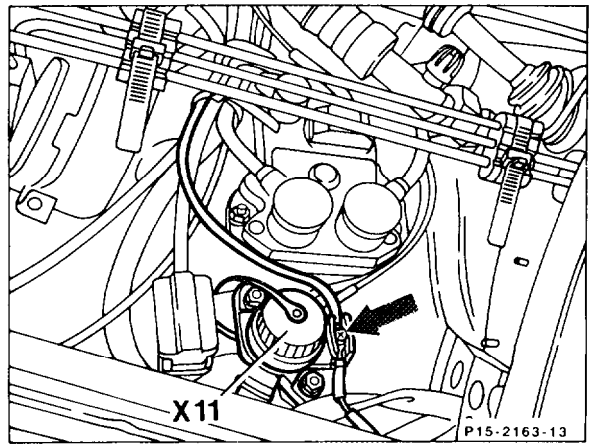
When performing tests, the On time (t, e.g. 70% of the individual square-wave pulses is measured as dwell angle in degrees or as on/off ratio in percent (related to period, d).



The TD signal can be measured:

- with the dwell angle tester or on/off ratio tester in percent and degrees.
- with the voltage meter 6 volts up to 12 volts direct voltage.
- with the oscilloscope – square-wave signals.

Note
No TD signal exists if a short to ground is present at the connected equipment or at the diagnostic connectorterminal block terminal TD (Xl 1). To locate the problem, detach cable connection (arrow). Rectify short to ground in the respective circuit.

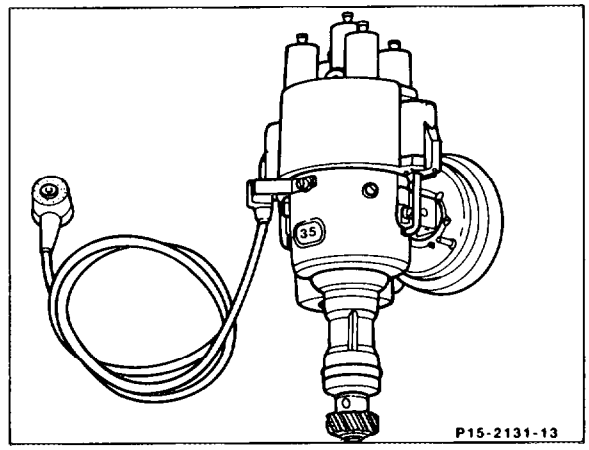


The following electronic components have a TD connection, e.g.:
Tachometer, CFI control module, fuel pump relay and compressor cutoff control module.

Ignition distributor **(S5/2)**

- The induction sensor is installed in the distributor. It produces an alternating voltage up to approx. 100 volts for actuating the transistorized control module.

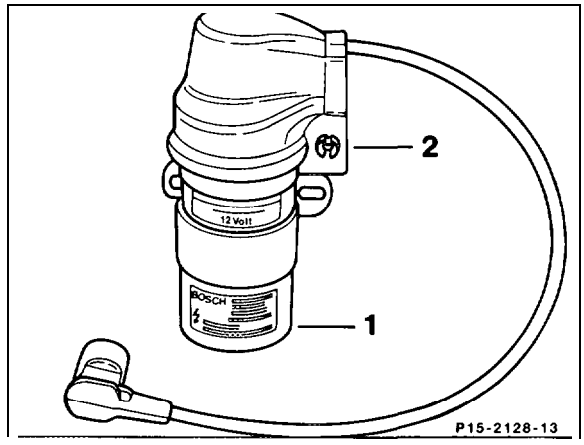
  The alternating voltage passes along the green control cable (coaxial cable) to the ignition control module. The cable is a single-wire lead. The screening is used as a second lead.



- Engine speed-dependent ignition advance by flyweights. Load-dependent ignition advance by vacuum (above approx. 60 °C coolant temperature).

- Interference suppression resistors: distributor rotor 1 kΩ (code number R1, on rotor), distributor cap 1 kΩ per cylinder.

Ignition coil (T1)



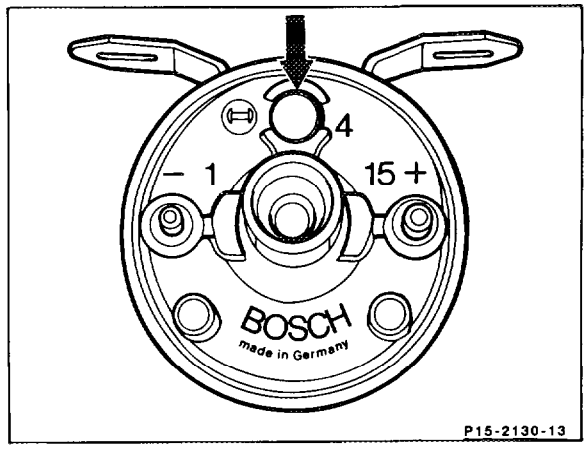
The ignition coil is matched to the ignition control module and designed for a higher ignition capacity. Identification: yellow sticker.

The ignition coil must on no account be replaced by one of the previous ignition coils.

Distinguishing features from previous ignition coils are:

- The safety plug in the cover of the ignition coil.
- A higher dome.
- Cable connection at terminal 1 with M5 thread.
- Cable connection at terminal 15 with M6 thread.

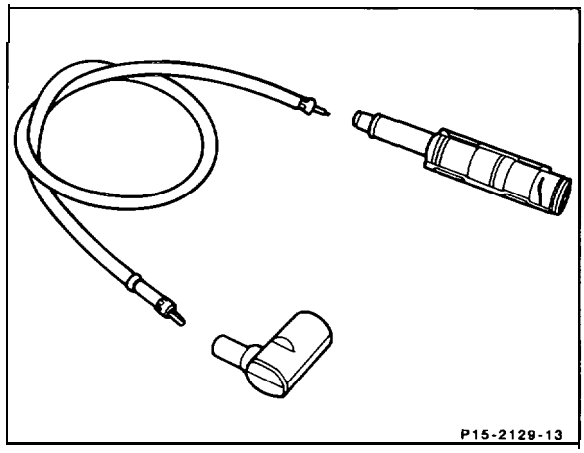
A 5.5 mm opening (arrow) which is sealed with a plug is located in the cover of the ignition coil. This cover detaches if an pressure as a result of severe heat formation is produced in the ignition coil by a defective output stage in the control module. The ignition coil is provided with a cover cap to prevent uncontrolled escape of the plug or of the sealing compound.



Ignition cables

The partially screened spark plug and angled distributor connectors are designed for high ignition voltage.

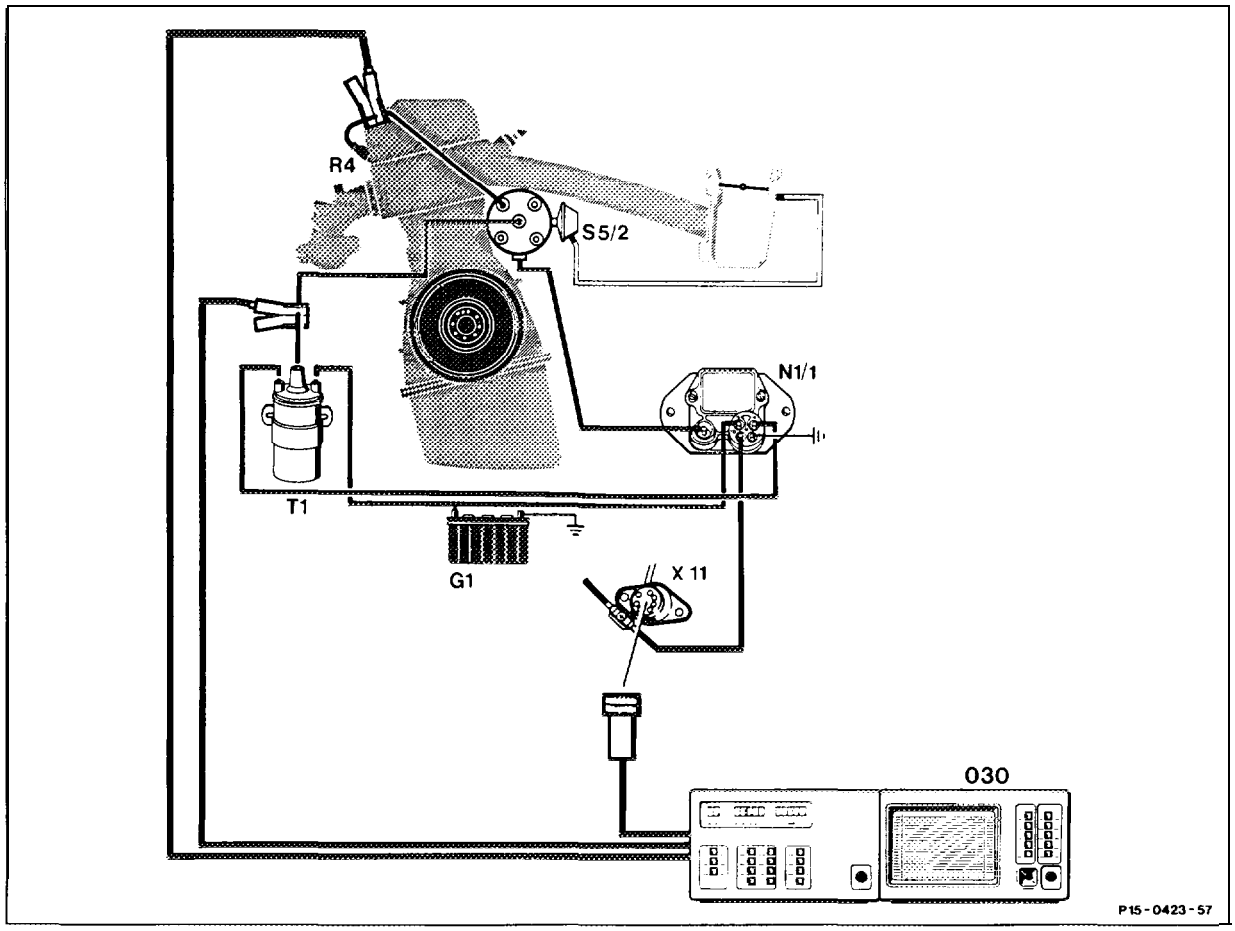
An interference suppression resistor of 1 kΩ is installed in the spark plug connectors. These can be unscrewed (M3 thread).



15-515 Testing ignition point

Preceding work:

A. Vehicles with TSZ ignition system



G1	Battery	**T1**	Ignition coil
N1/1	Transistorized ignition **(TSZ)** control module	x11	Diagnostic connector/terminal block terminal TD
R4	Spark plugs	030	Engine tester with oscilloscope
S5/2	Breakerless distributor		

Engine tester with oscilloscope (030)	connect to diagnostic socket (Xl 1).
Safety precautions	observe (15-505). Selector lever in position P or N. Apply parking brake.
Ignition point	test at specified engine speed with or without vacuum (see table).

Ignition point	set by turning distributor. Then re-test.
Flywheel vacuum advance	test at specified engine speeds (see table).

Commercially available testers

Engine tester (engine speed, dwell angle, ignition angle, oscilloscope, voltmeter	e. g.	Bosch, MOT 002.02 Sun, 1019

ignition point (TSZ) basic version

Engine	Type of fuel[3])	Distributor Bosch No.	Test and setting data [1]) of ignition point in °CKA BTDC ± 1 without/with vacuum		Ignition point advance in °CKA (crank angle) before TDC without vacuum			Vacuum advance of ignition point in "CKA BTDC at	installed value of ignition point in "CKA BTDC at starting speed without vacuum
			4500[1] min	at idle	at idle	1500/ min	3000/ min	4500[1] min	
102.961	un-leaded	0 237 002 084 0 237 002 059	27 without	– –	8 ± 3[4])	11–16	21–25	8-12	8
102.985	un-leaded	0 237 002 105	27 without	–	10 ± 3	13–19	21–25	8-12	8

See next page for footnotes.

Ignition po(TSZ :) basic version

Engine	Type of fuel [3])	Distributor Bosch No.	Test and setting data [1]) of ignition point in "CKA BTDC ± 1 without/with vacuum		Ignition point advance in "CKA (crank angle) before TDC without vacuum			Vacuum advance of ignition point in "CKA BTDC al:	Installed value of ignitron point in "CKA BTDC alt starting speed without vacuum
			4500/ min	at idle	at idle	1500/ min	3000/ min	4500/ min	
(USA) 102.961 1984	un-leaded	0 237 002 094	–	5 with	–	5–11	19–25[2])	24-28')	5
102.961 102.985 as of 1983		0 237 002 098				10-14	22–26[2])	14-I 8[2])	5

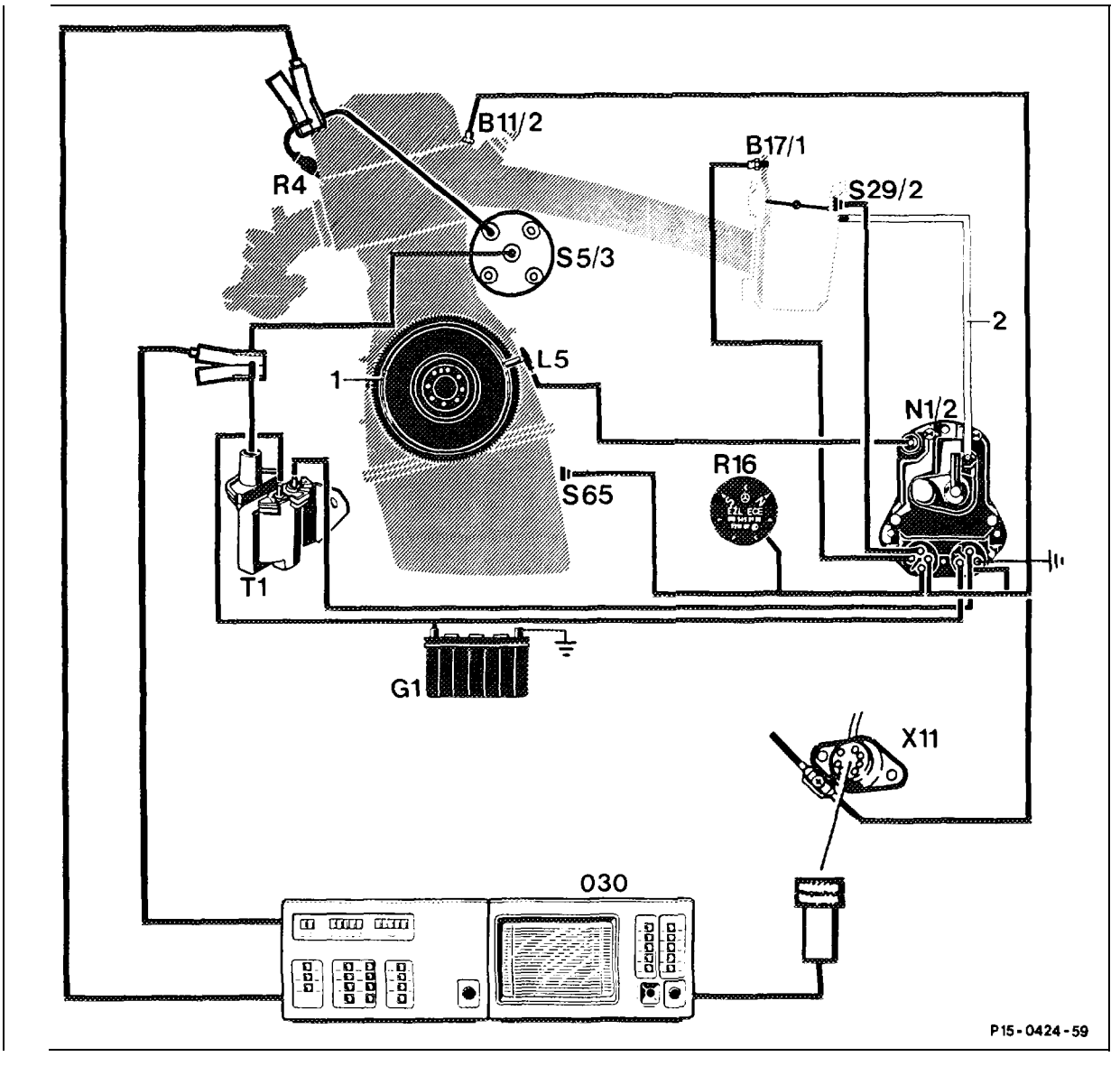
[1]) If normal-compression engines are operated with fuel of less than 98 RON (mm. 88 MON) or low-compression engines with less than 92 RON (mtn. 82 MON), the ignition point should be retarded and adapted to the octane number of the fuel used. A reference value for this adlustment is: retard ignition point by I-2 ° CKA per 1 RON. The maximum retardation must not exceed 6° CKA.
The Ignition correction should be entered by hand on the "engine setting data" Information plate.
Thrs results in reduced performance and increased fuel consumption. In addition, the engine must not be operated at full load.
The full ignition advance should be reset as soon as fuel of the specified octane number is again available.

[2]) Test at 3500/min.

[3]) Vehicles with catalytic converter must be ooerated with unleaded fuel.

4) This value must be identicalwith and without vacuum when engine at normal operating temperature: check ignition advance in warming-up phase if necessary (15–543).

B. Vehicles with distributor ignition system (DI)



B11/2	Engine coolant temperature sensor	S65	Transmission overload protection switch (only engines 102.983199)
B17/1	Intake air temperature sensor	T1	Ignition coil
G1	Battery	x11	Diagnostic connector/terminal block terminal TD
L5	Crankshaft position sensor		
N1/2	Ignition control module	1	Segments at flywheel/driver disk
R4	Spark plugs	2	Vacuum line
R16	Reststance trimming plug (EZL)	030	Engine tester with oscilloscope
S5/3	High voltage distributor		
S29/2	Wide open throttle/closed throttle position switch		

Engine tester with oscilloscope (030)	connect to diagnostic socket (Xl 1).
Safety precautions	observe (15–505). Selector lever position P or N. Apply parking brake.
Ignition point	test at a engine coolant temperature for approx. 80 °C with or without vacuum at specified engine speed (see table).

Engine 102.96/98 KAT as of 09/89
Detach engine coolant temperature sensor (B11/2) and intake air temperature sensor (B17/1) for test.

⚠
Following the test, the DTC memory must be erased (see 07.3-121, section "D"). Use impulse counter scan tool 124 589 19 21 00 for this or unscrew/ screw on negative pole terminal or battery.

Note
The ignition point cannot be set. If the ignition point is incorrect, test distributor ignition system (DI) (15-540).

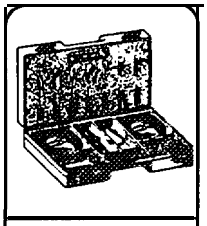
Radio with code
Following repairs to the vehicle which involve disconnecting the battery terminals, the radio must be made operational again by entering the code number. The CODE card must be available when repairs are performed.

Engine	Version	Production break point Model year	Ignition control module Part No. alternatively	Engine speed 1/min	Resistance trimming plug setting, type of fuel [7]	Ignition point in °CKA BTDC without vacuum	Ignition point in °CKA BTDC with vacuum
102.983	(USA)	1986/1987	004 545 57 32 004 545 59 32	4000	Reference resistor 750 Ω	18–22 [3]	29–33 [3]
				Idling		**14–18**	**14–18**
102.985		1987/1988	005 545 30 32 005 545 32 32	3200		25–29	39–43
				Idling		18-12	18-12
102.985		1989	007 545 47 32 [5][6] 007 545 48 32 [5][6]	3200		23-27	39–43
				Idling		8-12	8-12
102.985		1991	010 545 59 32 010 545 60 32	3200	Reference resistor 1.3 kΩ (man. transm.) 2.4 kΩ (aut. transm.)	22-26 [9]	39–43 [9]
				Idling		8-12	8-12

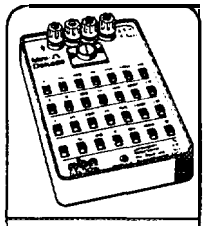
1) Manual transmission.
2) Automatic transmission.
3) Intake air temperature sensor connector disconnected.
4) Resistance trimming plug position results from setting.
5) These ignition control units may also be installed in vehicles prior to 08/88. In this case the ignition point values are altered as shown in the table. The resistance trimming plug setting "7" is no longer permitted for these ignition control units.
6) Test ignition point at 80 °C coolant temperature by unplugging the temperature sensor connector B11/2 and feeding in 320 Ω with resistance decade between green/black cable (coolant temperature sensor coupling 4-pin, contact 1) and engine ground.
7) Vehicles with catalytic converter must be operated with unleaded fuel.
8) Reference resistor (resistance ∞ Ω) not fitted to vehicles with ignition control unit 003 545 70 32.
9) For testing, detach the intake air temperature sensor and coolant temperature sensor connectors. Test ignition point at 80 °C coolant temperature by feeding in 320 Ω with resistance decade between contact 1 at 4-pin connector and engine ground.

Note
Ignition control unit with ignition map for manual and automatic transmission (actuated by different EZL resistance trimming plugs), boiling point correction (max. 5 °CKA), intake air correction (max. 7 °CKA) and safety retardation (6 °CKA) in the event of open circuit to reference resistance trimming plug.

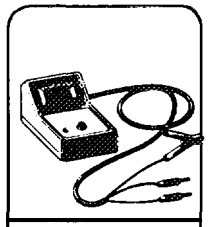
Special tools



201 589 00 99 00



124 569 09 63 00



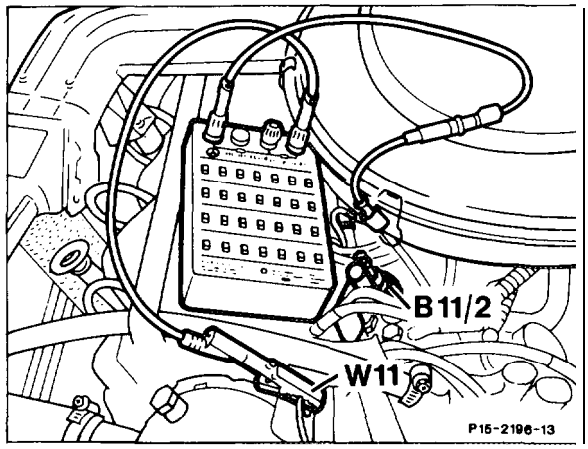
124 589 19 21 00

Commercially available testers

Engine tester (engine speed, dwell angle, ignition angle, oscilloscope, voltmeter)	e. g.	Bosch, MOT 002.02 Sun, 1019

Note

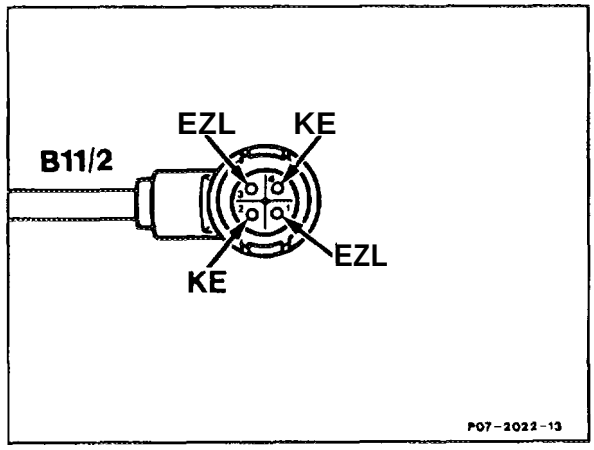
The ignition point test must be conducted at an engine coolant temperature between 75 °C and 90 °C because of the boiling protection correction as the ignition point alters outside of this temperature range. To avoid an incorrect measurement of the ignition point, detach connector for the engine coolant temperature sensor and feed in a resistance of 320 Ω (= 80°C engine coolant temperature) with the resistance decade.

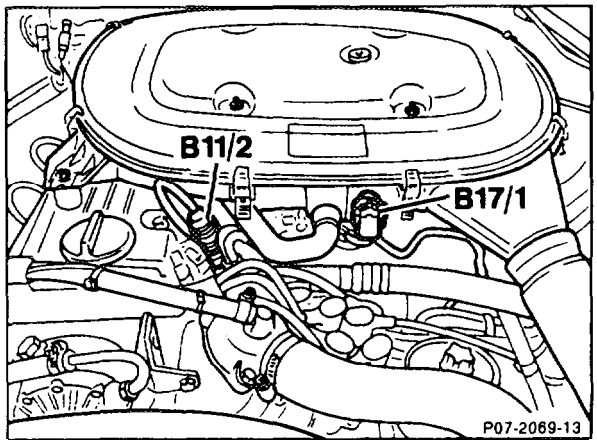


Engines 102.96/98
B11/2 Engine coolant temperature sensor
W1 1 Engine ground

Pin assignment of Cpin engine coolant temperature sensor (B11/2):

1 = Ignition temperature sensor
2 = CFI temperature sensor
3 = Ground W3, front left wheelhouse
4 = CFI control module ground





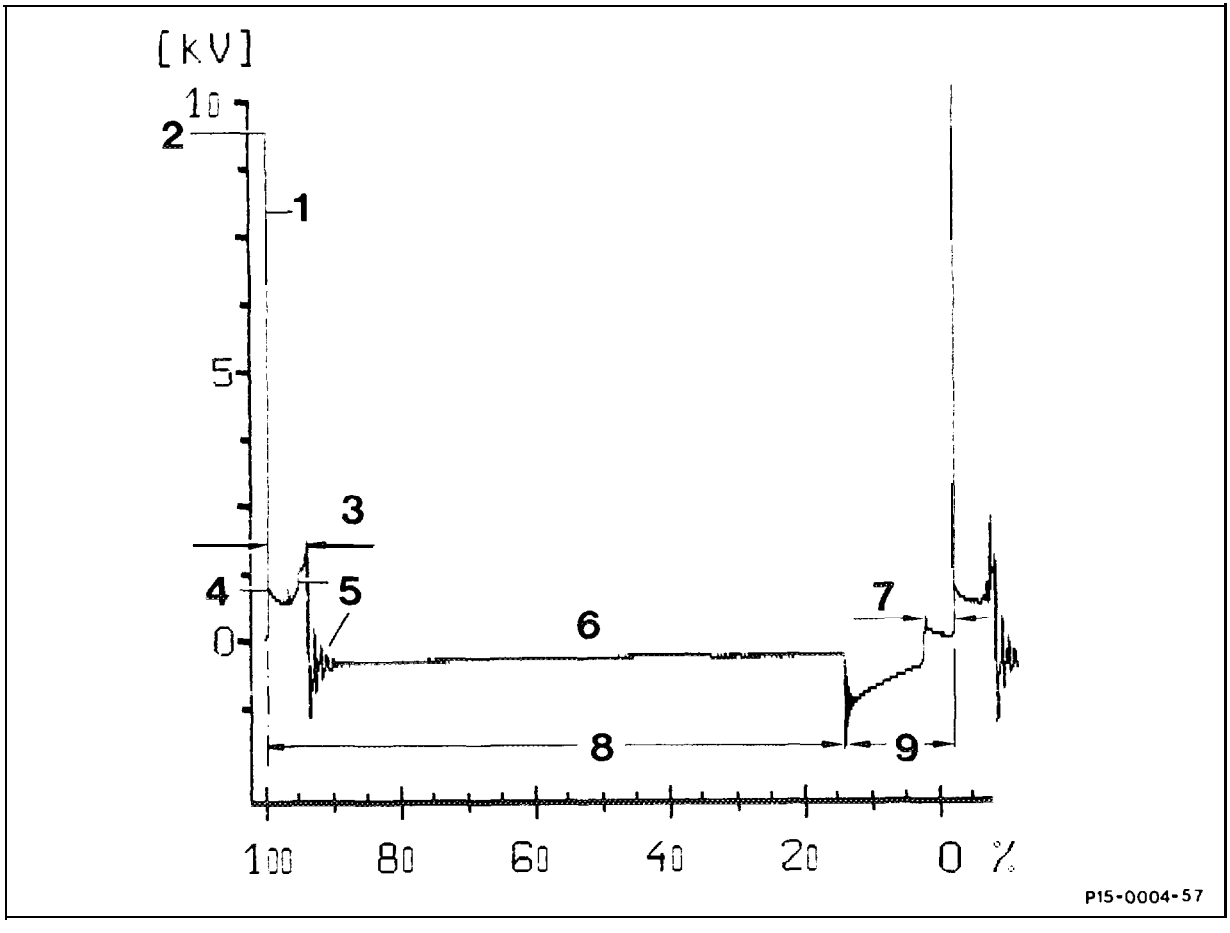
Engines 102.96/98 KAT
as of 09/89
B11/2 **Engine coolant temperature sensor**
B17/1 **Intake air temperature sensor**

15-525 Analyzing oscilloscope images

Description of oscilloscope image

Good image

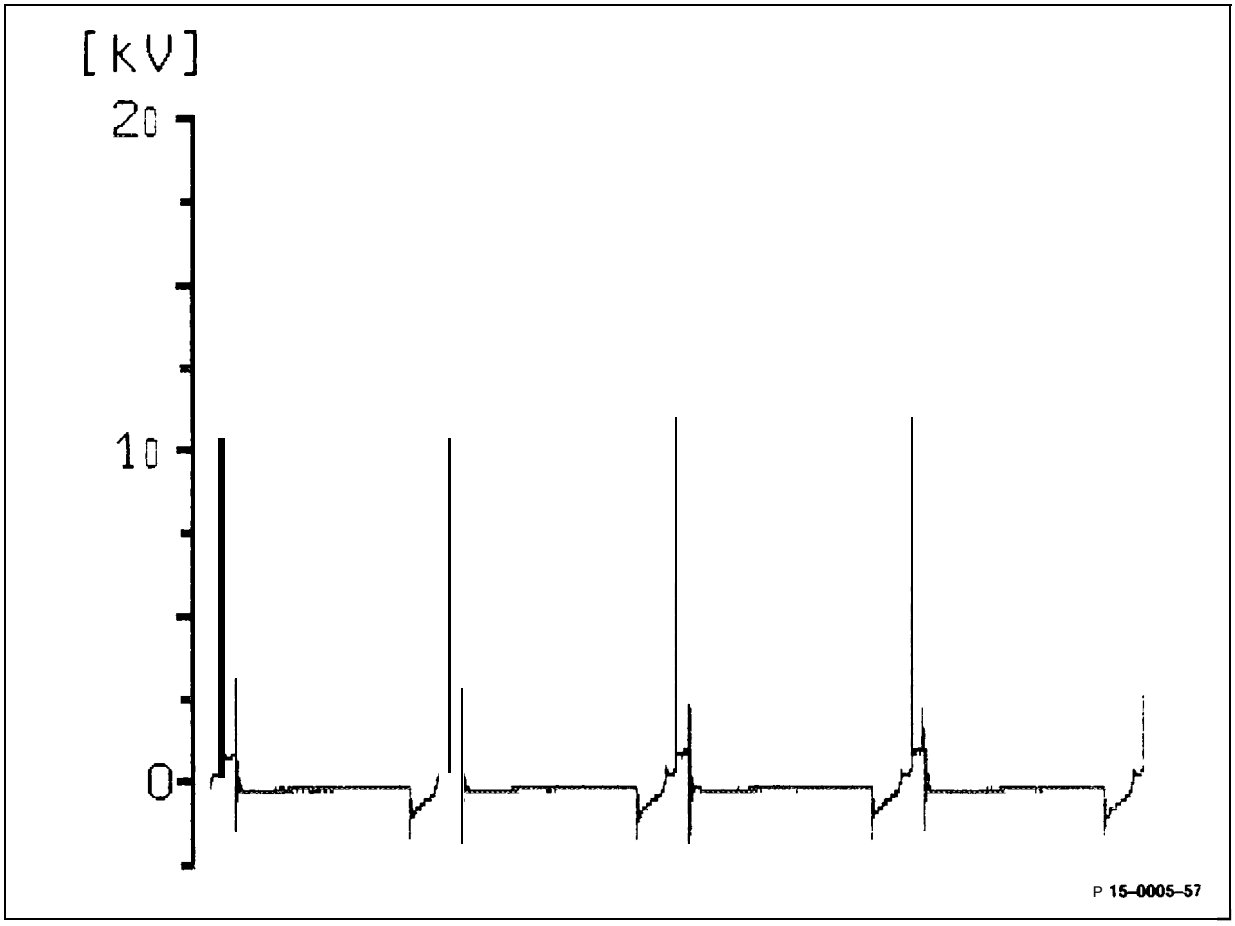
Note
Primary current limiter (7) is only operative up to approx. 2000/min.



1	Ignition voltage line	6	Decay process
2	Ignition voltage	7	Primary current limiting
3	Combustion period	6	Opening section
4	Combustion voltage	9	Closing section (dwell angle)
5	Combustion voltage line		

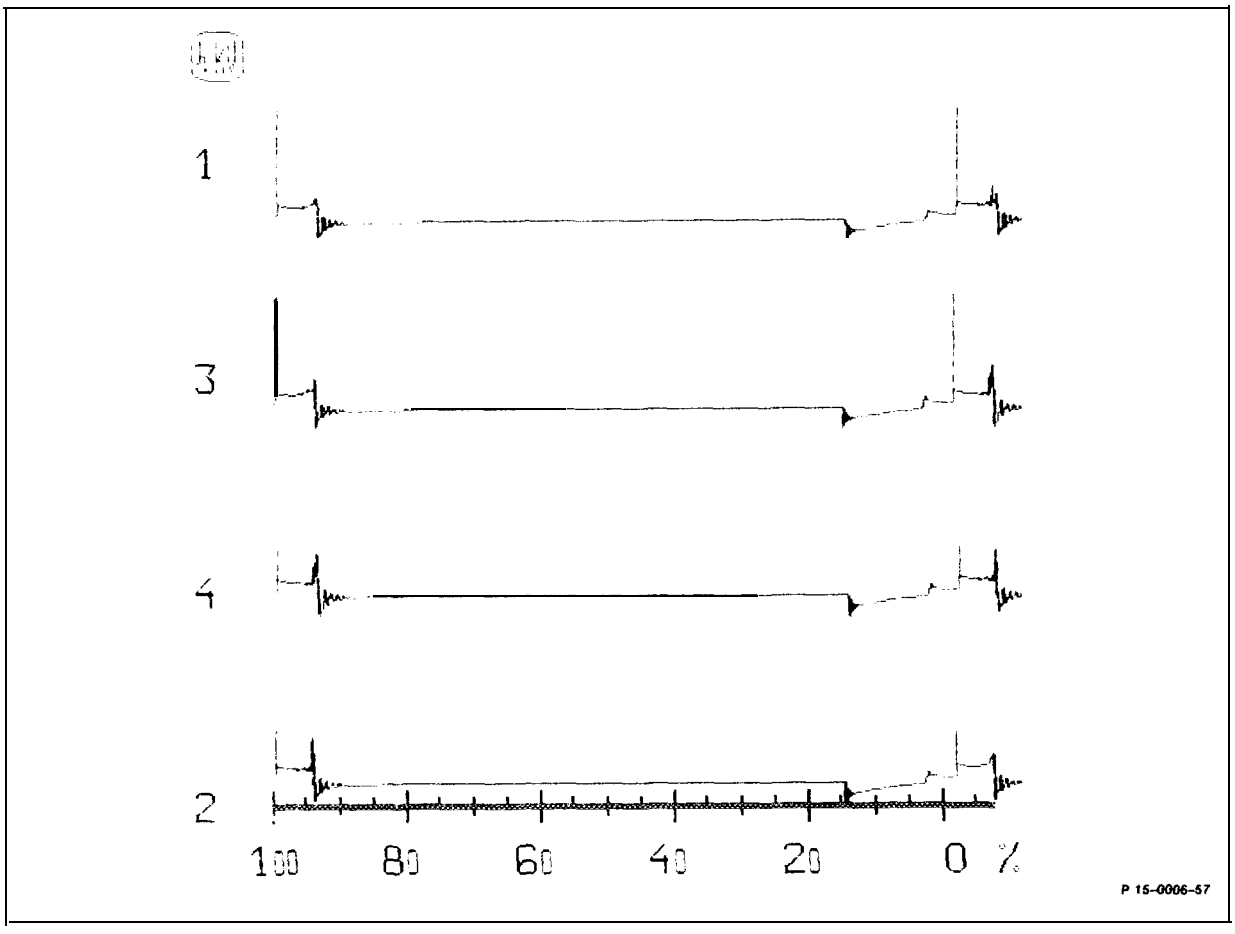
Good image

1. Secondary parade



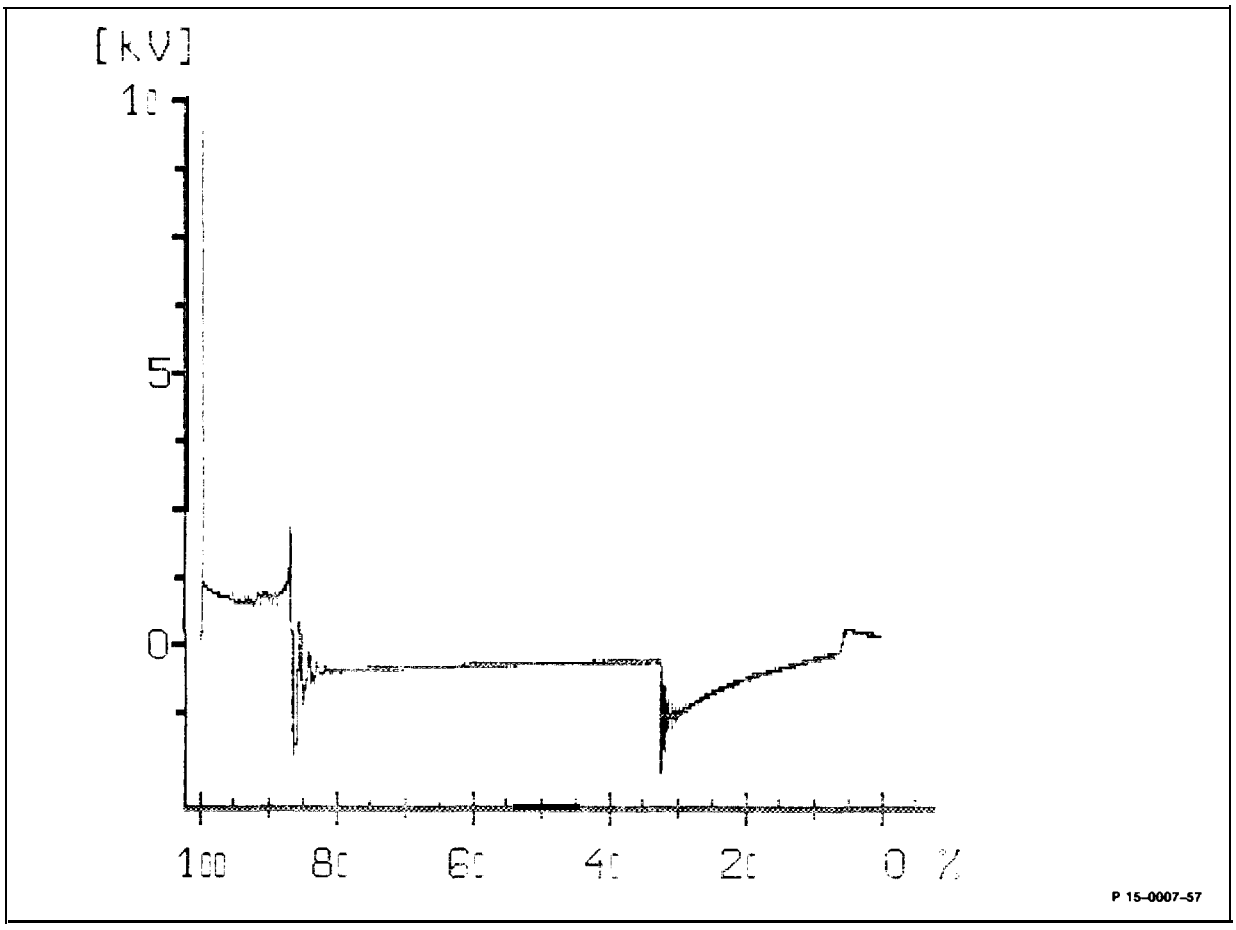
Good image

2. Secondary grid



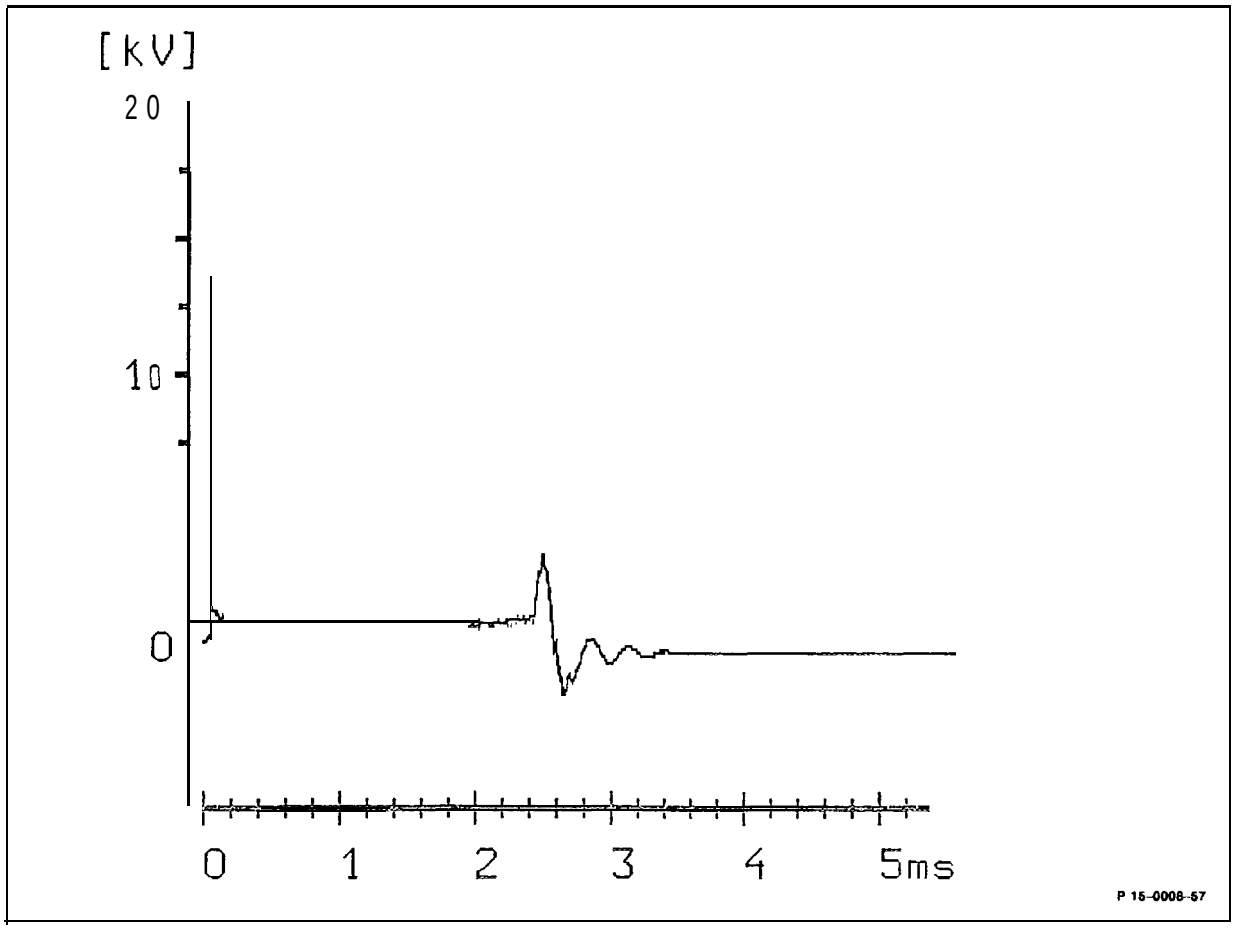
Good image

3. Secondary single image



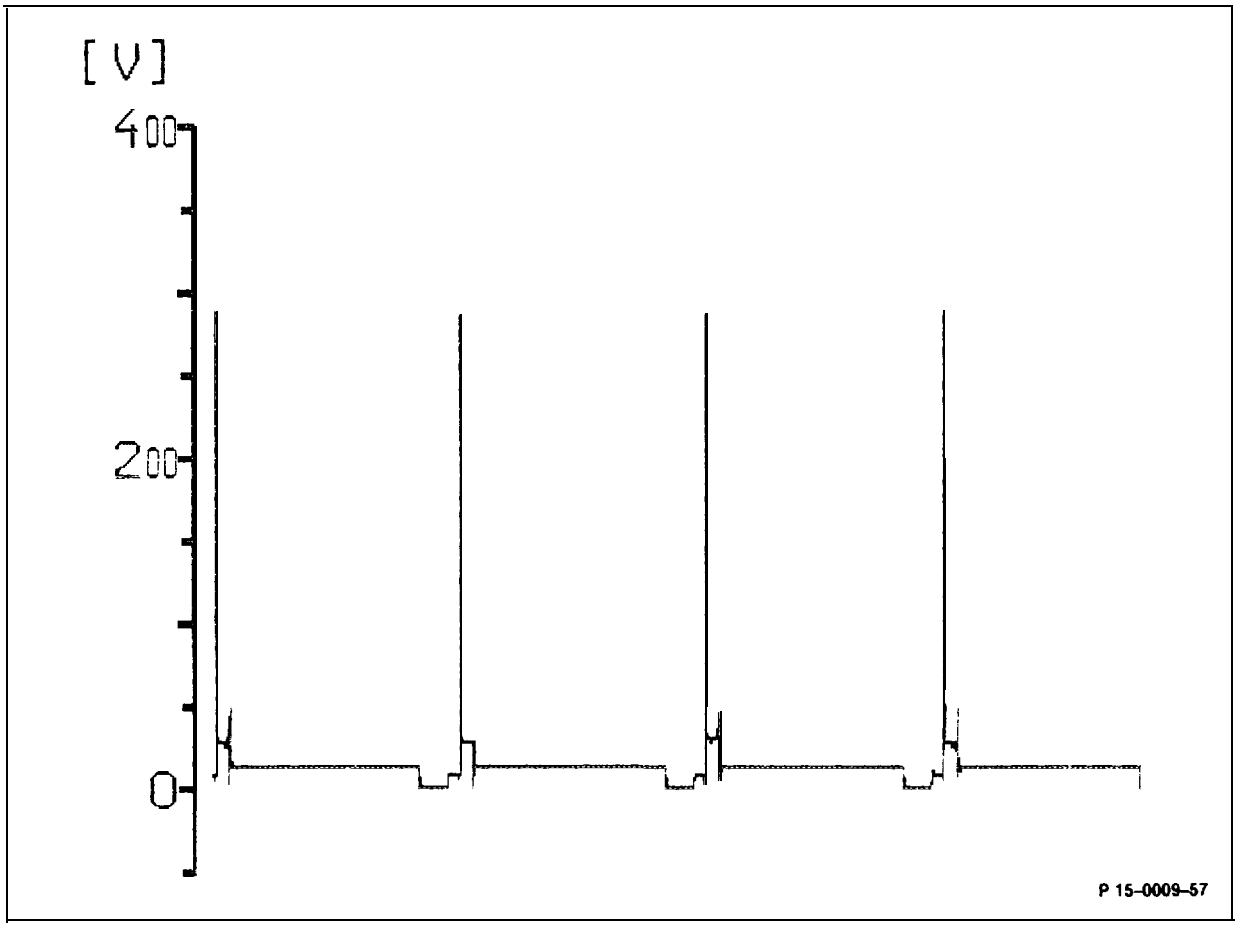
Good image

4. Secondary single image



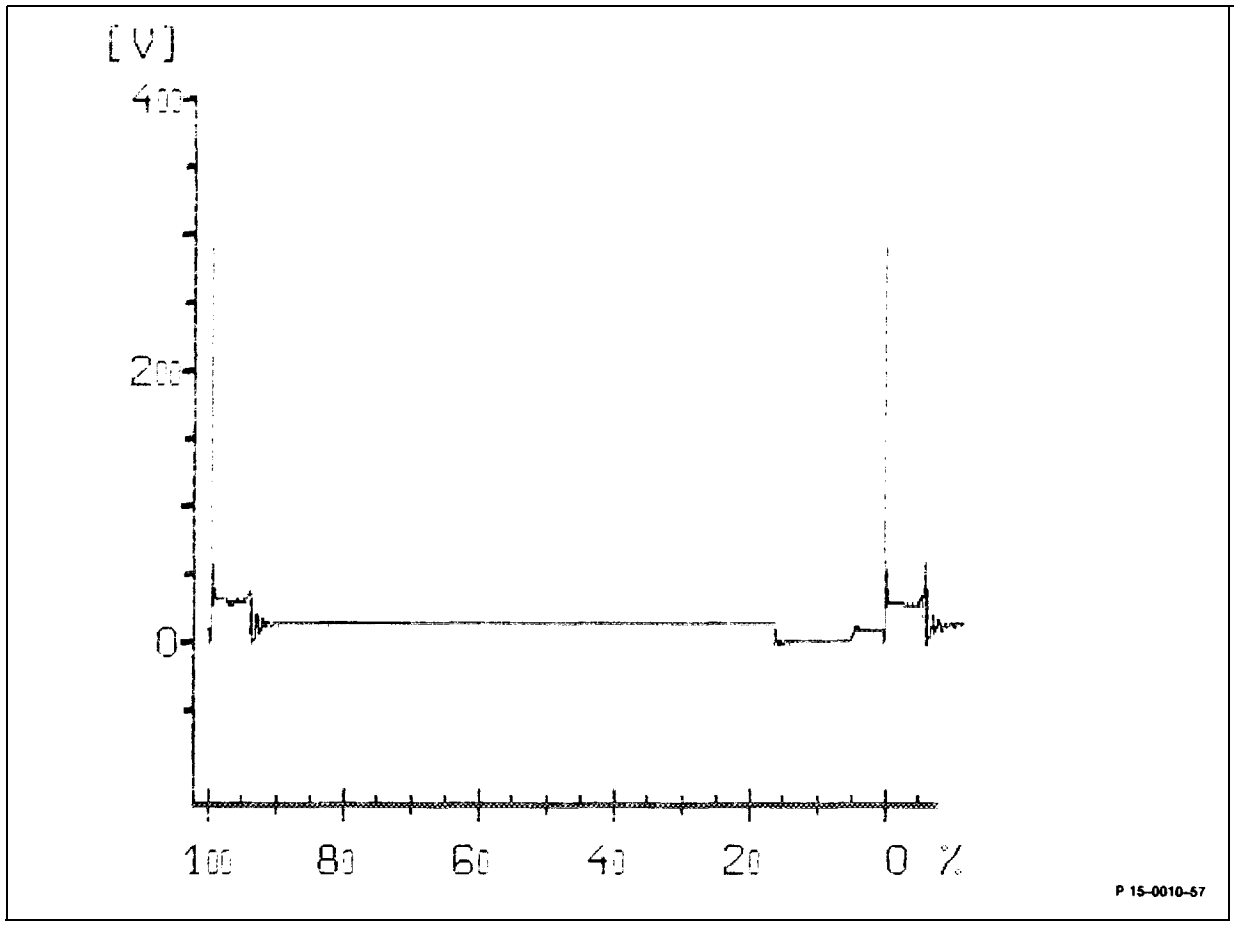
Good image

5. Primary parade



Good image

6. Primary single image



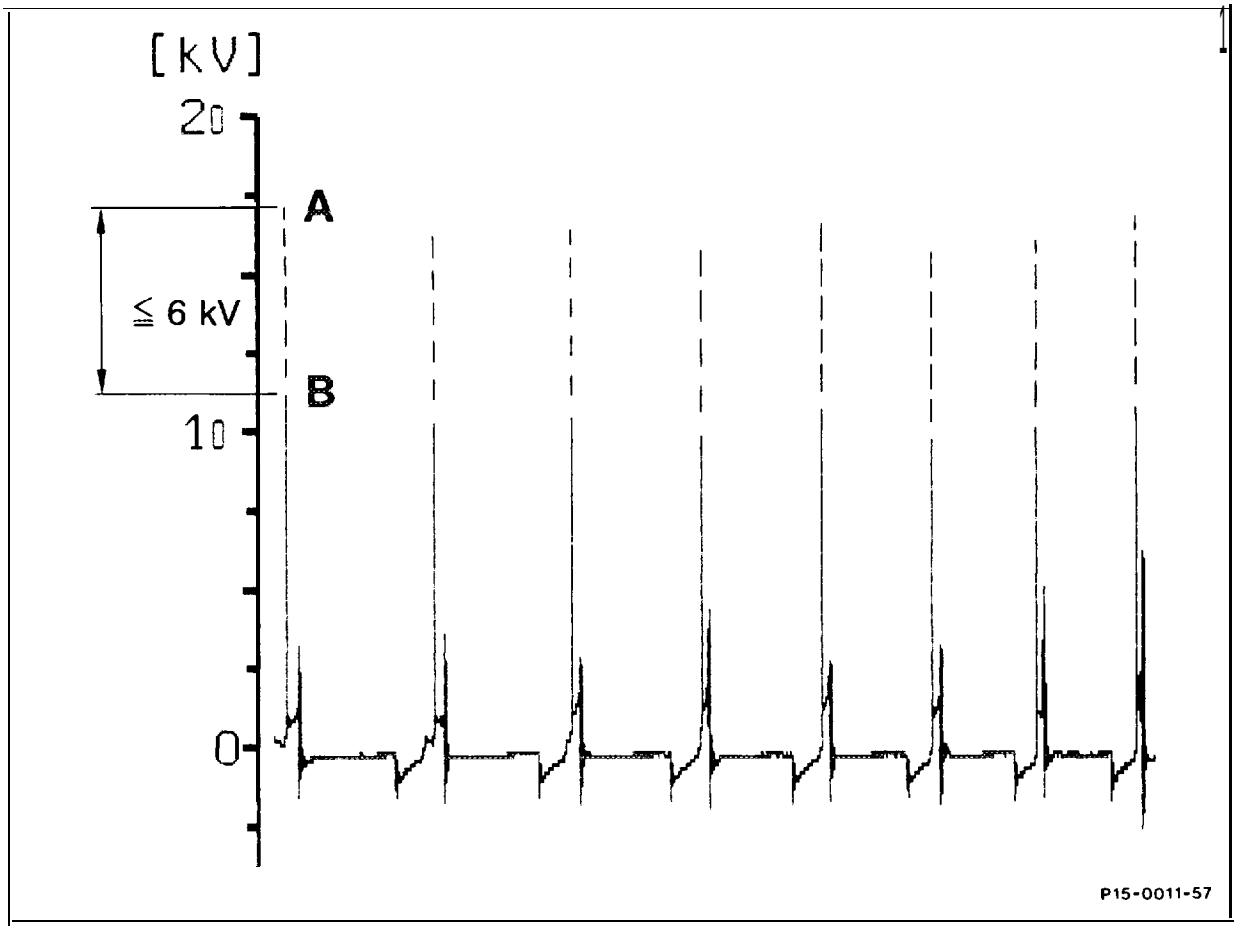
Good image

7. Blipping throttle

Test requirement: Repeatedly accelerate engine to approx. 3000/min by blipping throttle.

Note

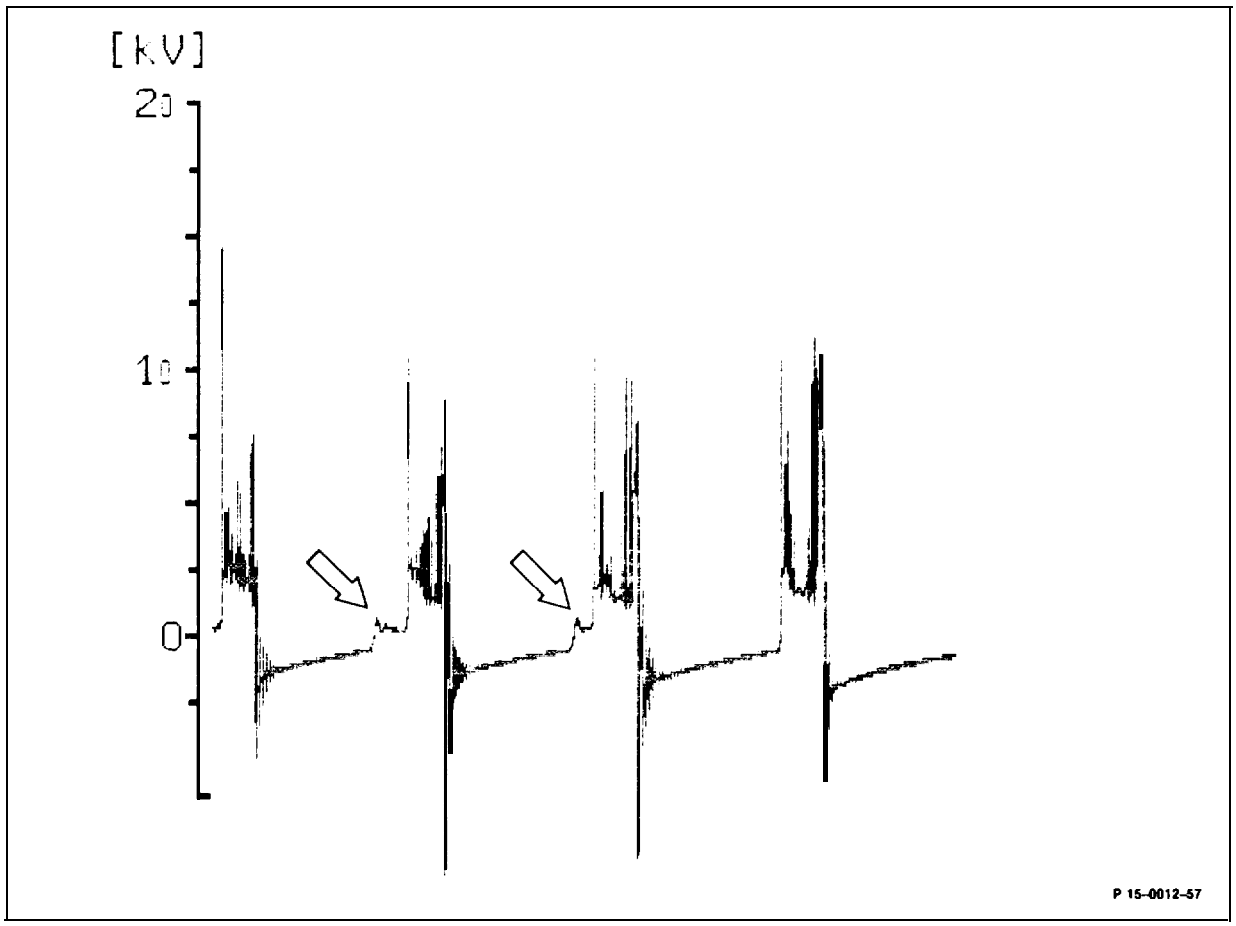
- As a result of the acceleration process, several cylinders are recorded in turn according to the firing sequence, e. g. image example (1 st 3rd 4th 2nd, 1 st 3rd 4th 2nd, etc.)
- The ignition voltage rises uniformly at all the cylinders during the acceleration phase. The ignition voltage rise must not exceed 6 kV.



Good image

8. Primary current limitation

Note
Primary current limitation may occur intermittently at individual or at all cylinders at engine speeds above 2000/min with and without load.

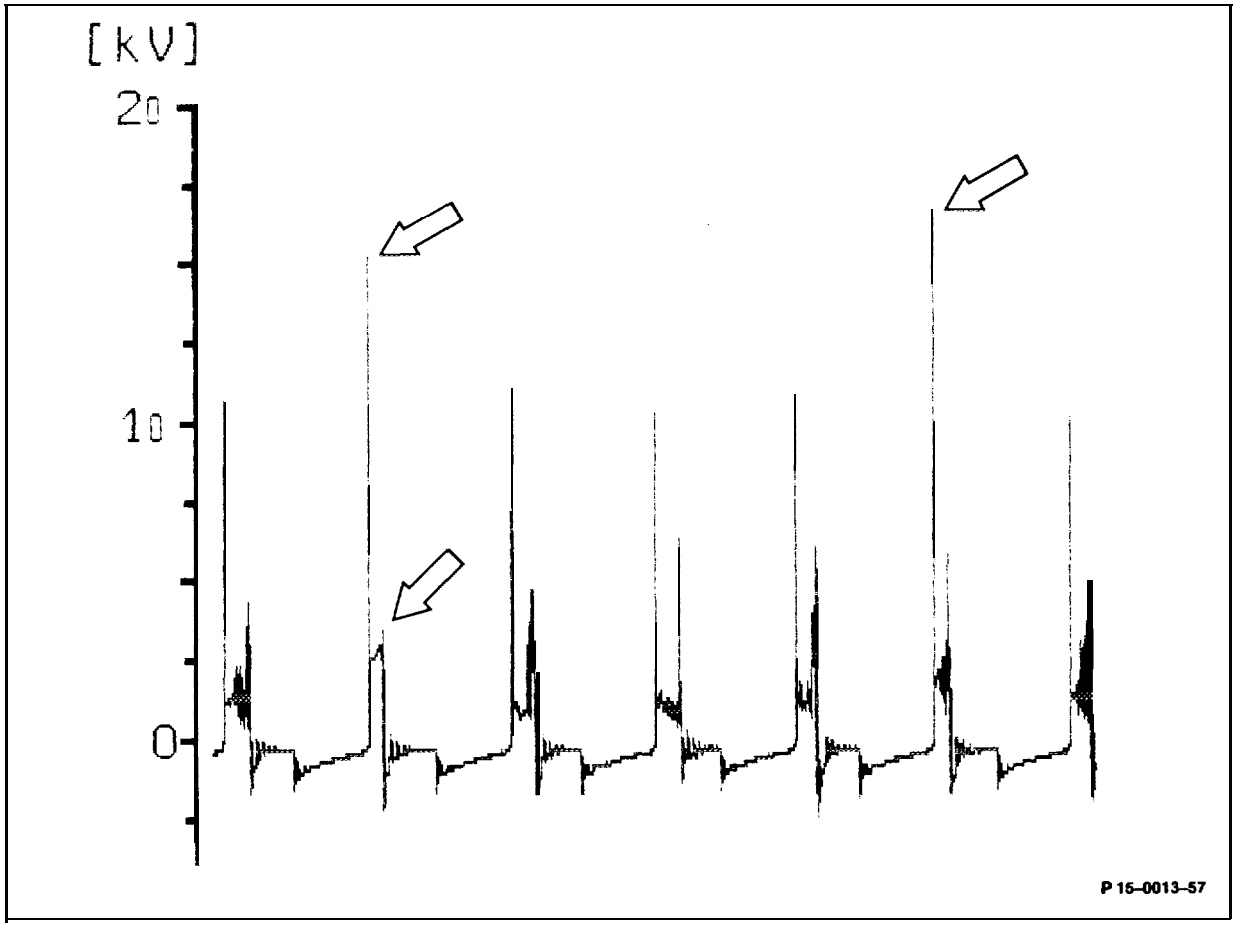


Fault image

9. Ignition voltage too high/combustion period shorter.

Test requirement: May occur at any engine speed with or without load.

Cause
Spark plug electrode gap too large; additional spark gap at secondary side; fuel/air mixture too lean.

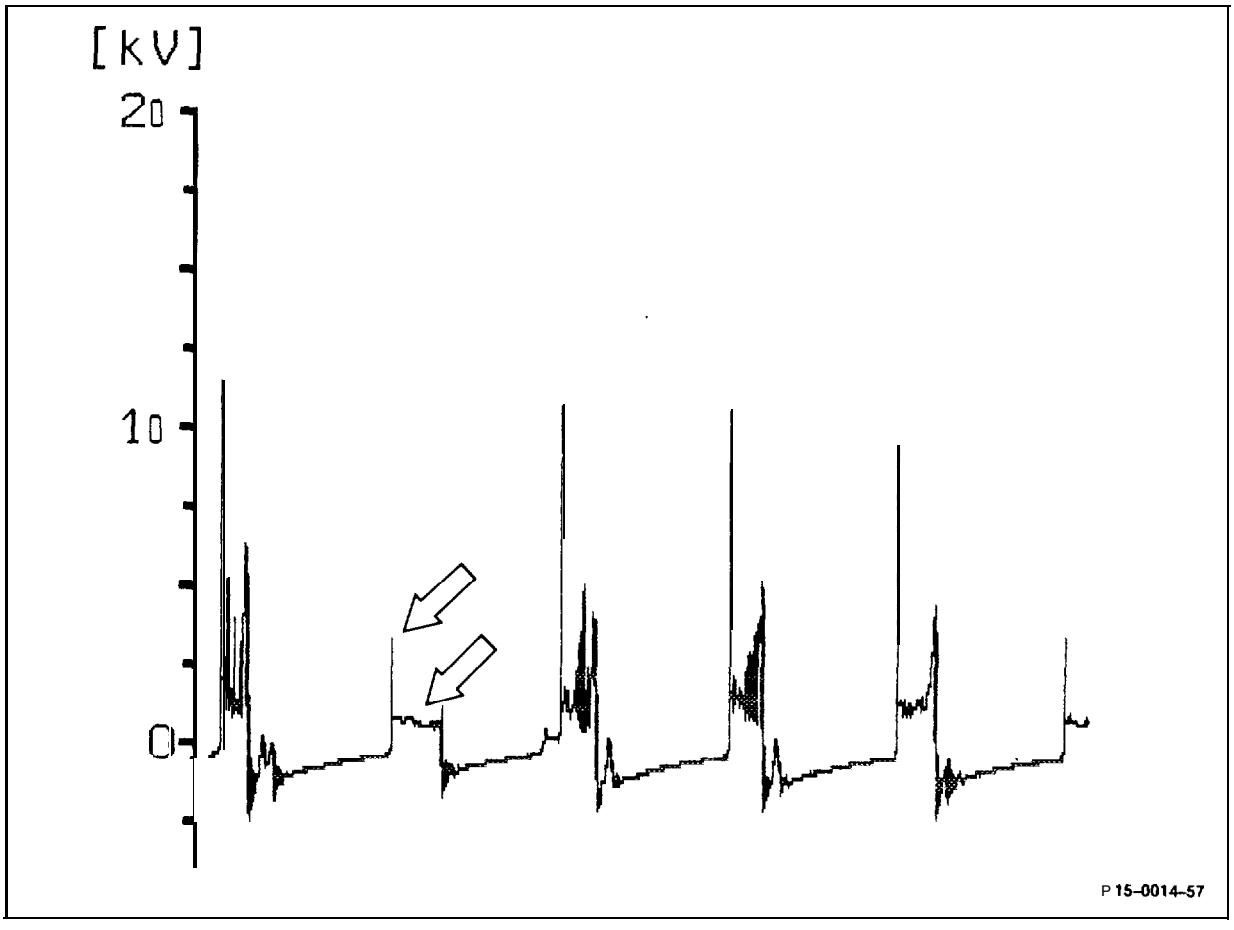


Fault image

10. Ignition voltage too low/combustion period longer.

Test requirement: May occur **at** any engine speed with or without load.

Cause
Spark plug electrode gap too small;
fuel/air mixture too lean;
compression loss.



Fault image

11. Decay process too high

Test requirement: Accelerate engine repeatedly to approx. 3000/min by blipping throttle or run engine under load on roller dynamometer.

Cause

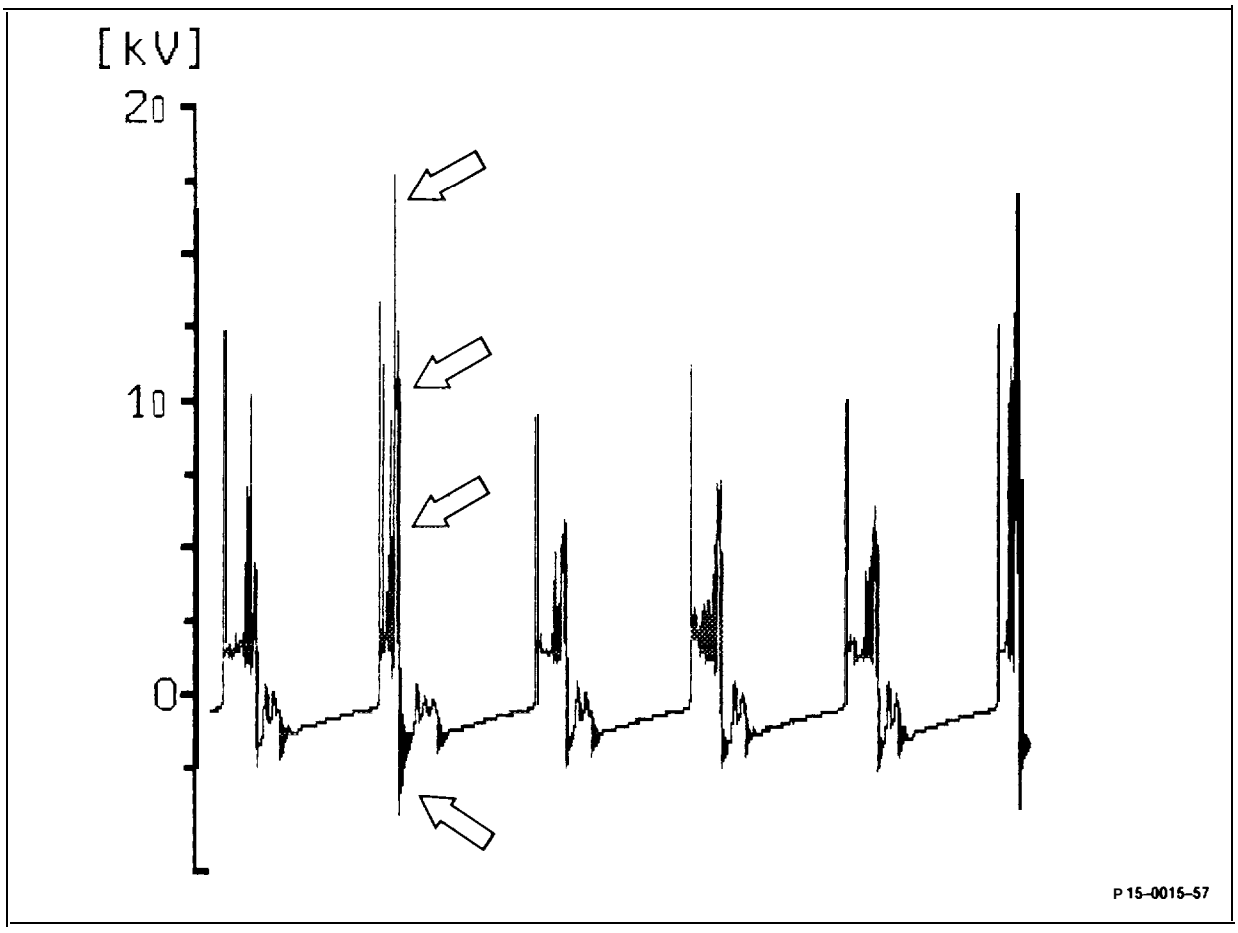
Fuel/air mixture at one cylinder too lean.

Note

If engine running is rough (does not run on all cylinders) after start, the engine should be switched off at operating temperature and restarted after a lengthy period (approx. 30 minutes) to obtain a better diagnosis.
It is essential to pay attention to test requirement when repeating the starting operation.

⚠Warning!

Problem may only occur briefly.



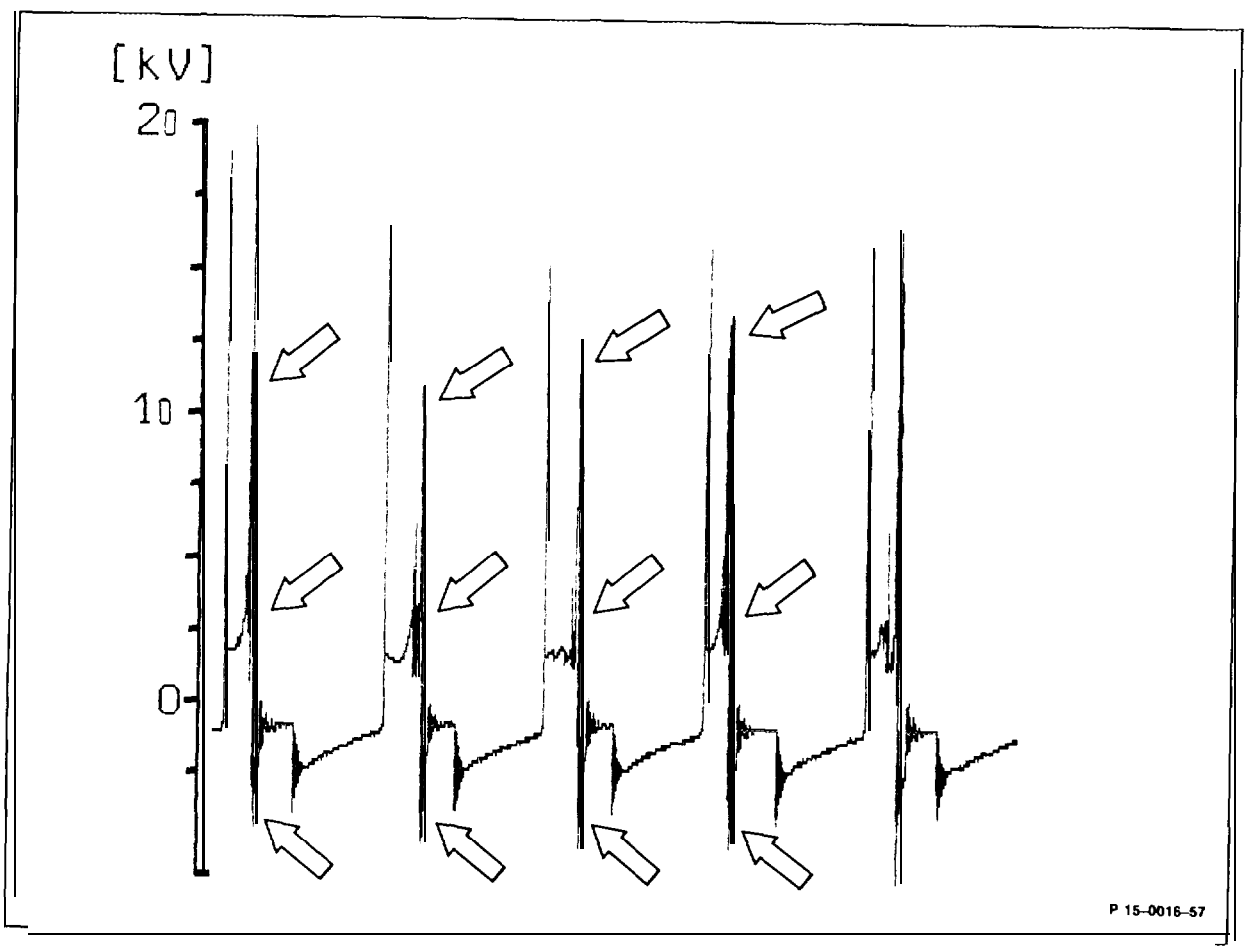
Fault image

12. Decay processes too high.

Test requirement: Accelerate engine repeatedly to approx. 3000/min by blipping throttle or run engine under load on roller dynamometer.

Cause

Fuel/air mixture on all cylinders too lean.



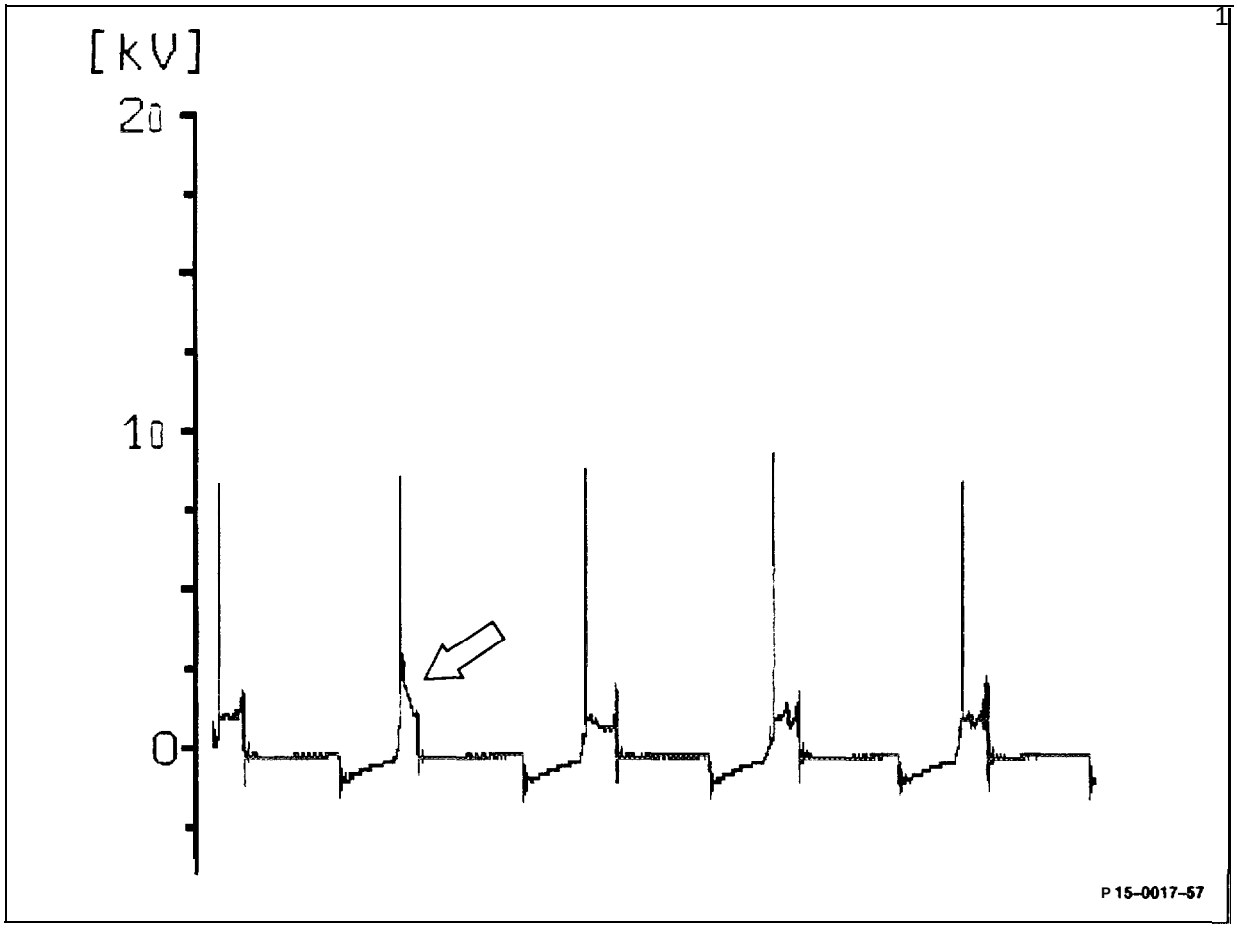
Fault image

13. Higher combustion voltage > 1.5 kV at single cylinder.

Test requirement: May occur at any engine speed with or without load.

Cause

Soot, oil, lead deposits on spark plug.
Too high ohmic resistance at secondary side.

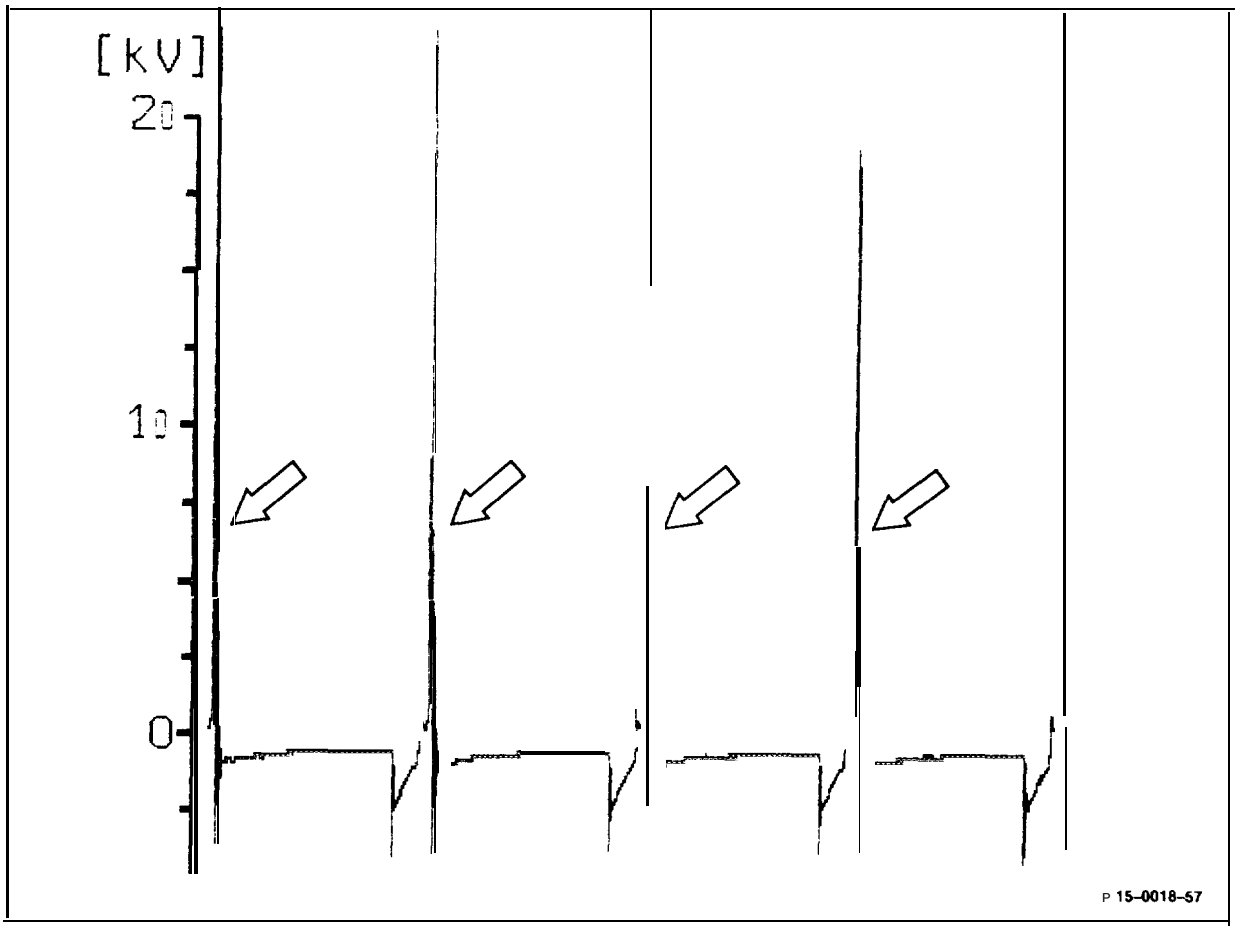


Fault image

14. Higher combustion voltage **>** 1.5 **kV** at all cylinders.

Test requirement: May occur at any engine speed with or without load.

Cause
Too high ohmic resistance at secondary side.



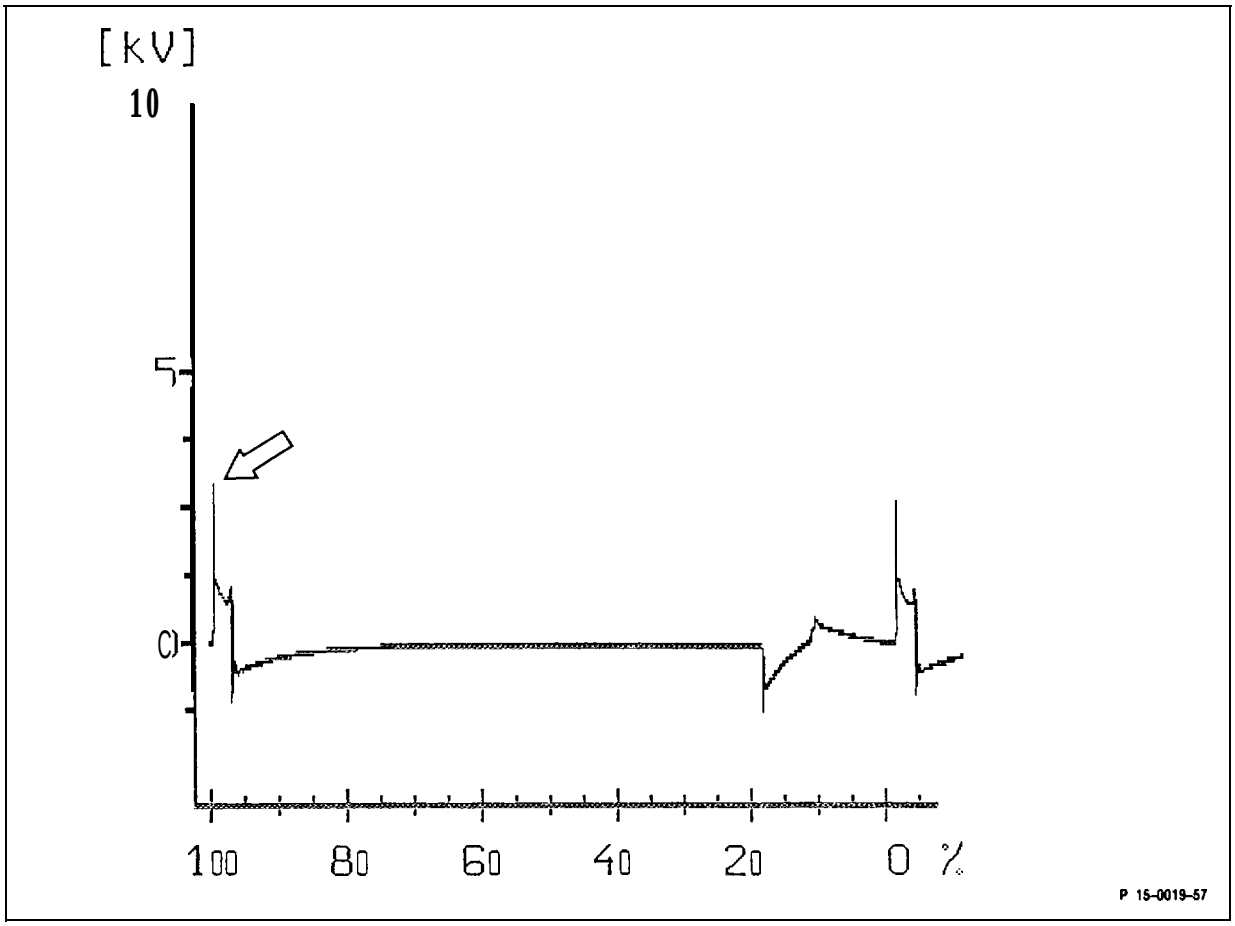
Fault image

15. Ignition voltage **< 8** kV at terminal **4**

Test requirement: Starting speed.

Cause
Ignition coil

Note
Engine does not start



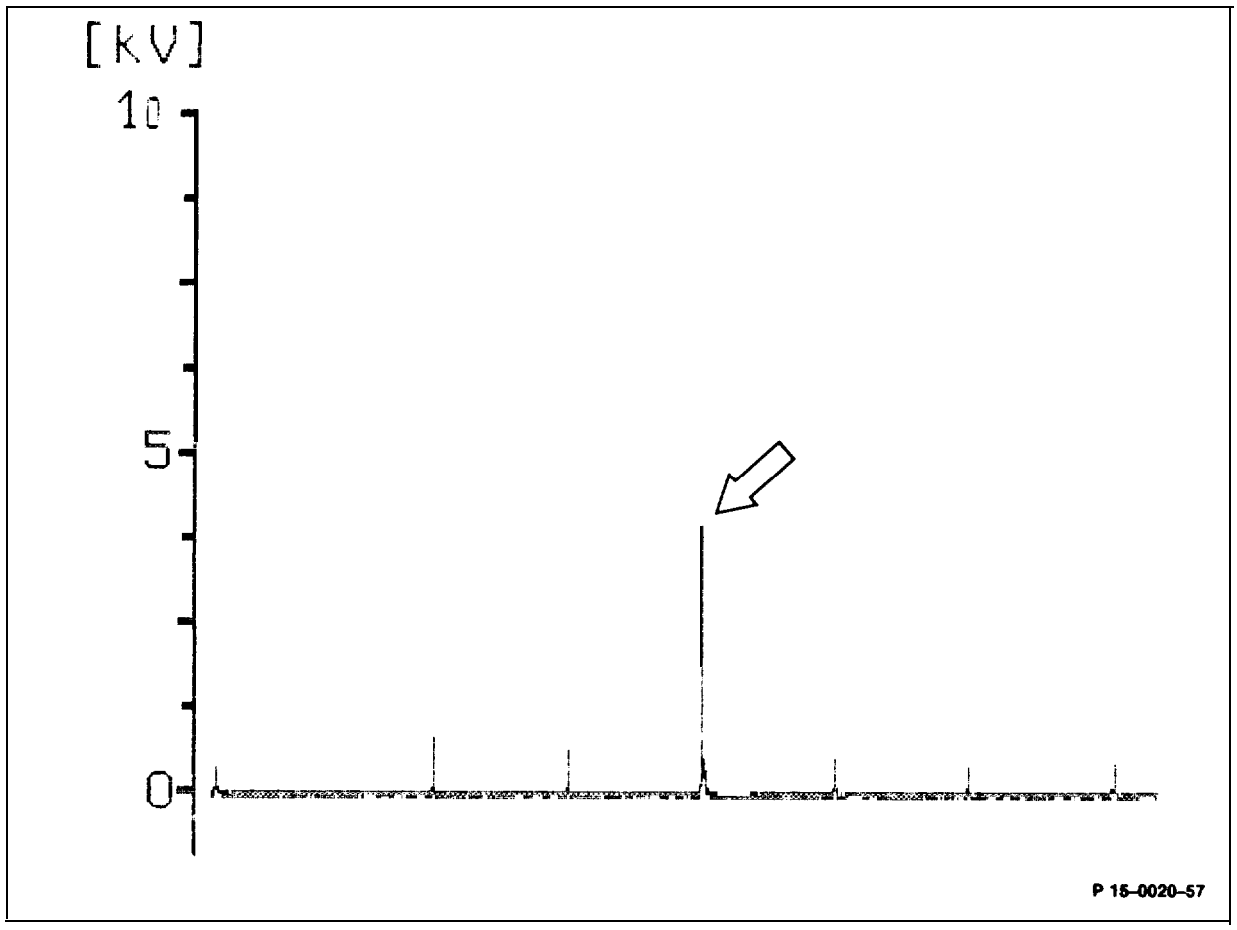
Fault image

16. Ignition voltage **< 6 kV** at single cylinder

Test requirement: Starting speed

Cause
Ignition coil

Note
Engine does not start



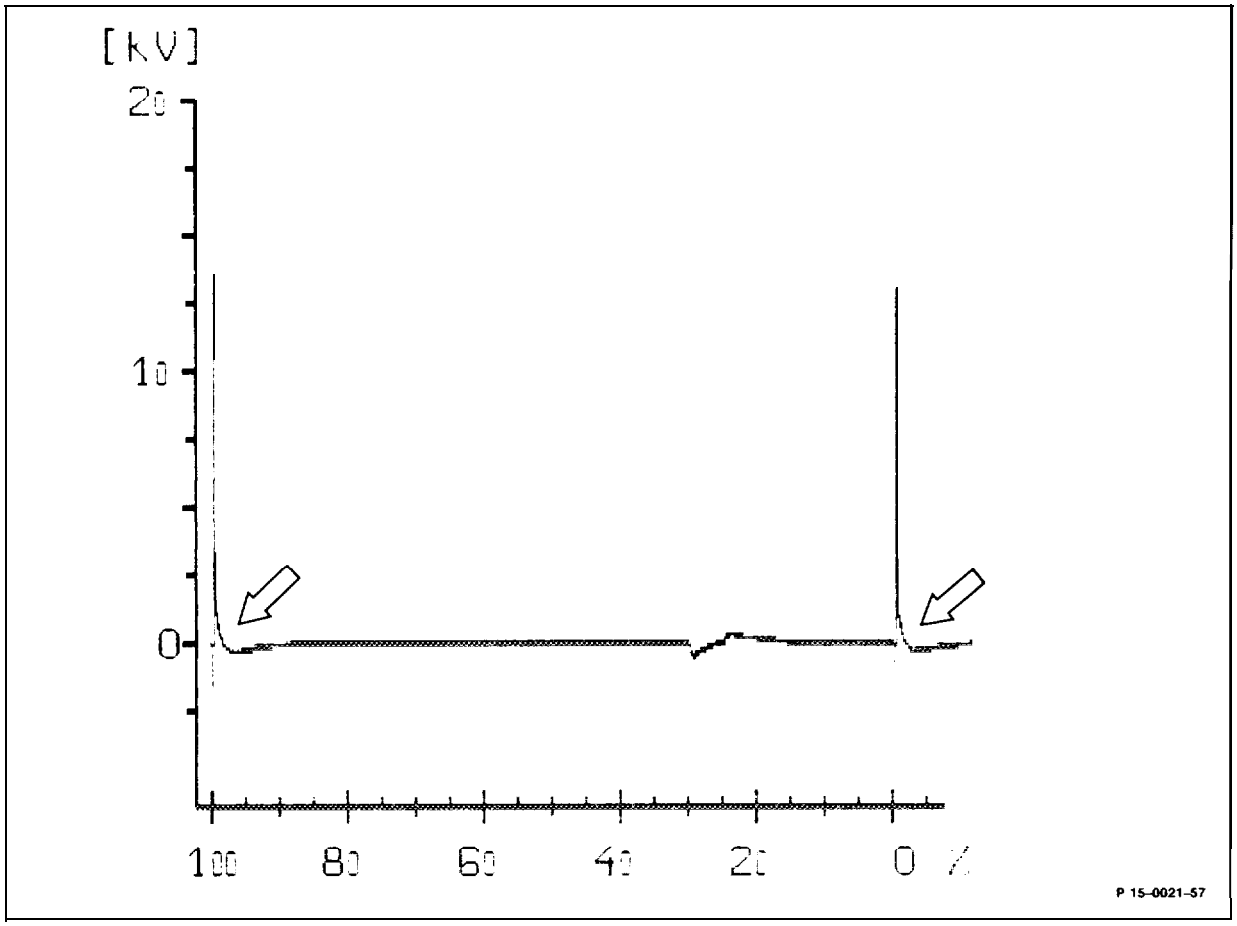
Fault image

17. **No** decay process

Test requirement: Starting speed

Cause
Ignition coil or ignition control module.

Note
Engine does not start

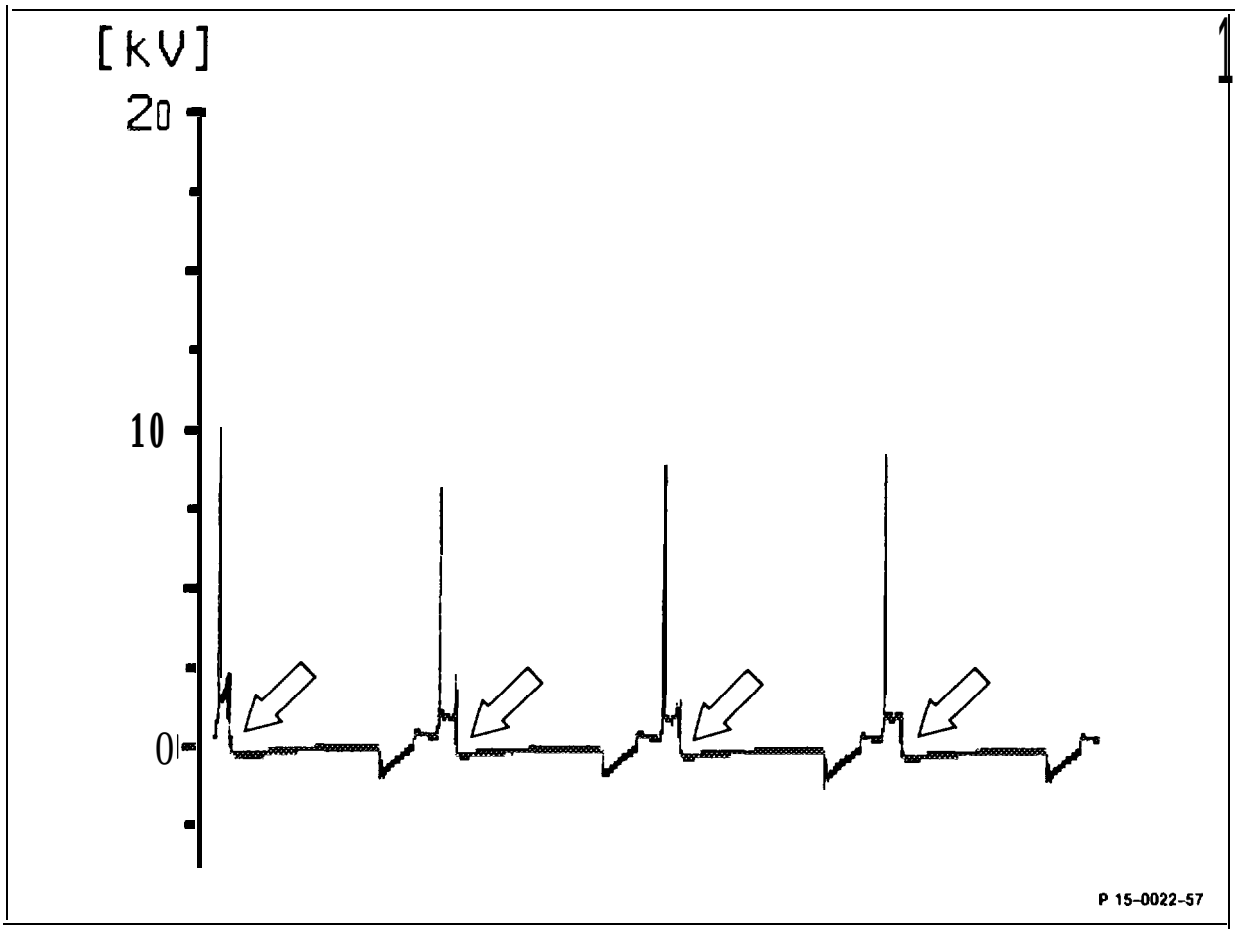


Fault image

18. Too few decay processes

Test requirement: May occur at any engine speed with or without load.

Cause
Ignition coil or ignition control unit

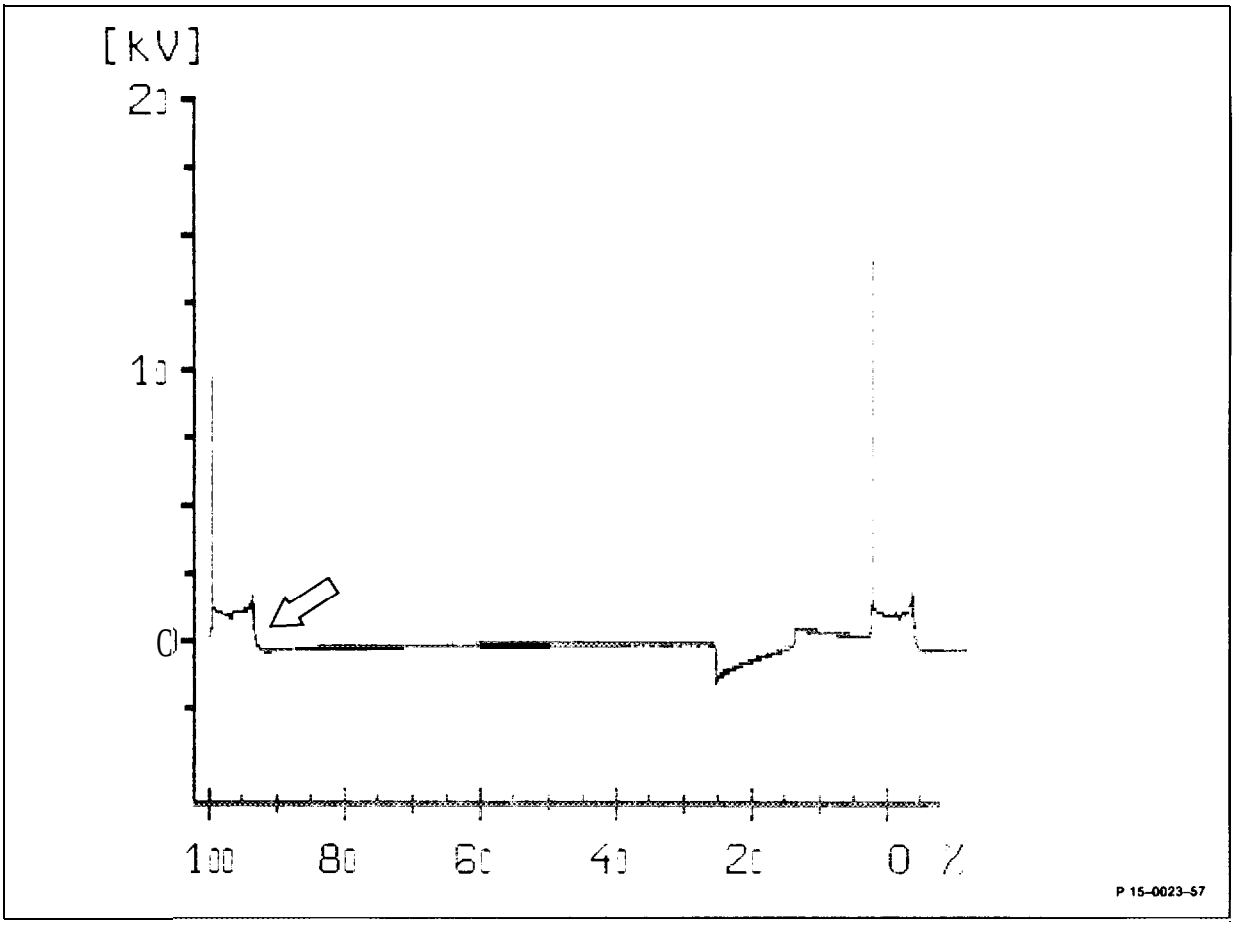


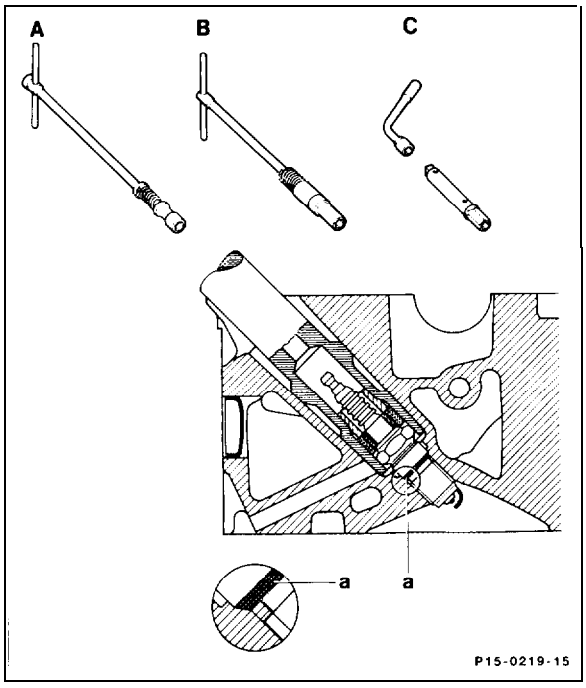
Fault image

19. Too few decay processes.

Test requirement: May occur at any engine speed with or without load.

Cause
Ignition coil or ignition control module.





Spark plug connector ..... loosen by turning to left and right and pull off. Blow out recesses with compressed air.

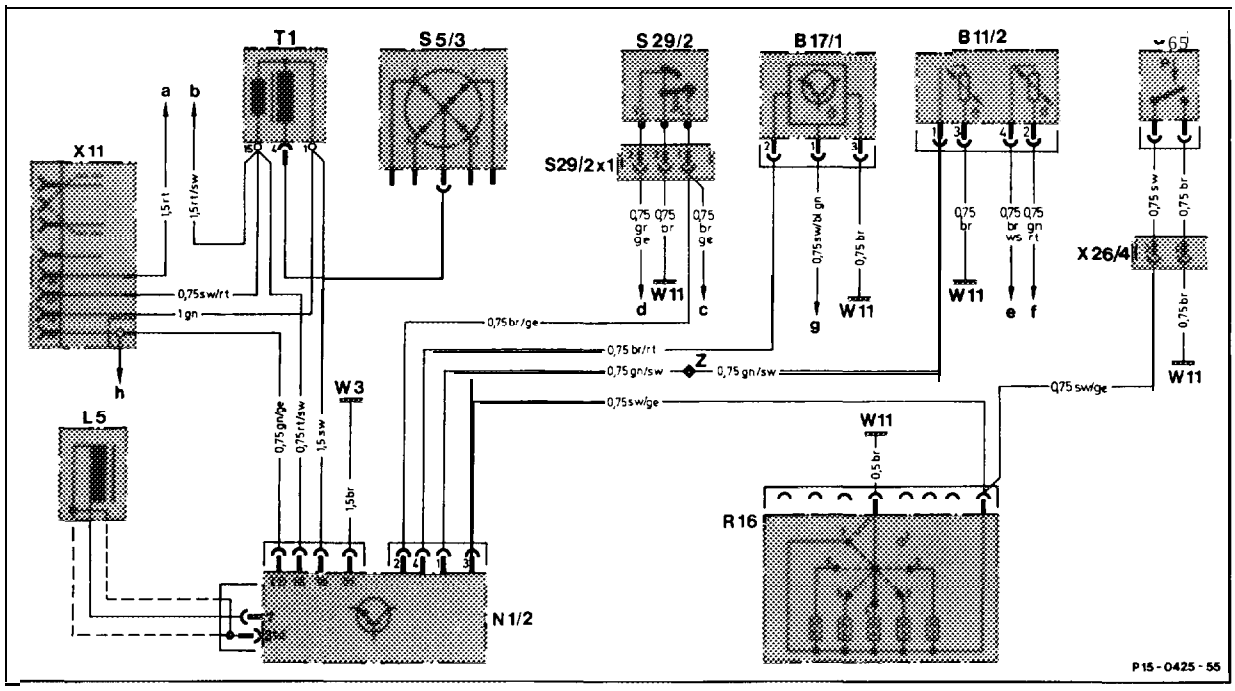
Ignition cables ..... clean, when installing, ensure the ignition cables are correctly laid.
Firing sequence: l-4-3-2

Spark plugs ..... remove, install, use only approved spark plug wrench (with Nm limiter "B").
A 102589020900
B 16258901 0900
C Vehicle tool

Installation note
Install only approved spark plugs with tapered seat (a).
Tightening torque 20 Nm.

1 s-535 Removal and installation of ignition or high voltage distributor

Preceding work:



Distributor cap	unscrew, screw on.
With TSZ, vacuum line and sensor cable (2)	detach at distributor, fit on.
Engine	set to ignition TDC of No. 1 cylinder by aligning markings on distributor rotor (3) and distributor housing (1). In addition, the pointer (8) on timing case cover must be above the TDC mark of vibration damper (arrow).
	Caution! Crank engine only in direction of rotation.
Distributor mounting (5)	loosen. Remove distributor.

Installation	set engine to ignition TDC by aligning the pointer (8) on timing case cover exactly to TDC mark of vibration damper.
Sealing disc and distributor rotor (3)	install at distributor. Align distributor rotor to marking on housing. Insert distributor. With EZL ignition system, align screw in middle of oblong hole (pay attention to note). With TSZ ignition system, set ignition point (15-515).
Screw (5)	tighten.
Ignition cables	Install. Firing sequence l-4-3-2

Note

It is not possible to set the ignition point on the EZL ignition system by turning the high voltage distributor. The ignition point is determined by the Ignition control module. Test distributor ignition system, if necessary (15-540).

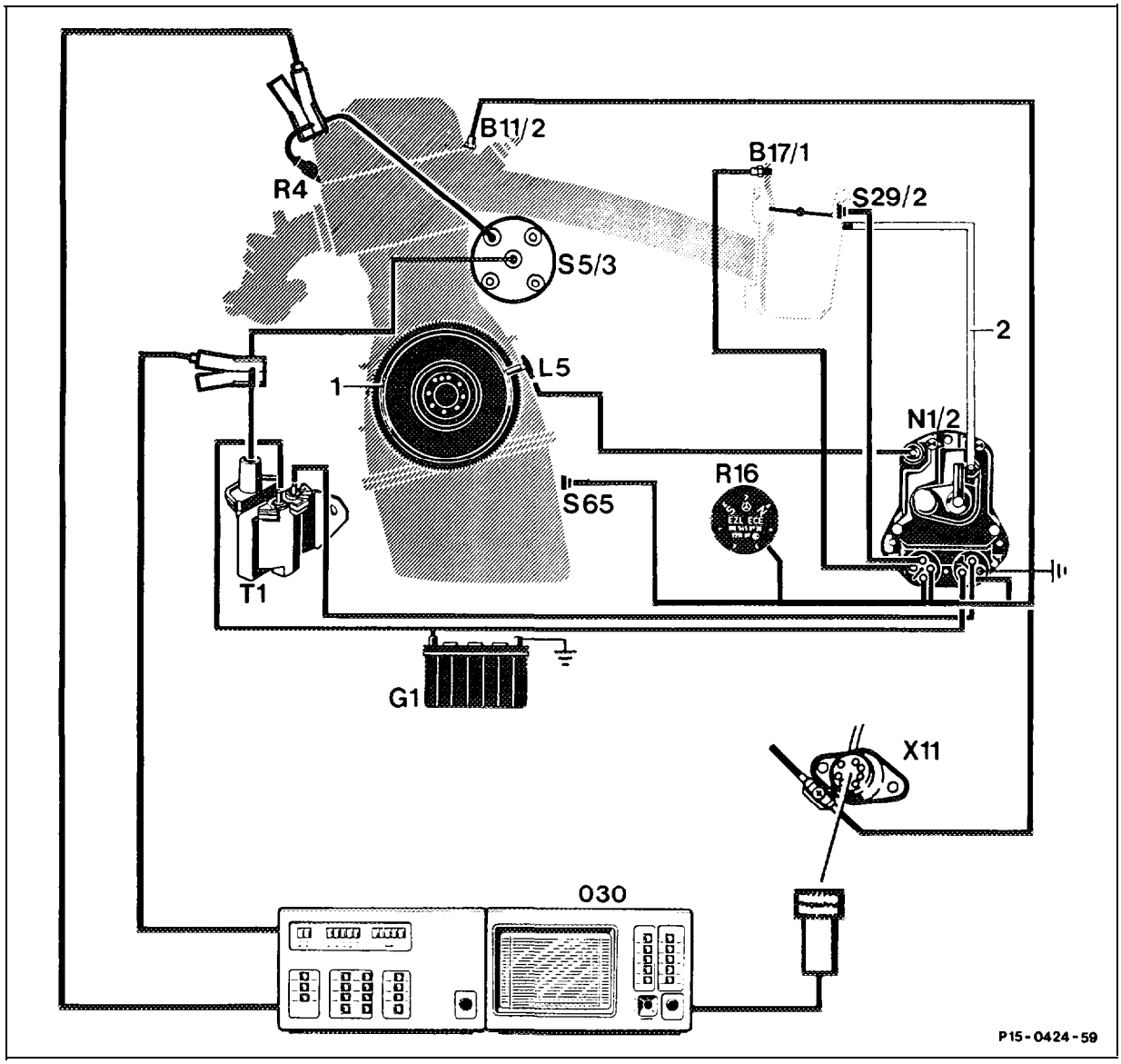
If the engine has been cranked with the distributor removed, set ignition TDC of No. 1 cylinder (05-215).

Preceding work:
Testing, adjusting engine (07.3-1 10)

Precondition for test

Spark plugs, Ignition cables, distributor rotor and distributor cap in proper mechanical and electrical order.

Test e. g. by visual inspection, measuring resistance and ignition oscilloscope.



Connection diagram for engine tester with oscilloscope

B11/2	Engine coolant temperature sensor	N1/2	Ignition control module
B17/1	Intake air temperature sensor	R4	Spark plugs
G1	Battery	R16	Reference resistor
L5	Crankshaft position sensor		

S5/3	High voltage distributor	1	Segments on flywheel/driver disc
S29/2	Wide open throttle/closed throttle position switch	2	Vacuum line
T1	Ignition coil	030	Engine tester with oscilloscope
x11	Diagnostic connector/terminal block terminal TD		

Note

Pay attention to the safety precautions (15-505) when performing work on the ignition system. Switch off ignition when unplugging and connecting the connectors at the Ignition control module.

The test is split up into two sections:

A. Engine not running

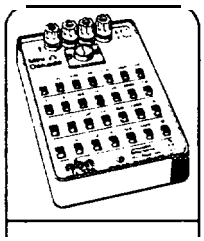
The basic functions of the ignition system are tested in this section.

B. Engine running

Fault sources in the ignition advance or at the appropriate components may affect the handling of the vehicle.

If a complaint is received regarding the handling of the vehicle, first of all test the ignition system. Then, continue troubleshooting at the CFI system.

Special tools



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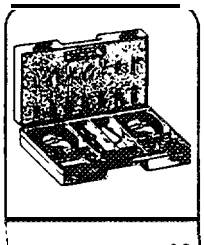


201 589 00 99 00

Commercially available testers

Multimeter	e. g. Sun, DMM-5 Fluke, Multimeter 23 Hermann, Avometer 2003
Engine tester	e. g. Hermann, Datascope 9800 Bosch, MOT 301/400 Sun, 2110 BEAR, D AC E

Test data

Resistances (test data from O-100" C)

Ignition coil	primary (terminals 1 and 15)	Ω	0.3–0.6
Ignition coil	secondary (terminals 1 and 4)	kΩ	8–13
Position sensor	coil resistance (terminals 7 and 31d) insulation (terminal 7 and ground)	 Ω kΩ	 660-l 200 ≥ 200
Distributor cap per terminal, distributor rotor, spark plug connector		Ω	700-l 300

Voltages, engine not running, ignition switched on

Terminals 15 and 31 (contacts 5 and 2 diagnostic connector)		Battery voltage
Between terminals 1.5 and 1 (contacts 5 and 4 diagnosis socket)	V	0
4-pin round connector terminals 15 and 31	V	Battery voltage
4-pin round connector terminals 16 and 31	V	Battery voltage

Dwell angle

At starter speed	9–49° or 10–54%
At 3200/min	27–54° or 30–60%

Ignition point at starter speed	in ° CKA	TDC ± 2°

Test ignition points with engine running (15-515).

A. Engine not running

Note

If the specified value of a test step, e. g. test step 1 .0, is in order, continue immediately with test step 2.0.

If the specified value of step 1.0 is not in order, it is then necessary to continue with step 1 .1.

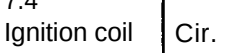
key to symbols:

- Multimeter direct voltage mode
- Multimeter resistance mode
- Oscilloscope
- c Contact
- Connector
- Ground

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	1.0 Voltage supply	N1/2 31 — 15	Ignition: ON	Battery voltage	Test wiring and contacts according to wiring diagram (from battery via ignition lock to Ignition control module).
	2.0 Crankshaft position sensor L5	L5 31d — 7	Ignition: **OFF** Detach crankshaft position sensor connector at Ignition control module.	680– 1200 Ω	Replace crankshaft position sensor (L5).

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	2.1	L5 31d —(Ω)— 7'	Detach crankshaft position sensor connector at Ignition control module. Engine: **Start**	see diagram $U_S \geq 1$ V	Signal too small/no signal: replace position sensor. Different voltage height: test segments. Replace Ignition control module.
	2.2 Insulation of sensor coil	L5 —(Ω)— 7 ⊥	Detach crankshaft position sensor connector at Ignition control module.	≥200 kΩ	Replace crankshaft position sensor.
	3.0 Dwell angle	Engine tester	Engine: **Start**	9°–49° or 10–54%	Dwell angle not to tolerance: replace Ignition control module. No dwell angle: test stall current cutoff.
–	4.1 Stall current cutoff	T1 Cir. 1 —(V)— Cir.	Ignition: ON	0V	Replace Ignition control module and ignition coil.
			Engine: **Start**	0V >0V	Test wiring and contacts from Ignition control module to ignition coil or replace Ignition control module. Replace ignition coil.
–	4.2 Ignition coil primary T1	T1 Cir. 1 —(Ω)— Cir.	Ignition: OFF Unscrew wiring at ignition coil.	0.3–3.6 Ω	Replace ignition coil.

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	5.0 Primary current	Engine tester Scope image: primary parade	Engine: **Start**	> 200 v	Replace Ignition control module.
–	6.0 Primary current limiting	Engine tester Scope image: Secondary overlap	Engine: **Start**	see diagram	Replace Ignition control module.
–	7.0 Ignition voltage at terminal 4 ignition coil	Engine tester Scope image: Secondary parade	Engine: **Start**	≥ 8 kV	Test ignition cable terminal 4, distributor rotor, distributor cap and ignition coil.
–	7.1 Ignition cable terminal 4	T1 Cir. 4 – Ω + S5/3 Cir. 4	Ignition: **OFF** Detach ignition cable terminal 4 at ignition coil and distributor cap.	< 1 Ω	Replace ignition cable terminal 4.
–	7.2 Distributor rotor	Distributor rotor – Ω + Middle Peak	Ignition: OFF Remove distributor cap.	700-1300 Ω and visual inspection	Replace distributor rotor.
–	7.3 Distributor cap	S5/3 – Ω + Cir. 4 Carbon	Ignition: OFF Distributor cap removed and detach ignition cable terminal 4.	700-1300 Ω per terminal and visual inspection	Replace distributor cap.

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	7.4 Ignition coil secondary T1	T1 Cir. 4  Cir. 1	Ignition: OFF Unscrew cables at ignition coil.	3-13 kΩ	Replace ignition coil.
	8.0 Ignition voltage at single cylinder	Engine tester Scope image: Secondary parade High voltage clamp at cylinder ignition cable (e. g. cylinder 3)	Engine: **Start**	> 6 kV	Test distributor cap, distributor rotor, ignition cables with spark plugs.
–	8.1 Ignition cable with spark plug connector	Ignition cable — Spark plug connector	Ignition: OFF Detach ignition cable with spark plug connector at spark plug and distributor.	700–1300 Ω	Replace ignition cable with spark plug connector.
–	8.2 Spark plugs	Visual inspection	Ignition: OFF Remove spark plug.	Electrode gap 0.8 mm	Replace according to condition.

Test A completed.

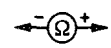
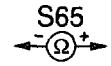
B. Engine running

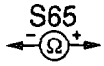
Pay attention to safety precautions (15-505).

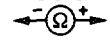
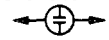
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	1.0 Ignition point	Engine tester	Engine: Test at normal operating temperature at specified speeds and with/without vacuum.	see table (15-515)	Reference resistor, coolant temperature sensor, WOT/CTP switch, vacuum advance, transmission overload protection (102.983199).
–	1.1 Reference resistor (R16)	N1/2 ⊥ Ω + 3 Sensor connector 4-pin	Ignition: **OFF** Detach sensor connector at Ignition control module. Pay attention to assignment engine/ reference resistor.	depending on reference resistor setting, see table	Reference resistor, cables, contacts.
–	1.1.1 Reference resistor (R16)	R16 Ω Middle A Z	Ignition: **OFF** Detach reference resistor.	see table	Reference resistor
–	1.1.2 Cables and contacts	R16 Ω N1/2 3 Sensor connector 4-pin	Ignition: **OFF** Detach reference resistor. Detach sensor connector at Ignition control module.	> 1 Ω	Replace cables or contacts.
		R16 ⊥ Ω +		> 1 Ω	Test negative cable to W1 1 or W10, replace.

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	1.2 Engine coolant temperature sensor (B1 li2)	N1/2 ⊥ Ω 1 Sensor connector 4-pin	Ignition: **OFF** Detach sensor connector at Ignition control module	at 80 °C 290-360 Ω further values, see diagram	Coolant temperature sensor (B11/2) Cables, contacts.
–	1.2.1 Engine coolant temperature sensor (B1112)	B11/2 (2-pin) ⊥ Ω Green/black cable	Ignition: **OFF** Detach sensor connector at Ignition control module		Replace coolant temperature sensor (B11/2) (07.3-251).
		B11/2 (4-pin) Ω		measure 2 x diagonally	Replace coolant temperature sensor (B11/2) (07.3-251).
–	1.2.2 Cables and contacts	B11/2 Green/black cable Ω N1/2 1 Sensor connector 4-pin	Ignition: **OFF** Detach connector at temperature sensor and sensor connector at Ignition control module.	< 1 Ω see note	Replace cables or contacts.
–	1.3 WOTCTP switch closed throttle position detection	S29/2x 2 Ω 1	Ignition: **OFF** Detach connector (S29/2x).	Idle position: < 1Ω Other positions: ∞	Set or replace WOT/CTP switch. Open circuit.

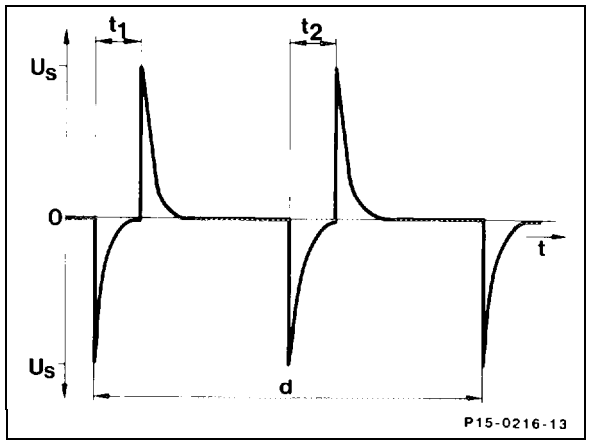
Onioff ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	1.3.1 Cables and contacts	N1/2 — N3 2 — Ω — 13 Sensor connector 4-pin	Ignition: OFF Detach sensor connector at Ignition control module and CFI control module.	< 1Ω	Replace cable or contact.
–	1.4 Vacuum advance	Engine tester	Engine: normal operating temperature, speed 1500/min. Detach vacuum hose at Ignition control module. Connect vacuum hose at Ignition control module.	Ignition point retarded Ignition point advanced	Vacuum hose leaking. Connection at intake manifold blocCFId. Pressure sensor in Ignition control module faulty.
–	1.5	L5 31d — ⏚ — 7	Detach crankshaft position sensor connector at Ignition control module. Engine: **Start**	see diagram $U_S \geq 1V$	Different voltage heights: Test segments (visual inspection) Replace flywheel/driver disc with segments.

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	1.6 Transmission overload protection, only engine 102.983199 with automatic transmission	 N1/2 — 4 Sensor connector 4-pin	Depress parking brake. Pay attention to safety precautions. Engine: **Start** Idle speed selector lever position: "D"	< 1Ω	Transmission overload protection switch (S65) Cables Contacts
			Selector lever position: "P" or "N"	∞	Transmission overload protection switch (S65) Cables Contacts
	1.6.1 Transmission overload protection switch (S65)	 S65	Detach connector at transmission overload protection switch S65. Depress parking brake. Pay attention to safety precautions. Engine: **Start** Idle speed selector lever position "D"	< 1Ω	Replace transmission overload protection switch (S65).
			Selector lever position: "P" or "N"	∞	Replace transmission overload protection switch (S65).

On/off ratio readoutt	Test step/ Test scope	Test connection	Operation/ Requirement	Specifi- cation	Possible cause/Remedy
–	1.6.2 Cables and contacts	S65 – c Nli2 4 Sensor connector 4-pin	Ignition: OFF Detach connector at transmission overload protection switch (565) and Ignition control module (N1/2).	< 1Ω	Replace cable or contact.
		 - L	Ignition: OFF Detach connector at transmission overload protection switch (S65) and Ignition control module (N1/2).	< 1Ω	Replace cable or contact.
–	2.0 Dwell angle	Engine tester	Engine speed 3200/min, normal operating temperature. Detach sensor connector at Ignition control module and vacuum line. Engine: **Start**	27–54° or 30–60%	Replace Ignition control module.
–	3.0 High voltage distributor/ distributor rotor	Visual inspection	Ignition: OFF Remove distributor cap.	-	Distributor cap, distributor rotor has cracks, interference suppression resistors faulty.

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	3.1 Distributor cap	S5/3 	Ignition: OFF Remove distributor cap.	700-1300 Ω per terminal	Replace distributor cap.
	3.2 Distributor rotor	Distributor rotor Middle Peak	Ignition: OFF Remove distributor cap.	700-1300 Ω and visual inspection	Replace distributor rotor.
–	4.0 Scope images	Engine tester  Scope images Parade Overlap Raster	Engine: **Start** At idle.	**see** scope images 15-525	Ignition coil Distributor Ignition cables Spark plugs

Test B completed.

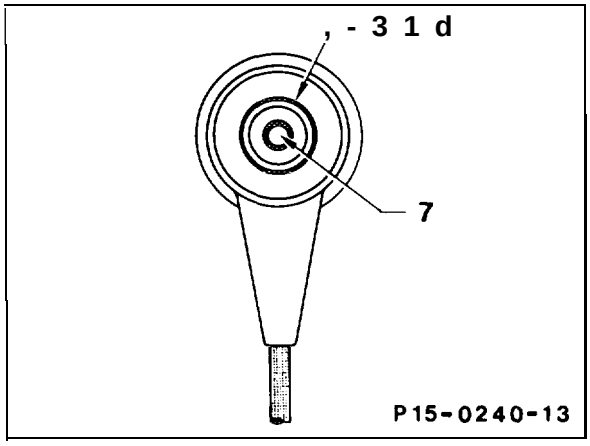


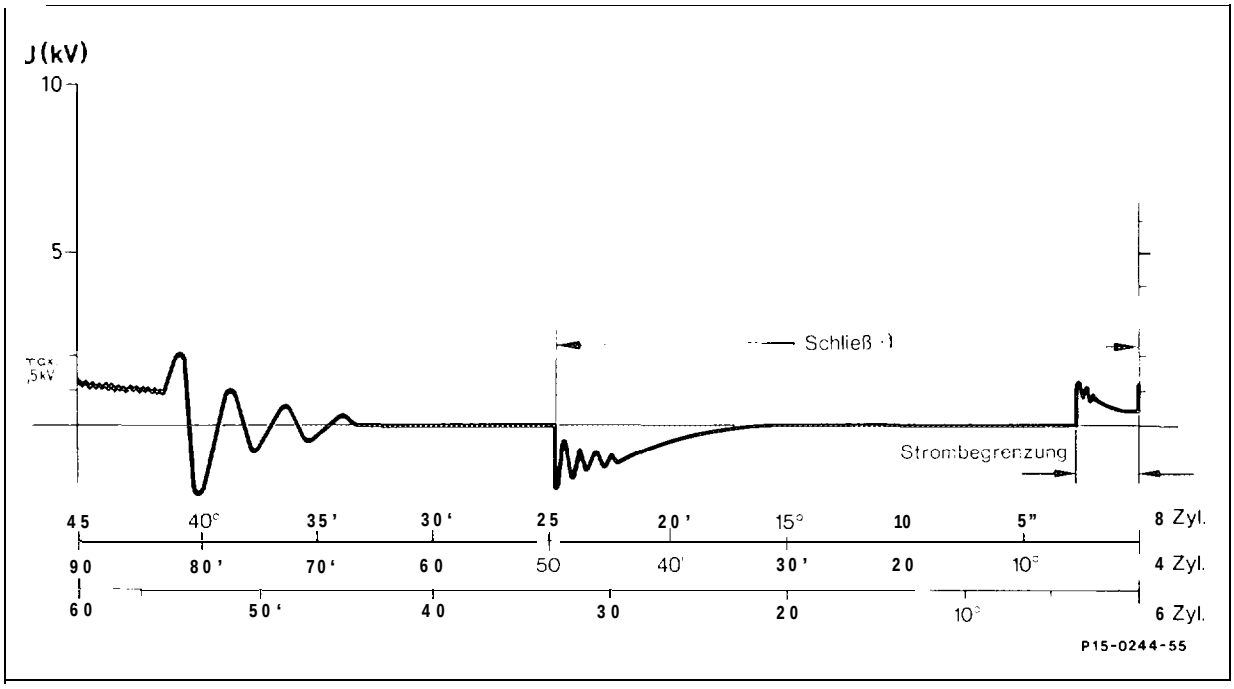
Crankshaft position sensor signal L5

t1 1st segment
t2 2nd segment
d Period for one crankshaft revolution
Us Voltage (≥1V)

Crankshaft position sensor connector L5

Test resistance or voltage signal between connection 7 and 31d.





Current limiting

Notes regarding test
Engine coolant temperature sensor (B11/2)

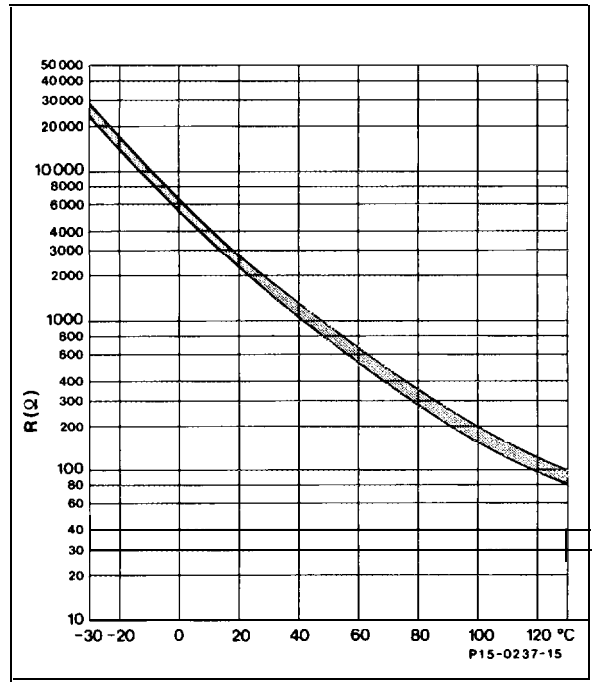


Diagram of coolant temperature sensor (B11/2)

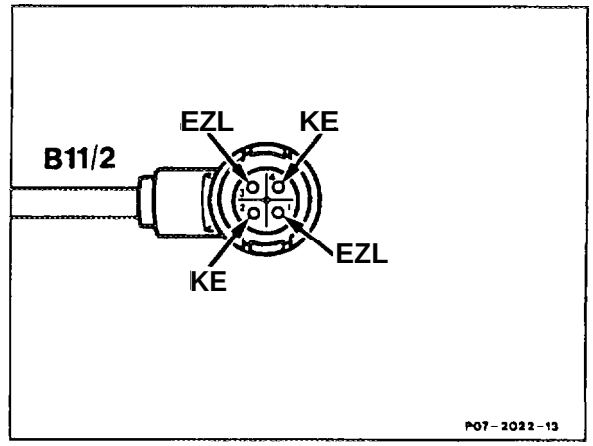
4-pin engine coolant temperature sensor

Pin assignment of connector:

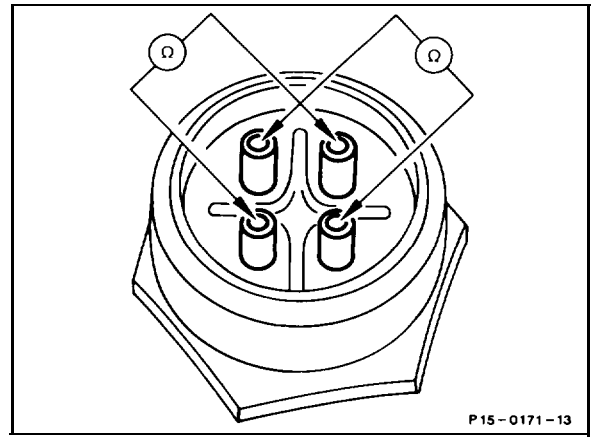
1 = Ignition system temperature sensor
2 = CFI temperature sensor
3 = Engine ground at intake manifold for DI
4 = CFI control module ground

Note

National version (USA) 1988 without connector designations.



When testing the engine coolant temperature sensor, measure the resistances 2 × diagonally and compare.

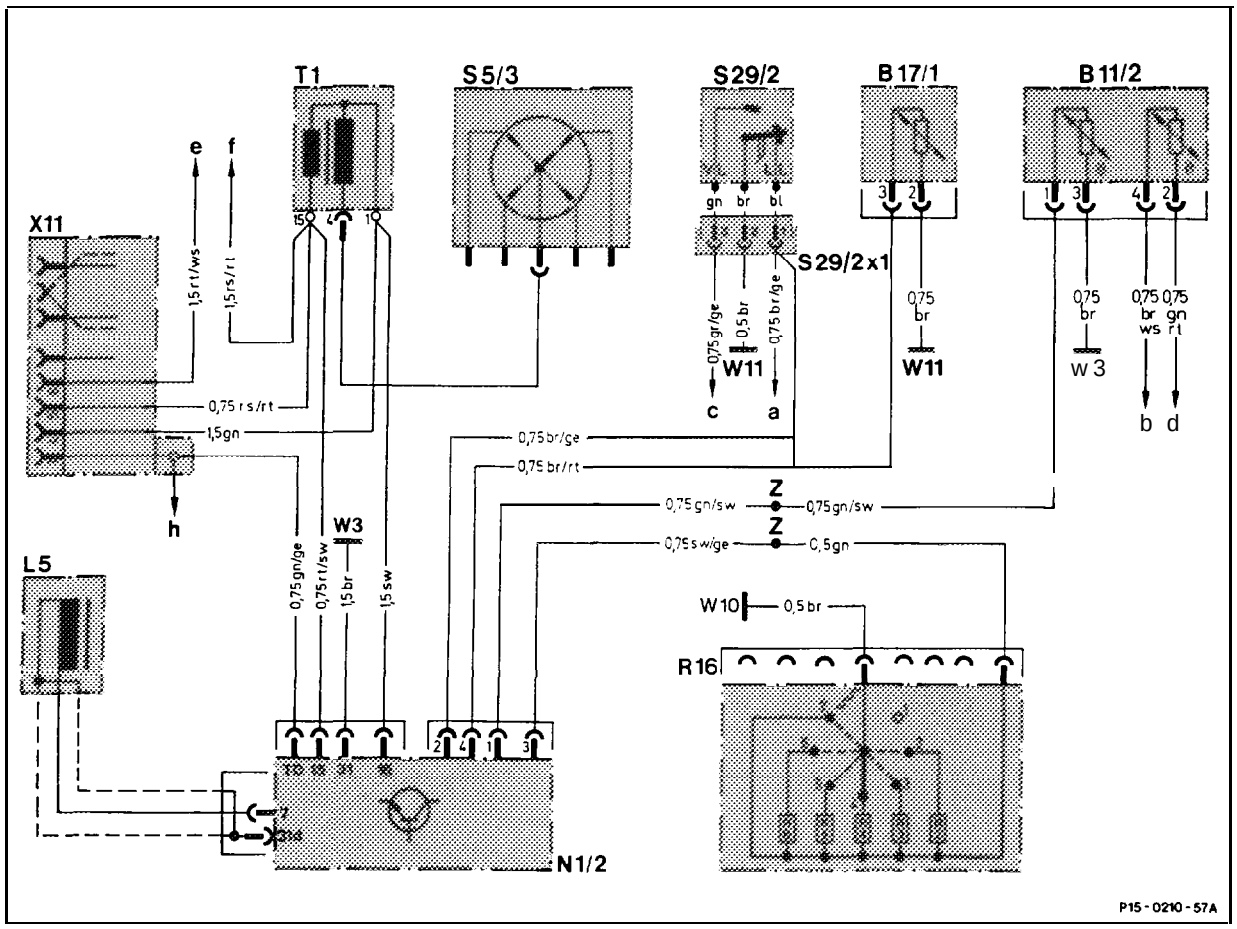


Note regarding ignition distributor

Improved distributor rotor with polyamid bush.

Production breakpoint: January 1989

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission
201.024	102.962	211498	108898
201.028	102.985	30070	78183



Distributor ignition system wiring diagram, engines 102.96/98 KAT as of 09/89

B11/2	Engine coolant temperature sensor (DI/CFI)	a	To CFI control module contact 13
B17/1	Intake air temperature sensor (DI)	b	To CFI control module contact 7 (ground)
L5	Crankshaft position sensor	c	To CFI control module contact 5
N1/2	Transistorized ignition control module (DI)	d	To CFI control module contact 21
R16	Reference resistor (DI)	e	Voltage supply terminal 30 Model 201: to fuse 13 via electrical center connector S, contact 11
S5/3	High voltage distributor		
S29/2	Wide open throttle/closed throttle position switch		
S29/2x1	Wide open throttle/closed throttle position switch plug connection	f	Voltage supply terminal 15, unfused Model 201: electrical center connector S, contact 4
T1	Ignition coil		
W3	Ground, front left wheelhouse (ignition coil)	h	Equipment with terminal TD (e. g. tachometer, fuel pump relay, CFI control module, compressor cutoff control module)
W10	Battery ground		
W11	Engine ground (electric cable bolted on)		
x11	Diagnosis socket/terminal block terminal TD	z	Connector sleeve (soldered connector in wiring harness)

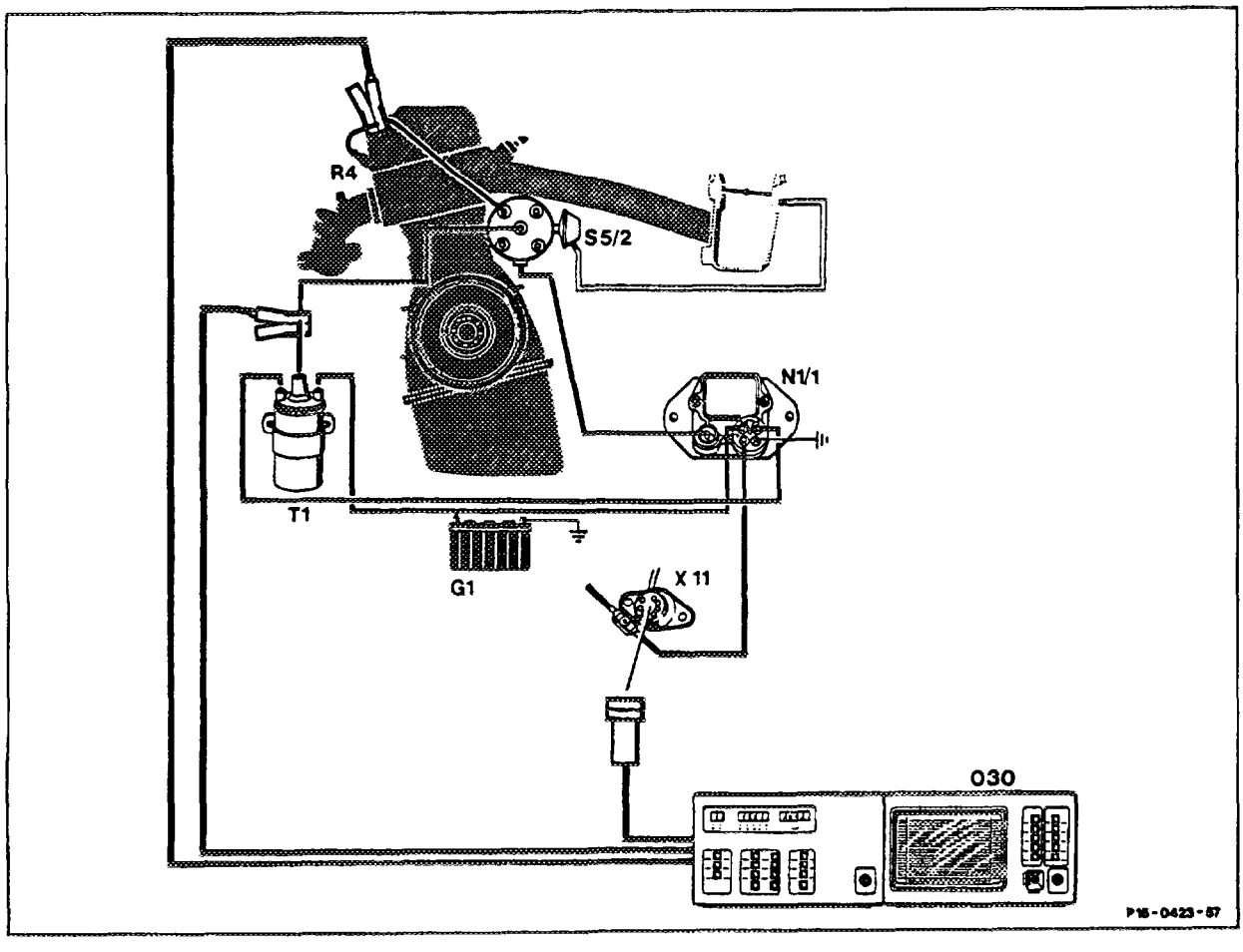
15–542 Testing breakerless transistorized ignition (TSZ)

Preceding work:
Testing, adjusting engine (07.3-I 10)

Precondition for test

Spark plugs, ignition cables, distributor rotor and distributor cap in proper mechanical and electrical condition.

Test e. g. by visual inspection, measuring resistance and ignition oscilloscope.

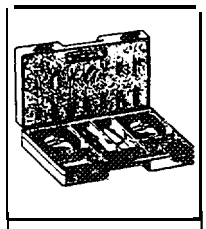


Connection diagram for engine tester with oscilloscope

G1	Battery	S5/2	Breakerless distributor
N1/1	Transistorized ignition (TSZ) control module	TI	Ignition coil
R4	Spark plugs	XI 1	Diagnostic connector/terminal block terminal TD
		030	Engine tester with oscilloscope

Note
Pay attention to the safety precautions (15-0505) when performing work on the ignition system. Switch off ignition when unplugging and connecting the contacters at the TSZ control module.

Special tool



201 589 00 99 00

Commercially available testers

Multimeter	e. g. Sun, DMM-5 Fluke, Multimeter 23 Hermann, Avometer 2003
Engine tester	e. g. Hermann, Datascope 9800 Bosch, MOT 3011400 Sun, 2110 BEAR, D AC E

Test **data**

Resistances (test values at approx. 20 °C)

Ignition coil	primary (terminals 1 and 15)	Ω	0.5-0.9
Ignition coil	secondary (terminals 1 and 4)	kΩ	6–16
Induction sensor	Coil resistance (terminals 7 and 31d) Insulation (terminal 7 and ground)	 Ω kΩ	 600f 100 ≥ 200
Distributor cap per terminal, distributor rotor, spark plug connector		Ω	700-l 300

Voltages, engine not running, ignition switched off

Terminals 15 and 31 (contacts 5 and 2 diagnostic connector)		Battery voltage
Between terminals 15 and 1 (contacts 5 and 4 diagnostic connector)	V	0

Dwell angle

At starter speed	7–34°

gnition pont (TSZ) national version

Engine	Type of fuel[3])	Distributor Bosch No.	Test and setting value [1]) of ignition point in "CKA BTDC ± 1 without/with vacuum		Ignition advance in °CKA BTDC without vacuum			Vacuum advance of ignitior point in °CKA 3TDC at	Installed value of ignition point in °CKA before TDC at starting speed without vacuum
			4500/ nin	idling	Idling	1500/ min	3000/ min	4500/ nin	
(USA) 102.961 1984	un-leaded	0 237 002 094	–	5 with	·	5–11	19-252)	24–28[2])	5
102.961 102.985 as of 1983		0 237 002 098				10–14	22–26[2])	14-I 8[2])	5

) If normal-compression engines are operated with fuel of less than 98 RON min. 88 I)N) or low-compressron engines with fuel of less than 92 RON (min. 82 MON), the ignition point should be retar ed and adapted to the octane number of the fuel used. A reference value for this adjustment is: retard ignition point by 1 – 2" CKA per 1 RON. The maximum retardation must not exceed 6° CKA.
The ignition correction should be entered by hand on the "engine setting data" information plate.
The result is reduced power output and increased fuel consumption. In addition, the engine must not be operated at full load.
The full ignition advance should be re-set as soon as fuel of the specified octane number is again available.

2) Test at 3500/min.

3) Vehicles with catalytic converter must be operated with unleaded fuel.

4) This value must be identical at normal operating temperature of engine with and without vacuum: test ignition advance in the warming-up phase if necessary (15-543).

Note

If the specified value of a test step, e. g. test step 1.0, is in order, continue immediately with test step 2.0.

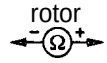
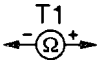
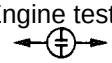
If the specified value of step 1.0 is not in order, it is then necessary to continue with step 1.1.

Key to symbols:

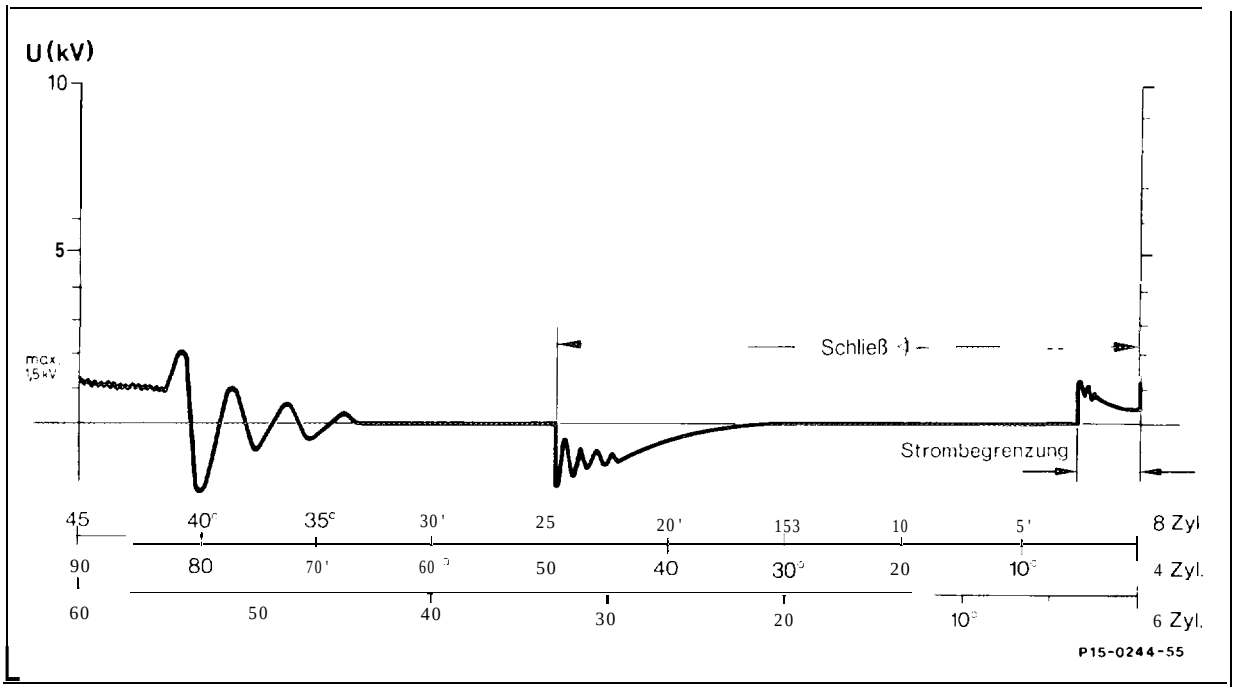
- Multimeter direct voltage mode
- Multimeter resistance mode
- Oscilloscope
- Contact
- Connector
- Ground

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
	1.0 Voltage supply	N1/1 31 — (V) — 15	Ignition: ON	Battery voltage	Test cables and contacts according to wiring diagram (from battery via ignition lock to TSZ control module), ground connection (W3).
–	2.0 Induction sensor	Connector 31d — (Ω) — 7	Ignition: **OFF** Detach induction sensor connector at TSZ control module (green cable).	600 Ω ± 100 Ω	Replace induction sensor. Test cables and contacts from TSZ control module to distributor.
–	2.1 Insulation of sensor coil	Sensor coil ⊥ (Ω) ▬	Detach induction sensor cable connector at distributor.	≥ 200 kΩ	Replace induction sensor.
–	3.0 Dwell angle of (TD signal)	Engine tester	Engine: **Start**	7-34”	Dwell angle not to tolerance: replace TSZ control module. No dwell angle: test stall current cutoff. Pay attention to notes on TD signal (15-512).

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	4.0 Stall current cutoff	T1 Cir. 1 ⊖ Ⓥ ⊕ Cir.	Ignition: ON Engine: **Start**	0V 0V >0V	Replace TSZ control module and ignition coil. Test cables and contacts from TSZ control module to ignition coil or replace TSZ control module. Replace ignition coil.
–	4.1 Ignition coil primary T1	T1 Cir. 1 ⊖ Ω ⊕ Cir.	Ignition: **OFF** Unscrew cables at ignition coil.	0.5– 0.9 Ω	Replace ignition coil.
–	**5.0** Primary voltage	Engine tester Scope image Primary parade	Engine: **Start**	>200 V	Replace TSZ control module.
–	6.0 Primary current limiting	Engine tester Scope image Secondary overlap	Engine: **Start**	**see** diagram	Replace TSZ control module.
–	7.0 Ignition voltage at terminal 4 ignition coil	Engine tester Scope image Secondary parade	Engine: **Start**	ha kV	Test ignition cable terminal 4, distributor rotor, distributor cap and ignition coil.
–	7.1 Ignition cable terminal 4	T1 S5/2 Cir. 4 ⊖ Ω ⊕ Cir. 4	Ignition: OFF Detach ignition cable terminal 4 at ignition coil and distributor cap.	< 1 Ω	Replace ignition cable terminal 4.

On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	Possible cause/Remedy
–	7.2 Distributor rotor	Distributor rotor  Middle Peak	Ignition: OFF Remove distributor cap	700-1300 a and visual inspection	Replace distributor rotor.
–	7.3 Distributor cap	S5/2 Cir. 4 Carbon	Ignition: OFF Distributor cap removed and detach ignition cable terminal 4.	700-1300 Ω per terminal and visual inspection	Replace distributor cap.
–	7.4 Distributor cap/rotor	Visual inspection	Ignition: OFF Remove distributor cap.		Distributor cap, distributor rotor has cracks.
	7.6 Ignition coil secondary T1	T1  Cir. 4 Cir. 1	Ignition: OFF Unscrew cables at ignition coil.	6-16 kΩ	Replace ignition coil.
	8.0 Ignition voltage at single cylinder	Engine tester  Scope image Secondary parade High voltage clamp at cylinder ignition cable (e. g. cylinder 3)	Engine: Start	>6 kV	Test distributor cap, distributor rotor, ignition cables with spark plugs.
	8.1 Ignition cable with spark plug connector	 Ignition cable Spark plug connector	Ignition: OFF Detach ignition cable with spark plug connector at spark plug and distributor.	700-1300 a	Replace ignition cable with spark plug connector.

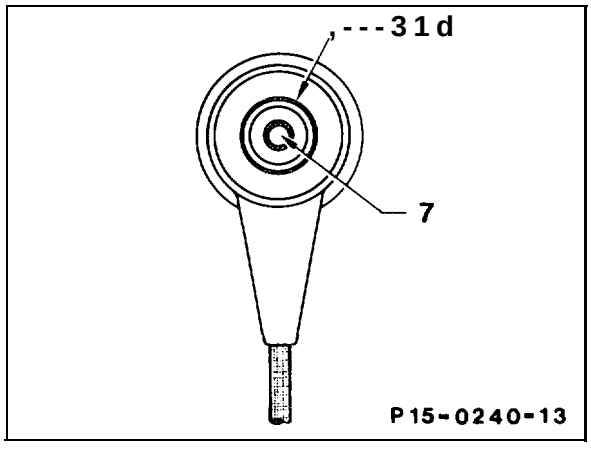
On/off ratio readout	Test step/ Test scope	Test connection	Operation/ Requirement	Specification	possible cause/Remedy
	8.2 Spark plugs	Visual inspection	Ignition: OFF Remove spark plugs.	Electrode gap 0.8 mm	Replace according to condition.
	3.0 Ignition point	Engine tester	Engine: Test at normal operating temperature at specified speeds and with/without vacuum.	see table	Setting of vacuum advance Ignition advance in warm-up phase (15–545).
	9.1 Vacuum advance	Engine tester	Engine: Normal operating temperature, speed approx. 1500:min. Detach vacuum hose. Fit on vacuum hose.	Ignition point retarded Ignition point advanced	Vacuum hose leaking Connection at intake manifold blocked. Vacuum unit faulty. Distributor faulty.



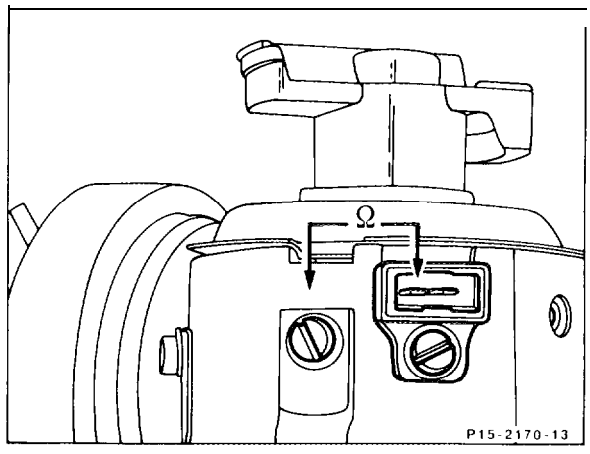
Current limiting

induction sensor connector

Test resistance between connections 7 and 31d.

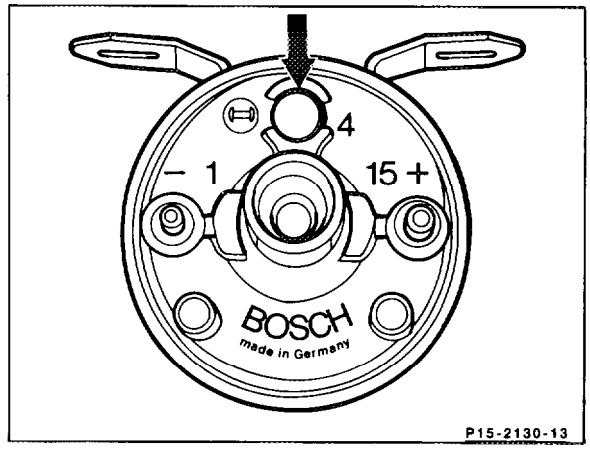


Test insulation of induction sensor coil to ground (≥ 200 kΩ).

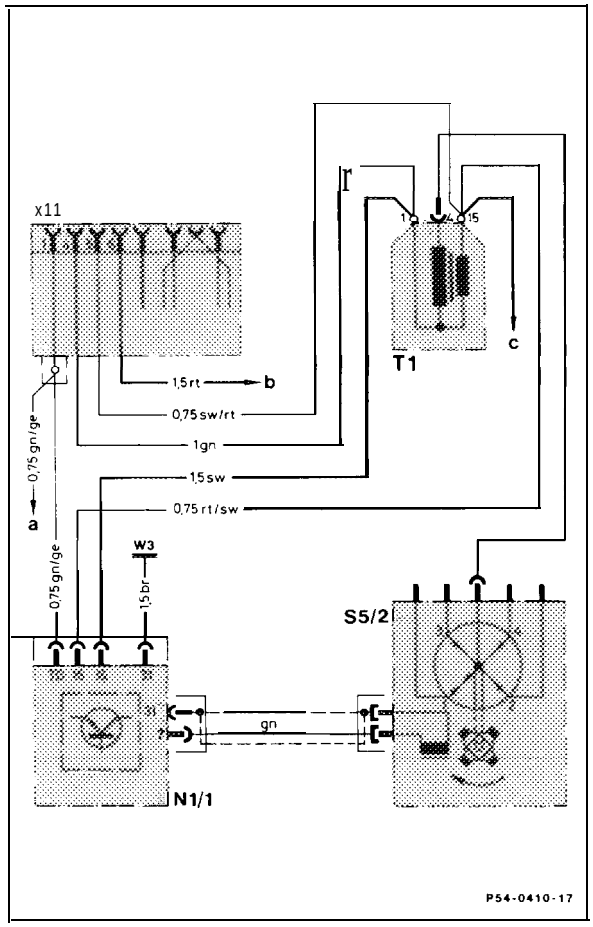


Ignition coil (T1)

If plug (arrow) pressed out, replace.



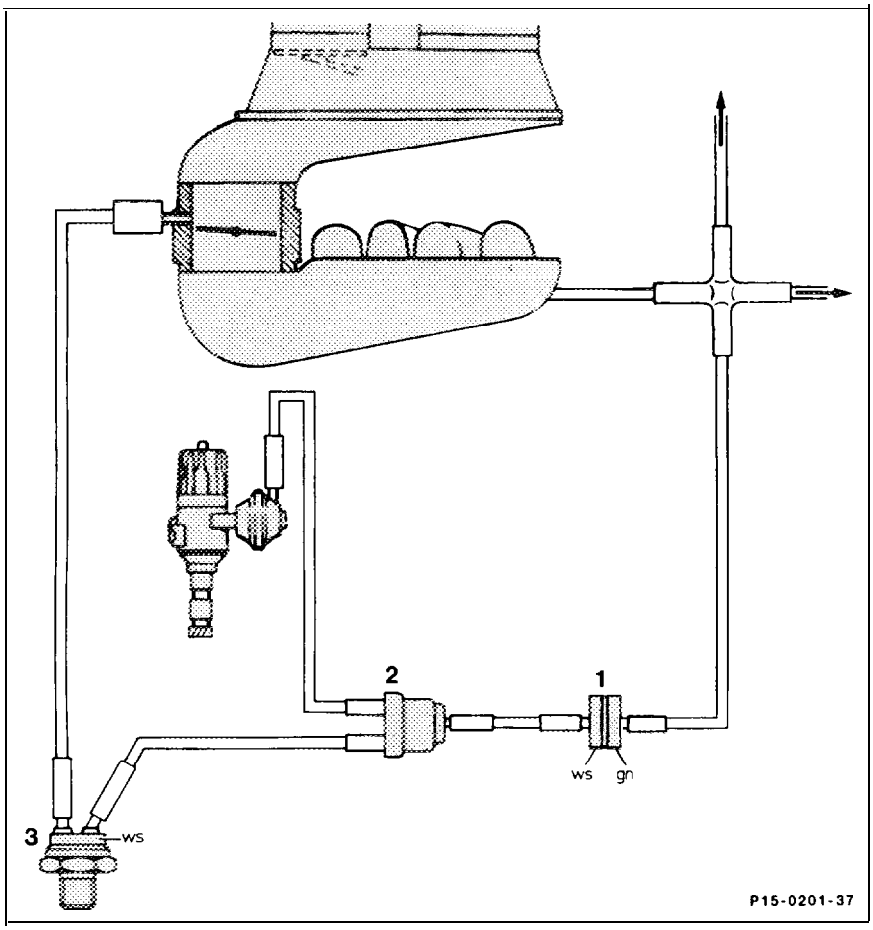
TSZ wiring diagram



N1/1 Transistorized ignition control module
S5/2 Distributor
T1 Ignition coil
W3 Ground, front left wheelhouse (ignition coil)
x11 Diagnostic connector/terminal block terminal TD
a Equipment with terminal TD
(e.g. tachometer, fuel pump relay, CFI control module, compressor cutout control module)
b Voltage supply terminal 30
Model 201: to fuse 13 via electrical center coupling S, contact 11
c Voltage supply terminal 15, unfused
Model 201: electrical center coupling S, contact 4

15-543 Testing ignition advance in warm-up phase (only TSZ)

Engine 102.961 Basic Version



Tester	connect (16415).
Engine	warm up to approx. 80 °C engine coolant temperature. Run at idle speed and take reading of ignition point.
Vacuum line	white/red, detach at thermo valve (3). The ignition point must not alter.

If the ignition point alters, check whether vacuum lines are correctly laid and leaktight. Check thermo valve. The thermo valve should have clear passage above approx. 60 °C.

Vacuum line ..... white/red, detach at thermovalve (3) and plug the vacuum connection at thermovalve. The ignition point must be advanced approx. 8 – 12”.

If the ignition point is not advanced, check restrictor (1) for clear passage, check valve (2) and vacuum unit at distributor for leaktightness.

Function description

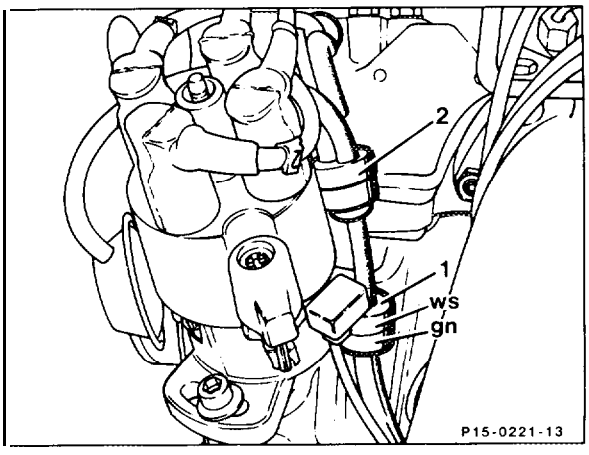
To improve the perfprmance in the warm-up phase, the ignition point is advanced 8 – 12” CKA via the vacuum unit at the distributor up to a coolant temperature of approx. + 60 °C in addition to the centrifugal advance.

Below approx. 60 °C engine coolant temperature (thermo valve closed) the vacuum passes from the intake manifold via the restrictor (1) and check valve (2) to the vacuum unit at the distributor when the engine starts.

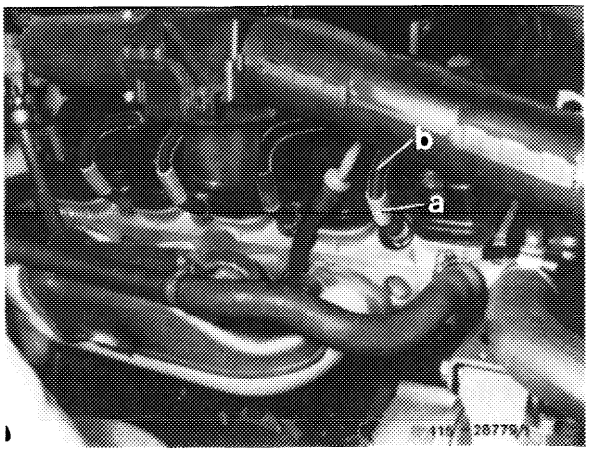
The check valve (2) ensures that the maximum vacuum is retained at the distributor ‘(also when accelerating) which results in the additional ignition advance via the vacuum unit.

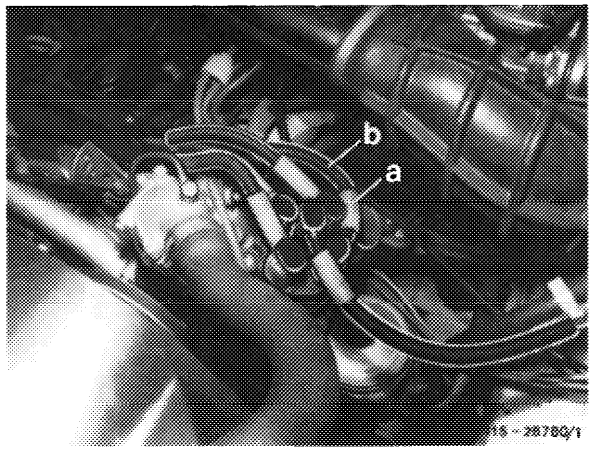
Above approx. 60 °C the thermovalve (3) opens, and the vacuum is reduced at idle speed to the throttle valve assembly.

A restrictor (1) is installed to ensure that the vacuum for the other connected components cannot escape through the connection at the intake manifold at idle speed.



15-547 Retrofitting corrugated hoses for ignition cables





Corrugated hoses (a) Ø 13 mm and (b) Ø 10 mm	cut to size according to table as protection against beech martens biting through cables. Push corrugated cables (a) Ø 13 mm and (b) Ø 10 mm approx. 10 mm together.
Spark plug connector	unplug, plug in. Unscrew spark plug connector from ignition cables, screw on. Push corrugated hoses onto ignition cables.
Angled connector at distributor	unplug, plug in. Unscrew angled connector from ignition cables, screw on. Push corrugated hoses appropriate length onto ignition cables.

Qty.	Length (mm)*	Assignment
Corrugated hose Ø 10 mm (total length approx. 1260 mm)		
4	110	Ignition cable at spark plug connector
2	125	Ignition cable at distributor, cylinders 1 and 4
1	175	Ignition cable at distributor, cylinder 2
1	75	Ignition cable at distributor, cylinder 3
1	320	Ignition cable from distributor to ignition coil
Corrugated hose Ø 13 mm (total length approx. 300 mm)		
10	30	1 ea. at each spark plug and angled connector

* Maximum length; shorten ignition cable accordingly, if necessary.

Parts

Designation	Part No.
Corrugated hose (10 mm diameter) running meters	000 159 01 83
Corrugated hose (13 mm diameter) running meters	000 159 02 83

Available from: ZEG Germersheim

Time allowed

Basic work: 02-I 508/01

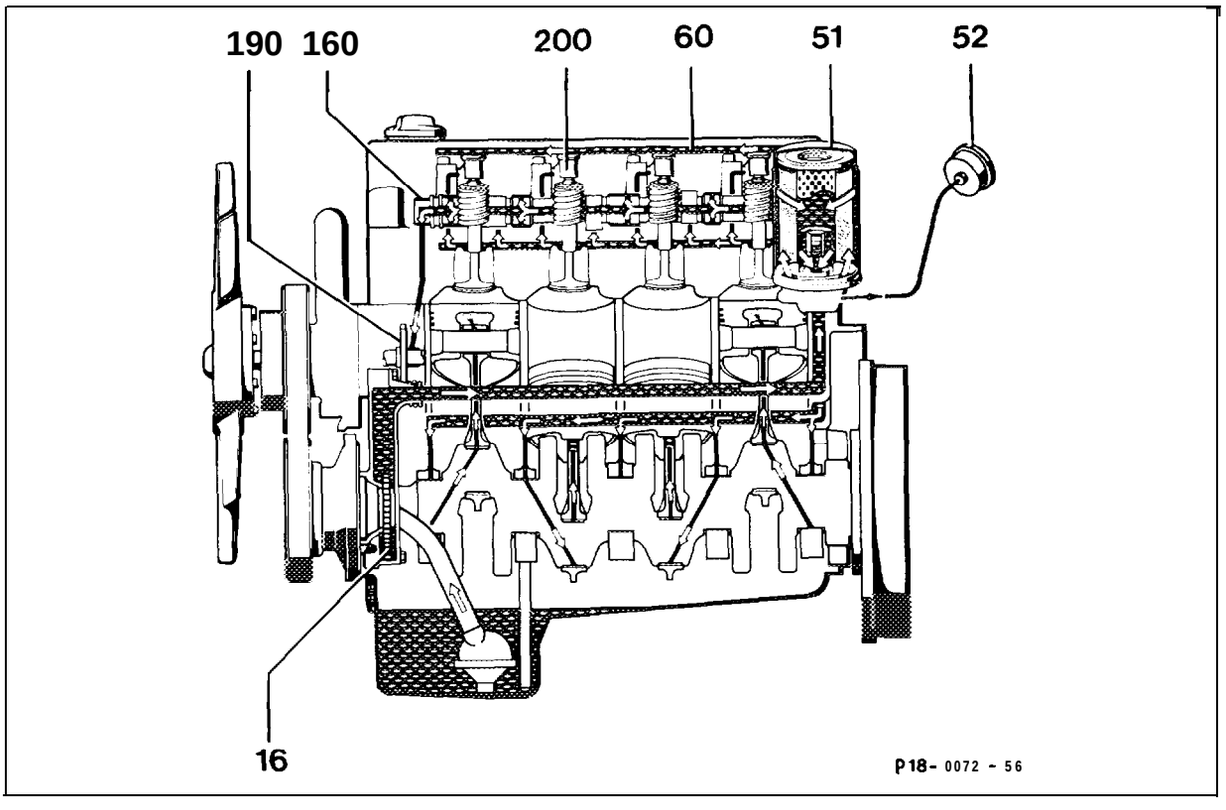
Combined work: 02-I 509/01

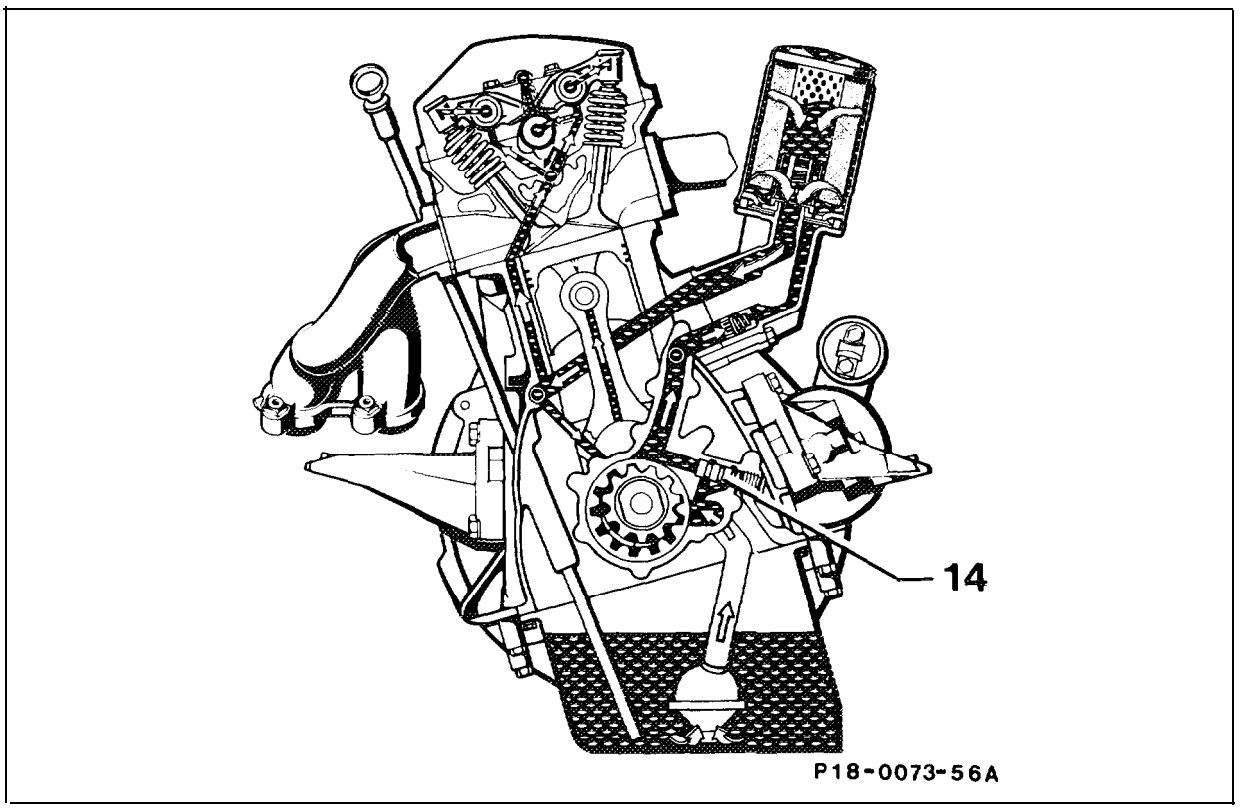
Job No.

Oil circuit, oil pressure, overpressure and bypass valve ..... 18 – 005
Measuring oil consumption 18-025
Removal and installation of oil filter ..... – 110
Removal and installation of oil pump ..... – 210
Removal and installation of oil overpressure valve ..... – 215
Checking oil level indicator ..... – 220
Function of low engine oil level indicator ..... – 225

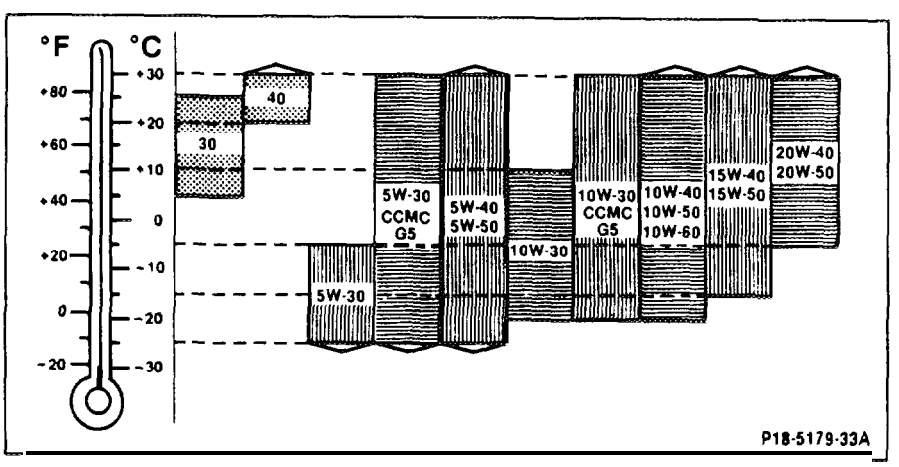
18-005 Oil circuit, oil pressure, overpressure and bypass valve, oil filter

Oil circuit





14	Oil overpressure valve	60	Oil pipe
16	Oil pump	160	Camshaft
51	Oil filter	190	Idler gear shaft
52	Oil pressure gauge		



Viscosity grades for engine oils according to SAE

Adhering to the SAE grades in accordance with ambient temperatures would result in frequent oil changes. Consequently, the temperature ranges are merely guidelines, which can be exceeded in the upper or lower limits for brief periods.

In moderate climatic zones SAE 30 may be used from the spring on for all engine models. SAE 10W-40 or SAE 10W-50 may be used as an all-seasons oil for all gasoline engines.

Oil capacity in liters (approved engine oils see Service Product Specifications).	
Engine (total capacity when refilling)	5,5
Engine capacity when changing oil and filter	5,0
Oil sump, max./min.	4,8/2,8

Opening pressures of oil overpressure and oil filter element bypass valve	bar gauge pressure
Oil overpressure valve in timing case cover	4,5–0,8
Oil filter element bypass valve in oil filter (difference pressure)	3,5

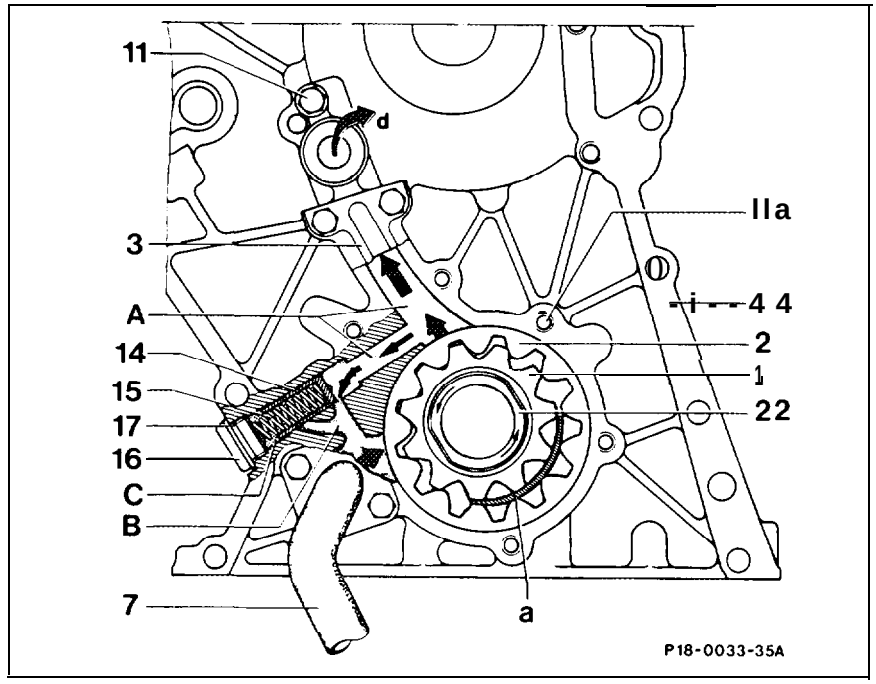
Function of oil circuit

The oil is drawn off at the lowest point of the oil sump through the strainer basket and the oil suction pipe (7) to the suction chamber (B) and pumped into the tooth gaps, which produce pressure chamber (A) as a result of the eccentric arrangement of the oil pump gears (1 and 2).

To ensure that the oil remains in the tooth gaps on its way from the suction to the pressure chamber, a sickle (a) is attached between both gears in this area.

1 Inner oil pump gear
2 Outer oil pump gear
3 Oil pump cover
7 Suction pipe
11 M6 x30 bolt (9 off)
11a Torx bolt
14 Overpressure valve
15 Compression spring
16 Screw plug
17 Seal
22 Drive sleeve
44 Timing case cover

A Pressure chamber
B Suction chamber
C Damping chamber
a Sickle
b To oil filter



The teeth mesh again at the end of the pressure chamber and force the oil out of the tooth gaps.

The oil flows from the pressure chamber (A) along the feed passage (d) in the timing case cover and crankcase to the oil filter.

Pressure chamber (A) and vacuum chamber (B) are linked by the oil overpressure valve.

From an oil overpressure of approx. 4 bar, the piston (14) of the oil overpressure valve is pushed against the force of the compression spring (15) and opens the relief cross-section, through which part of the oil flows back to the suction chamber (B), depending on oil pressure.

As the piston (14) is moved, the oil in chamber (C) is displaced and flows through the relief grooves on the outside of the piston to the suction chamber (B).

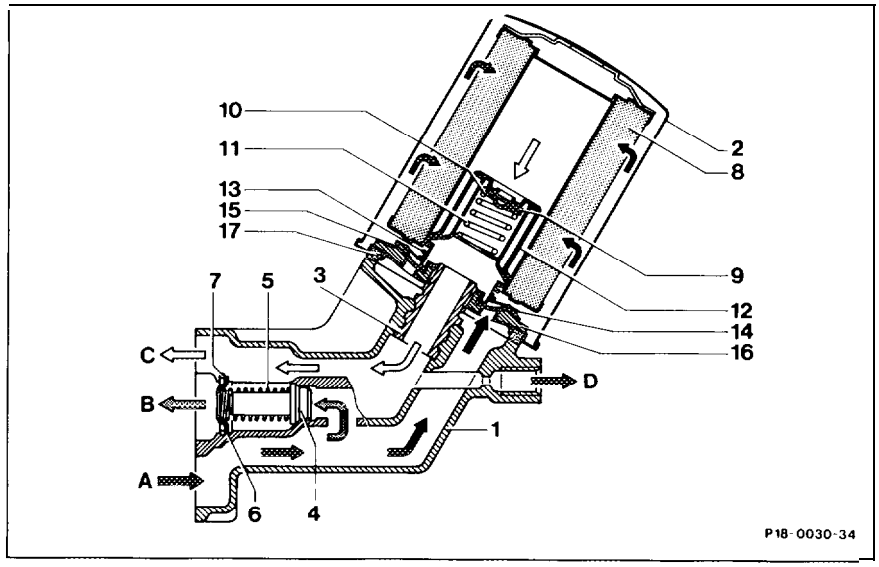
Oil filter

The oil coming from the feed passage (A) flows through the feed and discharge hose in the contact-pressure plate (16) into the replaceable cartridge.

As a result of the oil pressure, the rubber diaphragm (15) is raised and the oil flows through the filter element (8) from the outside to the inside (arrows).

On the inside, the valve plate (9) is opened as a result of the pressure of the filtered oil. The oil flows through the connection fitting (3) to the gallery (C) and on to the main oil gallery in the crankcase.

1 Oil filter bottom section
2 Replaceable cartridge
3 Connection fitting
4 Valve cone
5 Compressron spring
6 Spring plate
7 Locking ring
8 Filter element
9 Valve plate
10 Valve plate carrier
11 Compressron spring
12 Valve holder
13 Compressron spring
14 Spring plate
15 Rubber diaphragm
16 Contact-pressure plate
17 Seal
A Feed from oil pump
B Unfiltered oil to main oil gallery
C Filtered oil to main oil gallery
D Connectron for electrical oil pressure sensor



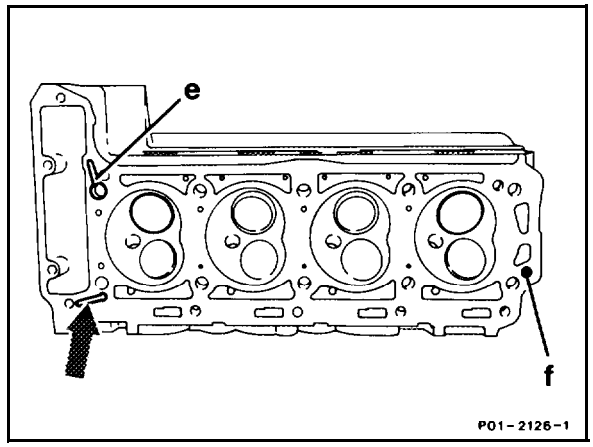
The two check valves (9-12 and 13-16) prevent the filter cartridge from running empty when the engine is switched off and when changing the filter.

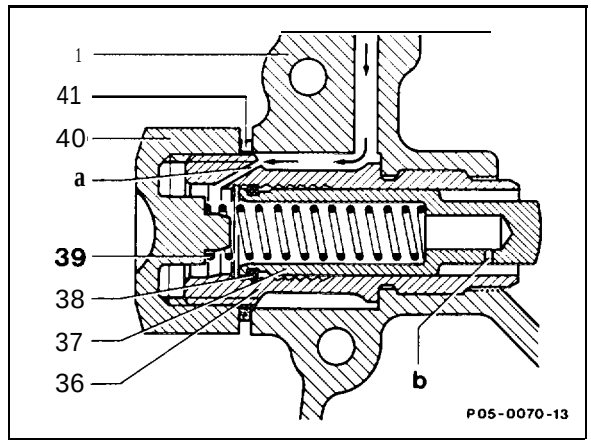
The bypass valve (4-7) opens when the difference pressure between dirty and clean oil side exceeds 3 bar. This is the case if the filter element is severely fouled. The oil then flows through the gallery (B) unfiltered to the main oil gallery.

When changing the filter, a slight quantity of oil flows out of the replaceable cartridge despite the check valves, which flows together with oil from the bottom of the oil filter along the galleries (A and C) to the engine.

Oil supply of chain tensioner

The oil flows through a passage which branches off vertically up the way at the front of the main oil gallery, to the cylinder head, flows in a cross groove (arrow) to a vertical feed passage in crankcase and on to the chain tensioner.

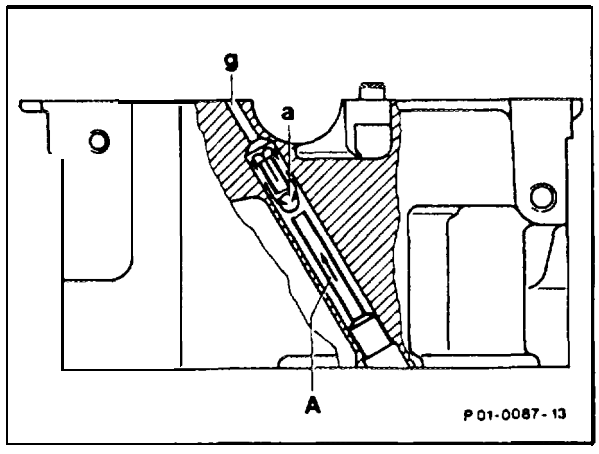




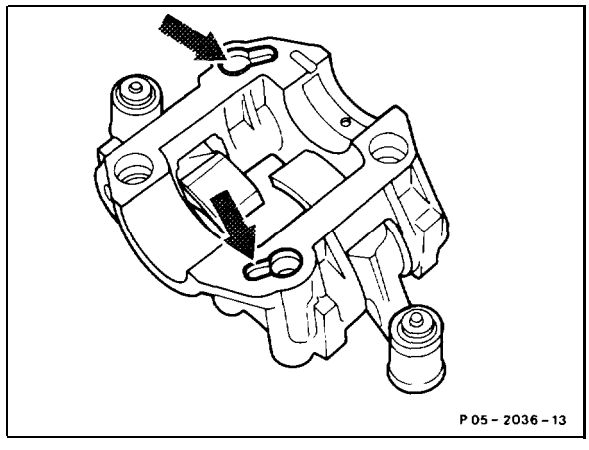
1 Crankcase
36 Chain tensioner housing
37 Thrust pin
38 Detent spnng
39 Compression spnng
40 Cap nut
41 Seal
a Feed passage 1 .1 mm dia.
b Restnction passage 1.2 mm dia.

Lubrication of valve timing

The oil coming from the main oil gallery in the crankcase, flows through a 4.5 mm dia. jet (A) installed in the cylinder head, and through the annular gap (arrows) direct to the longitudinal gallery (a) in the cylinder head (pressure-oriented oil feed). This oil supply system ensures that the oil pressure prevailing downstream of the oil filter depending on the operating state, always exists at the hydraulic valve clearance compensating elements. In addition, the nozzle (A) serves as an oil return flow stop which prevents the longitudinal passage (a) and the valve clearance compensating elements running dry.

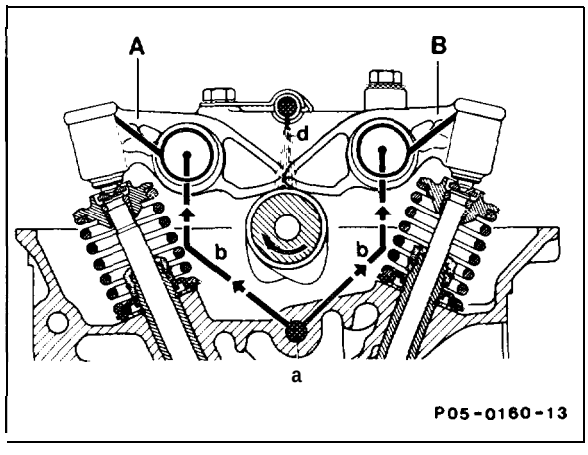


Part of the oil flows through the restriction passage (g) with dia. of 2.5 mm and the two grooves (arrows) in the rear rocker arm bearing bracket to the rear camshaft bearing and there into the hollow-drilled camshaft. The oil flows through the camshaft to the other camshaft bearings (flow-oriented oil feed).



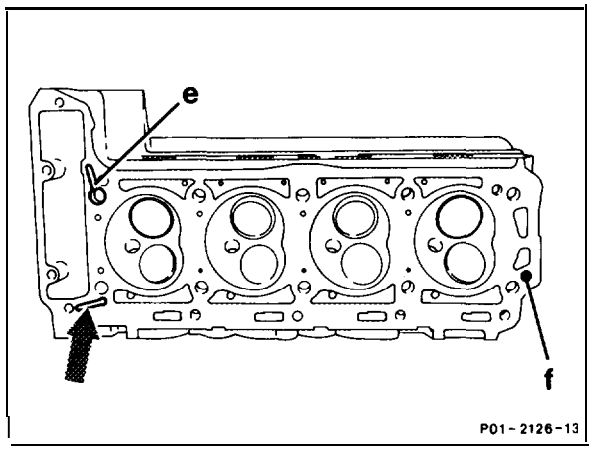
The rocker arm bearing points are lubricated from the longitudinal passage (a) in the cylinder head and the hydraulic valve clearance compensating elements supplied with oil (b) from there through a passage in the rocker arm.

The cam lubrication is provided through the oil pipe (d) bolted to the rear camshaft bearing.



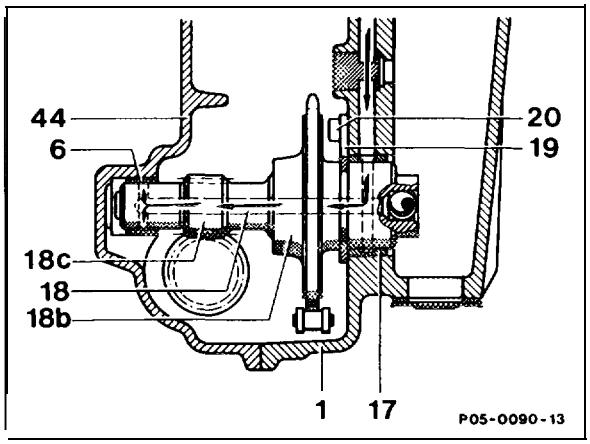
Lubrication of idler gear shaft and ignition distributor drive

The oil flows from the front camshaft bearing through a cross passage to the left front cylinder head bolt bore and from there along a cross groove (e) to the feed passage in the crankcase.

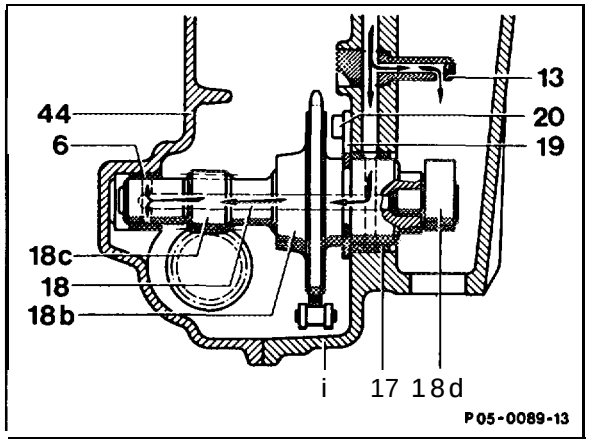


The oil flows on to the rear bearing bush (17) of the idler gear shaft and through the hollow-drilled idler gear shaft (18b) to the front bearing bush (6) in the timing case cover (44).

The ignition distributor drive (18) is lubricated by splash oil.

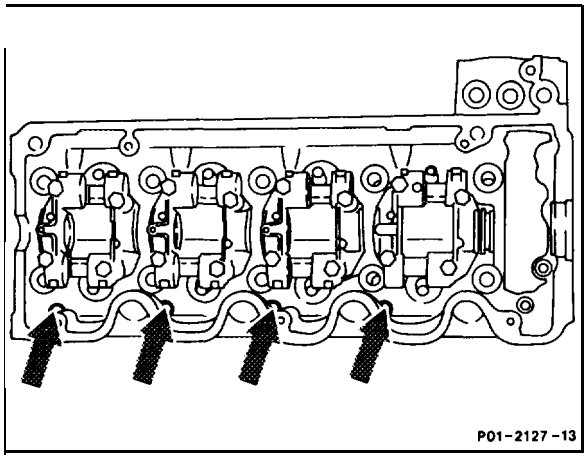


The cam (18d) which is press-fitted to the rear end of the idler shaft gear on engines 102.9221924 (non-U.S.) and drives the fuel pump, is lubricated by the oil splash jet (13).

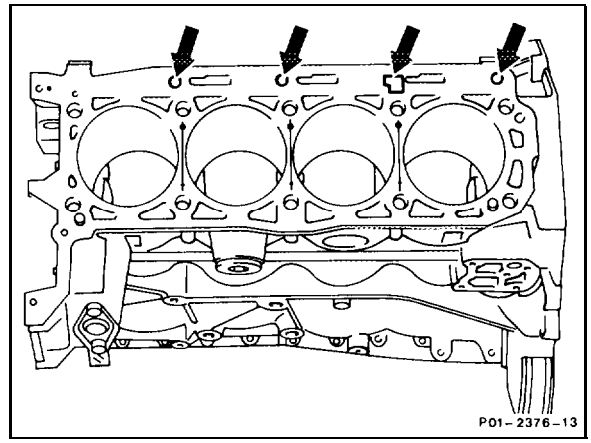


Oil return

Four return passages (arrows) are provided on the righthand side of the cylinder head (looking in direction of travel) for the oil return to the sump; part of the oil flows back through the chain box.



In the crankcase, the oil flowing back is passed along an oil collecting gallery (arrows) to the cast return passage.
From here, it flows into the oil pan.

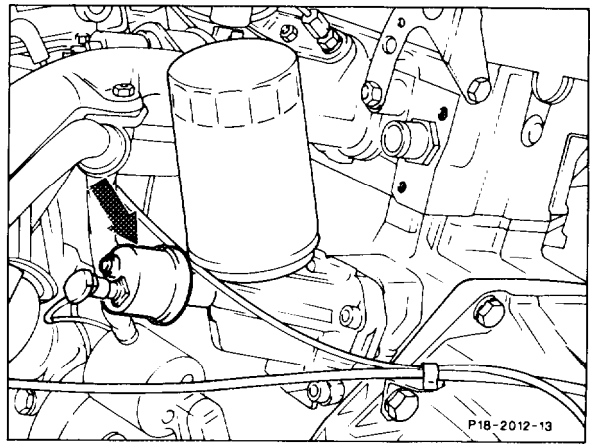


Oil pressure and oil pressure gauge

At normal operating temperature, the oil pressure at idling speed must drop to 0.3 bar gauge pressure.

When the accelerator is depressed, the oil pressure must immediately rise again and be at least 3 bar gauge pressure at 3000 rpm.

The oil pressure gauge in the instrument cluster is actuated electrically by an oil pressure sensor which is bolted onto the oil filter housing (arrow).



Function

When the ignition is switched on, the gauge in the instrument cluster is constantly energized. Ground is applied in the gauge through the pressure sensor. As the pressure increases, the ohm resistance of the pressure sensor increases and thus alters the gauge reading.

Resistances of pressure sensor as a function of oil pressure.

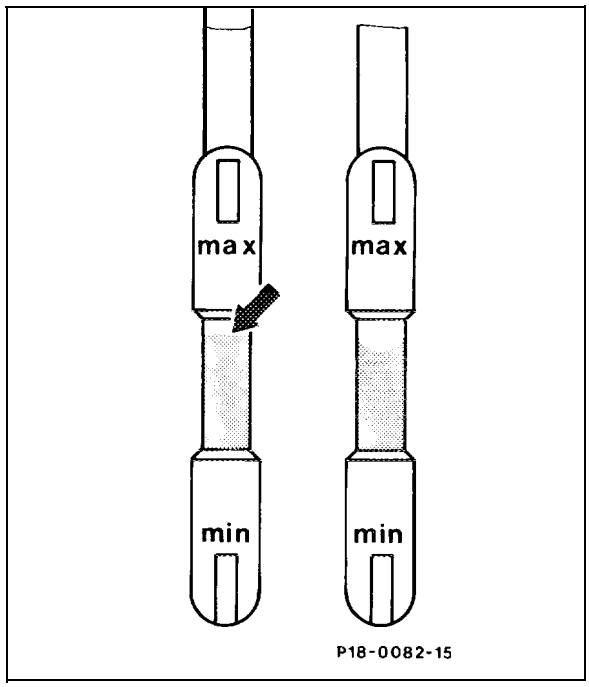
Pressure (bar)	0	1	2	3
Resistance approx. Ω	10	69	129	184

Checking oil level

The oil level depends, among other factors, on the oil temperature and on the time for the oil to flow back after the engine is switched off. For this reason, do not measure oil level until approx. 5 minutes after switching off the engine from normal operating temperature (approx. 80 °C oil temperature).

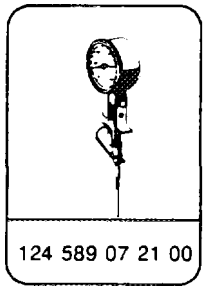
The dipstick must always be withdrawn and wiped off before checking the oil level.

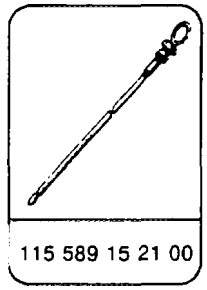
To properly assess the oil level, the dipstick must be viewed from both sides. The determining factor is always the clear horizontal indication of the dipstick (arrow).



18-025 Measuring oil consumption

Special tools



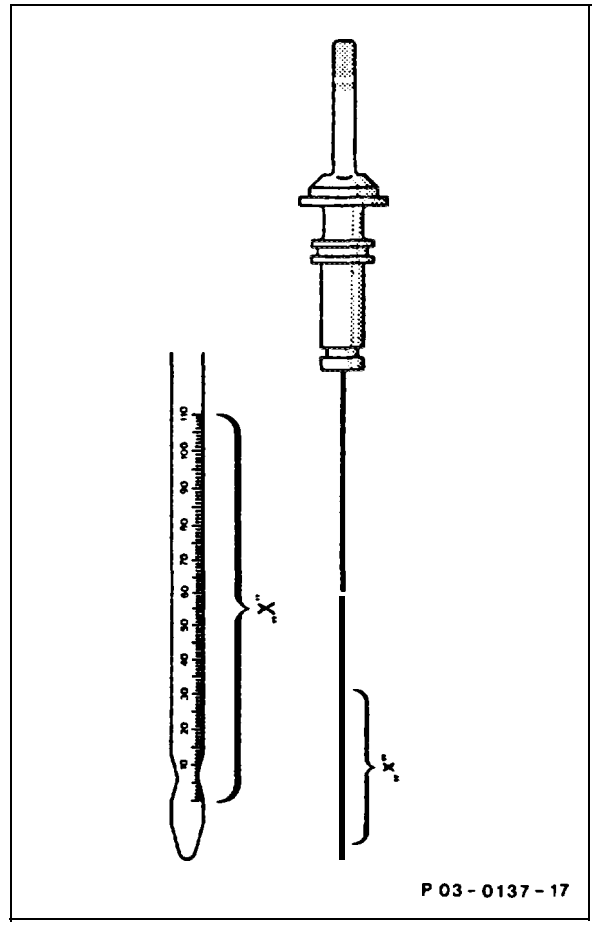


Note

Oil consumption should be calculated with the dipstick with millimeter graduations and the related test sheet. It should not exceed 1.0 li1000 km.

The procedure for measuring oil consumption is described on the front of the test sheet. It is essential to properly observe this procedure.

Oil consumption indicated in mm on the dipstick should be read off on the basis of the diagram on the rear of the test sheet in cm^3.

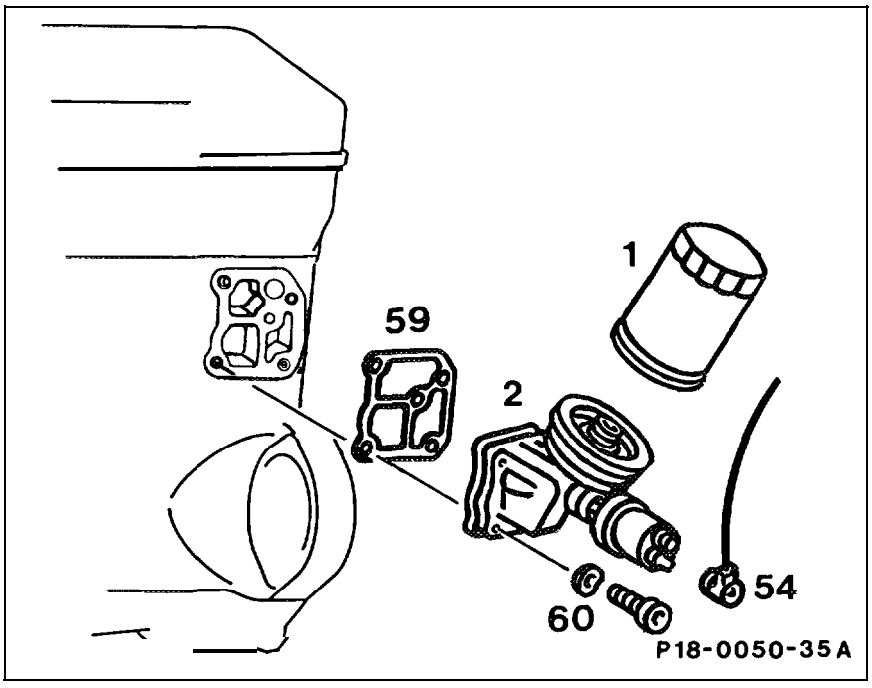


⚠Caution

To **avoid any** incorrect measurements, check whether the engine oil has been diluted with fuel before measuring oil consumption.

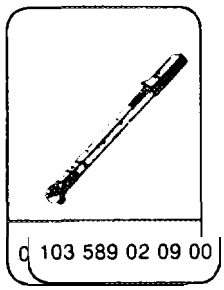
18-110 Removal and installation of oil filter

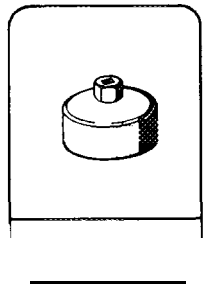
Preceding work:
Air filter removed (09-400 and 09-410).



Replaceable cartridge (1)	unbolt, bolt on, special tool 103 589 02 09 00.
	Note Tighten replaceable cartridge by hand, then tighten a further 1/4 turns (90") (step 2).
Plug (54)	for oil pressure sensor, detach, plug in.
Oil filter base (2)	unbolt, bolt on, tightening torque 25 Nm (step 4).
Gasket (59)	replace.
Sealing surfaces	clean, seal main oil gallery for this step, open (step 5).
Run engine	check for leaks.

Special tools

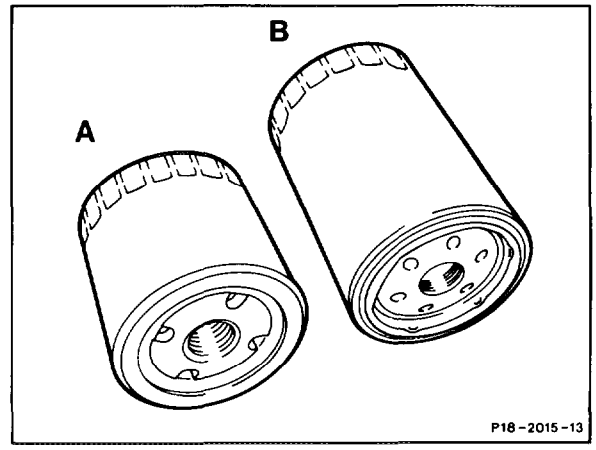




Note

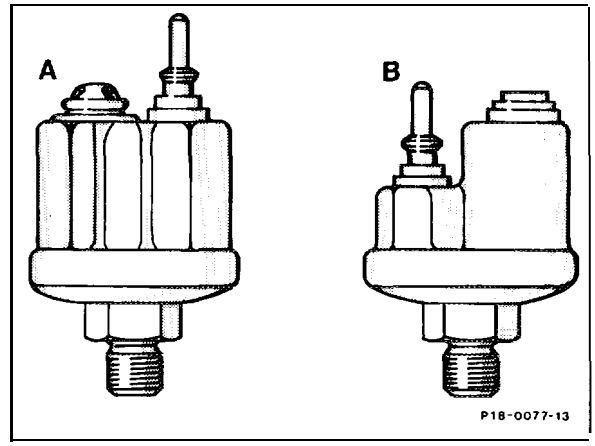
M **102** engines are equipped with an oil filter with replaceable cartridge (disposable filter).
When changing the filter, the replaceable cartridge is unscrewed and replaced with a new one.

The initial operation and continuous operation cartridges were of different sizes up to 5188.



A Initial operation replaceable cartridge
B Continuous operation replaceable cartridge

The housing of oil pressure sensor has been modified to provide adequate clearance for the speedometer shaft.



A Previous version
B Present version

Standard implementation: December 1984

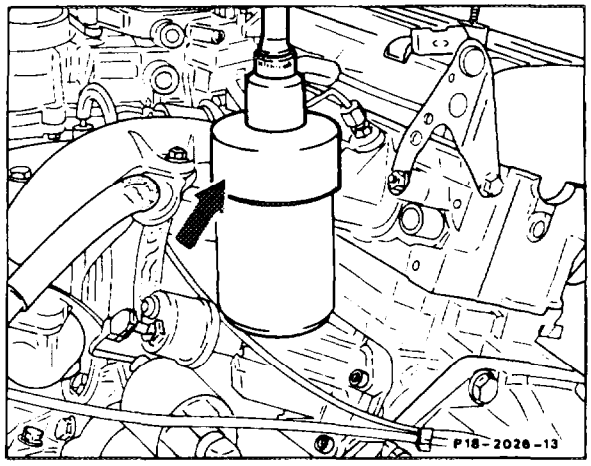
Model	Engine	Engine end No. Man. trm.	Autom. trm.	Vehicle ident end No.	
Non-U.S. version vehicles	102.924	005181	001370	A 170601	F 063039
	102.962	016655	007928		F 063008
201.024 (USA)	102.985	000782	006991		F 066585

The initial operation oil filter replaceable cartridge has been modified (same size as continuous operation filter) to achieve standardization with engine 103.

Removal and installation

1 Remove and install air filter (09-400 and 09-410).

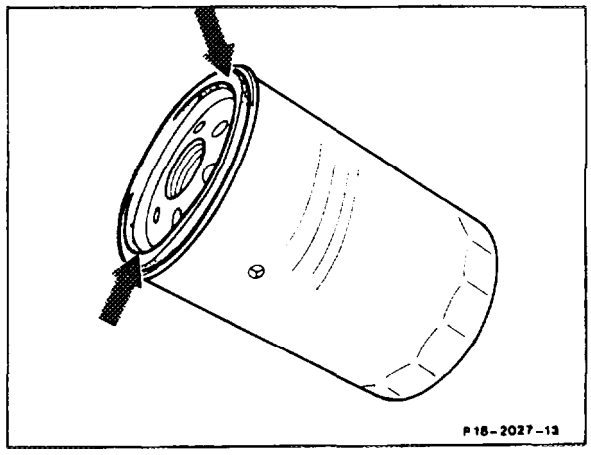
2 Remove and install oil filter replaceable cartridge, special tool 103 589 02 09 00.



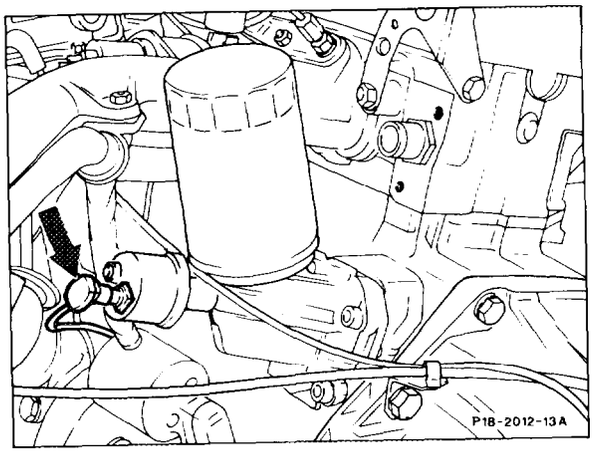
Note
Apply a light coating of oil to gasket (arrows) before installing the replaceable cartridge.

Screw on replaceable cartridge and tighten by hand.

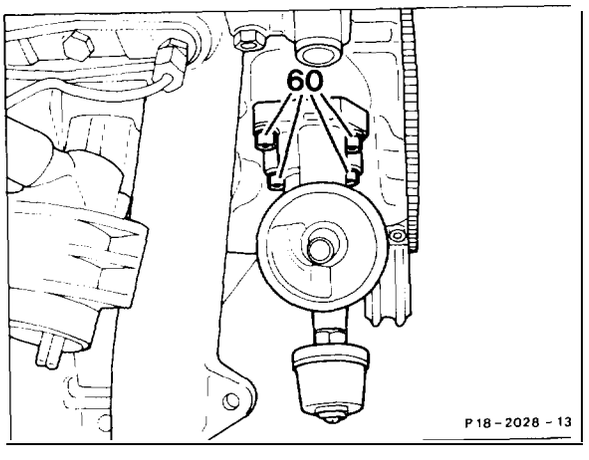
Then tighten a further 1/4 turns (90°) with the wrench socket.



3 Disconnect plug (arrow) for oil pressure sensor, plug in.



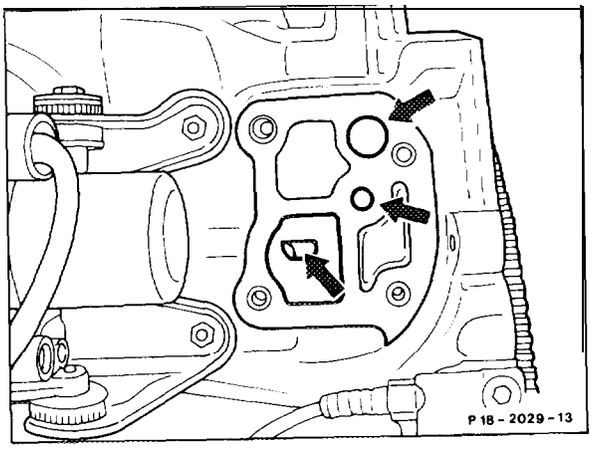
4 Unscrew oil filter base section, screw on, tightening torque 25 Nm.



5 Clean sealing surfaces on oil filter and crankcase.

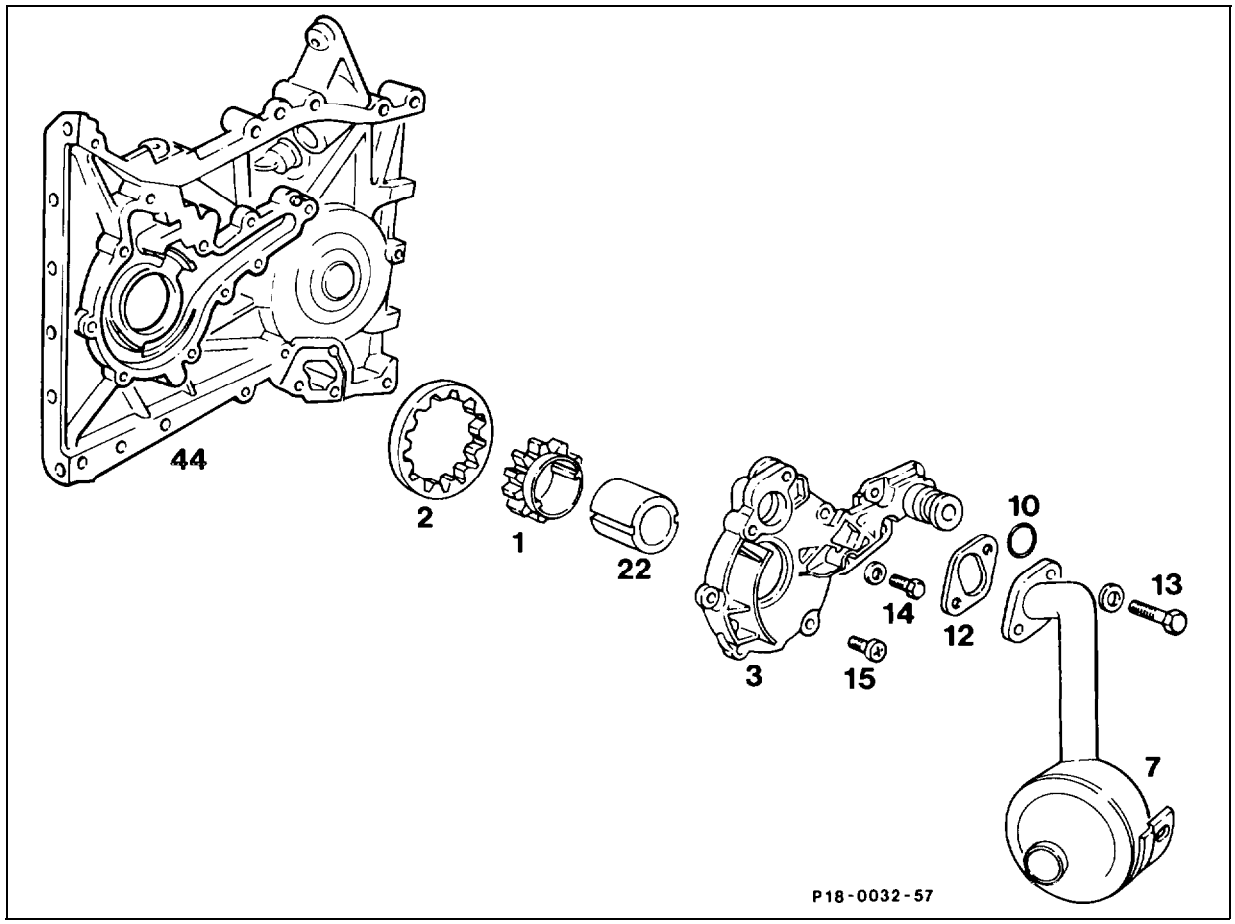
For this purpose, seal the bores on the crankcase, open (arrows).

6 Run engine, check for leaks.



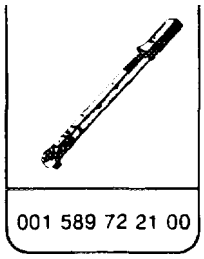
18-210 Removal and installation of oil pump

Preceding work:
Timing case cover removed (01-210).



Oil pickup (7) with strainer basket	unbolt, bolt on, tightening torque 10 Nm (step 2).
Gasket (12)	replace.
Oil pump cover (3)	unbolt, bolt on, tightening torque 10 Nm (step 3).
	Note Re-install Torx bolt at the same point (for space reasons).
O-ring (10)	replace.
Oil pump gears (1 and 2)	remove, insert, oil.
Driver sleeve (22)	if removed, install before fitting timing case cover.

Special tool



Note

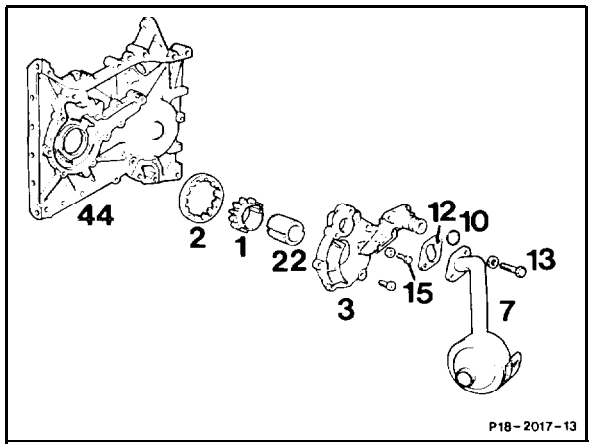
The two oil pump gears (1 and 2) are arranged eccentrically in the timing case cover (44).

The oil pump gears (1 and 2) are driven by the drive sleeve (22) which has two faces on the outer surface for this purpose and is attached by the central bolt to the crankshaft, which also holds the vibration damper or the hub with belt pulley and the crankshaft gear on the crankshaft.

The bore of the driven, externally toothed gear (1) has the identical contour as the outer surface of the drive sleeve.

The oil pump gears are supplied as **replacement parts only together (rotor set).**

The oil pump cover (3) is attached to the rear of the timing case cover (44). It is fixed in place on the timing case cover (44) with a centering sleeve.

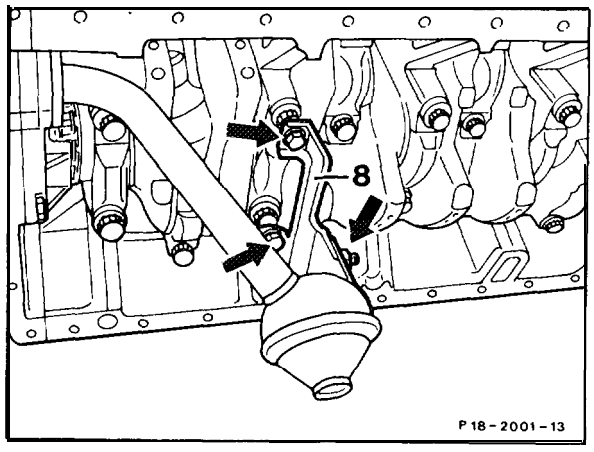


The sealing ring (12) seals the connection fitting at the oil pump cover (oil feed) to the oil passage in the crankcase.

The jump overlock for the timing chain is also cast onto the oil pump cover.

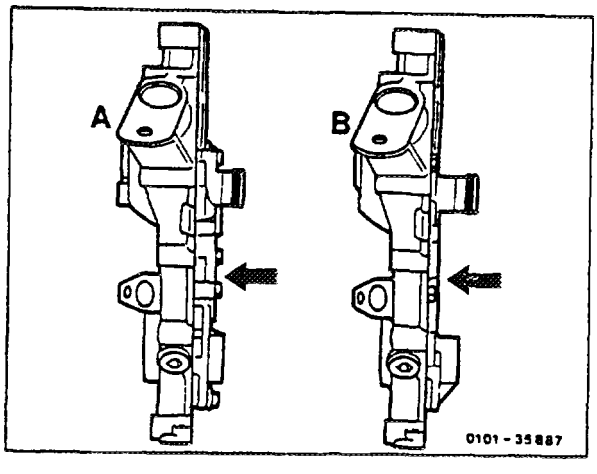
Oil suction pipe together with oil strainer basket is bolted to the oil pump cover (13) with a gasket (12).

The oil suction pipe with oil strainer basket is additionally attached by means of a bracket (8) to the main bearing cover (arrows).

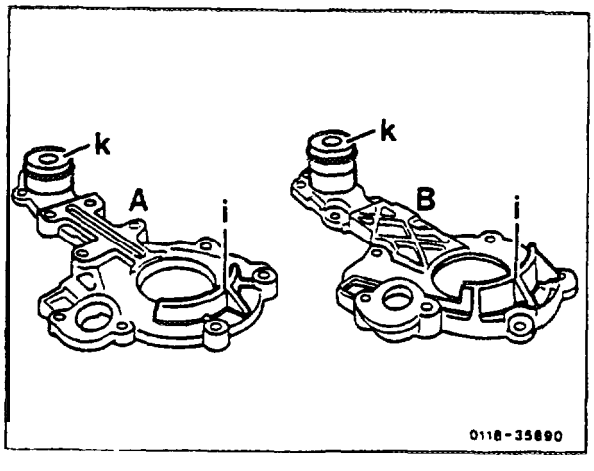


The timing case cover has been modified with the installation of the double roller timing chain (as of November 1987).
The contours on the rear have been lowered.

A Previous version
B Present version



In addition, it has a different rib pattern on the top. The jump overlock (i) is wider and the connection fitting (K) longer.



The drive sleeve for oil pump is manufactured from sintered metal, previously from steel.

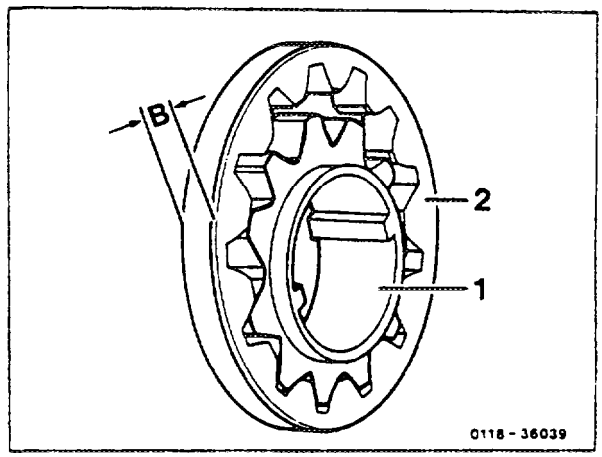
Implementation: August through December 1985

Model	Engine	Engine end Nos. Man. trm.	Engine end Nos. Vehicle ident end No. Autom. trm.
201.024 (USA)	102.985	002517-003158	002505028724 F 137963-/F 182815

* End of implementation not recorded.

2 mm wider pump gears (1, 2) are installed to improve the delivery of the oil pump.

Size "B" previously 7.5 mm
now 9.5 mm

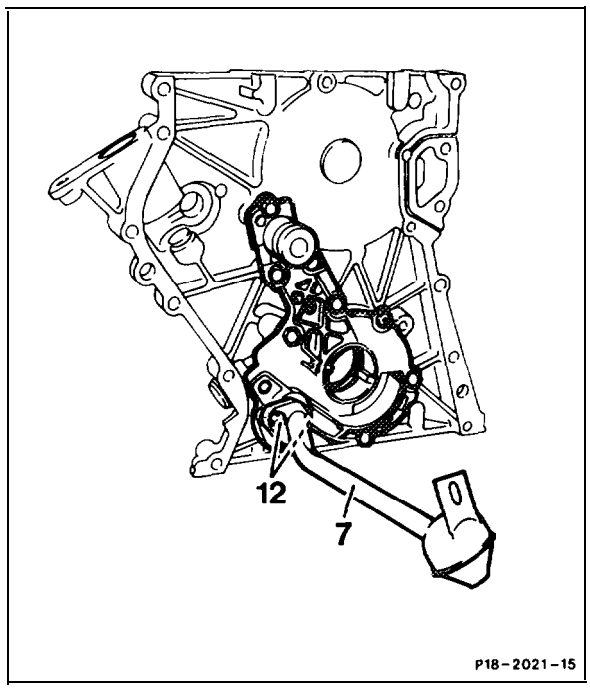


Removal and installation

1 Timing case cover removed (01-210).

2 Unbolt oil pickup together with strainer basket (7), bolt on. Replace gasket.

Tightening torque: 10 **Nm**

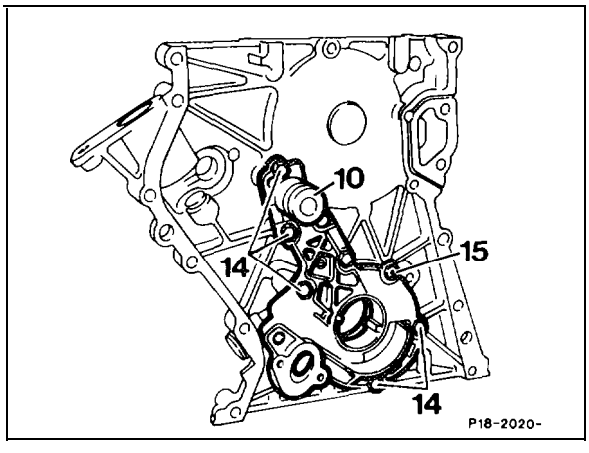


3 Unbolt oil pump cover, bolt on, replace O-ring (10).

Tightening torque: 10 Nm

Note
As of implementation of the flatter oil pump cover, a Torx bolt (15) is installed for space reasons.

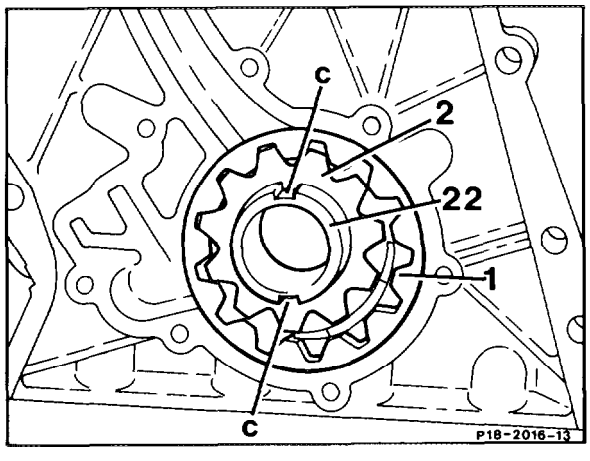
Tightening torque: 10 Nm



4 Remove oil pump gears, insert, oil with engine oil for this purpose.

Caution!
The oil pump gears may only be replaced as a pair.

If the driver sleeve (22) has been removed, this can be inserted after installing the timing case cover.

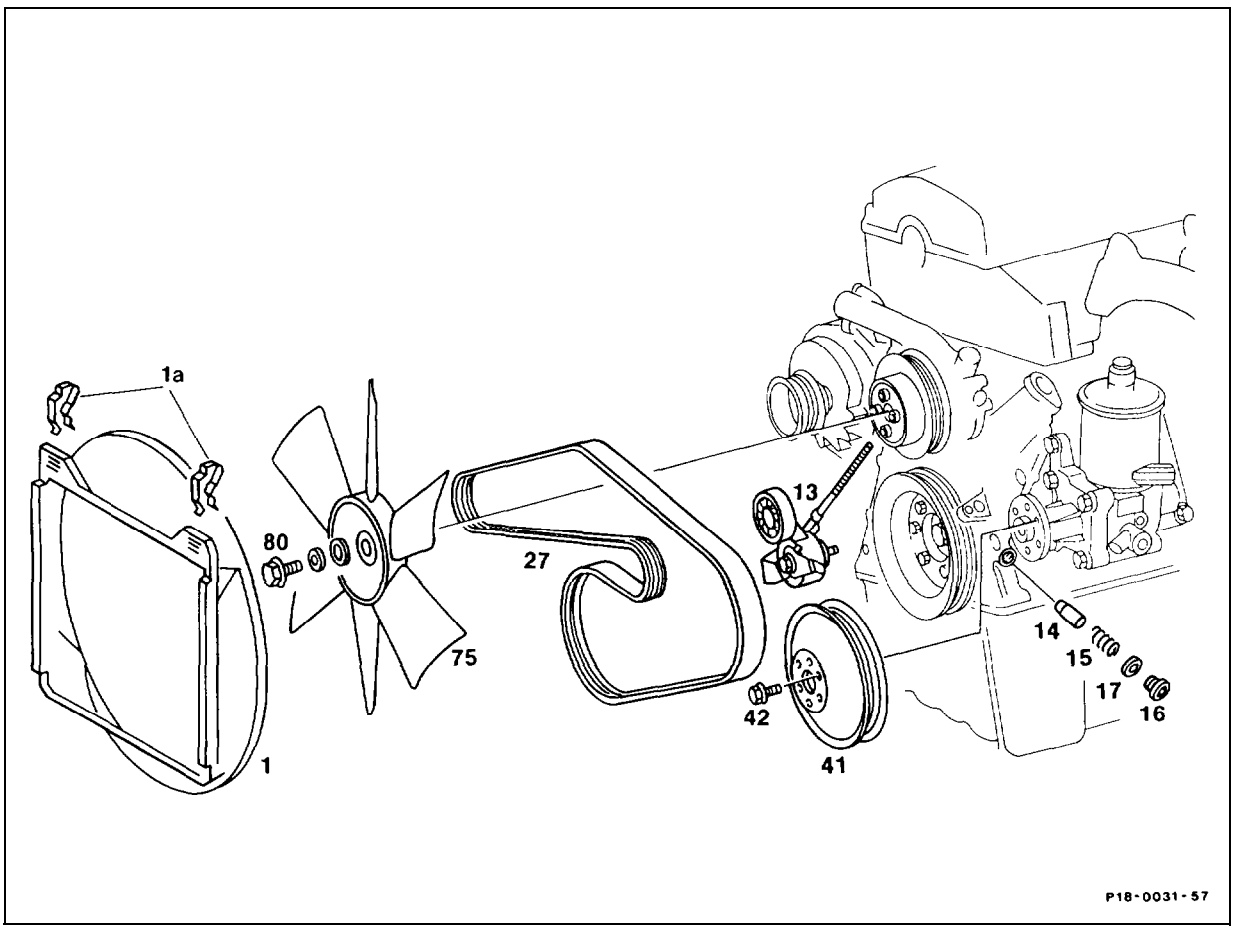


5 Check oil level, adjust to correct level if necessary.

6 Run engine, check oil pressure and oil leaks.

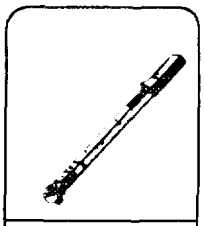
18-215 Removal and installation of oil overpressure (bypass) valve

Preceding work:
Removal and installation of V-belt (13-342).
Removal and installation of V-belt tensioning device (13-345).

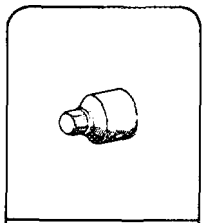


Screw plug (16)	unscrew, screw on, special tool 103 589 01 09 00. Tightening torque 30 Nm.
	Note Screw plug is pressurized by compression spring. Replace seal (17).
Oil overpressure valve (14)	remove, insert.
	Note Check that oil overpressure valve is in proper condition and moves easily in timing case cover, clean bore if necessary and replace oil overpressure valve.
With engine running	check for leaks.

Special tools



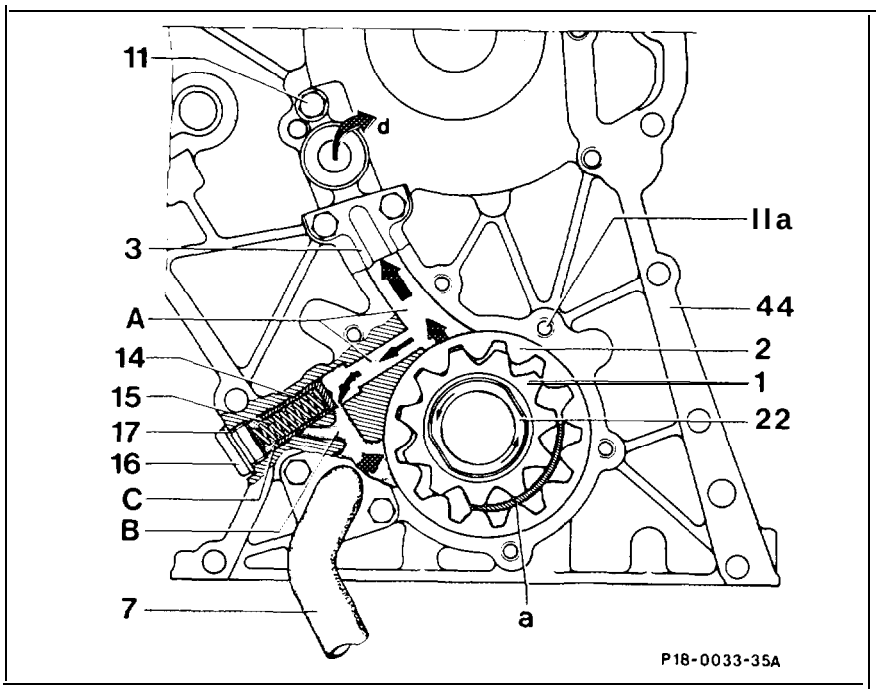
001 589 72 21 00



103 58901 0900

Note

The oil overpressure valve is installed at the side (on the left looking in direction of travel) in the timing case cover and connects pressure chamber **(A),** and suction chamber (B) of the oil pump.



14 Piston
15 Compression spring
16 Screw plug
17 **Seal**

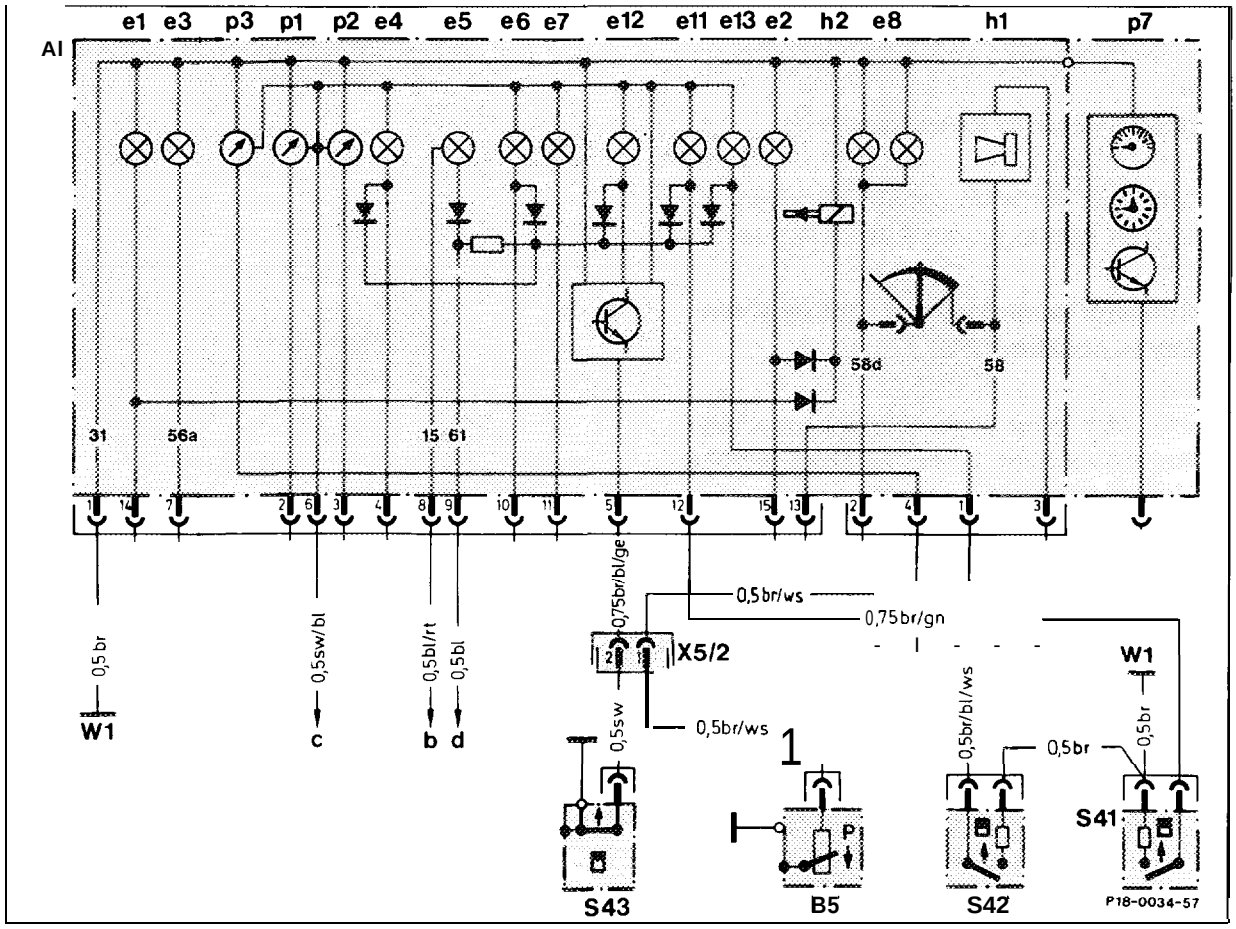
A Pressure chamber
B Suction chamber

From an oil overpressure of approx. 4 bar, the piston (14) is pushed against the force of the compression spring (15) and opens the relief cross-section along which part of the oil flows back to the suction chamber (B), depending on pressure.

When the piston (14) is moved, the oil which is on the rear of the piston in chamber (C) is displaced and flows through the relief grooves on the outside of piston likewise to the suction chamber (B).

18-220 Checking oil level indicator

Model 201



Wiring diagram engine oil level indicator, engine coolant level indicator, windshield washer level indicator

AI	Instrument cluster
e1	**Left** turn-signal indicator
e2	Right turn-signal indicator
e3	High beam indicator
e4	Fuel reserve warning lamp
e5	Battery charge Indicator
e6	Brake pad wear indicator lamp
e7	Brake fluid and parking brake indicator lamp
e8	Instrument lighting
e11	**Engine** coolant level indicator lamp
e12	Oil level Indicator lamp
e13	Windscreen washer indicator lamp
p1	Engine coolant temperature gauge
P2	Fuel gauge
p3	Oil pressure gauge
P7	**Electronic** clock/tachometer
B5	**Oil** pressure gauge sensor
S41	Engine coolant level Indicator lamp **switch**
S42	**Windsshield** washer level indicator lamp **switch**
S43	**Oil** level Indicator lamp **switch**
W1	Main ground (behind instrument cluster)
X5/2	Connector, interior/starter 4-pin

Test data

Resistance at max. oil level	< 1 Ω
Resistance at min. oil level	∞ Ω
Battery voltage	approx. 12 V

Commercial tool

Multimeter	e.g. Sun, DMM-5

Note

If problems occur as for example:

A. Indicator lights up constantly when engine running and oil at correct level.

B. Indicator lamp does not light up when key in position "2".

C. Indicator lamp does not light up when engine running, oil temperature > 60 °C and oil level below "min".

Test

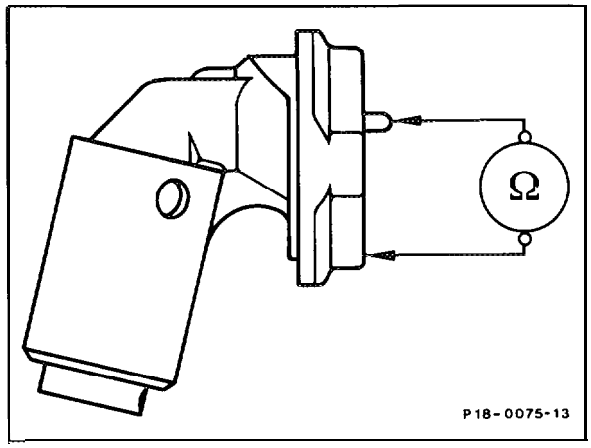
A. Indicator lamp lights up constantly when engine running and oil at correct level.

Test oil level sensor. Detach connector. Test connector to ground with multimeter.

Reading: < 1 Ω

Yes	No

Replace oil level sensor.



Test cable. Remove instrument cluster for this purpose. Test resistance with ohmmeter between contact 5 of 15-pin connector and contact of oil level sensor.

Reading: < 1 Ω

Yes	No

Replace cable harness.

Replace indicating instrument.

End of test

Modul 102 Format 1 ,0 (77x58 mm)
Bild-Motiv
Foto/Zg-Nr.
Abgabe
Korrektur
Bild-Nr. **P18-0076-13**

B. Indicator lamp does not light up when key in position "2" (check function).

Check operation of bulb.

Yes	No

Replace bulb.

Remove instrument cluster. Measure voltage with multimeter at contacts 6 and 9 of the 15-pin connector.

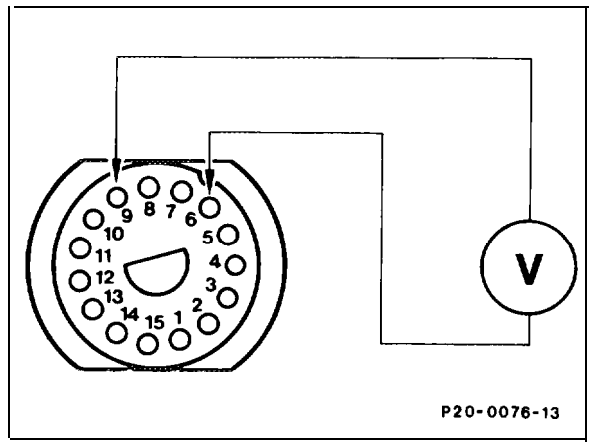
Reading: approx. 12 V

Yes	No

Replace cable harness.

Replace indicating instrument.

End of test



C. Indicator lamp does not light up when engine running, oil temperature > 60 °C and oil level below “min”, check function section "B" in order.

Test oil level sensor. Detach connector for this purpose. Test connector to ground with multimeter.

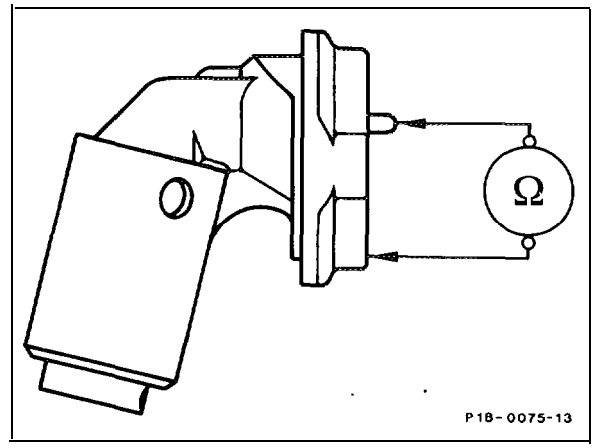
Reading: ∞ Ω

Yes | **No**

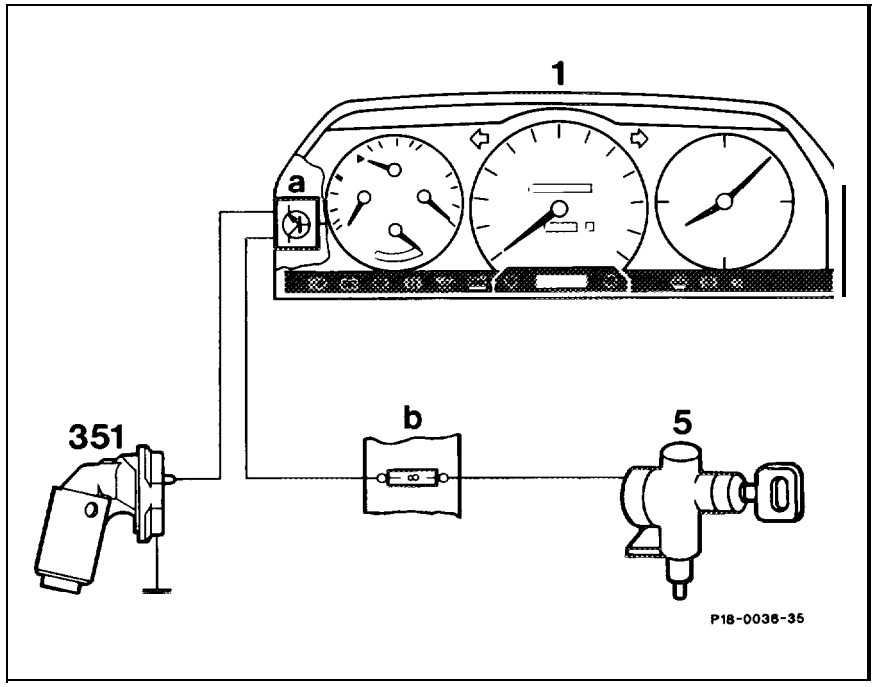
Replace oil level sensor.

Replace indicating instrument.

End of test



18-225 Function of low engine oil level indicator



1 instrument cluster
5 Ignition lock
351 Oil level sensor

a Electronics
b 8A fuse

Components

Oil level sensor in oil sump (351).

Indicator lamp in instrument cluster. Symbol: dripping oil can (1).

Electronics at instrument cluster (a).

General

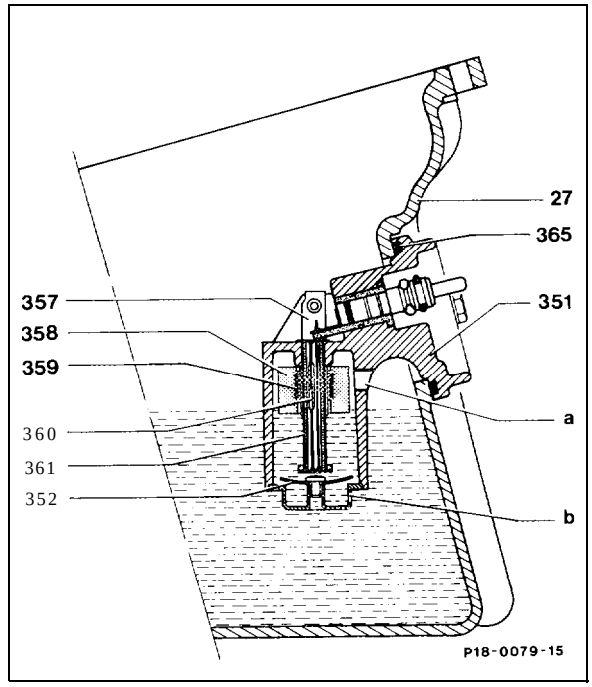
The dynamic low engine oil level indicator monitors the oil level in the sump when the engine is running and at an oil temperature above 60 °C.

No indication is given below 60 °C.

The low engine oil level indicator lights up when the ignition is switched on (check function) and goes out as soon as the engine is running.

The low engine oil level indicator shows a weak light for the check function and a bright light in the event of a fault.

The oil level in the sump is detected by a float (358) with permanent magnet (359) installed in the oil level sensor. Within the minimum range of the dipstick, the float opens the Reed contact (360) and a signal from the electronics in the instrument cluster is interrupted. The indicator lamp lights up.



27	Oil sump
351	Oil level sensor
352	Bimetal snap disk
356	Float
359	Permanent magnet
360	Reed contact
365	O-ring
a	Air admission passage 8 mm dia.
b	Discharge passage 4 mm dia.

The same also occurs in the event of a cable interruption.

When the oil level drops, the indicator lamp lights up first of all briefly and later shows a steady light, depending on the driving style.

To avoid unnecessary warnings in various driving situations, e.g. a sharp lefthand curve, the electronics is equipped with a delay circuit. It prevents the indicator lamp from lighting up until an oil shortage has been signaled for 60 seconds.

To avoid incorrect indications when the engine is cold (viscous oil flows back only slowly to the sump), the oil level sensor is equipped with a bimetal snap disk (352). This prevents the float chamber above the discharge passage (b) running empty at low temperatures.

Switching points of bimetal snap disk

Opens at approx. 60 °C oil temperature.

Closes at approx. 30 °C oil temperature.

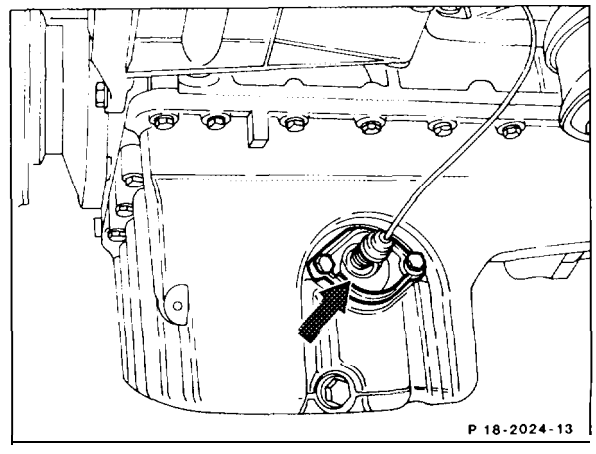
When changing the oil, the float chamber above the air admission passage (1) is filled with oil. Any subsequent faulty indications are thus not possible.

The oil level indicator is designed so that the indicator lamp lights up just before the “min” marking on the dipstick (safety margin).

Maintenance and repair instructions

The oil level indicator does not eliminate the need for checking the oil level with the dipstick when changing the oil.

The oil level sensor (351) can be removed when the oil sump is installed. Drain approx. 2 liters of engine oil for this purpose.



Job No.

Engine coolant circuit and engine cooling	20 – 005
Draining, adding coolant - Antifreeze protection table	20 – 010
Cleaning, flushing engine cooling and heating system	– 015
Removing oil from engine cooling and heating system	– 016
Checking engine cooling system for leaks	– 017
Removal and installation of engine coolant thermostat	– 110
Removal and installation of engine coolant thermostat housing	– 115
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Testing radiator or expansion tank pressure cap	– 430
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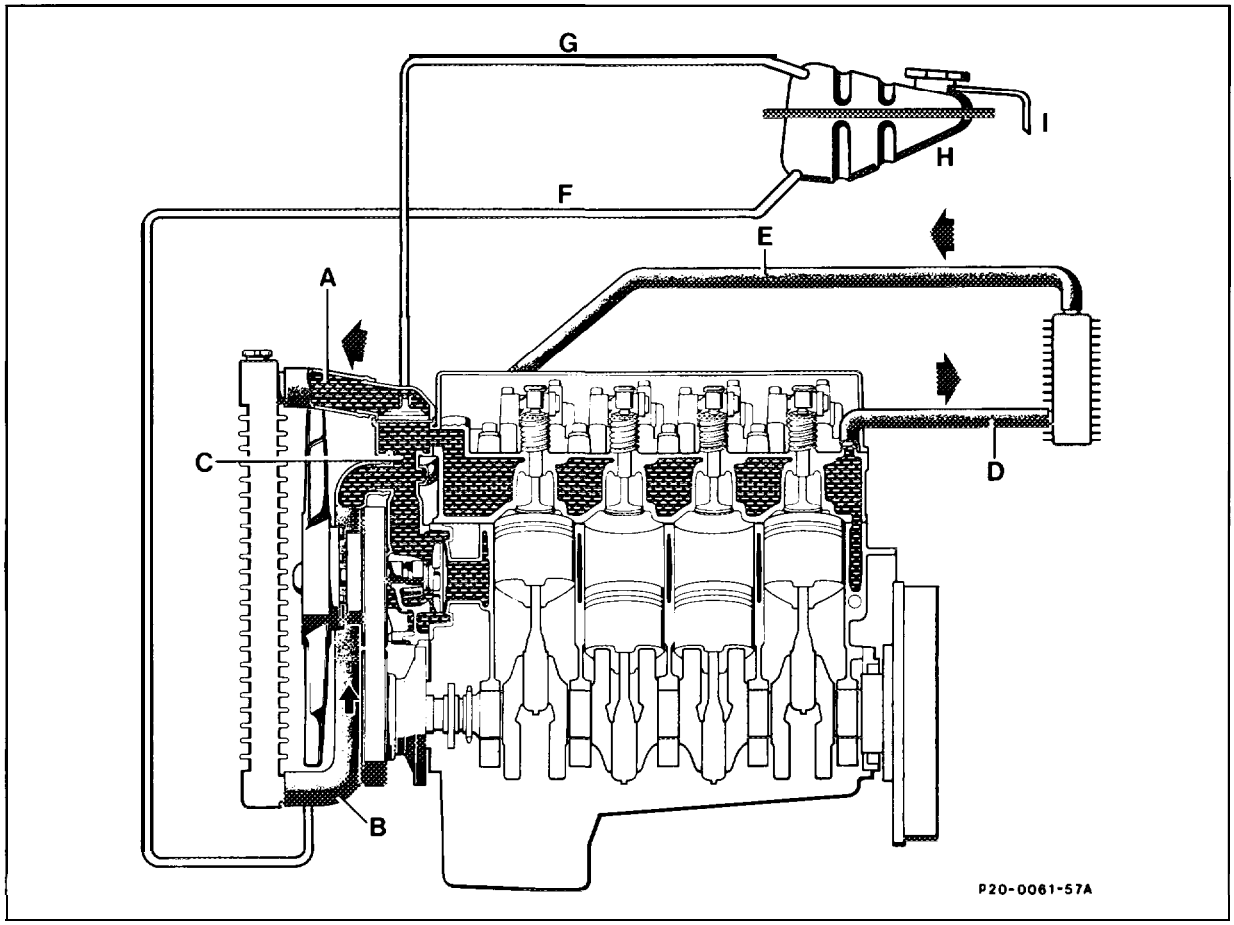
Function of engine coolant level indicator	– 445

20-005 Coolant circuit and engine cooling



Coolant circuit

A	From thermostat housing to radiator	F	Filling line from coolant expansion tank to coolant pump
B	From radiator to coolant pump		
C	Bypass line from thermostat housing to coolant pump	G	Vent line from thermostat housing cap to coolant expansion tank
D	Feed line to heater (heat exchanger)	H	Coolant expansion tank
E	Return line from heater (heat exchanger) to coolant pump	I	Overflow hose

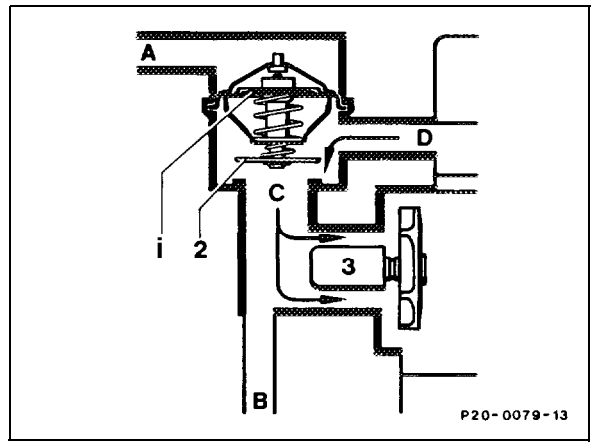
Thermostat

Engine	Thermostat start to open	Fully open
102	87 °C	102 °C

Function

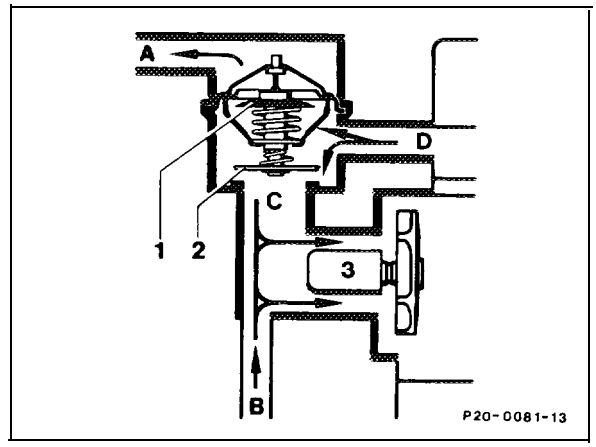
Warming-up period (engine coolant temperature up to approx. 87°C)

The main valve (1) is closed and the bypass valve (2) fully open. Consequently, the flow (A) to the radiator is interrupted and the coolant flows along the bypass line (C) directly to the coolant pump (3) and from there to the engine.



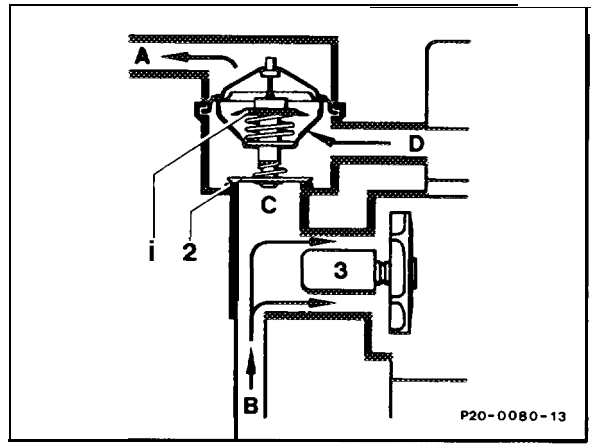
Part load operation (engine coolant temperature approx. 87 °C up to max. 102 "C)

The main valve (1) and bypass valve (2) are more or less wide open depending on engine load and outside temperature. The coolant flows both through the radiator (A) as well as through the bypass line (C), depending on the position of the coolant thermostat.

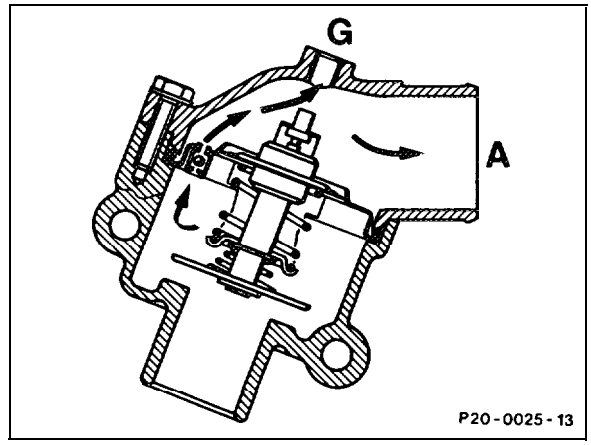


Full load operation – High outside temperatures (engine coolant temperature above 102 °C)

The main valve (1) is fully open and the bypass valve (2) closed. All of the coolant must flow through the radiator and, in so doing, is optimally cooled. It is therefore incorrect to remove the coolant thermostat in order to "improve" engine cooling.

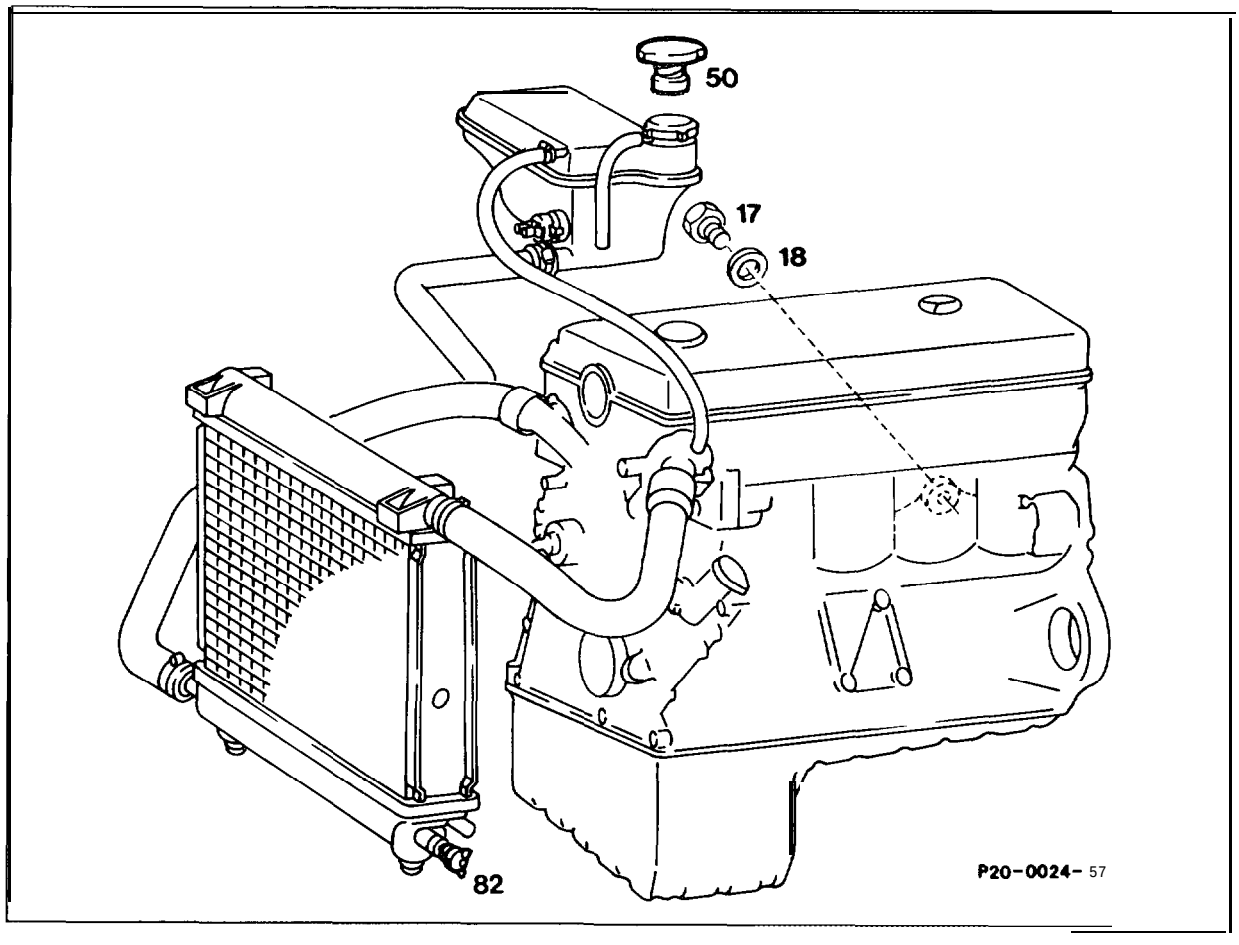


The cooling system is vented through the ball valve when the system is being filled and automatically when the engine is operating. The system is vented at the cap of the coolant thermostat housing (G) along a vent line to the coolant expansion tank.



20-010 Draining, adding coolant – Antifreeze protection table

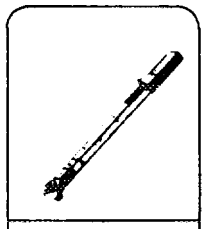
Preceding work:
Bottom engine compartment panelling removed
(except Model 201.024).



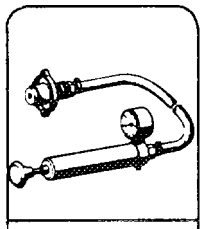
Pressure cap (50)	open in stages, close. ⚠ Do not open until coolant temperature below 90 °C (step 2).
Drain plug (82)	open, close, tightening torque 1.5 Nm (reference value, step 3). **Note** A suitable extension hose can be fitted onto the outlet connection for collecting the coolant.
Drain plug (17)	unscrew, insert, renew seal (18), tightening torque 30 Nm (step 4).

Coolant	pour in up to marking on expansion tank, press filler hose down a little if necessary. Switch on heater (step 5).
Cooling system	check for leaks (20-017).

Special tools



001 589 72 21 00



124 589 15 21 00

Commercial tool

Antifreeze protection tester Prestone-W-Check (Union Carbide)	e.g. Ph. Gather, 4020 Mettmann

Total filling capacities of cooling system with heater and mixing ratio of corrosion protection/antifreeze agent[1]) and water*) in liters

Model	Engine	Total capacity of cooling system with heater	Mixing ratio Antifreeze agent'water -37 °C	-45 °C
1241'20 1	102	8,5	4,25/4,25	4,75/3,75
		9,5[3])	4,75/4,75	5,25/4,25

[1]) See Service Product Specifications sheet 325.
[2]) See Service Product Specifications sheet 310.
[3]) With air conditioning/automatic climate control.

Notes

Disposing of coolant

Refer to municipal, county and state laws.

Coolant composition

See Factory Approved Service Product s sheet.

Water

Use clean water which is not too hard. Drinking water may frequently meet these requirements, but not always. The content of dissolved substances in the water may be of significance for the *occurrence* of corrosion. In cases of doubt, the water should be analysed.

Corrosion protection/antifreeze agents

The purpose of corrosion protectionantifreeze agent is as follows:

- To provide adequate corrosion and cavitation protection for all components
- Antifreeze protection
- Increasing the boiling point

Approx. 50 % by vol. of corrosion protectionantifreeze agent must be added to the water. This concentration offers antifreeze protection down to approx. -37 °C.
A higher concentration is only advantageous at lower ambient temperatures.

More than 55 % by vol. corrosion protectionantifreeze agent reduces the antifreeze protection and impairs heat dissipation.

55 % by vol. corrosion protection/antifreeze agent offers antifreeze protection down to approx. -45 °C.
Corrosion protection/antifreeze agent increases the boiling point. This means that the coolant does not evaporate so rapidly. Discharge of coolant is avoided at high coolant temperatures.
Use *only* approved corrosion protection/ antifreeze agents (see Service Product Specifications sheet 325.1 and 325.2).

Operational monitoring of coolant

Before the start of the cold season of the year, check the antifreeze protection of the coolant. In countries with high outside temperatures, check the corrosion protection antifreeze agent concentration once a year.

When topping up system (after loss of coolant), ensure that the share of corrosion protection' antifreeze agent in the coolant is 50 % by vol. to provide antifreeze protection down to -37 “C.

The antifreeze protection in the coolant reduces during engine operation. These coolants have a severely corrosive effect.

The maximum permissible period of use for the specified coolant in a car engine is 3 years.

Draining – filling up

1 Unscrew front bottom section of noise encapsulation, screw on.

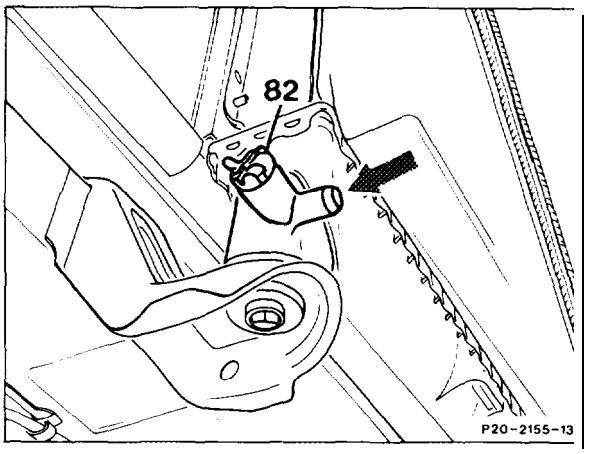
2 Open pressure cap on expansion tank in stages.

⚠Warning!
Do not open pressure cap until coolant temperature is below 90 °C.

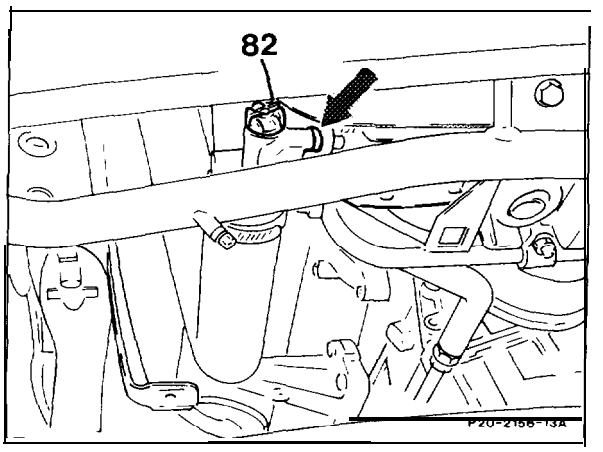
3 Open drain plug (82) at the radiator, close. Tightening torque 1.5 Nm (reference value).

Note

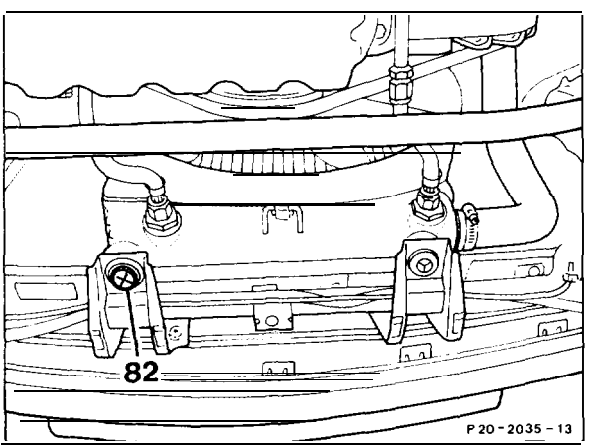
A suitable extension hose can be fitted onto the drainage connection (arrow) for collecting the coolant.



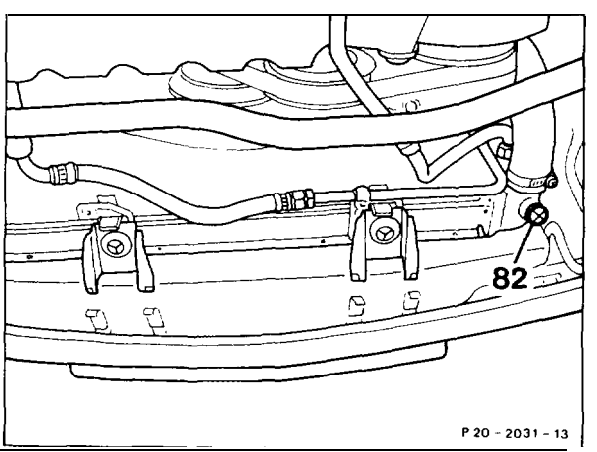
Dram plug Model 124 without air conditioning



Model 124 with air conditioning

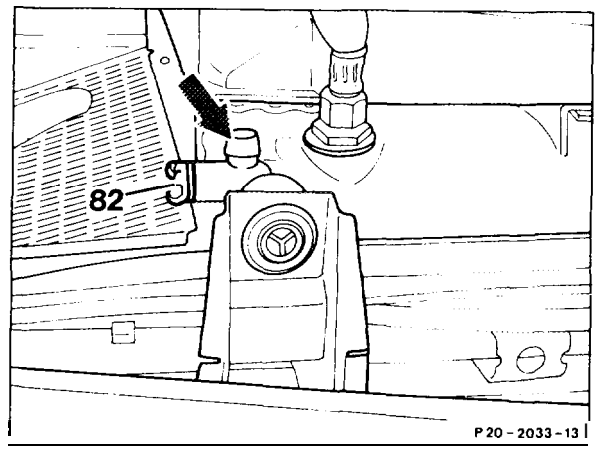


82 Downflow radiator dram plug Model 201 (vehicles without air conditioning, radiator 1 st version)

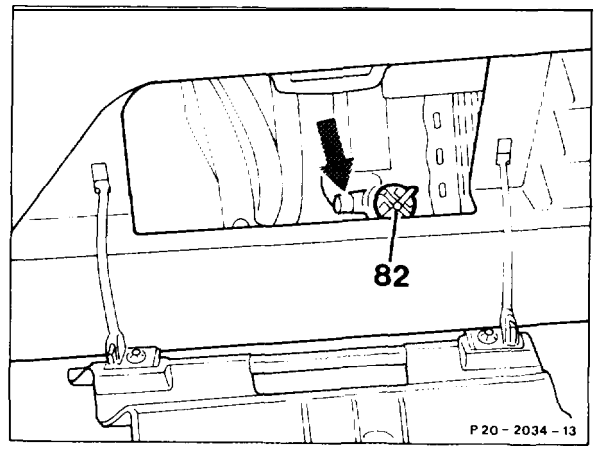


82 Crossflow radiator dram plug Model 201 (vehicles with air conditioning, radiator 1 st version)

On **Model 201 with drain system 2nd version fit** a 12 mm ∅ hose approx. 1500 mm long to the outlet connection (arrow) and run below the wheelhouse. Unscrew drain plug **(82).**

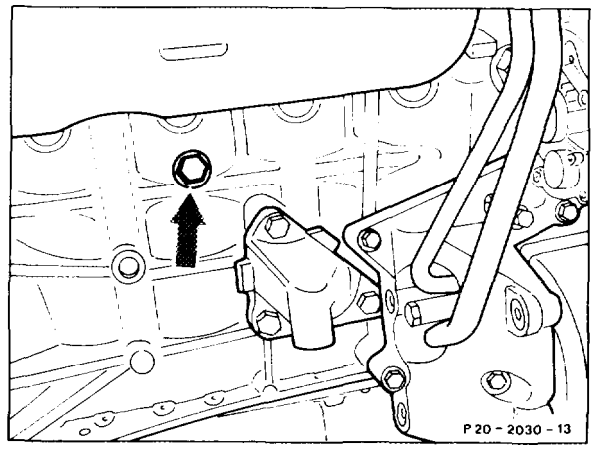


Downflow radiator Model 201 (vehicles without air conditioning)
Drain plug (82) on outside left in direction of travel, outlet connection (arrow) to the rear.



Crossflow radiator Model 201 (2nd version) drain plug (82) at front right in direction of travel, accessible from righthand flap for towing eye in front moulded skirt. Outlet connection (arrow) to the side right.

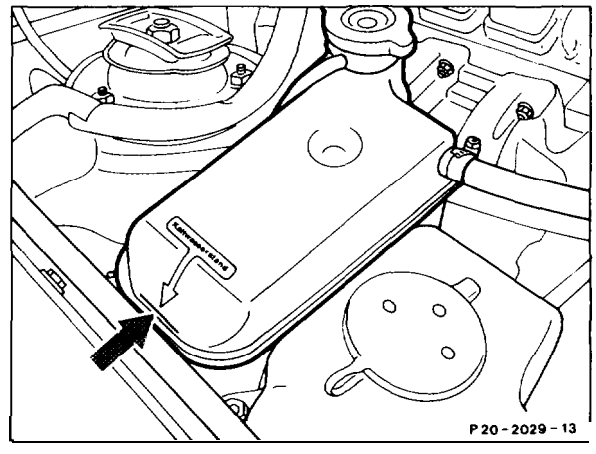
4 Unscrew drain plug **(arrow)** on crankcase, screw in.
Tightening torque 30 Nm.



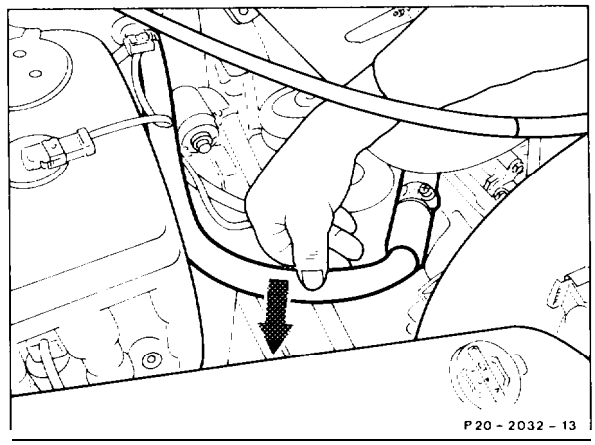
5 **Fill** in coolant up to the marking on expansion tank (arrow).

Note
Switch on heater and run engine until warm.

Close filler neck on expansion tank from a coolant temperature of approx. 60-70 °C.



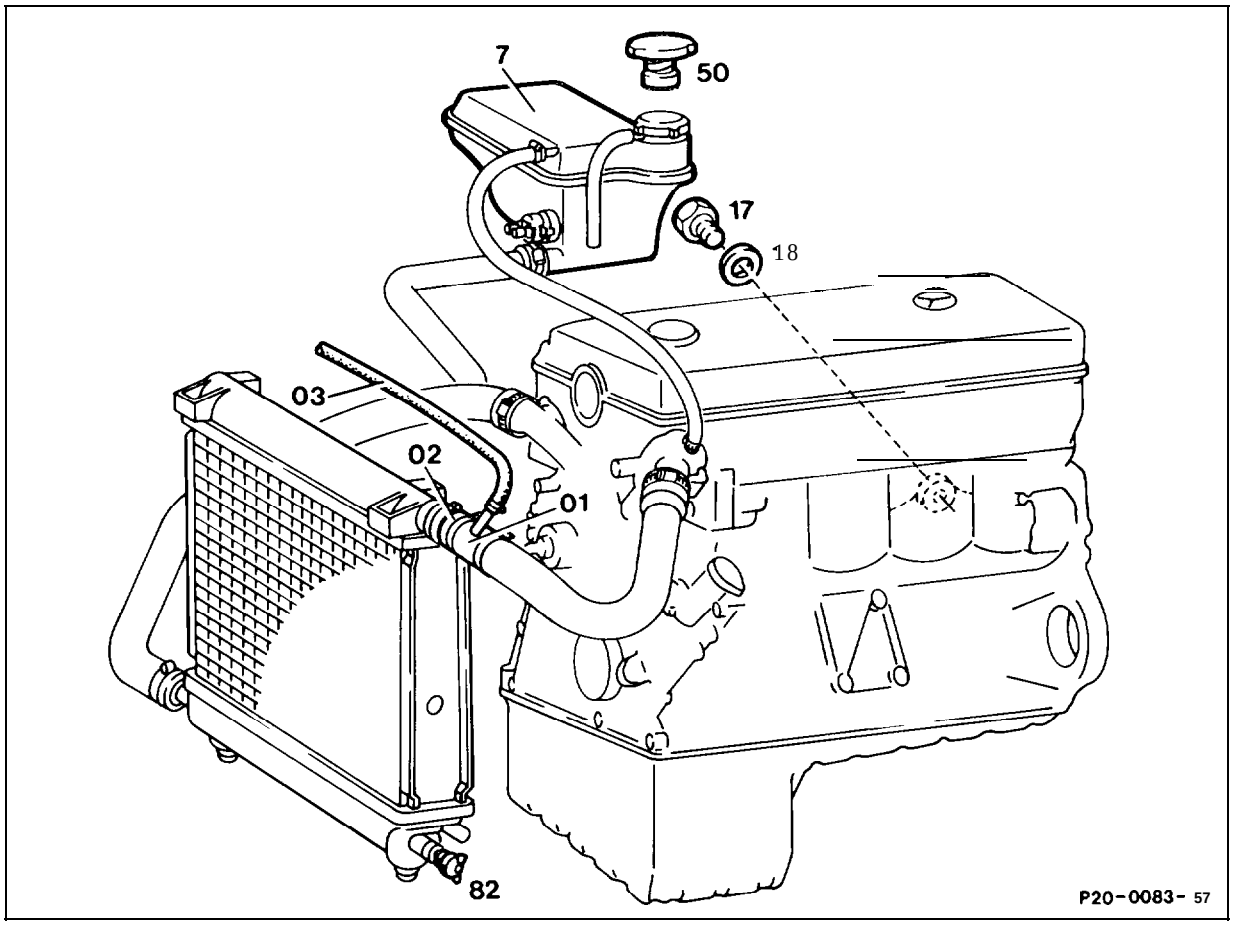
Note
The filler hose can be pressed down for filling (arrow) to ensure the coolant flows more briskly from the expansion tank to the radiator or engine.



6 Check cooling system for leaks (20-017).

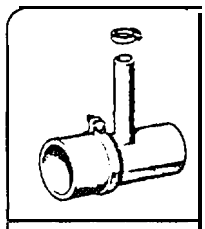
20-015 Cleaning, flushing engine cooling and heating system

Preceding work:
Bottom engine compartment panelling removed (01-006).
Coolant drained (20-010).

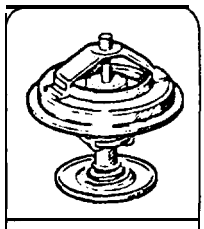


Coolant thermostat	remove and install positive opening part No. 000 589 74 63 00, remove (step 1).
Flushing connection pipe (01)	install and connect tap water hose (steps 2 and 3).
Cooling system	flush (steps 4 to 20 and 22).
Coolant expansion tank (7)	remove and install, flush out (step 21).
Cooling system	check for leaks (20-017).

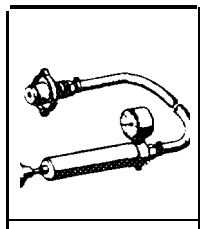
Special tools



117 589 00 90 00



300 589 74 63 00



124 589 15 21 00

Service products	
Corrosion protectionantifreeze agent	000 989 08 25
Citric acid powder (0.5 kg)	000 989 10 25

Note

High coolant temperatures and low heating capacity may also be caused among other things by deposits of corrosion products in the radiator or in the heat exchanger.

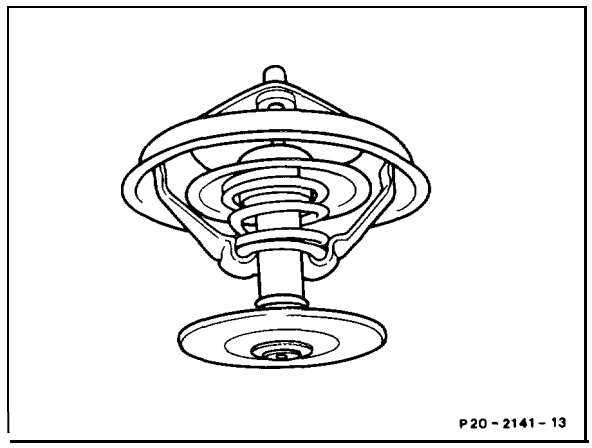
The deposits can be recognized from a gelly-like mass or, when the radiator is emptied and dry, from a grey layer on the radiator connection pipes.

In this case, the radiator and heating system should be cleaned with a 10% citric acid solution.

If the cooling pipes of the radiator are completely or partially blocked, the radiator must be renewed.

Scope of work

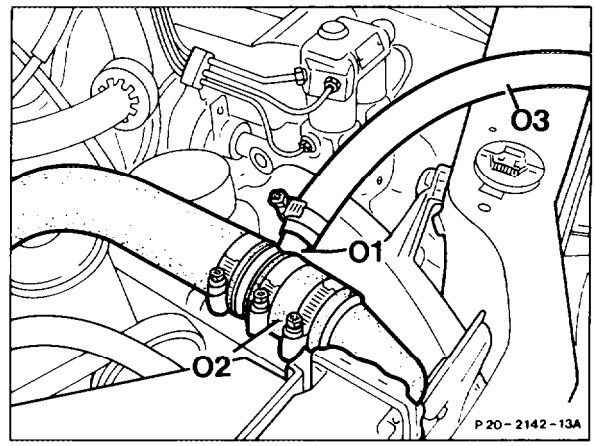
1 Remove coolant thermostat and install positive opening thermostat 000 589 74 63 00 with sealing ring.



P20 - 2141 - 13

2 Connect rinsing connection pipe (01) 117 589 00 90 00 with connection hose (02) between radiator and coolant hose.

3 Connect a tap water hose (03) to the flushing connection pipe (01).



4 Open pressure cap of expansion tank.

5 Set heater to “warm”.

6 On vehicles with recirculation pump, switch on recirculation pump.

This is done by switching on the ignition and:

a) On vehicles with automatic heater control, locking the temperature selectors to the " Max” position.

b) On vehicles with automatic climate control, pressing the “Defrost” pushbutton.

7 Open vent valve of auxiliary heater.

8 Rinse cooling and heating system for approx. 5 minutes with flowing water and engine running (approx. 2500 rpm) to flush out the remaining coolant.

⚠

During the rinsing procedure, the cooling system must always be completely filled.
Adjust feed quantity accordingly.

9 Allow flushing water in the radiator and crankcase to drain out completely. Screw in drain plugs (17 and 82).

10 Dissolve 1.5 kg citric acid powder (0.5 kg, Part No. 000 589 10 25) in approx. 5 liters of water in a suitable vessel.

11 Pour cleaning solution into the expansion tank and top up with water to the marking on the expansion tank.

12 Close bleeder screw of auxiliary heater.

13 Close pressure cap of expansion tank.

14 Run engine for 15 minutes at approx. 2500 rpm. The flushing liquid must flow through the heat exchanger when performing the step (step 6).

15 Following this, drain cleaning solution.

⚠

The cleaning solution (citric acid mixture) should be drained into a standard workshop oil and water separator.

16 Open bleeder screw of auxiliary heater.

17 Flush cooling and heating system for approx. 10 minutes with flowing water and engine running (2500 rpm). The flow must pass through the heat exchanger when performing the step (see steps 5 and 8).

18 Remove flushing connection pipe and connect coolant hose to radiator.

19 Install normal coolant thermostat with new seal.

20 Screw in coolant drain plug at radiator (82) and crankcase (17), renew seal (18).

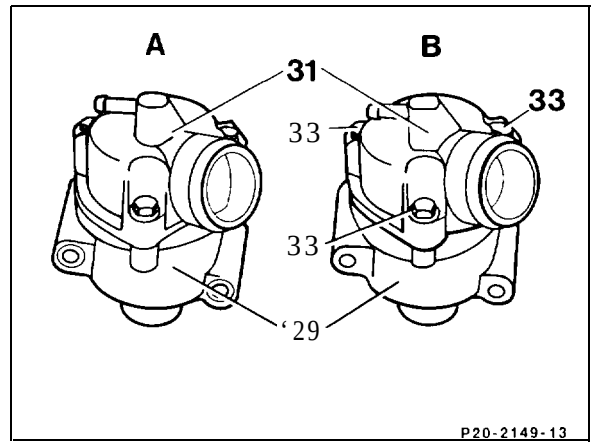
21 Remove and install coolant expansion tank and flush out once again separately.

Note
Because of the pockets and recesses in the coolant expansion tank, not all of the solution is removed during draining.

22 On vehicles with auxiliary heater, connect plastic hose to vent valve and open valve.

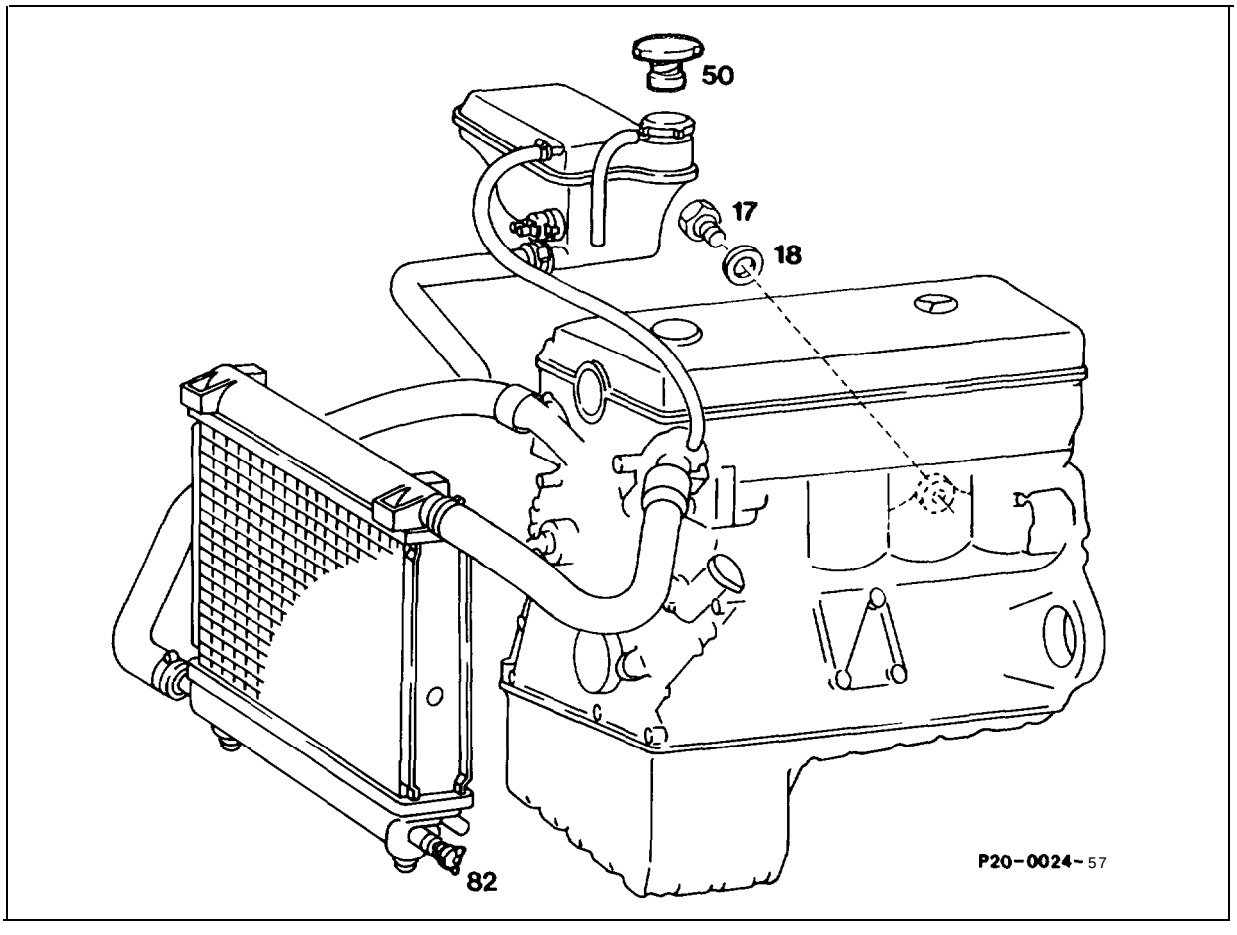
23 Pour in new coolant (20-010)

24 Check cooling system for leaks (20-017).



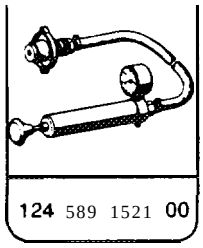
20-016 Removing oil from engine cooling and heating system

Preceding work:
Engine **coolant drarned (20-O 10).**
Engine coolant thermostat removed (20-l 10).



Heater controls	set to full capacity (step 1).
Engine cooling system	fill with a 5% solution (step 2).
Engine	raise to normal operating temperature and run for approx. 5 minutes (step 3).
Solution	drain flushing solution and fill engine cooling system twice with fresh water, run each time for approx. 5 minutes and drain completely (steps 5 and 6).
Engine cooling system	check for leaks (20-017).

Special tool



Removing oil

Note
It is necessary to remove oil from the engine cooling system if, for example, engine oil, gear oil in the case of an automatic transmission or hydraulic oil has got into the engine cooling system.

1 Set heater controls on vehicles with and without air conditioning to full capacity.

2 Fill the engine cooling system with a 5% solution of water and neutral cleaner or with a mild alcaline cleaner, e.g. P3-Croni (supplier: Henkel) or Grisiron 7220 (supplier: Farbwerke Hoechst).

Caution!
Sharply alcaline cleaners, such as P3 Standard (supplier: Henkel) must not be used on these vehicles (light alloy radiator).

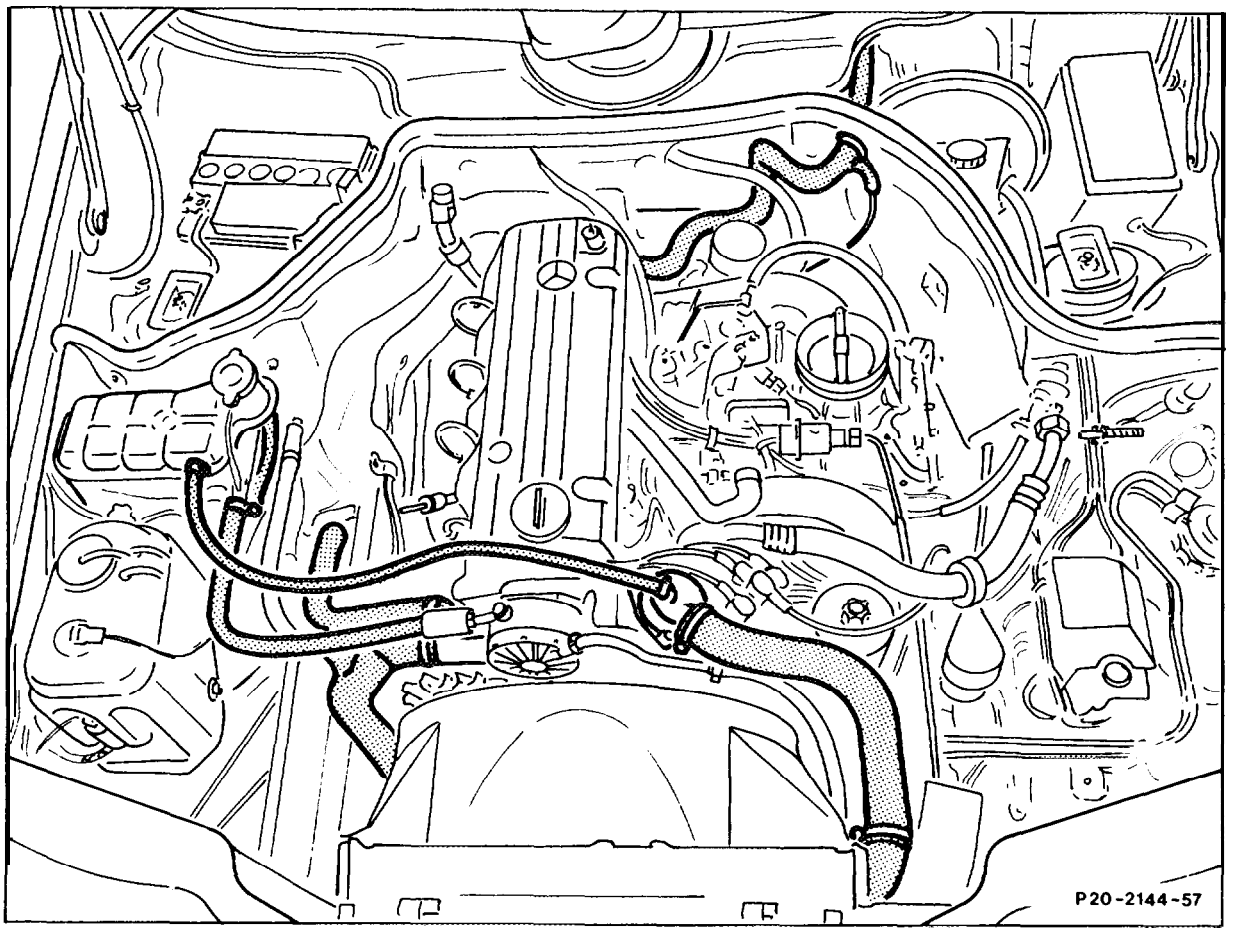
3 Warm up engine to approx. 80 °C at a moderate speed and maintain at this temperature for approx. 5 minutes.

4 Switch off engine and allow enginecooling system to cool down to approx. 50 “C.

5 Completely drain solution.

6 Immediately after this, fill engine cooling system twice with fresh water, run until warm (approx. 5 minutes) and drain.

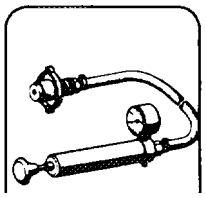
20-017 Checking engine cooling system for leaks



Pressure cap	turn to 1st detent to release pressure. Twist off to 2nd detent and remove (step 1).
Coolant level	check (step 2).
Tester	124 589 15 21 00, attach to expansion tank and pressurize engine cooling system to approx. 1.4 bar (step 3). Check all engine coolant and heater hoses and connection points for loss of engine coolant. Check condition of hose clips, tighten if necessary (step 4).

Note
The illustration shows connections which must be checked for leaks when pressure-testing the engine cooling system.

Special tool



124 589 15 21 00

Commercial tool

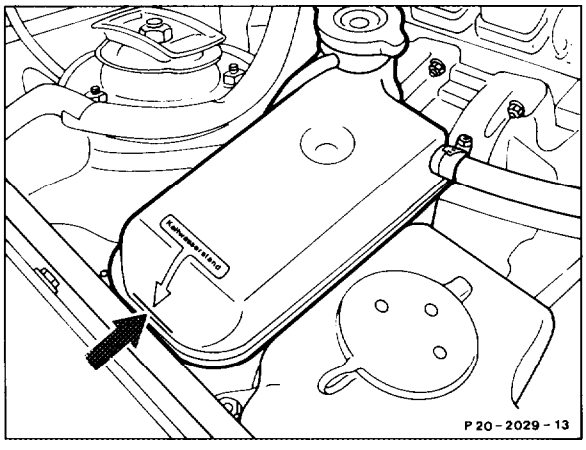
7 mm socket wrench hexagon on flexible shaft for hose clips with worm drive	e.g. Hazet, D-5630 Remscheid Order No. 426-7

Checking leaktightness

1 Turn pressure cap to 1st detent and release system pressure. Then turn to 2nd detent and remove cap.

Warning!
Do not remove the pressure cap until enginecoolant temperature is below 90 °C.

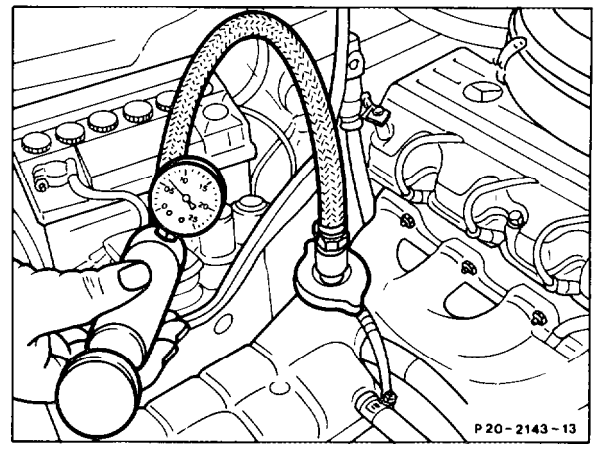
2 The engine coolant level must extend up to the marking on the expansion tank (arrow).



3 Pressurize engine cooling system to approx. 1.4 bar with the tester 124 589 15 21 00.

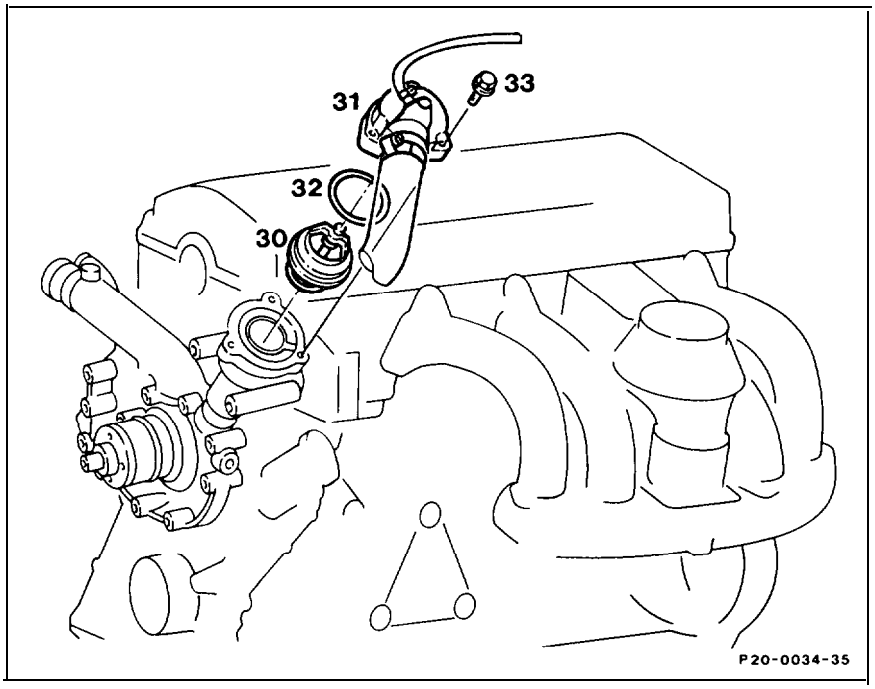
4 Check all engine cooling and heating water hoses and the connection points for loss of engine coolant.

Check condition of hose clips, replace or tighten as necessary.



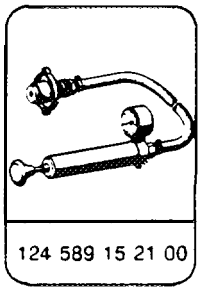
20-110 Removal and installation of engine coolant thermostat

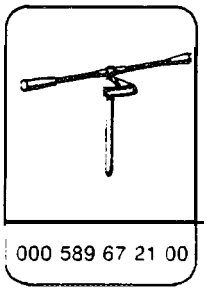
Preceding work:
Drain – fill in coolant (20-010).



Cap (31)	unscrew with connected engine coolant hose, screw on, tightening torque for light alloy cap 10 Nm, plastic cap 8 Nm.
O-ring (32)	replace.
Engine coolant thermostat (30)	remove and install.
	Note Install the enginecoolant thermostat so that the ball valve is at the highest point.
Engine cooling system	check for leaks (20-017).

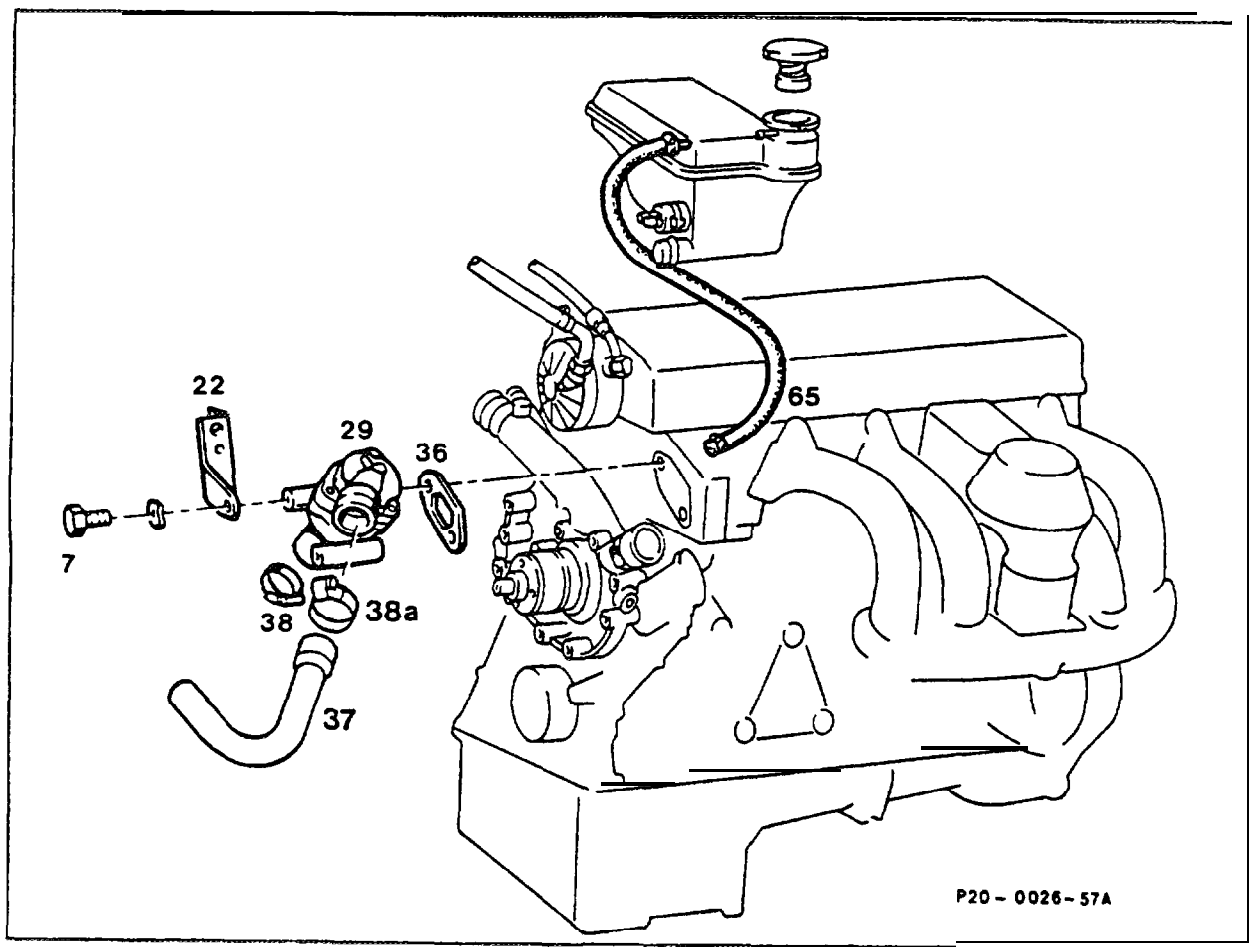
Special tools


124 589 15 21 00


000 589 67 21 00

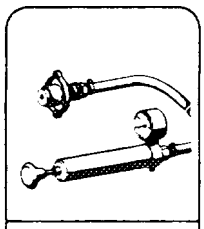
20-I 15 Removal and installation of engine coolant thermostat housing

Preceding work:
Drain – fill in coolant (20-010).

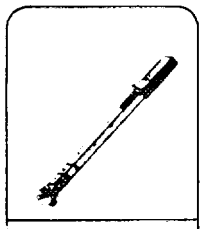


Vent line (65)	disconnect, connect (step 2).
Lifting lug (22)	unbolt, bolt on. Tightening torque 25 Nm (step 3).
Hose clip (38, 38a)	at top of bypass hose, loosen, tighten (step 4).
Engine coolant thermostat housing (29)	unbolt, bolt on. Tightening torque 25 Nm (step 5).
Gasket (36)	replace (step 6).
Engine cooling system	check for leaks (20-017).

Special tools



124 589 15 21 00



001 589 72 21 00

Commercial tool

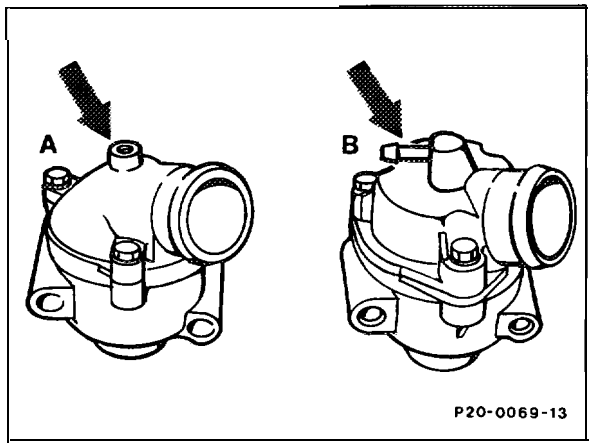
7 mm socket wrench hexagon on flexible shaft for hose clips with worm drive	e.g.	Hazet, D-5630 Remschetd Order No. 426-7

Note

Since January 1985, Model 201 has been equipped with a plastic engine coolant thermostat housing.

The gasket to the cylinder head is manufactured from rubberized cork.

The vent line is pushed on with **a** hose clip; previously with hollow bolt (arrow).

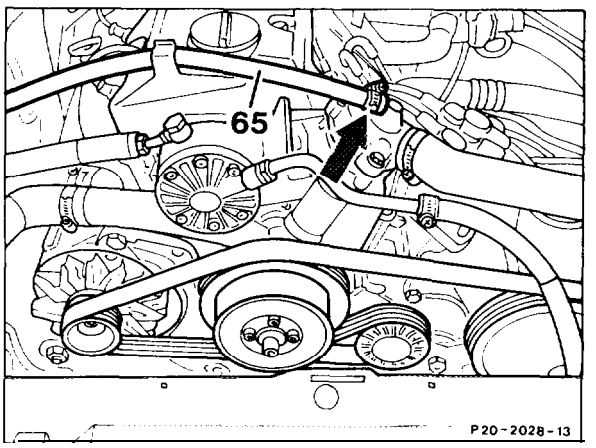


A 1st version
B 2nd version

Removal and installation

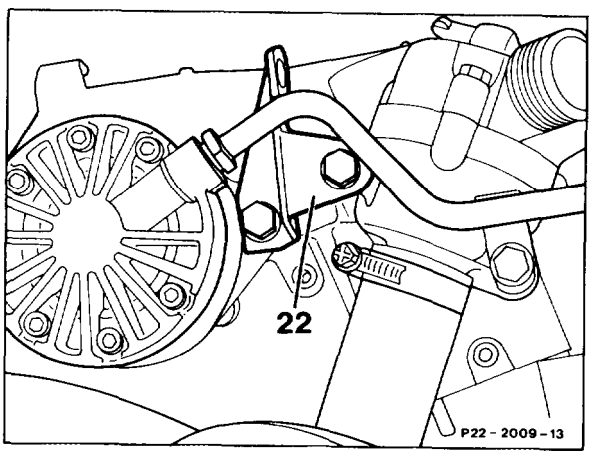
1 Draining – adding engine coolant (20-010).

2 Detach vent line (65) at the cap of the engine coolant thermostat housing, connect (arrow).

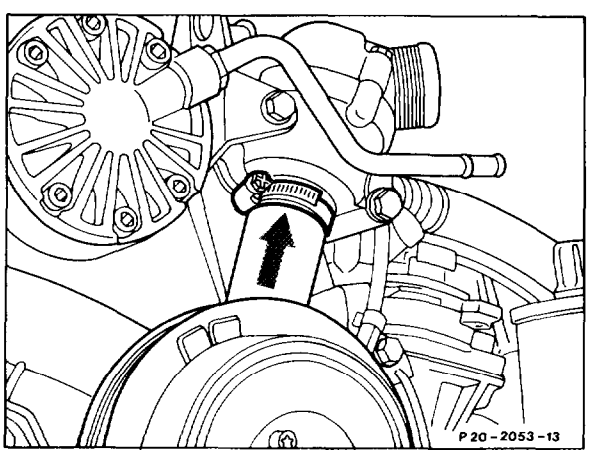


3 Unbolt lifting lug (22, only on engines with hydraulic oil pump), bolt on.

Tightening torque 25 Nm.



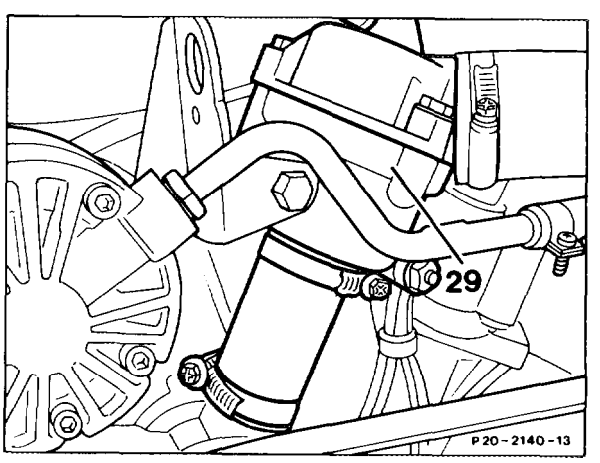
4 Loosen hose clip (arrow) at bypass hose, tighten.



5 Unbolt engine coolant thermostat housing (29), bolt on. Tightening torque 25 Nm.

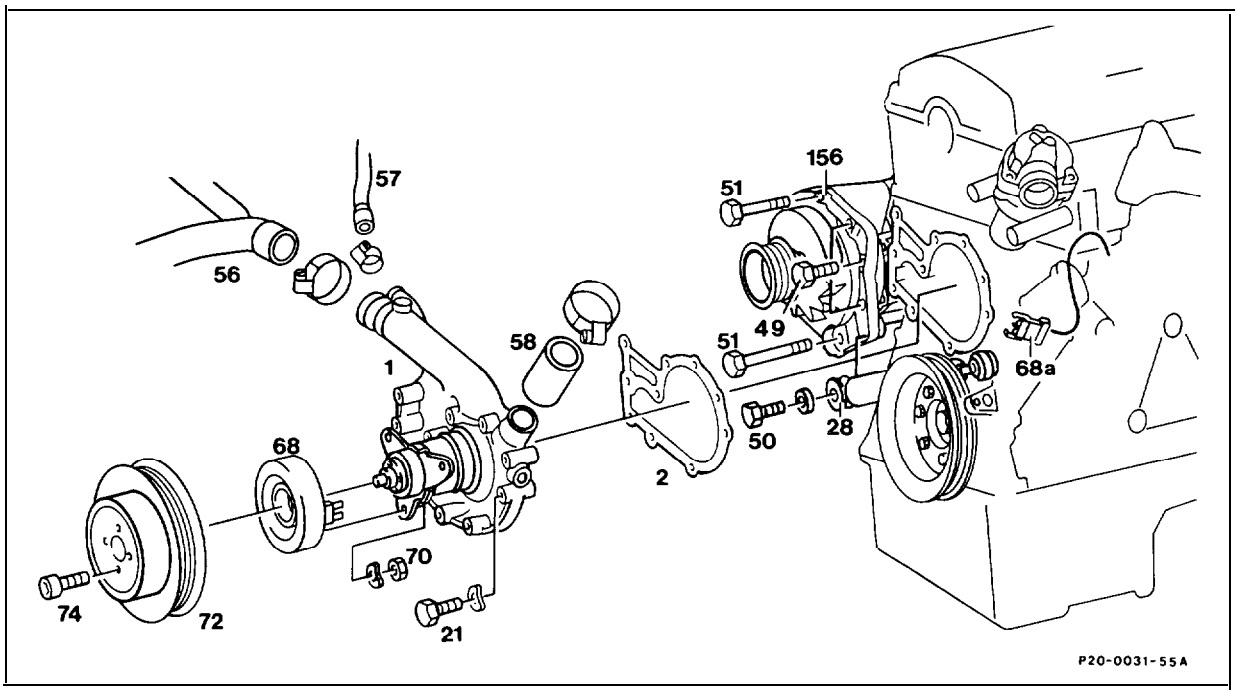
6 Clean sealing surfaces, replace gasket.

7 Check engine cooling system for leaks (20-017).



20-210 Removal and installation of engine coolant pump

Precedmg work:
Drainmg – addmg engine coolant (20-010).
Removal and installation of V-belt (13-342).



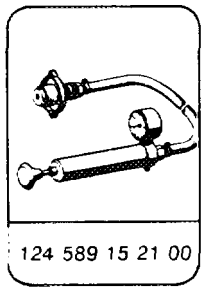
Belt pulley (72)	unbolt, bolt on, tightening torque of hex. socket bolt 10 Nm, Torx socket bolt 15 Nm (step 3).
Cable connector (68a)	detach from solenoid body, plug in (step 4).
Solenoid body	unbolt, bolt on, pay attention to installed position, tightening torque 10 Nm reference value (step 4).
Engine coolant hoses (56, 57 and 58)	detach, attach (step 5).
Bolt (50)	for shock absorber (28), unbolt, bolt on, tightening torque 25 Nm (step 6).
Bolts (51)	unbolt, bolt on. Place alternator with connected cable to the side (step 7).
Bracket (156)	detach, attach by removing bolts (49, 3 off), bolting on, tightening torque 25 Nm.

Coolant pump (1) . . . . . unbolt, bolt on, pay attention to bolt length, tightening torque 10 Nm. Clean sealing surfaces (step 10).

Note
Only use paper gasket 102 201 00 80 (2) if the timing case cover is sealed with liquid sealant. Otherwise seal engine coolant pump with sealant
002 589 00 20 10.

Engine cooling system . . . . . check for leaks (20-017).

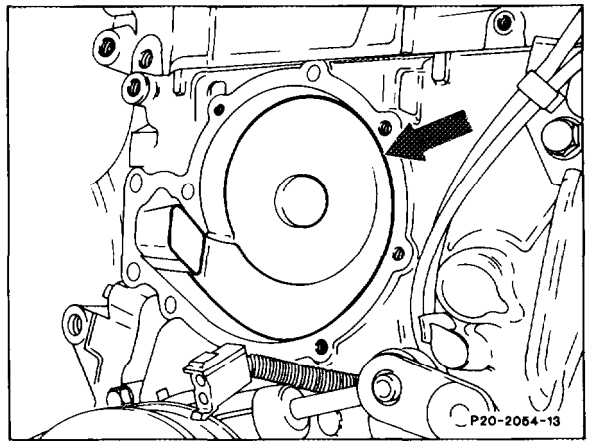
Special tools



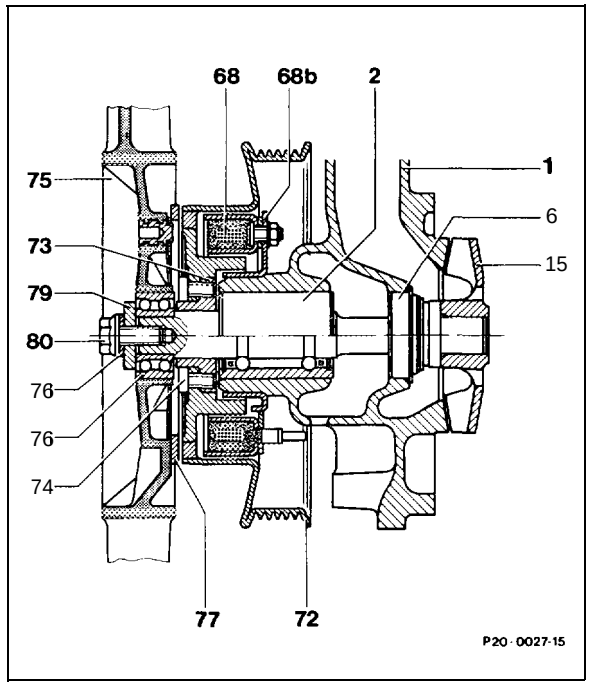
Commercial tool

7 mm wrench socket on flexible shaft for hose clips with worm drive	e.g. Hazet, D-5630 Remscheid Order No. 426-7

Note
The pump chamber for the impeller of the engine coolant pump is located in the timing case cover (arrow).



Components
The bearing (2) of the engine coolant pump shaft and the cassette-type seal (6) are press-fit into the engine coolant pump housing.



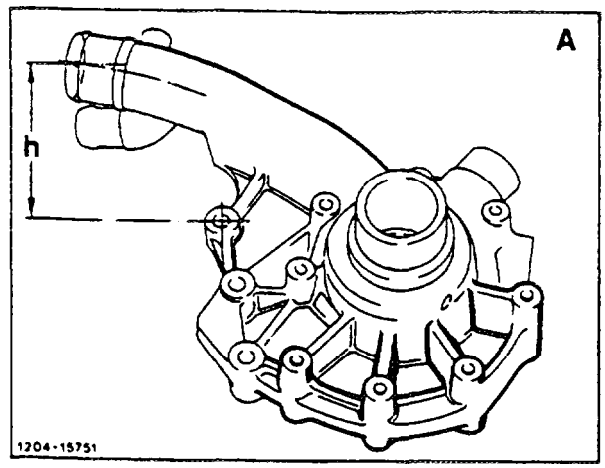
1 Engine coolant pump housing
2 Engine coolant pump bearing
6 Cassette-type mechanical seal
15 Impeller
68 Solenoid body
68b Carrier
72 Belt pulley
73 Flange
74 Fastening bolts
75 Fan
76 Angular-contact ball bearing
77 Armature
78 Tensioning pulley
79 Pulley
80 Fastening bolt

To achieve added safety for the fastening bolts of the belt pulley at the engine coolant pump, M6 × 12 Torx bolts (previously M6 × 12 hex. socket bolts) are installed. Tightening torque 15 Nm.

Produktion breakpoint: September 1985

Model	Engine	Engine end No. Man. trm.	Autom. trm.
201.024 (USA)	102.985	002692	023655

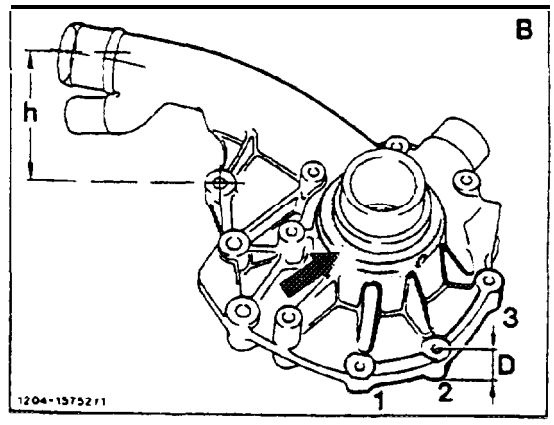
The engine coolant pump housing had to be modified with implementation of the top damper point of the belt tensioning device.



Modifications:

a) Mounting eyes (Fig. B, 1, 2, 3) on engine coolant pump housing lowered, size "D" 18.4 mm (previously 42.4 mm), matching M6 × 30 bolt + washer assys (previously M6 × 55). This creates clearance for top shock absorber of belt tensioning device (P 13123).

b) Engine coolant inlet connection lowered, size "h" = 90.5 mm (previously 100.5 mm).



c) Housing wall strengthened in transition area from hub to housing flange (Fig. B, arrow).

d) Bottom coolant hose (radiator to engine coolant pump) modified.
Identification: Modified Part No. on coolant hose.

Bottom coolant hose

Model 124	Part No.
Manual transmission	124 501 38 82
Automatic transmission	124 501 40 82
Automatic air conditioning	124 501 39 82

Model 201

Model	Version	Transmission manual	Transmission automatic	Air conditioning	Part No.
201.028	USA			×	201 501 66 82

Temporary installation of a cassette-type mechanical seal with modified material (silicone carbide, previously ceramic).

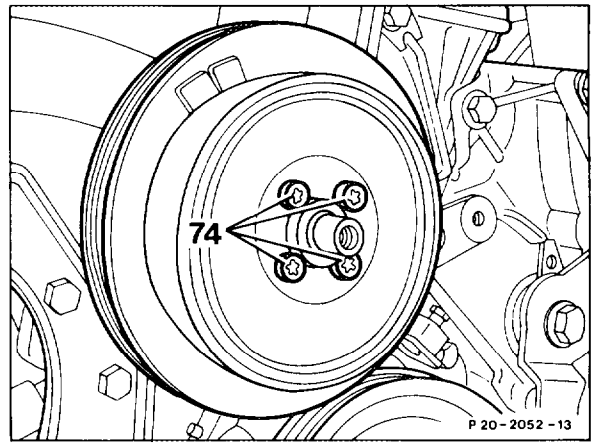
Identification:
Red dot on coolant pump housing.

Removal and installation

1 **Drain** cengine oolant, fill (20-010).

2 Remove and install V-belt (13-342).

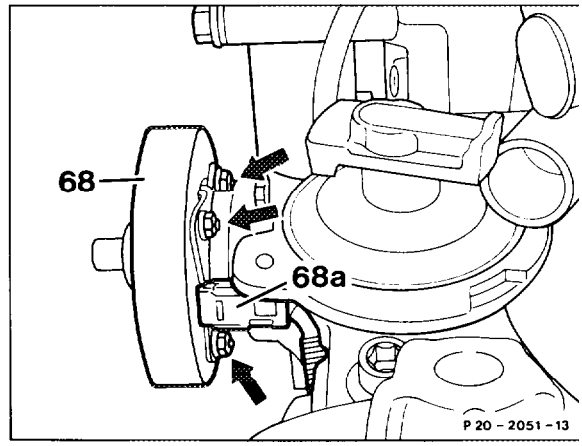
3 Unbolt belt pulley for engine coolant pump.



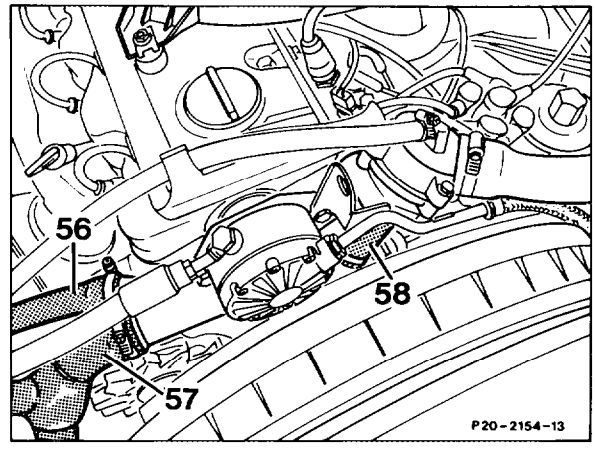
Note
Pay attention to bolt versions and tightening torques.

Hex. socket bolts	10 Nm
Torx socket bolts (as of 9/85)	15 Nm

4 Disconnect cable connector (68a), plug in, unbolt solenoid body (68), bolt on (arrows).



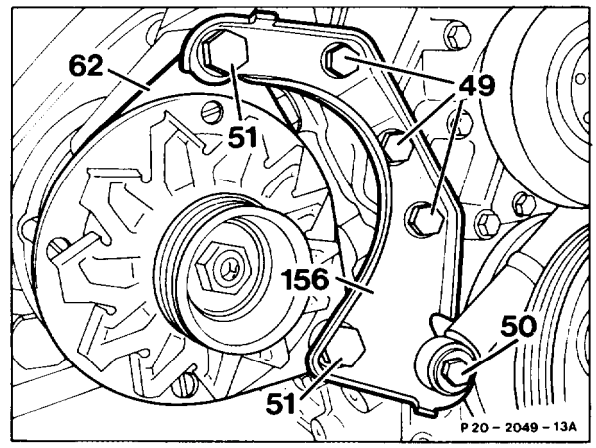
5 Detach engine coolant hoses (56 and 57) as well as bypass line (58), connect.



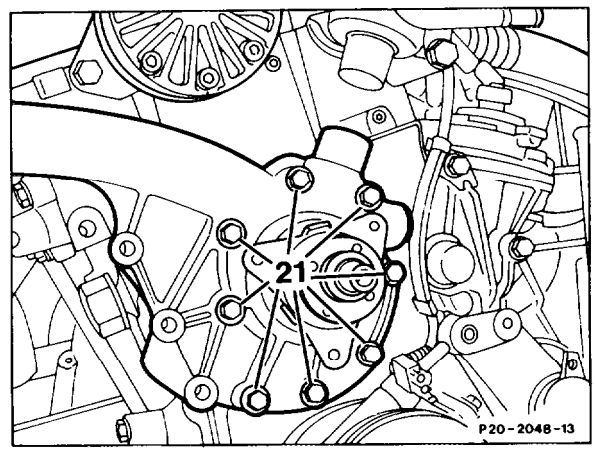
6 Remove bolt (50) for shock absorber of belt tensioning device, bolt on, tightening torque 25 Nm.

7 Unscrew bolts (51) and place alternator to the side.
Tightening torque 45 Nm.

8 Unscrew bracket (156), screw on, tightening torque 25 Nm. For this step, remove bolts (49, 3 off), screw on, tightening torque 25 Nm.



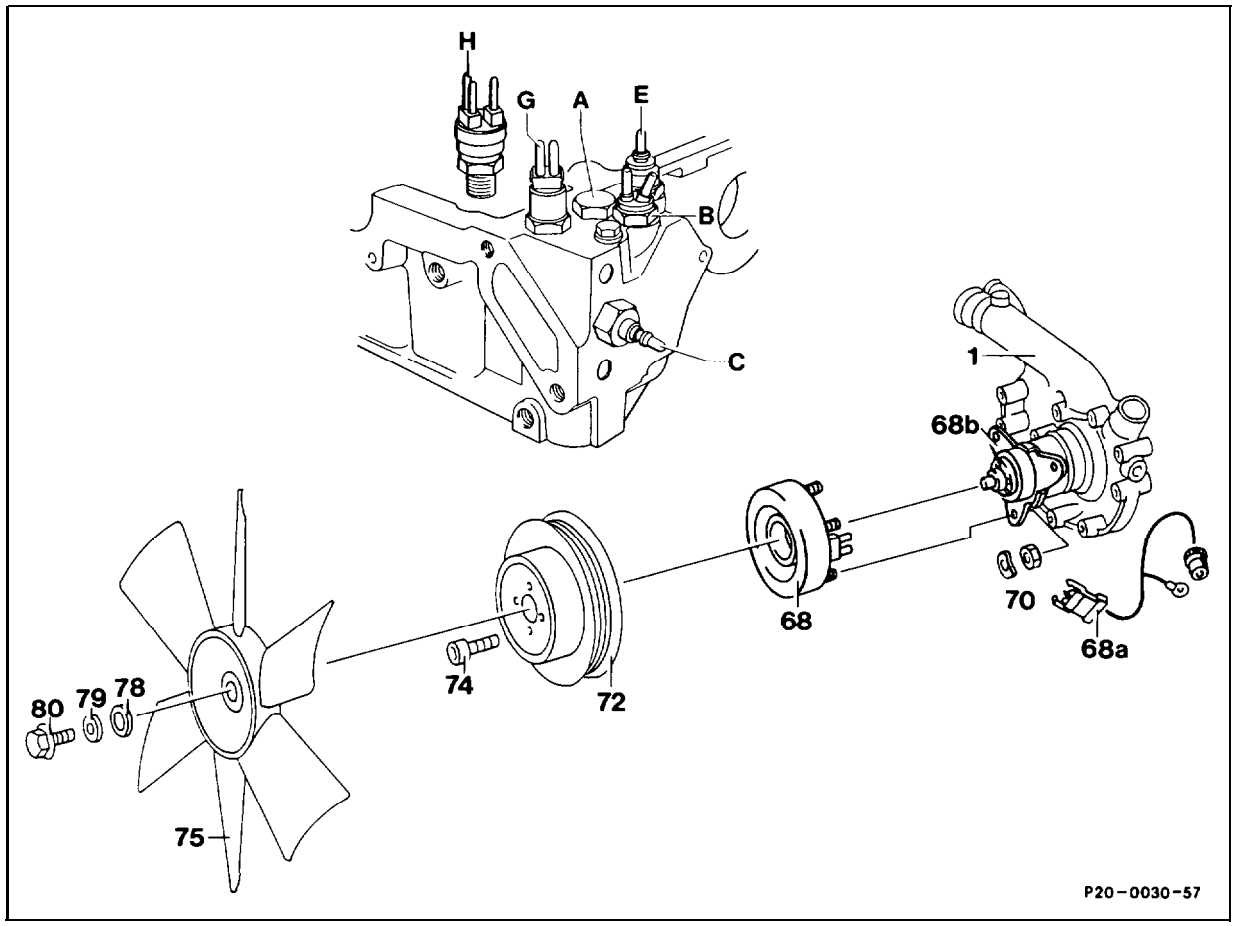
9 Detach engine coolant pump, attach. For this step, remove bolts (21), bolt in, tightening torque 10 Nm. Pay attention to bolt length.



10 Clean sealing surfaces.

Note
A paper gasket Part No. 102 201 00 80 is supplied in the parts sector as a seal of the engine coolant pump at the timing case cover. This gasket may only be installed if it is assured that the timing case cover is sealed only with liquid sealant. Otherwise use sealant 002 589 00 20 10.

11 Check engine cooling system for leaks (20-017).



1	Engine coolant pump	75	Fan with armature ring
66	Solenoid body	78	Spacer disk
6aa	Connector with cable for solenoid body	79	Tensioning disk
66b	Carrier for solenord body	80	Collar bolt
72	Belt pulley with steel ring insert		
74	socket bolt or M6 x 12 Torx bolt M6 × 12 hex.	G	Temperature switch for solenord fan coupling, red 100 °C
		H	Temperature switch for solenord fan coupling and 2-stage auxiliary fan, 110 °C, red for air conditioning or automatic climate control

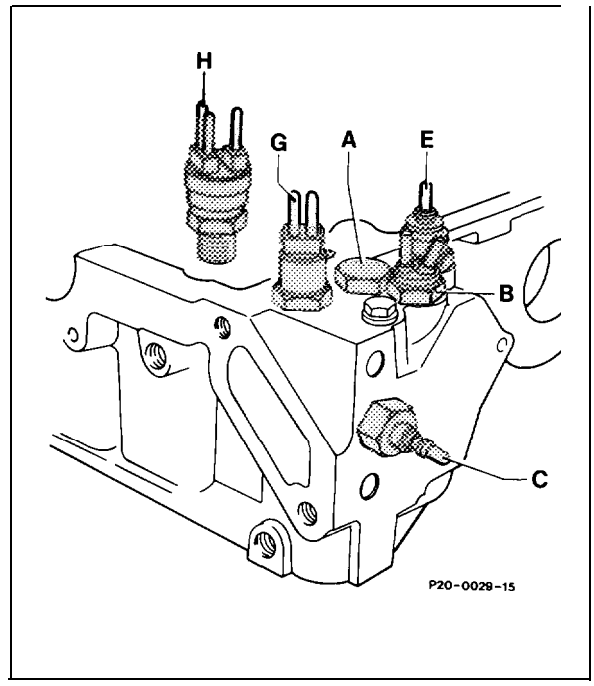
General

The engines have a temperature-controlled electromagnetic fan coupling.

It is engaged or disengaged by a temperature switch (100 °C, G) inserted into the sensor box on the cylinder head.

The same function is performed on vehicles with air conditioning system or automatic climate control by a 110 °C temperature switch (H).

The electromagnetic fan coupling is maintenance-free.



Fan

The fan (75) is mounted on a stud on the engine coolant pump bearing and is attached by a collar bolt (86).

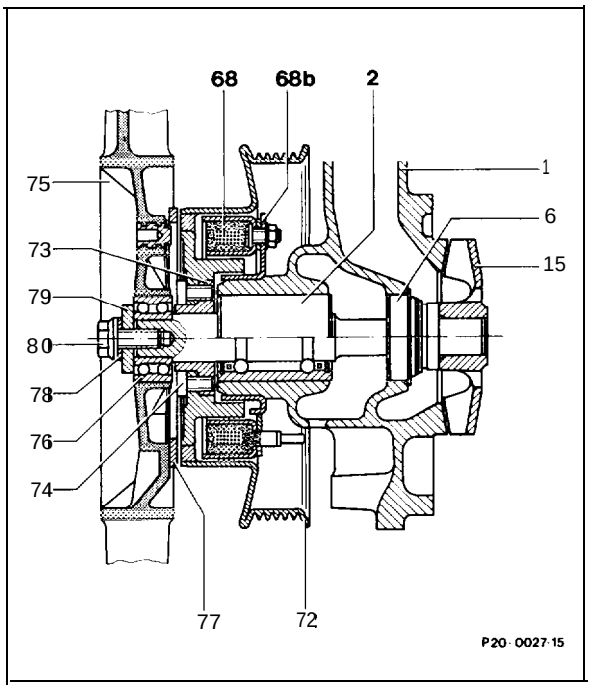
Matching

Model	Engine	Air conditioning/ Automatic climate control with	without	Fan dia.	No. of blades	Capacity %
201	102.961		x	380	6	100
		x		430	5	100
	102.985	Man. transmission	x	380	6	100
		Autom. transmission	x	430	5	100
		x		430	5	100

Design of electromagnetic fan coupling

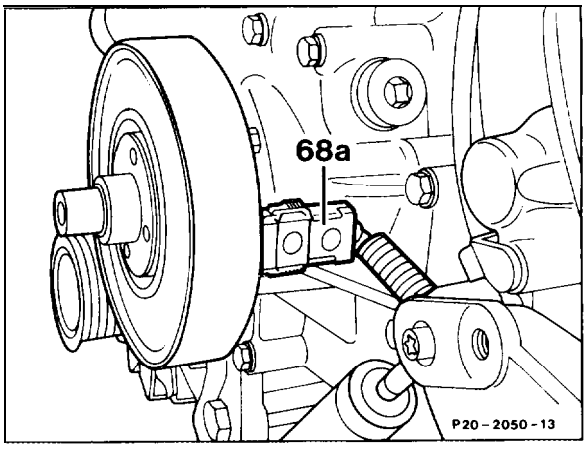
The solenoid body (68) is attached to the solenoid carrier (68b) by 3 nuts (70).

The solenoid carrier is bonded to the engine coolant pump housing.



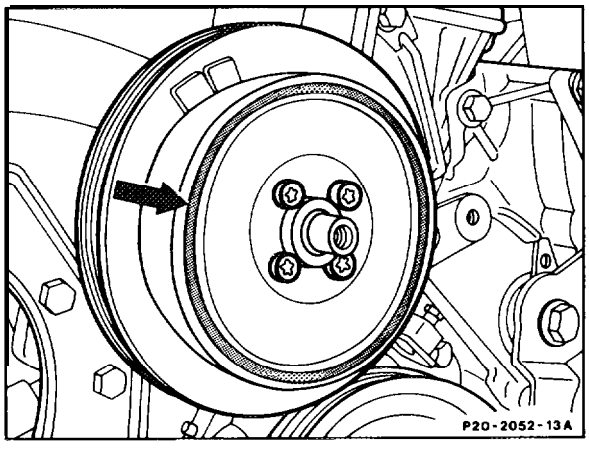
1 Engine coolant pump housing
2 Engine coolant pump beanng
6 Cassette-type mechanical seal
15 Impeller
68 Solenoid body
68b Carrier
72 Belt pulley
73 Flange
74 Fastening bolts
75 Fan
76 Angular-contact ball bearing
77 Armature
78 Tensioning pulley
79 Pulley
80 Fastening bolt

The electric cable is connected to the solenoid body by a connector (68a).

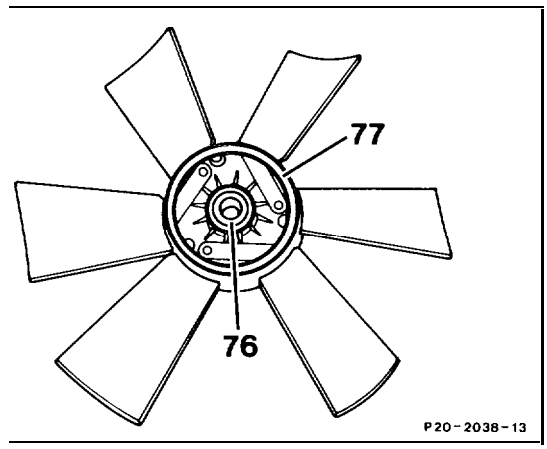


The belt pulley is located on the engine coolant pump shafts ahead of the solenoid body.

A steel ring is inserted in the belt pulley which attracts the armature ring on the fan when the fan coupling is engaged (arrow).



The armature ring (77) and the angular-contact roller bearing (76) are installed on or in the fan, respectively.



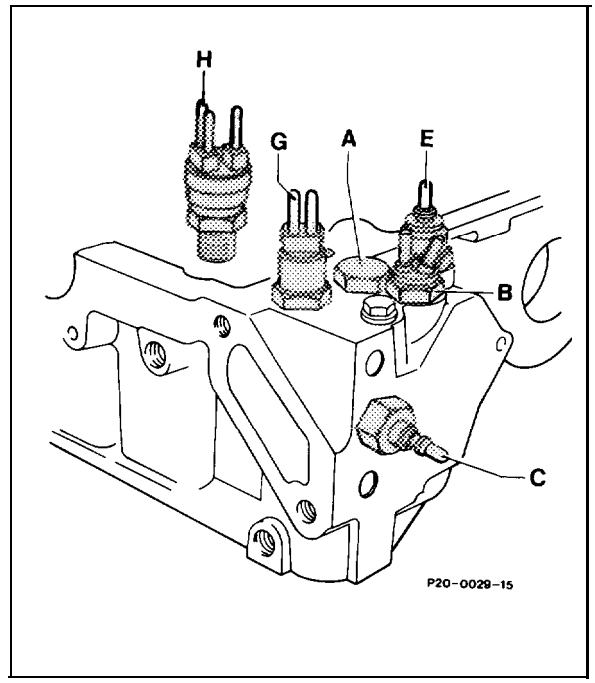
Function

The fan is engaged only when the ignition is switched on and at a engine coolant temperature above 98-I 02 °C.

A constant positive exists at the solenoid body (68).

Below a engine coolant temperature of 98-102 °C, the fan is switched off and only rotates as a result of the airstream or as a result of the bearing friction.

Minus is engaged at a engine coolant temperature of not more than 102 °C through the temperature switch (G or H) at the sensor box.



The armature (76) is attracted by the solenoid body (68) and presses against the end face of the belt pulley.

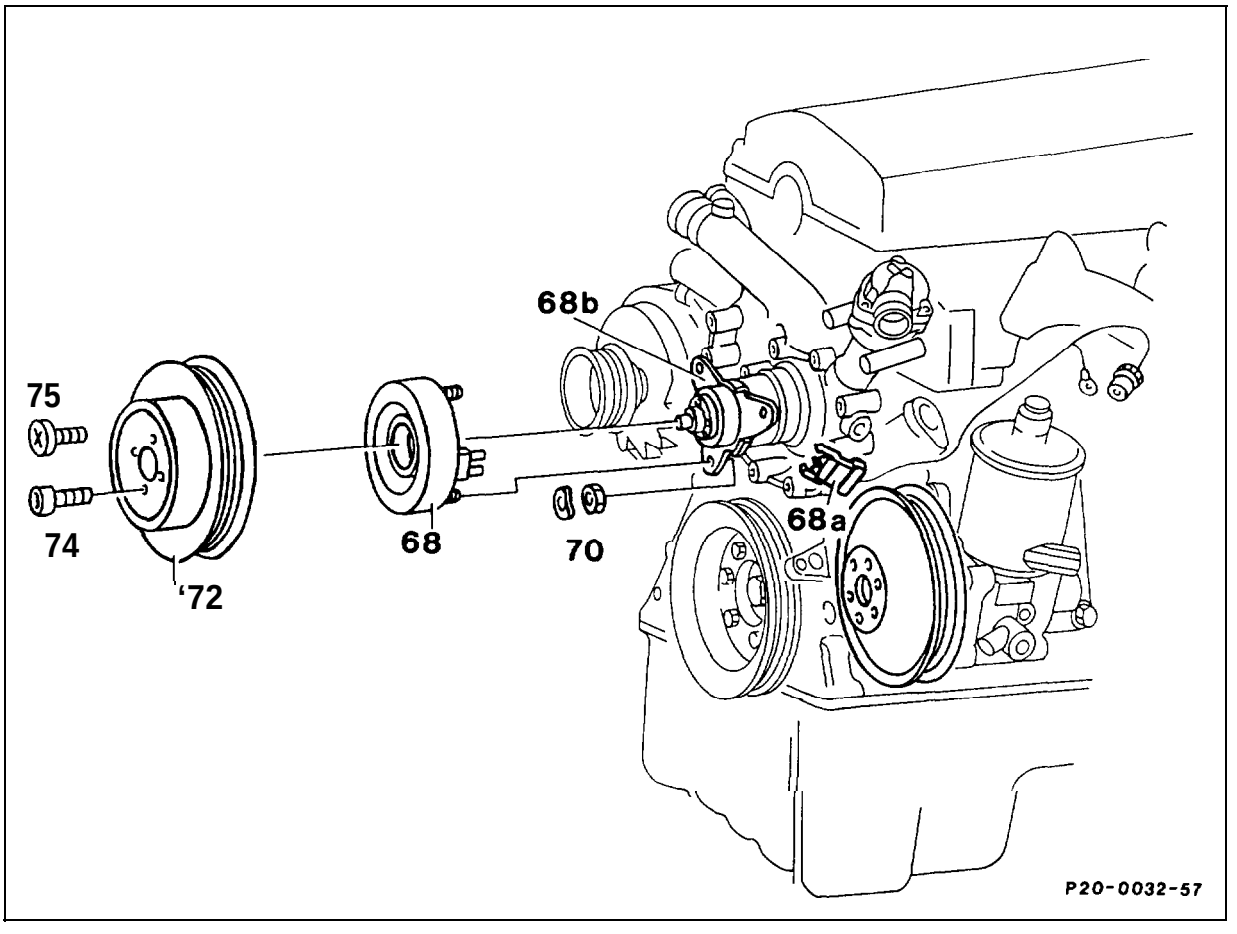
The fan is now rigidly connected to the belt pulley and rotates in line with the engine coolant pump speed.

If the engine coolant temperature drops below 93-98 “C, the temperature switch opens and the armature (76) is lifted off the belt pulley by the leaf springs.

On vehicles equipped with automatic air conditioning, the fan and the electric auxiliary fan are engaged by a double-contact relay which is activated by the triple temperature switch (H).

20-335 Removal and installation of solenoid fan coupling

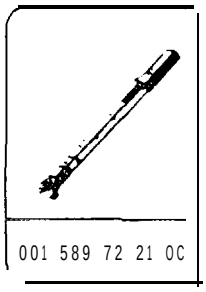
Preceding work:
Removing and installing V-belt (13-342).



Belt pulley (72)	unbolt, bolt on, tightening torque hex. socket bolts 10 Nm, hex. Torx bolt 15 Nm (step 2).
Cable connector (68a)	detach from solenoid body, plug in (step 3).
Solenoid body (68)	unbolt, bolt on, pay attention to installed position, tightening torque 10 Nm (reference value, step 4).

Note
The carrier (68b) for the solenoid body is bonded to the engine coolant pump, do not pull off. Stick on loose carriers with adhesive 001 989 47 20.

Special tool



Note
Hex. Torx bolts (M6 × 12) are fitted instead of hex. socket bolts to achieve greater security against slackening or fracturing of the belt pulley fastening bolts.

Standard implementation: September 1985

Model	Engine	Engine **end No.** Man. trm.	Autom. trm.
201.028 (USA)	102.985	002692	023655

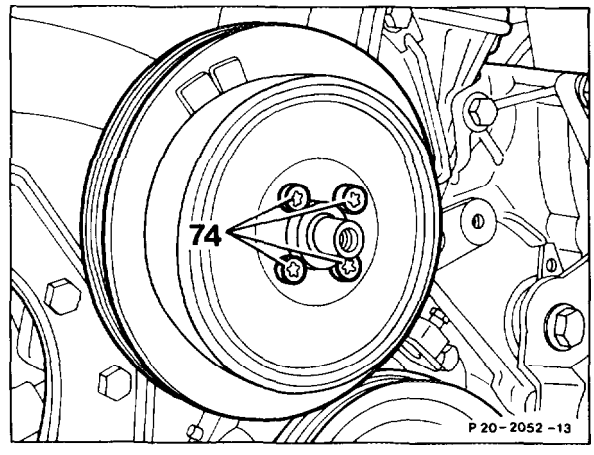
Removal and installation

1 Remove and install V-belt (13-342).

2 Unbolt bet? pulley for **engine** *coolant pump*, bolt on.

Tightening torques:

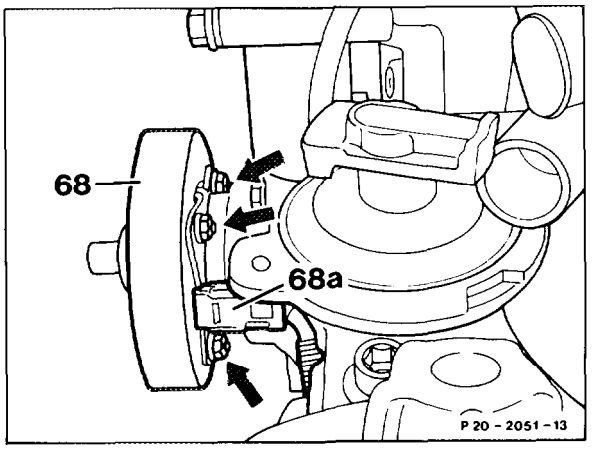
Hex. socket bolts	10 Nm
Hex. Torx bolts	15 Nm

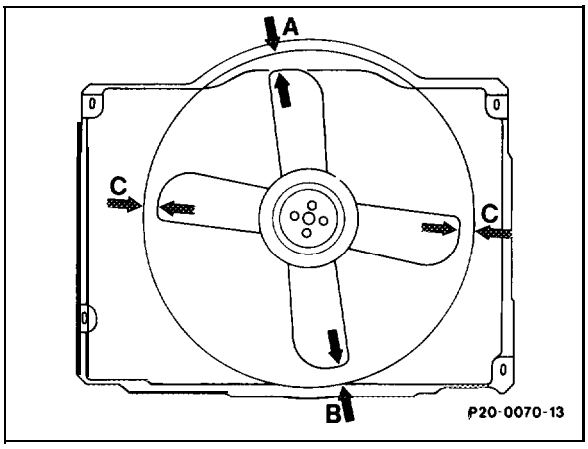


3 Detach cable connector (68a) from solenoid body, plug in.

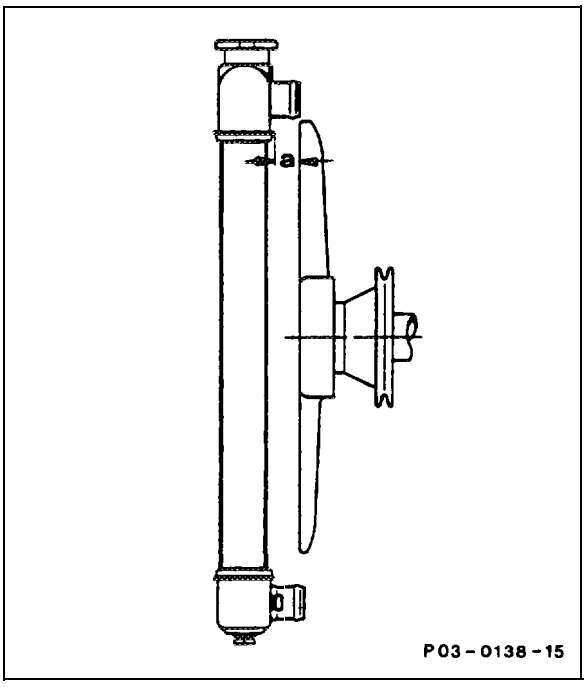
4 Unbolt solenoid body (68), bolt on, pay attention to installed position, tightening torque 10 Nm (reference value).

Note
The carrier for the solenoid body is bonded to the engine coolant pump housing. Attach loose carrier with adhesive 001 989 47 20.





Fan cowl/Fan



Radiator/Fan

Installation measure for radiator, fan and fan cowl

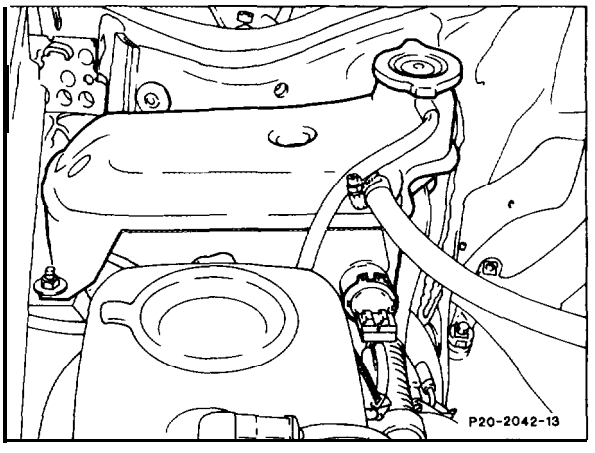
Model	Engine	Distance “a” from fan to radiator, approx. mm	Distance from fan to cowl, approx. mm		
			A	B	C
201.024 201.028	102.961 102.985	36	22	28	20

1) Fan cowl 1 24 500 05 55 (2nd version) on vehicles with manual transmission.

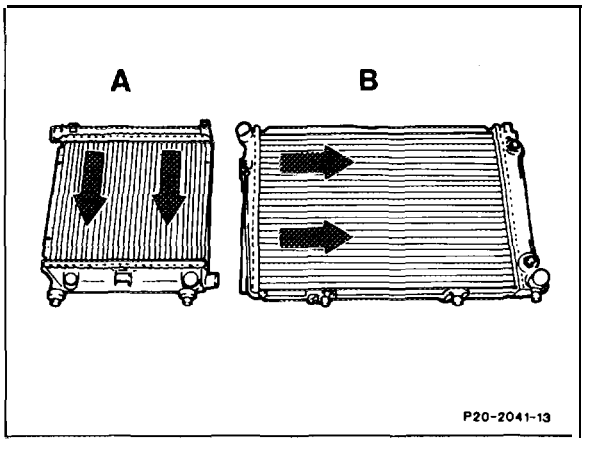
Radiator expansion tank

The expansion tank is attached to the right wheelhouse.

Different radiators are installed depending on the vehicle equipment.

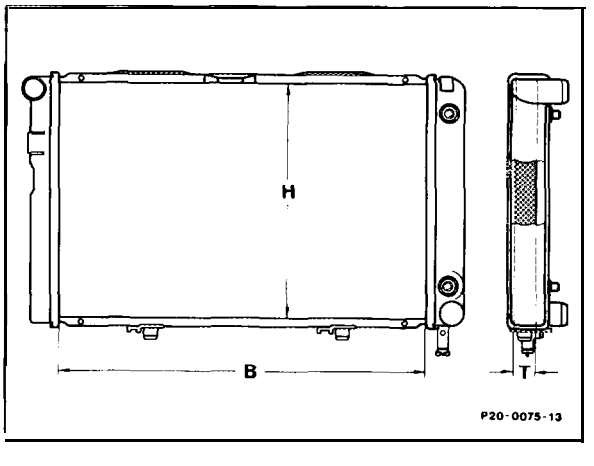


On vehicles with air conditioning/automatic climate control, crossflow radiators (B), arrows, are installed.



Radiator with air conditioning/automatic climate control

Radiator block:: Width „B” = 410mm
Height „H” = 388 mm
Depth „T” = 42 mm



Fan cowl

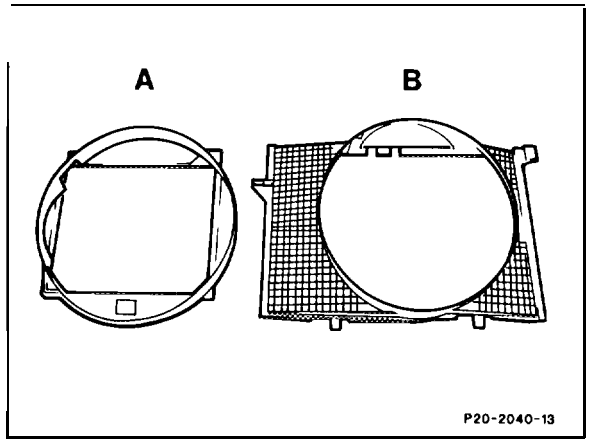
There are different fan cowl versions depending on the various radiator design.

Version "A"

On vehicles without air conditioning (narrow radiator non-USA vehicles).

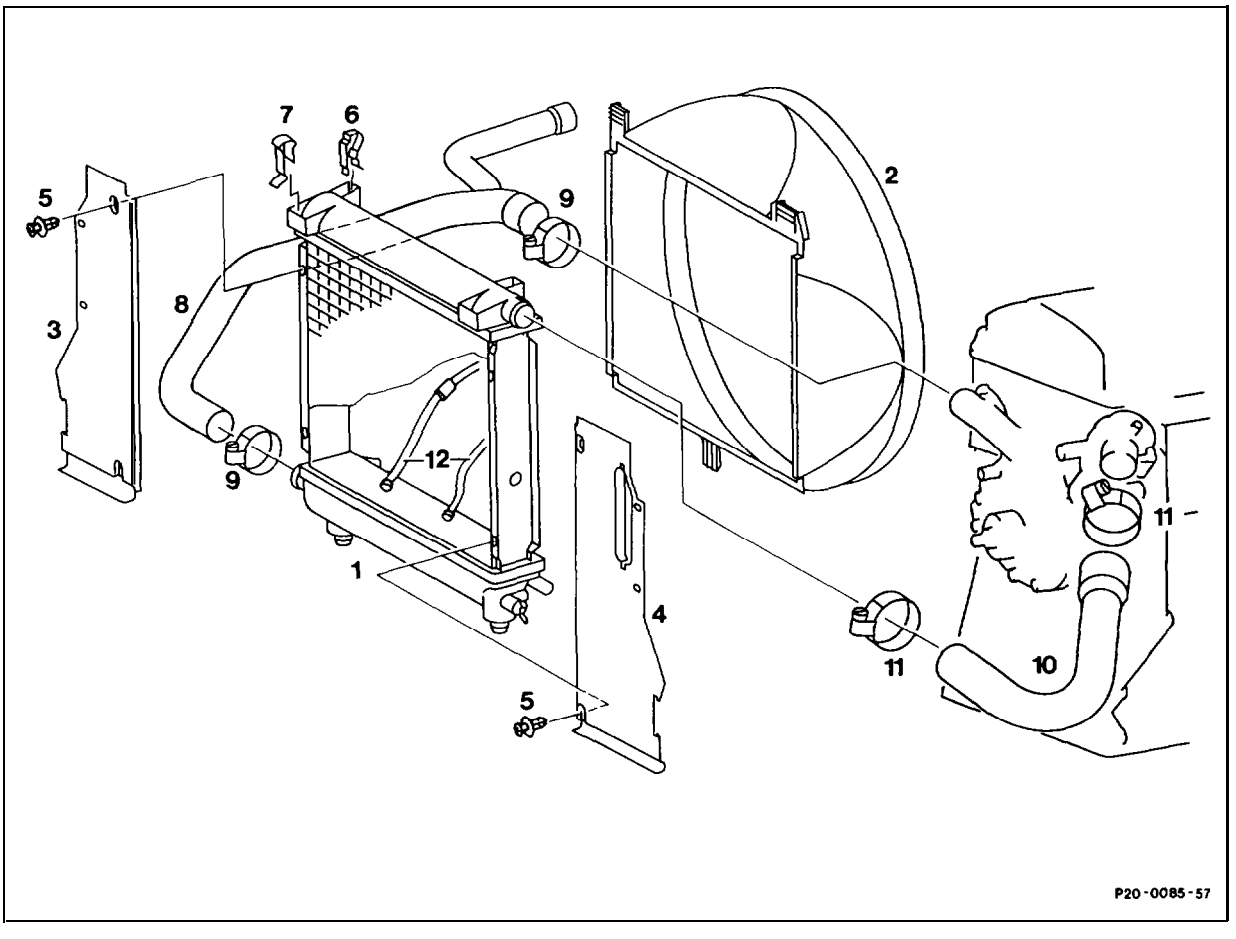
Version "B"

On vehicles with air conditioning (wide radiator).



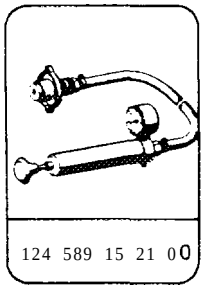
20-420 Removal and installation of radiator

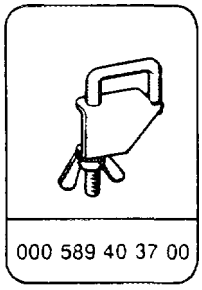
Precedmg work.
Draining and adding coolant (20-101).



Engine coolant hose (8 and 10)	at radiator, detach, attach (step 1).
Fan cowl (2)	detach and place over fan (step 2).
Clip (5)	on vehicles without air conditioning, remove, install (step 3).
Transmission oil lines (12)	on vehicles with automatic transmission, detach, attach. Pinch lines with clamp 000 589 51 21 00 (step 4).
Retaining clips (7)	remove and install and lift out, insert radiator (step 5).
Engine cooling system	check for leaks (20-017).
Oil level	in automatic transmission, adjust to correct level (Op. No. 27-010).

Special tools



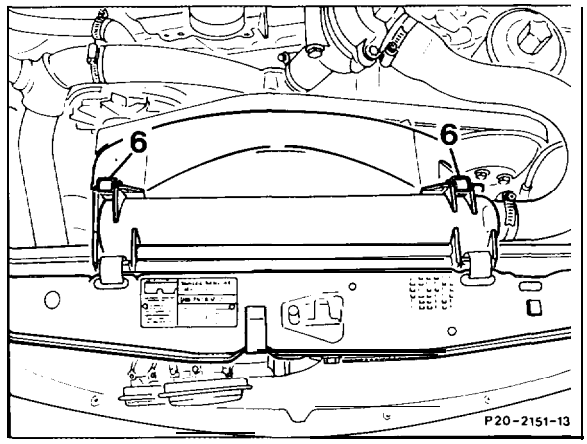


Commercial tool

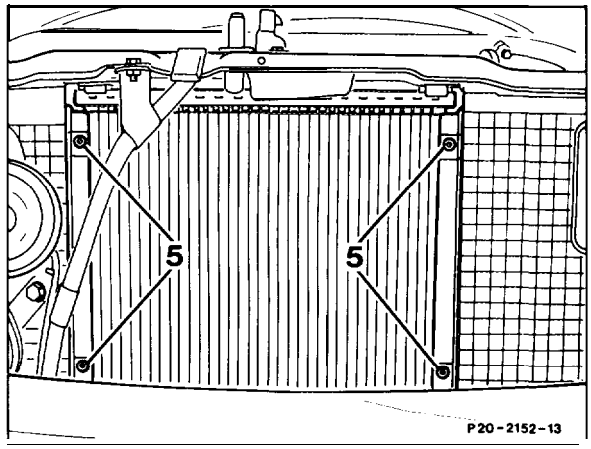
7 mm wrench socket on flexible shaft for hose clips with worm drive	e.g. Hazet, D-5630 Remscheid Order No. 426-7

1 Detach engine coolant hoses at radiator, attach.

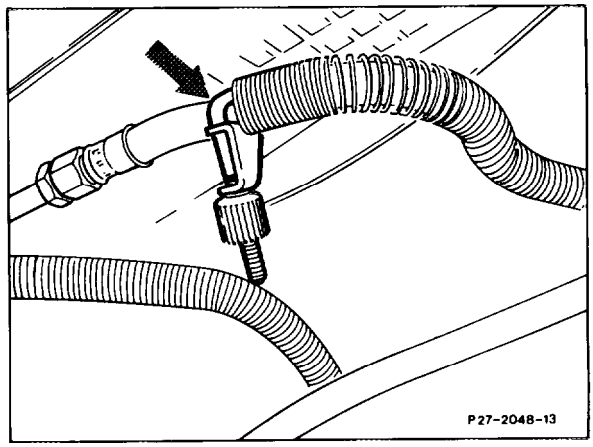
2 Pull off clips (6), install and place fan cowl over fan.



3 On vehicles without air conditioning/ automatic climate control, remove clips (5) on front of radiator, insert.



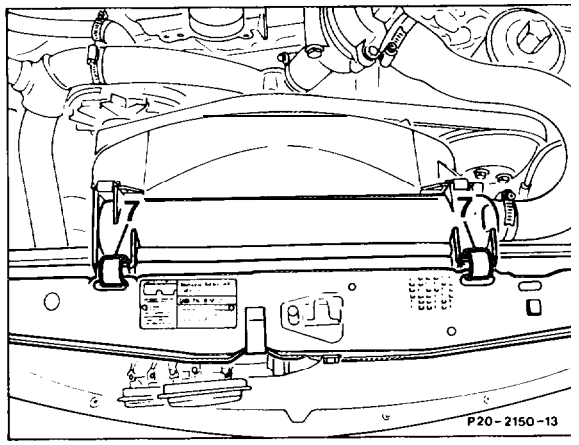
4 **On** vehicles with automatic transmission, detach oil cooler lines, attach, pinch with the clamps 000 589 40 37 00.

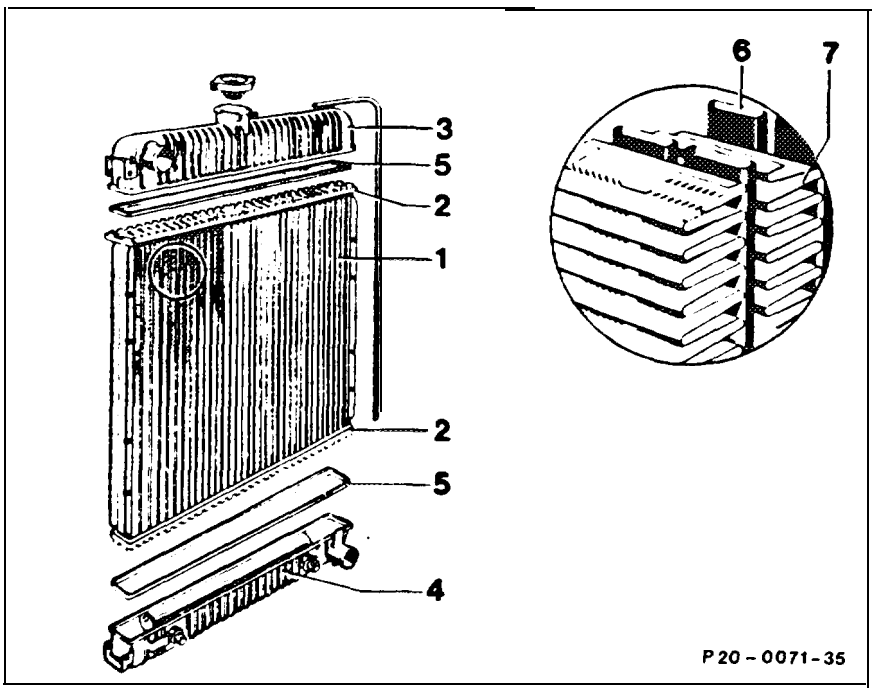


5 Remove retaining clips (7) for radiator, fit on and lift out, insert radiator.

6 Check engine cooling system for leaks (20-017).

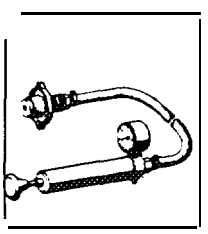
7 Adjust oil level in automatic transmission to correct level (27-010).





1 Radiator honeycomb
2 Tube bottom
3 Top water tank
4 Bottom water tank
5 Gasket
6 Cooling lubes
7 Fins

Special tool



124 589 15 21 00

Commercial tool

7 mm wrench socket with flexible shaft for hose clips with worm drive	e.g.	Hazet, D-5630 Remscheid Order No. 426-7

Note
Light alloy radiators with plastic water tanks cannot be repaired by soldering.

Because of the different access possibilities to the radiator (e.g. more difficult in the honeycomb than at the water tank), sealing compounds are available in diluted and undiluted form.

The different sealing compound versions and the priming liquid are combined in a repair kit, Part No. 123 989 00 20.

Designation	Application
Priming liquid	Preparation of primer
Undiluted sealing compound	For sealing easily accessible points
Diluted sealing compound	For sealing difficult-to-reach points (e.g. on side of cooling tubes)

Sealing compound and priming liquid can be kept for approx. 1 year provided they are always sealed airtight after use.

Priming liquid which has become cloudy should not be reused.

The following individual parts or points in the coolant circuit can be sealed with the sealing compound:

a) Plastic water tanks (3 and 4).

b) Heavy metal water tanks (holes up to 1.5 mm dia.).

c) Light and heavy metal cooling tubes (6).

d) Tube bottom (2).

e) Beaded collar (connection point between radiator honeycomb and water tank).

f) Heat exchanger of heater system.

Fractured or torn fastening straps, tears at the connection fittings or splintering cannot be repaired.

On heavy metal radiators with plastic water tanks, soldering may be performed on the honeycomb only up to a distance of 20 mm from the water tank otherwise the gasket (5) and the water tank (3 and 4) will be damaged as a result of the high soldering temperature. Leaks which are closer to the water tank, should be sealed only with the sealing compound.

It is not necessary to remove the radiator for sealing. In this case, it is sufficient to drain the coolant and after sealing the cooling system, to pressure-test with the tester (1.0-1.2 bar gauge pressure).

⚠

The priming liquid is easily combustible (observe safety regulations, Hazards Class **AI).**

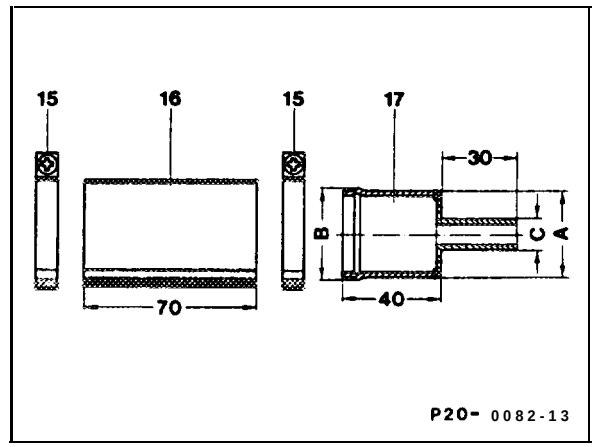
Acetic acid is released until the sealing compound has completely set. For this reason, avoid skrn contact. Clean affected areas immediately with soap and water. Rinse out eyes with water. Consult a doctor, if necessary.

Sealing

1 If it is not possible to locate the leak point properly when the radiator is installed, remove radiator (20-420).

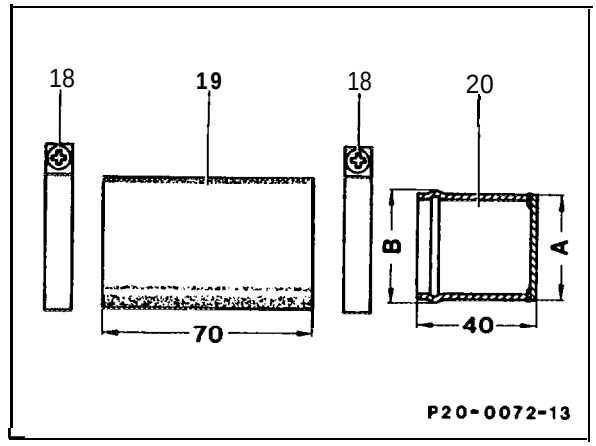
2 Clean radiator.

3 Plug hose connections with the shop-made caps.



Parts required for the top hose connection:

15 2 clips L36-46, Part No. 916026 036000
16 Piece of hose, Part No. 201 501 38 62
17 Reducer made of two tubes
A 35 mm 0
B 39 mm Ø
C 12 mm **0**



Parts required for the bottom hose connection:

18 2 clips L36-46, Part No. 916026 036000
19 Piece of hose, Part No. 201 501 38 82
20 Cap from a tube
A 35 mm 0
B 39 mm Ø

4 Seal connections of transmission oil cooler with plastic caps or plugs from old oil cooler line. To do this, cut off the oil cooler lines just behind the nipple and close by soldering.

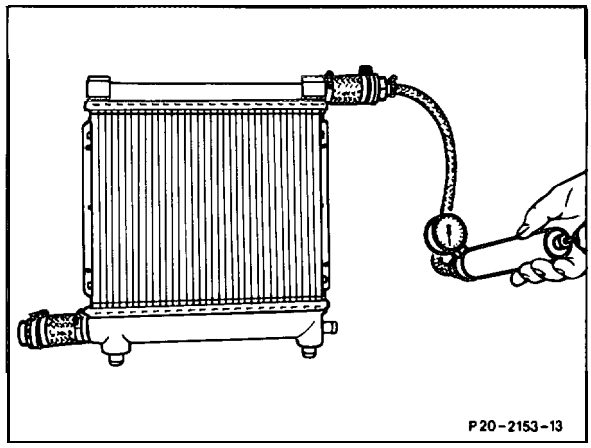
5 Connect tester to radiator.

6 Place radiator in a water bath.

7 Pressurize radiator with the tester and check where air bubbles rise.

8 Mark leak point.

9 Remove radiator and release pressure.



10 Blow radiator dry with compressed air.

11 Clean point to be sealed with a commercial cleaner (e.g. Tri or cleaner's naphtha). Always clean more than the point to be sealed (e.g. approx. 20-30 mm beyond the ends of cracks).

It is not necessary to remove the paint. Following this, blow the radiator dry at the affected point with compressed air.

There must not be any dust or grease residues present after performing the step.

12 Apply a very thin and even coat of priming liquid with a brush.

In the same way as for cleaning, apply the priming liquid beyond the point to be sealed. Pour the quantity of priming fluid required for the repair into a separate vessel to avoid the remaining priming fluid in the container being contaminated.

⚠ Warning!
Observe safety instructions!

13 Allow priming liquid to dry for approx. 10 minutes at room temperature.

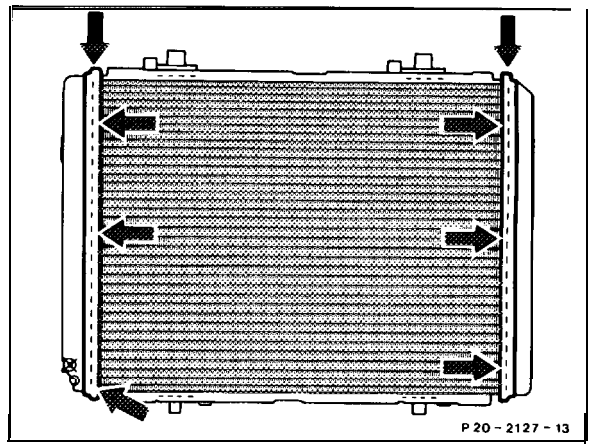
14 Position radiator so that the sealing compound cannot run off the point to be sealed.

15 Depending on accessibility, apply diluted or undiluted sealing compound. Use a brush, spatula or similar to spread the sealing compound.

Caution!
Ensure that no air is entrapped in the compound when applying and spreading it.

As for cleaning and priming, apply the sealing compound beyond the point to be sealed. If there are several leakage points at the beaded collar (arrows), it is recommended to seal the beaded collar all-round.

Seal leaks in the honeycomb from both sides.



After completion of the sealing operation, immediately close tube. Acetic acid is released until the sealing compound is completely set. Avoid skin contact. Clean affected points immediately with soap and water. Rinse out eyes with water. Consult a doctor, if necessary.

16 Place radiator down, or position upright, for at least 3 hours to allow sealing compound to dry. Depending on the quantity of sealing compound applied and on the size of the point sealed, it may take up to 24 hours at room temperature for the sealing compound to set completely to form a durable elastic joint.

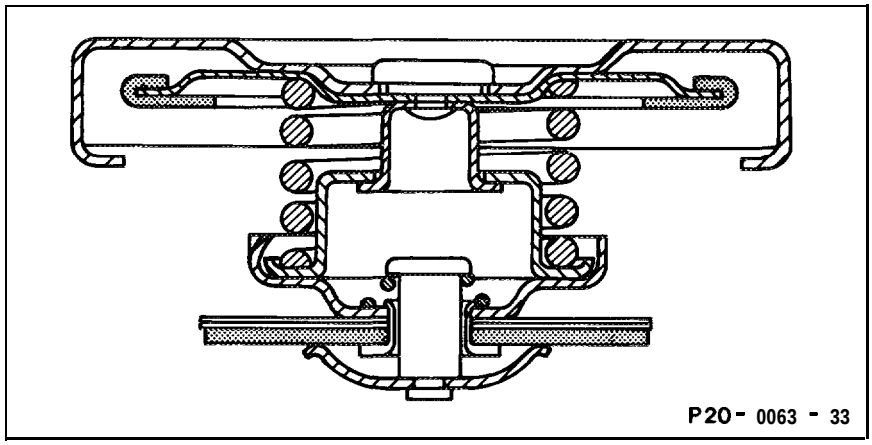
17 Pressure-test radiator in water bath for approx. 5 minutes at 1.5 bar gauge pressure.

If there are still leaks present, repeat sealing operation as from step 7.

18 Remove tester and plugs.

19 After re-installing radiator, check engine cooling system for leaks (20- 017).

20-430 Testing radiator or expansion tank pressure cap

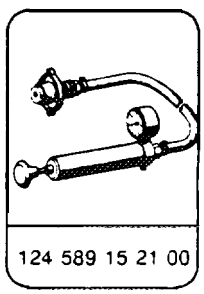


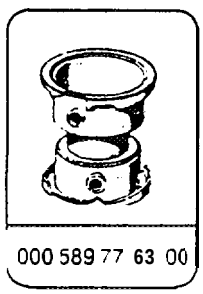
Double connection	attach 000 589 77 63 00 to tester 124 589 15 21 00, remove (step 1).
Pressure cap	fit onto double connection (step 2).
Overpressure valve	test opening pressure by pumping (step 3). See table **for** test pressure.
Vacuum valve	test. It must be resting against rubber seal, must rise easily and spring back after being released (step 4).

Pressure cap

Code number		120
Overpressure valve opens at bar gauge pressure	new pressure cap	1,2 + 0,1
	used pressure cap	1,2–0,1
Vacuum valve opens from	vacuum	0,1

Special tools


124 589 15 21 00


000 589 77 63 00

Note

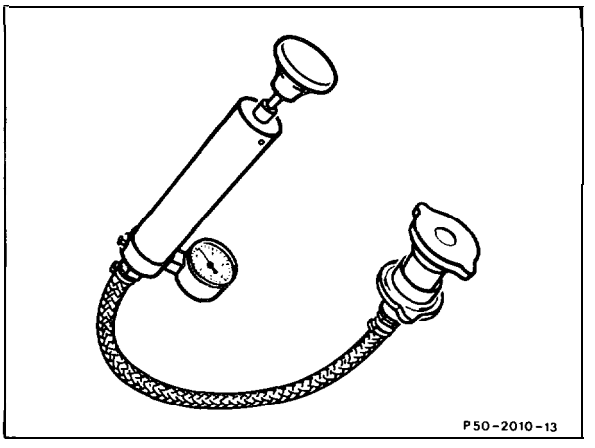
Replace pressure cap if corrosion is present on radiator or expansion tank cap.

Testing overpressure **valve**

1 Attach double connection to tester.

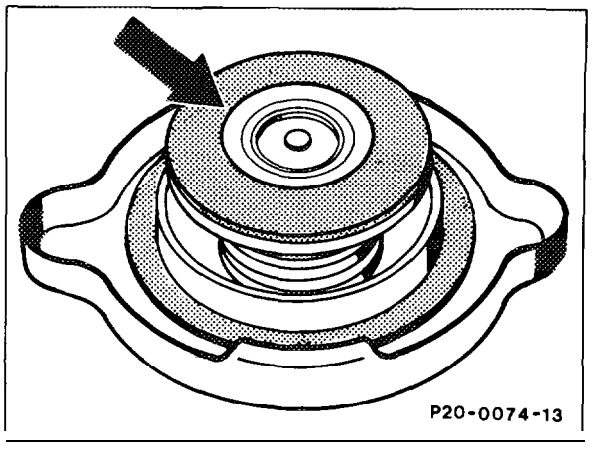
2 Fit pressure cap onto double connection.

3 Test the opening pressure by pumping.



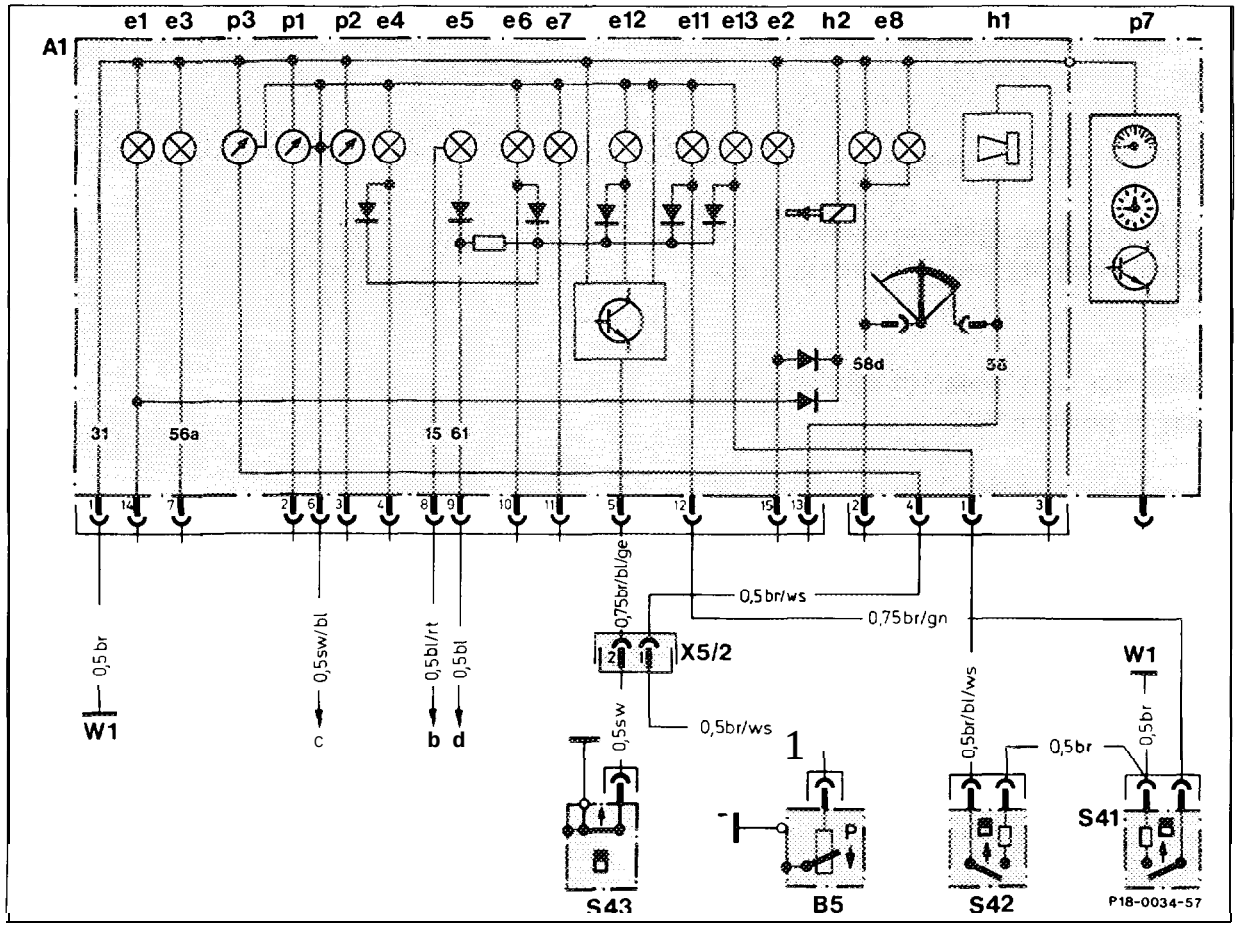
Testing vacuum valve

4 The vacuum valve (arrow) must be resting against the rubber seal, must rise easily and spring back after being released.



20-440 Checking engine coolant level indicator

Model 201



Wiring diagram engine oil level indicator, coolant level indicator, windshield washer level indicator

A1	Instrument cluster	h1	Warning busszer
e1	Left turn-signal indicator	h2	Acoustic turn-signal indicator
e2	Right turn-signal Indicator	B5	Oil pressure gauge sensor
e3	High beam Indicator	S41	Coolant level indicator lamp switch
e4	Fuel reserve warning lamp	S42	Windshield washer level Indicator lamp switch
e5	Battery charge Indicator	S43	011 level Indicator lamp switch
e6	Brake pad wear indicator lamp	W1	Marn ground (behind Instrument cluster)
e7	Brake fluid and parking brake indicator lamp	X5/2	Connector, interior/starter 4-pin
e8	Instrument lighting		
e11	Coolant level indicator lamp	b	Electrical center connector contact 15 terminal 15 unprotected
et2	Oil evel ndicator lamp		
e13	Windshield washer indicator amp	c	Electrical center connector D contact 2 terminal 15 fuse a
p1	Coolant temperature gauge		
p2	Fuel gauge	d	Electrical center connector D contact 6 alternator terminal 61
p7	Electronic clocktachometer		

Test data

Resistance at coolant level sensor at "max" coolant level	∞ Ω
Resistance at coolant level sensor at "min" coolant level	approx. 5 Ω
Battery voltage	approx. 12 V

Commercial tool

Multimeter	e.g. Sun, DMM-5

Note

If problems occur such as:

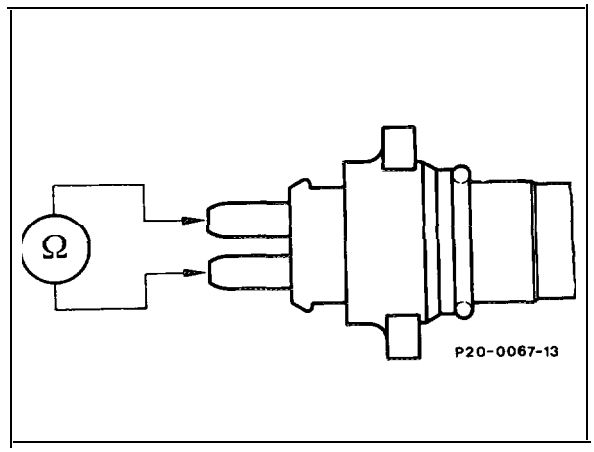
A. Indicator lamp lights up constantly when engine running and coolant at correct level.

B. Indicator lamp does not light up when key in position "2".

C. Indicator lamp does not light up when engine running and coolant below "min" level.

Test

A. Malfunction indicator lamp lights up constantly with engine running and coolant at correct level.



Test coolant level sensor. Detach connector. Connect both pins to multimeter and test resistance.

Reading: ∞ Ω

Yes	No

Replace coolant level sensor.

Test cable. Remove instrument cluster. Test contact **12** of the 15- pin connector to ground with multimeter.

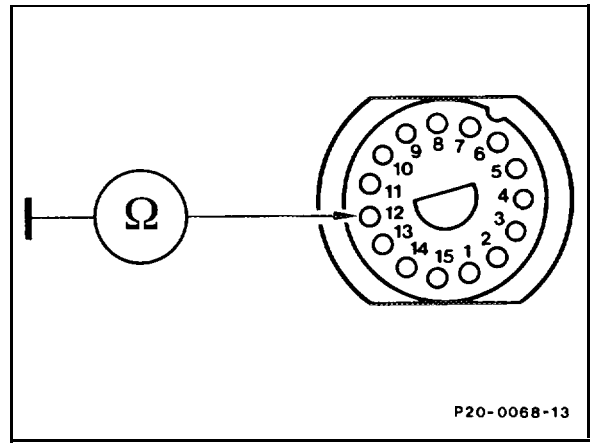
Reading: ∞ Ω

Yes	No

Rectify short to ground.

Replace indicating instrument.

End of test



8. indicator lamp does not light up when key in position "2".

Test function of bulb.

Yes	**No**

Replace bulb.

Remove instrument cluster. Measure voltage with multimeter at contacts 6 and 9 of the 15-pin connector.

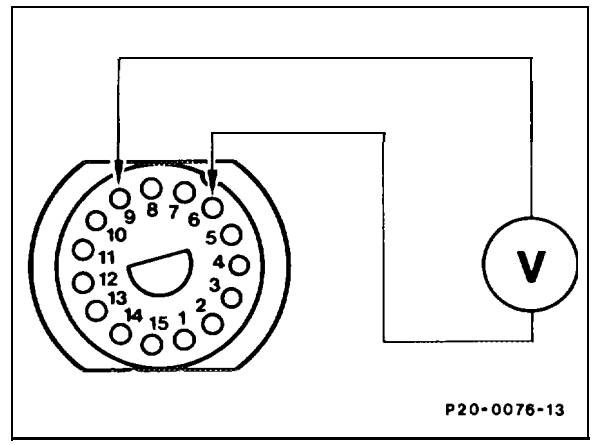
Reading: approx. 12 V

Yes	No

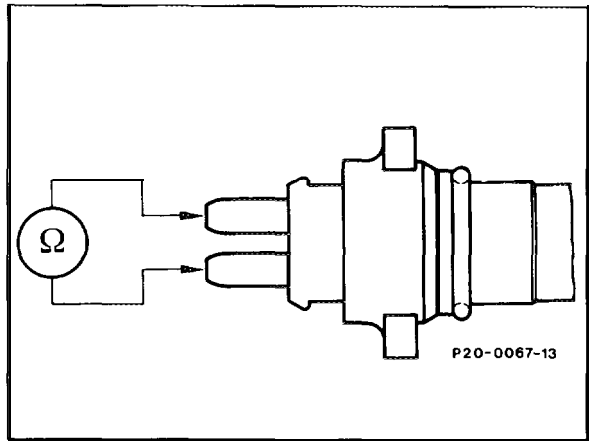
Rectify interruption according to wiring diagram.

Replace Indicating instrument.

End of test



C. Indicator lamp does not light up when engine running and coolant below "min" level. Check function section "B" in order.

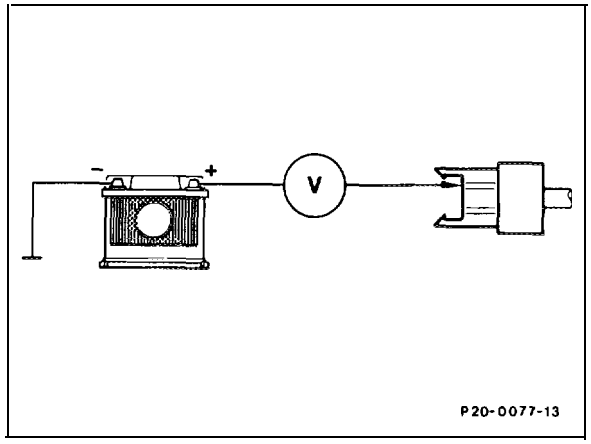


Test coolant level sensor. Detach connector. Connect both pins with multimeter and test resistance.

Reading: approx. 5 Ω

Yes	No

Replace coolant level sensor.

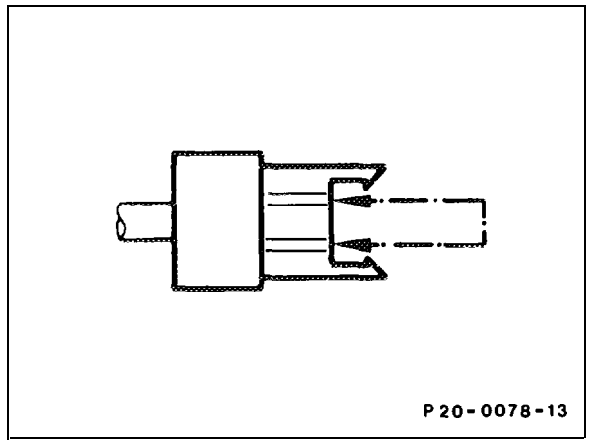


Test cable. Connect multimeter with 2-pin connector of coolant level sensor (brown cable) and battery positive.

Reading: approx. 12 V

Yes	No

Test connection to ground M1, correct if necessary.



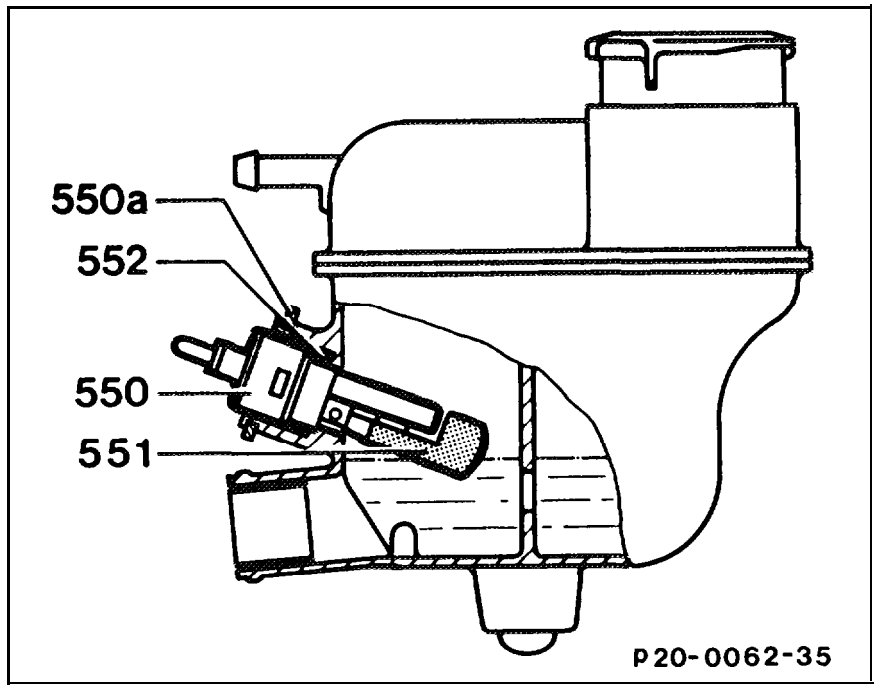
Jump coolant level sensor connector. Indicator lamp should light up when key in position “2”.

Yes	No

Rectify interruption according to wiring diagram.

End of test

20-445 Function of engine coolant level indicator



550 Engine coolant level sensor
550a Locking ring
551 Float
552 O-ring

General

The dynamic engine coolant level indicator monitors the engine coolant level in the expansion tank when the engine is running.

When the ignition is switched on, the engine coolant level indicator lights up (check function) and goes out as soon as the engine is running.

The engine coolant level indicator shows a weak light for the check function and a bright light if a fault exists.

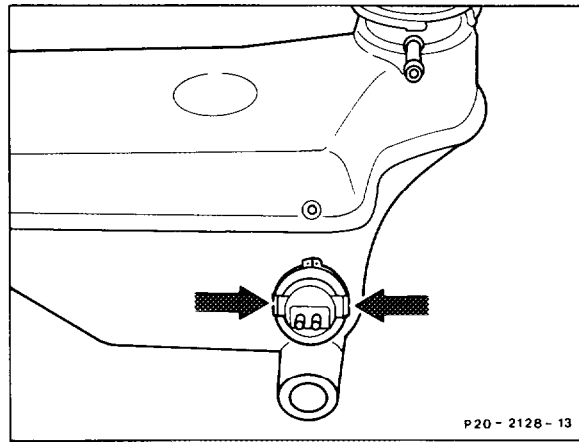
Components

- Engine coolant level sensor (550) in expansion tank.

- Indicator lamp in instrument cluster. Symbol: radiator.

The engine coolant level sensor has two lugs of different width which fit into appropriate slots on the expansion tank (arrows) to ensure that it is not incorrectly installed.

It is pressed into the expansion tank and sealed with an O-ring (552). Remove locking ring to withdraw engine coolant level sensor.



Function

When the ignition is switched on (key position 2), the indicator lamp shows a weak light and goes out when the engine is running (function check of bulb).

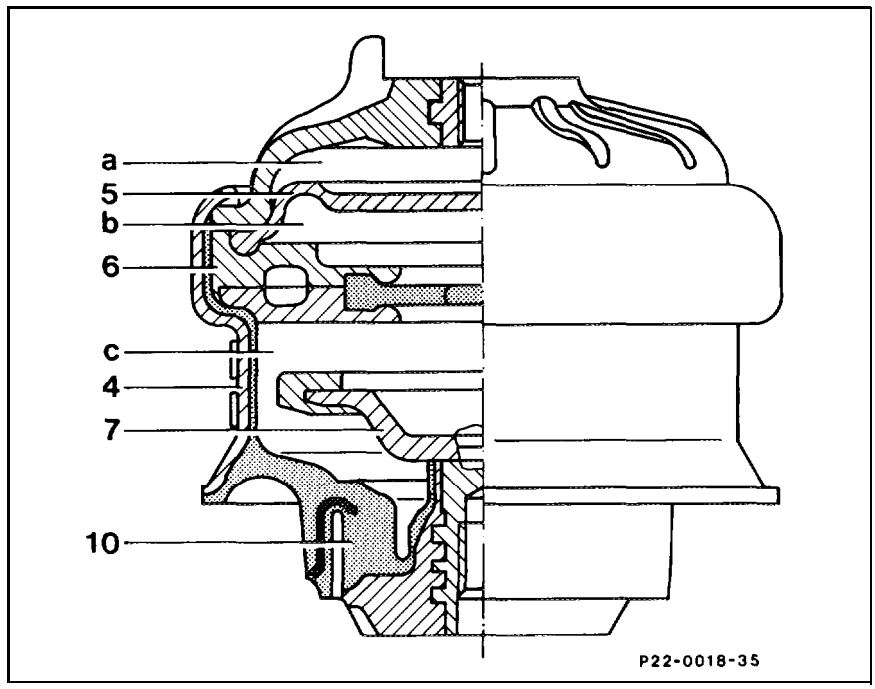
The engine coolant level in the expansion tank is sensed by a float (551) with permanent magnet which is attached to the engine coolant level sensor.

From a certain engine coolant level on, the contact is closed and the indicator lamp lights up.

Depending on the driving style, the indicator lamp will light up briefly at first and then later show a steady light. If the indicator lamp lights up, top off engine coolant.

Job No.

Function of hydraulic engine mounts . . . . . 22 – 210
Removal and installation of front engine mounts . . . . . 22 – 211
Removal and installation of rear engine mount . . . . . 22 – 212



4 Engine mount
5 Diaphragm
6 Plastic disk with annular passage
7 Rubber stop plate
10 Rubber mount

a Diaphragm chamber
b Top chamber
c Bottom chamber

All parts of the engine suspension are maintenance-free.

The hydraulic engine mounts differ in their bearing capacity on left and right.

To avoid accidental interchange, the Part No. is stamped on the housing.

The engine mounts are filled with a glycol mixture.

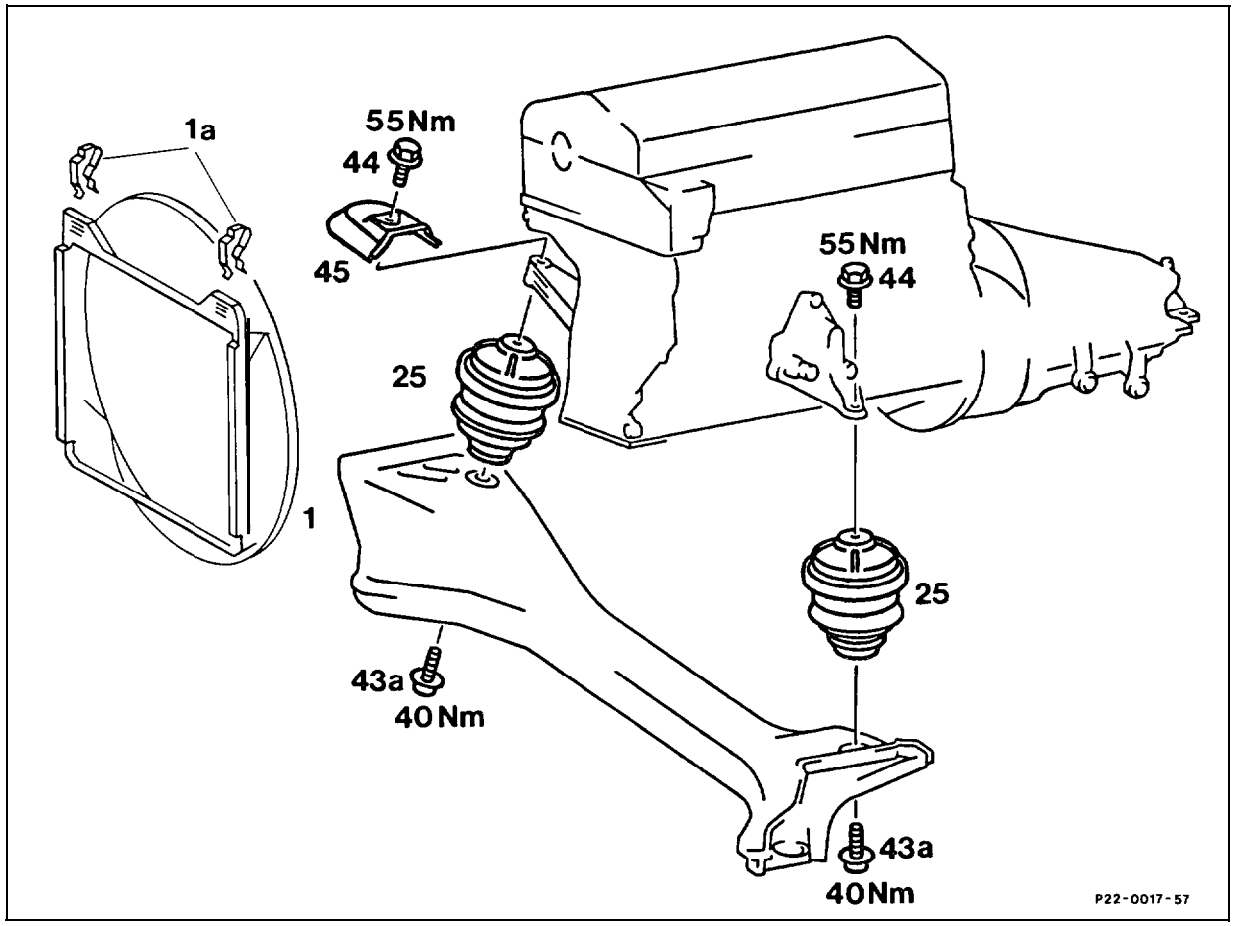
The two chambers (b and c) provided in the engine mount are linked by an annular passage in the plastic disk (6), through which the liquid flows into the respective chamber depending on compression or extension. As a result, a damping function takes place simultaneously in the annular passage.

Air is admitted to and released from the diaphragm chamber (a) in the top chamber through two passages (4 mm dia.) (arrow).

A rubber stop plate (7) connected to the base of the bearing and which limits the engine amplitudes, is located in the bottom chamber (c).

22-211 Removal and installation of front engine mounts

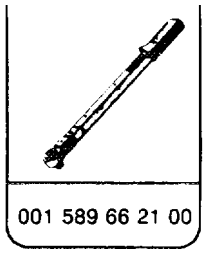
Preceding work:
Engine compartment panelling removed (01-006).



Hex. socket bolts (43a)	at bottom, unscrew, screw on, 40 Nm (step 1).
Both hex. bolts (44)	at top, unscrew, screw on, 55 Nm and take off heat guard (45), fit on (step 2).
Fan cowl (1)	detach, attach, place over fan (step 3).
Engine	raise with engine hoist, remove engine mounts (steps 4 and 5).

Note
When inserting engine mounts, ensure they are properly located.

Special tool

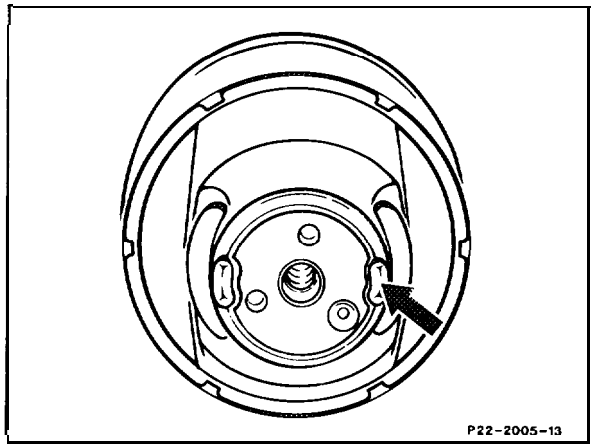


Commercial tool

Engine hoist No. 3188 self-locking	e.g.	Backer, Herder Str. D-5630 Remscheid

Note

Since February 1989 (phased-in to series production) 2 mm higher engine mounts have been installed. In addition, recesses (arrow) have been provided on the bottom of these engine mounts and lugs on the engine crossmembers. This enables the engine mount to be installed free of tension.



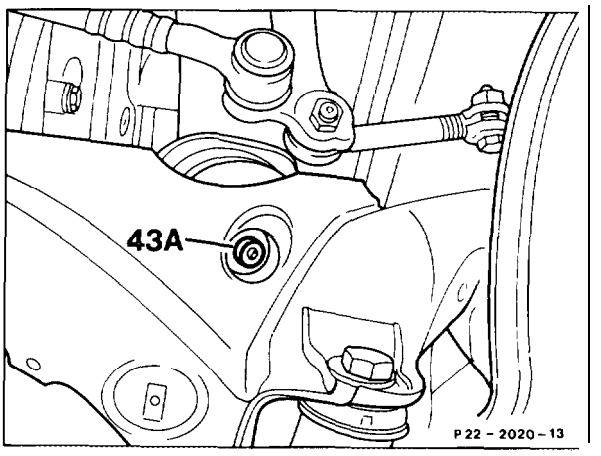
The modified engine mount has been installed as a standard feature as of August 1989.

The modified engine mounts can also be installed on vehicles manufactured prior to this dat.
Ensure that the engine mounts are installed free of tension.

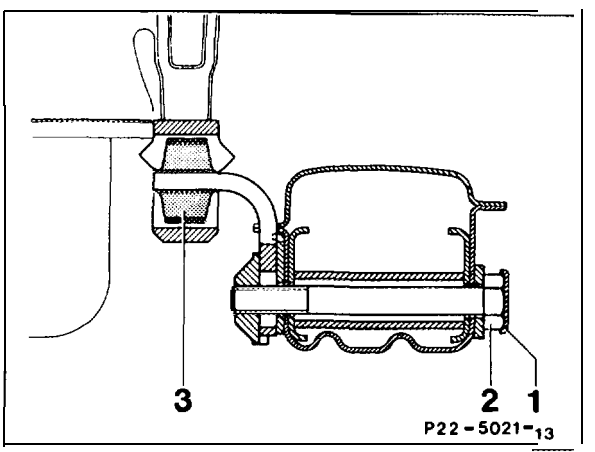
Engine mounts of the previous and the modified versions must not be installed in combination.

Removal and installation

1 **Unscrew** hex. socket bolts (43a) for bottom engine mounts, bolt on, tightening torque 40 Nm.



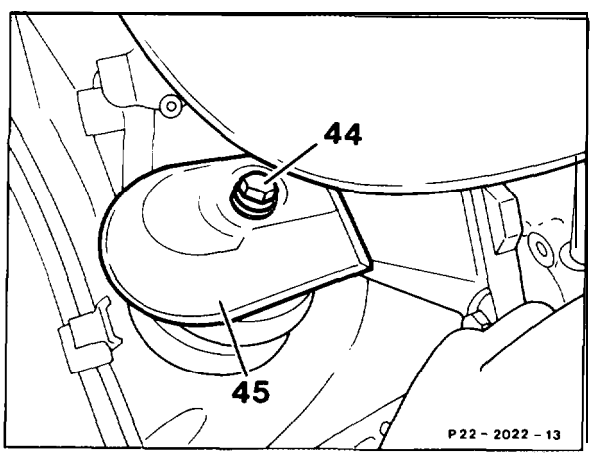
Hex. socket bolt, right



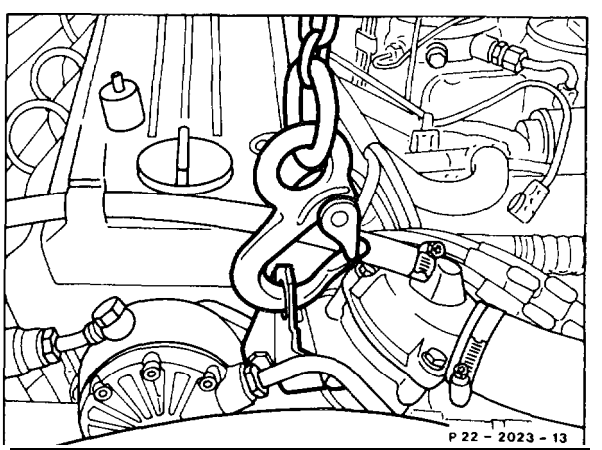
Hex. socket bolt, left

2 **Unbolt** both top engine mount fastening bolts **(44),** tightening torque 55 Nm.

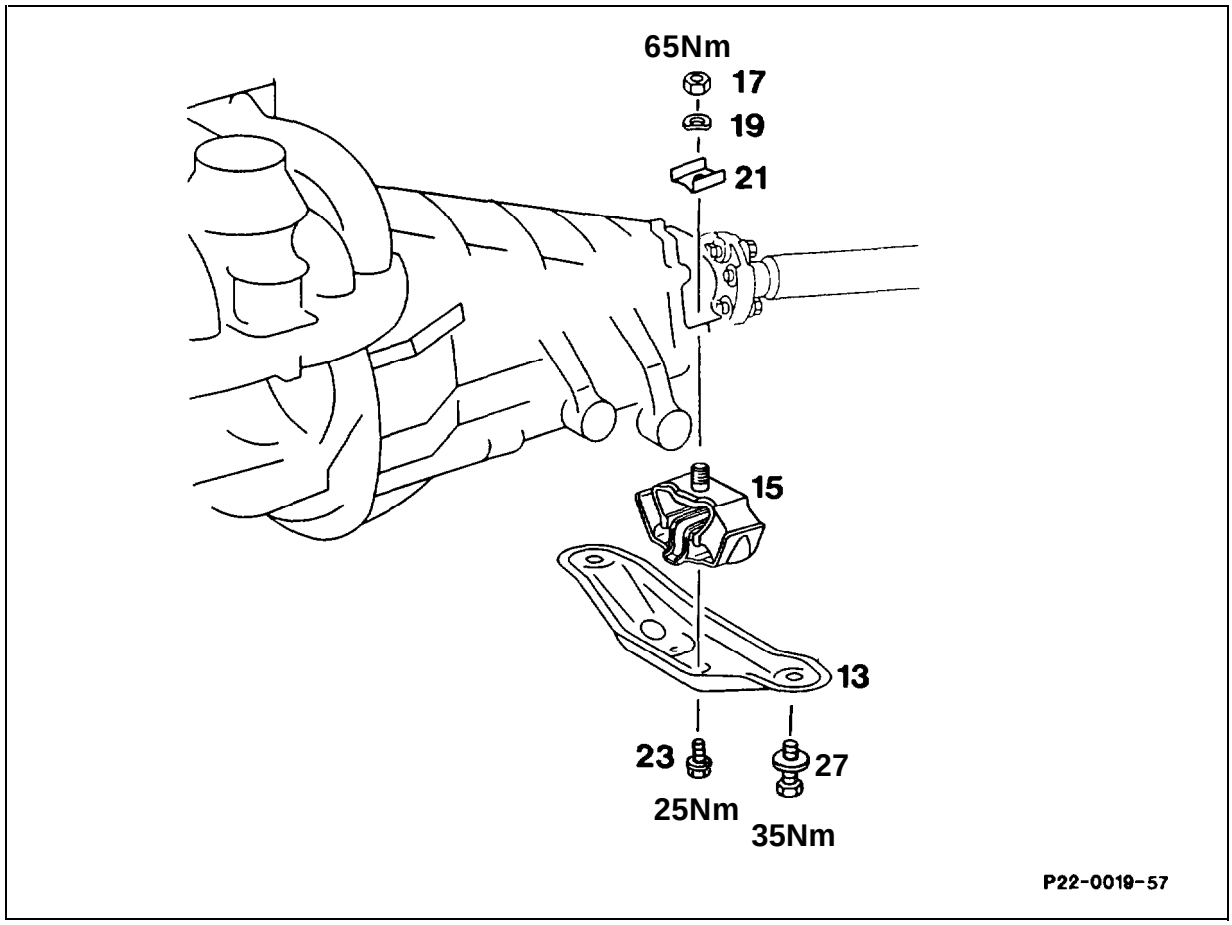
3 Detach fan cowl, attach and place over the fan.



4 Attach cables of engine hoist to front lifting lug (arrow) and raise engine with a crane, lower.

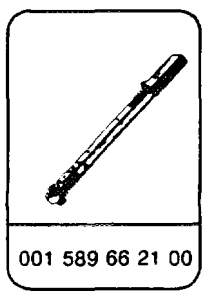


5 Remove engine mounts, insert. Ensure they are properly located.



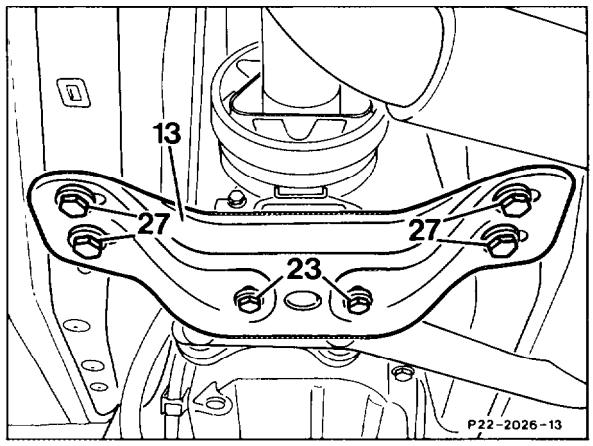
Crossmember (13)	. . . . .	unbolt, bolt on. Bolt (23), M8 25 Nm Bolt (27), Ml0 35 Nm (step 1)
Engine mount (15)	. . . . .	remove and install, Ml2 nut 65 Nm (step 2).

Special tools



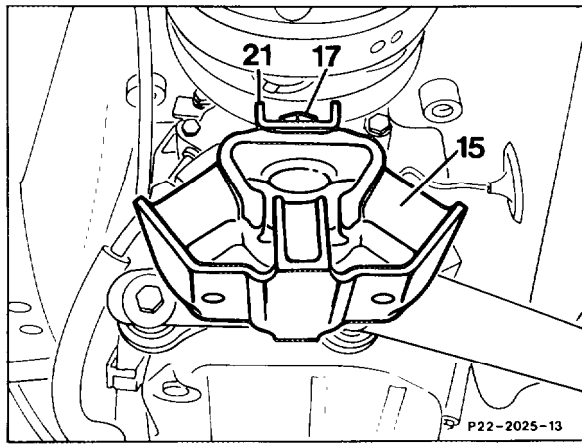
Removal and installation

1 Unbolt crossmember (13), bolt on. Raise transmission slightly for this step.
Tightening torques: Bolt (23) 25 Nm
Bolt (27) 35 Nm



2 Remove nut (17), screw on, detach engine mount (15), attach.
Tightening torque 65 Nm.

Note
Install the shaped washer (21) so that the open side is facing up.



Job No.

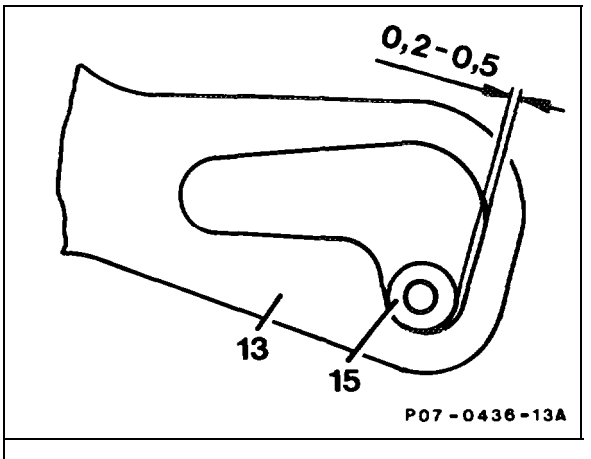
Adjusting throttle control . . . . . 30 – 300
Removal and installation of accelerator pedal lever with firewall bearing . . . . . 30 – 315
Removal and installation of Bowden cable . . . . . 30 – 325
Removal and installation of accelerator pedal . . . . . 30 – 330
Lubricating throttle control linkage and throttle control shafts . . . . . 30 – 335

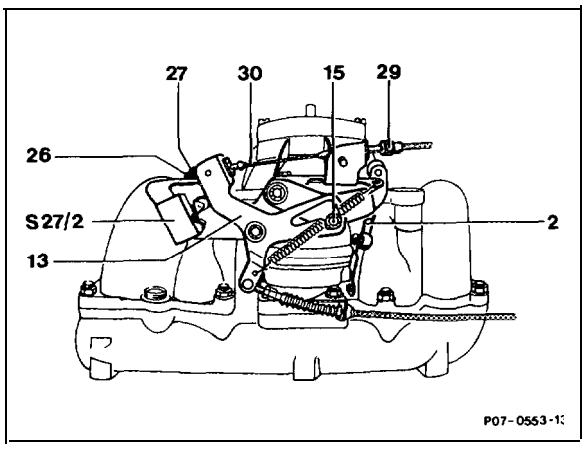
30-300 Adjusting throttle control

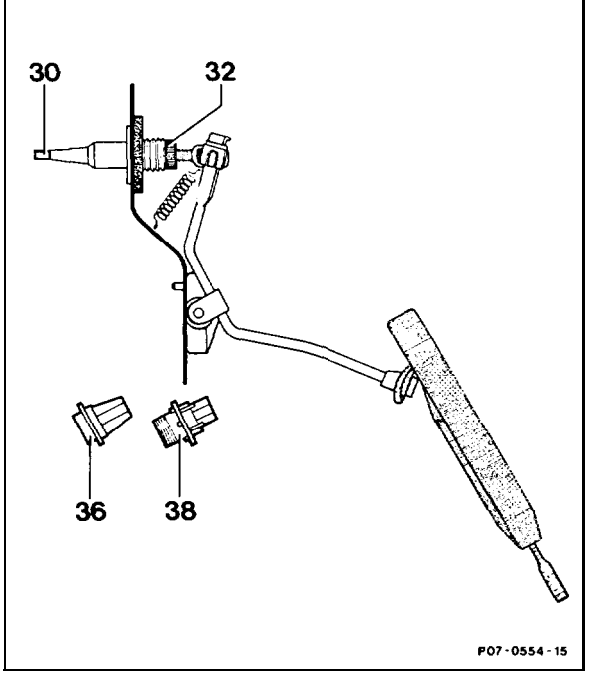
Preceding work:

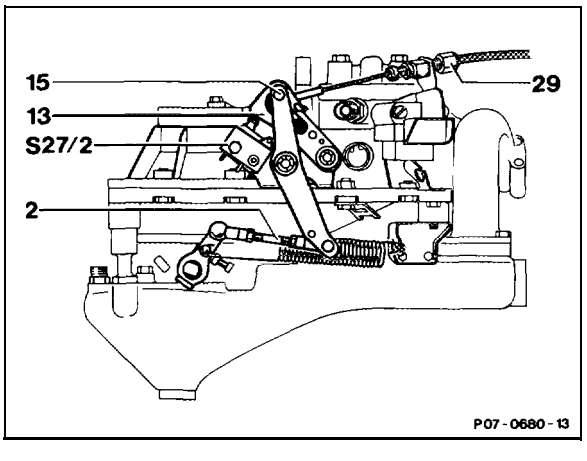
a) ● Vehicles with automatic transmission
- Vehicles with RHD version
- Vehicles with manual transmission

Note
Vehicles with manual transmission and LHD version are fitted with a variable wide open throttle stop to improve the response and adjustment characteristics. See section "b" for setting and use.









Throttle control linkage and Bowden cable .... check for ease of movement and bending.
Replace linkage or Bowden cable, if necessary.

Setting closed throttle position stop

Bowden cable **(30)**	detach at fulcrum lever (13).
Roller (15) in fulcrum lever (13)	must rest free of tension against end stop.
Throttle body	check. Throttle body must rest against idle speed stop.
Set closed throttle position stop	set the fulcrum lever (13) with the connecting rod (2) so that the roller (15) is resting free of tension against end stop. A play of max. 0.5 mm may exist between roller (15) and fulcrum lever track.

Caution!
The roller (15) must run centered in the fulcrum lever (13). Correct or replace parts if necessary.

Checking, **setting wide open throttle stop**

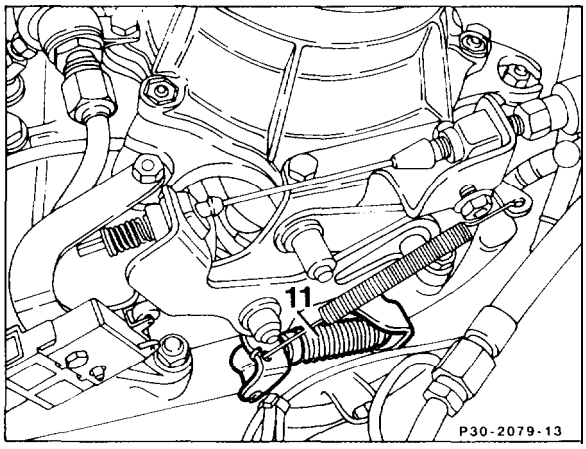
Bowden cable (30)	attach at fulcrum lever (13).
Accelerator pedal	with engine switched off, move slowly into wide open throttle position or, if automatic transmission fitted, down to stop at kickdown switch (38). The throttle body lever must be touching wide open throttle stop when performing this step. Set wide open throttle stop at adjusting screw (29).

Adjusting Bowden cable

Nipple (26)	must be resting free of tension against compression spring (27) and the microswitch (S27/2) must be operated.
Bowden cable	adjust in footwell with adjusting nut (32). Recheck idle speed and wide open throttle stop, adjust if necessary.

Note
With ignition switched on and lambda tester connected, an on/off ratio of 20 % must be indicated at wide open throttle (only CFI control modules with diagnostics via on/off ratio).

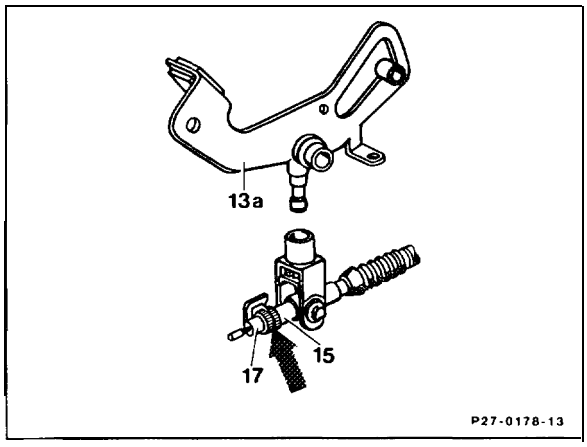
Adjusting control pressure cable (11) for automatic transmission



a) Control pressure cable with metal ball socket:

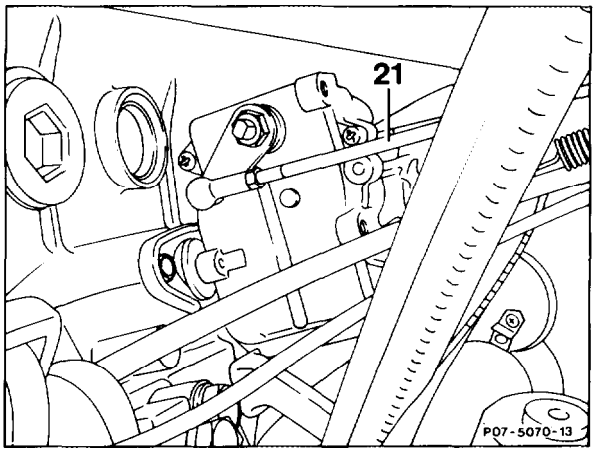
Detach Bowden cable and press back, then pull forward again until the stop is felt. Attach control pressure cable free of tension, adjust control pressure cable with ball socket, if necessary.

b) Control pressure cable with plastic attachment:



In closed throttle position, the adjusting pointer must be aligned with the annular groove (arrow) of the adjusting screw (015). Set adjusting screw, if necessary.

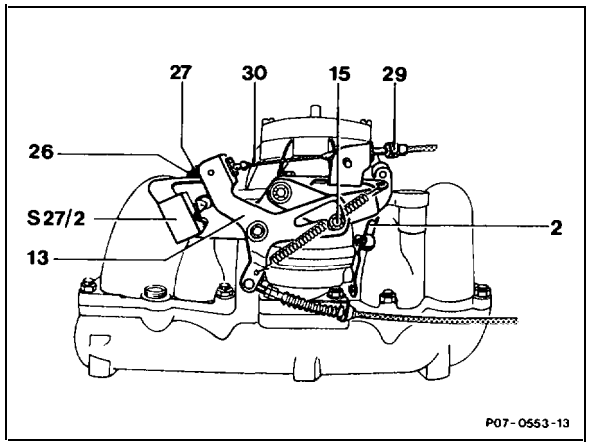
Vehicles with cruise control

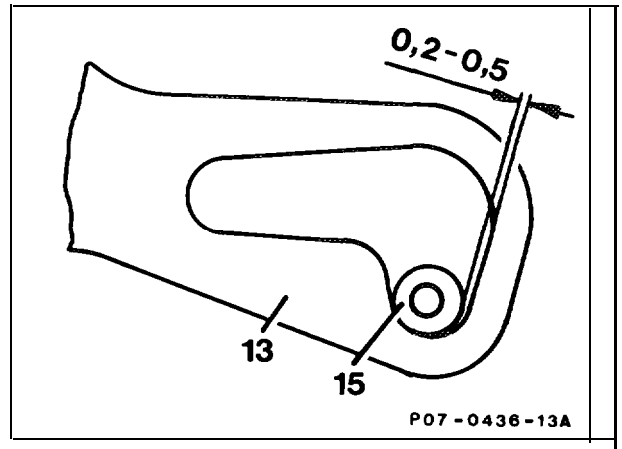


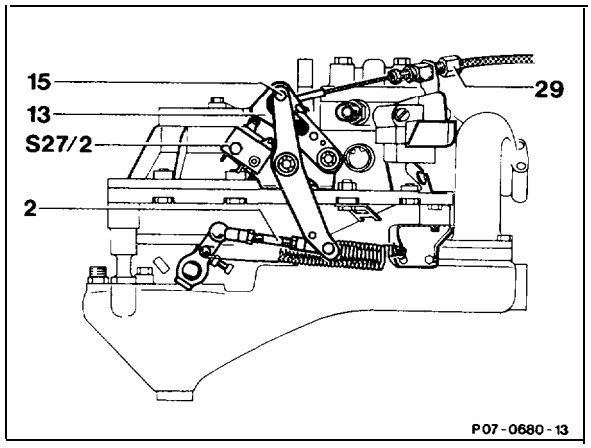
Check whether the actuator is resting against closed throttle position stop of the cruise control. To do this, detach pushrod (21) and press lever of actuator clockwise against idle speed stop. When attaching pushrod (21), ensure that the lever of the actuator is raised approx. 1 mm off the closed throttle position stop. Adjust rod, if necessary.

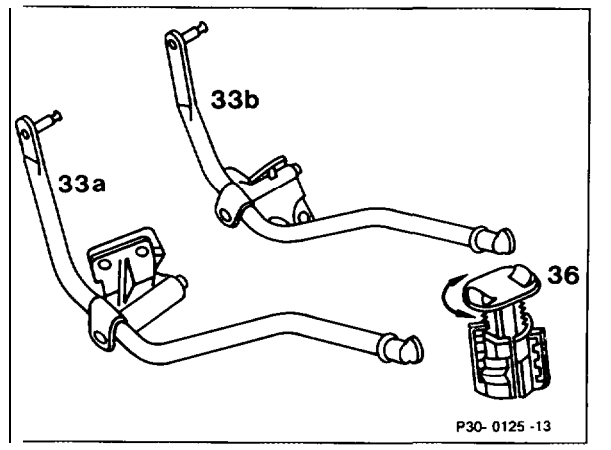
b) ● Vehicles with left hand drive version and manual transmission
as of following Vehicle Ident End No.:

Model	Vehicle Ident End No.
201	A 473 115 F 576 183









Throttle control linkage and Bowden cable ..... check for ease of movement and bending. Replace linkage or Bowden cable, if necessary.

Setting closed throttle po stop
Bowden cable (30) ..... detach at fulcrum lever (13).

Roller (15) in fulcrum lever (13) ..... must be resting free of tension against end stop.

Throttle body ..... check. Throttle body must be resting against closed throttle position stop.

Setting closed throttle position stop . . . . . set the fulcrum lever (13) with the connecting rod (2) so that the roller (15) is resting free of tension against end stop. A play of max. 0.5 mm may exist between roller (15) and fulcrum lever track.

⚠

The roller (15) must run centered in the fulcrum lever (13). Correct or replace parts, if necessary.

Setting Bowden cable

Bowden cable (30) . . . . . attach at fulcrum lever (13).

Nipple (26) . . . . . must be resting free of tension against compression spring (27) and the microswitch (S27/2) must be operated.

Bowden cable . . . . . adjust with adjusting nut (029).

Checking, setting wide open throttle stop . . . release adjustable wide open throttle stop (36) in footwell by turning to the left and withdraw stop pin part slightly. With engine off, slowly move accelerator pedal into wide open throttle position until the throttle body lever is resting against wide open throttle stop.
Accelerator pedal in closed throttle position.
Engage adjustable wide open throttle stop (36) in footwell by turning to the right into the adopted position.
Re-check idle speed and wide open throttle stop, adjust if necessary.

Note

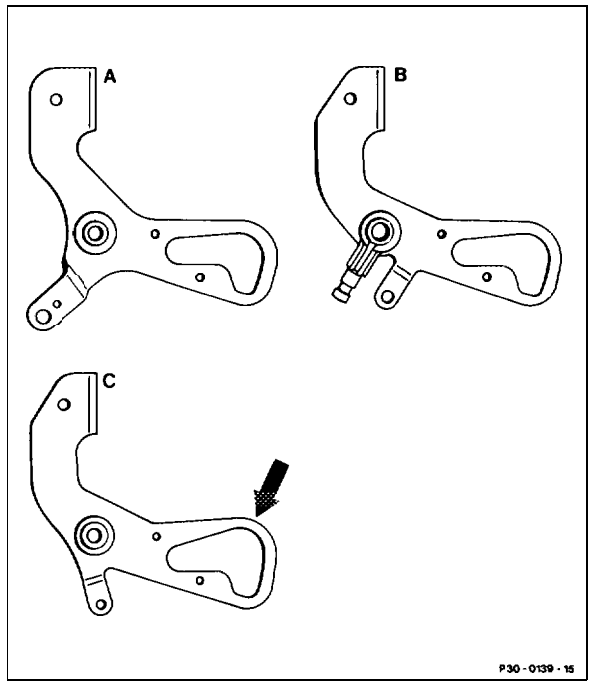
With ignition switched on and lambda tester connected, an on/off ratio of 20 % must be indicated at wide open throttle.

Notes

Fulcrum lever on vehicles with manual transmission
Engine 102.985

Version A was briefly replaced by version B (for automatic transmission).

Since January 1985 the fulcrum lever version C with modified fulcrum (arrow) has been installed (improved responsiveness of throttle control).



A First version
B Second version
C Third version

Production breakpoint: January 1985

Model	Engine	Engine End No. manual transmission	Vehicle Ident End No.
201.024	102.985	001073	F 073767

Locking washers for throttle control

Locking washers for relay lever made of corrosion-resistant material.

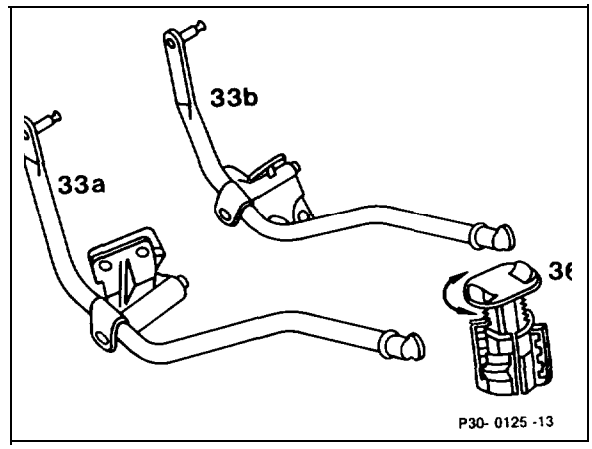
Production breakpoint: February 1988

Model	Engine	Engine End No. manual transmission	Engine End No. **autom. transmission**
201.028	102.985	022234	067638

Accelerator pedal lever, wide open throttle stop

Models 124 and 201 with LHD version and manual transmission:

fmprovement of response and adjustment facility by converting accelerator pedal lever (extending), mounting point and wide open throttle stop with increased pedal travel by 3° in direction of wide open throttle.

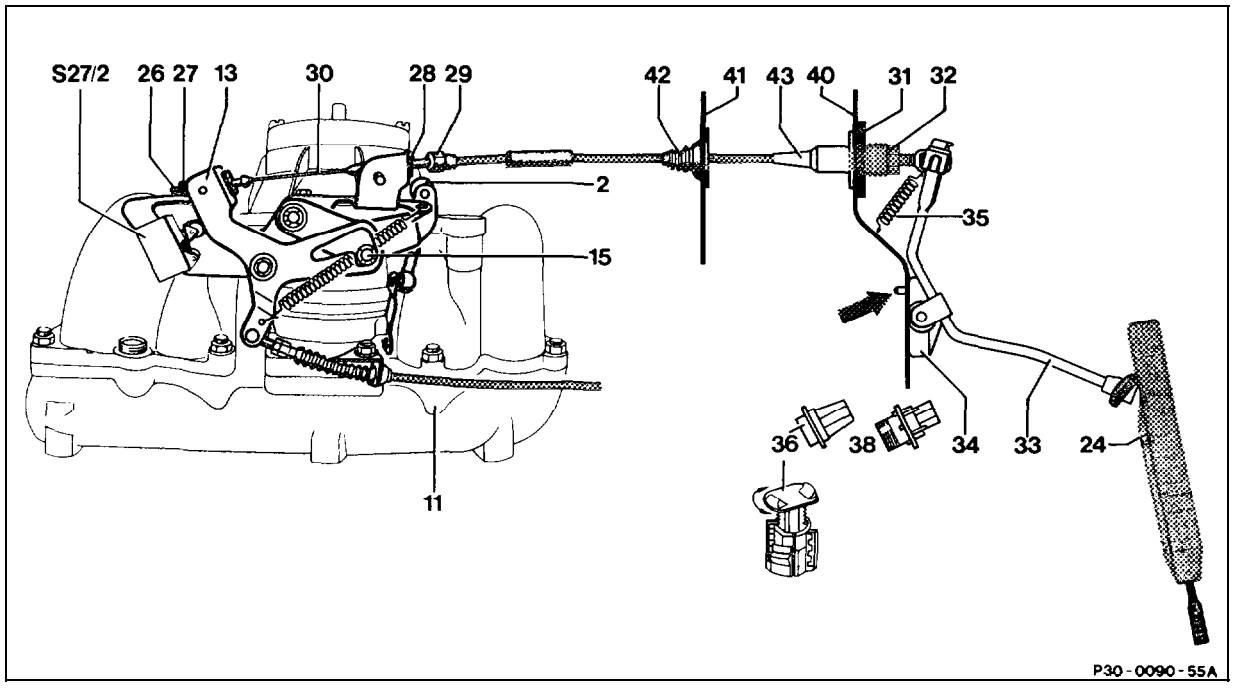


33b Accelerator pedal lever Model 201
36 Wide open throttle stop

Production breakpoint: November 1988

Model	Vehicle Ident End No.
201	A 473 115 F 576 183

30-315 Removal and installation of accelerator pedal lever with firewall bearing



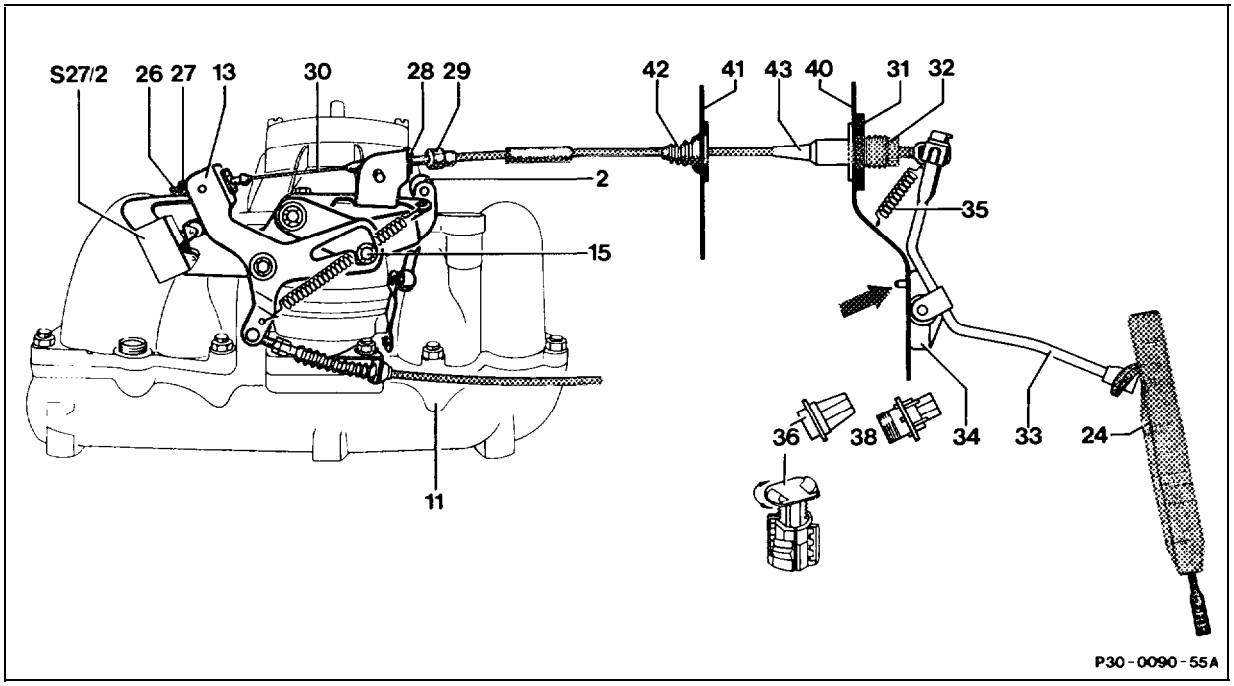
Accelerator pedal (24)	remove, install (30-330).
Cover	unscrew, screw on.
Bowden cable (30)	at accelerator pedal lever (33), detach, fit on. Model 201: pull off locking element, fit on.
Return spring (35)	remove, install.
Firewall bearing (34)	unscrew, screw on. Take off together with accelerator pedal lever (33), install.

Note

When installing, the lug on the firewall bearing must engage in the hole of the firewall (40) (arrow).

Accelerator pedal lever (33)	detach from firewall bearing (34), fit on. Pull off locking element, fit on to perform this step.
Throttle control	adjust (30–300).

30-325 Removal and installation of Bowden cable

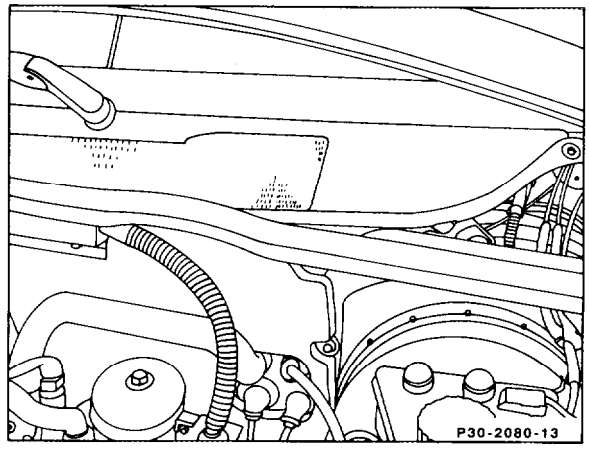


Bowden cable (30)	remove, install by pressing plastic ball forward and compressing and pressing out guide piece. Remove Bowden cable by guiding it through the slot.
Plastic clips (28)	compress and take out Bowden cable.
Windshield wiper arm (Model 201)	take off. Unscrew both screws (on left and right) which hold the cover. Withdraw plastic pins and take out cover (pay attention to note). Not applicable as of Vehicle Ident End No. 001 185.
Vacuum lines	detach, refit.
Accelerator pedal (24)	remove, install (30–330).
Cover	detach, refit.
Locking element for Bowden cable (30)	remove in car interior.
Return spring (35)	detach, attach.

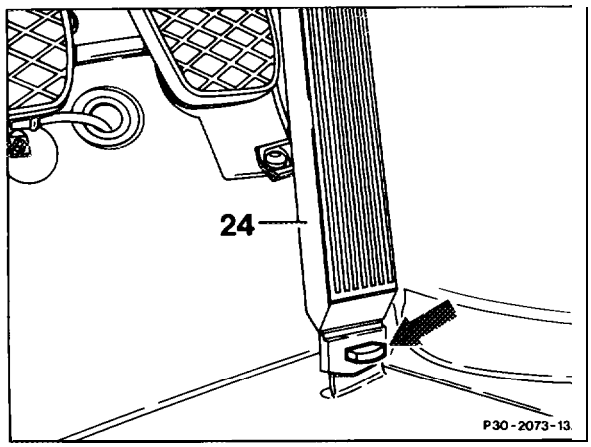
Bowden cable (30)	press to the outside. Do not press out rubber grommet (31). Take out Bowden cable complete from the engine compartment. Note Model 201, up to Vehicle Ident End No. 001 184: take out Bowden cable complete from the outside between firewall and component compartment wall.
Throttle control	adjust (30–300).

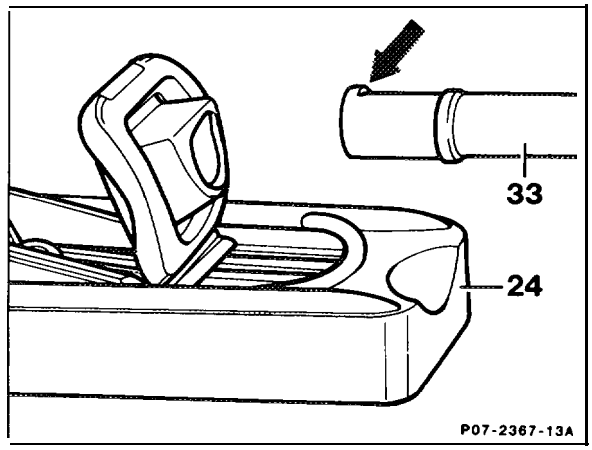
Note

Model 201
As of Vehicle Ident End No. 001 185 the diameter of the rubber grommet (042) in the component compartment wall (041) has been enlarged. For this reason, remove the component compartment wall on vehicles manufactured prior to this date when replacing the Bowden cable and enlarge the hole for the Bowden cable to 32 mm 0 (production breakpoint November 1982).



30-330 Removal and installation of accelerator pedal





Expanding clips (arrow) ..... remove, install.

To remove, compress expanding clips behind accelerator pedal (24) and withdraw.

When installing, ensure it engages properly.

Accelerator pedal (24) ..... remove by pushing accelerator pedal up and turning through 180".

Pull off accelerator pedal down the way. The lug (arrow) on the accelerator pedal lever (33) must be aligned with the slot in the accelerator pedal.

Installation in the reverse order.

Note

The connection from accelerator pedal lever to accelerator pedal is maintenance-free and does not need to be lubricated.

30-335 Lubricating throttle control linkage and throttle control shafts

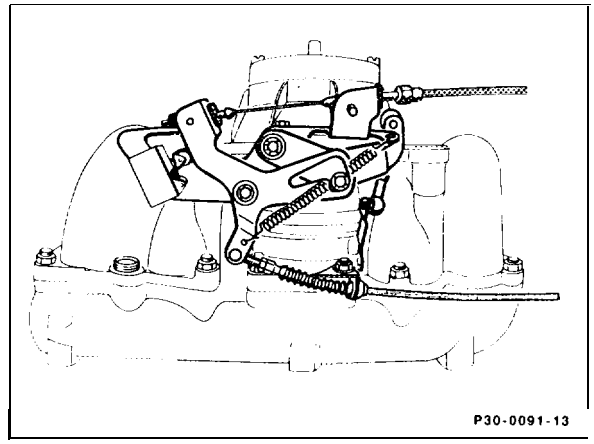
Check ease of movement and wear of throttle control shafts, throttle control levers, relay levers, ball sockets, Bowden cable and throttle control linkage.

After each engine wash and preservation of the engine compartment, lubricate all bearing points, all throttle control levers and joints of the throttle control linkage (use anticorrosion grease Part No. 000 989 87 51 10).

The Bowden cable is maintenance-free and does not need to be lubricated.

Only the following hydraulic oils may be used on models in USA version:

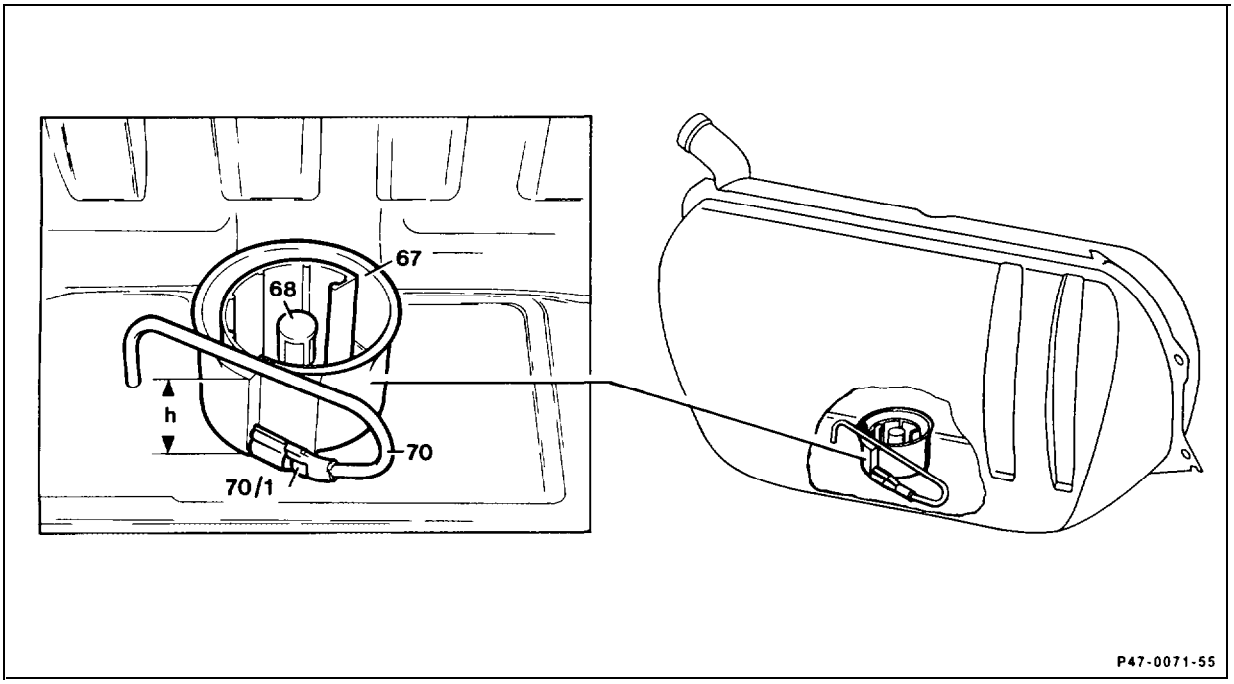
BP-Aero-Hydraulik 1
Castrol DB Hydraulik Fluid
Esso Univers J-13
Mobil Aero HFA
Shell Aero Fluid 4



Job No.

Function of fuel tank with surge bowl . . . . . 47 – 010
Function of fuel gauge sending unit . . . . . 47 – 020
Function of fuel tank ventilation . . . . . – 030
Removal and installation of fuel tank . . . . . – 100
Removal and installation of fuel gauge sending unit . . . . . – 120
Function of evaporative emission system . . . . . – 200
Testing evaporative emission system . . . . . – 300
Function of fuel cooler . . . . . – 400

47-010 Function of fuel tank with surge bowl



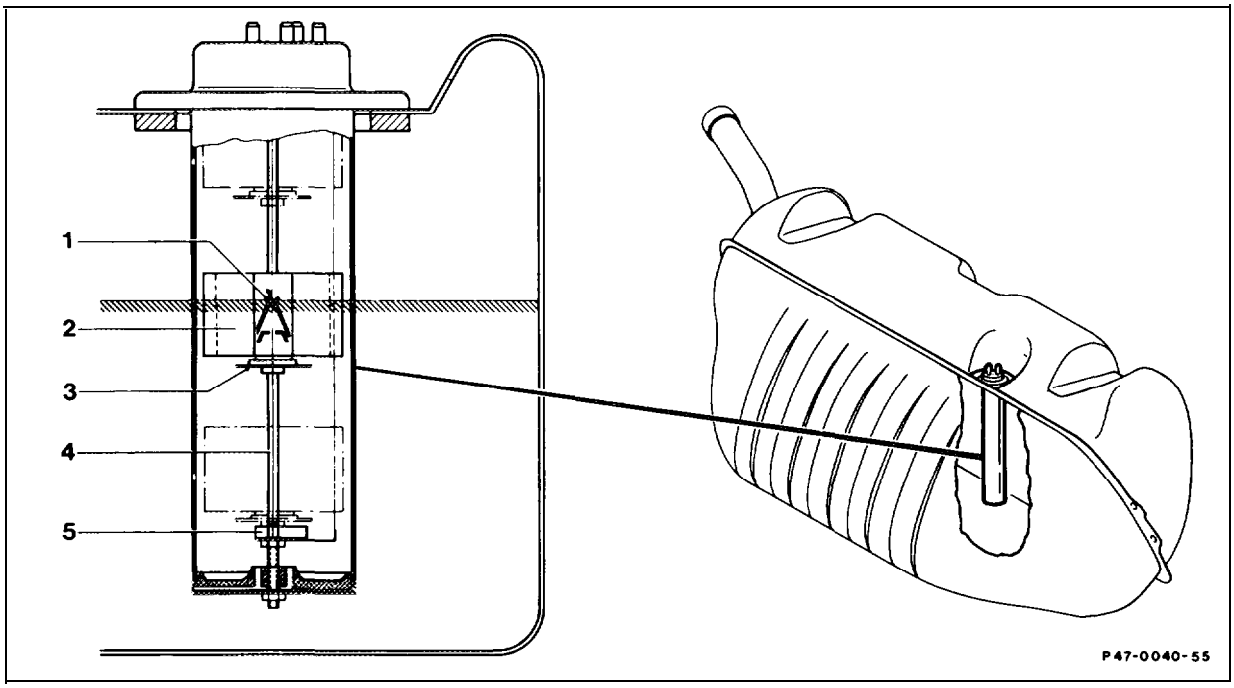
67	Surge bowl	70	Return line
68	Fuel filter	70/1	Return jet

A surge bowl (67) with fuel strainer (68) is installed in the fuel tank. Its task is to reliably supply fuel to the engine when the fuel level in the tank is low and when driving through long curves.
When the fuel pump is running, the fuel return jet flows along the return line (70) at high speed out of the return nozzle (70a) into the surge bowl. It entrains and carries with it into the surge bowl the fuel around the return nozzle.

The fuel height (h) in the surge bowl is maintained even if the fuel level in the fuel tank drops below the height (h).

As of 1989, a cover with an approx. 20 mm 0 hole is fitted additionally on the surge bowl (67). This ensures that the fuel supply of the injection system is assured even if there is only a slight quantity of fuel in the tank (reserve quantity) and during high lateral acceleration.

47-020 Function of fuel gauge sending unit



1	Wiper contact	4	Guide and contact rod
2	Float	5	Reserve warning contact
3	Contact plate		

As the fuel level drops, the wiper contact (1) at the float (2) detects a higher resistance, the current drops and the gauge needle in the instrument moves back.

If the fuel level drops to reserve quantity, the reserve malfunction indicator contact (5) is closed and ground is thus connected to the reserve malfunction indicator lamp.

The reserve malfunction indicator lamp lights up when the ignition is switched on (check function). As soon as the engine is running, it goes out provided the fuel tank contains more than the reserve quantity.

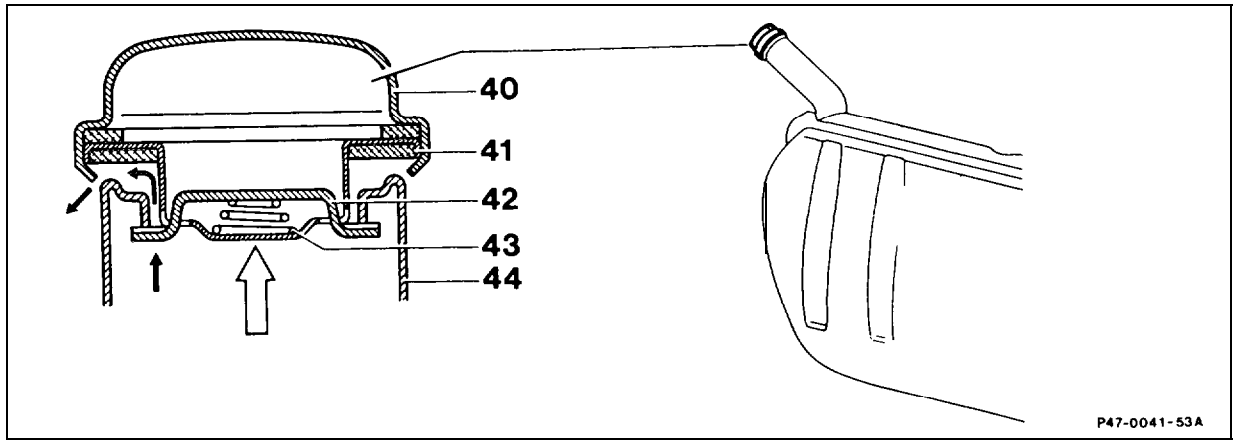
Note
The reserve malfunction indicator lamp lights up with a weak light for the check function, and with a stronger light to indicate reserve quantity.

Testing function of fuel gauge sending unit (54-256).
Testing fuel gauge (54-257).

Model 201 as of **09/87**
The installation attitude has been modified from approx. 15° (deviation from vertical) to approx. 5°. The gauge has been harmonized to the new attitude of the sending unit as follows:
An electronic control delays the switch-on and switch-off of the reserve malfunction indicator by approx. 2 minutes to prevent the lamp flickering in the transition range to the reserve indication.

47-030 Function of fuel tank ventilation

Fuel filler cap

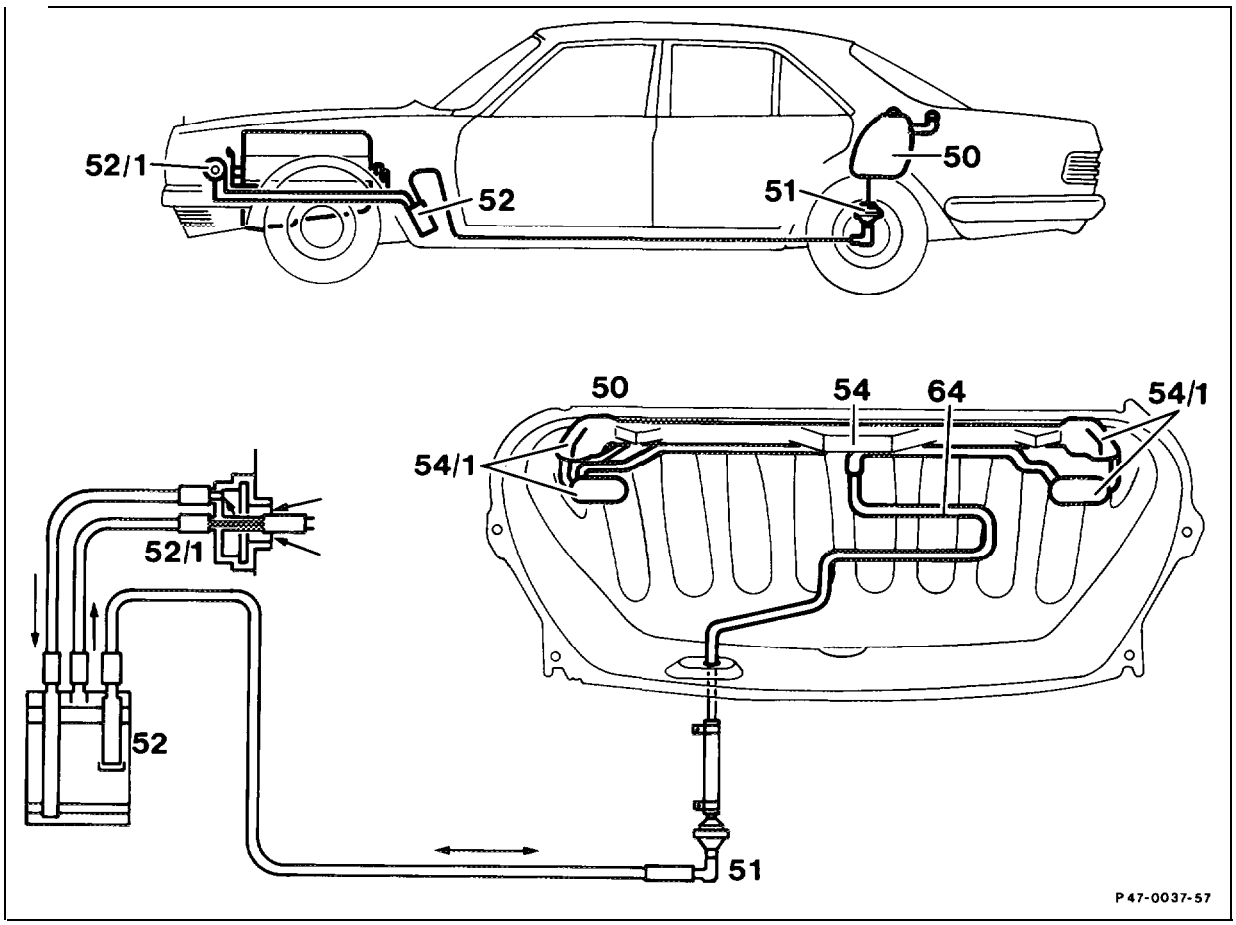


40	Filler cap	43	Compression spring
41	Seal	44	Filler neck
42	Locking bar		

When an pressure of 100 – 300 mbar exists, the fuel evaporation gases are able to escape through the fuel filler cap (emergency ventilation e. g. if vent line crimped or vent valve defective).

Note

The fuel filler cap is equipped with a plastic ring as a phased introduction measure to facilitate use. The filler cap (3) slides on this ring with low friction and engages in both end positions.



50	Fuel tank	**54**	Central pipe
51	Vent valve	**54/1**	Fuel trap
52	Charcoal canister	64	Vent line
52/1	Cup seal		

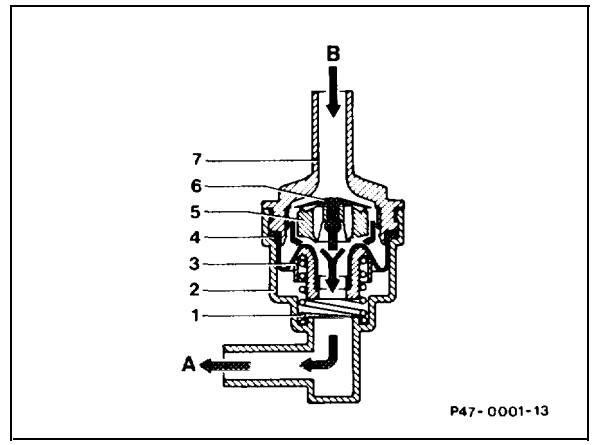
The vent system consists of a central pipe (54) with fuel traps **(54/1).** The fuel traps prevent the fuel escaping along the vent line (64).
The vent line (64) runs from the central pipe to the vent valve (51).

Air is admitted to and released from the fuel tank (50) through the charcoal canister (52) and the cup seal **(52/1).**
The fuel tank on models without fuel evaporation control system is vented directly to atmosphere by the vent valve (51).

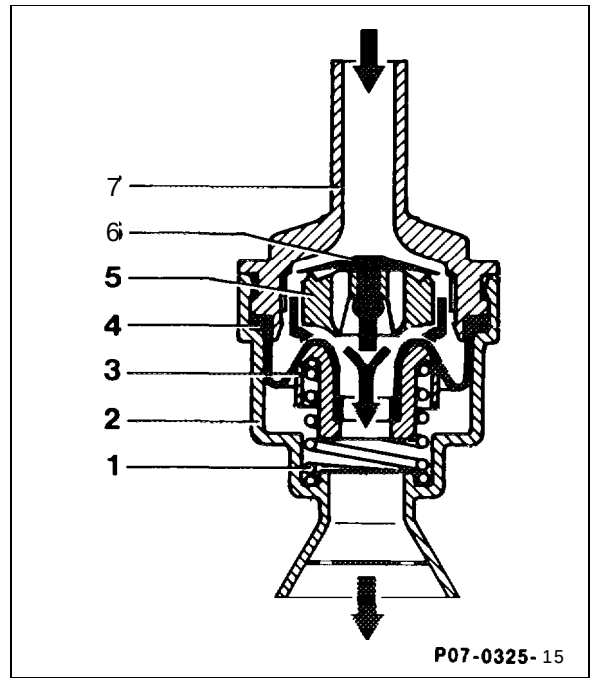
Function of vent **valve** (51)
If an overpressure of 30 – 50 mbar is exceeded in the fuel tank, the vent valve (4) opens and the fuel vapors flow to the charcoal canister.

Note
The pressure in the fuel tank improves the fuel supply and counteracts the formation of vapor bubbles.

Vent valve (51) to charcoal canister open



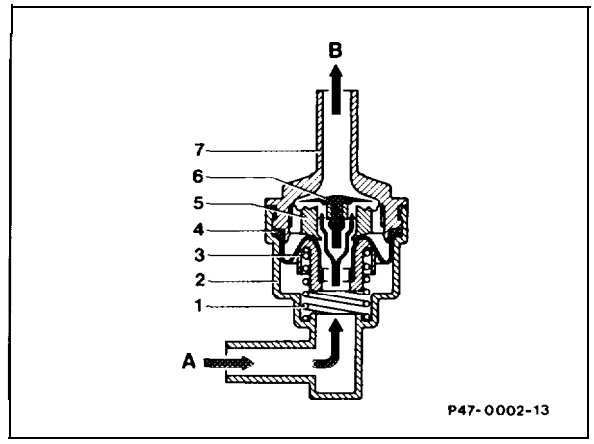
Vent valve opened when overpressure exists. Fuel tank vented to atmosphere (without fuel evaporation control system).



1 Compression spring
2 Valve housing
3 Spring retainer
4 Vent valve
5 Valve plate
6 Air admission valve
7 Connection fitting
A Charcoal canister connection
B Fuel tank connection

If a vacuum of 1 – 16 mbar is produced in the fuel tank, the air admission valve (6) opens. Air is admitted to the fuel tank of vehicles fitted with fuel evaporation control system through a seal on the left wheelhouse and through the charcoal canister (see 47-200).

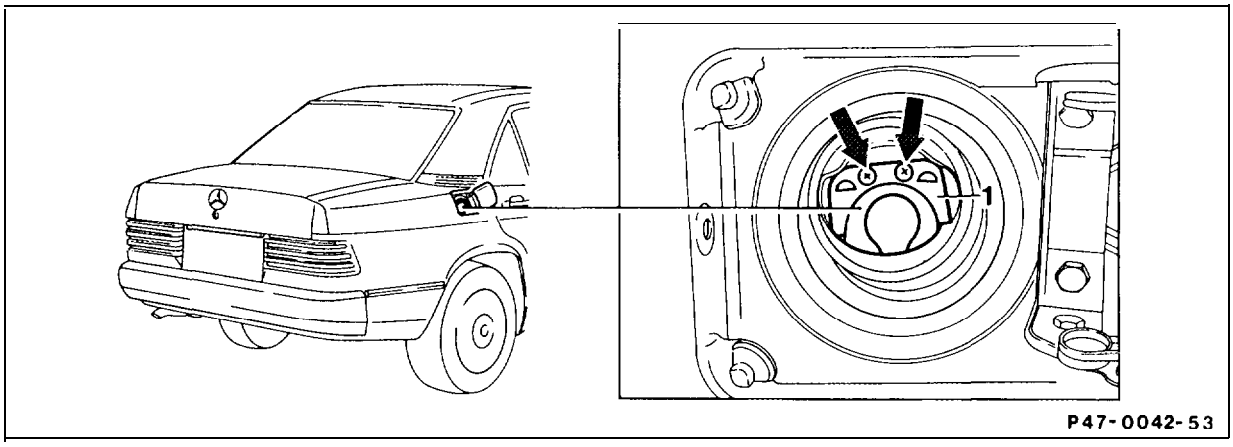
Vent valve (51) to fuel tank open



47-100 Removal and installation of fuel tank

Preceding work:

A. Removal and installation of guide funnel
(on all models with catalytic emissions control system)



Guide funnel (1) ..... remove, install by pulling out the two rivets (arrows) as far as the stop with special tool 123 589 05 33. When installing, knock in with drift.

Caution!
Ensure that no rivets drop into the fuel tank otherwise they negate the function of the surge bowl (reserve fuel quantity cannot be used).

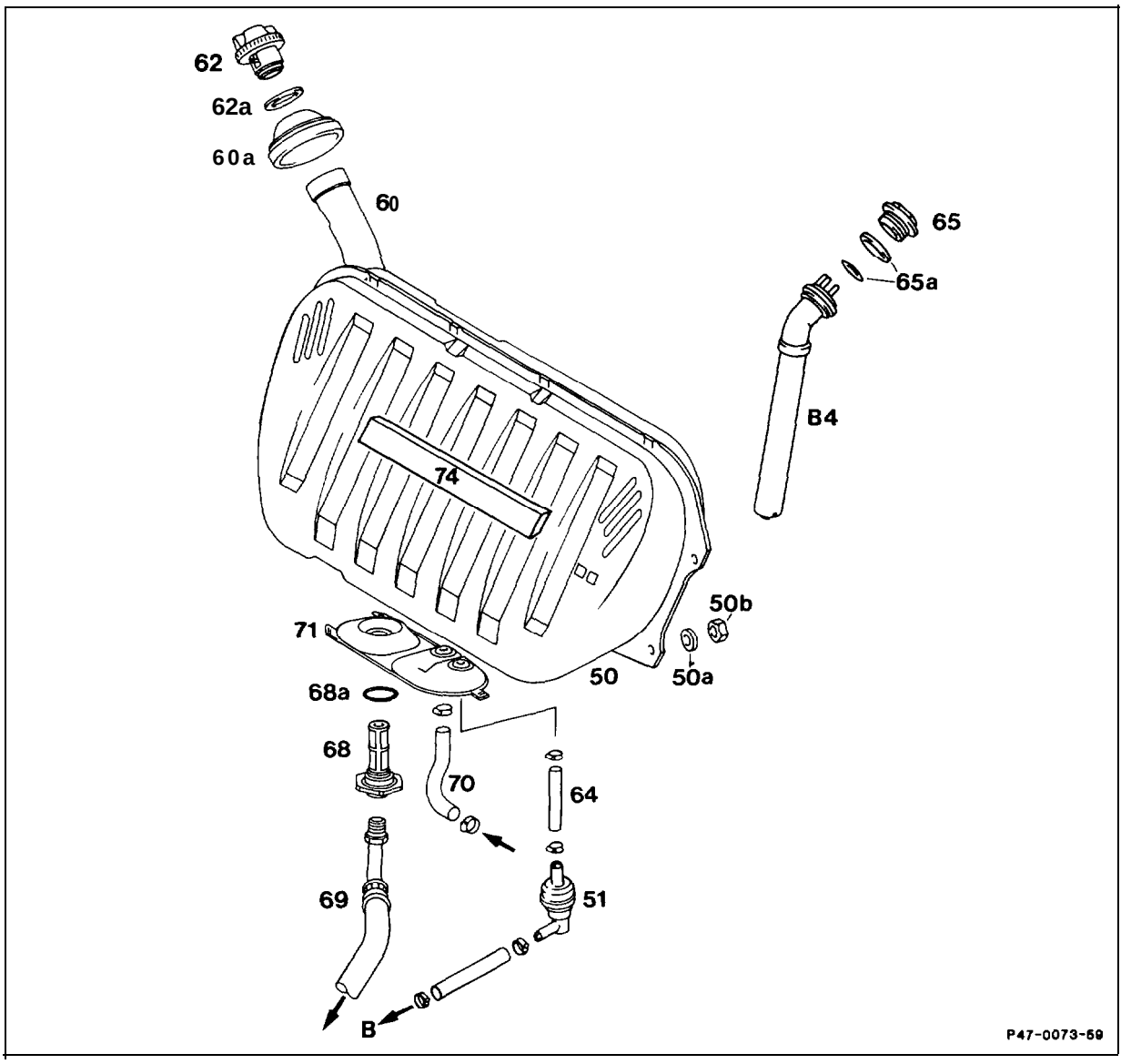
Note
A guide funnel (1) is installed because of the smaller dispensing pistol for unleaded fuel. A guide funnel must be installed if the fuel tank is replaced.

National version (USA)

Guide funnel with additional notches (arrows) to facilitate installation.

Production breakpoint: June 1989

Model	Vehicle Ident End No.	
	A/B	F
201		637121


62
62a
60a
60
65
65a
B4
74
50b
71
50
50a
68a
68
70
64
69
51
B
P47-0073-59

WARNING!

Pay attention to safety precautions. Risk of accident!

Fuel gauge sending unit (B4)	remove, install (47-l 20).
Fuel filler cap (62)	take off, fit on.
Seal (62a)	check, replace if necessary.
Fuel tank (SO)	empty. Carefully pump out fuel so that no fuel remains in the tank. Capacity approx. 55 or 70 litres, respectively.
Cup seal (60a)	remove, fit in.
Fuel tank panelling	remove, install.
Feed hose (69), return hose (70), vent valve (51)	take off, fit on.

Note

Collect remaining fuel.
Seal connections.
Check suitability for re-use.
Ensure cup seal (71) is correctly seated.
Tightening torque 28 Nm.

Nuts (50b, 4 off)	unscrew, screw on. Slacken tensioning screw at tensioning strap (see note), tighten.

Installation instruction

Use shims (50a).
Tightening torque 21 Nm.

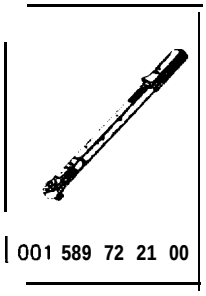
Fuel tank (50)	remove, insert.

Note

Pull drain hose slightly upward and lay behind the rim edge of fuel tank. After installing fuel tank, lay drain hose correctly again. Stick sound deadening strips (74) if necessary with MB universal adhesive 000 989 92 71.

Fuel strainer (68)	remove, clean, check suitability for re-use, install. Tightening torque 39 Nm.
Seal (68a)	replace.
Engine	run briefly. Check connections for leaks.

Special tool

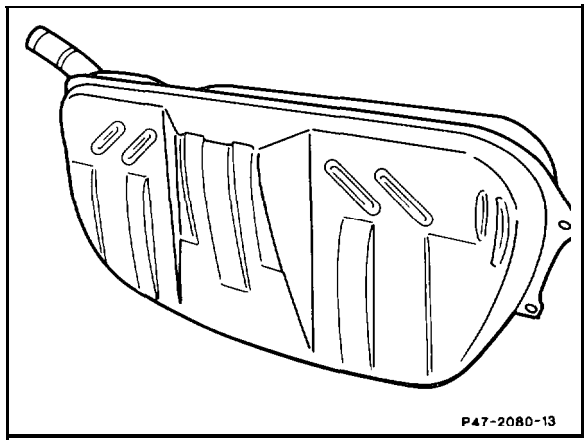


001 589 72 21 00

Note

Fuel tank, Model 201 as of 09/88

The contours of the fuel tank have been adapted to the modified space conditions.
Capacity approx. 55 or 70 liters, respectively, reserve quantity approx. 6.5 or 8 liters, respectively.



55-liter fuel tank of sheet steel

The 55-litre fuel tank is manufactured either of sheet steel or of plastic. Only the sheet steel version is supplied to the (USA).

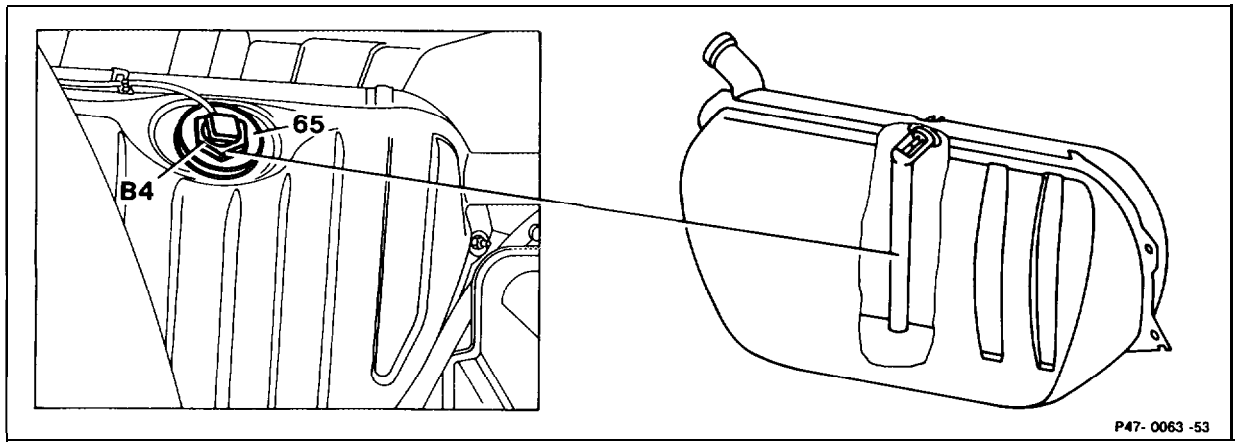
Repair Instruction

Fuel tanks as of 09/88 cannot be installed in vehicles manufactured prior to this date. The plastic fuel tank has different cup seals at the rear floor and filler neck from the sheet steel fuel tank.

47-I 20 Removal and installation of fuel gauge sending unit

Preceding work:

Model 201

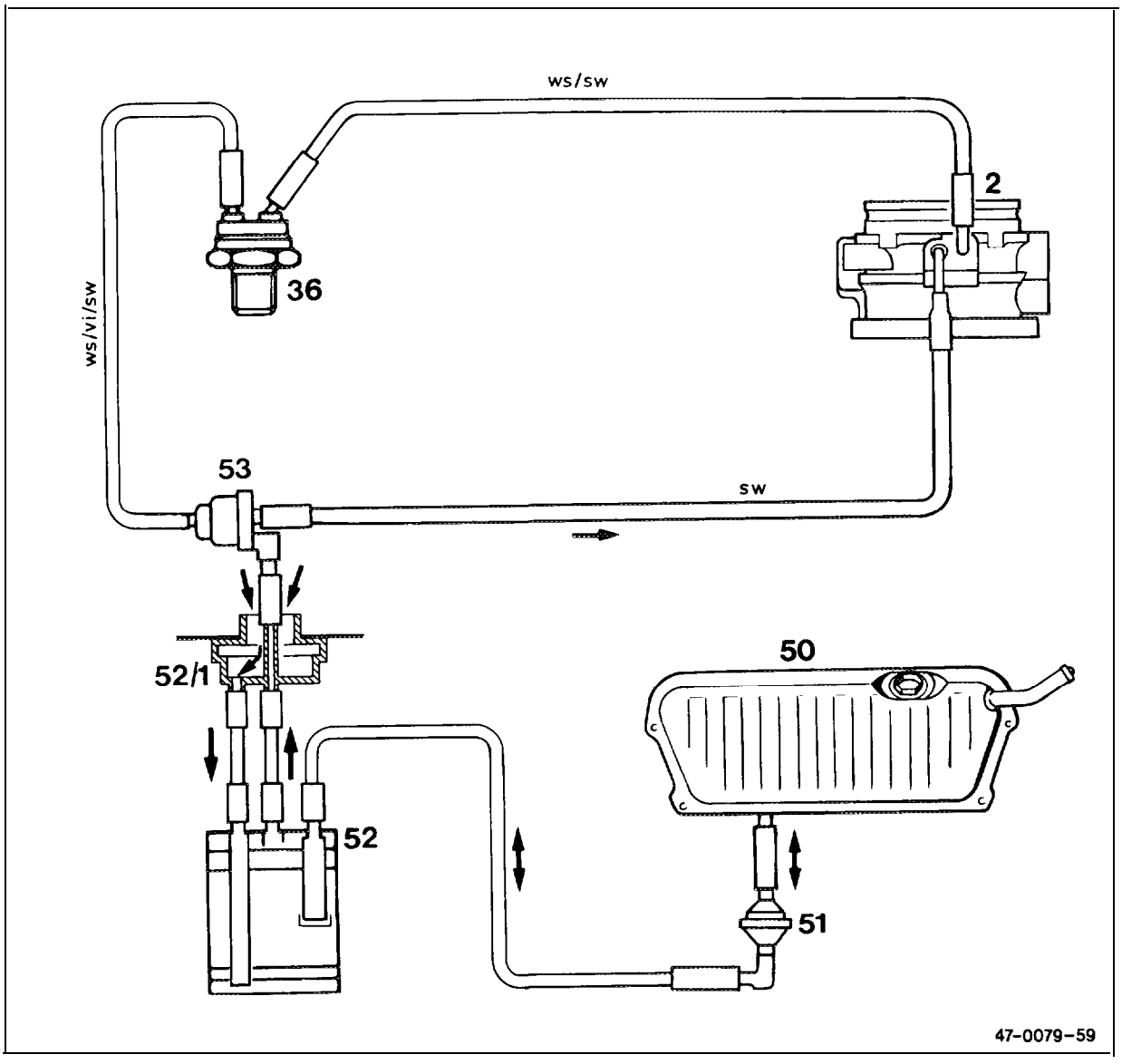


Battery ground cable	disconnect, connect.
Fuel tank panelling	Model 201 Remove fuel tank panelling only partially.
Connector at fuel gauge sending unit (84)	disconnect, plug in. Secure to prevent it slipping.
Sealing flange (65)	unscrew, screw on.
	Note If fuel tank full, pump out approx. 8 litres beforehand.
Fuel gauge sending unit (B4)	remove, run dry if necessary, install. Remove securing pin below adhesive strip (only new part). Replace seal. Tightening torque 39 Nm.

Model 201 as of 09/87

The installation attitude has been modified for approx. 15° (deviation from vertical) to approx. 5°. The gauge has been harmonized to the new sending unit attitude (see Group **54).**

The modified sending unit (5") may also be installed in place of the previous sending unit (15°), but not vice versa.



Function diagram of evaporative emission system

2	Throttle body assembly	51	Vent valve
36	Thermo valve (50 °C red or as of 09/87 70 °C black/white)	52	Charcoal canister
		52/1	cup seal
50	Fuel tank	53	Purge valve

General

To minimize the fuel vapors escaping to atmosphere, an evaporative emission system is installed. The fuel vapors from the fuel tank (50) are passed to the charcoal canister (52) where they are stored. Depending on the operating conditions of the engine, the fuel vapors are drawn off by means of the intake manifold vacuum through the purge valve (53) and the throttle body assembly and combusted in the engine.

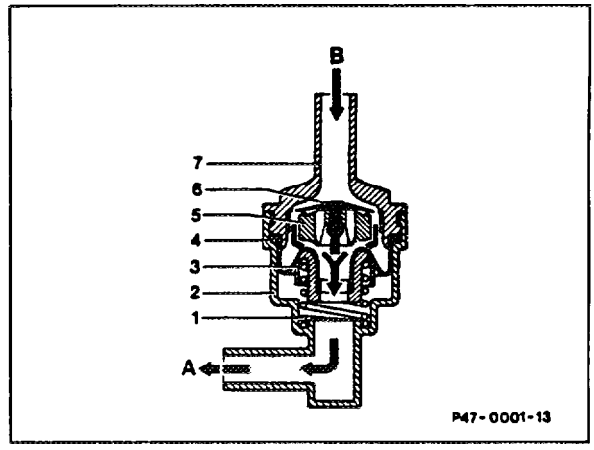
No fuel vapors are drawn off if:

- the engine coolant temperature drops below approx. 50 °C or 70 °C, respectively (thermo valve (36)),
- the throttle blade contacts the closed throttle position.

Function

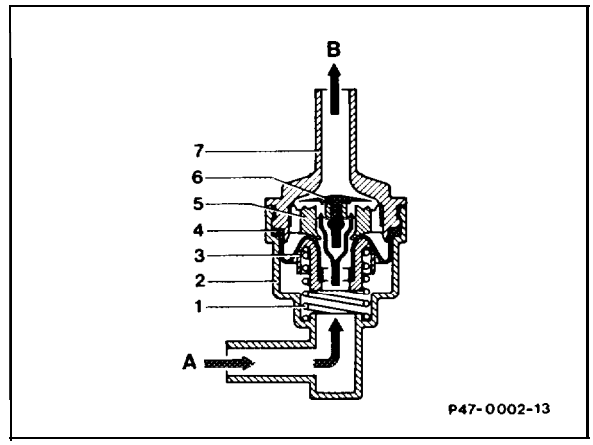
If an pressure of 30 – 50 mbar is reached in the fuel tank, the vent valve (4) opens and the fuel vapors flow to the charcoal canister.

Vent valve (51) to charcoal canister open



1 Compression spring
2 Valve housing
3 Spring retainer
4 Vent valve
5 Valve plate
6 Air admission valve
7 Connection fitting
A Charcoal canister connect.
B Fuel tank connection

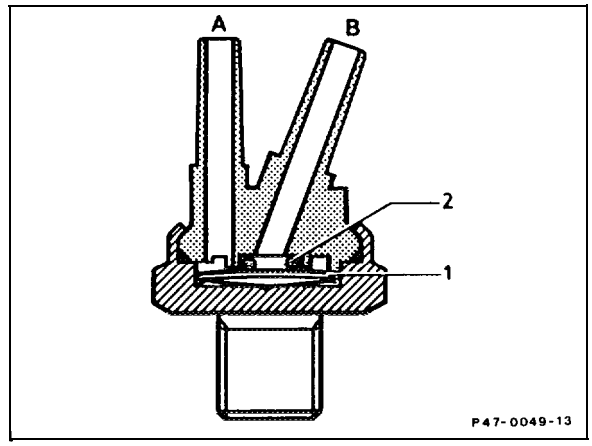
If a vacuum of 1 – 16 mbar is produced in the fuel tank, the air admission valve (6) opens. Air or fuel vapors are then drawn in through the charcoal canister.



Vent valve (51) to fuel tank open

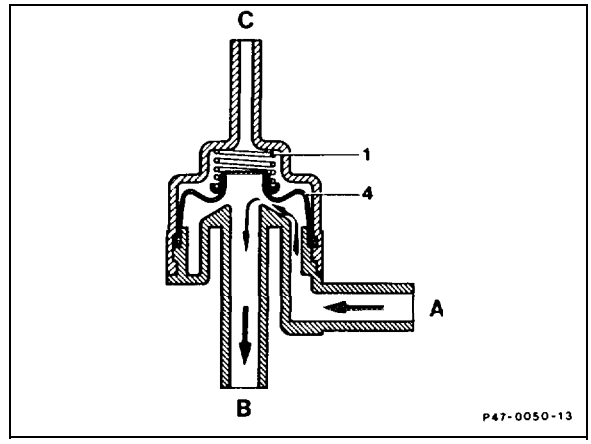
When the engine is running and the engine coolant temperature is more than 50 °C or 70 °C respectively, the intake manifold vacuum passes through the thermo valve to the purge valve (connection C) when the throttle is slightly open.

Thermo valve
40 °C black
50 °C red
70 °C black with white ring



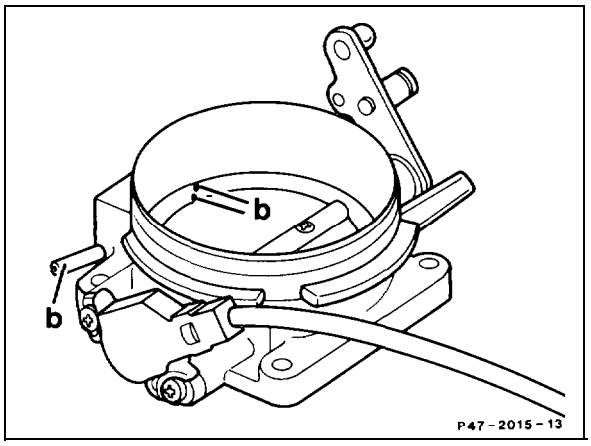
1 Bimetal plate
2 0-nng
A To purge valve
B To throttle valve assembly

The diaphragm (4) is pulled up against the spring force from a vacuum of 20 – 35 mbar. The passage from connection A to B is opened.

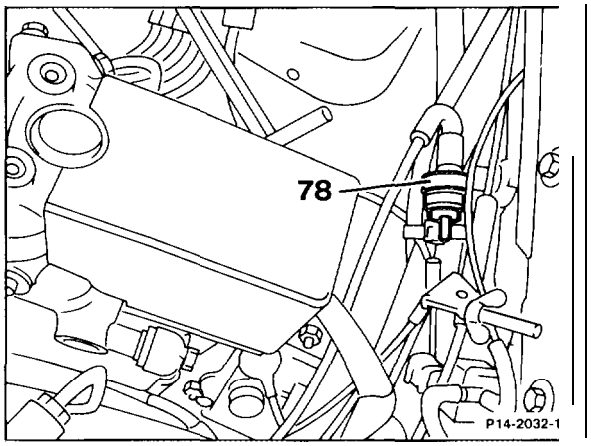


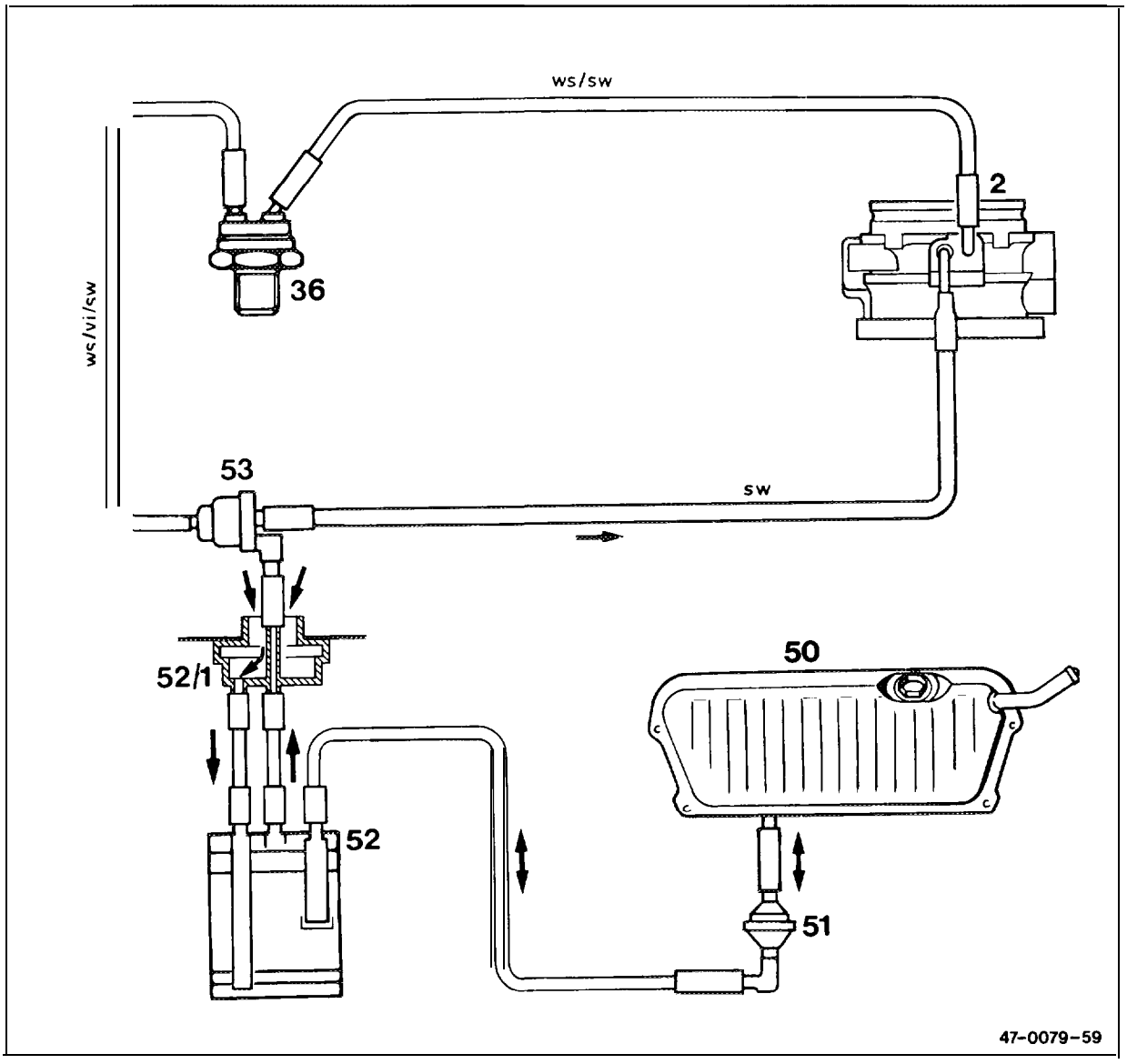
Purge valve (53) open
1 Compression spring
4 Diaphragm
A To charcoal canister
B To throttle body assembly
C Vacuum connection

If the throttle is opened further, the two exhaust ports (b) in the throttle body assembly, which merge into a common passage, are activated in turn. As a result, the fuel vapors stored in the charcoal canister are drawn off. The activated carbon is regenerated.
The throttle body assembly has a vacuum and an exhaust port.



Note
The purge line to the throttle body assembly should be detached at the purge valve (78) and sealed when performing work such as “adjusting idle speed” or “checking, adjusting engine” to prevent the mixture being enriched from the charcoal canister.

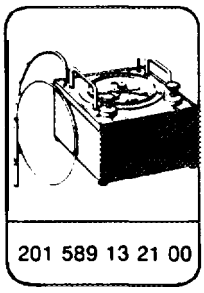


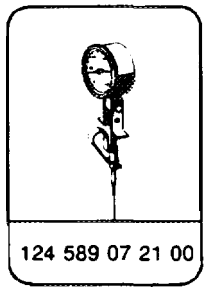


Engine oil temperature	approx. 80 °C.
	Special tool 124 589 07 21 00.
Purge switchover valve (53)	detach from black line to charcoal canister and slowly increase engine speed to approx. 3000/min. No extraction is performed when engine idling. Extraction occurs as engine speed rises.

Thermo valve (36, in sensor block)	check for clear passage.
Vacuum lines (white/black and white/violet/black)	check they are correctly connected to throttle body assembly and to thermo valve (36). Check condition.
Vent valve (51) , ... , ...	test function. Connect tester 201 589 13 21 00 to connection fitting to fuel tank (pressure 30 – 50 mbar, vacuum 1 – 16 mbar).
Lines	from fuel tank via vent valve (51), charcoal canister (52, remove bulkhead if necessary), purge switchover valve (53) to throttle body assembly (black), check.
Charcoal canister (52)	check. The connections to each other must not be blocked.

Special tools

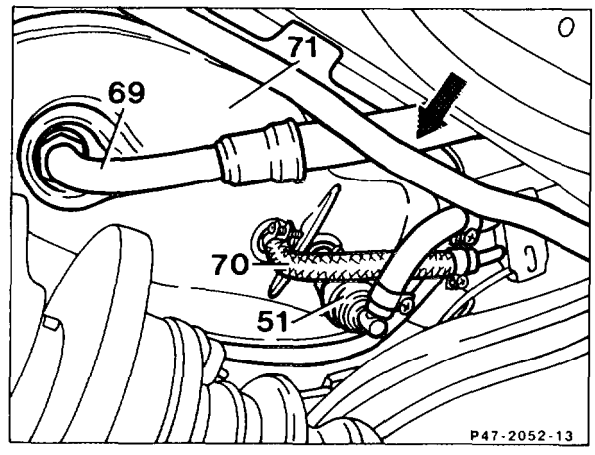




Arrangement of components

Vent valve (51)

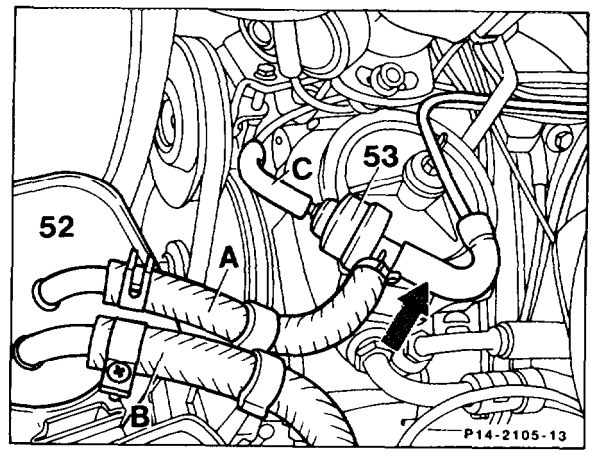
It is fitted on at the end of the vent line of the fuel tank.



e. g. Model 201

Charcoal canister (52)

a) Model 201 up to 08/84, arrangement in engine compartment.
The floor of the charcoal canister is air-permeable (perforated plate). If the stored fuel vapors are drawn off, the active carbon is regenerated.

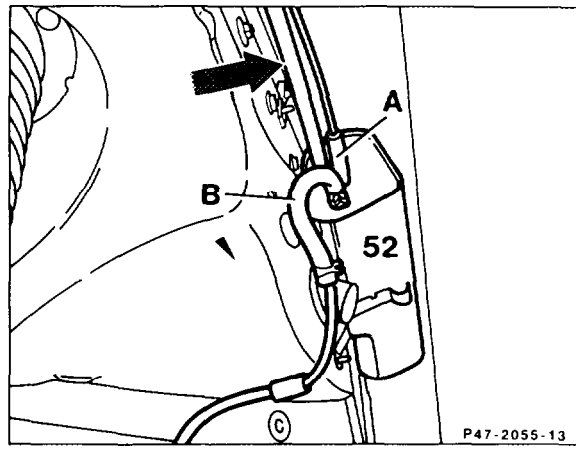


53	Regeneration valve
A/Arrow	Extraction line
B	To fuel tank
C	Vacuum connection

b) Model 201 as of 09/84
As of engines with single-belt drive, the charcoal canister is installed in the front, left wheelhouse. The charcoal canister has a closed metal bottom and therefore has a 3rd connection (arrow) for air admission.

Repair Instruction

Charcoal canister only accessible if bulkhead on left removed.

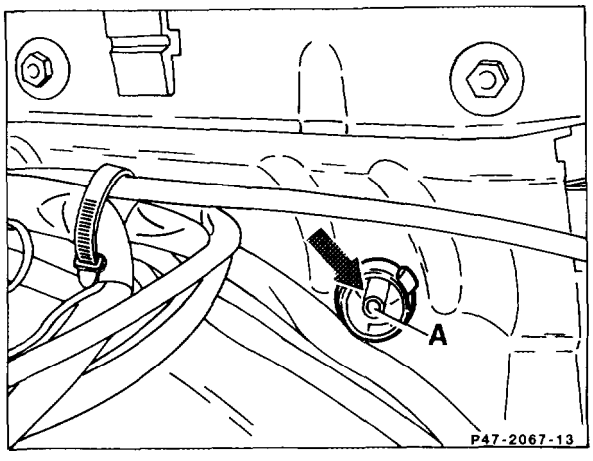


A	Extraction line
B	To fuel tank
Arrow	Air admission line

Model 201 as of **09/87**

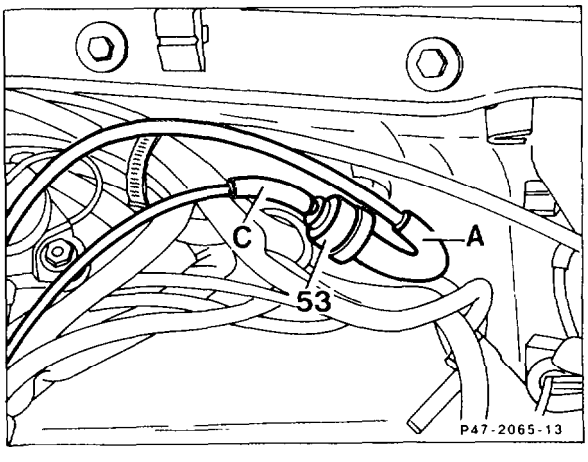
The housing of the charcoal canister is made of plastic (previously sheet steel). Replace steel with steel and plastic with plastic.

If the charcoal canister is installed in the wheelhouse, extractron and air admission line run to the seal (52'1) which is clipped into the wheelhouse. The air admission line merges in the annular chamber (arrow) in the middle of which is connection (A) for the regeneration valve.



Purge switchover valve (53)

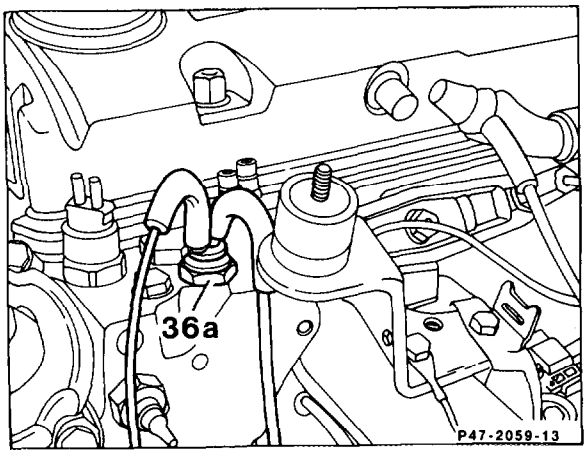
It is fitted into the extraction line (a) from the charcoal canister to the throttle valve assembly.



Thermo valve **(36a)**

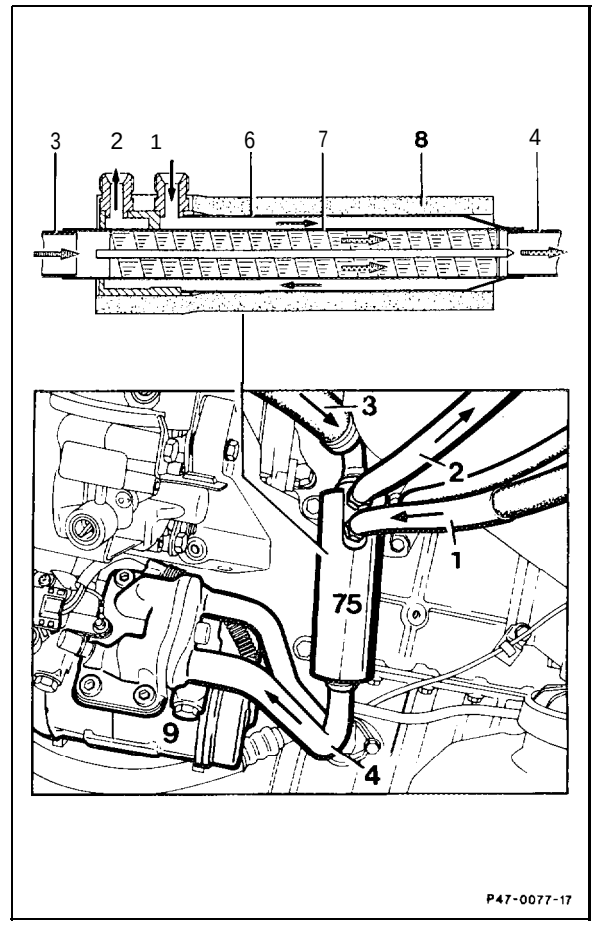
Engines **102.96/98**

Installed in the sensor box on the side or on the top of the cylinder head.



47-400 Function of fuel cooler

All models of national version
(USA)



Model 201 as of August 1985

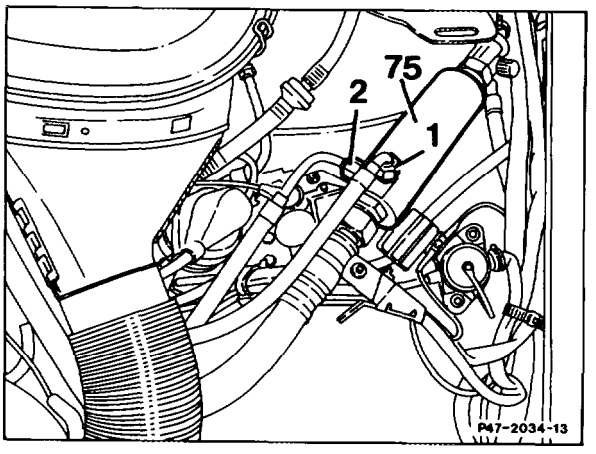
75	Fuel cooler attached to engine
1, 2	Fuel return line
3, 4	Engine coolant return line
6	Outer pipe
7	Inner pipe
8	Insulating hose
9	A/C compressor

A fuel cooler is installed to reduce the formation of vapour bubbles in the fuel system at high outside temperatures. The fuel cooler is located in the coolant return line between evaporator and AC compressor.

When the engine is running, the excess fuel in the fuel distributor flows back pressureless through the fuel cooler into the fuel tank.

As soon as the A/C compressor is switched on, heat is withdrawn from the fuel by the gaseous refrigerant which flows through the inner pipe of the fuel cooler.

Arrangement of fuel cooler, Model 201 up to 08/85



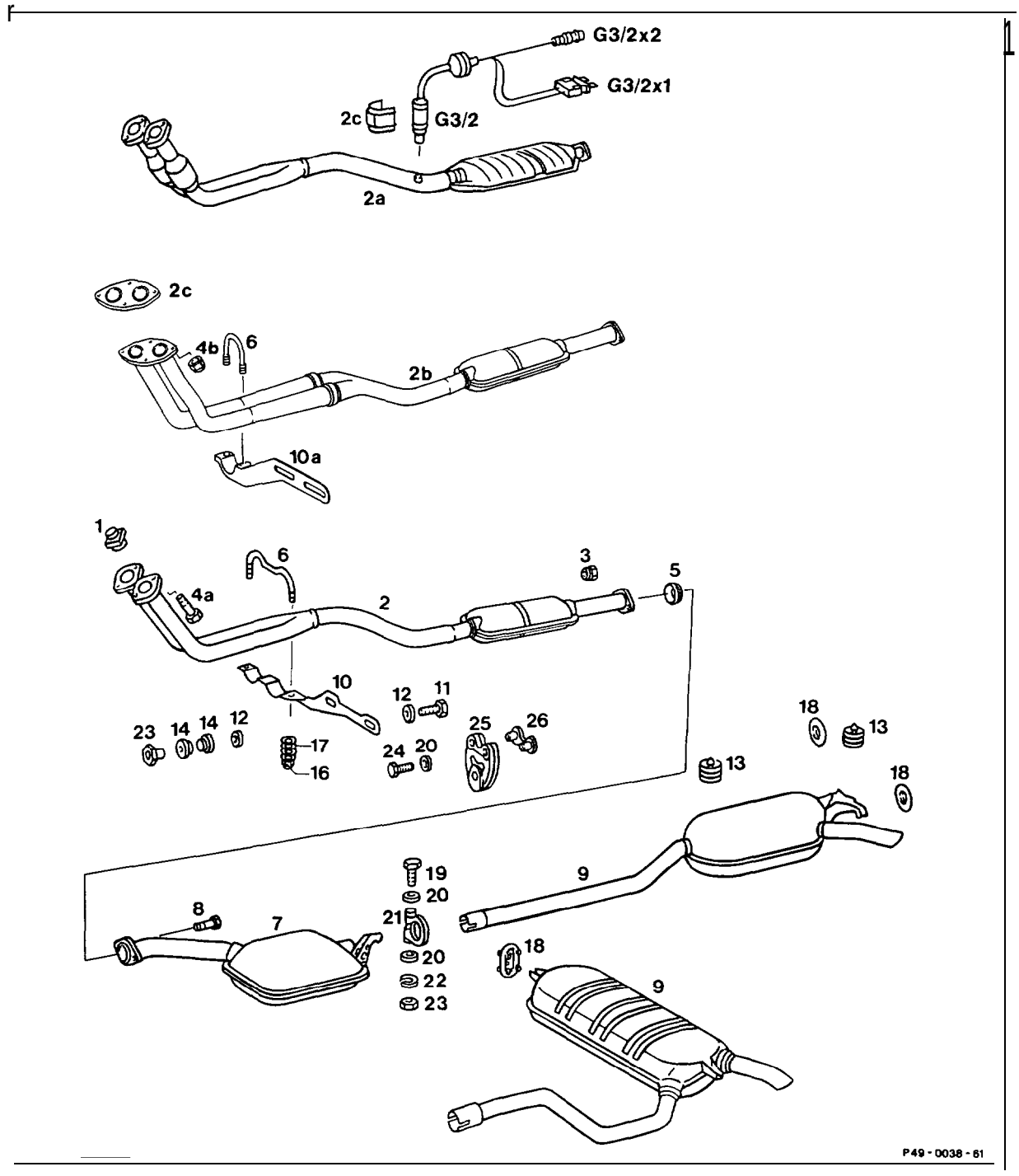
1 From fuel distributor
2 To fuel tank
75 Fuel cooler

Job No.

Removal and installation of exhaust system . . . . . 49 – 100
Removal and installation of exhaust system at push-in joint . . . . . 49 – 120
Replacement of center and rear mufflers . . . . . 49 – 140
Replacement of exhaust support bracket at transmission . . . . . 49 – 180

49-I 00 Removal and installation of exhaust system

Preceding work:
Removing and installing engine compartment panelling.

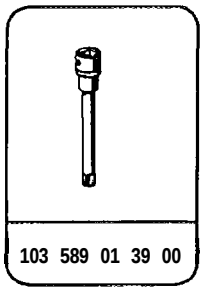


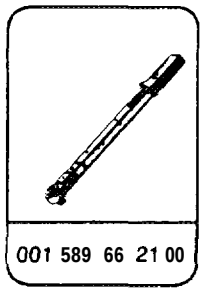
Shown on Model 124

Exhaust system as of plug connection	remove, replace and bolt together, install (49-I 20).
Heated oxygen sensor (G3/2) from front exhaust pipe (2a)	remove, install (depending on version). To do this: Separate heating coil plug connection (G3/2x1) and oxygen sensor signal plug connection (G3/2x2) in right footwell, plug together. Pull off shield (2c), fit on (open side to the rear). **Installation instruction** Coat thread with paste 000 989 88 51. Ensure line is correctly laid.
Pipe shackle (6) with Belleville spring washers (17) and self-locking nuts (23)	remove, fit on. Tightening torque 7 Nm. **Installation instruction** Check parts, replace if necessary. **Caution!** Pay attention to figure note for installing Belleville spring washers (17).
Bolts (4a)	unscrew, screw in. Replace bolts (4). Tightening torque 25 Nm. Tighten flanged joint evenly. **Note Model 201 up to 09/84:** **Replace gasket** (2c) and self-locking nuts (4b). Tightening torque 30 Nm.
Supporting bracket (10 or 1 Oa) with bolts (1 1), washers (12), rubber washers (14) and nuts (16)	**remove, fit on. Tightening** torque 20 Nm. **Installation instructlon** Check parts, replace if necessary.
Front exhaust pipe with catalytic converter (2a) or front muffler (2b, 2)	take off, fit on.

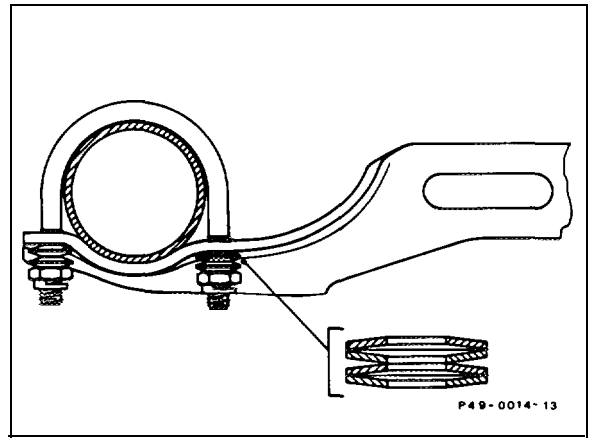
Rivet nuts (1)	.....	at exhaust manifold, remove, install. Knock out rivet nuts with suitable tool (e. g. bolt).
		Installation instruction Install rivet nuts with caulking bolt 103 589 01 39 00 einbauen. Tightening torque of caulking bolt 30 Nm.
Exhaust system	.....	check for leaks with engine running.

Special tools





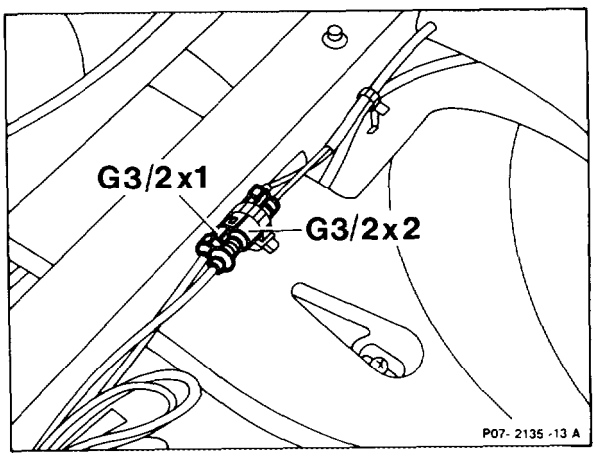
⚠Caution!
Install the Belleville spring washers at the pipe shackle so that the concave faces stand off from each other (as shown in illustration).



Plug connections of oxygen sensor in front of front right seat (if heated oxygen sensor screwed into front exhaust pipe).

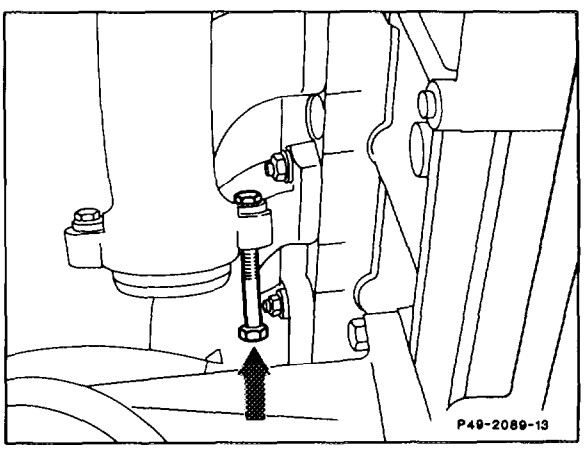
Note

Engine 102.96/98 KAT as of 09189 heated oxygen sensor in exhaust manifold.

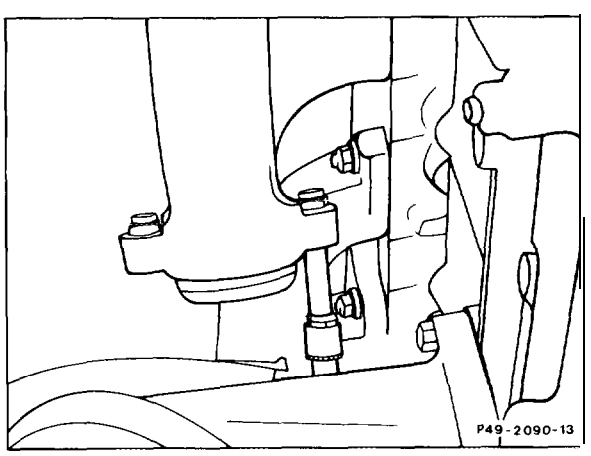


G3/2x1 Oxygen sensor heating coil plug connection
G3/2x2 Oxygen sensor signal plug connection

Knock rivet nuts out of the holes in the exhaust manifold with a suitable bolt. Screw in bolt by hand only.



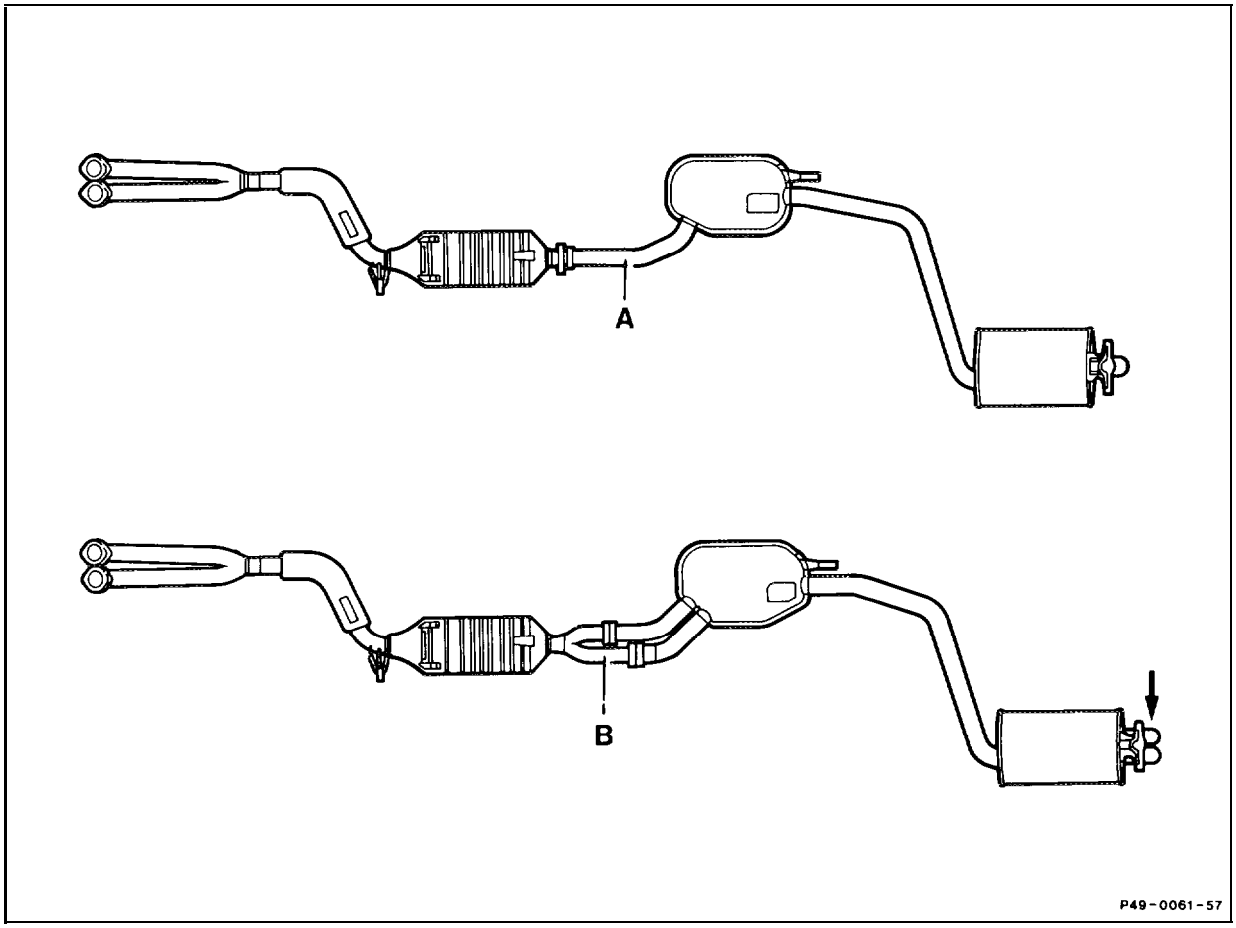
Insert new rivet nut into hole of exhaust manifold. Screw in caulking bolt and tighten to a torque of 30 Nm.



Model 201 with engines 102.985 KAT
as of 01/91

As part of our policy of continuous technical development, engines of a higher output have been installed in the above models. The uprated engine output is achieved as a result of a modified exhaust system.

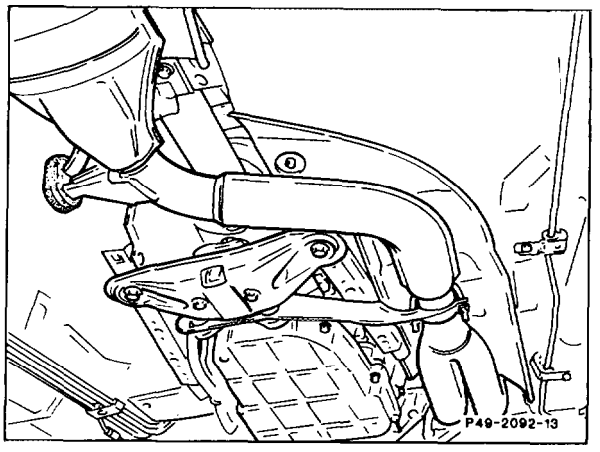
- Two-pipe between catalytic converter or front muffler and center muffler.
- Pipe diameter of 55 mm (was 48 mm) between center and tail muffler.
- Volume of center muffler enlarged.



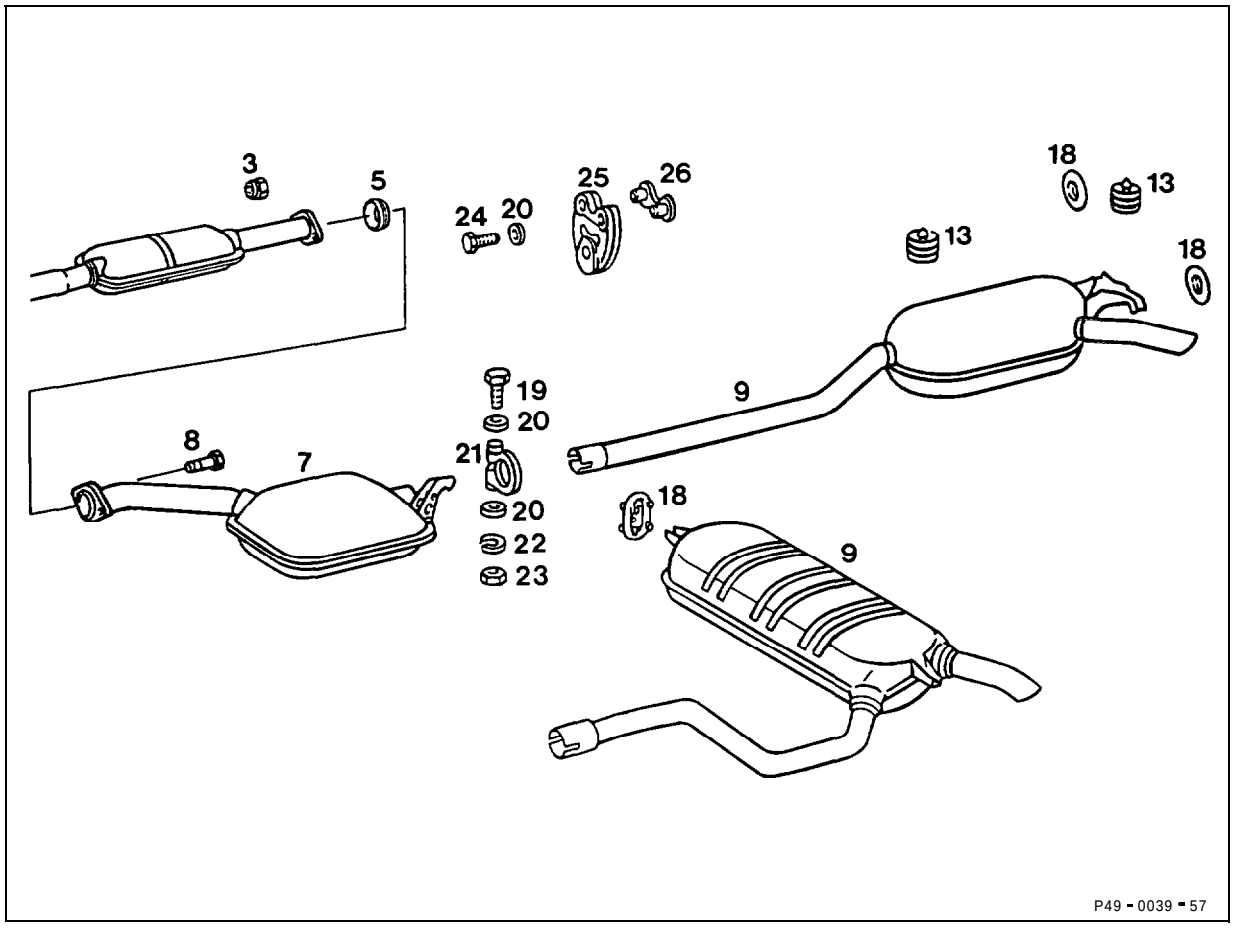
A Previous version
B Present version

(USA) 1991 **Model 201** with engine 102.985

- Pre-catalytic converters omitted.
- Insulation upstream of CAT.
- Catalytic converter enlarged (11 ").
- Suspended upstream of catalytic converter.



49-I 20 Removal and installation of exhaust system at push-in joint



As shown on Model 124, Model 201 similar

Bolt **(19),** washers **(20),** spring lock washer **(22),** nut (23)	remove, check, replace if necessary, fit on. Tightening torque 25 Nm.
Bolted joints, self-locking nuts **(3),** bolts (8)	remove, fit on. Replace self-locking nuts **(3),** bolts (8). Tightening torque 20 Nm.
Rear muffler (9)	remove from rubber ring (18) and take off, fit on and insert in ring.

Installation instruction

Check tail muffler (9) and rubber ring (18) for wear, replace if necessary.

Pipe clamp (21)	pull off rear muffler (9), check, replace if necessary, fit on.
Bolt (24), washers (20), hanger plate (25) and tensioning plate (26)	take off, examine for wear, fit on.
Center muffler (7)	take off, fit on.
Sintered seal (5), flange (5a), graphite seal (5b)	check suitability for reuse, replace if necessary.

Installation instruction

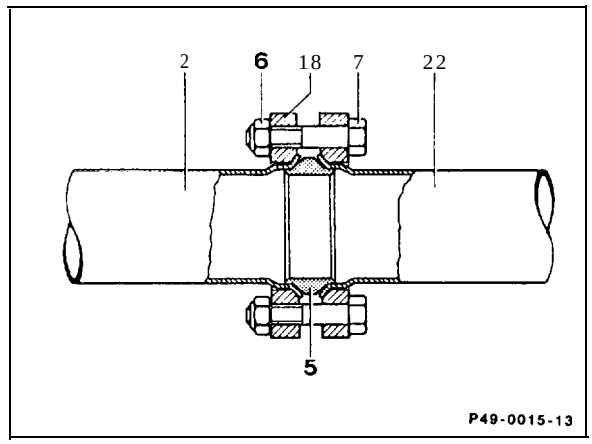
Ensure parts are correctly installed.

Rubber buffer (13)	check for wear, replace if necessary.
Exhaust system	check for leaks with engine running.

Note

If necessary, clean off combustion or corrosion residues from tapered connections of pipe (2, 22) and sintered seal (5) with emery cloth.

Ensure the parts are correctly installed.



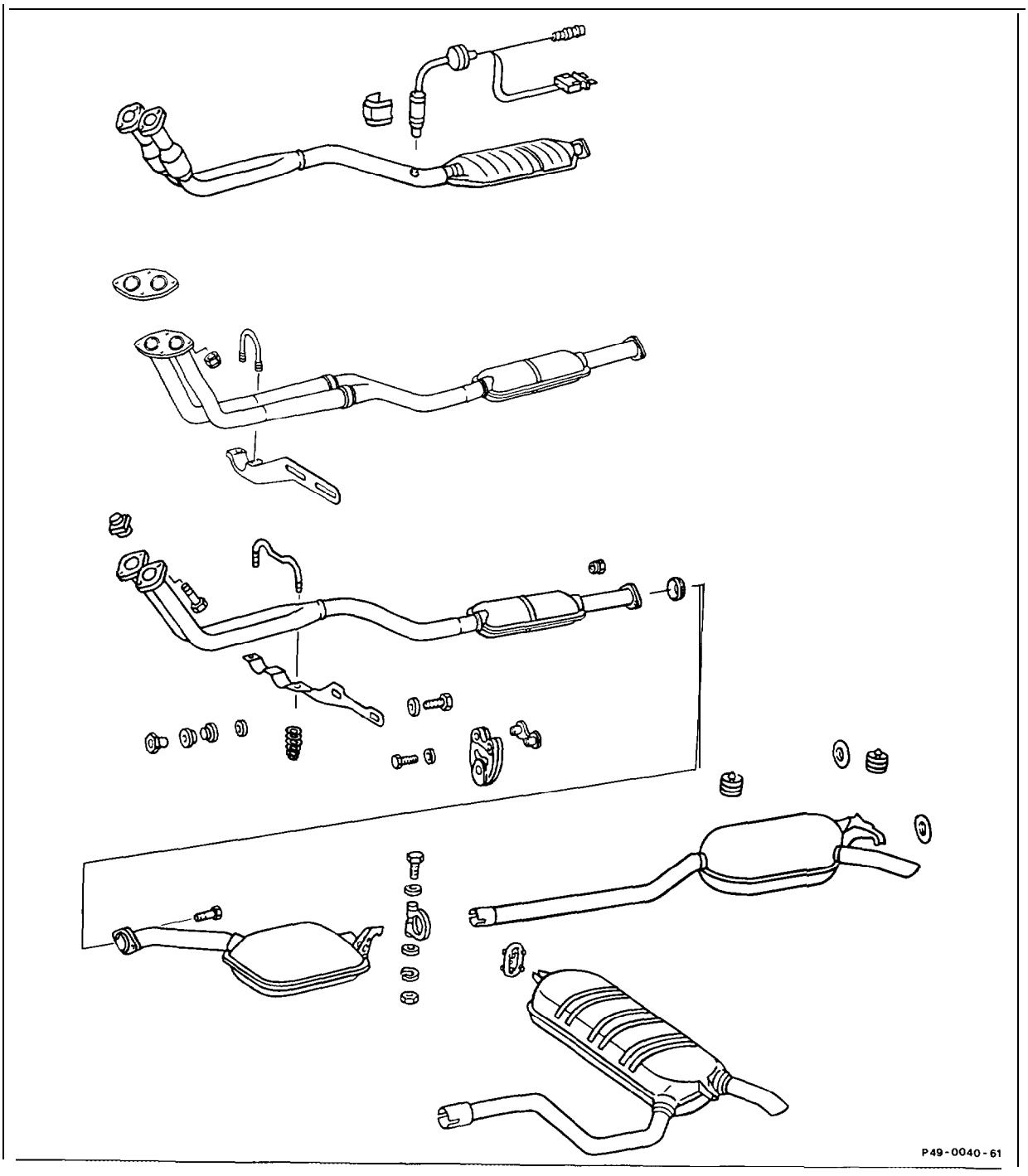
2 Front exhaust pipe
5 Sintered seal
6 Self-locking hexagon nut
7 Hexagon bolt
18 Flange
22 Rear exhaust pipe

49–140 Replacment of center and rear mufflers

Preceding work:
Removing exhaust system as from plug connection (49-l 20).

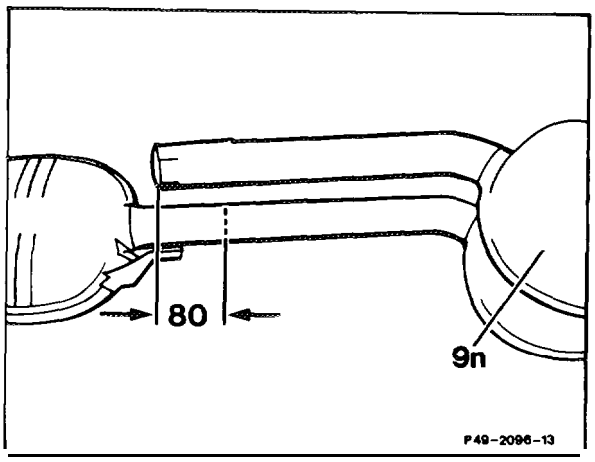
A. Push-flt version

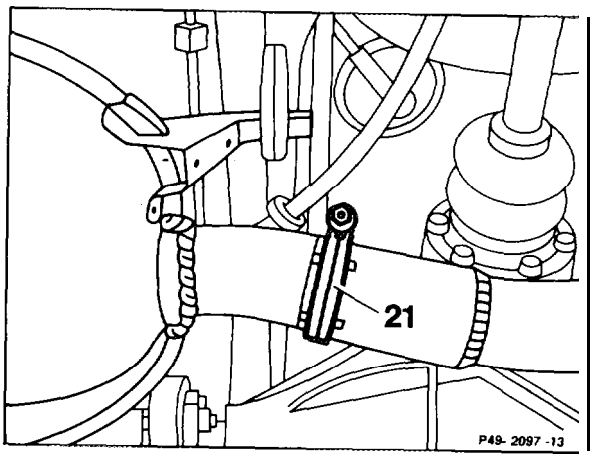
see removal and installation of exhaust system at plug connection (49-120).



Shown on Model 124, Model 201 similar

B. Welded version





New rear muffler (9n) ... place with plug connection exactly over the removed exhaust system and mark pipe length of new rear muffler on the removed exhaust system.

Cut through pipe 80 mm ... from the marking (tolerance minus 10 mm) in direction of rear muffler (broken line) to maintain an insertion depth of 70 – 80 mm.

Exhaust pipe clamp (21) ... use for installation.

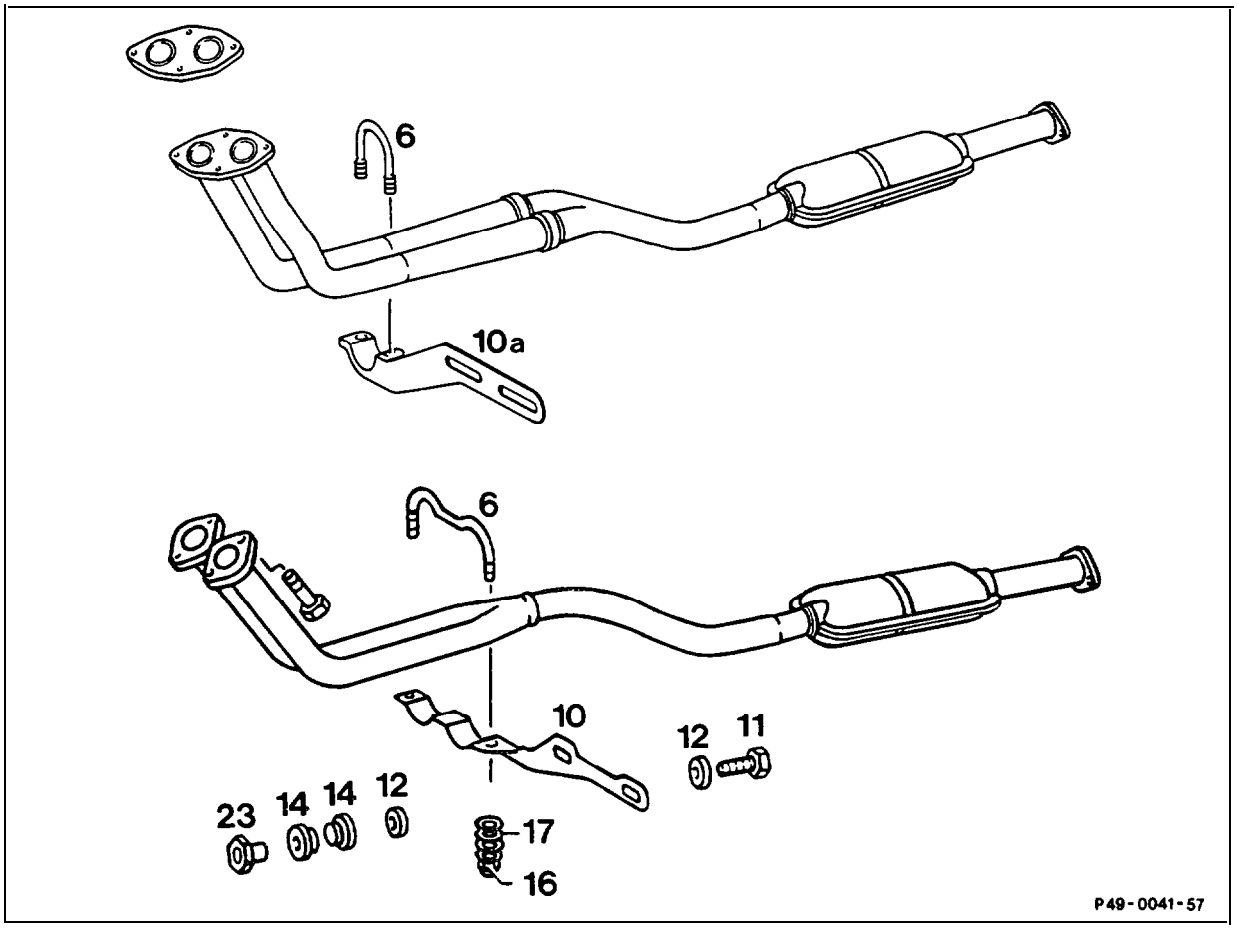
Installation ... is performed similar to reair steps in (49-120).

Note

Replacement of the rear muffler is similar to replacement of center muffler.

49-I 80 Replacement of exhaust support bracket at transmission

Preceding work:



Pipe shackle (6) with Belleville spring washers (17) and self-locking nuts (23) . . . . . remove, fit on. Tightening torque 7 Nm.

Caution!
Pay attention to figure note for installing Belleville spring washers (17).

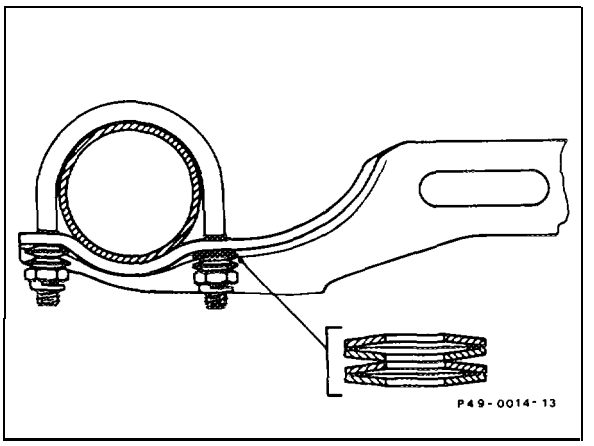
Supporting bracket (10) with bolts (1 1), washers (12), rubber washers (14) and nuts (23) . . . . . remove, fit on.
Tightening torque 20 Nm.

Note
Check parts, replace if necessary.

Model 201 as of 10/84
Double pipe supporting bracket (10) replaces single version (1 Oa).

ACautIon!

Install the Belleville spring washers at the pipe shackle so that the concave surfaces face each other (as shown in illustration).



Mercedes-Benz

Service

Service Manual Supplement
Engine 102.983

Mercedes-Benz of North America, Inc.

S-2347-SUP

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Order No. S-2347-SUP

Introduction

This supplementary manual is the product of existing technical publications. It is intended to supplement Service Manual Engine 102 and covers those areas where the 16-valve engine differs from the standard 8-valve engine. In Group 07.3, additional information covers fuel system changes for 1987.

The material in this manual is divided according to the Mercedes-Benz Component Group System as outlined on the GROUP INDEX page. This page will quickly direct the reader to the Major Component Group.

Mercedes-Benz of North America, Inc. recommends that repairs to, and maintenance of Mercedes-Benz automobiles be performed by **trained Mercedes-Benz personnel** at authorized Mercedes-Benz dealerships.

The information contained in this special publication is ordinarily issued by Mercedes-Benz of North America, Inc., in conjunction with supplementary service literature and special tools supplied **only** to its authorized dealers. The information outlined herein is intended for use by **trained Mercedes-Benz service and dealership personnel.** This manual can also be useful for Mercedes-Benz owners in diagnosing vehicle systems and performing repairs.

Special tools required in performing certain service jobs are identified in the manual and are recommended for use. Any part numbers given are only used for identification and easier differentiation between individual components, and are not intended for ordering purposes.

All procedures, illustrations and specifications contained in this manual were based on the latest information available at the time of publication. All rights are reserved to make production, design and specification changes at any time, without notice and without obligation to give notice. Any such changes will not be contained in this manual.

⚠ Caution!

The proper performance of service and repair procedures is essential for both the safety of the mechanic and the safe and efficient operation of the vehicle. The use of incorrect service procedures and tools may greatly increase the risk of personal injury and render the vehicle unsafe. The procedures in this manual are described in such a manner that the service may be performed safely and accurately.

However, it is a general assumption that the reader is familiar with basic automotive repair procedures and Mercedes-Benz vehicles. You should not attempt to use this manual if this is not the case.

Mercedes-Benz of North America, Inc. assumes no liability for any damage to person or property caused by the utilization of this publication to effect maintenance or repair work on Mercedes-Benz automobiles.

MERCEDES-BENZ OF NORTH AMERICA, INC.
Service and Parts Literature

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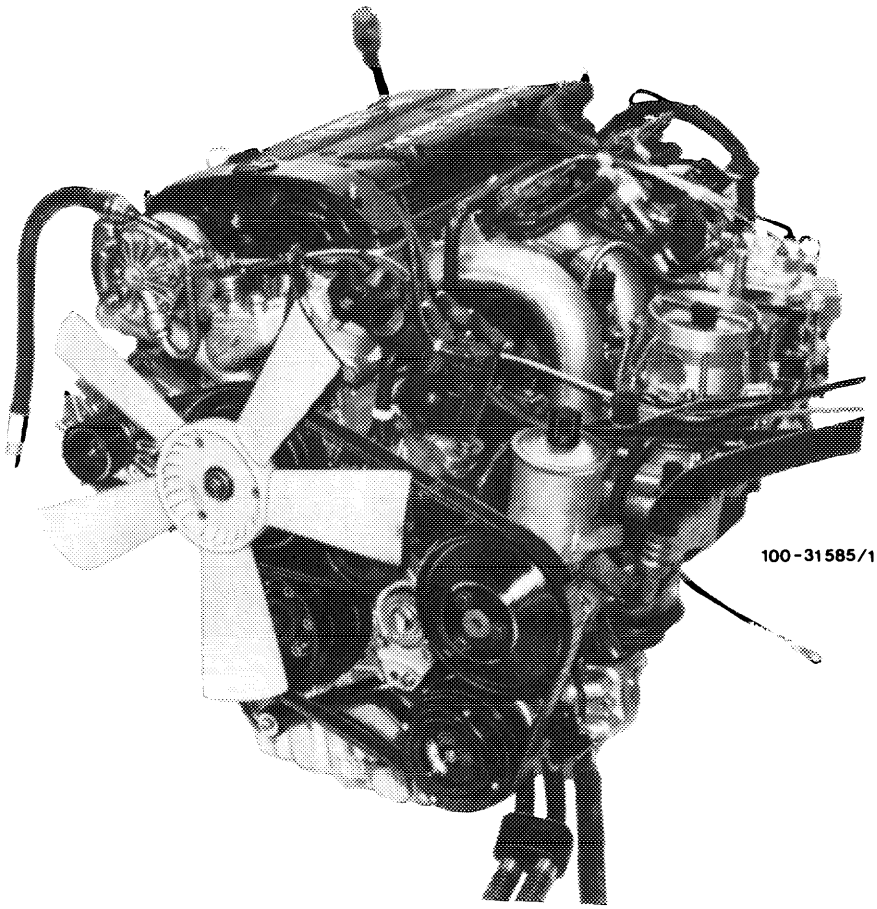

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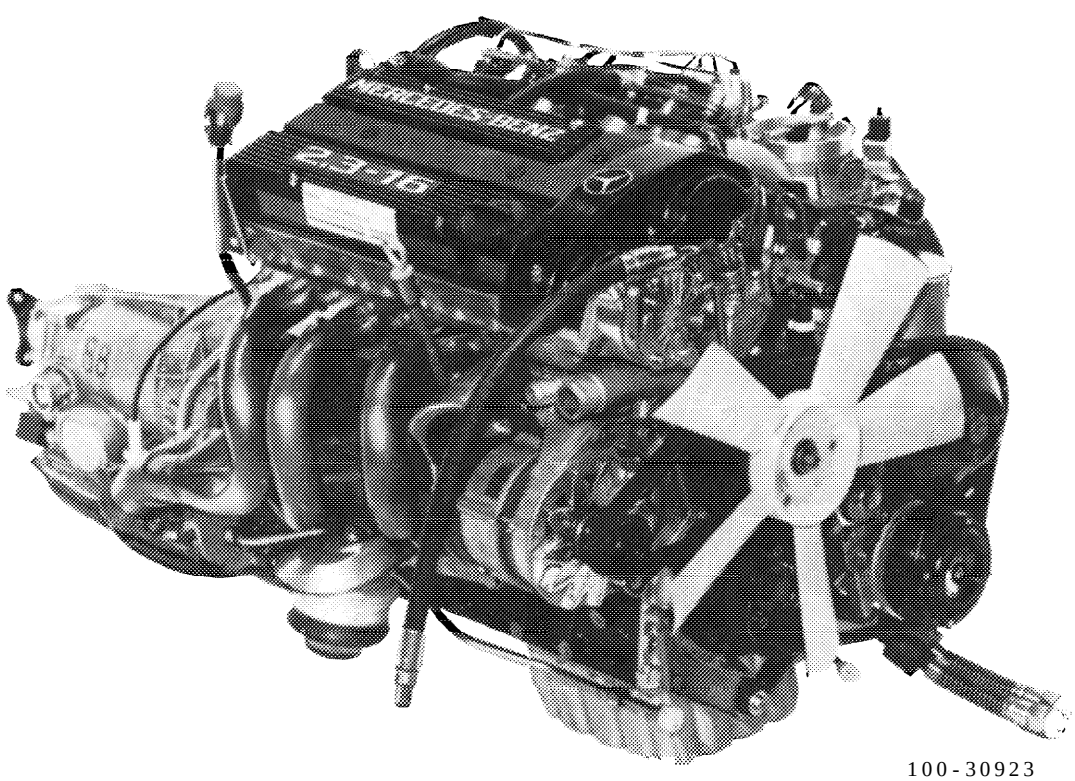
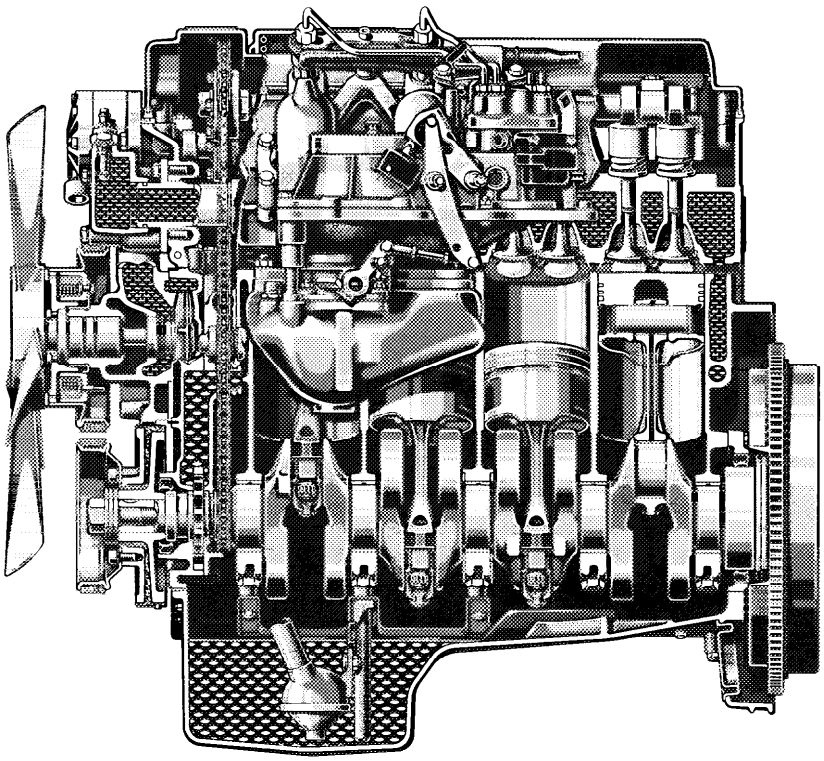
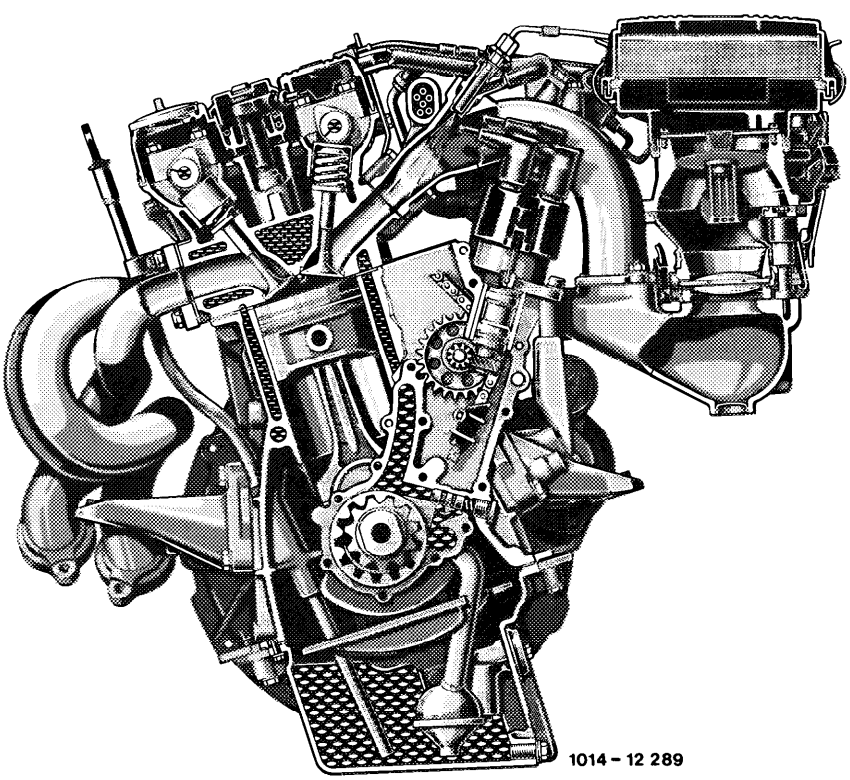


100-30923

Longitudinal and cross sectional views of engine 102.983





1014 – 12 289

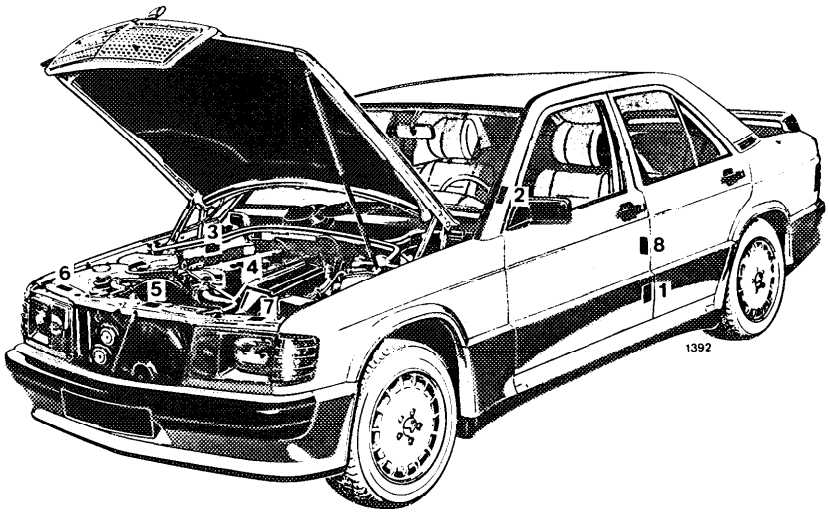
This manual applies to the following passenger cars, model years 1986 – 1987.

Gasoline engines

Model Year	Model	Sales Designation	Engine
1986 – 1987	201.034	190 E 2.3-16	102.983

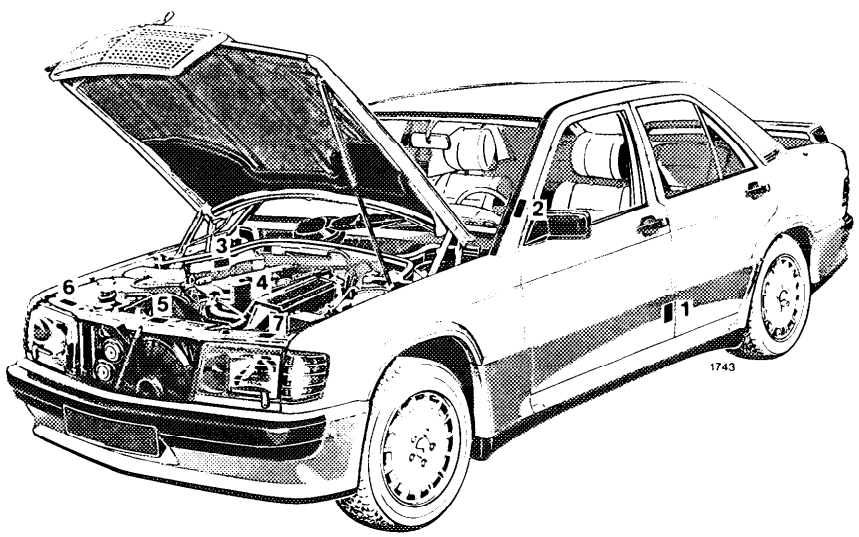
Model 201.034

When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag
8 Emission Control Tag
Catalyst Information
(model year 1986)

Model year 1986



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identrficatlon No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag

Model year 1987

Gasoline engine

Model	201.034
Sales designation	190 E 2.3-16 (Model Years 1986 - 87)
Engine	102.983
Operation	4-stroke spark ignition, mechanically/electronically controlled continuous fuel injection system with airflow sensor (CIS-E)
Number of cylinders	4
Cylinder arrangement	In-line 15 ° inclination
Bore/stroke mm	95.5/80.25
Total effective piston displacement cc	2299
Compression ratio	9.7 : 1
Firing order	I-3-4-2
Maximum speed rpm	6800 ± 50
Engine output (SAE) kW/rpm net bhp/rpm	 125/5800 167/5800
Maximum torque Nm/rpm net lb-ft./rpm	 220/4750 162/4750
Crankshaft bearings	5 (multi-component, anti-friction bearings)
Valve arrangement	Overhead, 4 per cylinder
Camshaft arrangement	2 overhead camshafts
Oil cooling	Oil-to-air-cooler
Cooling	Coolant circulation pump, thermostat with bypass line, fan with visco clutch, finned tube radiator
Lubrication	Pressure lubrication via gear type pump
Oil filter	Full flow filter
Air cleaner	Dry air filter with paper cartridge

Filling capacities

Model	201.034
Sales designation	190 E 2.3-16 (Model Years 1986 - 87)
Engine	102.983
Fuel tank/reserve approx. l	7018.5
During initial oil filling approx. l	5.5
During oil and filter change approx. l	5.0
Marks on dipstick max./min. approx. l	4.8/2.8
Cooling system with heater approx. l	8.0

Electrical system

Model	201.034
Sales designation	190 E 2.3-16
Engine	102.983
Battery Voltage Capacity	 12 v 62 Ah
Starter Bosch	12 v 1.5 kW
Alternator	14 V 70 A

Crankcase, cylinder head, crankcase ventilation

Crankcase

The crankcase corresponds with that of the engine 102.985, except for the following modifications.

The mounting bore for the TDC position indicator of the ignition system (arrow) is located above the starter mounting flange.

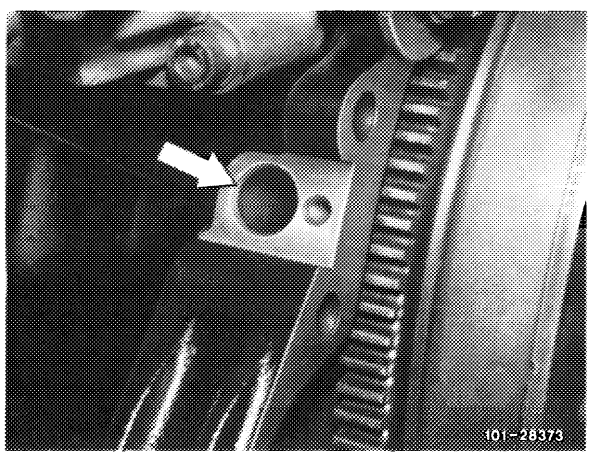


Fig. 01/1

The oil deflector plate fastened to crankshaft bearing caps 1 – 3 prevents splashing of oil at high engine speeds.

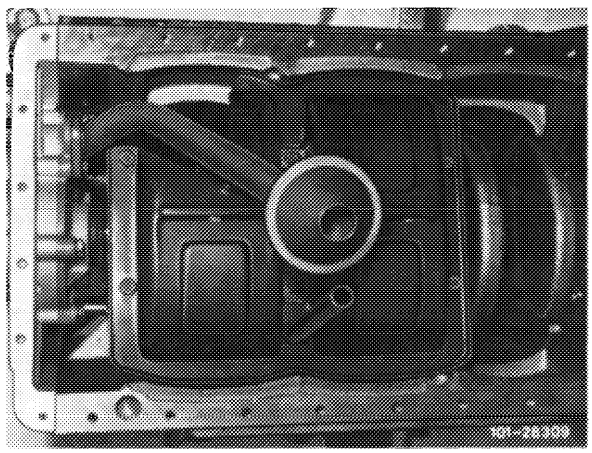


Fig. 01/2

Oil pan

The oil pan was reinforced by additional ribs on the bottom.

The low oil level switch was moved higher on the oil pan due to the lower oil quantity circulated through the engine.

Repair note

The oil pan can be removed without removing the engine.

Cylinder head

Cross flow cylinder head with roof-shaped combustion chambers.

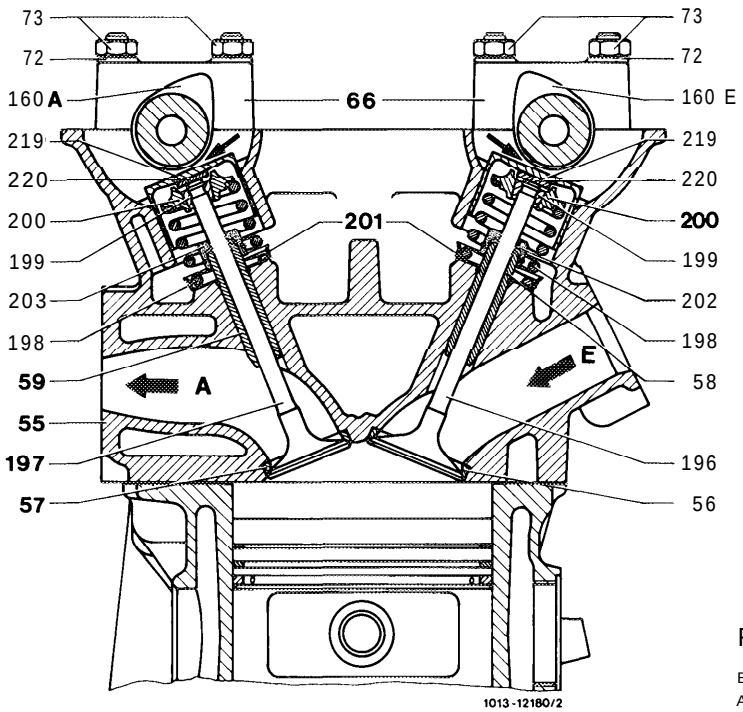


Fig. 01/3

E = Intake
A = Exhaust

Camshaft bearings

Intake and exhaust camshafts are mounted directly in the cylinder head. The four split bearing bores for each camshaft are half in the cylinder head and in mounted bearing caps.

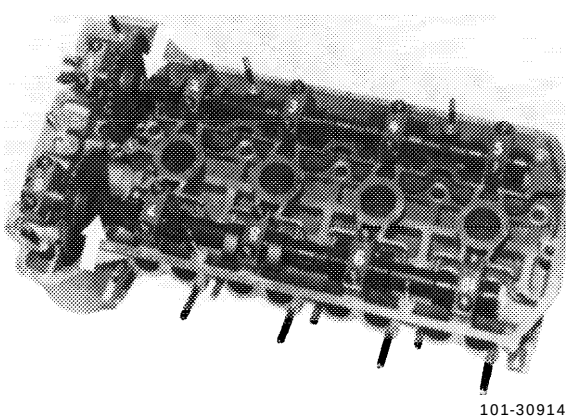


Fig. 01/4

The shaft ends of the camshaft sprockets are mounted in the two bearings (1 and 6).

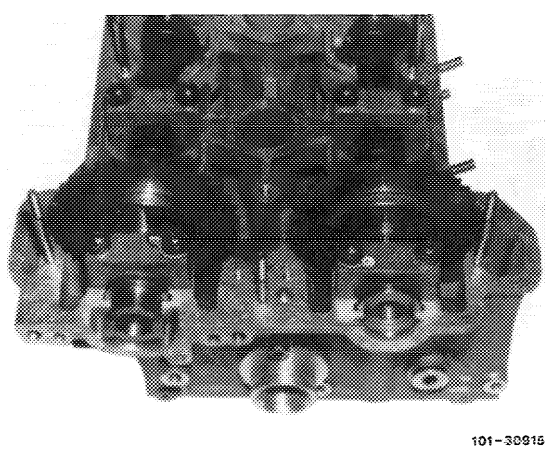


Fig. 01/5

All bearing caps are identical. They are line bored together with the cylinder head and are identified with the numbers 1 to 10. During assembly jobs, the original installation position must be maintained.

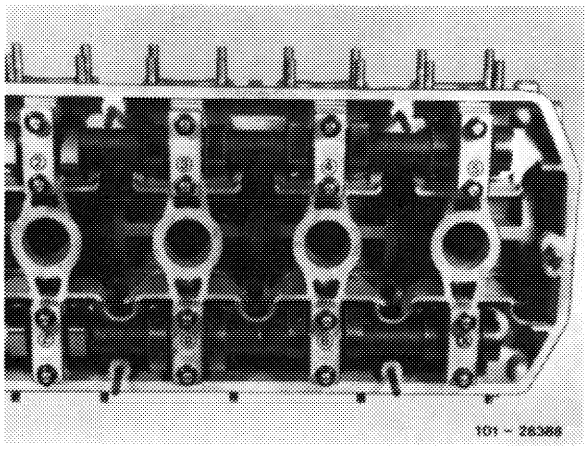


Fig. 01/6

Installation position of bearing caps

Bearing cap 1 = bearing of exhaust camshaft sprocket (Fig. 01/5).

Bearing caps 2 - 5 = bearings of exhaust camshaft (Fig. 01/6).

Bearing cap 6 = bearing of intake camshaft sprocket (Fig. 01/5).

Bearing caps 7 - 10 = bearings of intake camshaft (Fig. 01/6).

The bearing caps are fastened to the cylinder head with M 8 studs, wave washers and nuts.

Tightening torque of nuts 21 Nm.

Repair notes

In case of seizing or excessive scoring on camshaft bearings, replace cylinder head and camshaft.

Replace only one bearing cap per camshaft since during simultaneous replacement of several bearing caps the camshaft may bind.

The bearing caps are correctly installed, if the stamped in code numbers are closest to the inner studs (Figs. 01/5 and 01/6).

Valve guides

The valve guides are located at an angle of 45° in relation to each other (Fig. 01/8) and arefitted in the cylinder head with an interference fit of 0.012 - 0.041 mm.

The OD (13 mm) is 1 mm smaller than on the other engines 102. They are also shorter.

Repair note

The finished valve guides are available in four repair sizes.

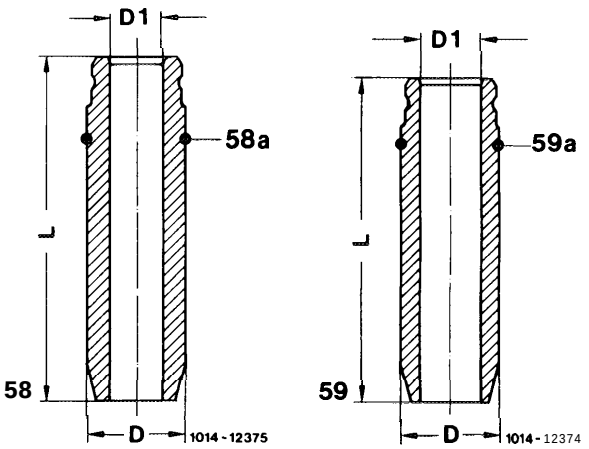


Fig. 01/7

58 Intake valve guide (copper colored)
D = 13.023 - 13.041 mm
D1 = 7.000 - 7.015 mm
L = 45.5 mm
58a Retaining ring

59 Exhaust valve guide (brass colored)
D = 13.023 - 13.041 mm
D1 = 8.000 - 8.015 mm
L = 42.9 mm
59a Retaining ring

Valve seat rings

The valve seat rings are press fitted in the cylinder head with an interference of 0.075 – 0.120 mm.

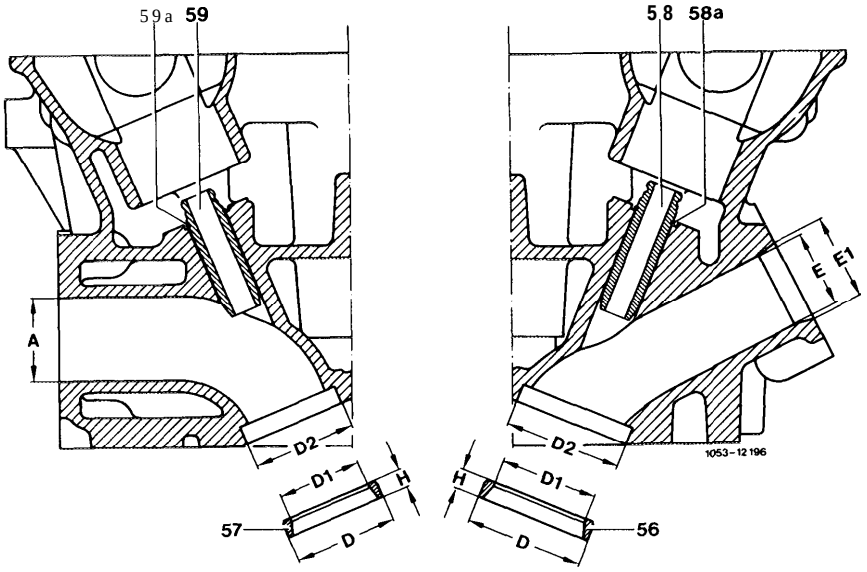


Fig. 01/8

56 Intake valve seat ring
D = 39.100-39.120 mm
D1 - 3 3 m m
D2 = 39.000 – 39.025 mm
H = 5.8 mm

57 Exhaust valve seat ring
D = 34.100 – 34.120 mm
D1 - 2 8 m m
D2 = 34.000 – 34.025 mm
H = 5.4 mm

Repair note

One repair size valve seat ring with a larger OD is available for intake and exhaust respectively.

Spark plug location

The spark plug with threads M 14 x 1.25 and tapered sealing seat is centrally located in the combustion chamber.

Repair note

Before unscrewing spark plugs clean out recesses with compressed air. This will help prevent dirt from entering the combustion chambers when removing the spark plugs.

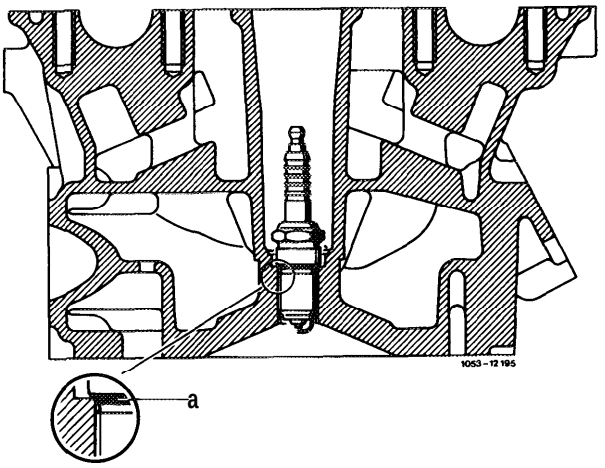


Fig. 01/9

a Tapered sealing seat

Core plugs

The core holes in cylinder head are closed with 18.2 mm dia. sheet metal plugs (59), the front and lateral oil ducts with 5.2 mm dia. sheet metal plugs (57) and the bottom oil duct with a 5 mm dia. dowel pin (58).

Repair note

Leaking plugs can be replaced similar to the other engines 102. Refer to special tools section.

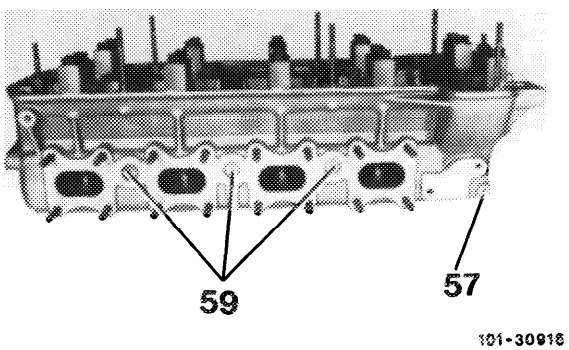


Fig. 01/10 Cylinder head right side

57 Sheet metal plug 5.2 mm dia
59 Sheet metal plug 18 2 mm dia

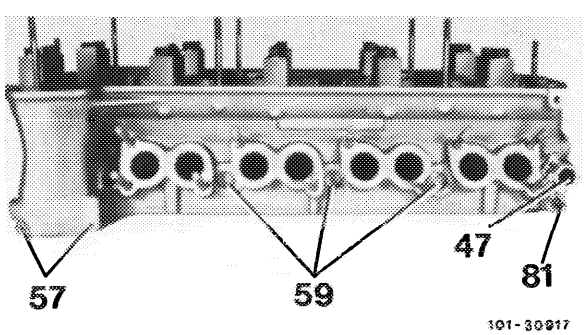


Fig. 01/11 Cylinder head left side

47 Threaded pipe connector for coolant to heater core
57 Sheet metal plug 5.2 mm dia.
59 Sheet metal plug 18 2 mm dia.
81 Threaded pipe connector for crankcase ventilation coolant heating

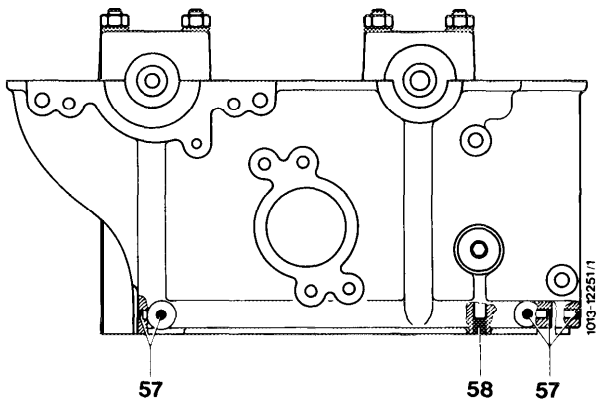


Fig. 01/12 Cylinder head front

57 Sheet metal plug 5.2 mm dia
58 Dowel pin, 5 mm dia.

Connections

A coolant return pipe (23) is inserted at the front of the cylinder head, leading through the timing chain housing to a coolant chamber.

Sealing

- In the coolant passage with O-ring (24)
- At the mounting flange with gasket (26)

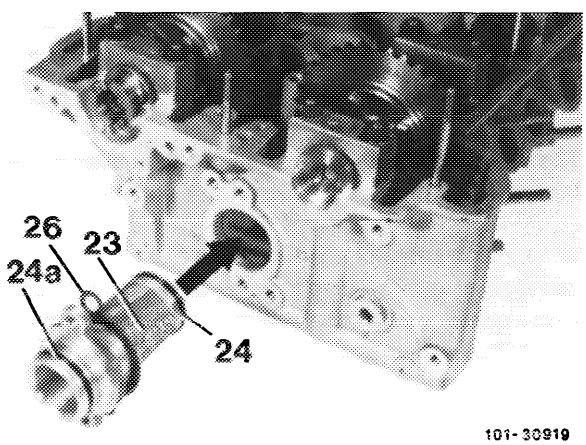


Fig. 01/13

A threaded connection for coolant to the heater core (47) and one for the crankcase ventilation heating (81) are screwed into the cylinder head left rear corner (Fig. 01/11).

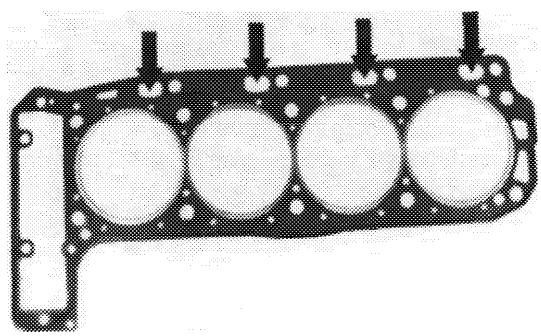
Cylinder head gasket

The cylinder head gasket does not require retorquing. There is only one gasket version for this engine, independent of cylinder dia. (standard, repair sizes + 0.5 mm dia. and + 1 .O mm dia.).

The gasket has an adhesive strip on the sealing surface. It is identified by the stamped in part number and by the relief holes (arrows).

Caution:

Do not interchange this cylinder head gasket with those of other 102 engines.



101-30918

Fig. 01/14

Valve cover

The valve cover is made of a magnesium alloy and is laminated with black plastic on the outside.

The ignition cable channel cover is plastic (113). It is fastened with three plastic screws (114) and sealed with a rubber gasket. To prevent excessive tightening which could damage the cover, each screw has a special washer.

The oil filler cap is plastic (90).

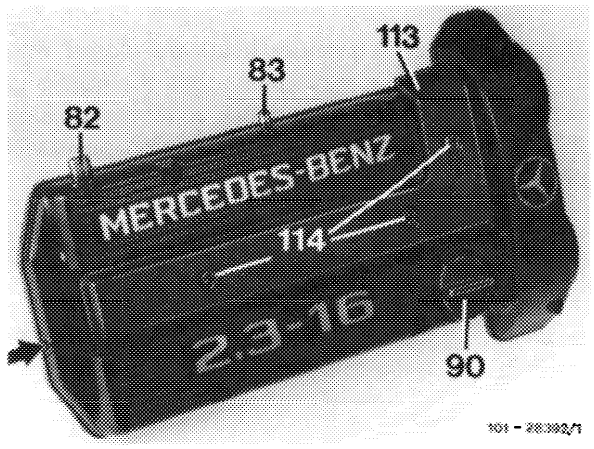


Fig 01/15

82 Hose connection for engine ventilation
83 Hose connection for engine ventilation with bypass bore 1.6 mm dia.
90 Oil filler cap
113 Ignition cable channel cover
114 Plastic screws (Tightening torque 1.5 – 2 Nm)

Inside/underside

The oil separator plate (85) for the engine ventilation is fastened with 8 screws and sealed with silicone adhesive.

Valve cover gasket (93) made of rubber (U section).

Rubber seal rings (112) for sealing spark plug recesses.

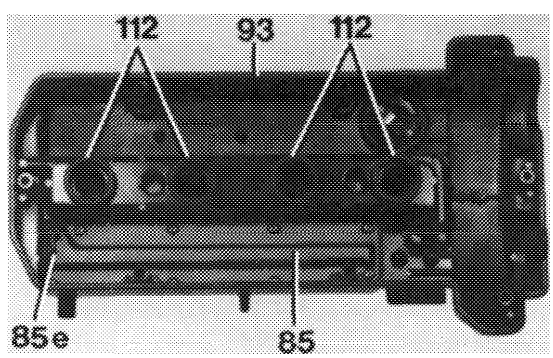


Fig. 01/16

85 Oil separator plate
85a Oil drain tube
93 Valve cover gasket
112 Rubber seal rings

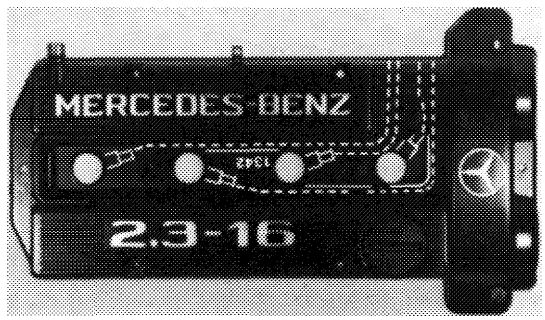
To make sure that the spark plug recesses and the ignition cable channels are not filled with water, e. g. during an engine wash, the valve cover has a drain hole at the rear (arrow, Fig. 01/15).

Assembly notes

The valve cover M6 cap nuts should be tightened crosswise and in several steps.

Tightening torque 9 Nm.

The ignition cable channel has guide ribs and symbols for correct installation of ignition cables.



101 - 28390

Fig. 01/17

Positive crankcase ventilation (PCV)

Operation

The engine blow-by gases flow from cylinder crankcase to oil separator (90) in the valve cover. The oil separated here flows back to the cylinder head through a drain pipe.

From the oil separator the engine blow-by gases flow into the combustion chambers depending on load condition (intake manifold vacuum) as follows:

Idle/decel
(high intake manifold vacuum)

Through bypass bore 1.6 mm dia. in hose connection (83) on the valve cover to idle speed air distributor (108) and through the insulating sleeve of the injection valves to combustion chambers.

Simultaneously, additional clean air is drawn in from air cleaner (111) via hose line (103a – 103c) and fed to the combustion chambers via the oil separator together with the blow-by gases.

Partial and full load operation
(low intake manifold vacuum)

Mainly via hose line (103a – 103c) to air cleanerclean side and with intake air to the combustion chambers.

To make sure that the vent line (103a – 103c) does not freeze at low outside temperatures, it is heated with coolant. The coolant line (106) is integrated in the vent line and is connected to the cylinder head via the supply line (104). The coolant is returned to the coolant pump (1) via return line (109).

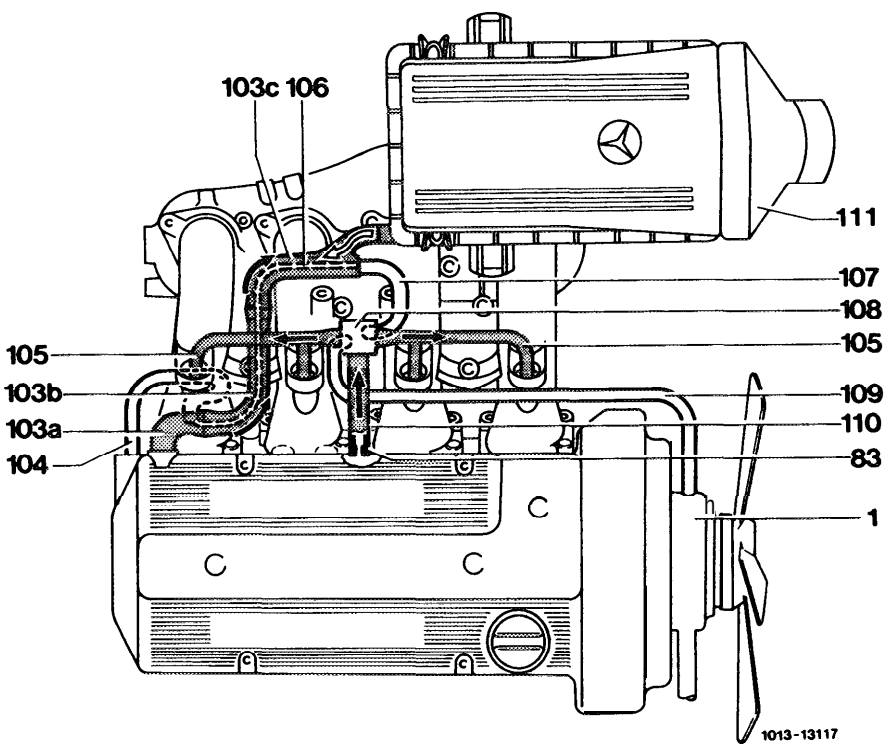


Fig. 01/18

1	Coolant pump
83	Hose connection with 1.6 mm throttle
103a – 103c	Vent lines
104	Coolant supply line for crankcase vent line
105	Idle speed air line
106	Heating water line (copper tubing)
107	Coolant connection line
108	Idle speed air distributor
109	Coolant return line
110	Crankcase vent line
111	Air filter

Removal and installation of cylinder head

Note: Only repair instructions not described in microfiche Engine 102, Mechanical I, will be discussed in the following pages.

Tightening torques	Nm
Chain tensioner in crankcase	40
Camshaft sprockets	12
Camshaft bearing caps	
Exhaust manifold to cylinder head	
Thermostat housing to cylinder head	21
Coolant connecting pipe (cylinder head – thermostat housing) to cylinder head	
Support (exhaust manifold – transmission) to exhaust manifold	
Exhaust system to exhaust manifold	27
Valve cover	9

Removal

Air filter housing

Disconnect plug from intake air temperature sensor (124) and crankcase ventilation hose (103c) on air cleaner (121).

Remove nuts (122), lift housing at the rear until it is released from studs, slide back slightly (direction of arrow) and lift from air flow sensor.

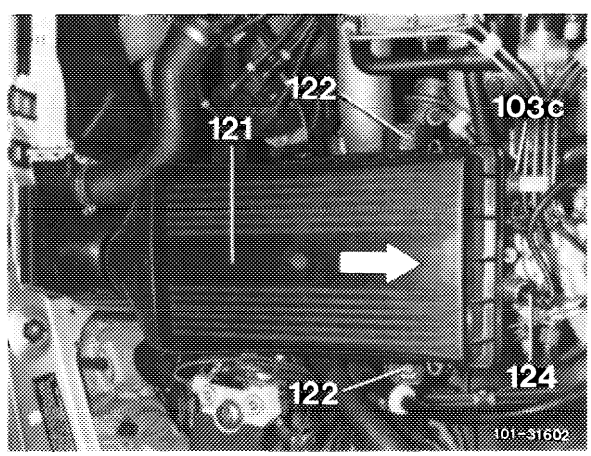


Fig. 01/19

Oil dipstick guide tube

Remove screw (46) and rotate clamp (47) away from bracket (45). Pull out oil dipstick (42).

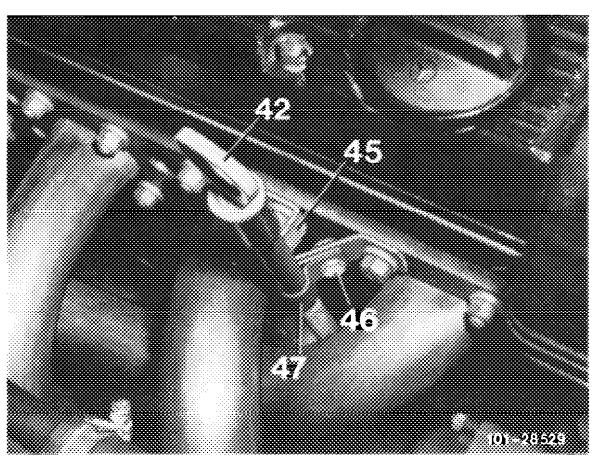


Fig. 01/20

Poly-V-belt drive

Loosen screw (25) by ¼ – ½ turn, slacken poly-V-belt (27) by turning tensioning nut (24) counterclockwise. Remove poly-V-belt (27).

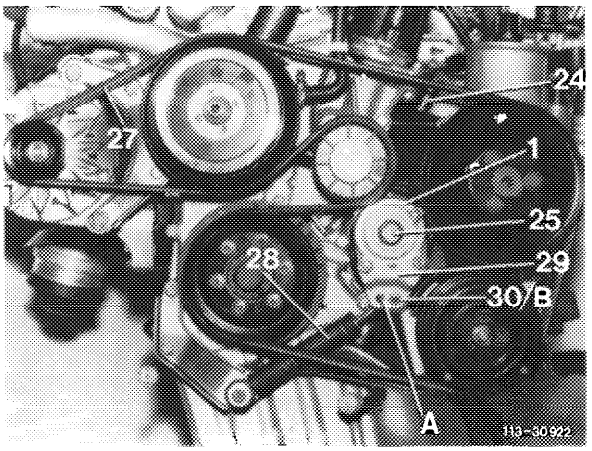


Fig. 01/21

Exhaust manifold

Remove screw (119) from support bracket (118) and loosen screws (120) on transmission.

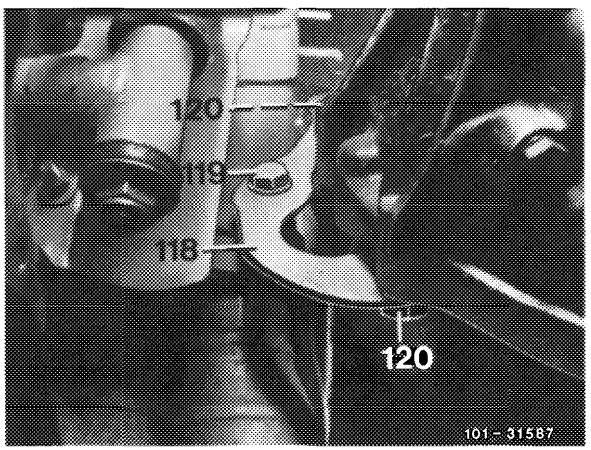


Fig. 01/22

Valve cover

Remove screws (114) of ignition cable channel cover (113), remove cover, pull off spark plug connectors and put ignition cables aside.

Loosen hose clamp (128) and pull hose (103) from valve cover (81).

Pull hose (110) from valve cover, remove nuts (96) and remove valve cover.

Caution!
If the valve cover is stuck, do not strike with a hammer to loosen it, the valve cover may crack

Try to loosen the valve cover by pushing at one side with your hands; if necessary, carefully tap corners with a rubber mallet.

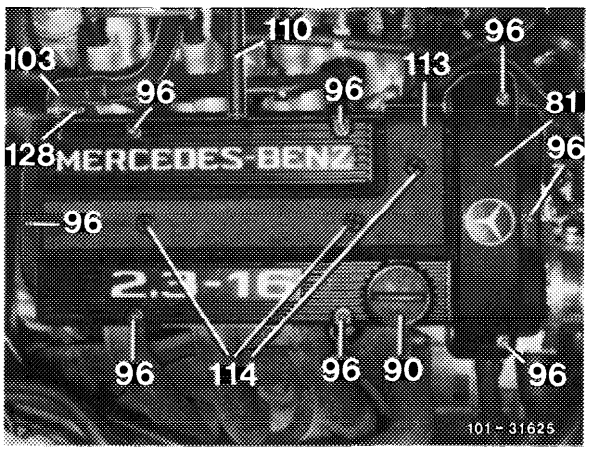


Fig. 01/24

Camshaft sprockets

Set engine to ignition TDC of 1st cylinder.

For this purpose, turn crankshaft until the bores in the camshaft sprockets (2 mm dia., arrows) are aligned opposite each other.

Mark camshaft sprockets (4A and 4E) and timing chain (21) in relation to each other.

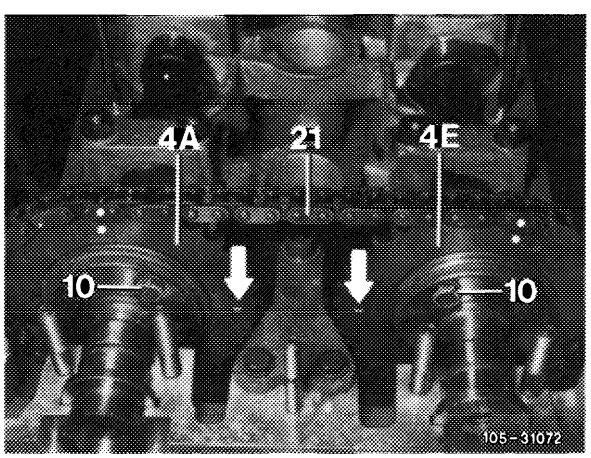


Fig. 01/25

Remove alternator air duct. Disconnect wires to alternator at terminal block. Pull harness through component compartment wall and put aside with air duct.

Remove screw (722), loosen screw (723) and rotate alternator (724) away from engine.

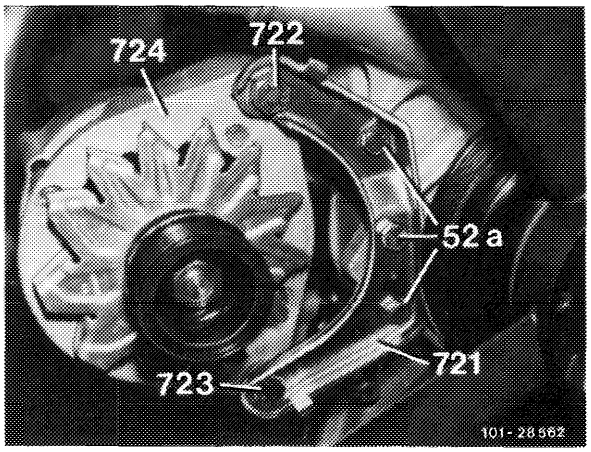
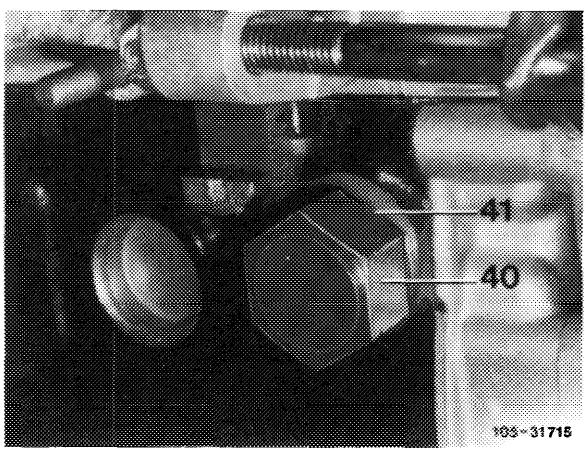


Fig. 01/26

Unscrew chain tensioner (40) at hex. head (32 mm).



Pig. 01/27

Remove screws (241) and flange (239).

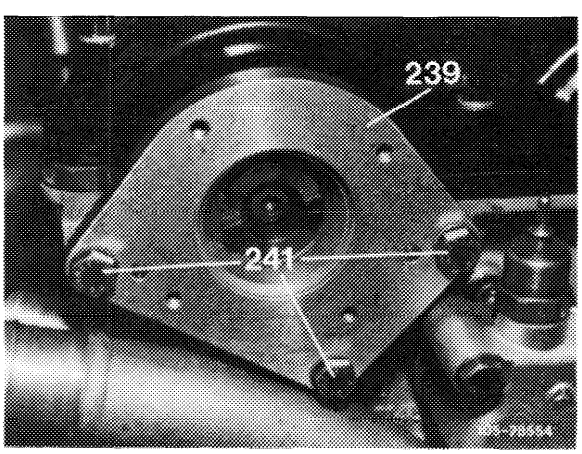


Fig. 01/28

Remove nuts (65) and remove bracket (27) together with slide rail (31).

Mote: If installed, remove the sheetmetal bracket which is attached at the two front cylinder head bolts and two eyes at timing chain housing cover.

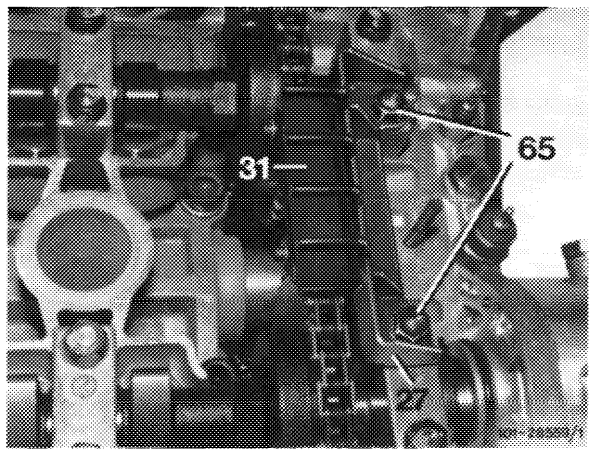


Fig. 01/29

Remove screws (10) (four, each sprocket), knock back camshaft (1A and 1 E) with a plastic hammer, remove nuts (65), remove bearing caps (61/1 and 61/6) and then remove camshaft sprockets (4A and 4E).

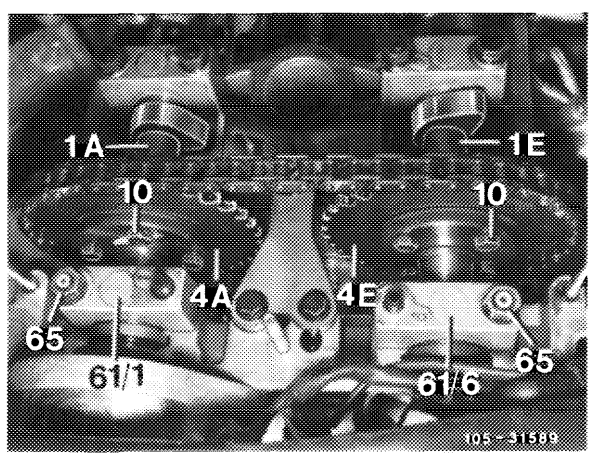


Fig. 01/30

Coolant return pipe between cylinder head and thermostat housing

Loosen hose clamp (38), remove screws (39), remove thermostat housing (29) and put aside.

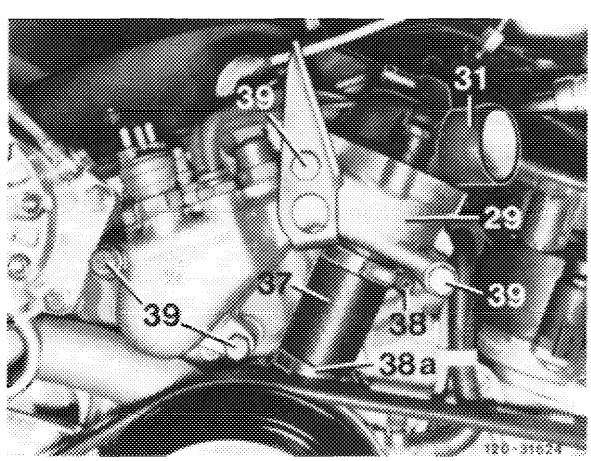


Fig. 01/31

Remove screws (402) and pull return pipe (399) out of cylinder head.

Note: If the pipe cannot be pulled out by hand, slightly rotate (direction of arrow) and force off with two screwdrivers, also refer to Fig. 01/13.

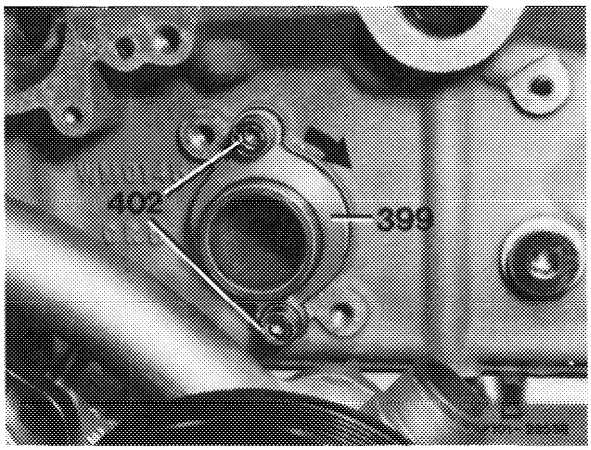


Fig. 01/32

Installation

Prior to installation, measure shaft length (L) of double hex. socket head stretch bolts.

Double hex. socket head stretch bolt

Threads	Shaft length	
	New	Max. length (replace)
M12	110 mm	113 mm

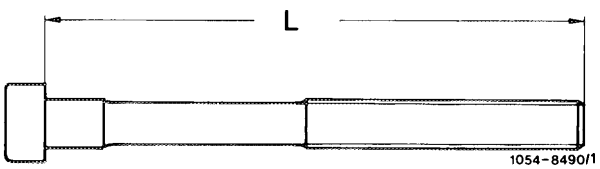


Fig. 01/33

Torque specifications and tightening diagram for cylinder head bolts are identical to other engines 102.

Replace O-rings and flange gasket on coolant return pipe (cylinder head-thermostat housing).

Install intake camshaft sprocket first, then exhaust camshaft sprocket. Note markings on timing chain and camshaft sprockets.

Check marking of camshaft sprockets in ignition TDC position of 1st cylinder.

For mounting and tensioning of poly-V-belt refer to maintenance jobs section.

Crankshaft assembly

Crankshaft

The crankshaft is similar to the other engines 102 with respect to material and dimensions.

All crankpin fillet radii are hardened. On the other engines 102 only crankpins 3 and 4, as well as pin 1, at front end are hardened.

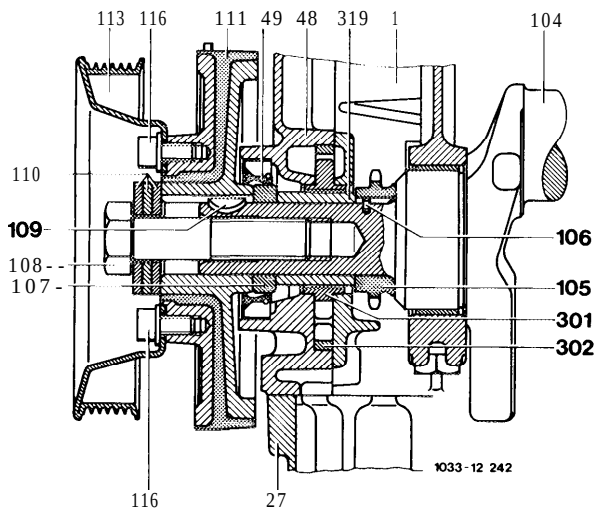


Fig. 03/1

1 Crankcase
27 Oil pan
48 Timing chain housing cover
49 Seal ring
104 Crankshaft
105 Crankshaft sprocket
106 Dowel pin 3 x 5 mm
107 Spacer
108 Screw, M 18 x 1.5 x 75
109 Woodruff key
1 10 Belleville washer
11 1 Vibration damper
113 Pulley
116 Screws, M 8 x 16
301 Internal gear, oil pump
302 External gear, oil pump
319 Driving sleeve, oil pump

A dowel pin (147) for locating the flywheel or the flex plate is inserted in the rear flange.

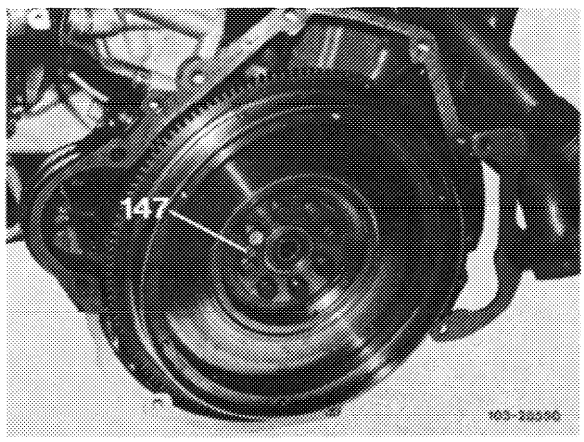


Fig. 03/2

Repair sizes are identical to the other engines 102.

Vibration damper (111)

Due to the higher engine speeds and the resulting higher load the adhesive surfaces between rubber and metal were designed larger than on the vibration damper of engine 102.985.

The TDC markings are located on the rubber surface.

Flywheel (manual transmission)

Due to higher engine speeds the material for the flywheel is of increased strength.

It is also lighter in weight than that of engine 102.985. The two 55° segments (A) on the back are located at an angle of 180° (Fig 03/3 and 03/4) in relation to each other. The installation position is fixed by a dowel pin (for bore refer to arrow).

Together with the position indicator in crankcase the segments are transmitting a signal to the control module of the ignition system.

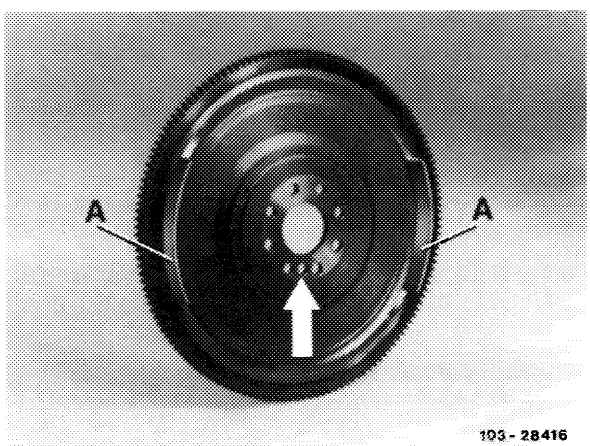


Fig. 03/3

A Segments
Arrow Locating bore

Flex plate (automatic transmission)

Due to the higher loads, the flex-plate is reinforced with 2 mm thick steel rings riveted to the ring gear (engine 102.985 has one 2.4 mm thick steel ring).

The two 55° segments (A), spaced 180° apart (Fig. 03/3 and 03/4), produce together with the ignition position sensor in the engine block an alternating current signal which is transmitted to the ignition control module. Due to the segments, the flywheel or the flex plate must be assembled to the crankshaft in a specific fixed position. This position is determined by a dowel pin in the crankshaft flange.

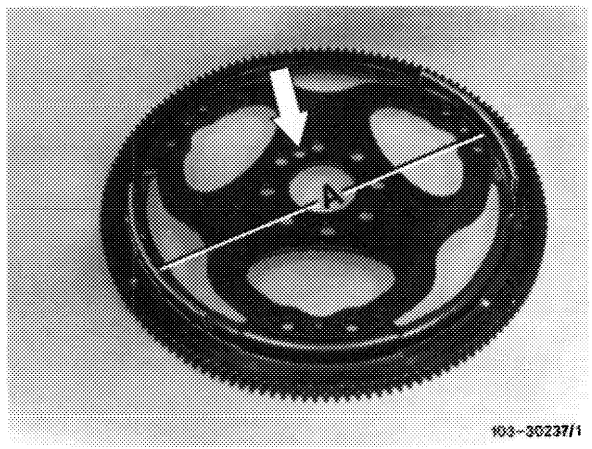


Fig. 03/4

A Segments
Arrow Locating bore

Pistons

The light-alloy pistons are manufactured by a hot forging process to provide higher strength.

Four valve recesses are located on the flat piston top.

The piston play is 0.051 – 0.075 mm (on engine 102.985 = 0.016 – 0.040 mm).

Designation and repair sizes are identical to other engines 102.

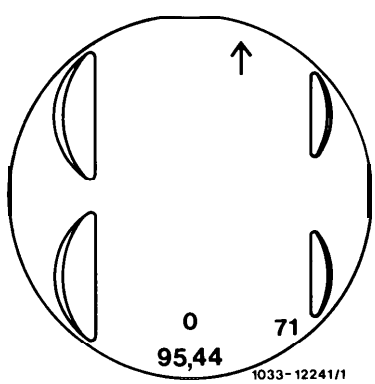


Fig. 03/5 Piston top

Compared with rings of engine 102.985 the rectangular and baffle taper compression rings are lower in height by 0.25 mm. Ring height 1.5 or 1.75 mm. The chamfered oil control ring is made of a higher strength material.

The piston wrist pin has been reinforced.

ID 14 mm
Length 65 mm.

Contrary to engine 102.985 the connecting rods on this engine are guided at the crank pins.

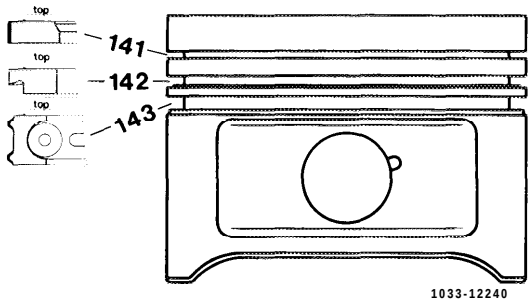


Fig. 03/6

141 Rectangular ring, contact surface molybdenum-laminated, 1 5 mm high
142 Baffle taper compression ring, with precision turned contact surface (not laminated), 1.75 mm high
143 Chamfered oil control ring with expander, contact surfaces chromed

Engine timing, valves

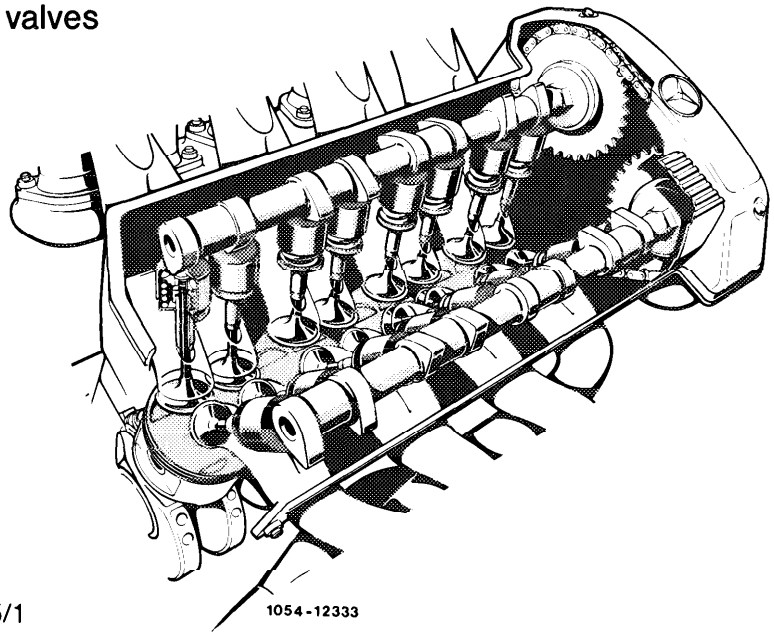


Fig. 05/1

Camshaft

The hollow-bored camshafts are made of chilled cast iron and are left and right of identical design.

The bearings are supplied with oil through the longitudinal bore. At the rear end, the camshaft is closed by a sheet metal cap.

Each camshaft is mounted in four bearings (28 mm dia.).

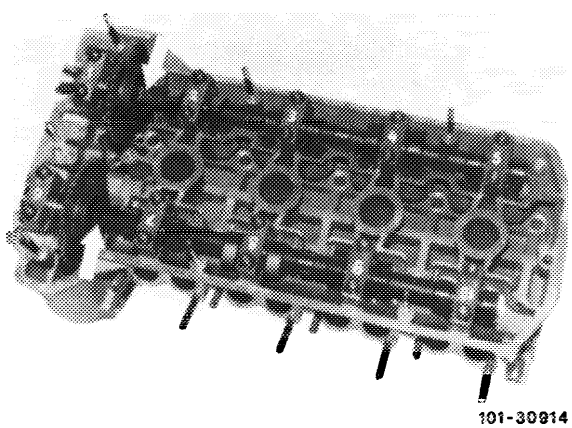


Fig. 05/2

With the camshaft sprocket removed, the camshaft can be rotated or counterheld at the 24 mm hex. (arrows).

If the timing is correct, the bores (2 mm dia.) in the camshaft sprockets (arrows, Fig. 05/9) are opposite to each other in ignition TDC position of 1st cylinder.

Repair notes

When replacing *camshafts,* also replace valve tappets.

When removing and installing camshafts, note installation position of bearing caps. (Refer to Group 01, page 33).

Carefully and uniformly tighten fastening nuts of bearing caps.

Tightening torque 21 Nm.

Checking valve timing

Check valve timing on 1. cylinder:
Check intake camshaft – begin of opening
Check exhaust camshaft – end of closing

The test procedure is the same as on engine 110 (see repair instructions on microfiche, Engine 110, Mechanical II).

Slip gauge blade on intake camshaft in from outside and on exhaust camshaft from inside. Hold down cup-type tappet with suitable tool which has no sharp edges.

Minor deviations (approx. 4 – 5°) are within tolerance and cannot be corrected. If deviations are higher, e. g. due to timing chain elongation, install new chain.

Testing and adjusting values

Timing in crank angle degrees at 2 mm valve lift

Camshafts Code number')	Intake valve opens after TDC	closes after BDC	Exhaust valve opens before BDC	closes before TDC
	with new timing chain			
Left	7°	26"		
Right	–		32°	13°
	with used timing chain (approx. 20 000 km, 12 500 mi)			
Left	8°	27"		
Right	–		31°	12°

') Installed are selectively: 102 050 24 01 without code no. or 102 050 28 01 with code no. 25.

Vatve arrangement

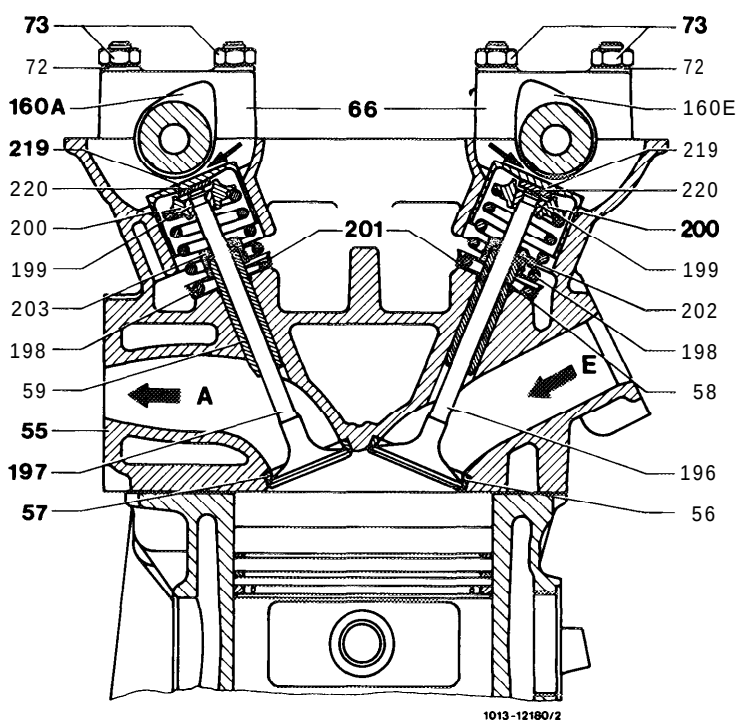


Fig. 05/3

55 Cylinder head
56 Valve seat ring, intake
57 Valve seat ring, exhaust
58 Valve guide, intake
59 Valve guide, exhaust
160E Camshaft, intake
160A Camshaft, exhaust
196 Intake valve
197 Exhaust valve
198 Valve spring
199 Valve keeper
200 Valve spring retainer
201 Thrust ring
202 Valve stem seal, intake valve
203 Valve stem seal, exhaust valve
219 Valve tappet
220 Thrust plate
E Intake
A Exhaust

The intake and exhaust valves (two each per cylinder) are mounted overhead at an angle of 45° in relation to each other. They are actuated by the intake or exhaust camshaft and case-hardened cup type valve tappets (219).

Intake and exhaust valves

Valve seat angle 45°

Inta ke valve

Valve seat and valve stem bath nitrited.

Exhaust valve

Valve seat is high quality sintered metal

Valve stem induction hardened and filled with sodium.

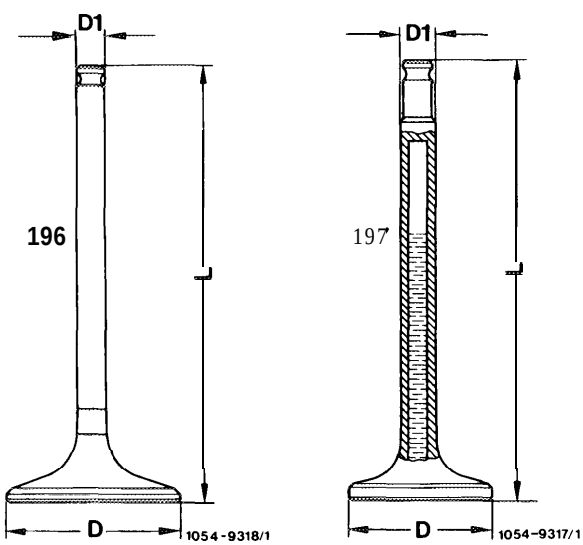


Fig. 05/4

196 Intake valve
D = 38 mm Ø
D1 = 6.97 mm Ø
L = 111 65 mm

197 Exhaust valve
D = 33 mm Ø
D1 = 7.96 mm Ø
L = 111.5 mm

Valve spring (198)

Each valve has a double progressive valve spring. The spring can be installed in either direction.

Color code: yellow-black.

Refer to special tool section for removal and installation tools.

Valve keepers (199)

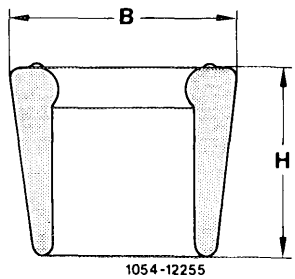


Fig. 05/5

B (mm)	9
H (mm)	9.2 - 9.8

Caution

The valve keepers must not be interchanged with those of the other 102 engines.

Valve stem seals (202 and 203)

Valve stem seal	Material	Wire ring Color	ID "D"
Intake	Viton	black	6.3 mm
Exhaust	Viton	yellow	7.2 mm

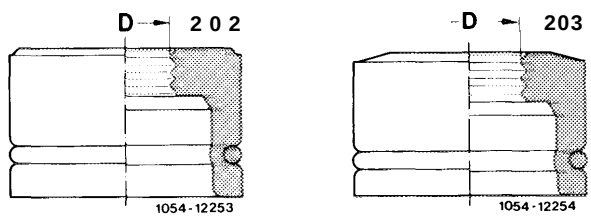


Fig. 05/6

202 Intake valve stem seal
203 Exhaust valve stem seal

Due to the different ID they are not interchangeable.

Checking and adjusting valve clearance

The valve clearance is measured between cam base circle and cup-type tappet (arrows, Fig. 05/3).

Valve clearance (in mm)

Valve	Coolant temperature up to 50 °C (engine cold)	60 – 80 °C (engine warm)
Intake	0.10 – 0.20	0.15-0.25
Exhaust	0.25 – 0.35	0.30 – 0.40

If the valve clearance is too large or too small install a thicker or a thinner thrust plate (220, Rg. 05/3).

There are 23 thrust plates of varying thickness (0.025 mm increments). 15 thrust plates are available for repair sector (0.05 mm increments). The thickness dimension is stamped into thrust plate.

A storage box is available for storing thrust plates (refer to special tools). For checking and adjusting refer to maintenance jobs.

The valve clearance must be checked during maintenance service every 24 000 km (15,000 miles) and adjusted, if required.

Chain drive

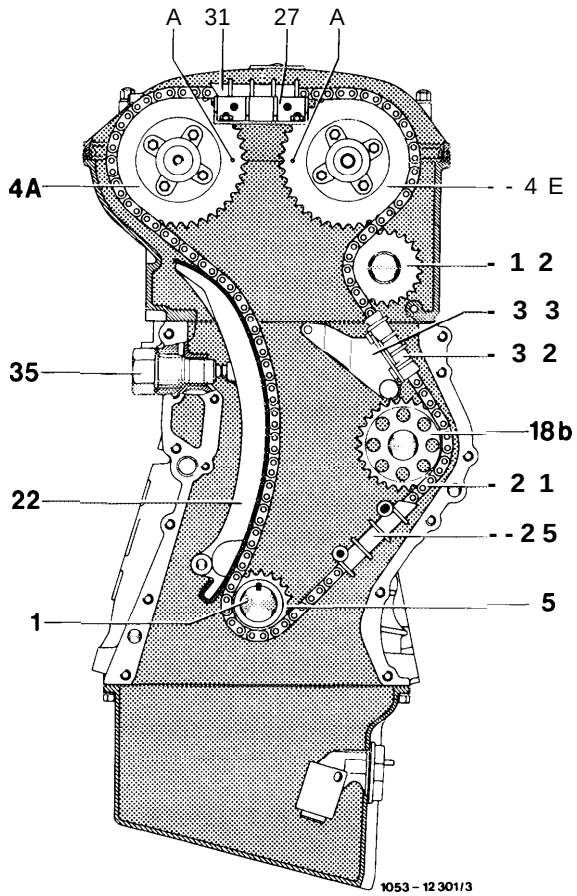


Fig. 05/7

1	Crankshaft	25	Guide rail
4A	Camshaft sprocket exhaust	27	Holder
4E	Camshaft sprocket intake	31	Guide rail
5	Crankshaft sprocket	32	Guide rail
12	Intermediate sprocket	33	Holder
18b	Idler sprocket	35	Chain tensioner
21	Single roller chain	A	Check bores
22	Tensioning rail		

Camshaft sprockets (4 A and 4 E)

The camshaft sprockets have a shaft end by which they are mounted in the cylinder head.

Bearing dia. 28 mm, same as camshaft bearing.

Each camshaft is fastened to a camshaft sprocket by four screws M 6 x 25 mm (10). The hole pattern of the four screws is non-symmetrical. Therefore, they can only be screwed on in one position.

Tightening torque 12 Nm.

The bearings are supplied with oil via the hollow camshaft sprockets.

The front bore on the intake camshaft sprocket is closed with a sheet metal plug.

On the exhaust camshaft sprocket the bore is closed by the hex. socket head screw for mounting the driver for the hydraulic oil pump of the level control system.

The camshaft sprockets are of a different design due to the shaft ends.

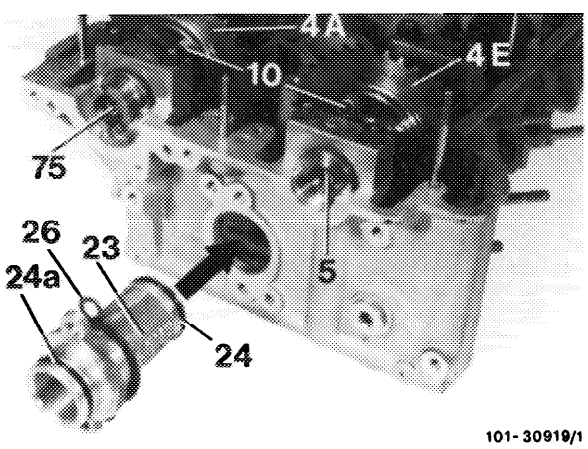


Fig. 05/8

The camshaft assembly with camshaft sprocket is axially fixed by a collar on the shaft end of the respective camshaft sprocket running in a groove in the cylinder head.

When the two bores (2 mm dia.) in the camshaft sprockets are opposite each other (arrows) the piston of the 1st cylinder is in TDC position of the compression stroke.

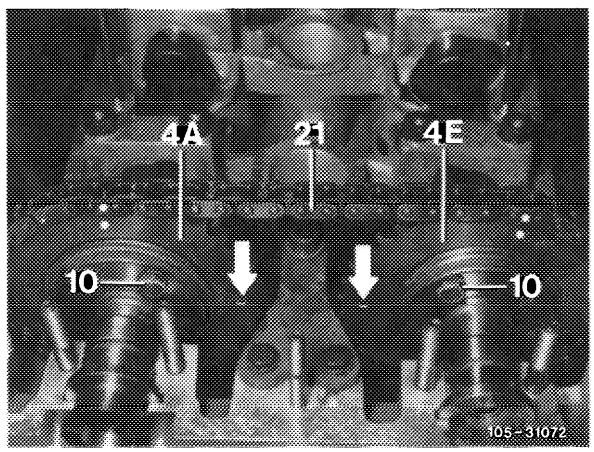


Fig. 05/9

Repair note

The camshaft sprockets need not be removed for removal and installation of camshafts.

Single roller chain (21)

The single roller chain has 134 links. For repairs, a timing chain with a connecting link is available. The connecting link is riveted with the riveting tool 000 589 58 43 00 (as on diesel engines) and the rivet set 103 589 01 63 00.

Guide rail (32)

Due to the longer timing chain drive, the guide rail (32) prevents vibrations between intermediate sprocket and idler sprocket. The guide rail is snapped into bracket (33). This bracket is fastened with a pin in a bore at the bottom and at the top with a timing chain housing cover screw at the boss (arrow) of the cylinder block.

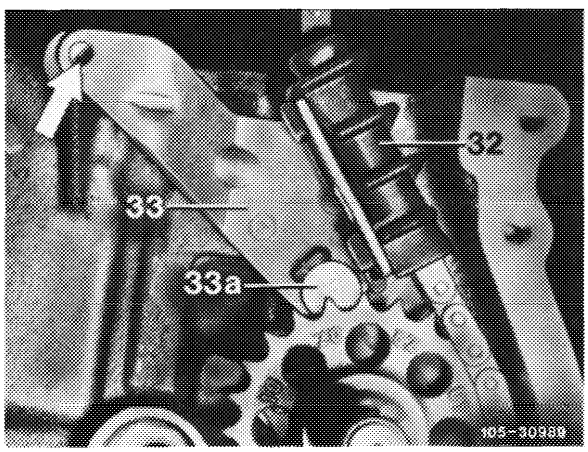


Fig. 05/10

Guide rail (31)

Guides the timing chain between the sprockets and floats on the two pins (27a) of bracket (27) and is secured by the lockrings (34). The axial clearance of the guide rail (31) is limited through the use of two spring washers (28).

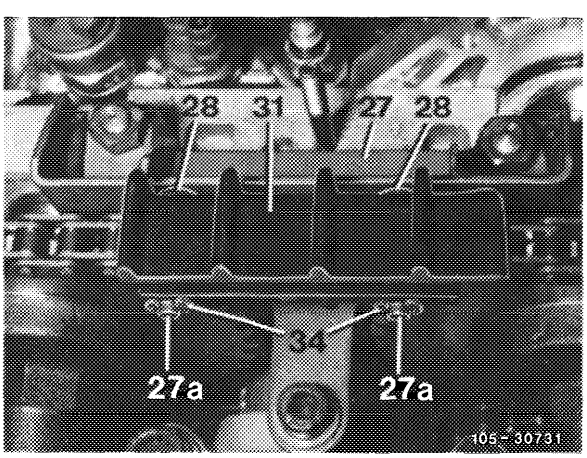


Fig. 05/11

Repair note
In case of noise complaints from the area of the cylinder head front, check if spring washers (28) are installed.

Tensioning rail (22)

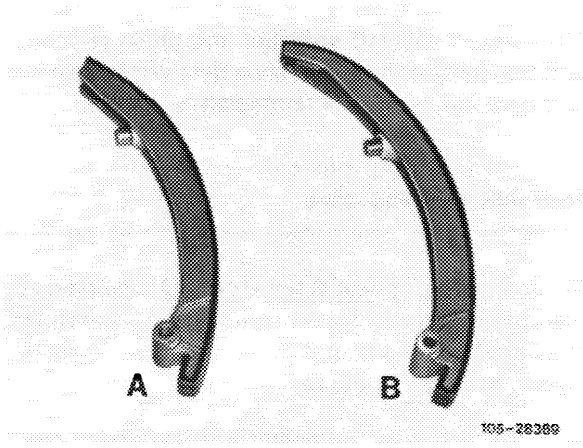


Fig. 05/12

Version A Engines 102.92/93/96/980
Version B Engine 102.983

The tensioning rail differs in shape and length from that of the other engines 102. They are not interchangeable.

Intermediate sprocket (12)

The intermediate sprocket floats on the shaft. The shaft is pressed into the cylinder head and closed by a plug M 18 x 1.5 mm (14) and a sealing ring (15) towards the outside.

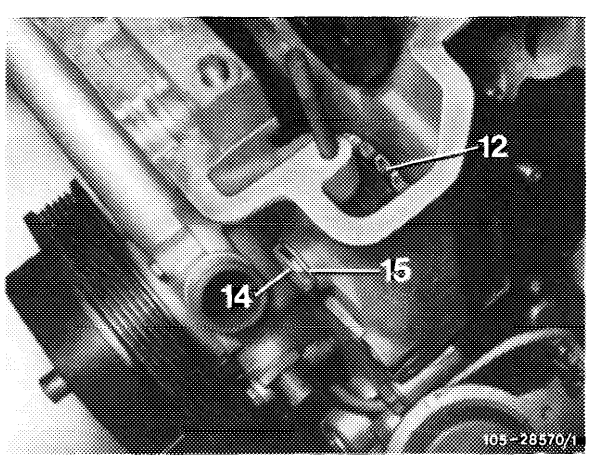


Fig. 05/13

Repair note

The intake camshaft sprocket, the chain tensioner and the radiator shroud must be removed for removal and installation of the intermediate sprocket.

Hydraulic oil pump drive

The hydraulic oil pump for level control is mounted to the cylinder head with a separate flange. It is driven by the camshaft sprocket of the exhaust camshaft. For layout, refer to Fig. 05/15.

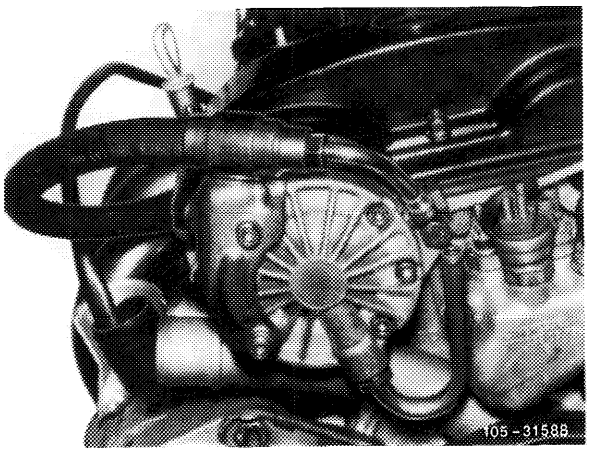


Fig. 05/14

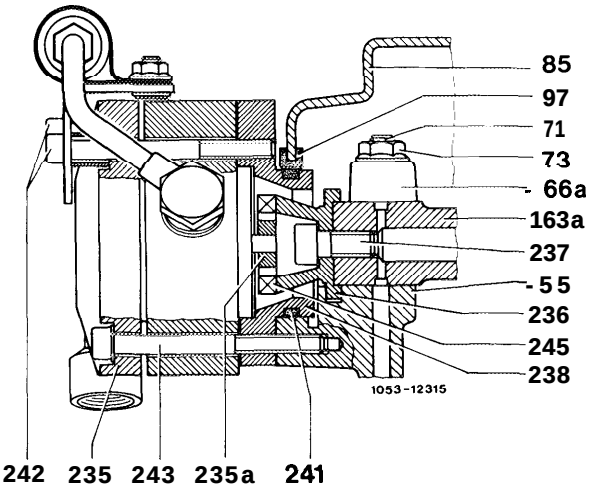


Fig. 05/15

55	Cylinder head	236	Drive sleeve
66 a	Bearing cap	237	Mounting screw, drive sleeve
85	Valve cover	238	Flange
97	Valve cover gasket	241	O-ring
163 a	Camshaft sprocket, exhaust		
235 a	Driver		

Mechanically/electronically controlled gasoline injection system (CIS-E)

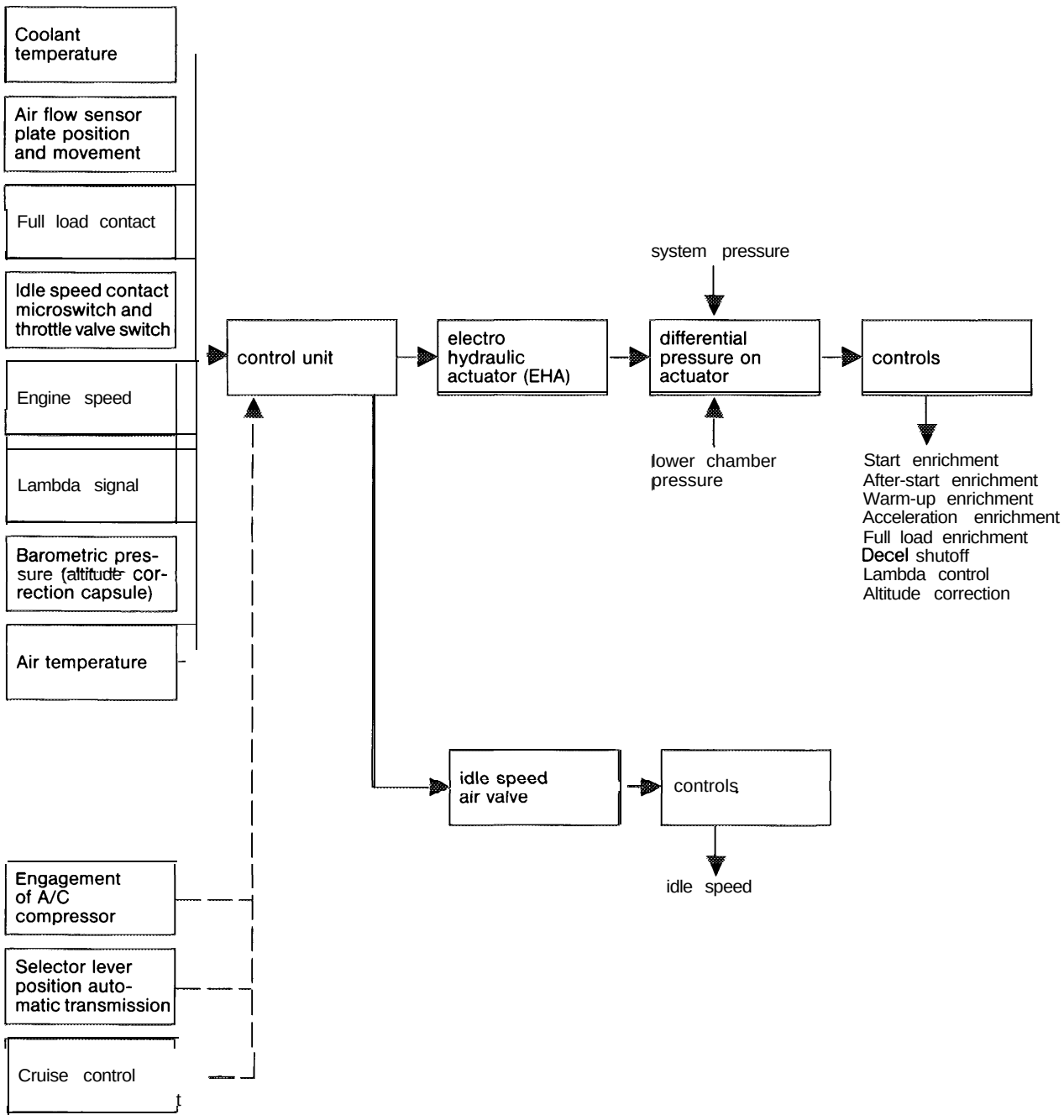
The construction and function of the gasoline injection system is similar to engine 102.985 except for the following modifications:

For this reason, the following description covers only the modifications and not the complete system.

Modifications:

- Maximum engine speed cut-out is controlled by the fuel pump relay
- Fuel pump (same as models 107 and 126) with integrated suction damper
- Fuel pump package suspended on rubber rings
- System pressure increased to 5.8 bar
- Fuel distributor and airflow sensor adapted to engine
- Air enveloped injection valves
- Location of injection valves and cold-start valve modified
- CIS-E electronic control unit with air/fuel mixture adaptation by microprocessor and logic circuit
- Intake air temperature sensor on air filter
- Altitude correction capsule
- Electronic idle speed control by a single coil rotary air valve. The bypass adjusting screw was eliminated
- Throttle valve switch with idle and full load contact
- Deceleration shutoff microswitch
- O_2-sensor replacement indicator was replaced by an O_2-sensor malfunction indicator.

Input signals affecting the electronically controlled mixture correction



Components and function

Fuel pump relay (N16/3 or N16/4)

The relay is located on the right side in the component compartment.

N16/3 is used on manual transmissions and N16/4 on automatic transmissions with the following functions:

- cold start valve activation
- rpm limitation
- kickdown shutoff (N16/4 only)

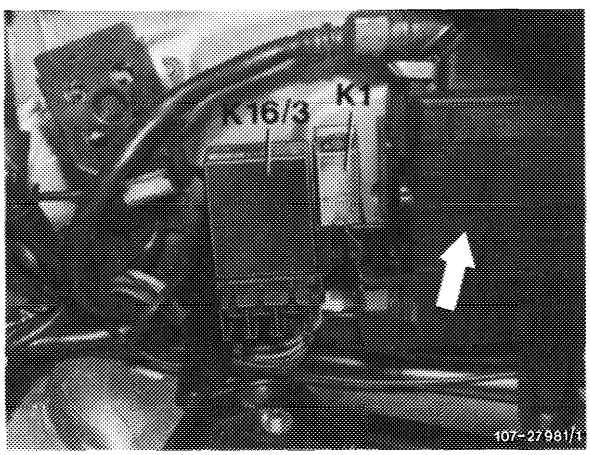


Fig. 07.3/1

Cold start valve activation

Its function depends on coolant temperature and cranking speed signal. Voltage supply is via the fuel pump relay. The length of time during which the cold-start valve injects fuel is dependent on the coolant temperature. For example, at — 20 °C the valve opens for 10 seconds. Above 15 °C the valve remains closed.

If the engine starts before the cold-start valve completes its cycle, cold-start injection is canceled immediately.

Maximum engine speed cut-out

If the fuel pump relay receives a certain frequency signal corresponding to the maximum engine rpm, the contact between circuit 30 and 87 is interrupted and the fuel pump is turned off.

Fuel pump package

The fuel pump package is located at the left in front of the rear axle on the frame floor, seen in driving direction. The fuel pump package is suspended on rubber rings (35).

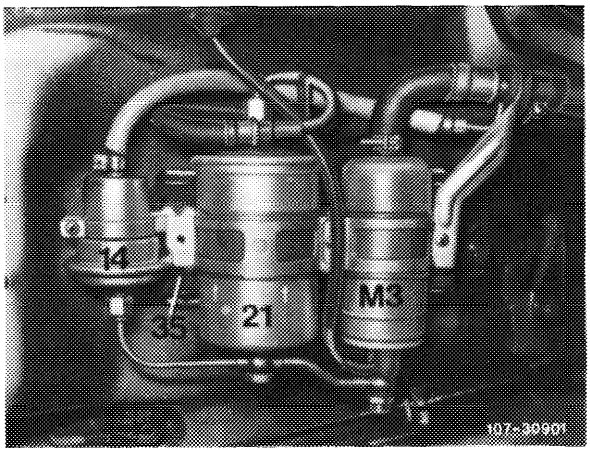


Fig. 07.312

14 Fuel accumulator
21 Fuel filter
M 3 Fuel pump
35 Rubber rings

Diaphragm pressure regulator (40)

The system pressure was increased to approx. 5.8 bar. The pressure is set by manufacturer and cannot be adjusted.

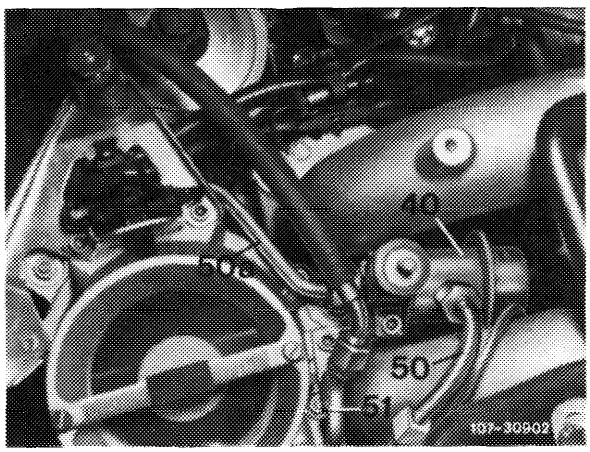


Fig. 07.3/3

40 Diaphragm pressure regulator
50 Supply system pressure
50a Line to fuel cooler
51 Fuel return flow

Mixture preparation

The fuel requirement is adapted to the various engine load conditions by wider metering slots (29) in the metering sleeve (28). The air funnel in the air flow sensor is designed for an air-fuel mixture ratio of $\lambda = 1$.

For better mixture preparation at idle air is injected around the injection valves similar to engines 1161 117.

Note: Due to the limited space, fuel line 117 070 28 32 must be used for measuring lower chamber pressure at the pressure connection.

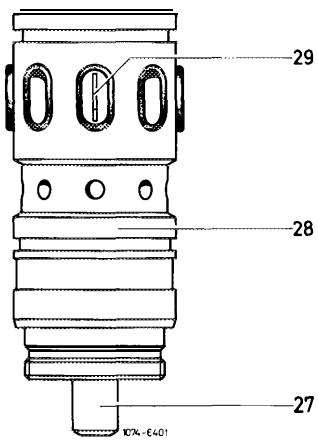


Fig. 07.3/4

27 Control plunger
28 Metering sleeve
29 Metering slot

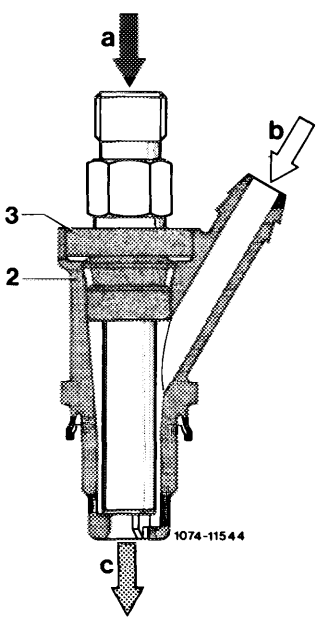


Fig. 07.3/5

2 Insulating sleeve
3 Plastic supporting ring
a Fuel
b Air
c Fuel-air mixture

Overvoltage protection relay (K1)

The relay is located in the component compartment in driving direction on the right side (K1). The wiring was correspondingly changed.

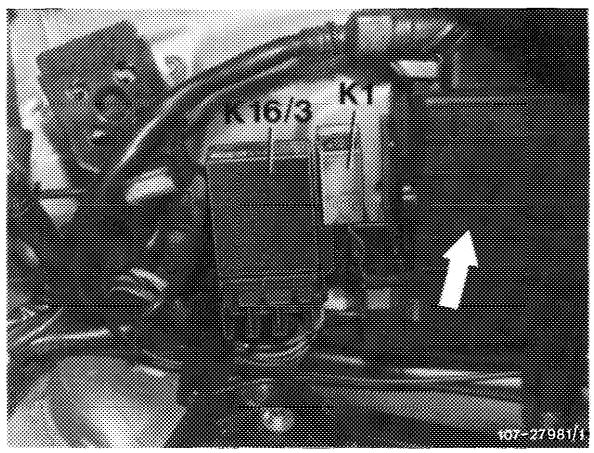


Fig. 07.3/6

Intake air temperature sensor (B17/2)

The temperature signal is transmitted to the CIS-E control unit. The resistance values are identical to the coolant temperature sensor. At low ambient temperatures a correction of the acceleration enrichment takes place.

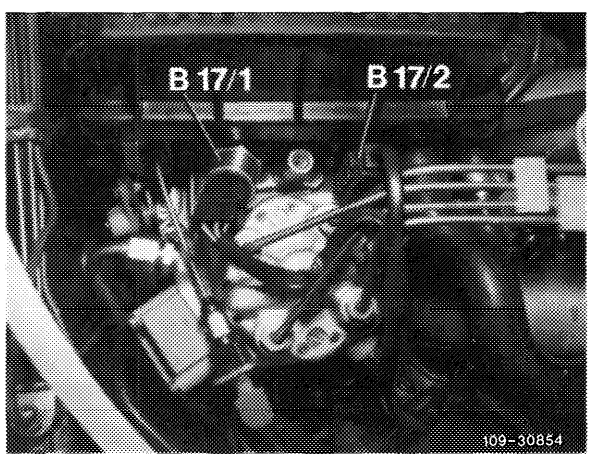


Fig. 07.3/7

B 17/1 Intake air temperature sensor (EZL)
B 17/2 Intake air temperature sensor (CIS-E)

Coolant temperature sensor (NTC)

The coolant temperature is picked-up by a dual temperature sensor (arrow). One temperature is transmitted to the CIS-E control unit and the other to the electronic ignition control module (EZL). The nominal test values are the same for both temperature signals. Their test values correspond with the coolant temperature sensor of model 201.024.

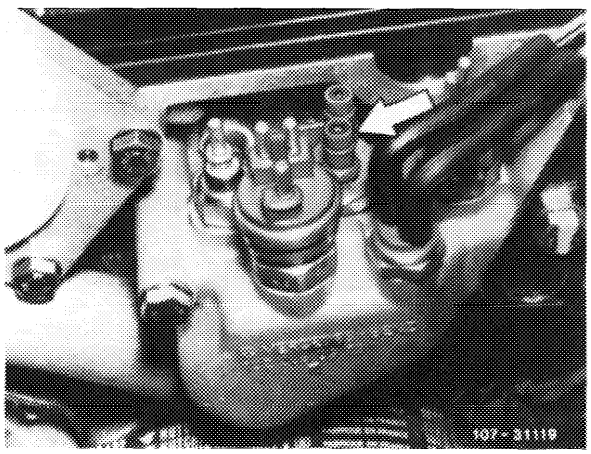


Fig. 07.3/8

CIS-E control unit

It is located in the component compartment in driving direction on the right side (arrow).

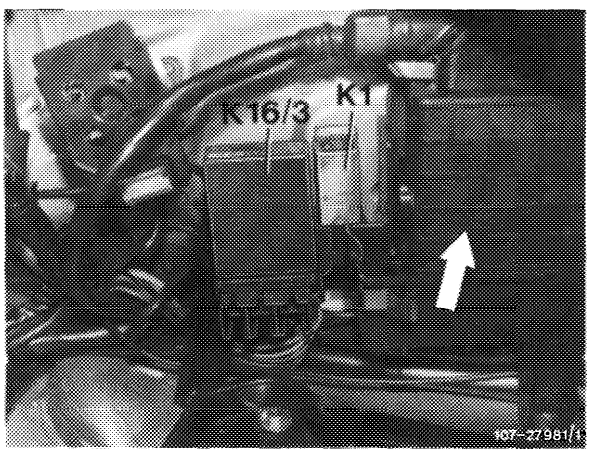


Fig. 07.3/9

The basic control functions of start enrichment, after-start enrichment, warm-up, acceleration and full load enrichment, as well as deceleration shutoff are the same as previously, however the control values are adapted to this engine.

Cranking **enrichment/after-start enrichment**

During cranking, the microprocessor in the control unit recognizes the cranking speed (start of cranking above 30 rpm, end of cranking approx. 500 rpm) from rpm impulses. When the cranking speed is attained, the control unit releases the start enrichment and the after-start enrichment. Extent and duration of enrichment (current on EHA) depend on coolant temperature.

The input of the cranking signal (terminal 50) into the CIS-E control unit is eliminated.

Acceleration enrichment

It becomes effective in the warm-up stage and with the engine at operating temperature. The current to the EHA is dependent on acceleration.

Full **load enrichment**

Effective with throttle valve fully opened. Depending on the engine speed, the current at the EHA can vary between 5 mA (–) to 10 mA (+). Lambda control is set by the control unit (no regulation).

An idle speed contact is additionally integrated in the switch. The idle speed signal is required by the electronic ignition switching unit.

Deceleration shutoff

Changes to the deceleration shutoff are as follows:

Restart of fuel injection begins at an engine speed of 1500 rpm.

Deceleration shutoff occurs only if the engine speed exceeds 2500 rpm.

Current to the electrohydraulic actuator (EHA) is approx. 45 mA (–).

New routing of wiring harness.

(For complete wiring diagram, refer to Fig. 07.3/13).

Logic circuit

Input signals from the various sensors and switches are continuously monitored by the electronic control unit. If, for example, with the engine at operating temperature, a rapid temperature change is simulated by unplugging the coolant temperature sensor – the microprocessor in the control unit will compare this momentary temperature with the temperature in its memory. The control unit will recognize the abrupt temperature change as a short circuit, and is programmed to the fixed operating mode.

The control unit does not recognize gradual changes as malfunctions, and will continue to operate normally.

Fixed operating mode

In the event of an illogical signal received by the control unit (i. e. system malfunction, open or short circuit) the control unit will automatically revert to a Fixed Operating Mode (FOM). This means that the engine will continue to run but not at its optimum, electronically controlled performance level.

O_2-sensor

The O_2-sensor replacement indicator is now an O_2-sensor malfunction indicator. The O_2-sensor malfunction light will come on only if a malfunction is present in the O_2-sensor circuit. The O_2-sensor malfunction indicator lamp receives voltage from the CIS-E control unit. The indicator lamp lights up briefly when ignition is turned on.

Electronic idle speed control

The function of the electronic idle speed control is essentially the same as previously.

The control unit processes the following information:

Engine speed (ignition terminal TD)
Coolant temperature
Idle speed signal (microswitch)
Air flow sensor, voltage
Voltage, altitude correction sensor
Automatic transmission, shift lever position
A/C compressor, cut-in signal

The function of the idle speed control system is extended by the air flow sensor voltage signal. As a result, the control unit recognizes the momentary air flow rate. In combination with the engine speed, the position of the microswitch and the coolant temperature, the activation of the idle speed air valve and thereby the idle speed will be determined.

Note: At deviating idle speed (too high or too low) the voltage signal must be checked on the air flow sensor.

Idle speed air valve

Designed as a single coil rotary actuator with a two-pin connection.

The adjusting screw for bypass air was eliminated.

The idle speed air valve has the following functions:

1. The electronic control unit supplies a specific voltage to the air valve which determines the respective valve opening and thereby the engine speed.
2. The nominal idle speed is controlled depending on temperature, between 1200 rpm at – 30 °C to 890 ± 50 rpm at + 70 °C.
3. With the ignition switched on (engine not running) the idle speed air valve is activated by a specific voltage. The port for the fixed operating mode is closed and the control port is opened.
4. If the voltage supply fails, the port for the fixed operating mode is opened automatically.

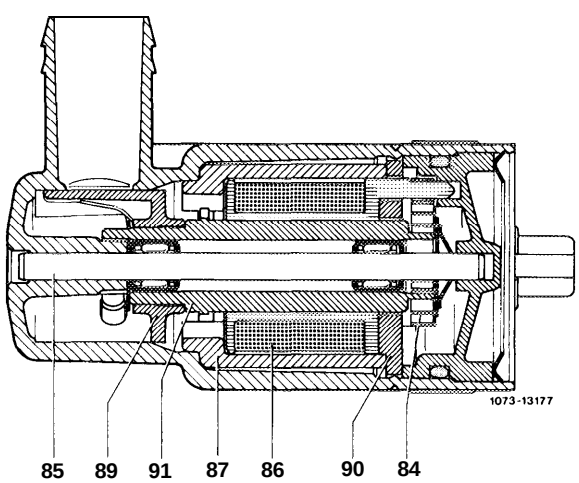


Fig. 07.3/10

84 Spiral spring
85 Shafl
86 Magnetic coil
87 Coil Jacket
89 Aperture valve
90 Coil cap washer
91 Hollow shaft

Rpm stabilization on engines with A/C compressor engaged

When the air conditioning system is switched on, the CIS-E control unit (terminal 19) is connected to voltage. This signal goes over a time delay relay (350 ms) to the A/C compressor control unit. The CIS-E control unit processes the signal and gives a specific signal to the idle speed air valve. The control opening in the air valve becomes larger before the A/C compressor is engaged and the idle speed deviates only slightly.

Idle speed stabilization on engines with automatic transmission

With the selector lever in a driving position, the ground connection to the starter is interrupted at terminal 50 of the starter lockout switch.

Ground is present in position P and N. The control unit processes the signal change and transmits a defined voltage signal to the idle speed air valve, so that a specific idle speed will result.

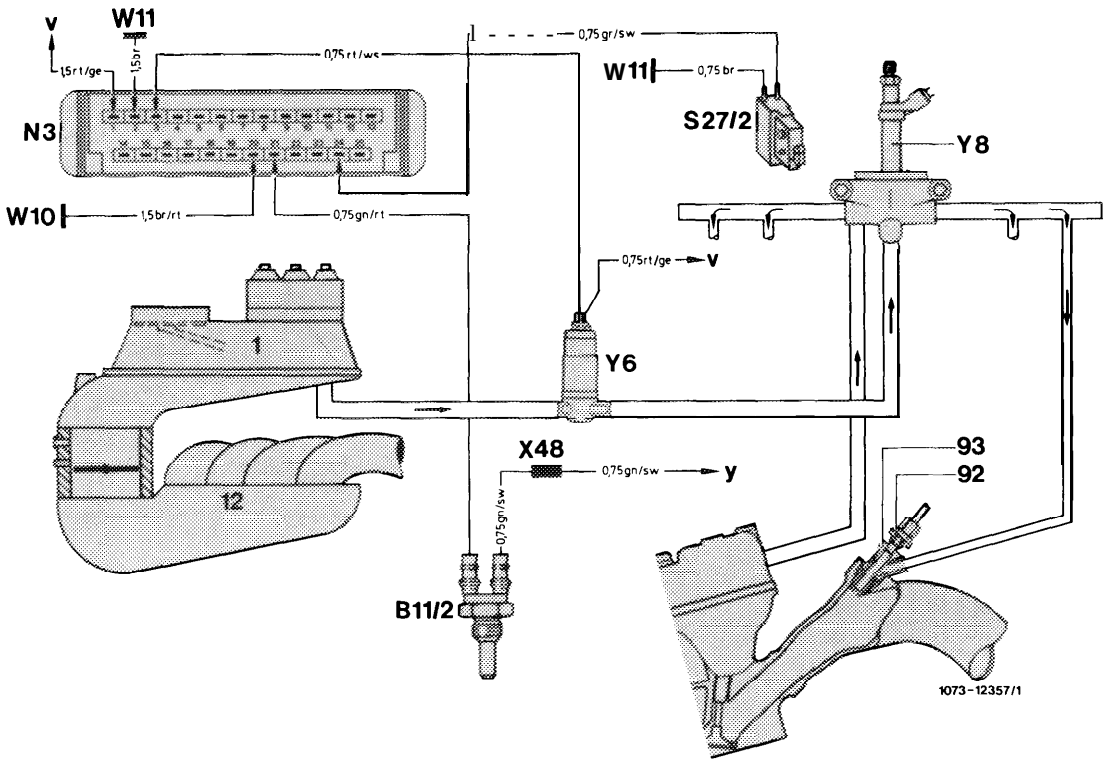


Fig. 07.3/11 Function diagram of electronic idle speed control

1	Fuel distributor	W	10	Ground, battery	bl	=	blue
12	Intake manifold	w	11	Ground, engine (electric wire connection)	br	=	brown
92	Injection valve	Y	6	Idle speed air valve	ge	=	yellow
93	Insulating sleeve	Y	8	Cold start valve	gn	=	green
B 1 1/2	Coolant temperature sensor (2-pin)	X	48	Solder terminal in wiring harness	gr	=	grey
N 3	CIS-E control unit (25-pin connector)	v		to overvoltage protection relay (pin 2) circuit 87	rt	=	red
S 27/2	Micro switch, deceleration shut off	Y		to ignition control module connector (teminal 1)	SW	=	black
					ws	=	white

Idle speeds depending on transmission are shown in the following table.

Idle speeds above 70 °C coolant temperature

		Idle speed rpm	
Manual transmission		890 ± 50	
Automatic transmission	shift lever position "P" or "N"	890 ± 50	
	driving position engaged	670 ± 50	

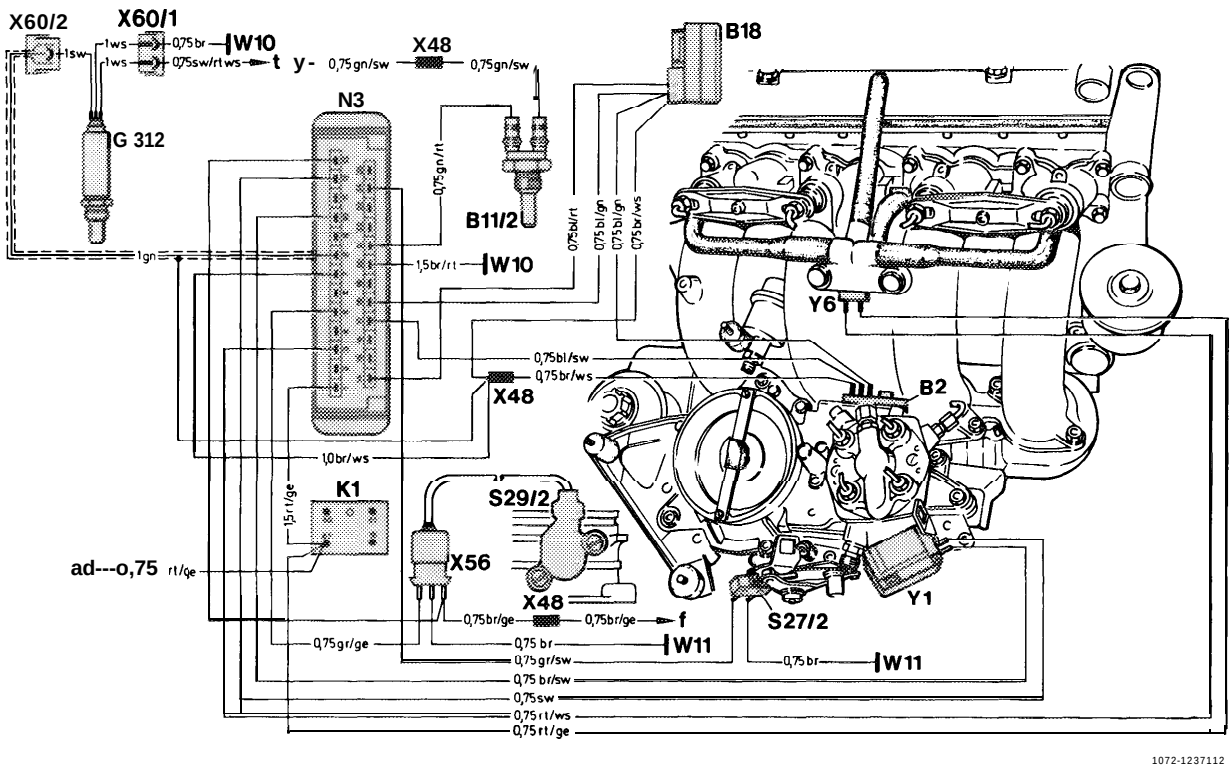


Fig. 07.3/12 Function diagram, CIS-E gasoline injection system

B	2	Air flow sensor position indicator
B	11/2	Coolant temperature sensor (2-pin)
B	18	Altitude correction capsule
G	3/2	O_2-sensor, heated
K	1	Overvoltage protection relay
N	3	CIS-E control unit (25-pin connector)
s	27/2	Micro switch, deceleration shut off
s	29/2	Throttle valve switch, idle and full load contacts
w	10	Ground, battery
w	11	Ground, engine (electric wire connection)
X	48	Solder terminal in wiring harness
X	56	Plug connection, throttle valve switch
X	60/1	Plug connection, O_2-sensor heating coil
X	60/2	Plug connection, O_2-sensor signal
Y	1	Electrohydraulic actuator (EHA)
Y	6	Idle speed air valve
	a	to Indicator lamp, O_2-sensor malfunction
	t	to Fuel pump relay, circuit 87 connector (terminal 2)
	Y	to ignition control module connector (terminal 1)
	f	to ignition control module (EZL) connector (terminal 2)

bl	= blue
br	= brown
ge	= yellow
gn	= green
gr	= grey
rt	= red
SW	= black
ws	= white

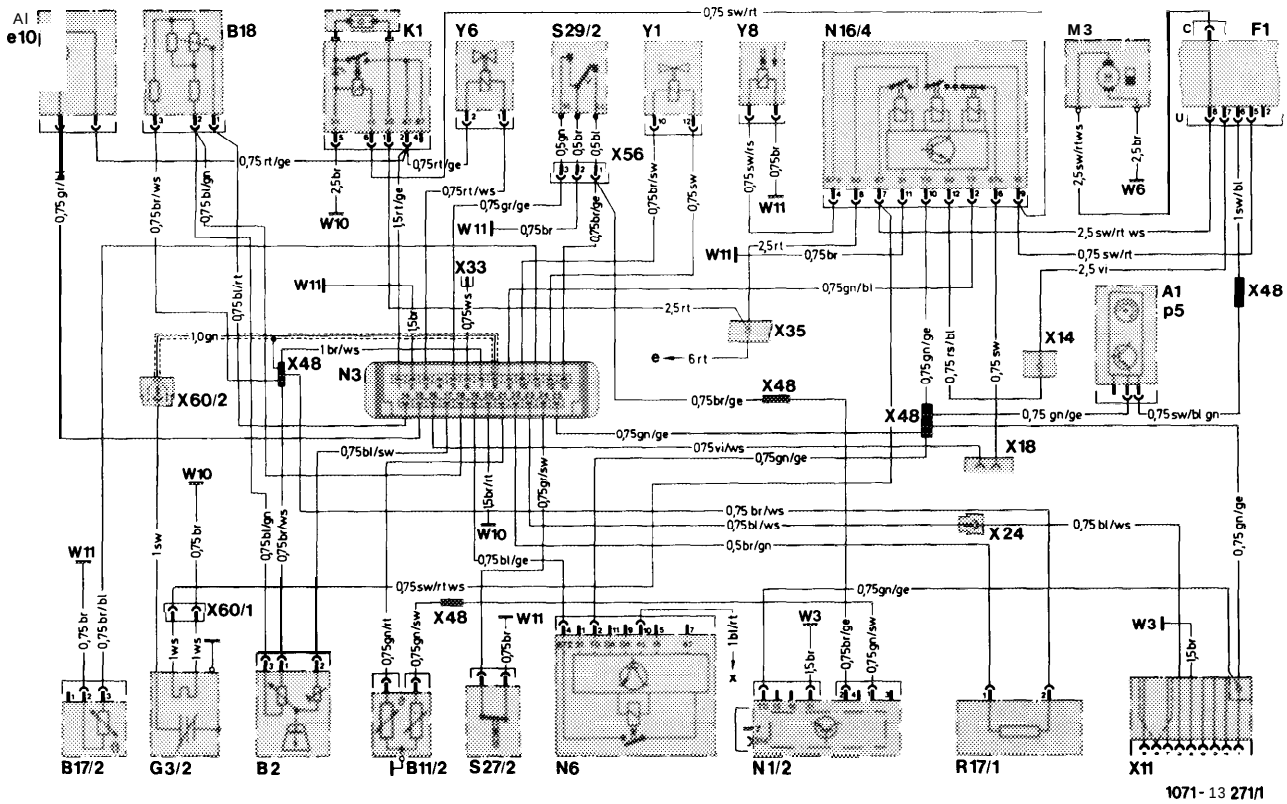


Fig. 07.3/13 Wiring diagram, CIS-E gasoline injection system

A	1e10	Indicator lamp, O_2-sensor
A	1p5	Tachometer
B	2	Air flow sensor position indicator
B	11/2	Coolant temperature sensor (2-pin)
B	17/2	Intake air temperature sensor
B	18	Altitude correction capsule
F	1	Electrical center
G	3/2	O_2-sensor, heated
K	1	Overvoltage protection relay
M	3	Fuel pump
N	1/2	Ignition control module (EZL)
N	3	CIS-E control unit (25-pin connector)
N	6	A/C compressor cut-out control unit
N	16/4	Fuel pump relay (automatic transmission)
R	17/1	Bridge, CIS-E
S	27/2	Micro switch, deceleration shut off
s	29/2	Throttle valve switch, idle and full load contacts
w	3	Ground, left front wheel housing
W	6	Ground, in trunk on left wheel housing
w	10	Ground, battery
w	11	Ground, engine (electric wire connection)
x	11	Diagnostic socket/wire connector, terminal TD
x	14	Plug connection, circuit 50
X	18	Plug connection, tail lamp harness
x	24	Plug connection, head lamp harness
x	33	Plug connection, CIS-E system to cruise control (1 -pin)
x	35	Plug connection, circuit 30/circuit 61 (battery)
X	48	Solder-terminal in wiring harness
X	56	Plug connection, throttle valve switch
X	60/1	Plug connection, On-sensor heating coil
X	60/2	Plug connection, O_2-sensor signal
Y	1	Electrohydraulic actuator (EHA)
Y	6	Idle speed air valve
Y	8	Cold start valve
e		to wire connector, circuit 30 (fuse and relay box)
x		to pressure switch, A/C compressor

Note: Unmarked ground connections are grounded on engine or chassis. The wire on terminal 6 (circuit 87 K) on the fuel pump relay connector does not apply to vehicles with manual transmission.

Altitude correction

Depending on altitude, the amount of fuel is changed based on a signal from the altitude correction capsule (B 18).

With the ignition switched on or with the engine running, the altitude correction capsule will receive a constant voltage signal (approx. 5 volts) from the control unit.

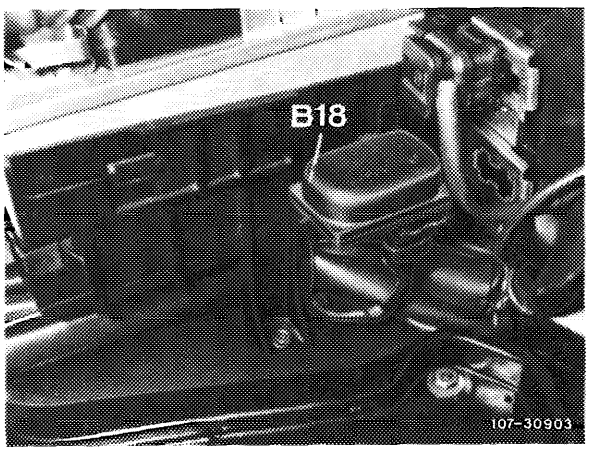


Fig. 07.3/14

If the electronic control unit operates in a fixed mode, correction for altitude will not take place.

With increasing altitude, i. e. decreasing air pressure, the mixture will be adapted to the altitude by a reduction of the voltage.

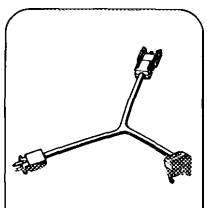
Measurements are made between terminal 1 and terminal 3 of the altitude correction capsule.

Height above sea level	Barometric pressure	Voltage at altitude correction capsule, plug connected
m	mbar	volts
0	1013	4 ± 1
1000	899	3 ± 1
2000	795	2 ± 1

Checking electric components of CIS-E injection system

(after checking fuel pressures and for internal leaks)

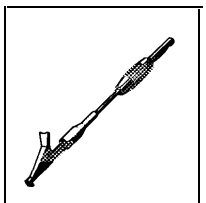
Special tools



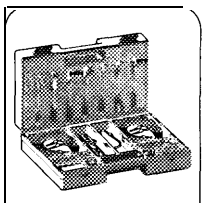
102 589 04 63 00

Adapter plugs for test cable

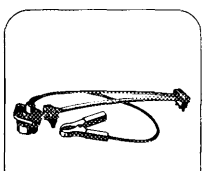
903589036300



102 589 05 63 00



201 589 00 99 00



103589006300

On-off ratio tester (e. g. Bosch KDJE-P 600)

909 589 00 21 00

Conventional testers

Multimeter')	e.g. SUN DMM-5

') Available through the MBNA Standard Equipment Program

Testing overvoltage protection relay (K 1)

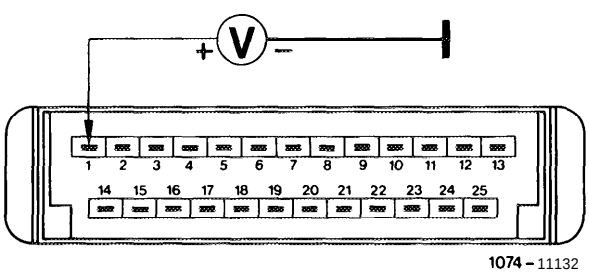
Switch-on ignition, test voltage from control unit plug (terminal 1) to ground.

Battery voltage

OK

Not OK

End of test



1074 – 11132

Fig. 07.3/15

Test fuse of overvoltage protection relay.

Fuse OK | Fuse not OK

Switch-off ignition.
Replace fuse.

Switch-on ignition.

Fuse OK | Fuse blows

Repair short circuit

Unplug overvoltage protection relay.
Jump connector terminals 1 and 2.

Battery voltage present at terminal 1 of control unit plug.

OK | Not OK

Repair circuit

Test voltage at terminals 6 and 5 on plug of overvoltage protection relay.

Battery voltage

OK | Not OK

Replace overvoltage protection relay

Repair circuit

End of test

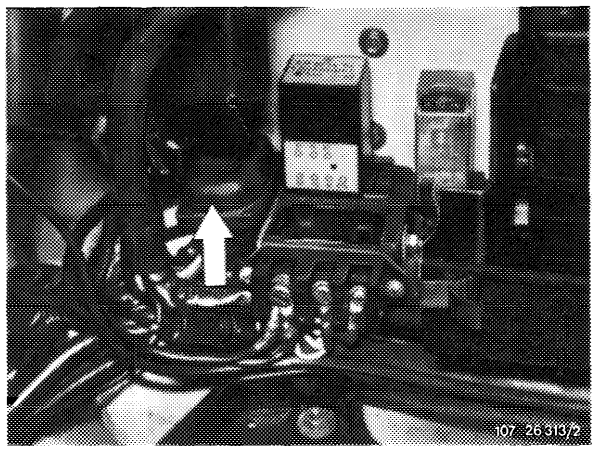


Fig. 07.3/16

Testing coolant temperature sensor

Unplug coolant temperature sensor. Test resistance from sensor terminal to ground.

For nominal value, refer to diagram.

Test sensor resistance at two temperatures.

Example:

+ 20 °C ≙ 2.2–2.8 kΩ
+ 80 °C ≙ 290-370 Ω

OK	Not OK

Replace temperature sensor.

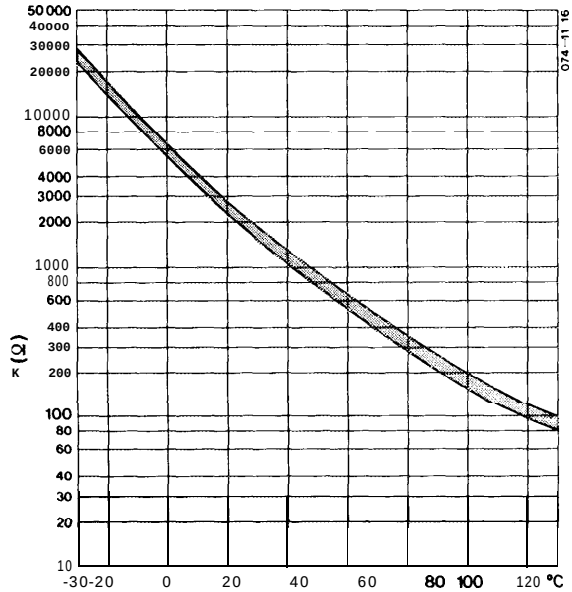


Fig. 07.3/17

Connect test cable to EHA. Set multimeter to mA. Switch on ignition. Read current value.

- Engine not running, reading approx. 50 mA.
- Engine at idle speed and operating temperature – reading fluctuates.
- Engine at idle speed, + 20 °C coolant temperature simulated with 2.5 kΩ tost cable (Fig. 07.3/20). O_2-sensor plug disconnected – Reading 5 – 15 mA.

OK	Not OK

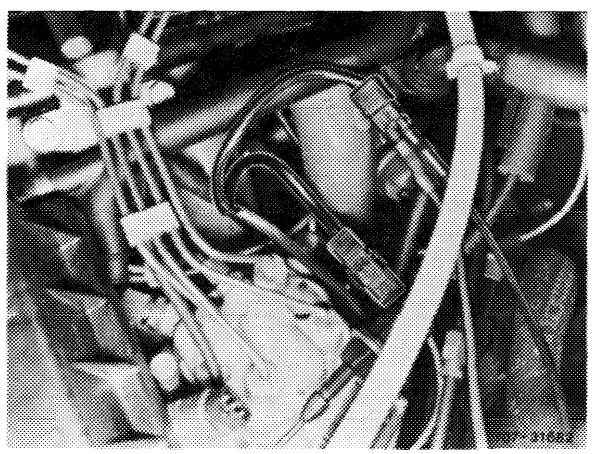
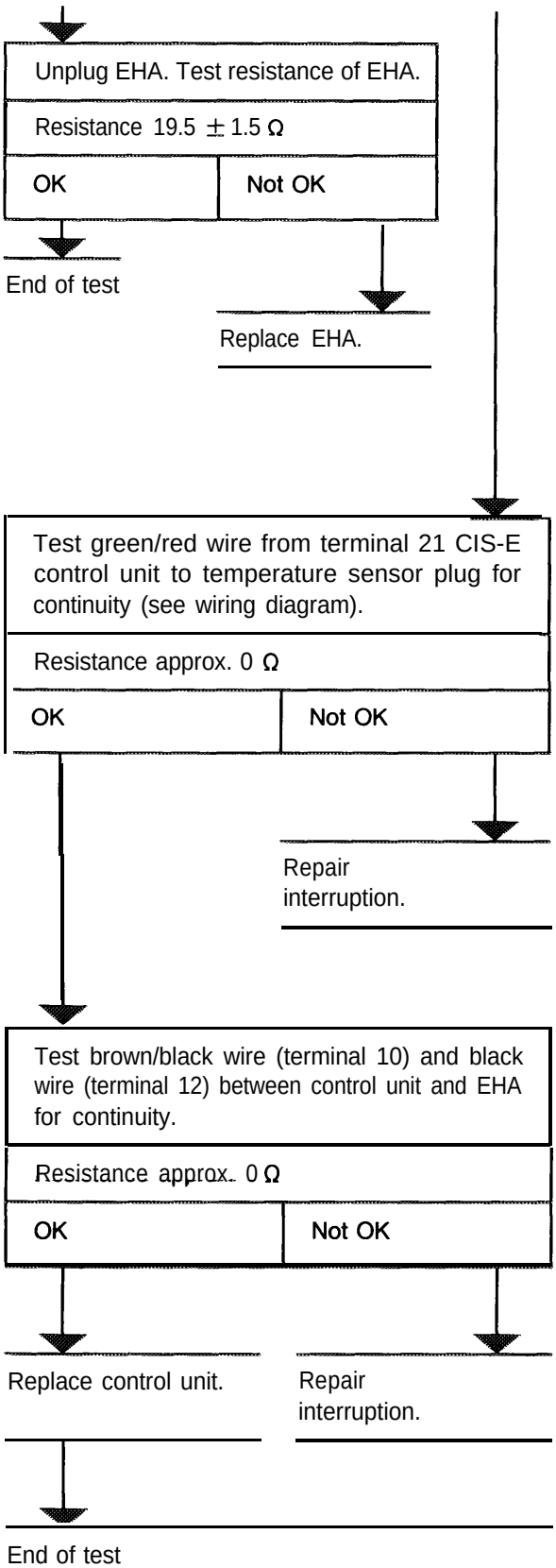


Fig. 07.3/18


Unplug EHA. Test resistance of EHA.
Resistance 19.5 ± 1.5 Ω
OK
Not OK
End of test
Replace EHA.
Test green/red wire from terminal 21 CIS-E control unit to temperature sensor plug for continuity (see wiring diagram).
Resistance approx. 0 Ω
OK
Not OK
Repair interruption.
Test brown/black wire (terminal 10) and black wire (terminal 12) between control unit and EHA for continuity.
Resistance approx. 0 Ω
OK
Not OK
Replace control unit.
Repair interruption.
End of test

Testing acceleration enrichment and air flow sensor position indicator

Connect test cable to EHA. Set multimeter to mA. Simulate + 20 °C with 2.5 kΩ test cable (Fig. 07.3/20). Disconnect O_2-sensor plug. Start engine (increased idle speed).

Nominal value 5-l 5 mA. Increase engine speed quickly, current value should increase.

OK	Not OK

End of test

Stop engine. Deflect air flow sensor plate with adjusting device from fuel quantity comparison tester until the upper edge of the air flow sensor plate is in alignment with lower edge of the cylindrical part of the air funnel. Loosen plug of air flow sensor position indicator so that the voltage can be measured at the pins (do not disconnect plug). Switch on ignition.

(Refer to Fig. 07.3/22)
Terminal 3 and terminal 1 : approx. 5 V
Terminal 2 and terminal 1 : 0.2-0.5 V

OK	Not OK

Slowly deflect air flow sensor plate.

Voltage increases continuously to approx. 5 Volts.

OK	Not OK

Replace air flow sensor position indicator.

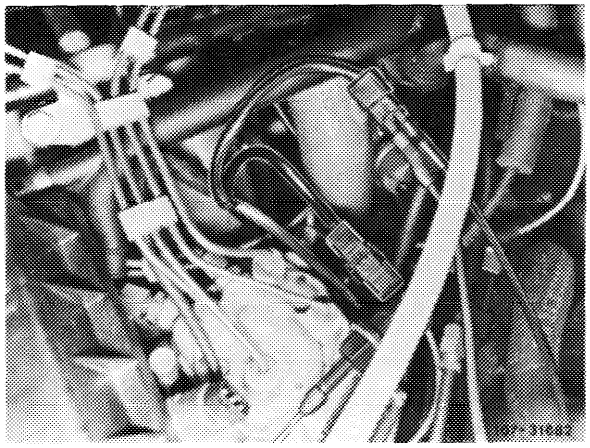


Fig. 07.3119

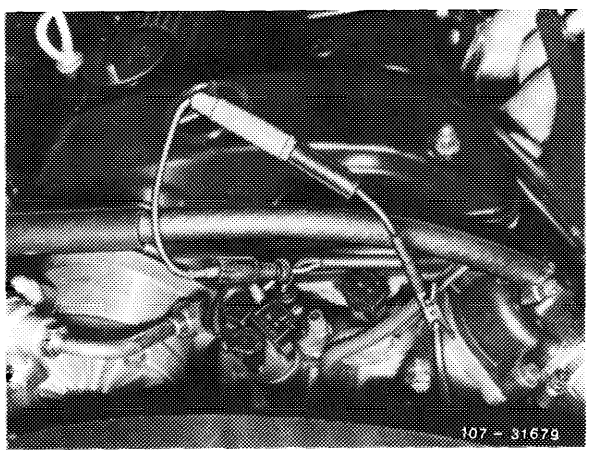


Fig. 07.3/20

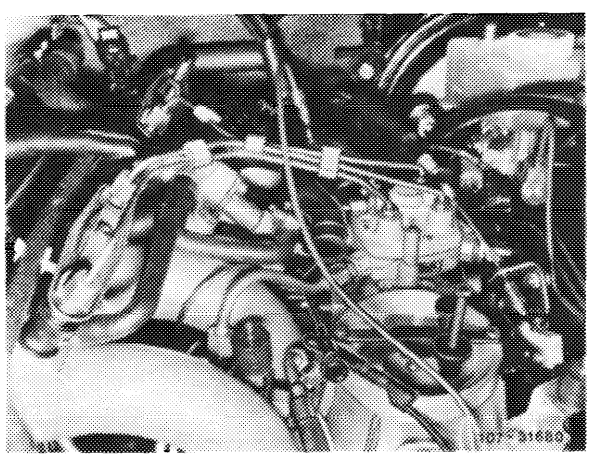


Fig. 07.3121

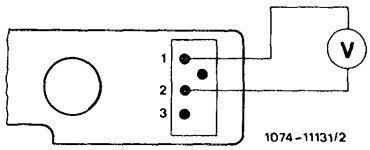


Fig. 07.3/22

Test wires between air flow sensor plug and CIS-E control unit plug for continuity (see wiring diagram for wire colors and terminal numbers).

Resistance approx. 0 Ω

OK | Not OK

Not OK → Repair interruption

Test rpm signal on CIS-E control unit plug terminal 25 (green/yellow).

Voltage 6 – 12 Volts.

OK | Not OK

Not OK → Repair interruption

Test wires between CIS-E control unit plug and EHA plug for continuity (see wiring diagram for wire colors and terminal numbers).

Resistance approx. 0 Ω

OK → Replace CIS-E control unit.

Not OK → Repair interruption.

End of test

Testing throttle valve switch

Disconnect plug between throttle valve switch and CIS-E control unit. Test resistance of throttle valve switch.

Idle contact: Idle position approx. 0 Ω
Full-load position approx. ∞ Ω

Full-load contact: Idle position approx. ∞ Ω
Full-load position approx. 0 Ω
Partial-load position approx. ∞ Ω

OK	Not OK

Adjust or replace throttle valve switch

End of test

Note: Without an idle speed signal, idle speed will be irregular.

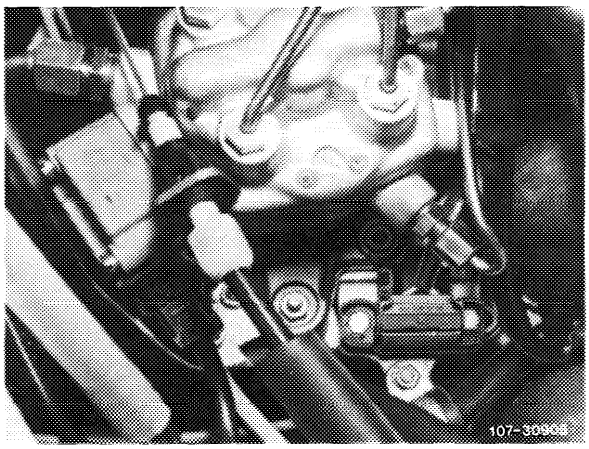


Fig. 07.3/23

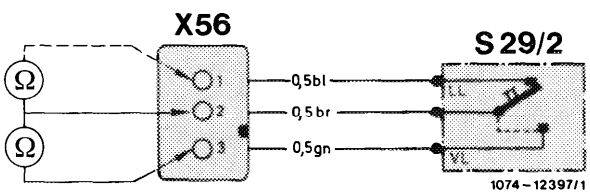


Fig. 07.3/24

S 29/2 Throttle valve switch plug (idle and full load contacts) full load/idle speed stabilization
X 56 Throttle valve switch plug
1 Idle contact (LL)
2 Common
3 Full-load contact (VL)

Testing cold start valve activation

ignition turned off. Pull plug off coolant temperature sensor. Unplug green cable on ignition control module. Crank engine and check voltage at plug of cold start valve.

Minimum voltage 10 V for 10 to 15 seconds

OK | Not OK

Check wire from cold start valve to fuel pump relay, terminal 4 (circuit 87 V) and ground wire to engine ground for continuity.

Resistance approx. 0 Ω

OK | Not OK

Repair interruption

Check voltage between fuel pump relay plug terminal 12 as well as terminal 2 and engine ground. Crank engine.

Minimum voltage at terminal 12 = 10 V. Voltage at terminal 2 = 3 to 5 V (coolant temperature sensor plug disconnected).

OK | Not OK

Replace fuel pump relay

Repair interruption

End of test

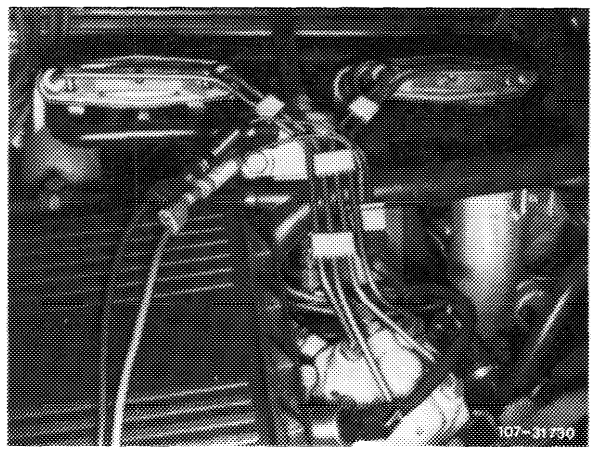


Fig. 07.3/25

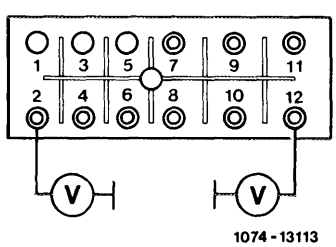


Fig. 07.3/26

Testing intake air temperature sensor

Unplug intake air temperature sensor. Test resistance from sensor terminal to ground.

For nominal value, refer to diagram.

Example

+ 20 °C = 2.2 - 2.8 kΩ
0 °C = 5.5 - 6.1 kΩ

OK	Not OK

Replace intake air temperature sensor

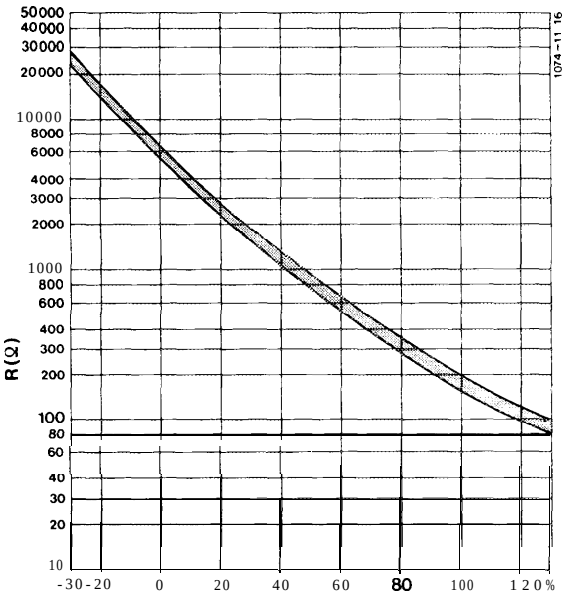


Fig. 07.3/27

Check wire between intake air temperature sensor and ground as well as wire to CIS-E control unit terminal 11 for continuity.

Resistance approx. 0 Ω

OK	Not OK

Repair interruption

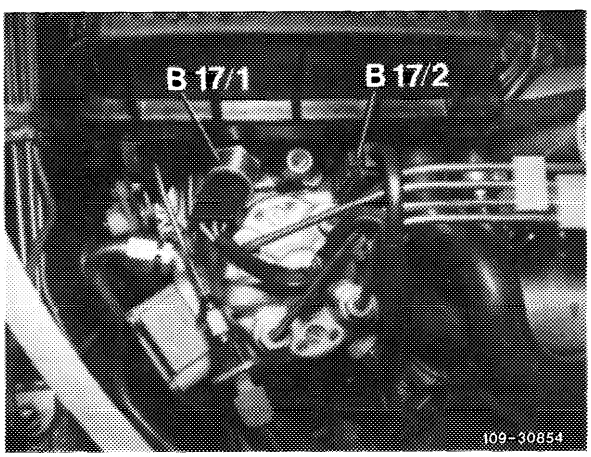


Fig. 07.3/28

End of test

Testing electronic idle speed control

Connect test cable to idle speed air valve and to lambda control tester 909 589 00 21 00 (Bosch KDJE-P600). Push IR 100 % button.
Engine at idle (operating temperature).

Nominal value: 35 to 45 % at 890 ± 50/min.

OK	Not OK

Perform idle speed stabilization test on page 75.

Readout 0 % or 100 %.

Disconnect plug from idle speed air valve. Connect battery voltage to idle speed air valve.

The idle speed air valve switches audibly. This can also be felt.

OK	Not OK

Replace idle speed air valve

Test voltage supply according to wiring diagram.

Switch on ignition. Voltage on terminal 2 of idle speed air valve plug (red/yellow wire) approx. 12 Volts.
Test red/white wire for continuity between terminal 1 of idle speed air valve plug and terminal 3 of CIS-E control unit plug.

OK	Not OK

Test input signals:
Coolant temperature sensor, Air flow sensor position indicator, Idle speed contact on throttle valve switch
or replace control unit

Repair interruption

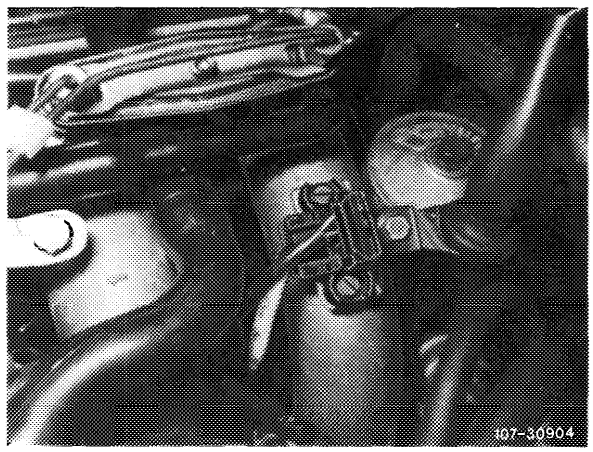
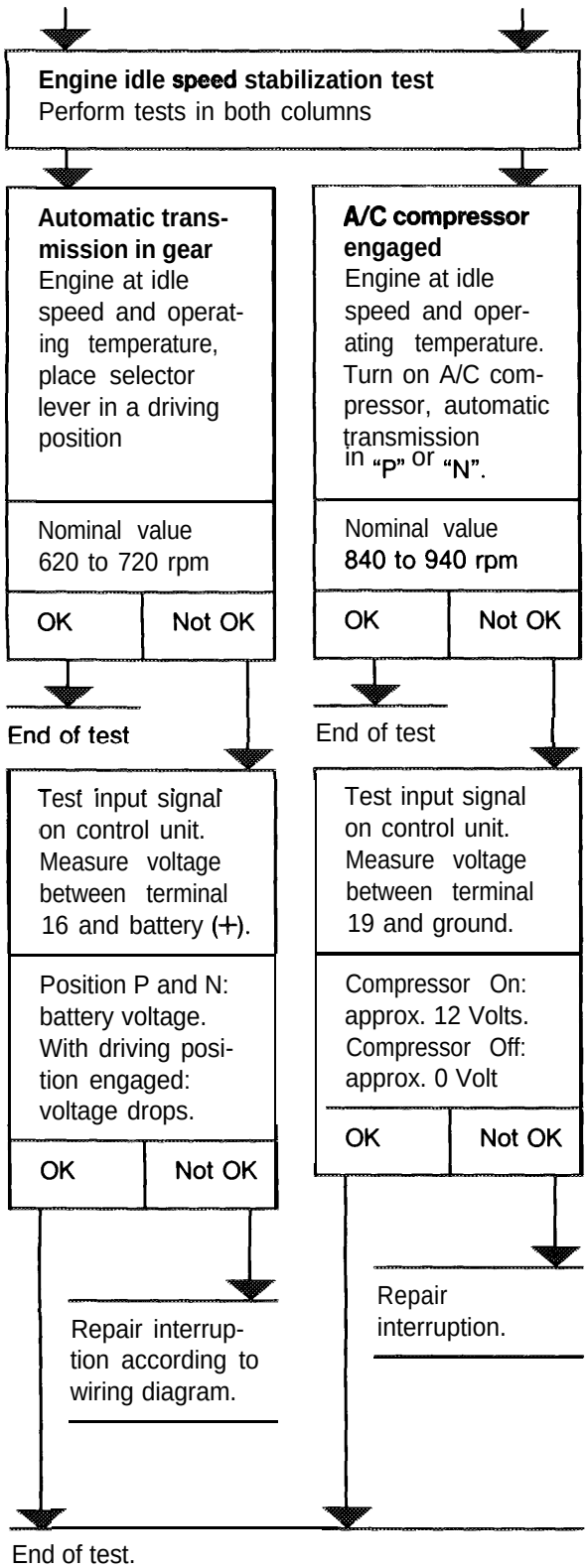
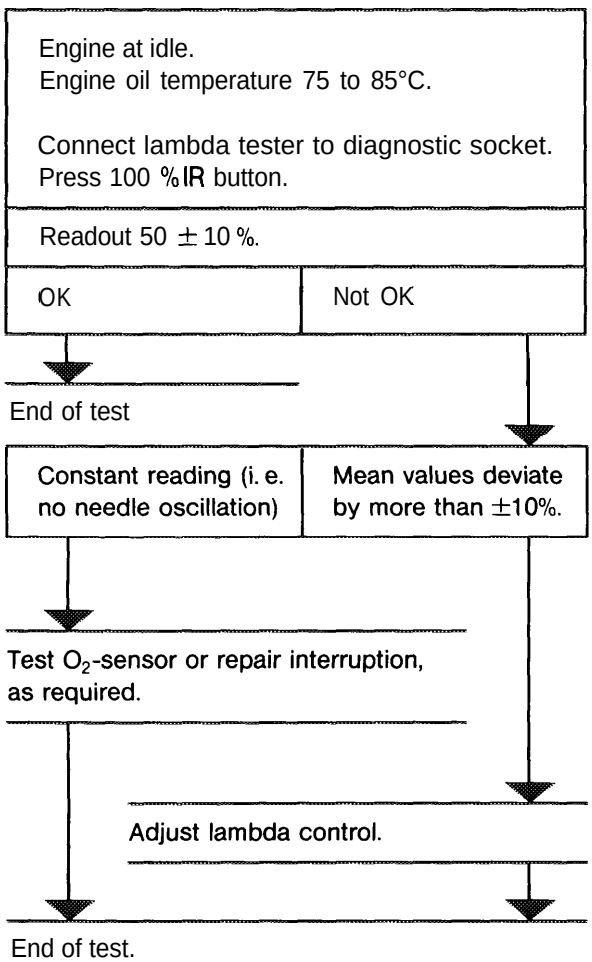


Fig. 07.3/29

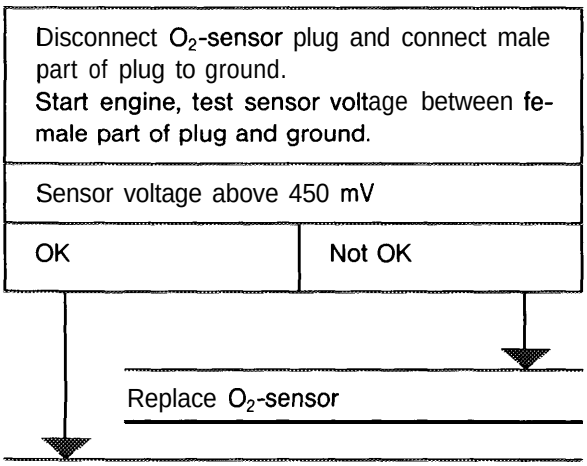

Engine idle speed stabilization test
Perform tests in both columns
Automatic transmission in gear
Engine at idle speed and operating temperature, place selector lever in a driving position
Nominal value
620 to 720 rpm
OK
Not OK
A/C compressor engaged
Engine at idle speed and operating temperature. Turn on A/C compressor, automatic transmission in "P" or "N".
Nominal value
840 to 940 rpm
OK
Not OK
End of test
End of test
Test input signal on control unit. Measure voltage between terminal 16 and battery (+).
Position P and N: battery voltage. With driving position engaged: voltage drops.
OK
Not OK
Test input signal on control unit. Measure voltage between terminal 19 and ground.
Compressor On: approx. 12 Volts. Compressor Off: approx. 0 Volt
OK
Not OK
Repair interruption according to wiring diagram.
Repair interruption.
End of test.

Testing lambda control



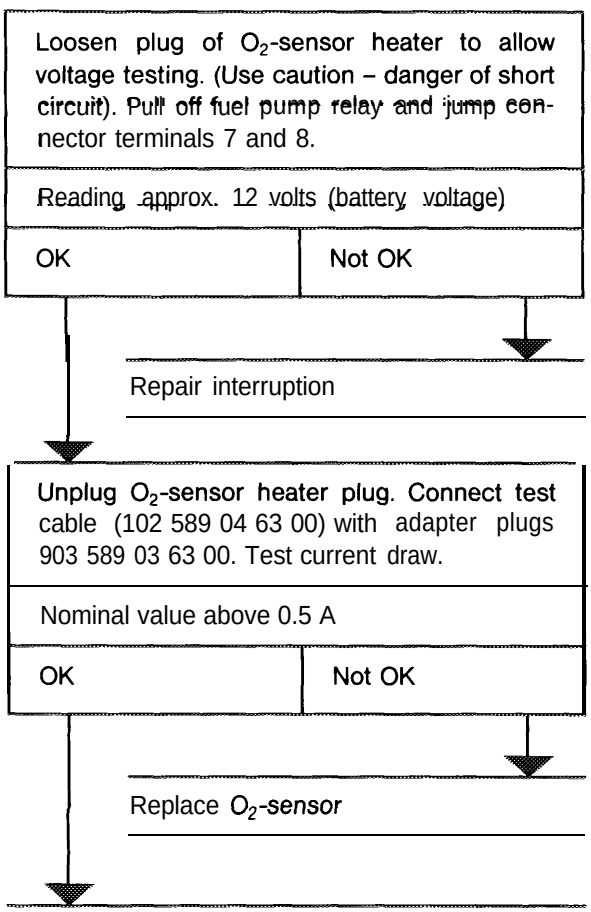
Testing O_2-sensor

Note: The O_2-sensor must be tested with the engine at operating temperature.
Function test: With the engine running, deflect airflow sensor plate slightly by hand. The needle on the lambda tester must move to the lean mixture stop. If not, perform the following test:



End of test.

Testing O_2-sensor heater (engine shut off)



End of test.

Test and adjustment data

Static current at EHA	Engine not running, ignition "ON"		approx. 50 mA
Coolant temperature sensor	Coolant temperature + 20 °C (basic warm-up value) Coolant temperature + 80 °C	Resistance Current on El-IA Resistance Current on EHA	2.2-2.8 kΩ 5-15 mA 290-370 Ω value fluctuating
Lambda control	Engine at idle		50 ± 10 %
Deceleration shutoff		Current on EHA	approx. 45 mA (-)
Rpm and control range	Idle speed Max. engine speed		890 ± 50 rpm 6800 ± 50 rpm

Fuel pressures

System pressure at idle with engine cold or at operating temperature		5.7 – 5.9 bar
Lower chamber pressure with engine at operating temp.		0.4 bar below previously measured system pressure
Lower chamber pressure at + 20 °C coolant temperature	with the vehicle at standstill, at idle speed	0.5 bar below previously measured system pressure
	Acceleration enrichment	above 3.8 bar
Decel shutoff		lower chamber pressure equal to system pressure
Return flow quantity at orifice in fuel distributor		130 – 150 cc/minute

Fuel pump

Bosch No.		0 580 254 974
Measuring instruction		with engine stopped and a voltage of min. 11.5 volts at fuel pump
Delivery capacity')	Measuring point	Fuel line after diaphragm pressure regulator
	min. 1 liter	in 40 seconds
Current draw		approx. 7.5 amps

') For measuring delivery capacity the fuel tank should be at least half full

Model Year 1987 changes to Mechanically/electronically controlled gasoline injection system (CIS-E)

Mechanically/electronically controlled gasoline injection system (CIS-E)

Fuel pump package

The two fuel pumps are arranged in series. A diaphragm damper is integrated in the fuel pumps on the suction side.

The fuel pump package is located as before on the left side in front of the rear axle on the frame floor.

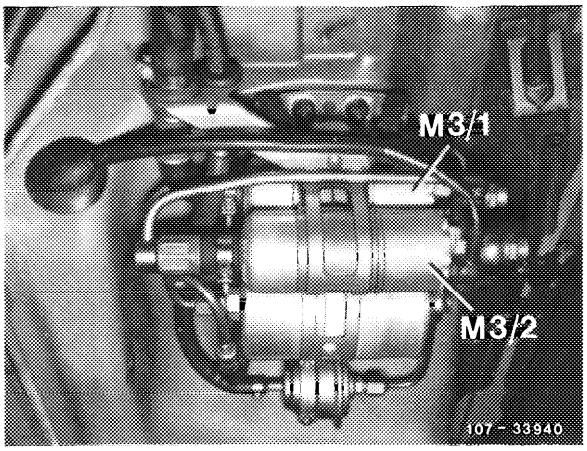


Fig. 07.3/1

55 Fuel filter
57 Fuel accumulator
M3/1 Fuel pump
M3/2 Fuel pump

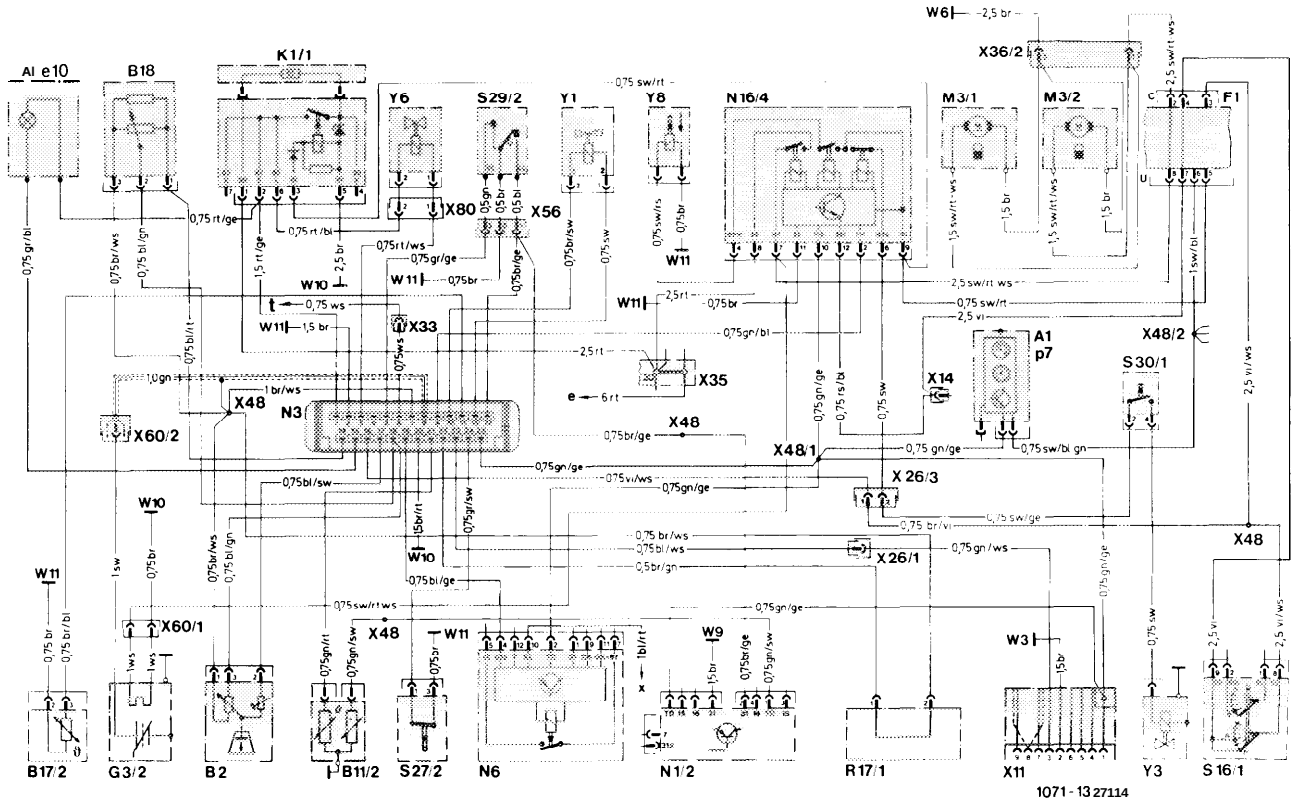


Fig. 07.312 Wiring diagram, CIS-E gasoline injection system

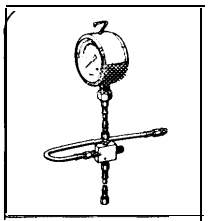
A	1e10	O_2-sensor, indicator lamp
A	1p7	Electronic clock/tachometer
B	2	Air flow sensor position Indicator
B	11/2	Coolant temperature sensor
B	17/2	Intake air temperature sensor
B	18	Altitude correction capsule
F	1	Electrical center
G	3/2	Heated O_2-sensor
K	1/1	Overvoltage protection relay
M	3/1	Fuel pump
M	3/2	Fuel pump
N	1/2	Electronic Ignition control unit
N	3	CIS-E control unit
N	6	A/C compressor control unit
N	16/4	Fuel pump relay (with starting valve control, kick-down cut-out and rpm limiting)
R	17/1	Reference resistor, (CIS-E)
S	27/2	Deceleration shut-off, microswitch
s	29/2	Throttle valve switch, full load/idle
s	30/1	Kick-down switch
W	3	Ground, left front wheel housing (at ignition coil)
W	6	Ground, left rear wheel housing (in trunk)
w	10	Ground, battery
w	11	Ground, engine (connectron point for ground wires)
x	11	Diagnostic socket/terminal block (circuit TD)
x	14	Connector, circuit 50
X	18	Connector, tail lamp harness
X	24	Connector, head lamp harness
X	26/1	Connector, engine/headlamp harness (1 -pole, diagnostic)
X	26/3	Connector, engine/stop lamp harness (2-pole)
x	33	Connector, CIS-E system to cruise control (1 -pole)
x	35	Terminal block, circuits 30/61 (battery)
X	36/2	Connector, fuel pump wiring harness/taillamp wiring harness
x	48	Connector sleeve (sholder joint in harness)
X	56	Plug connection, throttle valve switch
X	48/1	Connector sleeve, circuit TD (solder joint in harness)
X	48/2	Connector sleeve, circuit 15 (solder joint in harness)
X	60/1	Connector, O_2-sensor heater
X	60/2	Connector, O_2-sensor signal
Y	1	Electra-hydraulic actuator (EHA)
Y	3	Kick-down solenoid (automatic transmission)
Y	6	Idle speed air valve
Y	8	Starting valve

e	to wire connector, circuit 30 (fuse and relay box)
t	to cruise control amplifier pin socket 5
x	to pressure switch, A/C compressor

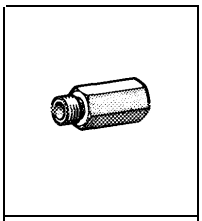
Note: Unmarked ground connections are grounded on engine or chassis. The wire on terminal 6 (circuit 87 K) on the fuel pump relay connector does not apply to vehicles with manual transmission

Testing fuel pump delivery

Special tools



103 589 00 21 00



103 589 02 63 00

Testing fuel pump delivery

(see Service Microfiche, Job No. 07.3-130)

Nominal value: 1 liter minimum in 40 seconds. If this delivery quantity is not obtained determine cause by performing a pressure test.

Testing fuel pressure

1 **Remove fuel pump package cover (Fig. 07.3/3)**

2 **Unscrew cap nut on fuel pump M 3/1. Attach connection fitting and pressure gauge 0 to 10 bar (Fig. 07.3/4)**

3 **Unplug fuel pump relay and bridge terminals 7 and 8 (circuit 30 and 87).**

4 **Reading on pressure gauge must be between 2 and 4 bar. If the pressure is below 2 bar, fuel pump M 3/1 is defective. If the pressure is above 4 bar, fuel pump M 3/2 is defective.**

5 **Disconnect pressure gauge, unscrew connection fitting and install cap nut.**

6 **Install fuel pump package cover.**

Note:

This test can also be used on engines 103,116 and 117 equipped with two fuel pumps.

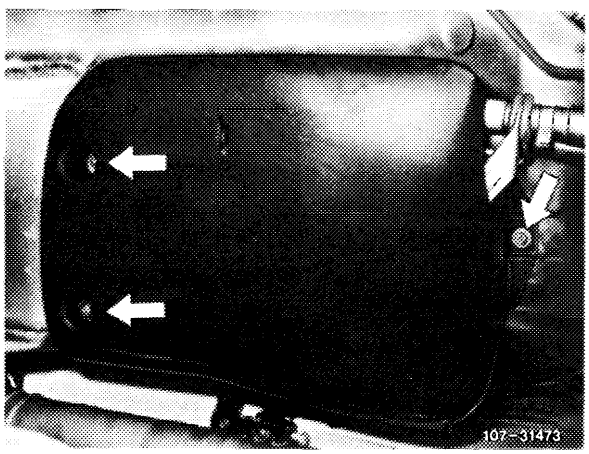


Fig. 07.3/3

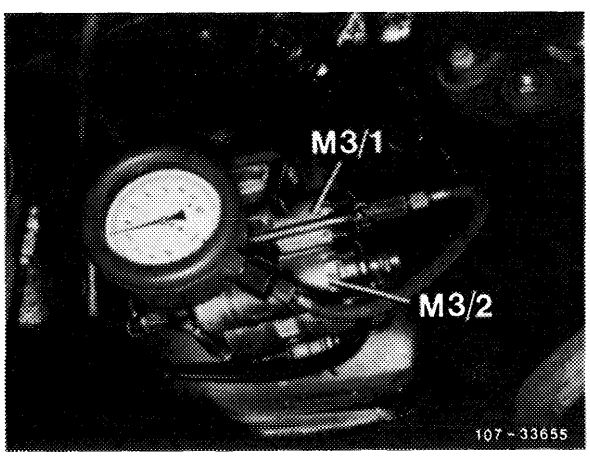


Fig. 07.3/4

Air filter

The air filter housing is adapted to the installation conditions. It is fastened by one clip and two nuts.

The air is drawn in form outside the engine compartment via plastic scoop (arrow) and air hose (1).

The filter element is a plate-type filter.

Note: Two temperature sensors are installed in the air cleaner housing.

Repair note

To prevent damage to the air filter housing, disengage carefully rearward out of clip fastener after the two mounting nuts have been removed.

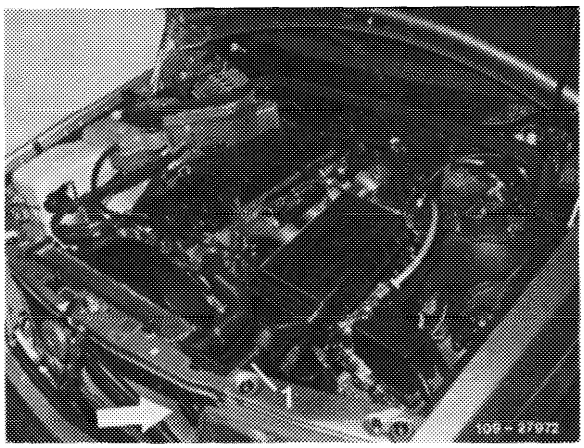


Fig. 09/1

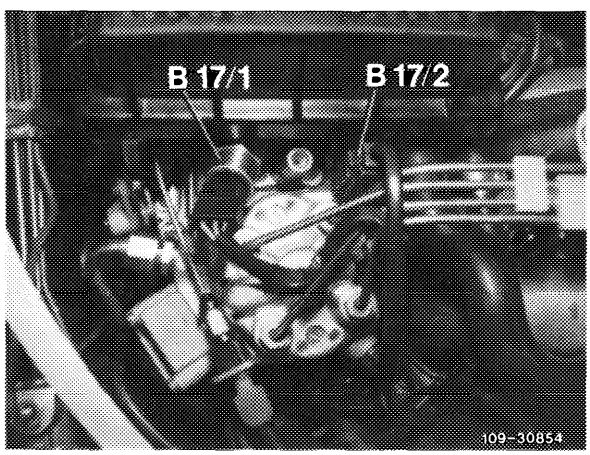


Fig. 09/2

B 17/1 Intake air temperature sensor (EZL)
B 17/2 Intake air temperature sensor (CIS-E)

Belt drive

Single-belt drive

Similar to engine 102.985, all the accessories are driven by a poly-V-belt.

Shock absorber (28) for the tensioning device (1) of the poly-V-belt (27) and bracket (29) were changed.

The modified shock absorber can be recognized by its circular grooves.

Length of belt ≈ 1885 mm

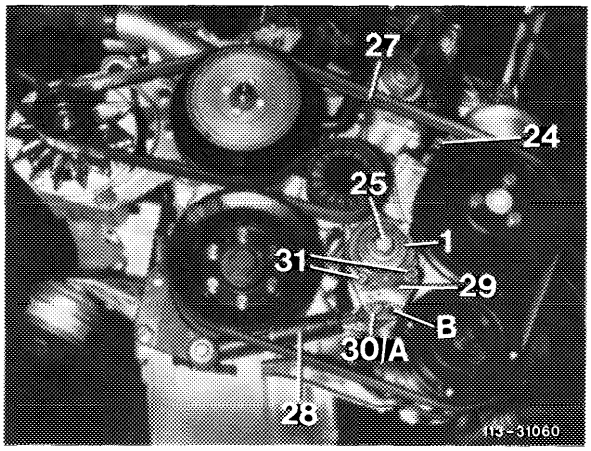


Fig. 13/1

Repair note:

In case of repairs, the shock absorber must be fastened in bore (B) of the bracket (29).

Intake manifold, exhaust manifold

Intake manifold

The intake manifold is adapted to installation conditions and to engine. The diameter of the intake ducts (per intake valve) is approx. 26 mm. The intake ducts are fork-shaped prior to cylinder head. As a result, each intake valve has one intake duct.

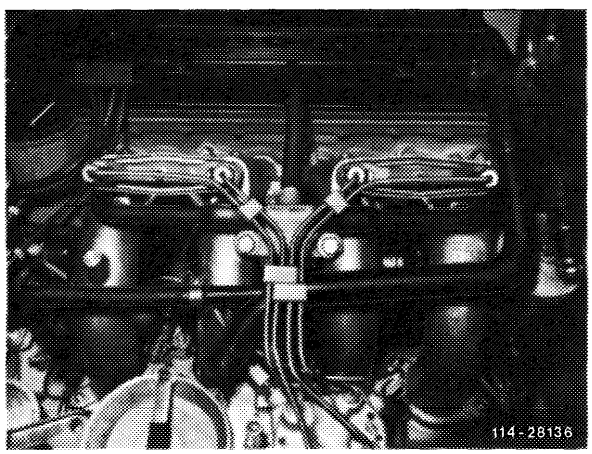


Fig 14/1

Exhaust manifold

The exhaust manifold is designed as a steel pipe manifold and enters a dual pipe exhaust system. The pipes of cylinder 1 and 4, as well as of cylinder 2 and 3 are joined. The pipe diameter is approx. 42 mm.

A sheet metal gasket per cylinder is installed as an exhaust manifold seal.

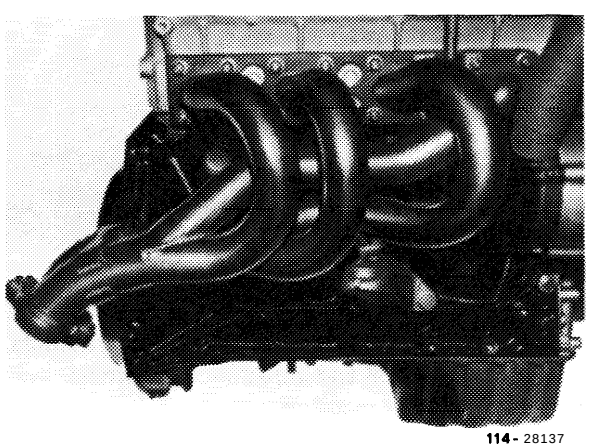


Fig. 14/2

Repair note
For removal and installation of exhaust manifold remove screw (arrow) from heater return flow pipe and pull return flow pipe in direction of engine.

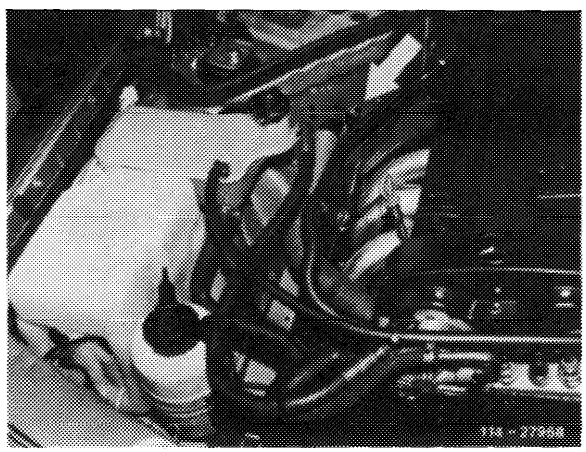


Fig 14/3

During assembly proceed as follows:

1 Insert screw for holder (on transmission bell) hand tight.

2 Tighten nuts for exhaust manifold on cylinder head.

3 Tighten screw for holder.

Catalyst

The exhaust system is equipped with two primary catalysts (Fig., **14/4)** and one under floor catalyst.

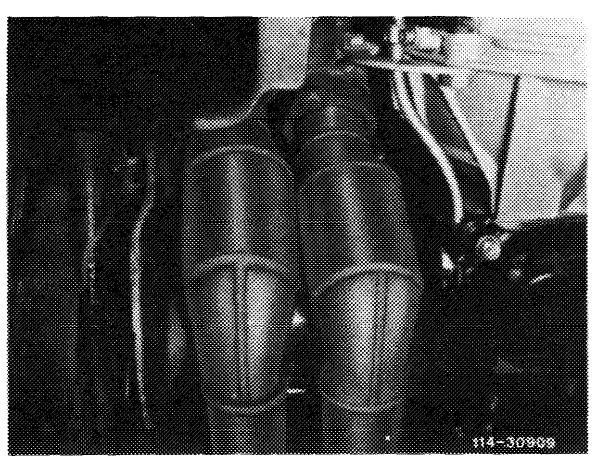


Fig. 14/4

Electrical system, engine

Electronic ignitiin system with electronic timing adjustment (EZL)

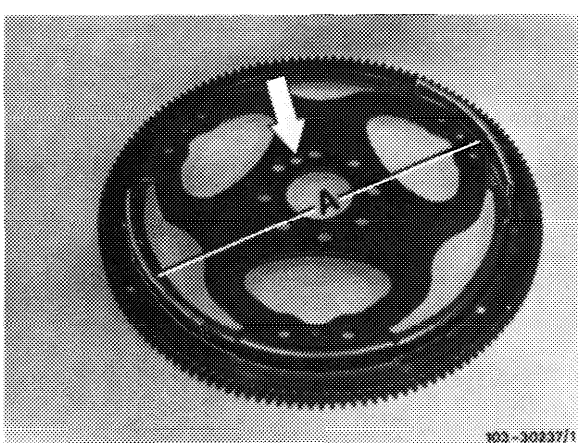
The ignition system corresponts to that of model 124.030 except for the following modifications:

- The ignition control module was adapted to engine 102.983.
- Position indicator with longer cable.
- Flywheel or flex plate with two segments.
- An additional intake air temperature sensor is installed in the air filter.
- High voltage distributor with modified internal construction.
- New spark plug connectors.

Components of ignition system

flywheel or flex plate with segments

Two segments offset by 180° on the ring of the flex plate or flywheel are used for controlling ignition timing.



Pig. 15/1

A Segment
arrow Locating bore

Temperature sensor intake air with electronic control 25 °C

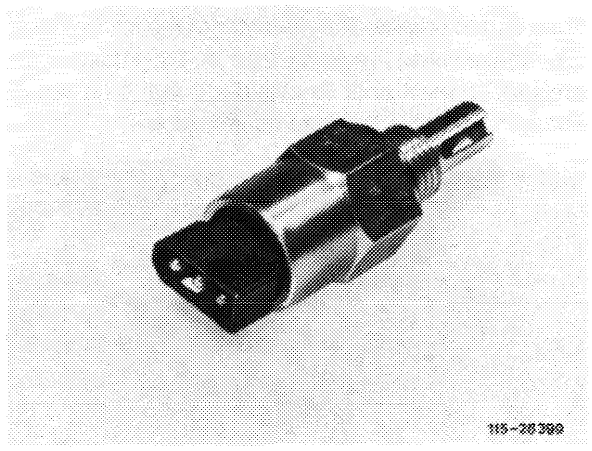


Fig. 15/2

The intake air temperature sensor has an electronic device, which retards the full load characteristic at temperatures above 25 °C.

High voltage distributor (ignition distributor)

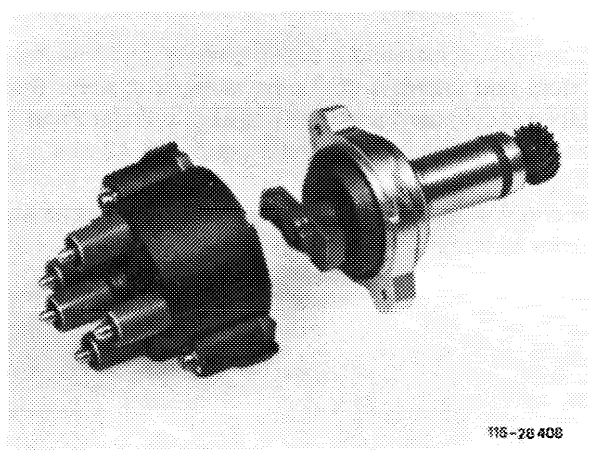


Fig. 15/3

The high voltage distributor is now only serving the purpose of high voltage distribution. Flyweights, vacuum control unit and inductance transmitter system are no longer installed.

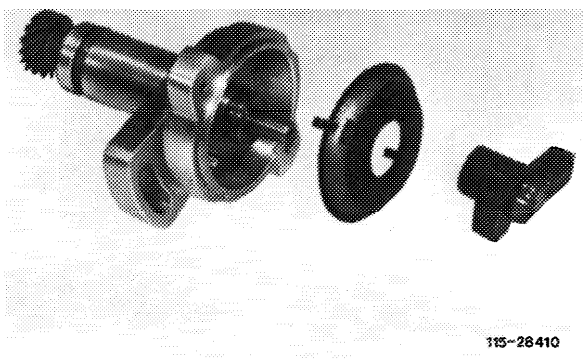


Fig. 15/4

The distributor cap is attached to ignition distributor by special M 6 screws. The protective cap for the interference suppression is mounted on distributor cap and fastened with two star washers.

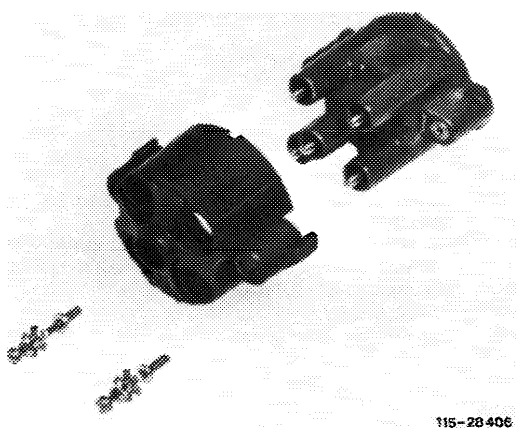


Fig. 15/5

Interference suppression resistors: on distributor cap per connection 1 kΩ, distributor rotor 1 kΩ.

Spark plug connector

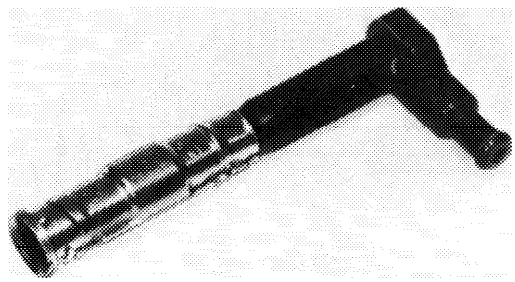


Fig. 15/6

A new spark plug connector with 1 kΩ interference suppression resistor is installed.

Note: Twist spark plug connector prior to pulling.

Reference input resistor plug (EZL, R 16/1)

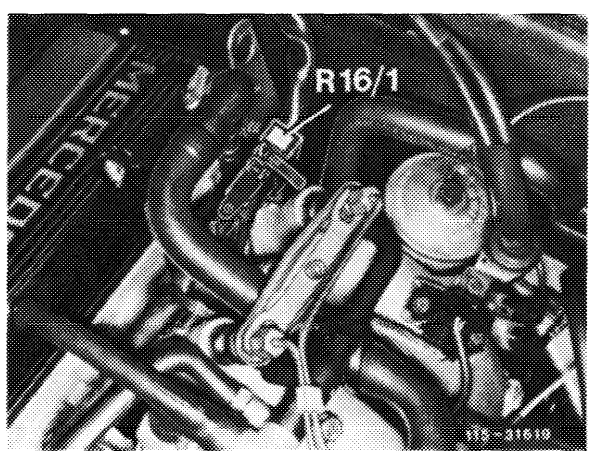


Fig. 15/6a

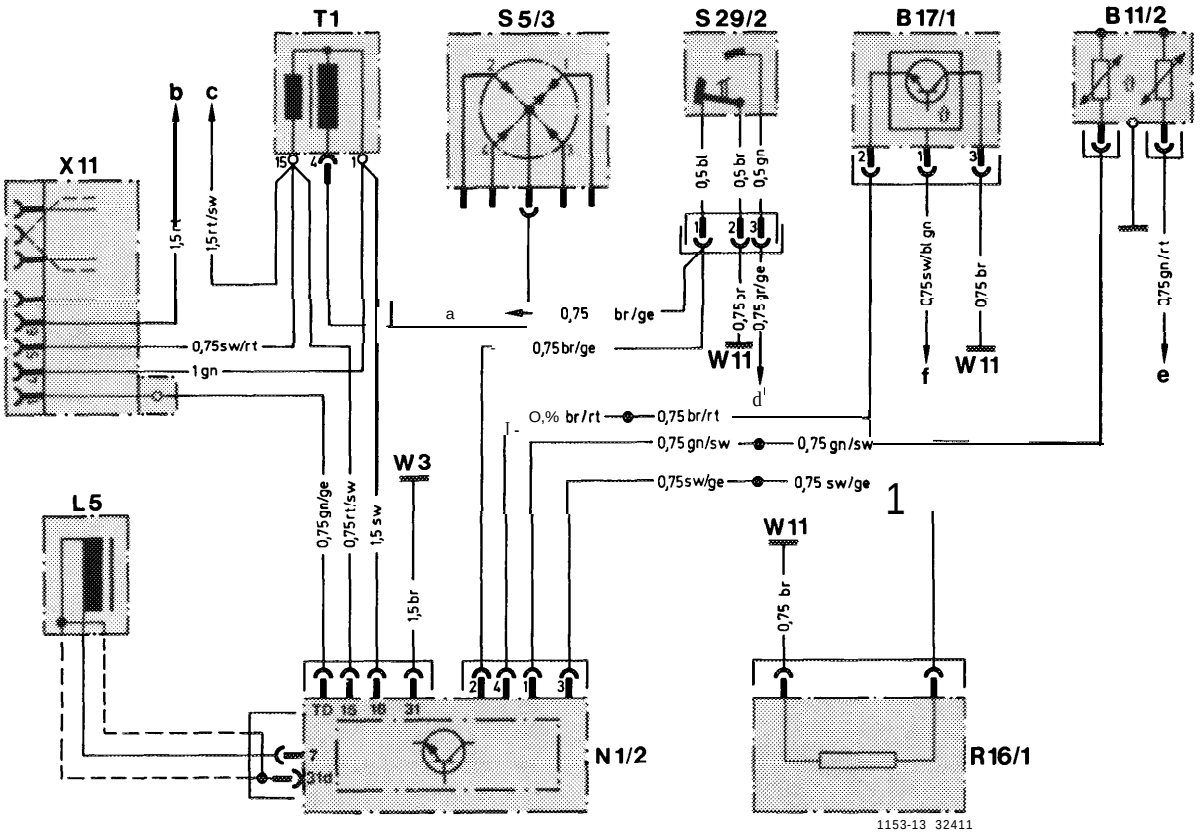


Fig. 15/7 Wiring diagram, electronic ignition system with electronic timing adjustment (EZL)

B	11/2	Coolant temperature sensor
B	17/1	Intake air temperature sensor (EZL)
L	5	Position indicator, flywheel/flex plate
N	1/2	Ignition control module
R	16/1	Reference input resistor plug (EZL)
S	5/3	High voltage distributor
S	29/2	Throttle valve switch, full load/idle speed contacts
T	1	Ignition coil
w	3	Ground, front left wheelhousing (ignition coil)
w	11	Ground, engine (electric wire connection)
x	11	Diagnostic socket, terminal block, terminal TD
a		to CIS-E control unit plug (terminal 13)
b		to electrical center, connector S, terminal 11 (circuit 30)
c		to electrical center, connector S, terminal 4 (circuit 15)
d		to CIS-E control unit plug (terminal 5)
e		to CIS-E control unit plug (terminal 21)
f		to electrical center, connector U, terminal 6 (circuit 15 R)

Removal and installation of high voltage distributor

Removal/installation is as before. Pay attention to the following items:

1 Ignition distributor cap is fastened with screws.

2 Adjustment of ignition timing is no longer required. The ignition timing is determined by the switching unit.

Removal and installation of spark plug connectors and spark plugs

Note

Clean ignition cable cover, loosen the 3 screws and remove.

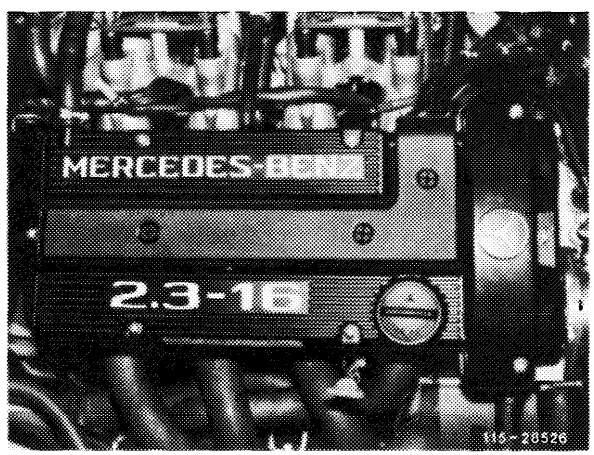


Fig. 15/8

Loosen spark plug connectors by twisting to the right and left and pulling off.

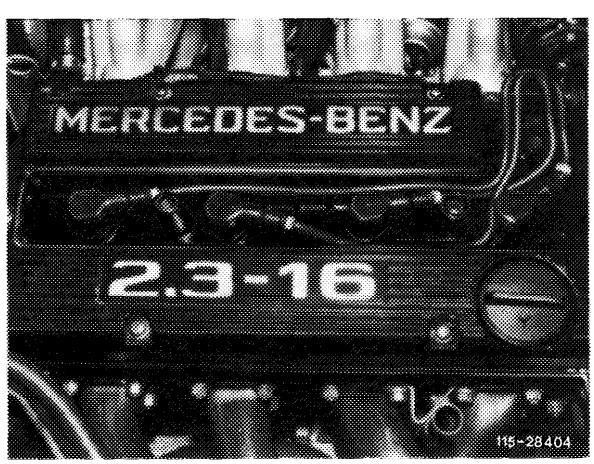


Fig. 15/9

Testing EZL electronic ignition system

Test **values**

Voltages

Ignition on (engine off)	Coil terminal 15 (terminal 5 diagnostic socket)		Battery voltage
	between coil terminal 15 and 1 (terminal 5 and 4 diagnostic socket)		o v
	4-pole round plug (ignition control module)	Terminal 15 and terminal 31	Battery voltage
		Terminal 16 and terminal 31	Battery voltage

Resistances (test data at 0 °C to 100 °C)

Ignition coil	Primary (terminal 1 and 15)	0.3-0.6 Ω
	Secondary (terminal 1 and 4)	7-13 kΩ
Position sensor		680-l 200 Ω
Reference input resistor (EZL)		750 Ω

Dwell angle

at cranking speed		1 O-54 % or 9-49 °
at 4000 rpm		30-60 % or 27-54 °

Ignition timing (firing point)

at cranking speed		TDC ± 2 °
at idle		below 20 °
at 4000 rpm	without vacuum, intake air temperature sensor plug pulled off	18-22 °
at 4000 rpm	with vacuum, intake air temperature sensor plug pulled off	29–33 °

Conventional testers

Multimeter')	SUN DMM-5
Engine tester')	SUN EMT-l 019, Master 3, MCM-2110
Tachometer')	All-Test 361 O-MB

') Available through the MBNA Standard Equipment Program

For test procedure see engine 103 with the following exception.

Disconnect intake air temperature sensor plug (arrow) when checking ignition timing at 4000 rpm.

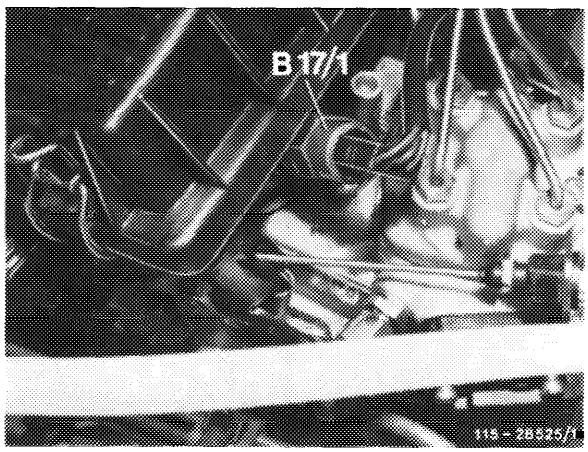


Fig. 15/10

B 17/1 Intake air temperature sensor (EZL)

Spark plugs (with conical seat)

BERU	**BOSCH**	**CHAMPION**
Designation	Designation	Designation
Electrode gap	Electrode gap	Electrode gap
Part number	Part number	Part number
14 **K- 6 DU**	**H 6 DC**	s7 YC
0.8	0.8	0.8
102 159 1203	102 159 1203	102 159 1203

Engine lubrication

Lubrication circuit

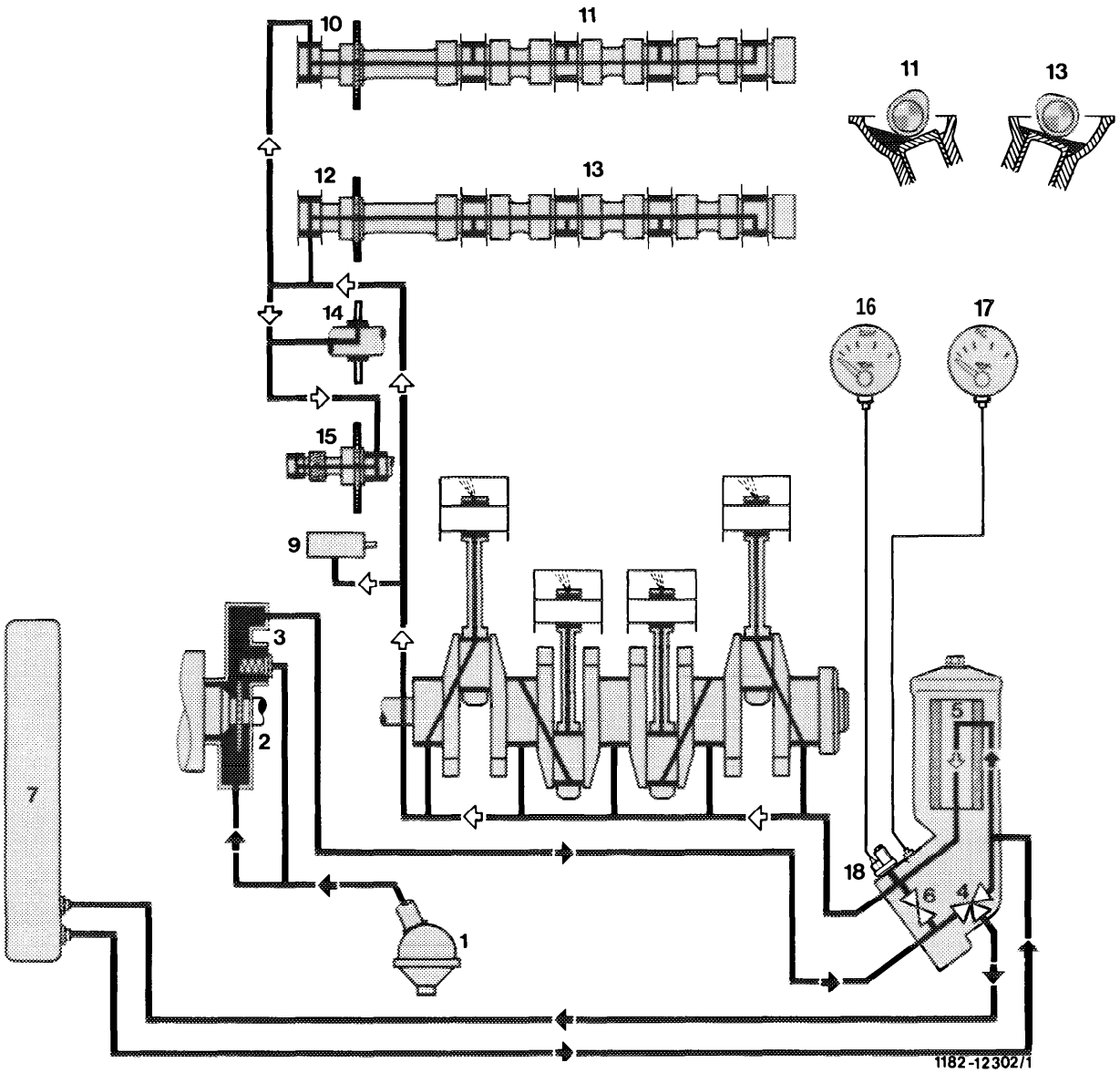


Fig. 18/1

1 Oil strainer
2 Oil pump
3 Oil pressure relief valve
4 Thermostat 110 °C (in oil filter housing)
5 Oil filter element
6 Bypass valve oil filter element
7 Oil-to-air cooler
9 Chain tensioner
10 Camshaft sprocket – exhaust
11 Camshaft – exhaust
12 Camshaft sprocket – intake
13 Camshaft – intake
14 Intermediate sprocket
15 Idler sprocket
16 Oil pressure gauge (instrument cluster)
17 Oil temperature gauge
18 Oil pressure sensor

Oil filling capacities in liters (for approved engine oils, refer to Specifications for service products)

Total quantity for initial filling	5.5
Quantity at oil and filter change	5.0
Oil pan max./min	4.8/2.8

Oil filter

A thermostat (332 b, Fig. 18/2) in the oil filter controls the oil flow through the oil-to-air cooler.
Opening begins at 110 °C oil temperature. Fully opened at 125 °C oil temperature.

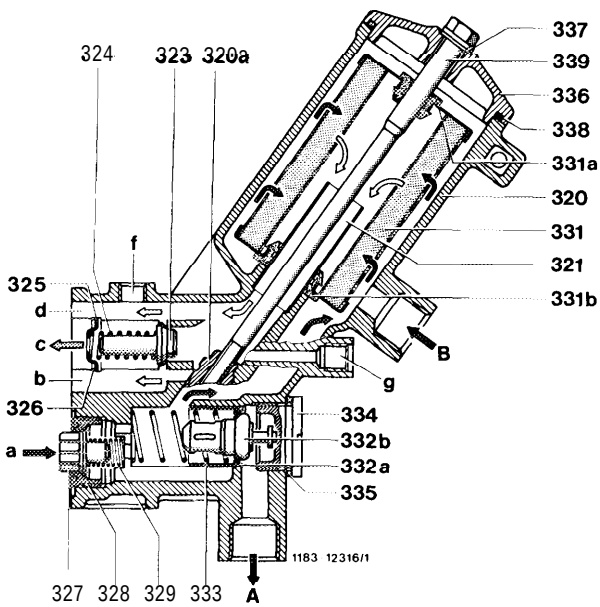


Fig. 18/2

320 Oil filter housing
320a Threaded bushing
321 Return tube
323 Valve cone
324 Compression spring
325 Spring retainer
326 Retaining ring
327 Valve cone
328 Valve seat ring
329 Compression spring
331 Oil filter element
331 a Rubber seal
331 b Rubber seal
332 a Slide
332 b Thermostat
333 Compression spring
334 Plug
335 Seal ring
336 Cover
337 Seal ring
338 O-ring
339 Center bolt
A Connection to oil-to-air cooler
B Connection from oil-to-air cooler
a Supply from oil pump
b Return flow to oil pan
c Uncleaned oil to main oil duct
d Cleaned oil to main oil duct
f Connection for oil temperature gauge
g Connection for oil pressure gauge

[1]) Filter element bypass valve
[2]) Return flow check valve

Note:
The oil filter is sectioned in different planes to show its function properly. Therefore, the connections for hoses and sensors are not always shown in the correct position.

Even with the thermostat fully opened, a given oil quantity will still flow directly to oil filter element.

The oil cooler lines are screwed directly into oil filter housing.

Cup-type tappet and cam lubrication (Fig. 18/1)

The cup-type tappet and cams are lubricated in an oil sump (sump lubrication). The oil sump is filled with the oil emerging laterally on camshaft bearings (leak oil).

Oil temperature gauge

For instrument refer to Group 54.

The oil temperature is picked up on the oil filter by a temperature sensor **(67).**

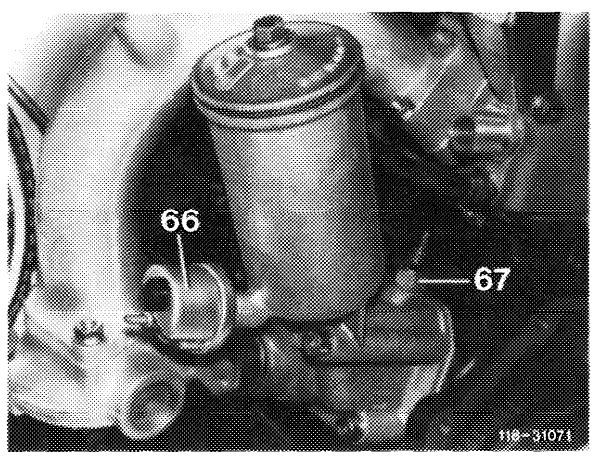


Fig. 18/3

The operating temperature of the oil is 80-l 20 °C.

An increase up to max. 150 °C is permitted. If this value is exceeded, check oil level first. Level should not be above max. mark.

Engine cooling

Coolant pump

To provide sufficient clearance for the cylinder head, the long feed connection (B, arrow) has been moved downward.

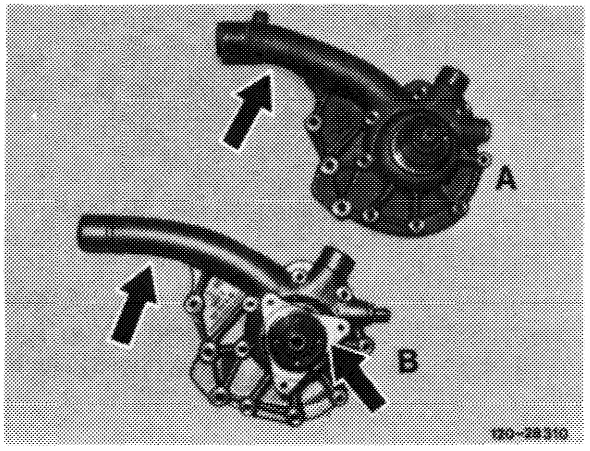


Fig. 20/1

A Coolant pump Engine 102.985

B Coolant pump Engine 102.983

Repair note

Coolant pumps are not interchangeable.

Thermostat housing and thermostat

The thermostat housing is sealed with an O-ring to the coolant return flow pipe in the cylinder head (109, Fig. 01/1 8) and is fastened by 4 screws.

Tightening torque 21 Nm.

The following temperature switches or temperature sensors are screwed into the thermostat housing:

Temperature sensor for coolant temperature gauge (B 13).

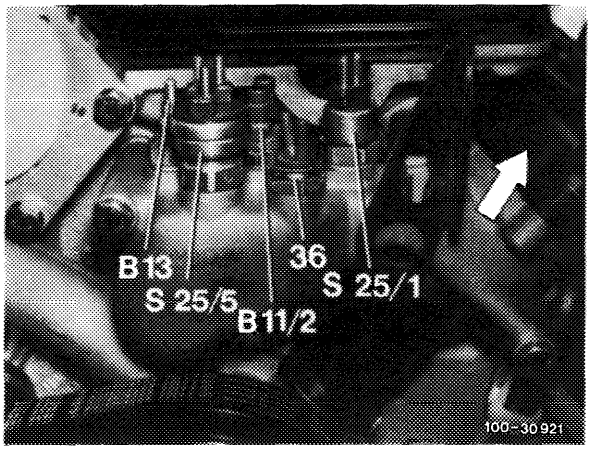


Fig. 20/2

2-pin temperature sensor for CIS-E injection and EZL ignition system (B 1 1/2).

100 °C temperature switch for fan clutch (S 25/1).

Thermovacuum valve for fuel evaporation system (38).

Temperature switch for auxiliary fan 105 °C and A/C compressor cutout at 115 °C (S 25/5).

The thermostat housing cover is made of plastic (arrow). The thermostat is the same as for the other 102 engines.

Fan clutch

Function and layout of fan clutch are the same as for fan clutch of the engine 102.985.
Diameter of the 5-blade fan is 430 mm.

Repair note

The fan cannot be interchanged with fan of other engines 102 in model 201.

Radiator

Light-alloy cross flow radiator (block depth 42 mm), with screwed on light-alloy oil-to-air cooler.

Engine mounts

All components of engine mounts are maintenance-free.

The right and left front engine mounts are the same (engine 102.985 has right and left different mounts). The rear engine mount is identical with model 201.024 with engine 102.985.

Throttle control

The throttle position is controlled by a **Bowden** cable (30) connecting the accelerator pedal to the engine.

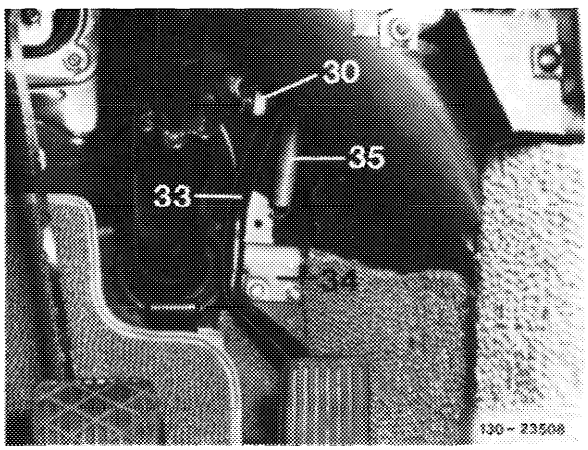


Fig. 30/1

30 Bowden cable
33 Accelerator pedal
34 Bearing
35 Return spring

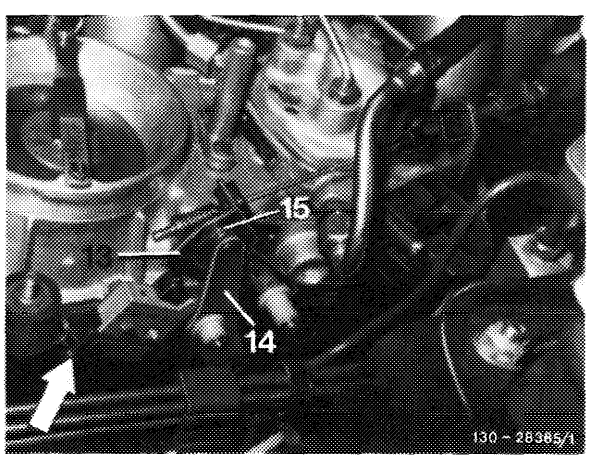


Fig. 30/2

The length of the connecting rod to the throttle valve housing is 82 ± 2 mm (measured from center of ball joint to center of ball joint).

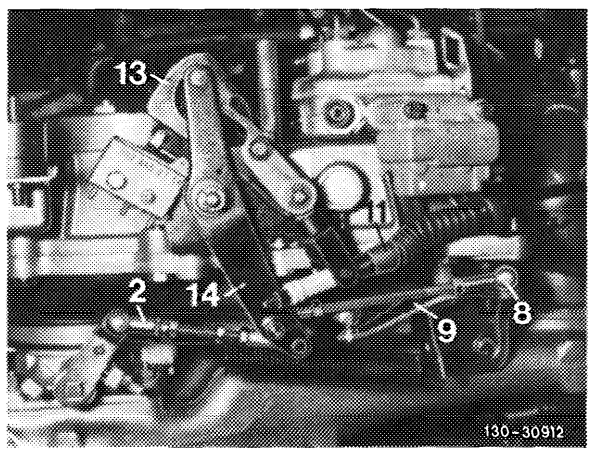


Fig. 30/3

Mercedes-Benz

Service

Service Manual
Engine 103

Mercedes-Benz of North America, Inc.

S-2421-103

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Order No. S-2421 -103

Introduction

This service manual is the product of existing technical publications. Special care has been taken to provide accurate information on removal, disassembly, inspection, Installation, and adjustment procedures, together with the necessary technical data for the particular job.

The material in this manual is divided according to the Mercedes-Benz Component Group System as outlined on the GROUP INDEX page. This page will quickly direct the reader to the Major Component Group. Each Major Component Group begins with a JOB INDEX listing all jobs within that group.

Mercedes-Benz of North America, Inc. recommends that repairs to, and maintenance of Mercedes-Benz automobiles be performed by trained Mercedes-Benz personnel at authorized Mercedes-Benz dealerships.

The information contained in this special publication is ordinarily issued by Mercedes-Benz of North America, Inc., in conjunction with supplementary service literature and special tools supplied only to its authorized dealers. The repair and maintenance procedures outlined herein are intended for use by trained Mercedes-Benz service and dealership personnel. This manual can also be useful for Mercedes-Benz owners in diagnosing vehicle systems and performing repairs. Supplementary service literature will not be provided with this publication, but may be contained in reprints of this service manual.

Please note that this manual has been compiled from various sources, some of which cover models other than the subject of this book. Always refer to the engine and vehicle identification table for model and component Information.

Special tools required in performing certain service jobs are identified in the manual and are recommended for use. Any part numbers given are only used for identification and easier differentiation between individual components, and are not intended for ordering purposes.

If your Mercedes-Benz model differs from the specifications contained in the manual you select, consult your authorized Mercedes-Benz dealer.

All procedures, illustrations and specifications contained in this manual were based on the latest information available at the time of publication. All rights are reserved to make production, design and specification changes at any time, without notice and without obligation to give notice. Any such changes will not be contained in this manual.

Caution!

The proper performance of service and repair procedures is essential for both the safety of the mechanic and the safe and efficient operation of the vehicle. The use of incorrect service procedures and tools may greatly increase the risk of personal injury and render the vehicle unsafe. The procedures in this manual are described in such a manner that the service may be performed safely and accurately.

However. it is a general assumption that the reader is familiar with basic automotive repair procedures and Mercedes-Benz vehicles. You should not attempt to use this manual if this is not the case.

Mercedes-Benz of North America. Inc. assumes no liability for any damage to person or property caused by the utilization of this publication to effect maintenance or repair work on Mercedes-Benz automobiles.

MERCEDES-BENZ OF NORTH AMERICA, INC.
Service and Parts Literature

Group Index

General, Technical Data	00
Crankcase and cylinder head	01
Crankshaft assembly	03
Engine timing, valves	05
Mechanically/electronically controlled gasoline injection system (CIS-E)	07.3
Air cleaner	09
Belt drive	13
Intake manifold, exhaust manifold	14
Electrical system, engine	15
Engine lubrication	18
Engine cooling	20
Englne suspension	22
Throttle control	30
Fuel system	47
Exhaust system	49

Job No.

Instructions for use of service manual . . . . . 00 – 005
Engine and vehicle identification . . . . . – 010
Vehicle identification number locations . . . . . – 015
Technical data . . . . . – 020

Complete Service Manual coverage for late model year Mercedes-Benz vehicles requires four individual manuals:

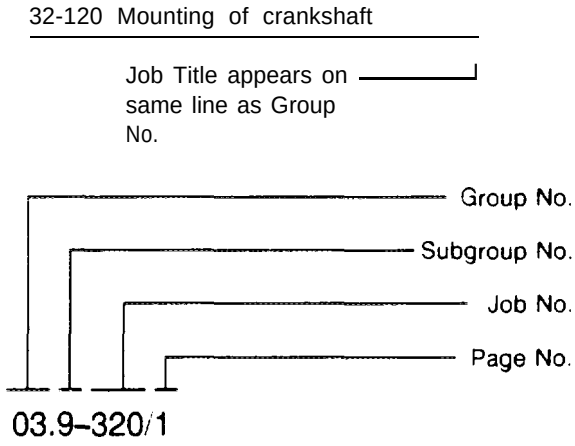
Service Manual, Engine
Service Manual, Chassis and body
Service Manual, Heating and air conditioning

Throughout these manuals. the vehicles are identified by their chassis and engine numbers. These numbers are made up of the first six digits of the respective serial number. For the actual location of chassis and engine numbers. see page 00–015/1. In case where the repair instructions apply to all versions, only the first three digits of the respective number are referenced.

For example, chassis 124 applies to all 124 models. However, chassis 124.050 would only apply to model 300 CE.

Location of specific repair instructions

First locate the **Group No. in** the Group Index. Individual groups are separated by an easily visible dividing page, which is followed by the job index page. Then check the job index for the exact job required. The first page of a typical job description looks like this:



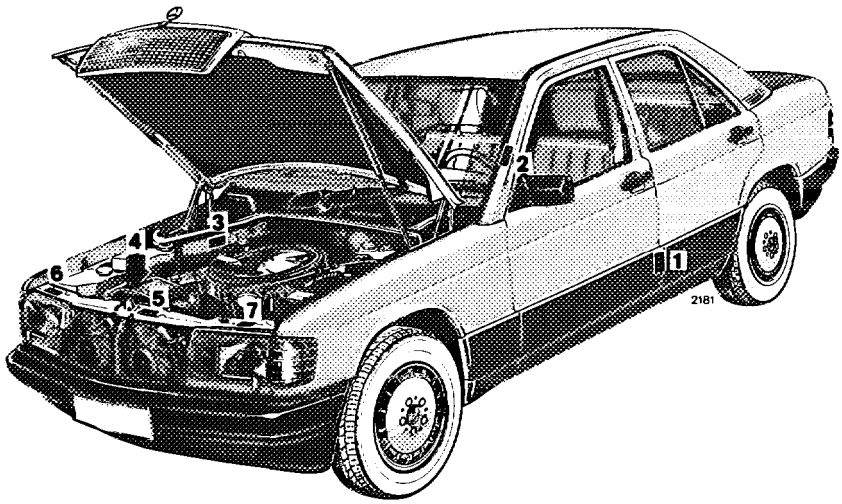
Technical data. tightening torques and tools are listed at the beginning of each job.

All dimensions are in metric units. unless otherwise Indicated. Any part numbers given are only used for identification and easier differentiation between Individual components, and are not Intended for ordering purposes.

Engine	Model	Sales designation	Power in kW at rpm	Compression ratio
103.940	124.026	260 E	11815800	9.2:1
103.942	201.029	190 E 2.6	118/5800	9.2:1
103.981	126.024	300 SE	132/5700	9.2:1
103.981	126.025	300 SEL	132/5700	9.2:1
103.982	107.041	300 SL	132/5700	9.2:1
103.983	124.030	300 E	132/5700	9.2:1
103.983	124.050	300 CE	132/5700	9.2:1
103.983	124.090	300 TE	132/5700	9.2:1
103.985	124.230	300 E 4MATIC	13215700	9.2:1
103.985	124.290	300 TE 4MATIC	132/5700	9.2:1

Model 201

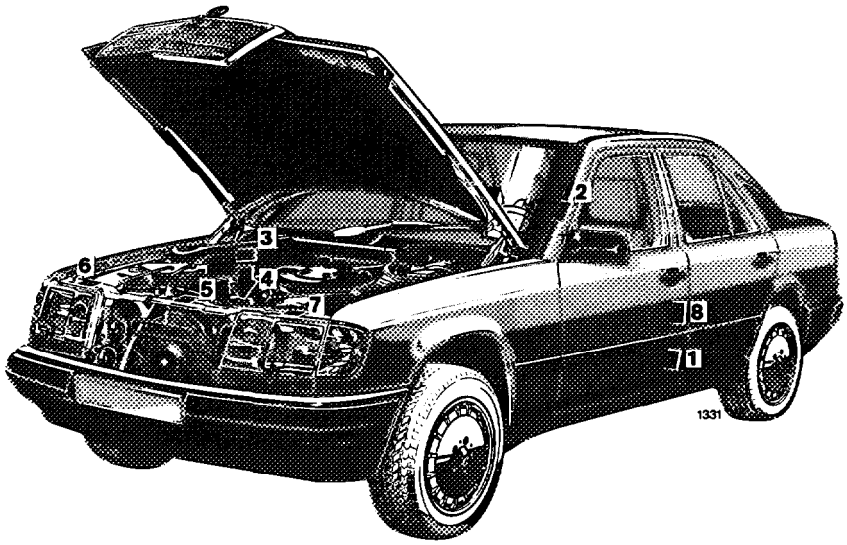
When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left windshield post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag

Model 124 (4MATIC similar)

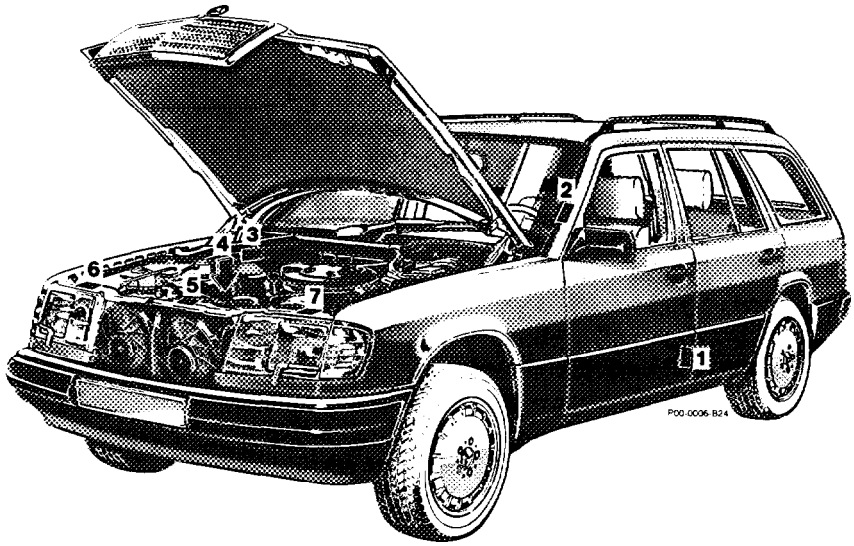
When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag
8 Emission Control Tag
Catalyst Information

Model 124 TE (4MATIC similar)

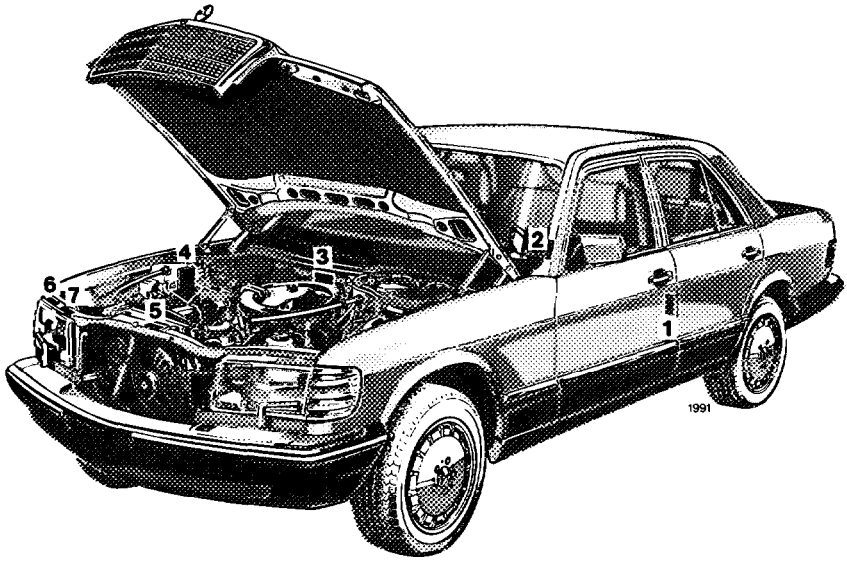
When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left windshield post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag

Model 126 (SEL, SE similar)

When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Emission Control Tag
7 information Tag
California version
Vacuum line routing
for emission control system

Gasoline engines

Model	124.026	201.029	126.024	126.025
Sales designation	260 E	190 E 2.6	300 SE	300 SEL
Engine	103.940	103.942	103.981	103.961
Operation	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle. electronic, mechanical gasoline injection system with airflow sensor (CIS-E)
Number of cylinders	6	6	6	6
Cylinder arrangement	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination
Bore/stroke mm	82.9/80.25	82.9/80.25	88.5/80.25	88.5/80.25
Total effective piston displacement cc	2599	2599	2962	2962
Compression ratio	9.2	9.2	9.2	9.2
Firma order	I-5-3-6-2-4	I-5-3-6-2-4	I-5-3-6-2-4	I-5-3-6-2-4
Maximum speed rpm	6550 ± 50	6550 ± 50	6350 ± 50	6350 ± 50
Engine output (SAE)kW/rpm net bhp/rpm	118/5800 158/5800	118/5800 158/5800	132/5700 177/5700	132/5700 1 77 5700
Maximum torque Nm/rpm net lb-ft./rpm	220/4600 1624400	220/4600 162/4400	255/4400 188/4400	2554400 1664400
Crankshaft bearings	7	7	7	7
Valve arrangement	Overhead	Overhead	Overhead	Overhead
Camshaft arrangment	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft
Oil cooling	-	-	-	-
Cooling	Coolant circulating pump, thermostat with bypass line. fan with visco fan clutch. finned tube radiator	Coolant circulating pump, thermostat with bypass line. fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line fan with visco fan clutch. finned tube radiator
Lubrication	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump
Oil filter	Full flow filter	Full flow filter	Full flow filter	Full flow filter
Air cleaner	Dry paper cartridge	Dry paper cartridge	Dry paper cartridge	Dry paper cartridge

Gasoline engines

Model	124.030	124.050	124.090
Sales designation	300 E	300 CE	300 TE
Engine	103.983	103.983	103.983
Operation	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system with airflow sensor (CIS-E)
Number of cylinders	6	6	6
Cylinder arrangement	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination
Boreistroke mm	88.5/80.25	88.5/80.25	88.5/80.25
Total effective piston displacement cc	2962	2962	2962
Compression ratio	9.2	9.2	9.2
Firing order	I-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4
Maximum speed rpm	6350 ± 50	6350 ± 50	6350 ± 50
Engine output (SAE)kW/rpm net bhp/rpm	132/5700 177/5700	13215700 177/5700	13215700 17715700
Maximum torque Nm/rpm net lb-ft./rpm	255/4400 188/4400	25514400 188/4400	25514400 1 88/4400
Crankshaft bearings	7	7	7
Valve arrangement	Overhead	Overhead	Overhead
Camshaft arrangment	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft
Oil cooling	-		-
Cooling	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator
Lubrication	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump
Oil filter	Full flow filter	Full flow filter	Full flow filter
Air cleaner	Dry paper cartridge	Dry paper cartridge	Dry paper cartridge

Gasoline engines

Model	124.230	124.290
Sales designation	300 E 4MATIC	300 TE 4MATIC
Engine	103.985	103.985
Operation	4-cycle, electronic1 mechanical gasoline injection system with airflow sensor (CIS-E)	4-cycle, electronic/ mechanical gasoline injection system withairflow sensor (CIS-E)
Number of cylinders	6	6
Cylinder arrangement.	In-line 15° inclination	In-line 15° inclination
Bore/stroke mm	88.5/80.25	88.5/80.25
Total effective prston displacement cc	2962	2962
Compressron ratro	9.2	9.2
Firing order	I-5-3-6-2-4	I-5-3-6-2-4
Maximum speed rpm	6350 ± 50	6350 ± 50
Engine output (SAE)kW/rpm net bhp/rpm	1325700 17715700	13215700 17715700
Maximum torque Nmirpm net lb-ft./rpm	25514400 188/4400	25514400 18814400
Crankshaft bearings	7	7
Valve arrangement	Overhead	Overhead
Camshaft arrangment	1 overhead camshaft	1 overhead camshaft
Oil cooling		
Cooling	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator
Lubrication	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump
Oil filter	Full flow filter	Full flow filter
Air cleaner	Dry paper cartridge	Dry paper cartridge

00-020 Technical data

Electrical system

Model	124.026	201.029	126.024 126.025	124.030, 124.050 124.090	124.230 124.290
Sales designation	260 E	190 E 2.6	300 SE 300 SEL	300 E 300 CE 300 TE	300 E 4MATIC 300 TE 4MATIC
Engine	103.940	103.983	103.981	103.983	103.985
Battery Voltage Capacity	 12 v 62 Ah	 12 v 62 Ah	 12 V 62 Ah	 12 V 62 Ah	 12 V 62 Ah
Starter Bosch	12 v 1.7 kW	12 v 1.7 kW	12 v 1.7 kW	12 v 1.7 kW	12 v 1.7 kW
Alternator	14 V 80 A	14V 80A	14 V 80 A	14V 80A	14 V 80 A

Filling capacities

Model	124.026	201.029	126.024	126.025
Sales designation	260 E	190 E 2.6	300SE	300 SEL
Engine	103.940	103.942	103.981	103.981
Fuel tank/reserve approx. l	70/9.0	55/6.0	90/12.5	90/12.5
Engine oil initial filling approx. l	6.5	6.5	6.5	6.5
During oil and filter change approx. l	6.0	6.0	6.0	6.0
Marks on dipstick max./min. approx. l	5.7/3.7	5.7/3.7	5.7/3.7	5.7/3.7
Cooling system with heater approx. l	9.0 (MY1987) 10.0 (MY1988-up)	10.0	10.0	10.0

Filling capacities (continued)

Model	124.030	124.050	124.090	124.230	124.290
Sales designation	300 E	300 CE	300 TE	103.985	103.985
Engine	103.983	103.983	103.983	300 E 4MATIC	300 TE 4MATIC
Fuel tank/reserve approx. l	70/9.0	70/9.0	72/9.0	70/9.0	72/9.0
Engine oil initial filling approx. l	6.5	6.5	6.5	6.5	6.5
During oil and filter change approx. l	6.0	6.0	6.0	6.0	6.0
Marks on dipstick max./min. approx. l	5.7/3.7	5.7/3.7	5.7/3.7	5.7/3.7	5.7/3.7
Cooling system with heater approx. l	8.0 (MY1986) 9.0 (MY1987) 10.0 (MY1988-up)	10.0	10.0	10.0	10.0

Job No.

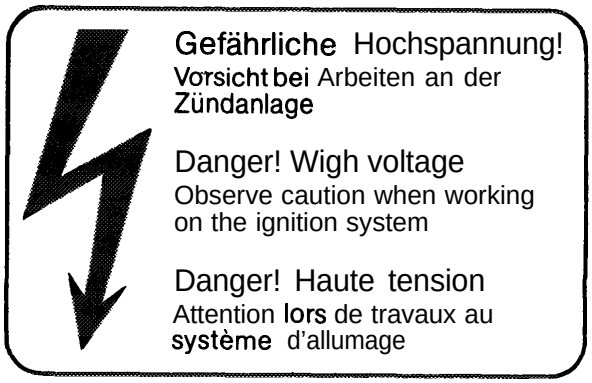
Engine and model survey . . . . . 01 – 001
Opening hood, setting vertical warnings . . . . . 01 – 008
Testing compression pressure . . . . . – 010
Testing cylinders for leaks . . . . . – 015
Draining, replacing engine (oil capacities) . . . . . – 030
Replacing freeze plug in engine block . . . . . – 140
Removing, installing timing cover . . . . . – 210
Removing, installing top front cover . . . . . – 212
Removing, installing rear main seal cover . . . . . – 222
Removing, installing oil sump or front axle housing (4MATIC) . . . . . – 310
Removing, installing cylinder head . . . . . – 415

⚠

There is risk of injury whenever the engine is running and the hood is open.
The engine is equipped with an electronic ignition system. Because of the high voltage ignition, it is very dangerous to touch ignition system components (ignition coil, distributor, cables, spark plug connector, test socket) if

- the engine is running, or
- the engine is cranked, or
- the key is in position 2 in the steering lock, and the crankshaft is turned by hand.

Observe these cautions when working on the breakerless, solid-state ignition system (15-505).

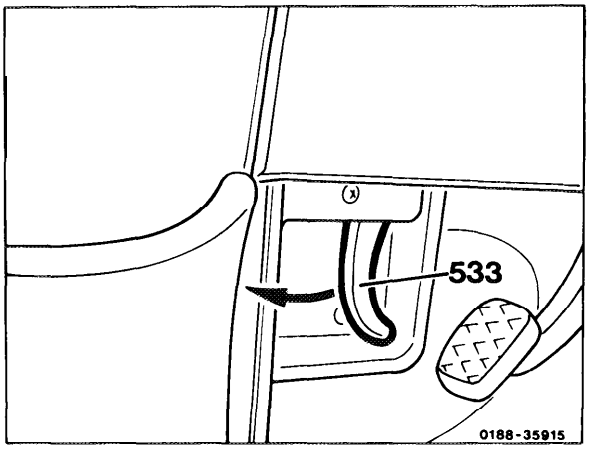


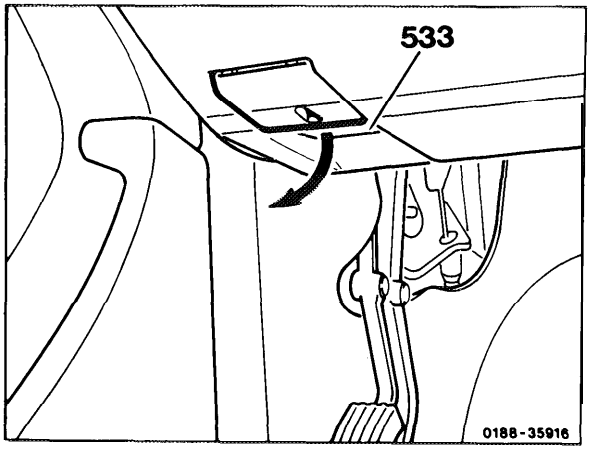
1154-9352

Opening hood

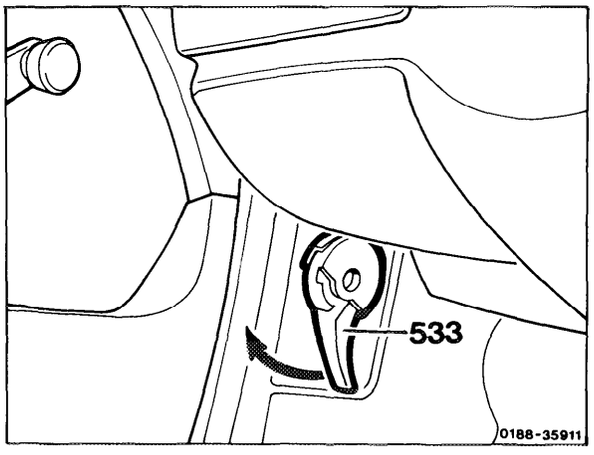
1 To unlock the hood, pull the lever (533) on the left below the instrument panel in the direction of the arrow. The hood opens to the safety hook stop.

Model 107
Model 126





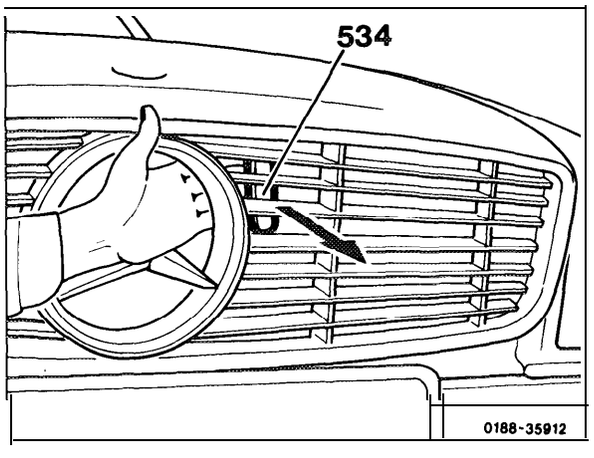
Model 124



Model 201

Model 107

2 Reach through the opening in the grille star and push the lever (534) behind the grille in the direction of the arrow. Open the hood to the stop.



Note:

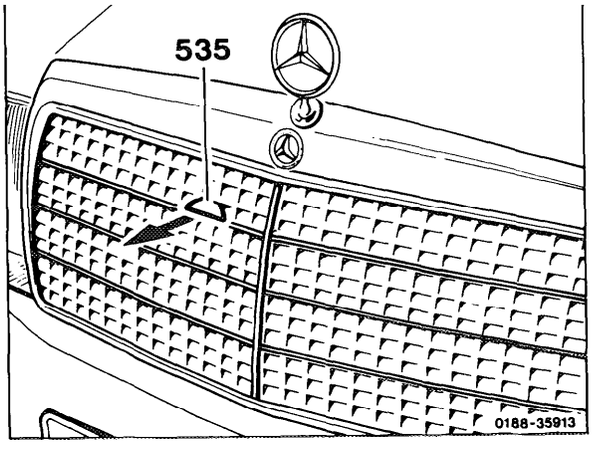
The windshield wiper arm must not be pivoted forward when the hood is lifted.

The **hood on this model cannot be moved into the vertical position.**

3 Close hood by pushing down forcibly.

Model 124, 126, 201

4 Pull the handle (535) extending from the grille as far as the stop and open hood (it may be necessary to lift the hood slightly to release the handle).



Note

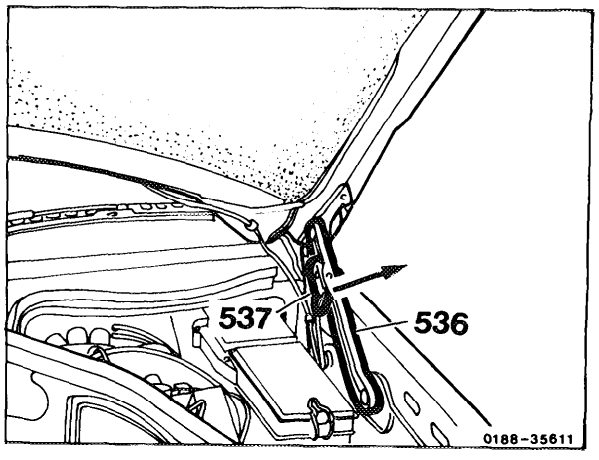
Do not attempt to lift the hood with handle (535).

The windshield wiper arm must not be pivoted forward when the hood is lifted.

Moving hood into vertical position

Model 124 (production up to August 1968)

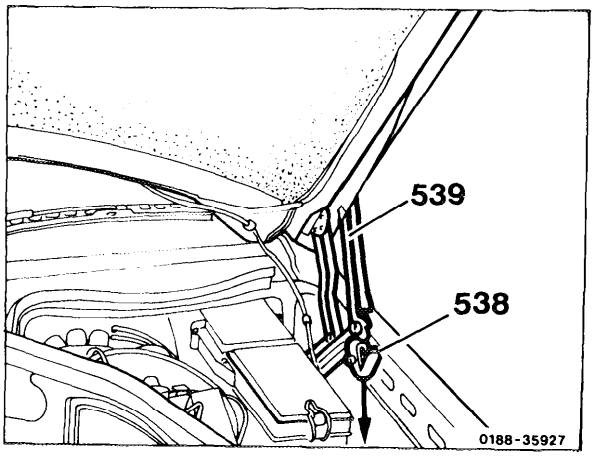
5 Push lock lever (537) on the left hood support (536) in direction of arrow. Lift hood slightly upward to keep the lock lever (537) from reengaging again.
Repeat the preceding at the right hood support and set the hood in a vertical position.



6 To close the hood, push in lock lever at the right hood support, and close the hood by pushing down forcibly.

Model 126

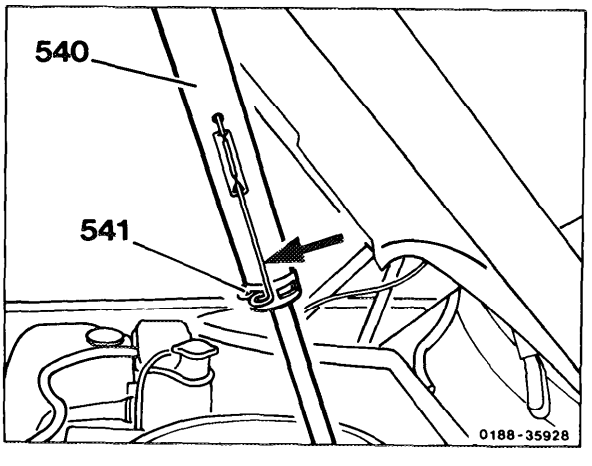
7 Push hood down slightly. Push lock lever (538) on the left hood support (539) down *in* the direction of the arrow. Push hood up slightly to keep the lock lever (538) from reengaging.
Repeat the preceding at the right hood support and set the hood in a vertical position.



8 To close the hood, push the lock lever (538) at the left hood support in the direction of the arrow, and close the hood by pushing down forcibly .

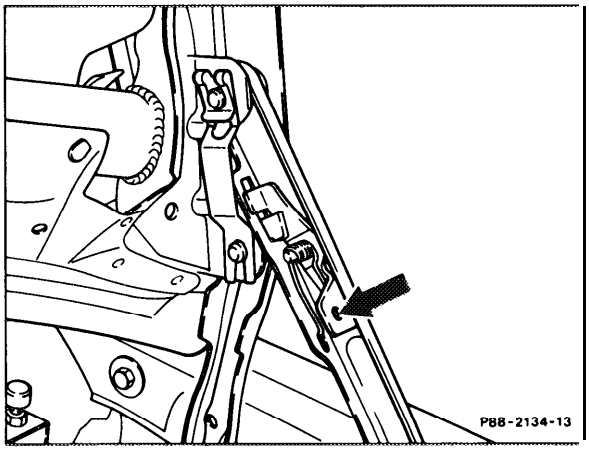
Model 201

9 Pull lock (541) on hood damper (540) in direction of arrow and set the hood in a vertical position.



10 When the hood is set vertical, a lock engages on the left hood support.

11 Close hood. Push in the lock lever (arrow) and close the hood by pushing down forcibly.



Job No. of job texts and job values or standard texts and fiat rates 01-1200

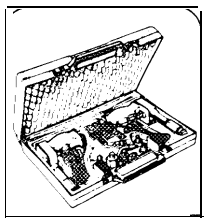
Model 124
Model 129

Test data for engine at normal operating temperature		Pressure
Minimum compression pressure at	Normal compression	approx. 12 bar
	Low compression	approx. 7.5 bar
Allowable difference between cylinders		max. 1.5 bar

Tightening torque

Spark plugs	20 Nm

Special tools



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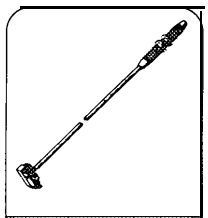

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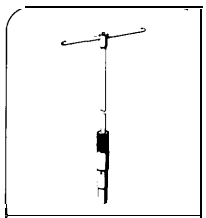

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Note

Test compression pressure at normal operating temperature.

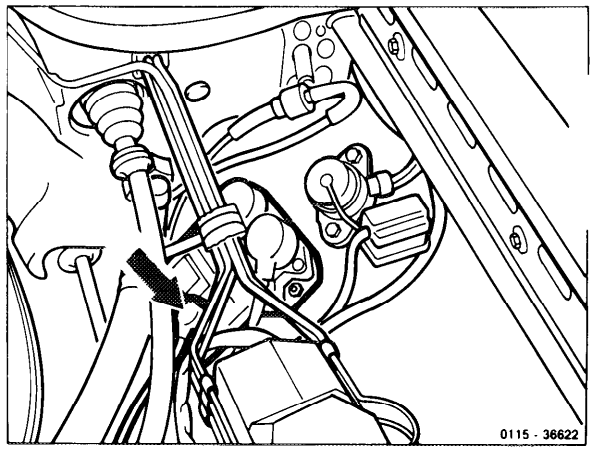
If the pressure reading is below the minimum compression pressure, test cylinders for leaks (01-015).

During the test, have all spark plugs removed.

1 Set hood vertical (01-008).

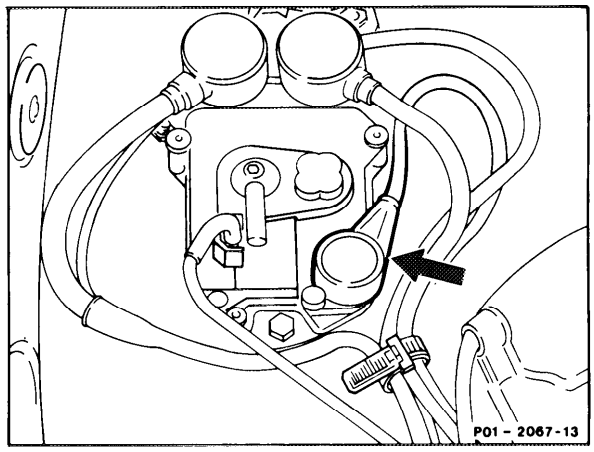
Model 124

2 Turn ignition off and unplug the connector (arrow) for the distributor inductive pickup (green cable) at the control unit.



Model 129

3 Turn ignition off and unplug the connector (arrow) for the distributor inductive pickup (green cable) at the control unit.



4 Unplug all spark plugs.

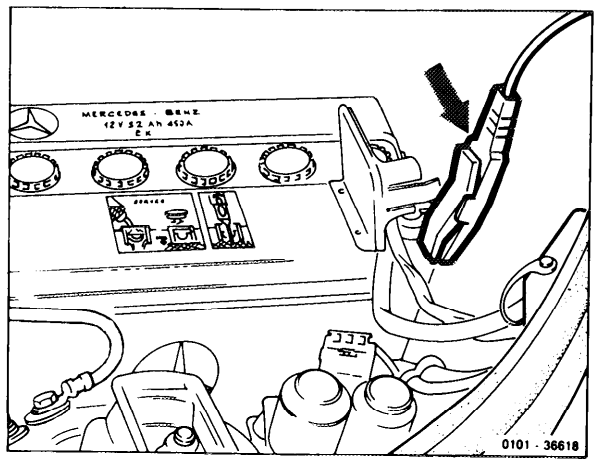
5 Blow out spark plug recesses with compressed air.

6 Remove spark plugs.

Connecting compression pressure recorder

Model 124

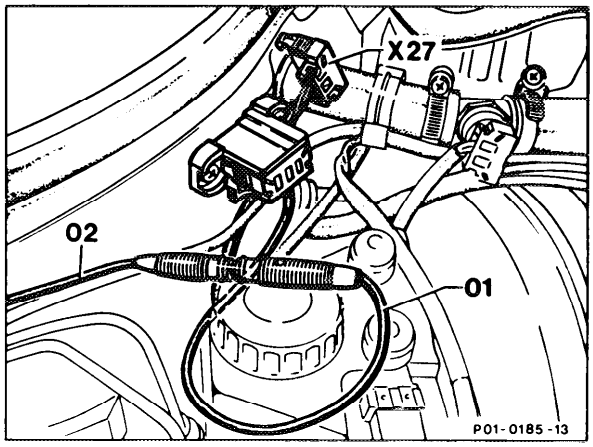
7 Connect an alligator clamp (arrow) from the compression pressure recorder (001 589 76 21 00) to the battery positive cable.



8 Unplug connector (X27) from connector (50).

9 Fit plug (63) of adapter cable
01 124 589 36 63 00 to connector (50).

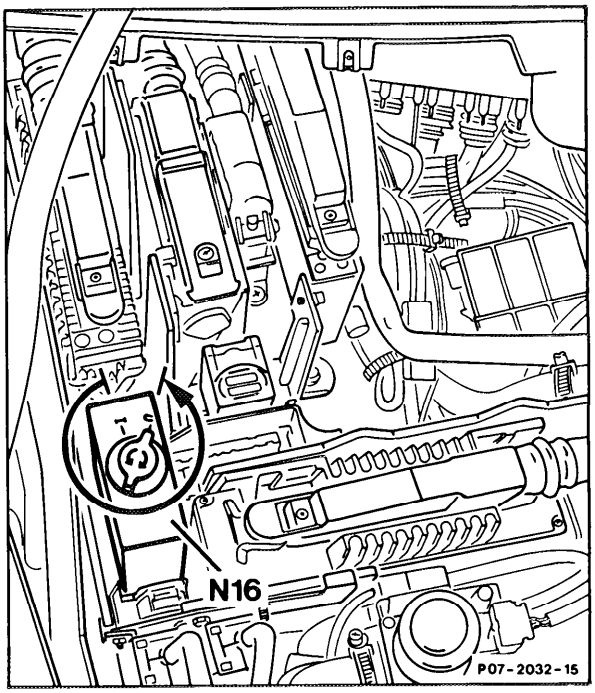
10 Connect adapter cable (01) to the compression pressure recorder cable (02).



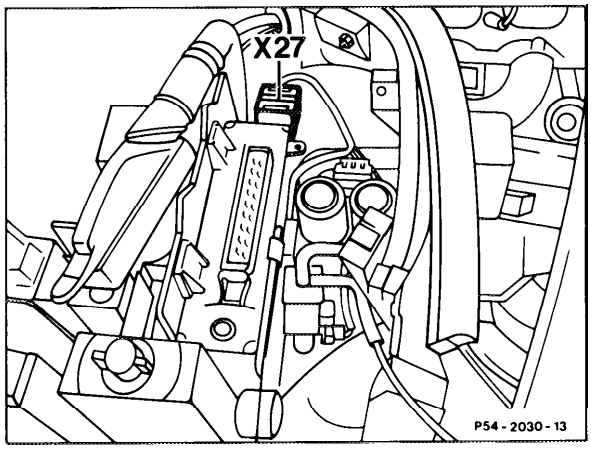
Model 129

11 Remove cover of component compartment.

12 Remove engine component control unit by turning the knob counterclockwise from position 1 to position 0, and remove the control unit upward.

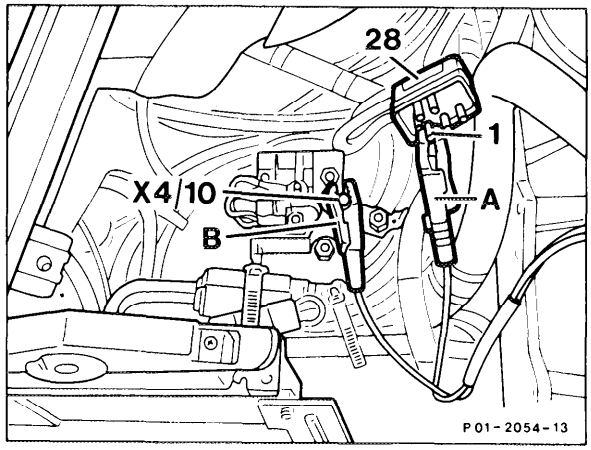


13 Unplug connector (28) at connection (X27).



14 Connect terminal (A) to pin 1 on the connector (28).

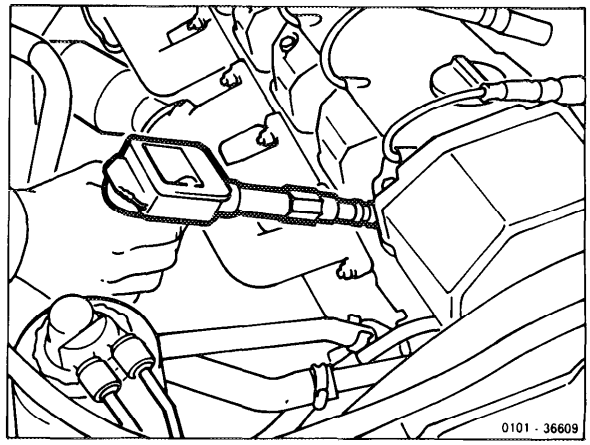
15 Connect terminal (B) to terminal block (X4/10).



Testing

16 With the throttle in the idle position and the parking brake applied, crank the engine with the starter several times to eject debris and soot.

17 Insert the diagram sheets in the compression pressure recorder and start with cylinder 1.



18 To test a specific cylinder, press the compression pressure recorder into the spark plug bore of the cylinder tested, and crank engine through approx. 8 compression strokes. Keep the throttle wide open during the test.

Test all the cylinders this way.

19 Blow out the spark plug recesses with compressed air. Remove residues on the tapered seat.

20 Thread in the spark plugs and tighten to 20 Nm.

01-015 Testing cylinders for leaks

Job No. of job texts and job values or standard texts and fiat rates 01-1300

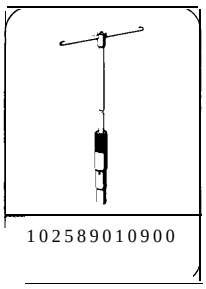
Data

Total pressure loss	max. 25 %
Through valves and cylinder head gasket	max. 10 %
Through pistons and piston rings	max. 20 %

Tightening torque

Spark plugs	20 Nm

Special tools



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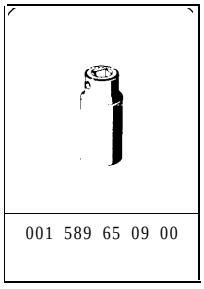


001 589 65 09 00

Commercial tool

Cylinder leak tester	e. g. Bosch, EFAW 210 A Sun, CLT 228

Testing

1 Run engine until it is at normal operating temperature.

2 Blow out spark plug recesses with compressed air.

3 Remove spark plugs.

Reinstallation note:

Retighten spark plugs to 20 Nm at the completion of the test.

4 Top up coolant and leave coolant expansion tank cap open.

5 Remove oil filler cap.

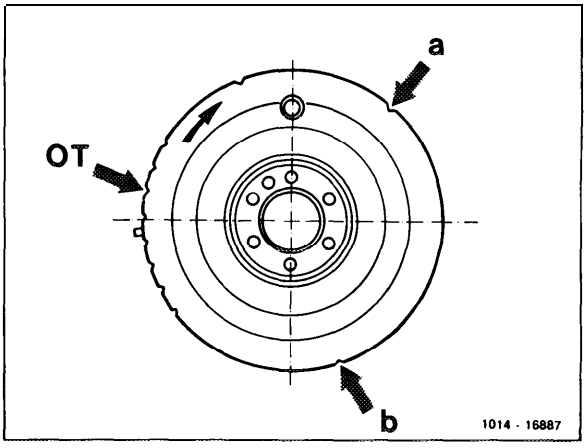
6 Remove air filter (09-400).

7 Connect cylinder leak tester to a compressed air source and calibrate tester.

8 Position the piston of cylinder No. 1 to compression stroke TDC.

A piston is at compression stroke TDC only if its mark (arrows) on the vibration damper, shown in the drawing, is aligned with the TDC pointer and if the distributor rotor points to that cylinder's electrode.

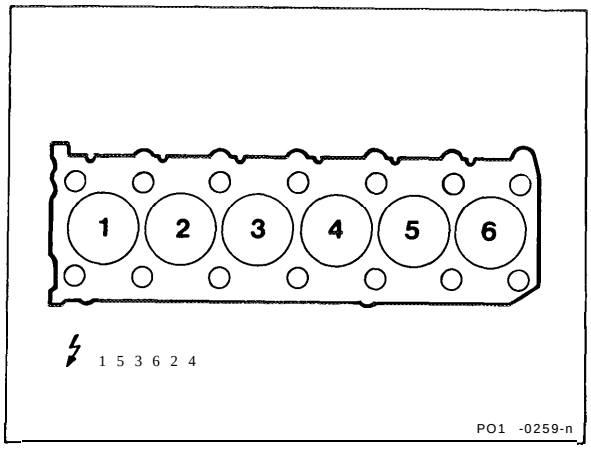
Marking	TDC	b = 120°	a = 240°
Piston in TDC Cylinder	1 or6	2 or 5	3 or 4



9 Thread the connector hose into spark plug hole # 1 and tighten, attach the connector hose of the tester.

Warning:

Keep hands and tools away from the radiator fan and all belts and pulleys during the next step. Pressurize that combustion chamber (approx. 5 bar applied air pressure). The crankshaft must not move during this step. If it does, the piston was not at TDC.



10 Read pressure loss on tester (in %).

11 Move throttle to wide open.

12 Listen to determine whether pressure escapes through the intake manifold, the exhaust, the oil filler opening, a spark plug hole of an adjacent cylinder or the coolant filler opening.

13 Continue test for each cylinder in the engine's firing order (l-5-3-6-2-4).

Note:

It is possible by spraying oil over the piston crown to determine whether the piston rings leak. The oil can temporarily seal the rings, but would have no sealing effect on valves or head gasket leaks.

01-030 Draining, replacing engine (oil capacities)

Job No. of job texts and job values or standard texts and flat rates. 01-2400, 01-2800

A. Models 124 and 124 4MATIC

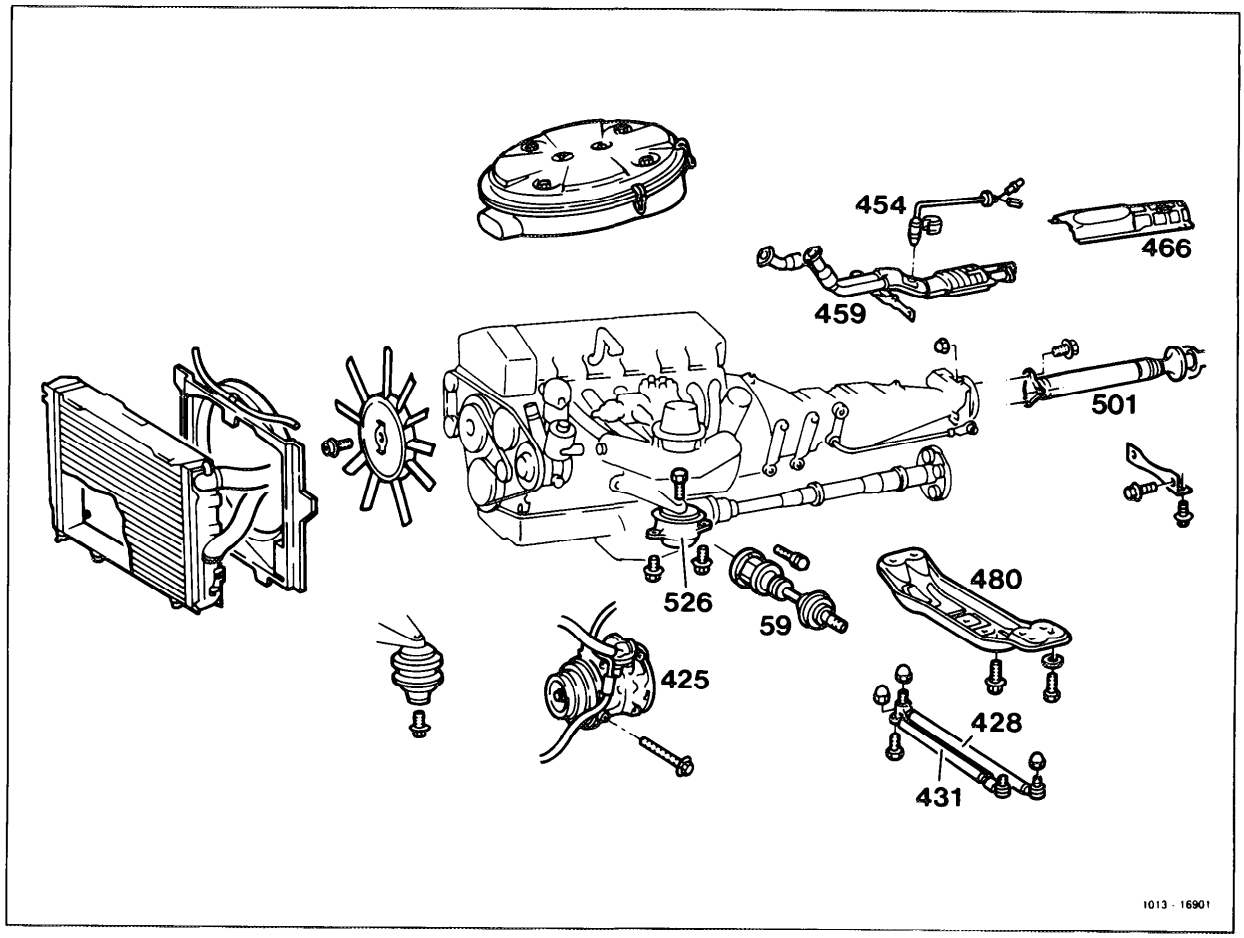


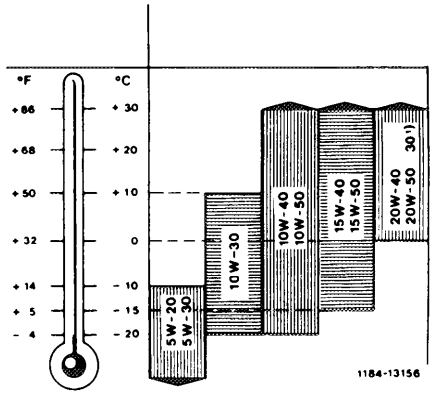
Illustration shows Model 124 4MATIC

Hood	set vertical (0 l-008).
Battery ground cable	disconnect, connect.
Lower engine compartment covering	remove, install (step 3).
Air filter	remove, clean and install (09-400) .
Radiator	remove, install (20-420).
With air conditioning	attach guard plate to condenser, remove and install poly V-belt (13-342).
Viscous fan clutch	remove, install (20-312).

Power steering pump/tandem pump	extract oil from reservoir, top up oil to correct level (46-710).
Oil lines	detach, attach (step 13).
With air conditioning	detach refrigerant compressor (425) with manifold connected, set aside, attach (step 14).
Hydraulic system, high-pressure expansion hose (4MATIC)	vent pressure, move lever on service valve to test position, unbolt and bolt on.
Fuel lines	detach, connect and seal, open fuel filler cap briefly first (step 15).
Bowden cable (accelerator)	detach, attach (30-325) (step 16).
Electrical connections and engine wiring harness	detach, reconnect (steps 17 and 18).
Heating water return line	detach, reconnect.
Oxygen sensor (454)	remove, install (step 27).
Exhaust system and heat shield over exhaust system	remove, install (49-100).
Crossmember (4MATIC)	remove, install (step 29).
Flexible joint on propeller shaft (501)	detach, attach, replace self-locking nuts (step 30).
Clamping nut and center bearing support	slacken, tighten (steps 31 and 32).
Transmission linkage	detach, reconnect (steps 36 and 37).
Starter lockout switch (automatic transmission)	unlock, unplug and reconnect connector (step 37).
Clutch hydraulic line	unbolt, reconnect (step 38).
Center link (428) with steering damper (431)	remove, reinstall, replace self-locking nuts and bolts (46-550).
Front axle shafts (59) left, right (4MATIC)	detach, attach on inside and suspend joints with wire (step 40).
Engine hoist to suspension lugs	connect, disconnect (step 41).
Transmission	support.
Guard plate at component compartment wall	insert, remove.
Rear engine mount (480) without engine mounts	remove, install (steps 44 and 45).
Front engine mounts (526 or 522) left and right	unbolt, install from below (step 46).

Engine with engine hoist	raise, lower (step 47).
Engine mounts, front and rear	check.
Coolant, oil and fuel hoses	check.
With automatic transmission	adjust control pressure cable (27-l 00).
Engine idle speed	check and adjust (017.3-l 00).
Oil drain plugs	check torque.
Oil level in engine and in transmission	adjust to correct level.
Coolant	top up, check anti-corrosion/antifreeze protection and correct (20-010).
Hydraulic system (4MATIC)	bleed (steps 56 to 60).

Specified viscosity classes according to SAE at extended outside temperatures



1) At extended outside temperature above + 30 °C SAE 40 may be used.
Precise use of the SAE classes according to the outside air temperatures would necessitate frequently changing engine oil. The temperature limits for the SAE classes should therefore be regarded as a guide which may be transgressed for brief periods.
In moderate climatic zones SAE 40 may be used from April onward for all engine versions.
The following oils may be used as an all-season oil for all gasoline engines

SAE 10 W-40 and SAE 10 W-50	
SAE 5 W-20	below + 10 °C
SAE 5 W-30, 10 W-30	all-year-round in moderate climatic zones, i.e. up to + 30 °C
SAE15 W-30	all-year-round in moderate climatic zones

Vehicle components and their respective lubricants must match. Therefore use only brands tested and recommended by us. Inquire at your authorized MERCEDES-BENZ dealer.

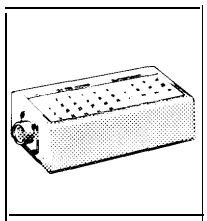
Oil capacities (refer to Service Product Specifications for approved engine oils)

Engine capacity at first filling or after overhaul	7.0 l
Engine capacity when changing oil and filter	6.5 l
Steering gear oil (automatic transmission fluid (ATF) or manual transmission oil)	approx. 0.6 l
Hydraulic oil for self-levelling suspension (refer to Service Product Specifications sheet 343)	approx. 2.0 l

Tightening torques

Driveshaft center bearing to chassis	25 Nm
Air conditioning compressor to engine block	25 Nm
Crossmember to chassis, 4MATIC	25 Nm
Fiexible coupling to driveshaft	45 Nm
Steering damper to center link and chassis	50 Nm
Center link to Pitman arm	35 Nm
Front axle shafts to inboard flange, 4MATIC	70 Nm
l-ligh-pressure expansion hose to tandem pump	30 Nm
Return line to tandem pump	40 Nm
Clamping nut to driveshaft	35 Nm
Engine mount front to engine support	55 Nm
Engine mount front to body, 4MATIC	20 Nm
Engine mount rear to transmission	45 Nm
Engine mount rear to engine mount bow	45 Nm
Engine mount rear to engine support	20 Nm
Engine support rear to chassis	40 Nm

Special tools



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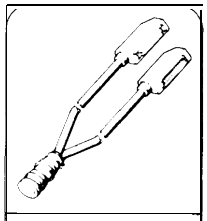

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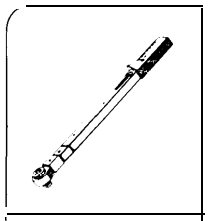

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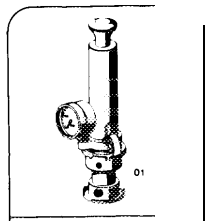

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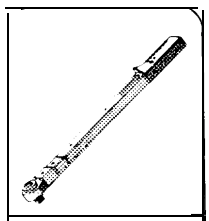

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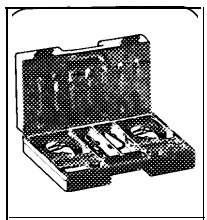

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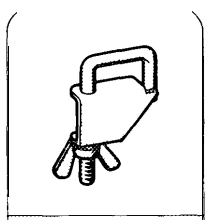

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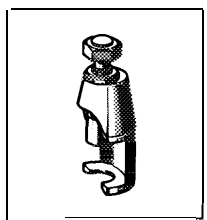

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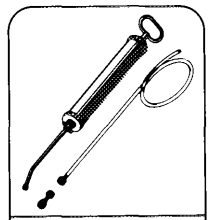

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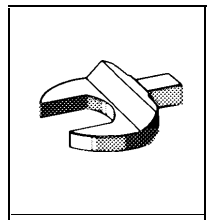


126 589 00 01 00

Commercially available tools

Engine hoist No. 3188 self-locking	e. g. Backer Herder Str. D-5630 Remscheid
Anti-corrosion/antifreeze tester Preston-VU-Check	e. g. Philipp Gather D-4020 Mettmann 2

Shop-made tools

Guard plate for radiator/condenser	Dimensions approx. 480 × 600 × 1
Metal panel for component compartment wall	Dimensions approx. 320 × 380 × 1

Note

Remove and install the engine with transmission attached, with 4MATIC with transfer case and front propeller shaft.

4MATIC reconditioned engines are supplied with an oil pan for shipping. This must be replaced with the original (01-310).

⚠

Do not strike or place a load on lube oil line at the transfer case when engine is positioned at an angle because this can cause it to leak.

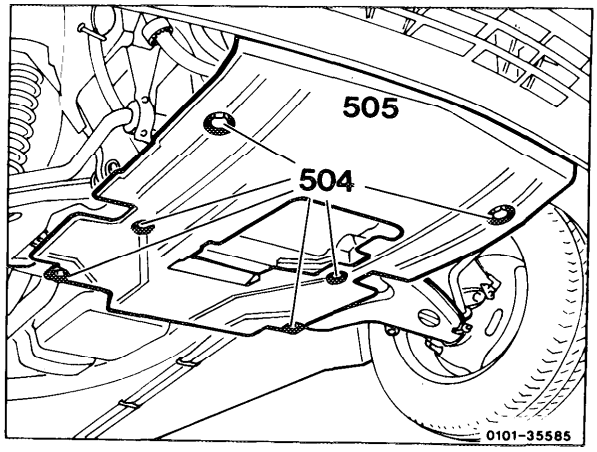
Removal, installation

1 Set the hood vertical (01-008).

2 Disconnect battery ground cable from the battery.

3 Unscrew bolts (504) and remove bottom engine compartment covering (505).

4 Remove air filter (09-400).

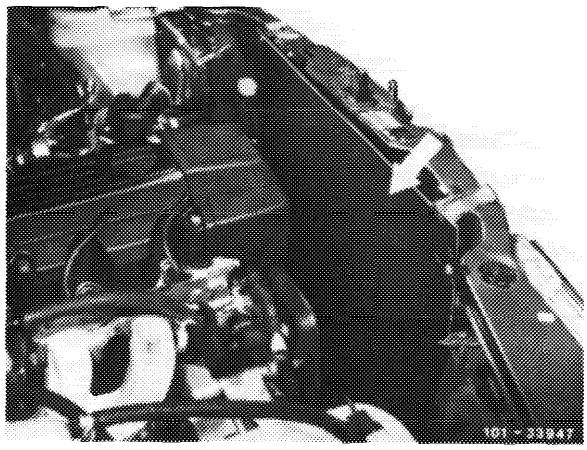


Reinstallation note:

Clean the air filter.

5 Remove radiator (20-420).

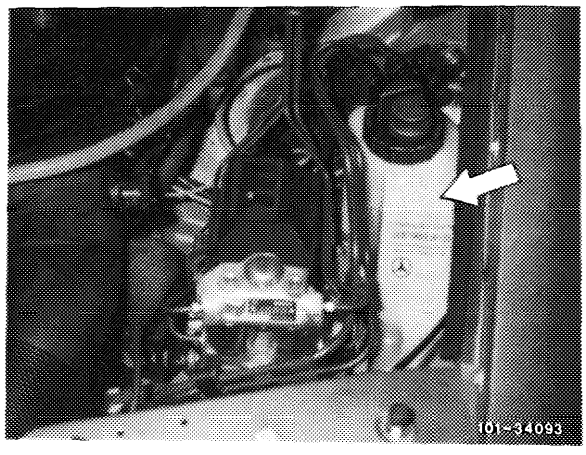
6 With air conditioning: Attach guard plate (arrow) to a/c condenser



7 With air conditioning: Remove poly-V-belt (13-342).

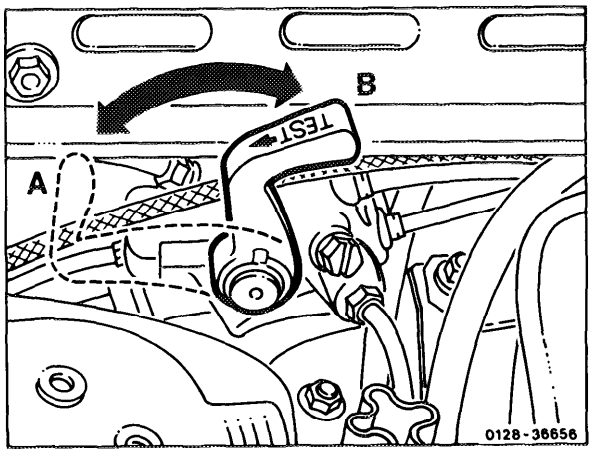
8 Remove viscous fan clutch (20-312).

9 4MATIC: Unclip oil hose at bottom of hydraulic oil reservoir (arrow) and detach at tandem pump.

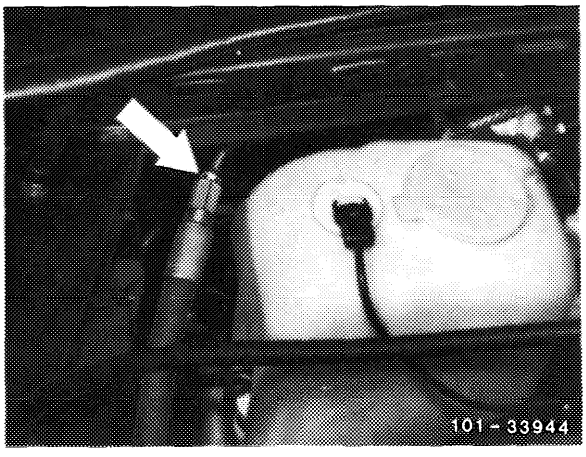


10 4MATIC: Release hydraulic system pressure by moving lever to test position on service valve.

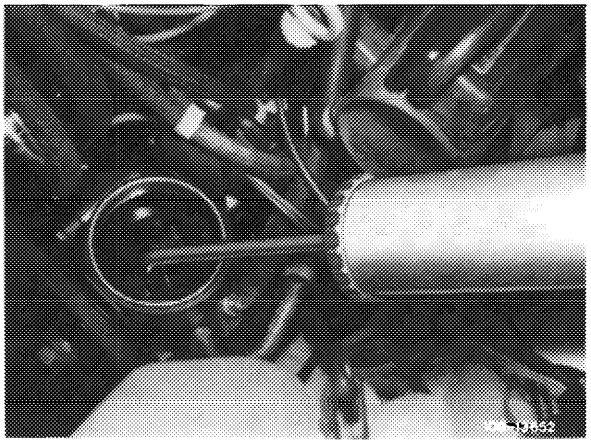
A Test position
B Operate position



11 Detach threaded connector (arrow) at high-pressure expansion hose.

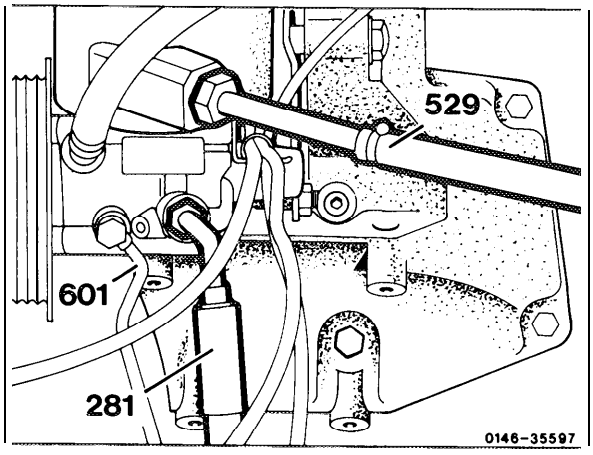


12 Draw oil from the reservoir of the tandem pump with a suction pump.



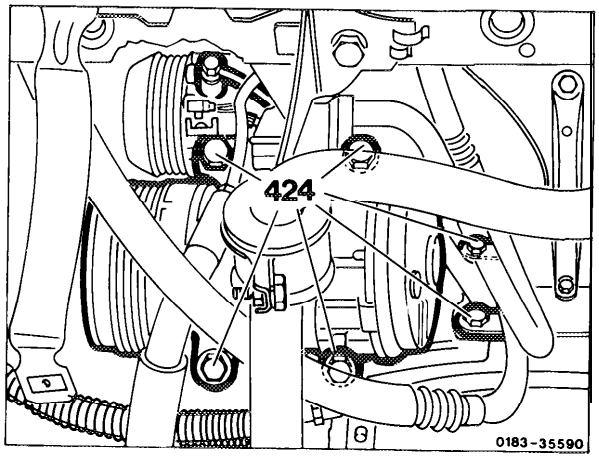
Installation note:
Check power steering oil level. Fill power steering system with the specified oil. With the engine running, top oil up to the mark. Turn steering several times from full lock to full lock. When the oil is at normal operating temperature, level is approx. 20 mm below the edge of reservoir, if the oil is cold it should be 6 – 8 mm below the mark (46-710).

13 Disconnect oil lines (281, 529) to steering gear and oil line (601) for self-levelling suspension at the tandem pump.

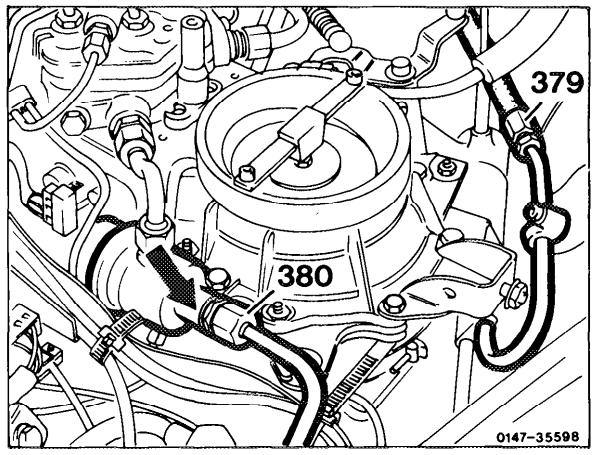


Installation note:
Replace seals.
High-pressure expansion hose (281) tightening torque 30 Nm.
Return line (529) tightening torque 40 Nm.

14 Detach air conditioning compressor from engine.
Remove bolts **(424),** tightening torque 25 Nm.
Secure air conditioning compressor with manifold connected at the bottom of the engine compartment to the side.

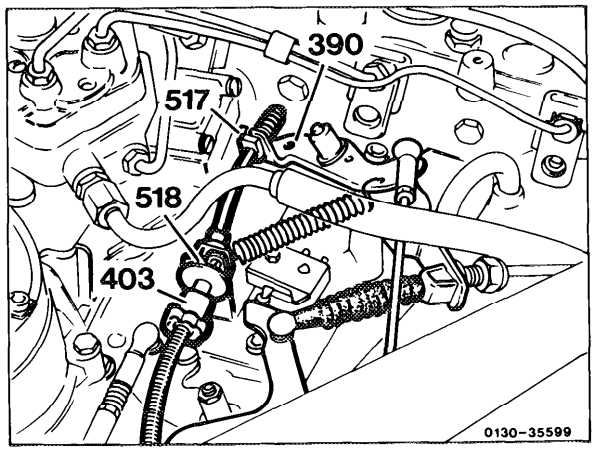


15 Briefly open the fuel filler cap to vent the fuel tank pressure.
Disconnect the fuel lines (380, 379).
Keep the connector fitting from turning (arrow) when detaching the fuel line (380).

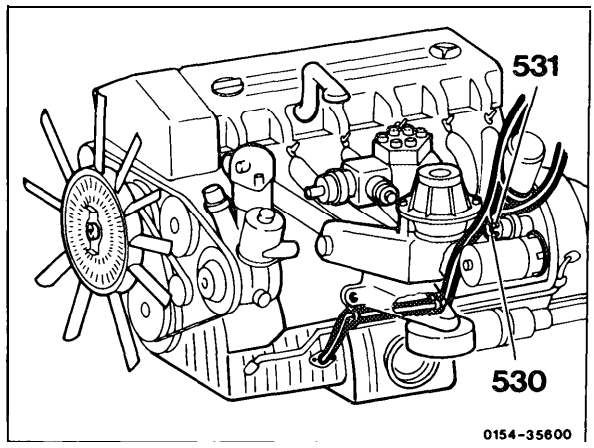


16 Detach the accelerator Bowden cable. Press plastic guide (517) out of its seat in the fulcrum lever (390) and withdraw Bowden cable (403) through the slot in the fulcrum lever.
Squeeze links of the plastic clip (518) together and push clip with the Bowden cable (403) through the bracket rearward.

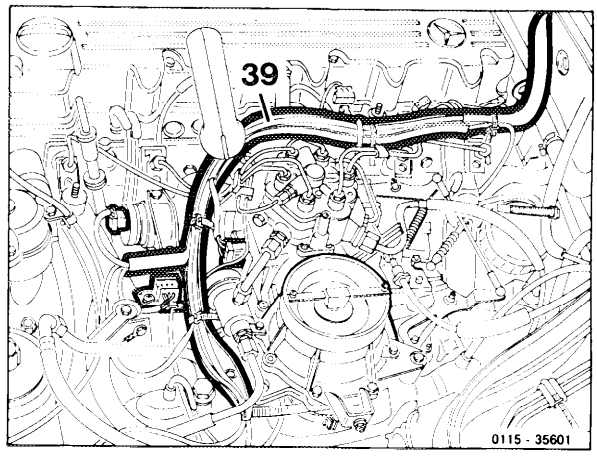
Installation note:
Readjust Bowden cable (30-325).



17 Disconnect electric wires. Turn nut (531) downward. Unscrew cross-head screw (530). Detach cable from the oil level gauge and from the oil pressure sensor.

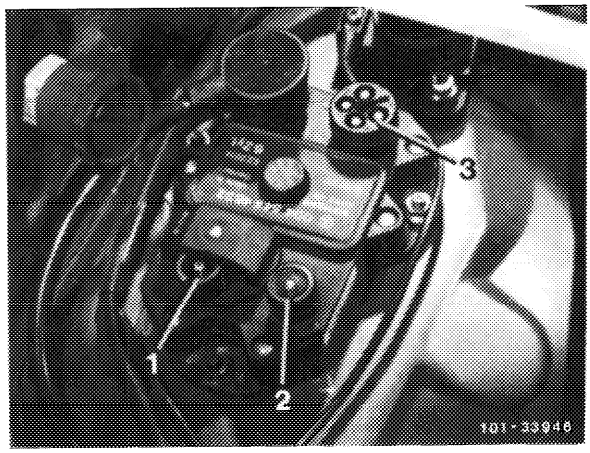


18 Release all cable straps of the engine wiring harness. Disconnect all the plug connectors along the engine wiring harness.
Remove engine wiring harness (39).



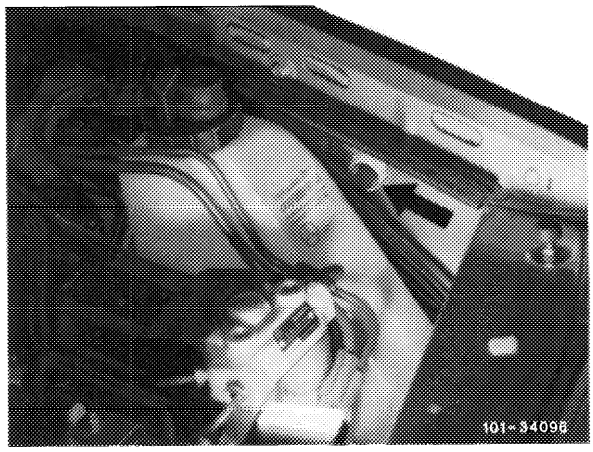
19 Detach heating hoses and vacuum lines in engine compartment.

20 Detach green control line from position sensor and vacuum line at ignition control unit connector - sensor.

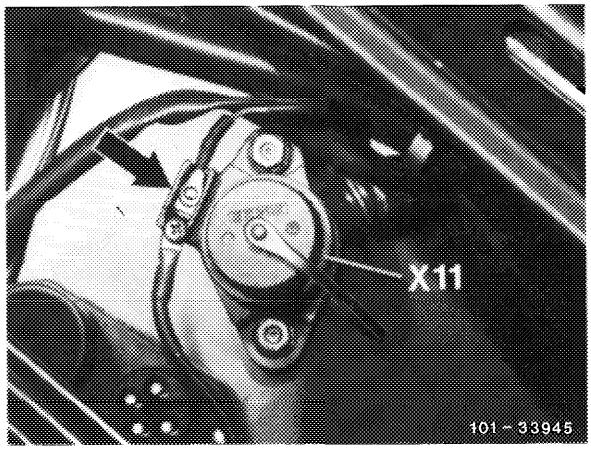


1 Vacuum connection
2 Control line connection
3 Connector - sensor connection

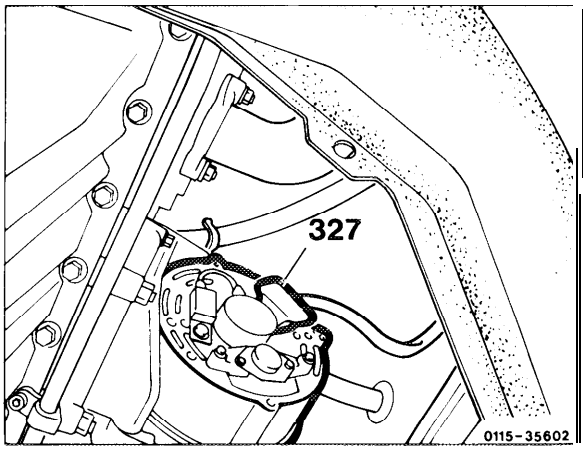
21 Detach vapor absorbtion line (arrow) of fuel evaporation control system from connector fitting on left wheelhouse.



22 Detach terminal block terminal TD (arrow) next to diagnostic socket (Xl 1), unbolt diagnostic socket, detach grey cable from TDC sensor on back side of diagnostic socket.



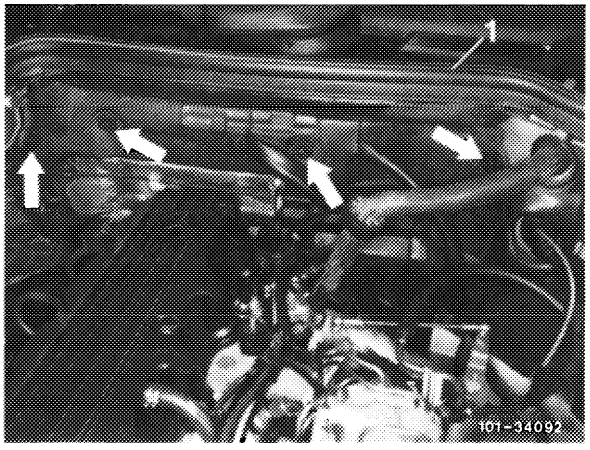
23 Detach wiring connector (327) at alternator.



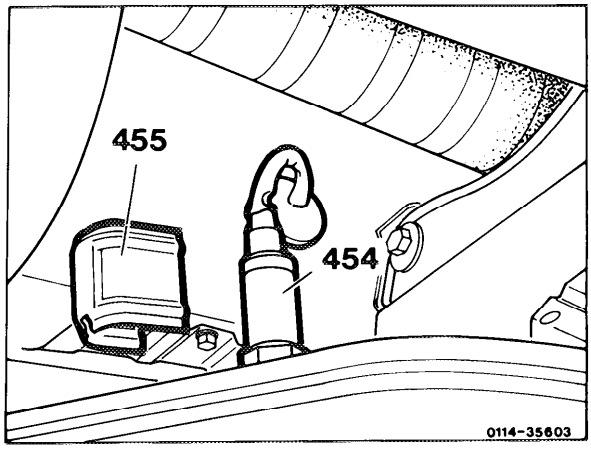
24 Remove rubber sealing strip (1) from component compartment wall.

25 Remove wiring harness cover by removing four plastic screws (arrows).

26 On vehicles with self-leveling suspension, unbolt wiring bracket at front of engine.

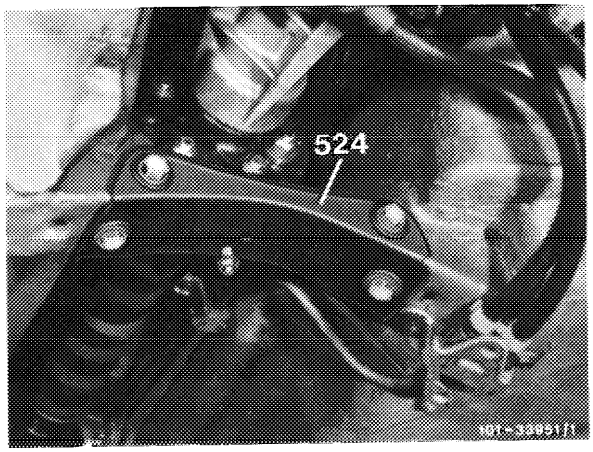


27 Remove protective cover (455), unscrew oxygen sensor (454).

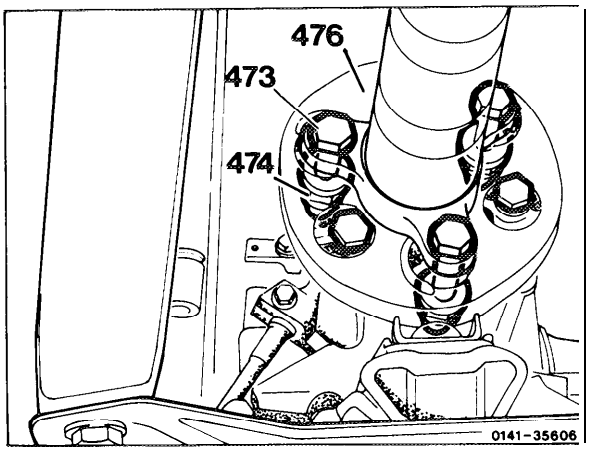


28 4MATIC: Remove heat shields at transfer case and center tunnel.

29 Unbolt crossmember (524) in center tunnel, tightening torque 25 Nm.

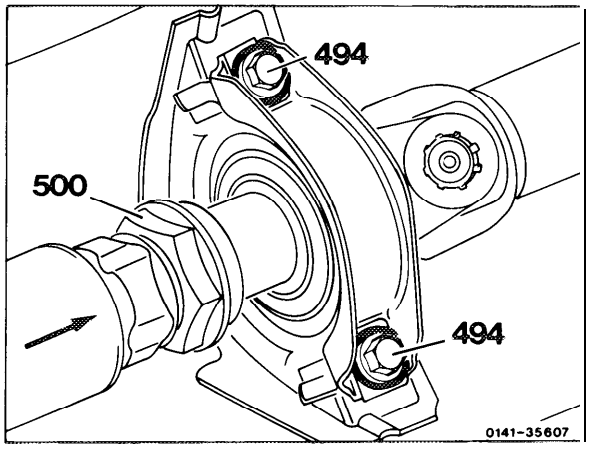


30 Remove driveshaft.
Unscrew nut (474), withdraw bolt (473), tightening torque 45 Nm. Flexible joint (476) remains on transmission.

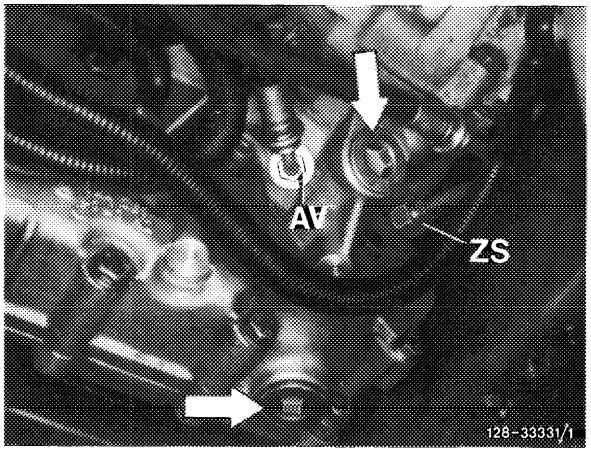


31 Loosen bolt (494) for propeller shaft intermediate bearing, but do not remove. Tightening torque 25 Nm.

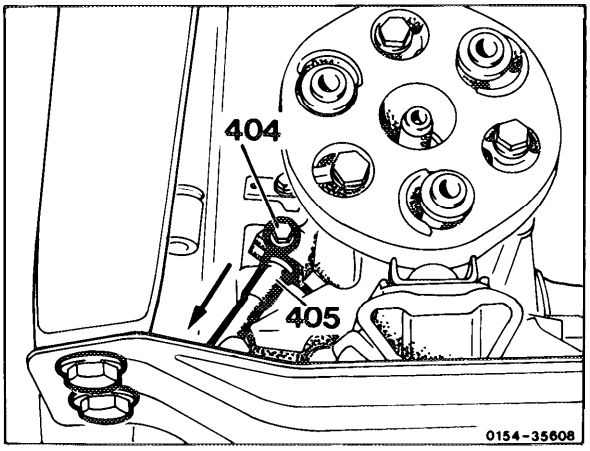
32 Loosen clamping nut (500) (wrench size 41/46 mm) on the driveshaft. Push driveshaft back as far as possible in direction of arrow, tightening torque 35 Nm.



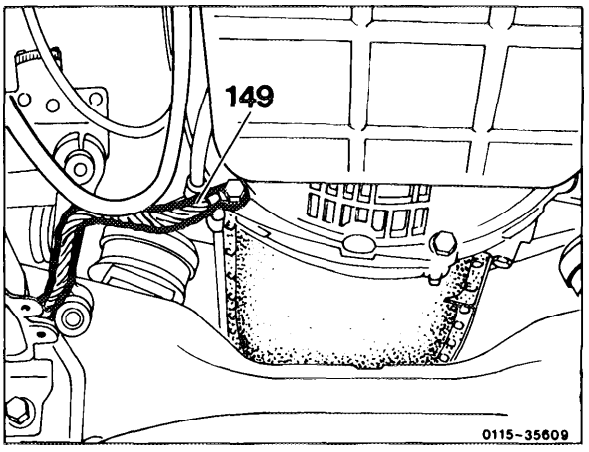
33 4MATIC: Unscrew hydraulic lines (AV, ZS) at transfer case.



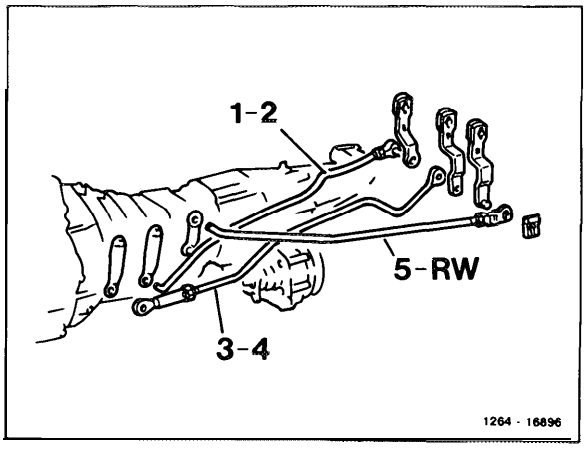
34 Unscrew bolt (404). Withdraw speedometer cable (405) in direction of arrow.



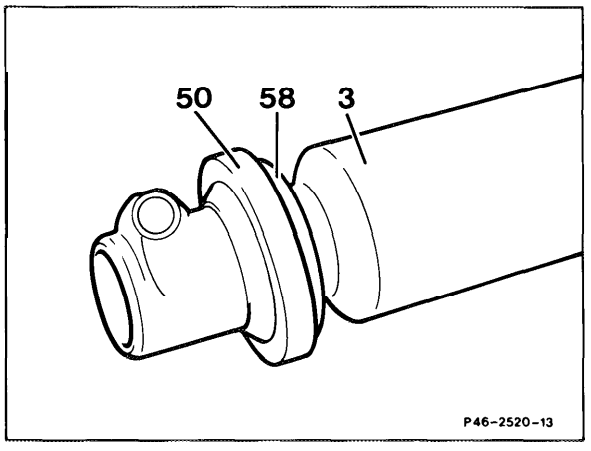
35 Unscrew ground cable (149) at transmission.



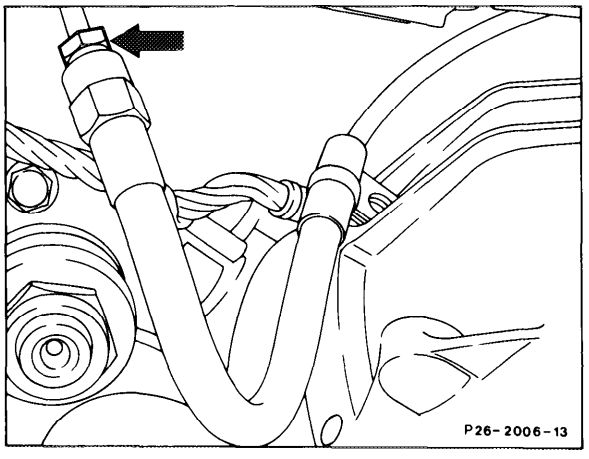
36 With manual transmission: Press the clip locks off first and then detach shift rods from the transmission shift levers.



37 With automatic transmission: Detach shift rod at center console. Turn white plastic lock on starter lockout, backup light switch (53) approx. 45° to the right and detach cable connector. Detach cable at kickdown solenoid valve.



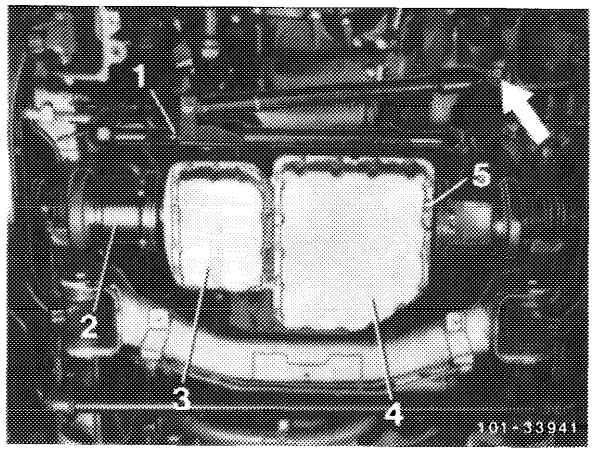
38 With manual transmission: Disconnect hydraulic line (arrow) to slave cylinder at hose union.
Seal lines with plugs or draw fluid from the rear chamber of the combined reservoir with a suction gun.



39 4MATIC: Remove center link together with steering damper (1). Unbolt steering damper (arrow) at the body.
Remove center link using the tapered stud remover, 201 589 08 33 00.

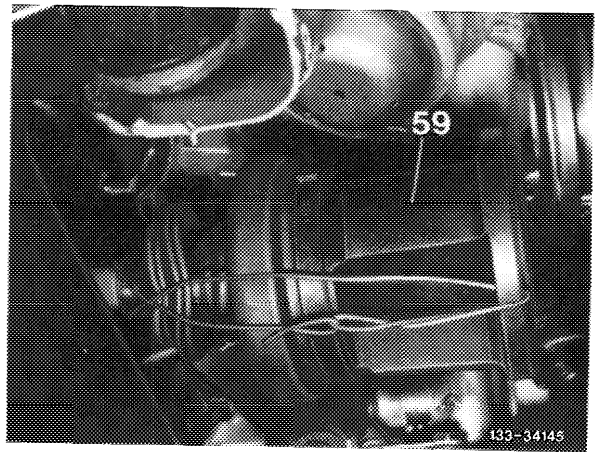
Note:
Replace self-locking nuts.
Tightening torques:

Steering damper	50 Nm
Center link	5 Nm

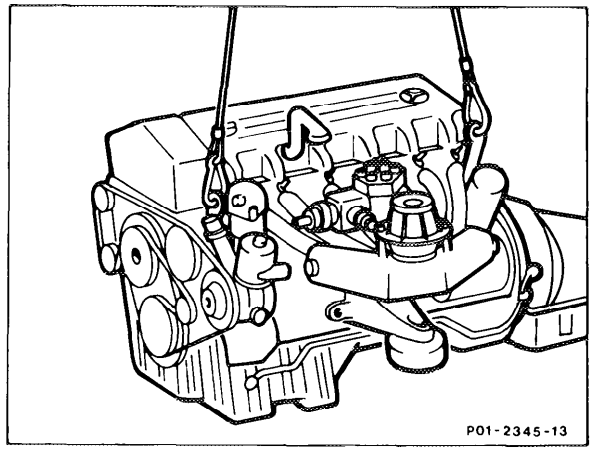


40 4MATIC: Remove front axle shafts (59).
Operate foot brake to slacken the six bolts (microencapsulated).
Compress front axle shafts as much as possible and hold in this position with wire.
Lay front axle shaft on crossmember, tightening torque 70 Nm.

Note
Do not pull inner joint too far apart and wire together to prevent the needle-bearing tripod joint rollers from dropping out of the journals at the tripod cross.

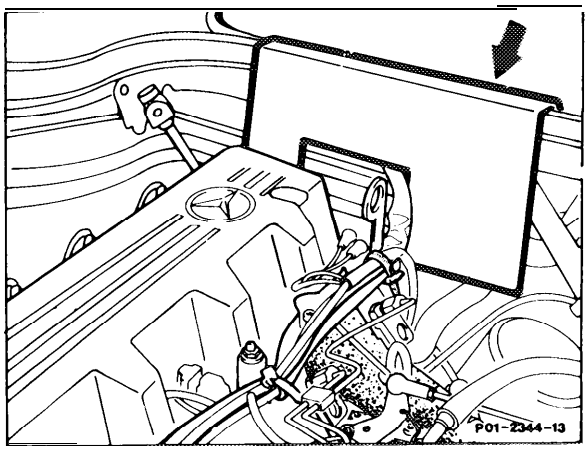


41 Attach engine hoist to the suspension lugs of the engine.
Adjust engine hoist so that the engine can be lifted horizontally.



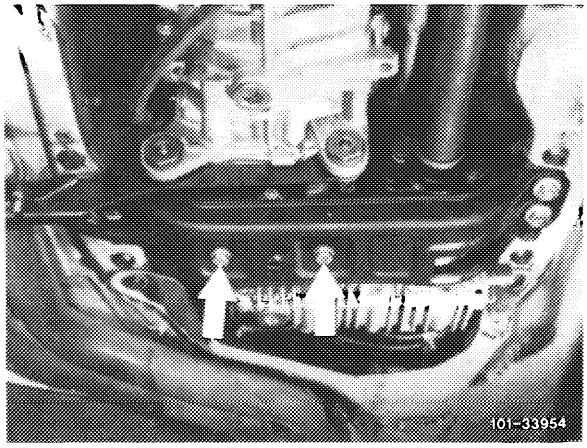
42 Insert guard plate (arrow) between the component compartment wall and the engine.

43 Support transmission with car jack or inspection pit lift.



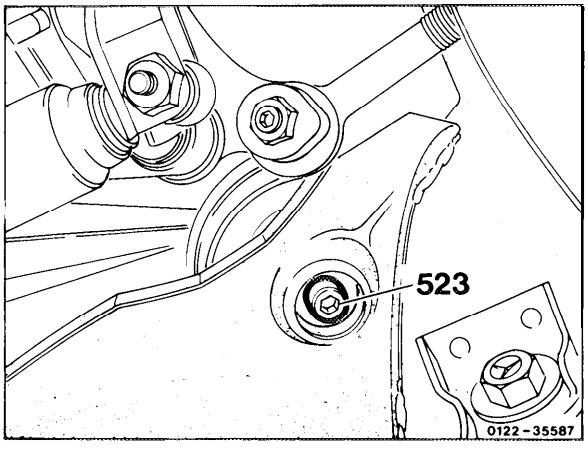
44 4MATIC: Unscrew bolts (arrows), tightening torque M8 20 Nm.

45 Remove rear engine support, tightening torque Ml0 35 Nm.



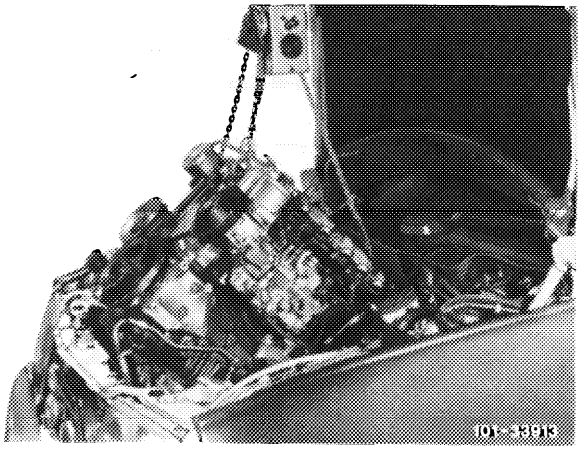
46 Unscrew bolt (523) on left and right front engine mount from below, tightening torque 40 Nm.

4MATIC: 2 bolts from below, tightening torque 20 Nm.



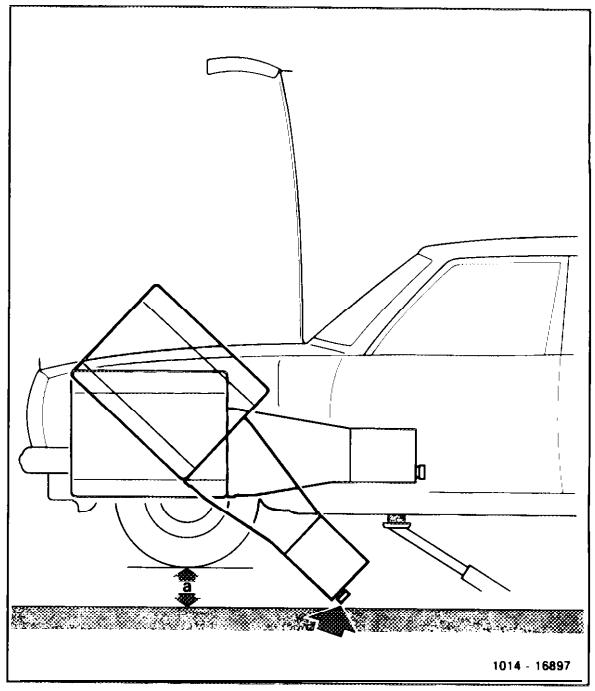
47 Angle engine and transmission and lift out of engine compartment, or install as appropriate, by readjusting engine hoist several times.

Note:
When tilting engine at the rear suspension lug, pay attention to oil filter.



4MATIC: Do not place any load and do not strike lube oil line on transfer case (arrow) otherwise leaks may occur.

a = approx. 30 cm
t-look height at least approx. 260 cm.



48 Reverse sequence for reinstallation.

49 Check engine mounts at front and rear.

50 Check coolant, oil and fuel hoses.

51 With automatic transmission, adjust cable for control pressure (27-l 00).

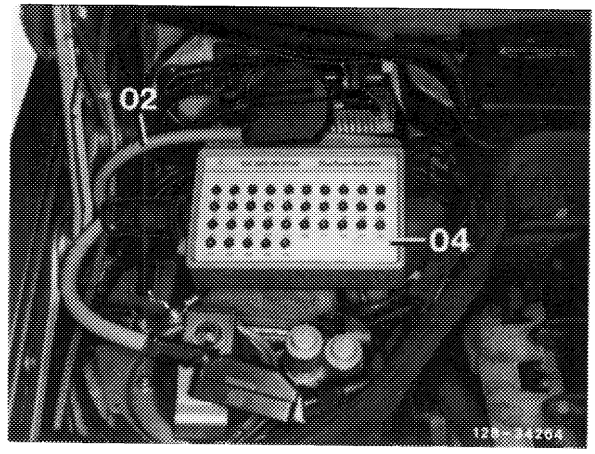
52 Check idle speed, adjust if necessary (07.3-l 00).

53 Check tightening torque of oil drain plugs.

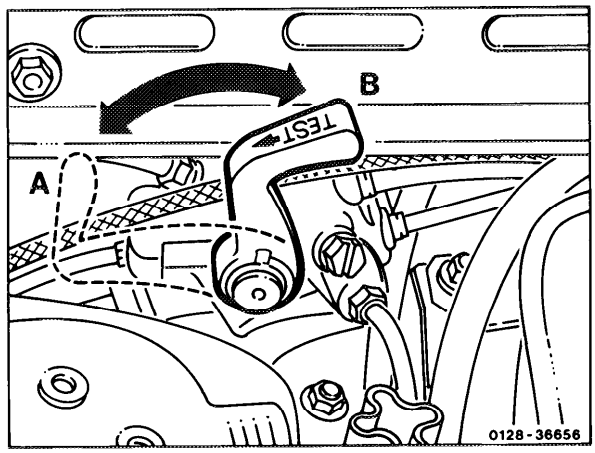
54 Correct oil level in engine and transmission.

55 Top up coolant, check anti-corrosion/ antifreeze agent, correct freeze point (20-010).

56 4MATIC: Bleed hydraulic system. Connect socket box. Disconnect 4MATIC control unit and connect 25-pin connector to the socket box (04) with the Y cable (02). The control unit remains disconnected.

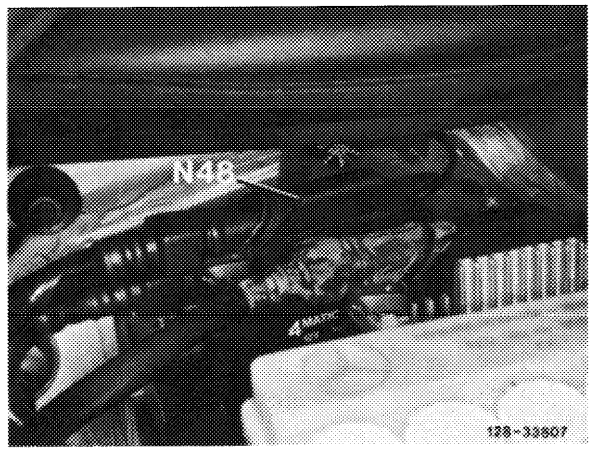


57 4MATIC: Bleed hydraulic oil pump. Check hydraulic oil level in reservoir. Put service valve in test position. Start engine for bleeding and run for approx. 30 seconds at 1000 - 2000 rpm. After bleeding, move service valve back to operating position.

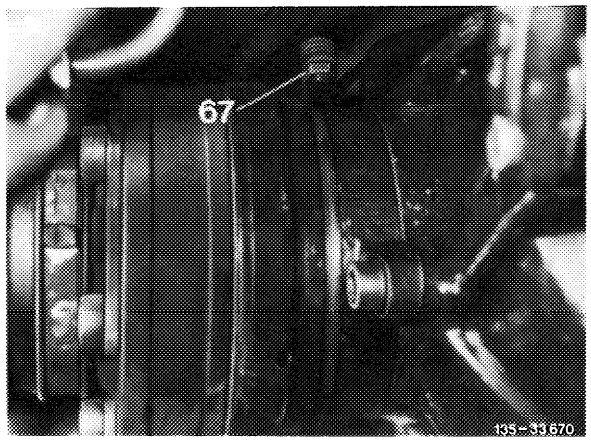


A Test position
B Operating position

58 4MATIC: Detach 25-pin connector from control unit (N 48) and connect socket box. Service valve in operating position. Apply parking brake. Start engine and run at idle speed.



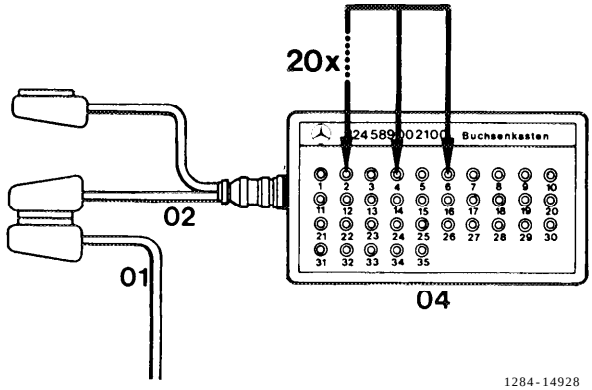
59 4MATIC: Bleed rear axle differential lock. Activate HS solenoid valve by jumpering contact 8 and contact 2 (ground) on socket box. Open bleeder (67) on rear axle center piece until the hydraulic oil flows out without bubbles (attach hose).



60 4MATIC: Bleed front and center differential multi-disk clutches. Activate front and center differential solenoid valves together 20 times by connecting contacts 4 and 6 on the socket box and jumpering to contact 2 (ground) 20 times.

Note

By actuating the front and center differential multi-disk clutches several times, the trapped air is removed with the hydraulic oil.

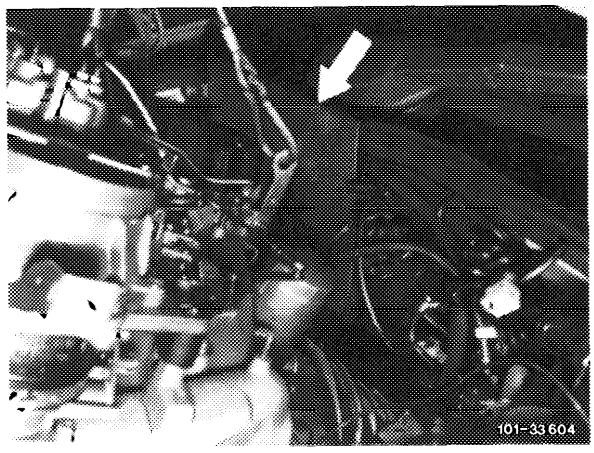


1284-14928

B. Model 201

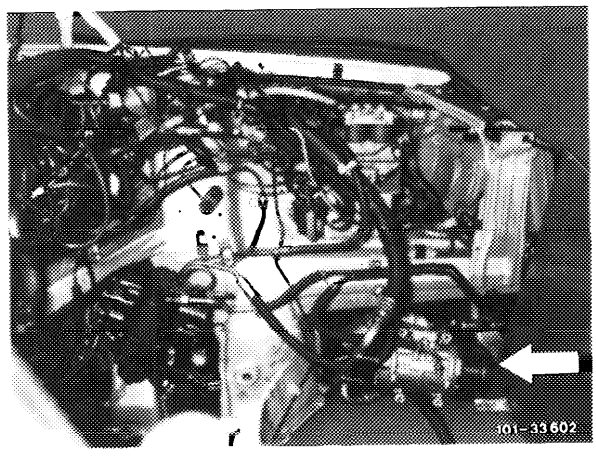
Removal, installation

1 Position suitable panel (arrow) between firewall and engine to prevent damage to to firewall.



2 Remove fan with visco clutch and radiator.

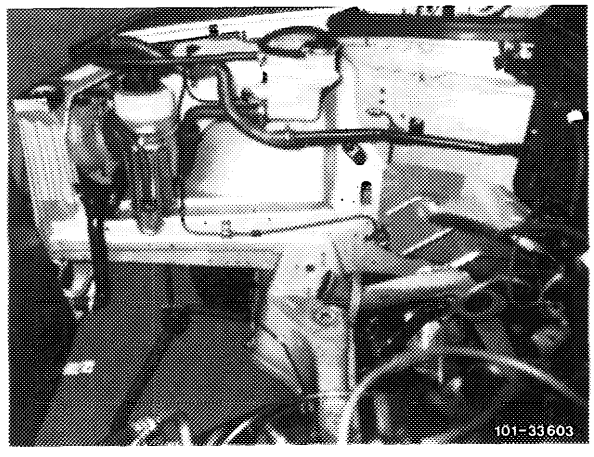
3 Protect condenser with suitable panel. Unbolt holder for refrigerant lines (2 bolts) and compressor (4 bolts). The compressor (arrow) remains in the vehicle with the refrigerant lines connected.



4 Disconnect steering linkage at left.

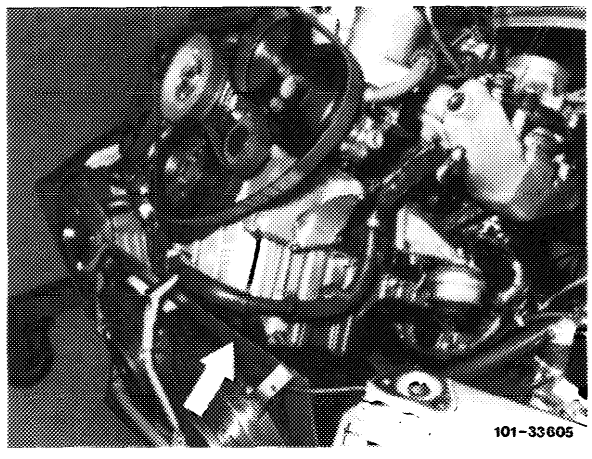
5 Engine mounts remain on engine.

6 Use new self-locking nut on steering linkage.



7 Lift engine out while altering angle of engine on hoist as necessary.

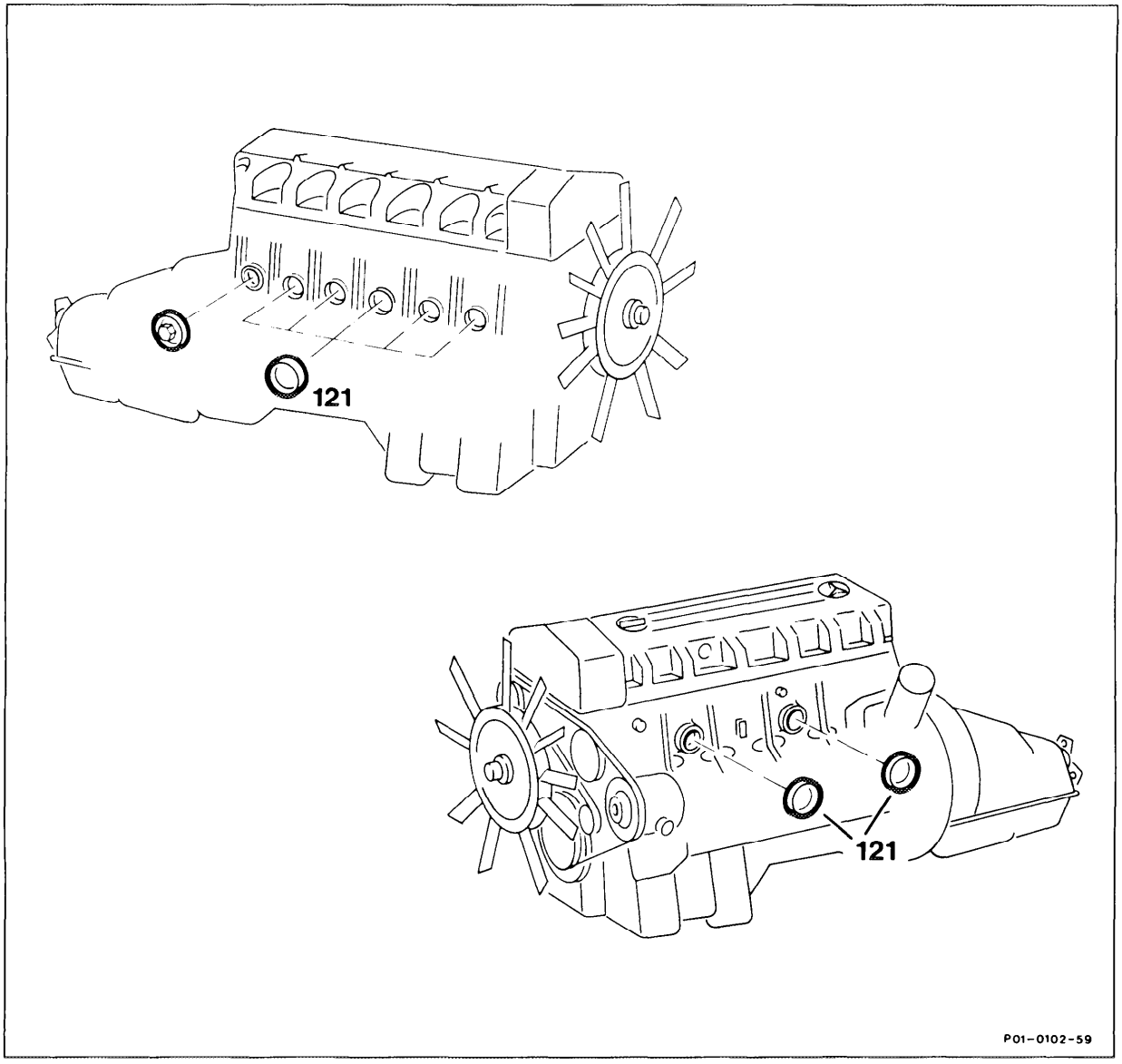
Install in the reverse order.



01-140 Replacing freeze plug in engine block

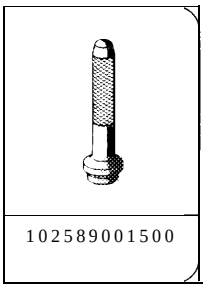
Preceding work:
Freeze plug to be replaced exposed.

Job No. of job texts and job values or standard texts and flat rates ..... 01-8501 -01-8741



Coolant	drain, pour in (20-010).
Freeze plug (121)	remove (steps 3 and 4).
Freeze plug hole	clean.
Freeze plug hole	coat with sealant 002 989 09 71.
Freeze plug (121)	drive in with drift. Special tool 102 589 00 15 00
Sealant	allow to cure.
Engine	check for leaks.

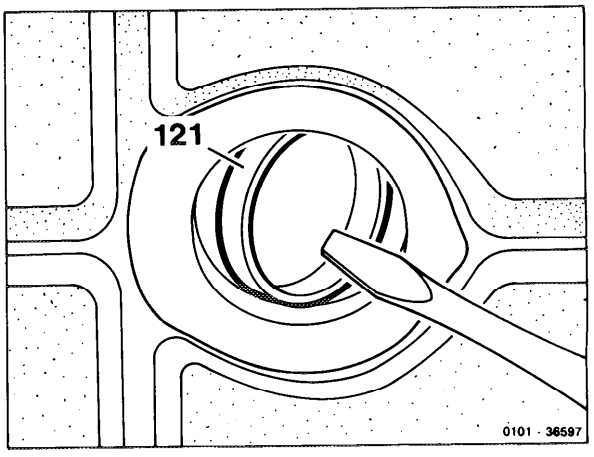
Special tool



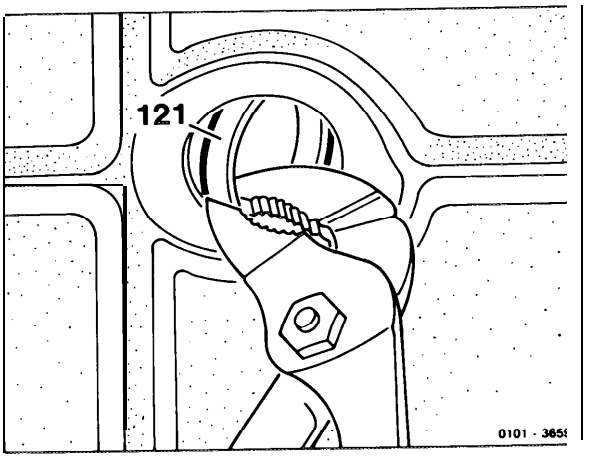
Replacement

1 Drain coolant (20-010).

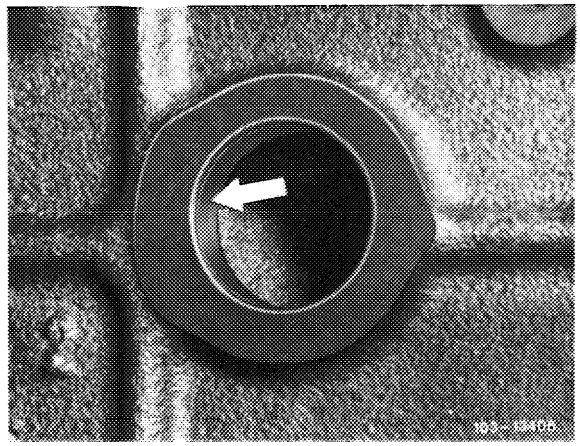
2 Use a screwdriver to tap in freeze plug (121) on one side far enough to turn it.



3 Pull freeze plug (121) out with pliers.

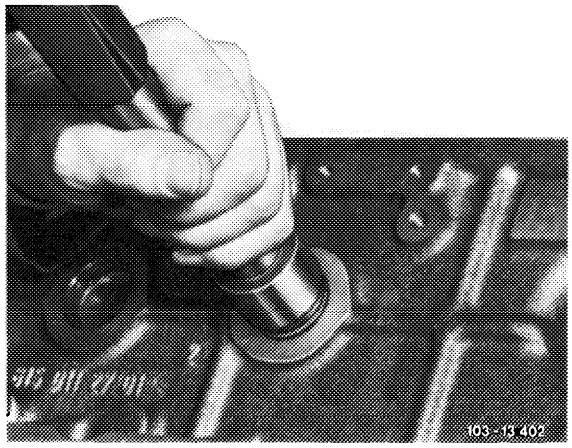


4 Thoroughly clean freeze plug hole. Spray the bore (arrow) with activator. It must be free of grease.



5 Coat freeze plug hole with sealant 002 989 09 71.

6 Drive in new freeze plug with drift 102 589 00 15 00 until flush.



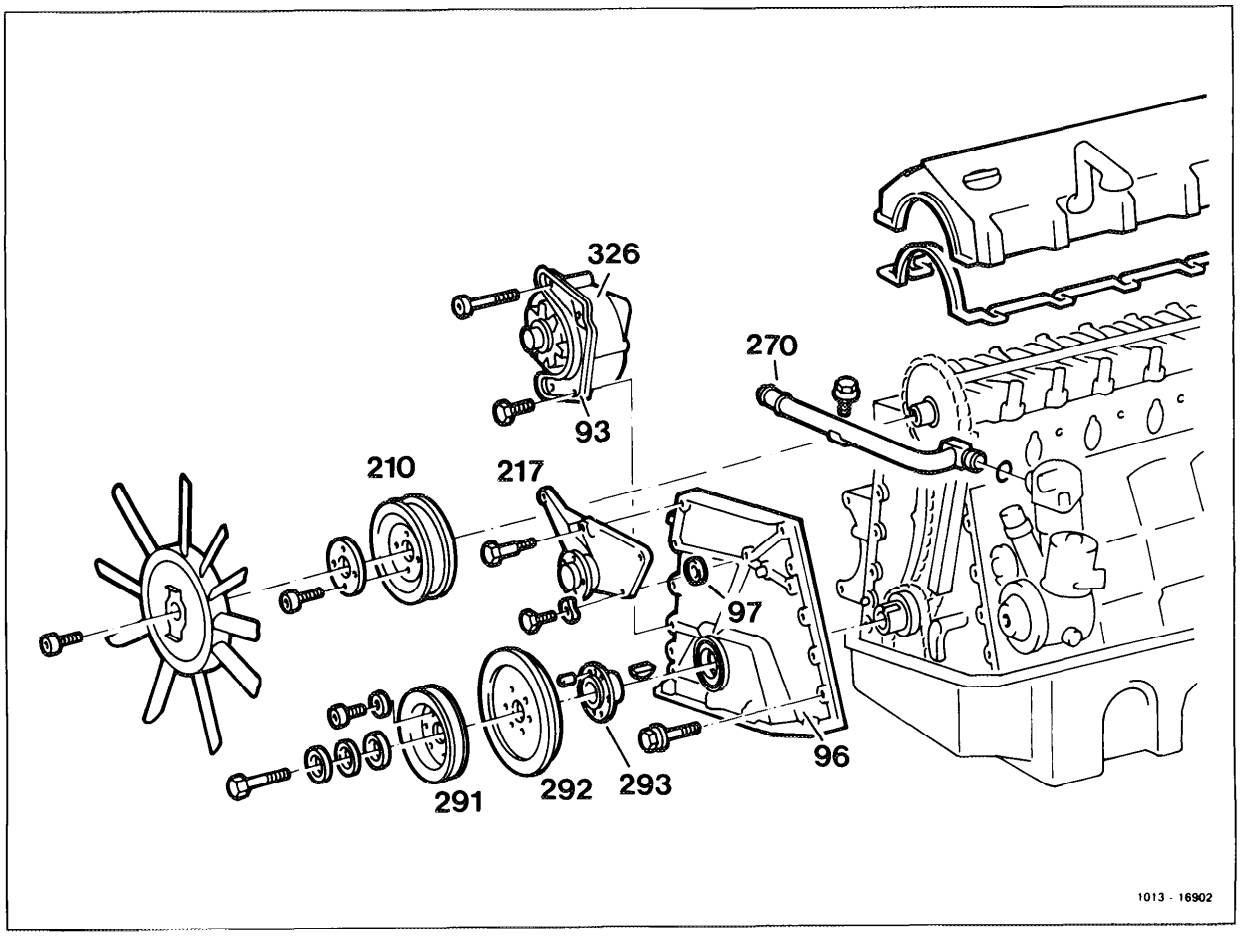
Note:
The sealant must harden for approx. 45 minutes before the coolant is poured in.

7 Run engine until it is warm and check for leaks.

01-210 Removing, installing timing cover

Job No. of job texts and job values or standard texts and flat rates . . . . . 01-8000 - 01-8009

Model 124



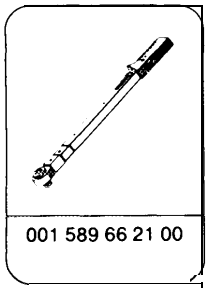
Hood	set vertical (01-008).
Ground cable at battery	disconnect, reattach.
Air filter and air scoop	remove, install (09-400).
Engine compartment lower cover	remove, install (step 5).
Radiator	remove, install (20-420).
Viscous fan clutch	remove, install (20-312).
Fastening bolts of belt pulleys: Fan clutch, coolant pump, tandem pump	loosen, tighten, 10 Nm.
Poly V-belt	remove, install (13-342).
Belt pulley: fan clutch (210), coolant pump, tandem pump	take off, reinstall (step 10).

Belt pulley (291), vibration damper (292) and hub (293)	remove, install (03-342).
Heating water return line (270)	detach, attach and place to one side (step 12).
Level control line	detach, attach and place to the side (step 13).
Front top cover	remove, install (01-212).
Tensioner bracket	loosen, swivel, seal and secure (step 15).
Tandem pump	unbolt, bolt on(step 16).
Fan bearing support(217)	remove, install, 21 Nm (step 17).
Sealing ring (97)	replace (step 24).
Alternator (326) with bracket (93) and TDC sensor	remove, install (steps 18 and 19).
Chain tensioner	remove, install (05310).
Timing cover (96) front lower	unbolt, replace M6 10 Nm, M8 21 Nm (step 22).
Timing cover (96) with TDC sensor bracket	remove, seal and replace.

Tightening torques

Fastening bolts of oil pan		10 Nm
Timing case cover to crankcase	M6	9 Nm
	M8	21 Nm
Belt pulley to coolant pump shaft		10 Nm
Belt pulley to tandem pump		10 Nm

Special tool



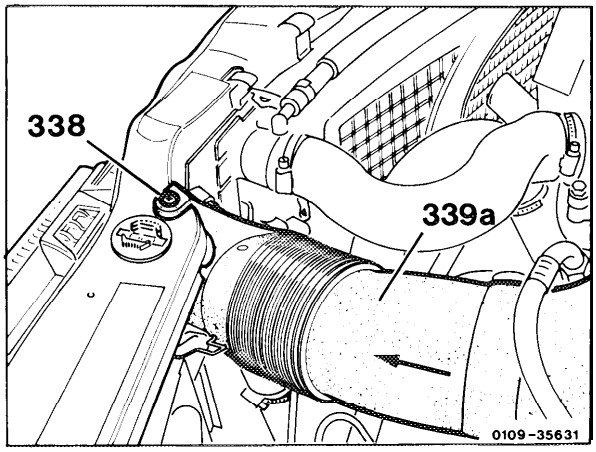
Removal, installation

1 Set hood vertical (01-008).

2 Disconnect battery ground cable.

3 Unscrew bolt (338). Pull air scoop (339a) from air filter in direction of arrow and remove.

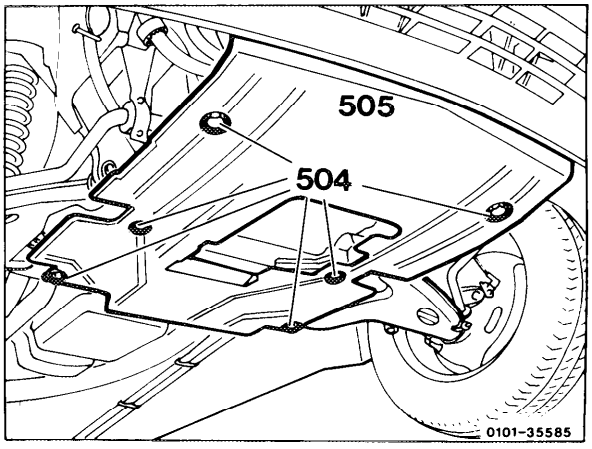
4 Remove, install air filter (09-400).



5 Unscrew bolts (504) and take off engine compartment covering (505).

6 Remove radiator (20-420).

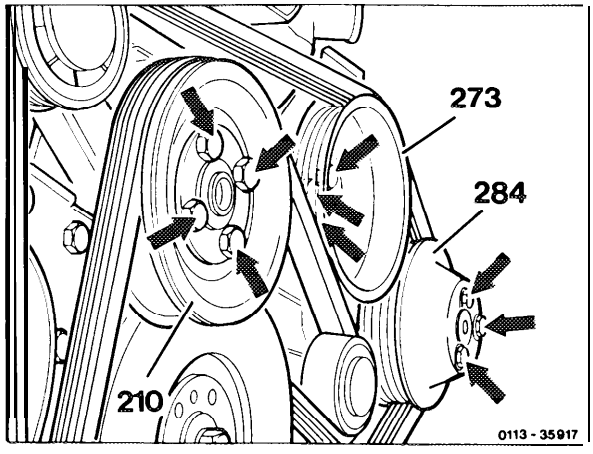
7 Remove viscous fan clutch (20-312).



8 Loosen bolts (arrows).

9 Remove poly V-belt (13-342).

10 Unscrew bolts (arrows), tightening torque 10 Nm.
Take off belt pulleys from fan clutch (210), coolant pump (273) and tandem pump (284).

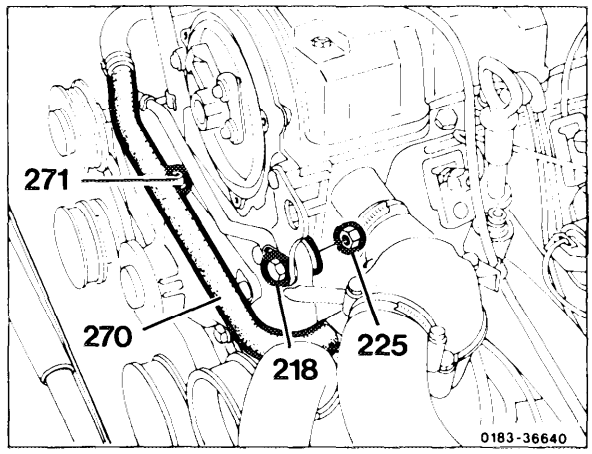


11 Remove belt pulley, vibration damper and hub (03-342).

12 Loosen bolt (271). Withdraw heating water return line (270) from coolant pump and place to one side. Unscrew nut (225) and withdraw bolt (218) from the front.

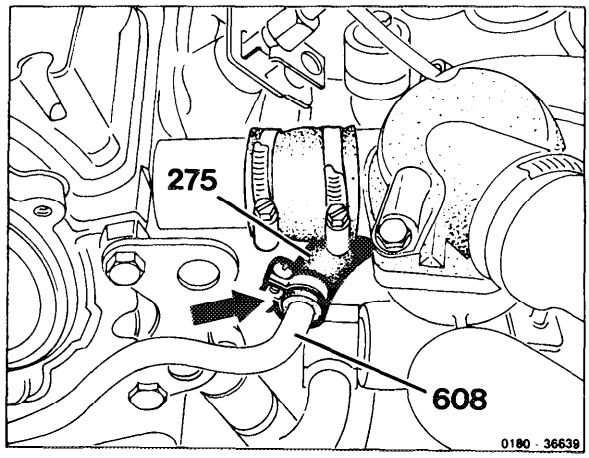
Note:
Effective 10/1987, the heating water return line is also bolted to the coolant pump.

Installation note:
Replace heating water return line seal (270).



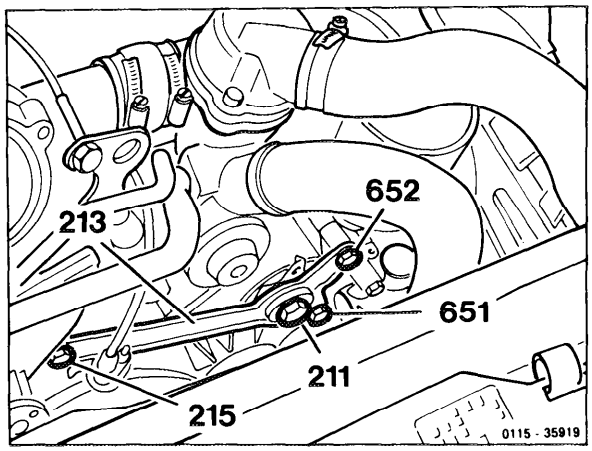
13 With self-levelling suspension, loosen clip (arrow). Detach hose (275) and plug line (608).

14 Remove front upper cover (01-212).



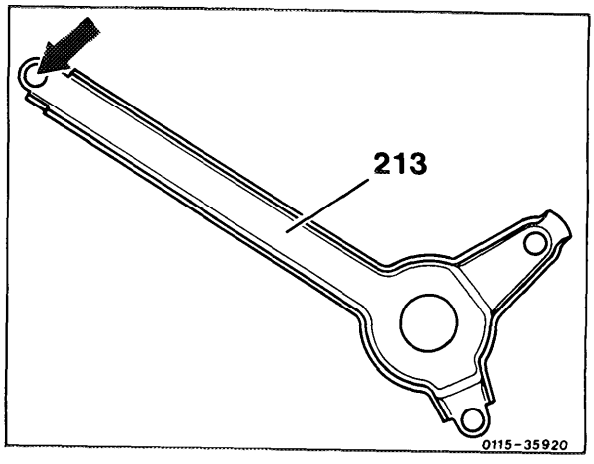
15 Loosen bolt (211) and remove bolts (215, 651, 652) together with spring washers. Swivel bracket (213).

Note:
Hold nut of bolt (651) to prevent it turning.

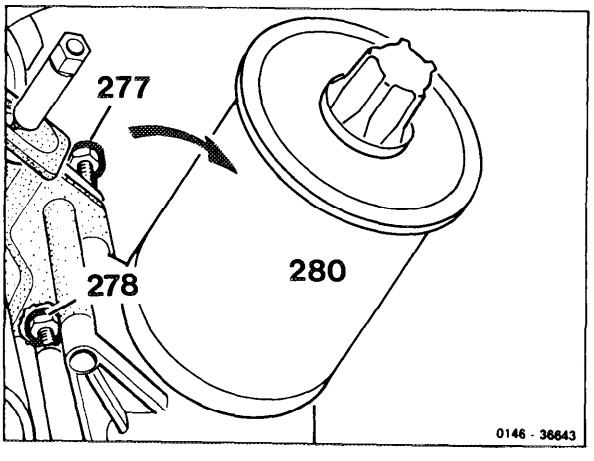


Installation note:

Apply sealant 001 989 29 20 to the front and rear sides of the attachment hole (arrow) of the bracket (213).



16 Unscrew bolts (277, 278). Swivel tandem pump (280) in direction of arrow.

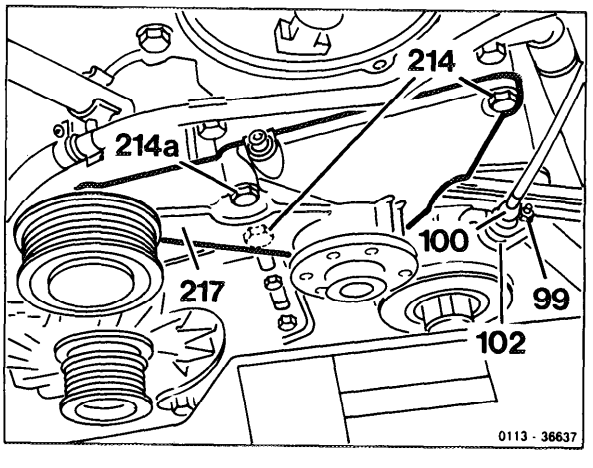


17 Unscrew bolts (214), tightening torque 21 Nm, and remove fan bearing support (217). Unscrew nut (99). Take off TDC sensor (100) together with cable and place to one side.

Note

TDC sensor bracket (102) remains on timing case cover.

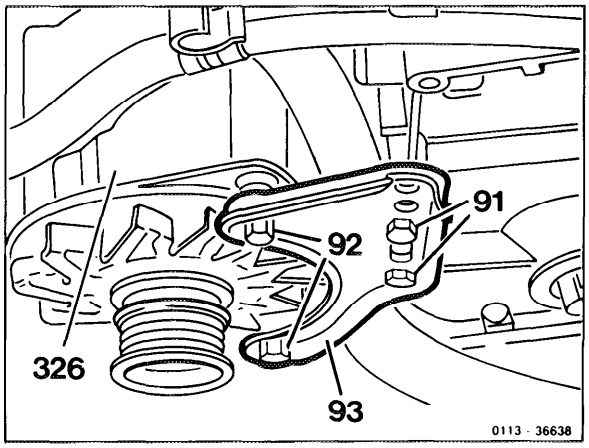
If replacing timing case cover, adjust TDC sensor.



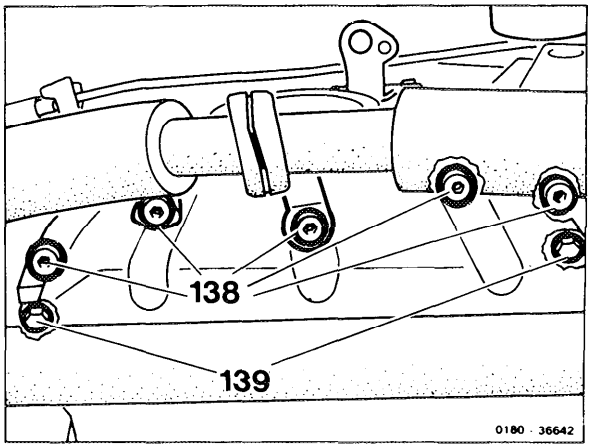
18 Disconnect wiring connector at the alternator (326).

19 Unscrew bolts (91, **92).** Remove bracket (93) and alternator (326).

20 Remove chain tensioner (05310).

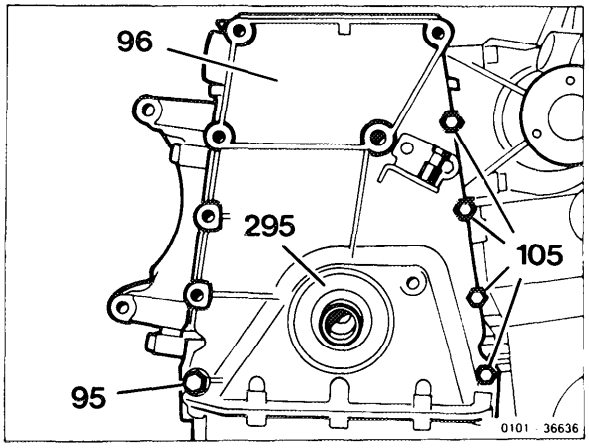


21 Unscrew bolts (138), tightening torque 10 Nm, and bolts (139), tightening torque 21 Nm, on the oil pan.
With self-levelling suspension: Place retaining clip with high-pressure hose to the side.



22 Unscrew bolts (95, 105) and remove timing case cover (96).

Note:
Do not damage oil pan gasket!
If necessary, replace oil pan gasket.
Check crankshaft front seal (295); renew if necessary.



23 Clean sealing surfaces on crankcase and on timing case cover.
Apply an even coat of sealant 001 989 45 20 to sealing surface of timing case cover.

4MATIC: Also, clean sealing surfaces of oil pan and coat with sealant 001 989 61 20 10.

Note

The timing case cover is held in place by two roll pins in the engine block. Do not damage oil pan gasket.

Tightening torque 10 Nm.

Timing case cover to engine block:

M6 : 9 Nm

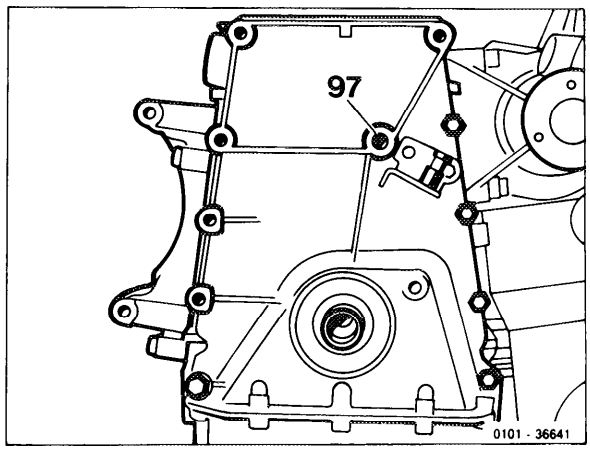
M8 : 21 Nm

24 Replace seal (97).

25 Install in reverse sequence.

26 Check engine oil level in and top up if needed.

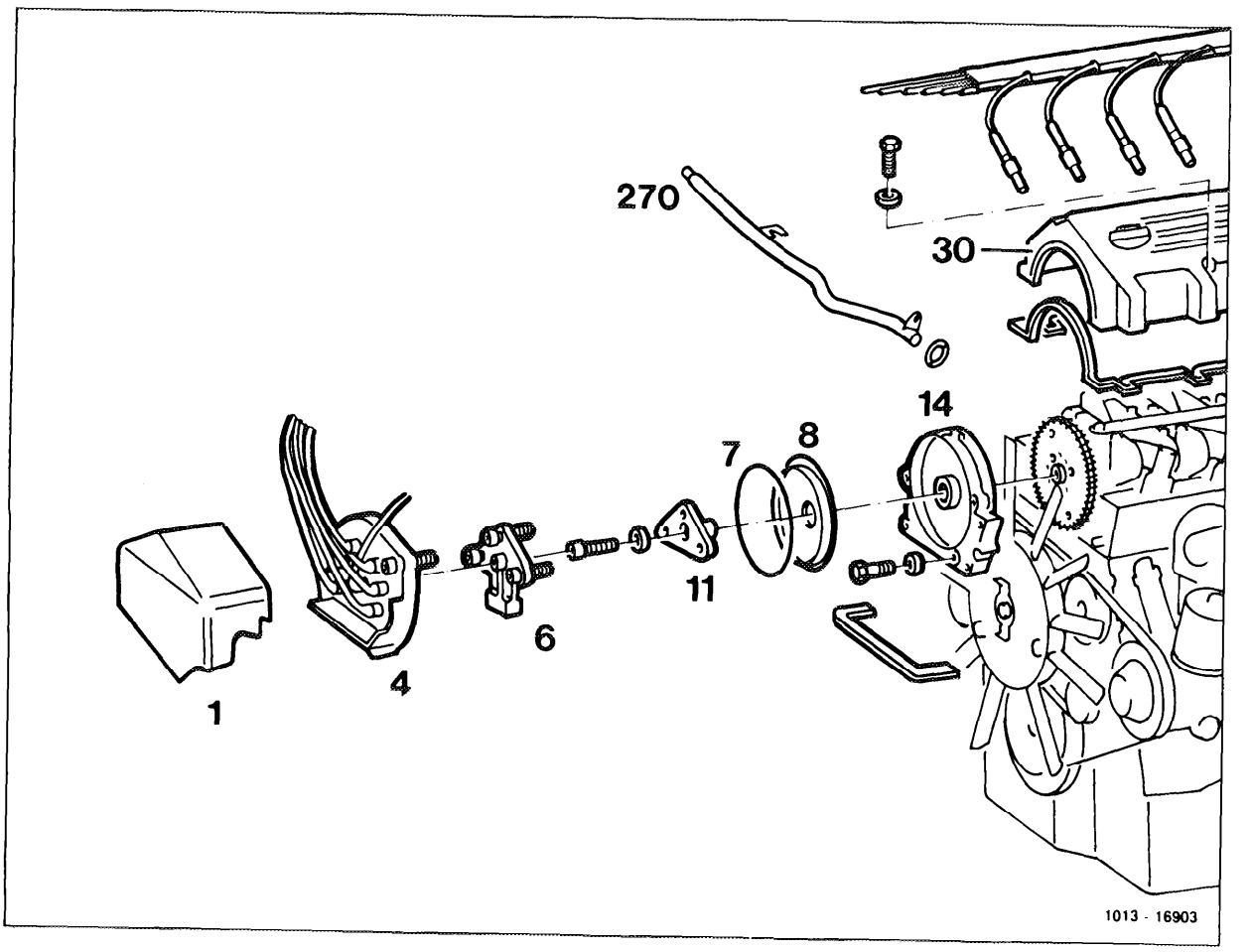
27 Check engine for leaks with engine running.



01-212 Removing, installing top front cover

Job No. of job texts and job values or standard texts and flat rates . 01-5700

Model 124
Model 129



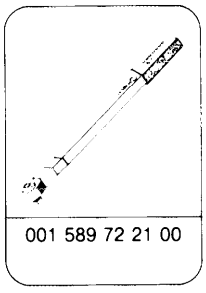
Hood	set vertical (01-008).
High-voltage distributor (4) with protective cover (1)	remove, install (steps 2 and 3).
Cap of expansion tank	open, release pressure, close.
Heating water return line (270)	remove, install (step 5).
Missing coolant	top up.

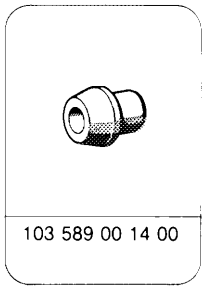
Valve cover (30) with ignition cables and high-voltage distributor (4)	remove, install (Caution: Observe steps 6 and 7).
Distributor rotor (6) and driver (11)	remove, Install (steps 8 and 9).
Guard cover (8) and seal (7)	take off, fit on (step 10).
Front cover at top (14)	remove, seal and install (steps 11 to 13).

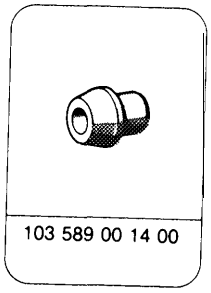
Tightening torques

Valve cover to cylinder head	8.5 Nm
Distributor rotor to driver (reference value)	2.5 Nm
Front cover at top to cylinder head	21 Nm
Distributor driver (1 st version, aluminum, diameter 21.5 mm) to camshaft M8	21 Nm
Distributor driver (2nd version, steel, diameter 20 mm) to camshaft M7	16 Nm

Special tools


001 589 72 21 00

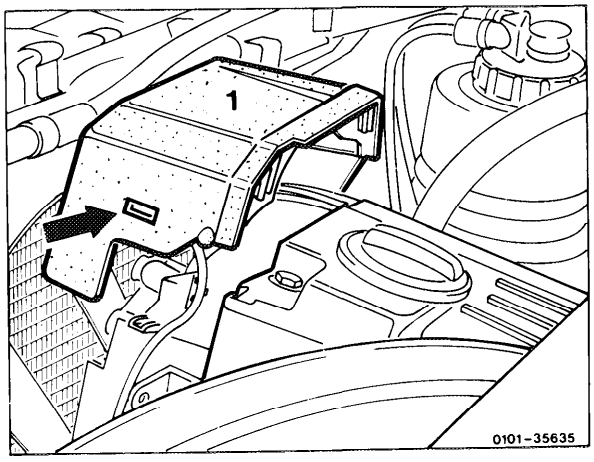

103 589 00 14 00


103 589 00 14 00

Removal, installation

1 Set hood vertical (01-008).

2 Remove protective cover (1) from high-voltage distributor. Unclip catches (arrow) and pull protective cover (1) upwards out of the guides.

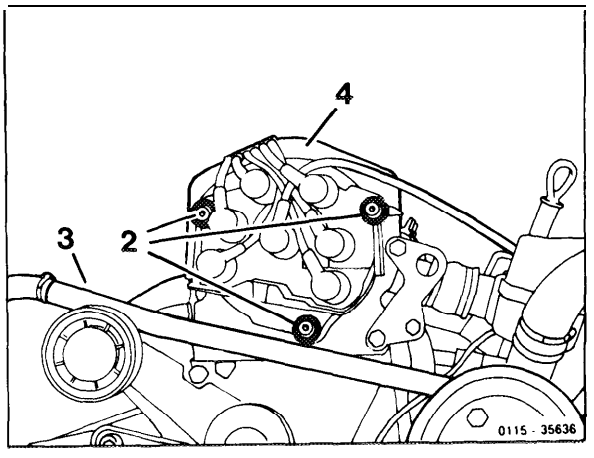


3 Remove distributor cap screws (2), take off distributor cap (4) and unplug spark plug cables.

4 Open expansion tank cap to release cooling system pressure.

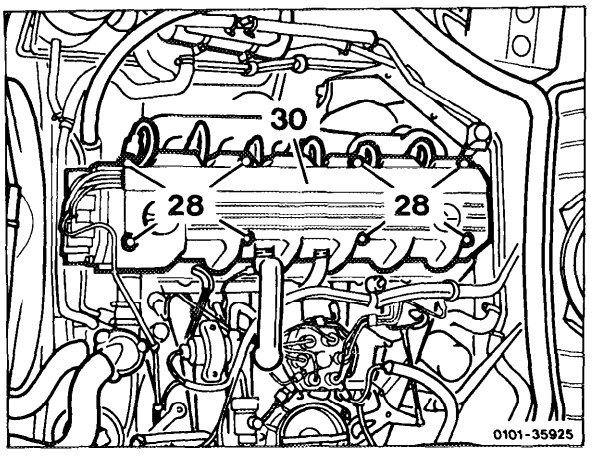
5 Remove heating water return line (3).

Installation note:
Replace seal.

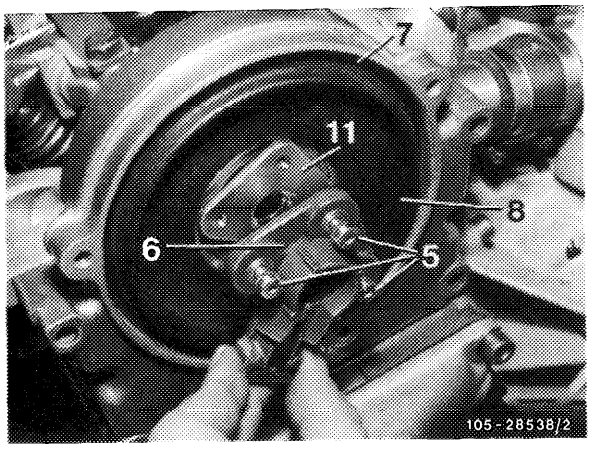


6 Unscrew bolts (28), tightening torque 8.5 Nm.
Take off valve cover (30) with ignition cables and distributor cap.

Caution!
If valve cover is difficult to remove, do not strike cover with a hammer (risk of cracking and fracturing).

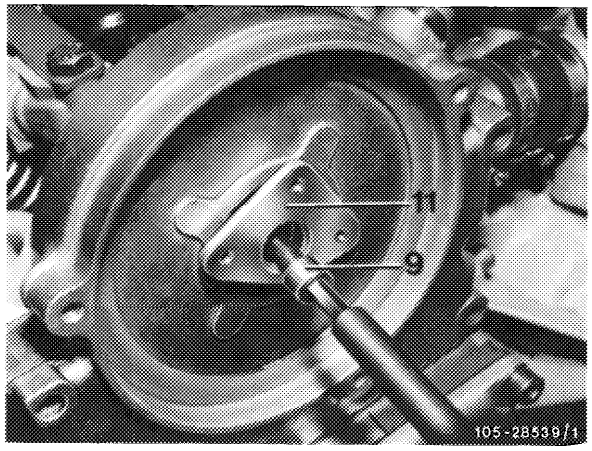


7 Unscrew bolts (5), tightening torque 2.5 Nm. Remove distributor rotor (6).



8 Unscrew bolt (9), tightening torque 21 Nm. Pull driver (11) out by hand.

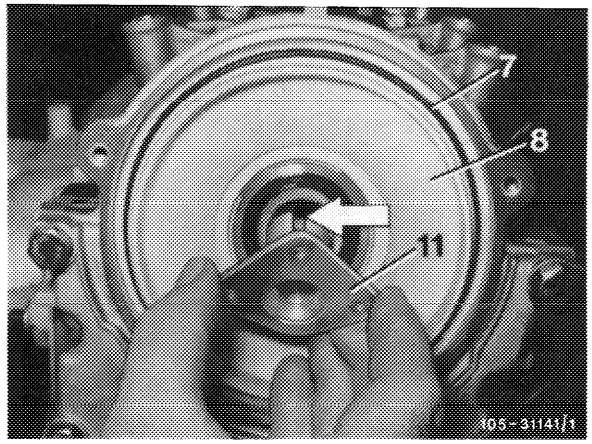
9 Take off guard cover with seal.



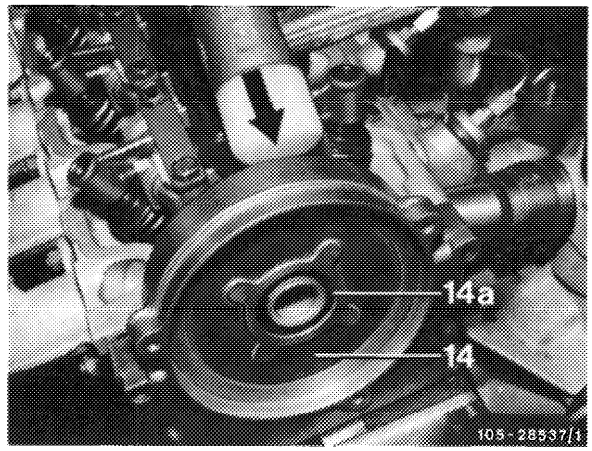
Installation note:
Steel driver with 20 mm diameter flange must be fitted with M7 x 26 mm bolt, and aluminium driver with 21.5 mm diameter flange with M8 x 29 mm bolt.

Installation note:
The groove (arrow) in the driver (11) must engage the pin in the camshaft.

Driver	1 st version	2nd version
Material	Aluminum	Steel
Bolt	M8 × 29	M7 × 26
Torque	21 Nm	16 Nm
Insertion sleeve collar diameter	103 589 00 14 00 21.5 mm	103 589 01 14 00 20 mm



10 Unscrew front cover bolts (14), tightening torque 21 Nm.
Tap off front cover (14) with a plastic hammer.
The front cover (14) is centered with two dowels.

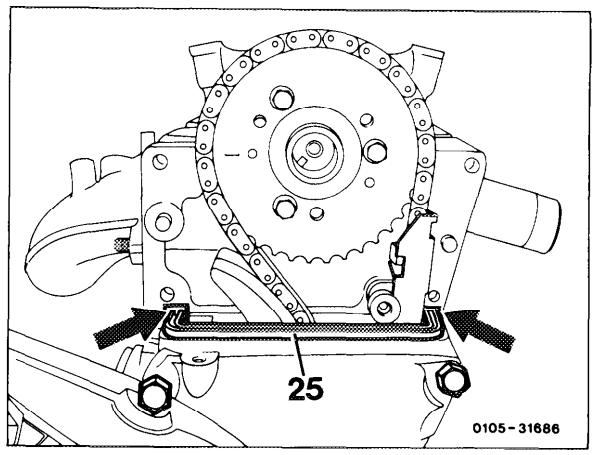


Note
If the camshaft seal (14a) in the front cover (14) is replaced, it must be pressed in from the front until flush.

11 As a seal, apply sealant 001 989 61 20 10 at the points marked (arrows) on the left and right sides of the oil-free groove of the timing case cover (at joint to cylinder head).

Insert new seal (15) dry (without sealant) into the groove and push rearward.

12 Coat contact surfaces of front cover to cylinder head with sealant 002 989 00 20 10.

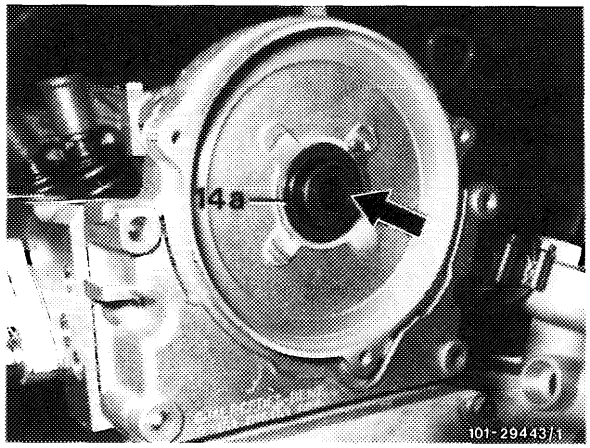


13 Insert guide sleeve (arrow) 103 589 00 14 00 (for camshaft diameter 21.6 mm), or 103 589 01 14 (diameter 20 mm) onto camshaft. Coat sealing lip of radial seal (14a) with engine oil. Install front cover (14).

14 Tighten the two bottom bolts first, tightening torque 21 Nm.

15 Install in reverse sequence.

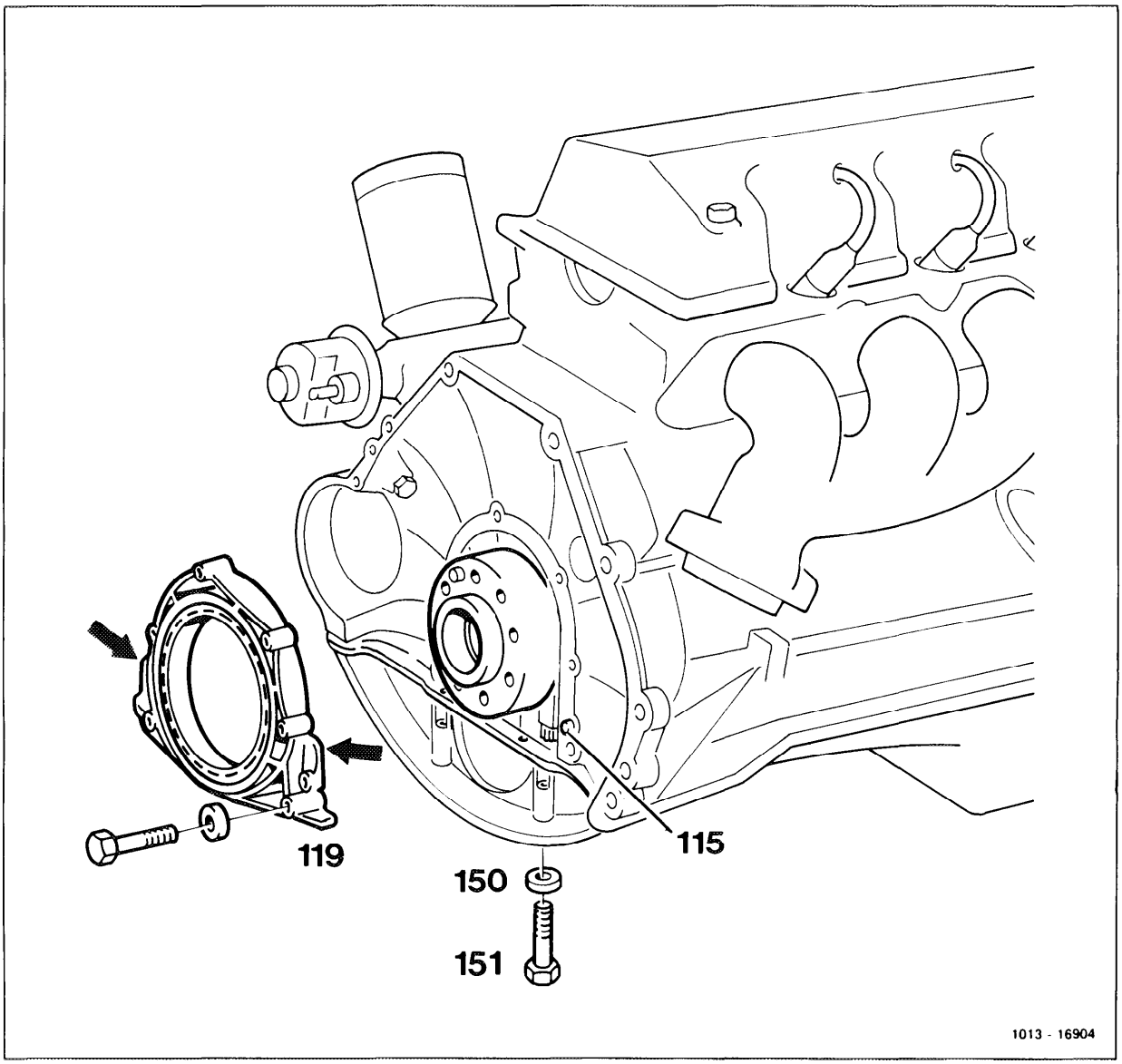
16 Top up coolant.



01-222 Removing, installing rear main seal cover

Transmission removed.

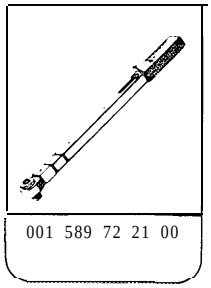
Job No. of job texts and job values or standard texts and flat rates 01-8913



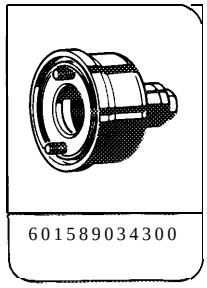
Ground cable	detach, attach at battery.
Flywheel or flex plate	remove, install (03-410).
Bolts (151)	remove, install, 10 Nm. When installing, tighten these bolts first.
Washers (150)	note location

Rear main seal cover (119)	remove, install. Pry off at bosses (arrows) (steps 2 to 7). Sealant 001 989 45 20 10. Installation tool 601 589 03 43 00. Preserve oil pan gasket. On 4MATIC engines sealant on oil sump.
Sealing surfaces	clean.
Dowels (115)	note location.
Rear main crankshaft seal	check, replace if necessary. Coat sealing lip with engine oil.
Oil level in engine	check, top up.
Engine in installation position	support, secure.
Leaks once engine is running	check for.
Flywheel or driven plate	install.

Special tools



001 589 72 21 00



601589034300

Note

The rear main seal cover is sealed to the engine block with sealant and centered with 2 dowels. In addition, it is bolted to the oil pan and sealed on the bottom by the oil pan gasket, or on 4MATIC engines with sealant.

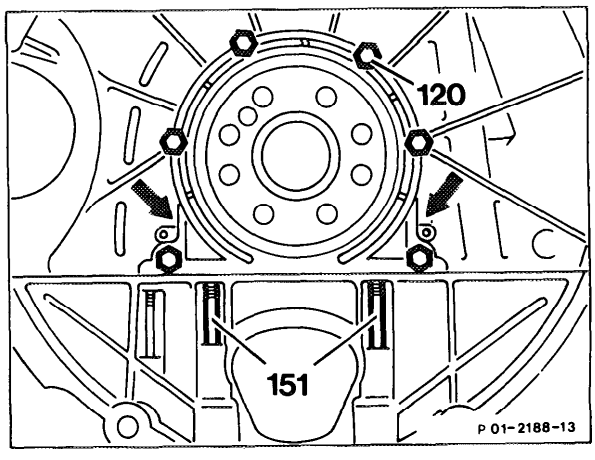
There must not be any scoring or unevennesses in the sealing surface of the rear main seal cover or of the engine block.

Removal, installation

1 Disconnect ground cable at battery.

2 Remove flywheel or flex plate (03-410).

3 Remove bolts (120, 151) and pry off closing cover at the two bosses (arrows) and remove.



⚠
Do not damage oil pan gasket. If necessary, replace oil pan gasket.

4 Clean sealing surface on crankcase, on closing cover and, on 4MATIC engines, also on oil sump.

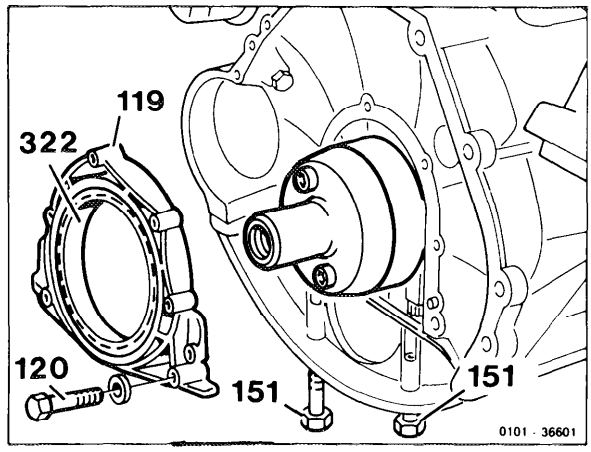
5 Check radial seal, renew if necessary (03-327).

6 Apply an even coating of sealant 001 989 45 20 10 to the sealing surface of the closing cover and, on 4MATIC engines, also to the sealing surface of the oil sump.

7 Coat sealing lip of radial seal with engine oil.

⚠
Do not use grease. Grease prevents the inclined webs on the sealing lip transporting back the engine oil.

8 Press on closing cover (119) with radial seal (322) over the bolted-on insertion tool inner section 601 589 03 43 00 and over oil sump gasket and bolt on.



⚠
Do not damage oil sump gasket.

First of all tighten bolts (151) to 10 Nm, then tighten bolts (120) to 9 Nm.

9 Check oil level in engine and adjust to correct level.

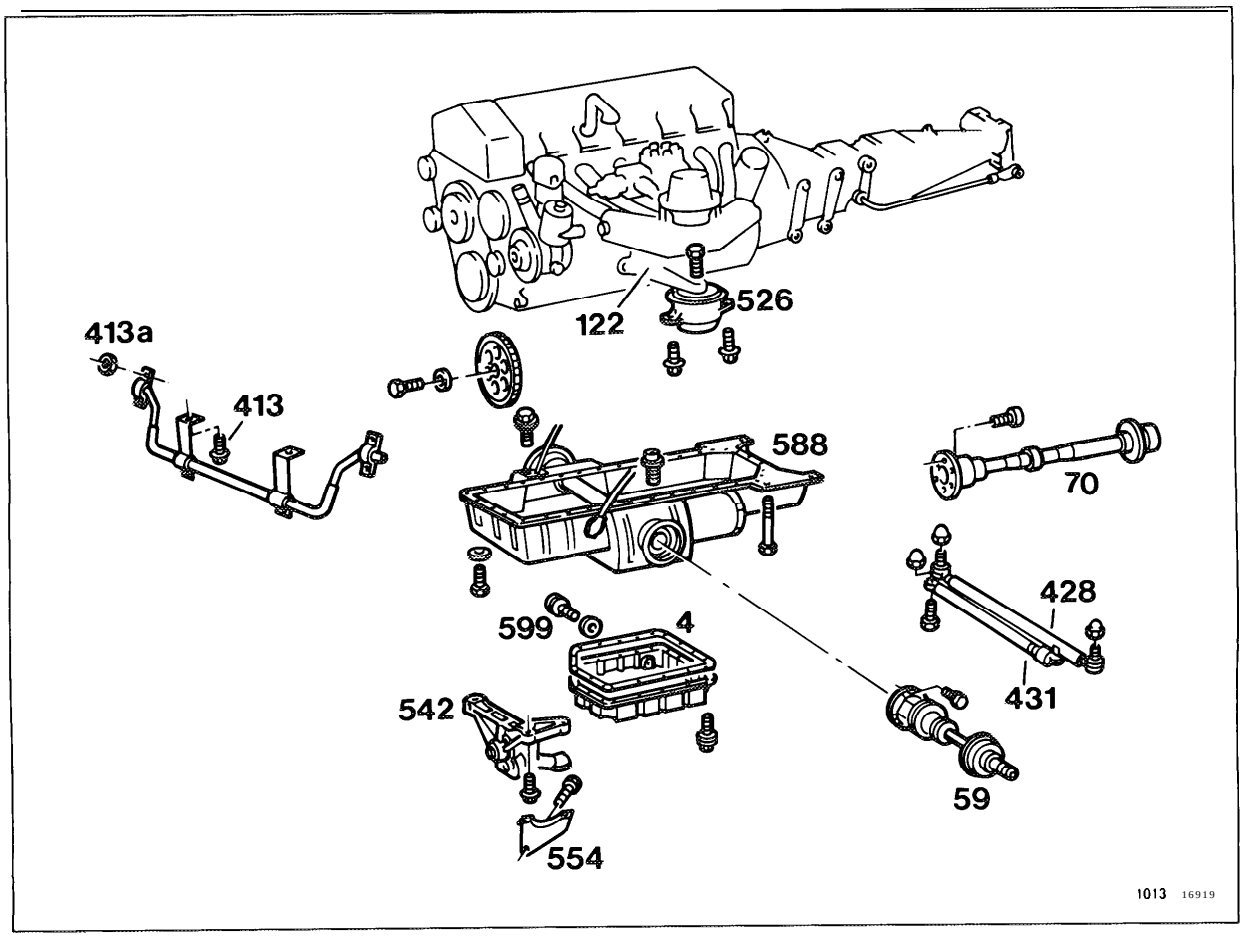
⚠
Before starting engine, move into installation position and secure at the rear by supporting.

10 Attach ground cable.

11 Check for signs of leaks with engine running, prior to installing transmission.
12 Install in the reverse order.

Job No. of job texts and job values or standard texts and flat rates 01-7500

A. Model 124 and 124 4MATIC



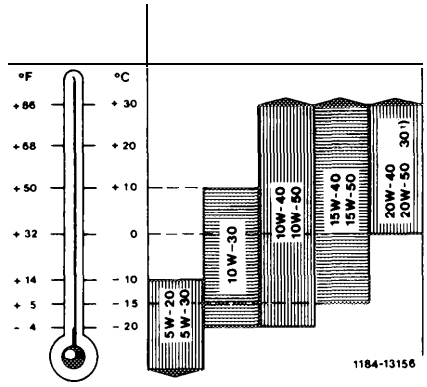
The Illustration shows Model 124 4MATIC

Hood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Air filter (4MATIC)	remove, install (09-400).
Engine compartment covering below	remove, install (step 4).
Engine oil	drain, fill in, oil drain plug (599) 25 Nm.

Both engine mounts (526) front	unscrew, screw on from below. Model 124 4MATIC M8 (527) 20 Nm Model 124 M10 40 Nm
Bolts (413) and nuts (413a) on both sides	unscrew, screw in, 60 Nm (step 7).
Fan cowl	detach, attach.
Dipstick guide tube (4MATIC)	remove, install, 10 Nm (step 9).
Drag link (428) with steering damper (431)	remove, install, tapered removal tool 201 589 08 33 00, (step 10). Drag link 35 Nm Steering damper 50 Nm
Self-locking bolts and nuts	renew.
Exhaust system	unscrew at flange of exhaust manifold (step 11).
Front propeller shaft (70, 4MATIC)	unscrew, screw on, 25 Nm (step 12).
Front axle shafts (59, 4MATIC)	unscrew, screw on, 70 Nm (step 13).
Plug connection, oil level switch	on oil sump or front axle housing, detach.
Bottom section of oil sump (4, 4MATIC)	remove, install, 10 Nm (step 15).
Support (554) for oil pump (542, 4MATIC)	remove, install (step 16).
Guard plate on component compartment wall	insert, remove (step 17).
Oil sump	on crankcase, unscrew, screw on, (step 18) M6 10 Nm, M8 22 Nm.
Packing	renew.
Sealant (4MATIC)	apply.
Engine	raise, lower (steps 19 and 20).
Piston of 3rd and 4th cylinder	set to TDC (step 21).
Lefthand engine support (122) at crankcase (4MATIC)	remove, install, M8 20 Nm (step 22).
Front axle housing (588, 4MATIC)	unscrew, screw on, (step 23) M6 10 Nm, M8 22 Nm.
Oil pump (542, 4MATIC)	remove, install, 25 Nm (step 24).
Oil sump or front axle housing (588)	remove, install.

Specified viscosity classes according to SAE at prolonged outside temperatures

[1]) At prolonged outside temperature above + 30 °C SAE 40 may be used.
Precise use of the SAE classes according to the outside air temperatures would necessitate frequently changing engine oil. The temperature limits for the SAE classes should therefore be regarded as a guide which may be transgressed for brief periods.
In moderate climatic zones SAE 30 may be used from April onward for all engine versions.
The following oils may be used as an all-season oil for all gasoline engines
SAE 10 W–40 and SAE 10 W-50 below + 10 °C.
SAE 5 W-20
SAE 5 W-30, 10 W-30 all-year-round in moderate climatic zones, i.e. up to + 30 °C
SAE 15 W-30 all-year-round in moderate climatic zones



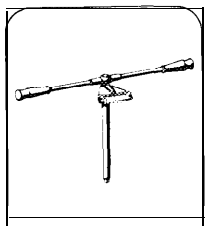
Oil capacities in liters (refer to Service Product Specifications for approved engine oils)

	124 4MATIC	124
Oil sump	6.25	5.7
Hypoid transmission oil SAE 90 for front axle differential	1.0	

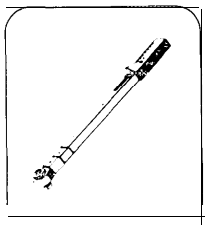
Tightening torques	Nm
Dipstick guide tube to front axle housing	10
Oil drain plug to oil sump	25
Steering damper to body	50
Self-locking nut for drag link	35
Microencapsulated bolts for propeller shaft	25
Microencapsulated bolts for front axle shafts	70
Bottom section of oil sump to front axle housing	10
Engine mount to body M10	40
Engine mount to body (4MATIC) M8	20
Engine mount front to engine support	55
Engine support to crankcase	20
Oil sump or front axle housing to crankcase	
Hexagon bolts M6	10
Hexagon bolts M8	22

Bolts for oil pump	25
Sprocket wheel to oil pump	25
Torsion bar of fastening bolt	60

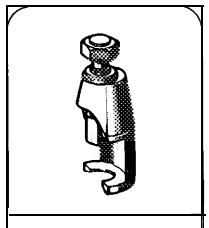
Special tools



001 589 51 21 00
00



001 5896621 00



201 589 08 33 00

Shop-made tools

Metal panel for component compartment wall	Dimensions: approx.320 × 380 × 1
Guard plate for radiator/condenser	Dimensions: approx.480 × 600

Note

Model 124: The oil sump is sealed to the crankcase with a gasket.

4MATIC: The oil sump is sealed to the crankcase with sealant 001 989 61 20 10.

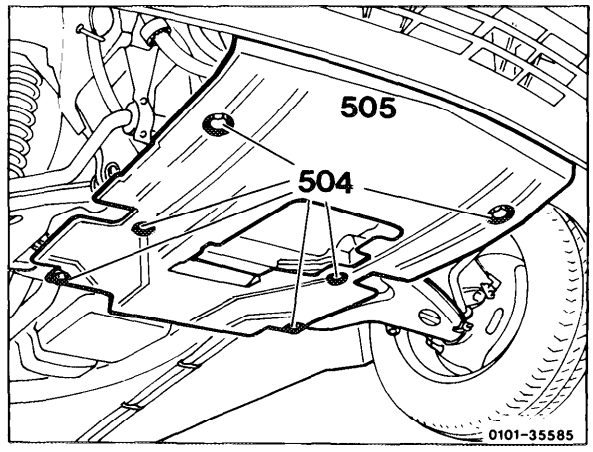
Removal, installation

1 Raise hood to vertical position (01-008).

2 Detach ground cable at battery.

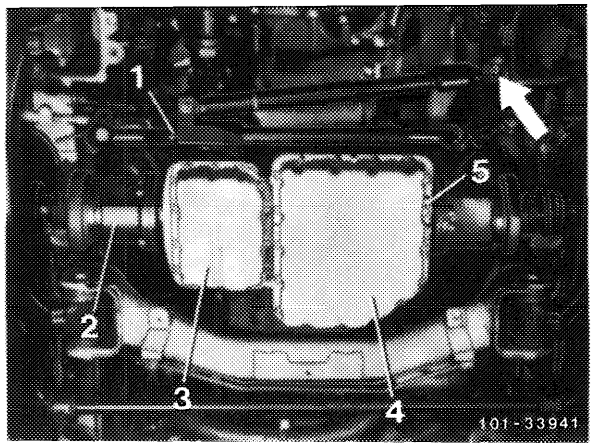
3 4MATIC: Remove air filter (09-400).

4 Unscrew bolts (504) and remove bottom engine compartment covering (505).



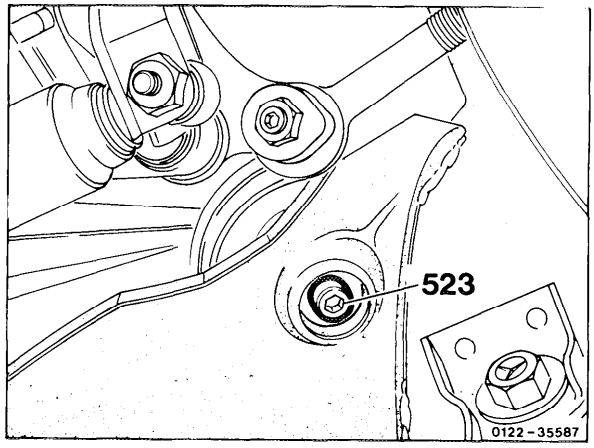
5 Drain engine oil (approx. 6.0 l) into a suitable vessel. Renew gasket. Oil drain plug tightening torque 25 Nm.

4MATIC: Unscrew oil drain plug (5).



6 Unscrew bolt (523) on left and right front engine mount from below. Tightening torque 40 Nm.

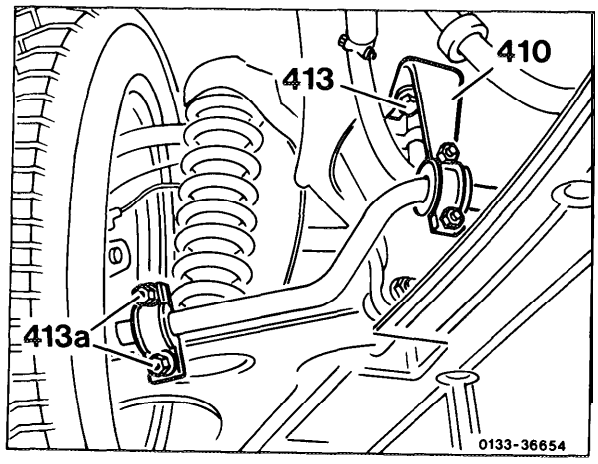
4MATIC: Unscrew 4 bolts from below. Tightening torque 20 Nm.



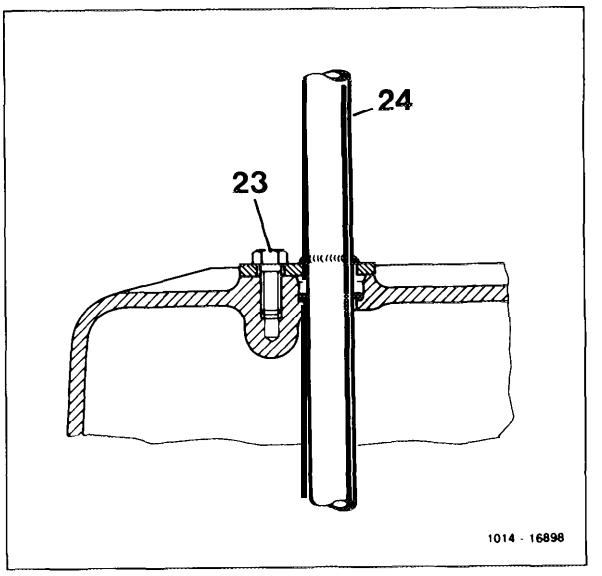
Model 124

7 Model 124: Unscrew bolt (413) for left and right spring leaf swing arm (410). Tightening torque 60 Nm.
Screw down nuts (413a).

8 Detach fan cowl.



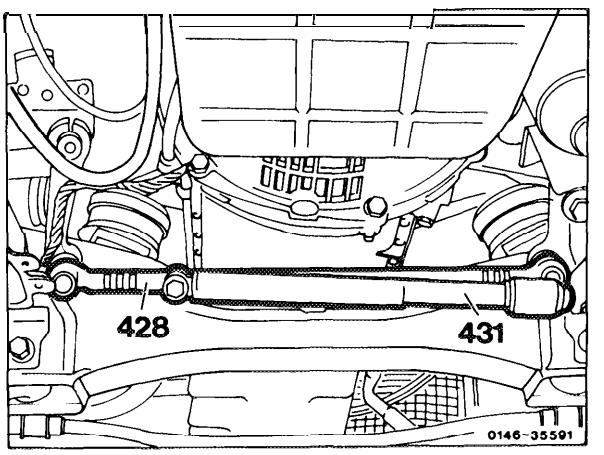
9 4MATIC: Unscrew bolt (23) and withdraw dipstick guide tube (24) from front axle housing, tightening torque 10 Nm.



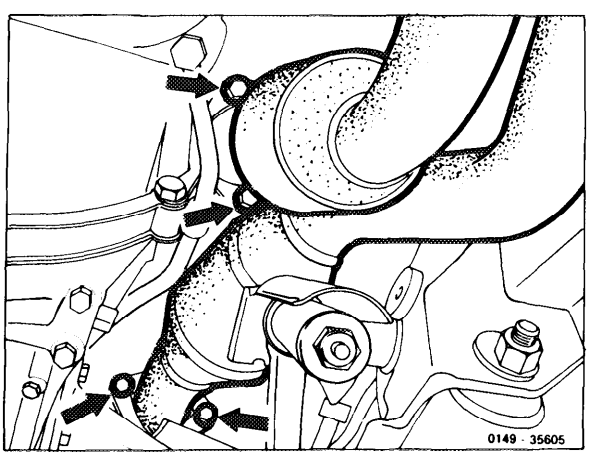
10 Remove drag link (428) with steering damper (431).
Unscrew steering damper (431) at body.
Remove drag link (428) using the tapered removal tool 201 589 08 33 00.

Note
Renew self-locking nuts.
Tightening torques:

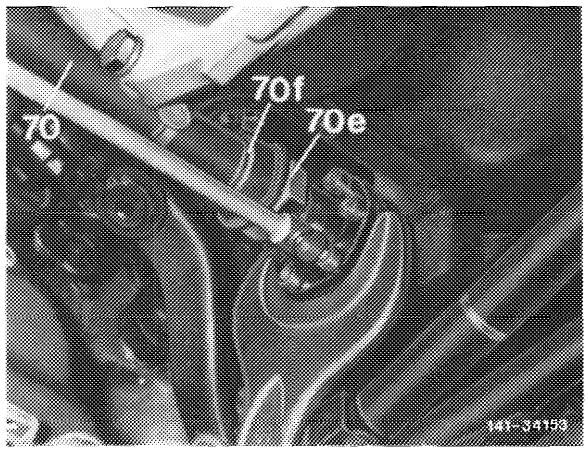
Steering damper	50 Nm
Drag link	35 Nm



11 Unscrew bolts (arrows) for exhaust system on the flange of the exhaust manifold.



12 4MATIC: Unscrew propeller shaft (70) to the front axle at the front axle housing. When performing the step, hold the connecting flange with a 65 mm open-end wrench and unscrew six bolts (microencapsulated).



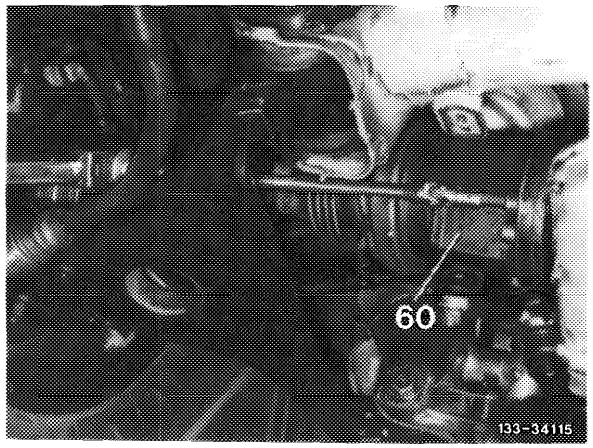
⚠

Do not hold the clamping nut (70e). Ensure that the connecting flange is not pushed out of the teeth.

Installation instruction

Renew microencapsulated bolts, tightening torque 25 Nm.

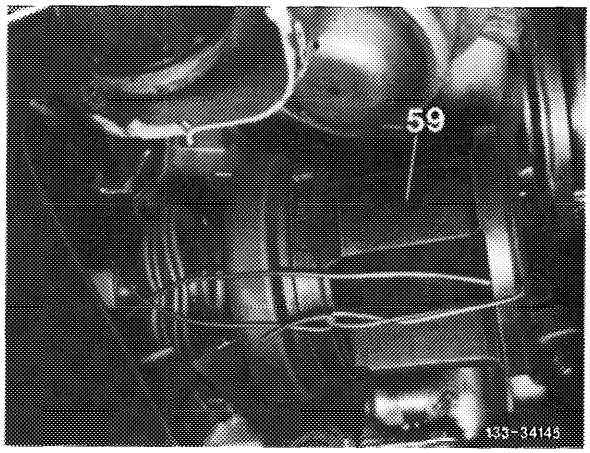
13 4MATIC: Unscrew front axle shafts (60). Operate foot brake to slacken the six bolts (microencapsulated).



Installation instruction

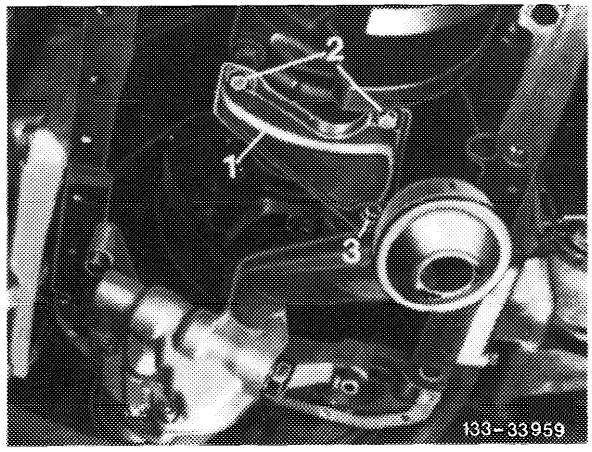
Renew microencapsulated bolts, tightening torque 70 Nm.

14 4MATIC: Push front axle shaft (59) together as far as possible and fix in this position with wire. Place front axle shafts on transverse link. Do not pull inner joint too far apart and angle in order to prevent the needle-bearing tripod joint rollers of the journals at the tripod cross from dropping out.

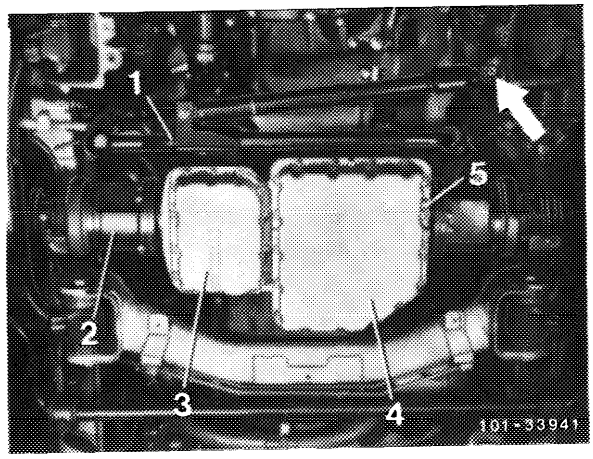


15 Detach plug connection of oil level switch on left of oil sump or front axle housing.

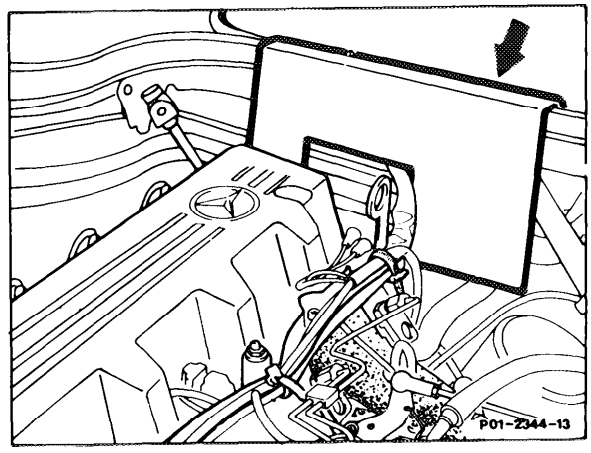
4MATIC: Unscrew bolts for bottom section of oil sump (4) and take off bottom section of sump (4), tightening torque 10 Nm.



16 4MATIC: Unscrew M6x12 bolts (2) and M6x18 bolt (3). Take off support (1) at intake snorkel of the oil pump.



17 Insert guard plate (arrow) between component compartment wall and engine.

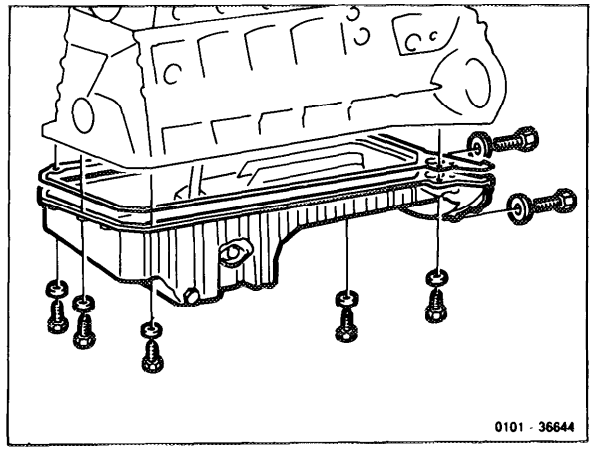


18 Model 124: Unscrew oil sump at the crankcase. Unscrew bolts.

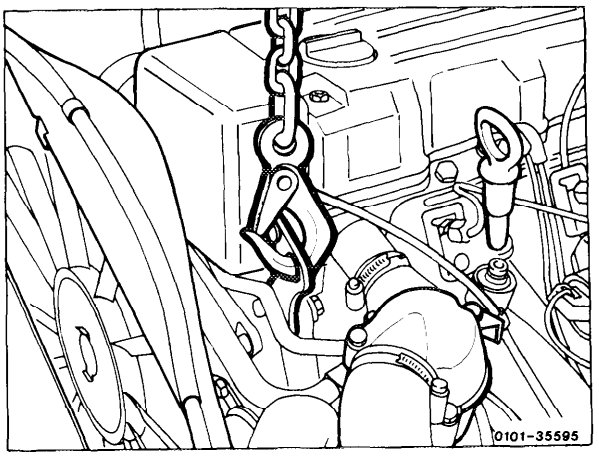
Tightening torque: M6 : 10 Nm
M8 : 25 Nm

Installation instruction

Renew oil sump gasket. Before bolting the oil sump tight, the mating face must be aligned relative to the transmission.



19 Attach engine hoist to the front suspension lug.

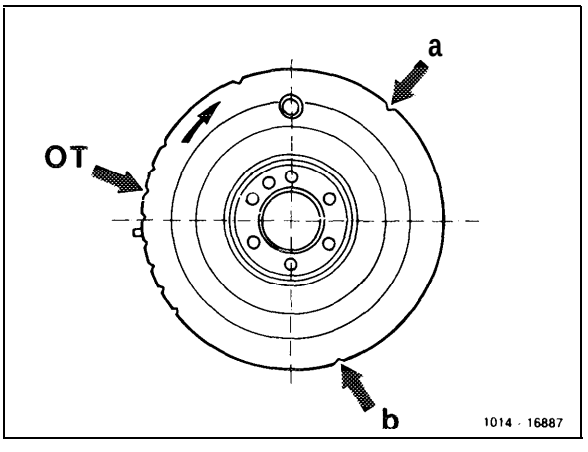


20 Model 124: Raise engine far enough to enable the oil sump to be removed to the front.

⚠

When raising the engine, ensure that the fan does not damage the radiator, and also pay attention to the rear suspension lug, oil filter and coolant hoses.

21 Set pistons of 3rd and 4th cylinder to TDC. The pistons of the 3rd and 4th cylinders are in the TDC position when the marking «a» on the vibration damper is aligned with the TDC pointer.

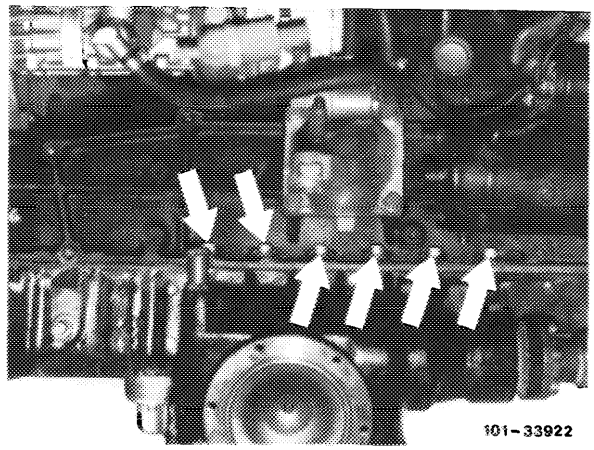


22 4MATIC: Unscrew lefthand engine support at the crankcase and take off together with engine mount.
Tightening torque 20 Nm.

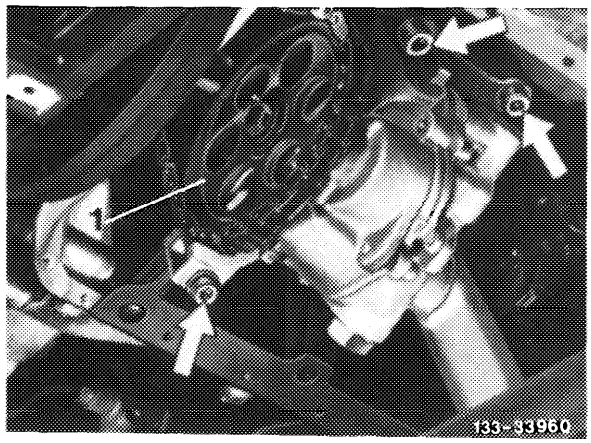
23 4MATIC: Unscrew front axle housing from transmission and crankcase.
Support front axle housing.
If car is fitted with automatic transmission, unscrew the oil line from or to the transmission along the front axle housing.

Note

The M8 bolts (arrows) on the lefthand side of t engine can be reached from above with the suitable tool combinations. In order to turn the two bolts below the starter, place screwdriver insert between starter and crankcase.



24 4MATIC: Lower front axle housing as far as possible. Unscrew bolt for sprocket wheel (1) and take off sprocket wheel (1), tightening torque 25 Nm.
Unscrew bolts (arrows) and take out oil pump down the way, tightening torque 25 Nm.
Take off front axle housing to the rear, paying attention to the drive chain of the oil pump.



25 4MATIC: Clean mating surfaces on front axle housing. Apply sealant 001 989 61 210 to the mating surface on the front axle housing
(a = silicone bead Ø 1.5 mm).
First of all mate front axle housing to the transmission then bolt to crankcase.

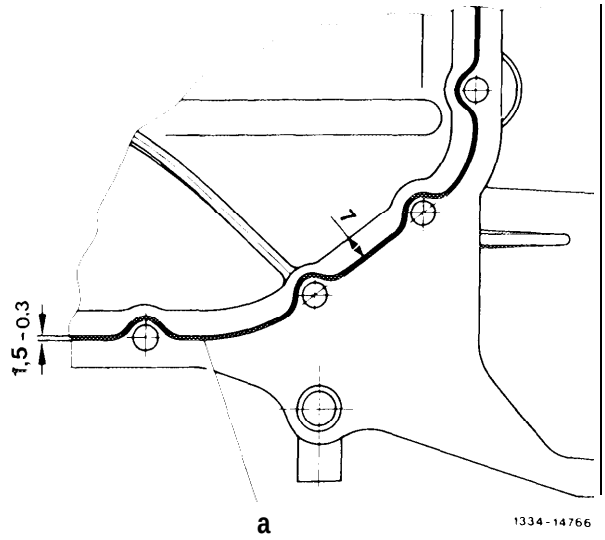
Installation instruction

Pay attention to different lengths of bolts.

Tightening torque	M6	: 10 Nm
	M8	: 22 Nm

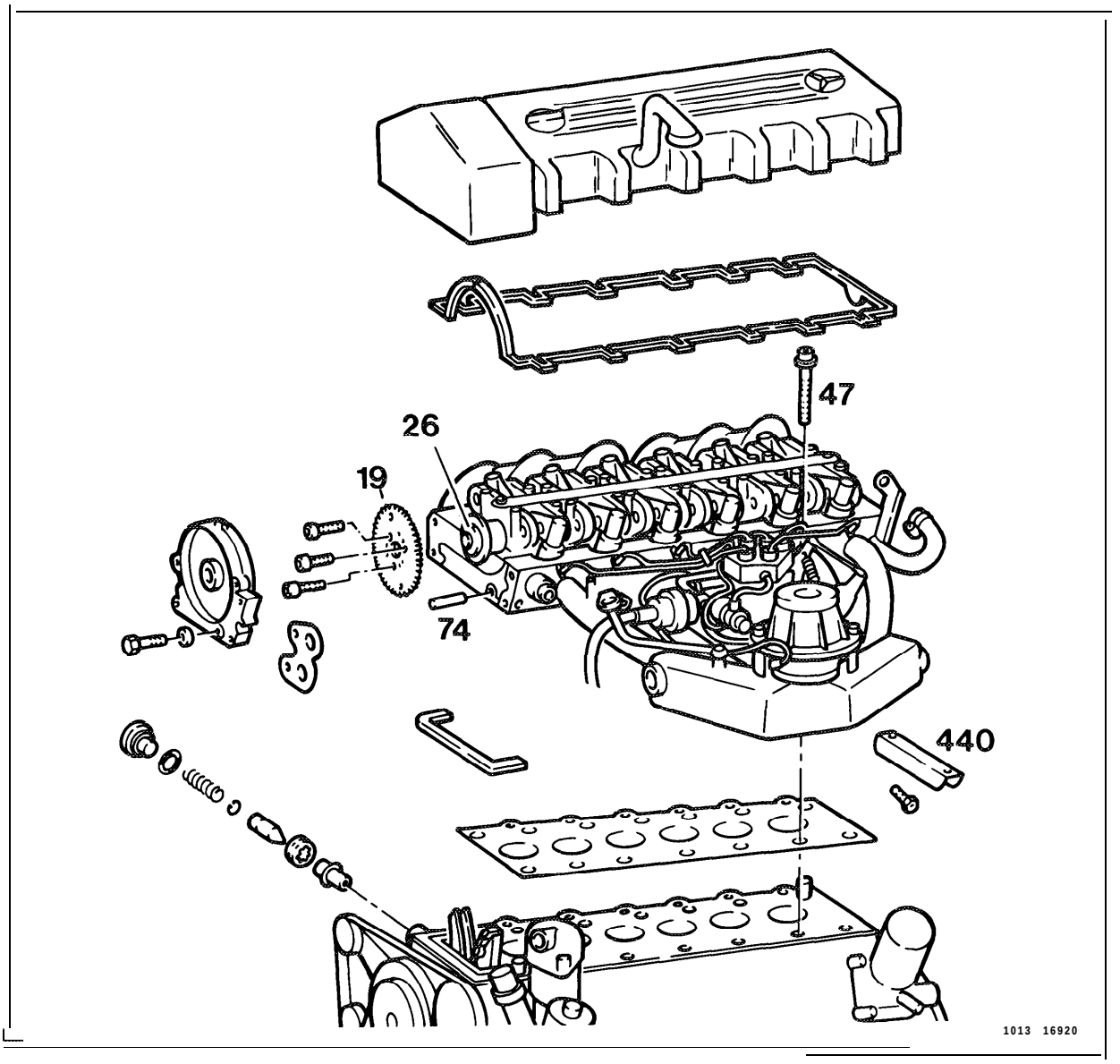
Renew self-locking nut and microencapsulated bolts.

Install in the reverse order.



a= bead diameter of 1 5 mm

Job No. of job texts and job values or standard texts and flat rates 01-5800, 01-5855

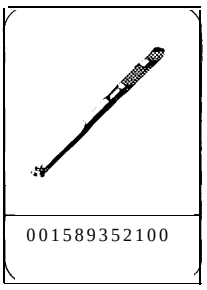


Hood	raise to vertical position (01-008).
Coolant	drain, pour in (20-010).
Front cover at top	remove, install (01-212).
Camshaft gear (19)	mark relative to camshaft (26), detach and attach (steps 4 to 7).
Chain tensioner	remove, install (05310).
Sliding rail pin (74)	withdraw, knock in, impact extractor 116 589 20 33 00 (step 8).

Bracket of dipstick guide tube and inlet pipe support (440)	unscrew, screw on (steps 9 and 10).
Fuel lines	detach, attach, briefly open fuel filler cap beforehand (step 14).
Bowden cable (accelerator control)	detach, attach (30-325).
Control pressure cable	detach, attach (step 16).
Coolant hoses and heating water return line	detach, attach (steps 11 and 12).
Engine wiring harness	detach, attach (steps 17 to 19).
If automatic transmission fitted, dipstick guide tube	unscrew, screw on (step 13).
Exhaust system at exhaust manifold	unscrew, screw on (step 20).
Cylinder head with intake manifold and exhaust manifold	take off, fit on (steps 21 to 23).
Camshaft (26)	set to marking (steps 24 and 25).
Piston of No. 1 cylinder	set to TDC (step 26).
Cylinder head bolts (47)	check, tighten (steps 27 to 29).

Tightening torques and angle of rotation torque		Nm
Cylinder head bolts when engine cold	1st stage	70
	2nd stage 90° angle of rotation	
	3rd stage 90° angle of rotation	
Bolts for cylinder head cover		8.5
Screw plug of chain tensioner		50
Threaded ring of chain tensioner		30
Camshaft gear to camshaft (hex. socket bolt M6, 1st version)		11
Camshaft gear to camshaft (Torx bolts M7, 2nd version)		16
Distributor rotor to follower (reference value)		2.5
Follower to camshaft		21
Front cover at top to cylinder head		21

Special tools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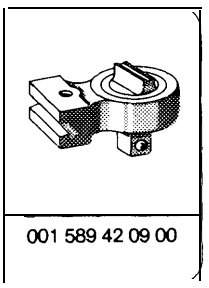
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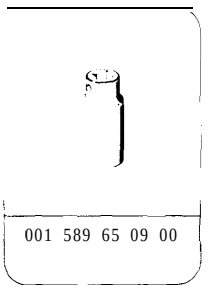
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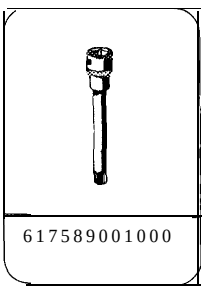
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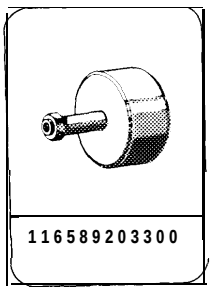
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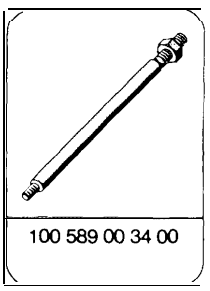

100 589 00 34 00

Note
Detach cylinder head together with camshaft, intake manifold and exhaust manifold after engine has cooled down.

Removal, installation

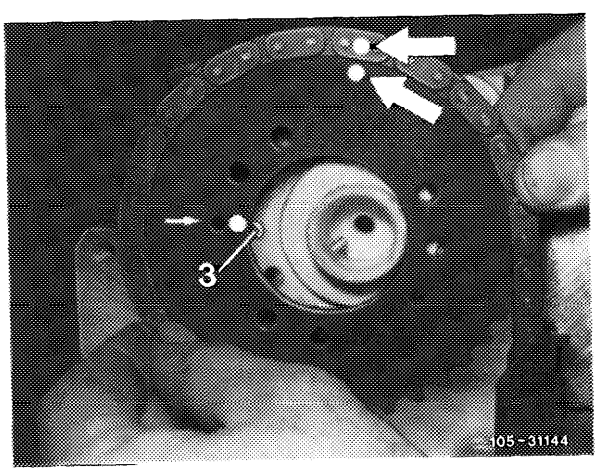
1 Raise hood to vertical position (01-008).

2 Drain coolant at crankcase (20-010).

3 Remove front cover at top (01-212).

4 Mark position of camshaft gear relative to camshaft. This is done by applying colored marking next to fixing pin (3) on the camshaft gear.

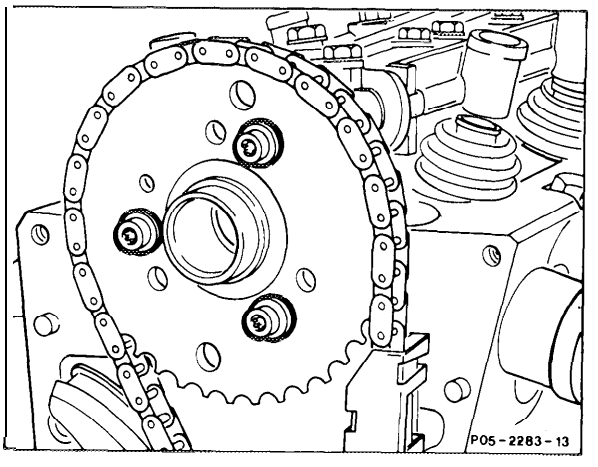
5 Remove chain tensioner (05310).



6 Unscrew bolts (16).

Tightening torque		
Hex. socket bolts	M6:	11 Nm
Torx bolts	M7:	16 Nm

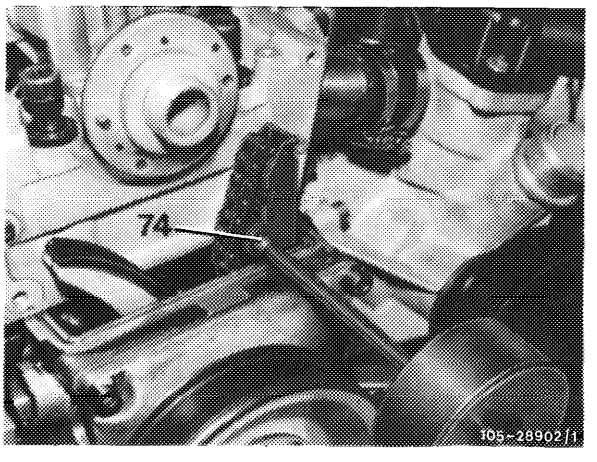
7 Pull off camshaft gear (19) by hand.



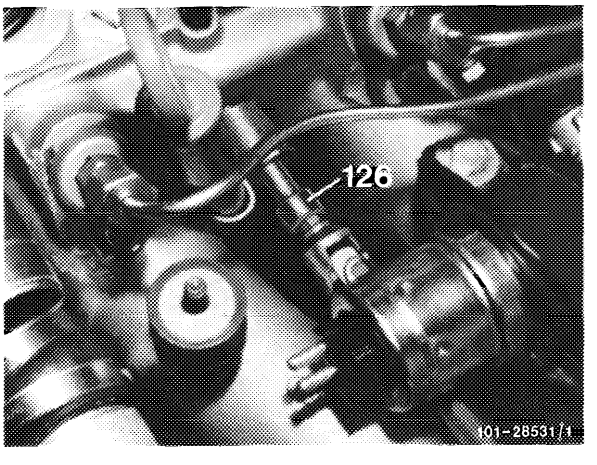
8 Use impact extractor 116 589 20 33 00 to withdraw slide rail pin (74).

Installation instruction

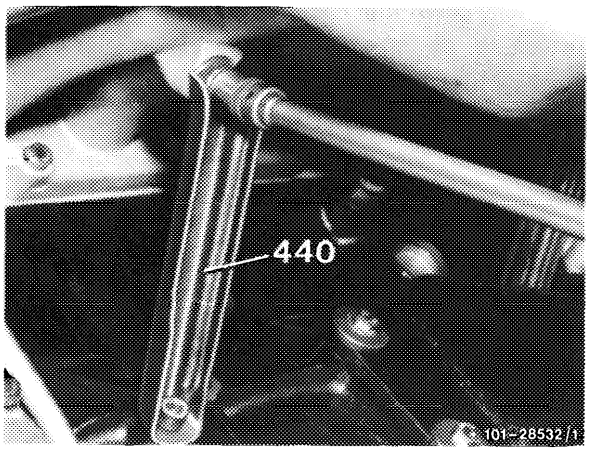
The thread in the slide rail pin (74) must be facing forward in direction of travel when it is knocked in.



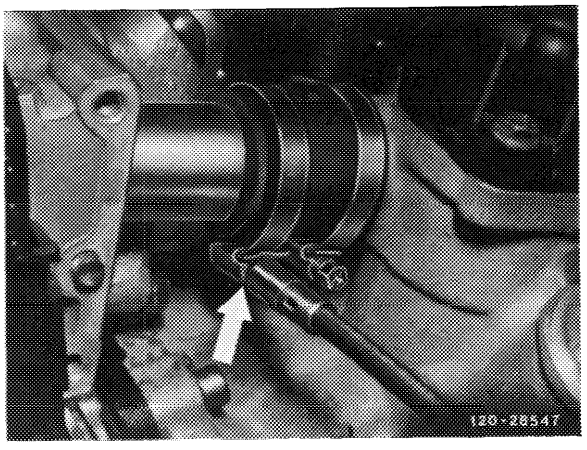
9 Unscrew bracket (126) for dipstick guide tube.



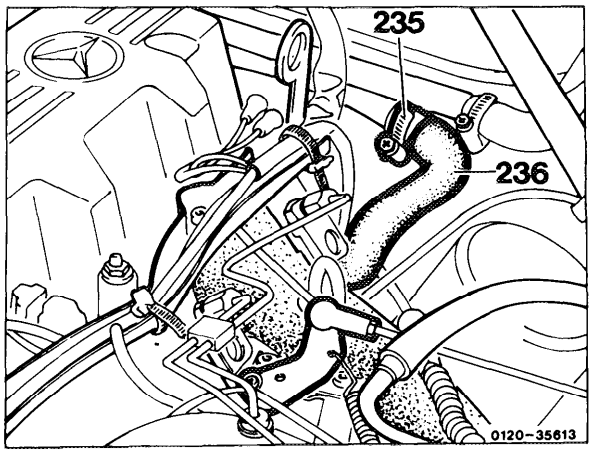
10 Unscrew intake manifold support (440) at top, detach at bottom.



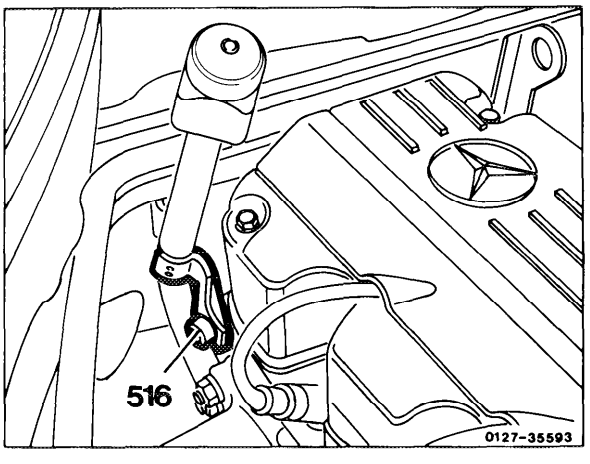
11 Slacken hose clips (arrow) on the coolant hose to the coolant pump.



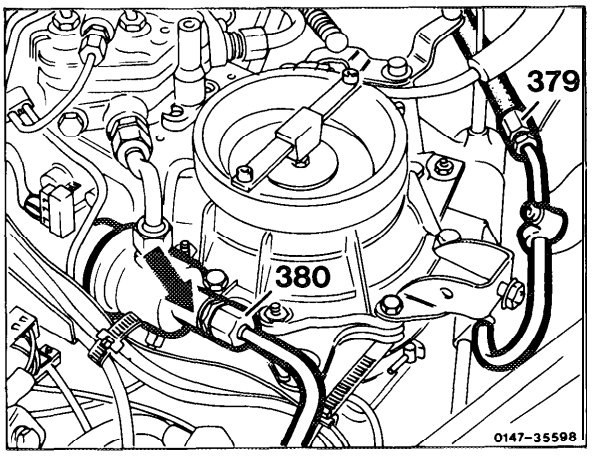
12 Slacken hose clip (235). Detach heating water return line (236).



13 If automatic transmission fitted: Unscrew bolt (516).



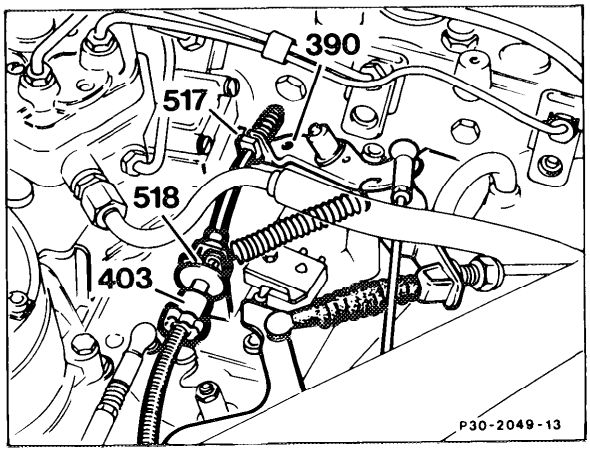
14 Briefly open fuel filler cap to release the pressure in the fuel tank.
Unscrew fuel lines (379, 380).
Hold the connection fitting (arrow) to prevent it moving when slackening the fuel line (380).



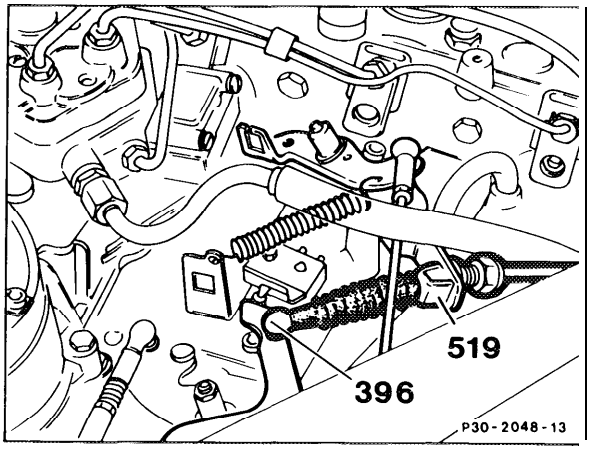
15 Detach Bowden cable (accelerator control). Press plastic guide (517) out of its seat in the fulcrum lever (390) and withdraw Bowden cable (403) through the slot in fulcrum lever (390). Compress the links of the plastic clip (518) and push plastic clip with the Bowden cable (403) to the rear through the bracket.

Installation instruction

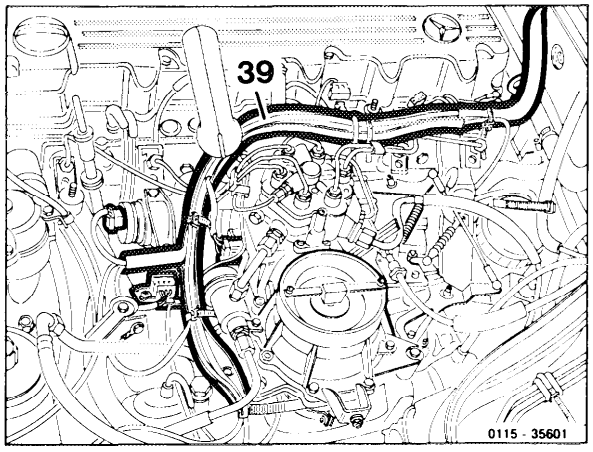
Adjust Bowden cable (403) (30-325).



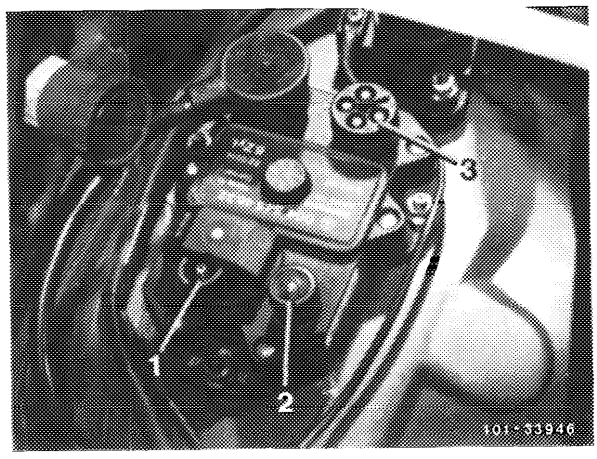
16 Detach control pressure cable (396). Compress links (519) of the plastic clip and guide plastic clip with linkage through the bracket.



17 Detach engine wiring harness (39). Slacken all the cable straps of the engine wiring harness (39). Detach all the plug connections along the engine wiring harness (39).

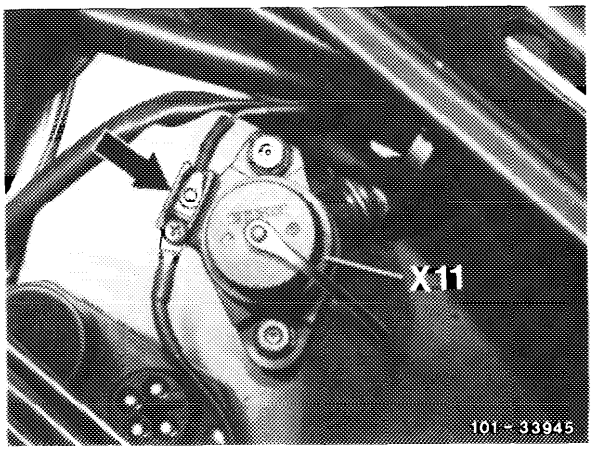


18 Detach green control cable and vacuum line at the connector-sensor ignition control unit.

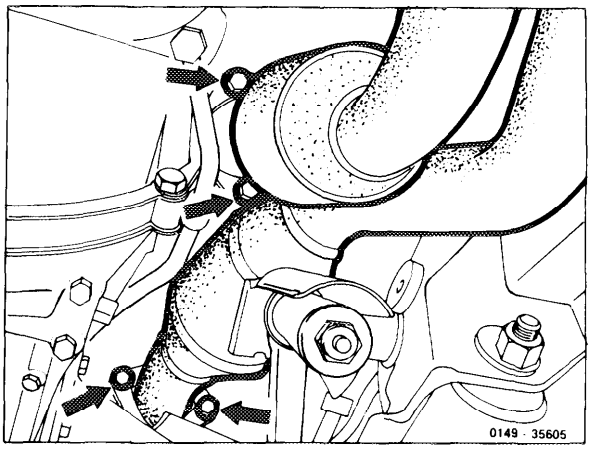


1 Vacuum connection
2 Control line-position sensor connection
3 Connector-sensor connection

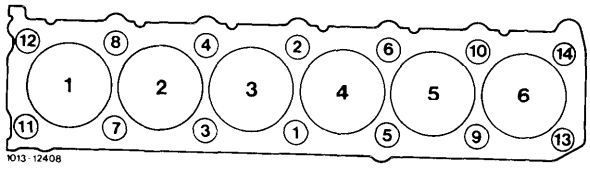
19 Detach terminal block terminal TD (arrow) next to diagnostic socket (Xl 1), unscrew diagnostic socket (Xl 1), detach grey cable from the TDC sensor on the rear of the diagnostic socket (Xl 1).



20 Unscrew bolts (arrows) for exhaust system on the flange of the exhaust manifold.



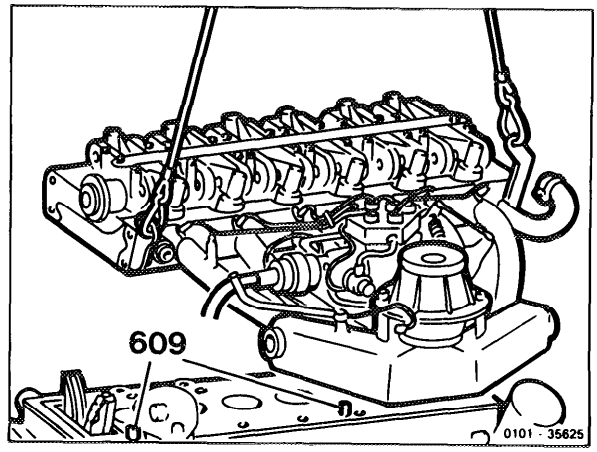
21 Slacken cylinder head bolts when engine cold in stages in the reverse order to the tightening diagram, starting with 14.



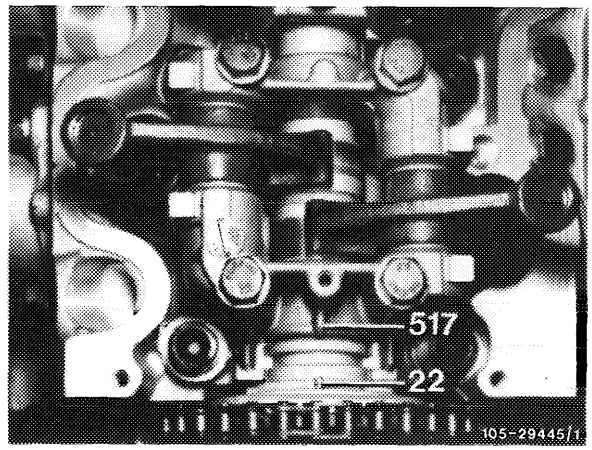
22 Attach engine hoist to the suspension lugs of the engine.
Take off cylinder head.

23 Renew cylinder head gasket.

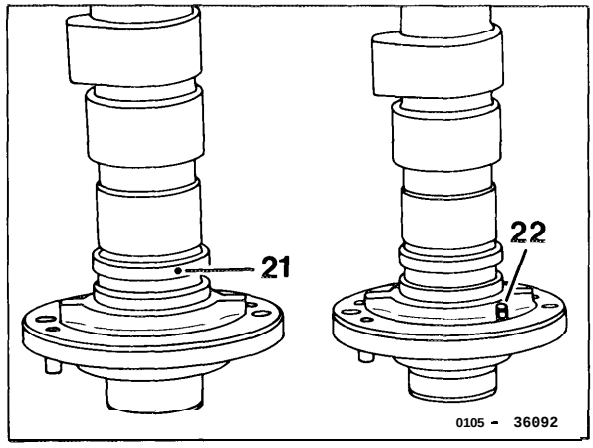
Installation instruction
Pay attention to the 2 fit pins (609) for locating the cylinder head on the crankcase.



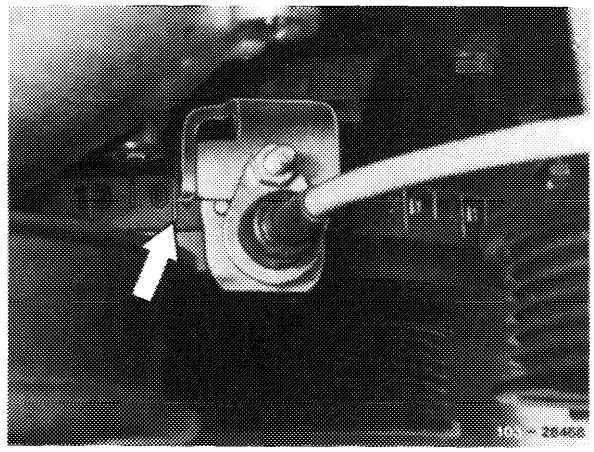
24 Turn crankshaft so that pin (22) or positioning bore of the camshaft is aligned with the marking (517) on the 1st camshaft bearing.



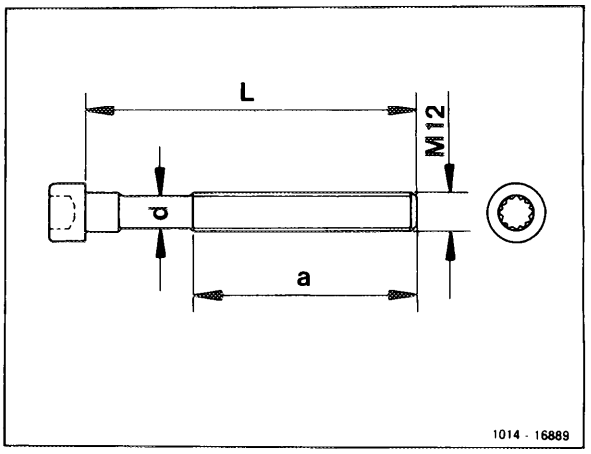
25 Effective 12/86 only the positioning bore (21) is provided in place of the pin (22).



26 Position piston of No. 1 cylinder to TDC (arrow).

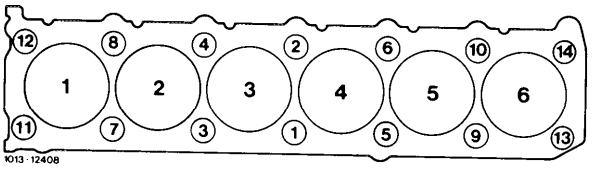


27 Check cylinder head bolts.
Each time the cylinder head bolts are tightened they are subject to a certain permanent stretch. If the maximum length (L) of 108.4 mm is exceeded, the bolts should be scrapped and replaced by new ones.



28 Oil the thread of the cylinder head bolts and also the contact surface of the bolt head and insert.

29 Tighten the cylinder head bolts in stages in the order shown in the tightening diagram, beginning with 1.
1st tightening stage 70 Nm
2nd tightening stage 90° angle of rotation
3rd tightening stage 90° angle of rotation



30 Install in the reverse order.

Job No.

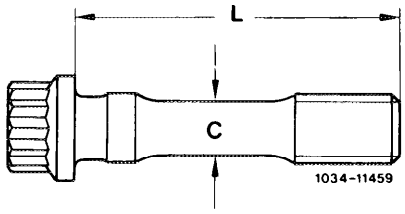
Checking, renewing and tightening conrod bolts . . . . . 03 – 310
Renewing front crankshaft radial seal . . . . . – 324
Renewing rear crankshaft radial seal . . . . . – 327
Removing, installing belt pulley, flywheel damper and hub . . . . . – 342
Removing, installing flywheel or driven plate . . . . . - 410
Machining flywheel . . . . . – 420

03-310 Checking, Renewing and Tightening Conrod Bolts

Job No. of job texts and job values or standard texts and fiat rates 03-4341, 03-4351

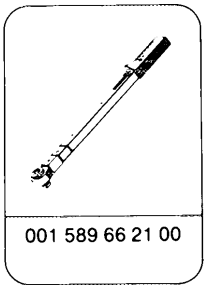
Conrod bolts

Part No.	102 038 00 71
Thread 0 (d)	M9 × 1
Stretch shaft 0 (c) when new	7.4 – 0.1
Minimum stretch shaft 0 (c)	7.1
Length (L) when new	52 – 0.3
Initial tightening torque	30 Nm
Angie of rotation torque	90 – 100"



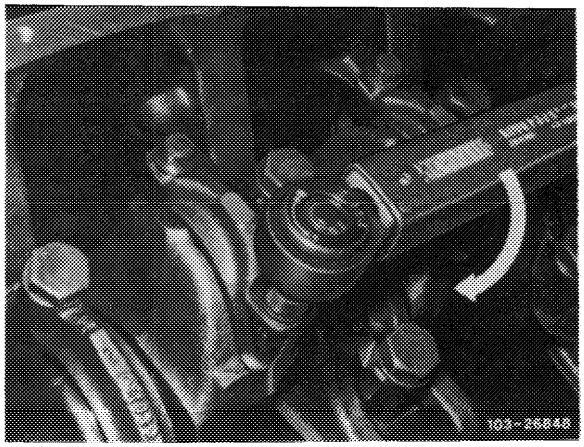
Conrod bolts	measure minimum stretch shaft 0 (c). If the minimum stretch shaft 0 has been reached or no longer exists, renew conrod bolt.
Thread and contact surface of conrod bolts	oil before installing.
Conrod bolt initial and angle of rotation torque ...	initial torque 30 Nm. Angle of rotation torque 90 – 100°. Use special tool 001 589 66 21 00 (see Note).

Special tool



Note

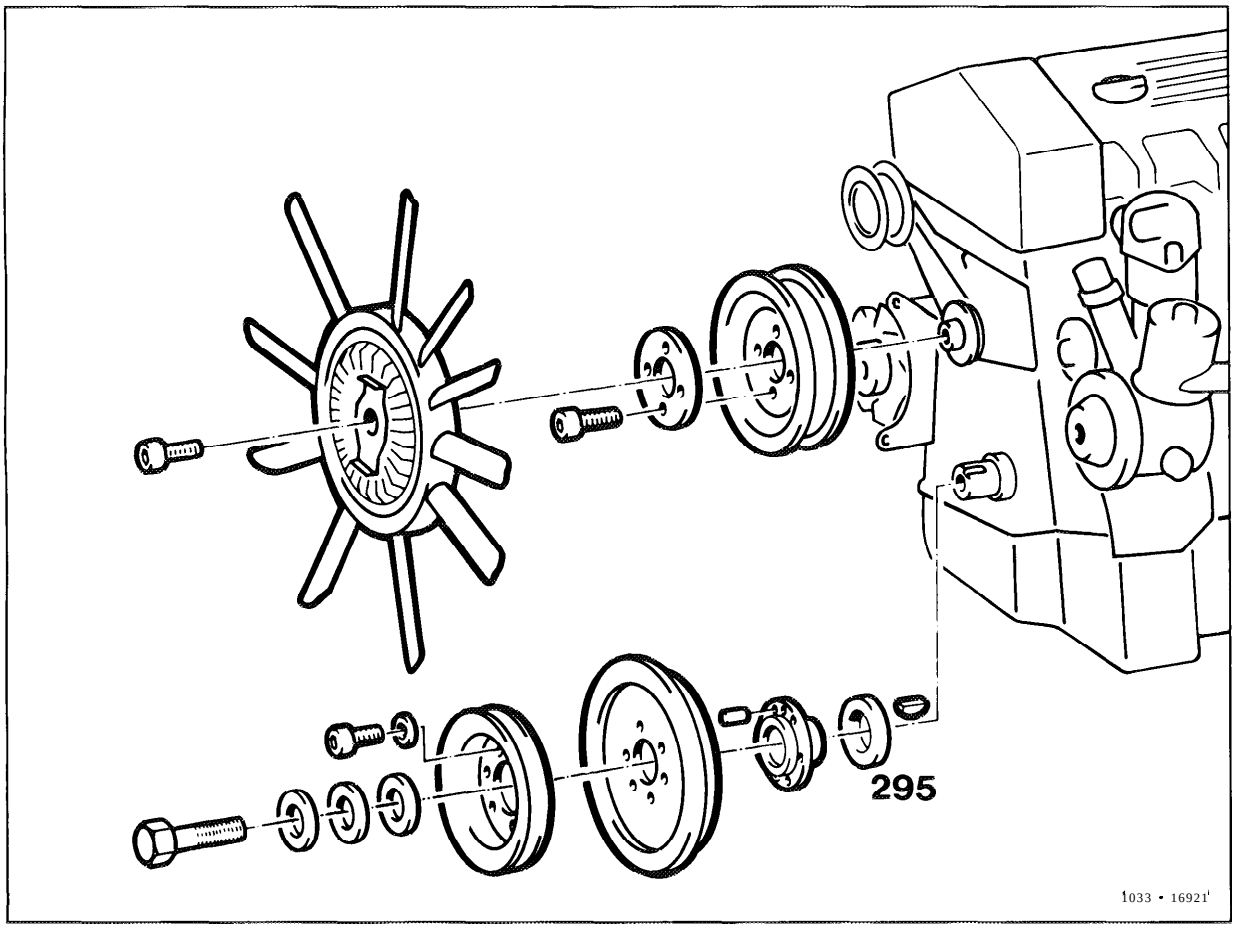
If no torquing wrench is available, the conrod bolt can be torqued on by the specified angle with a socket wrench and tommy in a single step. To rule out any possible angle errors, do not use a bending rod torque wrench for tightening according to degrees of angle.



03-324 Renewing Front Crankshaft Radial Seal

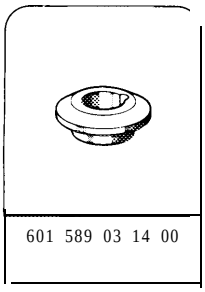
Job No. of job texts and job values or standard texts and flat rates ..... 03-3000 - 01-3112

Model 124



Belt pulley, vibration damper and hub	remove, install (03-342).
Radial seal (295)	remove, renew and install (step 2, use special tool 601 589 03 14 00).
Mounting hole	clean, check.
Sealing lip	oil (step 3).

Special tool



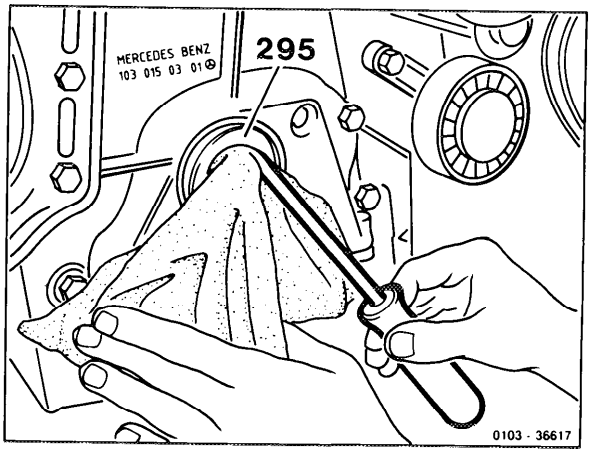
Note

An oil leak can be detected by spraying around the cleaned and dried area with Mercedes-Benz white contrast spray 000 989 03 59.

The radial seal has a sealing lip offset by 2 mm to the inside for the repair.

1 Remove belt pulley, vibration damper and hub (03-342).

2 Use a screwdriver to press radial seal (295) out of the timing case cover. Ensure that the crankshaft journal and the mounting hole in the timing case cover are not damaged.
Cover crankshaft journal with a cloth.
If necessary, deburr mounting hole.

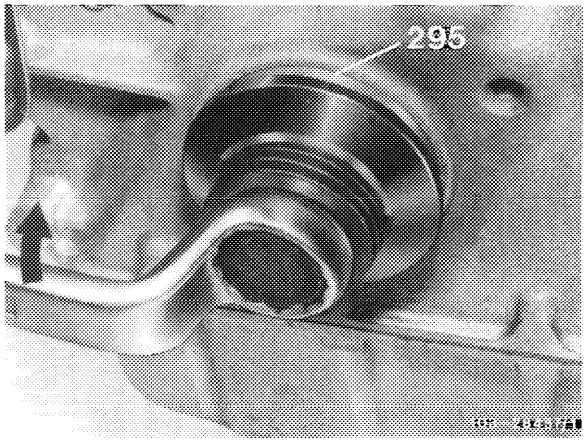


3 Oil sealing lip of radial seal (295).

⚠

Do not use any grease. Grease prevents the inclined webs on the sealing lip from transporting back the engine oil.

4 Press in radial seal (295) with the installation tool 601 589 03 14 00.



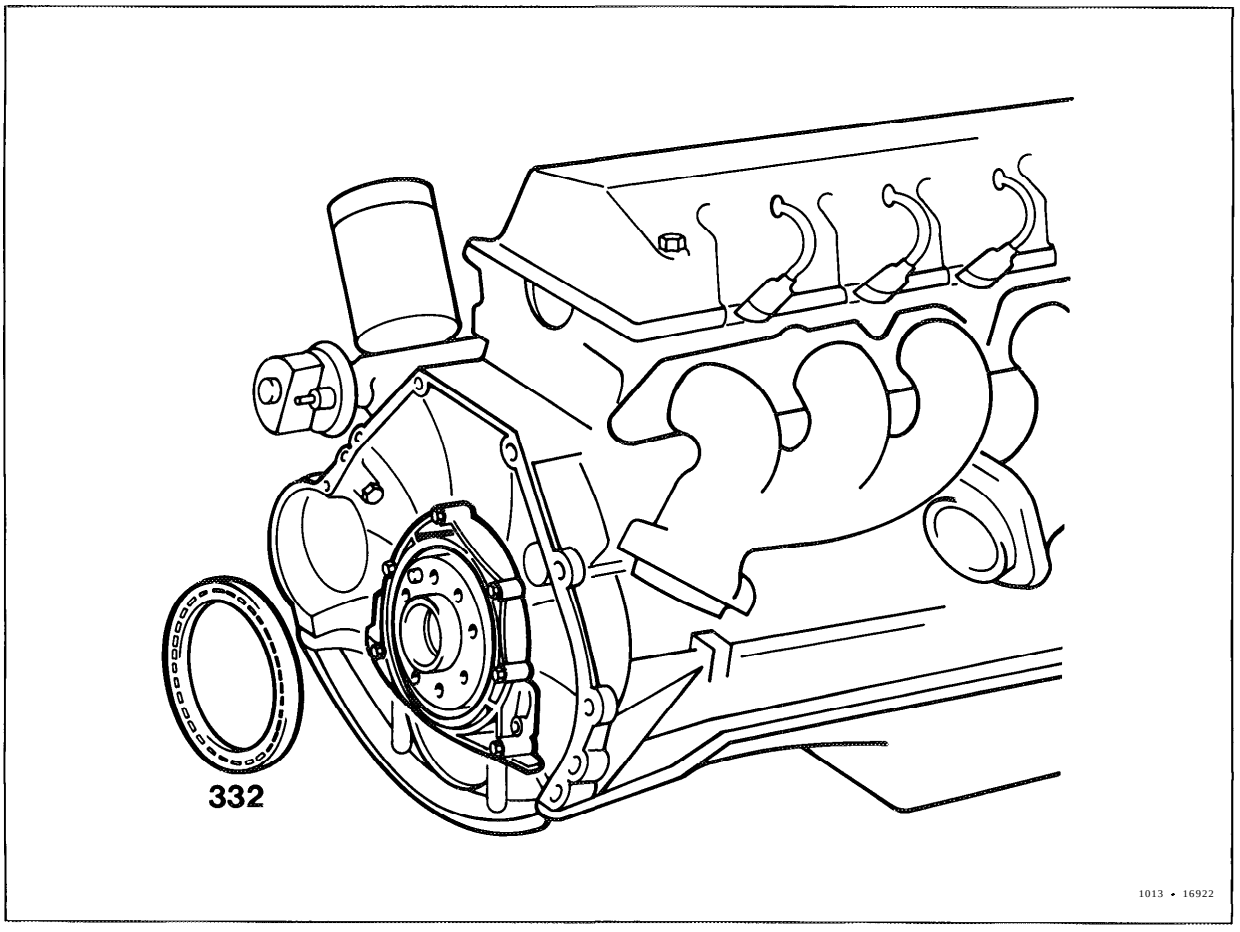
Note
The radial seal must be at right angles to the crankshaft journal otherwise it will not provide a proper seal.

Install in the reverse order.

03-327 Renewing Rear Crankshaft Radial Seal

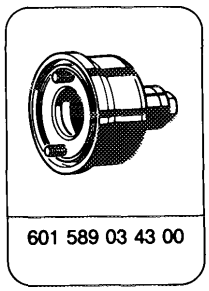
Transmission removed.

Job No. of job texts and job values or standard texts and flat rates . . . . . 03-3063 - 03-3301



Wood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Flywheel or driven plate	remove (03-410).
Radial seal (322)	remove, renew and install.
Mounting hole	clean, check.
Sealing lip	coat with engine oil.
Oil level in engine	check, correct.
Engine in installation position	support, secure.
Leaktightness with engine running	check.
Flywheel or driven plate	install.

Special tool



Note
The radial seal is press-fitted flush in the closing cover without sealant. The closing cover is fixed to the crankcase with 2 fit pins and bolted on.

An oil leak can be detected after spraying the cleaned and dried area with Mercedes-Benz white contrast spray 000 989 03 59.

The radial seal has a sealing lip offset by 3 mm to the inside for the repair.

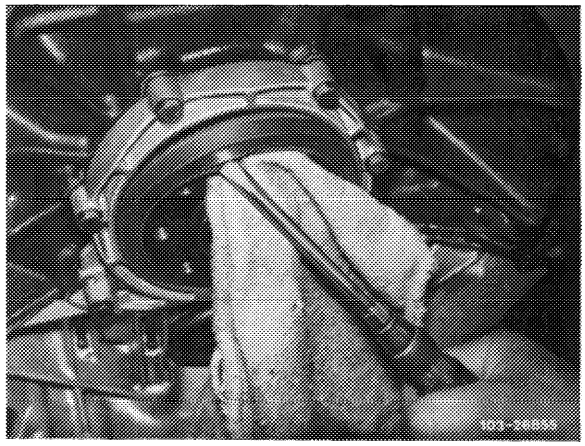
The mounting holes in the crankshaft are designed as blind holes.

1 Raise hood to vertical position (01-008).

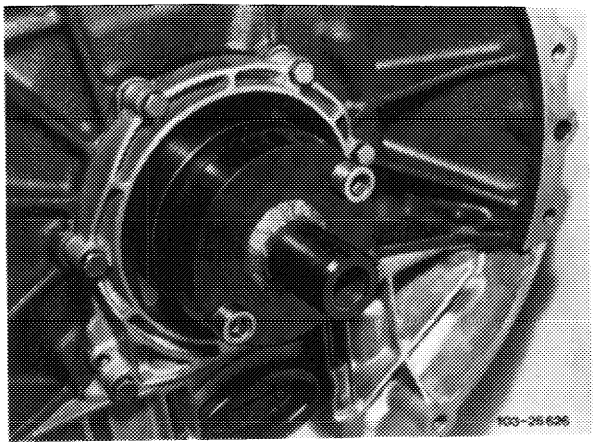
2 Detach ground cable at battery.

3 Remove flywheel or driven plate (03-410).

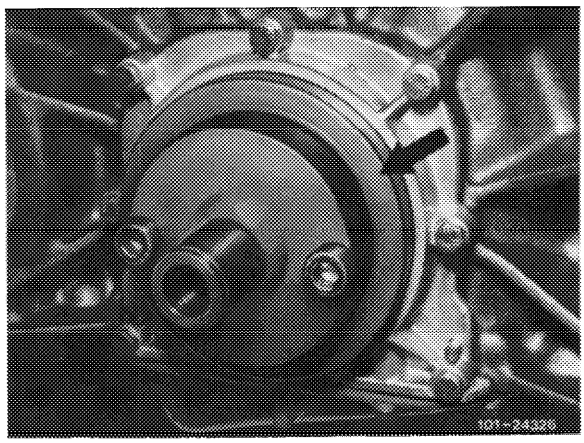
4 Use a screwdriver to press the radial seal out of the closing cover. Ensure that the crankshaft flange and the mounting hole in the closing cover are not damaged when performing this step.
Cover over crankshaft flange with a cloth.
If necessary, deburr mounting hole.



5 Bolt inner section of installation tool 601 589 03 43 02 to the crankshaft flange.

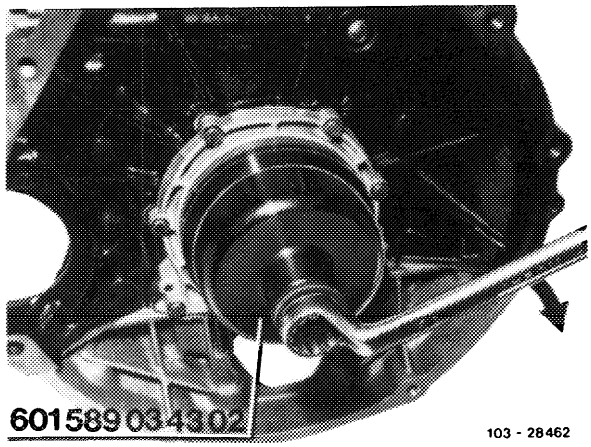


6 Push radial seal (arrow) over the inner section of the installation tool.



7 Press radial seal into the closing cover as far as the stop until flush using the outer section of the installation tool 601 589 03 43 02.

Note
The radial seal must be at right angles to the crankshaft flange otherwise it will not provide a proper seal.



8 Coat sealing lip of radial seal with engine oil.

Do not use any grease. Grease prevents the inclined webs on the sealing lip from transporting back the engine oil.

9 Check oil level in engine and adjust to correct level.

Before starting engine, move into installation position and secure at the rear by supporting.

10 Attach ground cable to the battery.

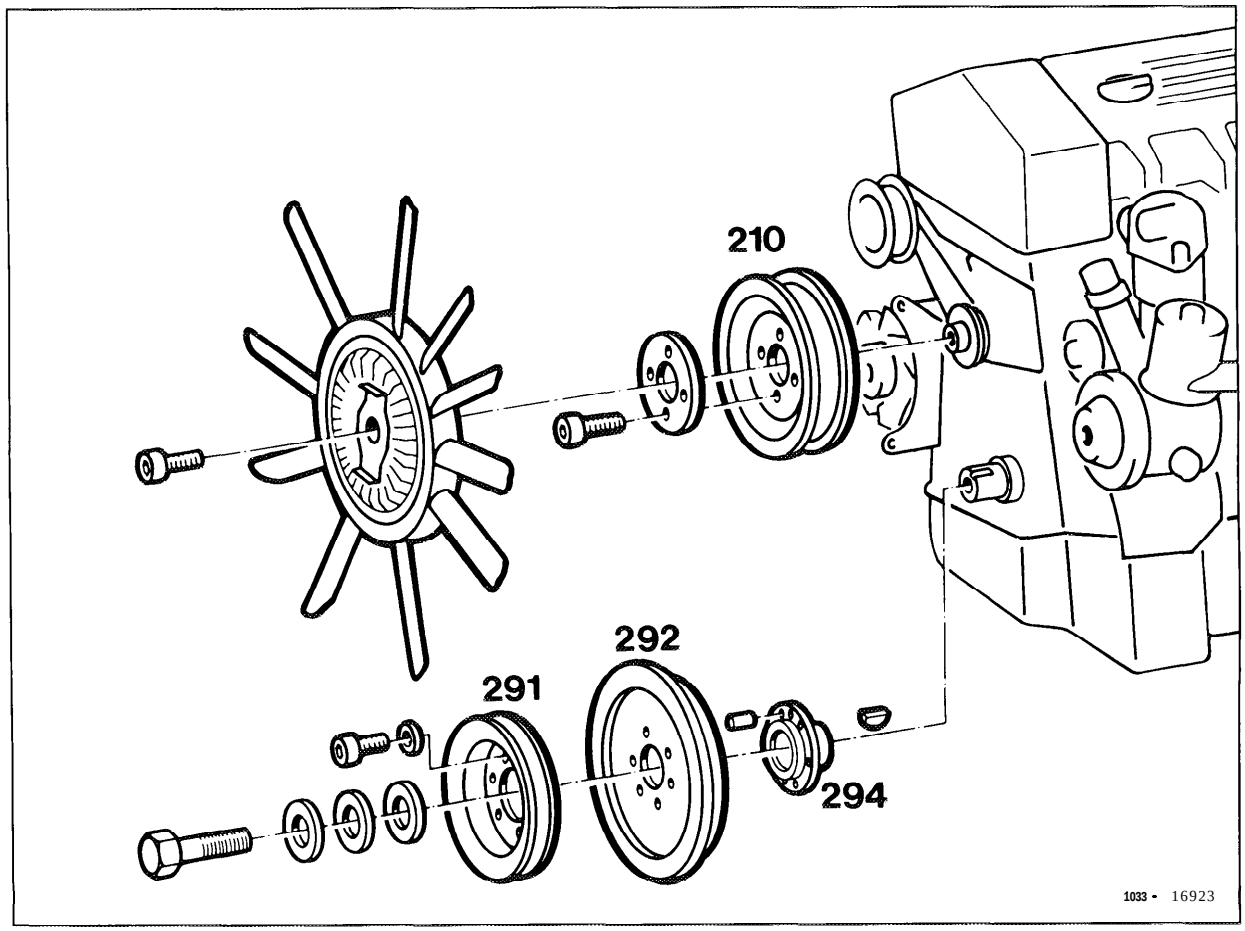
11 With the engine running, check for signs of leaks before installing transmission.

12 Install flywheel or driven plate (03-410).

03-342 Removing, Installing Belt Pulley, Flywheel Damper and Hub

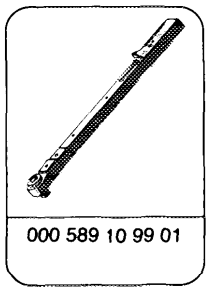
Job No. of job texts and job values or standard texts and flat rates ..... 03-I 320 – 03-I 911

Model 124

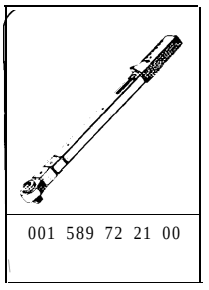


Hood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Engine compartment covering below	remove, install.
Poly V-belt	remove, install (13-342).
Guard plate in front of radiator	attach (step 6).
Belt pulley (210)	remove, install, tightening torque 10 Nm.
Retaining lock	install, remove, special tool 601 589 02 40 00 (steps 8 and 9).
Vibration damper (292) and belt pulley (291)	remove, install (step 10), tightening torque 23 Nm.
Hub (294)	pull off, press on, tightening torque 300 Nm.

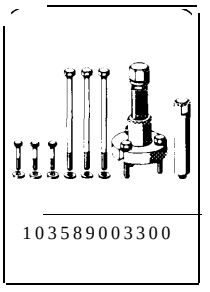
Special tools



000 589 10 99 01



001 589 72 21 00



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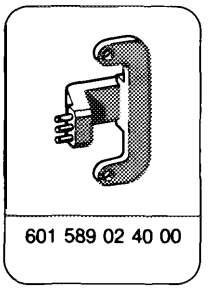


601 589 02 40 00

Shop-made tool

Guard plate for radiator/condenser	Dimensions approx. 600 × 480 × 1

Note

Belt pulley, vibration damper and hub can be renewed without balancing.

1 Raise hood to vertical position (01-008).

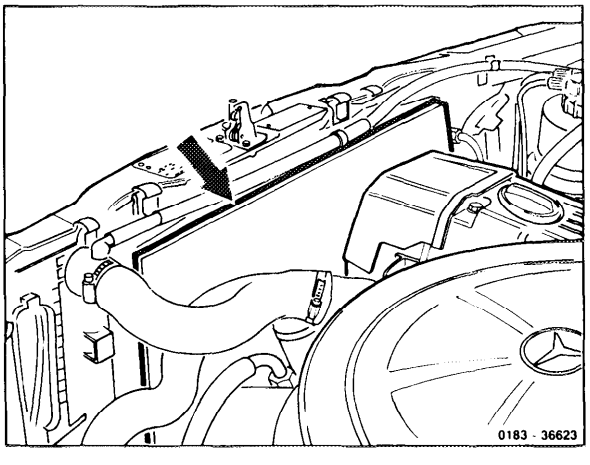
2 Detach ground cable at battery.

3 Remove engine compartment covering below.

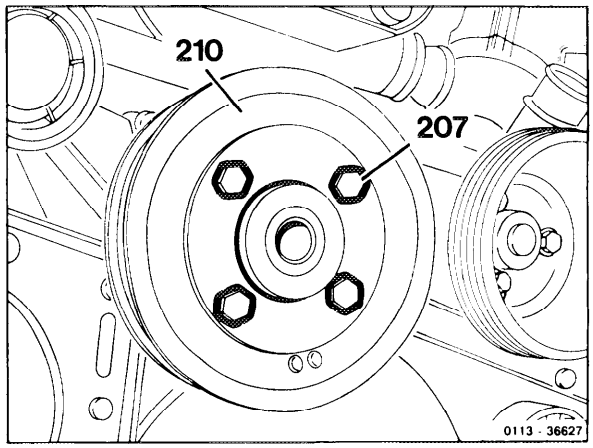
4 Slacken bolts of the belt pulley-fan coupling.

5 Remove V-belt (13-342).

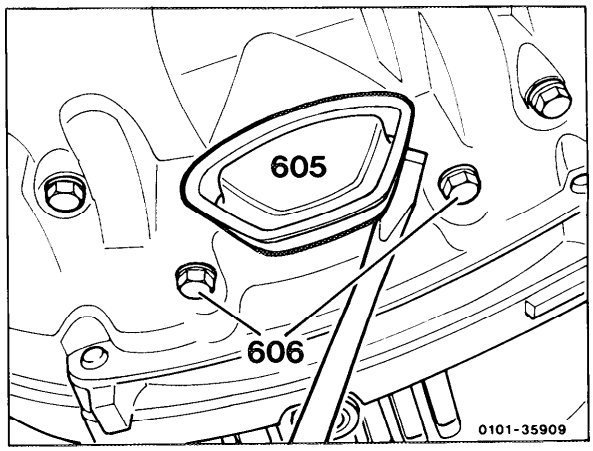
6 Fit guard plate (arrow) in front of radiator.



7 Unscrew bolts (207) and take off belt pulley-fan coupling (210), tightening torque 10 Nm.

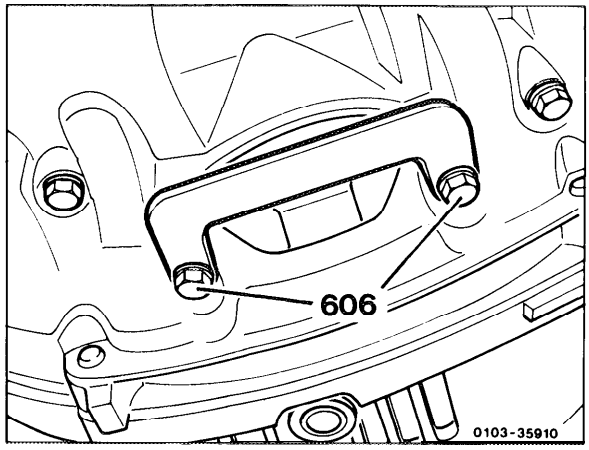


8 Take off plastic cap (605) on rear of oil sump. Unscrew bolts (606).



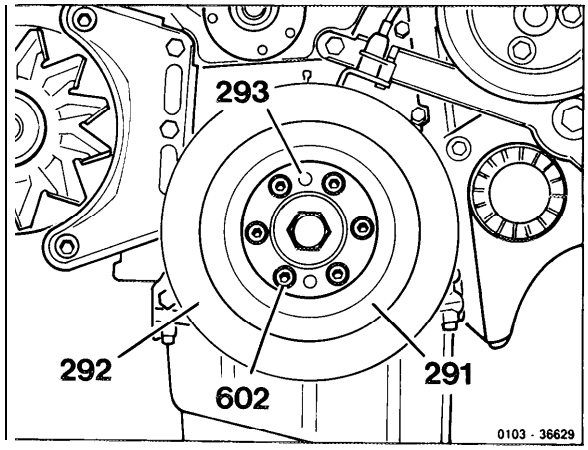
9 Attach retaining lock 601 589 02 40 00 with both bolts (606).

Note
Pins of the retaining lock must engage into the ring gear teeth.

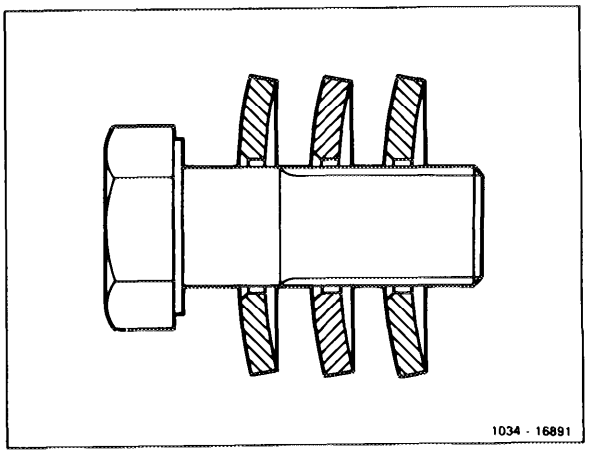


10 Unscrew bolts (602). Take off belt pulley (291) and vibration damper (292).

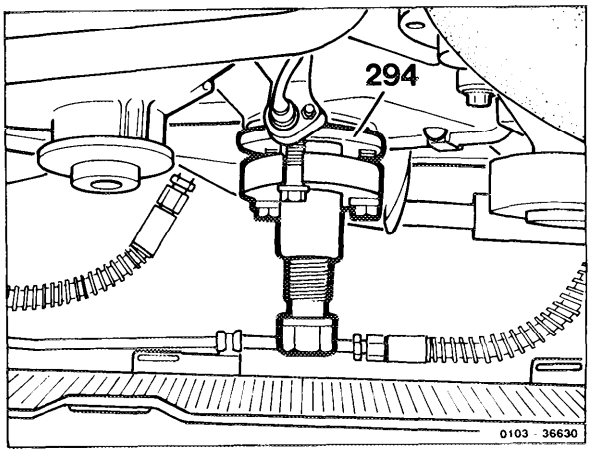
Installation instruction
The vibration damper (292) is located with a fit pin (293).
Install bolts (602) with washers, tightening torque 23 Nm.



Installation instruction
Oil bolt threads and Belleville spring washers. Fit Belleville spring washers with the curved face pointing toward the bolt head.
Tighten bolt to 300 Nm.



11 Pull off hub (294) with puller 103 589 00 33 00.



Installation instruction
Heat hub (294) to approx. 50 °C so that it can be easily fitted onto the crankshaft. When fitting on, perform turning movements to determine whether the slot of the hub (294) is aligned with the Woodruff key in the crankshaft.

Install in the reverse order.

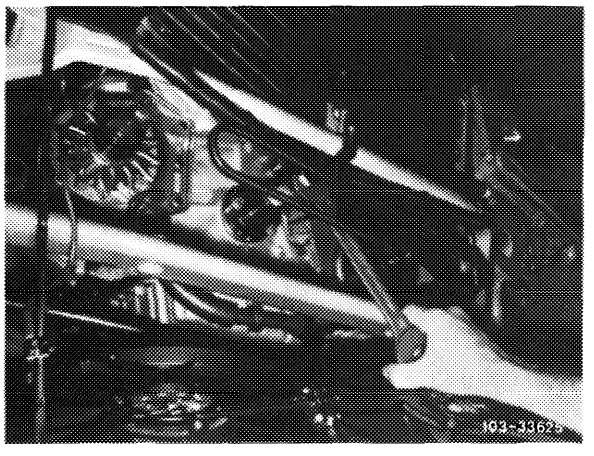
Model 201

1 Remove visco clutch, fan and radiator.

2 Disconnect steering oil cooler connections.

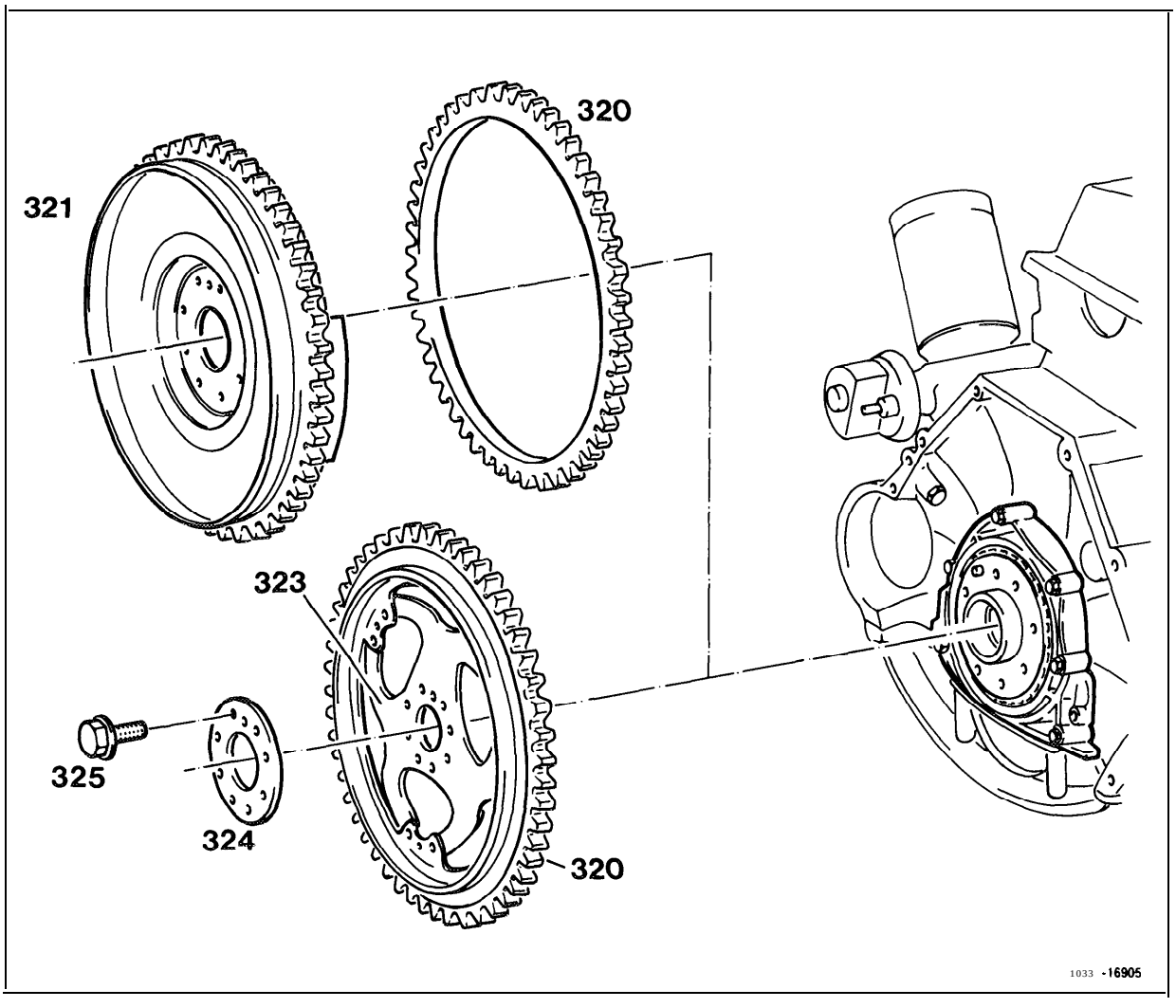
3 Disconnect both electric cooling fans.

Remaining procedure as on model 124.



03-410 Removing, Installing Flywheel or Driven Plate

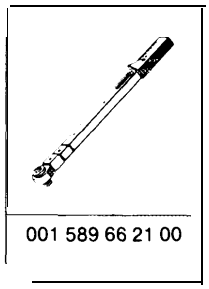
Job No. of job texts and job values or standard texts and flat rates 03-8001, 03-8201

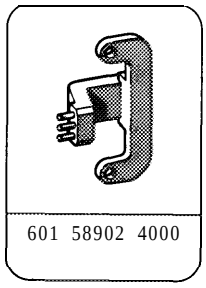


Manual or automatic transmission	remove, install (26-020 or 27-600).
Clutch	remove, install (25050).
Retaining lock	install, remove. Special tool 601 589 02 40 00 (steps 1 and 2).
Stretch bolts (325, Ml0 x 22)	unscrew, check and screw in. Tightening torque: Initial torque 30 Nm. Angle of rotation torque 90° (step 4).

Stretch bolts (325)	check.
Flywheel (321) or driven plate (323) with ring gear (320)	detach, attach (steps 5 to 7).

Special tools





Note
The flywheels of the engines 103.94 and 103.98 differ in their dimensions and weights.

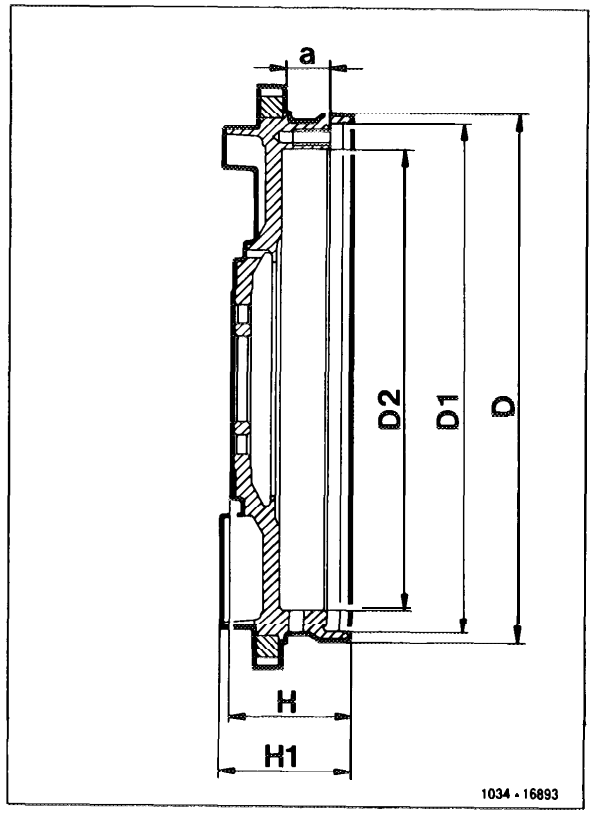
Distinguishing characteristics')

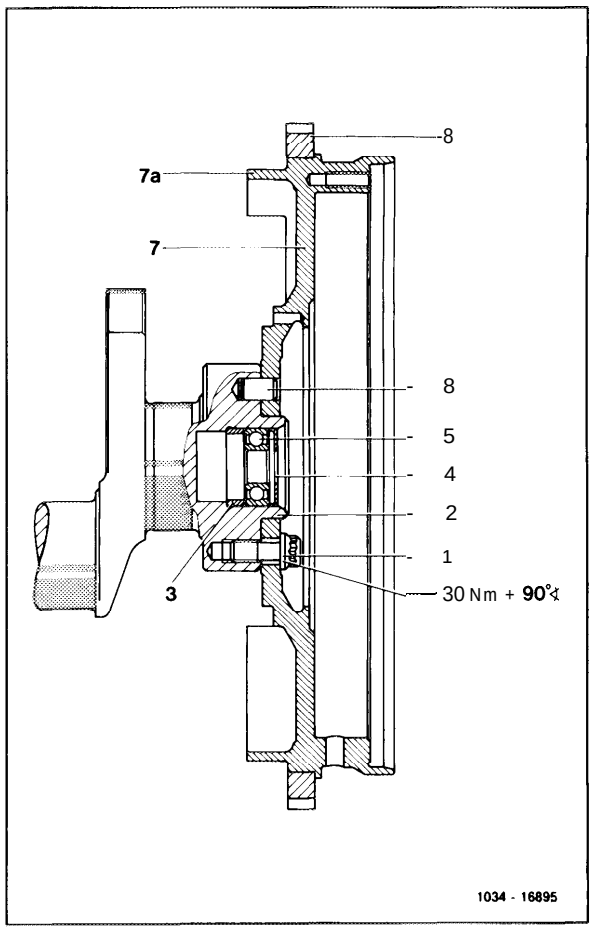
Engine	D	D2	H	H1	a
103.94	272.0	237	55.5	61.5	24.8
103.98	277.5	244	60.2	66.2	27.5

[1]) except cars with 4MATIC.

Flywheel and driven plate are guided on the crankshaft with fit holes and located each with a fit pin.

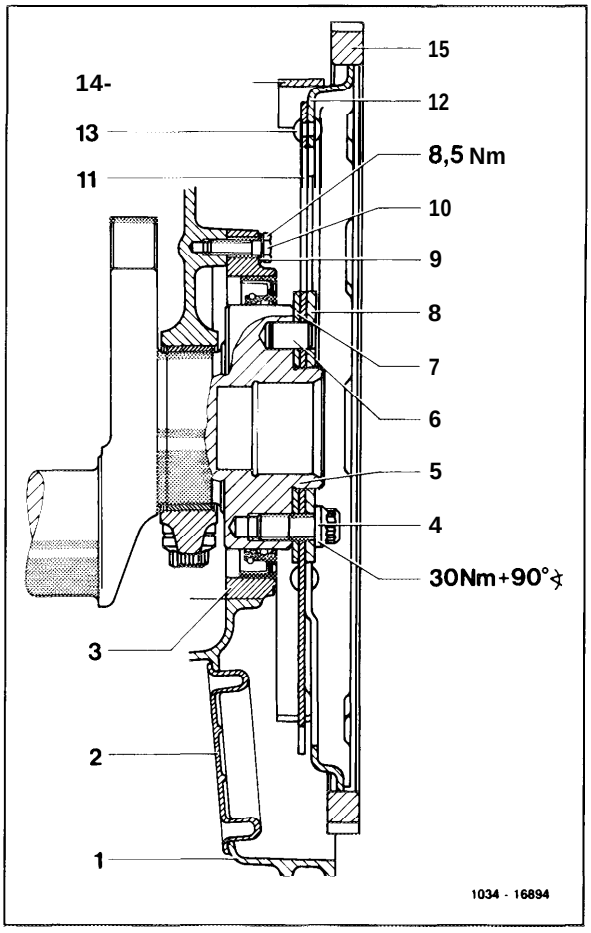
Flywheel or driven plate with ring gear are balanced individually and can be replaced without balancing.





Arrangement on manual transmission

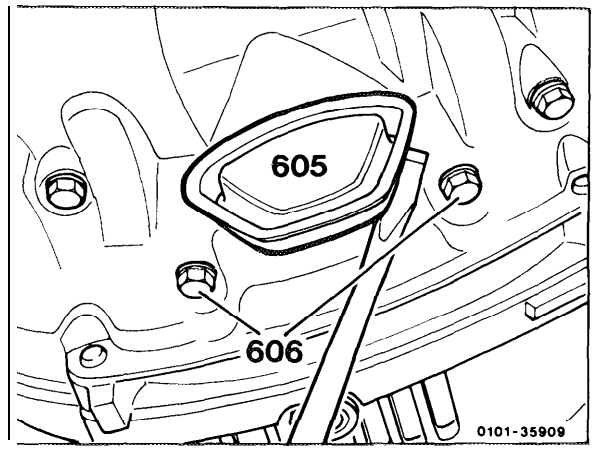
1 Stretch bolt MI 0 x 1 x 22
2 Crankshaft
3 Spacer ring
4 Closing cover
5 Grooved ball bearing
6 Fit pin
7 Flywheel
7a Segment
8 Ring gear



Arrangement on automatic transmission

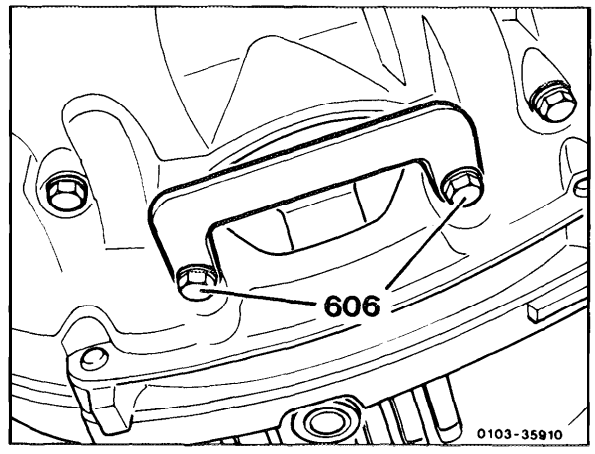
1 Oil sump
2 Cover
3 Closing cover with radial seal
4 Stretch bolt M 10 x 1 x 22
5 Crankshaft
6 Fit pin
7 Disk 2.6 mm (stuck on)
8 Disk 3.5 mm
9 Washer
10 Bolt
11 Driven plate
12 Ring for ring gear
13 Rivet
14 Segment
15 Ring gear

1 Take off plastic cap (605) on rear of oil sump. Unscrew bolts (606).

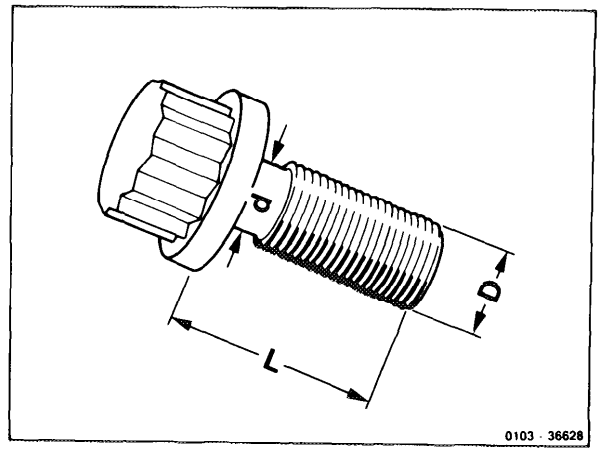


2 Fix retaining lock 601 589 02 40 00 with both bolts (606). Pins on the retaining lock must engage in the ring gear teeth.

3 Unscrew stretch bolts. Take off flywheel (321) or driven plate (320) with stuck-on disk and disk (324).



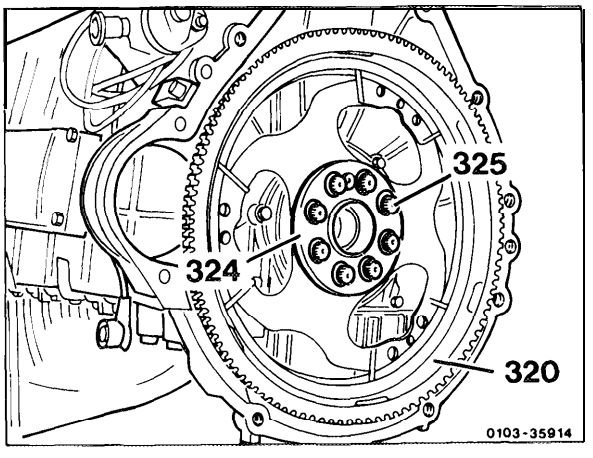
4 Check stretch bolts, measure diameter of stretch bolt shaft and length of bolts. If the specified minimum dia. «d» on the stretch shaft or if the maximum bolt length «L» is reached, the bolts must be renewed.



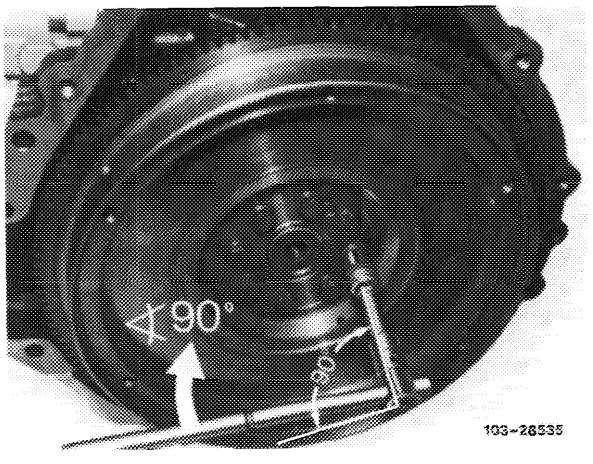
Thread	D		M10 × 1
Stretch shaft Ø	d	When new	8.5 – 0.2
		Minimum Ø	8.0
Bolt length	L	When new	22 ± 0.2
		Max. bolt length	22.5

5 Attach flywheel or driven plate and ring gear (320) with stuck-on disk and disk (324).

6 Screw in stretch bolts (325) and tighten with initial tightening torque of 30 Nm.



7 Torque stretch bolts (325) on in a single step by the specified angle of rotation torque of 90”.
Do not use a torque wrench in order to rule out any possible angle error.



03-420 Machining Flywheel

Job No. of job texts and job values or standard texts and flat rates 03-8022

Engine (except 103.984 and 103.985)		103.98	103.94
Distance a		25.4 + 0.2	19.4 ± 0.1
Distance b	when new	15.2 ± 0.4	16.6 ± 0.4
	for repairs up to	14.2 ± 0.4	15.6 ± 0.4
Permissible variation in concentricity on clutch face or clutch flange face		0.05	0.05

Note

Flywheels for manual transmission which have scorch points, scoring or cracking in the clutch face, should be machined by precision-turning.

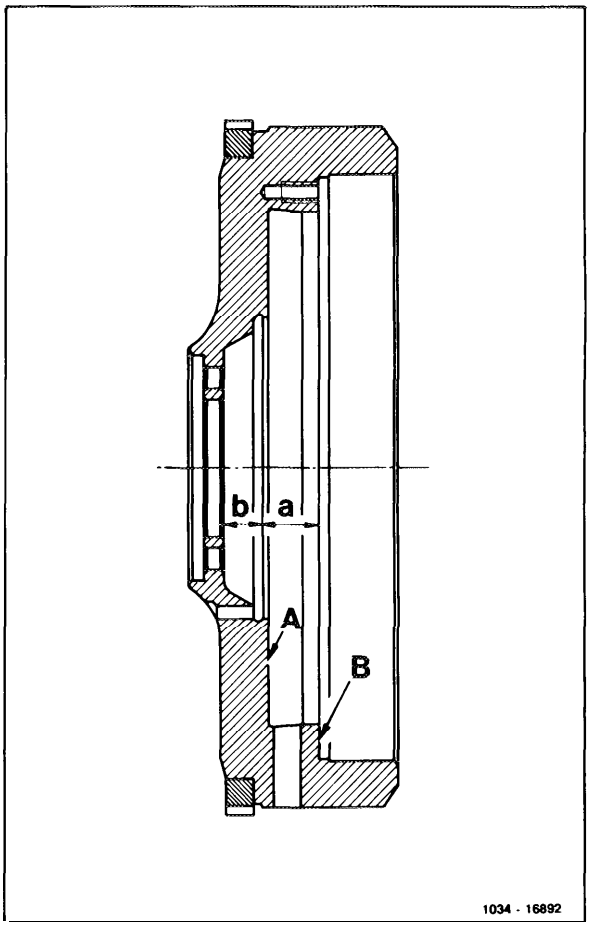
If the grooves or cracks are deeper than the maximum permissible stock removal, the flywheel must be renewed.

If the clutch face «A» is machined, the mounting face «B» must also be machined by the same amount in order to maintain the distance «a».

Size «b» must be maintained as a minimum size when performing repairs.

The flywheel must be properly clamped for machining to ensure that the permissible variation in concentricity of 0.05 mm is not exceeded.

Following machining, the clutch face must not have any shrinkholes or chatter marks.

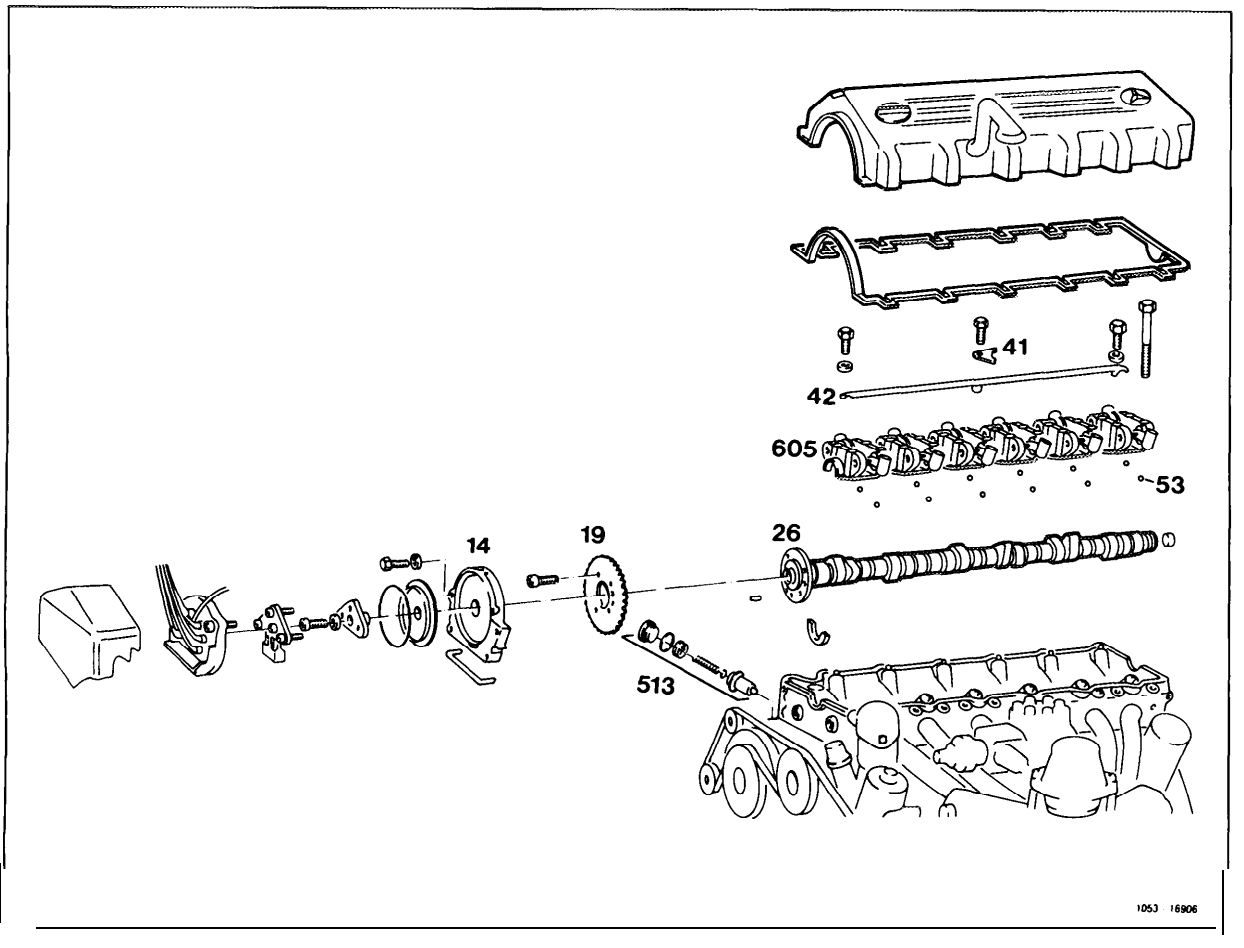


Job No.

Removing, installing camshaft . . . . . 05 - 220
Removing, installing valve springs . . . . . - 250
Renewing valve stem seals . . . . . - 270
Removing, installing chain tensioner . . . . . - 310
Renewing timing chain . . . . . - 320
Removing, installing tensioning rail . . . . . - 330
Removing, installing guide rail . . . . . - 335
Removing, installing crankshaft gear . . . . . - 460

05-220 Removing, Installing Camshaft

Job No. of job texts and job values or standard texts and flat rates ..... 05-5521, 05-5541 05-6292 - 05-7050



Piston of No. 1 cylinder	set to TDC (step 1).
Front cover (14) at top	remove, install (01-212).
Chain tensioner (513)	remove, install (05-310).
Camshaft gear (19)	mark relative to camshaft (26), detach, attach. Tightening torque M6 – 11 Nm, M7 – 16 Nm (step 4).
Oil pipe (42)	remove, install. Pay attention to oil spray holes. Install only oil pipe 2nd version with retaining plate (41) (steps 7 and 8).
All rocker arm bearing brackets (605) with rocker arms	remove, install, 21 Nm (step 9).
Ball sockets (53)	take off, insert (step 10).
Cam and rocker arm sliding surfaces	oil.

In the reverse order	. . . . .	install.
Setting of camshaft (26)	. . . . .	check (steps 16 and 17).
Camshaft lubrication when engine running	. . . . .	check (step 18).

Permissible test data

		When new	Wear limit
Camshaft bearing Ø	Normal size	30.934 – 30.950 mm	–
	Repair size	31.434 – 31.450 mm	–
Permissible variation in concentricity of middle bearing points and of camshaft gear seat when mounted in outer bearing points	Camshaft gear seat	**0.025** mm	–
	Bearing point 2, 3, 4	0.030 mm	
Camshaft bearing play	radial	0.050 – 0.091 mm	0.11 mm
	axial	0.030 – 0.110 mm	0.15 mm
Scleroscopic hardness of cams		70 – 82	63

Timing in °CA at 2 mm valve lift

Code number of camshaft stamped on front of camshaft flange	Inlet valve		Exhaust valve	
	opens after TDC	closes after BDC	opens before BDC	closes before TDC
18, 36[2]) 19[1]), 37[1])[2])	11.5” (12”)	17.0”	18.5”	13.5”
22[3]), 42[4]), 49[5]) 23[1]),[3])43[1])[4]), 50[1])[5])	11.5” (12°)	19.5”	21.5”	13.5”
20 Belgium 115 kW (power-reduced) 21’)	16° (16.5”)	0.5”	19.0”	14.5”
30[3]), 44[4]), 56[5]) 31 [1])[3]),45[1])[4]),57[1]),[5])	6.5” (7°)	14.0”	26.5”	18.5”
53[6]) 54’)“)	16.5” (17”)	24”	21.5”	13.5”

[1]) Repair camshaft with 0.5 mm larger bearing diameter.
[2]) USA 1986.
[3]) Installed since May 1986 (M7 thread) for mounting camshaft gear.
[4]) Camshaft tin-coated, cam 1 mm wider, standard as from October 1986.
[5]) Chilled cast camshaft, as from February 1989 (follower mounting Ø 20 mm).
[6]) 103.984 as from March 1989 (follower mounting Ø 20 mm).
Settings for used timing chains in parentheses.

Note

If the camshaft is renewed, the rocker arms must also be renewed.

Inductively hardened camshafts must only be used with hard chrome-plated rocker arms (standard up to February 1989).

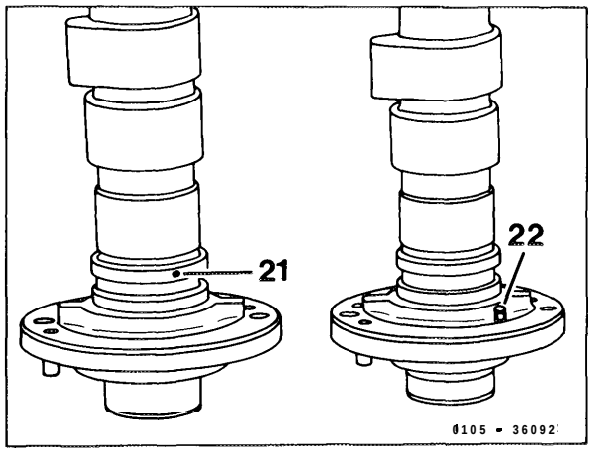
Chilled cast camshafts may only be used with rocker arms with carbide metal coating (standard as from March 1989).

If bearing fretting or severe scoring exists, the camshaft bearings can be drilled open by 0.5 mm in the cylinder head or in the rocker arm bearing brackets and a camshaft with oversized bearing journals installed.

After damage to a cam (e. g. worn cams), all the affected timing parts (hydraulic elements, valves, valve springs, valve plates and valve wedges) should be checked for signs of damage.

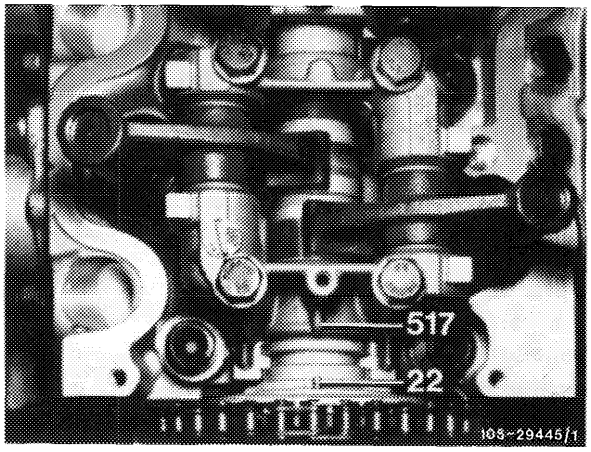
If individual rocker arm bearing brackets are renewed, all the bearing brackets must be tightened to specification and the camshaft checked to ensure that it moves freely.

A positioning hole (21) is provided in place of the pin (22) as from December 1986.

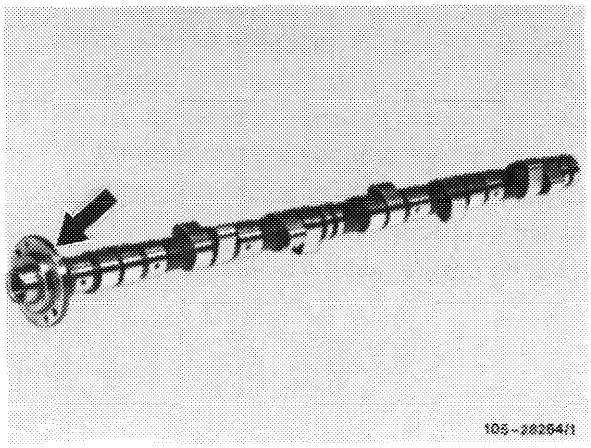


Basic setting

With No. 1 cylinder in TDC position, the pin (22) or the positioning hole (21) in the camshaft flange must be opposite the cast marking (517) on the 1st bearing bracket.



The camshaft code number is stamped in the flange (arrow).

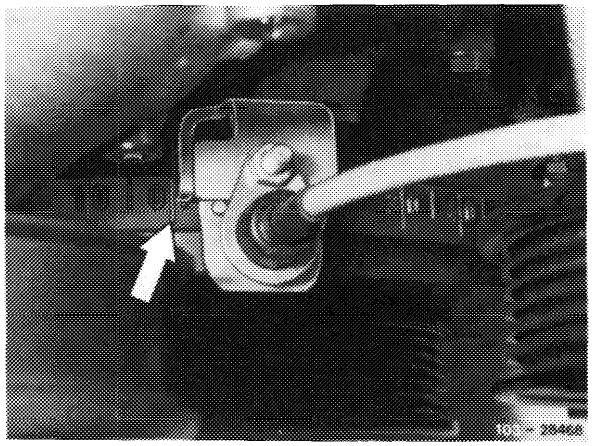


Removal, installation

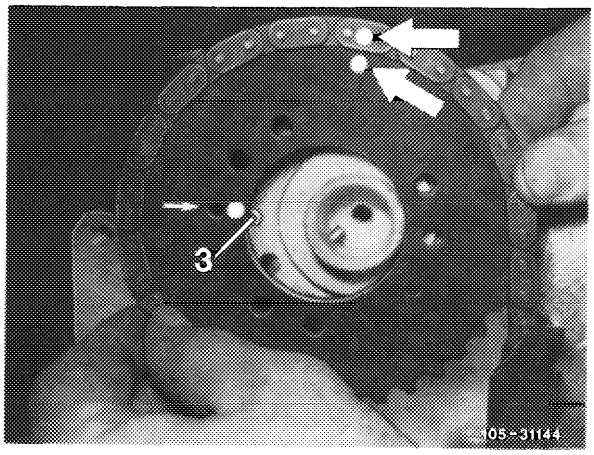
1 Set piston of No. 1 cylinder to TDC (arrow).

2 Remove front cover at the top (01-212).

3 Remove chain tensioner (05310).



4 Mark position of camshaft gear relative to camshaft. This is done by applying colored marking next to the locating pin (3) on the camshaft gear.



Note
If the camshaft gear is renewed, the colored marking must be applied to the corresponding point on the new camshaft gear.

The camshaft gear with 3 oblong holes (1st version) should be renewed if performing repairs with the camshaft gear 2nd version with 3 holes 0 6 m m .

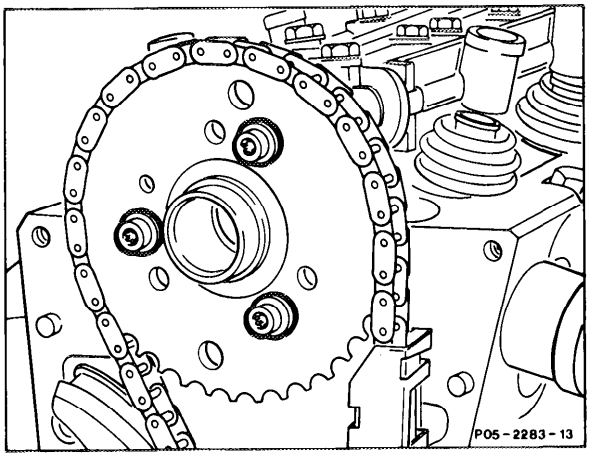
The camshaft gear 2nd version can be used when performing repairs in place of the camshaft gear 3rd version with 3 holes Ø 7 mm. In this case the 3 holes should be widened from Ø 6 mm to Ø 7 mm.

The timing can be set by turning or changing the side of the camshaft gear on the camshaft (05215).

5 Unscrew bolts (16).

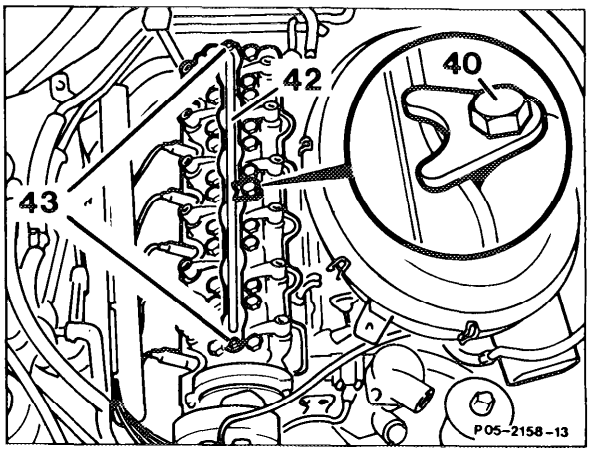
Tightening torque:

l-lex. socket bolts	M6 11 Nm
Tom bolts	M7 16Nm



6 Pull off camshaft gear (19) by hand.

7 Unscrew bolts (40, 43). Take off oil pipe (42).

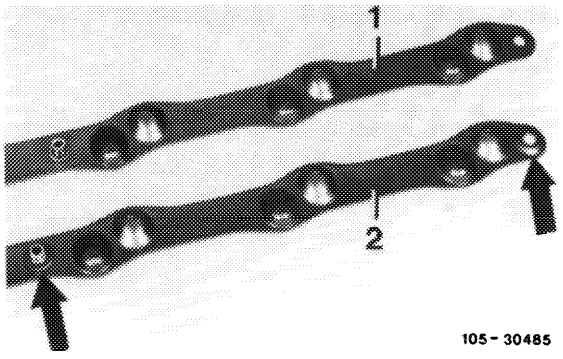


⚠

The shaped edge of the oil spray holes on the oil pipe must not be misshaped otherwise this will affect the spray direction.

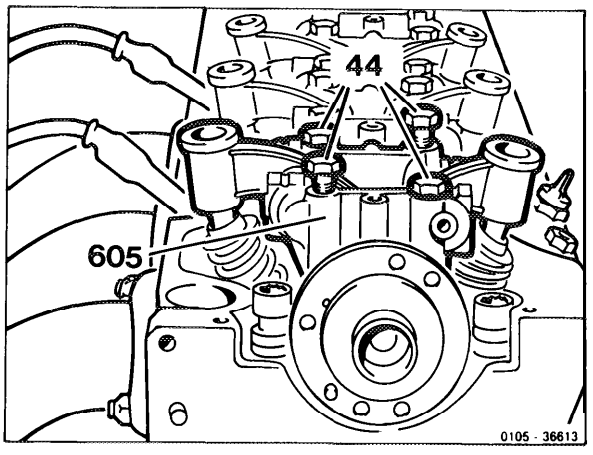
The oil pipe (42) for lubricating the camshaft is attached additionally with a retaining plate (41) and a bolt (40) without washer on the 3rd rocker arm bearing bracket at the rear hole (inlet manifold side) since October 1986.

8 Check whether 1st or 2nd version of the oil pipe is installed.



The 1 st version (1) must be replaced with the 2nd version (2), standard as from October 1986, and bolted on additionally to the 3rd rocker arm bearing bracket with a retaining plate (41).

9 Unscrew bolts (44) in such a way that the rocker arm bearing bracket (605) is not tensioned, tightening torque 21 Nm.

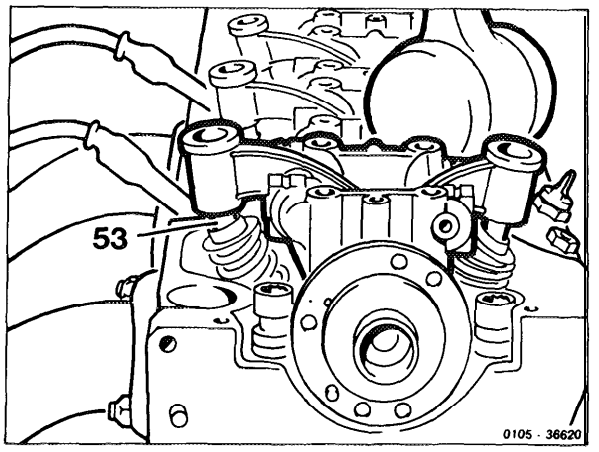


Note
The rocker arm bearing brackets must be installed again at the same point and at the same attitude.

Use rocker arm 1st version with 3 mm wide reinforcing rib only with camshafts which are not chill cast.

Use rocker arm 2nd version with 1.5 mm wide reinforcing rib only with chilled cast camshaft. The 2nd version of rocker arms have soldered-on carbide metal running surfaces.

10 Remove all rocker arm bearing brackets. (Slacken tight rocker arm bearing brackets with light blows from a plastic-headed hammer).



⚠

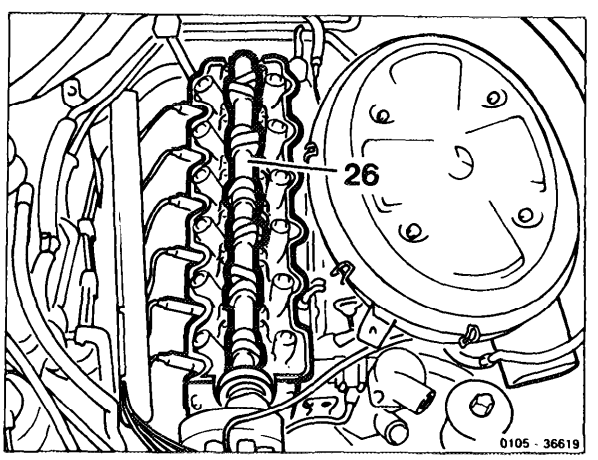
When taking off the rocker arm bearing brackets, the ball sockets (53) may catch on the hydraulic valve clearance compensating elements.

Installation instruction

The ball sockets must be installed again at the same point.

11 Take off ball sockets (53).

12 Lift out camshaft (26).



Note

When lifting out, pay attention to the thrust washer at the front (axial mounting).

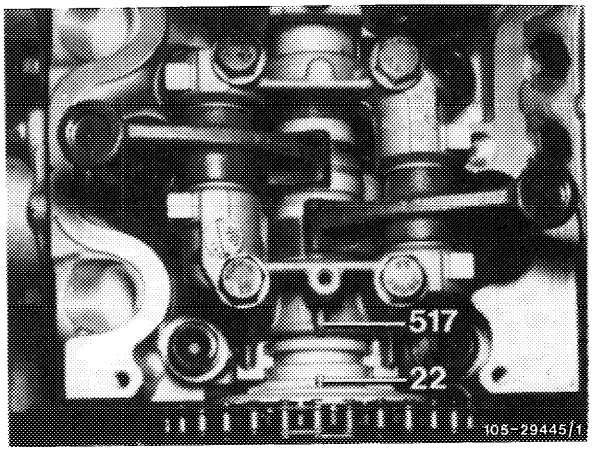
13 Oil camshaft bearing journals.

14 With No. 1 cylinder in TDC position, insert camshaft so that the pin (22) or the positioning hole (21) is facing up the way.

15 Oil cam and rocker arm sliding surfaces.

16 Fit on all rocker arm bearing brackets. Screw in all bolts by hand and tighten evenly, tightening torque 21 Nm.

17 Pin (22) or positioning hole on 1st camshaft flange must be aligned with the marking (517) when No. 1 cylinder is in the TDC position.



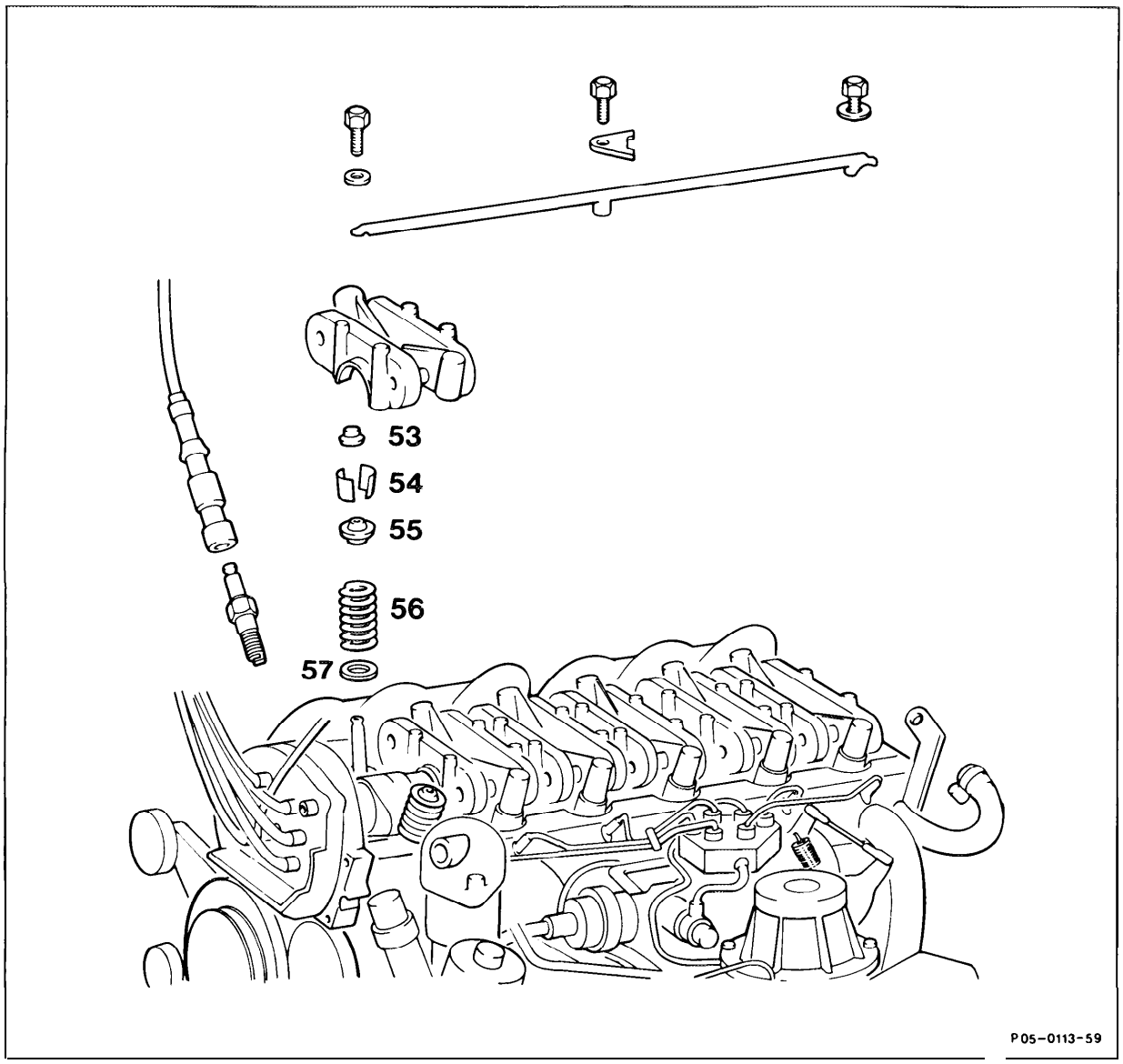
18 Check the oil supply (spray direction) of the camshaft at idling speed.

Note

If damage to a camshaft has been caused by a lack of oil resulting from a loose oil nozzle return lock without stop collar, an oil nozzle return lock with stop collar must be installed (standard as from December 1986) (18-415).

05-250 Removing, Installing Valve Springs

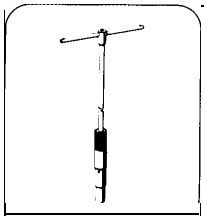
Job No. of job texts and job values or standard texts and flat rates 05-3510



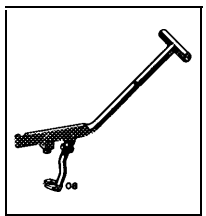
Rocker arm bearing bracket of respective cylinder	remove, install.
Ball sockets (53)	take off, insert, use magnetic finger 116 589 06 63 00 (step 2).
Piston of respective cylinder	set to TDC (step 3).
Supporting bracket 103 589 00 61 00	install (step 4).
Respective cylinder	pressurize (steps 5 to 7).

Valve collet halves (54), valve spring plate at top (55), and valve springs (56) ..... remove, install, use lever pusher 601 589 02 61 00 (steps 8 to 10).

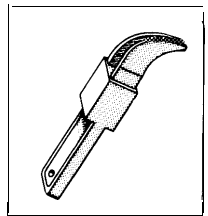
Special tools



10258901 0900



601 589 02 61 00



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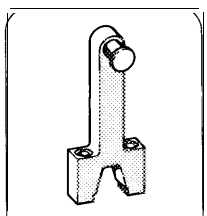


103 589 00 61 00

Note

Valve springs, top and bottom valve spring plates with scoring on the contact surfaces must be replaced.

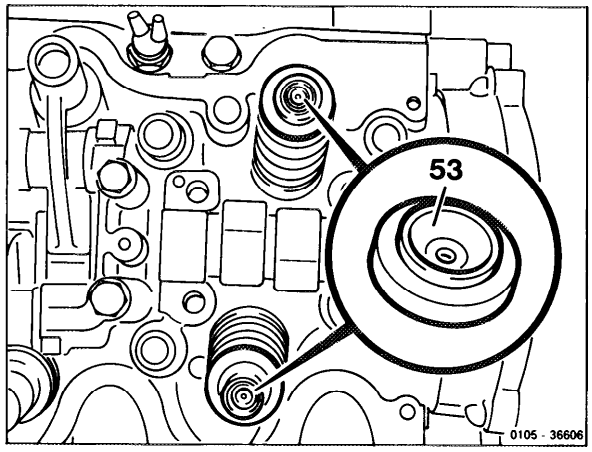
Commercial tool

Cylinder leaktightness tester	e. g. Bosch, EFAW 210 A Sun, CLT 228

Removal, installation

1 Remove rocker arm bearing bracket of the respective cylinder (05-235).

2 Take out ball sockets (53) using magnetic finger 116 589 06 63 00.

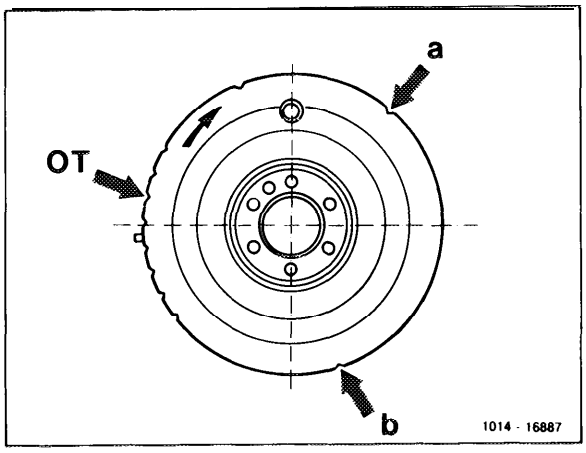


Installation instruction

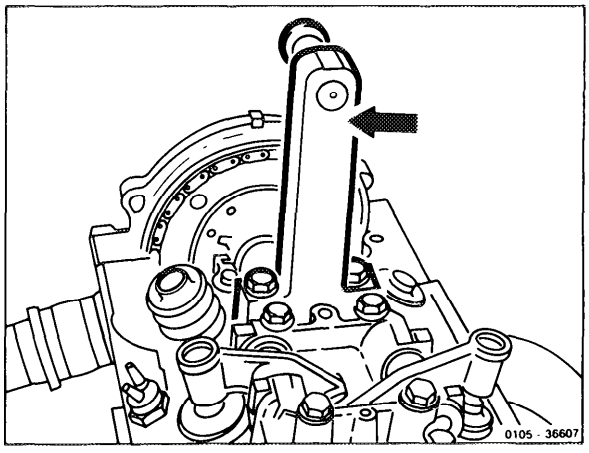
Ball sockets must be re-installed again at the same point.

3 The respective pistons are in ignition TDC position when the marking shown in the drawing opposite (arrows) on the flywheel damper are aligned with the TDC pointer and the cams of the respective cylinder are facing up the way.

Marking	TDC	b = 120	a = 240
Piston in TDC Cylinder	1 and 6	2 and 5	3 and 4



4 Screw supporting bracket (arrow) 103 589 00 61 00 onto cylinder head.



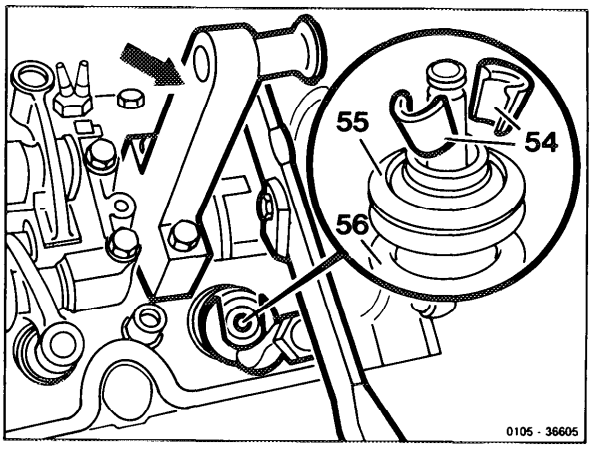
5 Detach spark plug connector of the respective cylinder. Blow out spark plug recesses with compressed air.

6 Unscrew spark plug.

Installation instruction
Tighten spark plugs to 20 Nm.

7 Screw connection hose of cylinder leaktightness tester into the spark plug hole and pressurize compression chamber (approx. 5 bar).

8 Attach lever presser 601 589 02 61 00 to the supporting bracket (arrow) and place against valve spring plate (55).
Detach the valve collet halves (54) with light blows to the valve spring plate (55).



9 Compress valve spring and remove valve collet halves (54) with magnetic finger 116 589 06 63 00.

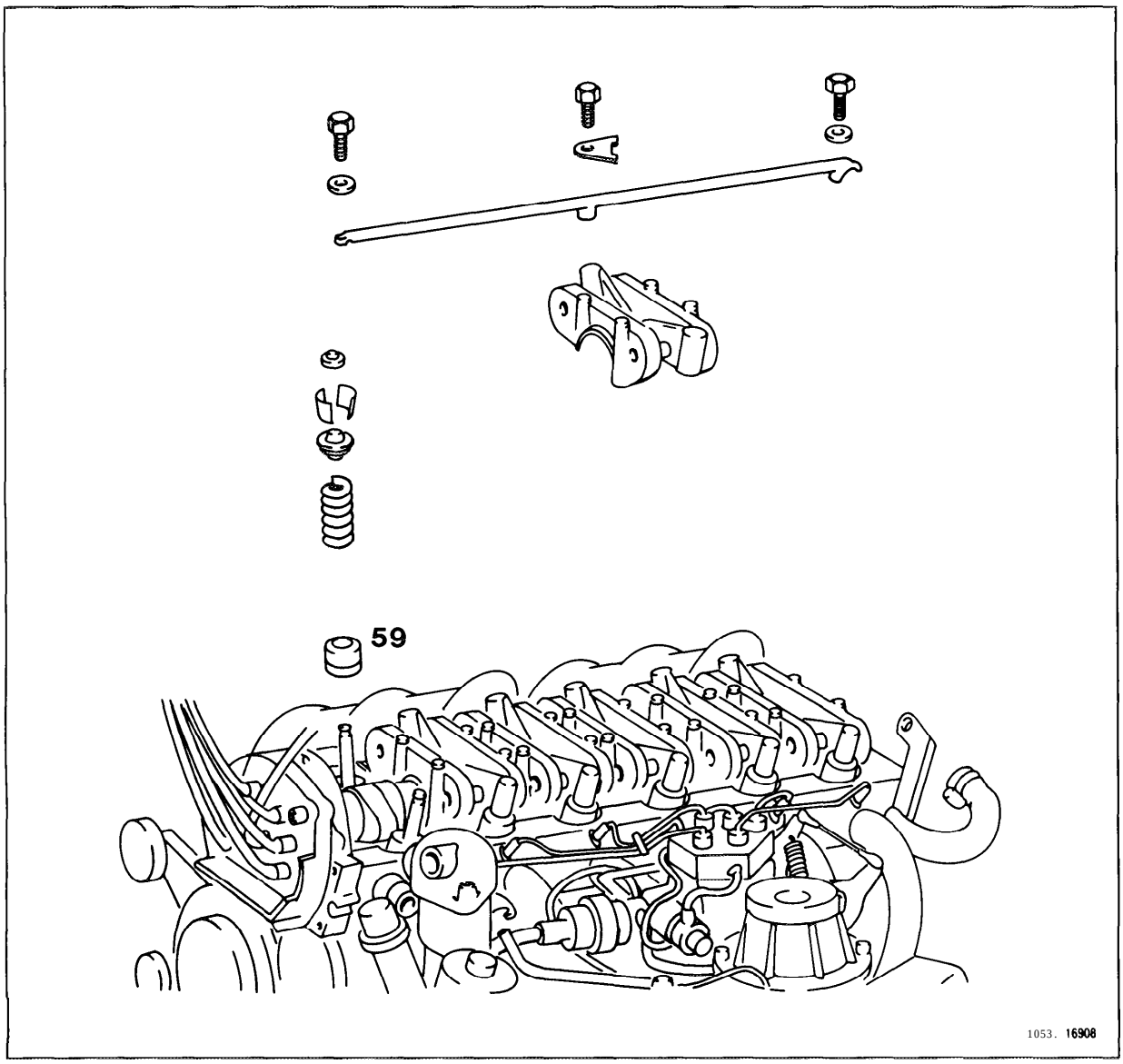
10 Take out valve spring plate (55), valve spring (56).

Note
The valve spring plates and valve springs of the exhaust and inlet valves are identical.

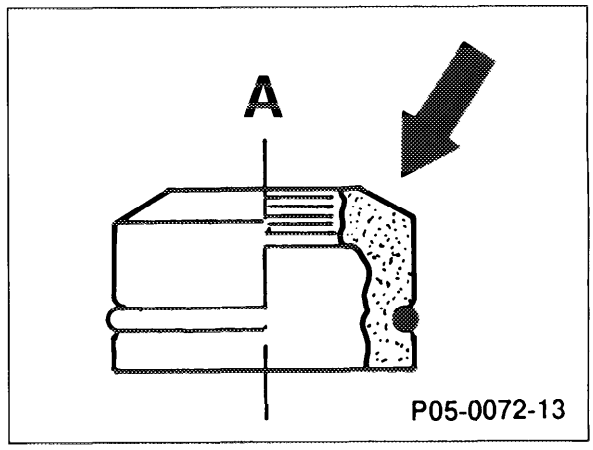
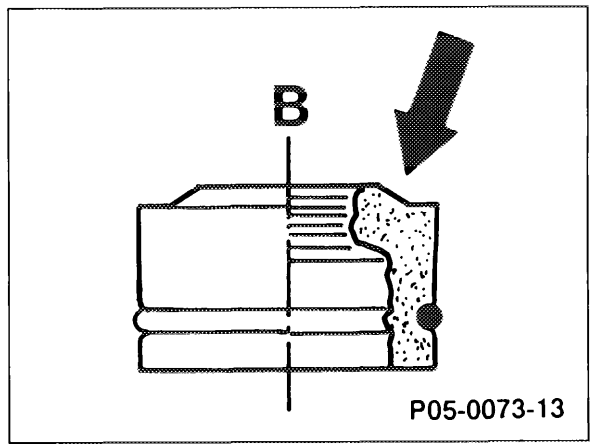
Install in the reverse order.

05-270 Renewing Valve Stem Seals

Job No. of job texts and job values or standard texts and **flat rates** **05-3510**



Valve springs	.....	remove, install **(05-250).**
Valve stem seals (59)	.....	remove, install.
Valve stem	.....	deburr, if necessary.

Valve stem seal identification	Part No.	Color	
Repair kit Exhaust 0 9 m m	102 053 03 58	bright zinc-coated (yellow)	
Repair kit Inlet 0 8 mm	103 053 16 58	phosphatized (black)	

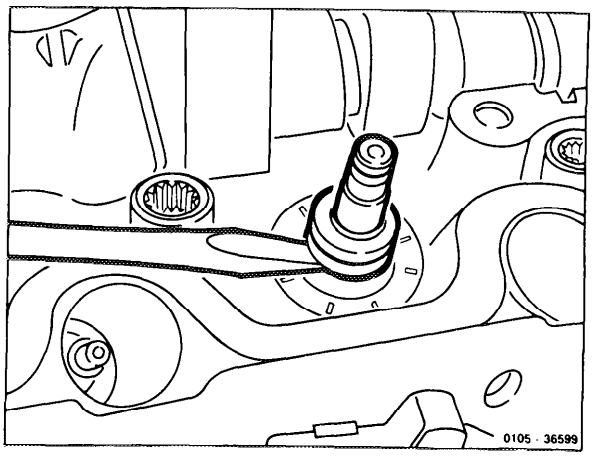
Note
Exhaust and inlet valve stem seals and assembly sleeves are supplied as a repair kit.
The assembly sleeves must be used to prevent the valve stem seals from being damaged.

Valve guides which are worn at the retaining slot for the valve stem seals and valves with damaged valve ends or valve stem must be renewed.

Renewal

1 Remove valve springs (05250).

2 Use a screwdriver to press off valve stem seal or pull off with pliers.



⚠
Do not damage cylinder head, valve stem and valve guide.

3 Fit assembly sleeve onto the valve stem on the inlet valve.

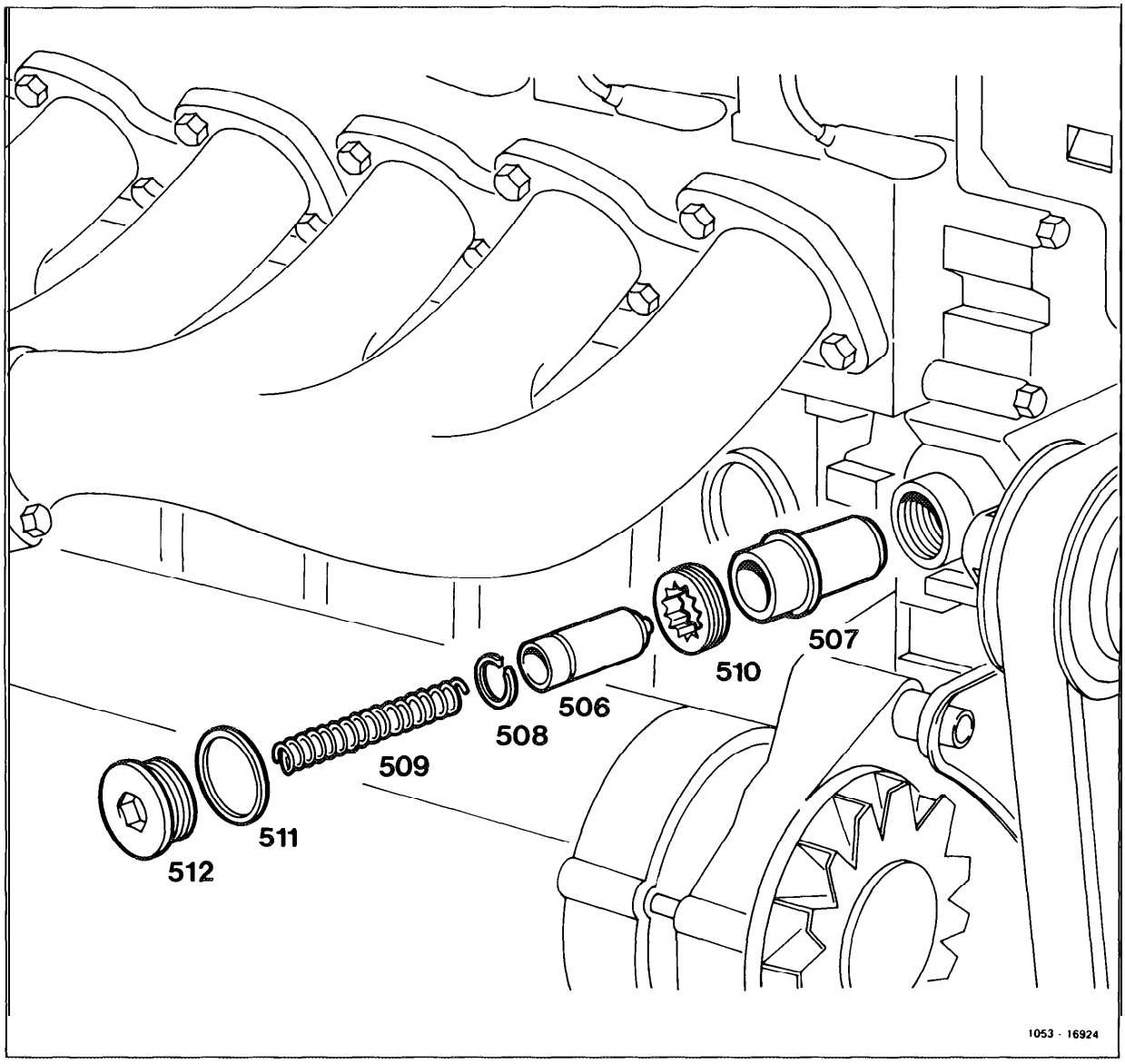
4 Oil valve stem seal and press on by hand.

⚠
Pay attention to matching of different valve stem seals as shown in table.

Install in the reverse order.

05-310 Removing, Installing Chain Tensioner

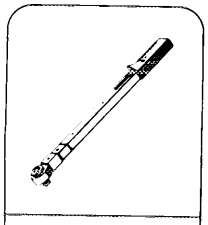
Job No. of job texts and job values or standard texts and flat rates **05-7800, 05-7801**



Hood	raise to vertical position (01-008).
Screw plug (512) with seal (511) and compression spring (509)	unscrew, take out (step 1).
Threaded ring (510)	unscrew (step 2).
Chain tensioner housing (507) with pressure pin (506)	withdraw (step 3).
Pressure pin (506) with detent spring (508)	press out of chain tensioner housing (507) in direction of pressure (step 4).

Chain tensioner housing (507) into mounting hole	insert (step 5).
Threaded ring (510)	screw in, tighten, 30 Nm (step 6).
Pressure pin (506) with detent spring (508) and compression spring (509)	insert (step 7).
Screw plug (512) with seal (511)	screw in, tighten, 50 Nm (step 8).
Leaktightness	check.

Special tool



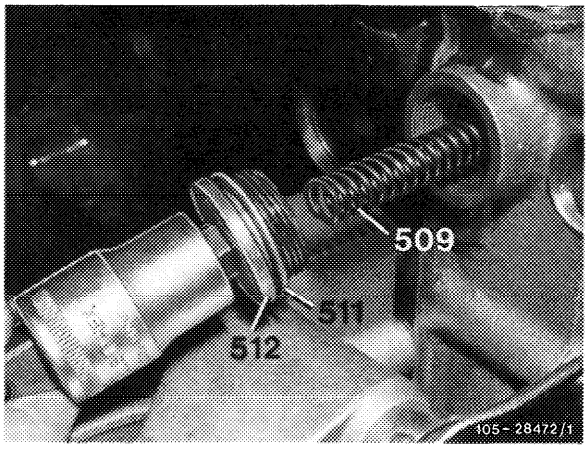
Commercial tools

Pin wrench insert 17 mm, 1/2" square	e. g. Hazet, D-5630 Wemscheid Order No. 985/17
Pin wrench insert 12 mm, 1/2" square	e. g. Hazet, D-5630 Wemscheid Order No. 985/12

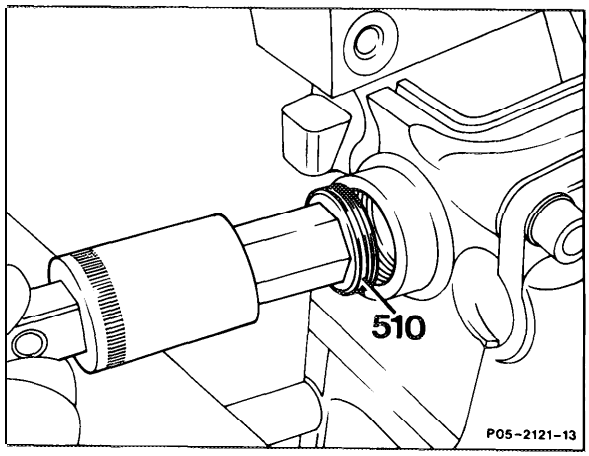
Removal, installation

1 Unscrew plug (512) with seal (511). Take out compression spring (509).

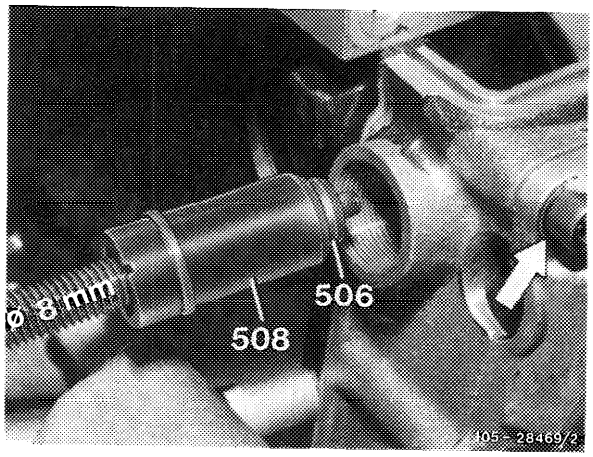
⚠ The screw plug is pressurized by the compression spring.



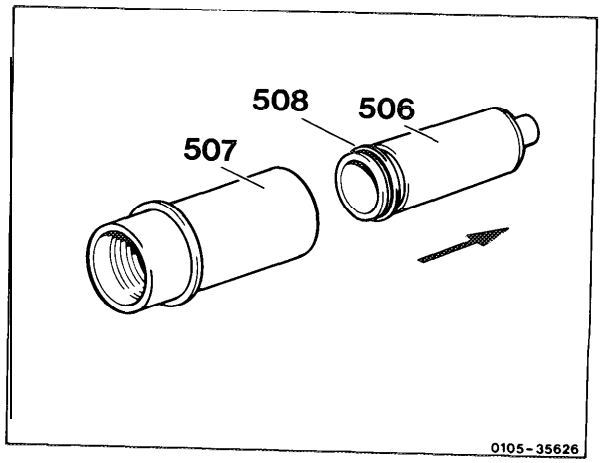
2 Unscrew threaded ring (510).



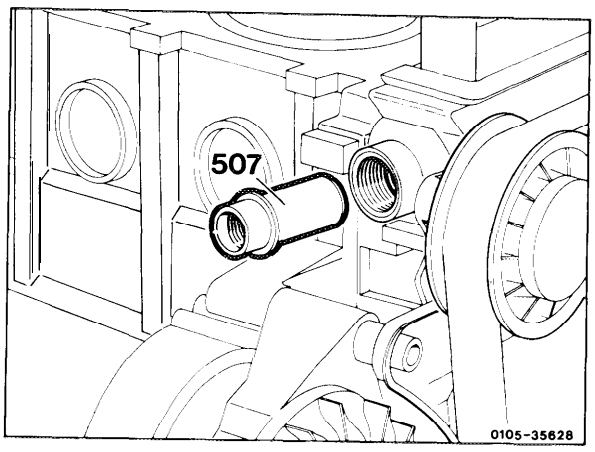
3 Withdraw chain tensioner with the aid of an M8 bolt.
The M8 bolt cannot be screwed in but should only be angled.
If it is not possible to withdraw the chain tensioner, slacken hex. socket bolt (arrow).
With the cylinder head cover removed, press with the handle of a hammer on the tensioning rail.



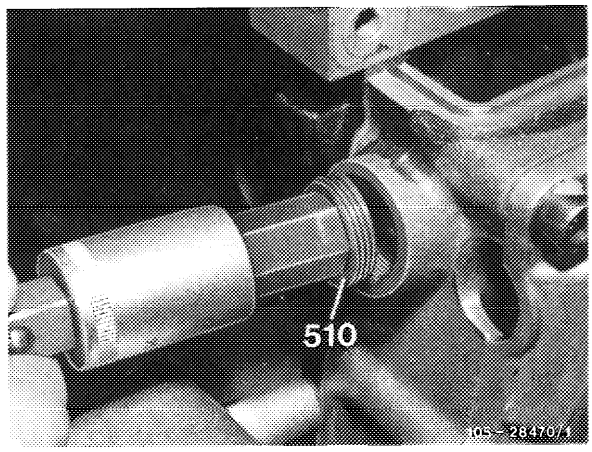
4 Chain tensioner must be disassembled before installing. This is done by pressing the pressure pin (506) with detent spring (508) out of the chain tensioner housing (507) in direction of arrow.
Thoroughly clean all parts.



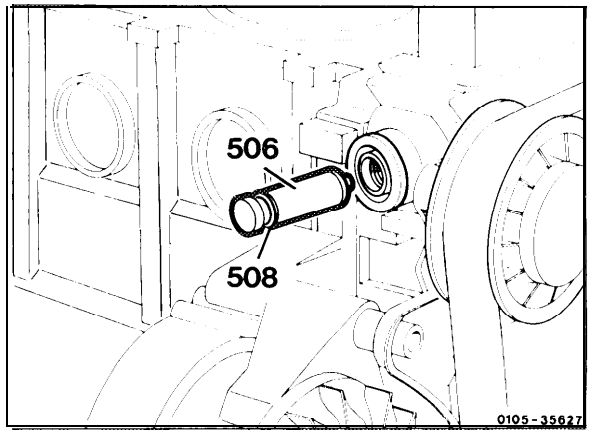
5 Insert chain tensioner housing (507) into mounting bore.



6 Screw in threaded ring (510), tightening torque 30 Nm.

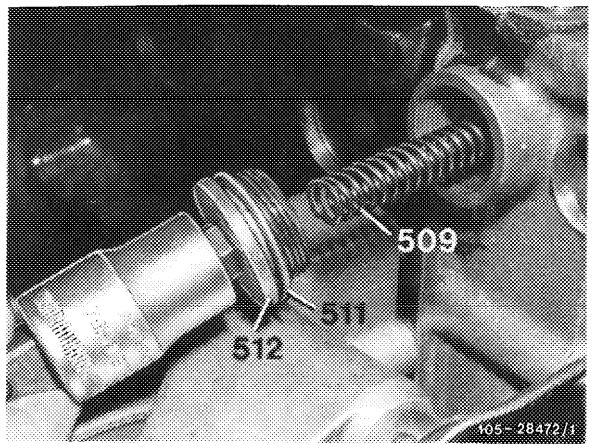


7 insert pressure pin (506) with detent spring (508) into the assembled chain tensioner housing.



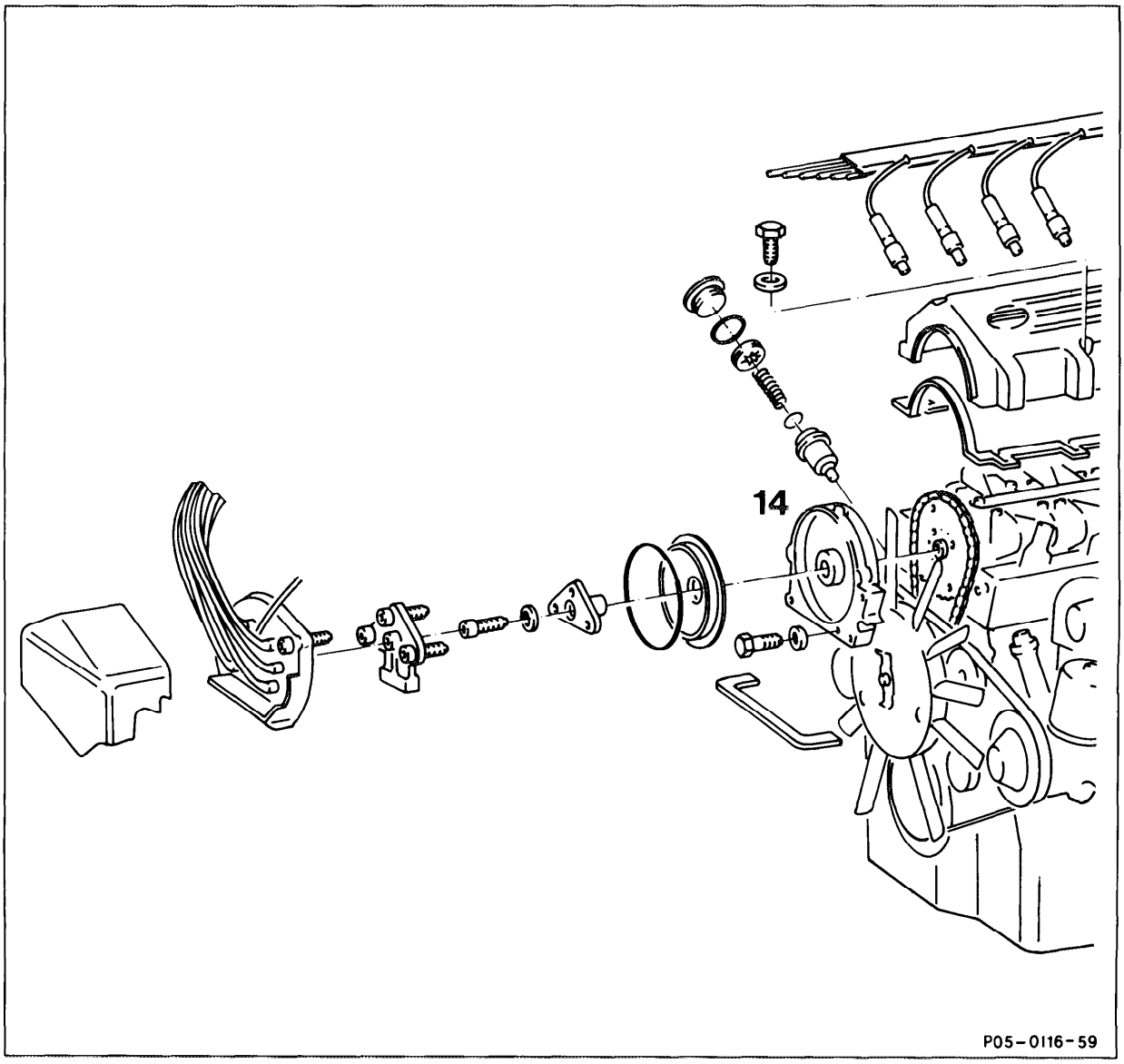
8 Install compression spring (509) and screw plug (512) with new seal (511). Tighten screw plug (512) to 50 Nm.

9 Run engine and check for signs of leaks.



05-320 Renewing Timing Chain

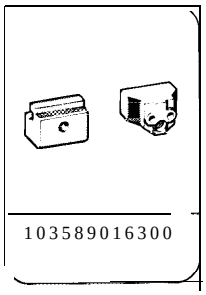
Job No. of job texts and job values or standard texts and flat rates 05-7601

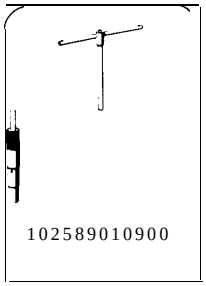


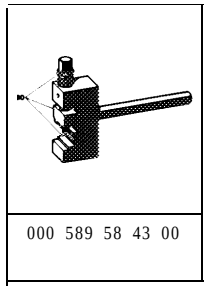
Front cover at top (14)	remove, install (01-212).
Chain tensioner	remove, install (05310).
All spark plugs	remove, install, 20 Nm (steps 3 to 5).
Chain pin	grind open (step 6).
New timing chain to old timing chain	connect, draw in (step 7 to 9).
New timing chain with rivet link	connect (step 10).
Plate	103 589 01 63 00, insert in rivet tool 000 589 58 43 00, press on (steps 13 to 15).

Rivet tool ..... take off, change over (step 16).
Individual pins of rivet link rivet, 30 Nm (steps 17 and 18).

Special tools







1 Remove front cover (14) at top (01-212).

2 Remove chain tensioner (14) (05310).

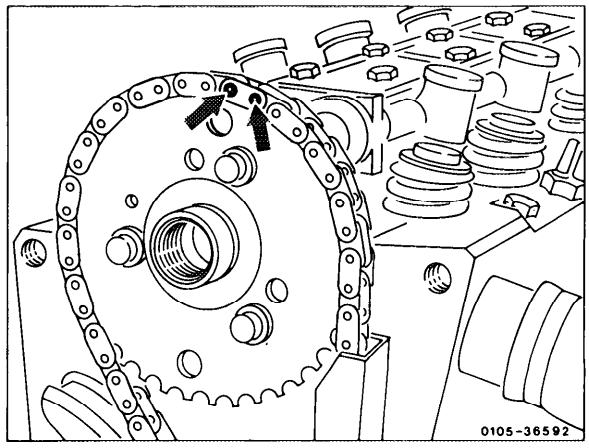
3 Detach all spark plug connections.

4 Blow out spark plug recesses with compressed air.

5 Unscrew all spark plugs, tightening torque 20 Nm.

6 Cover over the exposed part of the chain box with a clean cloth and grind open both chain pins (arrows) **at a double link** of the timing chain.

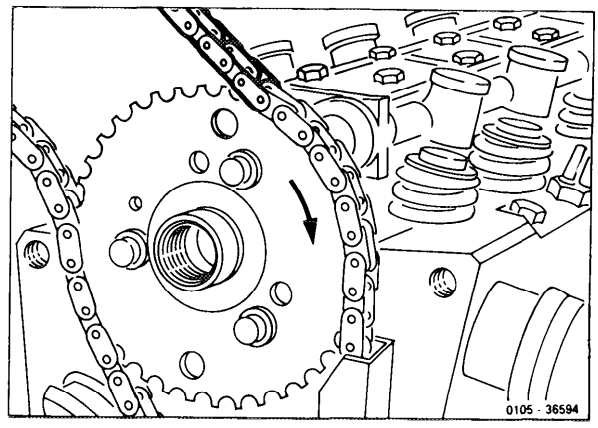
7 Attach new timing chain with the rivet link to the old timing chain.
This is done by pressing out the ground open double link.



8 Fit new timing chain connected to old timing chain onto the camshaft gear. Slowly turn crankshaft in direction of rotation of engine.

⚠

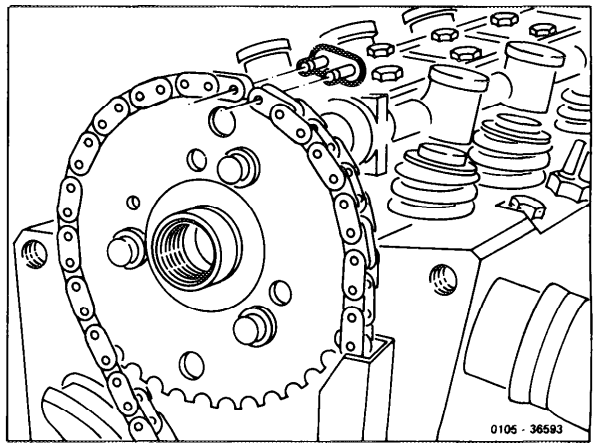
The timing chain must remain meshed when turning the camshaft gear.



9 Pull out the exposed end of the old timing chain evenly corresponding to the new timing chain being drawn in.

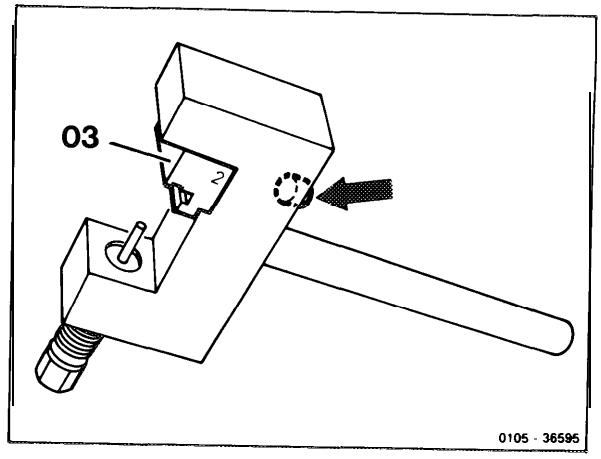
10 Turn crankshaft long enough for it to be possible to connect the ends of the new timing chain to the rivet link.

Note
Rivet link must be inserted from behind.

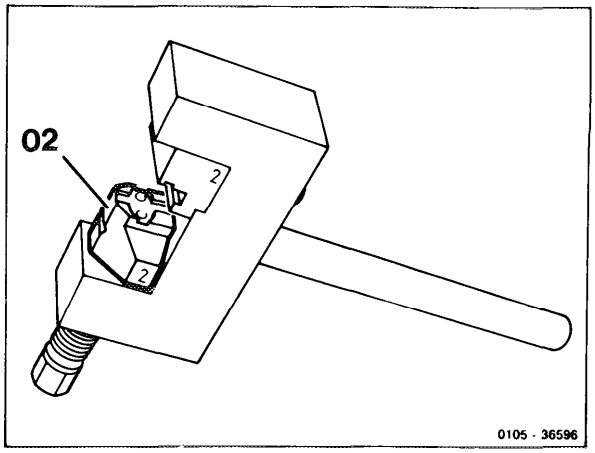


11 Insert thrust piece (03) as shown in drawing into the rivet tool and tighten with the screw (arrow).

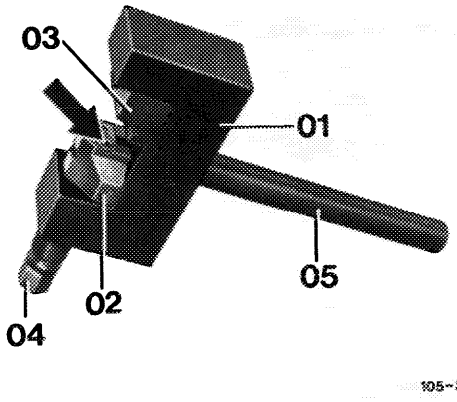
Note
The figure 2 is stamped on the side of the thrust piece (03).



12 Insert moving jaw (02) with the figure 2 into the rivet tool as shown in the drawing.

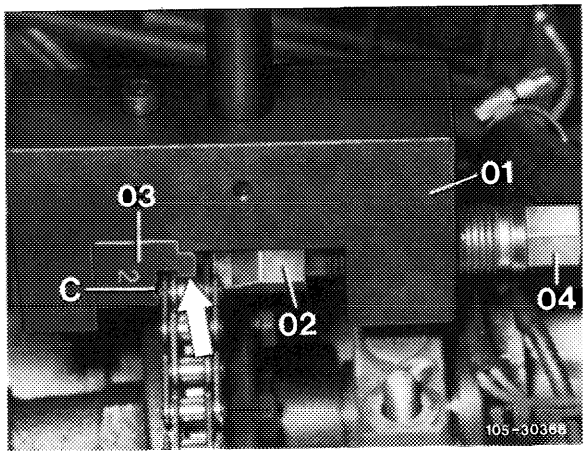


13 Insert plate (arrow) into the moving jaw (02).



14 Fit web (arrow) onto both rollers on the rivet link.

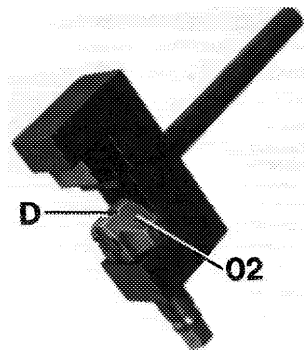
Note
Rivet heads of the rivet link pins must be guided in the slot (C).



15 Screw in spindle (04) until a firm resistance is felt.

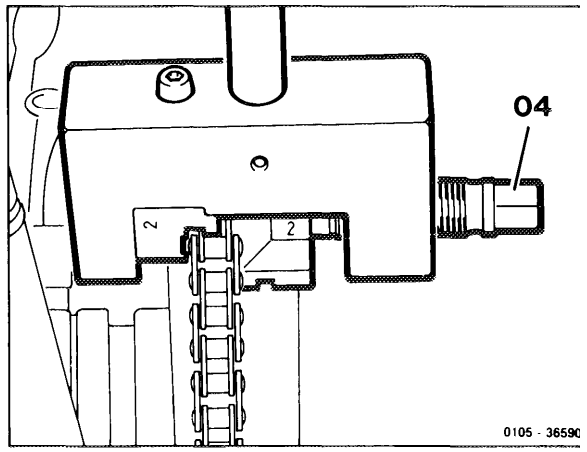
Note
When screwing in, ensure that the pins of the rivet link can be guided into the holes of the plate.

16 Take off rivet tool and change over the moving jaw (02) to the rivet profile (D).



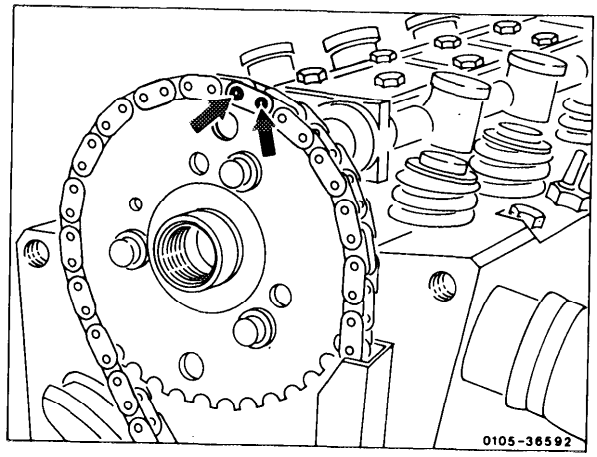
105-30367

17 Position rivet tool exactly over center of pin. Rivet pins of the rivet link individually by tightening the spindle (04) to approx. 30 Nm.



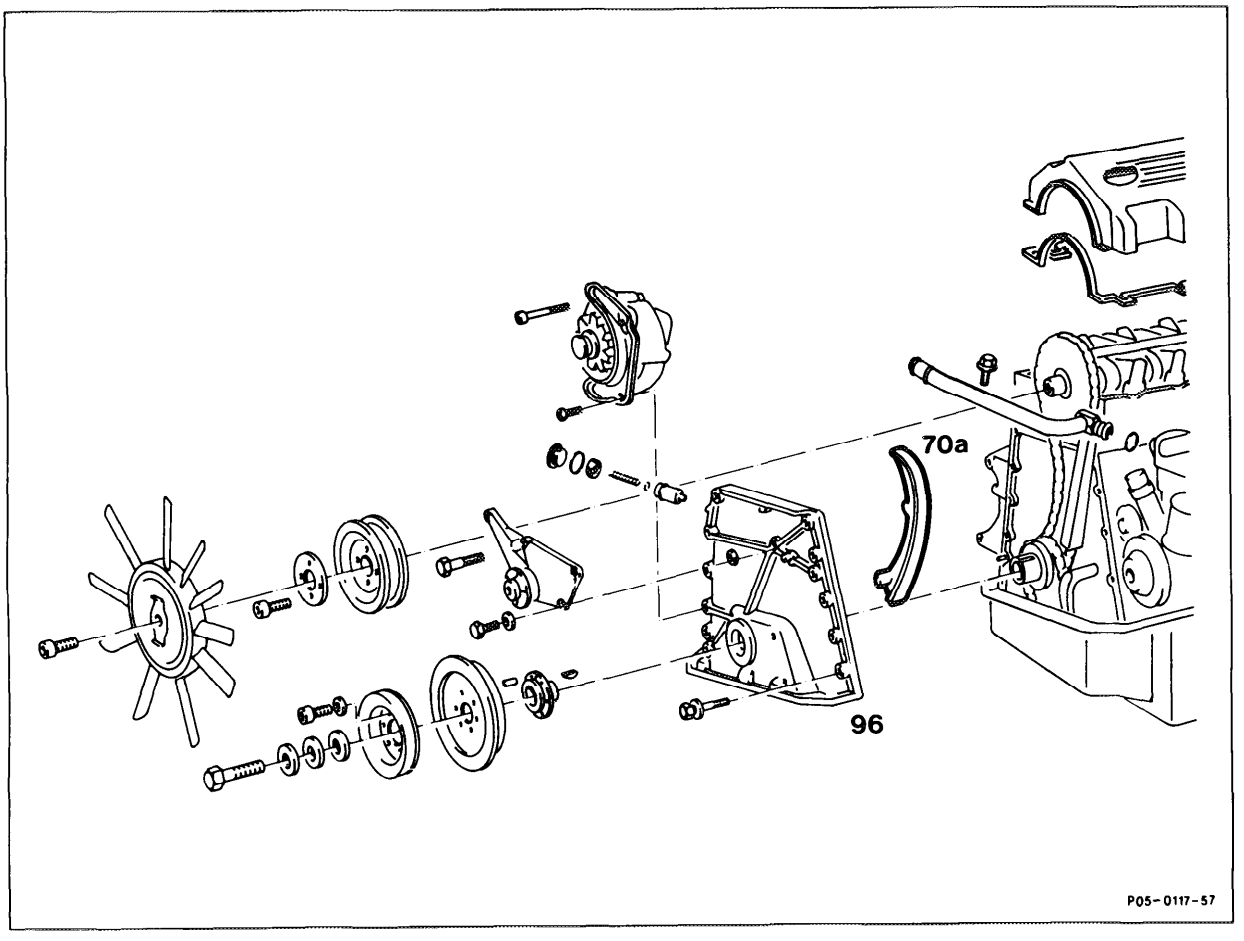
18 Check riveting (arrows), re-rivet if necessary.

19 Install in the reverse order.



05-330 Removing, Installing Tensioning Rail

Job No. of job texts and job values or standard texts and flat rates OS-81 21



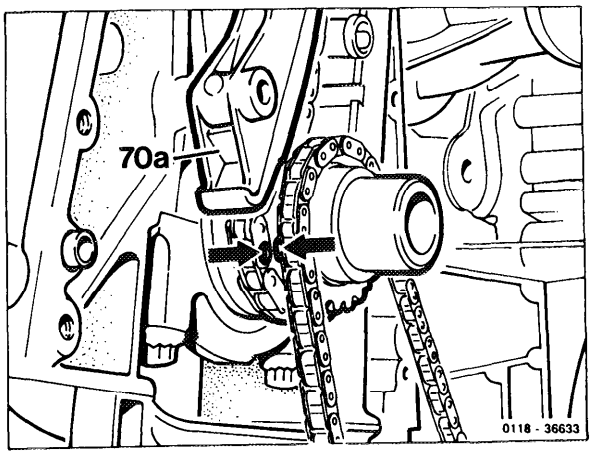
Timing case cover (96)	remove, install (01-210).
Timing chain with crankshaft gear	mark (step 2).
Tensioning rail (70a)	remove, install.
Setting of camshaft	check.

Removal, installation

1 Remove timing case cover (96) (01-210).

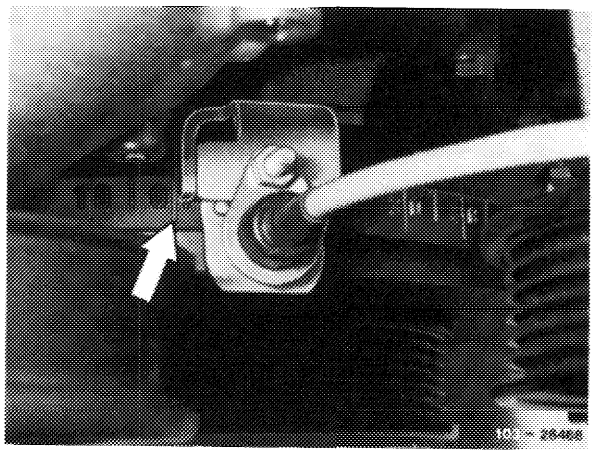
2 Mark timing chain with crankshaft gear (arrows).

3 Take off tensioning rail (70a).

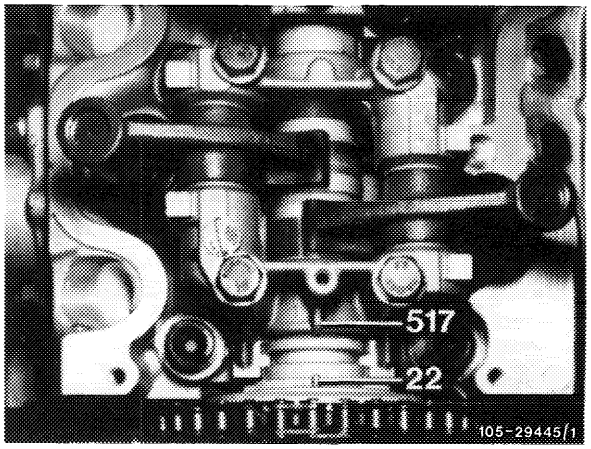


Installation instruction

Position piston of No. 1 cylinder to TDC (arrow).

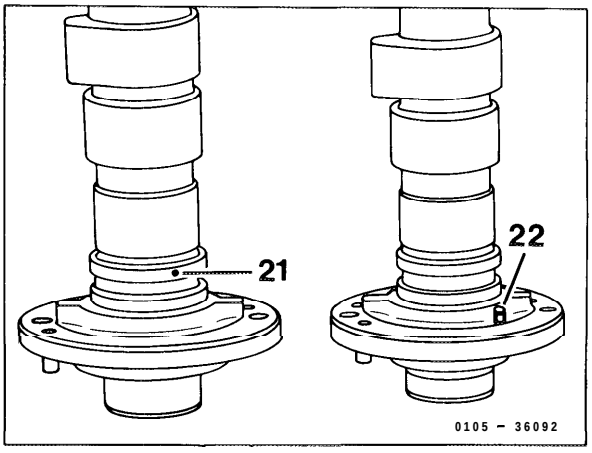


Positioning marking (22) or positioning hole of camshaft must be aligned with the marking (517) on 1st camshaft bearing.



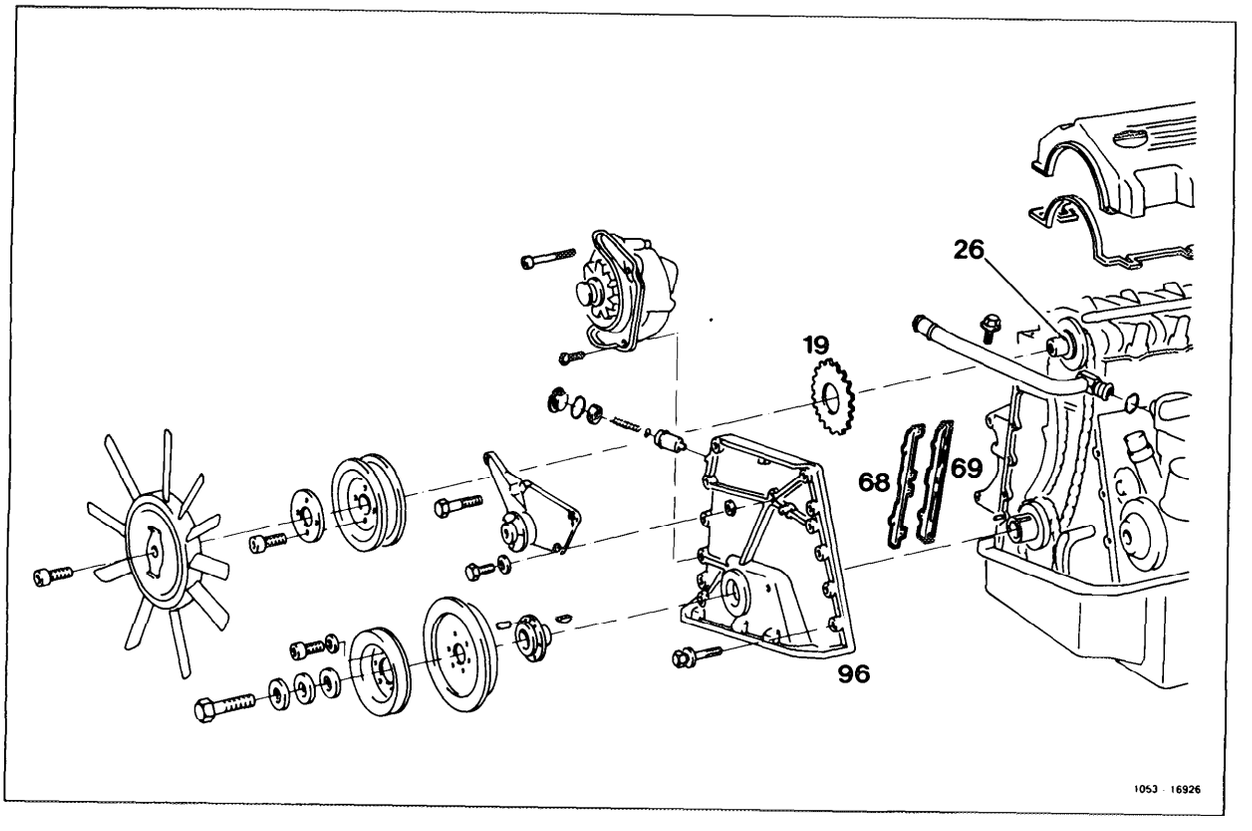
Only the positioning hole (21) is provided in place of the pin (22) as from 12/86.

Install in the reverse order.



05-335 Removing, Installing Guide Rail

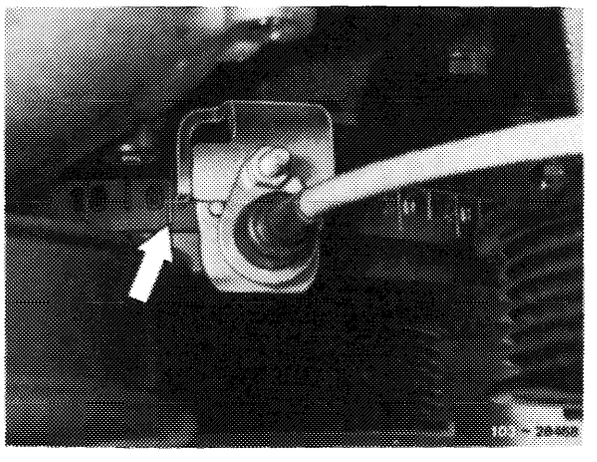
Job No. of job texts and job values or standard texts and flat rates .....



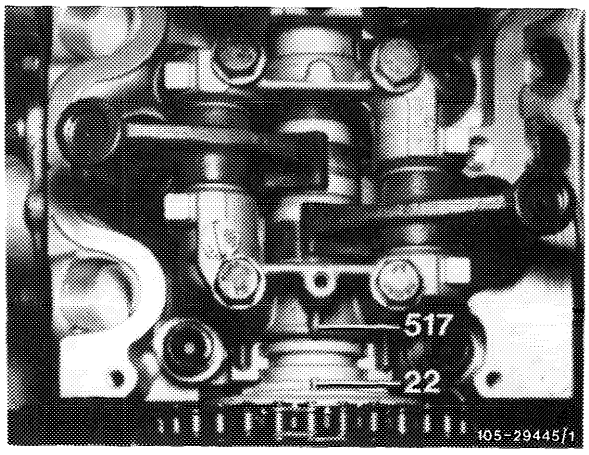
Piston of No. 1 cylinder	set to TDC (step 1).	
Timing case cover (96)	remove, install (01-210).	
Camshaft gear (19) to camshaft (26)	mark, detach and attach,	
	tightening torque	M6 11 Nm
		M7 16Nm
	(steps 4 and 5).	
Guide rail (68, 69)	remove, install (step 6).	

1 Set piston of No. 1 cylinder to TDC (arrow).

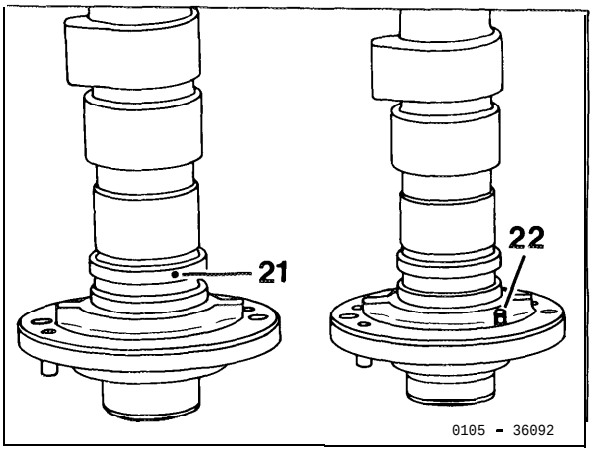
2 Remove timing case cover (01-210).



3 Positioning marking (22) or positioning hole of camshaft must be aligned with the marking (517) on 1st camshaft bearing.



Only the positioning hole (21) is provided in place of the pin (22) as from 12/86.

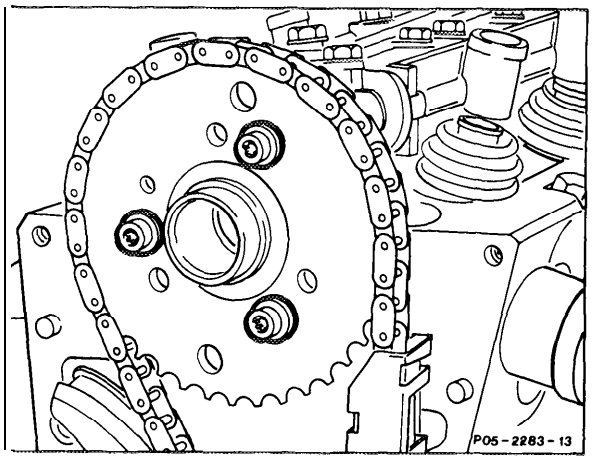


4 Unscrew bolts (16).

Tightening torque:

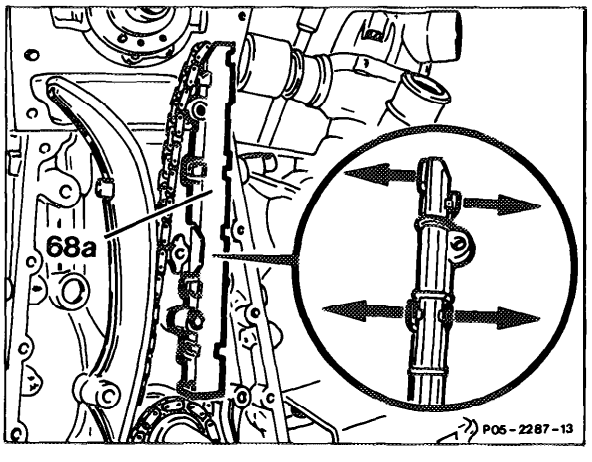
Hex. socket bolts	M 6 :	11 Nm
Torx bolts	M 7 :	16 Nm

5 Pull off camshaft gear (19) by hand.



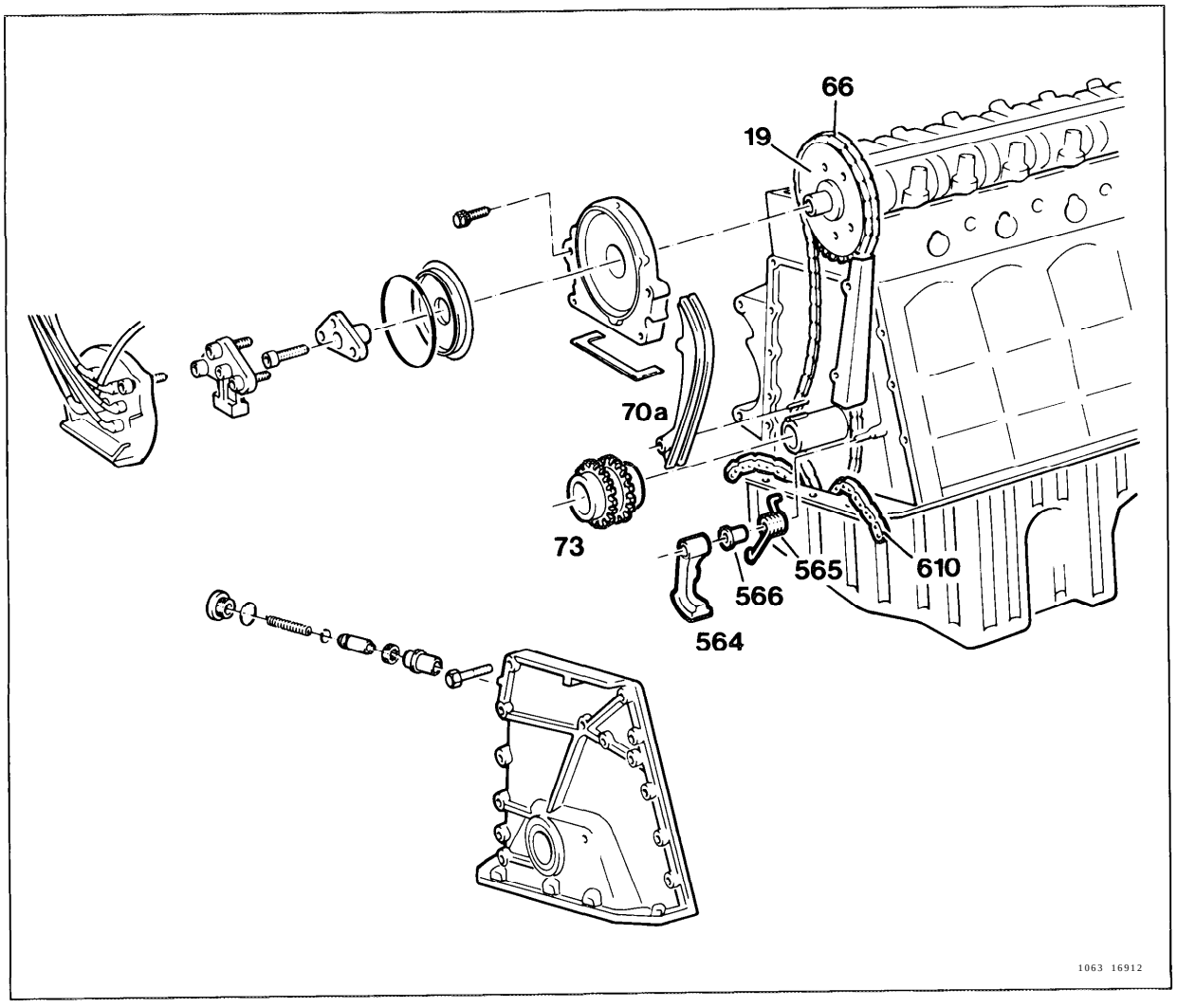
6 Unclip retaining lugs in direction of arrow and remove guide rail (68a).

7 Install in the reverse order.



05-460 Removing, Installing Crankshaft Gear

Job No. of job texts and job values or standard texts and flat rates .....

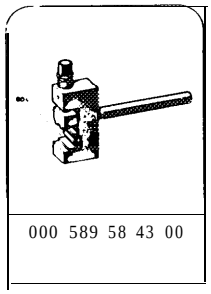


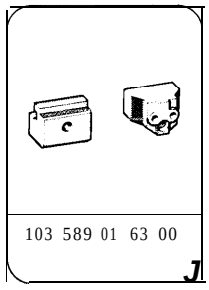
Hood	raise to vertical position (01-008).
Piston of No. 1 cylinder	set to TDC (step 2).
Tensioning rail (70a)	remove (05-330).
Tensioning bracket (564), spring (565) with bush (566)	pull off (step 6).
Oil pump chain (610)	grind open rivet link pins (step 7).
Timing chain (66) to camshaft gear (19)	mark, take off (step 8).
Crankshaft gear (73) with puller 615 589 01 33 00	pull off (step 9).
Crankshaft gear (73)	heat, fit on (step 10).

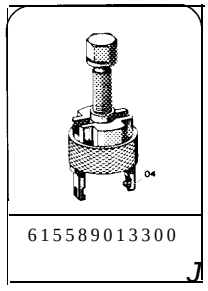
Timing chain (66)	fit onto camshaft gear (19).
Oil pump chain (610)	fit onto crankshaft gear (73).
Rivet link	insert from rear into oil pump chain.
Plate	insert in rivet tool, press on (steps 14 to 16).
Individual rivet link pins of oil pump chain	rivet (steps 17 to 19), 30 Nm.
Spring (565), bush (566) and tensioning bracket (564)	install.
Tensioning rail (70a)	install (05-330).

Tightening torques	Nm
Camshaft gear to camshaft (hex. socket bolt M6)	11
Camshaft gear to camshaft (Torx bolt M7)	16

Special tools







Note
When renewing a worn crankshaft gear, timing chain and camshaft gear must also be renewed.

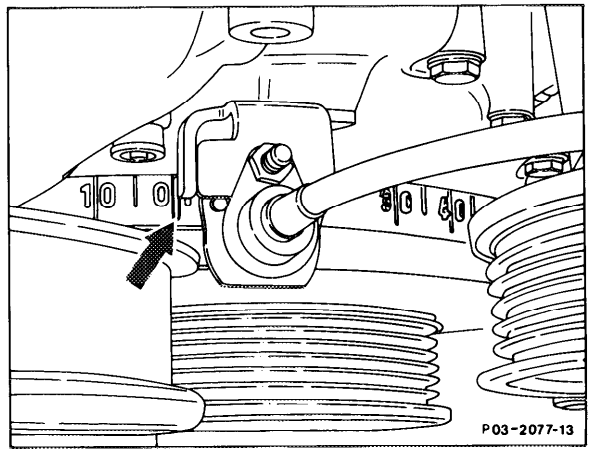
Removal

1 Raise hood to vertical position (01-008).

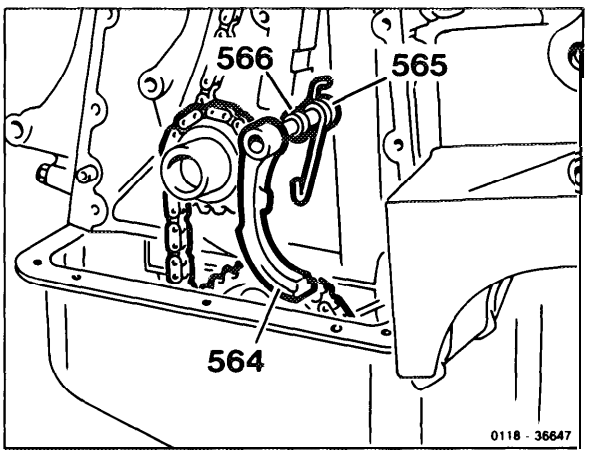
2 Position piston of No. 1 cylinder to TDC.

3 Remove tensioning rail (05-330).

4 Cover over oil sump with clean cloth.



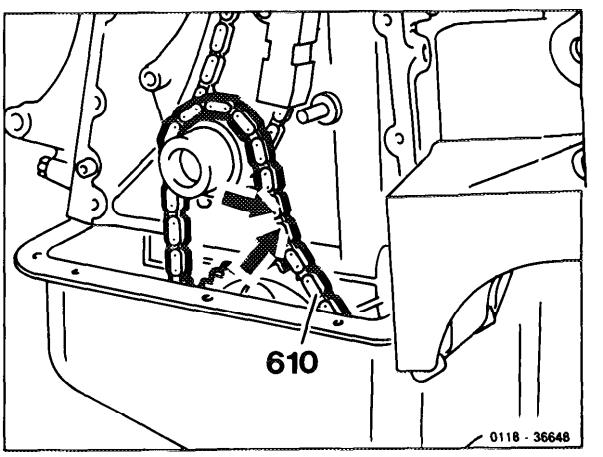
5 Pull off tensioning bracket (564), spring (565) with bush (566).



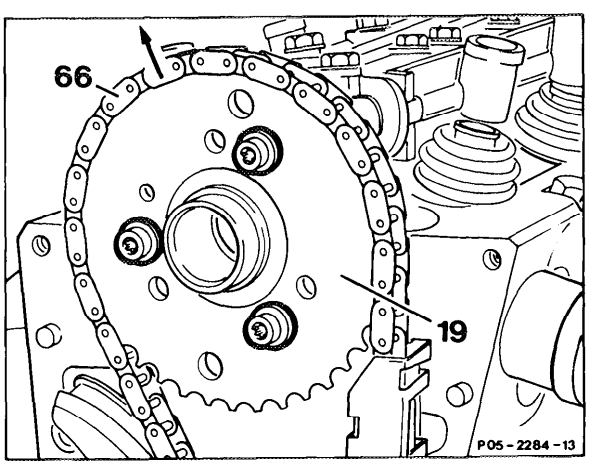
6 Grind open both rivet link pins (arrows) on a double link of the oil pump chain (610). Press out ground open double link.

Note

Do not take oil pump chain off the oil pump drive gear, tie on left and right with wire.



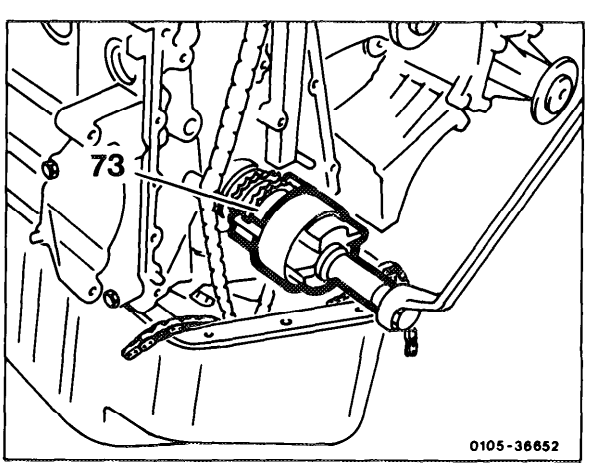
7 Mark position of timing chain (66) relative to camshaft gear (19) with a colored pen. Take timing chain off camshaft gear (19) in direction of arrow.



8 Pull off crankshaft gear (73) with puller 615 589 01 33 00.

Installation

9 Heat crankshaft gear to approx. 50 °C and fit onto the crankshaft.
Pay attention to the Woodruff keys.



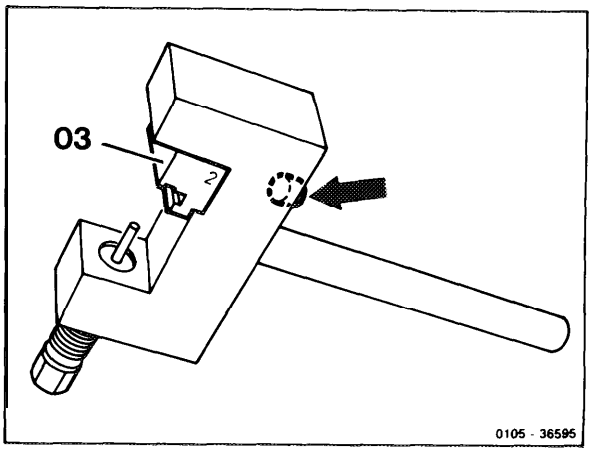
10 Fit timing chain onto the camshaft gear.

Note
Pay attention to colored marking.

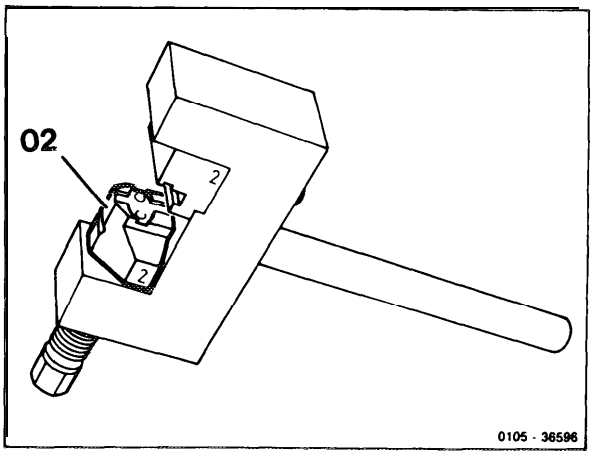
11 Fit oil pump chain onto the crankshaft gear. Insert rivet link from behind into the oil pump chain.

12 Insert thrust piece (03) into the rivet tool as shown in the drawing and tighten with the screw (arrow).

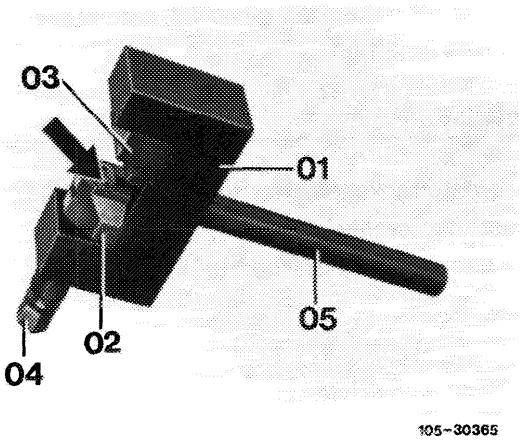
Note
The figure 2 is stamped on the side of the thrust piece (03).



13 Insert moving jaw (02) with the figure 2 into the rivet tool as shown in the drawing.

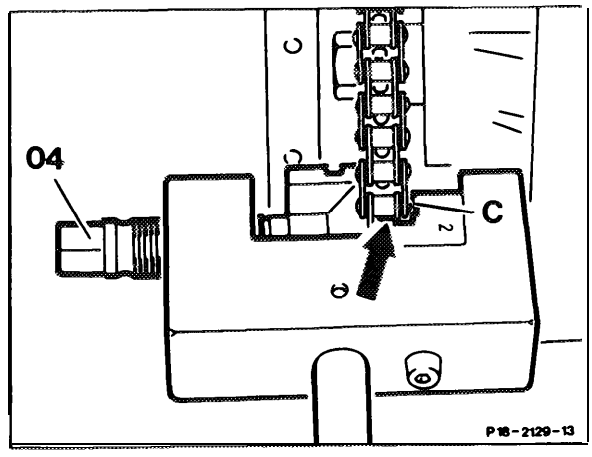


14 Insert plate (arrow) into the moving jaw (02) (magnetic surface).



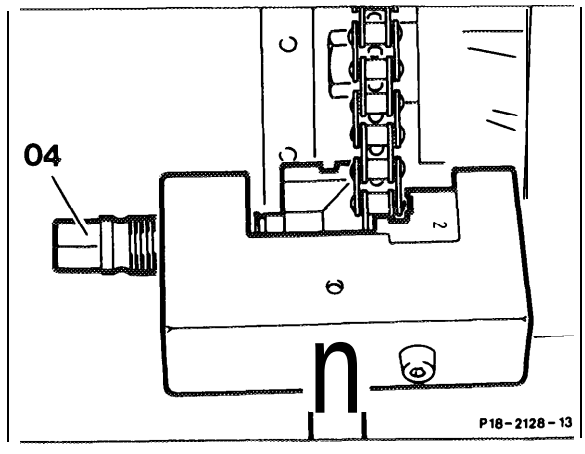
15 Fit web (arrow) onto both rollers on the link.

Note
Rivet heads of rivet link pins must be guided in the slot (C).

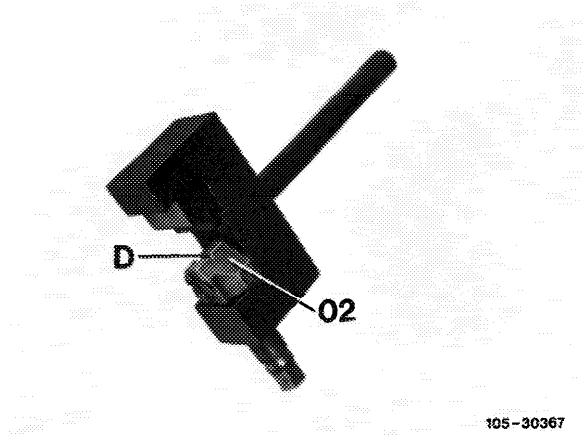


16 Screw in spindle (04) until a firm resistance is felt.

Note
When screwing in, ensure that the pins of the link are inserted into the holes of the plate.

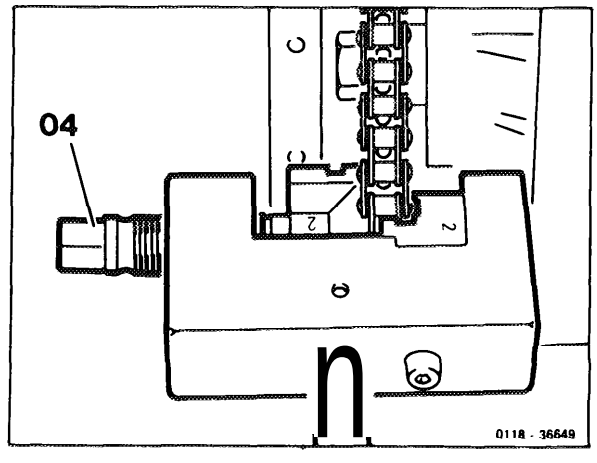


17 Take off rivet tool and change over the moving jaw (02) to the rivet profile (D).



18 Fit on rivet tool.
Rivet pins of the rivet link individually, by tightening the spindle (04) to 30 Nm.

19 Check riveting; re-rivet if necessary.



20 Install spring, bush and tensioning bracket.

21 Install tensioning rail (05330).

22 Install in the reverse order.

Check leaktightness with engine running.

Mechanically/electronically controlled gasoline injection system (CIS-E) 07.3

Job No.

Testing and adjusting jobs

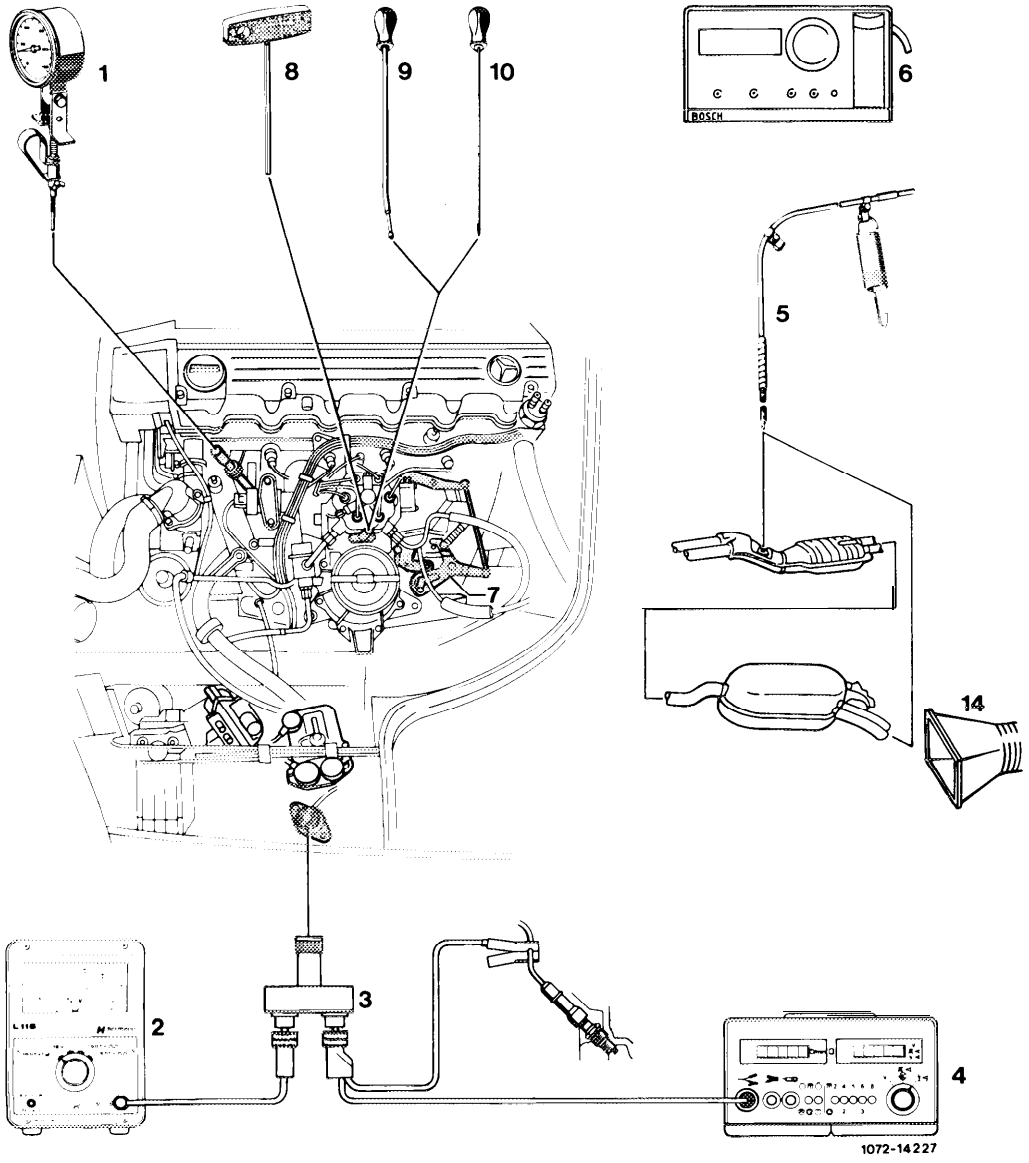
Checking idling speed, readjusting or special emission test (ASU) ..... 07.3 - 100
Testing, regulating engine ..... -110
Performing cylinder comparison test with engine tester SUN 2110 ..... -111
Testing electronic idling speed control ..... -112
Testing engine output and emissions on drum dynamometer ..... -115
Determining fuel consumption by driving on road ..... - 117
Checking fuel pressures and for internal leaks ..... - 120
Testing electrical components of CIS - E injection system ..... -121
A. Without trouble diagnosis by means of on-off ratio .....
B. With trouble diagnosis by means of on-off ratio .....
Testing throttle (orifice) in fuel distributor for unobstructed passage ..... - 122
Testing starting unit ..... -125
Testing starting valve activation ..... -126
Performing cold start ..... -127
Electric wiring diagrams ..... -128
Testing fuel pump ..... - 130
A. Delivery capacity .....
B. Fuel pressure .....
Testing injection valves ..... - 135
Testing, replacing throttle valve switch ..... - 152
Performing fuel quantity comparison measurement ..... - 160
Testing relay fuel pump ..... -165

Assembly jobs

Removal and installation of mixture control unit ..... - 200
Replacing fuel distributor ..... -205
Replacing sealing ring for control piston ..... -207
Removal and installation of injection valves ..... - 215
Replacing air volume meter ..... -220
Removal and installation of mixture control unit with air guide housing ..... -225
Removal and installation of throttle valve housing ..... -230
Replacing, centering air flow sensor plate,
testing and adjusting zero position of air flow sensor plate ..... - 245
Removal and installation of control unit ..... - 250
Replacing electrohydraulic actuator (EHA) ..... - 255
Replacing rubber ring or rubber buffers for fuel pump package ..... -268
Removal and installation of fuel pump package ..... -269
Removal and installation of fuel accumulator ..... -270
Removal and installation of fuel filter ..... -275
Removal and installation of fuel pump ..... -280

Job No. of work unit or standard texts and fiat rates data 07-2053, special emission test (ASU) 00-7600.

Basic and national versions starting 1986



Testers (1, 2, 3, 4, 5, 6).	Connect
Ignition timing (firing point)	Check (refer to Table)
Throttle control (7)	Check for easy operation and condition
Engine oil temperature	60 — 80 °C
Idling speed, idling speed emission value,	
lambda control	Check, readjust (refer to Table)
	For readjustment, use special tools (8, 9, 10)
Testing engine running performance	Engage all supplementary units for this purpose

Basic versions and (CH) KAY

Engine	Version	Idling speed rpm	Idling speed Control range	Idling speed emission value % CO	Lambda control Control range %
103.94	RÜF	650-750	35-45 % 21–27°	1 ± 0.5	–
	NV				
	KAT (CH) KAT			≤ 0.5[1]	[2]
103.980	Std.	600-700		1 ± 0.5	–
	Std. KAT			2 ± 0.5	
103.981 103.982 103.983	RÜF			1 ± 0.5	
	NV				
	KAT (CH) KAT			≤ 0.5[1]	[2]

[1]) With special emission test (ASU).
[2]) Test lambda control at 2500 rpm and read mean value. Compare this value with idling speed value and readjust, if required. The medium value at idling speed should not deviate from value measured at 2500 rpm by more than ± 10. For test, pull off purge line and close.

National versions

Engine	Version	Model year	Idling speed rpm	Idling speed Control range	Idling speed emission value % CO	Lambda control Control range %
103.981 103.983	(AUS) (J) (USA)	as of 1986	650 ± 50	35–45 % 21–27°	–	[1]
	(CH) (S)		780 ± 50		0.6 ± 0.3	–

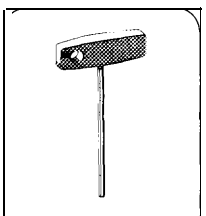
[1]) Test lambda control at 2500 rpm and read mean value. Compare this value with idling speed value and readjust, if required. The medium value at idling speed should not deviate from value measured at 2500 rpm by more than ± 10. For test, pull off purge line and close.

Ignition timing (EZL)

Engine	Version or type of fuel	Engine rpm / rpm	Ignition timing[1] in 'crank angle before TDC' — Adjustment plug position	Vacuum: without	Vacuum: with
Basic version and (CH) KAT					
103.94	RÜF/KAT (CH) KAT	3200	S	25–29	40–44
			N	19–23	
		Idling	S and N	7–11	
103.980	Premium grade leaded	3200	1	23–27	39–43
		Idling		8–13	
	Premium grade unleaded	3200	3	19–23	39–43
		Idling		8–13	
103.981 103.982 103.983	RÜF/KAT (CH) KAT	3200	S	27–31	40–44
			N	21–25	
		Idling	S and N	7–11	
(AUS) starting 1986 (single adjustment plug: 220 Ω)					
103.982 103.983	–	3200	–	21–25	40–44
		Idling		7–11	
(CH) starting 1986 (for (CH) KAT same values as basic version) **(S) starting 1986**					
103.981 103.983	–	3200	S	29–33	40–44
			N	23–27	
		Idling	S and N	TDC ± 2	
(J) (USA) starting 1986 (single adjustment plug: 750 Ω)					
103.94	–	3200	–	25–29	40–44
103.982 103.983				27–31	
		Idling	–	7–11	

[1]) In the event of deviations, check ignition system (15-563).

Special tools



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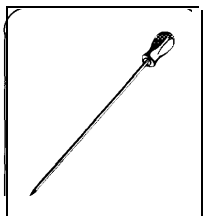

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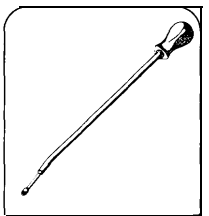

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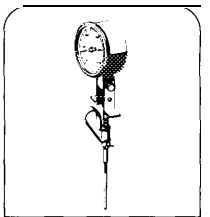

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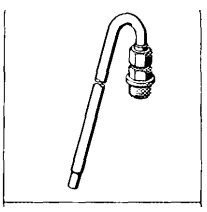
201 589 00 99 00



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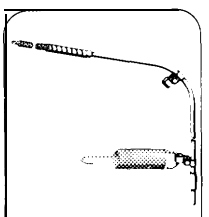

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Conventional testers

Tachometer	
Digital tester (t-pm, dwell angle, ignition angle)	**e.g. Bosch, MOT 001.03**
Lambda control tester	**e.g. Hermann, L 115**

Note

Test or adjust lambda control with a lambda control tester. If no lambda control tester is available, a dwell angle tester may be used.

Idling speed should not be adjusted when the engine is too hot, e.g. after a fast drive or after measuring output on an output dynamometer.

Testing, adjusting

1 **Switch off air conditioning system or automatic climate control. Move selector lever into position ,,P''.**

2 Connect testers.

3 Test ignition timing (firing point) (refer to Table).

4 Check throttle control for easy operation and condition.

5 Run engine to 60-80 °C oil temperature.

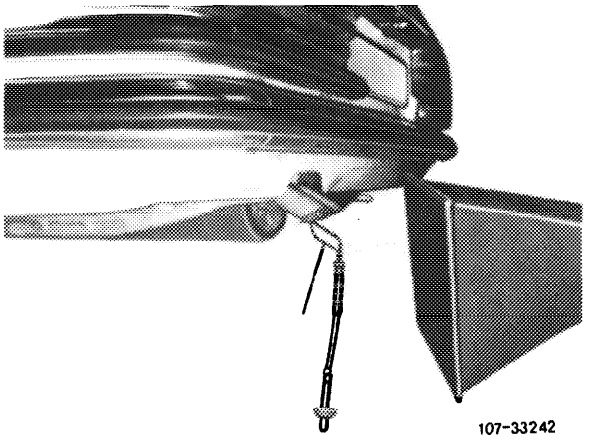
6 Check idling speed (refer to Table).

Attention!
The idling speed can no longer be adjusted on engines with electronic idling speed control. Perform test program if idling speed deviates (07.3-I 12).

7 Test idling speed emission value (refer to Table).

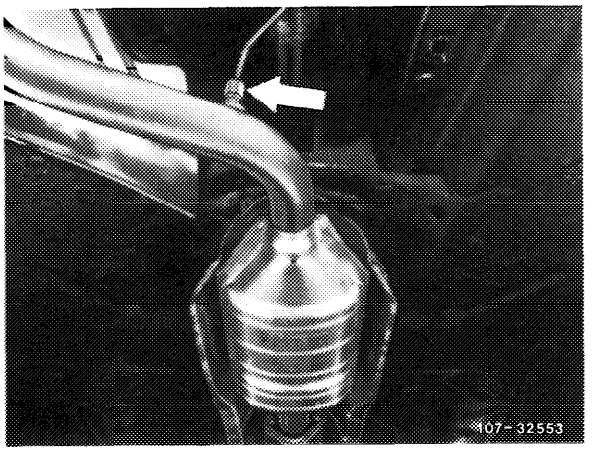
Measuring point at exhaust end pipe.

Measuring point (arrow) for open loop KAT, prior to catalytic converter.



8 Test lambda control.

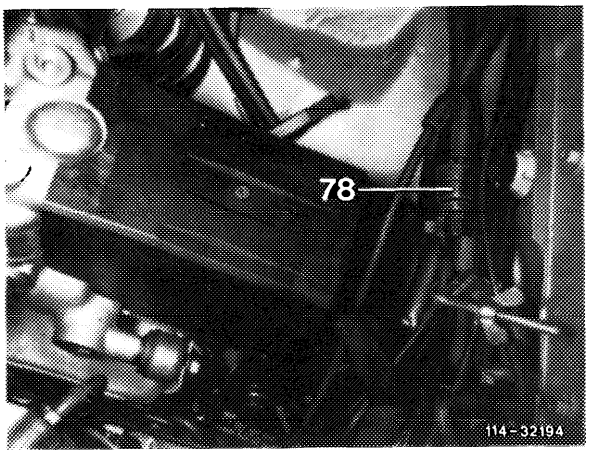
Attention!
While measuring, the indicated value should oscillate. If a constant value is shown, a fault on lambda control is indicated, e.g. O_2 sensor pulled off.



With lambda control tester, pull purge line to throttle valve housing from purge valve (78) and close.

Connect tester to diagnosis socket.
Push button 100 % ⎍⎍⎍.

Test on-off ratio at 2500 rpm and read mean value. Compare this value with idling speed value. The mean value at idling speed should not deviate from value measured at 2500 rpm for more than ± 10.



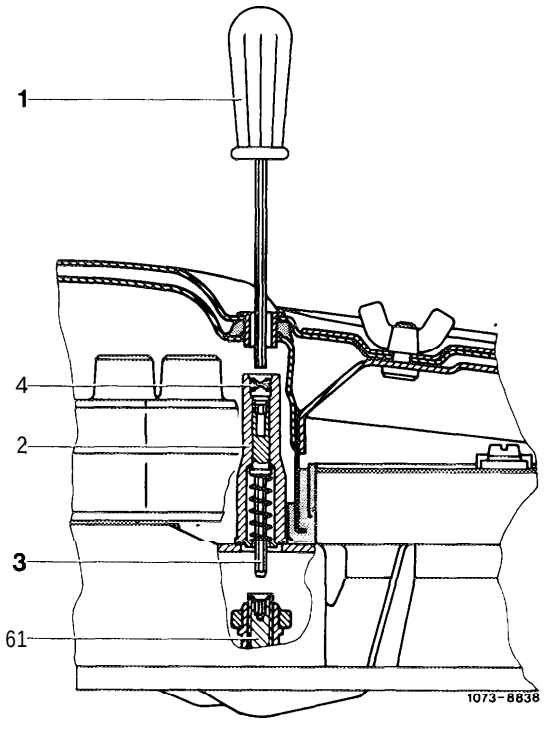
9 Set idling speed emission value or lambda control.

Pull out safety plug (4) with puller.

Push with screwdriver (1) through recess on air filter top against adjusting device (2). Push adjusting device downwards by means of screwdriver against spring force of adjusting device, turn slightly until hex. head (3) engages in mixture control screw.

Turning counterclockwise = leaner — voltage increases

Turning clockwise = richer — voltage drops



1 Screwdriver
2 Adjusting device
3 Hex. head
4 Safety plug
61 Mixture control screw

Accelerate for a short moment and test idling speed emission value or lambda control, adjust if required.

Upon adjustment, insert a blue safety plug (4), part No. 000 997 59 86, by means of installer.

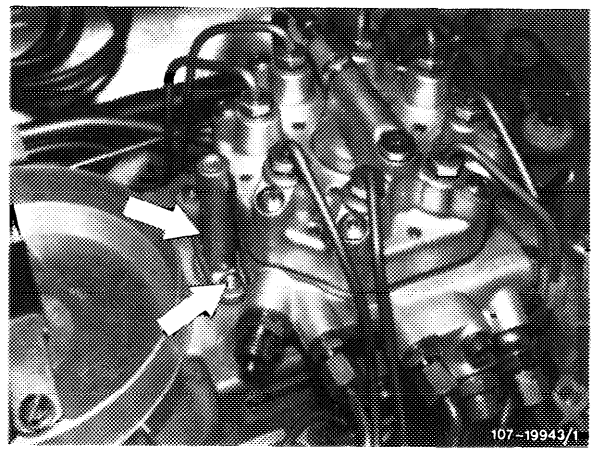
10 (USA)

Attention!
The adjusting device (2) is provided with a protective steel plug.

If upon completion of engine repairs or after exchanging a part of the CIS-E injection system an adjustment of the on-off ratio is required, proceed as follows:

Remove air cleaner.

Punch-mark breakaway safety screw (arrow) in center and drill with a 2.5 mm twist drill to a depth of approx. 6-8 mm.



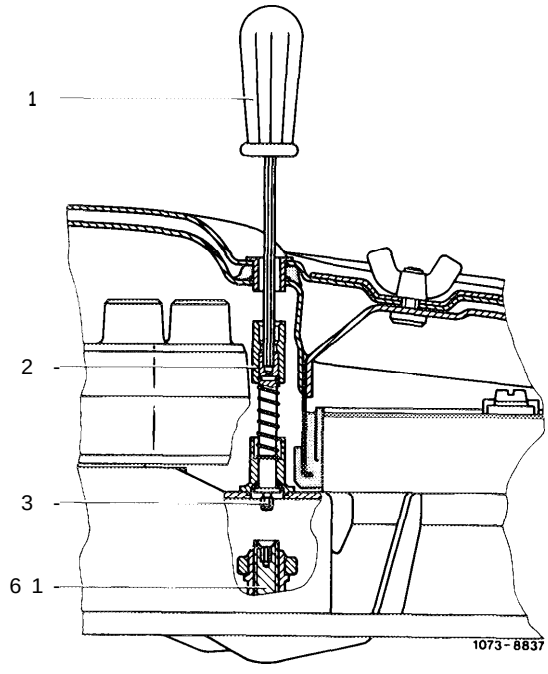
Attention!
Do not drill completely through screws, since engine damage may be caused by the resulting chips. Thoroughly remove metal chips with a rag.

Unscrew breakaway safety screws with a lefthand twist drill.

Install new repair set, part No. 102 589 02 07, while tightening screws until breakaway head breaks off.

Mount air cleaner.

Push with a screwdriver (1) through recess in air cleaner top against adjusting device (2).



1 Allen wrench
2 Adjusting device
3 Hex. head
61 Mixture control screw

Push adjusting device down with screwdriver against spring force, rotate slightly until hex. head (3) engages in mixture control screw (61).

Turning counterclockwise = leaner -voltage increases

Turning clockwise = richer -voltage drops

Accelerate for a short moment and test idling speed emission value or lambda control, readjust if required.

Remove air cleaner.

Push down steel safety plug (contained in repair kit).

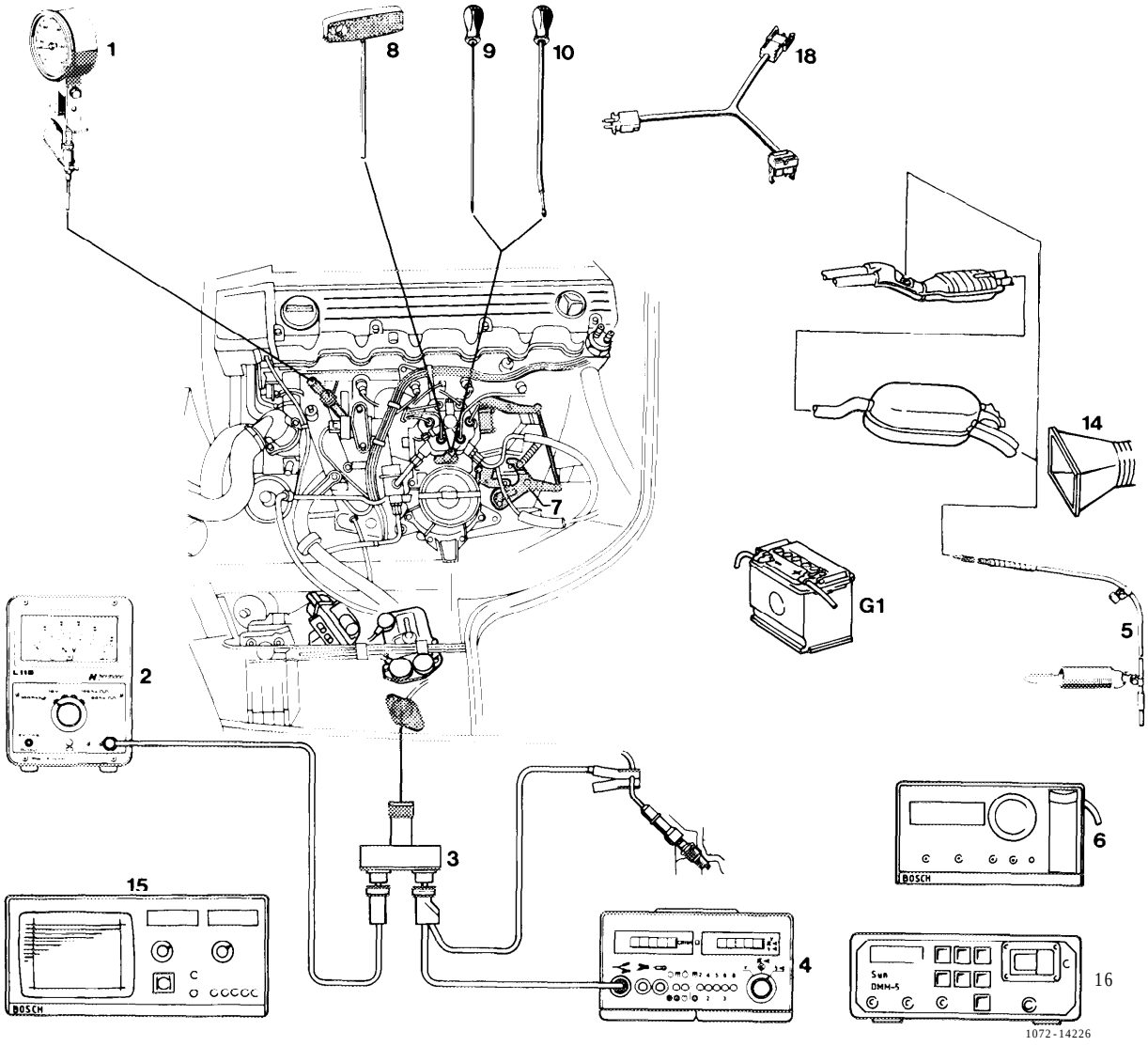
Mount air cleaner.

11 Reconnect purge line.

12 Check engine running performance. For this purpose, engage selector lever in driving position. Switch on air conditioning/automatic climate control. Turn power steering to full lock; engine should continue running.

Job No. of work unit or standard texts and flat rates data 07-I 100.

Basic and national versions starting 1986



Testers (1, 2, 3, 4, 5, 6, 15, 16)	Connect
Test cable (18)	Connect
Coolant level	Check, correct
Engine oil level	Check, while paying attention to oil condition (visual checkup)
Oil level in automatic transmission	Check, correct
Air cleaner	Remove and install
Regulating linkage (7)	Check throttle valve for easy operation and condition. Lubricate bearings, guide lever, ball sockets.
Slotted lever	Check, adjust
Full throttle stop	Check from direction of accelerator pedal, adjust
Voltages	Test battery start ignition coil terminal 1 and 15
Current on actuator	Test with ignition switched on
Ignition timing (firing point)	Test, adjust (refer to Table)
Vacuum adjustment	Check (refer to Table)
Engine oil temperature	60-80 °c
Oscilloscope pattern	Evaluate
Intake system	Spray-test for leaks
Decel shutoff	Check function
Function checkup of electric components	Test
Idle speed stop	Check
Idle speed, idle speed emission value, lambda control	Check, readjust (refer to Table) For readjustment, use special tools (8, 9, 10)
Check engine running performance	For this purpose, engage all auxiliary units

Basic versions and (CH) KAT

Engine	Version	Idling speed rpm	Idling speed Control range	Idling speed emission value % co	Lambda control Control range %	Current on actuator with ignition switched on mA
103.94	RÜF	650-750	35-45 % 21–27° ∡	1 ± 0.5	–	10
	NV					–
	KAT (CH) KAT			≤ 0.5[1]	[2]	20
103.980	Std.	600–700		1 ± 0.5	–	–
	Std. KAT			2 ± 0.5		
103.981 103.982 103.983	RÜF			1 ± 0.5		10
	NV					–
	KAT (CH) KAT			≤ 0.5[1]	[2]	20

National versions

Engine	Version	Model year	Idling speed rpm	Idling speed Control range	Idling speed emission value % CO	Lambda control Control range %
103.981 103.983	(AUS) (J) (USA)	as of 1986	650 ± 50	35-45 % 21–27° ∡	–	[2]
	(CH) (S)		780 ± 50		0.6 ± 0.3	–

[1] With special emission test (ASU).
[2] Test lambda control at 2500 rpm and read mean value. Compare this value with idling speed value and readjust, if required. The medium value at idling speed should not deviate from value measured at 2500 rpm by more than ± 10. For test, pull off purge line and close.

Ignition timing (EZL)

Engine	Version or type of fuel	Engine rpm	Ignition timing[1]) in °crank angle before TDC		
			Adjustment plug position	Vacuum	
		rpm		without	with
Basic versions and (CH) KAT					
103.94	RÜF/KAT (CH) KAT	3200	S	25–29	40–44
			N	19–23	
		Idling	S and N	7–11	
103.980	Premium grade leaded	3200	1	23–27	39–43
		Idling		8–13	
	Premium grade unleaded	3200	3	19–23	39–43
		Idling		8–13	
103.981 103.982 103.983	RÜF/KAT (CH) KAT	3200	S	27–31	40–44
			N	21–25	
		Idling	Sand N	7-11	
(AUS) starting 1986 (single adjustment plug: 220 Ω)					
103.982 103.983	–	3200	–	21–25	40–44
		Idling		7–11	
(CH) starting 1986 (for (CH) KAP same values as basic version) **(S) starting 1986**					
103.981 103.983	–	3200	S	29–33	40–44
			N	23–27	
		Idling	S and N	TDC ± 2	
(J) (USA) starting 1986 (single adjustment plug: 750 Ω)					
103.94	–	3200	–	25–29	40–44
103.982 103.983				27–31	
		Idling	–	7–11	

[1]) In the event of deviations, check ignition system (15–563).

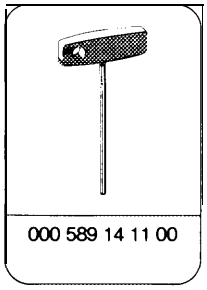
Battery voltages

No-voltage current	12.2 volts
Starting current min.	10 volts

Voltages on ignition coil (with engine stopped and ignition switched on)

Terminal 15 to ground	Battery voltage
Terminal 1 and terminal 15	0 volt

Special tools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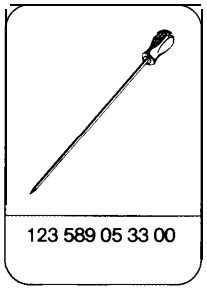
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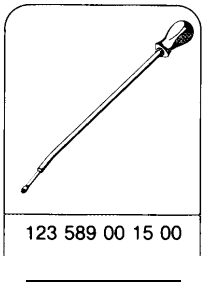
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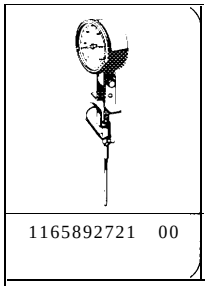
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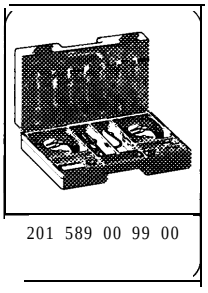
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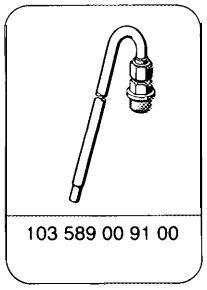
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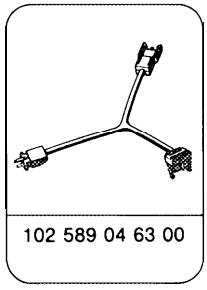
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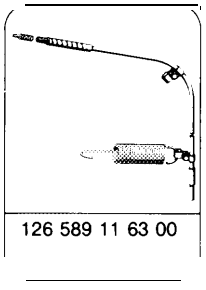
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Conventional testers

Speedometer	
Digital tester (rpm, dwell angle, ignition angle)	e.g. Bosch, MOT 002.02 Sun, 1019
Lambda control tester	e.g. Hermann, L 115
Multimeter	e.g. Sun, DMM-5

Note

Test or adjust lambda control with a lambda control tester. If no lambda control tester is available, a dwell angle tester may be used.

Idling speed should not be adjusted when the engine is too hot, e.g. after a fast drive or after measuring output on an output dynamometer.

Testing, regulating

1 Complete data sheet.

2 Check coolant level, correct.

3 Check engine oil level, while paying attention to oil condition (visual checkup).

4 Check oil level in automatic transmission.

5 Switch off air conditioning system or automatic climate control. Move selector lever into position „P".

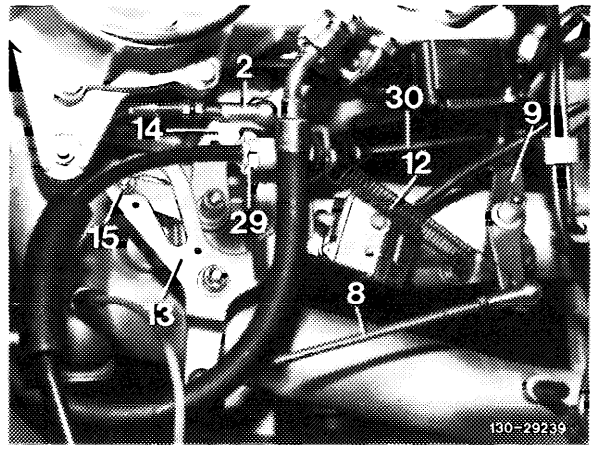
6 Remove air cleaner.

7 Check regulating linkage and throttle valve for easy operation and condition. Lubricate all bearing points and ball sockets.

8 Check slotted lever, adjust. Check whether roller (15) in slotted lever (13) rests free of tension against end stop. If required, adjust slotted lever (13) with connecting rod (2) in such a manner that roller (15) rests free of tension against end stop.

9 Check full throttle stop from direction of accelerator pedal, adjust (30–300).

10 Connect testers.



11 Test voltages (battery, start and ignition coil).

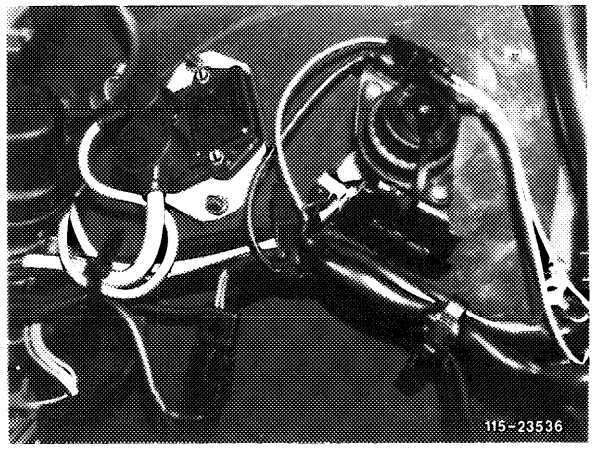
a) No-voltage current

Connect voltmeter while paying attention to polarity on battery and read voltages. Nominal value 12.2 volts.

b) Starting voltage

Pull off plug for ignition distributor sensor on switching unit (green cable) or connect protective plug, part No. 102 589 02 21 00 to diagnosis socket.

Test starting voltage.
Operate starter for a short moment while reading voltage.
Nominal value min. 10 volts.



c) Ignition coil

Switch on ignition with engine stopped. On jack 5 of diagnosis socket, test voltage, terminal 15 to ground.

Nominal value: battery voltage.

On jack 5 and 4 of diagnosis socket, check voltage difference between terminal 15and terminal 1.

Nominal value: 0 volt.

If nominal values are not attained, check ignition system (15–563).

12 Test current on actuator with ignition switched on. For this purpose, pull plug from actuator, make intermediate contact with test cable 102 589 04 63 00. Connect multimeter, set to mA.

Nominal value: refer to Table.
If not ok (07.3-121, refer to section ,,k'').

13 Test ignition timing (firing point) and vacuum adjustment. For test values refer to Table.

14 Run engine to 60-80 °C oil temperature.

15 Evaluate oscilloscope pattern (15–508).

16 Check intake system for leaks. For this purpose, spray-test all leak points with Iso octane DIN 51756 or benzine.

Attention!
For spray-testing, do not use conventional fuel (vapors detrimental to health). Pay attention to fire hazard and do not spray on glowing parts or parts of ignition system.

17 Check decel shutoff. For this purpose, keep engine speed constant > 2500 rpm.

Actuate microswitch manually, engine should be hunting.

Check fuel pressures and for internal leaks, if required (07.3-I 20 section ,,C'').

18 Function checkup of electrical components RÜF/KAT

a) Faulty diagnosis by measuring on-off ratio.

Engine at idling speed.

Nominal value: RÜF 50 % readout constant.
KAT readout oscillating.

If the values are not attained, perform test program (07.3-I 21).

b) Function test of idling speed and full load contact.

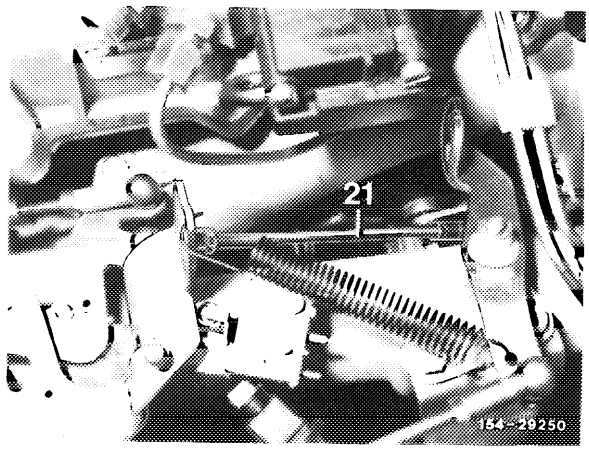
Engine stopped. Switch on ignition 70 %.

Deflect air flow sensor plate 10 %.
At 70 %, check throttle valve switch (07.3-I 21, section „e").

Air flow sensor plate zero position 70 %.

Fully open throttle valve 20 %.
At 40 %, check throttle valve switch (07.3-I 21, section „e").

19 Check whether throttle valve rests against idle speed stop. Disengage connecting rod for this purpose.



20 Vehicles with cruise control/Tempomat.

Check whether actuator rests against idle speed stop of cruise control/Tempomat. For this purpose, push lever of actuator clockwise to idling speed stop on cruise control/Tempomat. When engaging pull rod (21), make sure that the lever of the actuator is raised by the idle speed stop on cruise control/Tempomat by approx. 1 mm. Adjust pull rod, if required.

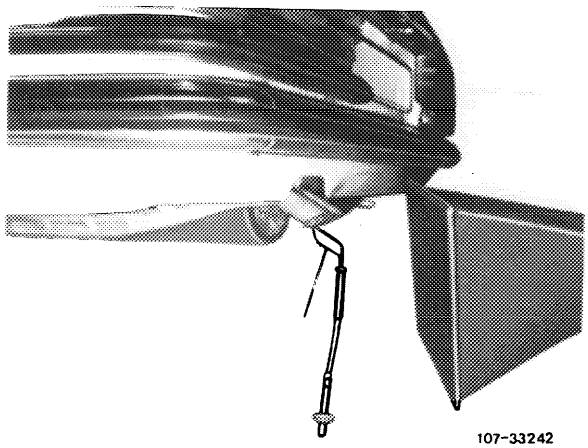
21 Mount air cleaner.

22 Check idling speed (refer to Table).

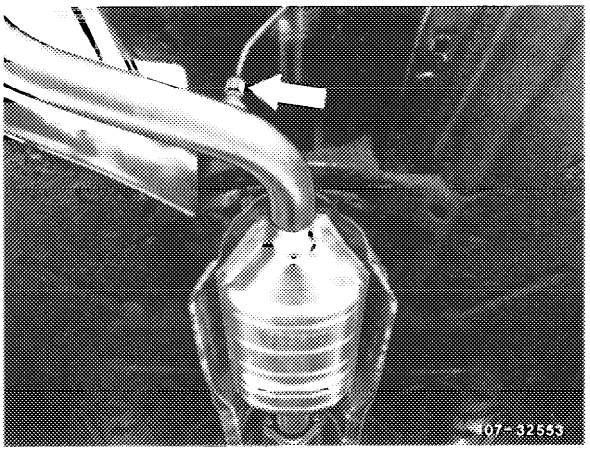
Attention!
On engines with electronic idle speed control, the idling speed can no longer be adjusted. Perform test program, if idling speed deviates (07.3-I 12).

23 Check idling speed emission value (refer to Table).

Measuring point at exhaust end pipe.



Measuring point (arrow) for open loop KAT in front of catalytic converter.



24 Test lambda control (refer to Table).

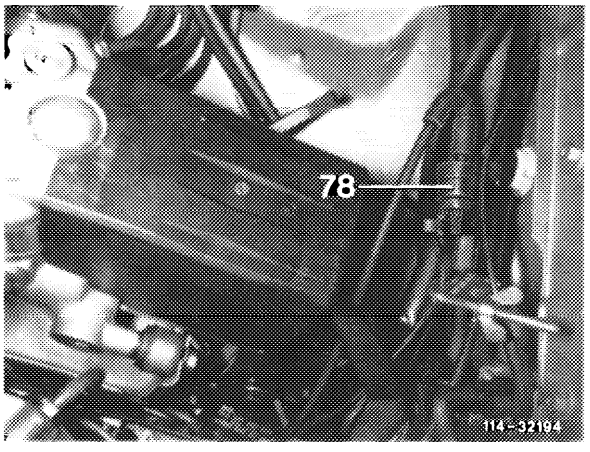
Attention!
While measuring, the indicated value should oscillate. If a constant value is shown, a fault on lambda control is indicated, e.g. O_2 sensor pulled off.

With lambda control tester

Pull off purge line toward throttle valve housing on purge valve (78) and close.

Connect tester to diagnosis socket.
Push button 100 % ⎍⎍⎍.

Check on-off ratio at 2500 rpm and read mean value. Compare this value with idling speed value. The mean value at idling speed should not deviate by more than ± 10 from value measured at 2500 rpm.



25 Adjust idling speed emission value or lambda control.

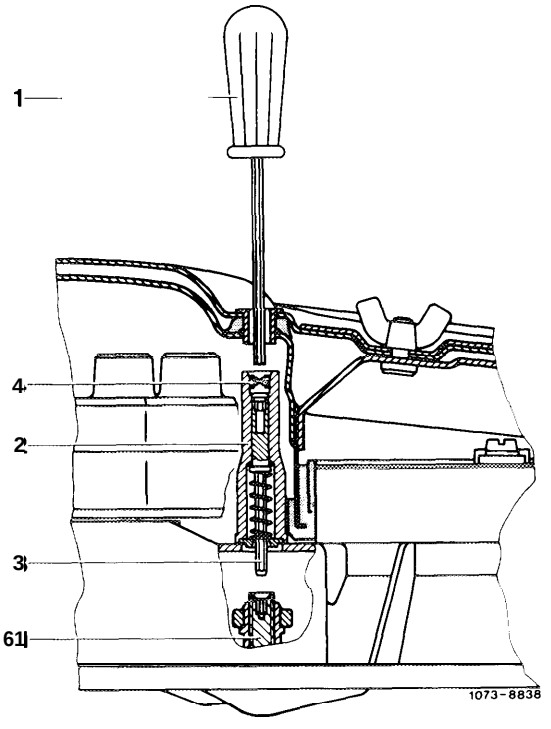
Pull out safety plug (4) by means of puller.

Push with screwdriver (1) through recess on air cleaner top against adjusting device (2). Push adjusting device down with screwdriver against spring force of adjusting device until hex. head (3) engages in mixture control screw (61).

Turning counterclockwise = leaner — voltage increases
Turning clockwise = richer — voltage drops

Accelerate for a short moment and test idle speed emission value or lambda control and adjust, if required.

Following adjustment, insert a blue safety plug (4), part No. 000 997 59 86, by means of installer.



1 Screwdriver
2 Adjusting device
3 Hexagon head
4 Safety plug
61 Mixture control screw

(USA)

Attention!
A protective steel plug is installed in adjusting device (2).

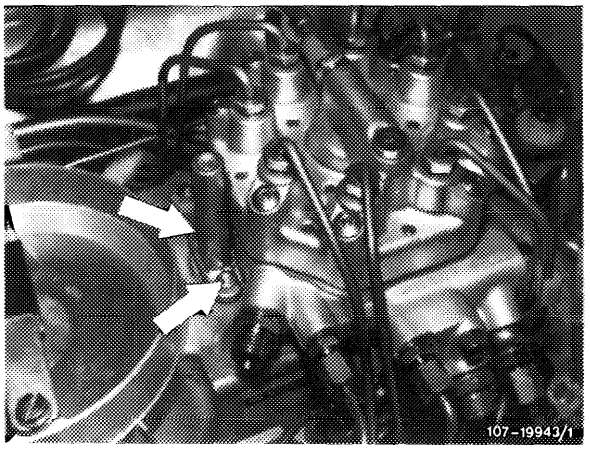
If upon completion of engine repairs or replacement of a part of the CIS-E injection system an adjustment of the on-off ratio is required, proceed as follows:

Remove air cleaner.

Center-punch breakaway screws (arrow) and drill with a 2.5 mm twist drill to a depth of approx. 6-8 mm.

Attention!
Do not drill through screws, since engine damage may be caused by the metal chips. Thoroughly remove metal chips with a rag.

Unscrew breakaway screws with lefthand twist drill.



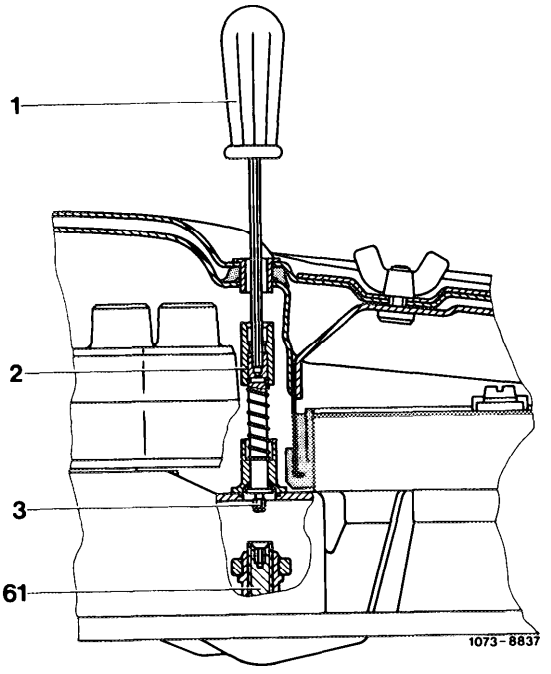
Install new **repair kit, part No. 102 586 02 07, while tightening screws until breakaway head is breaking off.**

Mount air cleaner.

Push with screwdriver (1) through recess in air cleaner top against adjusting device (2).

Push adjusting device down with screwdriver against spring force, slightly rotate until hex. head (3) engages in mixture control screw (61).

Turning counterclockwise = leaner -voltage increases
Turning clockwise = richer -voltage drops



1 Allen wrench
2 Adjusting device
3 Hex. head
61 Mixture control screw

Accelerate for a short moment and test mean control rod travel, readjust if required.

Remove air cleaner.

Push down steel safety plug (contained in repair kit).

Mount air cleaner.

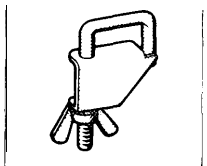
26 Reconnect purge line.

27 Check engine running performance. For this purpose, engage selector lever in driving position, switch on air conditioning/automatic climate control, turn power steering to full lock; engine should continue running. Check rpm stabilization, if required (07.3-I 12).

07.3-I 11 Performing cylinder comparison test with engine tester SUN 2110

Job No. of work unit or standard texts and flat rates data 07- 1150

Special tools



000 589 40 37 00

Conventional tester

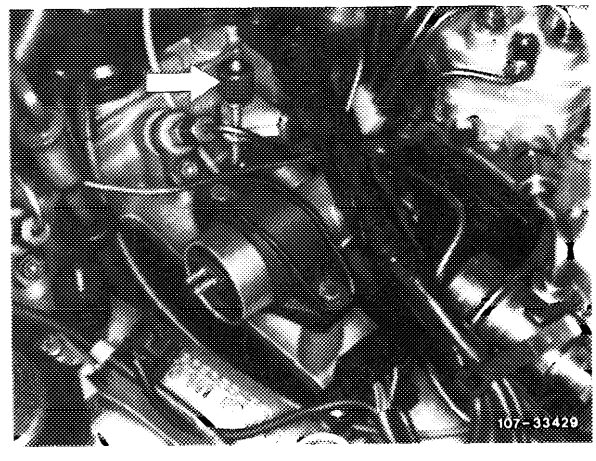
Engine tester	SUN, 2110

Testing

1 Run engine to 60-80 °C oil temperature.

2 Connect engine tester SUN 2110.

3 Pull connecting cable from idle speed adjuster (idle speed air valve). Adjust previously measured idling speed with clamp (arrow). Also adjust idling speed emission value.



4 Select illustrated page ,,Engine starting, measuring" with button # illustrated page.

5 Push button ,,Engine stop". Start engine (not running) until lettering ,,Data in memory" shows up.

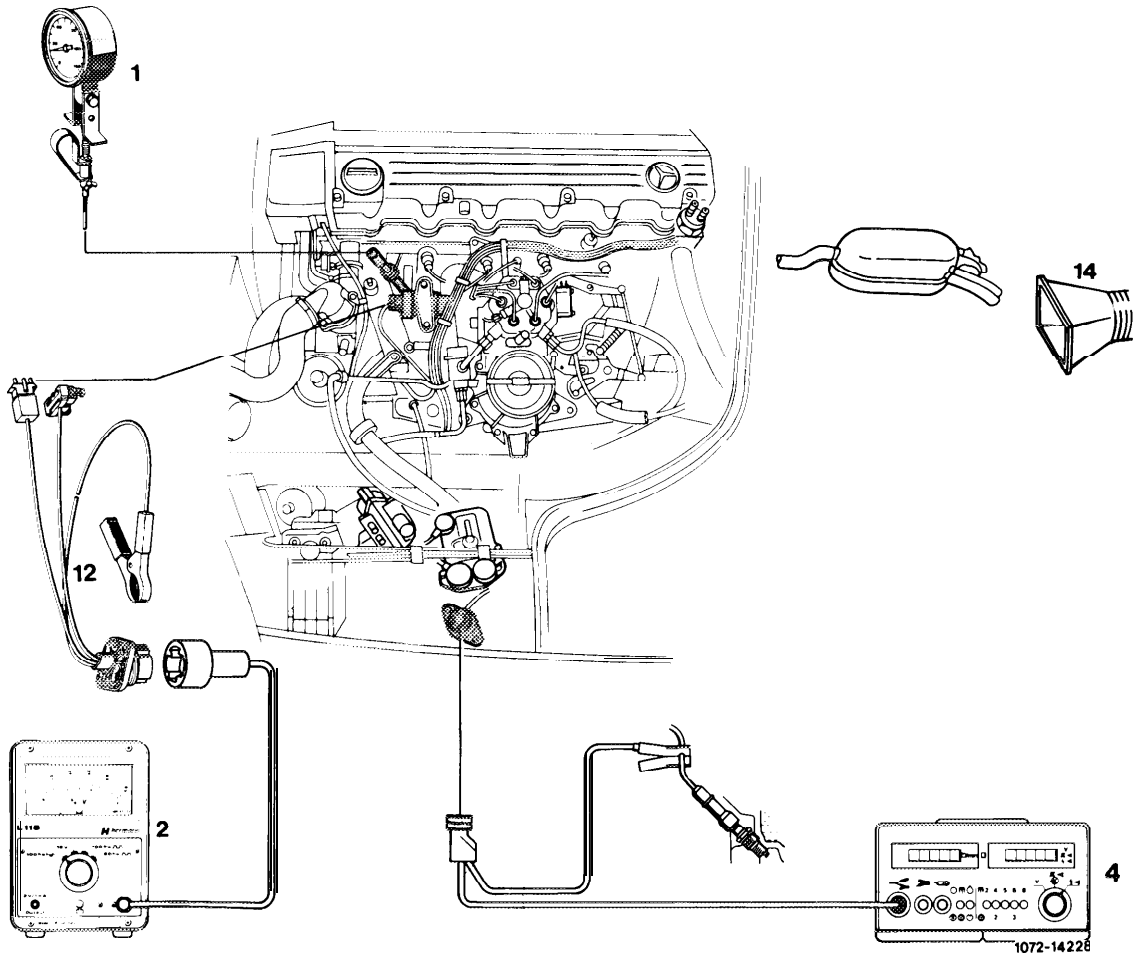
6 Push button ,,Engine stop" again, engine will be running.

7 Select illustrated page ,,Cylinder comparison" with button #. Run engine at idling speed until HC value is constant.

Perform cylinder comparison test and evaluate.

07.3-I 12 Testing electronic idling speed control

Job No. of work unit or standard texts and flat rates data 07-2006.



Testers (1, 2, 4)	Connect
Test cable (12)	Connect
Engine oil temperature	60-80 °C
Electronic idling speed control	Check (refer to Table)
Control range	Check (refer to Table)
Function idling speed adjuster (air valve)	Check. For this purpose, connect battery voltage for a short moment, valve should switch audibly.
Voltage supply	Check according to wiring diagram
Rpm stabilization	Check. On vehicles with automatic transmission and/or A/C compressor

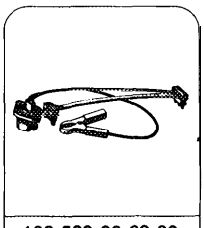
Basic versions and (CH) KAT

Engine	Version	Idling speed rpm	Control range %	Control range ° ∡	Model year
103.94	RÜF NV KAT (CH) KAT	650-750	35-45	21-27	–
103.980	Std. Std. KAT	600-700			
103.981 103.982 103.983	RÜF NV KAT (CH) KAT				

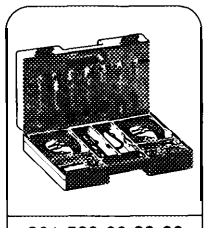
National versions

103.981 103.983	(AUS) (J) (USA)	650 ± 50	35–45	21–27	starting 1986
	(CH) (S)	780 ± 50			

Special tools



103 589 00 63 00



201 589 00 99 00

Conventional testers	**e.g.** make
Multimeter	Sun, DMM-5
Engine tester	Bosch, MOT 002.02
Lambda control tester	Hermann L 115

Note

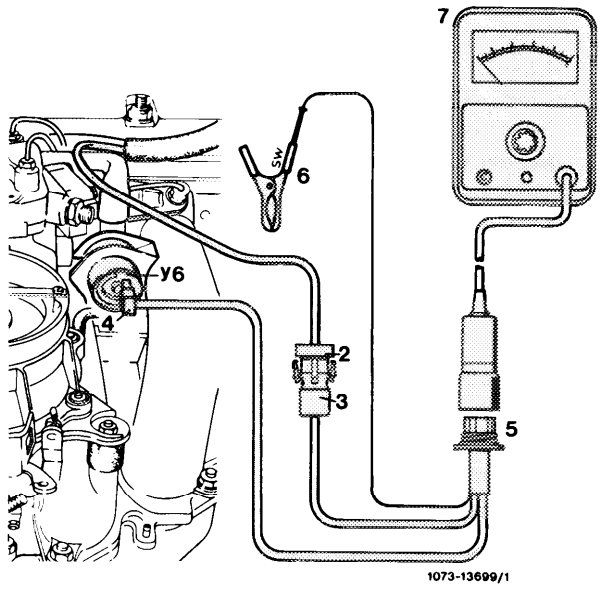
Electric wiring diagrams 07.3-I 28.

On analog measuring instruments the voltage may drop down to 0 volt.

Speed increases when plug is pulled from micro-switch.

Connecting testers

Connect test cable 103 589 00 63 00 to idling speed adjuster (air valve) and to lambda control tester or engine tester.



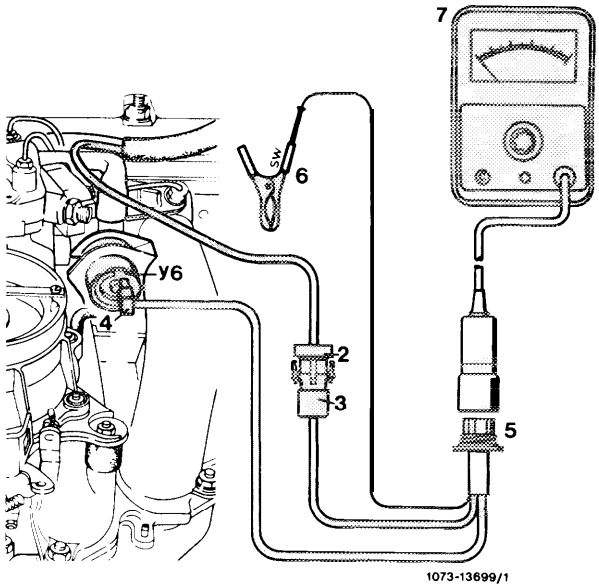
2 Plug, engine harness
3 Plug connection, test cable
4 Plug, idling speed air valve
5 Test cable
6 Ground terminal
7 Lambda control tester
Y6 Idling speed air valve

Connect test cable to idle speed air valve and to lambda control tester or engine tester.
A. Lambda control tester = % readout
B. Engine tester = °4 readout
Engine at idling (operating temperature).

Nominal value: 35-45 % at idling speed
21-27 °4

Ok	Not ok

End of test



Readout 0 % or 100 %
0 °4 or 90 °4

Pull plug from idling speed air valve.
Connect battery voltage and ground briefly to idling speed air valve.

Idling speed air valve is audibly switching.

Ok	Not ok

Replace idling speed air valve.

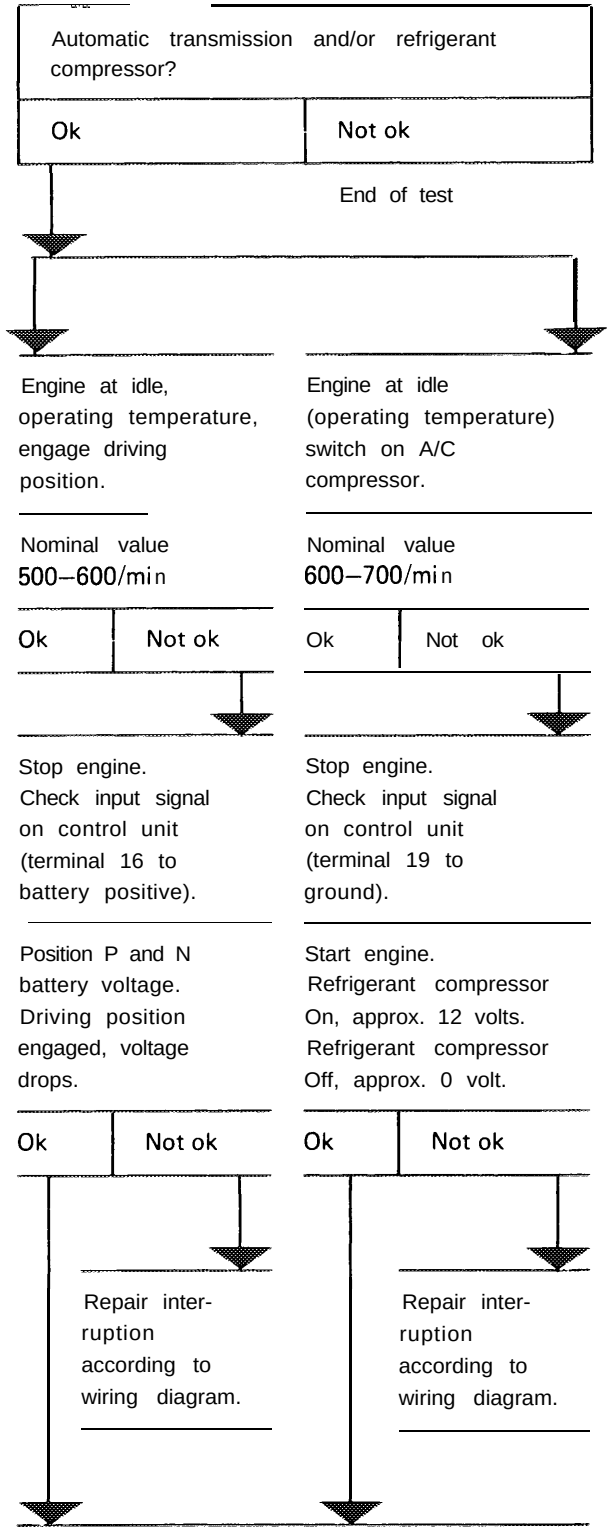
Check voltage supply according to wiring diagram.

Switch on ignition. Voltage on red/blue line approx. 12 volts.
Check red/white line for continuity.

Ok	Not ok

Check input signals or contour hoses for continuity.
Replace control unit.

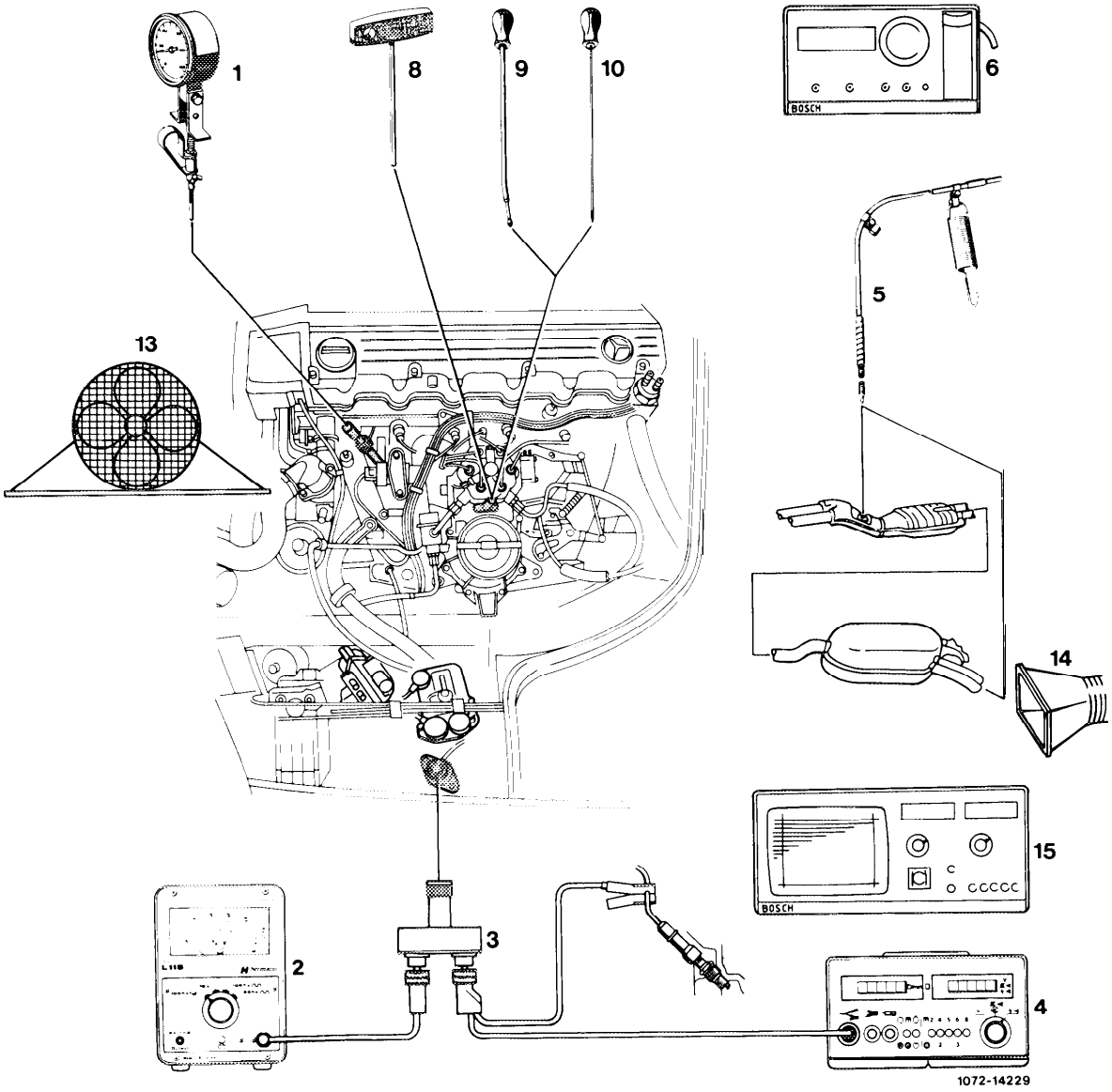
Repair interruption.


Automatic transmission and/or refrigerant compressor?
Ok
Not ok
End of test
Engine at idle, operating temperature, engage driving position.
Engine at idle (operating temperature) switch on A/C compressor.
Nominal value 500–600/min
Nominal value 600–700/min
Ok
Not ok
Ok
Not ok
Stop engine. Check input signal on control unit (terminal 16 to battery positive).
Stop engine. Check input signal on control unit (terminal 19 to ground).
Position P and N battery voltage. Driving position engaged, voltage drops.
Start engine. Refrigerant compressor On, approx. 12 volts. Refrigerant compressor Off, approx. 0 volt.
Ok
Not ok
Ok
Not ok
Repair interruption according to wiring diagram.
Repair interruption according to wiring diagram.
End of test.

07.3-I 15 Testing engine output and emissions on drum dynamometer

Job No. of work unit or standard texts and flat rates data 07-1203 or 07-1206.

Basic and national version (CH)



Data sheet	Complete
Fluid levels (engine oil, automatic transmission fluid, coolant)	Check, correct
Testers (1, 2, 3, 4, 5, 6, 15)	Connect
Trunk contents	Check. Remove heat-sensitive and heavy items.
Front wheels.	Secure. Place holding wedges at approx. 100 **mm distance in front of front wheels.**
Tire pressure of rear wheels	**Check, set to specified pressure.**
Suction device (14)	**Set up behind exhaust pipe**
Engine oil temperature	**Run under partial load to 60-80 °C while checking speedometer.**
Blower (13)	**Cool engine, do not exceed 120 °C engine oil temperature.**
Oscilloscope pattern	**Evaluate under load (15-508).**
Full load output	**Check (refer to table). Pay attention to notes concerning output and emission test. Attention! Run at full load output only as long as required for reading instruments.**

Emission values	**Check under load. If emission values are not attained, replace fuel distributor; check lambda control (07.3-I 00)**

Test and adjustment values

Engine output and emission test

Engine			103.940/941/942	
Version			RÜF	**KAT** (CH) **KAT**
Engine output test				
output test, full load')		rpm	**5500**	
	Manual transmission 3rd speed	kW	92	89
	Automatic transmission driving pos. ,,3''	kW	89	86
Emission test				
Idling speed		rpm	**650-750**	
		% CO	1 ± 0.5	≦ 0.5[2])
	Lambda control	%	–	Readout oscillating
Full load	**3rd speed driving position ,,3''**	% CO[3])	1.5–5	
		rpm	3500	
Upper partial load	**4th speed driving pos. „D" 120 km/h 24 kW**	% CO	**0.1-0.8**	**Readout oscillating**
Lower partial load	**4th speed driving pos. „D" 50 km/h 7 kW**	% CO	**0.1-0.8**	**Readout oscillating**

[1]) Test values are minimum outputs.
[2]) With special emission test (ASU).
[3]) On vehicles with lambda control, lambda control will move to control operation during full load test.

Note: When measuring output, be sure to take the various influencing factors into consideration.

Output correction factor

Notes for output test.

Engine	103.980		103.981/982/983	
Version	Std.	Std. KAT	RÜF	KAT (CH) KAT

Engine output test

		rpm	5500			
output test full load[1])	**Manual** transmission 3rd speed	kW	105	–	104	100
	Automatic transmission driving pos. ,,3''	kW	102	–	101	97

Emission test

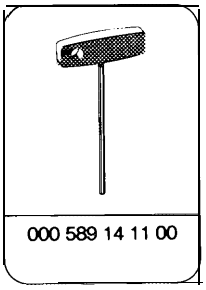
		rpm	**600-700**			
Idling speed		% co	**1 ± 0.5**	**2 ± 0.5**	1 ± **0.5**	≦ 0.5[2])
	Lambda control	%	–	**Readout oscillating**	–	**Readout oscillating**
Full **load**	3rd **speed driving position** ,,3''	**% CO**[3])	1.5-5			
		rpm	3500			
Upper partial load	**4th speed** driving pos. ,,D'' 120 km/h 24 kW	% co	0.1–0.8	Readout oscillating	0.1–0.8	Readout oscillating
Lower partial load	4th **speed driving pos. „D" 50 km/h 7.0** kW	**% co**	0.1–0.8	Readout oscillating	0.1–0.8	Readout oscillating

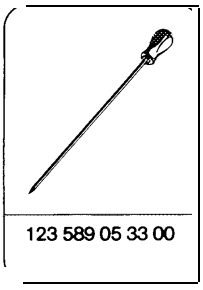
[1]) **Test values are minimum output values.**
[2]) **With special emission test (ASU).**
[3]) **On vehicles with lambda control, lambda control will move to control operation during full load test.**

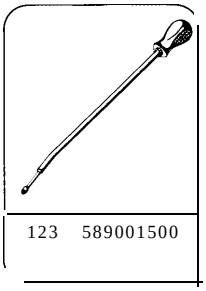
Note: When measuring output, be sure to take the various influencing factors into consideration.

Output correction factor
Notes for output test.

Special tools


000 589 14 11 00


123 589 05 33 00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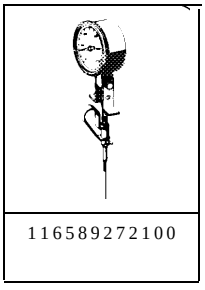
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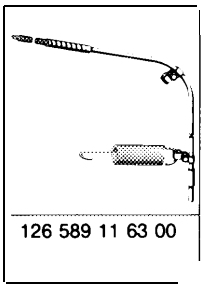

126 589 11 63 00

Conventional testers

CO measuring instrument		
Engine tester	(rpm, dwell angle, ignition angle, oscilloscope, voltmeter)	e.g. Bosch, MOT 002.02
		e.g. SUN, 1019
Lambda control tester		e.g. Hermann, L 115

Notes concerning output and emission test on drum dynamometer, as well as output corrections, driving rules and operating notes

Output test

This test is required only in the event of a complaint about output. The valid output reference values are minimum values and apply to vehicles with power steering. Take barometer reading and intake air temperature into account (refer to enclosure).

On vehicles where the firing point has been changed owing to a changeover from leaded to unleaded fuel, the output values may be slightly reduced.

Note: Vehicles with electronic ignition timing (EZL).

When a coolant temperature of approx. 95 °C on these vehicles is exceeded, the ignition timing (firing point) is put back in direction of ,,retard". This will reduce the output by approx. 2-5 %.

If during output test the specified minimum output is not attained, repeat output test with a simulated coolant temperature of 80 °C.

The coolant temperature can be simulated with the Ω-decade (special tool 124 589 09 63 00), 80 °C = 300 Ω.
For this purpose, pull green/black plug from temperature **sensor and connect to ground via a-decade.**

Emission tests

The emission tests at idle, partial load and full load are serving to evaluate the mixture composition in combustion chamber. They must be made in the event of complaints about engine performance, fuel consumption and engine output. A statement on absolute consumption is not possible. For emission tests, use measuring instruments in accordance with infrared absorption method.

Output correction on drum dynamometer

To determine the engine output, uniform directives according to 80/1 269 EEC were set up for the European Economic Community. They differ from DIN 70020 part 6, valid up to now e.g. by the atmospheric reference conditions named (air temperature now 25 °C, air pressure 990 hPa (mbar) instead of 1013 hPa(mbar).

The formulas for determining correction factors were also revised. Humidity conditions were not included.

Driving regulations, operating notes

To keep tire strain within permissible limits the following regulations should be observed:

1 Do not drive on drum dynamometers with winter tires. Mount shop-owned test bench tires. Only warming up under partial load is permitted (refer to item 8).

2 Check tire pressure of drive wheels, but do not increase beyond the pressure specified for road driving.

3 High axle load of drive wheels is **not permitted.**

4 Restrict duration of driving to the absolutely necessary time for reading the instruments (approx. 5 seconds **for emission test).**

5 Driving speed max. 130 km/h (with SR tires 120 km/h) on dynamometers with a drum diameter of min. 318 mm with original tires.

At a drum diameter of 220-318 mm and vehicles with SR tires for speeds above 100 km/h, shop-owned test bench tires must be mounted. Function and output tests at max. 100 km/h (e.g. diesel) can also be made with original tires.

6 Maintain test regulations and the following sequence:

Warming up — output test — emission test full load, upper partial load, lower partial load — idling speed — emission test idling speed.

The full load tests (output, emissions) must be made immediately after warming up, as long as the tire temperature is still low, since the temperature rises the most during these measurements. Two repeat measurements following adjusting jobs are permitted. Prior to additional measurements, be sure to wait for about 45 minutes for cooling the tires.

7 Cool vehicle with blower (minimum output 15 000 m^3/h). Direct air flow to radiator and underbody of vehicle (oil pan, exhaust, tires). Maintain a distance of approx. 1 m between blower and vehicle.

8 Warming up under partial load (driving position 3 or 3rd speed, approx. 60 km/h, approx. 25 kW) up to an oil temperature of 75 °C.

9 Insert emission probe (special tool 126 589 11 63 00) for at least 300 mm into exhaust pipe.

10 During output test drive in specified gear step at engine speed named, with the engine fully loaded. Read instruments. Decelerate. Compare indicated output with reference value. Take vehicle equipment, barometer reading and intake temperature into account (for output corrections, refer to enclosure and Data Manual).

11 During emission test drive in specified gear step at full load or partial load at specified engine speed or driving speed and test bench adjustment named. Do not drive longer than required for reading the instruments. Pull off engine vent. Air cleaner must be mounted. Perform emission test at partial load at an oil temperature between 75 and 85 °C. If required, cool engine after driving under full load.

12 During emission test at idling speed an oil temperature of 60-80 °C is required. The cooling blower must be switched off. Run engine for 5 minutes at idle for stabilization.

Use of correction table

All output data refer to normal operating conditions:

a) Reference pressure: 990 hPa = 990 mbar
b) Reference intake air temperature: +25 °C

The output measured on dynamometer must be corrected if test conditions are different, so that they can be compared with the output data in technical records.

Air pressure measuring system of weather station

The barometer of the weather station shows the air pressure with reference to height above sea level. Prior to operating station, the barometer must be set to the air pressure according to data from local weather service.

In addition to barometer reading the altitude and intake air temperature should also be included.

Output correction formula $Ne_o = Ne \times K_H$

Ne_o = Output with reference to normal operating conditions in kW (HP).

Ne = Measured output on dynamometer in kW (HP).

K_H = Correction for intake air temperature, barometer reading and altitude of respective test location.

The output correction factors are shown on correction table.

Example
(Looking up of values for this example is indicated).

Determined output: Ne = 100 kW
Barometer reading (with reference to height above sea level): p = 955 hPa (955 mbar)
Altitude of test location: 400 m above sea level
Intake air temperature: t = +20 °C

Result:

p test location = p barometer − p altitude

p test location = 955 hPa -46 hPa
= 909 hPa ≈ 910 hPa

K_H = 1.0787 (from correction table 910 hPa, +20 °C)

Ne_o = measured output Ne x correction KH

therefore Ne_o = 100 kW x 1.0787 = 108 kW

Output corrections on dynamometer for gasoline engines according to 80/1269 EEC

hPa (mbar)	Correction factor										
1040	0,9111	0,9194	0,9277	0,9358	0,9439	0,9519	0,9599	0,9678	0,9756	0,9833	0,9910
1035	0,9155	0,9239	0,9321	0,9403	0,9485	0,9565	0,9645	0.9724	0,9803	0,9881	0,9958
1030	0,9200	0,9284	0,9367	0,9449	0,9531	0,9612	0,9692	0,9772	0.9851	0,9929	1,0007
1025	0,9245	0.9329	0,9412	0,9495	0,9577	0,9659	0.9739	0,9819	0,9899	0,9977	1,0056
1020	0,9290	0.9375	0,9458	0,9542	0,9624	0,9706	0,9787	0.9867	0,9947	1.0026	1,0105
1015	0,9336	0,9421	0.9505	0,9589	0.9672	0,9754	0.9835	0,9916	0,9996	1.0076	1,0155
1010	0,9382	0,9467	0,9552	0,9636	0,9719	0,9802	0,9884	0,9965	1,0046	1,0126	1,0205
1005	0,9428	0,9514	0,9600	0,9684	0.9768	0.9851	0.9933	1,0015	1.0096	1,0176	1,0256
1000	0,9476	0,9562	0,9648	0,9732	0,9817	0,9900	0,9983	1,0065	1,0146	1,0227	1,0307
995	0,9523	0,9610	0,9696	0,9781	0.9866	0.9950	1,0033	1,0115	1,0197	1.0278	1,0359
990	0,9571	0,9659	0,9745	0,9831	0,9916	1,oooo	1,0084	1,0166	1.0249	1.0330	1,0411
985	0.9620	0,9708	0,9795	0,9881	0,9966	1,0051	1,0135	1.0218	1,0301	1,0383	1,0464
980	0,9669	0,9757	0,9845	0,9931	1,0017	1,0102	1,0186	1,0270	1,0353	1,0436	1,0517
975	0,9719	0,9807	0,9895	0,9982	1,0068	1,0154	1,0239	1,0323	1,0406	1,0489	1,0571
970	0,9769	0.9858	0,9946	1,0033	1,0120	1,0206	1,0291	1,0376	1.0460	1,0543	1.0626
965	0,9819	0,9909	0,9998	1,0085	1,0173	1,0259	1,0345	1,0430	1,0514	1,0598	1,0681
960	0,9870	0,9960	1,0050	1,0138	1.0226	1,0313	1,0399	1,0484	1,0589	1,0653	1,0736
955	0,9922	1,0013	1,0102	1,0191	1,0279	1,0366	1,0453	1,0539	1,0624	1,0709	1,0793
950	0,9974	1,0065	1,0155	1,0245	1,0333	1,0421	1,0508	1,0594	1,0680	1,0765	1,0849
945	1,0027	1,0119	1,0209	1,0299	1,0388	1,0476	1.0564	1,0651	1,0737	1,0822	1,0907
940	1,0080	1,0172	1,0263	1.0354	1,0443	1,0532	1.0620	1,0707	1,0794	1,0880	1,0965
935	1,0134	1,0227	1,0318	1,0409	1,0499	1,0588	1,0677	1.0764	1,0851	1,0938	1,1023
930	1,0189	1,0282	1,0374	1,0465	1,0555	1,0645	1,0734	1,0822	1,0910	1,0997	1,1083
925	1,0244	1,0337	1,0430	1,0522	1,0613	1,0703	1,0792	1,0881	1,0969	1,1056	1,1143
920	1,0300	1,0393	1,0487	1,0579	1,0670	1,0761	1.0851	1,0940	1,1028	1,1116	1,1203
915	1,0356	1,0450	1,0544	1,0637	1,0729	1,0820	1.0910	1,1000	1,1089	1,1177	1,1264
910	1.0413	1,0508	1,0602	1,0695	**1,0787**	1,0879	1,0970	1,1060	1,1150	1,1238	1,1326
905	1,0570	1,0566	1.0660	1,0754	1,0847	1,0939	1,1031	1,1121	1,1211	1,1300	1.1389
900	1,0528	1,0624	1,0720	1,0814	1,0907	1,1000	1,1092	1,1183	1,1273	1,1363	1,1452
895	1,0587	1,0684	1,0779	1,0874	1,0968	1,1061	1,1154	1,1246	1,1336	1,1427	1,1516
890	1.0647	1,0744	1,0840	1,0935	1,1030	1,1124	1,1217	1,1309	1,1400	1,1491	1,1581
885	1,0707	1,0805	1,9901	1,0997	1,1092	1,1186	1,1280	1,1373	1.1465	1.1556	1,1646
880	1,0768	1,0866	1,0963	1,1060	1,1155	1,1250	1,1344	1,1437	1,1530	1,1621	1,1712
875	1,0829	1,0928	1,1026	1,1123	1,1219	1,1314	1,1409	1,1503	1,1596	1,1688	1.1779
870	1,0892	1,0991	1,1089	1,1187	1,1283	1,1379	1,1474	1,1569	1,1662	1,1755	1,1847
865	1,0954	1,1054	1,1153	1,1251	1,1349	1,1445	1,1541	1,1636	1,1730	1,1823	1,1915
860	1,1018	1,1119	1,1218	1,1317	1,1415	1,1512	1,1608	1,1703	1,1798	1,1892	1,1985
855	1,1083	1,1184	1,1284	1,1383	1,1481	1,1579	1,1676	1,1772	1.1867	1,1961	1.2055
850	1,1148	1,1294	1,1350	1,1450	1,1549	1,1647	1,1744	1,1841	1,1937	1,2032	1,2126
845	1,1214	1,1316	1,1417	1,1518	1,1617	1,1716	1,1814	1,1911	1,2007	1,2103	1.2198
840	1,1281	1,1383	1,1485	1,1586	1,1686	1,1786	1,1884	1,1982	1,2079	1,2117	1,2270
835	1,1348	1,1452	1,1554	1,1656	1,1756	1,1856	1,1955	1,2054	1,2151	1.2248	1,2344
830	1,1416	1,1521	1,1624	1.1726	1,1827	1,1928	1,2077	1,2126	1,2224	1,2321	1,2418
825	1,1486	1,1590	1,1694	1,1797	1,1899	1,2000	1,2100	1,2200	1,2298	1.2396	1,2493
820	1,1556	1,1661	1,1765	1,1869	1,1971	1,2073	1,2174	1,2274	1,2372	1,2472	1,2569
815	1,1627	1,1733	1,1838	1,1942	1,2045	1,2147	1,2249	1,2349	1,2449	1,2548	1.2647
810	1,1698	1,1805	1,1911	1,2015	1,2119	1,2222	1,2324	1,1426	1,2526	1,2626	1,2725
805	1,1771	1,1878	1,1985	1,2090	1,2195	1,2298	1,2401	1,2503	1,2604	1.2704	1.2804
800	1,1845	1.1953	1,2060	1,2166	1,2271	1,2375	1,2478	1,2581	1,2683	1,2784	1,2884
795	1,1920	1,2028	1,2135	1,2242	1,2348	1,2453	1,2557	1,2660	1,2762	1,2864	1,2965
790	1,1994	1,2104	1,2212	1,2320	1,2426	1,2532	1,2636	1,2740	1,2843	1,2945	1,2047
785	1,2071	1,2181	1,2290	1,2398	1,2505	1,2611	1,2717	1,2821	1,2925	1,3028	1,3130
780	1,2148	1,2259	1,2369	1,2478	1,2585	1,2692	1,2798	1,2904	1,3008	1,3111	1,3214
	0	5	10	15	20	25	30	35	40	45	50

Air pressure

Intake airtemperaturet+ °C

Altitude correction

If the air pressure is read with reference to height above sea level (weather station), the following air pressure must be deducted from correction table.

m	hPa(mbar)	m	hPa(mbar)	m	hPa(mbar)	m	hPa(mbar)	m	hPa(mbar)	m	hPa(mbar)
0	0	300	36	600	69	900	145	1400	159	2000	221
50	6	350	41	650	75	950	109	1500	170	2100	230
100	12	400	46	700	81	1000	115	1600	181	2200	239
150	18	350	52	750	86	1100	126	1700	192	2300	250
200	24	500	58	800	92	1200	137	1800	201	2400	259
250	30	550	63	850	98	1300	148	1900	210	2500	268

07.3-I 17 Determining fuel consumption by driving on road

Job No. of work unit or standard texts and flat rates data 07-1333.

1 **Completely fill up vehicle on level ground in the presence of customer.**

2 Driving distance approx. 100 km, of which approx. 40 km on express road and approx. 60 km on high-way and in city traffic.

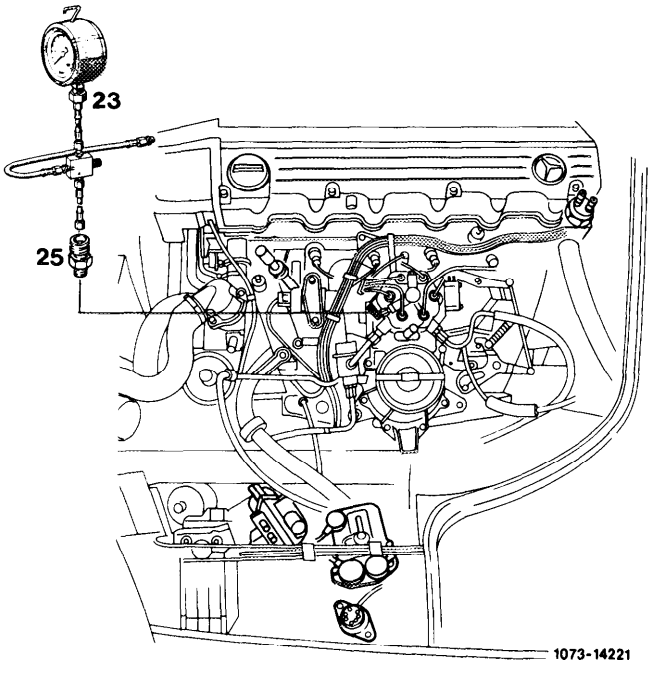
3 After driving, fill up again and calculate fuel consumption.

Example:
Fuel consumption in liters/l00 km

$$= \frac{\text{Fuel quantity consumed in liters}}{\text{Driven km}} \times 100$$

Job No. of work unit or standard texts and flat rates data 07–1603.

Basic and national versions



All fuel connections	Check for leaks
Easy operation of air flow sensor plate and control piston	Check
Control piston for leaks	Check
Pressure measuring device (23)	Connect. Special tool 103 589 00 21 00
System pressure.	Check
Lower chamber pressure	Check
Decel shutoff	Check
Full load enrichment	Check
Acceleration enrichment	Check
Fuel distributor and fuel pump for leaks	Check

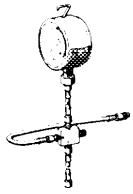
Test and adjustment values

Fuel pressures in bar gauge pressure

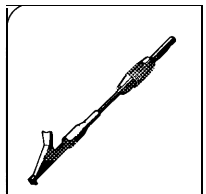
Engine				103.980	103 (except 103.980)
System pressure with engine cold or at operating temperature				5.3–5.5	
Lower chamber pressure	engine at operating temperature		approx.	0.4[1])	
	with plug pulled from coolant temperature sensor			–	
	at coolant temperature of +20 °C	stationary or at idle	approx.	0.5[1])	
		and acceleration enrichment		⩾3.8	–
	at full load enrichment with engine at operating temperature		approx.	–	
	at decel shutoff			5.3–5.5[2])	

[1]) **Below previously measured system pressure**
[2]) **Lower chamber pressure equals system pressure**

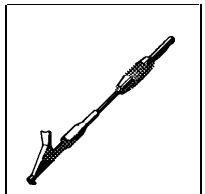
Special tools



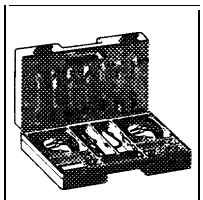
103 589 00 21 00



102 589 05 63 00



102 589 05 63 00



201 589 00 99 00

Note

Perform leak test only in the event of hot start complaints.

After stopping engine the fuel pressure should still amount to 2.5 bar gauge pressure after 30 minutes.

If there is no reaction whatsoever during pressure test of auxiliary functions, check overvoltage protection (07.3-I 21 section ,,a").

Visual checkup

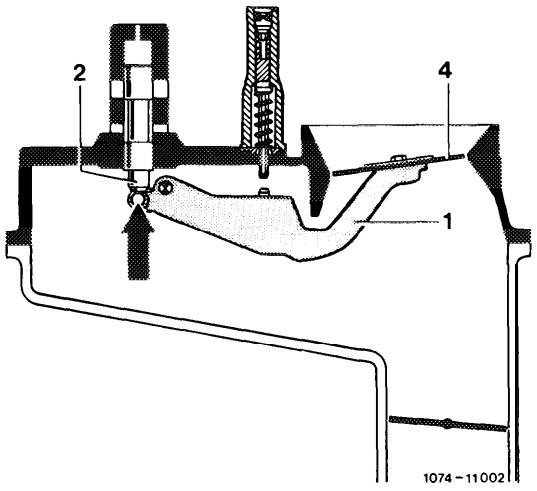
1 Remove air cleaner.

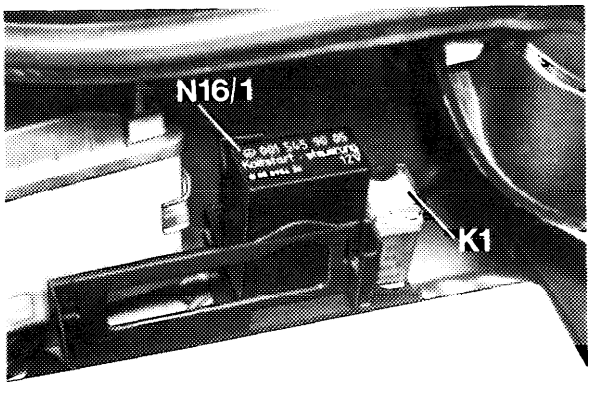
2 Check all fuel connections for leaks.

3 Check for easy operation of adjusting lever (1) in air volume sensor and of control piston (2) in fuel distributor. For this purpose, pull off fuel pump relay (N16/1) and bridge the two jacks 7 and 8 for a short moment to establish pressure. Push air flow sensor plate (4) manually down. Uniform resistance should be felt along entire distance. No resistance should be felt during fast upward movement, since the slowly following control piston lifts off from adjusting lever. During slow upward movement the control piston should closely follow.

4 Check control piston in fuel distributor for leaks.

Push air flow sensor plate for a short moment completely down and hold in this position, slight leaking is permitted.





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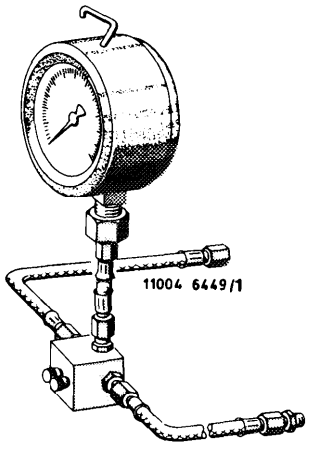
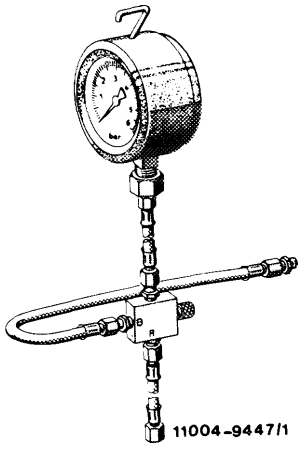
Connecting pressure measuring device



Pressure measuring device 1st version

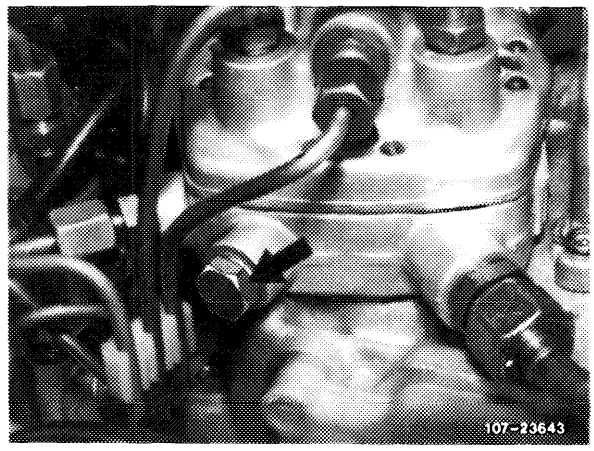
Connection 1 = Hose line to fuel distributor — lower chamber
Connection 2 = Hose line to pressure gauge
Connection 3 = Hose line to fuel distributor — upper chamber (connection cold start valve)



Pressure measuring device 2nd version

Connection A = Hose line to fuel distributor — lower chamber
Connection B = Hose line to fuel distributor — upper chamber on cold start valve

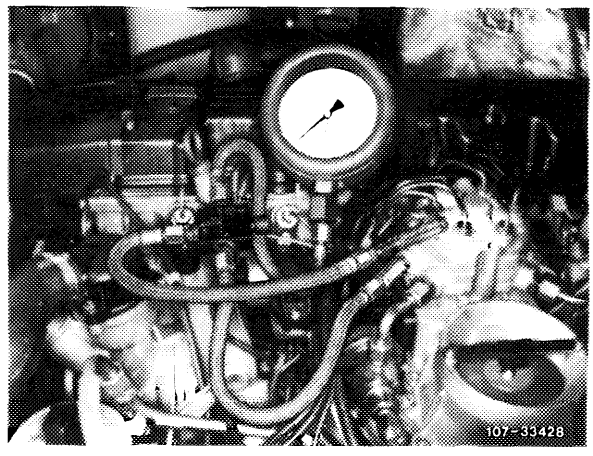
To relieve the sealing rings, keep valve screw or valve screws always open. Connections of three-way valve are numbered.



5 Unscrew closing plug (arrow) on lower chamber of fuel distributor.

When loosening closing plug, make sure that the open-end wrench is not pressing against sensor of air flow meter. The result would be damage to that sensor.

6 Connect hose line of connection ,,A" or ,,1'' to lower chamber. for this purpose, use M 8 x 1 /m 12 x 1.5, special tool part No. 102 589 06 63 00.



7 Unscrew fuel line on cold start valve on fuel distributor.

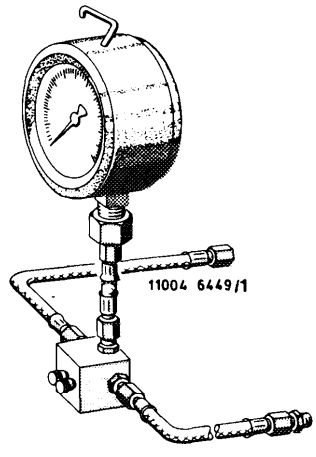
8 Connect hose line of connection ,,B'' or ,,3'' to fuel distributor.

9 Position of valve screws:

a) System pressure

Close pressure device 1st version = valve screw connection 1, open valve screw connection 3.

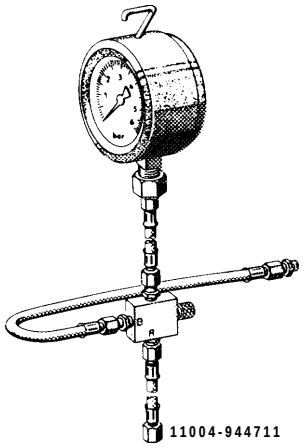
Open pressure measuring device 2nd version = open valve screw.



b) Lower chamber pressure, decel shutoff, acceleration enrichment

Pressure measuring device 1st version = open valve screw connection 1, **close** valve screw connection 3.

Pressure measuring device 2nd version = close valve screw.



Checking

Check system and lower chamber pressure with engine stopped.

Checking of acceleration enrichment as well as of decel shutoff must be **done with engine running.**

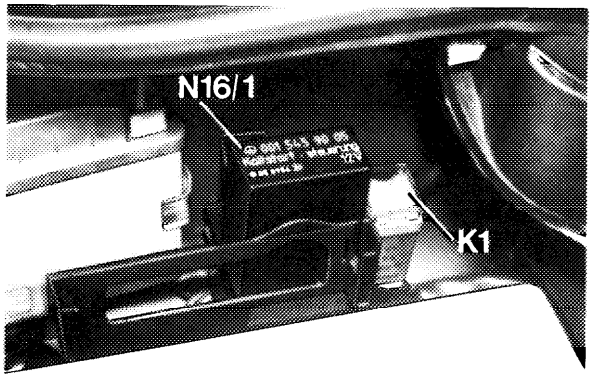
Place pressure measuring device on cylinder head cover.

a) System pressure with engine cold or at operating temperature

10 Pull off fuel pump relay (N16/1) and bridge the two jacks 7 and 8.

Pay attention to position of valve screws, read system pressure.

Nominal value:
5.3-5.5 bar gauge pressure.



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11 **If the nominal value is not attained or exceeded:**

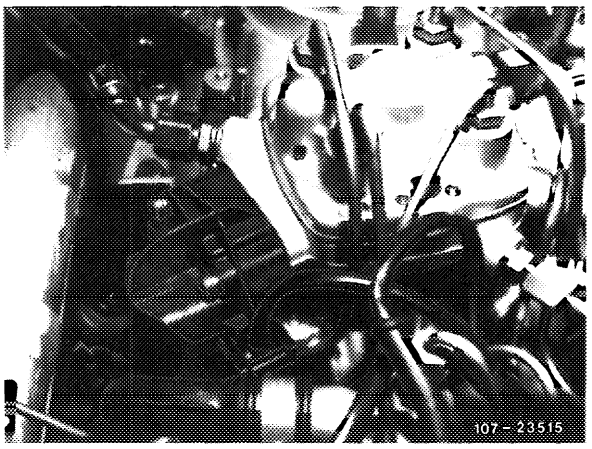
Check fuel pump (07.3–130).

Replace diaphragm pressure regulator.

Check fuel return line for unobstructed passage.

12 Re-open valve screw on connection 1.

b) Lower chamber pressure



13 Pull off fuel pump relay and bridge the two jacks 7 and 8. Switch on ignition.

14 With engine at operating temperature, pull electric connection from electrohydraulic actuator.

Pay attention to position of valve screws.

Read lower chamber pressure.

Nominal value at operating temperature approx. 0.4 bar below system pressure.

When plugging on electric connection, there should be no pressure change.

Note: During warm-up stage the actuator is energized by a given voltage, which is determined by the coolant temperature sensor and the control unit.

If the nominal value is not attained:
Check coolant temperature sensor (07.3-I 21, section ,,b'').

Test control unit (07.3-I 21, section ,,b'').

Test electrohydraulic actuator (07.3-I 21, section ,,b''),

If pressure in lower chamber is above nominal value, check throttle (orifice) in fuel distributor for unobstructed passage (07.3-I 22).

15 Put back fuel pump relay.

c) Decel shutoff

16 Run engine to operating temperature.

17 Pay attention to position of valve screws.

18 Run engine at idle. Increase speed for a short period to approx. 2500 rpm. When the speed drops, pressure in lower chamber should increase to system pressure.

Combustion starts again at approx. 1300 rpm.

If the nominal value is not attained:

Check microswitch (07.3-I 21, section ,,d'').

Check control current on actuator (07.3-I 21, section ,,d'').

Test control unit (07.3-I 21, section ,,d'').

Test TD signal (07.3-I 21, section ,,d'').

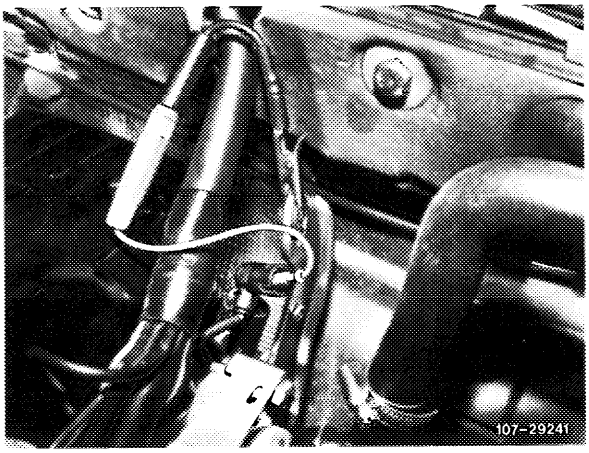
On vehicles with cruise control/Tempomat, check relay for cruise control/Tempomat (Group 54).

d) Acceleration enrichment (engine 103.980 only)

To check acceleration enrichment, simulate ,,engine cold".

19 Pay attention to position of valve screws,

20 Simulate ,,engine cold". For this purpose, connect resistor (arrow) at 2.5 kΩ,= approx. +20 °C, between connecting cable coolant temperature sensor and vehicle ground.



21 Start engine, increase rpm suddenly to approx. 2500 rpm. During increase of rpm, the lower chamber pressure shou ld drop.

If the nominal value is not attained:

Check sensor air volume meter (07.3-I 21, section ,,f'').

Check control current on actuator (07.3-I 21, section ,,f'').

Check control unit (07.3-I 21, section ,,f'').

Checking fuel distributor and **fuel pump for leaks**

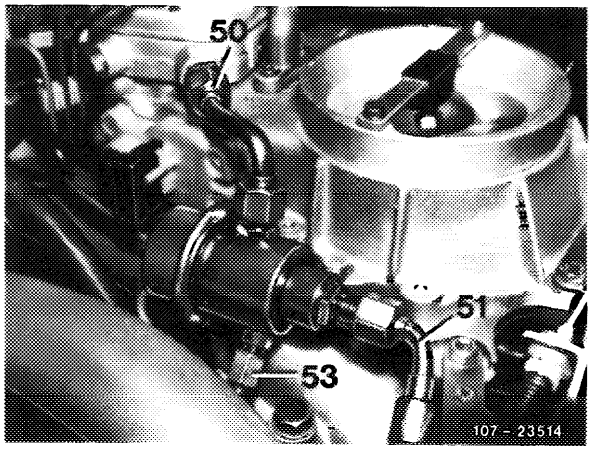
22 Stop engine. Pressure in system will then drop below opening pressure of injection valves (approx. 2.8 bar gauge pressure).

23 If the pressure drops immediately to 0 bar gauge pressure, replace check valve on fuel pump.

24 If the pressure drops slowly, unscrew fuel return line (51) on diaphragm pressure regulator. No fuel should follow (slight quantity of leak fuel is permitted).

Attention!
If fuel flows out of fuel return line (51), de-activate line.

25 Pinch off leak line on fuel accumulator. If the pressure does not drop immediately, replace fuel accumulator (07.3–270).



26 If upon leak test no leaks are showing up, test starting valve for leaks. For this purpose, remove starting valve (07.3-l 25, section ,,Checking for leaks").

27 Disconnect pressure measuring device, while catching fuel with a rag.

28 Connect fuel lines, run engine once again and check all fuel connections for leaks.

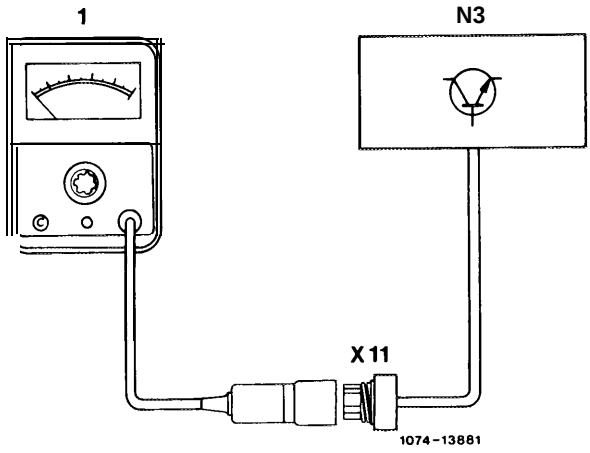
Basic and national versions

A. Without trouble diagnosis by means of on-off ratio

Up to March 1986 no fault detection is integrated in CIS-E control unit.

B. With trouble diagnosis by means of on-off ratio

Starting March 1986, faulty input signals are detected by CIS-E control unit (N3) and transmitted to lambda measuring output. Faults are picked up by means of lambda control tester (1) at diagnosis socket (XI 1).



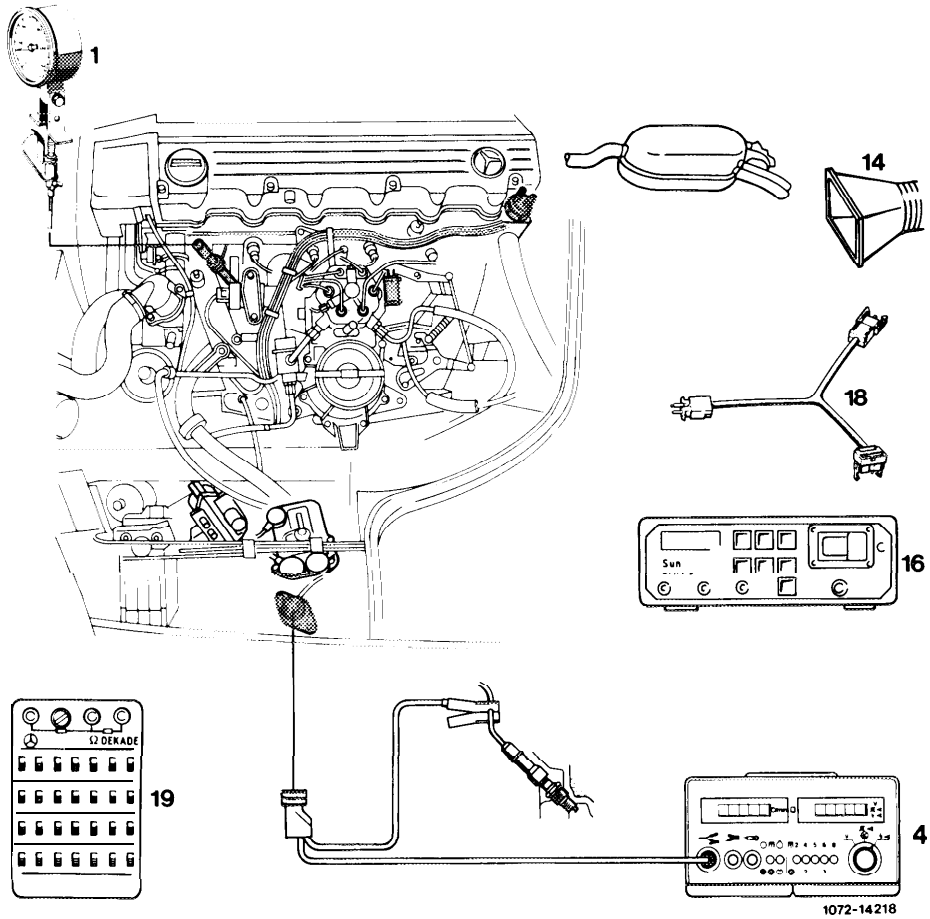
Fault detection permits testing different components of CIS-E injection system by means of measuring the on-off ratio.

Fault detection of control units:

On-off ratio indication	Control unit
70 %	with fault detection
100%	without fault detection

Electrical wiring diagrams 07.3-l 28.

A. Without trouble diagnosis by means of on-off ratio



Testers	Connect: oil telethermometer (1) 116 589 27 21 00. Engine tester (4). Multimeter (16). Test cable (18) 102 589 04 63 00. Ohm decade (19) 124 589 09 63 00.
Suction device (14)	Set up at exhaust end pipe.
Engine oil temperature	60-80 °C.
Overvoltage protection (“07-I 627)	Battery voltage.
Coolant temperature sensor (“07-I 613)	Refer to table.
Intake air temperature sensor (“07-1614)	Refer to diagram.
Decel shutoff (*07–1618)	Refer to table.
Throttle valve switch (*07–1622)	Idle speed contact approx. 0 Ω, full load contact approx. 0 Ω.
Acceleration enrichment or sensor for air volume meter (“07-1631)	Refer to table.
Partial load mixture adaptation RÜF only (“07-I 623)	Refer to table.
O_2 sensor (“07-I 610)	Readout oscillating.
Speed signal engine 103.942 only (“07-I 635)	O-I 2 V.
Current at actuator (*07–1634)	Without lambda control 10 mA, with lambda control 20 mA.
Altitude correction	approx. 5 V.

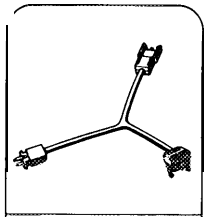
. Job No. of work unit or standard texts and fiat rates data.

Test values

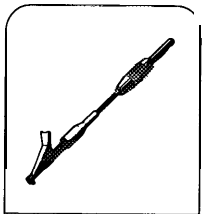
Engine			103.94	
Version			RÜF	KAT
Coolant temperature sensor	Coolant temperature +20 °C (warm-up basic value)	Resistance kΩ	2.2–2.8	
		Current at actuator mA	16–22	2–6
	Coolant temperature +80 °C	Resistance Ω	290–370	
		Current at actuator mA	1–2	Readout oscillating
After-start enrichment	After-start at +20°C	Current at actuator mA	25-31	3-9
Acceleration enrichment		Current at actuator at +20 °C and sudden acceleration mA	> 15	
Partial load mixture adaptation		Current at actuator mA	–7 to +4	Readout oscillating
Decel shutoff		Current at actuator mA	approx. –60	

Engine			103.98	
Version			Std./RÜF	KAT
Coolant temperature sensor	Coolant temperature +20 °C (warm-up basic value)	Resistance kΩ	2.2–2.8	
		Current at actuator mA	15–22	2–6
	Coolant temperature +80 °C	Resistance Ω	290–370	
		Current at actuator mA	1–2	Readout oscillating
After-start enrichment	After-start at +20°C	Current at actuator mA	21-27	8-12
Acceleration enrichment		Current at actuator mA at +20 °C and sudden acceleration	> 15	
Partial load mixture adaptation		Current at actuator mA	–7 to 4	Readout oscillating
Decel shutoff		Current at actuator mA	approx. -60	

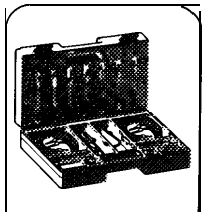
Special tools



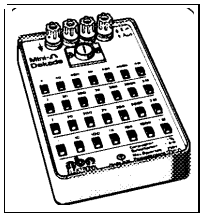
102 589 04 63 00



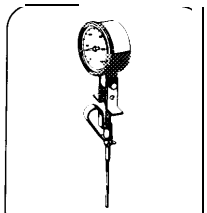
102 589 05 63 00



201 569 00 99 00



124589096300



1165892721 00

Conventional testers

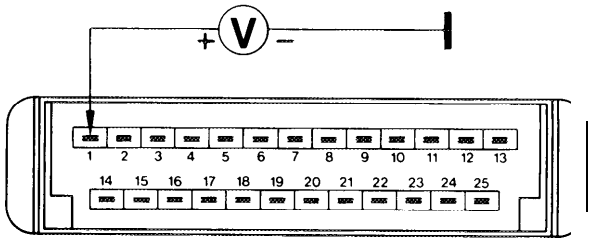
Multimeter	e.g. Sun, DMM-5
Engine tester	e.g. Bosch, MOT 002.02
Twin capsule	e.g. Hermann, ECD 53

a) Testing overvoltage protection

Test fuse on overvoltage protection.

Fuse ok.	Fuse defective.

Replace fuse.



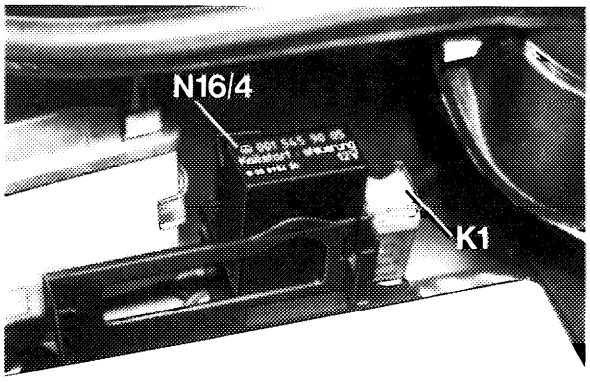
1074-11132

Pull off overvoltage protection. Bridge jack 1 and 2. Voltage on CIS-E control unit, test terminal 1 to ground.

Voltage approx. 12 volts.

Ok	Not ok

Check voltage according to wiring diagram.



107-29244/1

Check voltage on jack 5 and 6 on overvoltage protection.

Voltage approx. 12 volts.

Ok	Not ok

Replace overvoltage protection.

Check voltage supply according to wiring diagram.

End of test

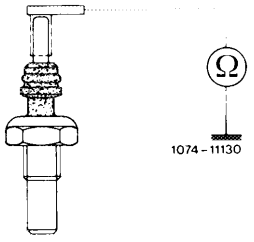
b) Testing coolant temperature sensor

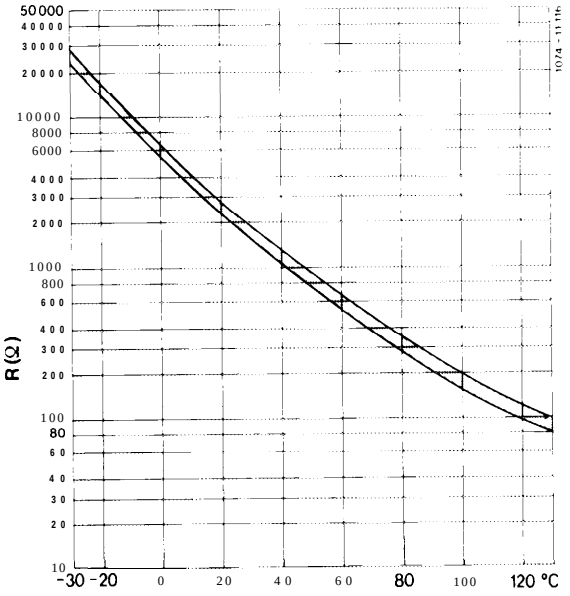
Pull **plug** from coolant temperature sensor.
Test resistance to ground.

For nominal value refer to diagram.
Test resistance at two temperature measuring points.

Example:
+ 20 °C = 2.2 – 2.8 kΩ
+ 80 °C = 290 – 370 kΩ

Ok	Not ok



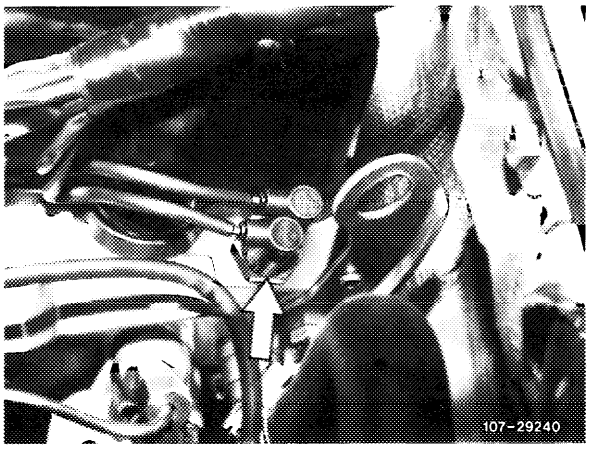


Replace coolant temperature sensor.

Connect test cable to actuator. Set measuring unit to mA. Pull off plug O_2 sensor. Switch on ignition. Read current value.

Coolant temperature + 80 °C
Std., RÜF 1–2 mA
KAT ± 3 mA
Coolant temperature + 20 °C
Engine 103.94 RÜF 16-22 mA
Engine 103.98 Std., RÜF 15-22 mA
Engine 103 KAT 2–6 mA

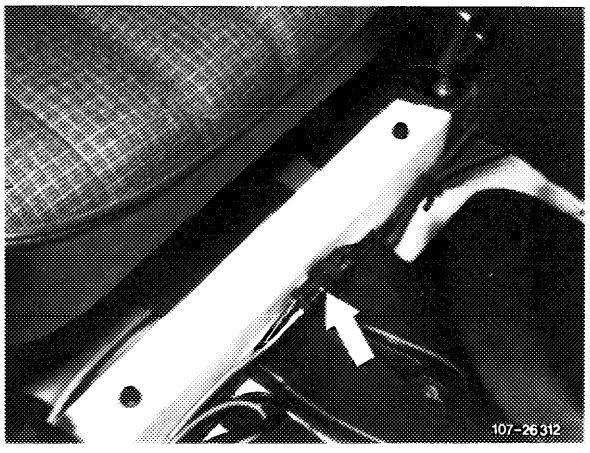
Ok	Not ok



With engine stopped.
Pull plug from actuator.
Test resistance of actuator.

Resistance 18-21 Ω

Ok	Not ok



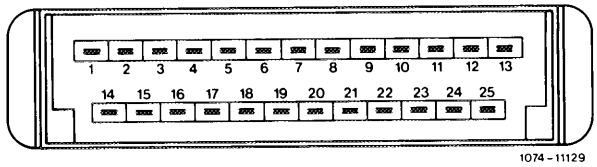
Replace actuator.

Check green/red line from terminal 21 plug control unit to plug coolant temperature sensor for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.



1074-11129

Except RÜF/KAT, check brown/black line (terminal 12) between control unit and actuator for continuity.

Resistance approx. 0 Ω

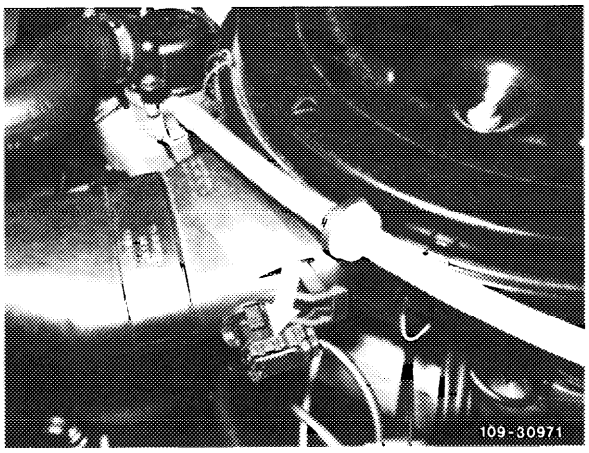
Ok	Not ok

Replace control unit.

Repair interruption according to wiring diagram.

End of test

c) Check temperature sensor intake air



Pull plug from temperature sensor intake air (arrow). Test resistance.

For nominal value refer to diagram.

Example:
+ 20 °C = 2.2-2.8 kΩ
0 °C = 5.5-6.1 kΩ

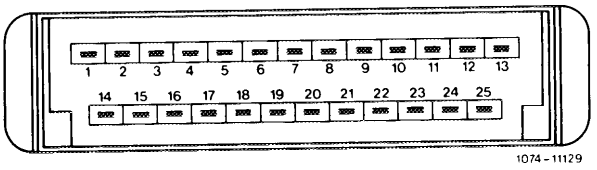
Ok	Not ok

Replace temperature sensor external air.

Check lines between temperature sensor intake air and ground or control unit injection system terminal 11 for continuity.

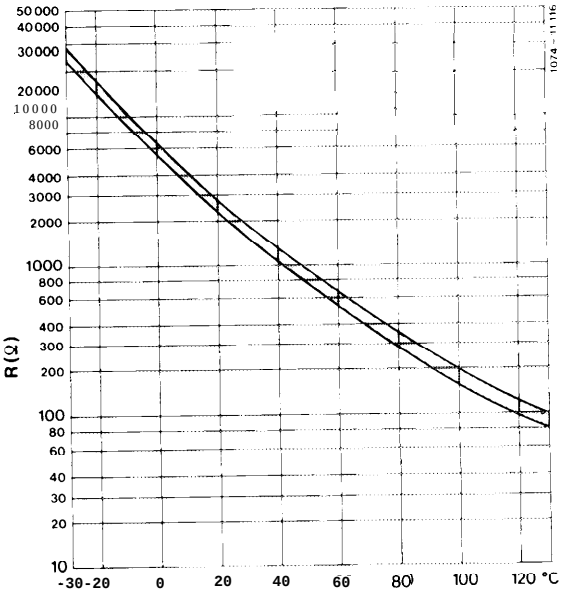
Resistance approx. 0 Ω

Ok	Not ok

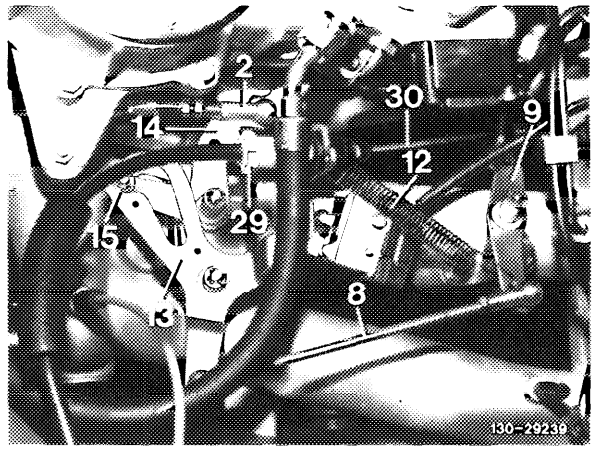


Repair interruption according to wiring diagram.

End of test



d) Testing decel shutoff



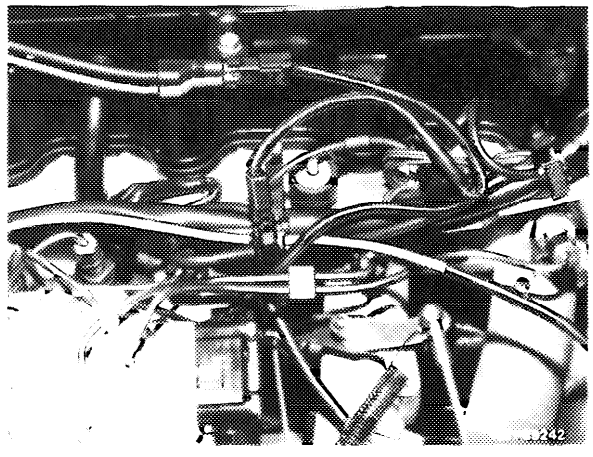
Engine at operating temperature. Pull off throttle valve switch and bridge jacks 1 and 2. Engine speed > 2500 rpm. Keep engine speed constant and actuate microswitch manually.

Engine hunting.

Ok	Not ok

1. Check adjustment of slotted lever. Roller (15) should rest free of tension against end stop.

2. Check throttle valve switch, section ,,e''.



1. Check resistance of microswitch.

2. Check throttle valve switch, section ,,e".

Idle speed position approx. 0 Ω
Idle travel cancelled ∞Ω

Ok	Not ok

Replace switch.

Connect test cable to actuator. Measuring unit to mA. Increase engine speed to approx. 2500 rpm and release throttle control.

Up to attaining restarting speed at approx. 1300 rpm, the current value should amount to approx. **-60** mA. Direction of current negative-positive.

Ok	Not ok

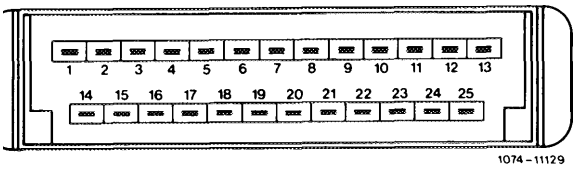
End of test

Test rpm signal (TD) on plug of control unit terminal 25 (green/yellow line). Measuring unit to volts. Start engine.

Voltage 6-l 2 V

Ok	Not ok

Repair interruption according to wiring diagram.



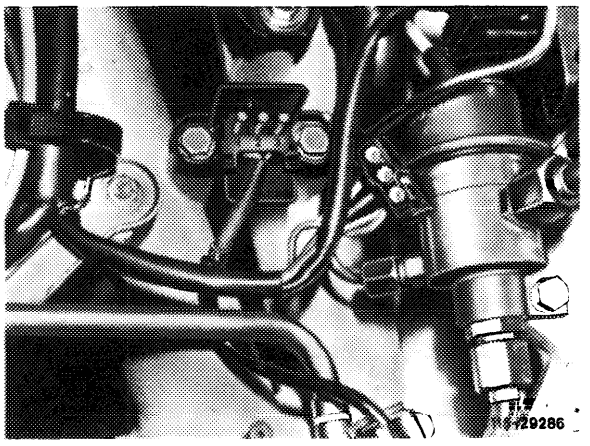
Except RÜF/KAT, test brown/black line (terminal 10) and black line (terminal 12) between control unit and actuator for continuity.

Resistance approx. 0 Ω

Ok	Not ok
Replace control unit.	Repair interruption according to wiring diagram.

End of test

e) Testing throttle valve switch

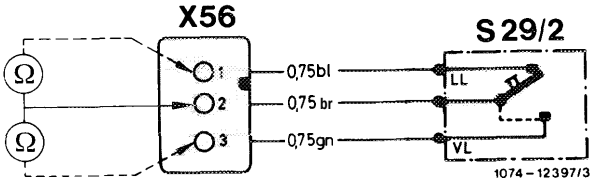


Stop engine.
Separate plug connection between throttle valve switch and control unit. Test resistance of throttle valve switch.

Idle speed contact: Idle speed position approx. 0 Ω
Full load position approx. ∞ Ω
Full load contact: Idle speed position approx. ∞ Ω
Full load position approx. 0 Ω
Partial load pos. approx. ∞ Ω

Ok	Not ok

Adjust or renew throttle valve switch, or wrong pole connection.



S29/2 **Throttle valve switch full load/idle detection**
X56 **Plug connection, throttle valve switch**

Test lines from throttle valve switch plug to CIS-E control unit and ground for continuity.

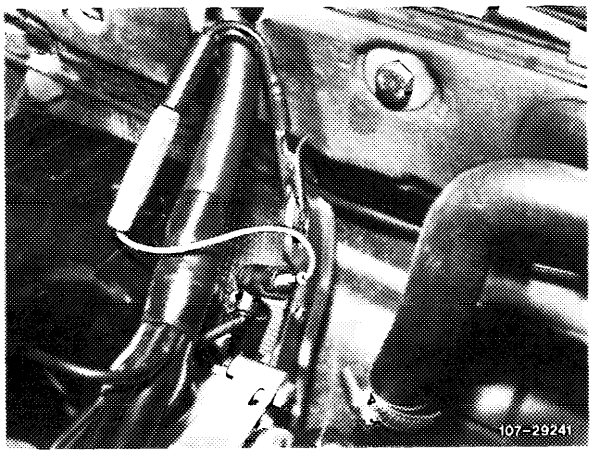
Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test

f) Checking acceleration enrichment or sensor of air volume meter



Connect test cable to electrohydraulic actuator. Set measuring unit to mA. With test resistor (on plug coolant temperature sensor and ground) simulate coolant temperature +20°C. With KAT, pull off O_2 sensor. Start engine (increased idling speed).

Current at actuator:
Engine 103.94 RÜF 16-22 mA
Engine 103.98 Std., RÜF 15-22 mA
Engine 103 KAT 2-6 mA

Ok	Not ok

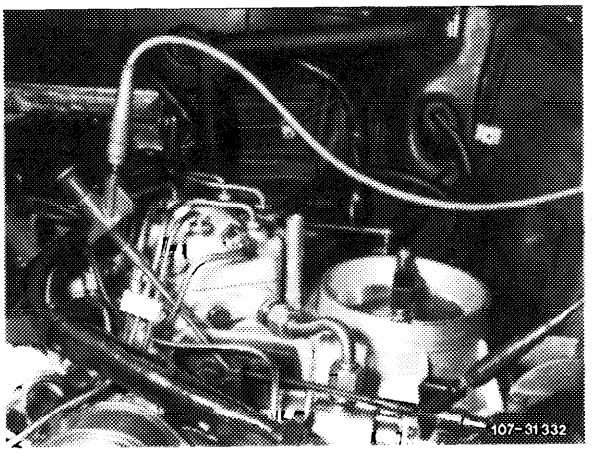
Connect coolant temperature sensor and O_2 sensor.

Pull off plug connection for sensor of air volume meter to the extent that voltage can be measured. Start engine. Check voltage between terminal 1 and 3.

Voltage 4.6–5.1 V

Ok	Not ok

Repair interruption according to wiring diagram.

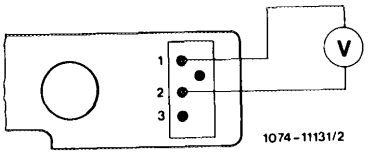


Measure voltage between terminal 1 and 2. Run engine at idling speed.

If idling speed deviates, pull plug from idling speed adjuster (air valve) and adjust idling speed with a clamp on air hose to mean value of tolerance data.

Worldwide	**0.57 – 0.81 V**
(CH) (S)	0.75 – 1.05 V

Ok	Not ok



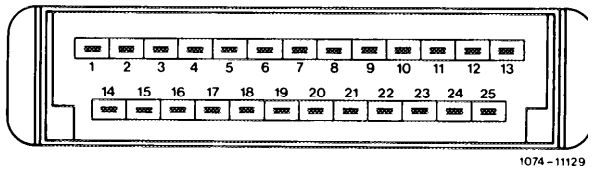
Voltage „0" volt: repair interruption. Voltage higher or lower: replace air volume meter.

Test rpm signal (TD) on control unit plug terminal 25 (green/yellow).

Voltage 6–12 volts

Ok	Not ok
Replace control unit (CIS-E).	**Repair interruption according to wiring diagram.**

End of test



g) Testing partial load mixture adaptation, RÜF only

Connect test cable to actuator. Set measuring unit to mA. Engine at idle (operating temperature).

Current on actuator 0 mA. Increase engine speed to approx. 2500 rpm. Current on actuator: — 7 to + 4 mA.

Ok	Not ok

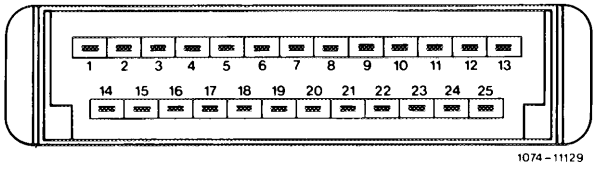
Test rpm signal (TD) on plug of control unit terminal 25 green/yellow.

Voltage 6-l 2 volts

Ok	Not ok

Replace control unit (CIS-E).	Repair interruption according to wiring diagram.

End of test



1074-11129

Note: If the test values on throttle valve switch are attained during adaptation of partial load mixture, full load enrichment is also effective.

h) Testing lambda control
refer to 07.3-100

i) Testing O_2 sensor

Note

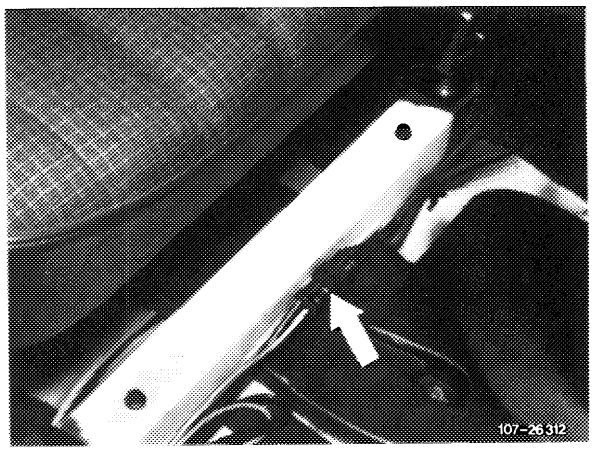
Test O_2 sensor with engine at operating temperature.

Function test: Slightly deflect air flow sensor plate manually with engine running, control range on tester should go back to lean stop. If not, perform test program.

Disconnect plug O_2 sensor signal. Plug to CIS-E control unit to ground. Start engine. Test voltage to ground at plug connection of O_2 sensor I ine.

Voltage 450 – 1000 mV

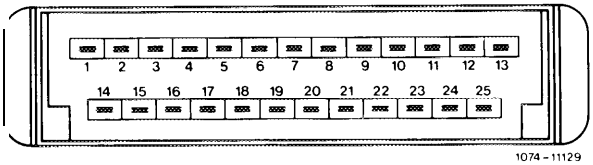
Ok	Not ok



Stop engine. Test line to CIS-E control unit jack 8 for continuity.

Resistance approx. 0 Ω

Ok	Not ok



Repair interruptionaccording to wiring diagram.

Pull off plug of O_2 sensor heater (two-pole) to the extent that the voltage can be tested. (Attention! short-circuit danger). Pull off fuel pump relay and bridge jack 7 and 8. Switch on ignition.

Readout approx. 12 volts (battery voltage)

Ok	Not ok

Repair interruption according to wiring diagram.

Disconnect plug of O_2 sensor heater. Check current input.

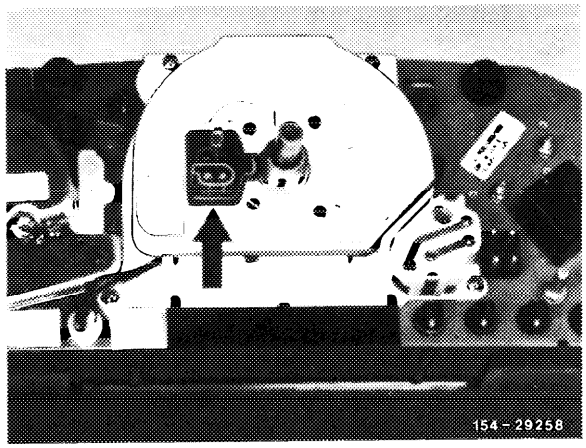
Nominal value 0.5-I .3 A

Ok	Not ok

Replace O_2 sensor.

End of test

j) Testing speed signal, engine 103.942 only



Function

For idle speed control, the Hall sensor (arrow) transmits a speed signal to control unit.

This signal will switch the idling speed rpm control off as from a speed of approx. 1.4 km/h. This will improve driving performance during deceleration. The idling speed rpm control is again operational below 1.4 km/h.

Note

In the event of replacements, the control unit cannot be interchanged with control units of engines 103.940/941 and 103.98.

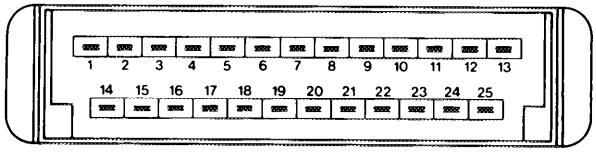
Ignition off. Pull plug from CIS-E control unit. Ignition on. Test voltage on plug of CIS-E control unit, jack 1 and 6, with multimeter (volt position).

Roll vehicle for approx. 1 m.

Readout osci I lates between O-I 2 volts.

Ok	Not ok

Test interruption according to wiring diagram and replace Hall sensor, if required.



1074-11129

Connect lambda control tester to diagnosis socket. Drive vehicle in 2nd speed or driving position 2 on dynamometer or on road.

Fully accelerate vehicle at approx. 2000 rpm (for approx. 6 seconds). Read on-off ratio.

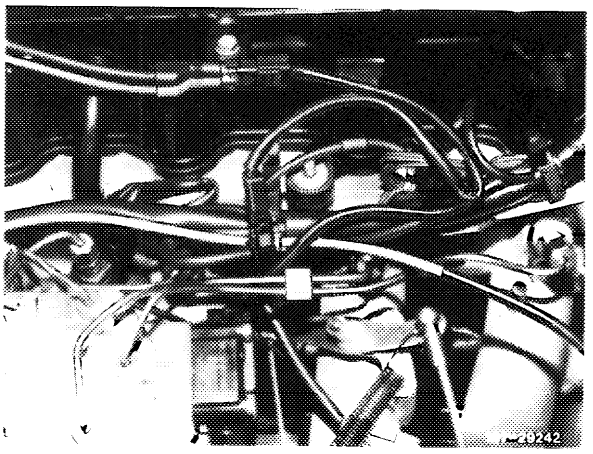
On-off ratio readout 60 % (constant).

Ok	Not ok

Replace control unit.

End of test

k) Testing current on actuator



Connect test cable to actuator.
Set measuring instrument to mA.
Switch on ignition.
Read voltage.

Current	Readout
without lambda control	10 mA
with lambda control	20 mA

Ok	Not ok

Start engine. Engine oil temperature 60-80 °C and idling speed.
Read voltage.

	Readout
without lambda control	1-2 mA
with lambda control	Readout oscillating

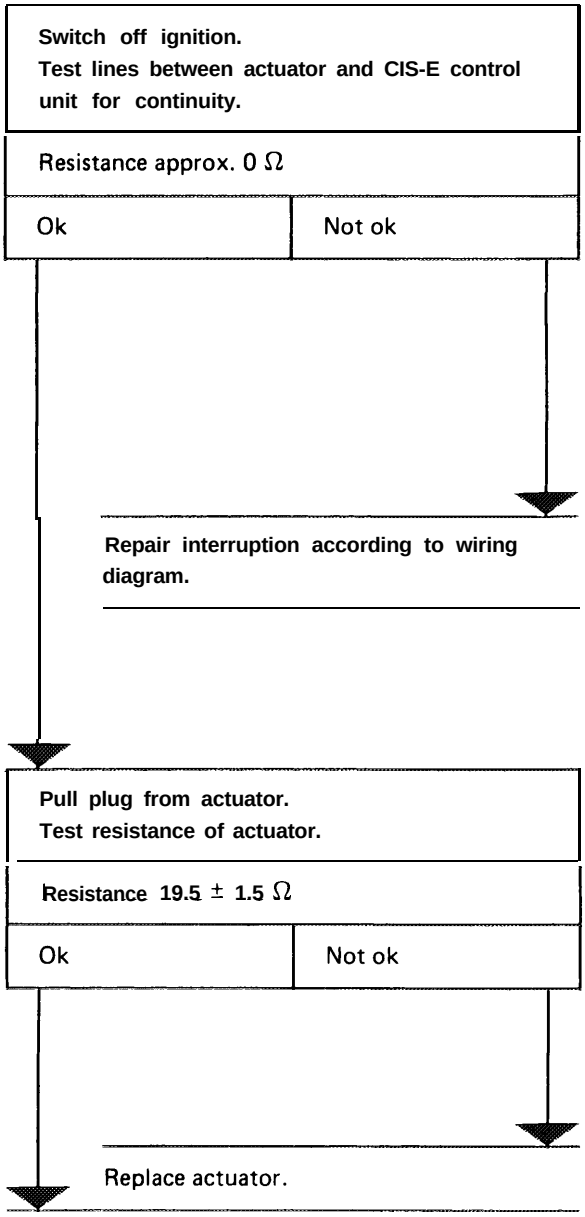
Ok	Not ok

Testing adjustment plug.

Designation without lambda control	ECE
Designation with lambda control	KAT

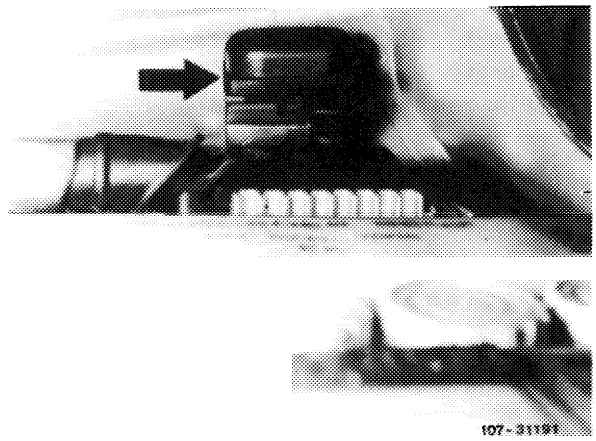
Ok	Not ok

Correct adjustment plug.


Switch off ignition.
Test lines between actuator and CIS-E control unit for continuity.
Resistance approx. 0 Ω
Ok
Not ok
Repair interruption according to wiring diagram.
Pull plug from actuator.
Test resistance of actuator.
Resistance 19.5 ± 1.5 Ω
Ok
Not ok
Replace actuator.

End of test

l) Testing sensor, altitude correction (arrow)
(AUS) (J) (USA)



Pull plug from sensor, altitude correction.
Switch on ignition.
Test voltage on jack 2 against jack 3.

Voltage approx. 5 volts

Ok	Not ok

Test voltage supply and ground according to wiring diagram.

Switch off ignition. Test line between plug sensor, altitude correction, jack 1 and plug CIS-E control unit, jack 11 for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

Start engine. Idling speed and engine at operating temperature.

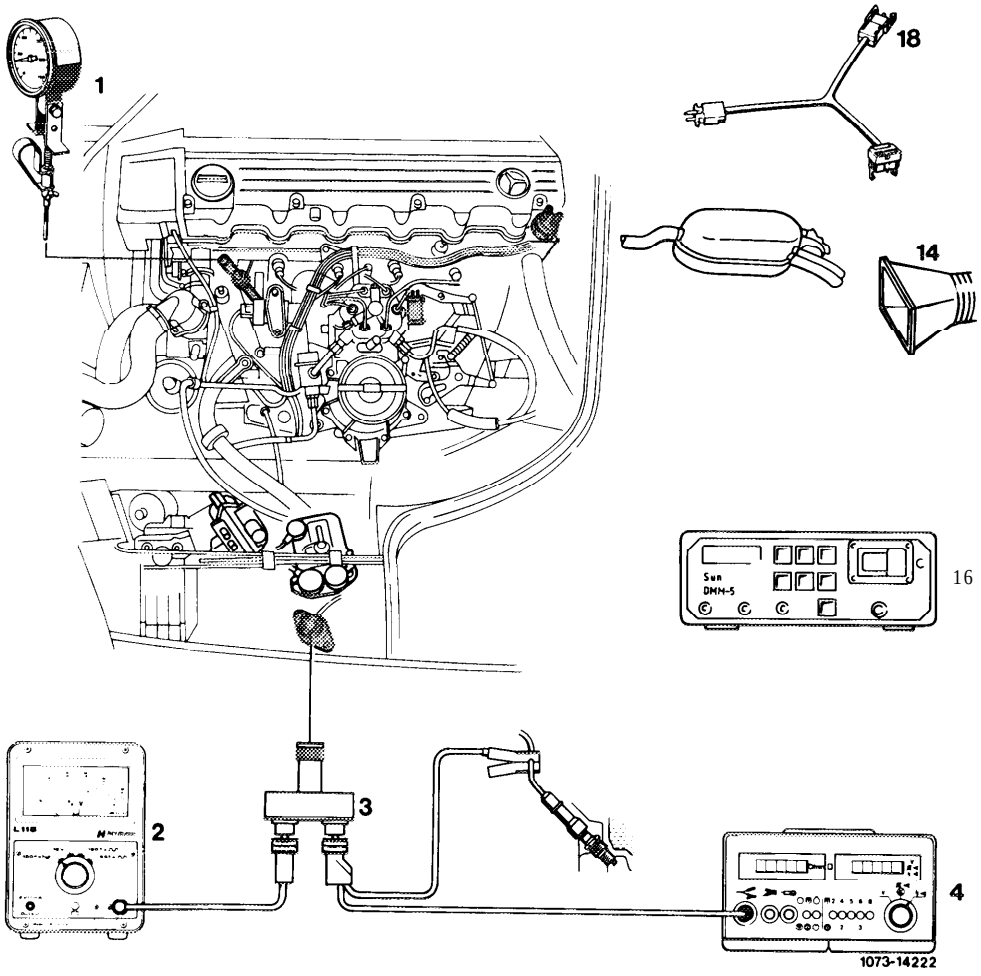
On-off ratio	Readout oscillating

Ok	Not ok

Replace sensor, altitude correction.

End of test

B. With trouble diagnosis by means of on-off ratio



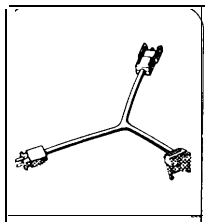
Testers	Connect: oil telethermometer (1) 116 589 27 21 00. Lambda control tester (2). Twin capsule (3). Engine tester (4). Multimeter (16). Test cable (18) 102 589 04 63 00.
Suction unit (14)	Set up at exhaust end pipe.
Engine oil temperature	60-80 °C.
Test procedure	Refer to on-off ratio in %.
Voltage supply CIS-E control unit (*07–1625)	0
Sensor, air volume meter (“07-l 633)	10
Throttle valve switch (“07-l 622)	20
Coolant temperature sensor (“07-l 613)	30
Acceleration enrichment or sensor, air volume meter (“07-1631).	40
O_2 sensor (*07–5206)	50
TD signal (*07–1626)	70
Temperature sensor intake air (“07-l 614)	80
O_2 sensor (*07–5206)	100

*Job No. of work unit or standard texts and flat rates data.

Test sequence

On-off ratio in %	Possible causes of faults	Test scope
0	Without lambda control: On-off ratio is not displayed or measuring instrument is defective. Line diagnosis socket jack 3 defective.	Voltage supply. Check ground and diagnosis socket line. Control unit defective.
	With lambda control: No voltage on CIS-E control unit or defective. Line diagnosis socket jack 3 defective or measuring unit defective. Mixture adjustment too rich, sensor signal of +12 volts.	Check voltage supply, ground and line diagnosis socket. Check lambda adjustment. Check 02 sensor signal.
10	Sensor air volume meter wrong pole connection or defective. Speed approx. 2000 rpm.	Check sensor air volume meter measuring signal and line routing.
	Wire routing of plug, idling speed and full load contact, wrong pole connection or short circuit. (Full load contact closed at insufficient rate of air flow).	Check throttle valve switch and routing of plug throttle valve switch (idle speed contact defective, firing point approx. 10° higher).
	No idle speed contact on throttle valve switch.	Check throttle valve switch.
20	Full load contact with wrong pole connection or defective. Readout 20 % with microswitch actuated only.	Test full load contact.
30	Short circuit or line interruption between CIS-E control unit and coolant temperature sensor or coolant temperature sensor defective.	Test coolant temperature sensor.
40	Line interruption or short circuit to sensor, air volume meter or defective. Temporarily increased idling speed.	Test sensor, air volume meter
50	Without lambda control	No fault in range of monitored signals.
	With lambda control: O_2 sensor not operational, line interrupted or defective.	Test operating temperature. Test O_2 sensor.
70	No TD signal (line interruption) on CIS-E control unit.	Test TD signal.
80	Line interruption or short to ground at temperature sensor, intake air, or defective.	Test temperature sensor, intake air.
90	Unused, no fault associated.	–
100	Without lambda control: On-off ratio not displayed or measuring unit defective. Overvoltage protection defective. Increased idling speed.	Test overvoltage protection.
	With lambda control: Lambda adjustment too lean. O_2 sensor defective (short to ground). Control unit or measuring instruments defective. No current on actuator. Increased idling speed.	Test adjustment of lambda control and O_2 sensor signal. Test lines between CIS-E control unit and electrohydraulic actuator for continuity.
Readout oscillating	With lambda control: No fault in range of monitored signals during control.	–

Special tools



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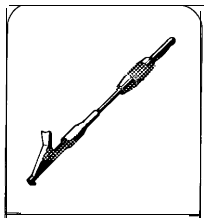

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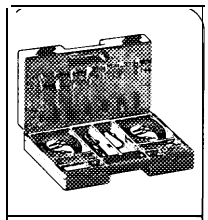
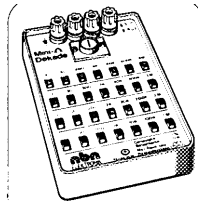
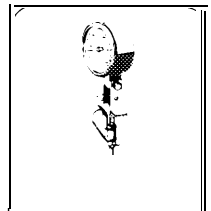


201 589 00 99 00



124 589 09 63 00



116 589 27 21 00

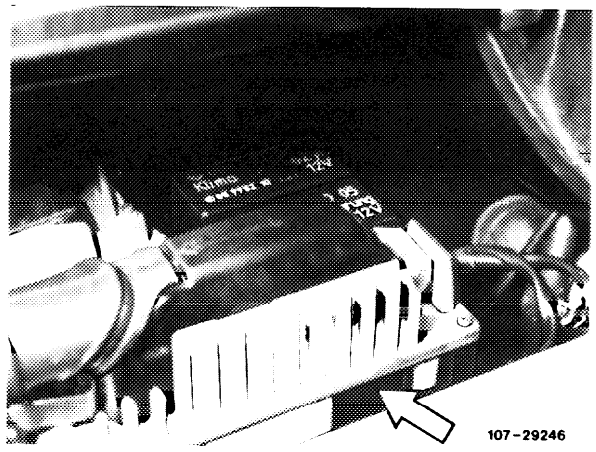
Conventional testers

Multimeter	e.g. Sun, DMM-5
Engine tester	e.g. Bosch, MOT 002.02
Twin capsule	e.g. Hermann, ECD 53
Lambda control tester	e.g. Hermann, L 115

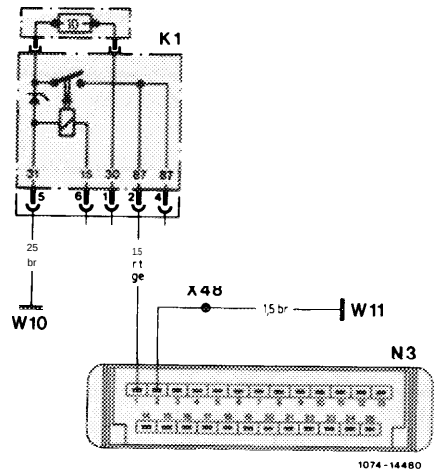
On-off ratio 0 %

Note: On vehicles with lambda control, test lambda control first and adjust, if required (07.3-100).

Testing voltage supply, CIS-E control unit	
Pull plug from CIS-E control unit. Switch on ignition, test voltage on jack 1 against jack 2.	
Voltage approx. 12 volts	
Ok	Not ok



107-29246



K1 **Overvoltage protection CIS-E**
N3 **Control unit CIS-E**
W10 **Ground, battery**
W11 **Ground, engine (electric cable screwed on)**

Test voltage on jack 1 against ground (battery).

Voltage approx. 12 volts

Ok	Not ok

Test voltage supply according to wiring diagram.

Test line from jack 2 and ground, engine (W1 1) for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

Test line between diagnosis socket jack 3 and control unit jack 23 for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

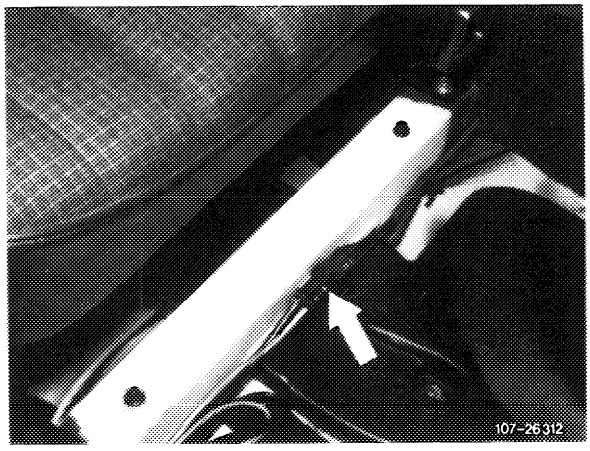
Disconnect plug O_2 sensor signal. Plug to CIS-E control unit to ground. Start engine. On plug connection of O_2 sensor line, check voltage to ground.

Voltage 450 – 1000 mV

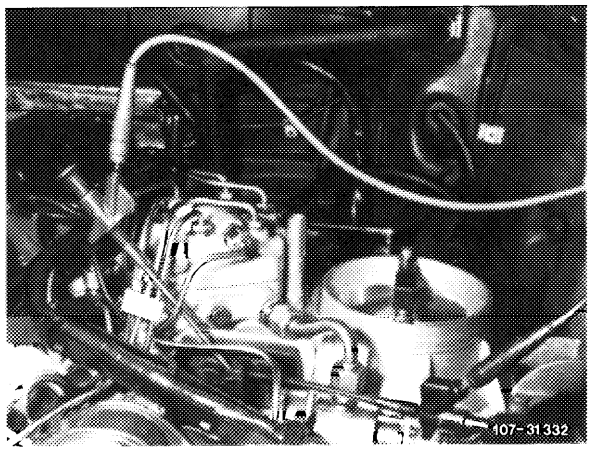
Ok	Not ok

Replace O_2 sensor.

End of test



On-off ratio 10 %



Testing sensor, air volume meter

Pull off plug of sensor air volume meter to the extent that voltage can be measured. Start engine.

Terminal 1 to 3 4.6-5.1 volts
Pay attention to wire routing.

Ok	Not ok

Repair interruption according to wiring diagram.

Test voltage between terminal 1 and 2 at idling speed.

Terminal 1 to 2 0.57–0.81 V

Ok	Not ok

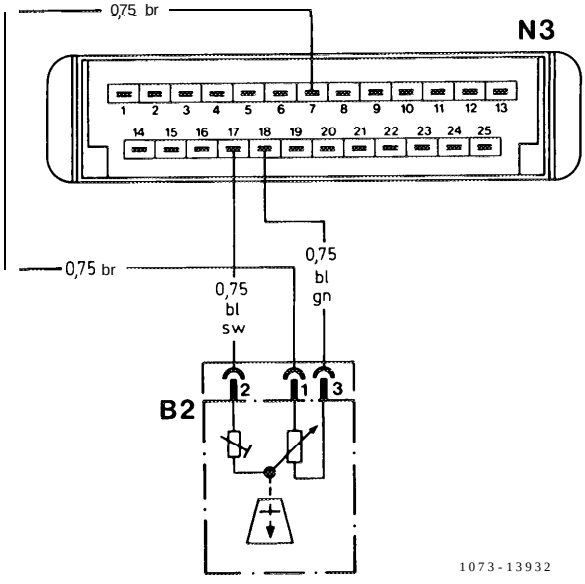
Voltage higher or lower, replace air volume meter.

Voltage 0 volt.
Stop engine. Test lines between sensor, air volume meter (B2) and plug, CIS-E control unit (N3) for continuity. Pay attention to wire routing.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.



Stop engine. Pull off plug to throttle valve switch. Test resistance at terminal 1 to 2.

Idle speed contact:

Idle speed position	approx. 0 Ω
Full load position	∞ Ω
Partial load position	∞ Ω

Ok	Not ok

Adjust or replace throttle valve switch.

Test lines from plug, throttle valve switch to CIS-E control unit and ground for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram

Start engine (idle speed and engine oil temperature 60-80 °C). Check on-off ratio on diagnosis socket.

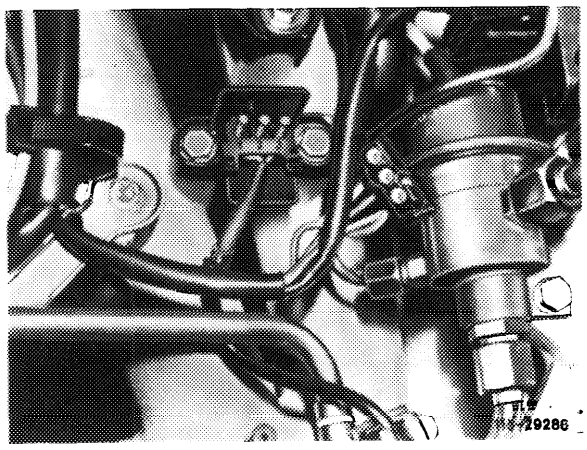
On-off ratio:

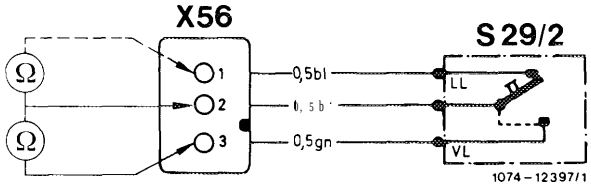
With lambda control:	Readout oscillating
Without lambda control:	Readout 50 %

Ok	**Not** ok

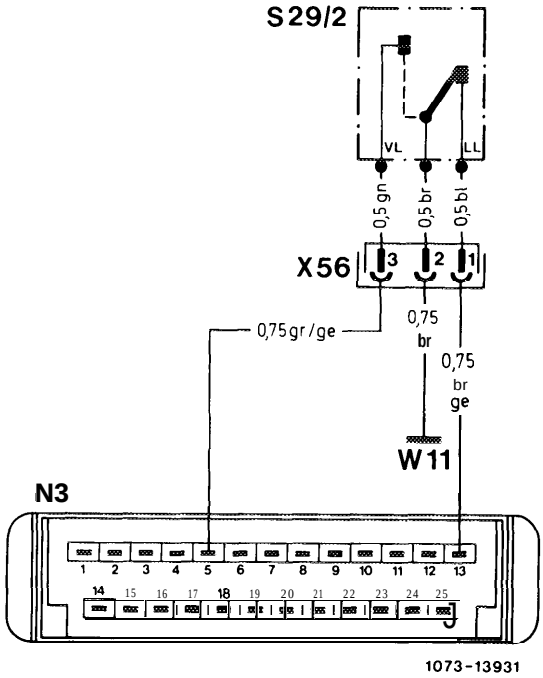
For other on-off ratio refer to test diagram.

End of test



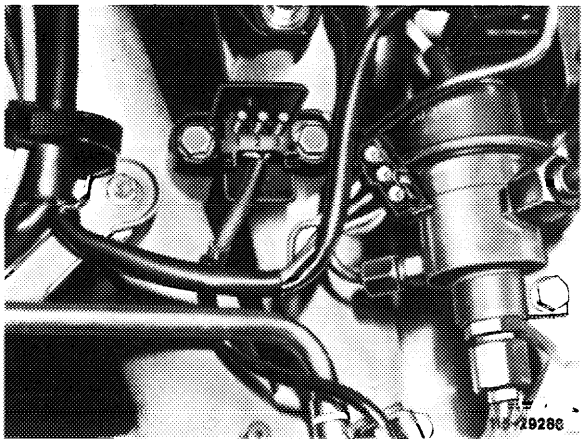


S29/2 **Throttle valve switch full load/idle detection**
X56 **Plug connection throttle valve switch**



N3 **Control unit CIS-E**
S29/2 **Throttle valve switch full load/idle detection**
W11 **Ground, engine (electric cable screwed on)**
X56 **Plug connection throttle valve switch**

On-off ratio 20 %



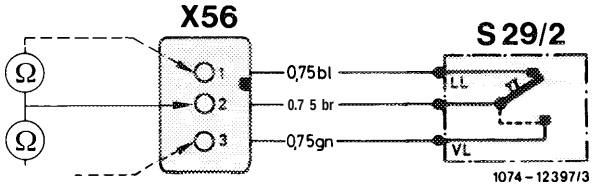
Testing throttle valve switch (full load contact)

Stop engine, disconnect plug, throttle valve switch. Check resistance on terminal 2 to 3.

Full load contact:	
Idle speed position	∞ Ω
Full load position	approx. 0 Ω
Partial load position	∞ Ω

Ok	Not ok

Adjust or replace throttle valve switch or wrong pole connection.



S29/2 **Throttle valve switch full load/idle detection**
X56 **Plug connection throttle valve switch**

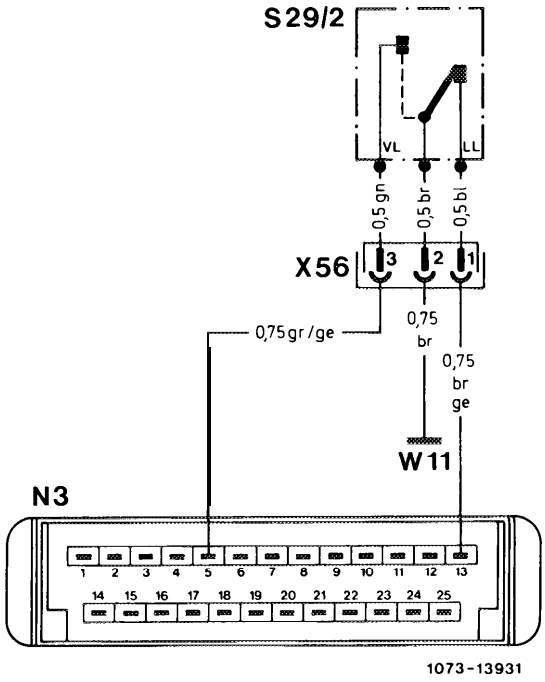
Test lines from plug, throttle valve switch to CIS-E control unit and ground for continuity.

Resistance approx. 0 Ω

Ok	Not ok

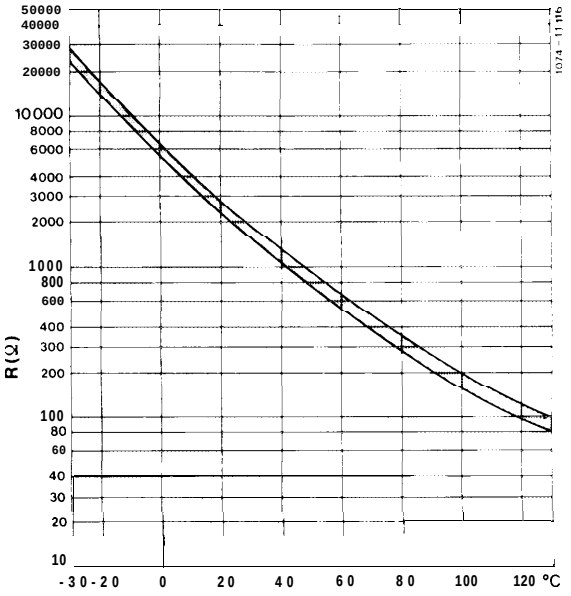
Repair interruption according to wiring diagram.

End of test



N3 **Control unit CIS-E**
S29/2 **Throttle valve switch full load/idle detection**
W11 **Ground, engine (electric cable screwed on)**
X56 **Plug connection throttle valve switch**

On-off ratio 30 %



Testing coolant temperature sensor

Pull plug from coolant temperature sensor. Test resistance to ground. (idling speed in order during short to ground or too high during interruption.)

For nominal value refer to diagram.
Test resistance at two temperature measuring points.

Example: +20 °C ≙ **2.2 -2.8** kΩ
+80 °C ≙ 290-370 Ω

Ok	Not ok

Replace coolant temperature sensor.

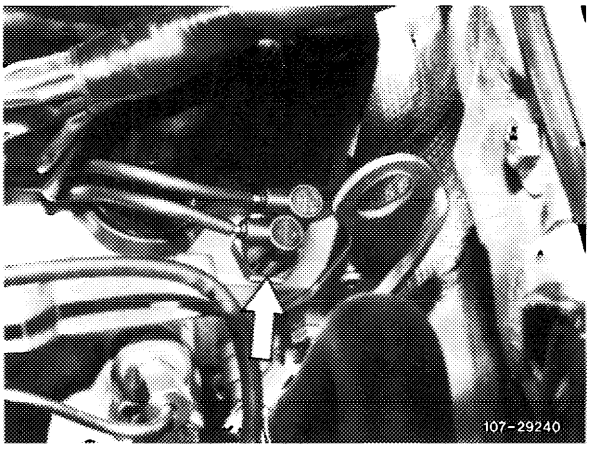
Test green/red line from terminal 21 plug, control unit (N3) to plug, coolant temperature sensor (B11/2) for continuity.

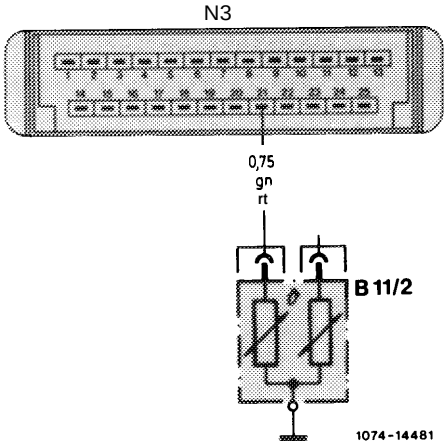
Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test





On-off ratio 40 %

Testing acceleration enrichment or sensor, air volume meter

Connect test cable 102 589 04 63 00 to electrohydraulic actuator and multimeter. Set multimeter to mA. Pull off plug, coolant temperature sensor and connect to 2.5 kΩ test resistor (special tool) or to ground with ohm decade (special tool) (simulate +20°C).

With KAT, pull off O_2 sensor. Start engine (increased idling speed).

Current at actuator

without lambda control	**16-22 mA**
with lambda control	**2– 6 mA**

Suddenly increase engine speed, voltage shou ld increase.

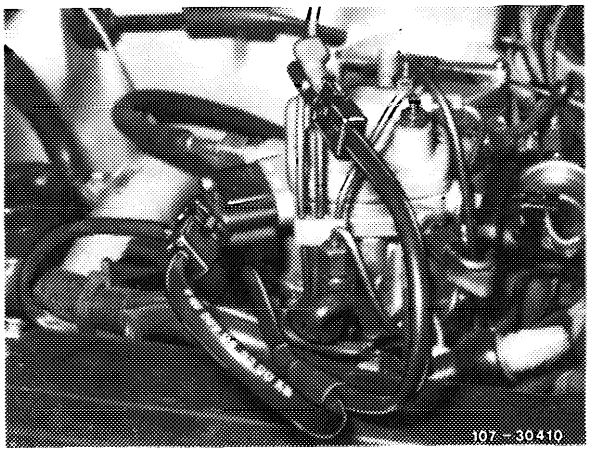
Ok	Not ok

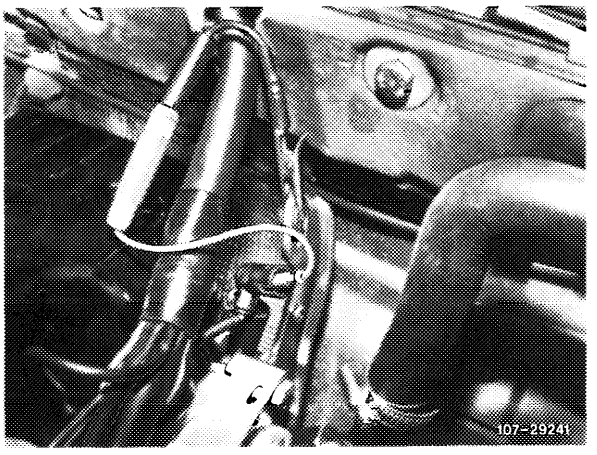
Reconnect coolant temperature sensor and O_2 sensor.

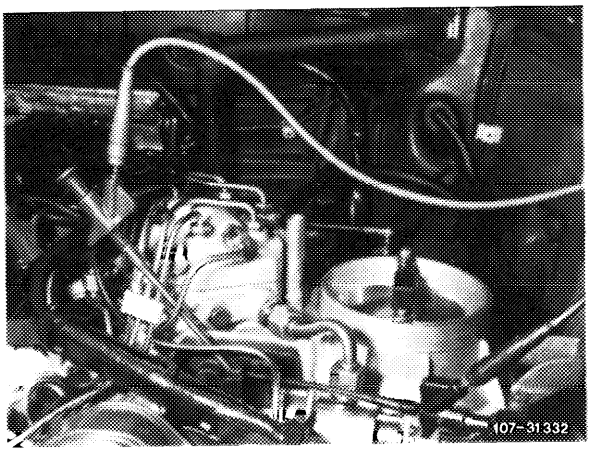
Pull off plug, sensor air volume meter to the extent that voltage can be measured. Start engine. Test voltage between terminal 1 and 3.

Voltage	**4.6-5.1 V**
Ok	**Not ok**

Repair interruption according to wiring diagram.



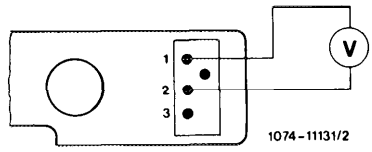




Measure voltage between terminal 1 and 2, run engine at idling speed.
If idling speed deviates, pull plug from idle speed adjuster (air valve) and set idle speed with a clamp on air hose to mean value of tolerance data.

Terminal 1 to terminal 2
0.57-0.81 V

Ok	Not ok



Engine off, ignition on. Slowly deflect air flow sensor plate. Test voltage between terminal 1 and terminal 2.

Voltage should continuously increase to 4.6-5.1 V.

Ok	Not ok

Replace air volume meter.

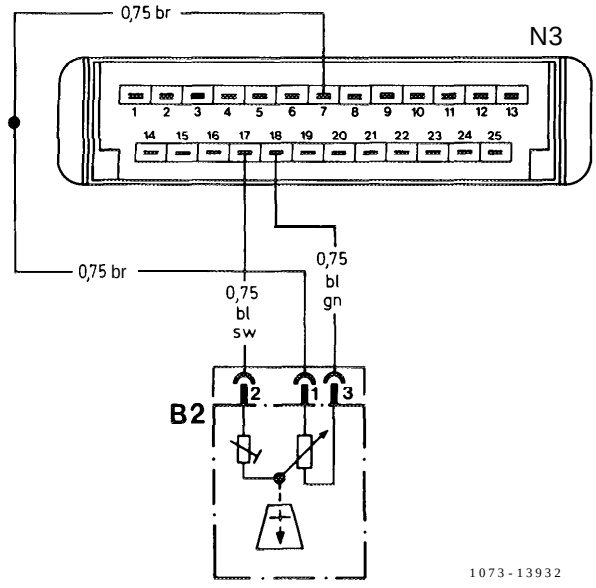
Voltage higher or lower, replace air volume meter.

Voltage 0 V.
Stop engine, test lines between sensor, air volume meter and plug, CIS-E control unit for continuity. Pay attention to wire routing.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.



B2 Sensor, air volume meter
N3 Control unit CIS-E

Start engine (idling speed and engine oil temperature 60-80 °C). Test on-off ratio on diagnosis socket.

On-off ratio:
with lambda control — Readout oscillating
without lambda control — Readout 50 %

Ok	Not ok

For different on-off ratio, refer to test program.

End of test

On-off ratio 50 %

Note: Without lambda control: No fault in range of monitored signals.

Testing O_2 sensor

Separate plug, O_2 sensor signal. Plug to CIS-E control unit to ground. Start engine. On plug connection of O_2 sensor line, test voltage against ground.

Voltage 450-1 000 mV

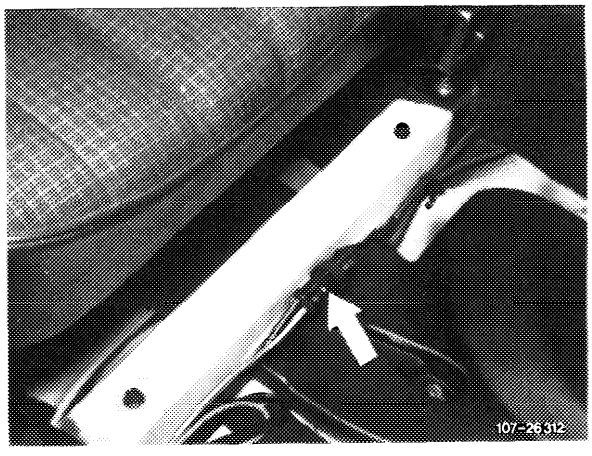
Ok	Not ok

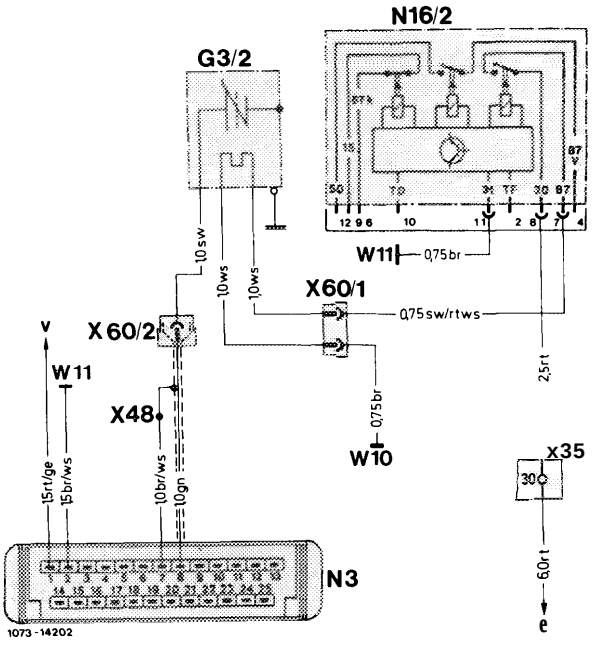
Stop engine. Test line to CIS-E control unit, jack 8, for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.





G3/2 O_2 sensor, heated
N3 Control unit CIS-E
N16/1 Relay, fuel pump
W10 Ground, battery
X60/1 Plug connection heater coil O_2 sensor
X60/2 Plug connection signal O_2 sensor

Pull off plug of O_2 sensor heater to the extent that voltage can be tested (Attention! short-circuit danger).

Pull off relay, fuel pump and bridge jack 7 and 8.

Readout approx. 12 volts (battery voltage).

Ok	Not ok

Repair interruption according to wiring diagram.

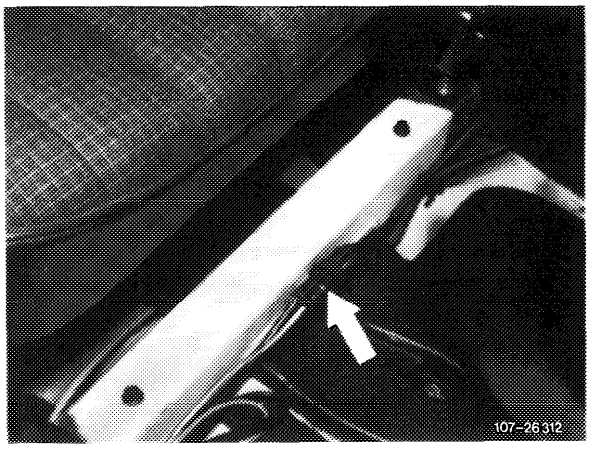
Disconnect plug, O_2 sensor heater.
Test current input.

Nominal value 0.5-l .3 A

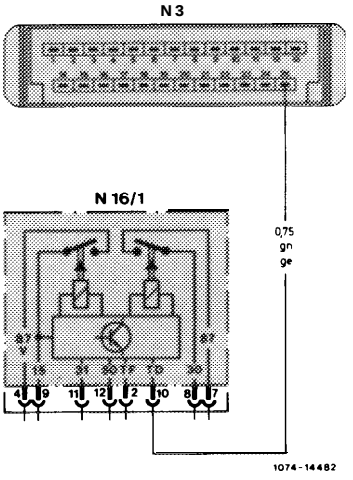
Ok	Not ok

Replace O_2 sensor.

End of test



On-off ratio 70 %



Testing TD signal

Pull plug from CIS-E control unit.
Start engine.
Test voltage on jack 25 to ground.

Voltage 6–12 volts

Ok	Not ok

Pull off relay, fuel pump (N16/1). Test line between jack 10 on relay, fuel pump and jack 25 on CIS-E control unit (N3) for continuity (pay attention to tie lug).

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

Test line between jack 10 (relay fuel pump) and diagnosis socket/line connector TD for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Test line between diagnosis socket/line connector TD and ignition switching unit terminal TD for continuity.

Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test

On-off ratio 80 %

Testing temperature sensor, intake air

Pull plug (arrow) from temperature sensor, intake air. Test resistance to ground.

For nominal value, refer to diagram.
Example: +20 °C = **2.2-2.8** kΩ
0 °C = 5.5-6.1 kΩ

Ok	Not ok

Replace temperature sensor, intake air.

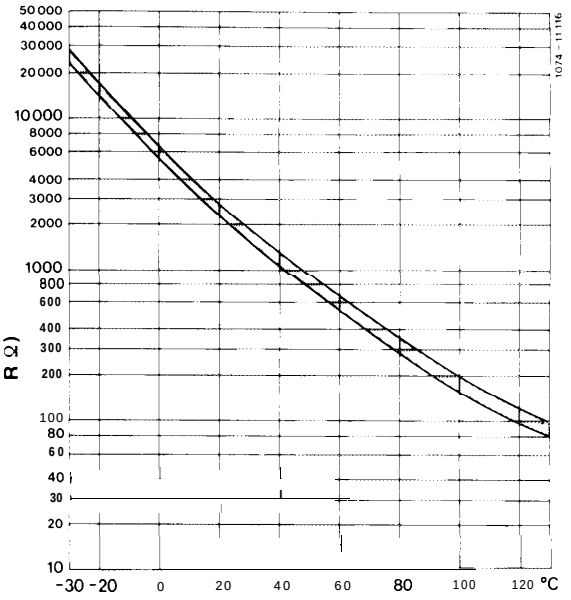
Check lines between temperature sensor, intake air and ground or control unit, injection system terminal 11 for continuity.

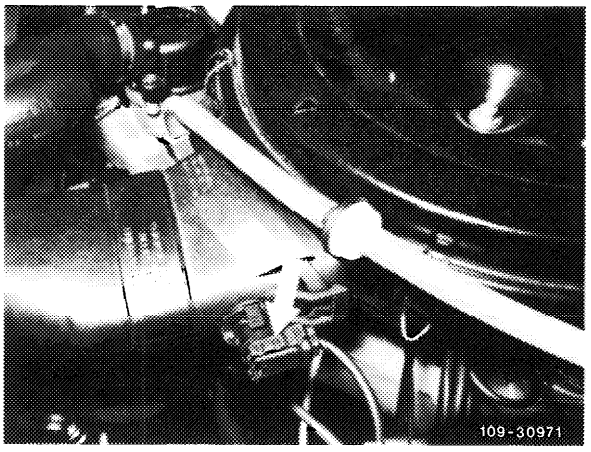
Resistance approx. 0 Ω

Ok	Not ok

Repair interruption according to wiring diagram.

End of test



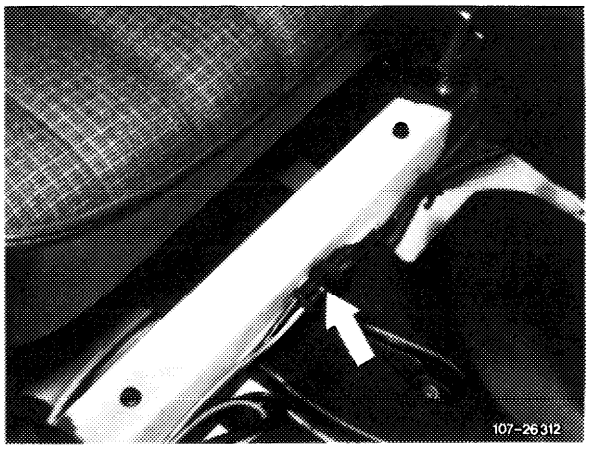


On-off ratio 100 %

Note: With and without lambda control: At on-off ratio 100 % and idling speed too high, test fuse on overvoltage protection or voltage supply and ground (refer to section ,,a").

Testing O_2 sensor	
Test adjustment of lambda control (07.3-I 00).	
On-off ratio can be regulated. Readout oscillating.	
Ok	Not ok

Disconnect plug, O_2 sensor signal. Plug to CIS-E control unit to ground. Start engine. On plug connection of O_2 sensor line, test voltage to ground.	
Voltage 450-I 000 mV	
Ok	Not ok



Stop **engine.**

Test line to CIS-E control unit jack 8 for continuity.

Resistance approx. 0 Ω

Ok	Not ok

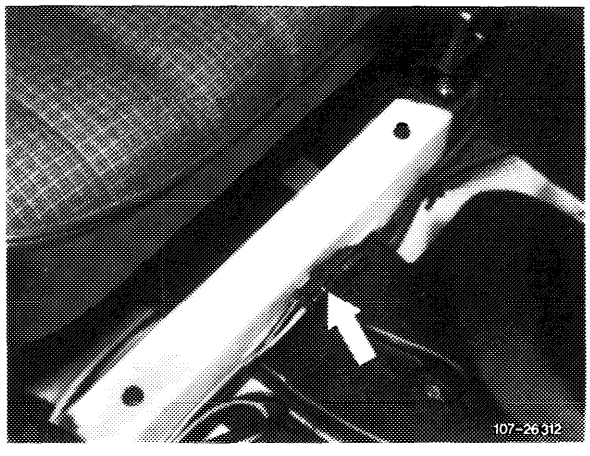
Repair interruption according to wiring diagram.

Pull off plug of O_2 sensor heater to the extent that the voltage can be tested **(Attention!** short-circuit danger). Pull off relay, fuel pump and bridge jack 7 and 8.

Readout approx. 12 volts (battery voltage).

Ok	Not ok

Repair interruption according to wiring diagram.



Disconnect plug, O_2 sensor heater.

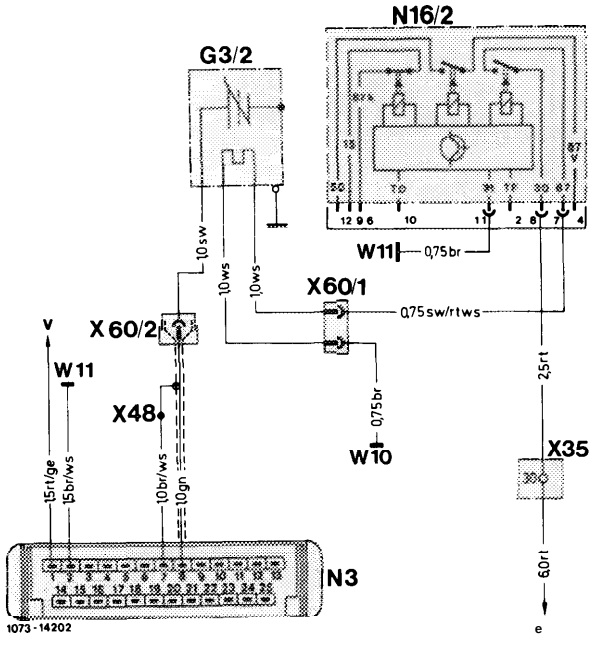
Test current input.

Nominal value 0.5-1 .3 A

Ok	Not ok

Replace O_2 sensor.

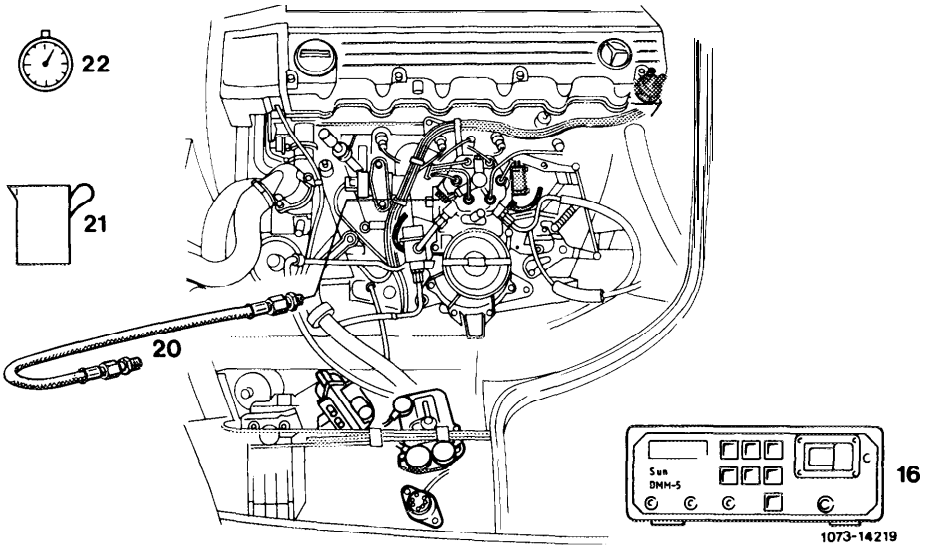
End of test



G3/2 O_2 sensor heated
N3 Control unit CIS-E
N16/1 Relay, fuel pump with starting valve activation
W10 Ground, battery
X60/1 Plug connection heater coil O_2 sensor
X60/2 Plug connection signal O_2 sensor

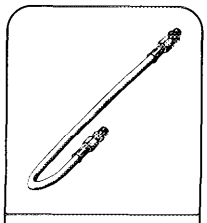
07.3-I 22 Testing throttle (orifice) in fuel distributor for unobstructed passage

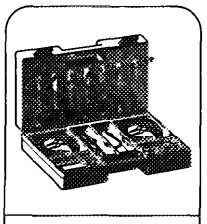
Job No. of work unit or standard texts and flat rates data 07-1604.



Plug on actuator	.....	Pull off.
		With lambda control, switch on ignition. Disconnect plug of O_2 sensor in vehicle interior.
Fuel line	.....	Unscrew on fuel distributor and close with closing plug M 10 x 1.
Pressure hose (20)	.....	Connect to fuel distributor and hold into measuring glass or measuring cup.
		Special tool 102 589 00 21 00
Fuel pump relay	.....	Pull off and bridge jacks 7 and 8 (fuel pump running).
		Special tool 201 589 00 99 00
Throttle (orifice)	.....	Check for unobstructed passage.
		Nominal: 130 — 150 cc/min at minimum voltage of 11.5 V on fuel pump.
		If nominal value is not attained, replace fuel distributor.

Special tools


102 589 00 21 05


201 589 00 99 00

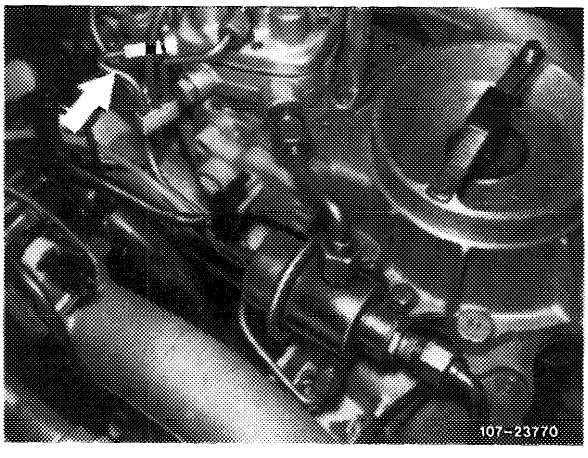
Voltmeter, measuring glass or measuring cup, stop watch

Testing

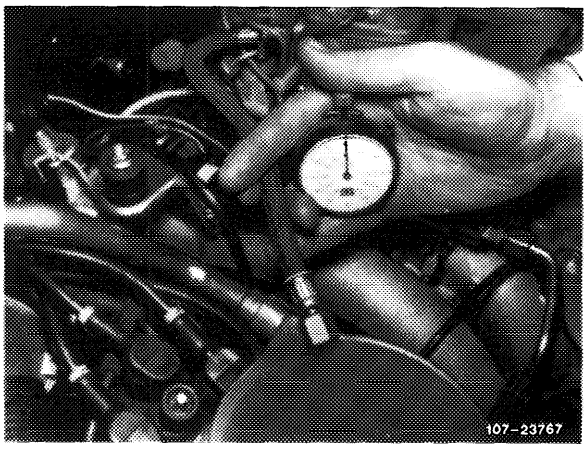
1 Pull plug from actuator.

With lambda control, switch on ignition. Disconnect plug of O_2 sensor in vehicle interior.

2 Unscrew fuel connecting line (arrow) between fuel distributor and diaphragm pressure regulator on fuel distributor. Close unscrewed connecting line with closing plug M 10 x 1, so that no fuel will run out.



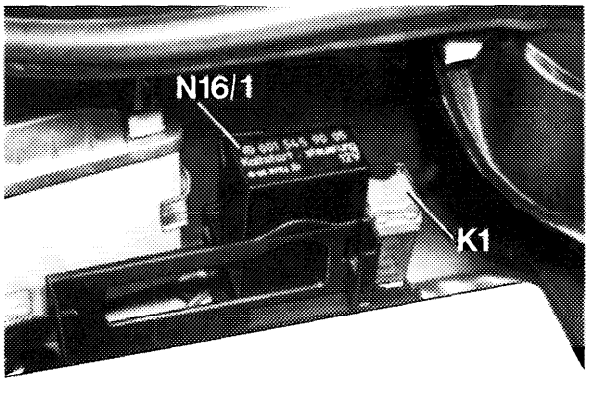
3 Connect fuel hose to fuel distributor and hold into measuring glass or measuring cup.



4 Pull off fuel pump relay and bridge the two jacks 7 and 8. This will energize the fuel pump.

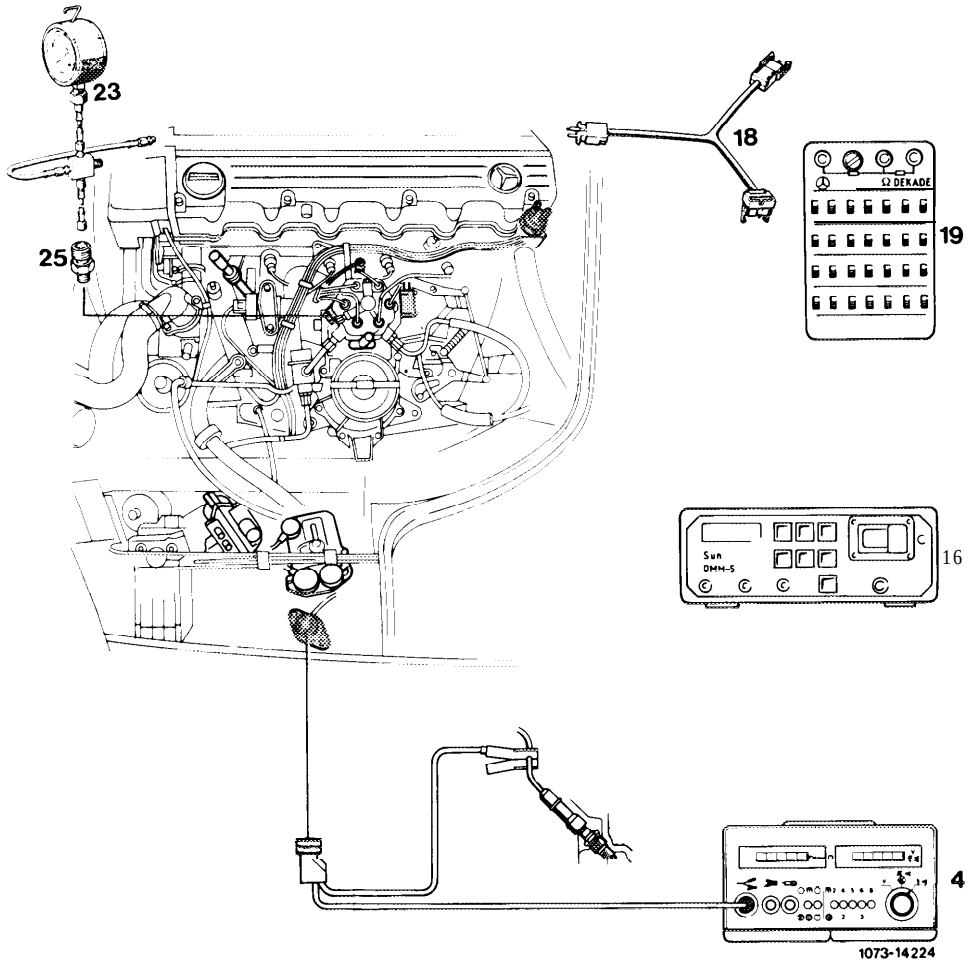
Pull off contact bridge after 1 minute.

If the nominal value of 130-l 50 cc/minute at a minimum voltage of 11.5 V on fuel pump is not attained, replace fuel distributor.



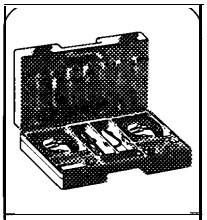
107-29244

Job No. of work unit or standard texts and flat rates data 07-2353.

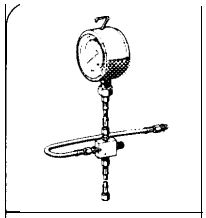


Fuel pressures and internal leaks	**Test (07.3-I 20).**
Starting valve	**Check for function and leaks.**
After-start enrichment	**Check.**

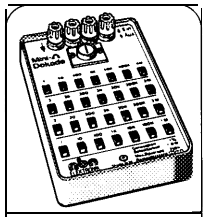
Special tools



201 589 00 99 00



103 589 00 21 00



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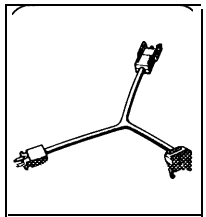
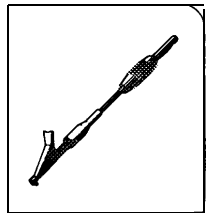
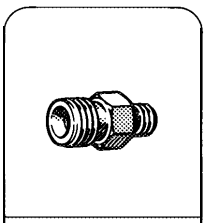


102 589 04 63 00



102 589 05 63 00



102 589 06 63 00

Conventional testers

Multimeter	**e.g. Sun, DMM-5**
Digital tester (rpm, dwell angle, ignition angle)	**e.g. Bosch, MOT 002.02** **e.g. Sun, 1019**

Note

Electric wiring diagrams 07.3-I 28.

Testing fuel pressures and for internal leaks (07.3-I 20).

Test lower chamber pressure at + 20 °C coolant temperature.

Nominal value: 4.8-5.0 bar.

Ok	**Not ok**

Test coolant temperature sensor (07.3-I 21, section „b").

Checking starting valve for function and leaks

Disconnect fuel line on starting valve (arrow).
Remove starting valve and reconnect fuel line.
Simulate 10 kΩ on coolant temperature sensor with ohm decade.
Hold starting valve into a container.

Check function.
Start engine, starting valve should eject.

Ok	Not ok

Test starting valve or activation (07.3–126).

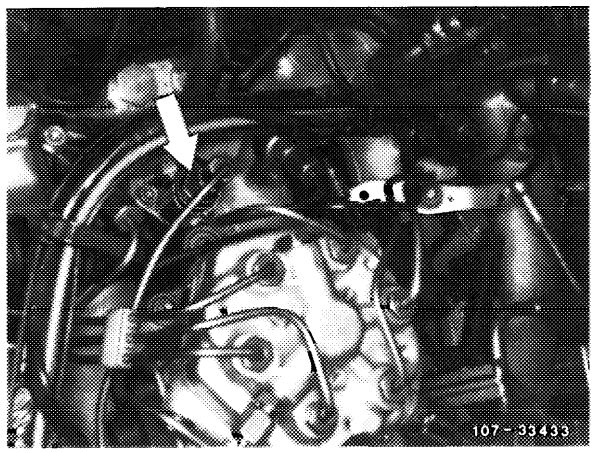
Check for leaks.
Dry starting valve on nozzle.

Formation of drops

Ok	Not ok

Replace starting valve.

End of test



Testing after-start enrichment

Test values

Engine		103.94		103.98	
Version		RÜF	KAT	Std./RÜF	KAT
After-start at +20 °C	mA	25–31	3–9	21–27	8–12
End of start	approx. seconds	20	60	20	60
Warm-up basic value	mA	16–22	2–6	15–22	2–6

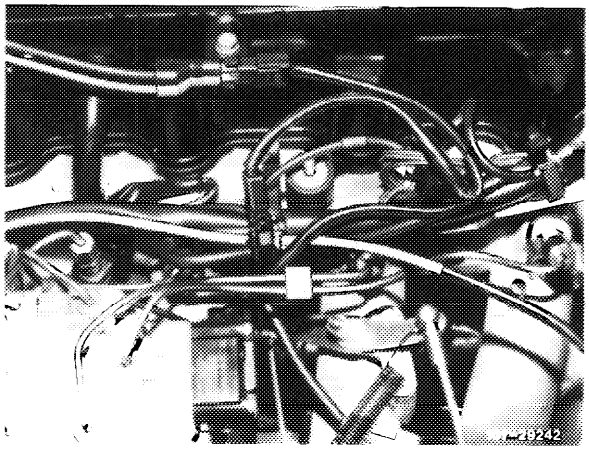
Connect test cable to actuator. Set measuring instrument to mA. With test resistor 2.5 kΩ simulate coolant temperature + 20 °C or with ohm decade 2.5 kΩ. With lambda control, pull off O_2 sensor. Start engine. Increase idling speed.

Voltage increase:
Refer to Table.

Following end of start approx. ... seconds constant. Refer to Table.

Dropping to warm-up basic value:
Refer to Table.

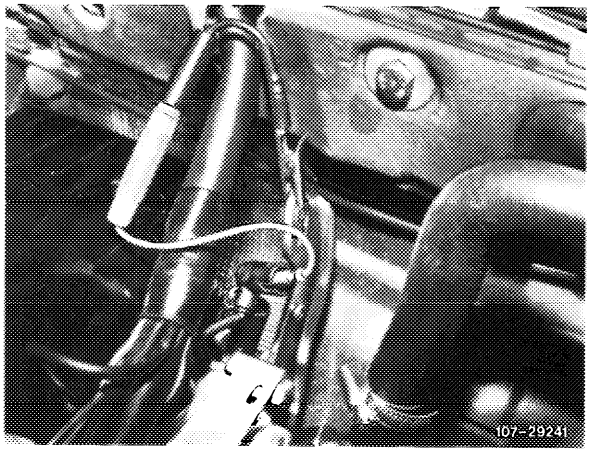
Ok | Not ok

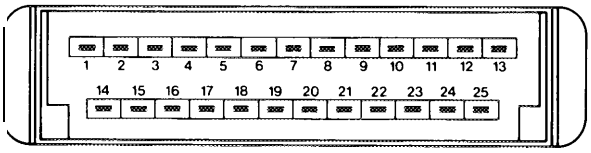


Test rpm signal (TD) on plug, control unit terminal 25 (green/yellow).
Start engine.

Voltage 6–12 volts.

Ok | Not ok

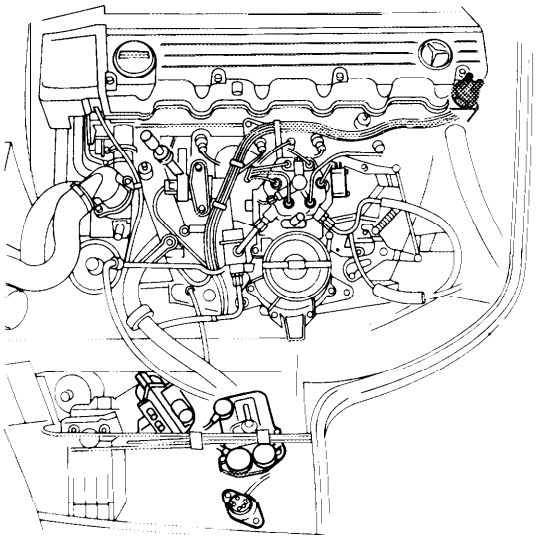


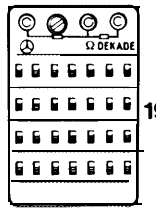


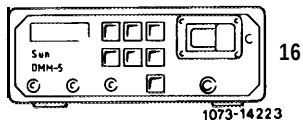
Repair interruption according to wiring diagram.

End of test

Job No. of work unit or standard texts and flat rates data 07-1607.

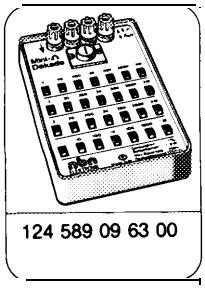






Testers.	Connect: multimeter (16). Ohm decade (19) 124 589 09 63 00.
Starting voltage	Check. Min. 10 V in approx. 5 seconds.
Electric lines between starting valve and fuel pump relay for continuity	Test. Resistance approx. 0 Ω.
Voltage on fuel pump relay	Test. Jack 12 (terminal 50) min. 10 V, jack 2 (terminal TF) 3-5 V, simulated at 10 kΩ.

Special tool



Conventional tester

Multimeter	e.g. Sun, DMM-5

Activation via fuel pump relay.

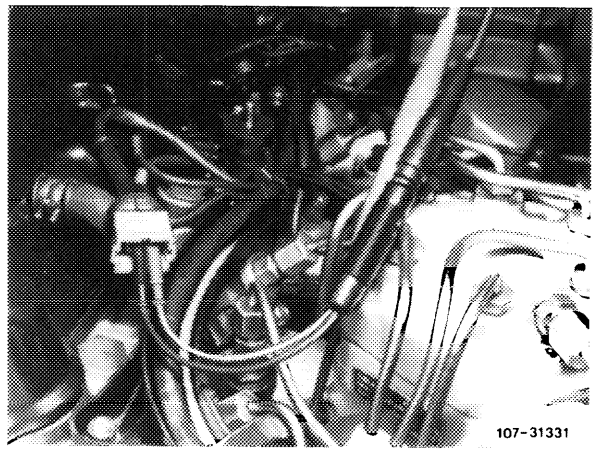
The starting valve is activated via fuel pump relay in accordance with coolant temperature.

Example: -20 °C = approx. 10 seconds.
No more activation above +15 or +60 °C.

Simulate 10 kΩ with ohm decade on coolant temperature sensor. Pull off green cable on switching unit or plug protective plug, part No. 102 589 02 21 00 to diagnosis socket. Actuate starter, while testing voltage on plug, starting valve to ground.

Voltage at least 10 volts
Time: approx. 5 seconds

Ok	Not ok



Test lines between starting valve and fuel pump relay, jack 4 (terminal 87V) or test ground, engine for continuity.

Resistance approx. 0 Ω

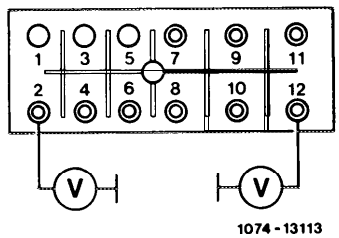
Ok	Not ok

Repair interruption according to wiring diagram.

Test voltage on fuel pump relay, jack 12 (terminal 50) as well as jack 2 (terminal TF) to ground, engine. Start engine.

Voltage, jack 12 min. 10 volts,
voltage jack 2 = 3-5 volts at 10 kΩ, simulated.

Ok	Not ok

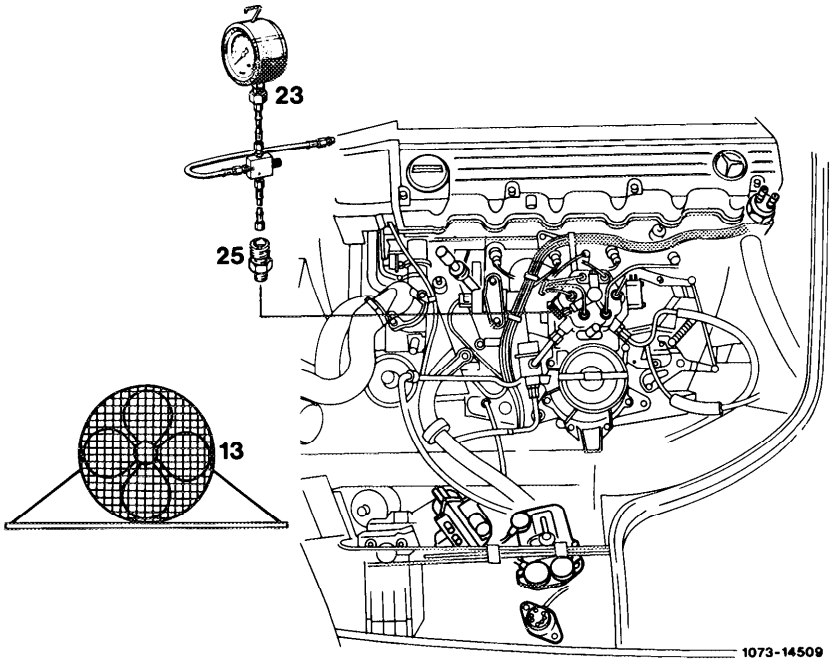


1074-13113

Replace fuel pump relay.	Repair interruption according to wiring diagram.

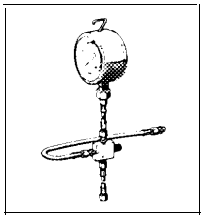
End of test

Job No. of work unit or standard texts and flat rates data 07-2320.



Pressure measuring device (23)	Connect (07.3-120) special tool 103 589 00 21 00. Run engine to establish pressure.
Blower (13).	Cool engine (or leave overnight).
Cold start.	Perform, paying attention to pressure gauge: If required, test fuel pressures 07.3-I 20 or electronic components of CIS-E injection system 07.3-I 21.

Special tool

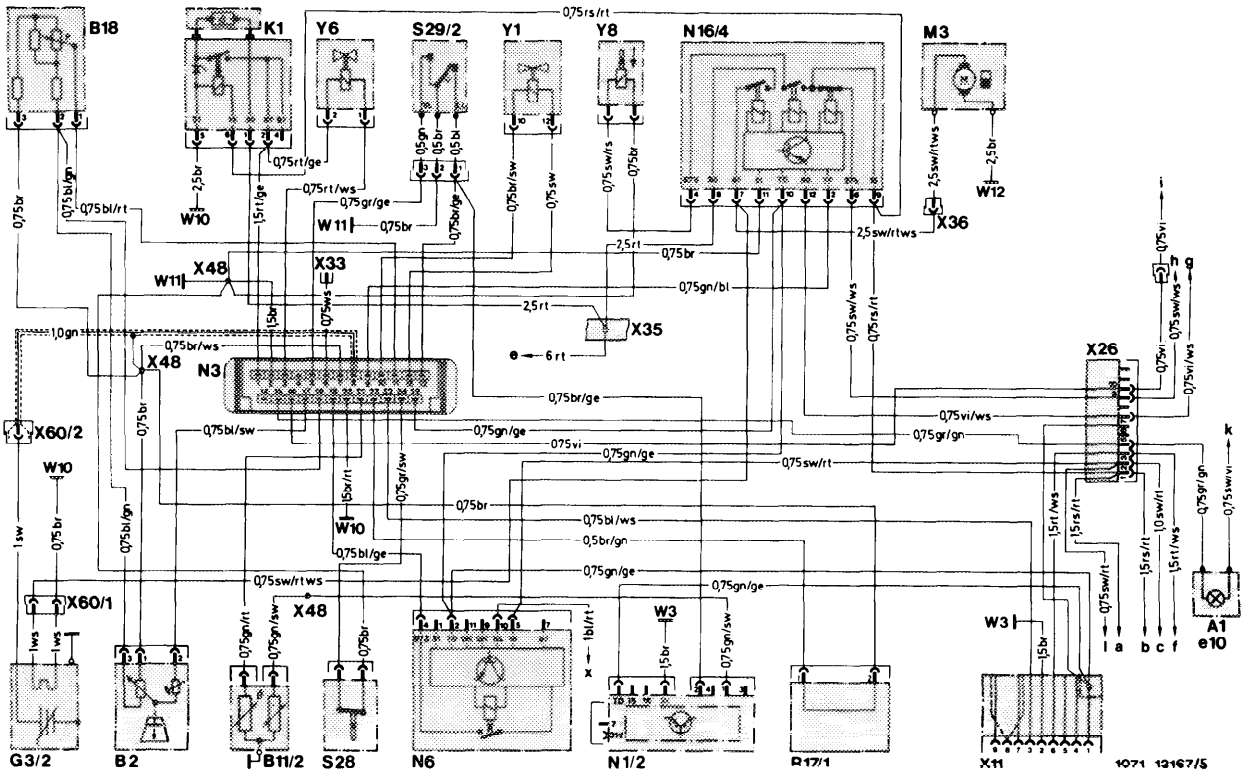


103 589 00 21 00

Test values

Fuel pressures in bar gauge pressure		
System pressure with engine cold or at operating temperature		5.3-5.5
Lower chamber pressure	with engine at operating temperature	approx. 0.4[1])
	stationary or idling at coolant temperature +20 °C	approx. 0.5[1])
	with decel shutoff	5.3-5.5

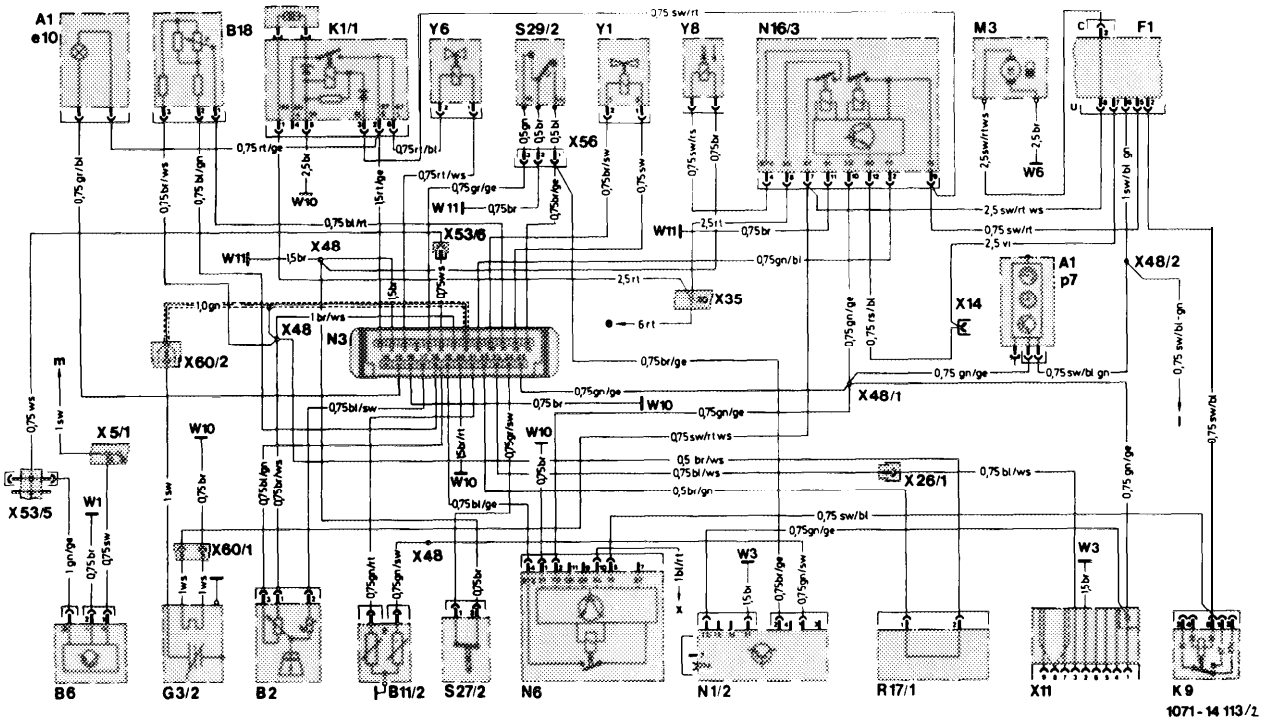
[1]) Below previously measured system pressure.



Wiring diagram mechanically/electronically controlled gasoline injection system

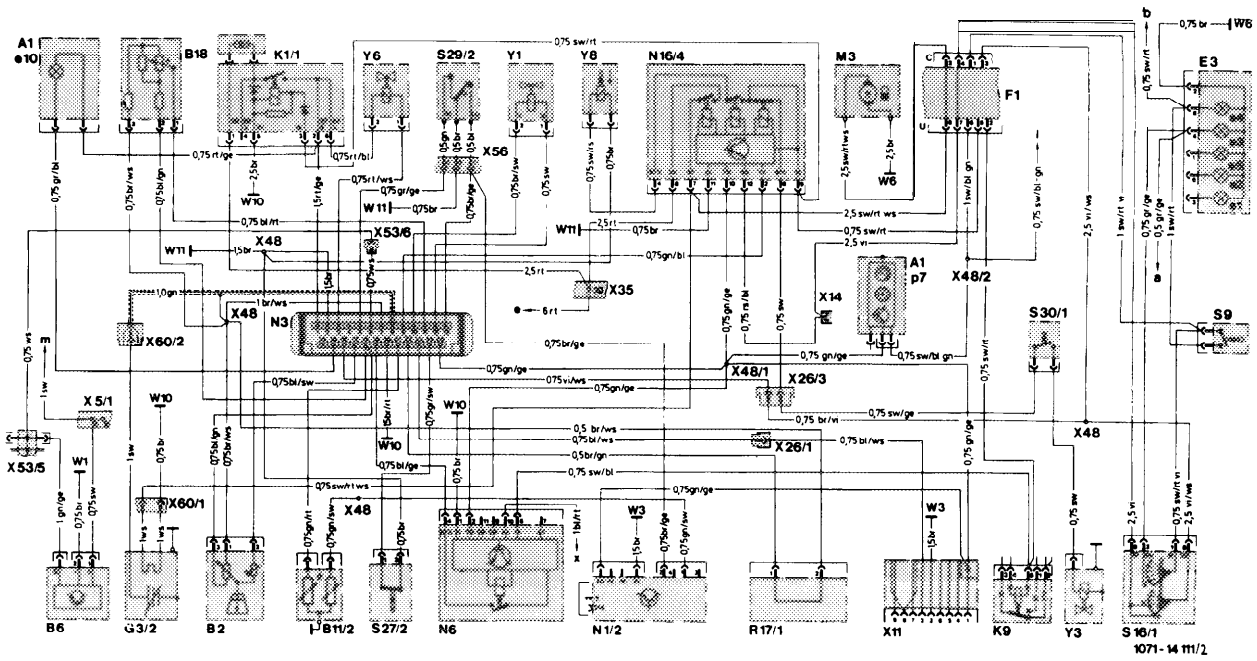
A1e10	O_2 sensor failure indicator
B2	Sensor, air volume meter
B11/2	Temperature sensor, coolant (2-pole)
B18	Sensor, altitude correction
G3/2	O_2 sensor heated
K1	Relay, overvoltage protection
M3	Fuel pump
N1/2	Switching unit, electronic ignition system
N3	Control unit CIS-E (25-pole plug)
N6	Control unit, compressor cutout
N16/3	Relay, fuel pump (manual transmission)
N16/4	Relay, fuel pump (automatic transmission)
R17/1	Single adjustment plug, injection system
S28	Microswitch, decel shutoff
S29/2	Throttle valve switch, full load/idle detection
w3	Ground, wheelhouse front left (ignition coil)
W9	Ground, front left (near lamp unit)
W10	Ground, battery
W11	Ground, engine (electric cable screwed on)
w12	Ground, center console
x11	Diagnosis socket/cable connector, terminal TD
X26	Plug connection, engine compartment harness (12-pole)
x33	Plug connection, injection system, cruise control/ Tempomat (1-pole)
x35	Cable connector, terminal 30/terminal 61 (battery)
X36	Plug connection, fuel pump harness
X48	End sleeve (soldered connector in cable connector)
X56	Plug connection, throttle valve switch
X60/1	Plug connection, heater coil O_2 sensor
X60/2	Plug connection, signal O_2 sensor
Y1	Electrohydraulic actuator (EHA)
Y6	Idle speed adjuster (air valve)
Y8	Starting valve
a	Ignition coil, terminal 15
b	Fuse 7
c	Fuse 7, terminal 15
e	Cable connector terminal 30 (fuse and relay box)
f	Fuse 9, terminal 30
g	Plug connection, starter lockout switch, jack 4
h	Switch, kickdown, jack 1 Automatic transmission, plug starter lockout switch, jack 3, terminal 50 Manual transmission, ground, engine (via starter coil)
k	Fuse 6, terminal 15 (fused) Relay, auxiliary fan, terminal 86
x	Pushbutton switch A/C compressor

Note: Unidentified grounding points to ground, engine or ground, body.



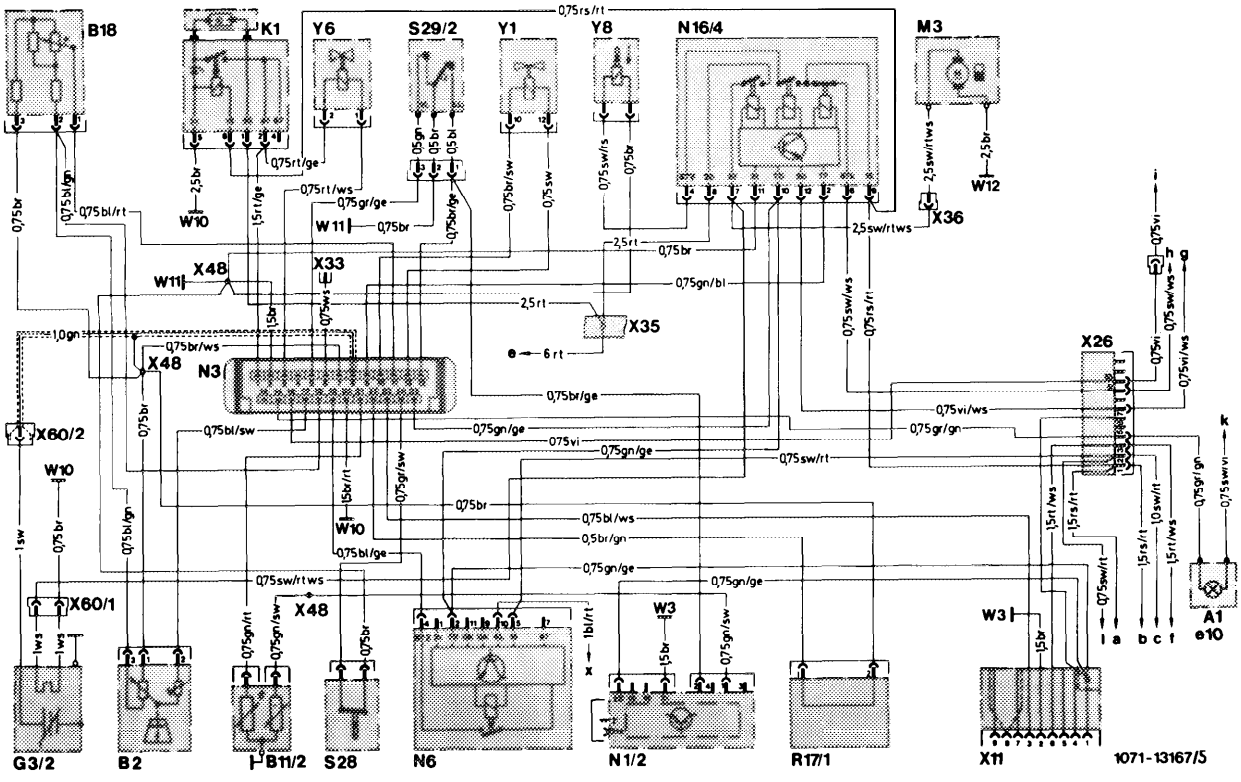
Wiring diagram, mechanically/electronically controlled gasoline injection system with manual transmission

Ale10	Failure indicator lamp, O_2 sensor
Alp7	Electronic clock/tachometer
B2	Sensor, air volume meter
B6	Hall sensor, road speed
B11/2	Temperature sensor, coolant (EZL/CIS-E)
B18	Sensor, altitude correction
F1	Central electrical system
G3/2	O_2 sensor heated
K1/1	Relay, overvoltage protection 87E/87L
K9	Relay, auxiliary fan
M3	Fuel pump
N1/2	Switching unit, transistorized ignition (EZL)
N3	Control unit, CIS-E injection system
N6	Control unit, compressor cutout
N16/3	Relay, fuel pump with starting valve activation and engine speed limiter
R17/1	Single adjustment plug (CIS-E)
S27/2	Microswitch, decel shutoff
S29/2	Throttle valve switch, full load/idle detection
w3	Ground, wheelhouse front left (ignition coil)
W6	Ground, trunk, wheelhouse left
W10	Ground, battery
W11	Ground, engine (electric cable screwed on)
X5/1	Cable connector, interior
X11	Diagnosis socket/cable connector terminal TD
x14	Plug connection, terminal 50
X26/1	Plug connection, engine harness/headlamp harness, 1 -pole, diagnosis socket
x35	Cable connector, terminal 30/terminal 61 (battery)
X48	End sleeve (soldered connector in harness)
x4811	End sleeve TD (soldered connector in harness)
X48/2	End sleeve, terminal 15 (soldered connector in harness)
x53/5	Multiple plug connection/Hall sensor
X56	Plug connection, throttle valve switch
X60/1	Plug connection, heater coil O_2 sensor
X60/2	Plug connection, signal O_2 sensor
Y1	Electrohydraulic actuator (EHA)
Y6	Idle speed adjuster (air valve)
Y8	Starting valve
e	Cable connector terminal 30 (fuse and relay box)
l	Washing nozzle heater, left (R2/2)
m	Central electrical system, plug L, fuse 10
x	Pushbutton switch A/C compressor



Wiring diagram, mechanically/electronically controlled gasoline injection system with automatic transmission

A1e10	Failure indicator lamp, O_2 sensor
A1p7	Electronic clock/tachometer
B2	Sensor, air volume meter
B6	Hall sensor, road speed
B11/2	Temperature sensor, coolant (EZL/CIS-E)
B18	Sensor, altitude correction
E3	Tail lamp unit, left
F1	Central electrical system
G3/2	O_2 sensor heated
K1/1	Relay, overvoltage protection 87E/87L
K9	Relay, auxiliary fan
M3	Fuel pump
N1/2	Switching unit, transistorized ignition (EZL)
N3	Control unit, CIS-E injection system
N6	Control unit, compressor cutout
N16/4	Relay, fuel pump with starting valve activation, kickdown cutout and engine speed limiter
R17/1	Single adjustment plug (CIS-E)
S9	Stop lamp switch
S16/1	Starter lockout and backup lamp switch
S27/2	Microswitch, decel shutoff
S29/2	Throttle valve switch, full load/idle detection
S30/1	Kickdown switch
W3	Ground, wheelhouse front left (ignition coil)
W6	Ground, trunk, wheelhouse left
W10	Ground, battery
W11	Ground, engine (electric cable screwed on)
X5/1	Cable connector, interior
X11	Diagnosis socket/cable connector terminal TD
x14	Plug connection, terminal 50
X26/1	Plug connection, engine harness/headlamp harness, 1 -pole, diagnosis socket
X26/3	Plug connection engine harness/tail lamp harness, 2-pole
x33	Plug connection, CIS-E, cruise control/ Tempomat, 1 -pole
x35	Cable connector, terminal 30/terminal 61 (battery)
X48	End sleeve (soldered connector in harness)
X4811	End sleeve TD (soldered connector in harness)
X48/2	End sleeve, terminal 25 (soldered connector in harness)
x53/5	Multiple plug connection/Hall sensor
X56	Plug connection, throttle valve switch
X60/1	Plug connection, heater coil O_2 sensor
X60/2	Plug connection, signal O_2 sensor
Y1	Electrohydraulic actuator (EHA)
Y3	Switchover valve, automatic transmission
Y6	Idle speed adjuster (air valve)
Y8	Starting valve
a	Tail lamp, right, jack 4 (E4)
b	Tail lamp, right, jack 5 (E4)
e	Cable connector terminal 30 (fuse and relay box) Washing nozzle heater, left (R2/2)
m	Central electrical system, plug L, fuse 10
x	Pushbutton switch A/C compressor



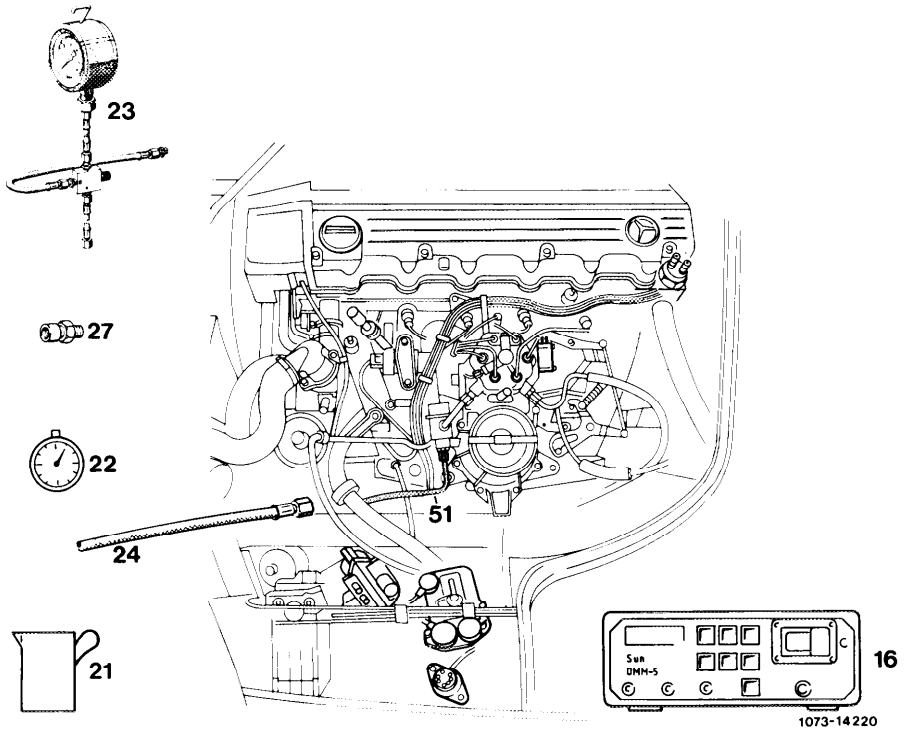
Wiring diagram, mechanically/electronically controlled gasoline injection system

Ale10	O_2 sensor failure indicator
B2	Sensor, air volume meter
B11/2	Temperature sensor, coolant (2-pole)
B18	Sensor, altitude correction
G3/2	O_2 sensor heated
K1	Relay, overvoltage protection
M3	Fuel pump
N1/2	Switching unit, electronic ignition system
N3	Control unit CIS-E (25-pole plug)
N6	Control unit, compressor cutout
N16/3	Relay, fuel pump (manual transmission)
N16/4	Relay, fuel pump (automatic transmission)
R17/1	Single adjustment plug CIS-E
S28	Microswitch, decel shutoff
S29/2	Throttle valve switch, full load/idle detection
w3	Ground, wheelhouse front left (ignition coil)
W9	Ground, front left (near lamp unit)
W10	Ground, battery
W11	Ground, engine (electric cable screwed on)
w12	Ground, center console
X11	Diagnosis socket/cable connector, terminal TD
X26	Plug connection, engine compartment harness (12-pole)
x33	Plug connection, injection system, cruise control/ Tempomat (1-pole)
x35	Cable connector, terminal 30/terminal 61 (battery)
X36	Plug connection, fuel pump, harness
X48	End sleeve (soldered connector in harness)
X56	Plug connection, throttle valve switch
X60/1	Plug connection, heater coil O_2 sensor
X60/2	Plug connection, signal O_2 sensor
Y1	Electrohydraulic actuator (EHA)
Y6	Idle speed adjuster (air valve)
Y8	Starting valve
a	Ignition coil, terminal 15
b	Fuse 7
c	Fuse 7, terminal 15
e	Cable connector terminal 30 (fuse and relay box) Fuse 9, terminal 30
g	Plug connection, starter lockout switch, jack 4
h	Switch, kickdown, jack 1 Automatic transmission, plug starter lockout switch, jack 3, terminal 50 Manual transmission, ground, engine (via starter coil)
k	Fuse 6, terminal 15 Relay, auxiliary fan, terminal 86
x	Pushbutton switch A/C compressor

Note: Unidentified grounding points to ground, engine or ground, body.

07.3-130 Testing fuel pump

Job No. of work unit or standard texts and flat rates data 07-5700.



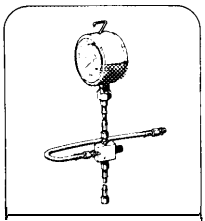
Fuel return line (51).	Unscrew
Fuel hose (24).	Self-made and connected to diaphragm pressure regulator
Del ivery capacity	Check. Nominal value 1 liter in max. 40 seconds. Use testers (16, 21, 22) for this purpose.
Current input	Check. Nominal value 7-10 amps Use tester (16) for this purpose.
Fuel hose	Check. Nominal value 2-4 bar gauge pressure. Use testers (23, 27) for this purpose. Special tool 103 589 00 21 00

Test values

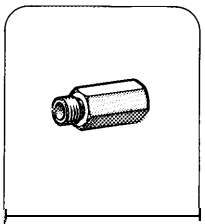
Fuel pump (each)		1	2
Designation		EKP4	EKP6
MB part No.		002 091 97 01	002 091 59 01[1])
Bosch No.		0580 254 942	0580 254 951
Measuring instructions		with engine stopped and a voltage of min. 11.5 volts at delivery pump	
Delivery capacity[2])	Measuring point	Fuel return line following diaphragm pressure regulator	
	min. 1 liter in	40 seconds	
Current input		7-I 0 amps	

[1]) Spare part No. 002 091 88 01
[2]) For measuring delivery capacity, the fuel tank must be at least filled by half.

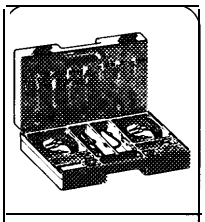
Special tools



103 589 00 21 00



103 589 02 63 00



201 589 00 99 00

Conventional testers

Measuring glass or measuring cup (min. 1 liter), stop watch	
Multimeter	e.g. Sun, DMM-5

Self-made tool

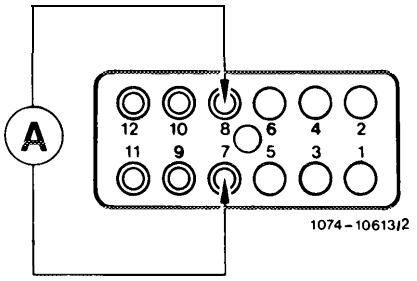
Fuel hose approx.	500 mm long
Pipe with sealing cone	
Coupling nut	M 14 x 1.5

A. Delivery capacity

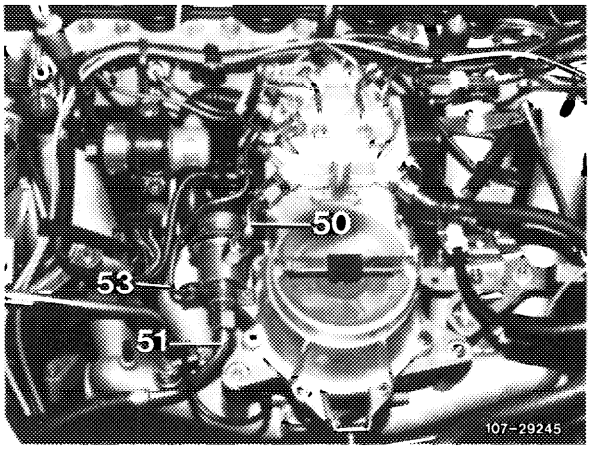
1 Check current input at jack 7 (terminal 87) and jack 8 (terminal 30).

Current input: 7-l 0 amps

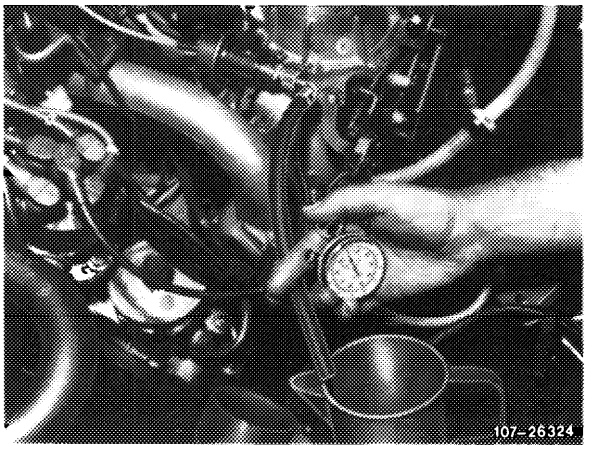
If more than 10 amps are measured, replace fuel pump.



2 Pull electric lines from multimeter. Check delivery capacity of fuel pump in fuel return line. For this purpose, unscrew fuel return line (51) at diaphragm pressure regulator.



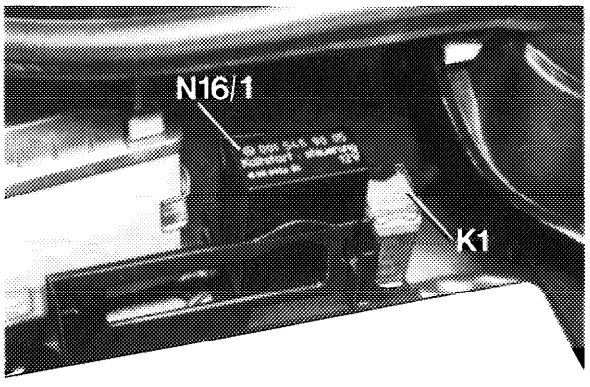
3 Screw self-made fuel hose to diaphragm pressure regulator and hold into measuring glass or measuring cup.



4 Bridge jacks 7 and 8. This will energize the fuel pump.

Pull off contact bridge after 40 seconds or before measuring glass/measuring cup starts overflowing.

Nominal value: 1 liter in max. 40 seconds at a minimum voltage of 11.5 volts on fuel pump.



5 If the delivered quantity is less than 1 liter in 40 seconds, check the following items:

a) Test voltage on fuel pump.
Nominal value min. 11.5 volts.

b) Check strainer in feed connection of fuel distributor for unobstructed passage.

c) Check fuel lines for pinched spots (squeezed lines).

d) Pinch off leak line between fuel accumulator and suction damper. Check delivered quantity once again. If the specified quantity is attained, replace fuel accumulator.

e) Replace fuel filter.

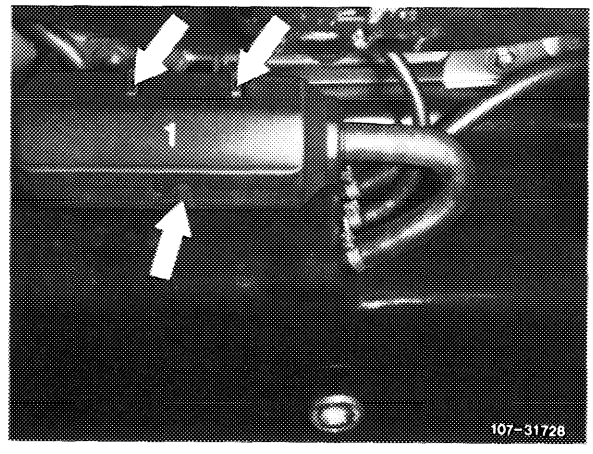
6 If the delivered quantity is still too low, replace fuel pump.

On vehicles with double pump version, find defective fuel pump by measuring fuel pressure (section „B").

7 Connect fuel return hose. Mount relay.

B. Fuel pressure

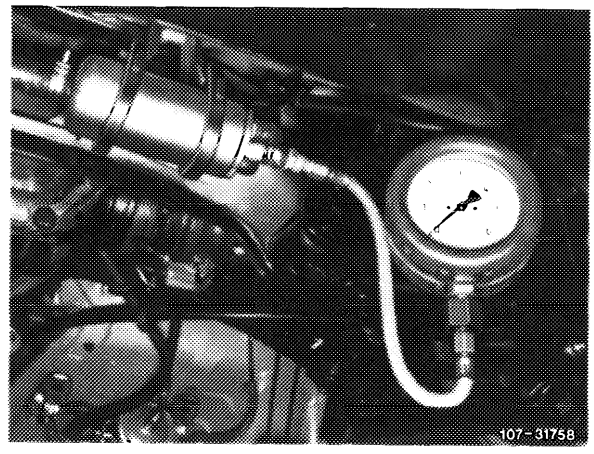
1 Disengage protective box (1) at rubber straps (arrows) and remove.



2 Unscrew cap nut on fuel pump 1, connect pipe connection part No. 103 589 02 63 00 and pressure gauge O-10 bar, part No. 103 589 00 21 00.

3 Pull off fuel pump relay and bridge the two jacks 7 and 8 (terminal 30 and 87).

4 Read pressure on pressure gauge. Pressure should be between 2-4 bar. If pressure is below 2 bar, the fuel pump 1 (between rear axle and fuel tank) is defective. If the pressure is above 4 bar, fuel pump 2 (mounted in fuel pump package) is defective.



5 Disconnect pressure gauge, connect cap nut and check for leaks.

6 Engage protective box.

Job No. of work unit or standard texts and flat rates data 07-6500.

Test values

Opening pressure of injection valves	**with new injection valves**	**3.5-4.1 bar gauge pressure**
	with used injection valves	**min. 3.0 bar gauge pressure**

Tightening torques	**Nm**
Injection lines on fuel distributor (reference value)	**10-12**
Injection lines on injection valves (reference value)	**10-15**

Conventional testers and accessories

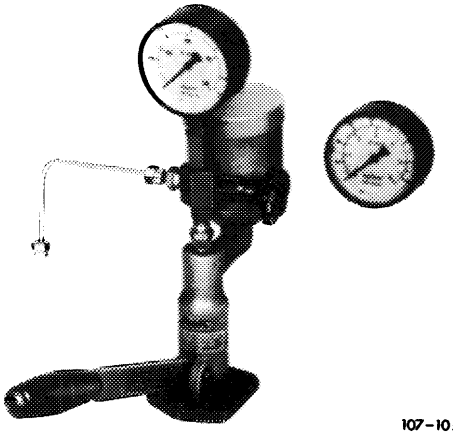
Valve tester Bosch KDJE-P 400	**Bosch order designation KDJE-P 400**
Nozzle tester EFEP 60 H[1])	**Bosch No. 0 684 200 700**
Pressure gauge O-6 bar gauge pressure housing dia. 100 mm Quality class 1 .O	**Bosch No. 1 687 231 000**
Pipe line	**Bosch No. 1 680 750 001**

[1]) **Similar to previous nozzle tester. Testing of injection valves requires the named pressure gauge or the pressure gauge of the pressure measuring device 100 589 13 21 00.**

Note

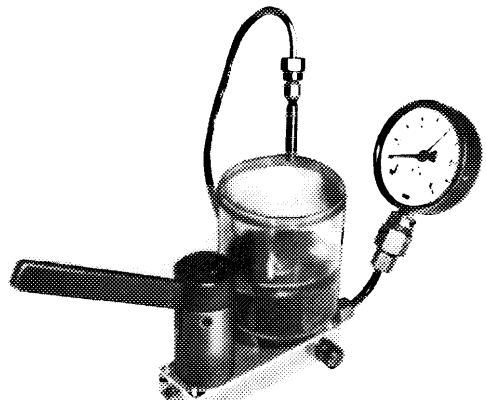
The **nozzle or valve tester serves to test the opening pressure, buzzing, the jet and the absence of leaks of injection valves.**

Prior to starting injection valve test, fill reservoir of tester and vent the unit. For testing, use kerosene exclusively.



107-10592

Replace injection valves beyond tolerance. Injection valves can be individually replaced within a set.



107-14212

Testing

Remove injection valves for testing (07.3–215).

1 Coarse leak test:

a) Connect removed injection valves to tester. Vent pressure line with shutoff valve opened and coupling nut released. Then tighten coupling nut.

b) **Open shutoff** valve, slowly actuate hand lever (4 s/stroke) and establish pressure up to max. 1.5 bar gauge pressure. If a leak on injection valve shows up, replace injection valve.

2 Check opening pressure.

With new injection valves 3.5-4.1 bar gauge pressure
With used injection valves min. 3.0 bar gauge pressure

Close shutoff valve. Flush injection valve by actuating hand lever several times fast.

Open shutoff valve and test opening pressure by means of slow movements of hand lever.

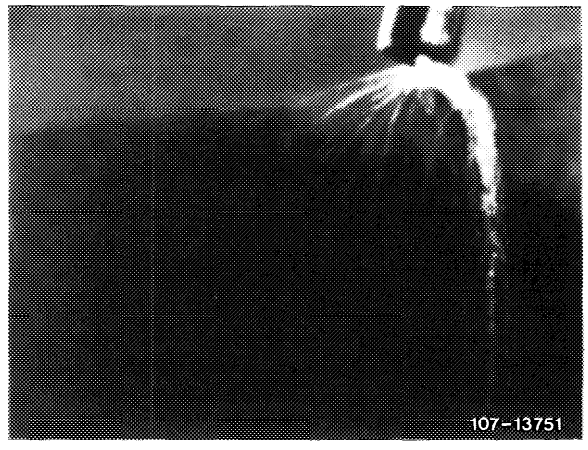
3 Precision leak test:

Close shutoff valve. Flush injection valve by a number of fast movements of hand lever. Open shutoff valve and increase pressure slowly up to 0.5 bar gauge pressure below the previously determined opening pressure and hold. No drops should show up on injection valve within 15 seconds.

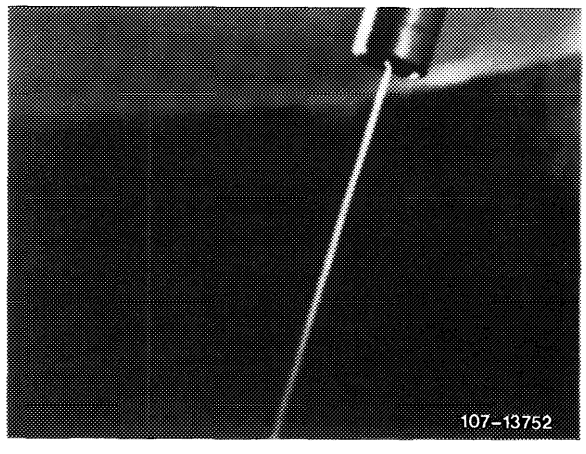
4 Buzzing test, evaluation of **jet**

Close shutoff valve and flush valve by actuating lever several times (0.5 s/stroke). Then reduce speed of lever actuation to approx. 1 s/stroke. Valve should be buzzing. No drops should show up at mouth of valve. There should be no cord-type jet. One-sided, atomized jet formation within a total jet angle (injection angle) of approx. 35^{o} is permitted.

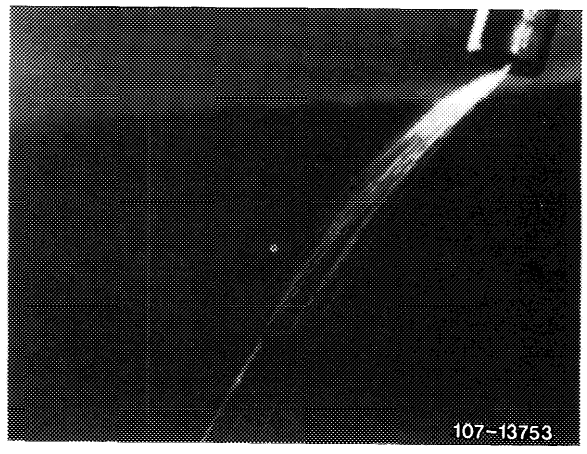
faulty injection valves



Formation of drops

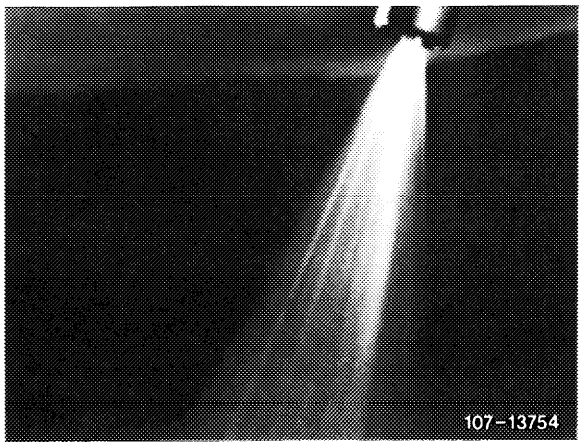


Cord-type jet

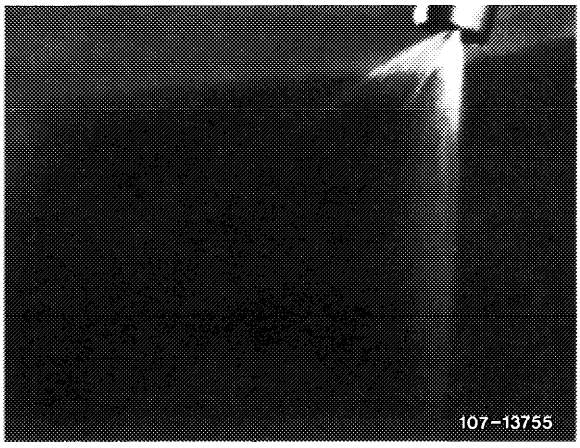


Spreading jet

Good injection valves



Well-proportioned jet



Slightly one-sided atomization

07.3-I 52 Testing, replacing throttle valve switch

Job No. of work unit or standard texts and flat rates data 07-1689.

Conventional tool

Ohmmeter

Note

Remove throttle valve housing to replace throttle valve switch (07.3-230).

Checking

1 **Set ohmmeter to measuring range of 0—∞ Ω.**

2 Check full throttle stop. Push throttle valve to full throttle stop for this purpose. The readout will then be 0 Ω.

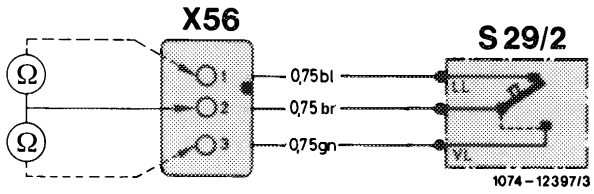
3 Turn throttle valve slightly in direction of idling, readout should move to ∞ Ω.

4 Check idle speed stop.

Push throttle valve to idle speed stop. Turn throttle valve until the readout shows 0 Ω.

Lift throttle valve by 0.2 mm, readout should move to ∞ Ω.

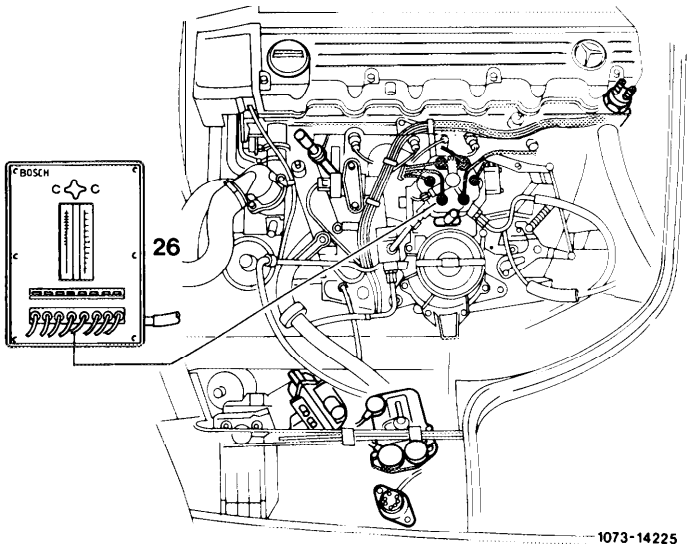
Idle speed contact:	**Idle speed position approx. 0 Ω**
	Full load position approx. ∞ Ω
Full load contact:	**Idle speed position approx. ∞ Ω**
	Full load position approx. 0 Ω
	Partial load position approx. ∞ Ω



S29/2 Throttle valve switch full load/idle speed detection
X56 Plug connection throttle valve switch

07.3-160 Perform fuel quantity comparison measurement

Job No. of work unit or standard texts and flat rates data 07-1609.

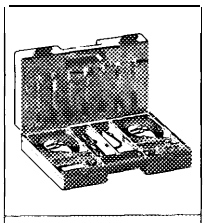


Injection lines	Unscrew
Quantity comparison measuring unit (26)	Connect
Fuel pump relay	Pull off. Bridge jacks 7 and 8. Special tool 201 589 00 99 00
Air flow sensor plate	Deflect and vent quantity comparison measuring unit
Air flow sensor plate	Locate
Test sheet.	Complete. Compute difference between smallest and largest flow quantity (for nominal values refer to Table)
Injection lines	Connect
Fuel pump relay	Plug on. Run engine and check all fuel connections for leaks
Idling speed	Adjust (07.3-100)

Test values

Simulated operating mode	Flow rate (minimum quantity) per connection in cc/min	Max. dispersion in cc/min
Idling speed	4	0.4
Partial load	30	4.0
Full load	100	10.0

Special tool



201 589 00 99 00

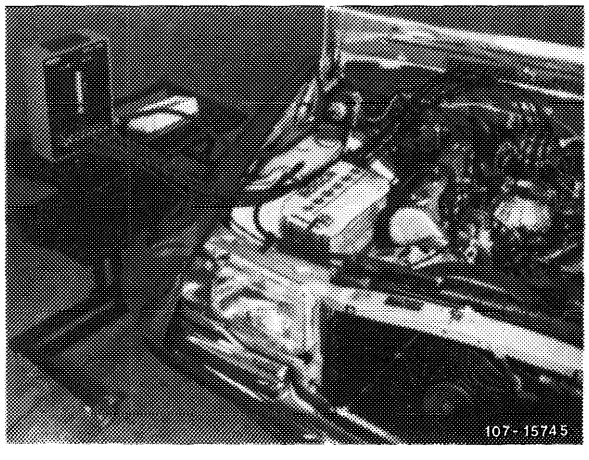
Conventional Bosch testers and accessories

Designation	Order designation
Quantity comparison unit	KDJE-P 300
Tester carriage[1]	M 200/2 or KDJE-W 100

[1]) If the tester carriage is used for the quantity comparison measuring unit, an additional angle plate is required. The plate can be self-made or acquired from a Bosch agency.

Note

A quantity comparison measuring unit is available to check the fuel distributor in vehicle. The unit serves to measure the individual fuel quantities which the fuel distributor distributes to the injection valves. The measuring proceeds with the engine stopped. The operating mode (idling speed, partial or full load) is simulated and adjusted on air flow sensor plate by means of an adjusting device.

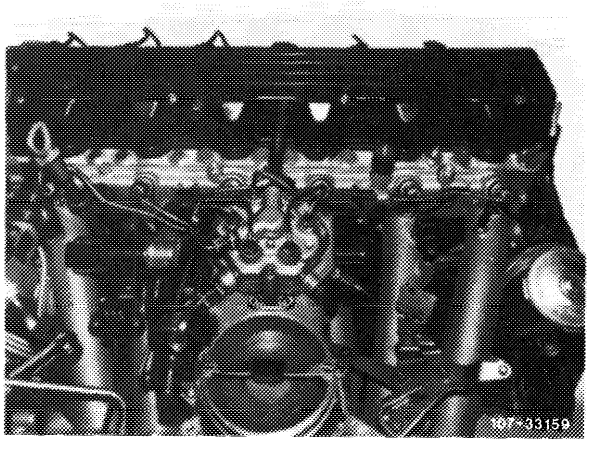


Testing

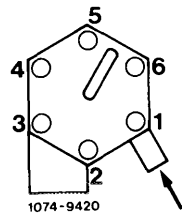
1 Place quantity comparison measuring unit horizontally adjacent to vehicle (tool or tester carriage).

2 Remove air cleaner.

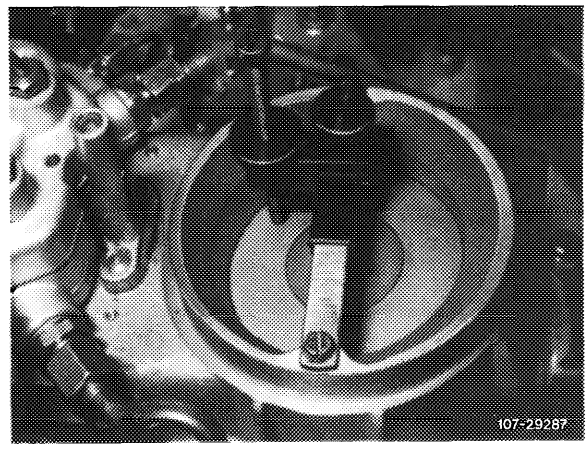
3 Unscrew injection lines on fuel distributor and release at injection valves, unscrew if required.



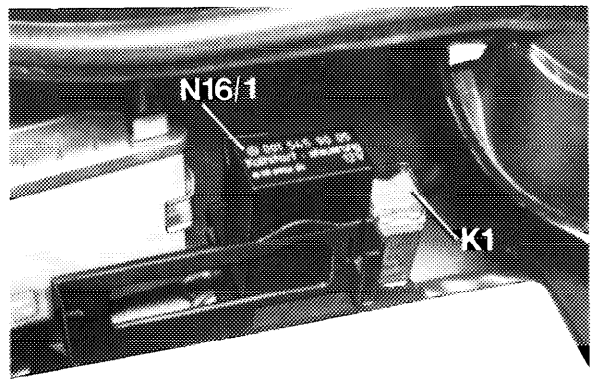
4 Attach connecting lines of quantity comparison measuring unit to fuel distributor (sequence according to Fig.) and insert fuel return line into filler neck of fuel tank.



5 Clamp adjusting device for fixing air flow sensor plate to stop bracket of air funnel.



6 Pull off fuel pump relay and bridge the two jacks 7 and 8. This will energize the fuel pump.



7 Deflect air flow sensor plate and quickly push buttons 1 to 6 individually for venting the equipment.

8 Keep one button pushed, deflect air flow sensor plate by means of adjusting device and fix an air flow rate of 4 cc/min (idling speed).

9 Push the remaining buttons, read the individual flow quantities and enter on test sheet.

Max. dispersion:
Idling speed 0.4 cc/min

Note: Orders for test sheets, print No. 800.99.472.00 should be directed by branches and general agencies in the Federal Republic of Germany on punched cards to the ,,Drucksachen-Zentrallager in Stuttgart-Untertiirkheim" and by the general representatives in export countries to ZKD/MI 2, Stuttgart-Unterttirkheim. The data sheets are available in blocks of 50 sheets each.

10 Compute the difference between the smallest and the largest flow quantity and compare with tolerance value.

11 For partial and full load, fix air flow sensor plate as described under item 8 at a flow rate of 30 cc/min or 100 cc/min. Then also compute the difference between the smallest and the largest flow rate and compare with tolerance value.

Max. dispersion:
Partial load 4.0 cc/min
Full load 10.0 cc/min

12 If the dispersion is beyond tolerance, exchange fuel distributor.

13 Run engine and check all fuel connections for leaks.

14 Adjust idling speed (07.3–100).

07.3-165 Testing relay fuel pump

Job No. of work unit or standard texts and flat rates data 07-5792

Function

The fuel pump relay for energizing the fuel pump has the following functions:

1. Activation of fuel pump when starting and with the engine running.

2. Rpm limitation after attaining engine max. speed.

3. Switching off fuel pump as soon as there are no more impulses via terminal TD of switching unit.

4. Kickdown cutout.

5. Starting valve activation.

Conventional tester

Multimeter	e.g. Sun, DMM-5

Test condition

Battery charged to min. 60 %.

If the engine is not regulated (breakaway speed) when the engine max. speed is attained, replace fuel pump relay.

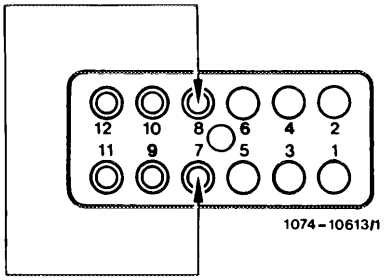
The respective breakaway speed is stamped on fuel pump relay.

For starting valve activation, refer to 07.3-l 26.

Testing relay, fuel pump

Pull off relay, fuel pump. Bridge jack 7 (terminal 87) and jack 8 (terminal 30). Fuel pump will be audibly running.

Ok | Not ok



Switch on ignition. Set multimeter to volts. Test voltage on jack 9 (terminal 15) against jack 11 (terminal 31).

Voltage approx. 12 volts

Ok | Not ok

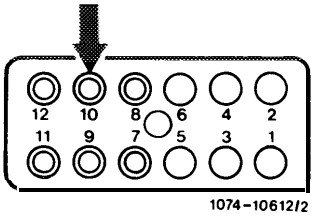
Repair interruption according to wiring diagram.

Bridge jack 7 and 8. Set multimeter to volts.
Test voltage on jack 10 (terminal TD) against jack 11 (terminal 31), start engine for this purpose.

Voltage 6-l 2 volts

Ok | **Not ok**

Repair interruption according to wiring diagram or test ignition switching unit.



Stop engine. Install relay, fuel pump. Switch on ignition. Fuel pump will temporarily start.

Ok | **Not ok**

Replace relay, fuel pump.

End of test

Test voltage on jack 8 (terminal 30) against jack 11 (terminal 31).
Set multimeter to volts.

Voltage approx. 12 volts

Ok	Not ok

Repair interruption according to wiring diagram.

Bridge jack 7 and 8.
Test voltage at fuel pump.

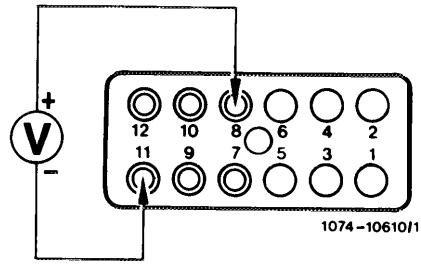
Voltage approx. 12 volts

Ok	Not ok

Replace fuel pump.

Repair interruption according to wiring diagram.

End of test



Testing kickdown cutout

Pull plug from kickdown switch.
Set multimeter to volts. Start engine and test voltage.
With selector program
jack 2 to ground.
Without selector program (AUS) (J) (USA)
jack 1 to ground.

Voltage approx. 12 volts

Ok	Not ok

Repair interruption according to wiring diagram.

Test voltage on plug, kickdown switch.
With selector program
jack 2 and 4.
Without selector program (AUS) (J) (USA)
jack 1 and 2.

Voltage approx. 12 volts

Ok	Not ok

Increase engine speed.
Voltage should drop at a speed approx. 200 rpm prior to attaining breakaway speed.

Ok	Not ok

Replace relay, fuel pump.

Stop engine. Set multimeter to ohms.
Test kickdown switch for continuity.

With selector program
jack 2 and 4.
Without selector program (AUS) (J) (USA)
jack 1 and 2.

Kickdown switch
actuated 0 Ω
not actuated ∞ Ω

Ok	Not ok

Replace kickdown switch.

End of test

Pull plug from solenoid valve (Y3). Set multimeter to volts. Test voltage to ground, while actuating kickdown switch manually (not with accelerator pedal).

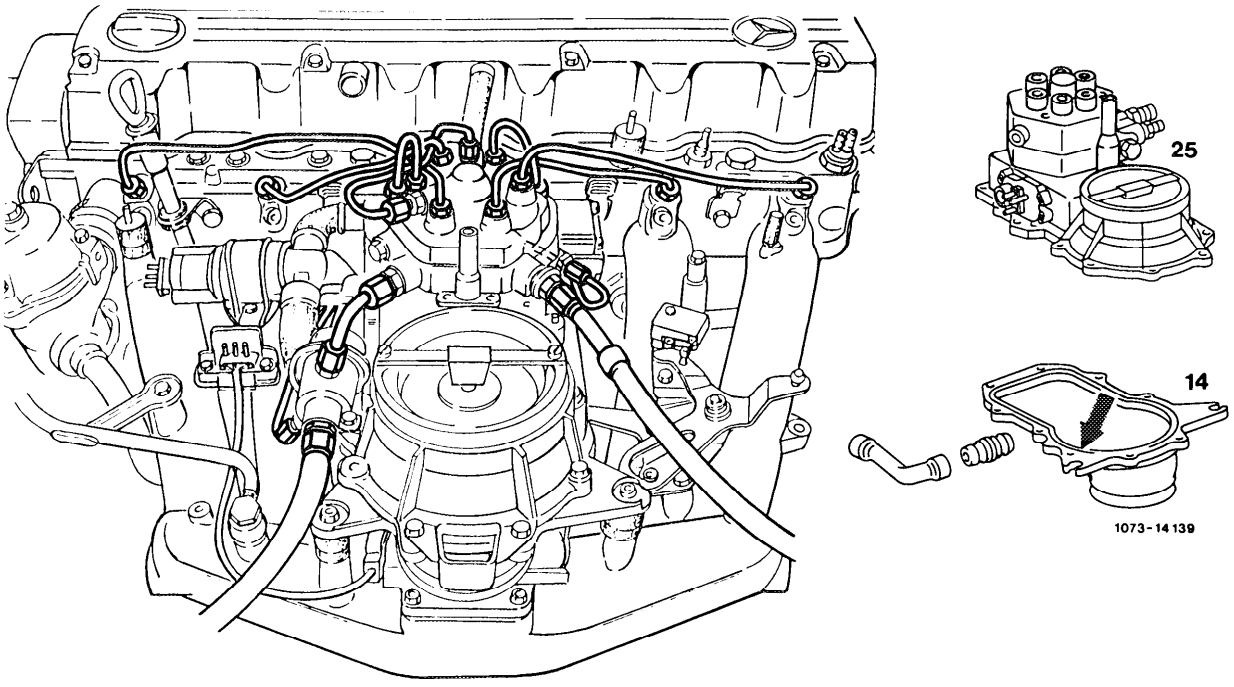
Voltage approx. 12 volts.

Ok	Not ok
Replace solenoid valve.	Repair interruption according to wiring diagram.

End of test

07.3-200 Removal and installation of mixture control unit

Job No. of work unit or standard texts and flat rates data 07-1668



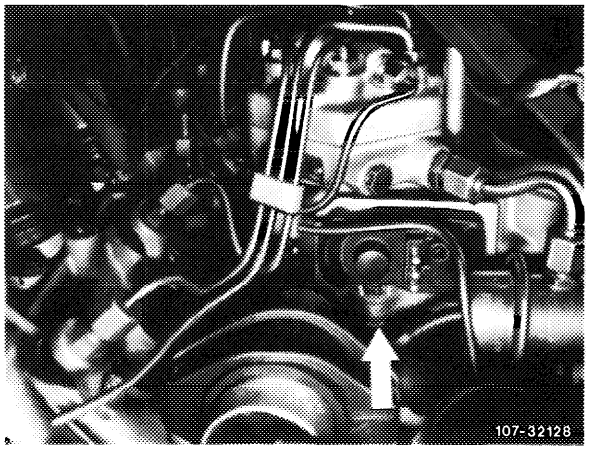
Mixture control unit (25) ..... Remove and install together with air guide housing (14) (07.3-225)

Air guide housing (14) ..... Unscrew from mixture control unit (25). Replace damaged parts.
Do not use sealing compound during assembly. Sealing is performed by sealing lip (arrow).

The air guide housing is made of rubber. It is fastened to light-alloy frame by means of buttons.

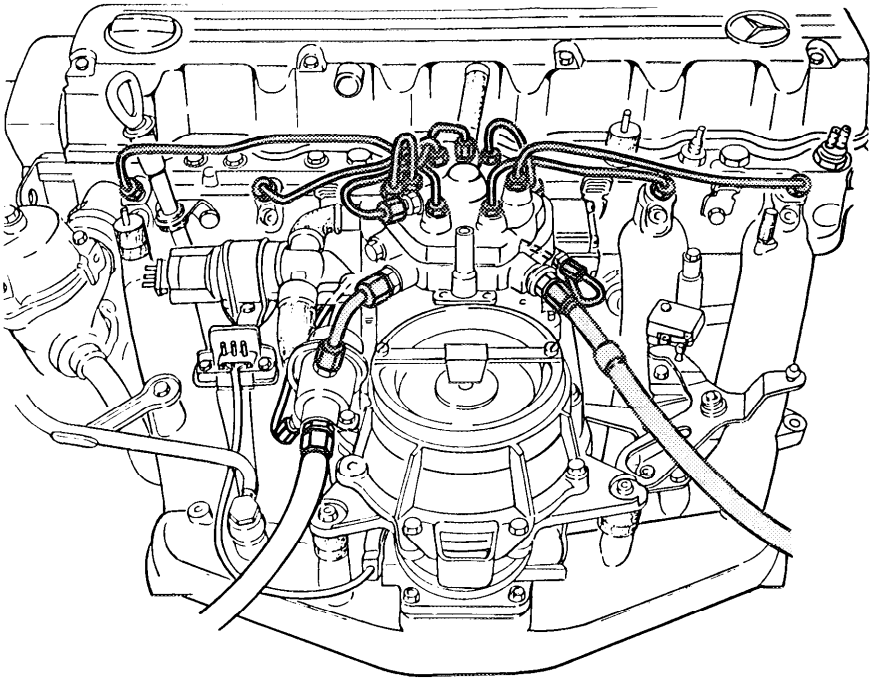
Note

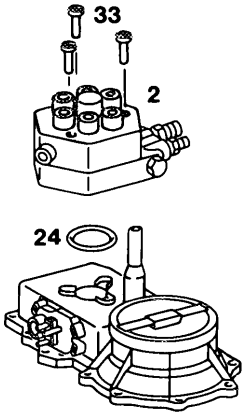
Screws of different length are used for fastening air guide housing to air volume meter (air flow sensor). For this reason, make sure that the removed screw below sensor, air volume meter (arrow) is again installed there. Using a longer screw will damage sensor of air volume meter.



07.3-205 Replacing fuel distributor

Job No. of work unit or standard texts and flat rates data 07-1674





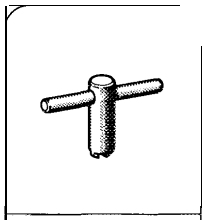
1073-14141

Fuel and injection lines.	Screw off and on, 10-l 5 Nm (reference value)
Fastening screws (33)	Screw off and on
Fuel distributor (2)	Remove by turning to and fro
Rubber sealing ring (24)	Replace, lubricate slightly, carefully mount fuel distributor
Test coordination of control piston in relation to air flow sensor plate and adjust, if required	For this purpose, pull off fuel pump relay and bridge jacks 7 and 8. The fuel should now just stop or start to flow at outlet connection for injection lines, adjust coordination by means of idle speed mixture control screw, if required.
Adjust idling speed (07.3–100)	Check all fuel connections, as well as rubber ring on fuel distributor for leaks by means of spray test.

07.3-207 Replacing sealing ring for control piston

Job No. of work unit or standard texts and flat rates data 07-1660

Special tool

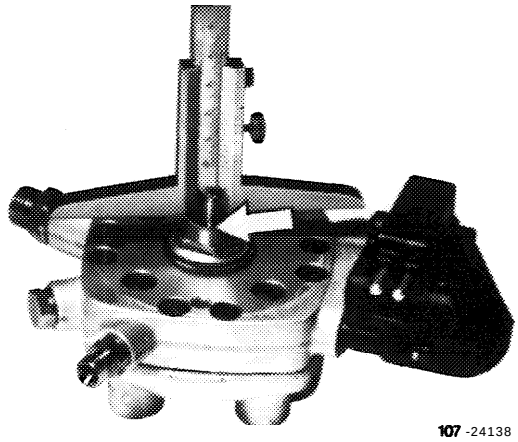


102 589 00 07 00

Replacing

1 Unscrew fuel distributor (07.3–205).

2 Measure position of closing plug with depth gauge (arrow) and mark position with scriber.



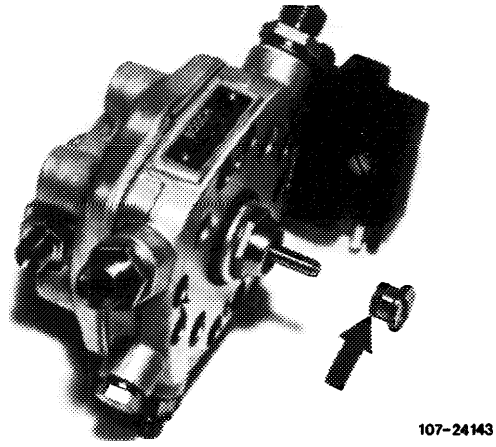
107-24138

3 Unscrew closing plug and replace contour ring (arrow).

4 Screw in closing plug to previous input value and mark.

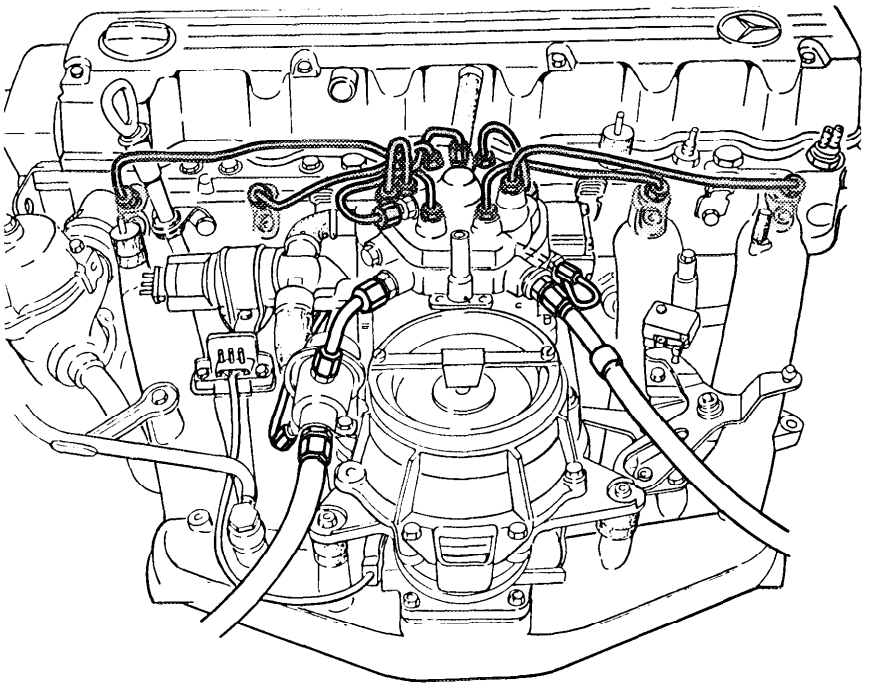
Attention!
Be sure to maintain previous input value.

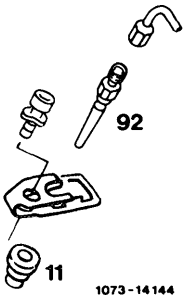
If not, basic adjustment of control piston will be wrong.



107-24143

Job No. of work unit or standard texts and flat rates data 07-6520

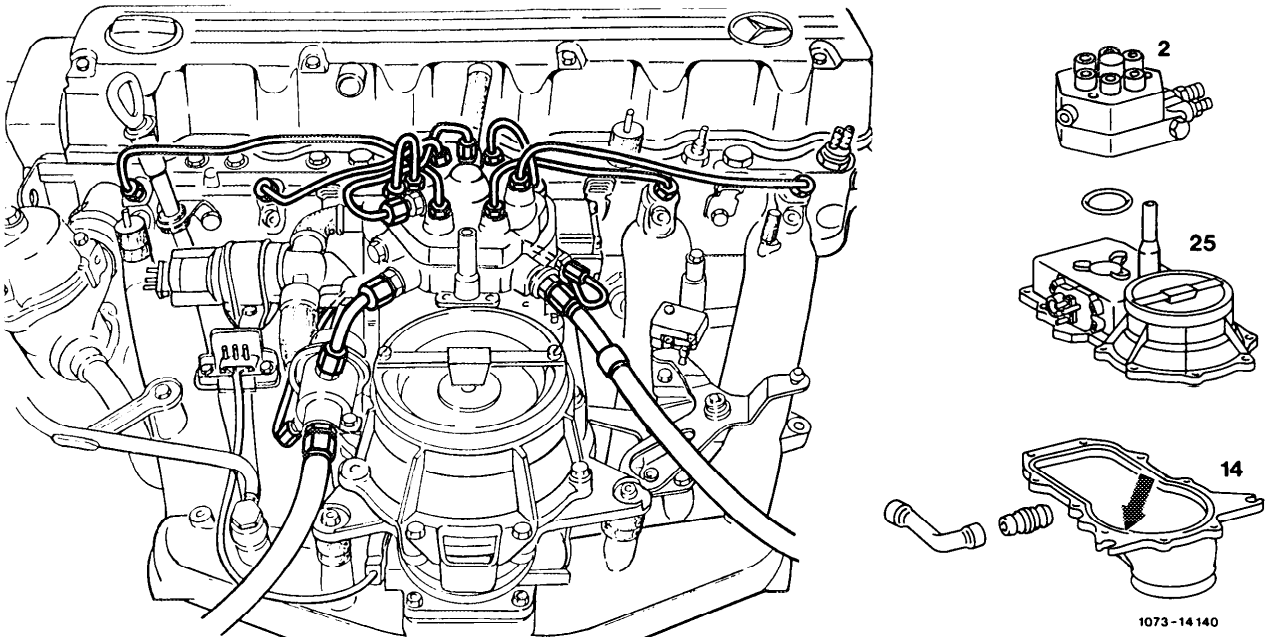




Injection lines	Remove and install, apply counterhold to injection valves. 1 O-l 5 Nm (reference value)
Holder.	Unscrew
Injection valves (92)	Pull out
Rubber sealing ring (11)	Replace

07.3-220 Replacing air volume meter

Job No. of work unit or standard texts and flat rates data 07-1686

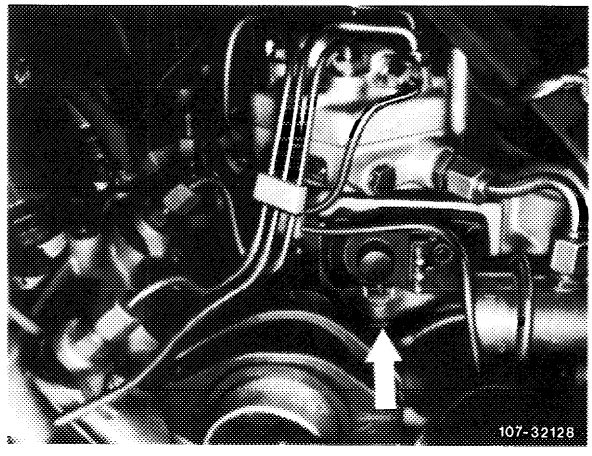


Mixture control unit (25)	. . . . .	Remove and install together with air guide housing (07.3–225)
Air guide housing (14).	. . . . .	Unscrew from mixture control unit (25). Replace damaged parts. Do not use sealing compound during installation. Sealing is performed by sealing lip (arrow). The air guide housing is made of rubber. It is fastened to light-alloy frame by means of buttons.
Fuel distributor (2)	. . . . .	Remove and install (07.3–205)

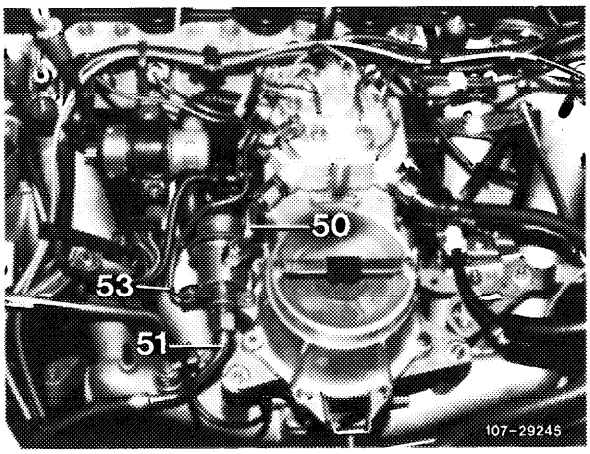
Note

Screws of different length are used for fastening air guide housing to air volume meter (air flow sensor). For this reason, make sure that during disassembly the removed screw below sensor of air volume meter (arrow) is again installed there.

Using a longer screw will damage sensor of air volume meter.

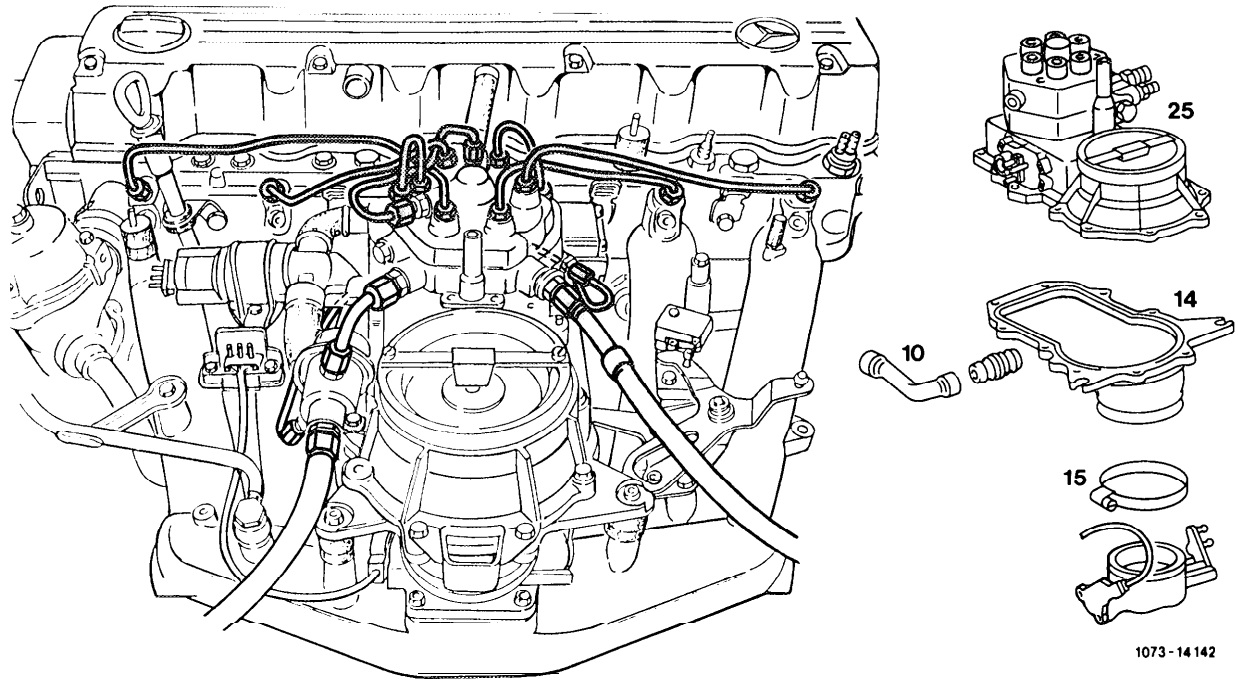


When loosening fuel line (50), fuel distributor to diaphragm pressure regulator make sure that the open-end wrench is not pressing against sensor for air volume meter and will damage the latter.



07.3-225 Removal and installation of mixture control unit with air guide housing

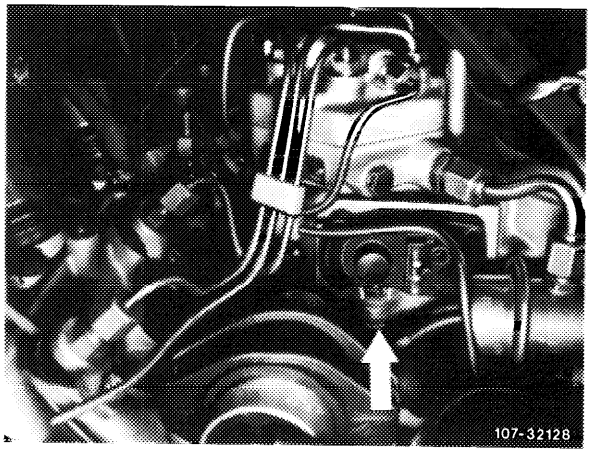
Job No. of work unit or standard texts and flat rates data 07-1668



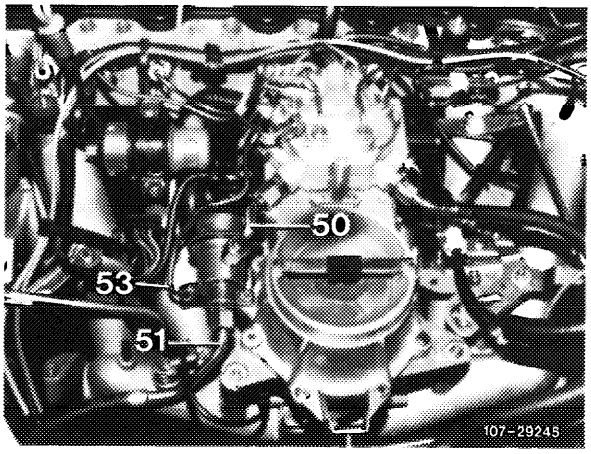
Fuel and injection lines.	Screw **off and** on. 10—15 Nm (reference value)
Electric lines	Disconnect and connect
Diaphragm pressure regulator	Screw off and on
Fastening nuts on rubber buffer	Screw off and on, 9-10 Nm (reference value)
Hose clamp (15)	Loosen, tighten
Mixture control unit (25)	Lift with air guide housing (14), while pulling off idle speed air hose (10)
Engine	Run engine and check all fuel connections for leaks
Idling speed	Adjust (07.3-100)

Note

Screws of different length are used for fastening air guide housing to air volume meter (air flow sensor). For this reason, make sure that during disassembly the removed screw below sensor of air volume meter (arrow) is again installed there. Using a longer screw will damage sensor of air volume meter.

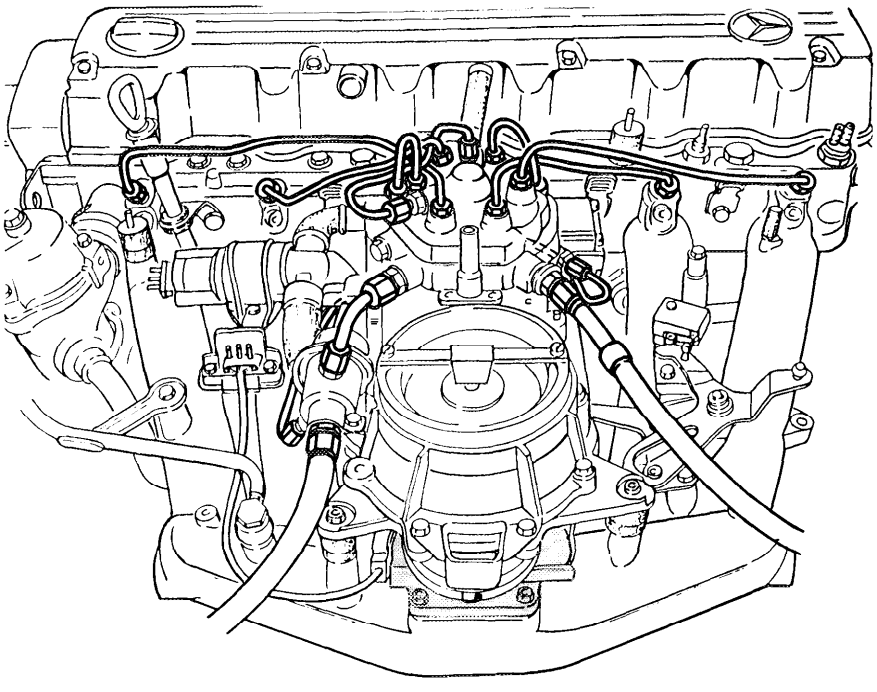


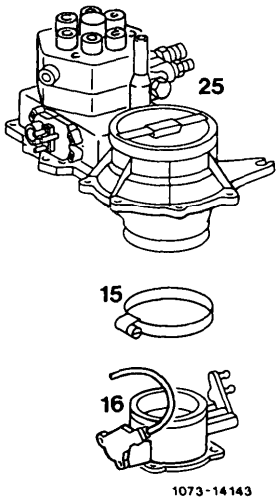
When loosening fuel line (50), fuel distributor to diaphragm pressure regulator make sure that the open-end wrench is not pressing against sensor for air volume meter and will damage the latter.



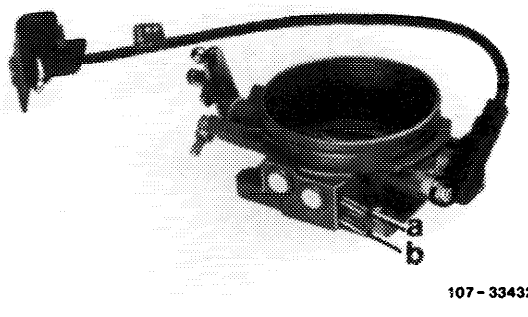
07.3430 Removal and installation of thrdttle valve housing

Job No. of work unit or standard texts and flat rates data 07-6210





Hose clamp (15)	Loosen, tighten
Mixture control unit (25)	Unscrew fastening nuts on front vibration dampers and pull out mixture control unit in upward direction
Return spring and regulating rod on throttle valve housing	Disengage, engage
Throttle valve housing (16)	Unscrew and remove. Use new gasket during installation
Vacuum lines and electrical connection for throttle valve switch	Disconnect, connect
Slotted lever	Adjust (30-300)
Idling speed	Adjust (07.3-l 00)

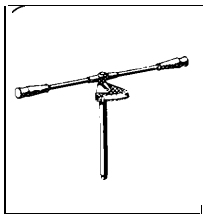


a To thermovalve
b Connection suction line to purge valve for fuel evaporation control system

07.3-245 Replacing, centering air flow sensor plate, testing and adjusting zero position of air flow sensor plate

Adjusting job No. of work unit or standard texts and flat rates data 07-1612, replacing 07-1665.

Special tool



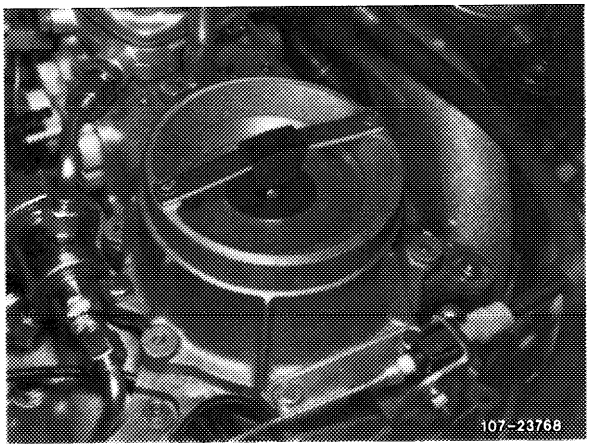
0005696721 00

Conventional units and tools

Hot air blower, tap M 6

Tightening torque	Nm
Fastening screw for air flow sensor plate	5.0-5.5

Removal



1 Remove air cleaner.

2 Unscrew stop bracket.

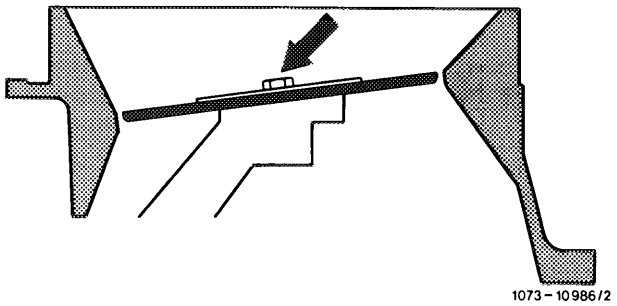
3 Heat fastening screw for air flow sensor plate with a hot air blower and carefully unscrew (avoid breaking off screw).

Attention!
The fastening screw is micro-encapsulated.

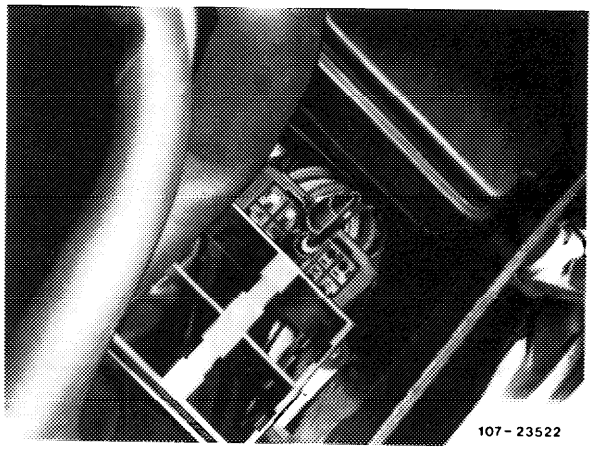
4 Clean bore for fastening air flow sensor plate with tap M 6.

Installation

5 Install parts of repair set. Insert air flow sensor plate and washer. Slightly attach micro-encapsulated fastening screws (arrow, self-locking).

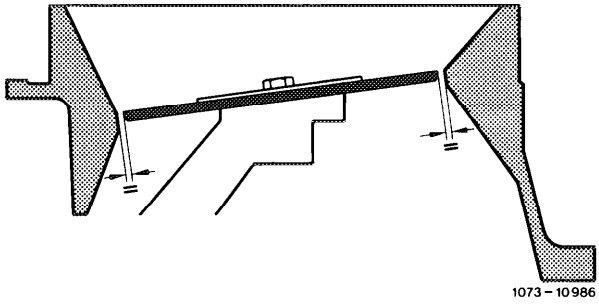


6 Center air flow sensor pla te. For this purpose, pull off fuel pump relay and bridge the two jacks 7 and 8 for a short period so that pressure will be established.



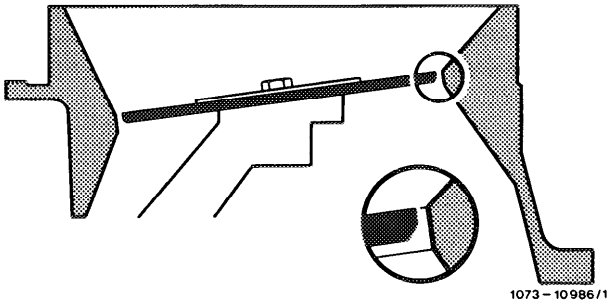
Use a slip gauge of approx. 0.05 mm to make sure that the air flow sensor plate is accurately centered. The air flow sensor plate should not bind even under slight, lateral pressure (bearing play cancelled).

7 Tighten fastening screw to 5.0-5.5 Nm and mount stop bracket.



8 Check air flow sensor plate for easy operation. For this purpose, push air flow sensor plate manually slightly down. Sensor plate should not bind. Release sensor plate, when moving back the sensor plate should also not bind and should audibly abut against resilient stop. Center air flow sensor plate once again, if required.

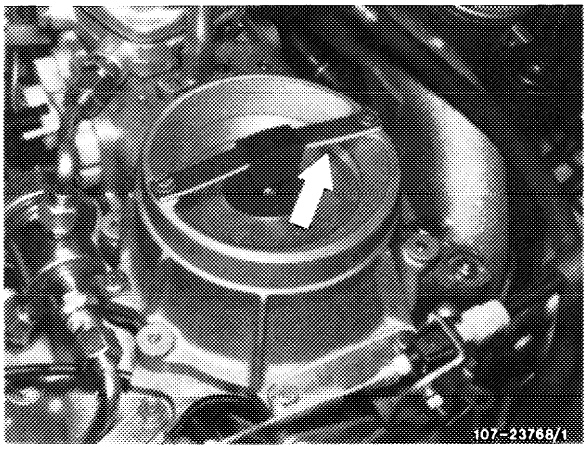
9 Test zero position (rest position) of air flow sensor plate. Upper edge of air flow sensor plate should be flush with upper edge of cylindrical part on air funnel.



The measuring point is directly underneath spring bracket (arrow).

A higher location up to max. 0.2 mm is permitted.

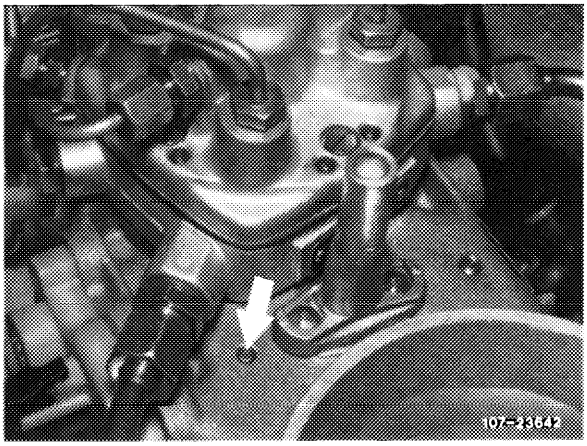
In this position, the clearance should be l-2 mm up to control piston when the air flow sensor plate is pushed.



10 Adjust to zero position of air flow sensor plate.

a) If sensor plate is located too high, knock guide pin (arrow) down as required by means of a mandrel.

b) If too low, remove mixture control unit and knock out guide pin from below (07.3-200).



Attention!
Displace guide pin very carefully, so that it is not displaced too far.

Avoid repeatedly displacing pin in both directions, since press-fit of pin will then be not tight enough.

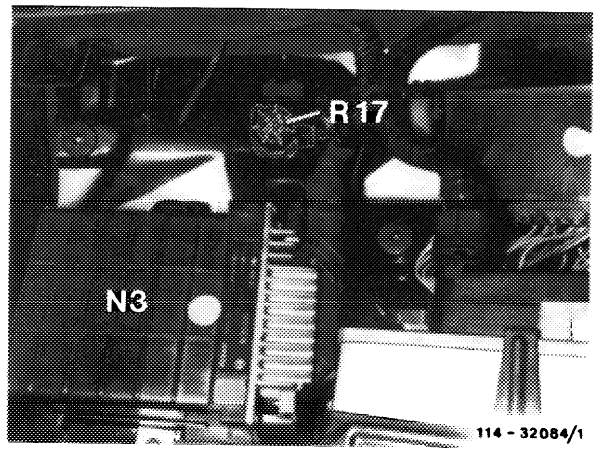
11 Mount fuel pump relay.

12 Adjust idling speed (07.3-100).

Job No. of work unit or standard texts and flat rates data 07-1698

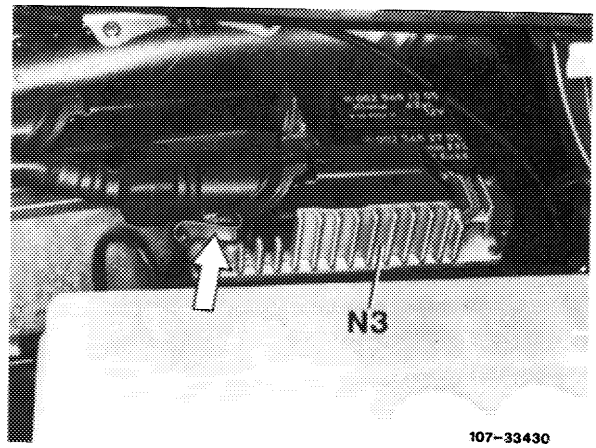
Layout CIS-E control unit (N3)

Model 107
At front right under leg support.

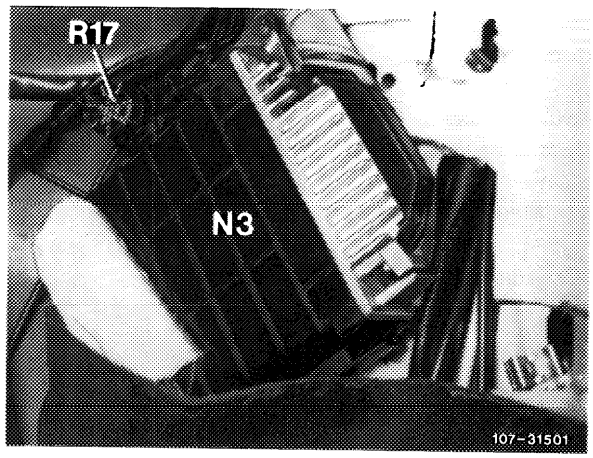


N3 Control unit
R 17 Adjustment plug CIS-E

Model 124
In unit compartment, right.

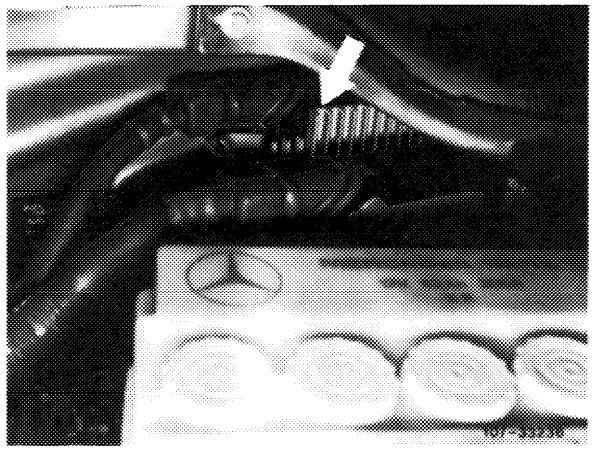


Model 126
In legroom, right, behind side panelling.



N3 Control unit
R 17 Adjustment plug CIS-E

Model 201
In unit compartment, right (arrow).



Removal, installation

1 **Pull plug from control unit. For this purpose, push sheet metal clip (arrow) down.**

2 Pull out control unit (N3) in upward direction.

Note: Model 124 and 201 remove 66 Ah batteries.

07.3–255 Replacing electrohydraulic actuator (EHA)

Job No. of work unit or standard texts and flat rates data 07-1692

Conventional tool

Screwdriver 2115-T 27	e.g. Hazet, D-5630 Remscheid

Tightening torque (reference value)

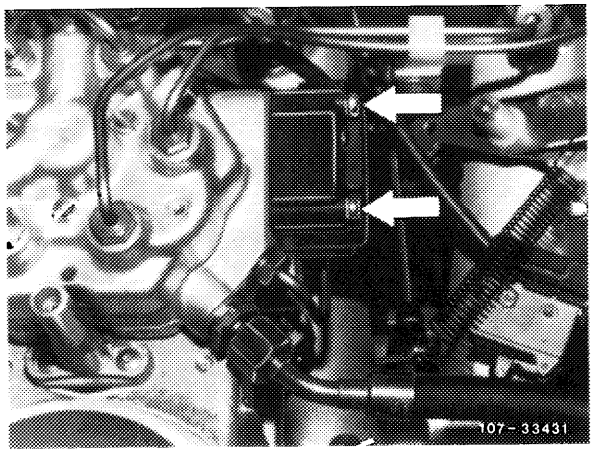
Fastening screws	3.0 + 0.5 Nm

Replacing

1 Pull off electric plug connection.

2 Reduce fuel pressure. For this purpose, loosen fuel line between fuel distributor and starting valve. Catch emerging fuel with a rag.

3 Unscrew both fastening screws (arrows).



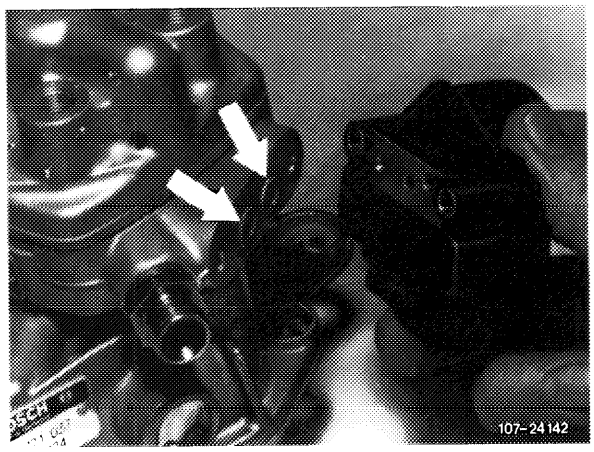
4 For installation, use 2 new O-rings (arrows) in reverse sequence.

Pay attention to special cleanliness of sealing surfaces. Clean with benzine and a non-fibrous rag.

5 Tighten fastening screws uniformly.
Pay attention to tightening torque.

6 Check fuel pressures once again.

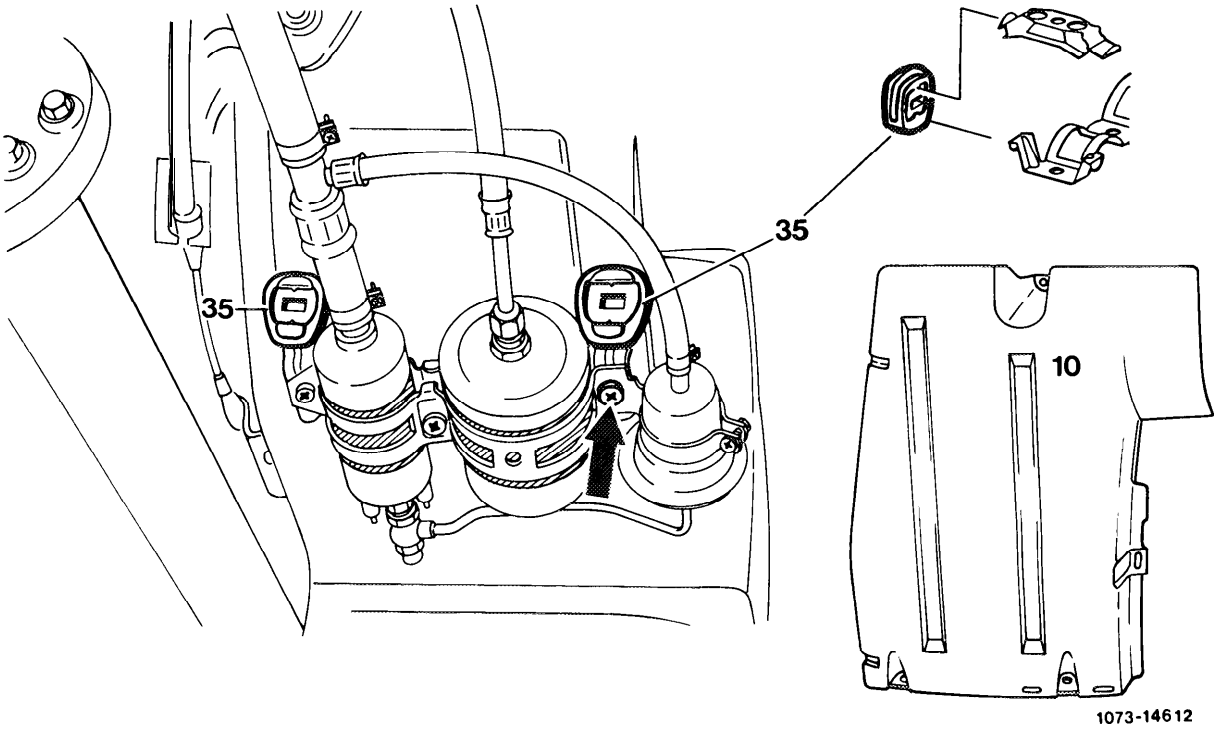
7 Check for leaks.



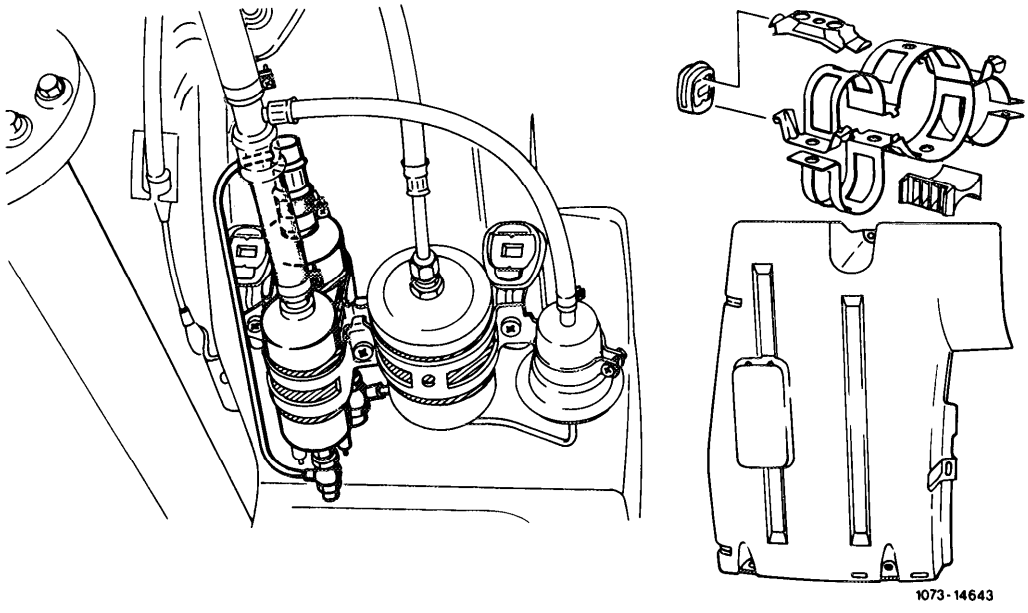
07.34268 Replacing rubber rings or rubber buffers for fuel pump package

Job No. of work unit or standard texts and flat rates data 07–5860/5862

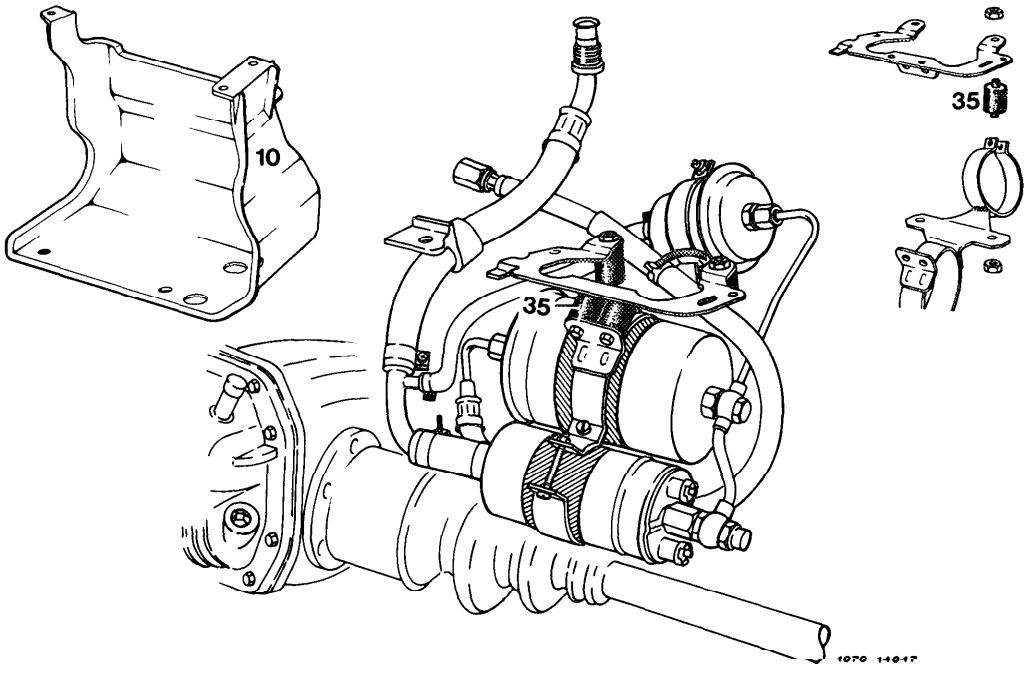
Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps

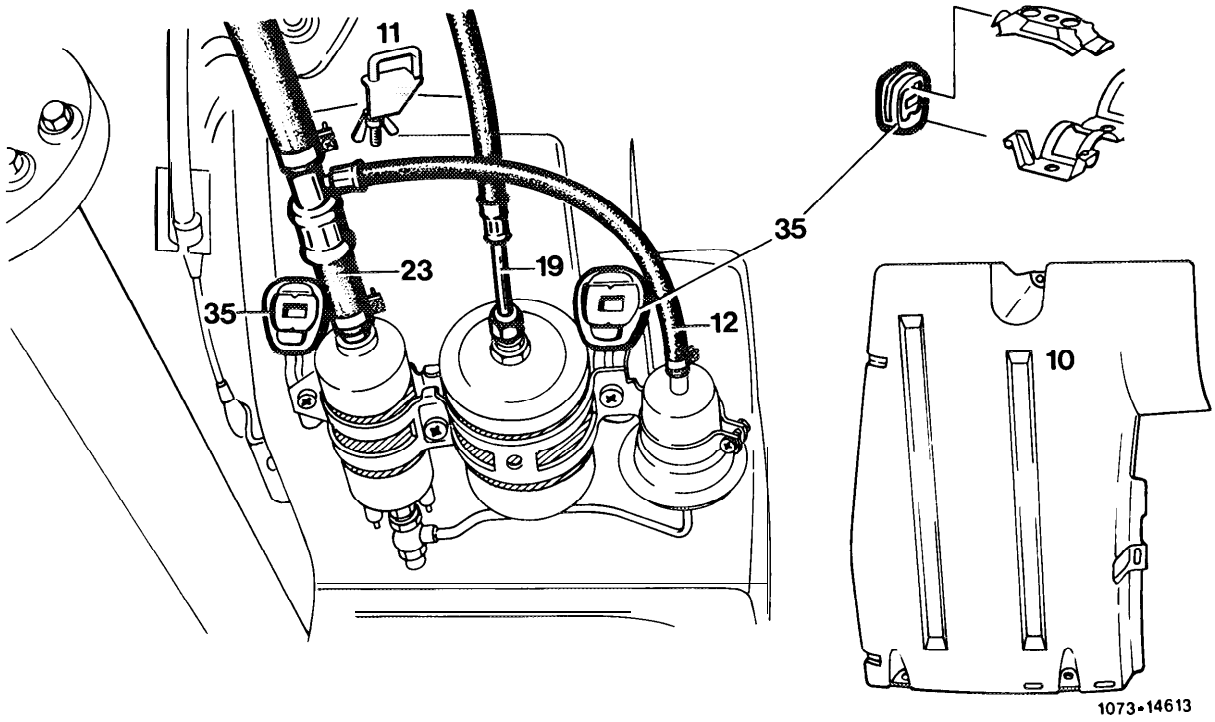


Model 107,126

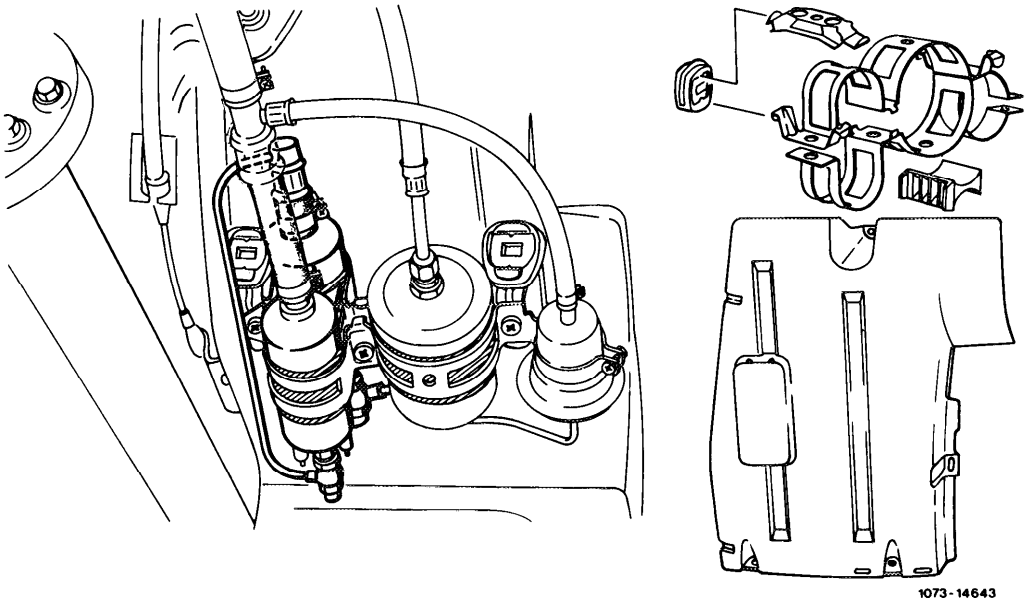


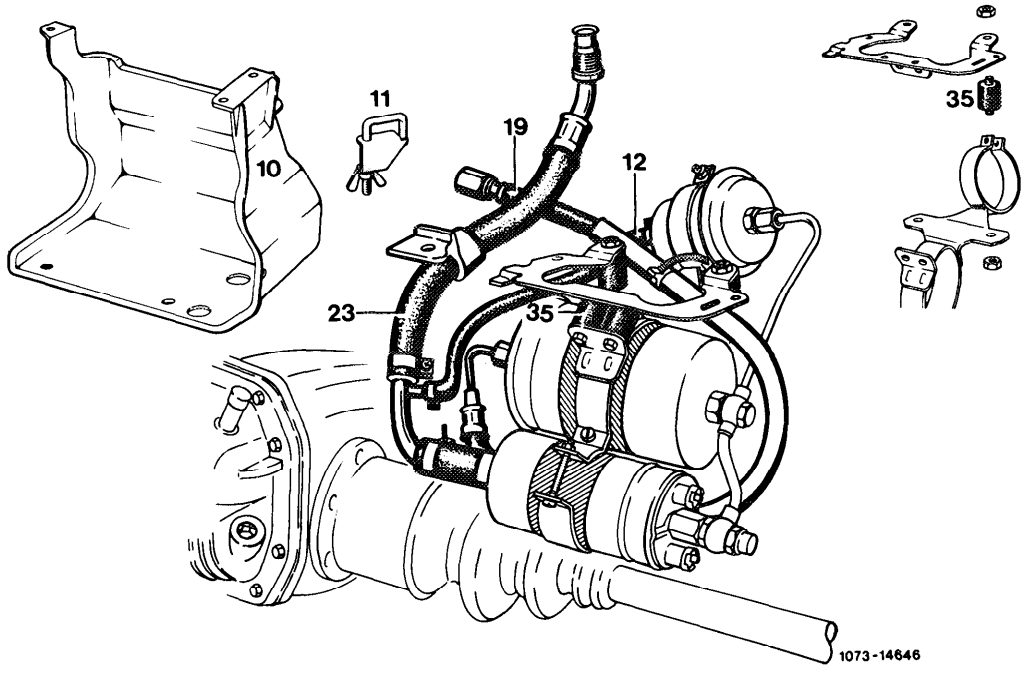
Protective box.	Screw off and on
Rubber rings or rubber buffer (35)	Remove and install, while paying attention to plastic clip for electric line (risk of breaking)
Fastening screw (arrow, model 124).....	Loosen for holder, fuel accumulator, pull slightly forward so that rubber strap will come out

Model 124
Fuel pump package with 1 fuel pump



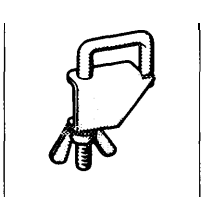
Model 124
Fuel pump package with 2 fuel pumps





Battery	Disconnect and connect
Protective box (10)	Screw off and on
Electric lines	Disconnect and connect
Fuel suction, pressure hose (19, 23)	Pinch with clamp (11) and remove Special tool 000 589 40 37 00 Attention! On model 124.090, pay attention to Note (07.3–280)
Fuel suction leak and pressure hose (12, 19, 23)	Screw off and on
Rubber rings or rubber buffer (35)	Remove and install

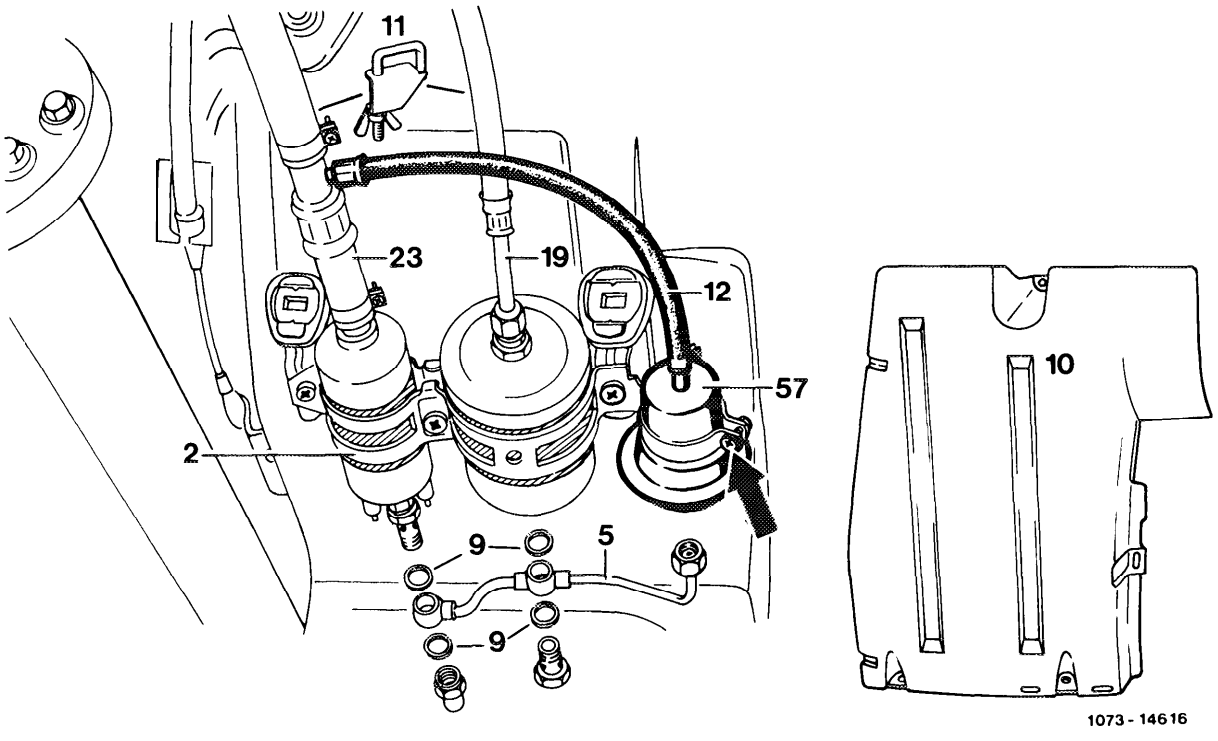
Special tool



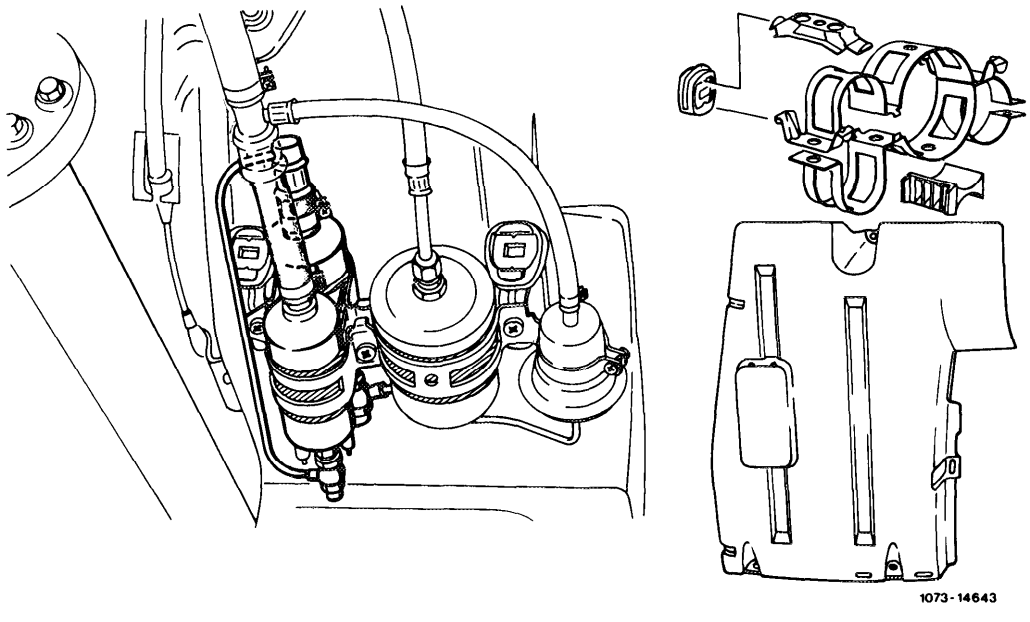
000 589 40 37 00

Job No. of work unit or standard texts and flat rates data 07-1683

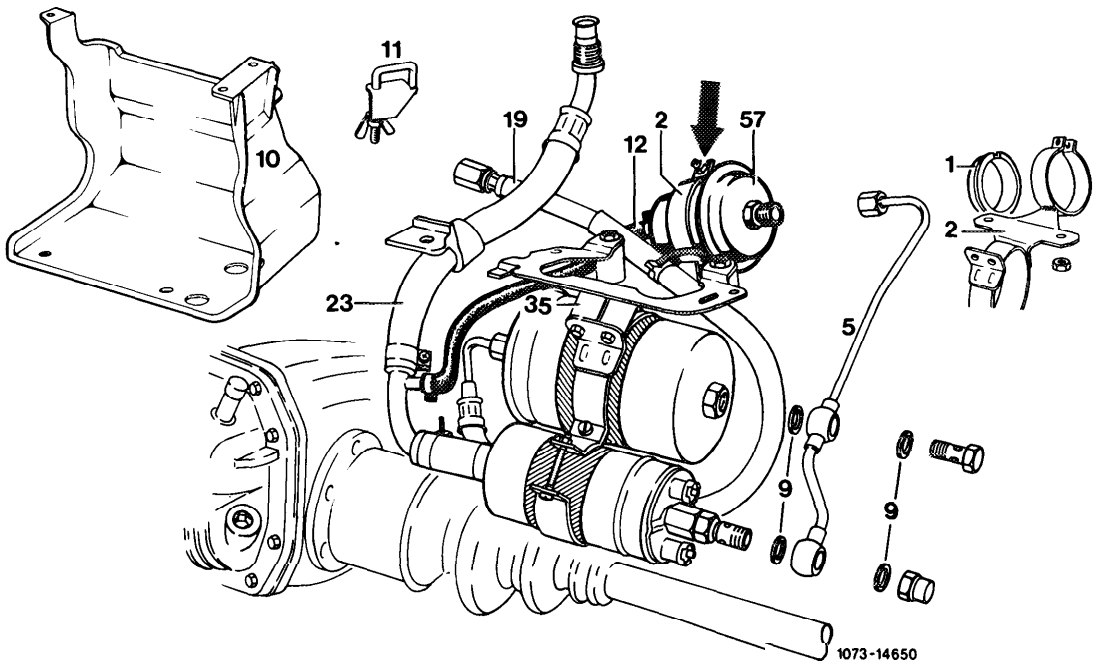
Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps

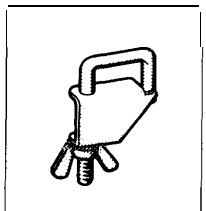


Model 107, 126



Gauge pressure in fuel tank	Exhaust gauge pressure, open closing cap for this purpose
Battery	Disconnect and connect
Protective box (10)	**Screw off and on**
Fuel suction (23) and pressure hose (19)	Pinch with clamp (11) and remove Special tool 000 589 40 37 00 **Attention!** On model 124.090, pay attention to Note (07.3–280)
Fuel line (5)	Unscrew on fuel accumulator, fuel pump and fuel filter
Leak hose (12)	Loosen and pull off
Fastening screw (arrow)	Remove on holder (2) and fuel accumulator (57). On model 107, 126 pay attention to spacing ring (1) in holder (2)
Sealing rings (9)	Replace
Run engine.	Check for leaks

Special tool

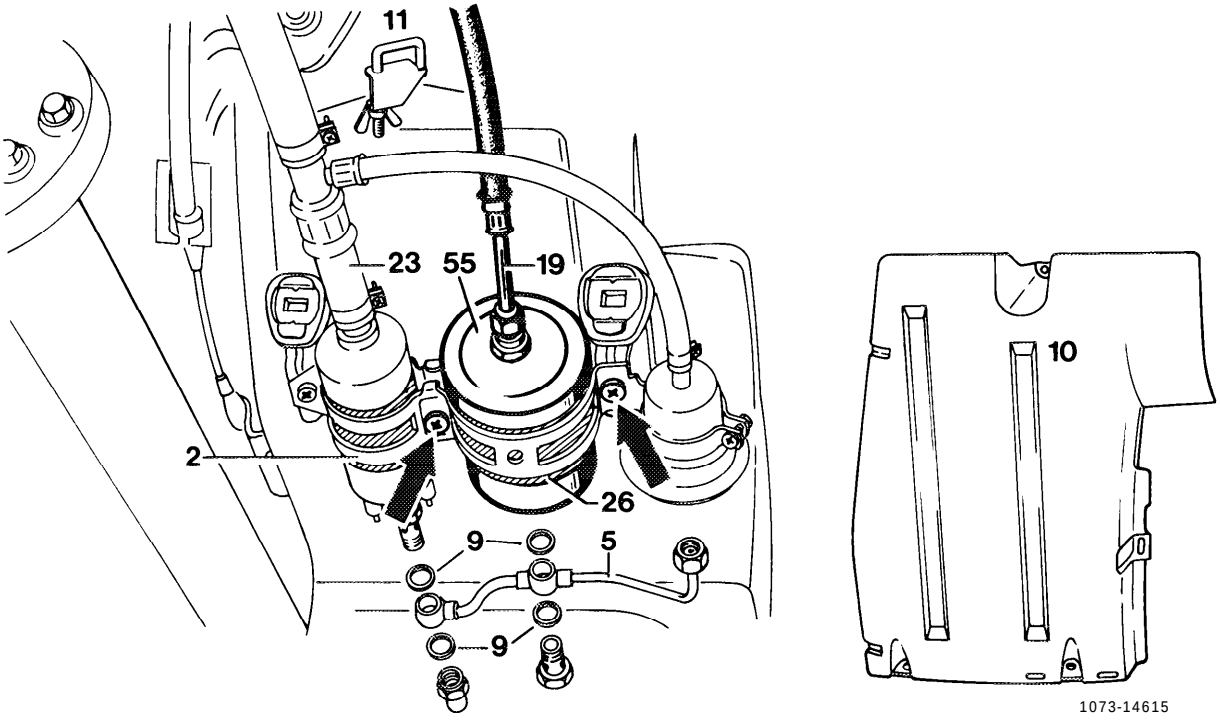


000 589 40 37 00

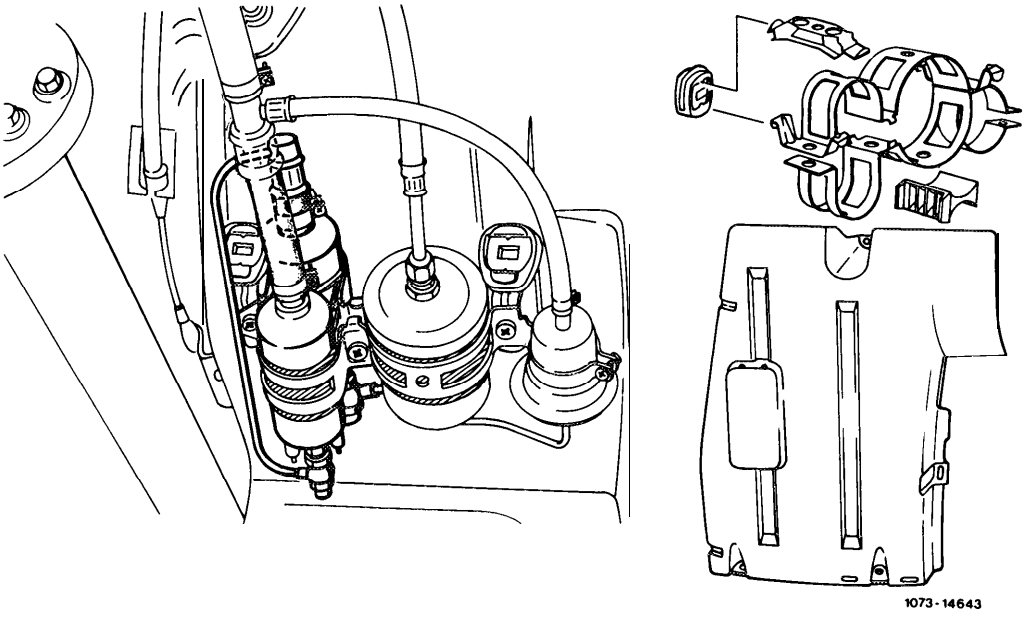
07.3-275 Removal and installation of fuel filter

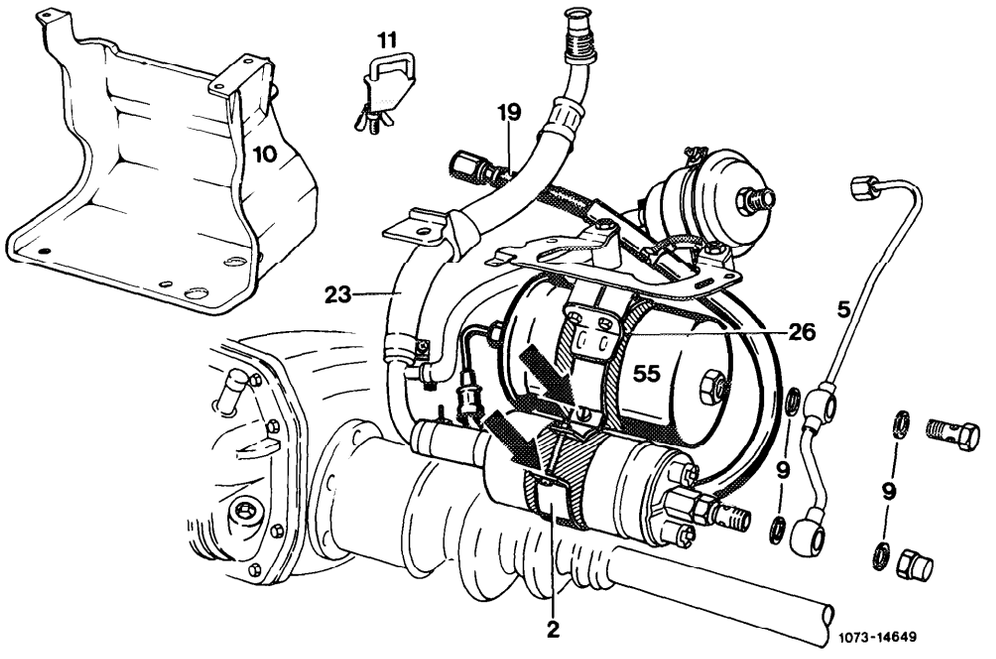
Job No. of work unit or standard texts and flat rates data 07-5563

Model 124
Fuel pump package with 1 fuel pump



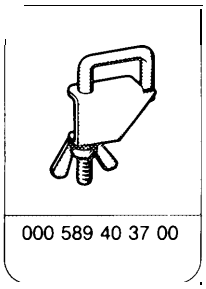
Model 124
Fuel pump package with 2 fuel pumps





Gauge pressure in fuel tank	Reduce gauge pressure, open closing cap for this purpose
Battery	Disconnect and connect
Protective box (10).	Screw off and on
Fuel suction (23) and pressure hose (19).	Pinch with clamp (11) and remove Special tool 000 589 40 37 00 Attention! On model 124.090 pay attention to Note (07.3-280)
Fuel line (5)	On fuel accumulator, fuel pump and fuel filter, screw off and on
Fuel pressure hose (19)	Screw off and on
Fastening screws (arrows)	Loosen on holder (2) and remove fuel filter (55)
Plastic sleeve (26).	Mount. (Pay attention to Note)
Sealing rings (9)	Replace
Run engine	Check for leaks

Special tool



000 589 40 37 00

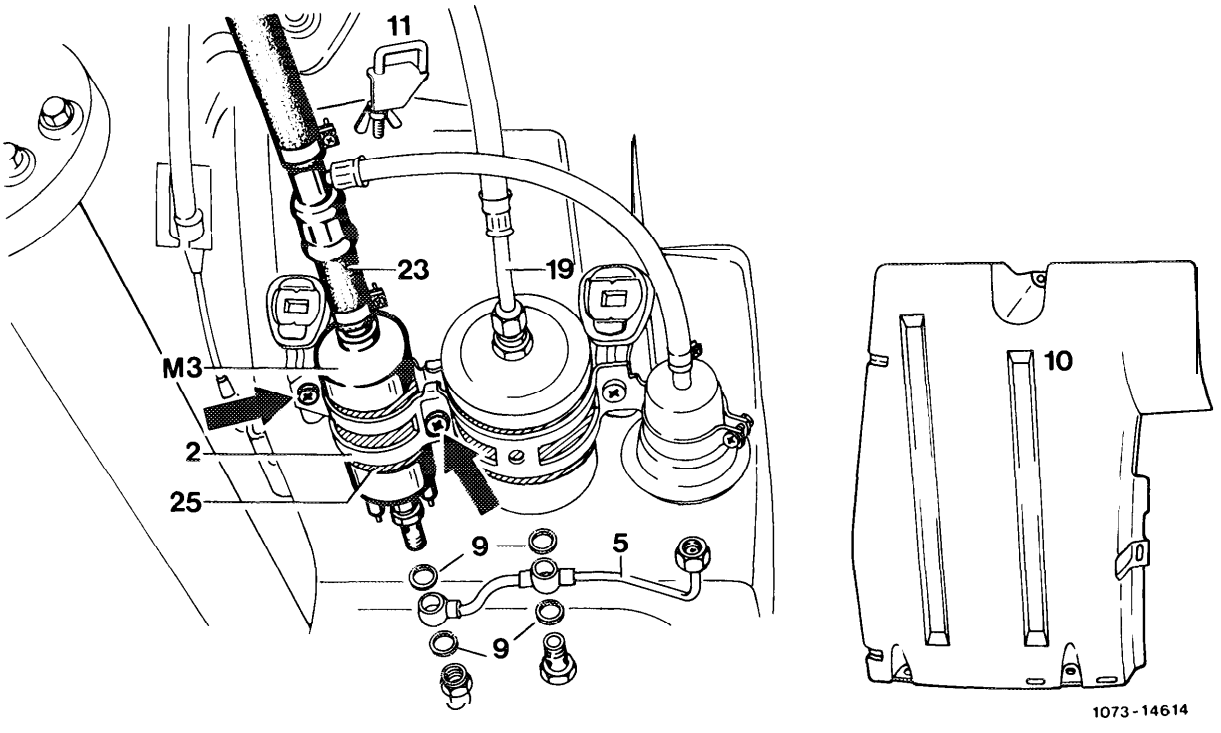
Note

To avoid contact corrosion the fuel filter is provided with a plastic jacket or a plastic sleeve.

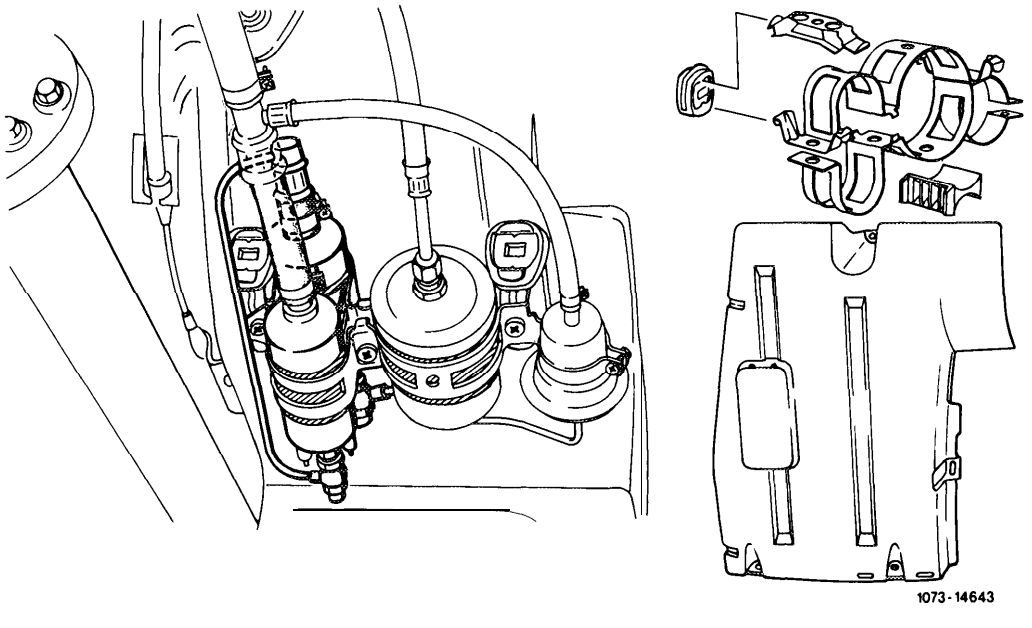
When replacing fuel filter, make sure that the plastic sleeve is mounted between fuel filter (55) and holder (2). The sleeve should project on both sides of holder, since direct contact of fuel filter with holder may lead to contact corrosion.

Job No. of work unit or standard texts and flat rates data 07-5710

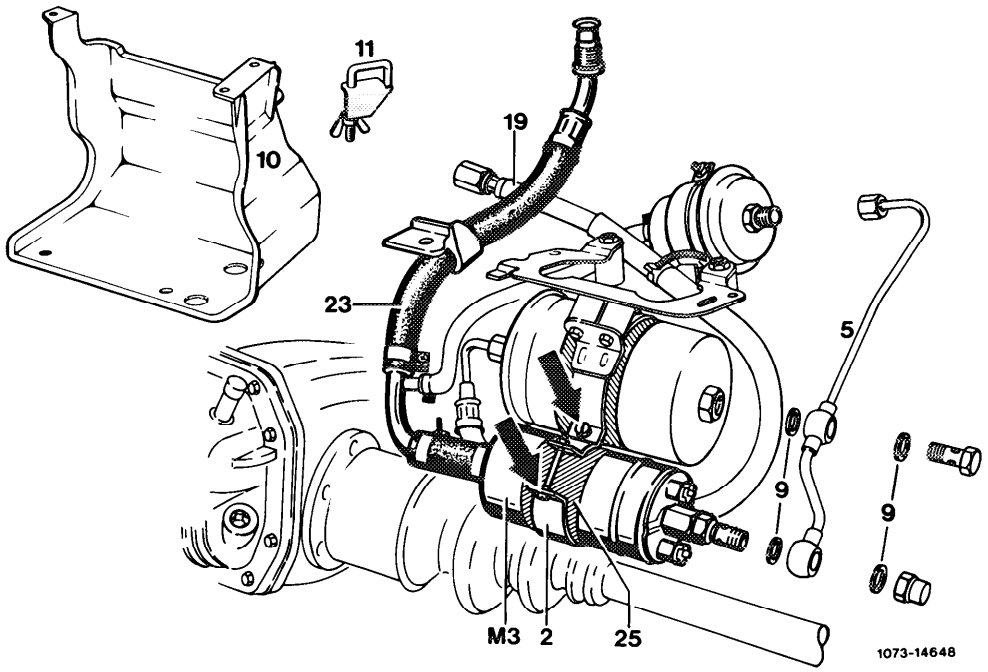
Model 124
Fuel pump package with 1 fuel pump



Model 124
Fuel pump package with 2 fuel pumps

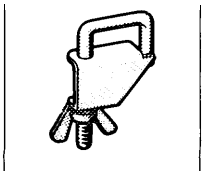


Model 107,126



Gauge pressure in fuel tank	Exhaust pressure, open closing cover for this purpose
Battery	Disconnect and connect
Protective box (10)	Screw off and on
Fuel suction (23) and pressure hose (19)	Pinch with clamp (11) and remove Special tool 000 589 40 37 00 Attention! On model 124.090, pay attention to Note
Fuel line (5)	On fuel accumulator, fuel pump and fuel filter, screw off and on
Fuel suction hose (23)	Loosen, pull off, mount
Electric lines	Disconnect and connect
Fastening screws (arrows)	Loosen on holder (2) and remove fuel pump (M3)
Plastic sleeve (25)	Mount, pay attention to Note
Sealing rings (9)	Replace
Run engine	Check for leaks

Special tool



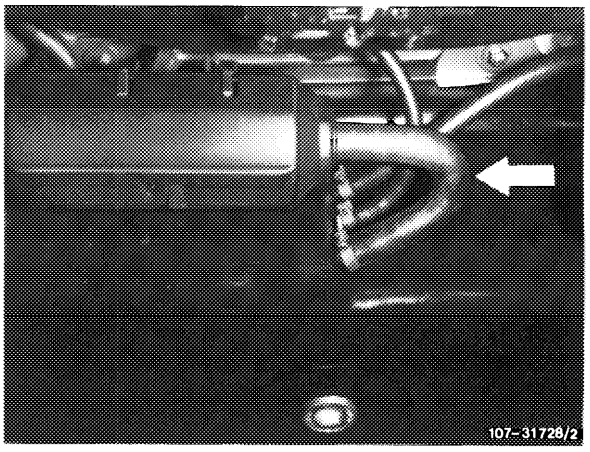
000 589 40 37 00

Note

When replacing fuel filter, make sure that the plastic sleeve (25) is mounted between fuel pump (M3) and holder (2). The sleeve should project on both sides of holder, since direct contact of fuel pump with holder may lead to contact corrosion.

The fuel pump is activated via relay, fuel pump (07.3-I 65).

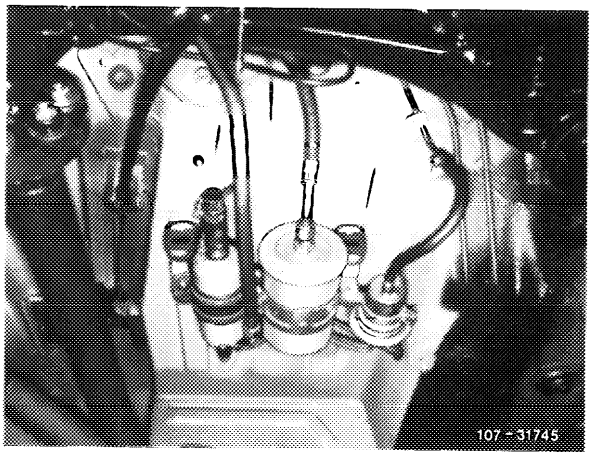
On model 124.090, do not pinch fuel suction hose at radius (arrow).

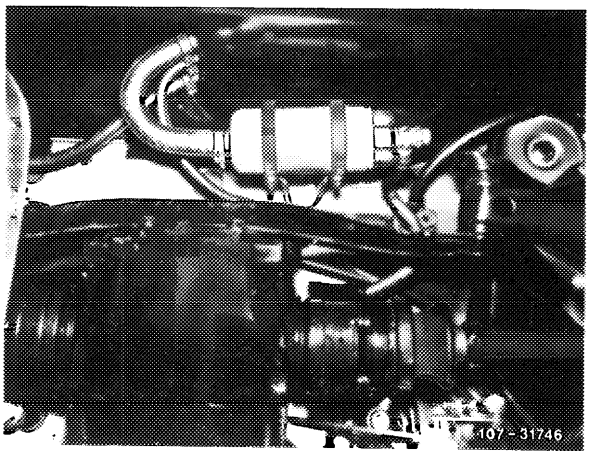


Engine 103.983, model 124.090

On this model, two fuel pumps are arranged in line.

To obtain short suction distances, a fuel pump is suspended between rear axle and fuel tank on rubber rings, and the other is housed in fuel pump package.

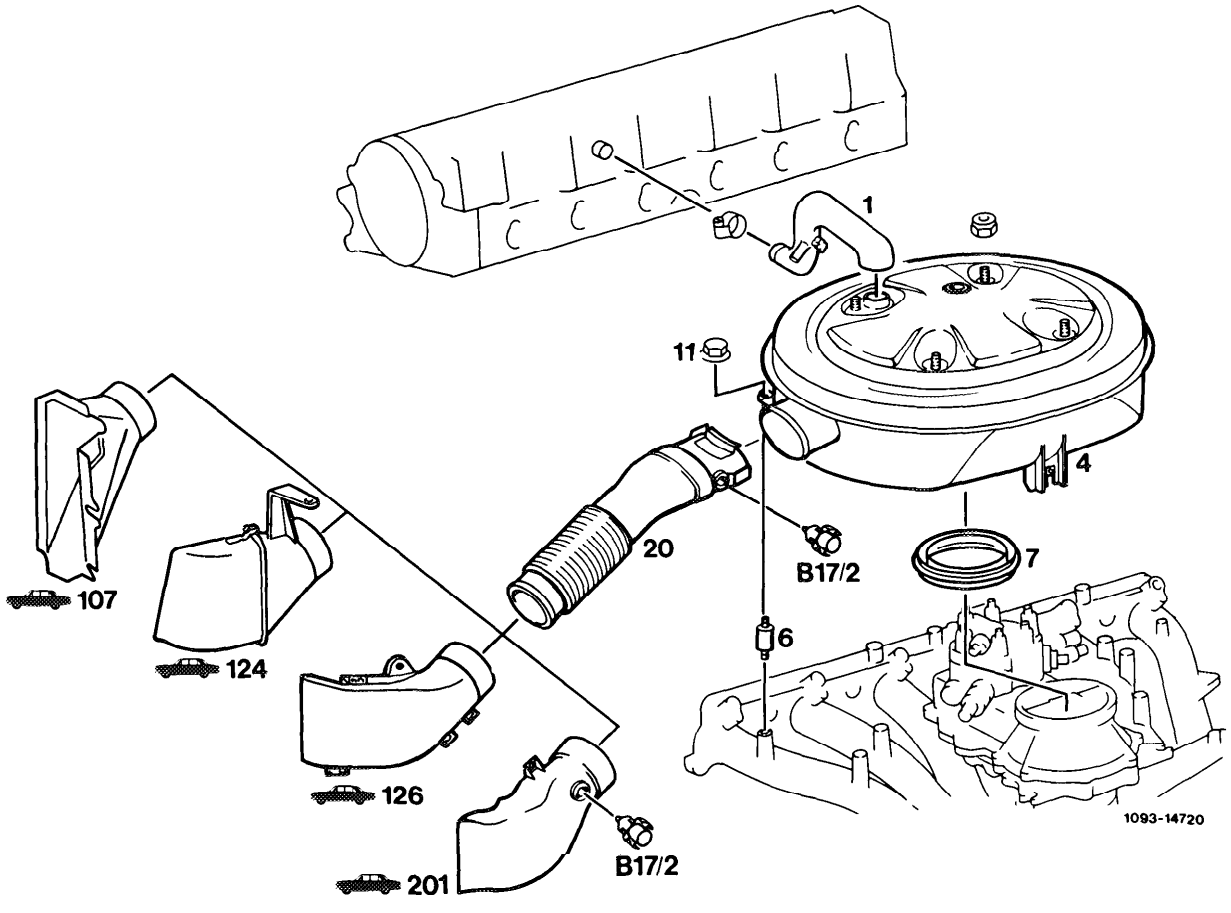




Job No.

Removal and installation of air cleaner . . . . . 09 – 400
Renewing of intake scoop . . . . . – 402

Job number of the job text and work units and standard texts and flat rates respectively 09-0015

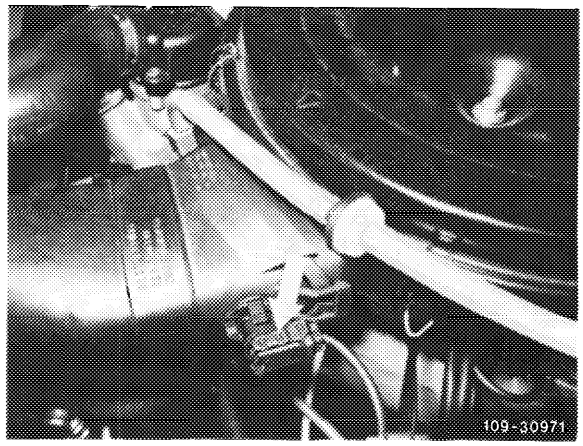


Intake air temperature sensor (B17/2)	dismount, mount.
Fastening nuts (11)	on anti-vibration mounts (6) and holder on mixture controller, unscrew and screw on.
Shaped hose (1)	for crankcase ventilation, dismount, mount.
Air cleaner (4)	dismount, mount. when doing so, ensure proper seating of the sealing ring (7) between air flow meter and air cleaner.

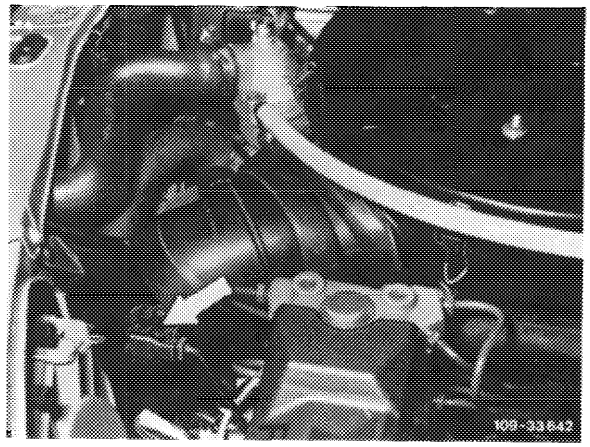
Note

The air cleaner top is provided with a recess for adjusting the idle speed mixture. On vehicles with RÜF/CAT version, an intake air temperature sensor is Installed.

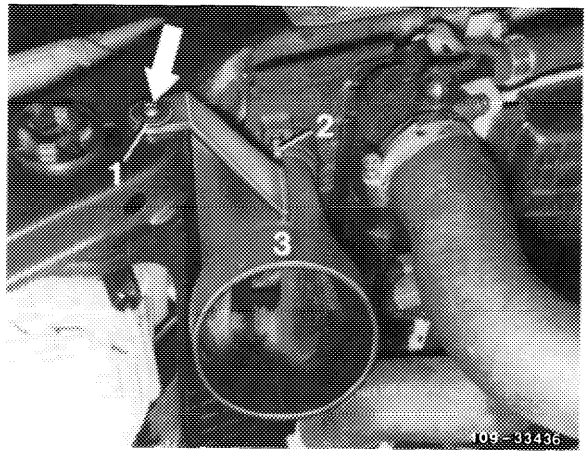
Intake air temperature sensor arrangement (arrow). Engine 103 (except 103.942) in the intake snorkel.



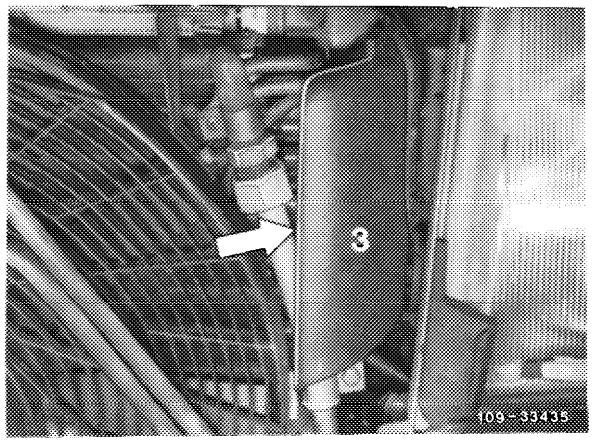
Engine 103.942 in the intake scoop.



The intake scoop is attached with a spreader clip (1) and locked twice.



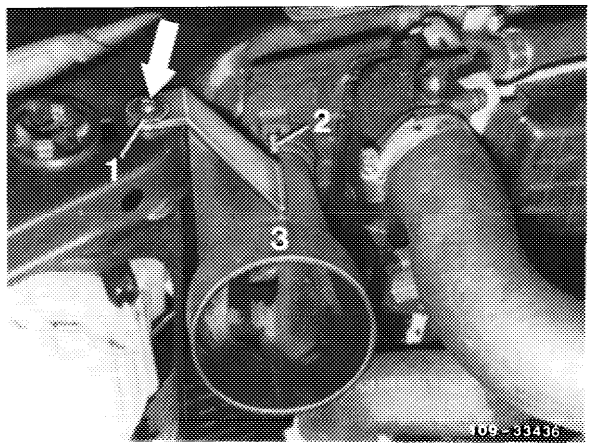
Note
The air is drawn in from outside the engine compartment (arrow) via the plastic scoop (3).



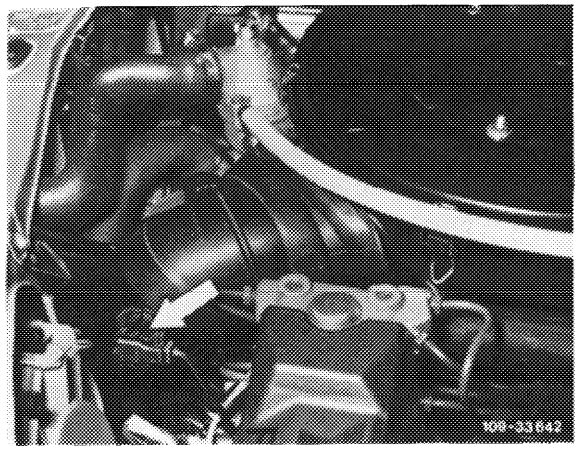
Renewal

1 Unscrew fastening screw (arrow) and force out spreader clips (1).

2 Force plastic clip(2) downwards and remove intake scoop (3).



On engine 103.942 the intake air temperature sensor (arrow) is installed in the intake scoop (3).

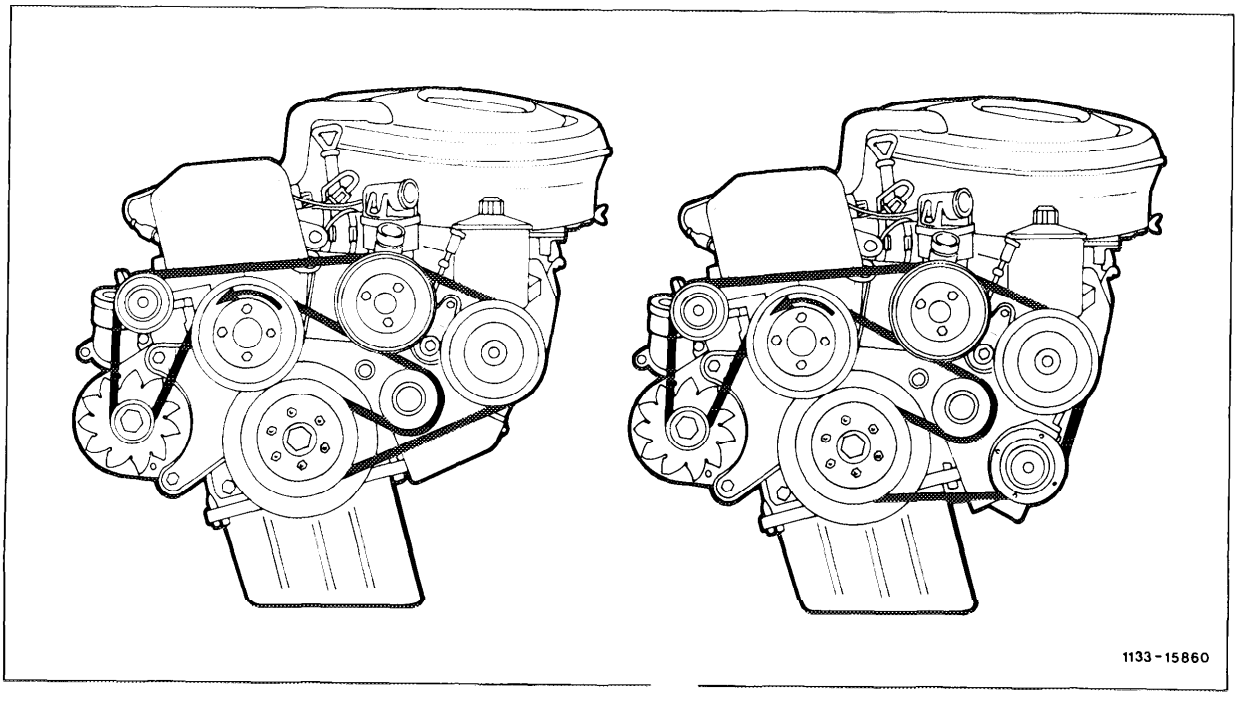


Job No.

Checking condition of poly V – belt and renewing . . . . . 13 – 342
Removing, installing tensioning device . . . . . - 345

13-342 Checking condition of poly V-belt and renewing

Job No. of job texts and job values or standard texts and flat rates . . . . . 13-1202 – 13-4001



Checking

Hood	raise to vertical position (01-008).
Engine	crank (01-010).

Renewing

Viscous fan clutch	remove, install (20-312).
Poly V-belt	remove, install (steps 5 to 11).

Checking

1 Raise hood to vertical position (01-008).

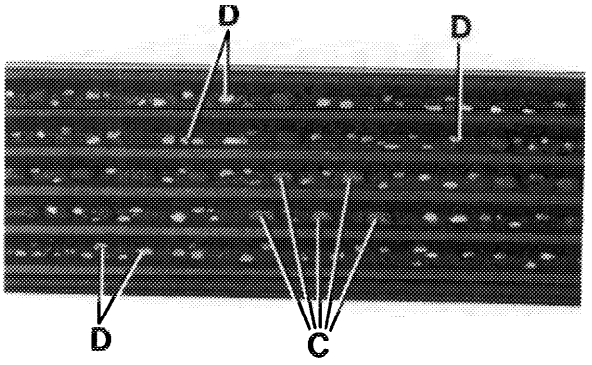
2 Check V-belt. Mark V-belt with chalk at a clearly visible point.

3 Crank engine in stages (01-010), at the same time checking V- belt for signs of damage.

4 This operation is completed once the marking is again visible (one complete revolution of belt).

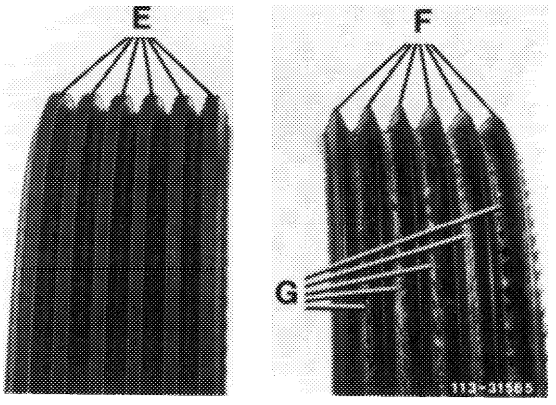
Patterns of damage

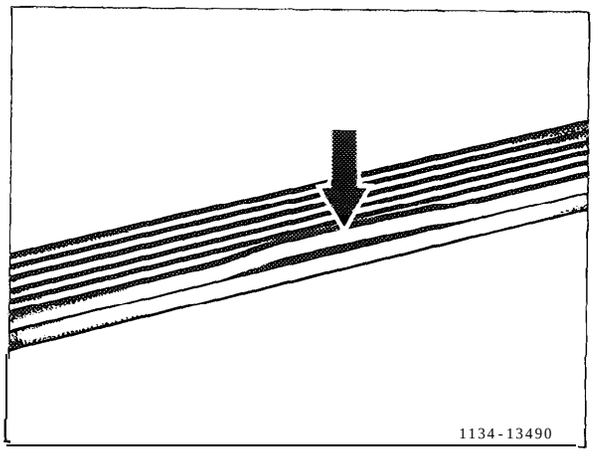
5 The V-belt must be renewed (to separate order) if the following patterns of damage exist:
Rubber knobs in base of belt (C),
dirt or grit embedded in belt (D).



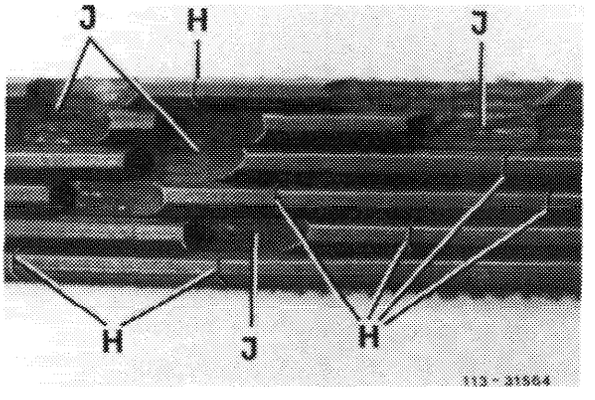
113-31547

Wear to flank (F),
ribs are pointed - trapezoidal in shape when new (E) and strands visible in base of belt (G, brighter points).

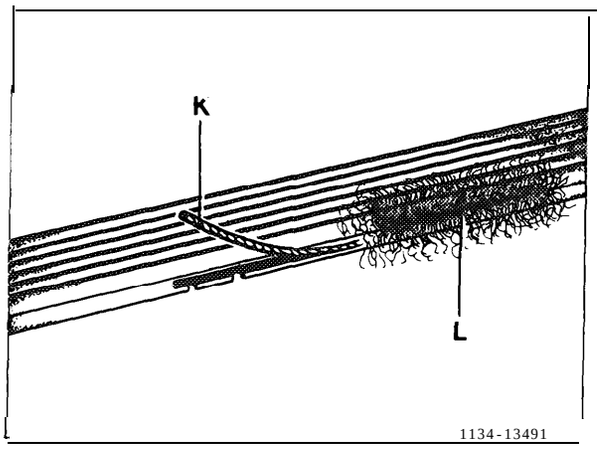




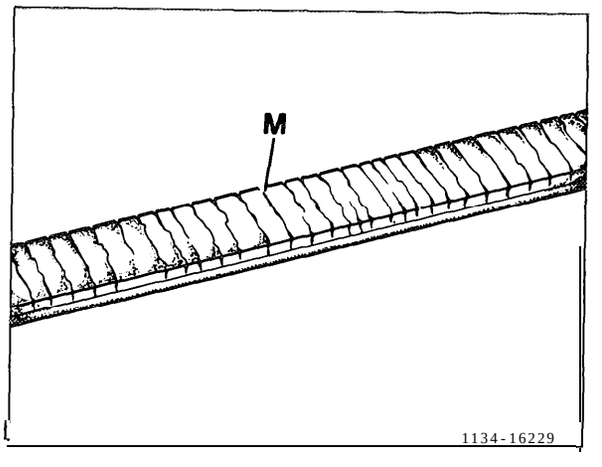
Cracks across the ribs (H) and/or sections of ribs broken off (J).



Strand torn at the side (K) or outer strands frayed (L).



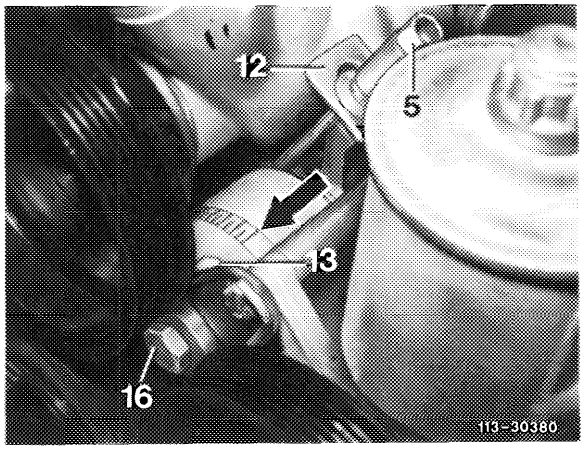
Cracks (M) across the back.



Renewing

6 Remove viscous fan clutch (20-312).

7 Slacken bolt (16) approx. 1/4 - 1/2 turns. Release tensioning device with tensioning nut (5) (turn to the left) until the belt can be removed. Check belt pulley profiles and tensioning device for signs of damage and dirt, renew if necessary (e. g. worn bearing points of tensioning device, dents in the belt pulleys etc.).

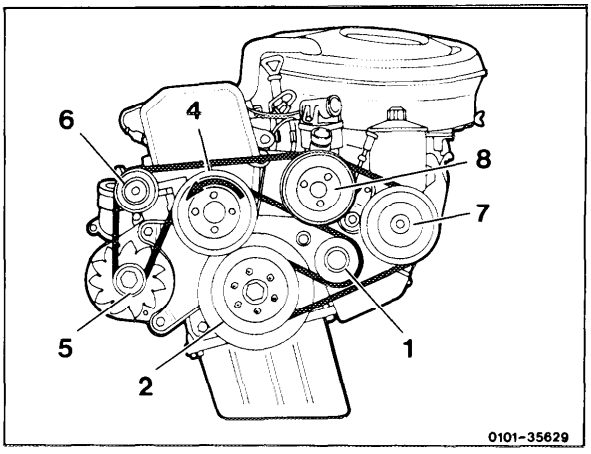


8 Turn setting pointer (13) to the left and position to the first graduation mark (arrow).

9 Fit on V-belt beginning in the numerical order of the running diagrams with tensioning pulley (1).

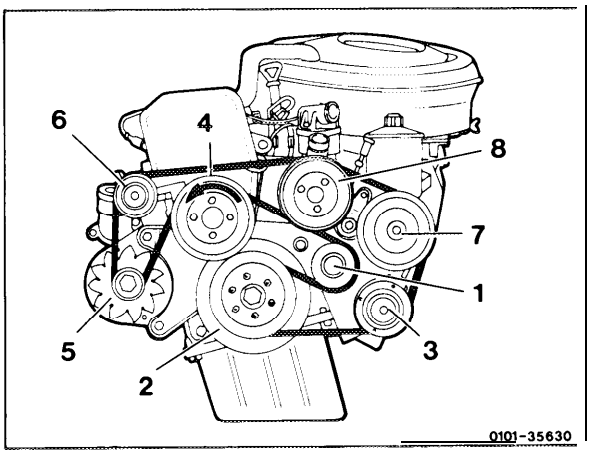
Note
Do not use belt wax or similar products.

Running diagram without refrigerant compressor:
Length of belt 2170 mm
Setting pointer/graduations 7



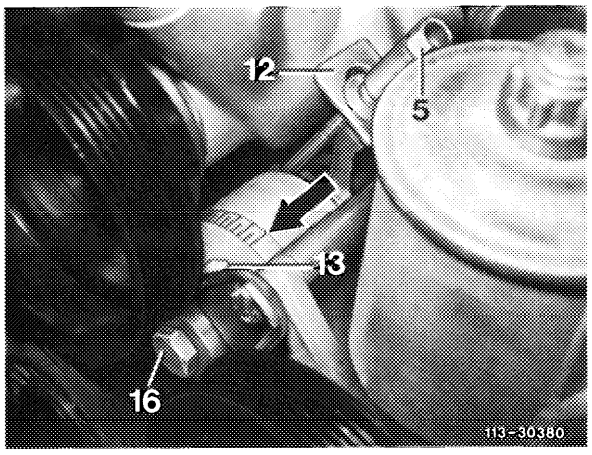
1	Tensioning pulley	6	Guide pulley
2	Crankshaft	7	Power steering pump
4	Fan	8	Coolant pump
5	Alternator		

Running diagram with refrigerant compressor:
Length of belt 2255 mm
Setting pointer/graduations 7



1 Tensioning pulley
2 Crankshaft
3 Refrigerant compressor
4 Fan
5 Alternator
6 Guide pulley
7 Power steering pump
8 Coolant pump

10 Turn tensioning nut (5) to the right until the setting pointer is positioned above the following graduations (arrow).
Engine without refrig. compr. 5th mark
Engine with refrig. compr. 7th mark



11 Tighten bolt (16) to 75 Nm (reference value).

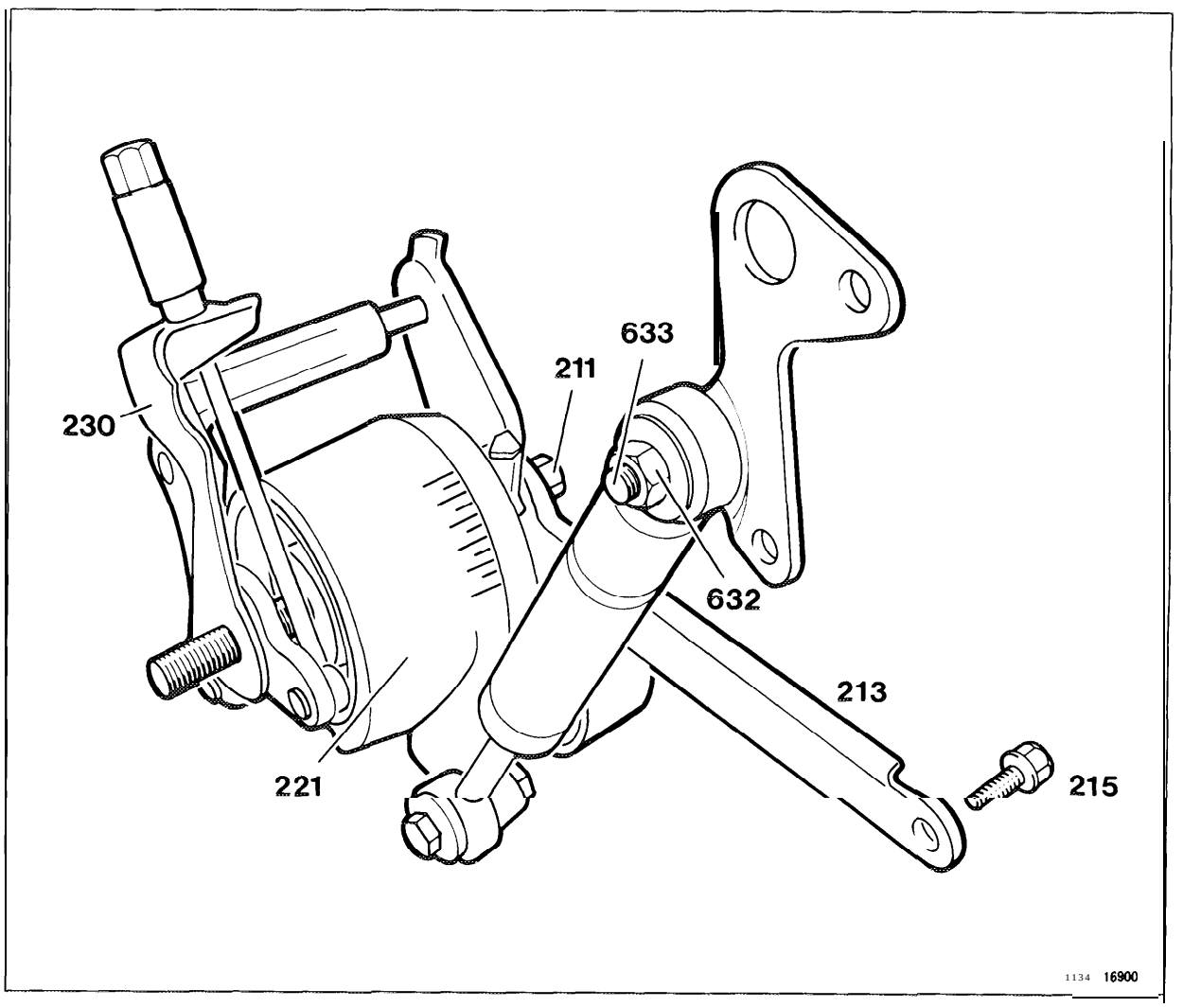
Note
As from November 1986 the alternator is attached at the bottom to the bracket with a 13 mm collar bolt. If this collar bolt is removed, the V-belt can be slackened by swivelling the alternator without slackening the bolt (16).

12 Check that the belt is correctly located on the belt pulleys.

13 Install in the reverse order.

13-345 Removing, installing tensioning device

Job No. of job texts and job values or standard texts and flat rates ..... 13-1202 – 13-4001



Air filter	remove, install (09-400).
Poly V-belt	remove, install (13-342).
Belt pulley of fan clutch, coolant pump, tandem pump	remove, install, 10 Nm (step 5).
Tensioning device (221)	remove, install, tightening torque for bolt (211) 75 Nm (steps 6 to 8).

Bracket (230)	remove, install (steps 9 and 10).
Nut (632)	screw down, withdraw bolt (633) (step 6).
Bolt (215)	unscrew, screw on, apply sealant 001 589 29 20 to mounting hole of bracket (213) (step 7).

Removal. installation

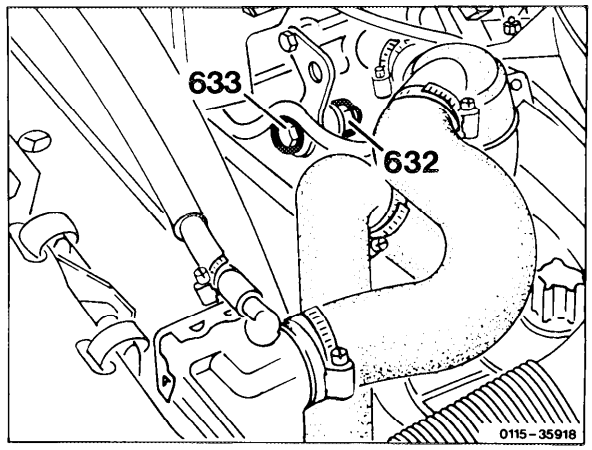
1 Remove air filter (09-400).

2 Remove viscous fan clutch (20-312).

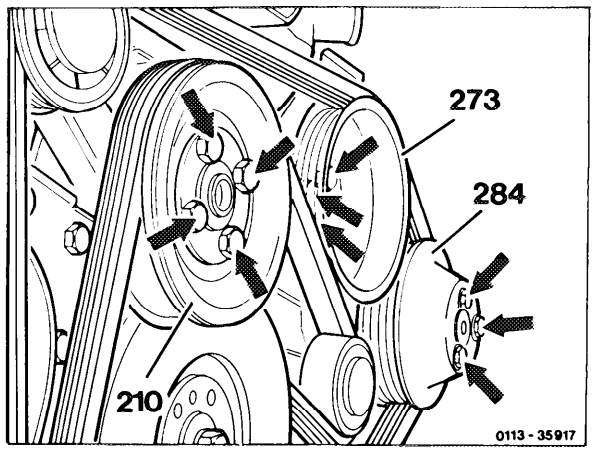
3 Slacken bolt (arrows).

4 Remove V-belt (13-342).

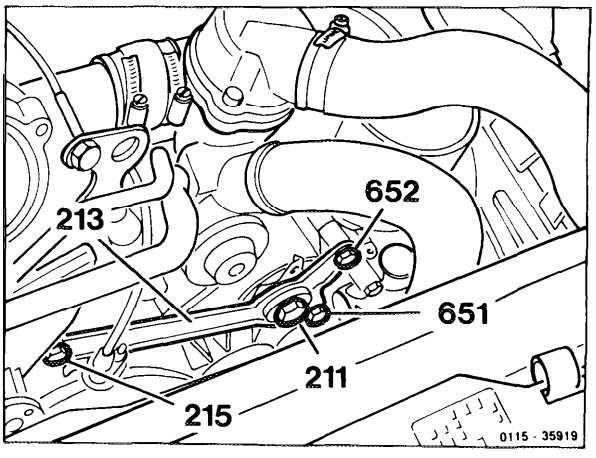
5 Unscrew bolts (arrows), tightening torque 10 Nm.
Take off belt pulleys of fan clutch (210), coolant pump (273) and tandem pump (284).



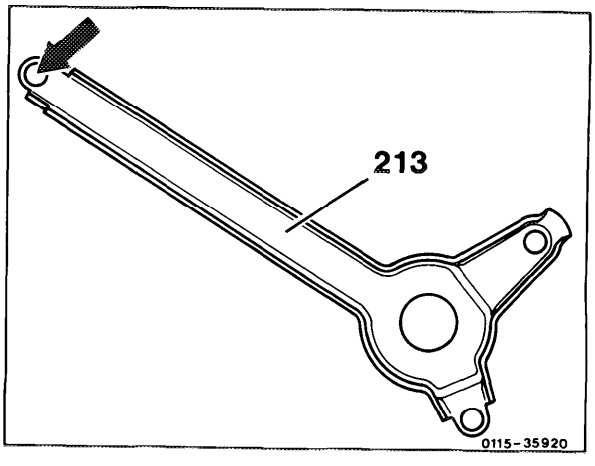
6 Screw down nut (632), withdraw bolt (633).



7 Unscrew bolts (211, 652, 651, 215).
Remove bracket (213).
Tightening torque for bolt (211) 75 Nm.

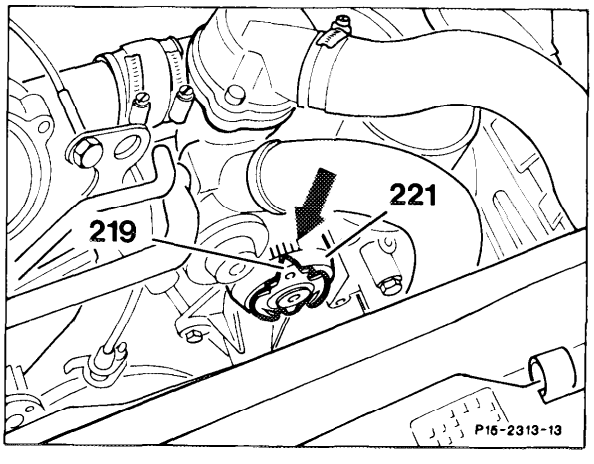


Installation instruction
Apply sealant 001 989 29 20 to the front and rear sides of the mounting hole (arrow) of the bracket (213).



8 Take off setting pointer (219), carefully pull tensioning device (221) forward and remove.

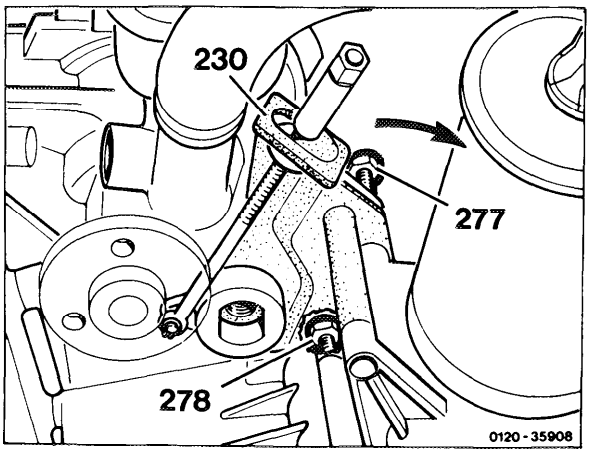
Installation instruction
In the untensioned state, the setting pointer (219) must be aligned with the first graduation mark (arrow).



9 Unscrew bolts (277, 278).

10 Swivel tandem pump in direction of arrow.
Remove bracket (230).

11 Install in the reverse order.

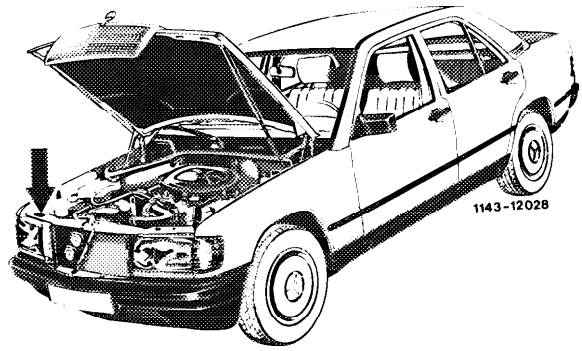


Job No.

Distinguishing features of vehicles with exhaust emission control system . . . . . 14 – 001
Function of emission control system . . . . . – 050
Checking oxygen sensor failure indication I . . . . . – 116
Removal and installation of intake manifold, replacement of gasket . . . . . – 450
Renewal of intake manifold (intake manifold removed) . . . . . – 455
Removal and installation of exhaust manifold . . . . . – 470
Renewal of oxygen sensor . . . . . – 480

14-001 Distinguishing features of vehicles with exhaust emission control system

In order to identify the vehicles an information plate (arrow) is glued onto the cross member. The plate shows the most important engine adjusting data.



(AUS) as of 1986
(CH) (S) as of 1986
Std./RÜF/CAT as of 1985

Identification of the information plates

(AUS)	silver
(CH)	green
(CH) CAT	light green
(S)	blue
(S) CAT	light blue
Std./RÜF/CAT	white

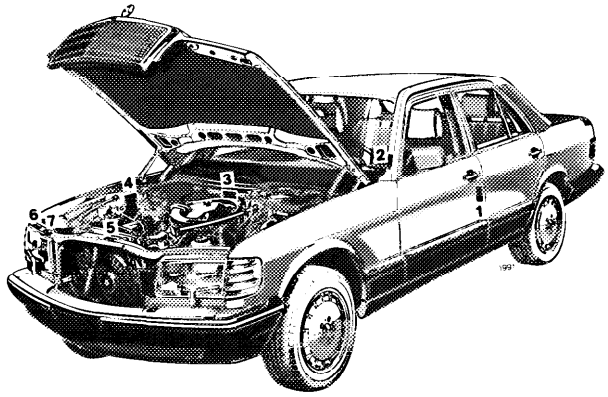
(J) as of 1986

Vehicles in version for Japan are provided with an information plate for the exhaust emission control system in the engine compartment in the local language. This plate shows the most important engine adjusting data.

(USA) as of 1986

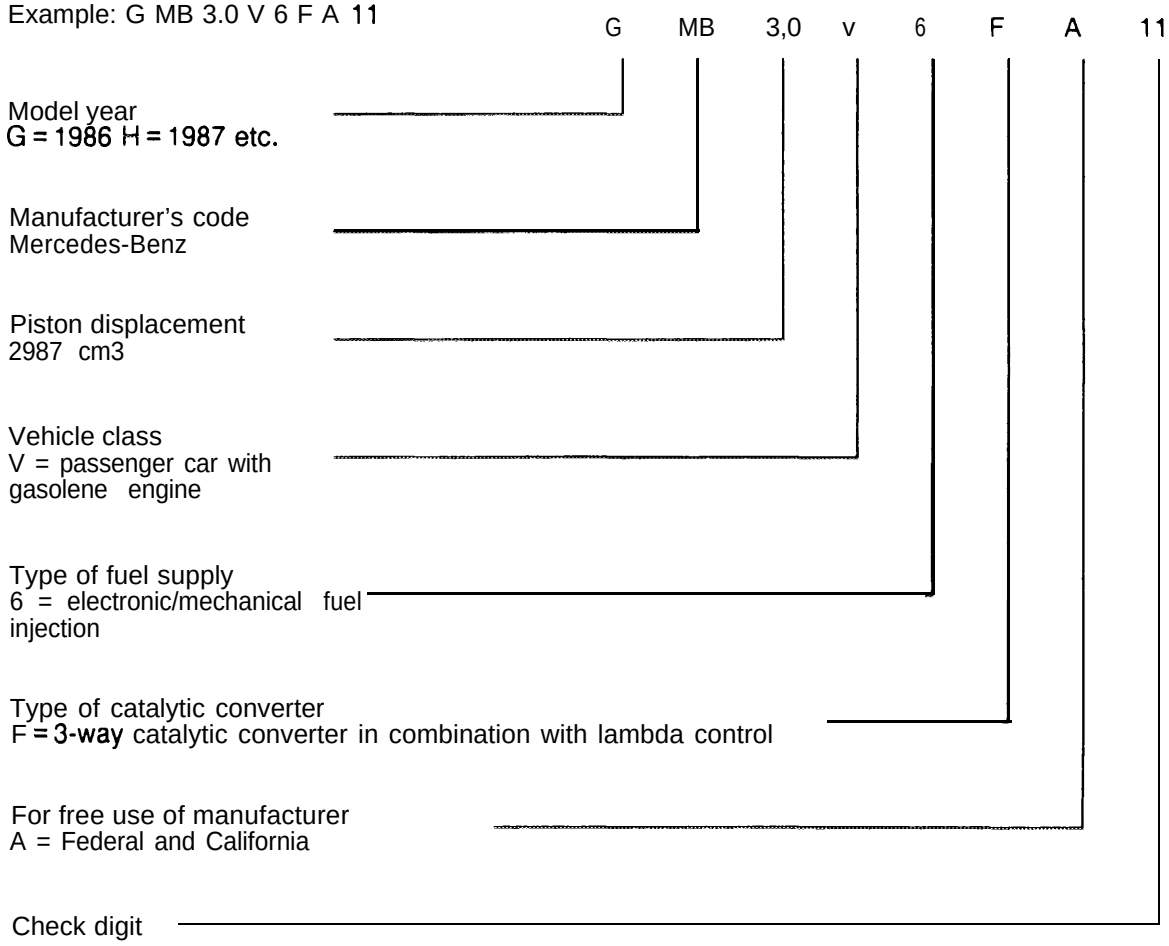
Information plate for the exhaust emission control system on the cross member in front of the radiator (7).

The engine characteristic data as well as the most important engine adjusting data are shown on this plate.



7 Information plate exhaust emission control system

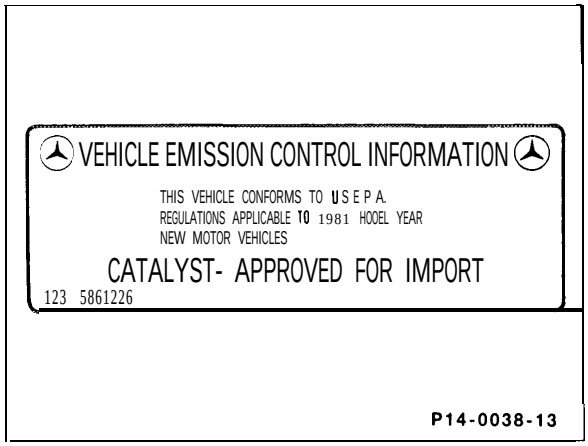
lo-digit code of engine identification data.



USA version
This vehicle is equipped with catalytic converters.

Color code of the information plate:
Basic color black, writing silver.

Tourist version
Vehicles in tourist version are not equipped with catalytic converters. Prior to importing into the USA the catalytic converters must be installed.

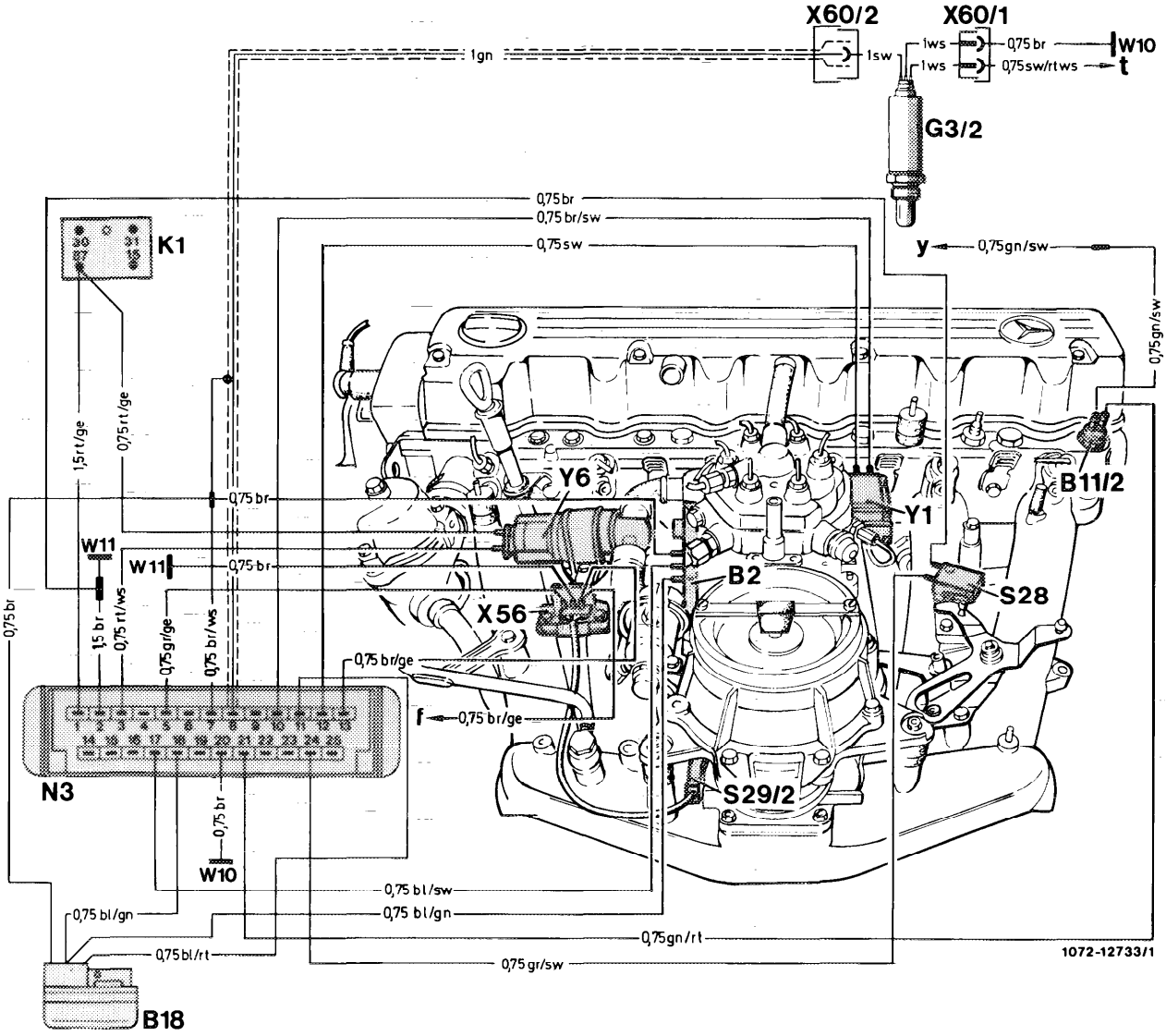


RÜF/CAT as of 1985
(AUS) (CH) (J) (S) (USA)
as of 1986

General

Components:

CIS-E control unit	with mixture characteristic, lambda control, oxygen sensor control signal amplification and from the input signals the calculation of the output signals for the electrohydraulic adjusting element.
Adjustment plug RÜF-version	with writing “ECE” and lead-sealed at the factory in postion 1.
Adjustment plug CAT-version	with writing “CAT” and lead-sealed at the factory in position 1.
Oxygen sensor	installed in the front exhaust pipe.
Catalytic converter	3-way catalytic converter, pre-catalytic converter and underfloor catalytic converter.
Catalytic converter warning system (J)	warning lamp in instrument cluster.
Oxygen sensor failure display (USA) 1986	control lamp in instrument cluster.
Fuel evaporation system	reduces escape of fuel vapors into the atmosphere (47-200, and 47-300).

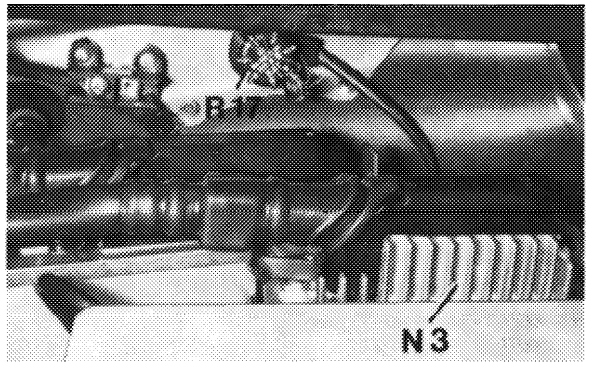


Function diagram for example of (J) (USA) mechanically/electronically controlled fuel injection

82	Sensor, air flow meter	X56	Plug connection, throttle valve switch
B11/2	Coolant temperature sensor (2-pole)	X60/1	Plug connection, heater coil oxygen sensor
B18	Altitude adjustment capsule	X60/2	Plug connection, oxygen sensor signal
G3/2	Oxygen sensor heated	Y1	Electrohydraulic actuator
K1	Relay, overvoltage protection	Y6	Idle speed adjuster
N3	Fuel injection system control unit (25-pole coupling)	f	To the control unit electronic Ignition system socket 2
S28	Deceleration cutoff	t	To the fuel pump relay socket 7 terminal 87
S29/2	Throttle valve switch, full load/idle detection	y	To the control unit electronic ignition system socket 1
W10	Ground, battery		
W11	Ground, engine (electric cable screwed on)		

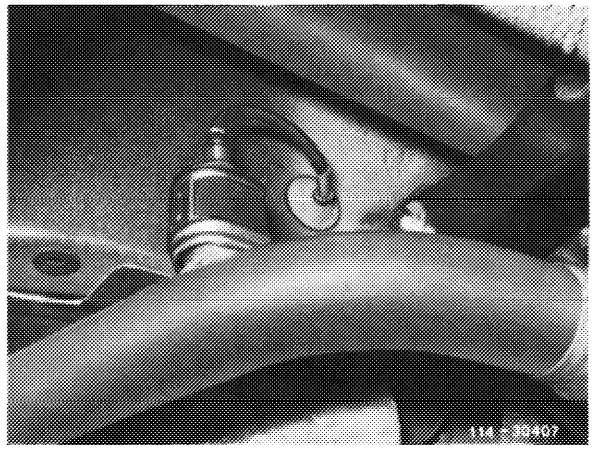
The lambda control is not functioning, i.e. not controlled , under the following operating conditions:
Oxygen sensor not operational or defective.
Coasting with deceleration cutoff.
Full load operation.
Acceleration enrichment.
When starting below 15 °C up to + 40 °C coolant temperature.

CIS-E control unit (N3)
Mounted at the right behind the battery.

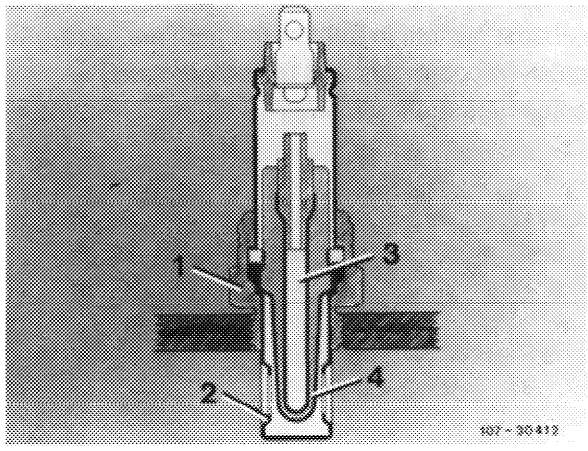


RUF/CAT
N3 Control unit fuel injection system
R17 Adjustment plug fuel injection system

Oxygen sensor
The oxygen sensor is screwed into the front exhaust pipe.



The outer electrocde is exposed to the exhaust emission, the inner electrode is connected with the atmosphere. The active part of the oxygen sensor is a ceramic body mainly consisting of zirconium dioxide. At the surface it is provided with a gas-permeable platinum layer and an additional protective layer on the exhaust side.



1 Sensor housing
2 Slotted protective tube
3 Heater element
4 Sensor ceramic element

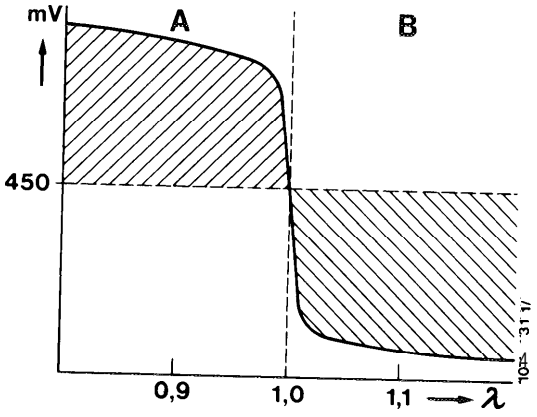
At operating temperature the ceramic material conducts the oxygen ions. The different oxygen proportion of exhaust gas and atmosphere generates a voltage in the oxygen sensor.

In order to maintain a constant operating temperature the sensor is heated.

The heater element of the oxygen sensor is supplied with voltage via terminal 87 of the fuel pump relay and is heated as long as the fuel pump is operating (circuit ciagram).

At operating temperature (> 300 °C) the oxygen sensor emits a voltage signal to the control unit.
Voltage > 450 millivolt mixture rich.
Voltage < 450 millivolt mixture poor

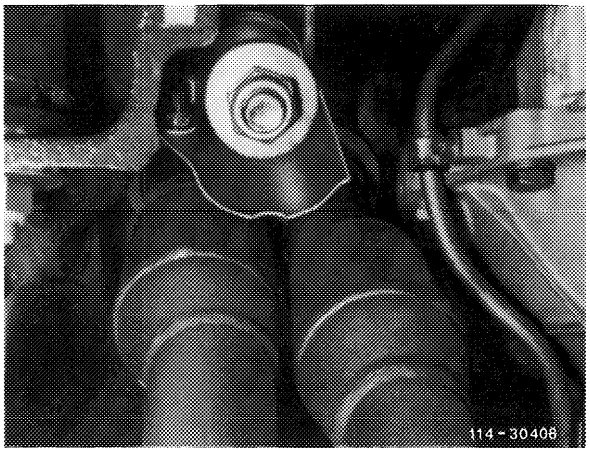
Because of the steep voltage jump with lambda (h) = 1, the exhaust gas composition can be analysed very quickly and the fuel-air mixture corrected within a narrow control range.



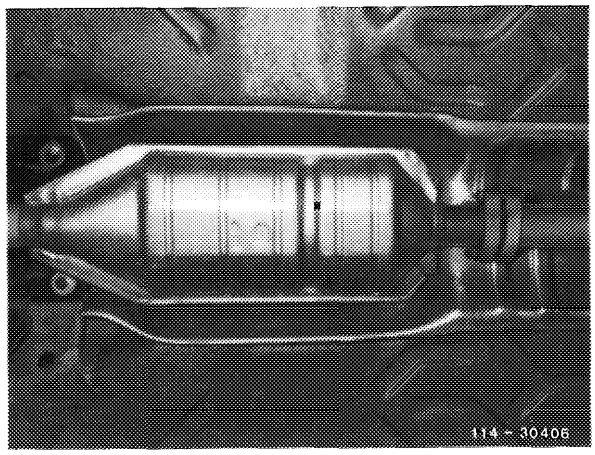
A Rich fuel-air mixture
B Poor fuel-air mixture

Catalytic converters

The 3-way catalytic converters are located in the exhaust system in front of the mufflers. Pre-catalytic converters and underfloor catalytic converters are installed.

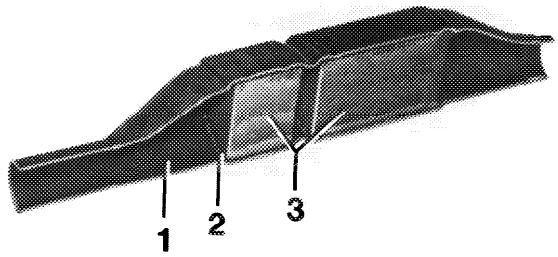


Pre-catalytic converter



Under-floor catalytic converter

The catalytic converters consist of three main parts:
Carrier material made of high-strength ceramic material and highly heat-resistant high-grade steel, also called monolith (ceramic material elastically mounted on wire braiding).
Intermediate layer for surface enlargement.
Catalytically active layer made of platinum/rhodium.



107 - 16849

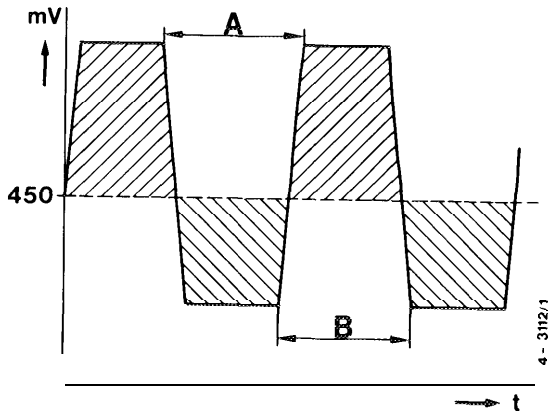
1 Braiding
2 Wire braiding
3 Monolith

Function

Exhaust gas flows through the catalytic converter and comes into contact with the precious metals. By way of **oxidation,** carbon monoxide (CO) is converted into carbon dioxide (CO_2) and hydrocarbons (HC) into water (H_2O), while the nitric oxides (NO_X) are converted into nitrogen (N_2) by way of **reduction.** Decisive in this process are temperature and the residual oxygen content in the exhaust gas. From a temperature of approximately 250 °C the catalytic process commences, i.e. a chemical reaction takes place. Too high temperatures lead to thermal overload.

Oxygen is required for the oxidation of CO and HC. The reduction of the nitric oxides takes place under oxygen deficiency.

Fluctuation betweenoxygen-deficient and oxygen-rich exhaust gas is achieved by changing the fuel-air mixture. The ratio of the fuel-air mixture is described with the letter lambda (A). Lambda <1 means rich mixture, lambda >1 means poor mixture.



A Rich fuel-air mixture
B Poor fuel-air mixture

The fluctuation of the oxygen content in the exhaust gas is controlled by the oxygen sensor. Only by means of these oxygen fluctuations is it possible to chemically convert the three mentioned exhaust cnstituents in the catalytic converter.

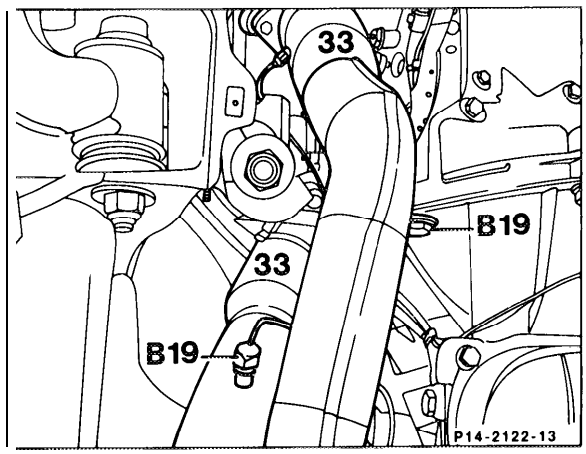
Only unleaded fuel may be used in vehicles with catalytic converters and oxygen sensor. Lead additives in the fuel form deposits on the chemically reactive surface of the catalytic converter and the oxygen sensor, rendering the system inactive.

Catalytic converter temperature warning system (J)

By means of a warning lamp in the instrument cluster, this warning system indicates to the driver an impermissibly high temperature rise in the catalytic converter.

Components of the catalytic converter temperature warning system:

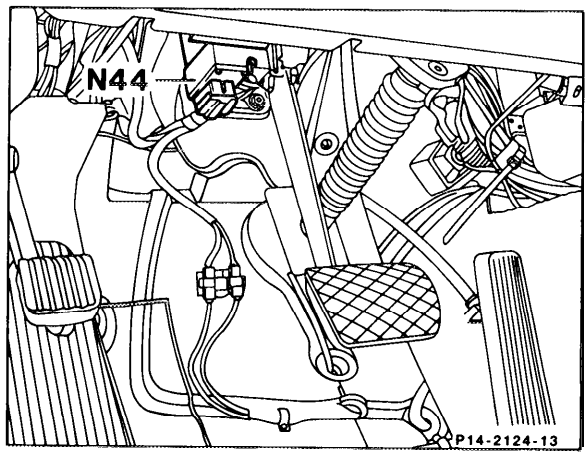
Catalytic converter temperature sensor (B19)
A temperature sensor (B19) is mounted behind the pre-catalytic converter; this sensor feels the exhaust gas temperature in the exhaust system, passing it on to the catalytic converter warning control unit (N44).



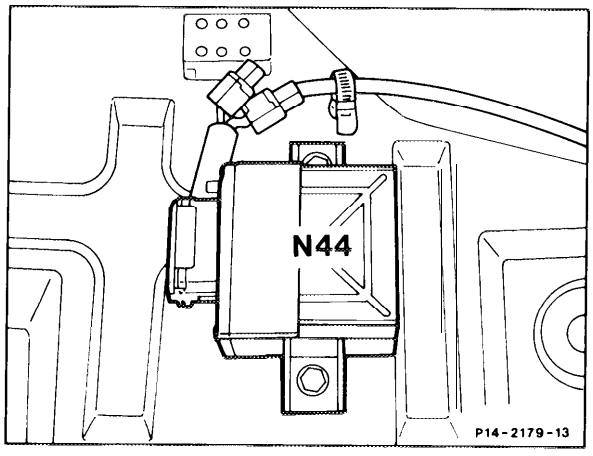
33 Pre-catalytic converter
B19 Temperature sensor

Catalytic converter warning control unit (N44)
A relay and a timer are housed in the control unit.

In the model 124 LHD this unit is installed at the front left near the pedal assembly



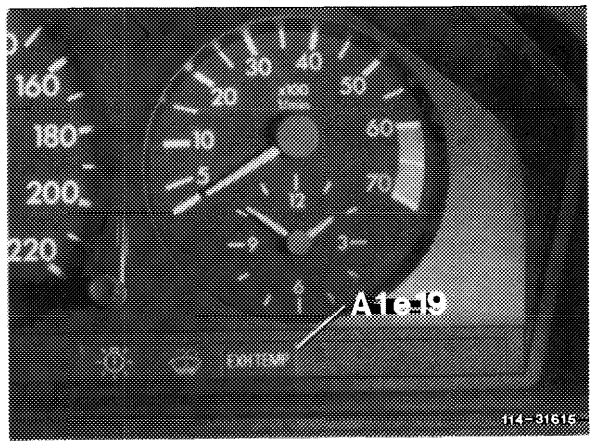
On model 124 RHD at the front left in the footwell.



On model 201 LHD and RHD, at the left below the rear seat.

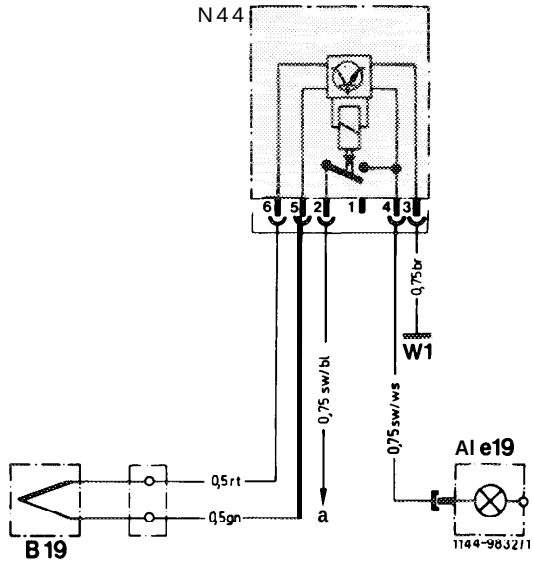
Indicator lamp catalytic converter overheating (A1e19) "EXH TEMP"

The indicator lamp catalytic converter overheating (Ale1 9) "EXH TEMP" is located in the instrument cluster bottom right.



Functional description

Depending on temperature, the temperature sensors (B19) send a very small voltage (millivolt) to the electronics in the control unit **(N44).** At temperatures of approximately 900 °C the voltage is so great that the electronic unit triggers the relay in the control unit. The relay closes and connects plus to the indicator lamp (Ale1 9), which is connected to ground. For an automatic check of the indicator lamp and the lines, actuate the warning system for 5-10 seconds after switching on the ignition.

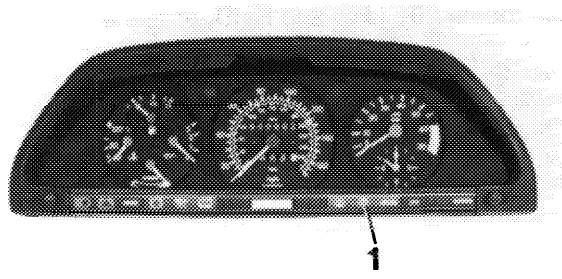


Ale19	Indicator lamp catalytic converter overheating
B 19	Temperature sensor catalytic converter
N 44	Control unit catalytic converter warning system
W 1	Main ground (behind instrument cluster)
a	To the fuse terminal 15

Oxygen sensor failure indication (USA) as of model year 1986

A failure of the oxygen sensor is indicated in the instrument cluster by the control lamp lighting up. The light is controlled by the CIS-E control unit.

The control lamp lights up when switching on the ignition.



During starting, the oxygen sensor failure indication (Ale1 0) lights up briefly.

yes	no

Remove and check control lamp.

Control lamp ok.	Control lamp defective.

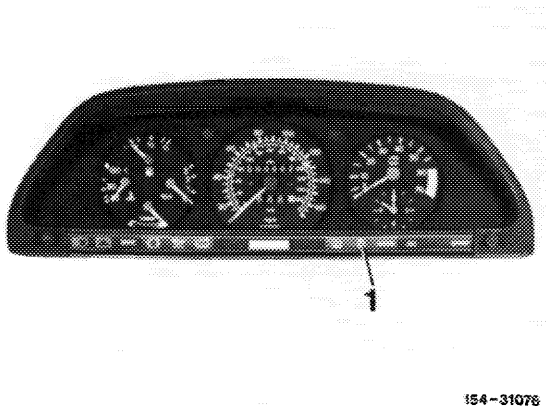
Renew control lamp

Switch on ignition. On oxygen sensor failure indicator A1e1 0, check voltage on wire rt/ge against ground.

Voltage approximately 12 volt

yes	no

Check voltage supply according to circuit diagram



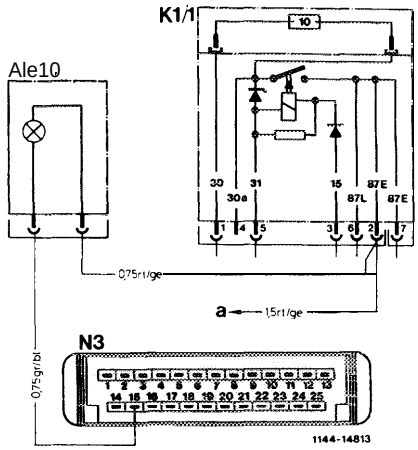
Switch off ignition. Check wire betwen oxygen sensor failure indication and CIS-E control unit (N3), socket 15, for continuity.

Resistance approximately 0 Ω

yes	no

Eliminate interruption according to circuit diagram.

End of test

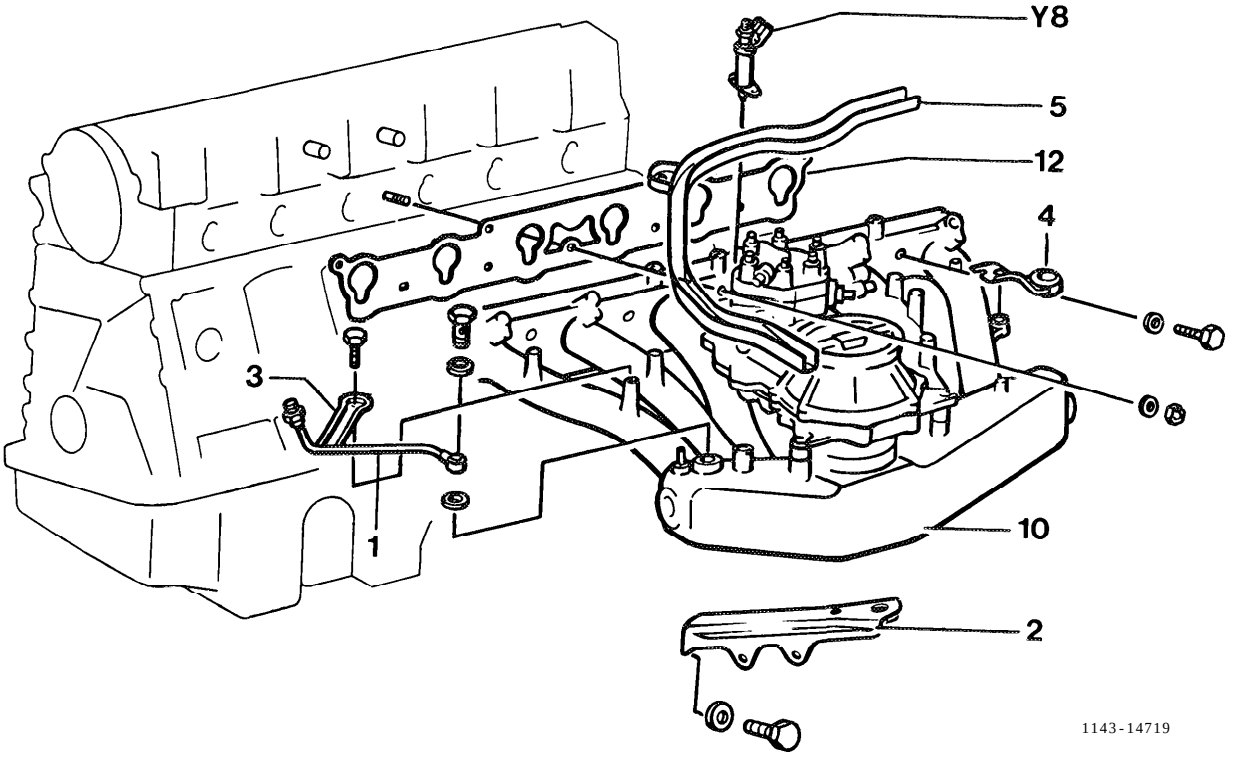


Ale10 Oxygen sensor Indicator lamp
K1/1 Relay overvoltage protection
3 CIS-E control unit
W10 Ground, battery
a To the CIS-E control unit, socket 1

Electric circuit diagrams see repair instructions engine 103 combustion CIS-E injection system 07.3-1 28.

14–450 Removal and installation of intake manifold, replacement of gasket

Job no. of the job texts and work units and standard texts and flat rates respectively 14-0180

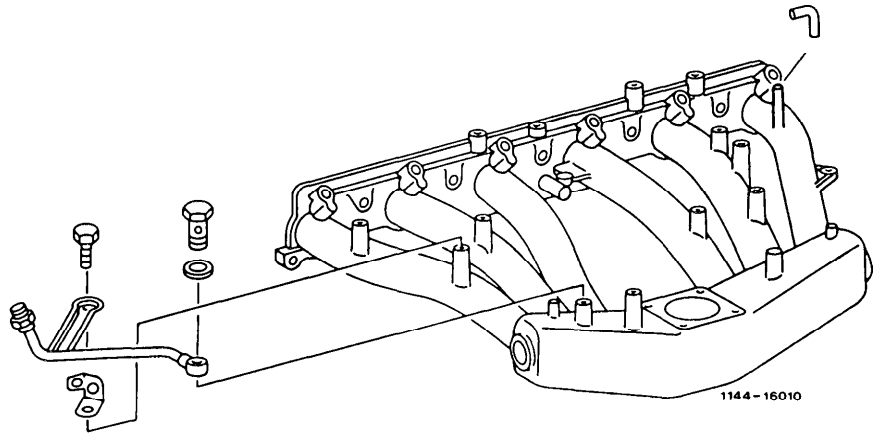


Engine compartment cover	remove, install
Plastic rail (5) for engine electric cable harness	remove, install
Mixture controller with air guide housing	remove, install (07.3225).
Holder (4) for starter cable	unscrew, screw on
Vacuum connections on intake manifold and throttle valve assembly	pull off, fit.
Vacuum line (1) for brake assembly with holder (3)	remove, install.
Starter valve (y8)	remove, install. Electrical connection to the engine, mount.
Bowden cable for control and for automatic transmission	disconnect, connect

Support (2) for intake manifold	unscrew, screw on. Unscrew both supports (on the intake manifold). Loosen on crankcase and, on vehicles with cruise control, unscrew (with cruise control).
Protective cap on ignition coil	remove, mount.
Vehicle with level control	remove suction hose. For this purpose, loosen hose clamp and force hose off the pipe, mount.
All fastening screws and one nut	unscrew, screw on.
Intake manifold (10)	remove, install. Clean, flange surfaces, check with straight edge, machine on straightening plate if necessary.
Intake manifold gasket (12)	renew.
Control linkage	adjust (30-300).
Idling	check, adjust (07.3-I 00).

14–455 Renewal of intake manifold (intake manifold removed)

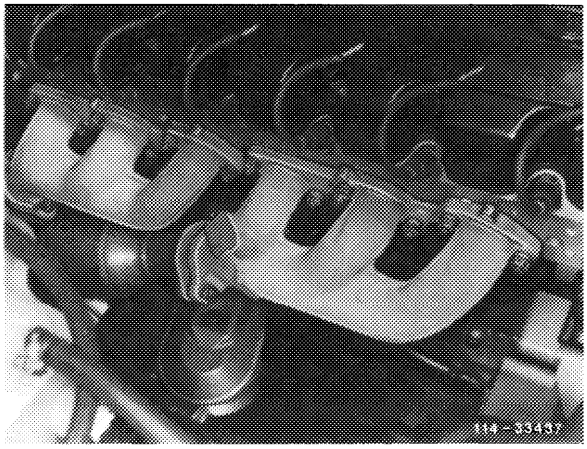
Job no. of the job texts and work units and standard texts and flat rates respectively 14-0205

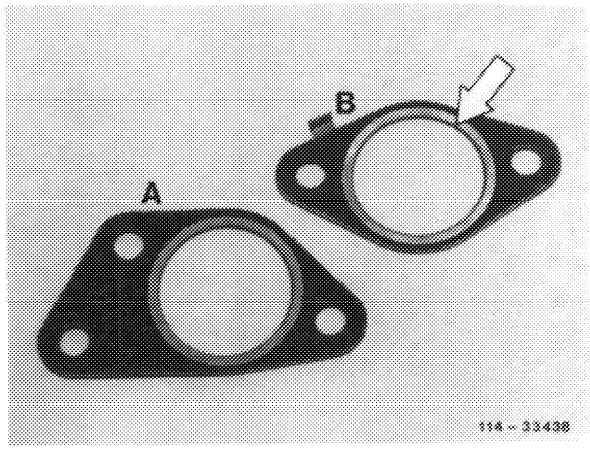


Intake manifold	remove, install (14-1 50)
Mixture controller with air guide housing	remove, install (07.3-225).
Intake manifold removed	unscrew from the removed intake manifold all parts that can be unscrewed and install in new intake manifold with new gaskets.

14–470 Removal and installation of exhaust manifold

Job no. of the job texts and work units and standard texts and fiat rates respectively 14-0350

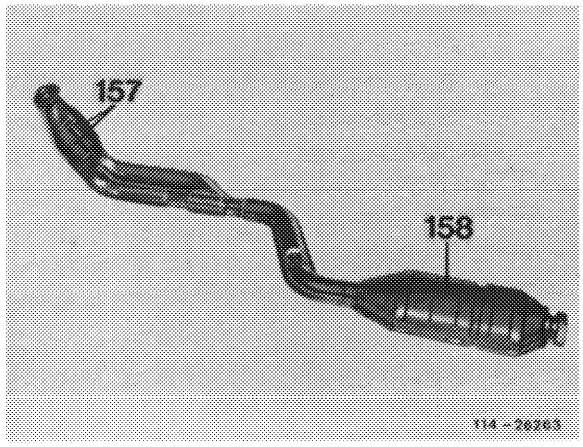




Exhaust system	partly remove and install (49-l 00).
Exhaust nuts	unscrew all exhaust nuts and remove exhaust manifold.
Exhaust manifold with new gaskets	mount. When doing so, observe that the flange (arrow) and the sheet metal lugs are facing the exhaust manifold. For improved stability, the gasket for cylinder 6 (A) has an additional bore. Gaskets for cylinder l-5 (B).

Note

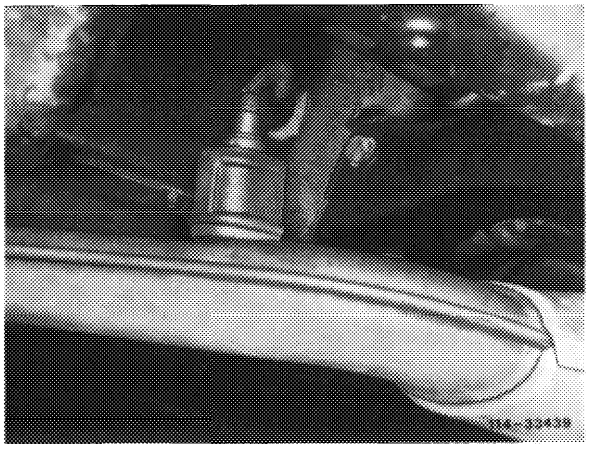
Vehicles with catalytic converters are equipped with pre-catalytic converters and under-floor catalytic converters.

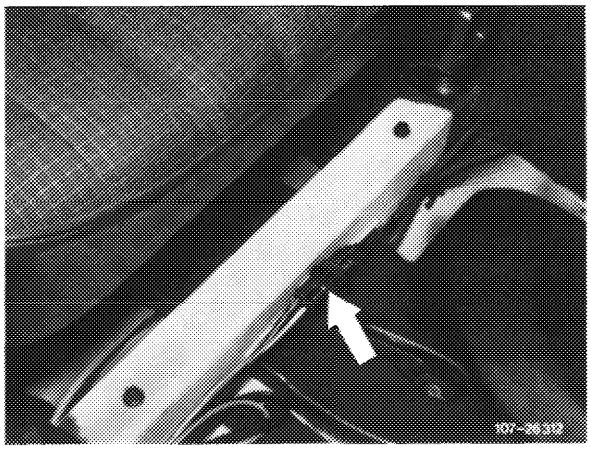


157 Pre-catalytic converter
158 Underfloor catalytic converter

14-480 Renewal of oxygen sensor

Job no. of the job texts and work units and standard texts and flat rates respectively 07-5303





Electric wire for oxygen sensor signal and heater	separate in the vehicle interior
Wire with rubber grommet	press from inside out.
#eat shield	press off. Install so that the opening faces to the back.
Oxygen sensor	unscrew.
Oxygen sensor	mount. Coat thread with paste 000 989 88 51.

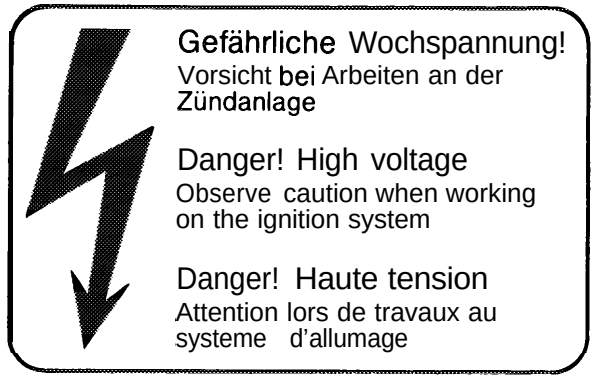
Job No.

Notes regarding jobs on breakerless transistorized ignition system . . . . . 15 – 505
Function of the electronic ignition system with variable characteristics (EZL) . . . . . – 510
Checking ignition timing . . . . . – 515
Evaluation of oscilloscope image . . . . . – 525
Renewing spark plugs . . . . . – 530
Removal and installation of high – voltage distributor . . . . . – 535
Checking the electronic ignition system with variable characteristics (EZL) . . . . . – 545

A. Safety information

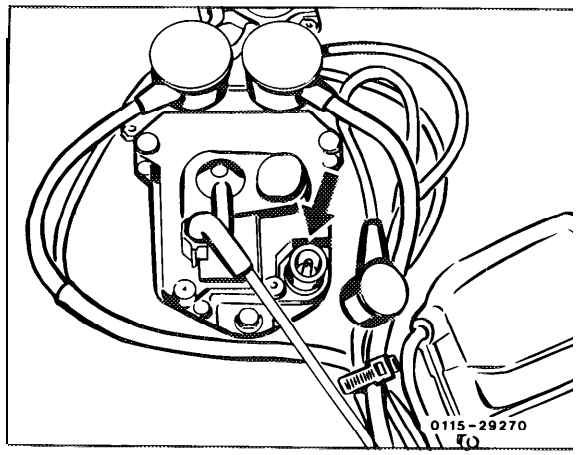
Increased demands of modern engines on ignition systems and the desire for maintenance-free operation have resulted in the use of series-produced electronic ignition systems.

As a rule, the firing output of electronic systems is superior to that of conventional systems: still further output improvements may be anticipated. As a result, electronic ignition systems enter an output range where the contact with live parts or terminals maybe lethal (see warning plate).



Warning plate in the engine compartment

For this reason it is absolutely vital to observe the following safety regulations when working on the breakerless transistorized ignition system:



- Prior to working at starter speed, e.g. when checking the compression or adjusting the valve clearance, switch off the ignition and pull off control cable from control unit (arrow) or fit protective plug, part no. 102 589 02 21 00, on the diagnostic socket.
- Persons with heart pace-makers should not work on these ignition systems.
- Do not touch and pull off any of the ignition system components at starting rpm or with the engine running.

- Perform assembly jobs on the ignition system or connect and disconnect transmitters to ignition cables only with the engine stopped and the ignition switched off.

- Do not install any intermediate pieces with a bright metallic finish or any such transmitters into ignition cables, e.g. cylinder 1.

B. Notes for avoiding damage to ignition system

- **In order to avoid damage to the control unit, only remove and fit the control unit plugs with the ignition switched off.**

- Do not connect any test lamp to terminal 1 of the ignition coil.

- Do not short-circuit terminals 1 and 15 of the ignition coil to ground, e.g. for burglar alarm provision.

- In order to avoid wrong polarity connections, the threaded pins of the ignition coil have different diameters (M5 and M6).

- Install only genuine ignition system components.

- Do not operate the ignition system at starting speed without fully connected ignition gear.

- In order to avoid damage to the control unit, the high-tension side of the ignition system must be loaded with at least 2 kΩ (distributor rotor 1 kΩ, distributor cap 1 kΩ per connection). Do not install 5 kΩ distributor rotors for interference suppression.

- At starting speed or with running motor, do not carry out tests such as holding ignition cable 4 with a distance against ground, pulling a spark plug connector or cable 4 from the ignition coil.

- For better heat dissipation, the control unit is mounted with heat conductive paste to the inner wing.
  During replacement, do not remove the protective foil as it does not impair the heat dissipation.

- If the short-circuit device (comparison of cylinders) is actuated and the engine stops, the test cannot be carried out with this tester.

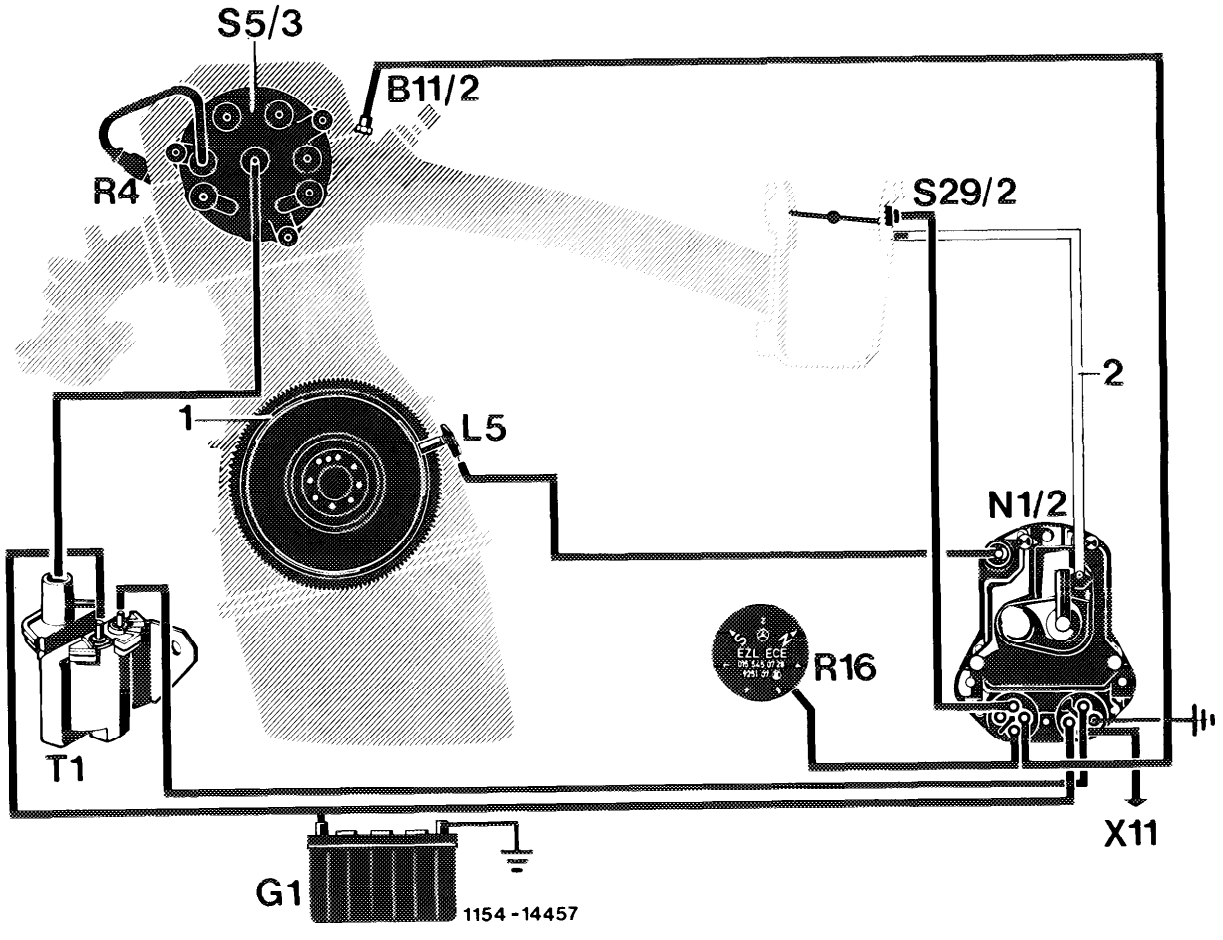
- During the separate ignition coil test, do not load the ignition coil with more than 28 kV in order to avoid damage to the ignition coil.

- If checking the ignition spark becomes necessary during a breakdown, this may only be carried out by means of a spark plug connected to a cylinder ignition cable. Ensure proper ground contact of the spark plug. Danger, risk of electrocution!

C. Motes for the use of testers and measuring devices

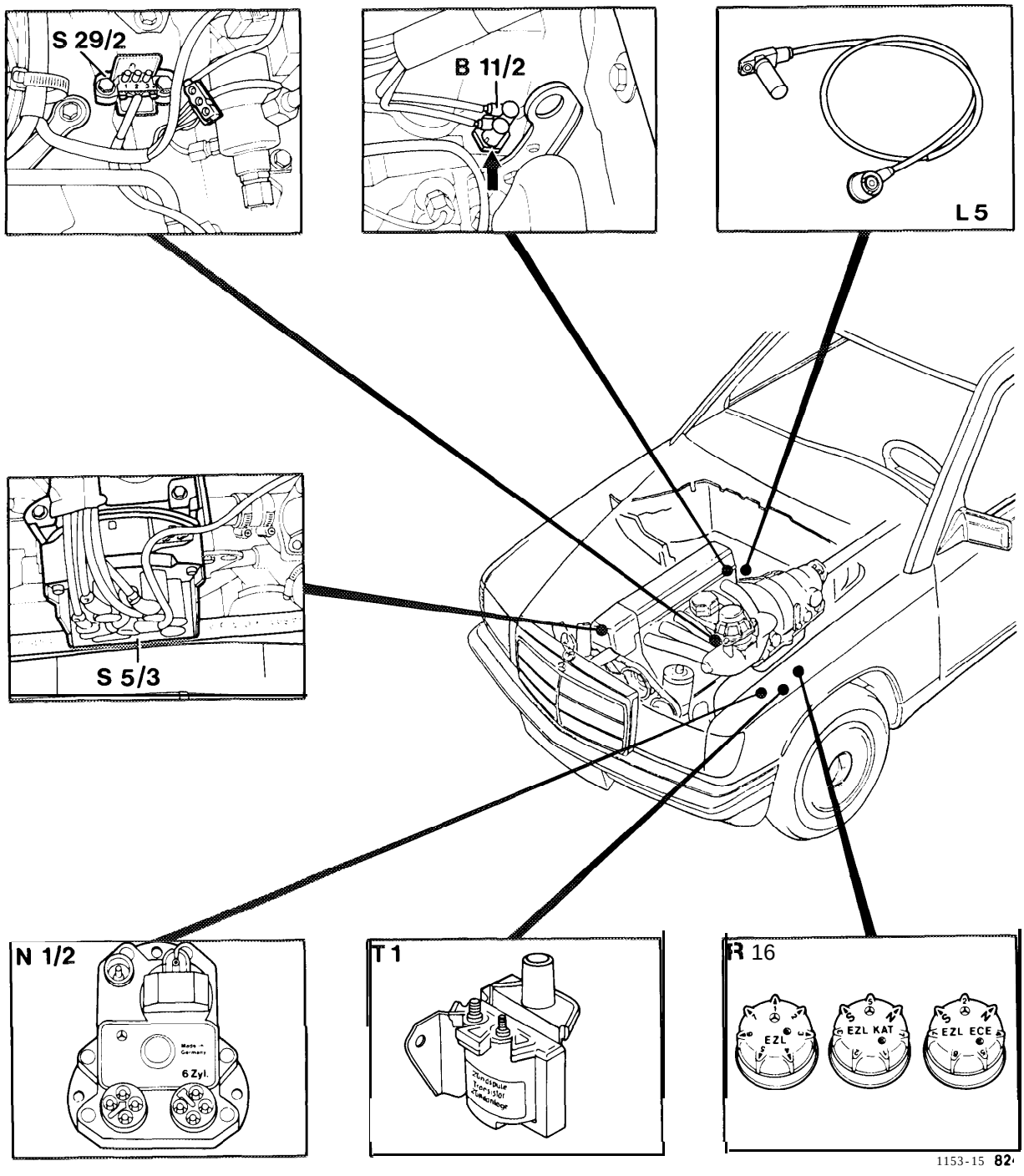
- Connect and disconnect voltage transmitter pliers to cable 4 and trigger pliers to cylinder 1 only with the engine stopped and the ignition switched off.

15-510 Function of the electronic ignition system with variable characteristics (EZL)



Function diagram electronic ignition system with variable characteristics (EZL)

B11/2	Temperature sensor, coolant (EZL/CIS-E/2E-E)
G1	Battery
L5	Position pickup, crankshaft
N1/2	Control unit transistorized ignition system (EZL)
R 4	Spark plugs
R16	Reference resistor plug (EZL)
S5/3	High voltage distributor
S29/2	Throttle valve switch, full load/idle speed detection
T1	Ignitron coil
x11	Diagnostic socket/cable connector, terminal TD
1	Segments on flywheel/driven plate
2	Vacuum pipe



Arrangement of components

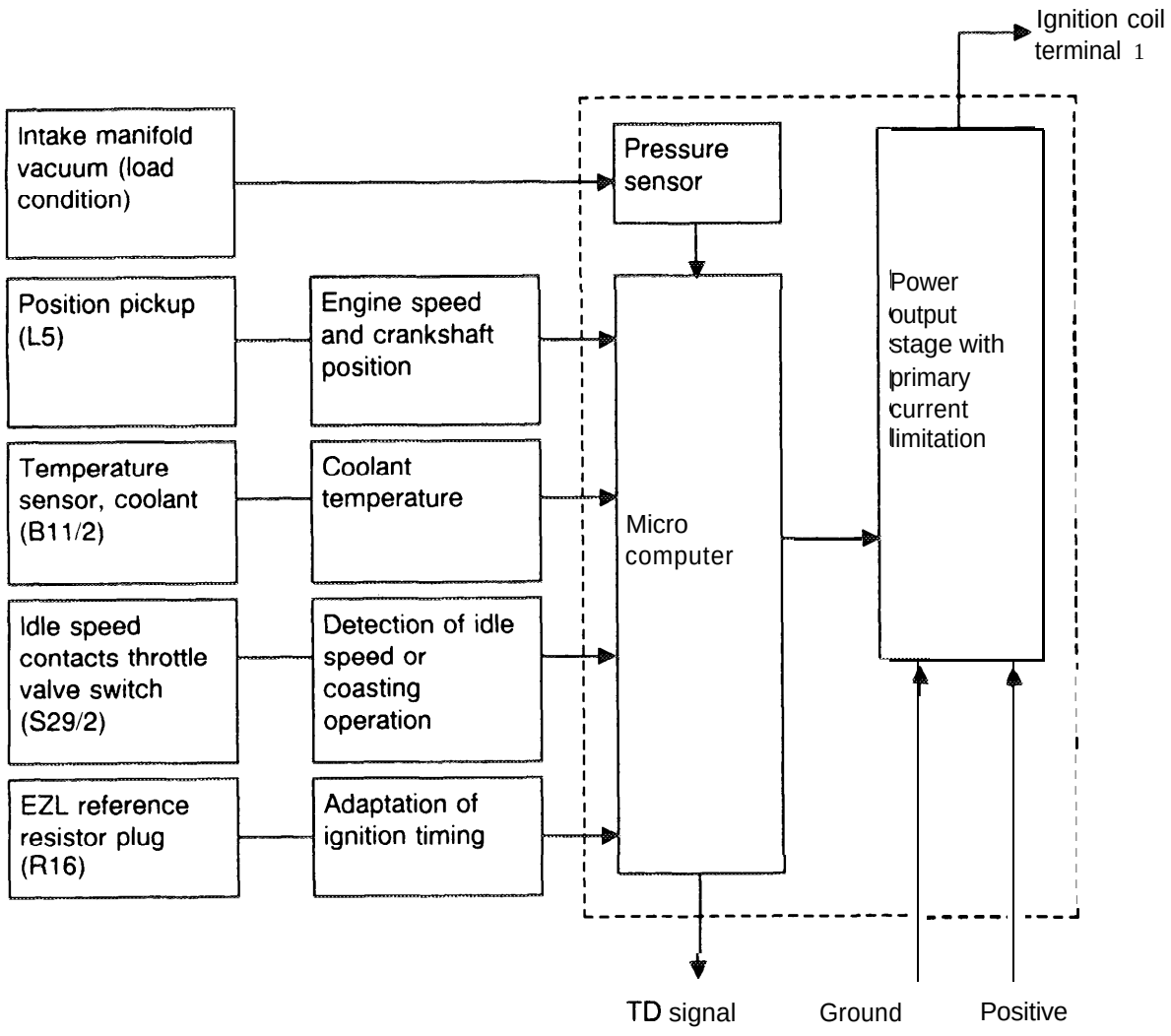
B11/2	Temperature sensor, coolant (EZL/CIS-E/2E-E)
L5	Position pickup, crankshaft
N1/2	Control unit transistonzed ignition system (EZL)
R16	Reference resistor plug (EZL)
S5/3	High voltage distnbutor
S29/2	Throttle valve switch, full load/idle speed detection
T1	Ignition coil

Model survey

Engine	Model	Version	output kW	Compression ε	EZL individual resistor plug
103.940	124.026	USA	118	9.2	750 Ω
103.942	201.029				
103.943	124.226				
103.981	126.024/025	USA	132	9.2	750 Ω
103.983	124.030/050 124.090				
103.985	124.230/290				

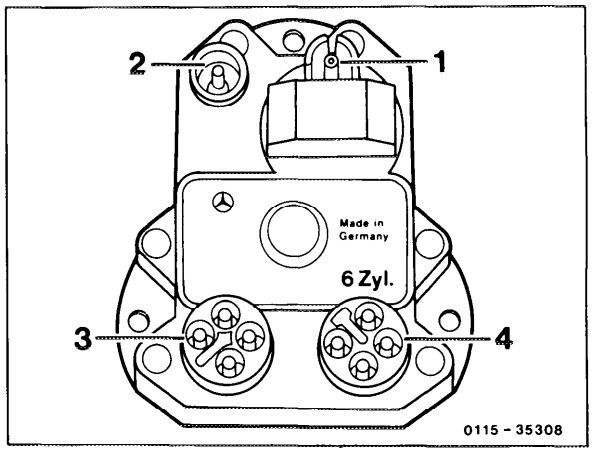
Components and function

Control unit (N1/2)



The ignition control unit is arranged on the left inner wing.

For improved heat dissipation it is installed with heat conducting paste. During replacement, do not remove the protective foil. The foil does not impair the heat dissipation. The control unit is equipped with a microcomputer, a pressure sensor and the power output stage.



1 Vacuum connection
2 Coaxial plug for control cable from position pickup
3 Plug - 4-pole pickup
1 temperature sensor, coolant
2 Throttle valve switch
3 EZL reference resistor plug
4 vacant (cable ends in cable harness)
4 Plug - 4-pole supply
15 = Terminal 15
16 = Ignition coil, terminal 1
TD = TD signal
31 = Ground

The characteristics for typical load/speed ranges and a fixed idle speed ignition characteristic are stored in the microcomputer of the control unit.

By means of various input signals, the control unit recognises the current operating condition of the engine. Engine speed and crankshaft position are picked up by the position pickup.

Considering all input signals, the stored characteristics are used to arrive at the optimum ignition timing for the respective operating condition,

The power output stage triggered by microcomputer controls the primary current of the ignition coil between terminals 16 and 31 (4-pole plug, supply).

The control unit also incorporates the known functions dwell angle control, primary current cutoff and primary current limitation.

The speed-dependent TD-signal is generated in the ignition control unit.

When starting the engine up to approximately 450/min, the ignition timing is controlled only via the segment edges of the flywheel. Only when reaching a certain speed (approximately 460/min), the control unit no longer uses the fixed ignition timing, but the timing calculated from the current operating conditions.

During the warming-up phase, various ignition characteristics are blocked depending on the coolant temperature in order to reach the operating temperature as quickly as possible.

At idle speed and during deceleration, a fixed characteristic is used while the idle speed contact of the throttle valve switch is closed. This characteristic is neither influenced by the temperature sensor, the intake manifold vacuum nor the EZL reference resistor plug.

Note
In the case of coolant temperature sensor interruption (resistance ∞Ω), the fixed characteristic on Bosch ignition control units is no longer used and a certain ignition timing in the family of characteristics is selected, i.e. the ignition timing is advanced.

At full load the ignition timing is determined by the full load characteristic. Under consideration of the octane requirement the ignition timing is advanced at this stage (higher engine torque).

Full load condition is recognised by the ignition control unit from the input signals intake manifold vacuum and engine speed.

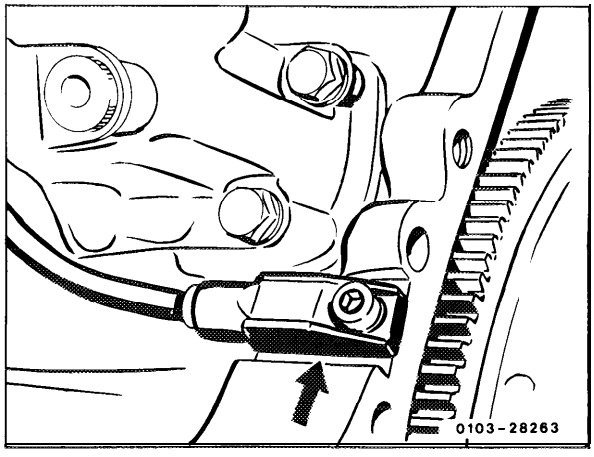
When exceeding a coolant temperature of approximately 95 °C, certain ignition characteristics are retarded in order to counteract further temperature rise.

Depending on the operating condition, the ignition timing of certain ignition characteristics can be adjusted by means of the EZL reference resistor plugs.

Position pickup (L5)

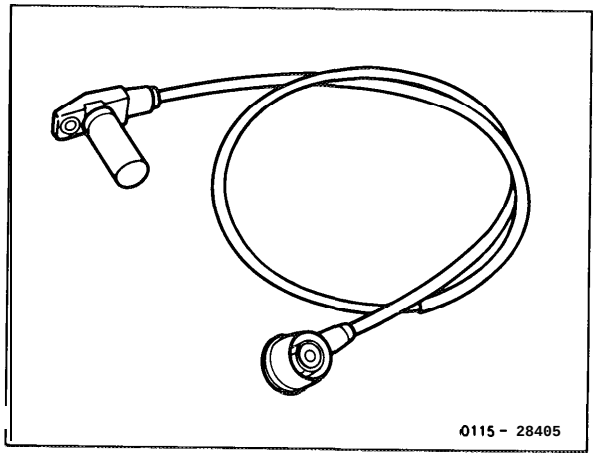
The position pickup registers the crankshaft position and the engine speed and signals this information to the ignition control unit.

The position pickup is mounted to the crankcase above the starter flange (arrow).



The coil body projects to just before the segments on the flywheel/driven plate. The segment position and speed is picked up without being in contact.

With the engine turning, due to induction an alternating voltage is generated in the position pickup. The peak value of the voltage (U,) is approximately 1.5 Volt at starting speed. The voltage rises with increasing speed (U_S approx. 3 Volt at 1200/min).

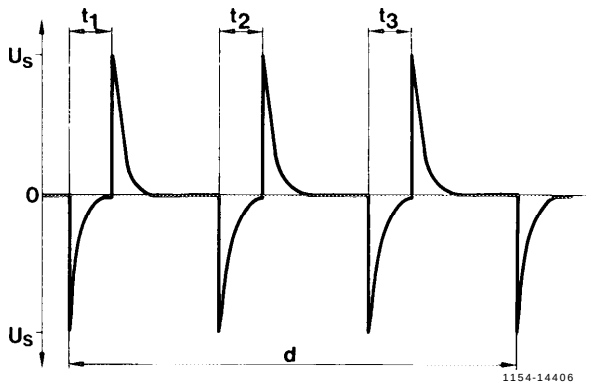


Note

Measure peak voltage (U,) with the oscilloscope.

The crankshaft position is recognised from the voltage as follows:

The segment front edge generates a negative voltage signal.
The segment rear edge generates a positive voltage signal.



t l First segment
t2 Second segment
t3 Third segment
d Period for one crankshaft rotation

The engine speed is determined by measuring the period.

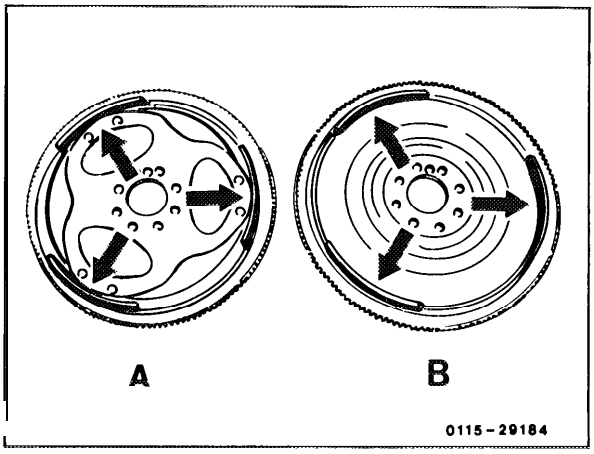
The alternating voltage from the position pickup is directed to terminal 7 on the ignition control unit via the control cable (coaxial cable). The cable is of the single-conductor type. The shield is used as second conductor.

If the ignition control unit does not receive a signal from the position pickup, the entire ignition system does not function, e.g. this can be caused by an interruption of the pickup coil.

The resistance of the position pickup is 680-120052.

Segments

Three segments (arrows) staggered by 120° are provided on flywheel/driven plate.



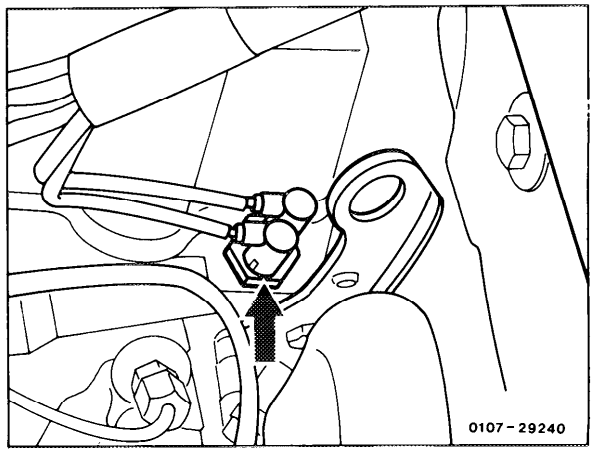
A Dnven plate with ring gear (automatic transmission)
B Flywheel (manual transmission)

Indications of damaged segments or mechanical damage to the position pickup:

- Alternating voltage from position pickup below nominal value.
- Alternating voltage signals of the individual segments differ greatly.
- No alternating voltage signal.

Temperature sensor, coolant (B11/2)

The temperature sensor coolant has two NTC with a one-pole connector each. One NTC for CIS-E and one NTC for EZL.
The temperature signal reaches the EZL ignition control unit via the green/black cable and the 4-pole plug-pickup (jack 1). The temperature sensor coolant is arranged on the cylinder head rear left.

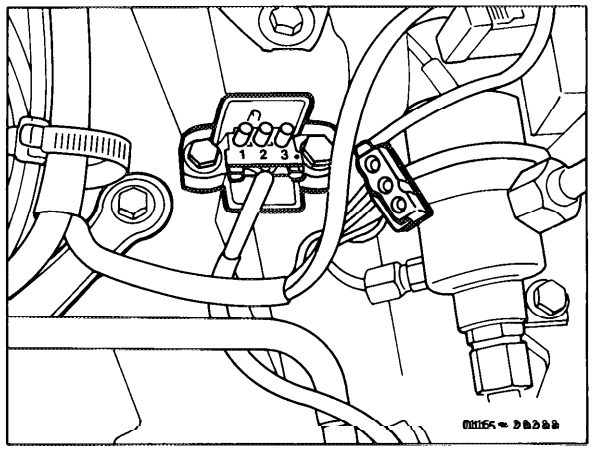


Note

NTC = negative temperature coefficient thermostat, i.e. the resistance is smaller in the hot state.

Throttle valve switch (S29/2)

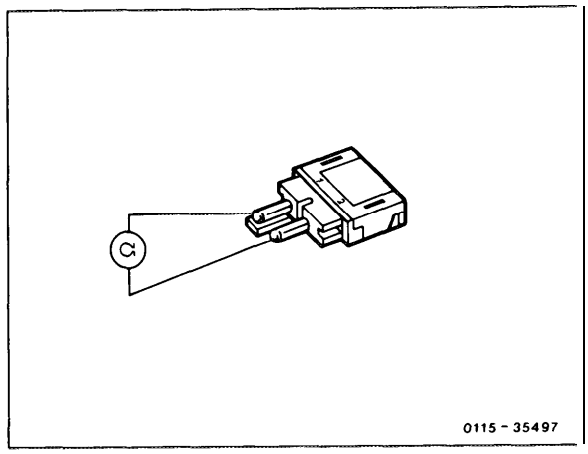
The fixed idle speed/deceleration characteristic is activated with closed idle speed contact in the throttle valve switch (accelerator not depressed). The control signal reaches the ignition control unit via the 4-pole plug-transmitter (jack 2).



Plug assignment on the plug
1 Idle speed contact
2 Ground
3 Full load contact

EZL individual reference resistor plug(R16/1)

The EZL individual reference resistor plug (R16/1) is provided with a fixed resistance. Depending on the national versions, the fixed resistances differ as follows:



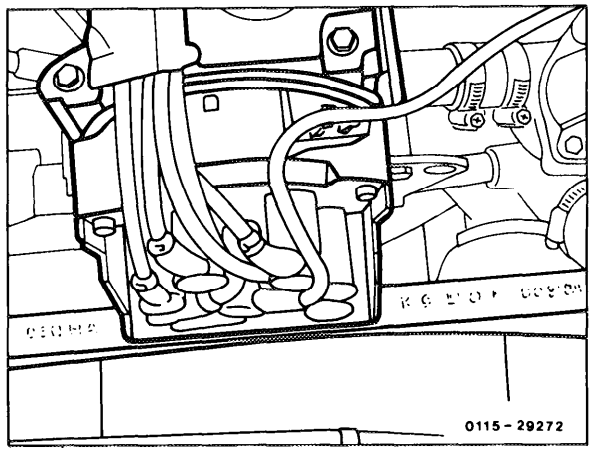
Part No.	Resistance	National version
000 540 21 80	OR	AUS
000 540 22 81	220 Ω	AUS
000 540 24 81	750 Ω	J USA

A certain family of characteristics is activated in the ignition control unit by means of the EZL individual reference resistor plug (R16/1)

Resistance measurement to check the individual reference resistor plug (R16/1) on the ignition control unit between plug-pickup (jack 3) and ground.

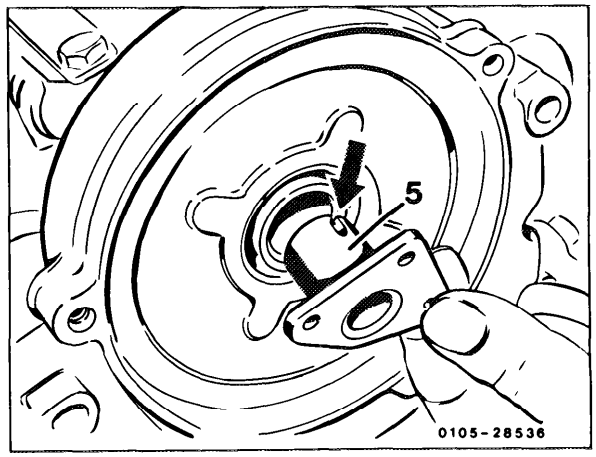
High-voltage distributor (SY3)

The high-voltage distributor only has the duty of distributing the ignition voltage, an adjustment of the ignition timing is no longer possible.

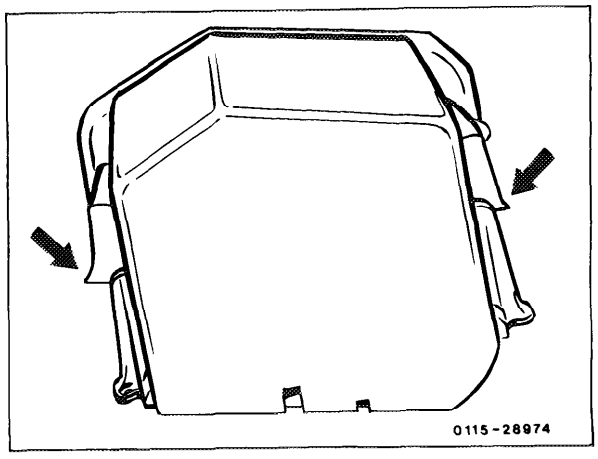


The high-voltage distributor is attached to the front cylinder head cover and is driven directly by the camshaft via the driver (5).

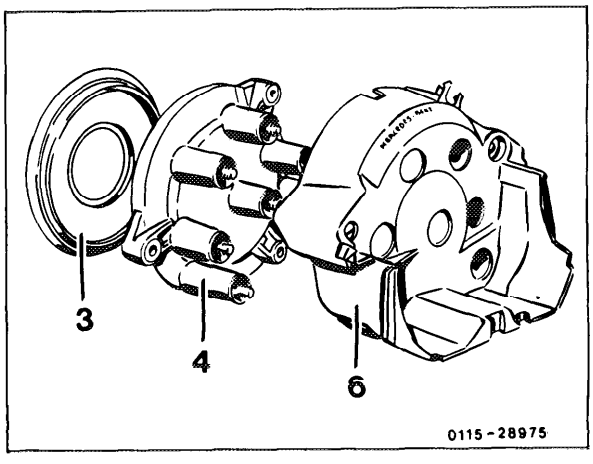
The distributor rotor is attached to the driver by means of three screws.
Interference suppression resistors: on the distributor cap for each connection 1 kΩ, spark plug connector 1 kΩ, distributor rotor 1 kΩ.



To protect against moisture and dirt, the high-voltage distributor is provided with a cover.



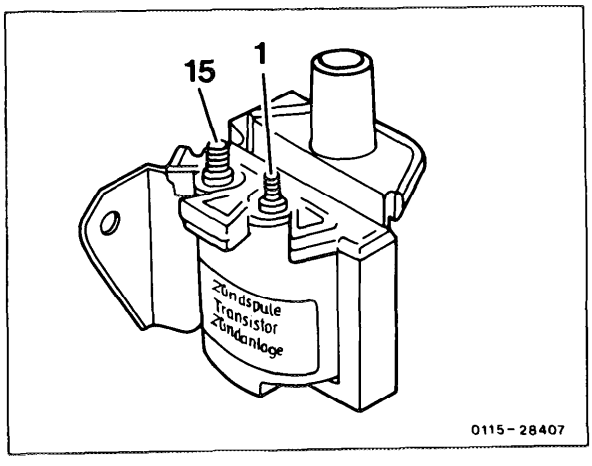
The shielding cover (6) for the long-distance intereference suppression is secured to the distributor cap by means of the three socket head screws.



Ignition coil (T1)

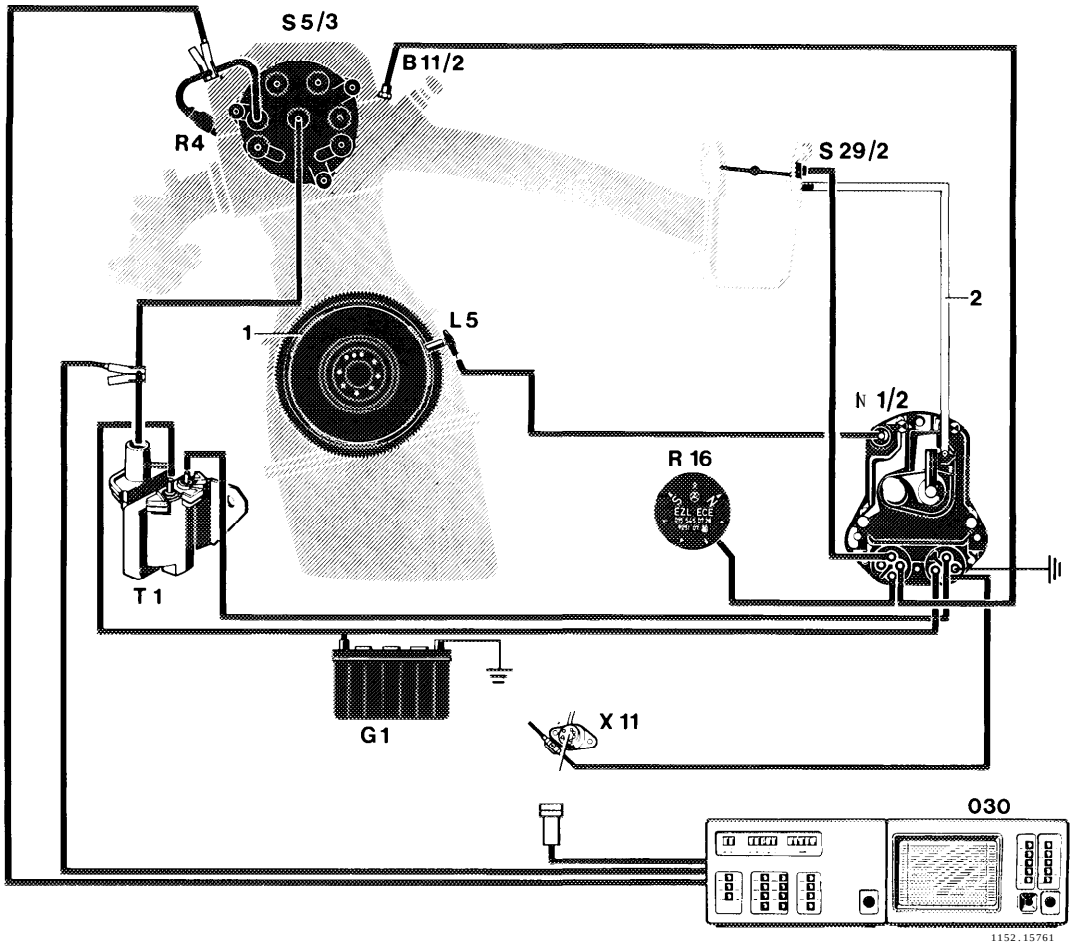
In order to achieve higher ignition energy, the ignition coil has been adapted to the ignition control unit. The high control output of the control unit permits further increase of the primary current. For this purpose the primary winding is designed with a very low resistance (0.3-0.6 Ω). Open-circuit current cutoff and primary current limitation allow ignition coil operation without pre-resistor.

Consequently the current limitation with the pre-resistor is no longer required. If the maximium primary current flows unlimited in the ignition coil (e.g. open-circuit current cutoff defective), the ignition coil will be damaged after a short time due to overheating.



For identification:
For 4- and 6-cylinder engines with electronic ignition systems with variable characteristics (EZL) the ignition coils are identical.
Identification: yellow nameplate.
The ignition coils are not interchangeable with the ignition coils for 8-cylinder engines (identification: green nameplate). Observe part number when replacing.

Observe notes regarding jobs on electronic ignition systems (15505).



B11/2	Temperature sensor, coolant (EZL/CIS-E/2E-E)	S29/2	Throttle valve switch, full load/idle speed detection
G1	Battery	T1	Ignition coil
L5	Position pickup, crankshaft	x11	Diagnostic socket/cable connector, terminal TD
N1/2	Control unit transistorized ignition system (EZL)	1	Segments on flywheel/driven plate
R4	Spark plugs	2	Vacuum pipe
R16	Reference resistor plug (EZL)	030	Engine tester with oscilloscope
S5/3	High-voltage distributor		

Engine tester with oscilloscope (030) ..... connect to diagnostic socket (Xl 1).

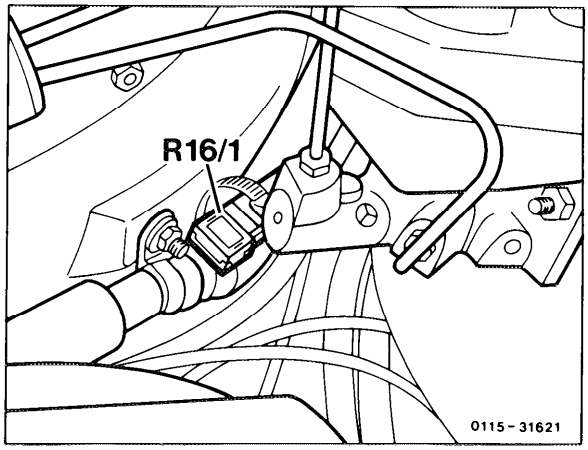
Ignition timing ..... check at specified speed at coolant temperatures below 95 °C with or without vacuum (see table).

Engine	Version or fuel type	Engine speed 1 /min	Ignition timing in °crankshaft BTDC		
			reference resistor plug position	without vacuum	with vacuum
103.940	USA	3200	Individual reference	25-29	40-44
103.942		Idle speed	resistor plug 750 Ω	7-11	7-11
103.983	USA	3200	Individual reference	25-29	40-44
103.985		Idle speed	resistor plug 750 Ω	6-11	6-11

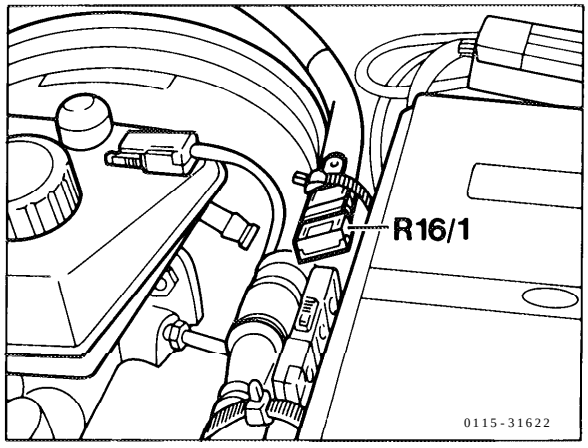
Arrangement of EZL reference resistor plug

(AUS) (J) (USA) EZL
individual reference resistor plug (R16/1)

Model 124
The EZL individual reference resistor plug is arranged on the left in the accessories compartment near the brake assembly.

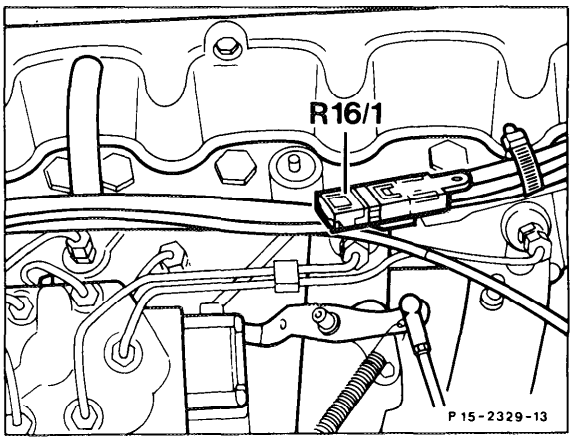


Model 126
The EZL individual reference resistor plug is connected to the cable harness between the fuse and relay box and the brake assembly.



Model 201

The EZL individual reference resistor plug is connected to the engine cable harness in the vicinity of the starting valve.



Go-image - parade pattern (engine speeds up to approx.1000/min)

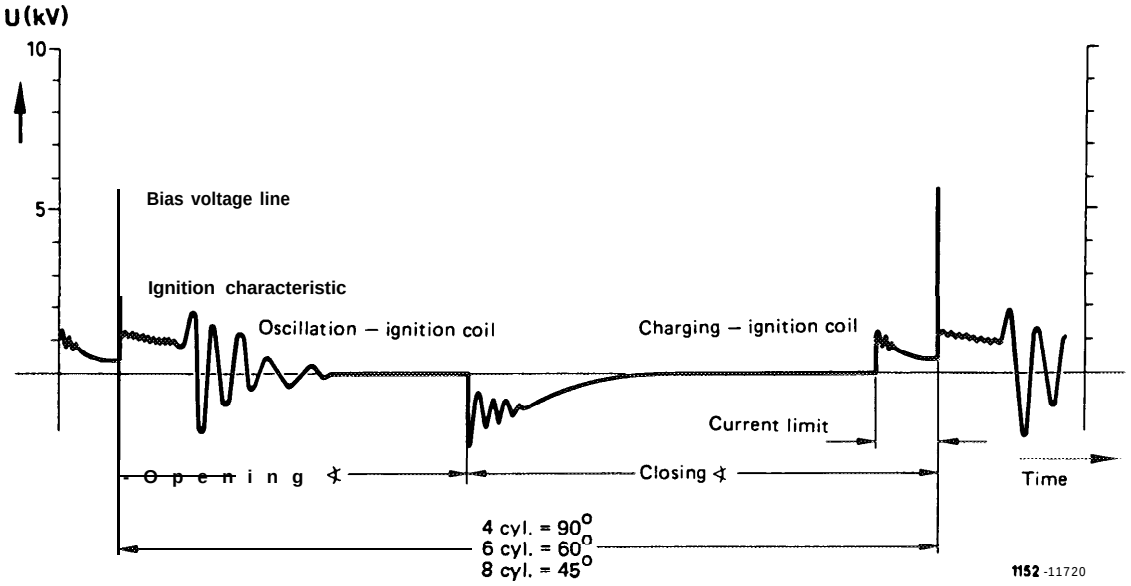


Image selection - Parade pattern. Display image is elongated in horizontal direction.

Go-image - superimposed pattern (engine speeds up to approx.1000/min)

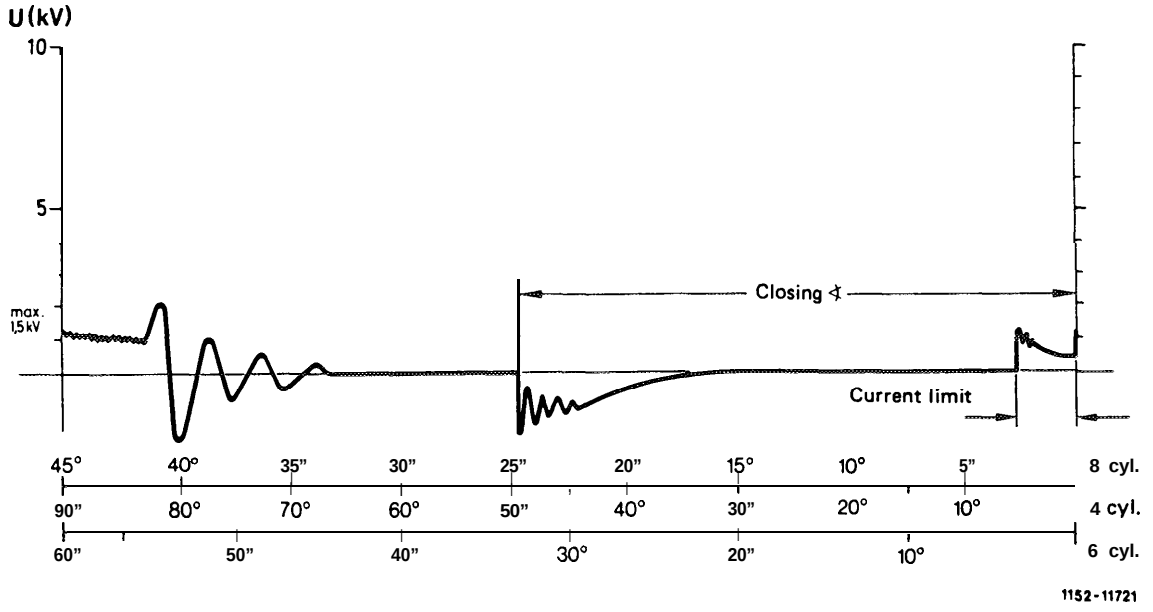


Image selection - Superimposition. For this purpose, set beginning and end of the ignition process on the left and right calibration lines.

Go-image - parade pattern (engine speeds above approx.1000/min)

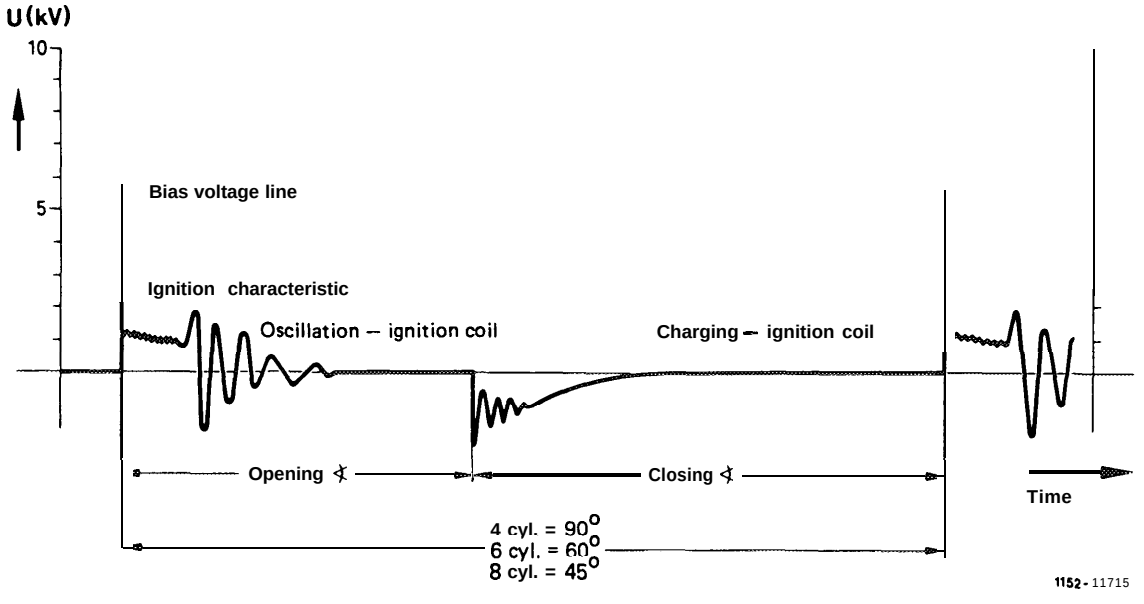


Image selection - Parade pattern. Display image is elongated in horizontal direction.

Go-image - Superimposition (engine speeds above approx.1000/min)

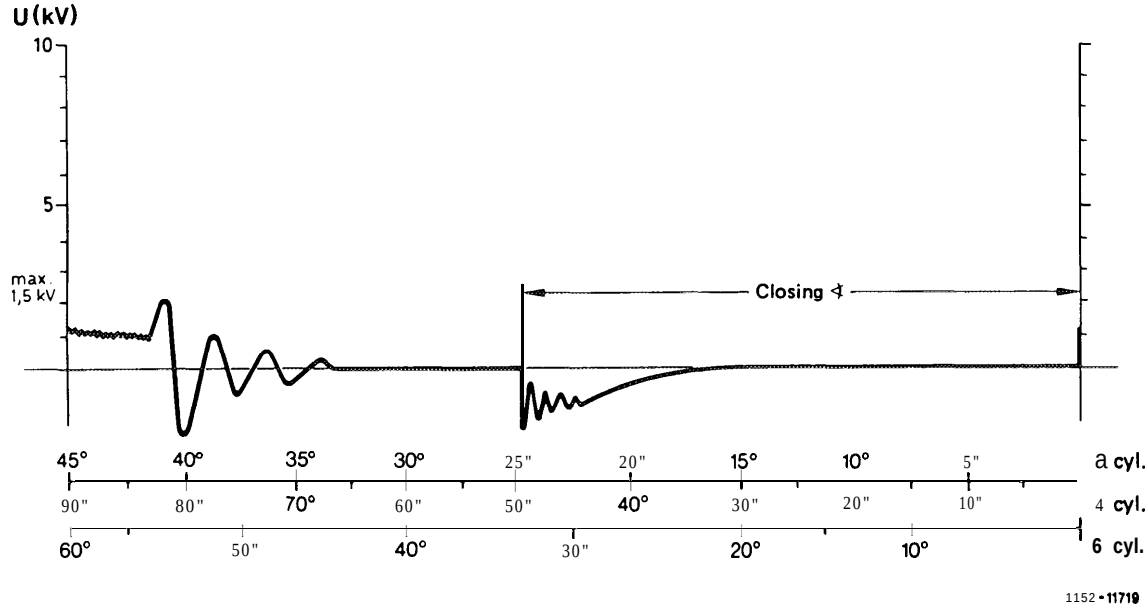


Image selection - Superimposition. For this purpose, set beginning and end of the ignition process on the left and right calibrating lines.

Too high but regular ignition curve starting point

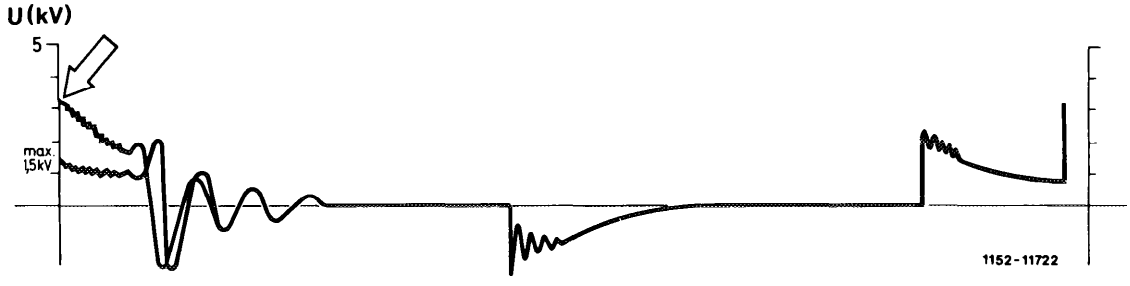


Image selection Superimposition.
Visible Idle speed on one or several cylinders

Image selection	Parade pattern.
Image error	Ignition curve starting point above 1.5 kV.
Visible	Idle speed on one or several cylinders.
Cause	Too high ohmic resistance on the secondary side due to spark plug connector, distributor rotor, distributor cap, ignition cable, spark plug.
Remedy	Renew parts with too high ohmic resistance (use ohmmeter).

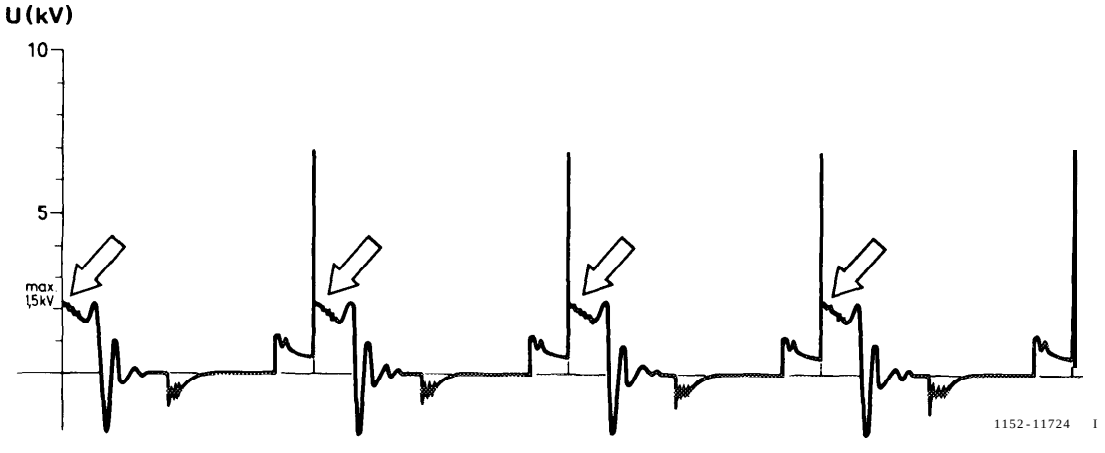


Image selection	Parade pattern.
Image error	Ignition curve starting point above 1.5 kV.
Visible	Idle speed on all cylinders.
Cause	Too high ohmic resistance on the secondary side due to distributor rotor, distributor cap or high-voltage cable no. 4 with plug.
Remedy	Renew parts with too high ohmic resistance (use ohmmeter).

Required ignition voltage

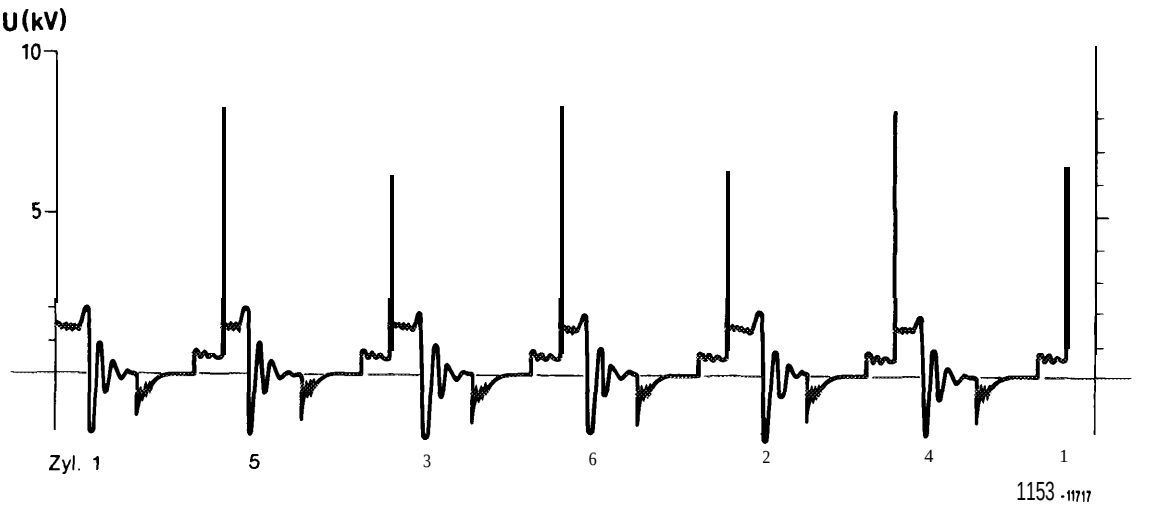


Image selection	Parade pattern.
Image error	Cylinders 4, 5 and 6 require a higher ignition voltage than cylinders 1, 2 and 3 (observe firing order).
Visible	idle speed.
Cause	Uneven mixture distribution.
Remedy	Check mixture distribution (e.g. fuel quantity comparitive measurement 07.3460).

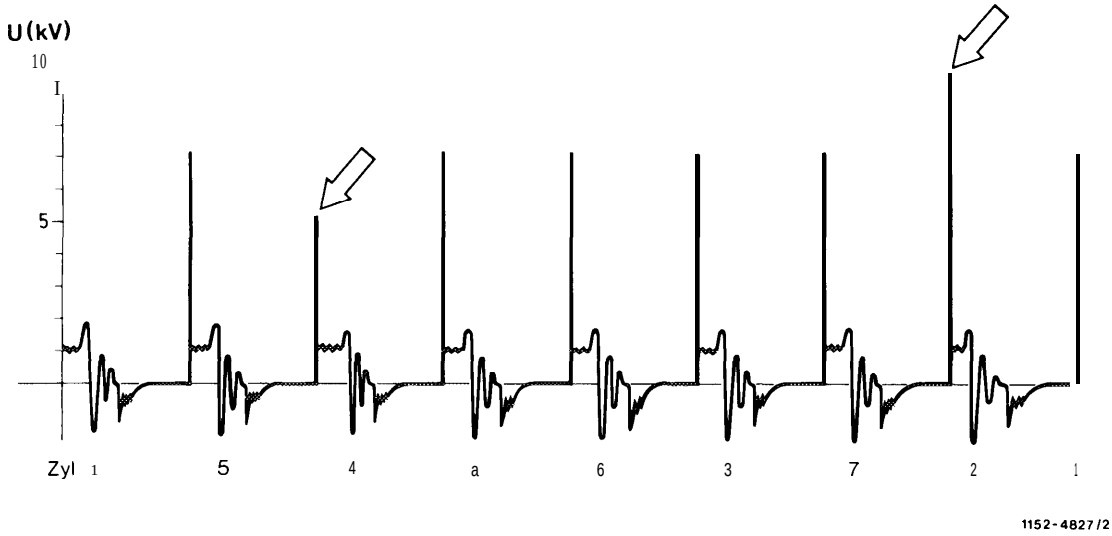


Image selection	Parade pattern.
Image error	Cylinder 4 bias too low • ignition curve longer Cylinder 2 bias too high - ignition curve shorter.
Visible	May occur at all speeds with or without engine load.
Cause	Cylinder 4 spark plug electrode gap too small, fuel-air mixture too rich, loss of compression. Cylinder 2 spark plug electrode gap too great, fuel-air mixture too lean, additional spark gap on the secondary side.
Remedy	Bias too low: correct spark plug electrode gap, check cylinder for leaks. Bias too high: correct spark plug electrode gap, check distributor cap, ignition cable and spark plug for continuity (use ohmmeter).

Jumping ignition curve starting point

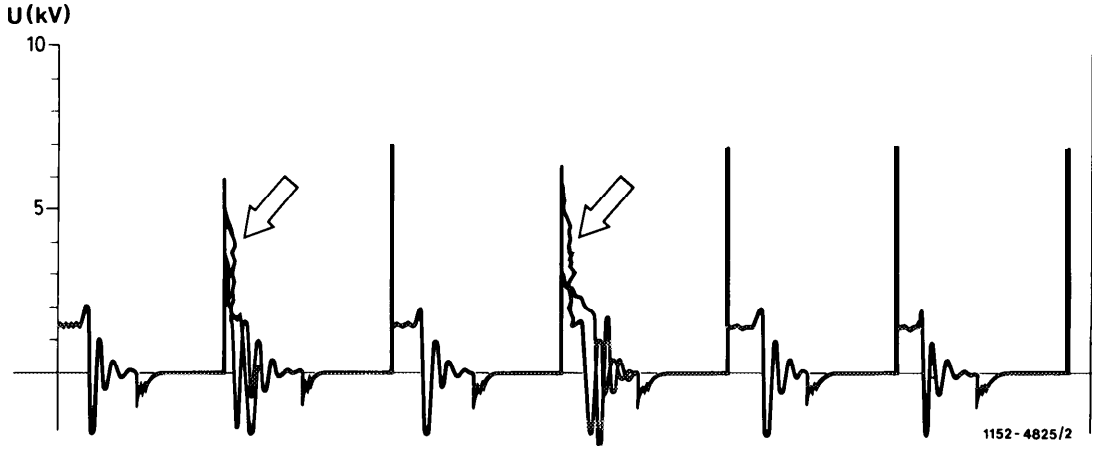


Image selection	Parade pattern.
Image error	Ignition curve starting point changes, jumps.
Visible	Can be visible at all speeds with or without engine load.
Cause	Spark plug carbon-fouled, oil-fouled, burnt, insulation damage on spark plug connector.
Remedy	Clean or renew spark plug, renew spark plug connector.

Required ignition voltage, intermittent acceleration load

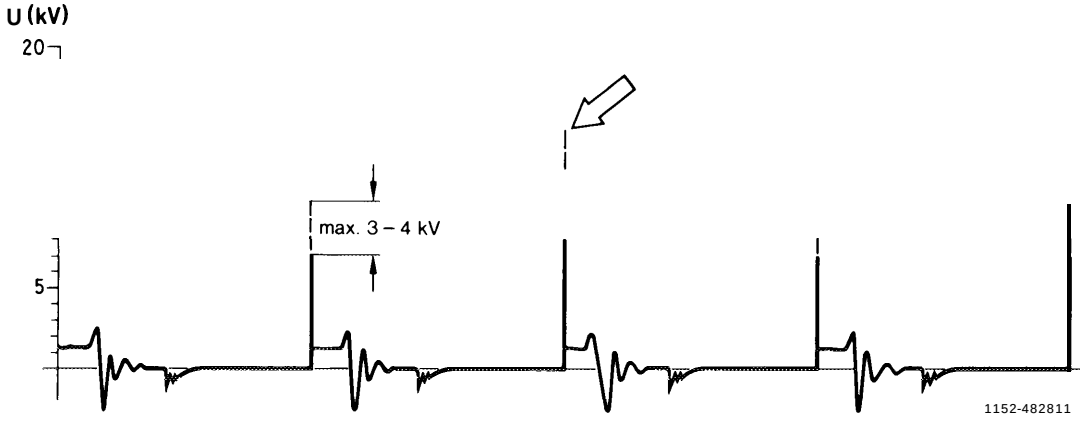


Image selection	Parade pattern.
Image error	Increase of required ignition voltage by more than 4 kV.
Visible	Accelerate engine intermittently to approx. 3000/min.
Cause	Spark plug electrode gap too large.
Remedy	Correct spark plug gap, renew spark plug if required.

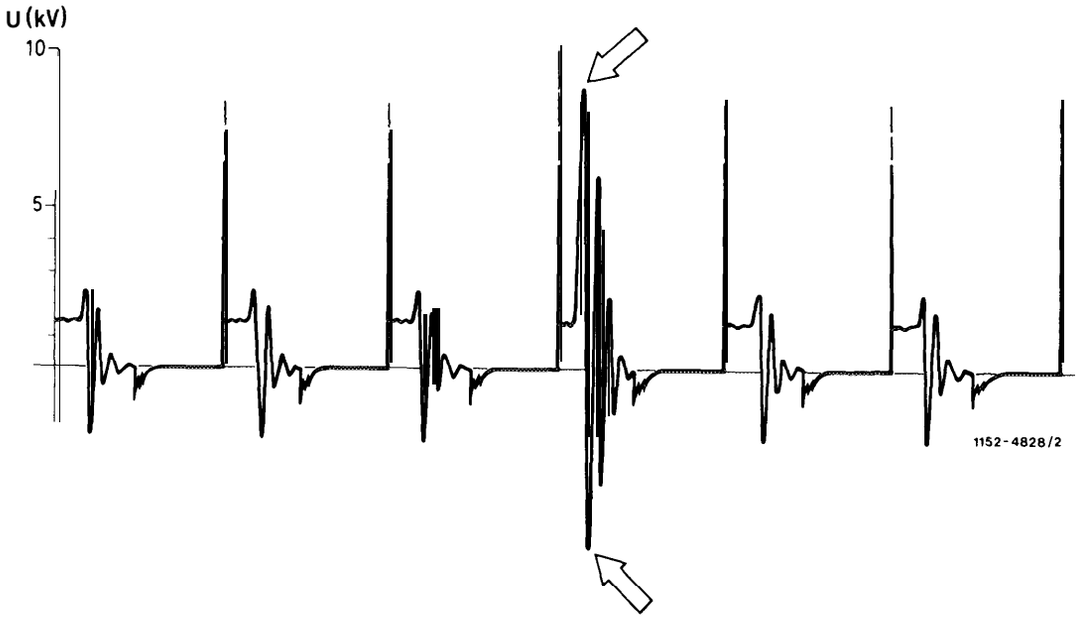
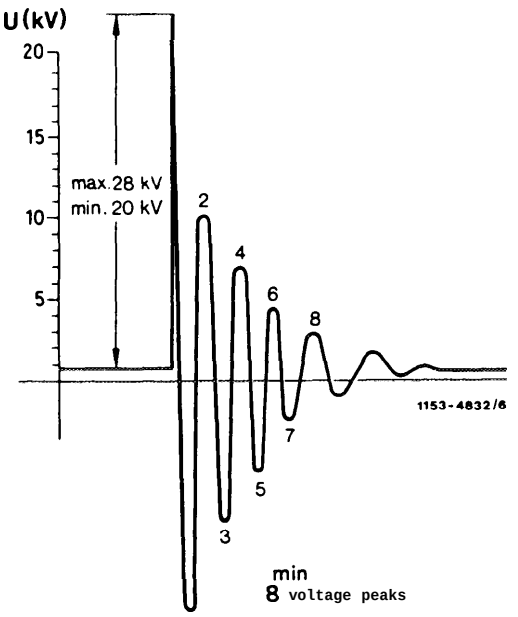


Image selection	Parade pattern.
Image error	The required ignition voltage increases by more than 4 kV on shortened ignition curve, high increase of the oscillations in the opening sector above and below the zero line.
Visible	With oscilloscope connected, start engine after prolonged inoperative period, repeatedly accelerate engine intermittently to approx. 3000/min.
Cause	Fuel-air mixture too lean.
Remedy	Check injection valve, renew if required (07.3135, 07.3-215).

Ignition coil - separate test

go



no-go

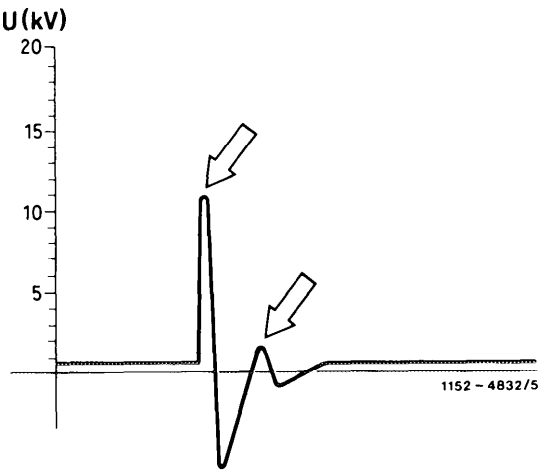
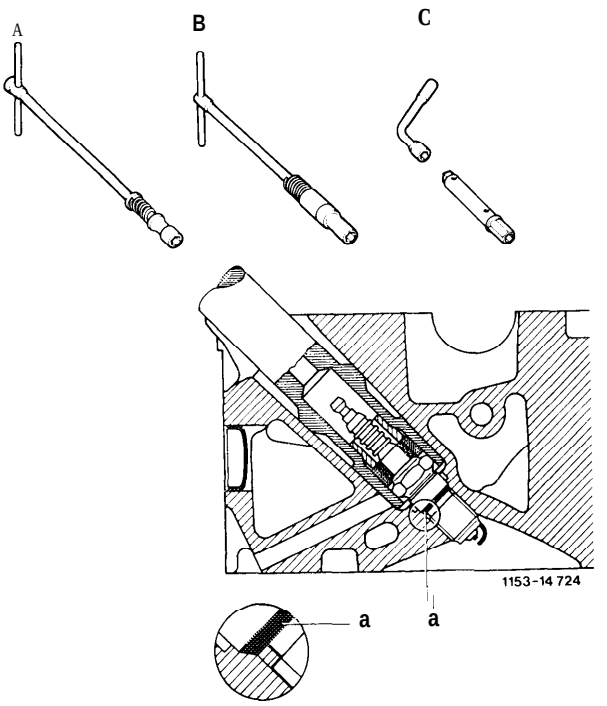


Image selection	Parade pattern.
Image error	Voltage below 20 **kV,** less than 8 voltage peaks.
Cause	Winding interruption, interturn short-circuit or insulation damage to ground.
Remedy	Renew ignition coil.
Note	Do not exceed 28 **kV** as this will already damage the ignition coil.

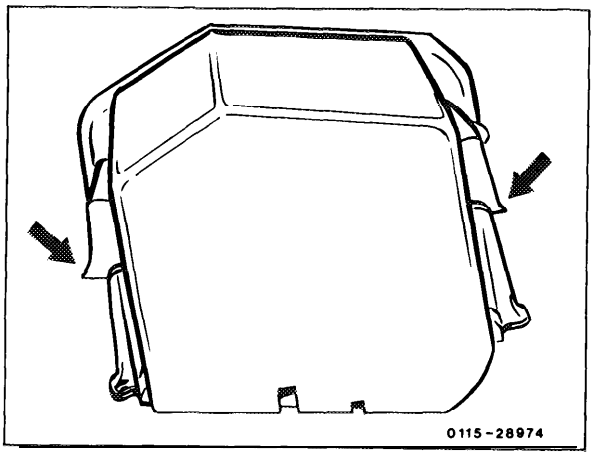
Job no. of the job texts and work units and standard texts and flat rates respectively 15-1031

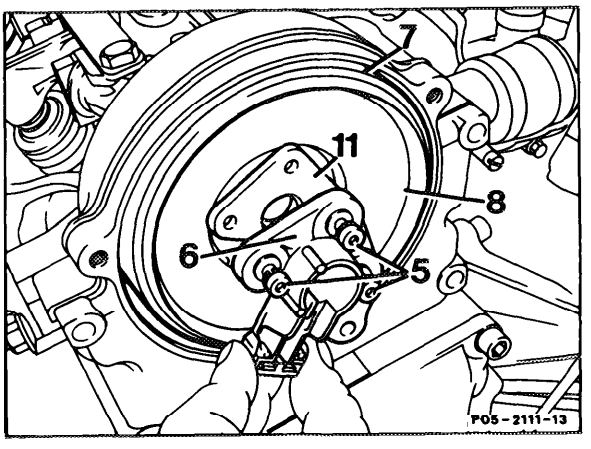


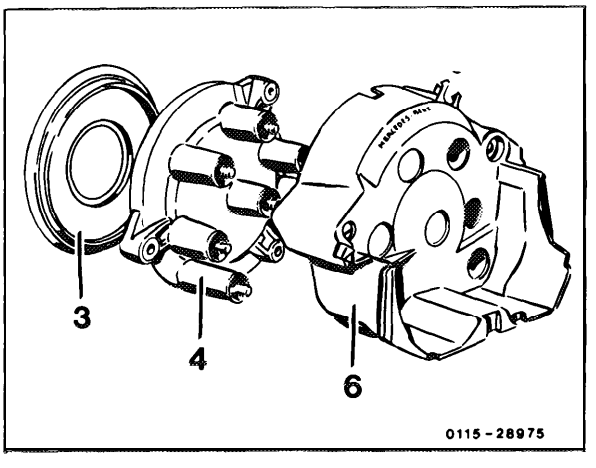
Spark plug connector	loosen by turning to the left and right and pull off. Blow recesses with compressed air.
Ignition cable cover	remove and clean, when fitting, ensure correct routing of ignition cables.
Spark plugs	for removal and installation use only approved spark plug wrench (with Nm limitation "B"). A102589020900 B 162 589 01 09 00 C on-board tools Install only approved spark plugs with tapered seat (a). Tightening torque 20 Nm

15-535 Removal and installation of high-voltage distributor

Job number of the job texts and work units and standard texts and flat rates respectively 1 S-3010







3 Sealing cover
4 Distributor cap
6 Shielding cap

Cover on high-voltage distributor . . . . . pull up by unclipping the two straps (arrows).

Distributor cap (4) . . . . . remove by loosening the three socket-head screws.

Caution!

During removal and installation of the distributor cap **(4),** observe in particular that the carbon does not contact the dome of the distributor rotor (2) with subsequent damage.

Distributor rotor (2) . . . . . remove by loosening the three socket-head screws (1) on the driver.

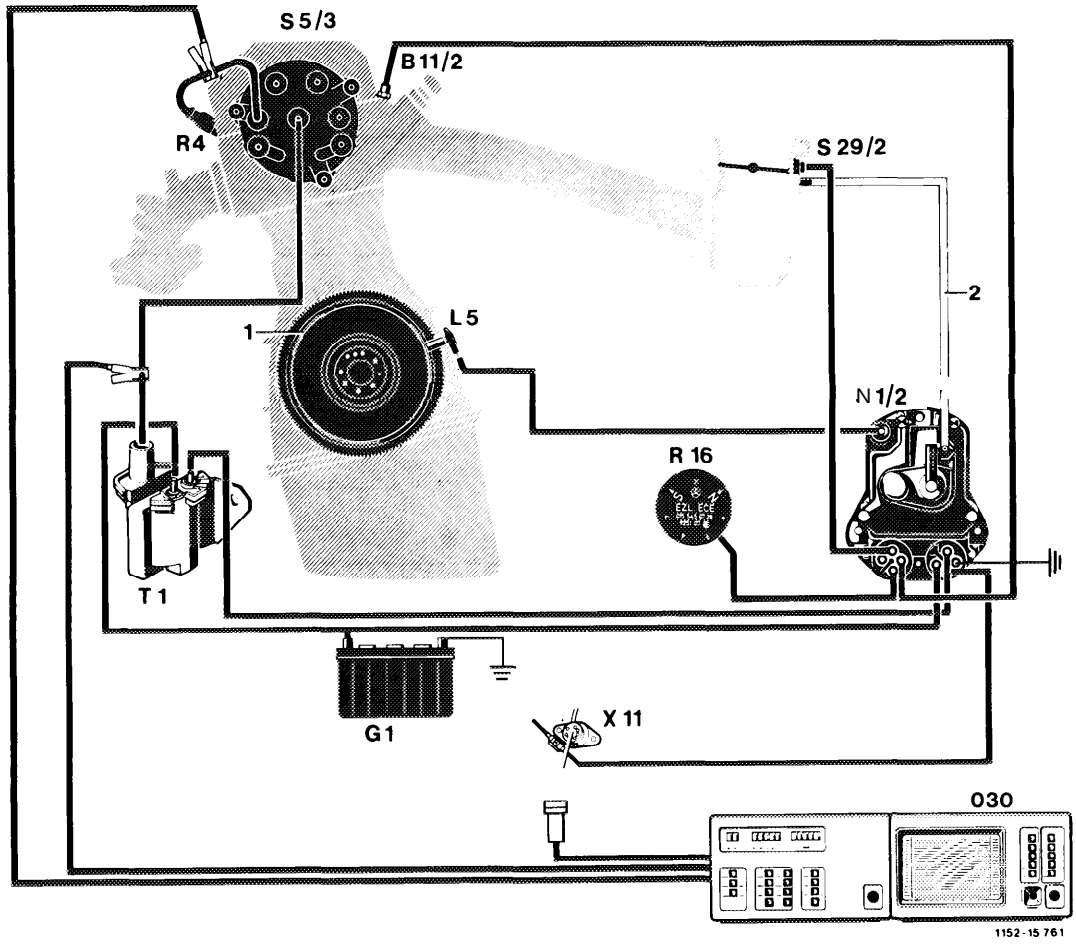
Note

After removal and installation of the high-voltage distributor the ignition timing need no longer be adjusted. The ignition timing is determined by the control unit.

Install the ignition cables on the distributor cap in the sequence 1, 3, 6, 2, 4, 5 so that the ignition cables can be routed properly.

15-540 Checking the electronic ignition system with variable characteristics (EZL)

Job number of the job texts and work units and standard texts and fiat rates respectively 1 S-2450



B11/2	Temperature sensor, coolant (EZUCIS-E/2 E-E)	S29/2	Throttle valve switch, full load/idle speed detection
G1	Battery	T1	Ignition coil
L5	Position pickup, crankshaft	x11	Diagnostic socket/cable connector, terminal TD
N1/2	Control uinit transistonzed ignition system (EZL)	1	Segments on flywheel/driven plate
R4	Spark plugs	2	Vacuum pipe
R16	Reference resistor plug (EZL)	030	Engine tester with oscilloscope
S5/3	High-voltage distributor		

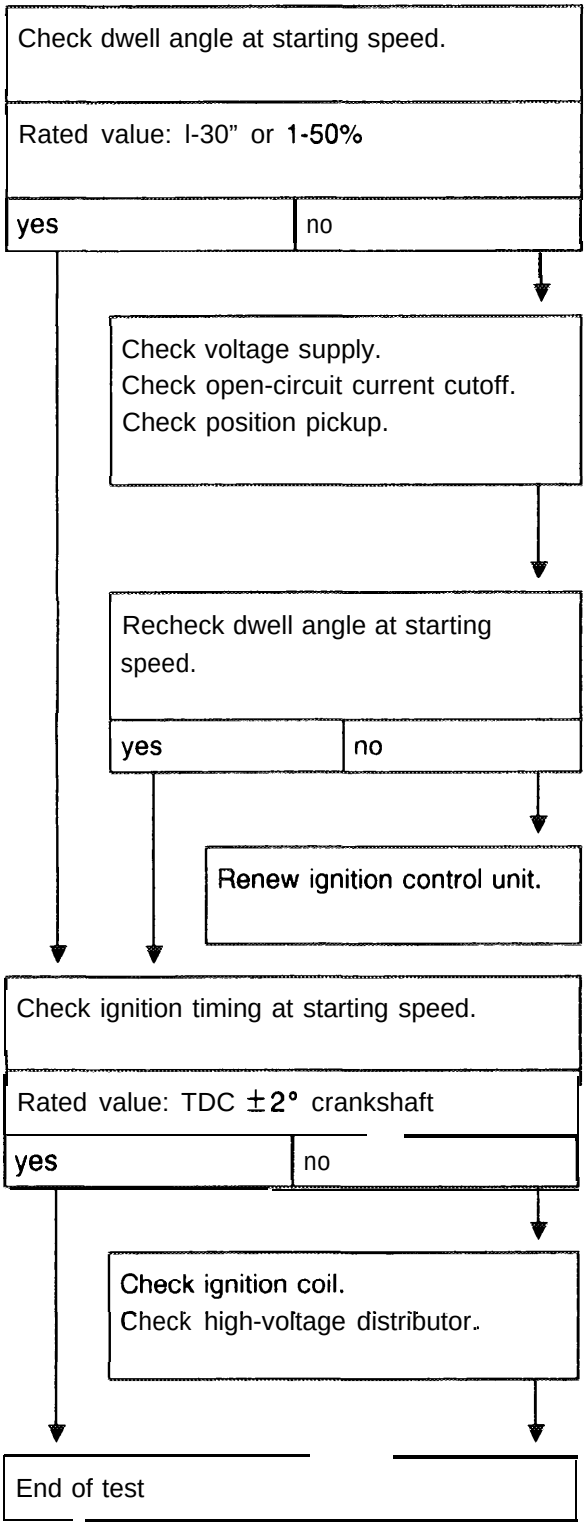
Precondition for the following ignition system tests:

Spark plugs, ignition gear, distributor rotor and distributor cap mechanically and electronically o.k.

Check for instance by means of visual inspection, resistance measurement and ignition oscilloscope.

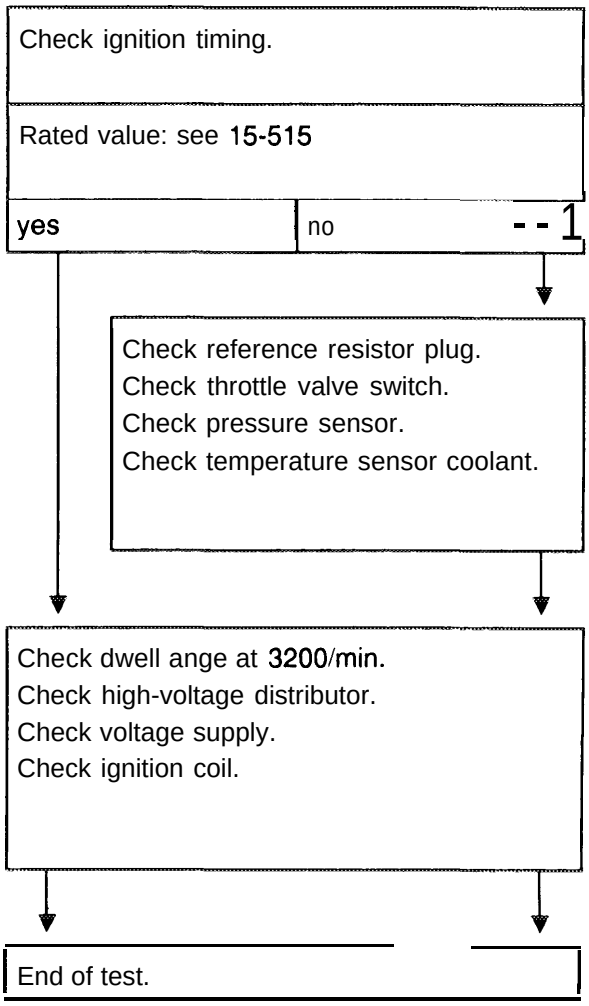
Test sequence - survey

A. Engine not running



Note
When complaint cannot be rectified, continue trouble diagnosis in CIS-E injection system.

B. Engine running



Note
When complaint cannot be rectified, continue trouble diagnosis in CIS-E injection system.

Test values

Resistances (test values from O-100 °C)

Ignition coil	primary (terminals 1 and 15)	Ω	0,3-0,6
Ignition coil	secondary (terminals 1 and 4)	kΩ	8-13
Position pickup		Ω	680-1200
Distributor cap for each connection, distributor rotor, spark plug connector		kΩ	1

Voltages, engine not running, ignition switched on

Terminals 15 and 31 (jack 5 and 2 diagnostic socket)			Battery voltage
Between terminals 15 and 1 (jacks and 5 and 4 diagnostic socket)		V	0
Round plug 4-pole	terminals 15 and 31		Battery voltage
Round plug 4-pole	terminals 16 and 31		Battery voltage

Dwell **angle**

At starting speed	I-30" or 1-50%
At 3200/min	24-53° or 40-88%

Ignition timing

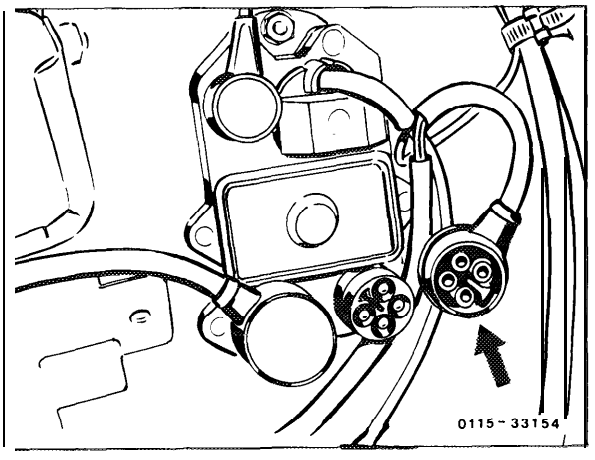
At starting speed	"crankshaft	TDC ± 2

A. Engine fails to run

Check dwell angle at starting speed
Connect measuring instruments.
Start engine.
Check dwell angle on jack 1 of the diagnostic socket.

Rated value: l-30" or 1-50%

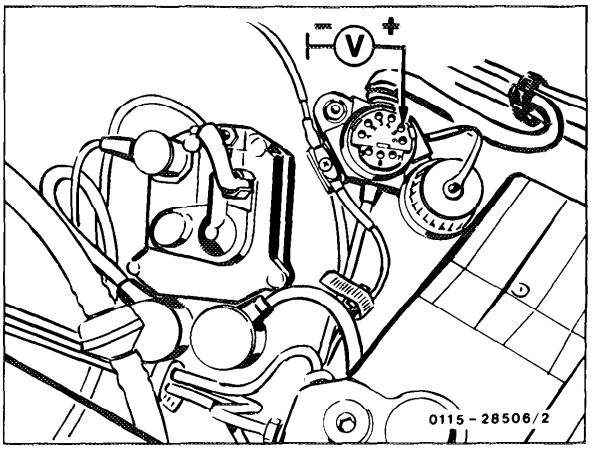
yes	no



Check voltage supply
Pull off 4-pole round supply plug on ignition control unit.
Switch on ignition.
Measure voltage on plug between terminal 15 (corresponding to jack 5 of the diagnostic socket) and terminal 31.

Rated value: battery voltage.

yes	no

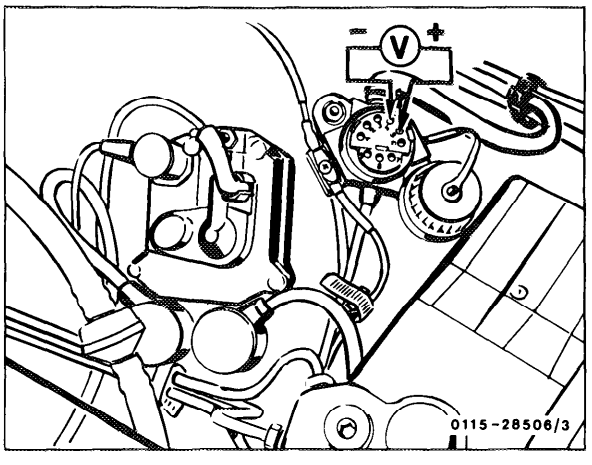


Check voltage supply via ignition lock.
Check ground cable.

Check open-circuit current cutoff
Check voltage differential between jacks 5 and 4 (terminals 15 and 1) of the diagnostic socket.

Rated value: 0 volt

yes	no



Renew ignition control unit and ignition coil.

Check position pickup
Switch off ignition.

Pull ignition pickup plug off ignition control unit. Measure pickup resistance between terminals 7 and 31d with the ohmmeter.

Rated value: 680-l 200 Ω

yes	no

Renew position pickup.

Check position pickup for ground connection.

Check resistance between terminal 7 and vehicle ground.

Rated value: ≥200 kΩ or ∞

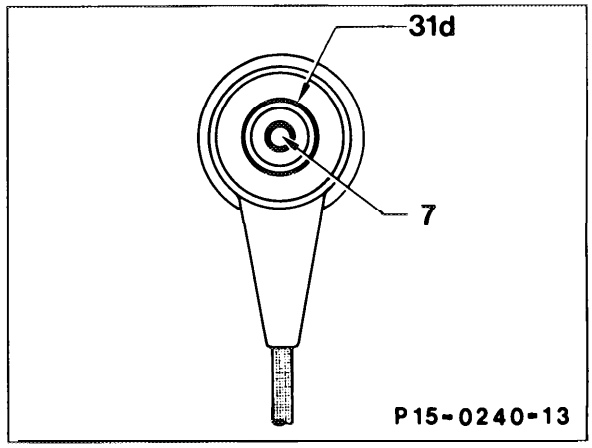
yes	no

Visual inspection of control cable.
Renew position pickup.

Check alternating voltage from the position pickup with the oscilloscope.
Pull off control cable.
Measure alternating voltage between terminals 7 and 31d at starting speed.

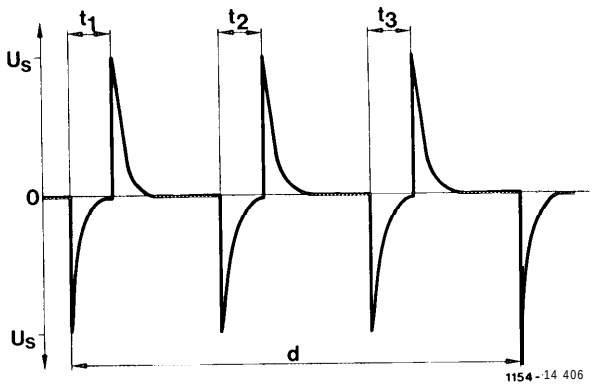
Rated value: $U_s \geq 1$ volt

yes	no



Renew position pickup.
If alternating voltage remains below rated value, check segments on the flywheel/driven plate.

t1 1st segment
t2 2nd segment
t3 3rd segment
d Period for one crankshaft rotation



Check dwell angle at starting speed

Connect measuring instruments.
Start engine.
Check dwell angle on jack 1 of the diagnostic socket (terminal TD).

Rated value: 1-30° or 1-50%

yes | no

Renew ignition control unit.

Check ignition timing at starting speed

Rated value: TDC ±2°

yes | no

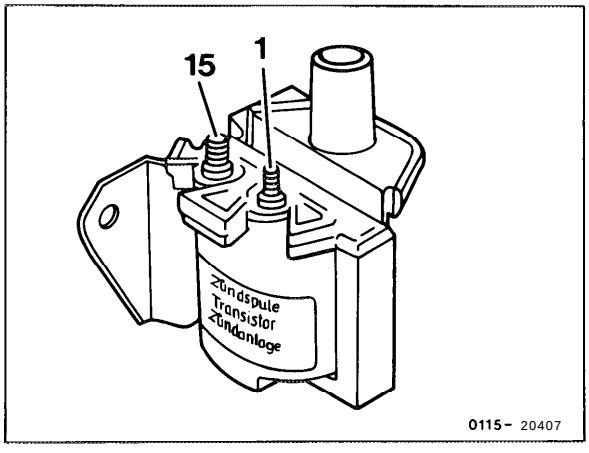
Check ignition coil

(Unscrew cables from the ignition coil).

Rated values:
Terminals 1 and 15: 0.3-0.6 Ω
Terminals 1 and 4: 8-13 kΩ

yes | no

Renew ignition coil.



Check high-voltage distributor
Visually inspect distributor cap and rotor.
Measure interference suppression resistors.

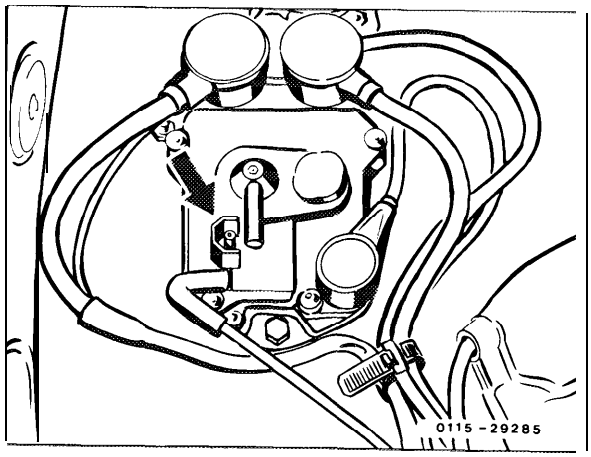
End of test.

B. Engine running

Check ignition timing
Engine at operating temperature.
Coolant temperature below 95 °C.
Check ignition timing at idle speed.
Check ignition timing at 3200/min with and without vacuum (disconnect vacuum line on control unit).
Observe reference resistor plug position.

Rated values: see 15-515

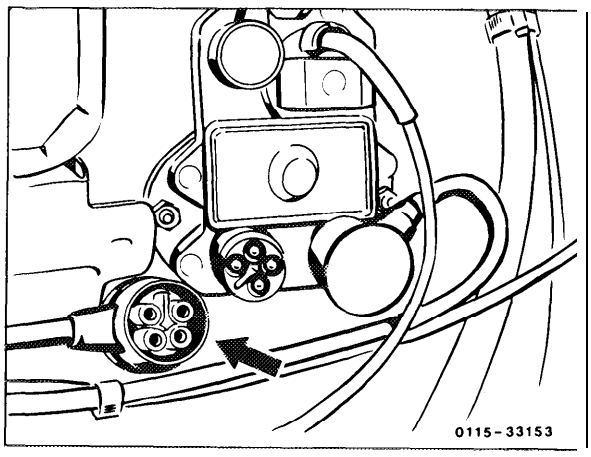
yes	no



Check reference resistor plug
a) Reference resistor plug (R16)
Compare engine version and reference resistor plug lettering. Pull 4-pole plug-pickup (arrow) off ignition control unit.
Measure resistance value between jack 3 and vehicle ground.

b) Individual reference resistor plug (R16/1)
Compare national version and part number.
Pull 4-pole plug-pickup (arrow) off ignition control unit.
Measure resistance value between jack 3 and vehicle ground.

yes	no

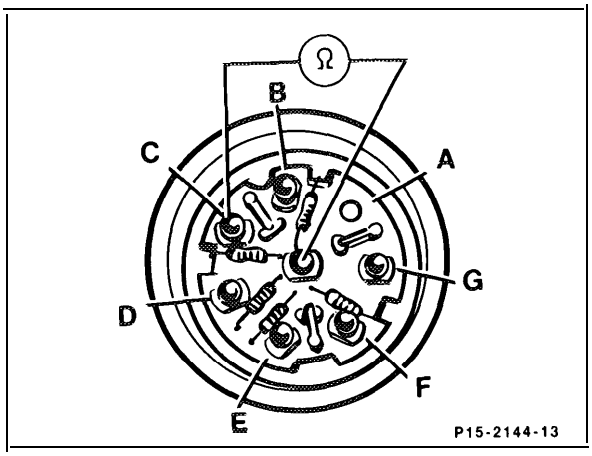


a) Reference resistor plug (R16)

Check resistance values in the reference resistor plug (between the outer and center plug pins).

Rated values for all reference resistor plugs:

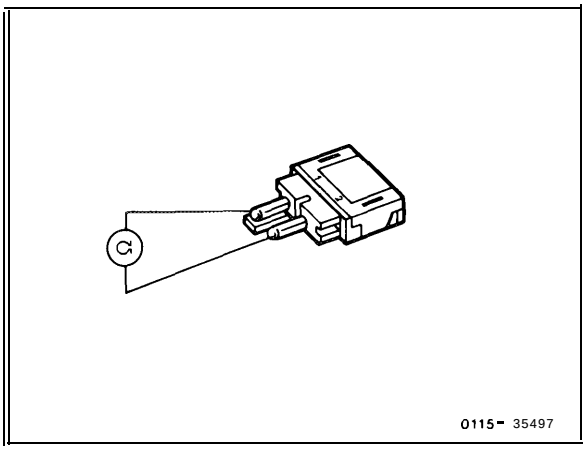
A		E	470 Ω
B	2.4 kΩ	F	220 Ω
C	1.3 kΩ	G	0 Ω
D	750 Ω		



b) Individual reference resistor plug (R16/1)

Check resistance values measure resistance values on the individual reference resistor plug between the two plug pins.

Part number	Resistance	National version
000 540 21 81	0 Ω	AUS
000 540 22 81	220 Ω	AUS
000 540 24 81	750 Ω	USA J



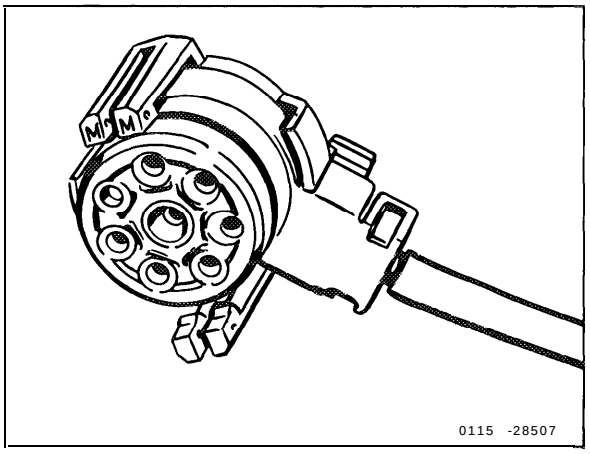
yes | no

Renew reference resistor plug.

Check cable to ignition control unit.
Check ground cable.
Check plug lower part.

yes | no

Renew damaged parts.



Disconnect vacuum line on control unit.
Run engine at approx. 1200/min (not idling).
Ignition timing changes when turning the reference resistor plug.

yes	no

Renew ignition control unit.

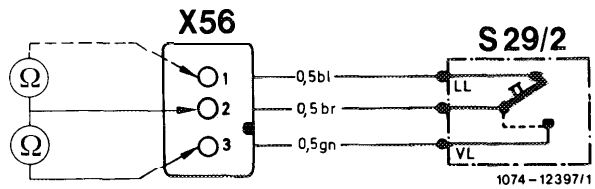
Check throttle valve switch
Disconnect coupling on throttle valve switch.
Check resistance of throttle valve switch.

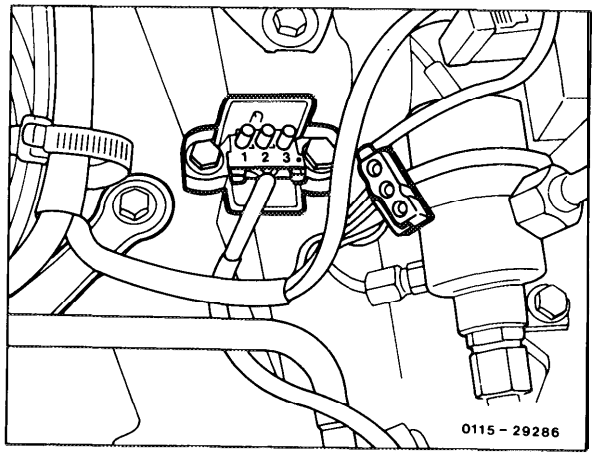
Idle speed position	approx. 0 Ω
Full load	approx. 0 Ω
Part load position	approx. ∞ Ω

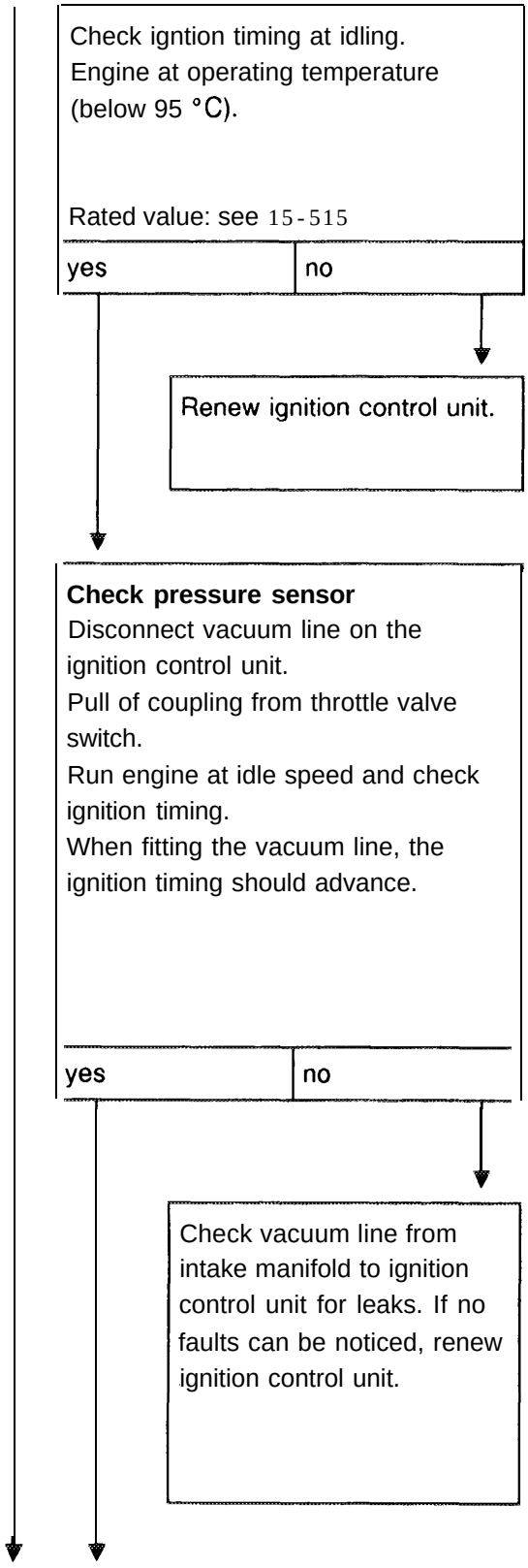
yes	no

Adjust or renew throttle valve switch.

Check cable to ignition control unit.
Check ground cables.






Check igntion timing at idling.
Engine at operating temperature (below 95 °C).
Rated value: see 15-515
yes
no
Renew ignition control unit.
Check pressure sensor
Disconnect vacuum line on the ignition control unit.
Pull of coupling from throttle valve switch.
Run engine at idle speed and check ignition timing.
When fitting the vacuum line, the ignition timing should advance.
yes
no
Check vacuum line from intake manifold to ignition control unit for leaks. If no faults can be noticed, renew ignition control unit.

Check temperature sensor, coolant

Disconnect 4-pole plug-pickup on control unit.

Measure resistance between jack 1 and ground.

Rated value see diagram.

Check resistance at two temperatures.

Example:

+ 20 °C ⇒ 2.28-2,72 kΩ

+ 80 °C ⇒ 290-364 Ω

yes	no

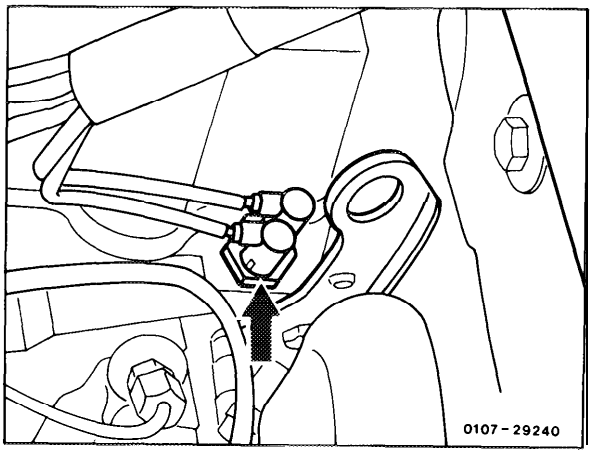
Check cable.
Renew temperature sensor, coolant.

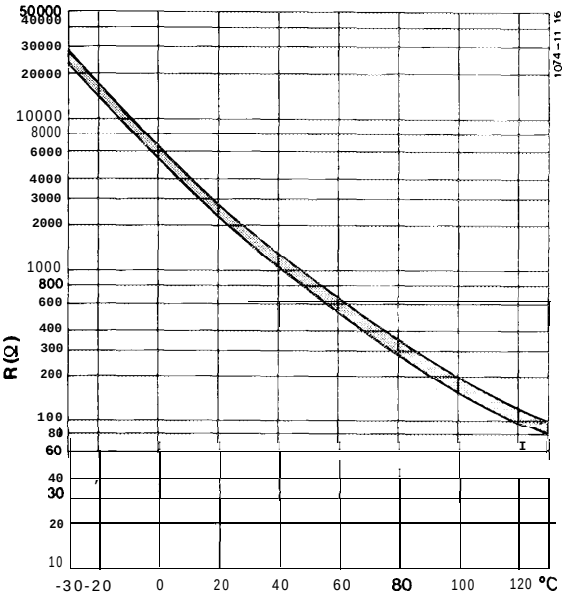
Check ignition timing at 3200/min without vacuum.

Rated value: see 15-515

yes	no

Renew ignition control unit.





Check dwell angle at 3200/min

Vacuum line and 4-pole plug (pickup) on ignition contol unit connected.
Run engine at 3200/min.
Check dwell angle

Rated value: 24-53° or 40-88%

yes	no

Renew ignition control unit.

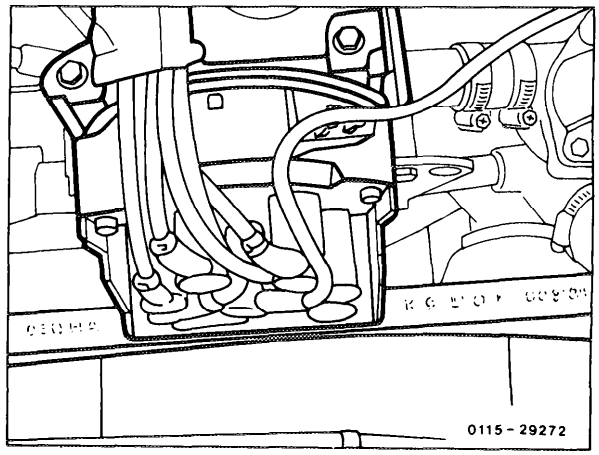
Check high-voltage distributor

Visually inspect distributor cap and rotor.
Measure interference suppression resistors.

Rated value: 1 kΩ

yes	no

Renew parts.

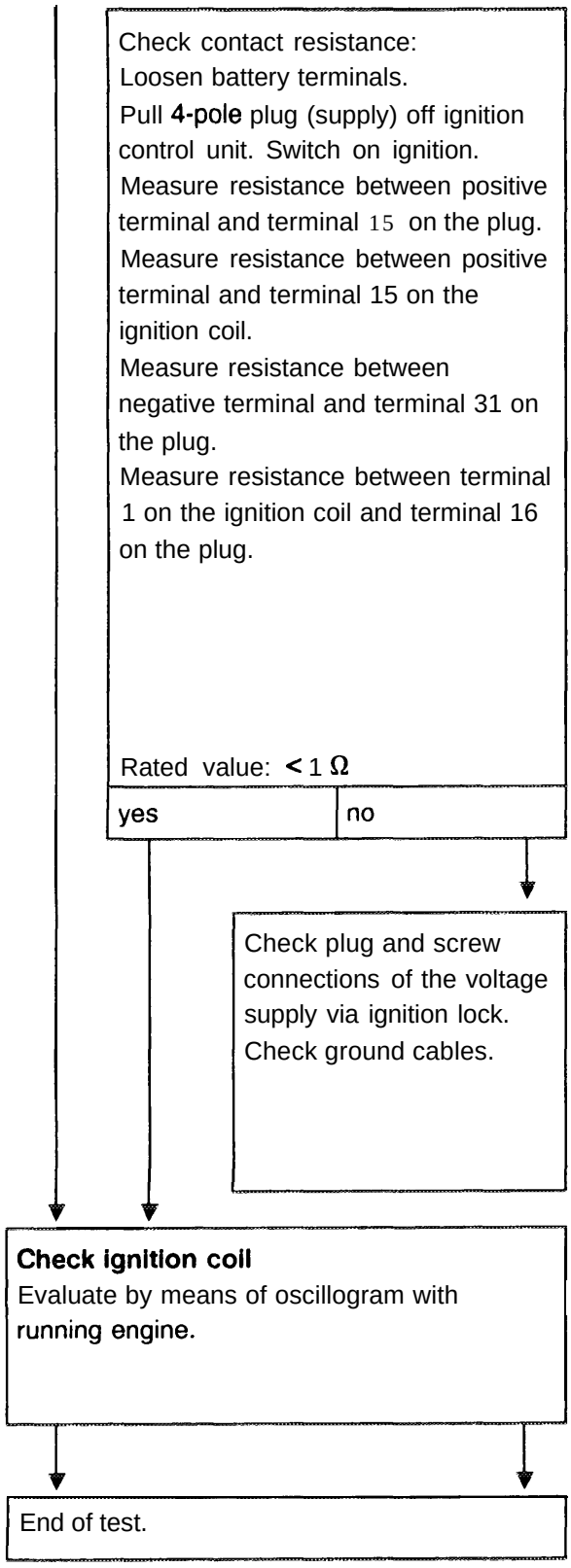


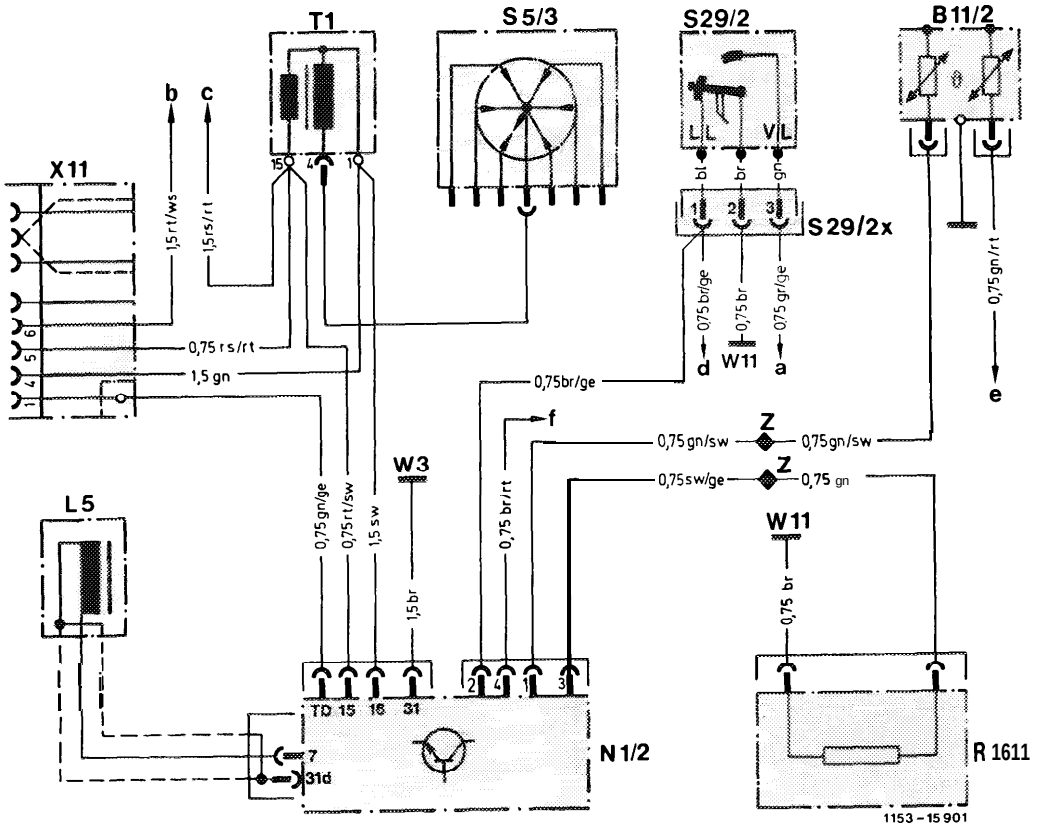
Check voltage supply

Measure voltage drop:
Remove ignition coil cover.
Connect measuring instrument to negative terminal of battery.
Run engine.
Measure voltage on the positive terminal of the battery and subsequently on terminal 15 of the ignition coil.

Rated value: voltage differential < 1 volt

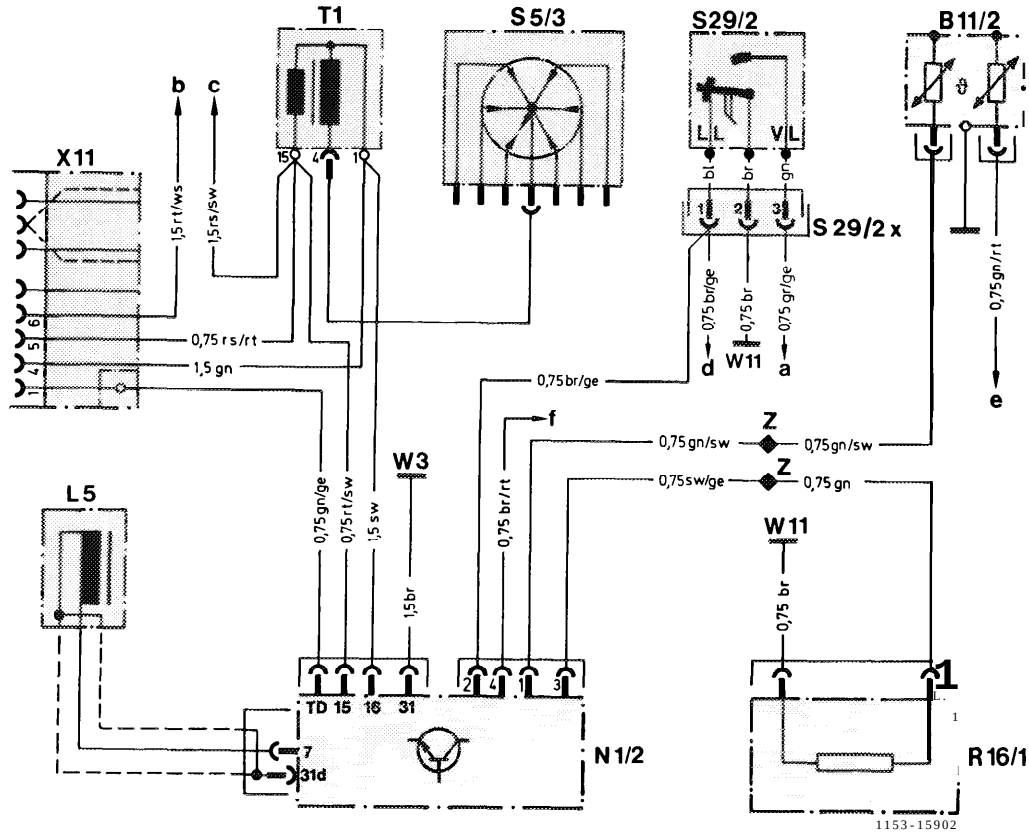
yes	no


Check contact resistance:
Loosen battery terminals.
Pull 4-pole plug (supply) off ignition control unit. Switch on ignition.
Measure resistance between positive terminal and terminal 15 on the plug.
Measure resistance between positive terminal and terminal 15 on the ignition coil.
Measure resistance between negative terminal and terminal 31 on the plug.
Measure resistance between terminal 1 on the ignition coil and terminal 16 on the plug.
Rated value: < 1 Ω
yes
no
Check plug and screw connections of the voltage supply via ignition lock.
Check ground cables.
Check ignition coil
Evaluate by means of oscillogram with running engine.
End of test.



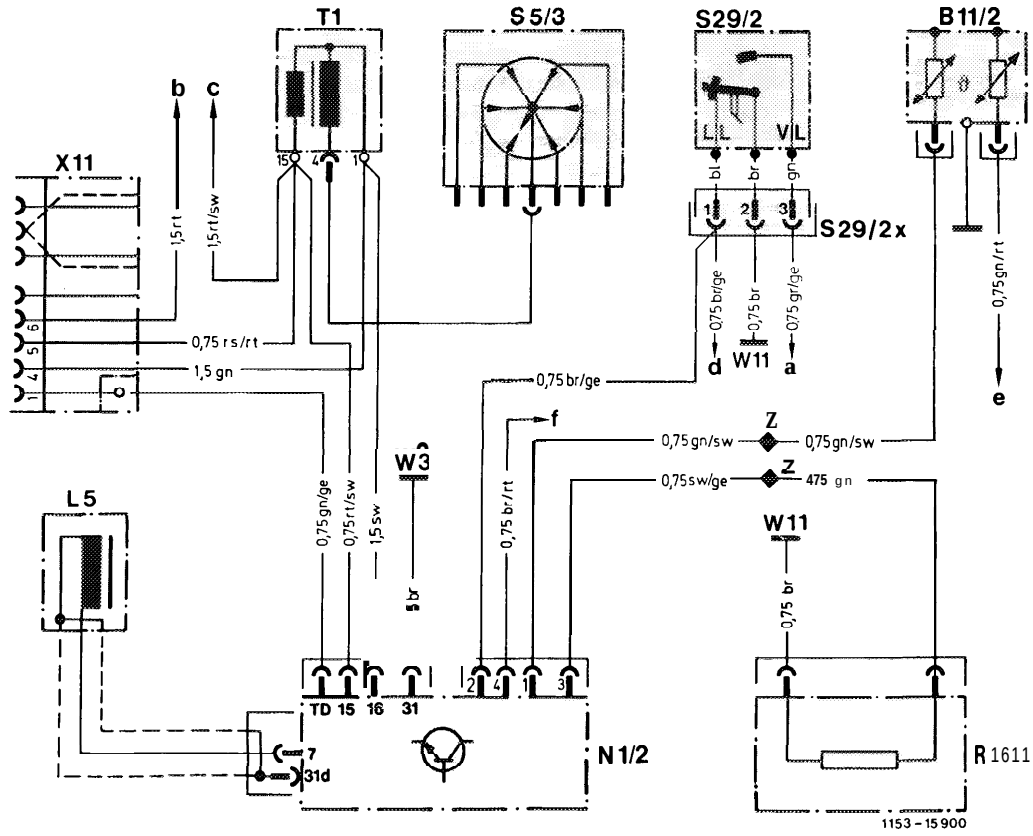
Circuit diagram electronic ignition system with variable characteristics EZL, model 124 (AUS) (J) (USA)

B11/2	Temperature sensor, coolant (EZL, CIS-E, 2 E-E)
L5	Position pickup, crankshaft
N1/2	Control unit transistorized ignition system (EZL)
R16	Reference resistor plug (EZL)
S5/3	High-voltage distributor
S29/2	Throttle valve switch, full load/idle speed detection
S29/2x	Plug connector throttle valve switch
T1	Ignition coil
W3	Ground, inner wing front left (ignition coil)
W11	Ground engine (electric line screwed on)
x11	Diagnostic socket/line connector, terminal TD
Z	End sleeve (soldering connector in cable harness)
a	CIS-E control unit, jack 5
b	Via plug connector X26 jack 3 to fuse 9, terminal 30
c	Via plug connector X26 jack 1 to fuse 7, terminal 15
d	CIS-E control unit, jack 13
e	CIS-E control unit, jack 21
f	Cable ends in cable harness



Circuit diagram electronic ignition system with variable characteristics EZL, model 126 (AUS) (J) (USA)

B11/2	Temperature sensor, coolant (EZL, CIS-E, 2 E-E)	a	CIS-E control unit, jack 5
L5	Position pickup, crankshaft	b	Via plug connector X26 jack 3 to fuse 2, terminal 30
N1/2	Control unit transistorized ignition system (EZL)	c	Via plug connector X26 jack 1 to fuse 7, terminal 15
R16	Reference resistor plug (EZL)	d	CIS-E control unit, jack 13
S5/3	High-voltage distributor	e	CIS-E control unit, jack 21
S29/2	Throttle valve switch, full load/idle speed detection	f	Cable ends in cable harness
S29/2x	Plug connector throttle valve switch		
T1	Ignition coil		
W3	Ground, inner wing front left (ignition coil)		
W11	Ground engine (electric line screwed on)		
x11	Diagnostic socket/line connector, terminal TD		
Z	End sleeve (soldering connector in cable harness)		



Circuit diagram electronic ignition system with variable characteristics EZL, model 201 (AUS) (J) (USA)

Bl 1/2	Temperature sensor, coolant (EZL, CIS-E, 2 E-E)
L5	Position pickup, crankshaft
N1/2	Control unit transistorized ignition system (EZL)
R16	Reference resistor plug (EZL)
S5/3	High-voltage distributor
S29/2	Throttle valve switch, full load/idle speed detectron
S29/2x	Plug connector throttle valve switch
TI	Ignition coil
W3	Ground, inner wing front left (ignitioncoil)
W11	Ground engine (electric line screwed on)
x11	Diagnostic socket/line connector, terminal TD
Z	End sleeve (soldering connector in cable harness)
a	CIS-E control unit, jack 5
b	To central electric system connector S jack 11, terminal 30
c	To central electric system connector S jack 4, terminal 15
d	CIS-E control unit, jack 13
e	CIS-E control unit, jack 21
f	Cable ends in cable harness

Job No.

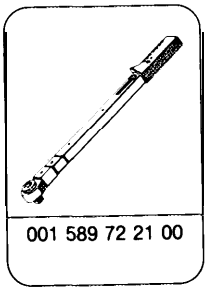
Engine oil and filter change . . . . . 18 – 002
Removing, installing oil filter . . . . . - 110
Removing, installing oil pump . . . . . – 210
Renewing oil pump chain . . . . . – 212
Removing, installing oil pressure relief valve in oil pump . . . . . – 215
Removing, installing oil level sensor . . . . . – 330
Renewing oil level return lock . . . . . - 415

18-002 Engine oil and filter change

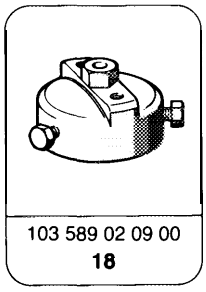
Job No. of job texts and job values or standard texts and flat rates 00-6200

Engine oil	drain or extract (25 Nm).
Cover (3) with seal (4)	unscrew, screw on (20 Nm), renew seal (4).
Filter element (5)	renew.
Cap(6)	open, close.
Engine oil	pour in.
Engine	run.
Oil level and leaktightness	check.

Special tools



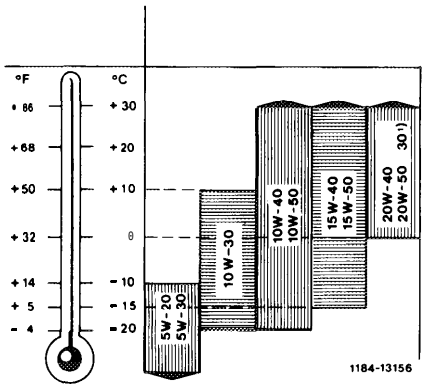
001 589 72 21 00



103 589 02 09 00

18

Specified viscosity classes according to SAE at prolonged outside temperatures



1) At prolonged outside temperature above + 30 °C SAE 40 may be used.

Precise use of the SAE classes according to the outside air temperatures would necessitate frequently changing engine o The temperature limits for the SAE classes should therefore be regarded as a guide which may be transgressed for brief periods.

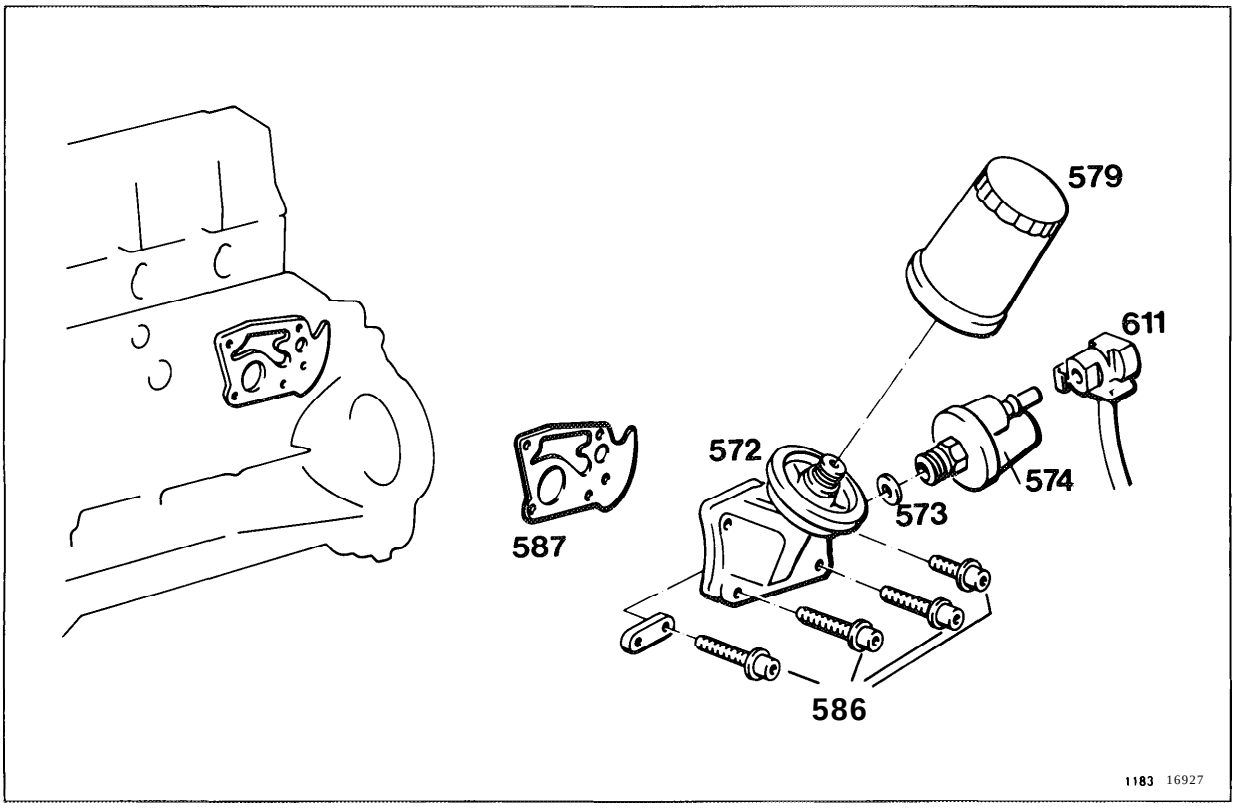
In moderate climatic zones SAE 30 may be used from April onward for all engine versions.

The following oils may be used as an all-season oil for all gasoline engines

SAE 10 W-40 and SAE 10 W-50	
SAE 5 W-20	below+ 10 °C
SAE 5 W-30, 10 W-30	all-year-round in moderate climatic zones, i.e. up to + 30 °
SAE15 W-30	all-year-round in moderate climatrc zones

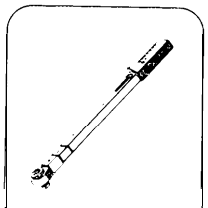
Job No. of job texts and job values or standard texts and flat rates ..... 18-3090 - 18-3800

Model 124



Hood	raise to vertical position (01-008).
Air filter	remove, install (09-400).
Replaceable cartridge (579)	remove, install, approx. 20 Nm (step 2).
Connector (611)	detach, plug in (step 3).
Oil filter housing (572)	remove, install, bolts (586) 25 Nm. Oil seal.
Sealing surfaces	clean.
(Gasket 587)	renew.
Oil level in engine	check.
Leaktightness check	perform.

Special tools



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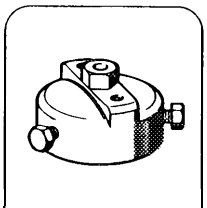

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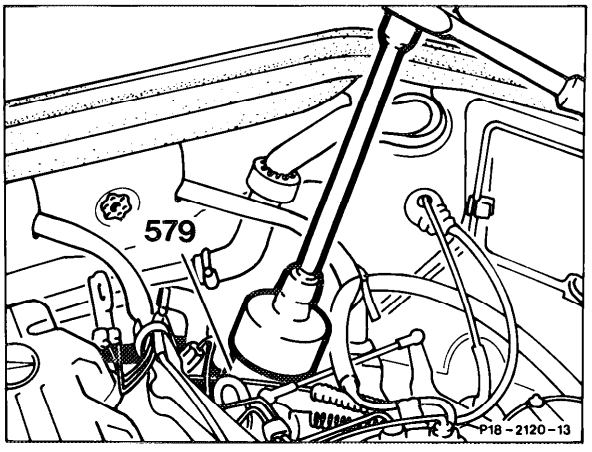
18

Removal, installation

1 Raise hood to vertical position (01-008).

2 Remove air filter (09-400).

3 Use socket wrench insert 103 589 02 09 00 to unscrew replaceable cartridge (579).

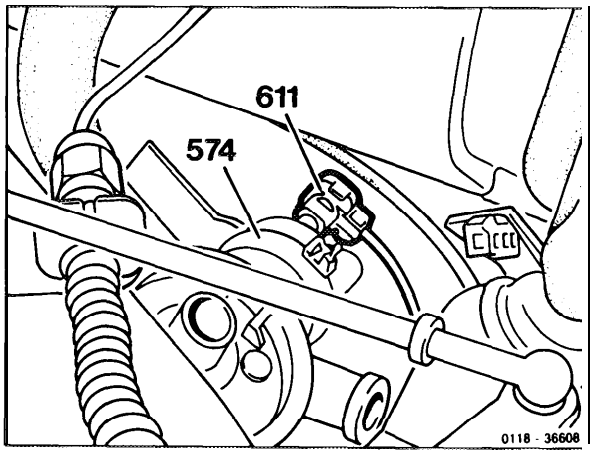


Installation instruction

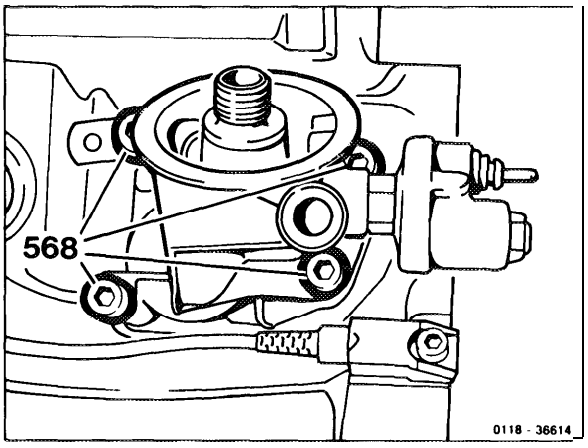
Apply a light coating of oil to gasket (arrows) of replaceable cartridge, screw on and tighten by hand. Following this, turn on 1/4 turns (90°) with the socket wrench insert 103 589 02 09 00.

118-28819

4 Detach connector (611) from oil pressure sensor (574).



5 Unscrew bolts (568) and take off oil filter housing.
Tightening torque 25 Nm.



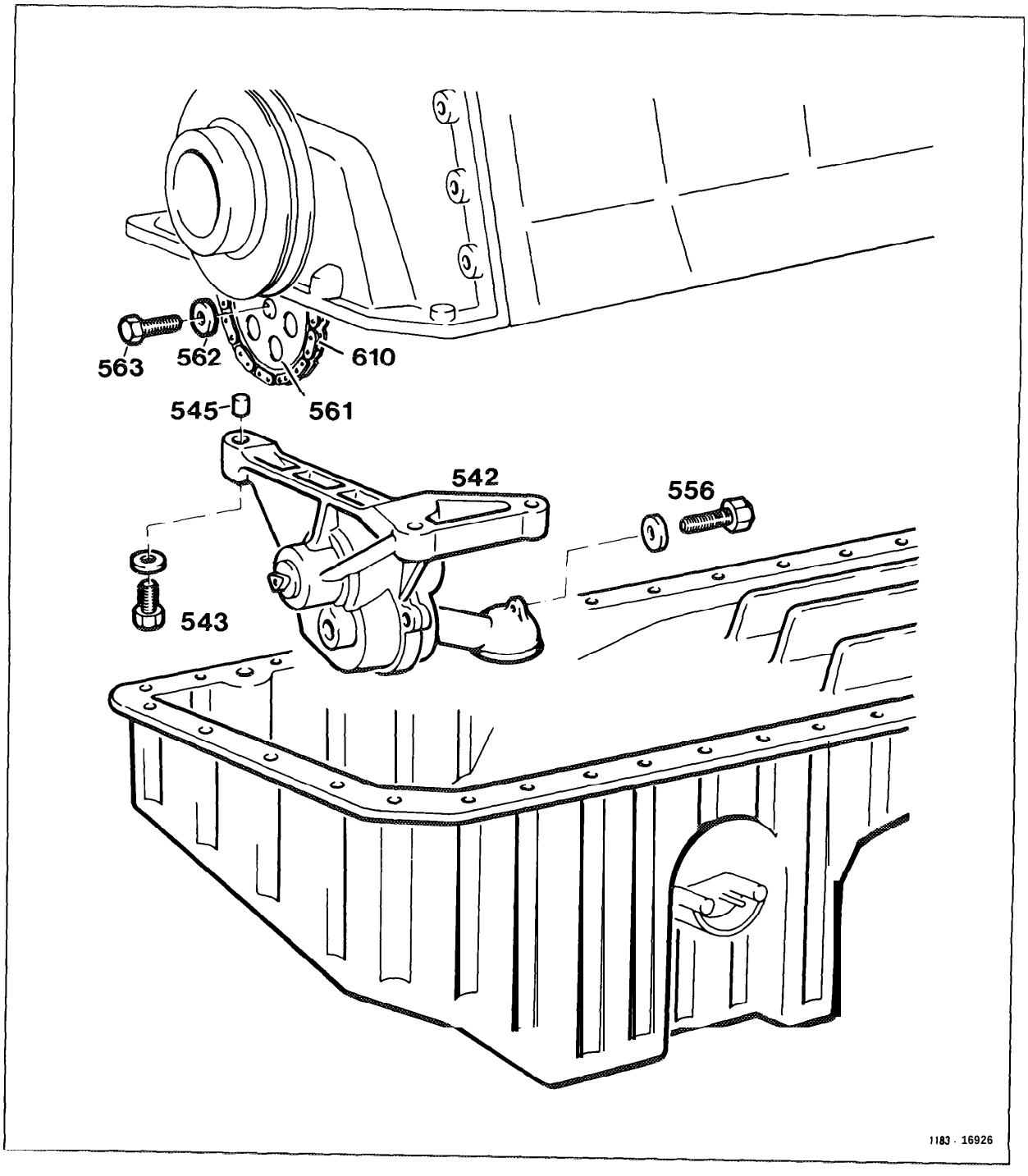
Installation instruction
Clean sealing surfaces and renew gasket.

Install in the reverse order.

6 Check oil level in engine.

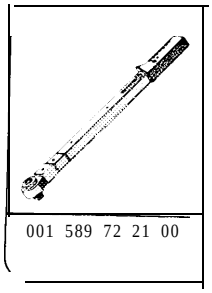
7 Perform leaktightness check.

Job No. of job texts and job values or standard texts and flat rates ..... 18-6020 – 18-6025



Oil sump	remove, install (01-310).
Bolt (563) with washer (562)	unscrew, screw in. Tightening torque 32 Nm. Detach oil pump drive gear (561) with oil pump chain (610), fit on (step 2). Pay attention to installation instruction.
Bolts (543, 556)	unscrew, screw in. Tightening torque 25 Nm (step 3).
Oil pump (542)	remove, install.

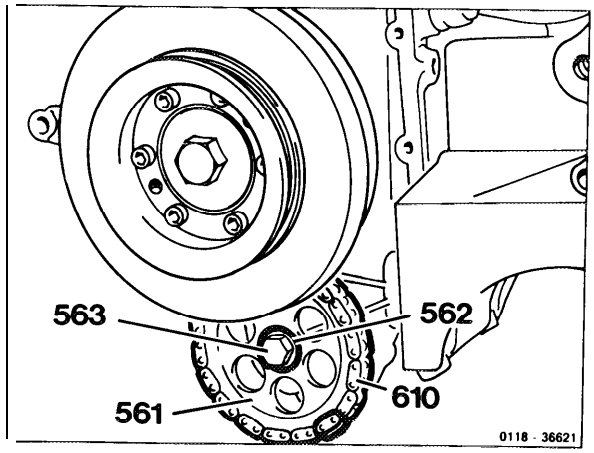
Special tool



Removal, installation

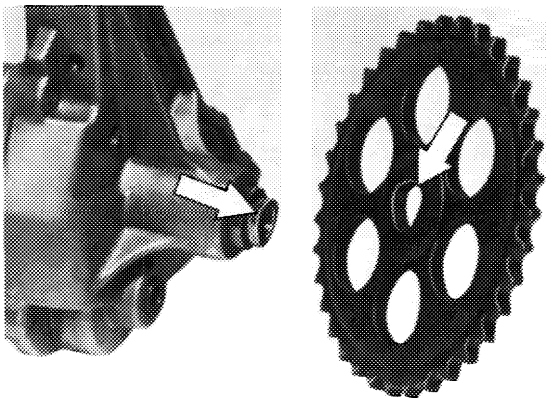
1 Remove oil sump (01-310).

2 Unscrew bolt (563) with washer (562), tightening torque 32 Nm. Detach oil pump drive gear (561) together with oil pump chain (610).



Installation instruction

Install oil pump drive gear with the curved face (arrow) toward the oil pump.



116 ▬ 26004

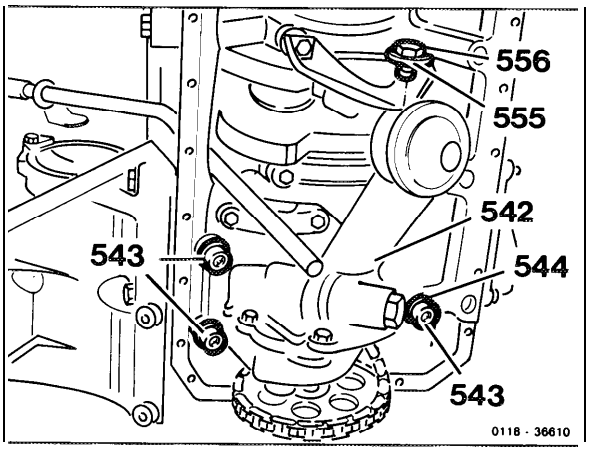
3 Unscrew bolt (543, 556) together with washers (544, 555), tightening torque 25 Nm.

4 Remove oil pump (542).

Note

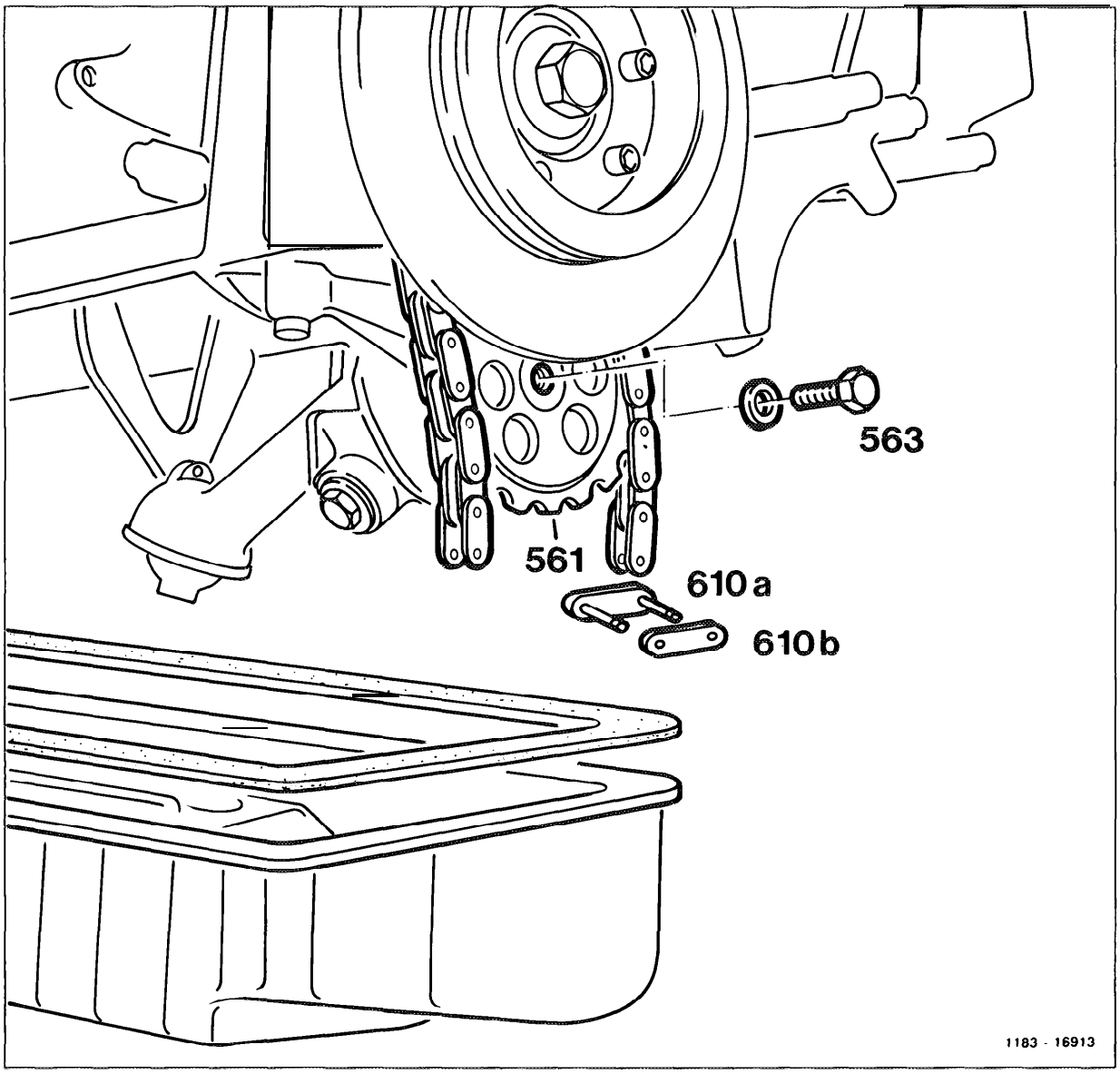
The oil pump (542) is located by two roll pins.

Install in the reverse order.



18-212 Renewing oil pump chain

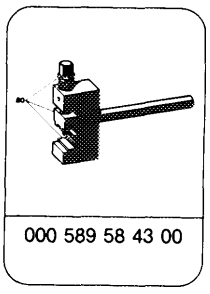
Job No. of job texts and job values or standard texts and flat rates .....

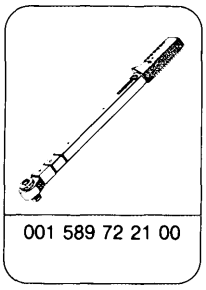


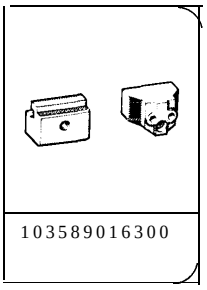
Oil sump	remove, install (01-310).
Bolt (563)	slacken, tighten, 32 Nm (step 2).
Rivet link pins	grind open (step 3).
Oil pump drive gear (561)	renew (steps 4 and 5).
New oil pump chain with old oil pump chain	connect, fit on (steps 6 and 7).
Rivet link (610a)	insert in oil pump chain from behind (step 8).

Plate (610b)	insert into rivet tool, press on (steps 11 to 13).
Individual rivet link pins of oil pump chain	rivet, 30 Nm (step 15).

Special tools







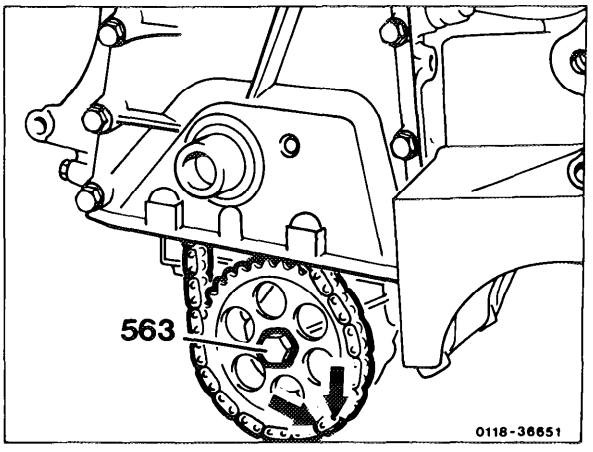
Note
When renewing the oil pump chain, the oil pump drive gear should also be renewed.

Removal, installation

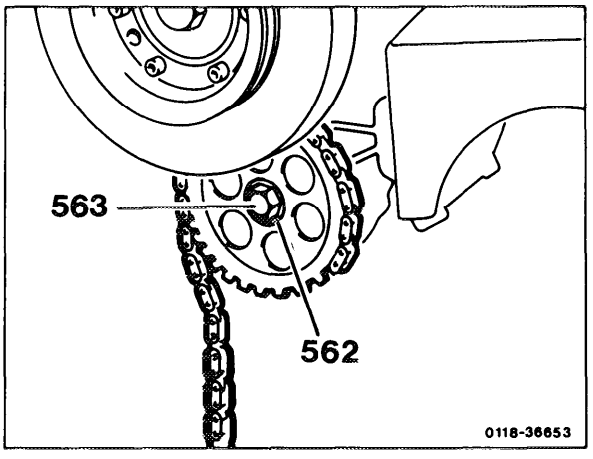
1 Remove oil sump (01-310).

2 Slacken bolt (563). Tightening torque 32 Nm.

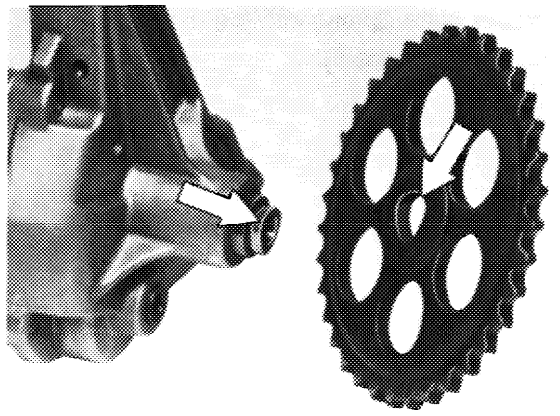
3 Grind open both rivet link pins (arrows) on **one double link** of the oil pump chain. Press out ground open double link.



4 Unscrew bolt (563) together with washer (562).



5 insert new oil pump drive gear with the curved face toward the oil pump.

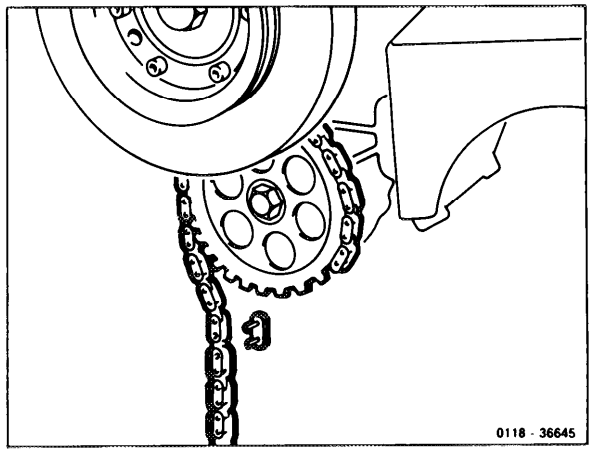


118 – 28004

6 Attach new oil pump chain to the old oil pump chain with the rivet link.

7 Pull in new oil pump chain connected to old chain, by slowly turning the crankshaft in the direction of rotation of the engine.

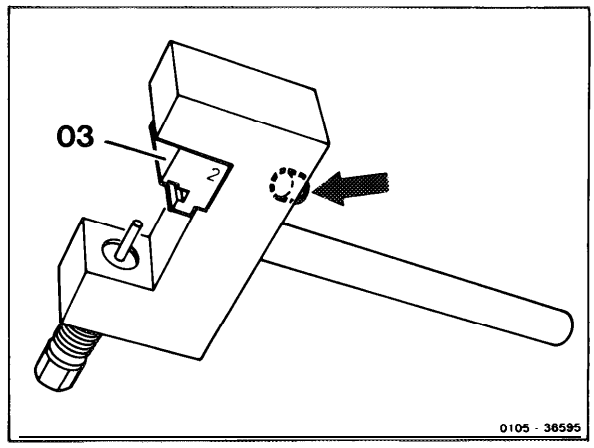
8 Detach old oil pump chain. Insert rivet link into the new oil pump chain from behind.



0118 - 36645

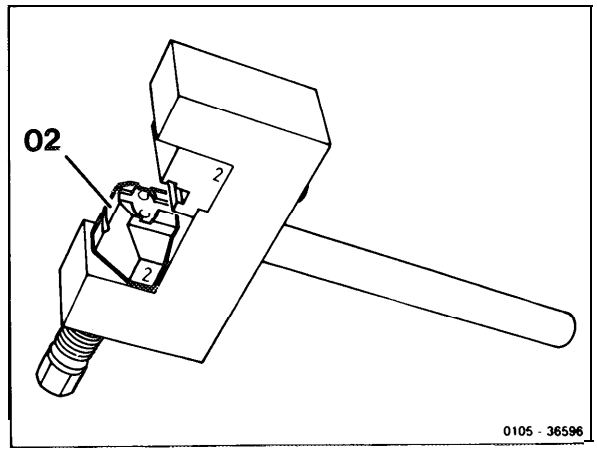
9 Insert thrust piece (03) into the rivet tool as shown in the drawing and tighten with the screw (arrow).

Note
The figure 2 is stamped on the side of the thrust piece (03).



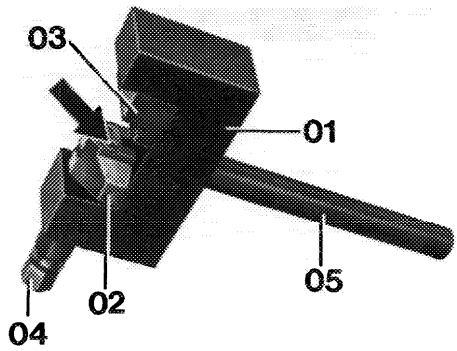
0105 - 36595

10 Insert moving jaw (02) with the figure 2 into the rivet tool as shown in the drawing.



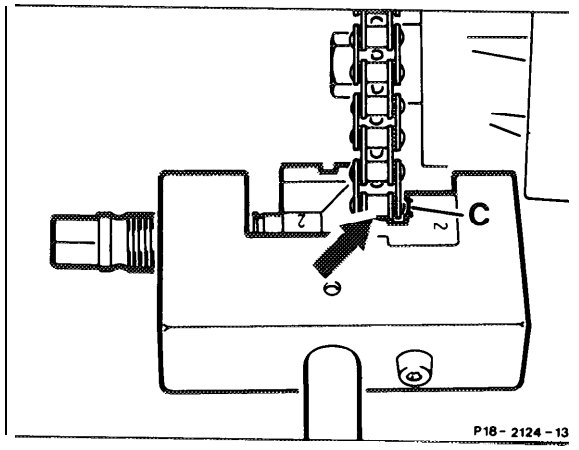
0105 - 36596

11 insert plate (arrow) into the moving jaw (02) (sticks by magnetism).



12 Place web (arrow) onto both rollers on the rivet link.

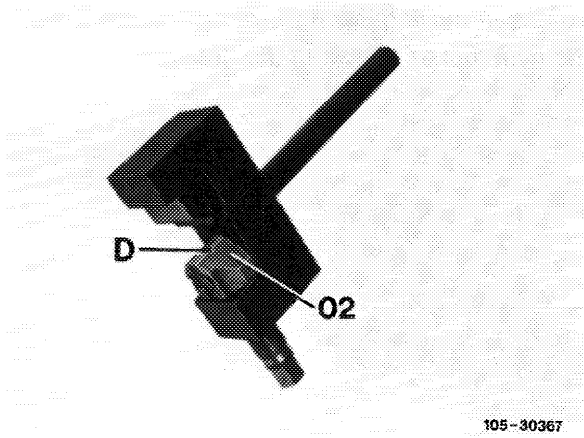
Note
Rivet heads of the rivet link pins must be guided in the slot (C).



13 Screw in spindle (04) until a firm resistance is felt.

Note
When screwing in, ensure that the pins of the rivet link are guided in the hose of the plate.

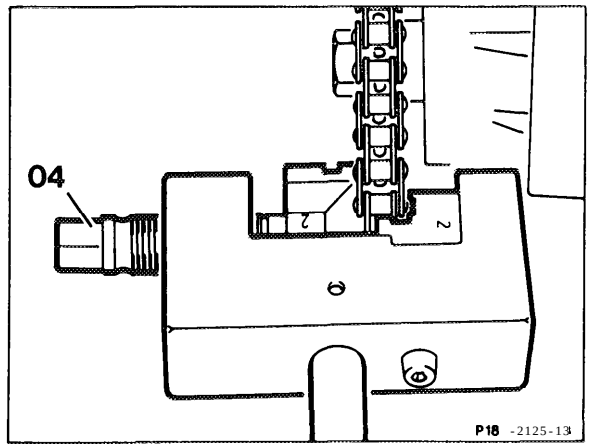
14 Take off rivet tool and change over the moving jaw (02) to the rivet profile (D).



15 Position rivet tool exactly in centre of rivet link pin.
Rivet pins of the rivet link individually by tightening the spindle (04) to 30 Nm.

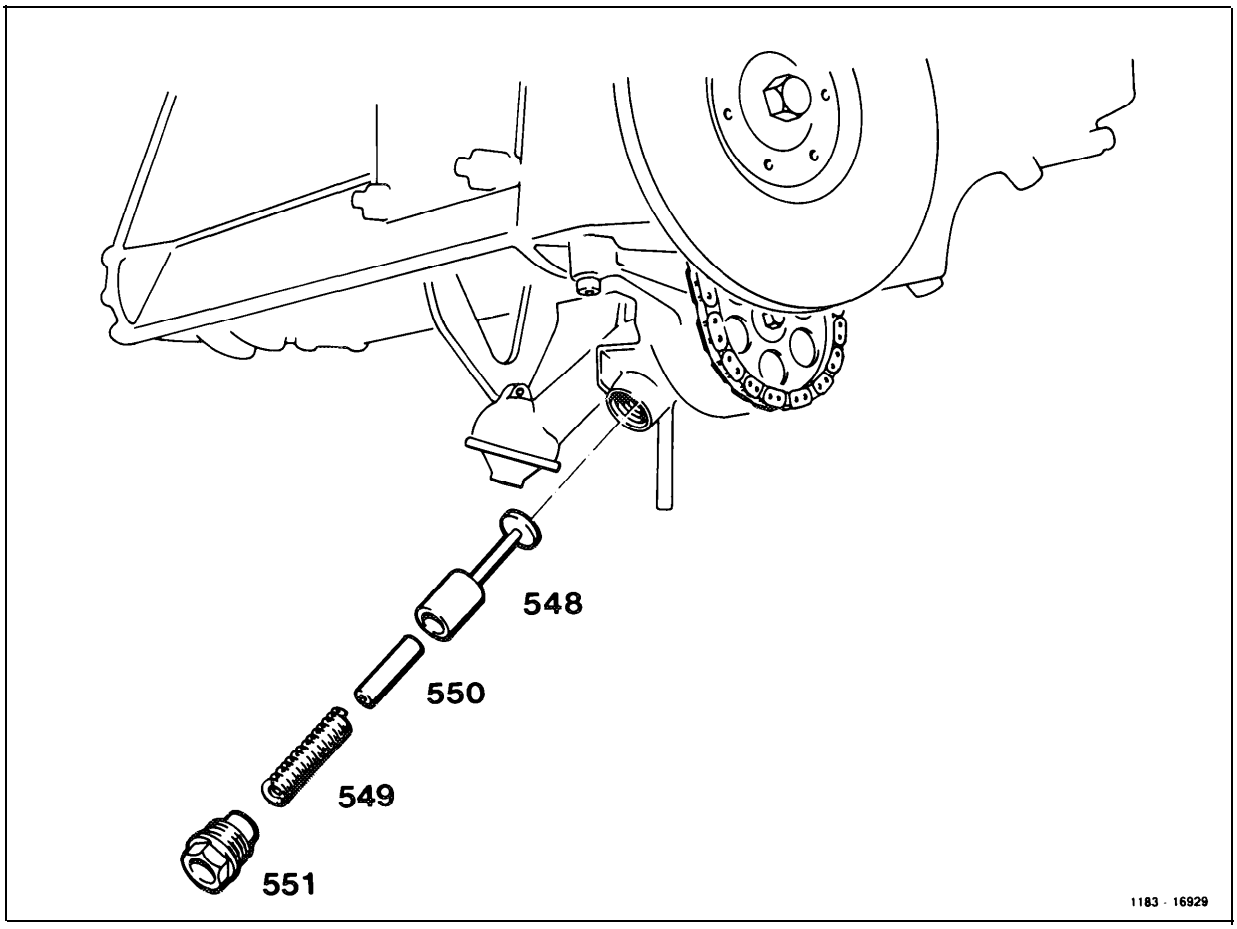
16 Check riveting, re-rivet if necessary.

17 Install in the reverse order.



18 Fit bolt (563) together with washer (562).
Tightening torque 32 Nm.

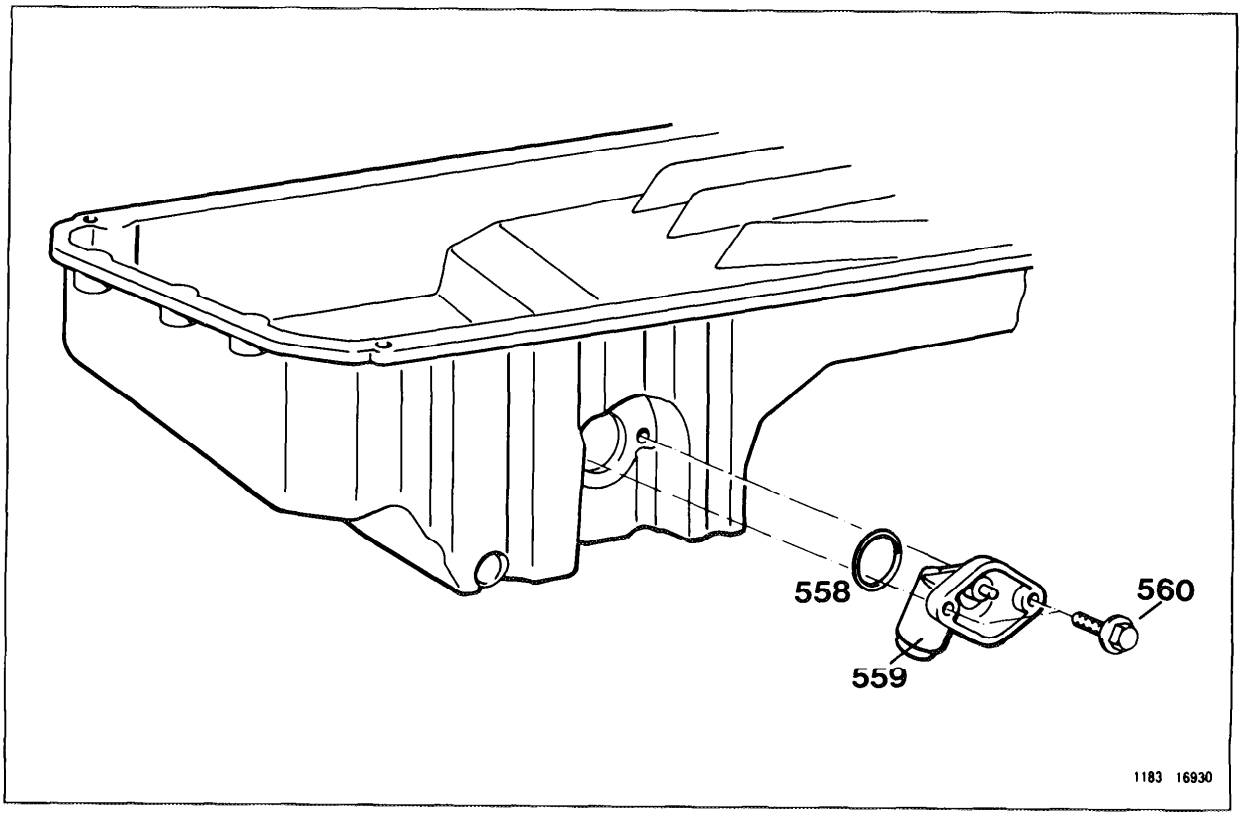
Job No. of job texts and job values or standard texts and flat rates 18-5043



Oil sump	remove, install (01-310).
Screw plug (551)	unscrew, tighten, 50 Nm, special tool 001 589 60 21 00. ⚠ Screw plug is pressurized by spring.
Compression spring (549)	remove, install.
Guide pin (550)	remove, install.
Piston (548)	remove, install.

18-330 Removing, installing oil level sensor

Job No. of job texts and job values or standard texts and flat rates 18-4111, 18-4113



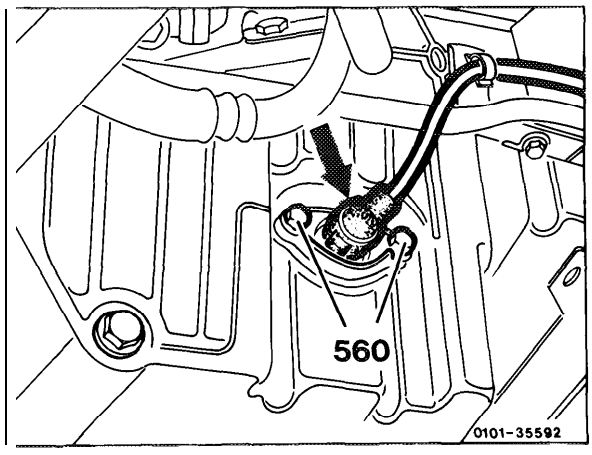
Engine compartment covering below	remove, install.
Engine oil (approx. 2.5 litres)	extract or drain, tightening torque of oil drain plug 25 Nm.
Bolts (560)	unscrew, screw in, 10 Nm. Remove, install oil level sensor (559) (step 4). Renew O-ring (558).

Special tool

001 5896621 00

Note
The dynamic oil level gauge monitors the oil level in the sump when the engine is running and when oil temperature is about 60 °C.

Removal, installation



1 Remove engine compartment covering below.

2 Partially drain or extract engine oil.

3 Detach cable connector (arrow) from the oil level sensor.

4 Unscrew bolts (560), tightening torque 10 Nm.

5 Remove oil level sensor.

Installation instruction
Renew O-ring from oil level sensor.

Install in the reverse order.

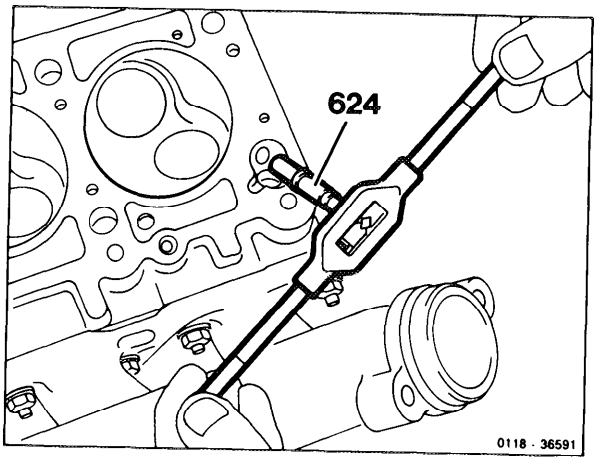
18-415 Rmewing oil level return lock

Job No. of job texts and job values or standard texts and flat rates .....

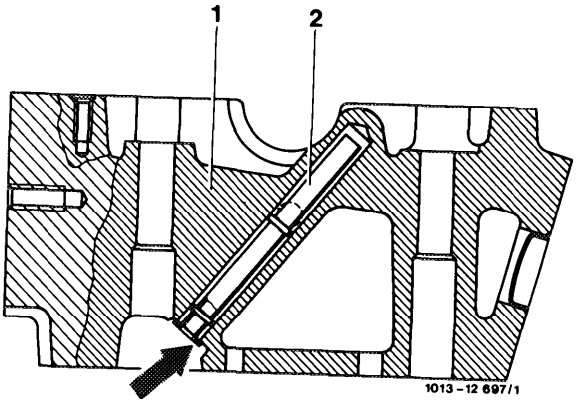
Removal, installation

1 Remove cylinder head (01-415).

2 Screw left-hand spiral drill into the oil nozzle return lock (624) and withdraw.



3 Use a suitable drift to knock in oil nozzle return lock as far as the collar (arrow).



Note
As from 12/86 an oil nozzle return lock with collar (arrow) is installed in the cylinder head.

4 Install cylinder head (01-415).

When performing repairs, install oil nozzle with collar (arrow) (standard as from 12/86).

Job No.

Draining, pouring in coolant – Antifreeze protection table ..... 20 – 010
Testing cooling system for leaks ..... – 017
Removing, installing coolant thermostat ..... – 110
Removing, installing coolant pump ..... – 210
Removing, installing viscous fan clutch ..... – 312
Removing, installing radiator ..... – 420
Removing, installing overflow tank ..... – 450

20-010 Draining, pouring in coolant - Antifreeze protection table

Job No. of job texts and job values or standard texts and flat rates ..... 20-I 142 – 20-I 151

Total capacities of cooling system with heater and mixing ratio of anti-corrosion/antifreeze agent[1]) and water[2]) in litres

Model	Total capacities of coolant system with heater	Mixing ratio antifreeze agent/water -37 °C	-45 °C
107/126	a 9.0	4/4 4.5/4.5	4.4/3.6 4.5
1241201	9.5[3])	4.75/4.75	5.25/4.25
129	11.5	5.75/5.75	6.3/5.2

[1]) Refer to Service Product Specifications sheet 325.1 and 325.2
[2]) Refer to Service Product Specifications sheet 310
[3]) With airconditioning/automatic climate control

Tightening torques	Nm
Radiator drain plug	1.5
Crankcase drain plug	30

Commercial tool

Antifreeze tester	e. g. Ph. Gather
Prestone-W-Check (Union Carbide)	4020 Mettmann

Note

Composition of coolant

50 % by vol. water (Service Product Specifications sheet 310)
50 % by vol. anti-corrosion/antifreeze agent (Service Product Specifications sheet 310, 325.1 and 325.2 respectively).

Water

Use water which is clean and not too hard. These requirements are frequently, but not always, met by drinking water. The content of dissolved substances in the water may be the cause for the occurrence of corrosion. If in doubt, have the water analysed.

Anti-corrosion/antifreeze agent

The anti-corrosion/antifreeze agent should perform the following tasks:

- Provide adequate anti-corrosion and cavitation protection for all components
- Provide antifreeze protection
- Increase the boiling point

Approximately 50 % by vol. anti-corrosion/antifreeze agent must be added to the water. This concentration offers antifreeze protection down to approximately –37 °C. A higher concentration is not recommended even if ambient temperatures are lower.

More than 55 % by vol. anti-corrosion/antifreeze agent reduces the antifreeze protection and impairs heat dissipation.

55 % by vol. anticorrosion/antifreeze agent offers antifreeze protection down to approx. -45 °C.

Anti-corrosion/antifreeze agent increases the boiling point which is why the coolant does not evaporate so rapidly. The ejection of coolant is avoided at high coolant temperatures.

Use only approved anti-corrosion/antifreeze agents (refer to Service Product Specifications sheet 325.1 and 325.2).

Operational monitoring of coolant

Before the commencement of the cold season of the year, check the antifreeze protection of the coolant.

In countries with high ambient temperatures, check anti- corrosion/antifreeze agent concentration once annually.

When topping up (after loss of coolant) it must be assured that there is **a 50 %** by vol. portion of anti- corrosion/antifreeze agent in the coolant to provide antifreeze protection down to -37 °C.

The corrosion protection in the coolant decreases during engine operation. Such coolants have an extremely corrosive effect. The maximum permissible life of the specified coolant in a car engine is 3 **years.**

Before adding new coolant, flush the used coolant out of the cooling system.

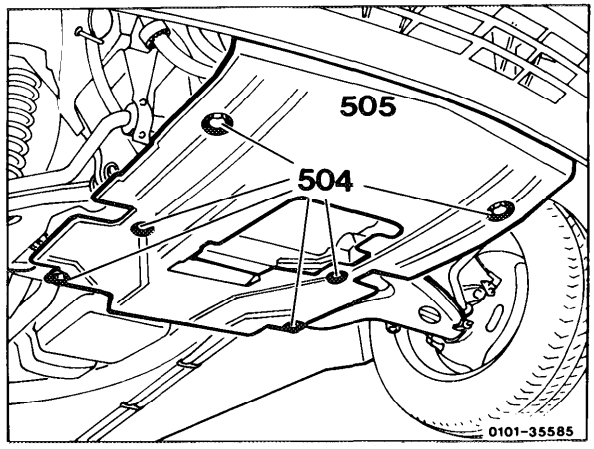
Disposing of coolants

Pay attention to statutory regulations or local waste water requirements regarding disposal of coolant agents.

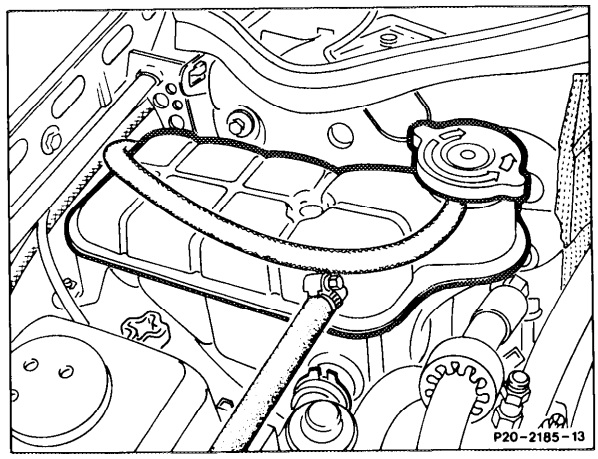
Draining, pouring in Model 124 and Model 129

1 Raise hood to vertical position (01-008).

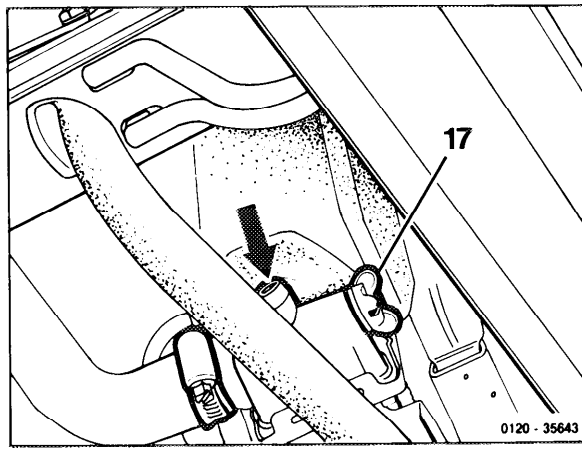
2 Remove bottom engine compartment covering (505).



3 Do not open the expansion tank or radiator cap unless the coolant temperature is below 90 °C.
To open expansion tank: First of all turn to 1 st detent only to release the pressure, then turn on to 2nd detent and remove radiator cap.

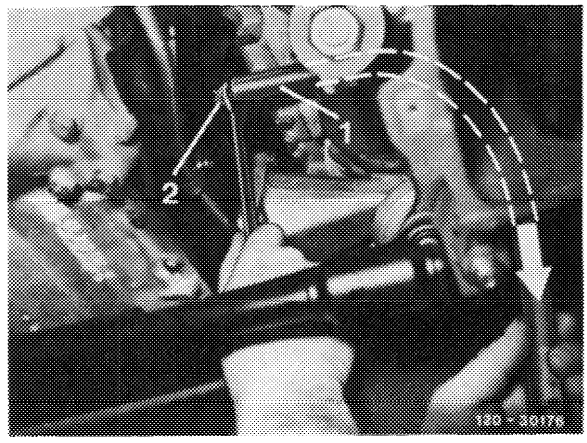


4 Drain coolant at radiator. This is done by connecting a hose (inner diameter 12 mm) to the connection (arrow) and unscrewing drain plug (17). Drain coolant into a suitable vessel (approx. 4 l).

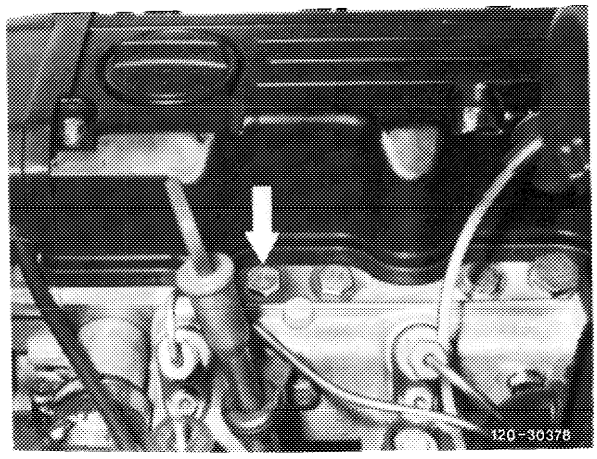


5 Drain coolant at crankcase. This is done by connecting a hose (arrow) (inner diameter 14 mm) to the drain plug and slackening the drain plug slightly. Drain coolant into a suitable vessel (approx. 4 l).

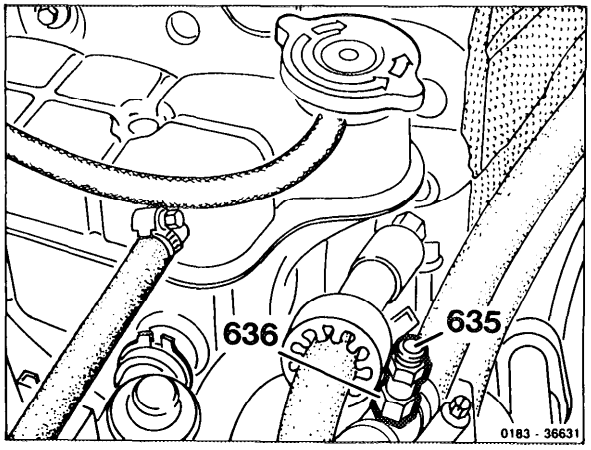
6 Tighten drain plugs for radiator and crankcase. Tightening torques: radiator 1.5 Nm, crankcase 30 Nm.



7 Pour in coolant.
Unscrew front screw plug (arrow) from the measuring sensor strip. Pour in coolant until it flows out at the tapped hole. Screw in plug and pour in remaining coolant.



8 If car fitted with auxiliary heater: Take off cap (635), slightly unscrew bleeder screw (636) until no more air flows out.



Note
Repeat operation several times.

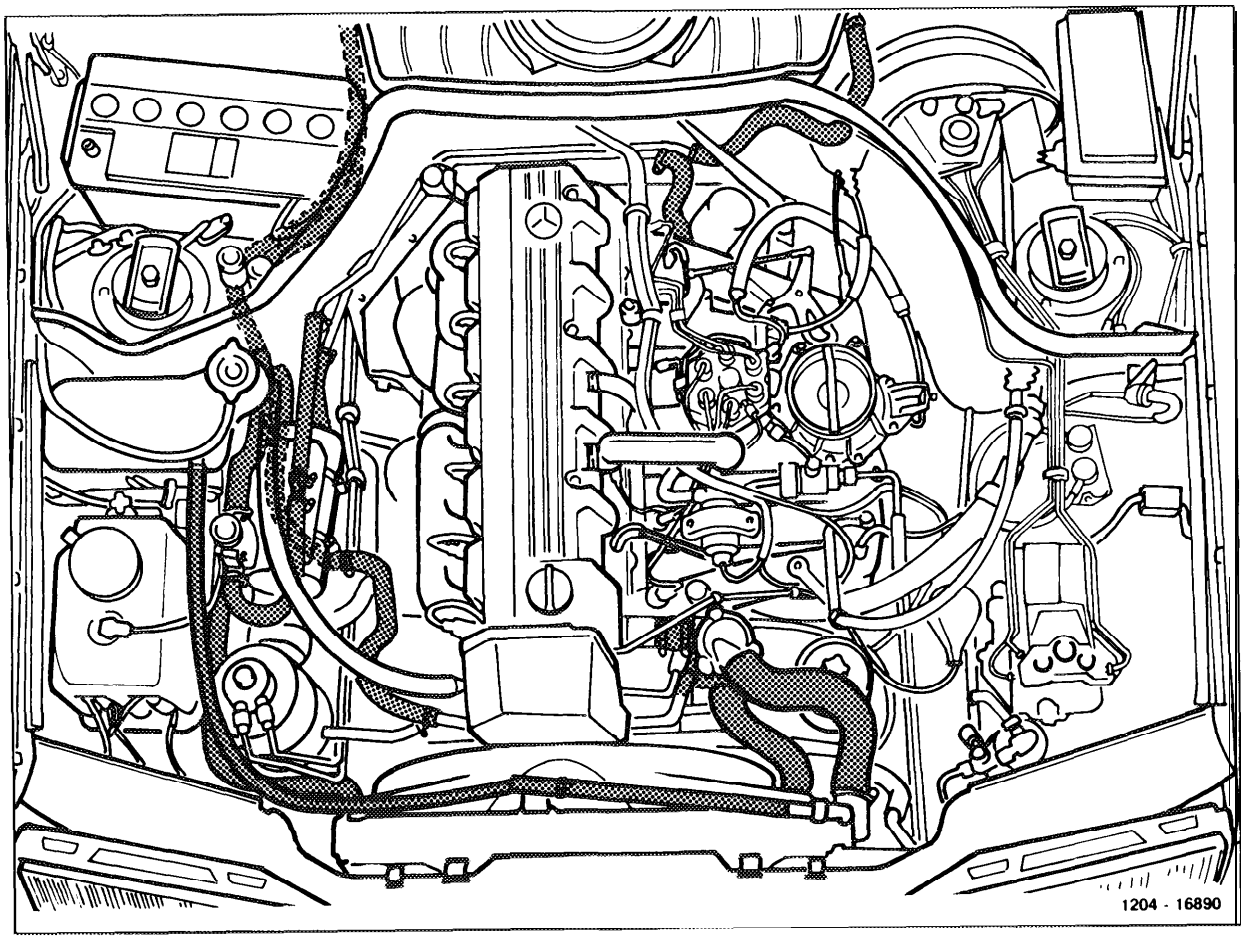
9 Switch on heater and warm up engine until the thermostat opens. Following this, top up coolant to the marking (arrow) on the expansion tank.

Note
Close filler connection on expansion tank as soon as coolant temperature has reached approx. 60 – 70 °C.

10 Test cooling system for signs of leaks (20-017).

Job No. of job texts and job values or standard texts and flat rates 20-1010

Model 124



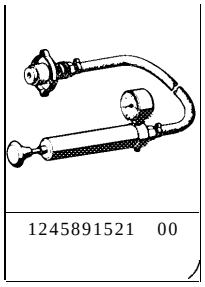
Note
Illustration shows joints which require to be examined when pressure-testing the cooling system.
Shown here with auxiliary heater.

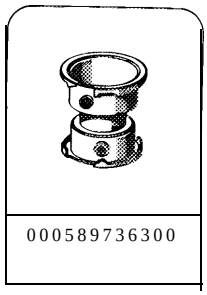
Cap	turn to 1st detent to relieve pressure. Turn on to 2nd detent and remove (step 1).
Coolant level	check (step 2).
Tester 124 589 15 21 00	attach to radiator or expansion tank. Test cooling system for leaks.

Testing cap and vacuum valve

Double connection 000 589 73 63 00	. . . . .	attach to tester 124 589 15 21 00, fit cap onto double connection. Test opening pressure (step 4).
Vacuum valve	. . . . .	test (step 5).

Special tools





Test data of caps

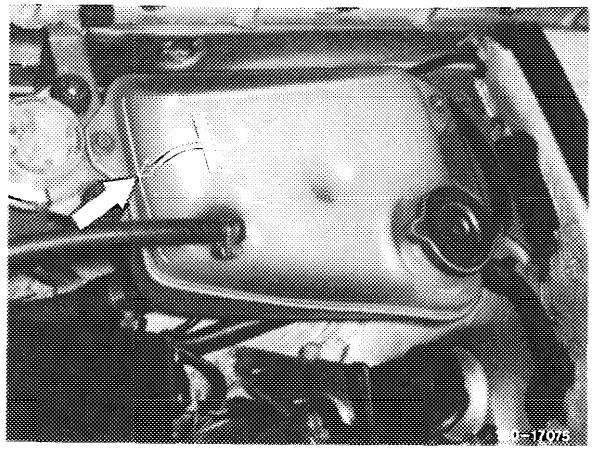
Cap code number	Pressure relief valve opens at bar gauge pressure		Vacuum valve opens at bar vacuum	Test pressure for pressure-testing cooling system, bar gauge
	new	used		
120	1.2 ± 0.1	1.2 – 0.1	0.1	1 – 1.3
140 as from 06/88	1.4 ± 0.1	1.4 – 0.1	0.1	1 – 1.3

Note

Do not open the cap unless the coolant temperature is below 90 °C.

1 To open: turn first of all only to the 1st detent to release the pressure, then turn on to 2nd detent and remove cap.

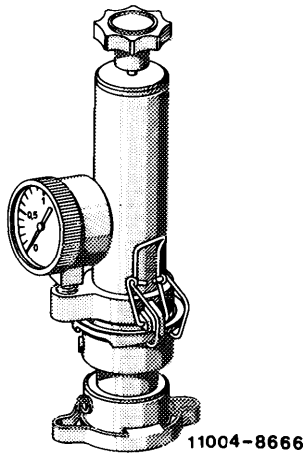
2 The coolant level must extend up to the marking (arrow) on the reservoir.
It should extend to approx. 1 cm above this marking at normal operating temperature.



3 Pressure-test cooling system with tester 124 589 15 21 00 and examine for signs of leaks.

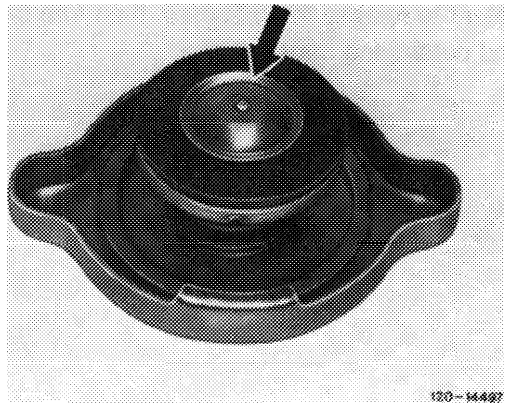
Testing cap and vacuum valve

Note
If corrosion exists on the radiator expansion tank, renew cap. The cap has been fitted with a rubber seal to ensure that no outside air can be drawn in through the cap when a vacuum exists in the cooling system.

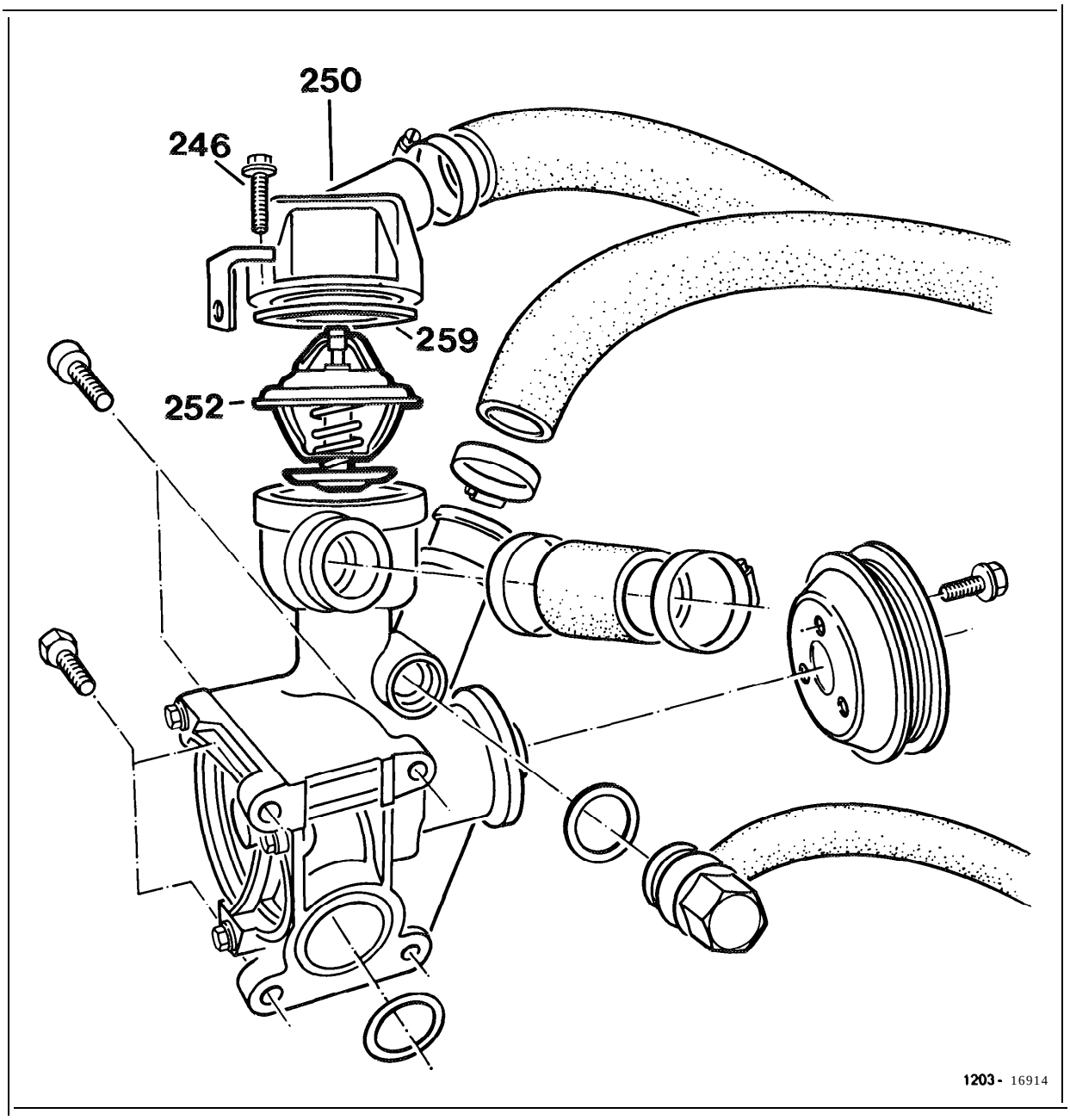


4 Attach double connection 000 589 73 63 00 to the tester. Fit cap onto the double connection. Test the opening pressure by pumping.

5 The vacuum valve (arrow) must be resting against the rubber seal. It must be possible to raise it slightly and it should spring back into place when released.



Job No. of job texts and job values or standard texts and fiat rates ..... 20-2460 – 20-2482



Coolant	drain, pour in (20-010).
Top section of coolant thermostat housing (250)	detach, attach, tightening torque for bolt (246) 6 Nm (steps 2 and 3).
Coolant thermostat (252)	remove, install, renew O-ring (259). Insert coolant thermostat so that ball valve (663) is at the highest point (step 4).

Removal, installation

1 Drain coolant at radiator (20-010).

2 Unscrew bolts (12), tightening torque 6 Nm.

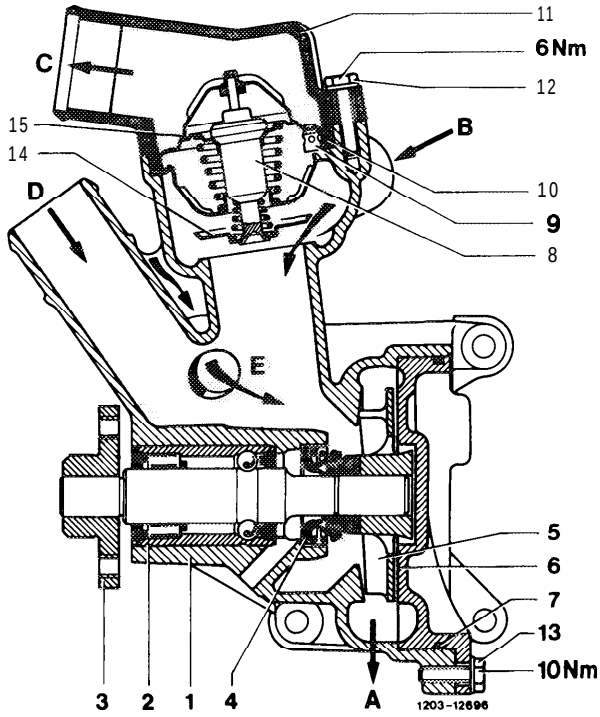
3 Place top section of coolant thermostat housing (11) with connected hose to the side.

4 Remove coolant thermostat (8).

Installation instruction

Renew O-ring (10).
Install coolant thermostat (8) so that the ball valve (9) is at the highest point.

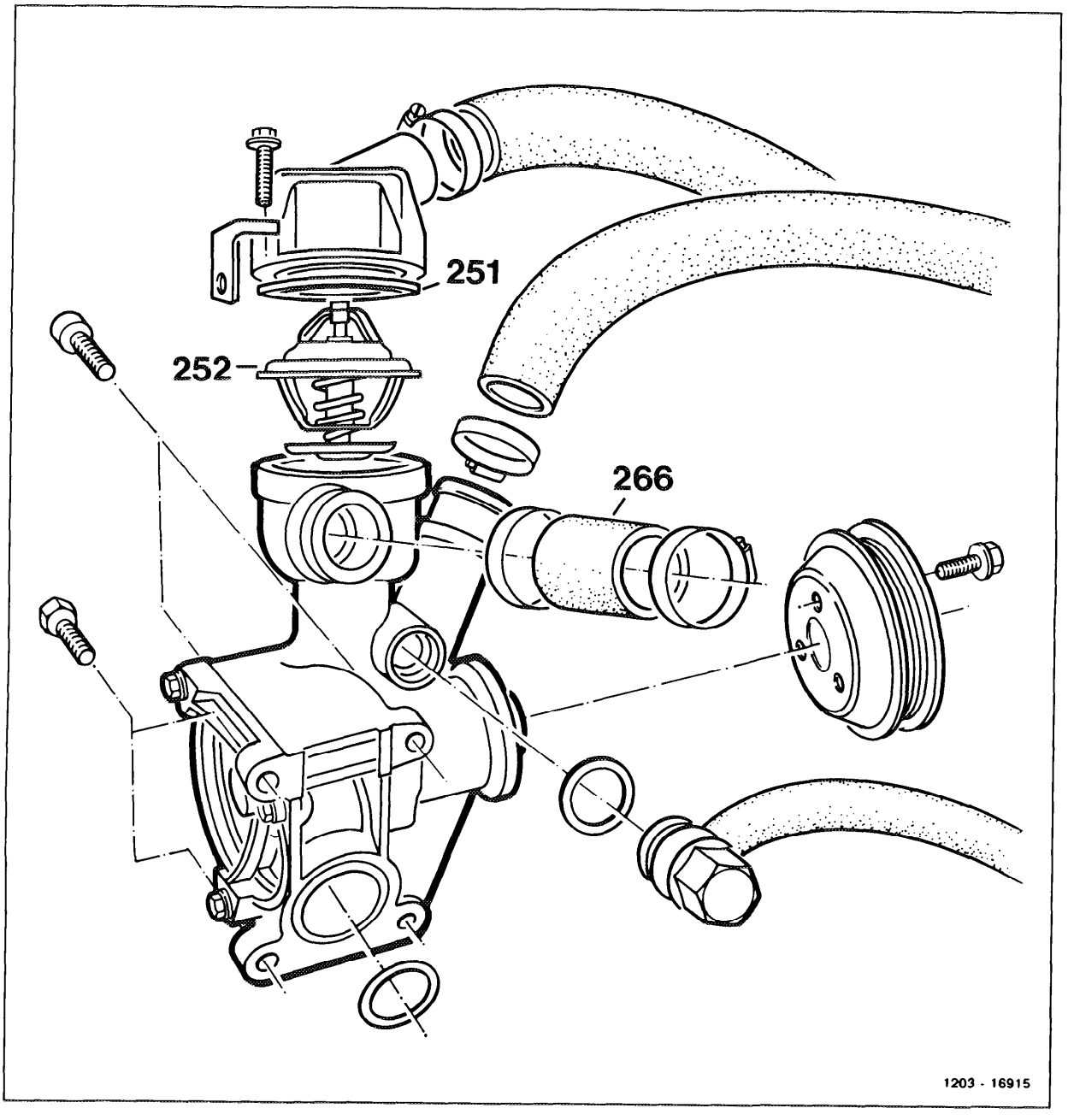
Install in the reverse order.



A	To crankcase
B	From cylinder head
C	To radiator (top)
D	From radiator (bottom)
E	From heater
12	Screw
11	Top section of coolant thermostat housing
10	O-ring
15	Main valve
14	Bypass valve
8	Coolant thermostat
9	Ball valve

Job No. of job texts and job values or standard texts and flat rates ..... 20-I 270 - 20-2351

Model 124



Hood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.

Coolant at engine and radiator	drain, pour in (20-010).
Air scoop	remove, install (step 4).
Viscous fan clutch	remove, install (20-312).
Poly V-belt	remove, install (13-342).
Belt pulleys of fan clutch and coolant pump	remove, install.
Engine compartment covering below	remove, install (step 9).
If airconditioning fitted	unscrew, screw on refrigerant compressor with pipe group from engine (step 10).
Support with tandem pump and connected lines	unscrew, screw on (step 11).
Thermostat (252) with new seal (251)	remove, install.
Belt tensioning bracket	slacken, remove.
Return line	unscrew, screw on (step 12).
Coolant hoses (266) and oil line	detach, attach (step 14).
Coolant pump	remove, install (step 15).

Tightening torques	Nm
Bolt of coolant pump to crankcase	25
Viscous fan clutch to bearing bracket	40
Belt pulley of viscous fan to hub	10
Support of power steering pump to crankcase	25
M 12 bolt of tensioning device for poly V-belt	70
Refrigerant compressor to support of power steering pump	25
Belt pulley to coolant pump shaft	10
Thermostat housing to cooling pump	6

Commercial tools

Hexagon socket wrench with 6 mm, 3/8" joint	
7 mm hexagon socket wrench on flexible shaft for hose clip with screw drive	e. g. Hazet 5630 Remscheid Order No. 426-7

Removal, installation

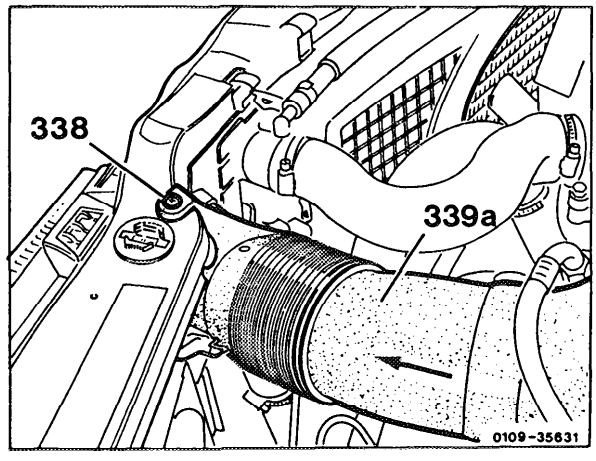
1 Raise hood to vertical position (01-008).

2 Detach ground cable on battery.

3 Drain coolant at engine and radiator (20-010).

4 Unscrew bolt (338). Detach air scoop (339a) from air filter in direction of arrow and remove.

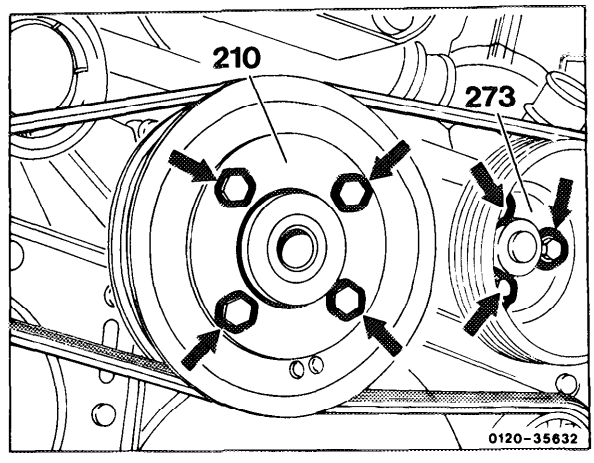
5 Remove viscous fan clutch (20-312).



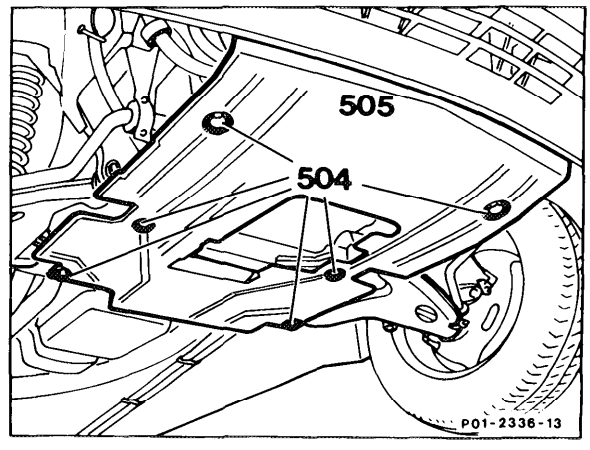
6 Slacken bolts (arrows).

7 Remove V-belt (13-342).

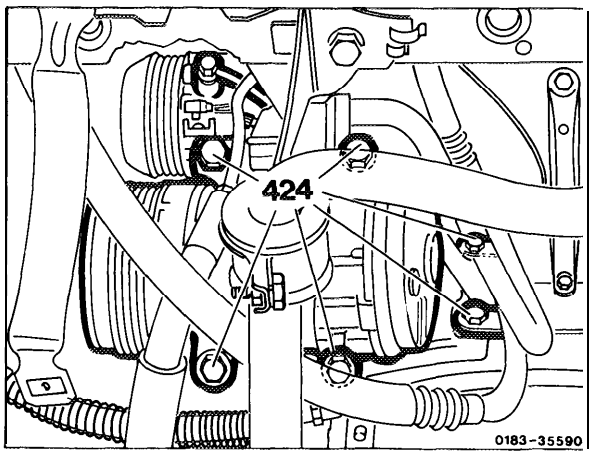
8 Unscrew bolts (arrows), tightening torque 10 Nm.
Take off belt pulleys of fan clutch (210) and coolant pump (273).



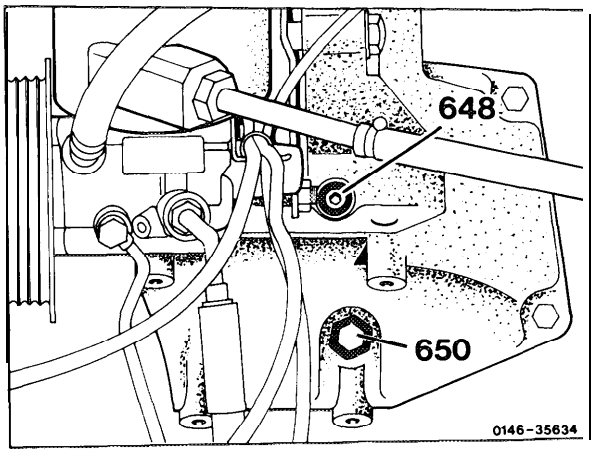
9 Unscrew bolts (504) and take ofl bottom engine compartment covering (505).



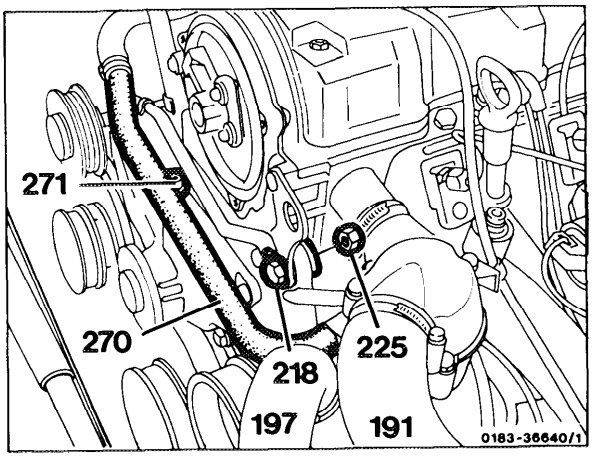
10 If air conditioning fitted: detach refrigerant compressor of air conditioning system from engine.
Unscrew bolts (424), tightening torque 25 Nm.
Attach refrigerant compressor with connected pipe group to side of bottom of engine compartment.



11 Unscrew bolts (648, 650) from support of tandem pump, tightening torque 25 Nm.



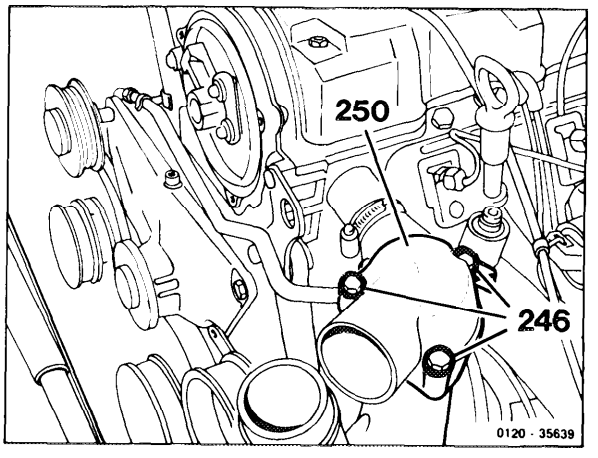
12 Slacken bolt (271). Withdraw heating water return line (270) from coolant pump and place to the side. Screw down nut (225) and withdraw bolt (218) from the front.
Detach coolant hoses (191, 197). Disconnect ignition cable from the bracket.
Place support with tandem pump and connected lines to the side.



Note
As from 10/1987, the heating water return line is attached additionally to the coolant pump with a bolt.

Installation instruction
Renew sealing ring of heating water return line (270).

13 Unscrew bolts (246), tightening torque 10 Nm. Take off thermostat housing (250) and remove thermostat.

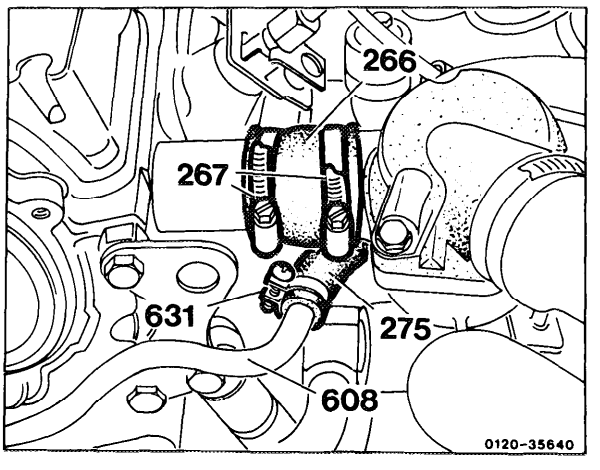


Installation instruction

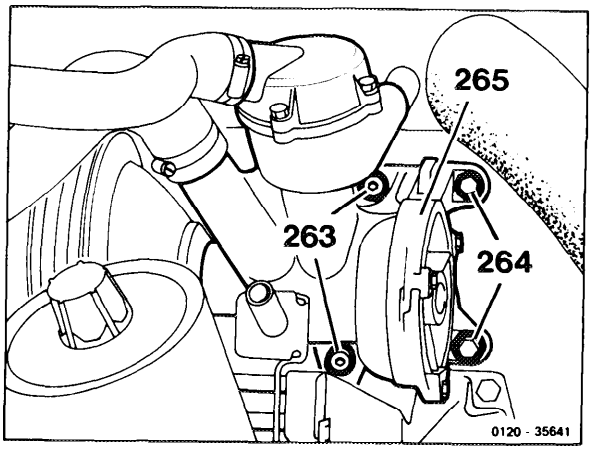
The thermostat must be installed so that the ball valve is at the highest point (20-l 10).

Install new seal.

14 Slacken clips (267), move coolant hose (266) to the left.
If car fitted with self-levelling suspension, slacken clip (631). Detach hose (275) and seal line (608).



15 Unscrew bolts (263, 264) on crankcase. Remove coolant pump (265).



Installation instruction

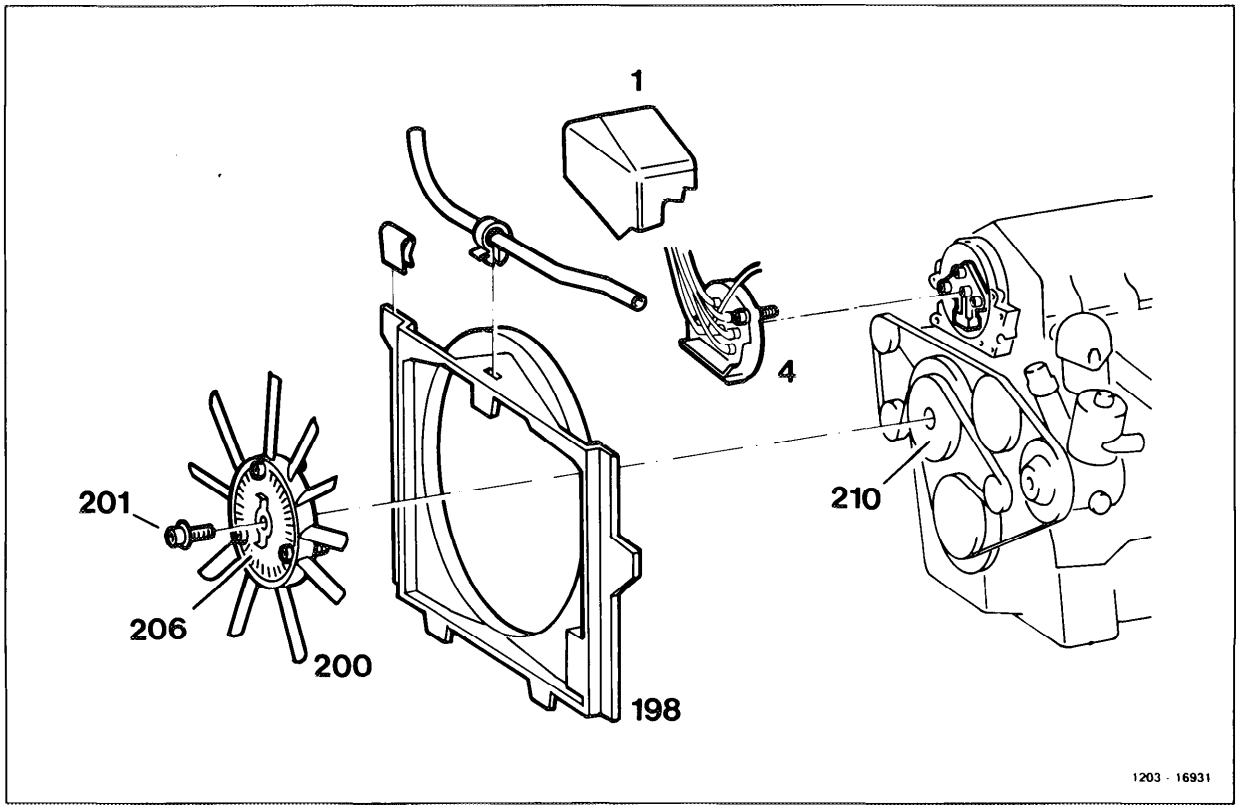
Renew seal of coolant pump (265).

Install in the reverse order.

20-312 Removing, installing viscous fan clutch

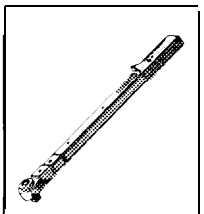
Job No. of job texts and job values or standard texts and flat rates ..... 20-6600 – 20-6602

A. Model 124

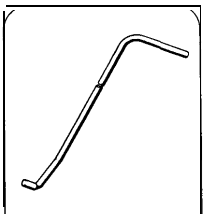


I-lood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Protective cover (1)	take off, fit on (step 3).
High voltage distributor (4)	remove, install (step 4).
Fan cowl (198)	detach, attach (steps 5 and 6).
Belt pulley (210)	turn and insert counter-holder 103 589 00 40 00, remove.
Viscous fan clutch (206) with fan (200)	remove, install, tightening torque bolt (201) 45 Nm (steps 6 to 9).
Fan (200)	detach from viscous fan clutch (206), screw on, 10 Nm (step 10).

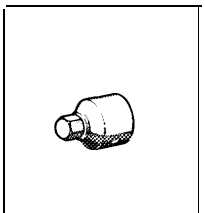
Special tools



001 589 67 21 00



103 589 00 40 00



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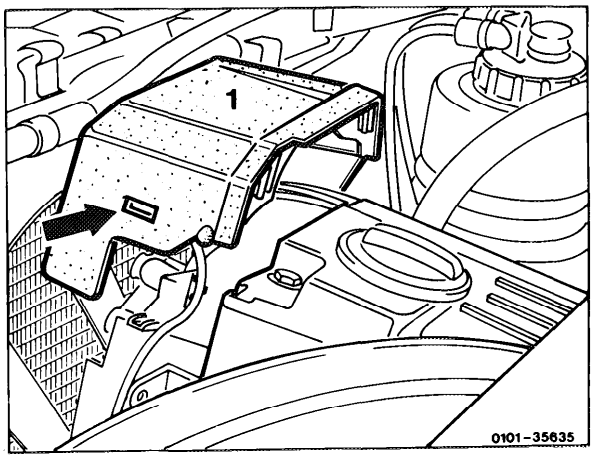
Removal, installation

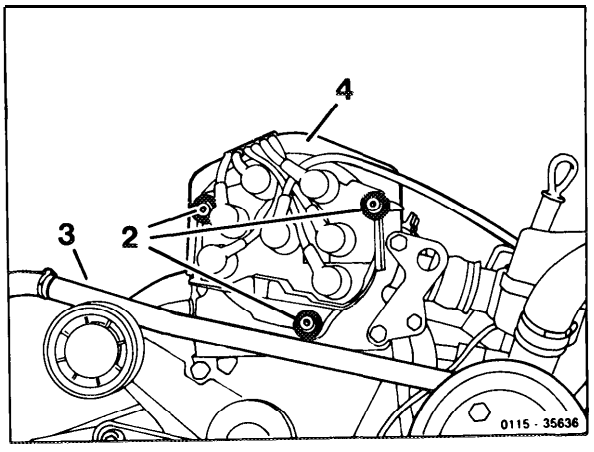
1 Raise hood to vertical position (01-008).

2 Detach ground cable on battery.

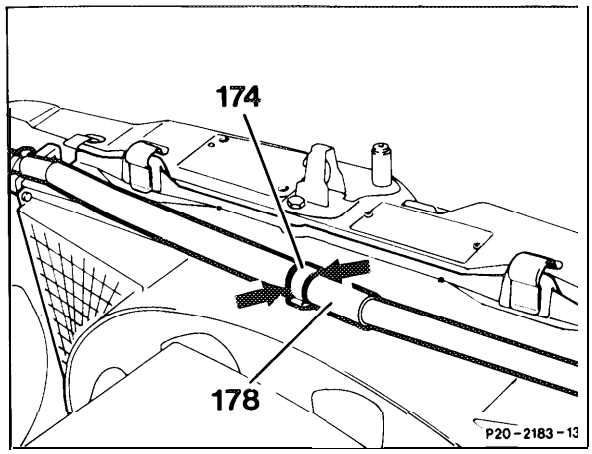
3 Unclip both catches (arrow).
Detach protective cover (1) up the way.



4 Unscrew bolts (2). Take off high voltage distributor (4) and place ignition cable to the side.

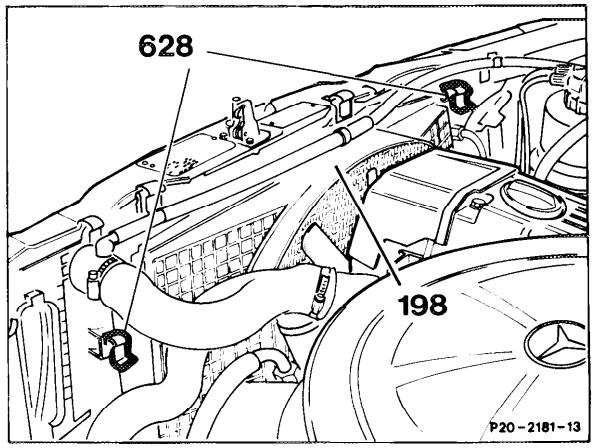


5 Compress plastic holder (174) at the point marked (arrows), pull off together with coolant hose (178) and place to the side.



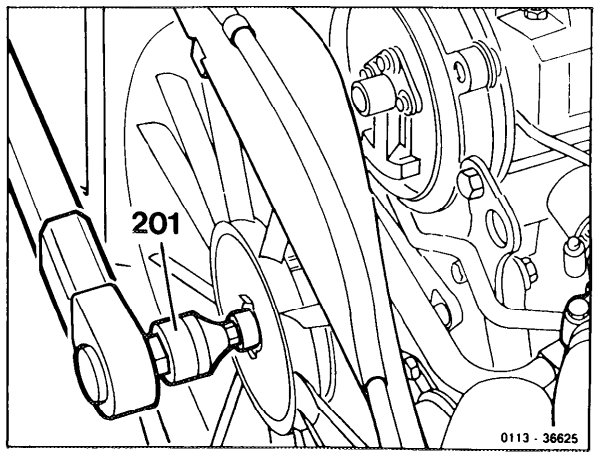
6 Withdraw flat springs (628) up the way. Raise fan cowl (198) slightly and place over the fan.

Installation instruction
Introduce retaining catches on the fan cowl into the mounts on the radiator.

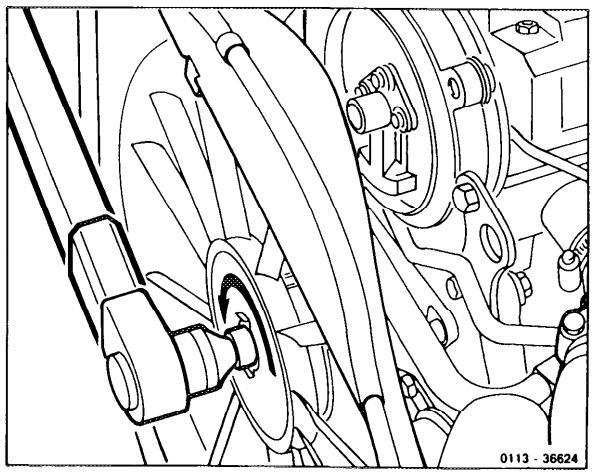


7 Insert hexagon socket insert (8 mm) 103 589 01 09 00 into the screw (201).

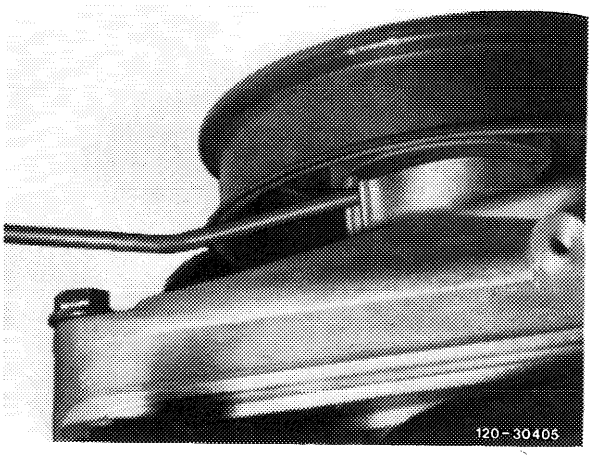
Fit on torque wrench 001 589 67 21 00, tightening torque 45 Nm.



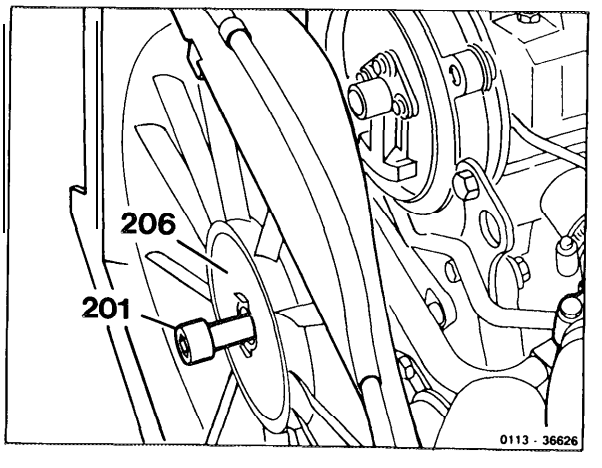
8 Turn belt pulley until retaining slot of fan bearing bracket and mounting bore of belt pulley are aligned.



9 Insert counter-holder 103 589 00 40 00 from the rear of the belt pulley into the retaining slot of the fan bearing bracket and at the same time into the mounting hole of the belt pulley.



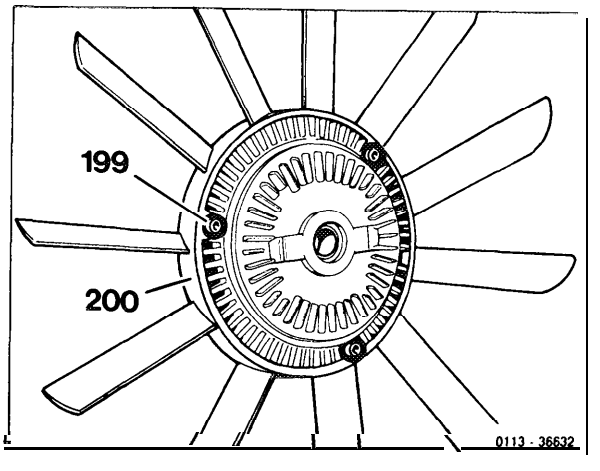
10 Remove screw (201).
Remove viscous fan clutch (206) up the way.



11 Unscrew bolts (199), tightening torque 10 Nm.
Take off fan (200).

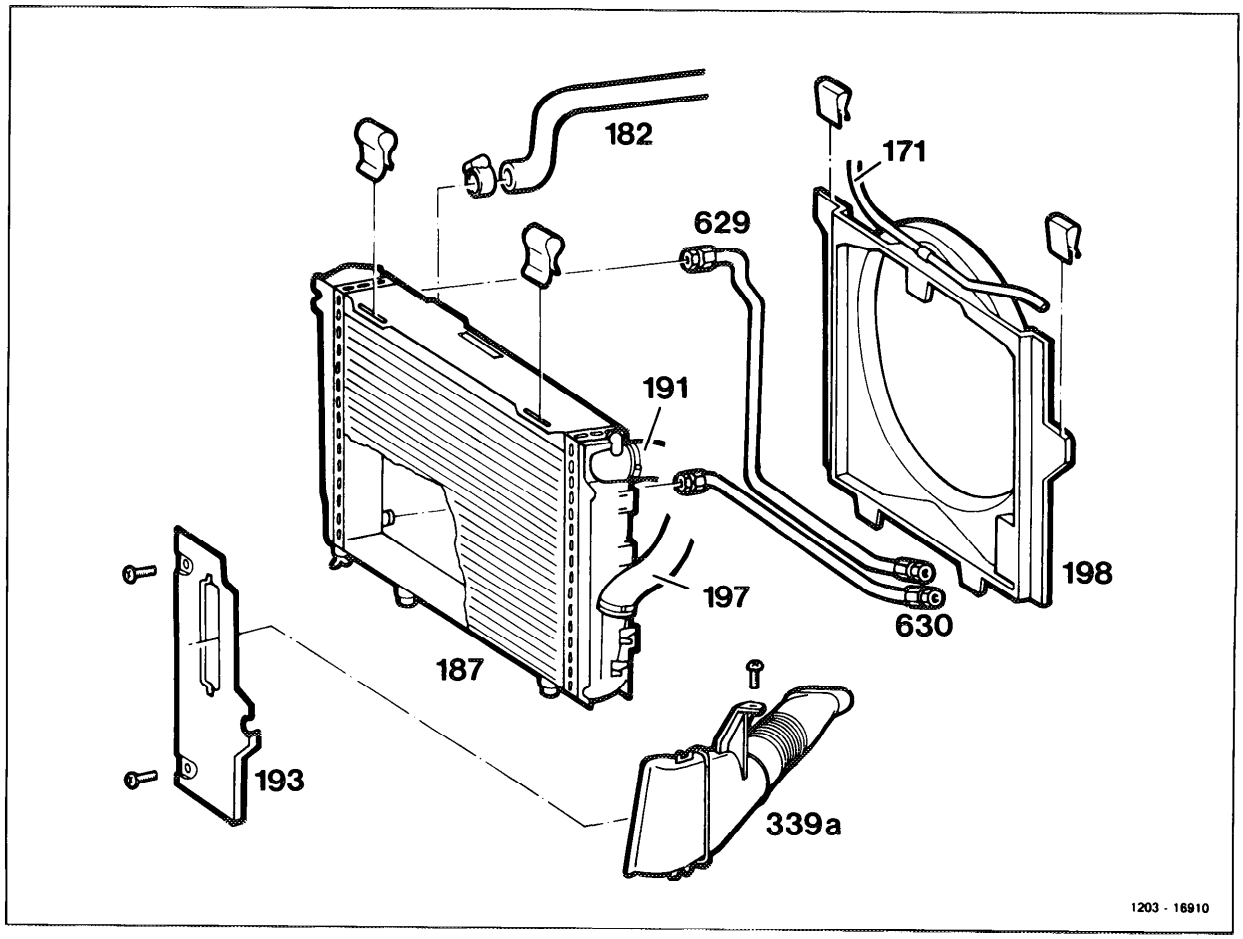
Installation instruction
The fan must be installed so that the cast part number is to the front (radiator side).

Install in the reverse order.



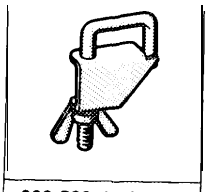
Job No. of job texts and job values or standard texts and flat rates ..... 20-3865 – 20-4535

A. Model 124



Coolant	drain, pour in (20-010).
Coolant hose (171, 182, 191, 197)	detach, attach (step 2).
If automatic transmission fitted	
oil lines (629, 630)	detach, unclip and attach, tightening torque 20 Nm. Pay attention to note.
Air scoop (339a)	remove, install (step 3).
Fan cowl (198)	detach, attach (step 4).
Radiator cover (193)	detach, attach (step 5).
Radiator (187)	remove, install (step 6).
If automatic transmission fitted	check oil level.

Special tool



000 589 40 37 00

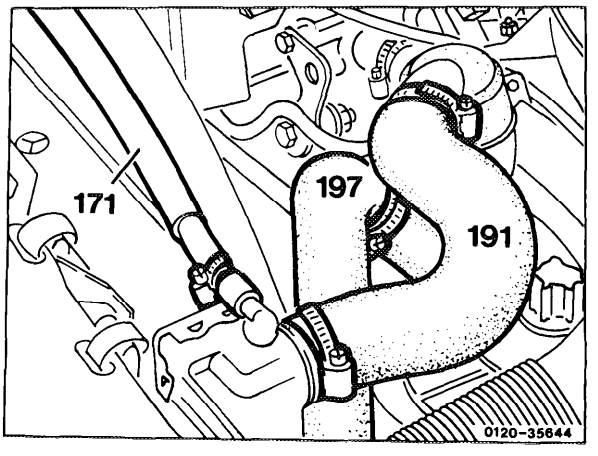
Commercial tool

Socket wrench insert 7 mm on flexible shaft for hose clip with screw drive	e. g Hazet D-5630 Remscheid Order No. 426-7

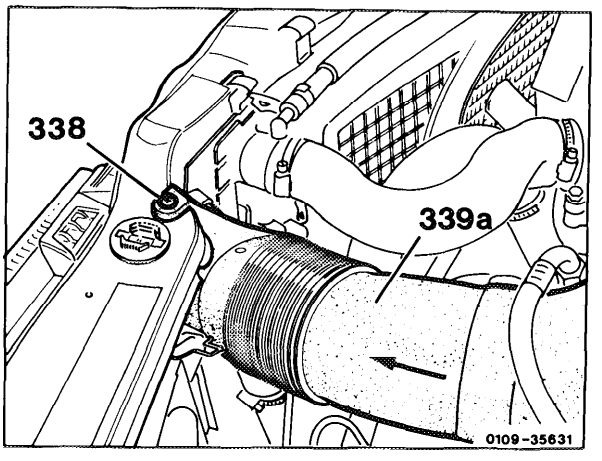
Removal, installation

1 Drain coolant (20-010).

2 Detach coolant hose (191, 197) on the coolant pump and coolant hose (171) at the radiator.

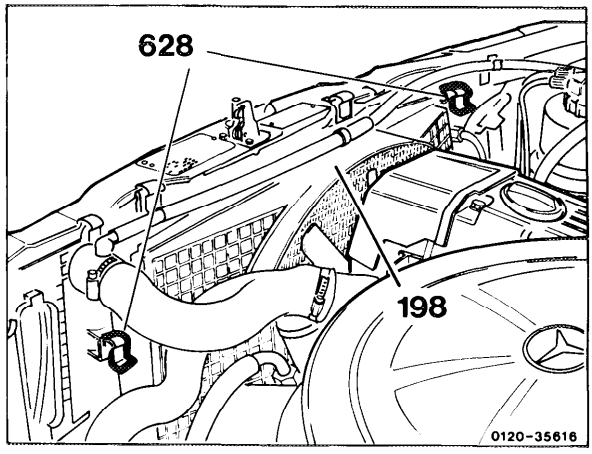


3 Remove screw (338). Detach air scoop (339a) from the air filter in direction of arrow and remove.



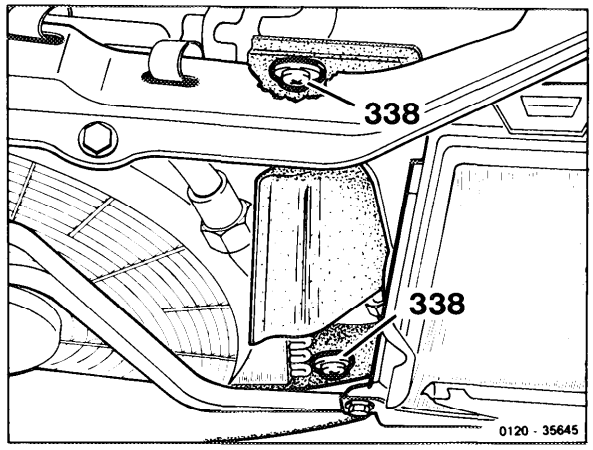
4 Withdraw flat springs (628) up the way, raise fan cowl (198) slightly and place over the fan.

Installation instruction
introduce retaining straps on the fan cover into the mount on the radiator.



5 Remove screws (338) for radiator cover.

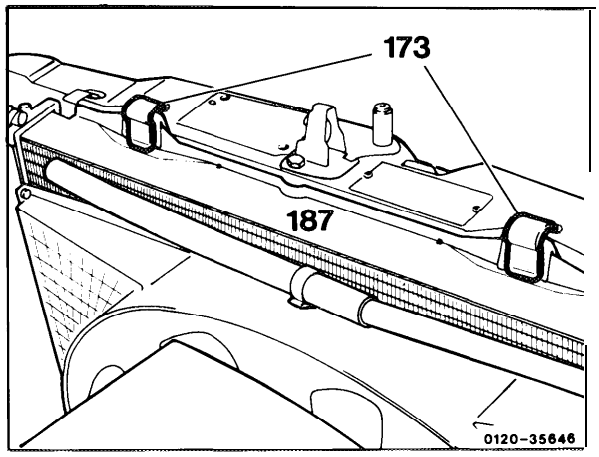
Note
If car fitted with automatic transmission, detach oil lines from or to the transmission and unscrew at the radiator. Tightening torque 20 Nm. Check oil level.



6 Withdraw flat springs (173) up the way and raise radiator (187) up the way out of the rubber grommets of the crossbar.

Installation instruction
The mounting spigots of the radiator must be inserted into the rubber grommets of the cross-piece or bracket.

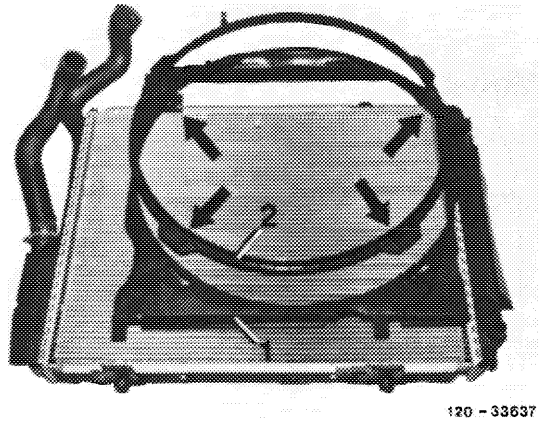
Install in the reverse order.



Removal, installation

Note:
The crossflow radiator is installed in a forward location under the removable front center reinforcement.

The fan shroud can be separated (4 bayonet latches, arrows).

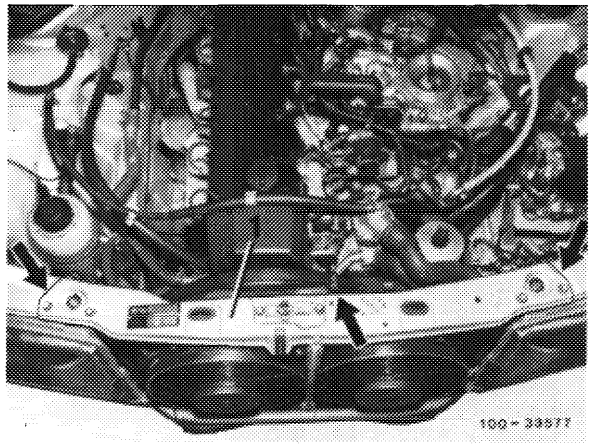


1 Main shroud
2 Ring

1 Remove bumper.

2 Drain coolant at radiator.

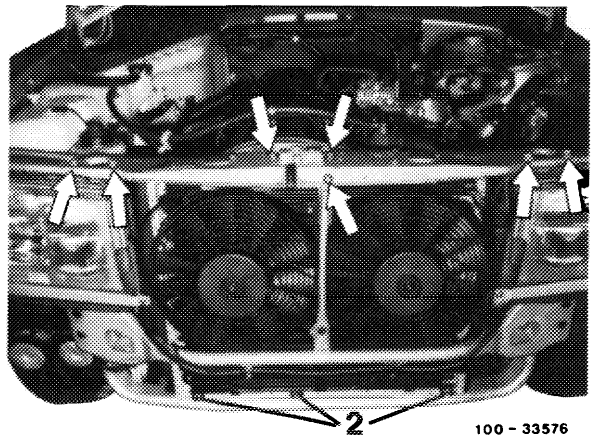
3 Mark position of front center reinforcement (1) to avoid altering hood latch adjustment. Remove front center reinforcement.



4 Remove upper and lower bolts (2) holding condenser to radiator.

5 Loosen and remove radiator hoses.

6 Release radiator shroud (arrow) and release the 4 bayonet latches by turning ring. The main shroud remains on the radiator.



7 Remove air scoop from intake noise damper.

8 Lift radiator out.

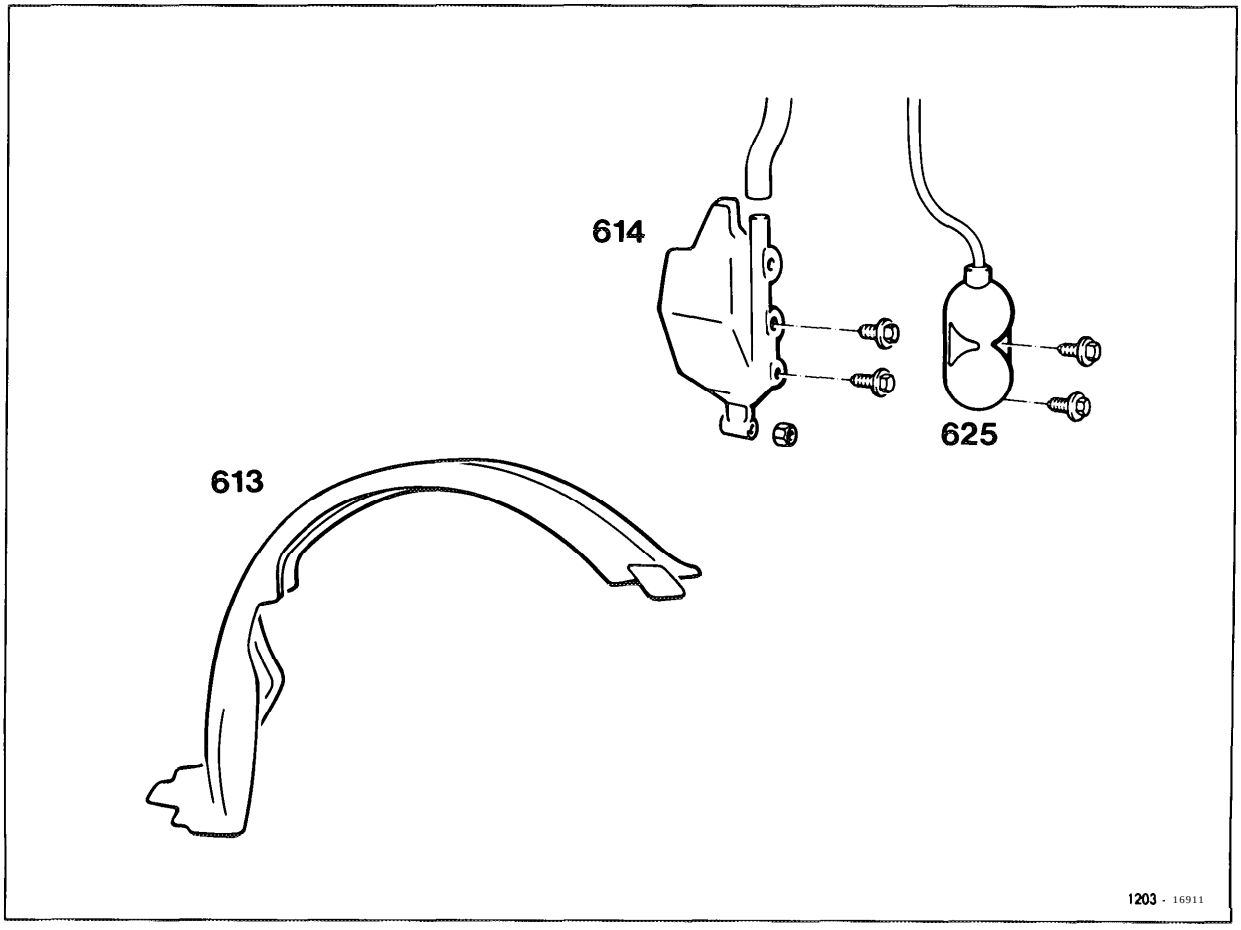
Installation instruction
The mounting spigots of the radiator must be engaged in the rubber grommets of the front center reinforcement.

Install in the reverse order.

20-450 Rmoving, installing overflow tank

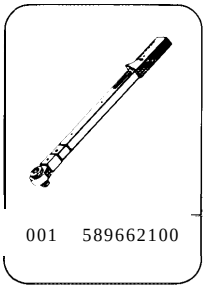
Job No. of job texts and job values or standard texts and flat rates .....

Model 124



Front right wheel	remove, fit on, tightening torque 110 Nm.
Partition wall (613) below front ring	remove, install (step 2).
Vacuum reservoir (625)	remove, install (step 3).
Overflow tank (614)	remove, install (step 4).

Special tool

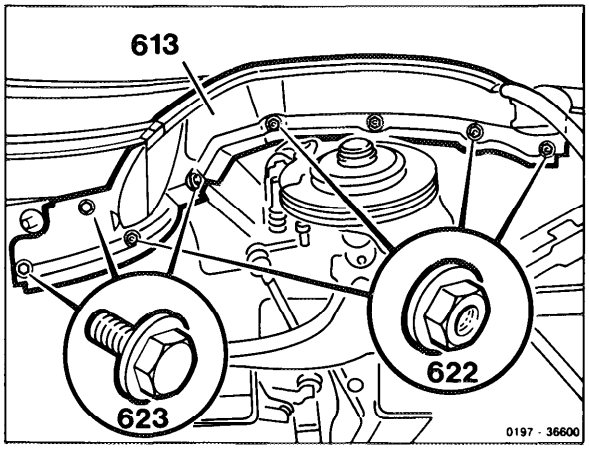


001 589662100

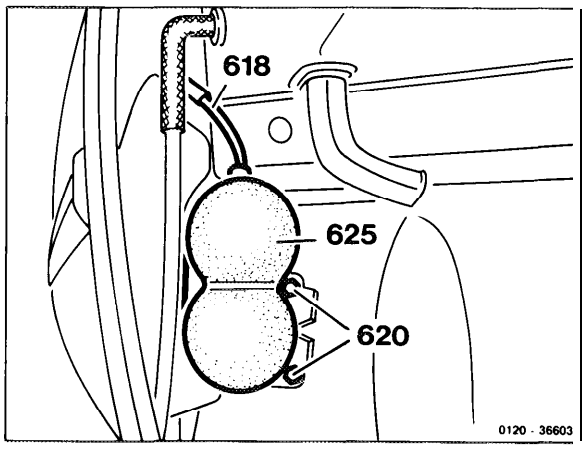
Removal, installation

1 Remove front right wheel.

2 Unscrew bolts (623) and nuts (622), remove partition wall (613).

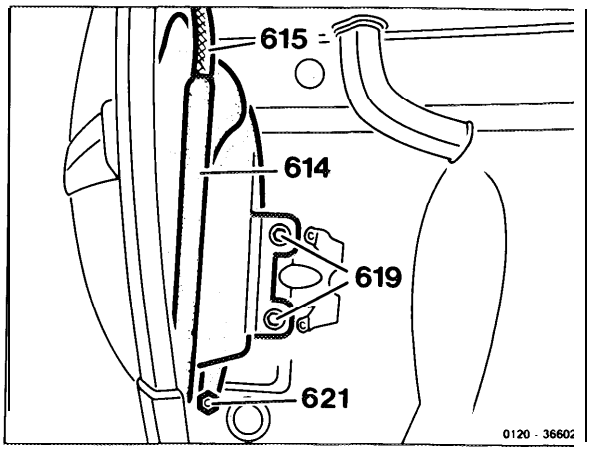


3 Detach vacuum hose (618). Unscrew bolts (620) and remove vacuum reservoir (625).



4 Unscrew bolts (619) and nuts (621). Detach hose (615) and remove overflow tank (614).

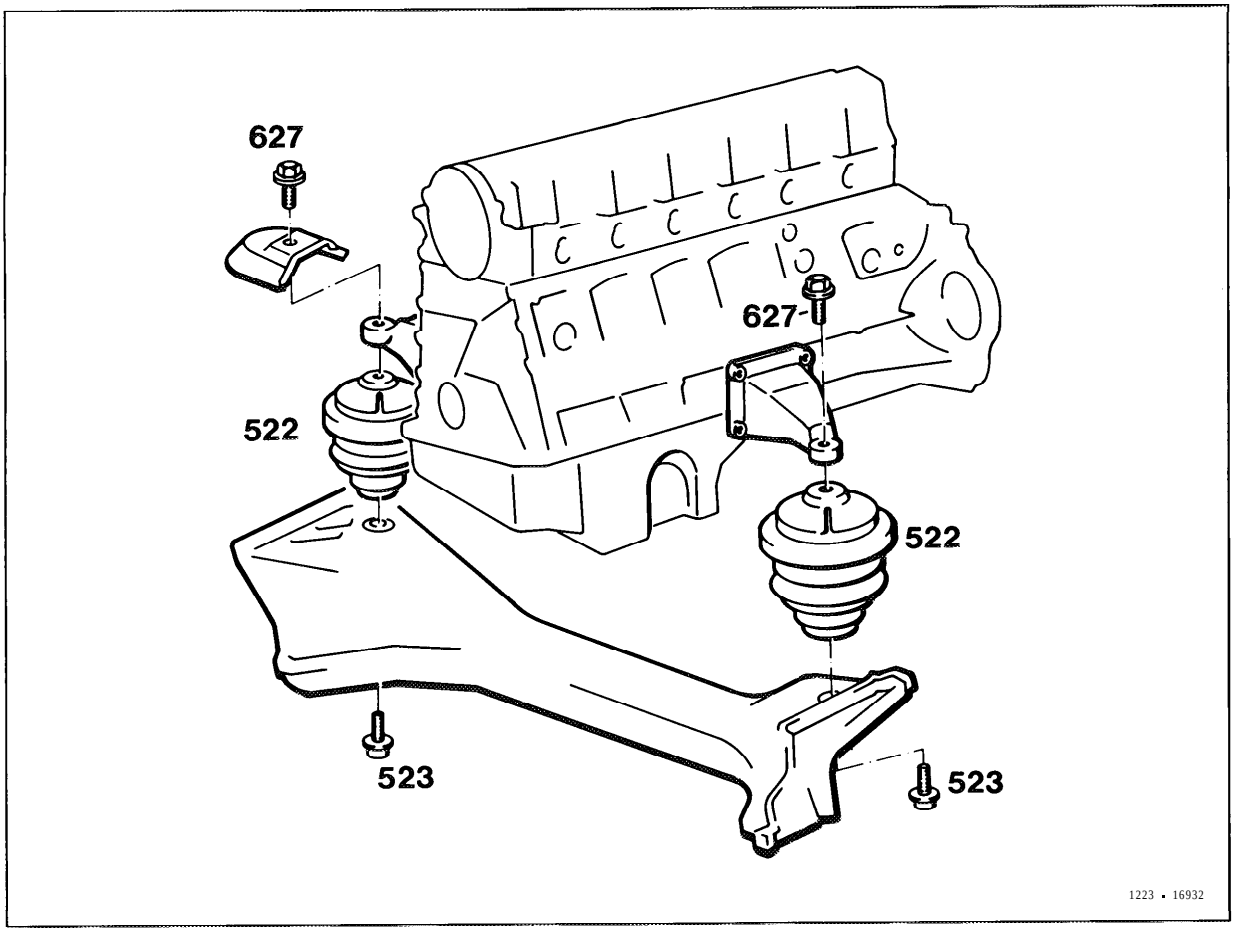
5 Install in the reverse order.



Job No.

Removing, installing front engine mounts . . . . . 22 – 211
Removing, installing rear engine mounts . . . . . – 212
Rear engine mount (Freeway hop) Model 124 USA . . . . . – 213
Setting engine stop, Model 124 4MATIC . . . . . – 220

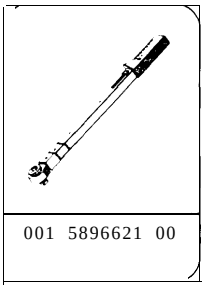
Model 124



Wood	raise to vertical position (01-008).
Ground cable to battery	detach, attach.
Air scoop	remove, install.
Fan cowl	detach, attach.
Engine compartment covering below	remove, install.
Bolts (627)	unscrew, screw in, tightening torque 55 Nm (steps 5 and 7). Pay attention to installation instruction.
Engine	raise, lower.
Bolts (523)	unscrew, tighten, tightening torque 40 Nm (step 9).
Engine mount (522)	remove, install.

Tightening torques	N m
Hexagon socket bolts for engine mounts to frame cross member	40
Hexagon bolt for engine mounts to engine support	55

Special tool



Removal, installation

1 Raise hood to vertical position **(01-008).**

2 Detach ground cable at battery.

3 Detach air scoop from air filter.

4 Detach fan cowl and place over the fan.

Installation instruction

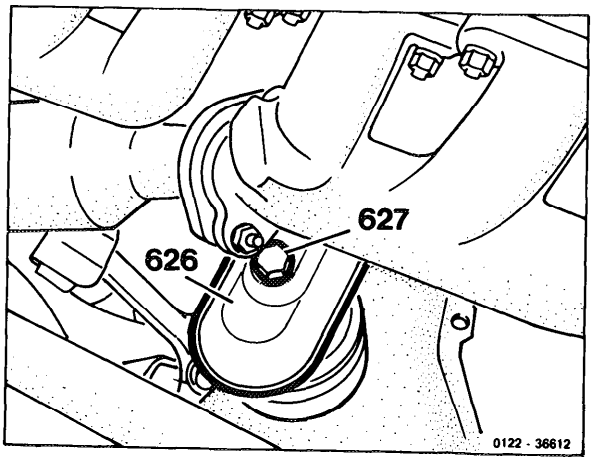
Introduce retaining catches into the mounts on the radiator.

5 Unscrew bolt (627) on the right engine mount from above, tightening torque 55 Nm.

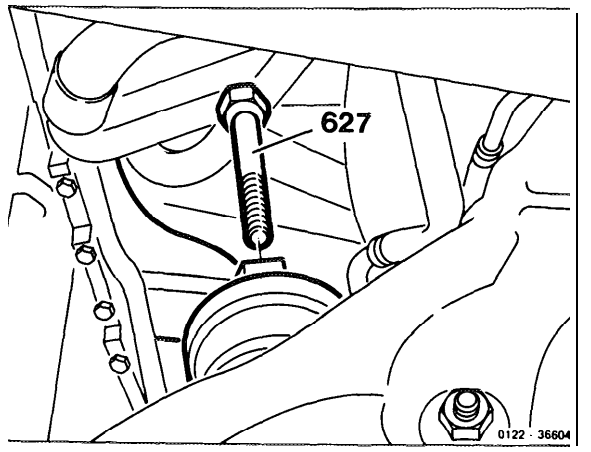
Note

A shield (626) is inserted above the right engine support.

6 Remove engine compartment covering below.

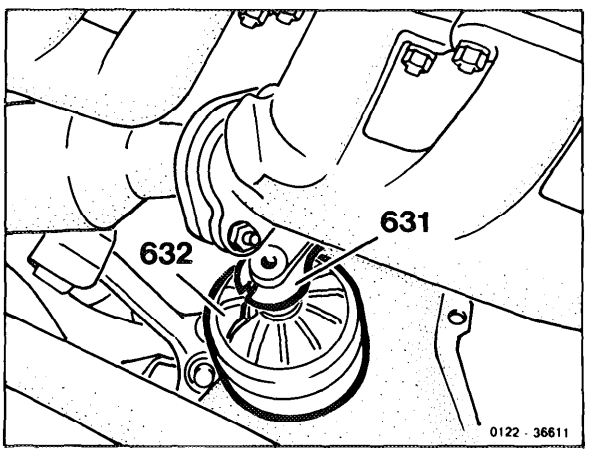


7 Unscrew bolt (627) on left engine mount, tightening torque 55 Nm.



Installation instruction

Anti-twist lock (632) on left and right engine mounts must engage into the retaining slot of the engine support.



8 Attach engine to the front suspension lock and raise slightly, paying attention to the rear suspension lock, oil filter and coolant hoses.

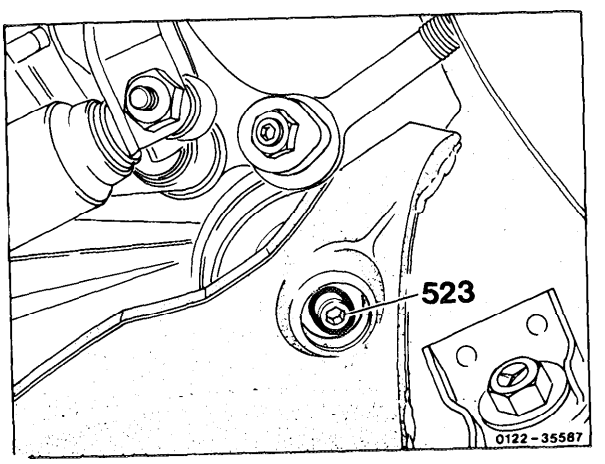
9 Unscrew bolts (523) on the left and right front engine mounts from below, tightening torque 40 Nm.

4MATIC: unscrew 2 bolts from below.

10 Take out engine mount.

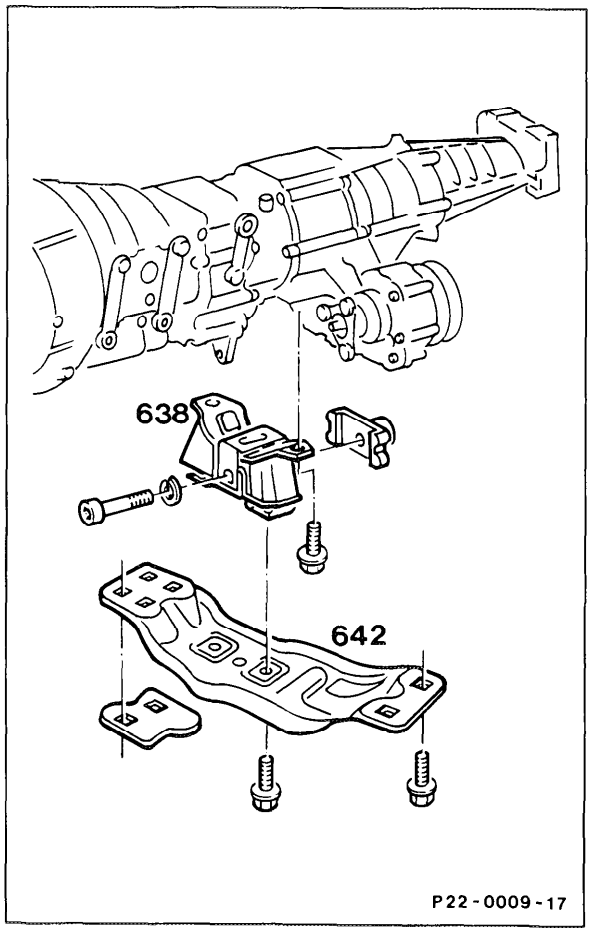
Note

The engine mounts on the left and right are identical.



Job No. of job texts and job values or standard texts and flat rates .....

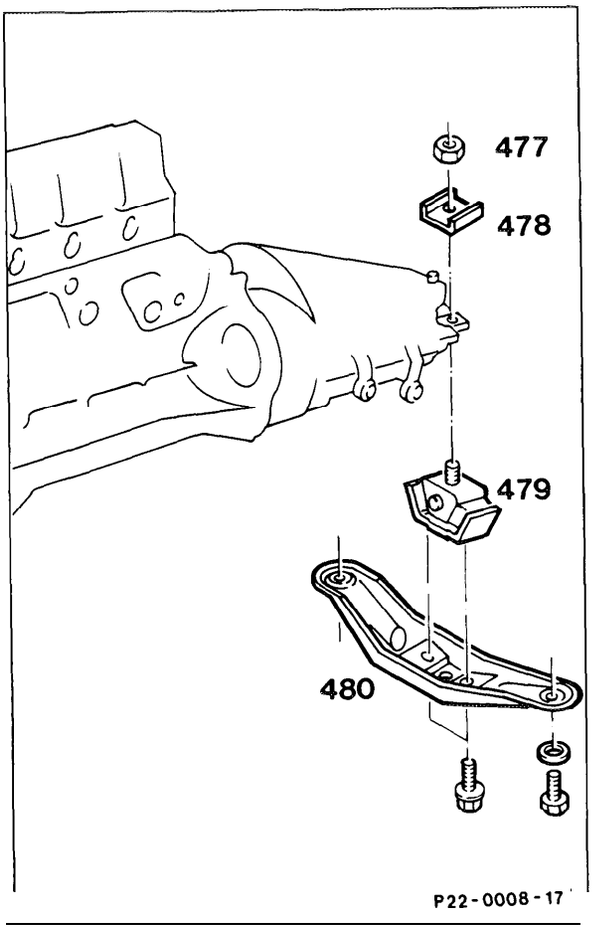
Model 124 4MATIC



Transmission	support.
Engine support (642)	remove, install, M8 (20 Nm), Ml0 (40 Nm), torque wrench 001 589 66 21 00.
Engine mount (638)	remove, install, torque wrench 001 589 66 21 00.

Note

If the rear engine mount on 4MATIC cars is renewed, the engine stop must be stress-relieved after approx. 1000 km or 10000 km distance, respectively (22-220).

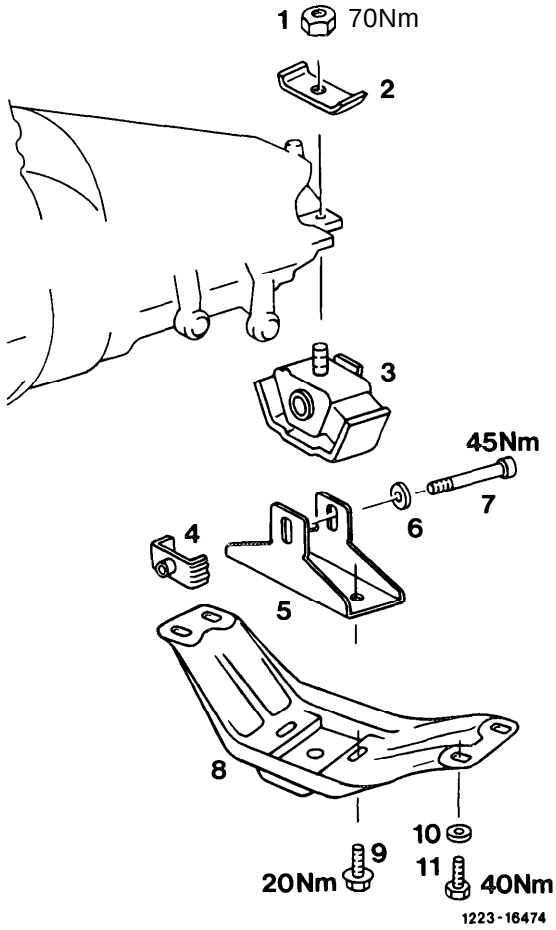


Transmission	support.
Engine support (480) or (8)	remove, install, M8 (20 Nm), Ml0 (40 Nm), torque wrench 001 589 66 21 00.
Engine mount (479) or (3) with bracket (5)	remove, install, nut (477) or (1) 70 Nm, bolt (7) 45 Nm. Torque wrench 001 589 66 21 00.

Note

If the rear engine mount with stop limit (Freeway hop) is renewed, the engine stop must be set after 1000 km and after approx. 10000 km distance (22-213).

Job No. of job texts and job values or standard texts and flat rates .....



1	Flat nut	7	Adjusting screw 10.9
2	Packing	8	Engine support
3	Engine mount	9	Screw-and-washer assy.
4	Nut	10	Washer
5	Bracket	11	Bolt
6	Washer		

The rear engine mount with variable engine stop and higher load carrying capacity can be installed if complaints are received regarding engine vibration on roads with transverse grooves (Freeway hop).

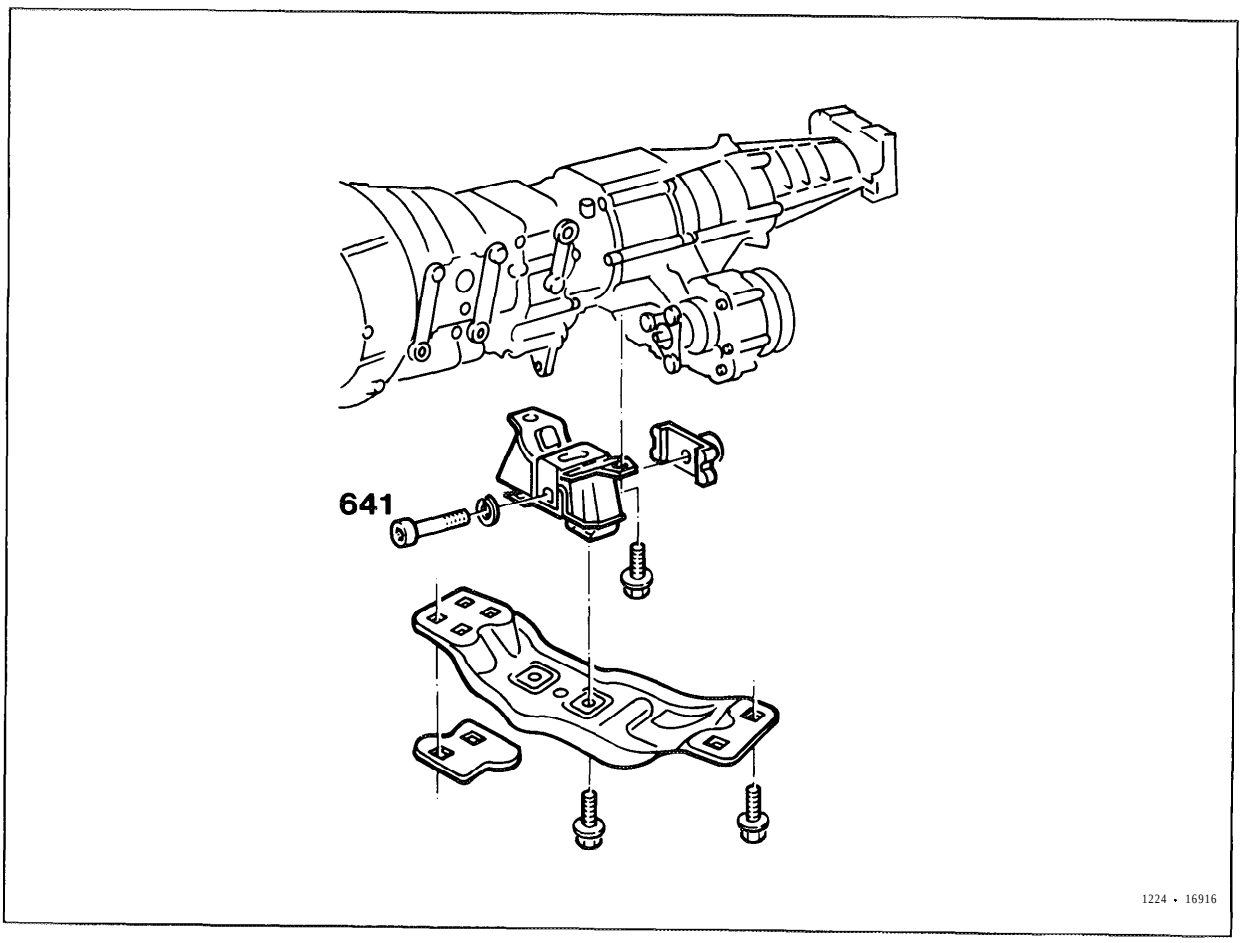
If this engine mount is installed, the engine stop must be set after approx. 1000 and after 10000 km distance.

Setting

1 Slacken adjusting screw **(7)** on rear engine mount completely.

2 Move engine by shaking back and forward by hand.

3 Tighten adjusting screw **(7)** on rear engine mount.

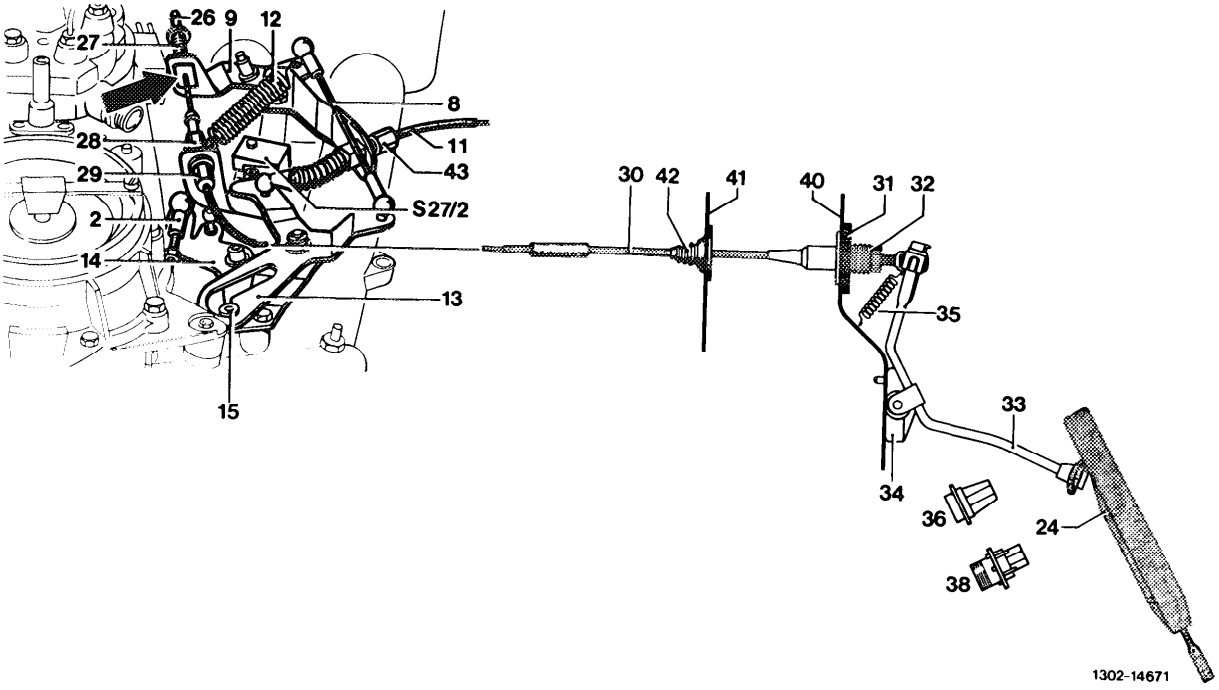


Screw (641)	.....	slacken.
Start engine	.....	depress accelerator pedal sharply several times to allow the engine stop to adjust.
Screw (641)	.....	tighten, 45 Nm. Torque wrench 001 589 66 21 00.

Job No.

Adjusting control linkage . . . . . 30 – 300
Removal and installation of accelerator pedal with front wall mounting . . . . . - 315
Removal, installation and adjustment of Bowden cable . . . . . – 325
Removal and installation of accelerator pedal . . . . . – 330
Lubricating control linkage and control shaft . . . . . – 335

A. Model 124



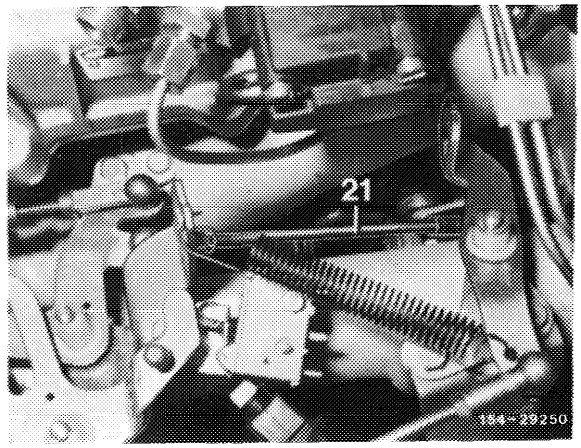
Control linkage and Bowden cable	check for easy operation and evidence of bending. Renew parts if necessary.
Bowden cable (30)	disconnect. To do so, press off plastic clips (arrow).
Connecting rod (2)	disconnect. Check if throttle valve rests against idle stop. Reconnect connecting rod without tension. Adjust so that the roller (15) rests against the end stop without tension in the slotted link arm (13).
Connecting rod (8)	adjust to approx. 155 mm and connect. Measured from center to center of the ball socket.
Bowden cable (30)	connect. The nipple (26) of the Bowden cable (30) must contact the compression spring (27) without tension. Adjust Bowden cable (30) from the vehicle inside by means of adjusting nut (32).

Full throttle stop . . . . . check. Disconnect control pressure cable (11) for automatic transmission. With engine switched off, press accelerator pedal from the vehicle inside up to full throttle stop (36) or, with automatic transmission, to the stop of the kickdown switch (38). While doing so, the throttle valve lever must rest against the full throttle stop. Adjust adjusting screw (29) on the Bowden cable if necessary. Slowly allow accelerator pedal to return into idle position. In this position, the roller in the slotted link arm must contact the end stop without tension and the microswitch (S27/2) must be actuated. Adjust the Bowden cable (30) from the vehicle inside by means of the adjusting nut (32) if required.

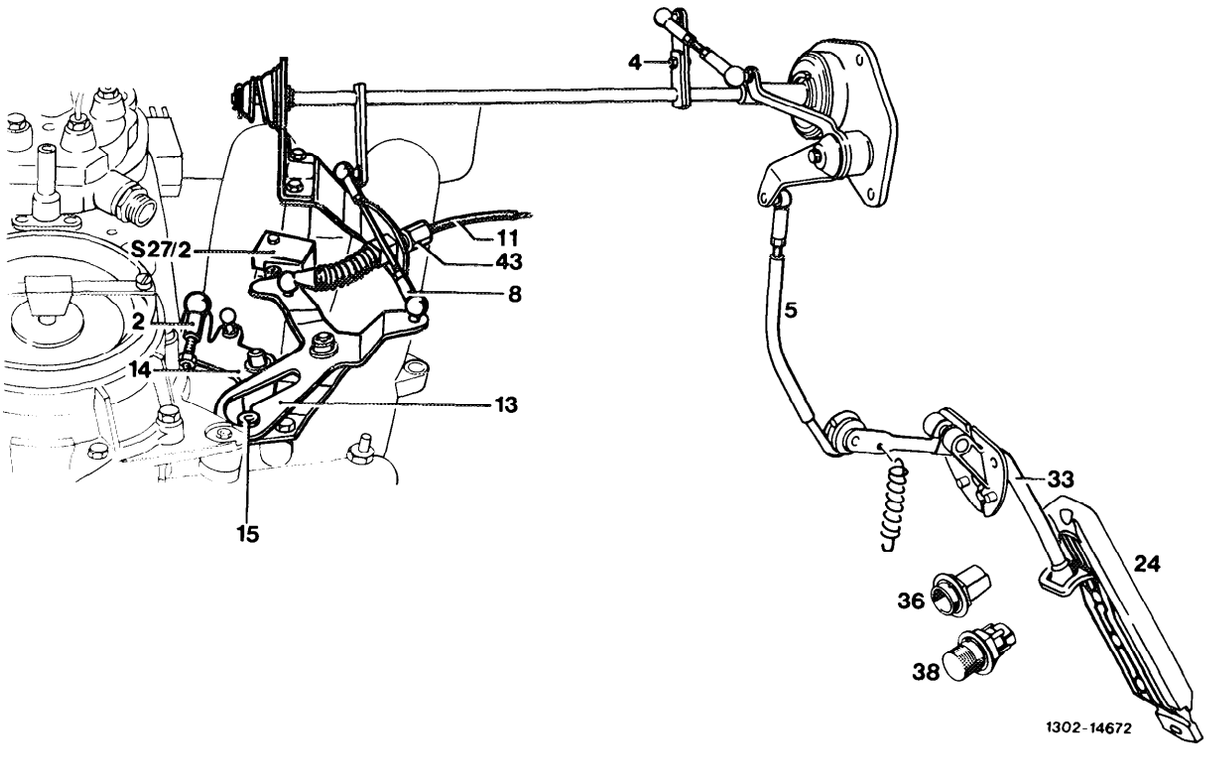
Control pressure cable (11) for automatic transmission . . . . . adjust. Push Bowden cable back, then pull forward against noticeable stop. Connect control pressure cable without tension, adjust with adjusting screw (43) if necessary.

Vehicles with cruise control

Check if the final control element contacts the idle speed stop of the cruise control. To do so, disconnect pushrod (21) and push lever of the control element clockwise against the idle speed stop. When connecting the pushrod (21), ensure that the lever of the control element is lifted by approx. 1 mm off the idle speed stop. Adjust pullrod if necessary.



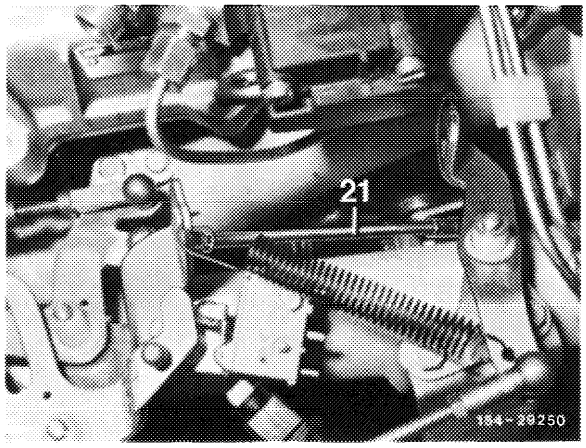
B. Model 126



Control linkage	check for easy movement and evidence of bending. Renew parts if necessary.
Connecting rod (2)	disconnect. Check if the throttle valve rests against the idle speed stop. Reconnect connecting rod without tension. Adjust so that the roller (15) contacts the end stop in the slotted link arm (13) without tension.
Connecting rod (8)	adjust and connect. Model 107 = 120 mm, model 126 = 105 mm, measured from center to center of the ball socket.
Full throttle stop	check. Disconnect control pressure cable (11) for automatic transmission. With the engine switched off, press accelerator pedal from the vehicle inside up to the full throttle stop (36) or, with automatic transmission, up to the stop of the kickdown switch (38). While doing so, the throttle valve lever must contact the full throttle stop. Loosen adjusting screw (4 or 7) if necessary, adjust control linkage so that the throttle valve lever contacts the full throttle stop. If the full throttle or idle speed stop is not achieved with this position, adjust pushrod (5) from the longitudinal control shaft to the accelerator pedal to the specified length, model 107 = 105 mm, model 126 = 220 mm, measured from center of ball socket to the center of damper ring. To check, slowly allow accelerator pedal to return into idle speed position. In this position, the roller in the slotted link arm must contact the end stop without tension and the microswitch (S27/2) must be actuated.
Control pressure cable (11) for automatic transmission.	adjust. Push back Bowden cable, then pull forward against noticeable stop. Connect control pressure cable without tension, adjust with adjusting screw (43) if required.

Vehicles with cruise control

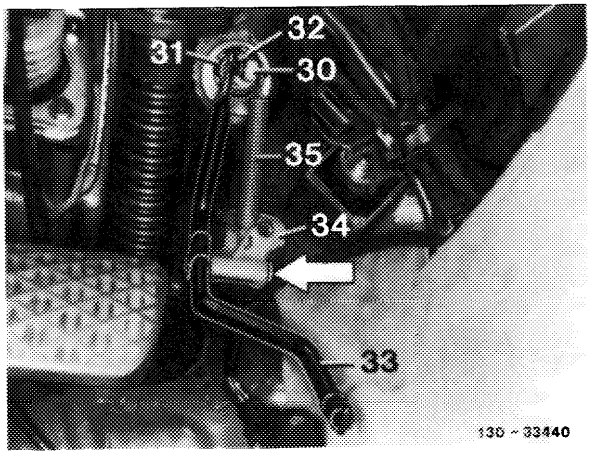
Check if the final control element contacts the idle speed stop of the cruise control. To do so, disconnect pushrod (21) and press the lever of the control element clockwise against the idle speed stop. When connecting the pushrod (21) ensure that the lever of the control element is lifted approx. 1 mm above the idle speed stop. Adjust pull rod if necessary.

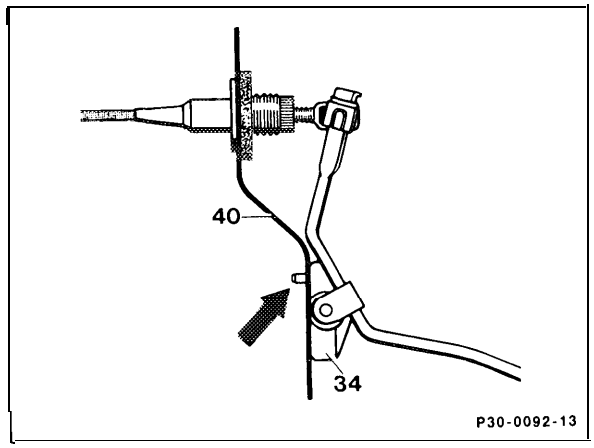


30–315 Removal and installation of accelerator pedal with front wall mounting

Job number of the job texts and work units and standard texts and flat rates respectively 30-0012

Model 124



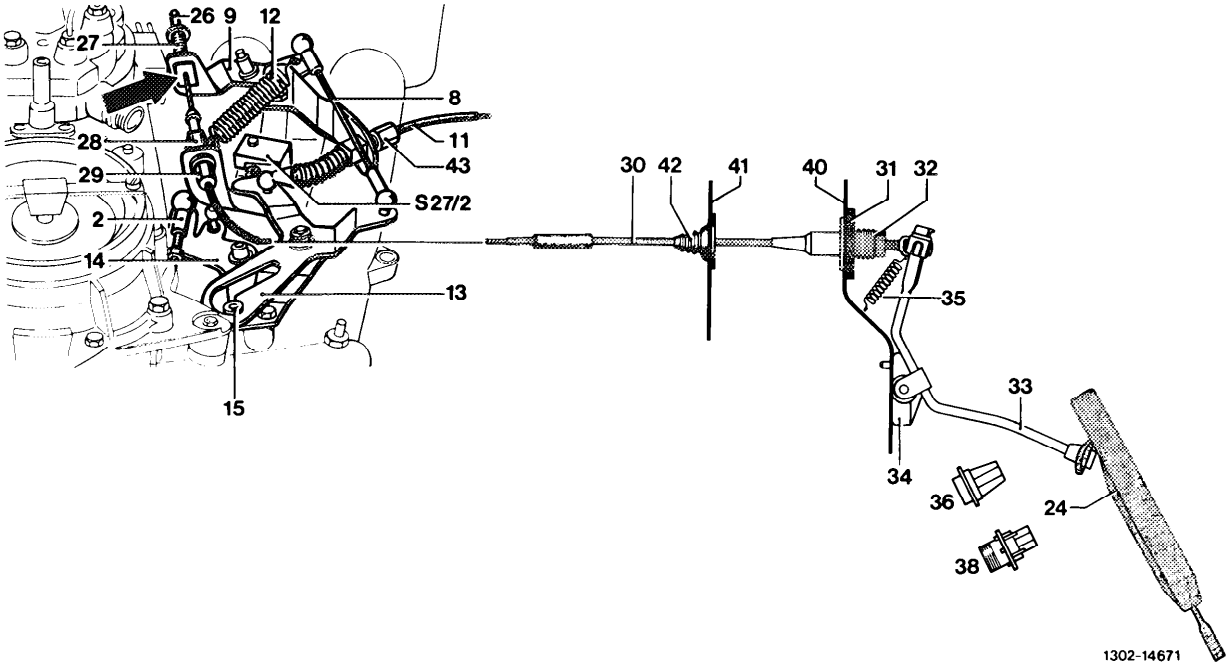


Accelerator pedal	remove and install (30-330).
Cover	unscrew.
Bowden cable (30)	remove. For this purpose, disconnect return spring (35).
Front wall mounting (34)	unscrew and remove together with the accelerator lever (33).
Front wall mounting (34)	remove from accelerator lever (33). For this purpose, pull of lock (arrow).
Installation	Installation takes place in reverse order. Ensure that the lug (arrow) of the front wall mounting (34) engages in the bore in the front wall (40). Grease the bearing points and the ball sockets of the control linkage with anti-corrosion grease 000 989 87 51 10.
Control linkage	check and adjust if required (30-300).

30-325 Removal, installation and adjustment of Bowden cable

Job number of the job texts and work units and standard texts and flat rates respectively 30-0025

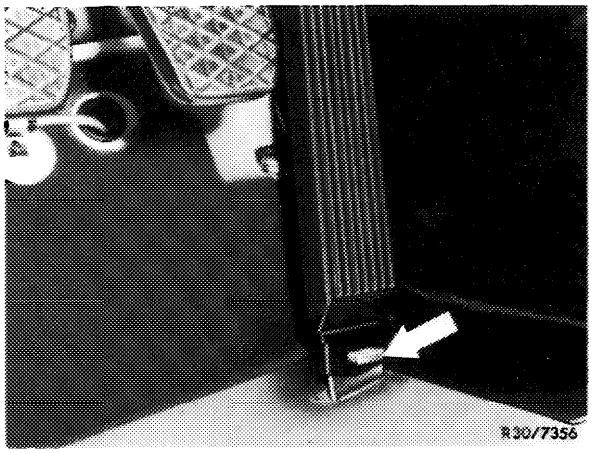
Model 124

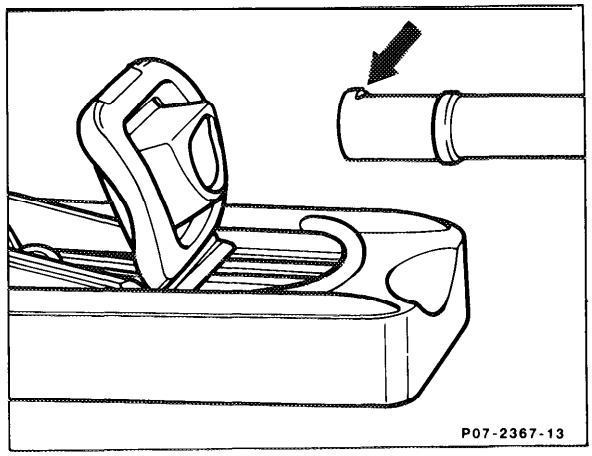


Return spring (12)	disconnect, connect.
Bowden cable (30)	disconnect, connect. To do so, push plastic ball forward and compress guide piece (arrow) and push out. Remove Bowden cable through the slot.
Plastic clips (28)	compress and remove Bowden cable.
Vacuum lines	disconnect, connect.
Accelerator pedal (24)	remove, install (30-300).
Cover.	dismount, mount.
Return spring (35) in the vehicle interior	disconnect, connect (serves as safey feature).
Bowden cable (30)	push outward, do not push out rubber grommet (31). Remove complete Bowden cable from the engine compartment.
Control linkage	adjust (30-300). Grease bearing points and the ball sockets of the control linkage with anti-corrosion grease 000 989 87 51 10.

30-330 Removal and installation of accelerator pedal

Job number of the job texts and work units and standard texts and flat rates respectively 30-0010





Spreader clip (arrow) . . . . . compress behind the accelerator pedal and pull out.

Accelerator pedal . . . . . push up and turn by 180°.

Accelerator pedal . . . . . pull down, while the lug (arrow) on the accelerator lever must correspond with the slot in the accelerator pedal.

Installation . . . . . The installation takes place in reverse order. Observe that the spreader clip engages securely.

The connection from accelerator lever to accelerator pedal is maintenance-free and need not be lubricated.

30–335 Lubricating control linkage and control shaft

Lubricating

Following each engine wash and engine compartment conservation, lubricate with an oil can all bearing points, all control levers and joints of the control linkage.

The Bowden cable is maintenance-free and need not be lubricated.

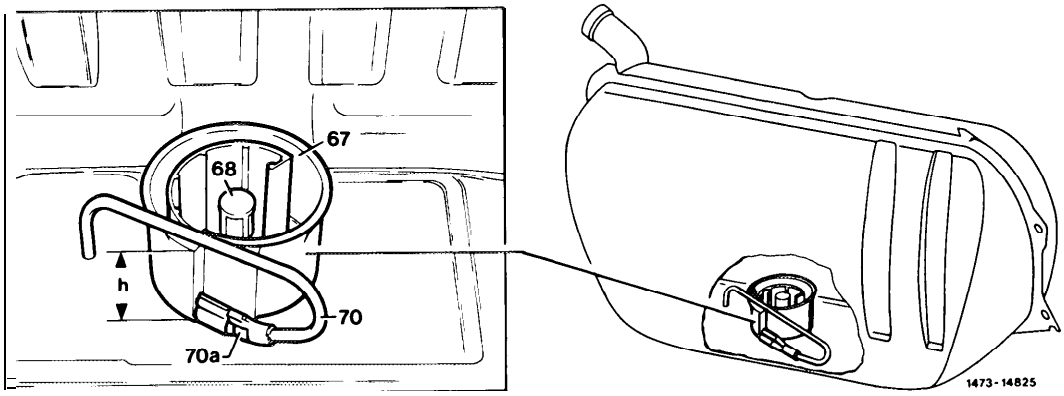
On vehicles in @-version only the following hydraulic oils may be used:

Castrol DB hydraulic fluid
Mobil Aero HFA
Shell Aero fluid 4

Job No.

Operation of fuel tank with surge bowl . . . . . 47 – 010
Operation of fuel gauge pickup . . . . . – 020
Operation of fuel tank positive and negative ventilation . . . . . – 030
Removal and installation of fuel tank . . . . . – 100
Removal and installation of fuel gauge pickup . . . . . – 120
Function of fuel evaporation system . . . . . – 200
Checking the fuel evaporation system . . . . . – 300
Function of fuel cooler . . . . . – 400

47-010 Operation of fuel tank with surge bowl



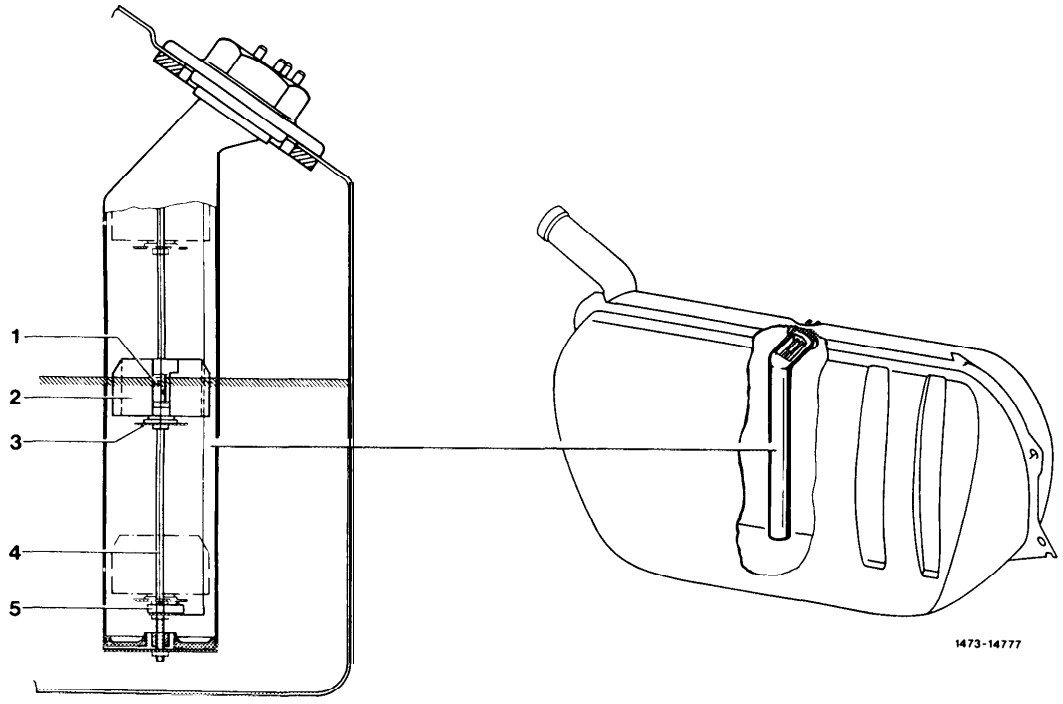
67 surge bowl
68 Fuel tank
70 Return line
70a Return nozzle

A surge bowl (67) is installed in the fuel tank. Its duty is to reliably supply the engine with fuel at low fuel level in the fuel tank and with prolonged driving on winding roads.

While the fuel pump is running, the return fuel jet flows from the return nozzle (70a) at high speed into the surge tank. In this way it drags along into the surge bowl (arrow) the fuel surrounding the return nozzle.

The fuel level (h) is maintained in the surge bowl even when the fuel level in the fuel tank drops below the level (h).

47–020 Operation of fuel gage pickup



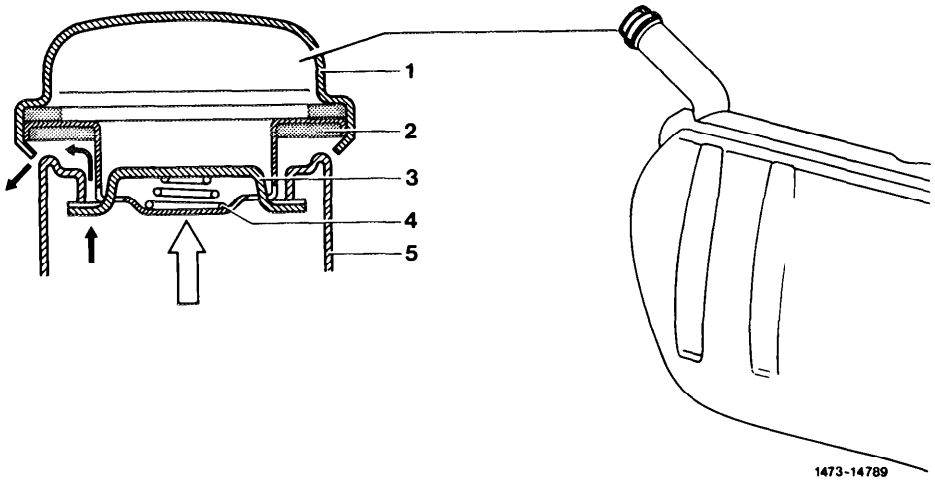
1 Sliding contact
2 Float
3 Contact plate
4 Guide and contact rod
5 Reserve warning contact

When the fuel level drops in the fuel tank, the sliding contact (1) on the float (2) increases the resistance value, the voltage drops and the indicating needle in the instrument cluster will swing back.
When the fuel level drops to the reserve volume, the reserve warning contact (5) closes and connects the reserve warning lamp to ground. The reserve warning lamp lights up when the ignition is switched on (control function). As soon as the engine is running, it goes out provided the fuel tank contains more than just the reserve volume.

Note
In control function the reserve warning lamp lights up with less intensity, when reaching the reserve volume, with more insensity.

Check fuel gage (54-269).

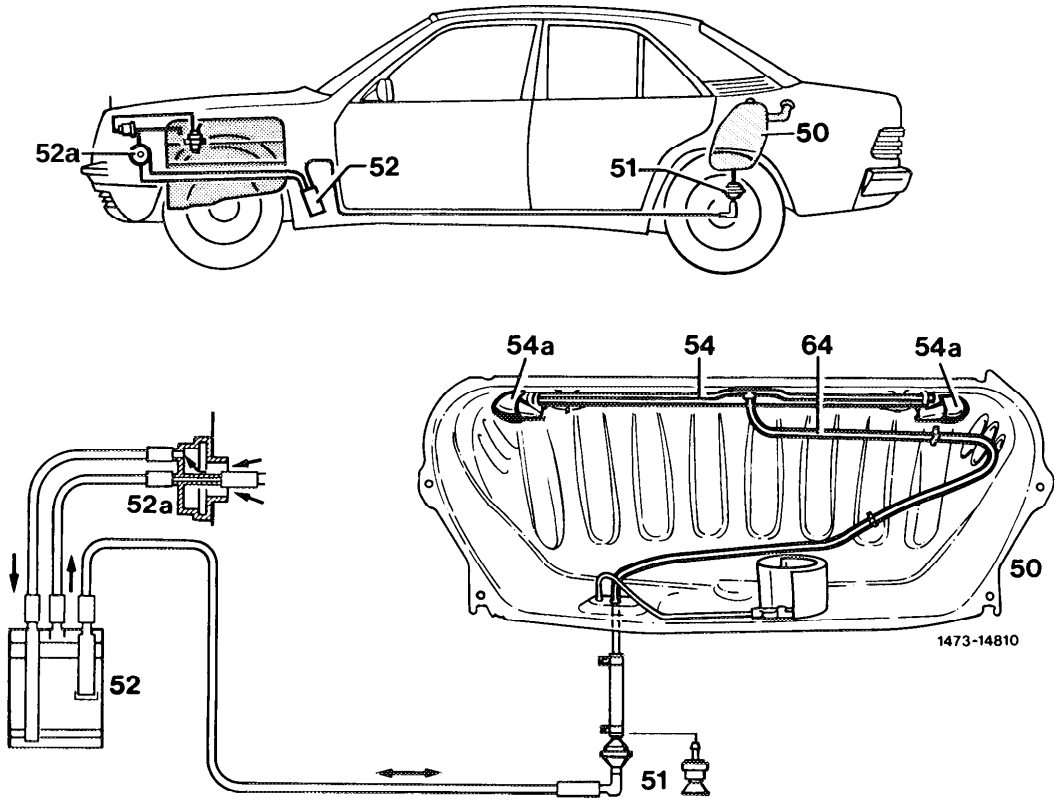
A. Closing cap



All models
1 Closing cap
2 Sealing ring
3 Closing clip
4 Compression spnng
5 Filler neck

At a gage pressure of **100-300** mbar the fuel vapors can escape via the closing cap. However, this is only possible when for instance the breather pipe from the fuel tank is blocked through damage or improper installation. With the system in operating condition, a pressure of up **to 50 mbar may occur in the fuel tank.**

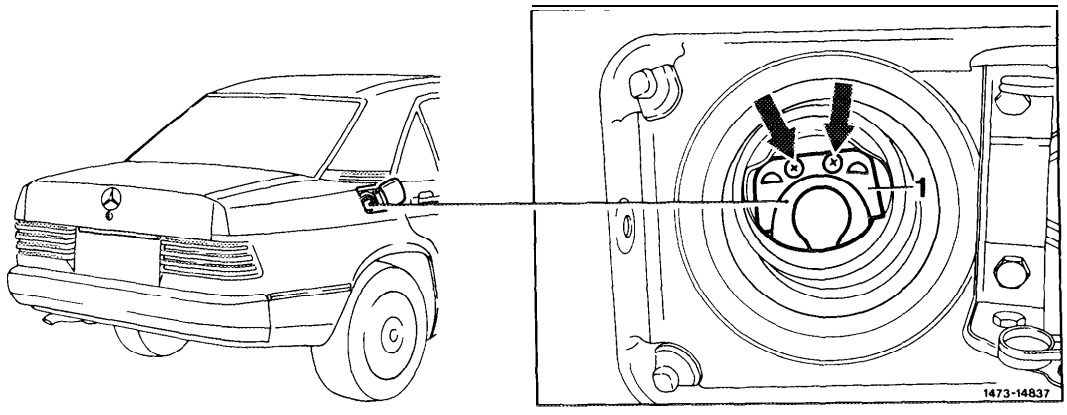
B. Models 124, 126 and 201



The ventilation system consists of a central pipe (54) each with one fuel trap (54a) at the ends. The fuel traps prevent that fuel escapes via the breather pipes. From the central pipe the breather pipe (64) leads to the breather valve (51). On vehicles with fuel evaporation system, positive and negative ventilation of the fuel tank (50) takes place via the charcoal cannister (52) and the diaphragm (52a).

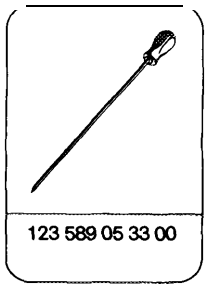
Job number of the job texts and work units and standard texts and flat rates respectively 47-0050

A. All models with catalytic converter emission control system

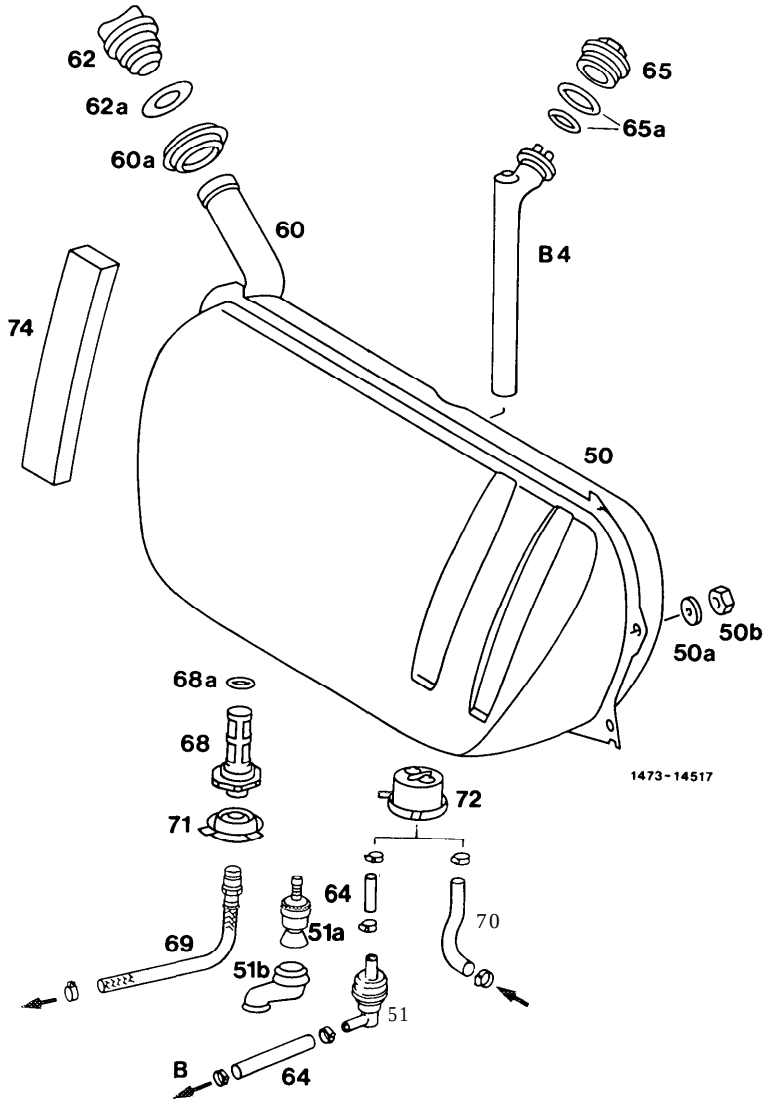


Guide funnel (1) . . . . . remove, install. For this purpose, use special tool 123 589 05 33 00 to remove as far as possible the rivets (arrows), drive in with mandrel. Because of the smaller filling gun for unleaded fuel a guide funnel (1) has been installed. When replacing the fuel tank, install a guide funnel.

Special tool



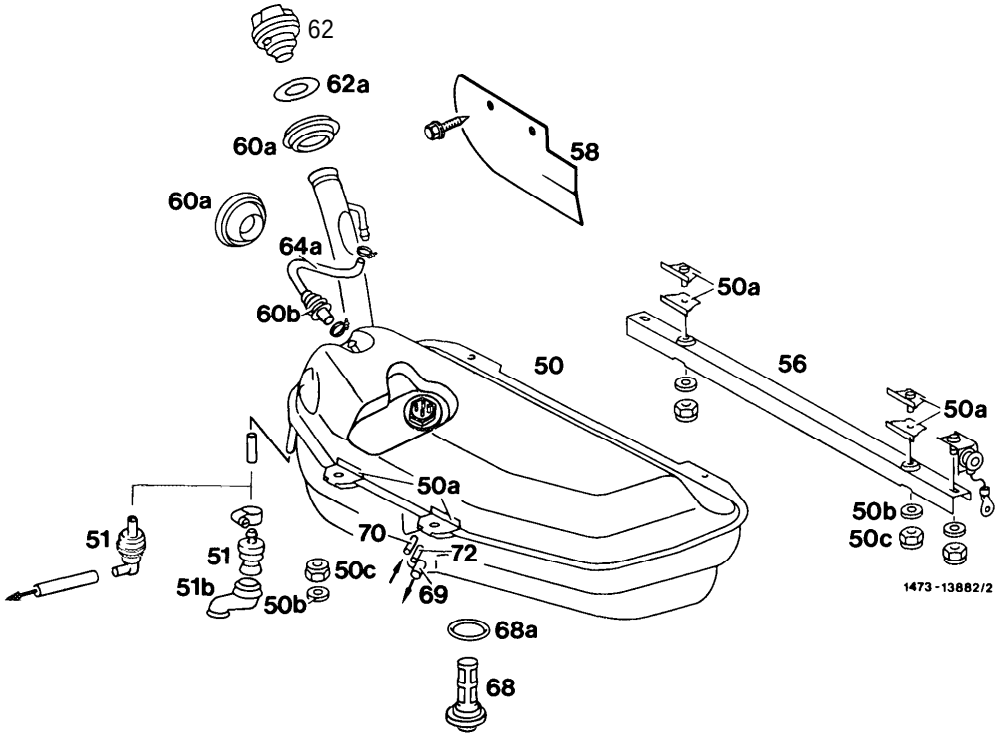
B. Model 124 Sedan



Safety regulations	observe, risk of accidents !
Ground cable, battery	disconnect, connect.
Fuel tank (50)	drain. Carefully pump out fuel so that no residual fuel quantity remains in the fuel tank. Filling capacity is approximately 70 liters. Glue on 4 damping strips (74) with MB universal glue 000 989 92 71 if required.
Closing cap (62)	remove, install. Check sealing ring (62a), renew if required.
Sealing sleeve (60a)	remove, install
Fuel tank covering and left, right lateral boot covering	remove, install.

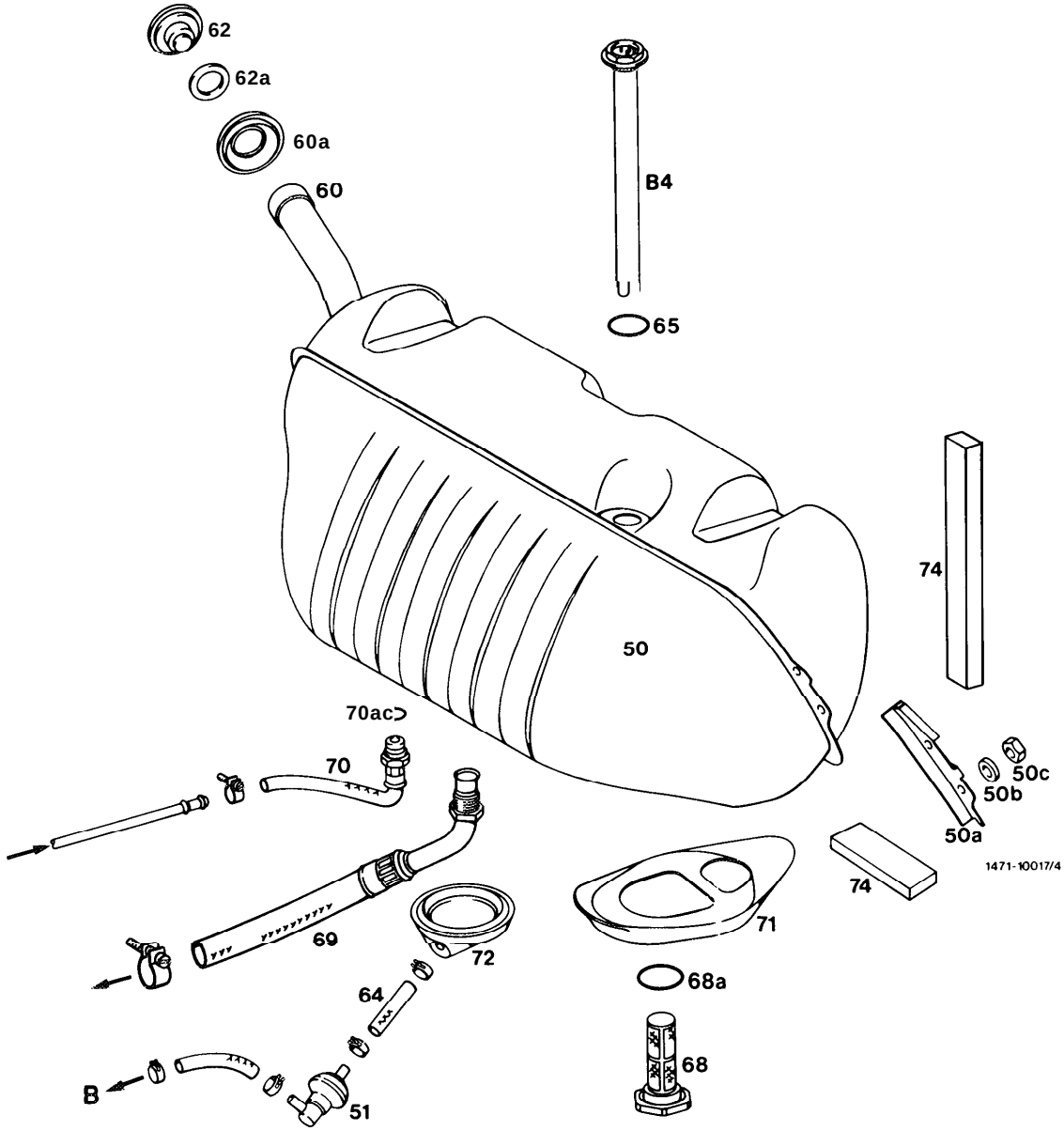
Fuel gage	pull off, fit connector on pickup (B4), check function. Remove, install pickup (B4) 39 Nm if required (47-120). Renew sealing rings.
Supply hose (69), return hose (70), breather valve (51, 51a)	disconnect, connect, 28 Nm. Check reusability. Collect residual fuel. Plug connections. Check seals (71, 72) for proper seating.
Nut (50b, 4 required)	21 Nm, use 4 washers (50a).
Fuel filter (68)	remove, install if required, 39 Nm, clean, check for reusability, renew sealing ring (68a).
Briefly run engine	check connections for leaks.

C.124 T-Sedan



Safety regulations	observe, risk of accidents!
Ground cable, battery	disconnect, connect.
Closing cap (62a)	remove, install. Check sealing ring (62a) renew if required.
Fuel tank (50)	drain, carefully pump out fuel so that no residual fuel quantity remains in the tank. Filling capacity is approx. 72 liters. Between rear-end floor and fuel tank, glue in damping strips with MB universal glue 000 989 92 71 if required.
Sealing sleeves (60a)	remove, install.
Front load compartment flap or 3rd seat bench back rest	remove, install.
Covering front storage compartment	loosen and fold back; fold forward and attach.
Breather line (64a)	remove, install. Pre-assemble on the fuel tank upon installation. Install the pipe with a steady decline and without kinks. Check sealing sleeve (60b) for proper seating.
Fuel gage	pull off, fit connector on pickup (B4). Check function. Remove, install pickup (B4) 39 Nm (47-120) if required, renew sealing rings.
Sealing sleeve (60a, 2 required)	remove, install.
Supply hose (69), return hose (70), leak-off pipe (72)	disconnect, connect, check reusability. Collect residual fuel. Plug hoses.
Breather valve (51)	dismount, mount (only vehicles with fuel evaporation system).
Exhaust	disconnect, connect (suspend with V-belt) on both rear exhaust suspensions.
Splashguard (58) filler neck	dismount, mount.
Bracket level pipe (left side)	dismount, mount.
U-rail (56)	remove, install, 30 Nm (support fuel tank). Nuts (50c) self-locking.
Attachment (50a-50c) fuel tank front	unscrew, screw on, 30 Nm. When removing the fuel tank ensure that the connection for the breather line (64a, on the filler neck) does not hook into a cable or pipe. Push exhaust and level pipe to the left.
Fuel filter (68)	remove, install if required, 39 Nm, clean, check reusability. Renew sealing ring (68a).
Briefly run engine	check connections for leaks.

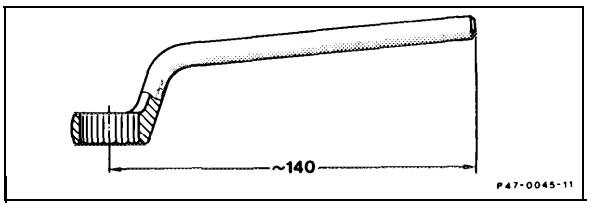
D. Model 126


62
62a
60a
60
B4
65
74
50
70ac
70
50c
50b
50a
1471-10017/4
74
71
69
72
68a
64
68
B
51

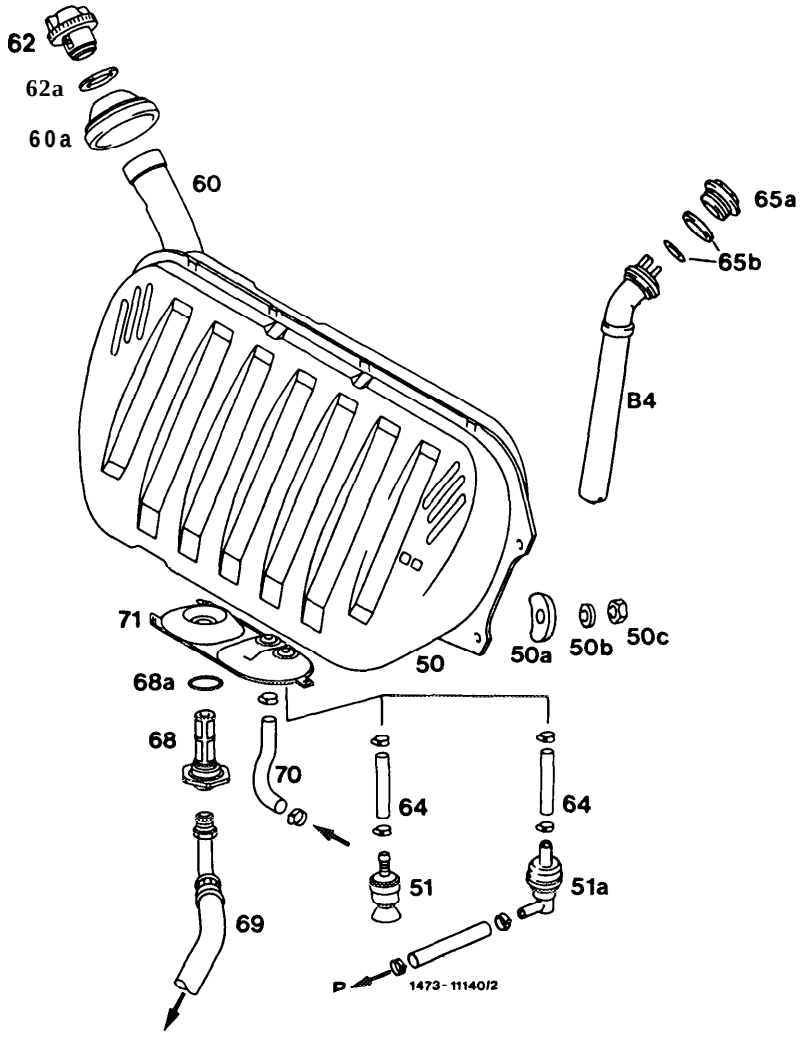
Safety regulations	observe, risk of accidents!
Ground cable, battery	disconnect, connect.
Closing cap (62)	remove, install. Check sealing ring (62a), renew if required.
Fuel tank (50)	drain. Carefully pump out fuel so that no residual quantity remains in the fuel tank. Filling capacity is approx. 90 liters. Glue in 4 damping strips (74) with MB universal glue 000 989 92 71 if required.
Sealing sleeve (60a)	remove, install.
Partition panel trunk/fuel tank	remove, install.
Supply hose (69), return hose (70), breather valve (51)	disconnect, connect, 28 Nm, check for reusability. For return line (70), use shortened box wrench (selfmade), renew sealing ring (70a). Collect residual fuel, plug connections. Check seals (71, 72) for proper seating.
Nuts (50c, 4 required)	21 Nm, use 4 washers (50b)
Fuel gage	pull off, fit connector to pickup (B4). Check function. Remove, install pickup (B4) 39 Nm, (47-120) if required, renew sealing ring.
Fuel filter (68)	remove, install if required. 39 Nm, clean, check for reusability, renew sealing ring (68a).
Briefly run engine	check connections for leaks.

Selfmade tool

Shorten commercially available box wrench as shown.

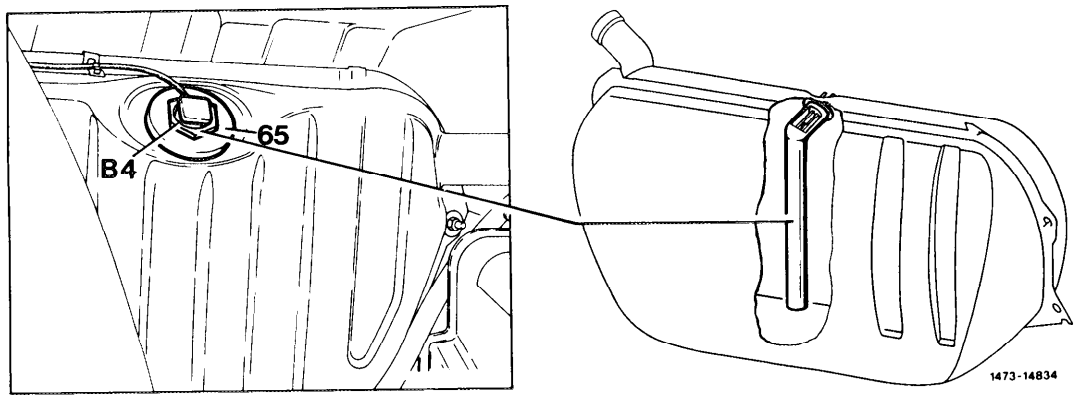


E. Model 201



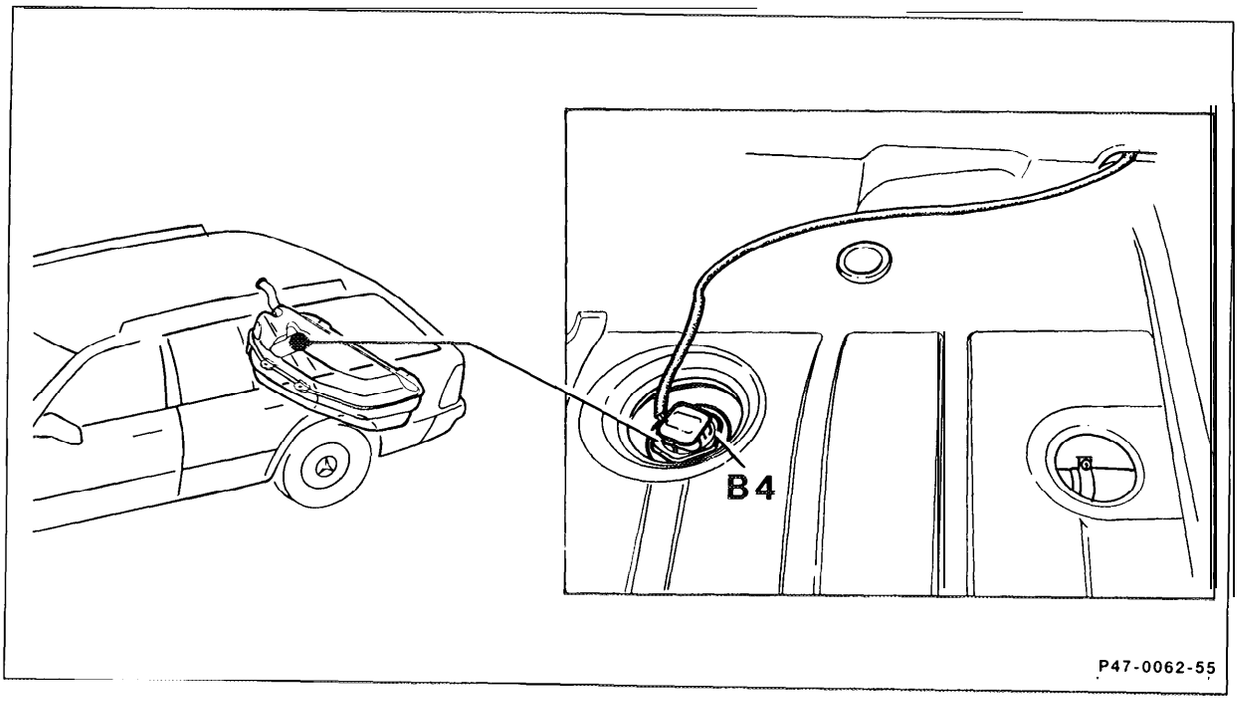
Safety regulations	observe, risk of accidents!
Ground cable, battery	disconnect, connect.
Closing cap (62)	remove, install. Check sealing ring (62a), renew if required.
Fuel tank (50)	drain. Carefully pump out fuel so that no residual quantity remains in the fuel tank. Filling capacity is approx. 55 liters. Glue in 4 damping strips with MB universal glue 000 989 92 71 if required.
Sealing sleeve (60a)	remove, install.
Covering fuel tank	disconnect, connect.
Fuel gage	pull off, fit connector on pickup (84). Check function. Remove, install pickup (B4) 39 Nm, (47-120) if required, renew sealing ring.
Supply hose (69), return hose (70), breather valve (51)	disconnect, connect, 28 Nm, check reusability. Collect residual fuel. Plug connections.Check seal (71) for proper seating.
Nut (50b, 4 required)	21 Nm. Use 4 washers (50a).
Drain hose from tank trough	before removing the fuel tank, pull drain hose slightly up and route behind fuel tank edge. After installation, route in the proper position.
Fuel filter (68)	remove, install, if required. 39 Nm, clean, check for reusability, renew sealing ring (68a).
Briefly run engine	check connections for leaks.

A. Models 124 Sedan, 201



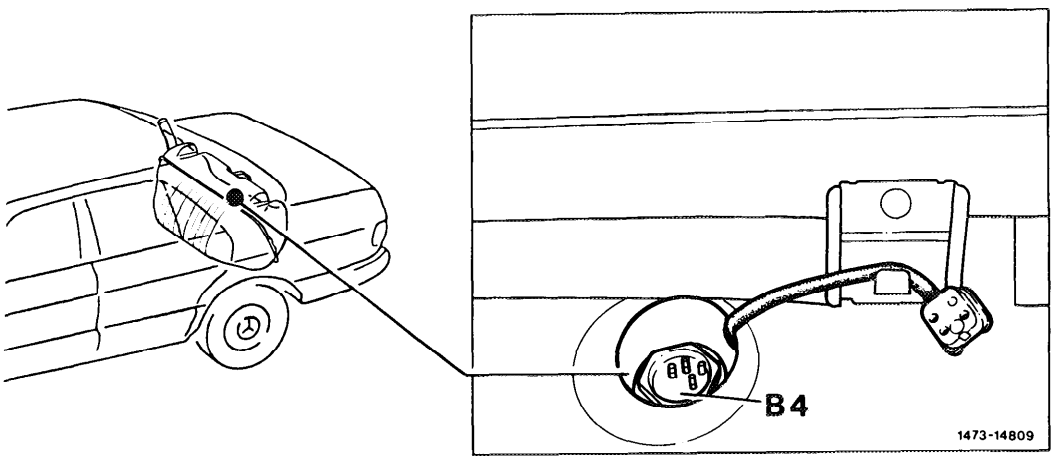
Ground cable, battery	disconnect, connect.
Covering fuel tank	remove, install, model 201 only partially.
Connector on pickup (B4)	pull-off, fit.
Sealing flange (65)	unscrew, screw on, 39 Nm, if fuel tank is full, first pump out approx. 8 liters. Renew sealing rings.
Pickup (B4)	remove, install, allow to run dry if required. Remove safety pin under adhesive foil (only with new part).

B. Model 124 T-Sedan

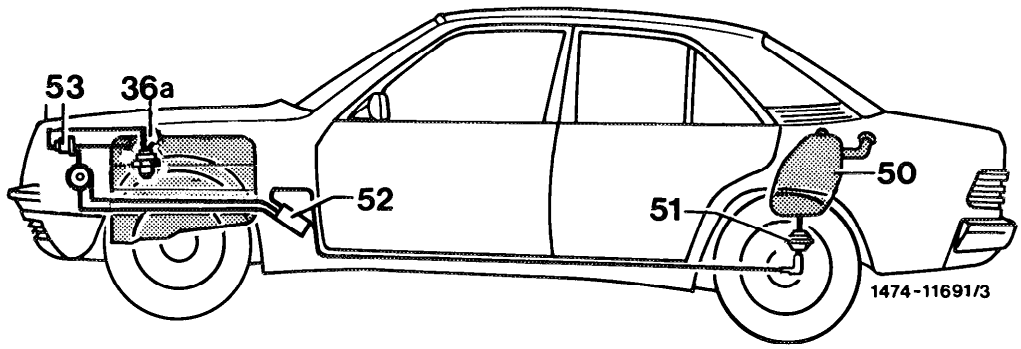


Ground cable, battery	disconnect, connect.
Front load compartment flap and 3rd seat bench back rest	remove, install.
Load compartment covering	partially remove, install.
Closing cab	remove, install.
Connector on pickup (B4)	pull off, fit.
Pickup (B4)	remove, install, 39 Nm, allow to run dry if required. Remove safety pin under adhesive foil (only with new part).

C. Model 126



Ground cable, battery	disconnect, connect.
Rear seat bench, rear back rest	remove, install (91-l 70).
Closing cap	remove, install.
Connector on pickup (B4)	pull off, protect against sliding, fit.
Pickup (B4)	remove, install 39 Nm, allow to run dry if required. Renew sealing ring. Remove adhesive foil and safety pin (only with new part).



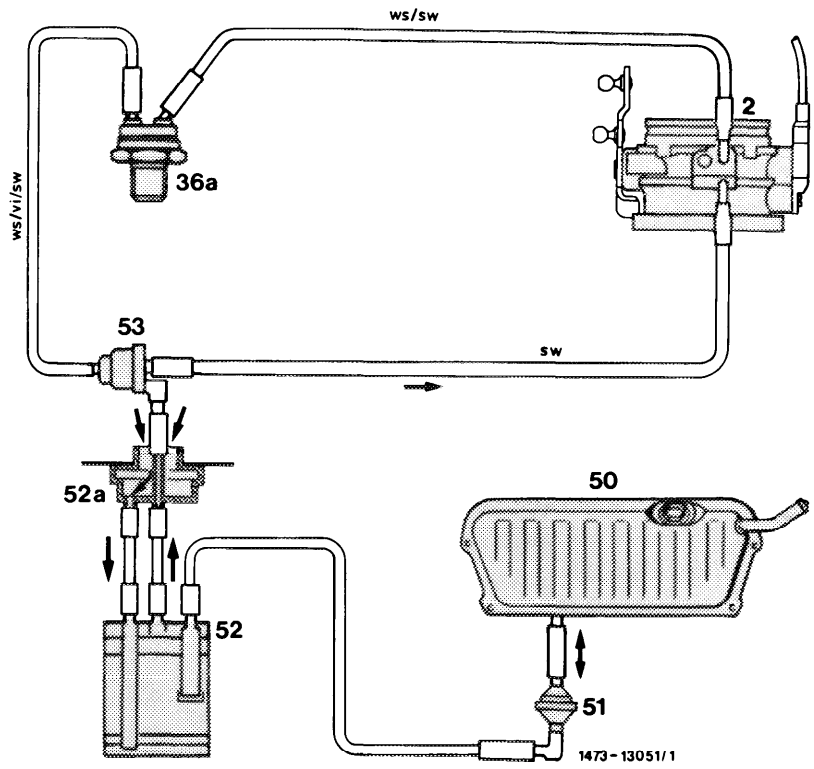
36a	50 °C red thermo valve
50	Fuel tank
51	Breather valve
52	Charcoal canister
52a	Diaphragm
53	Purge valve

General

A fuel evaporation system has been installed in order to allow less fuel vapors to escape into the atmosphere. The fuel vapors from the fuel tank (50) are directed to the charcoal canister (52) where they are stored. Depending on the operating conditions of the engine, the fuel vapors are evacuated via the purge valve (53) and the intake assembly by means of the intake manifold vacuum and burnt in the engine. Below approx. 50 °C coolant temperature and/or throttle valve at idle speed stop, the fuel vapors are not extracted.

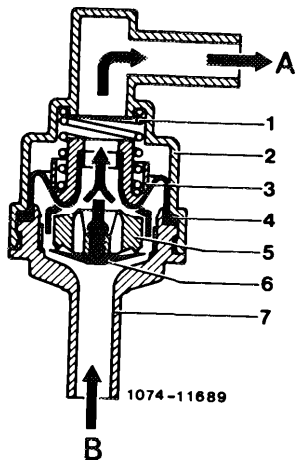
Function diagram

2	Intake pipe assembly
36	Thermo valve (50 °C, red)
50	Fuel tank
51	Breather valve
52	Charcoal canister
52a	Diaphragm



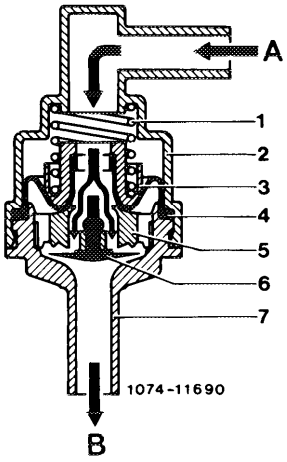
Function

If a gage pressure of 30-50 mbar is reached in the fuel tank, the breather valve (4) opens and the fuel vapors flow to the charcoal canister. The breather valve (51) to the charcoal canister is opened.



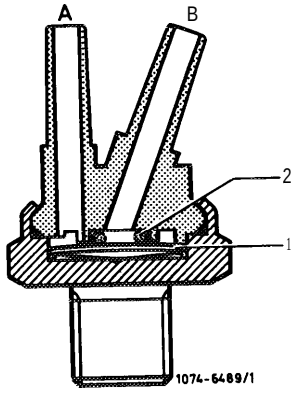
1	Compression spring	6	Vent valve
2	Valve housing	7	Connection
3	Spring retainer	A	Charcoal canister connection
4	Breather valve	B	Fuel tank connection
5	Valve plate		

If a vacuum of 1-16 mbar is reached in the fuel tank, the vent valve (6) opens. As a result, air and fuel vapors are drawn in via the charcoal canister.



Breather valve (51) to fuel tank open

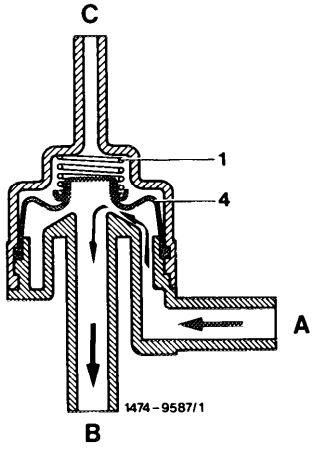
With engine running at a coolant temperature above 50 °C the intake manifold vacuum is applied to the purge valve (connection C) through the thermo valve as from a slightly opened throttle valve position.



Thermo valve 50 °C red
1 Bi-metal plate
2 0-nng
A To the purge valve
B To the intake pipe assembly

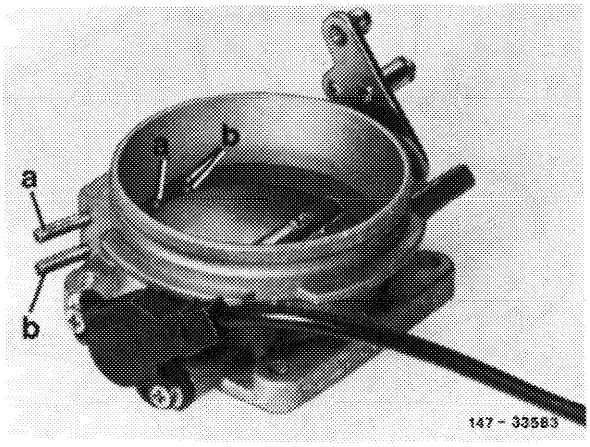
As of a vacuum of 20-35 mbar the diaphragm (4) is pulled up against the spring force. The passage from connection A to B is opened.

Purge valve (53) open
1 Compression spring
4 Diaphragm
A Connection charcoal canister
B Connection intake pipe assembly
C Vacuum connection

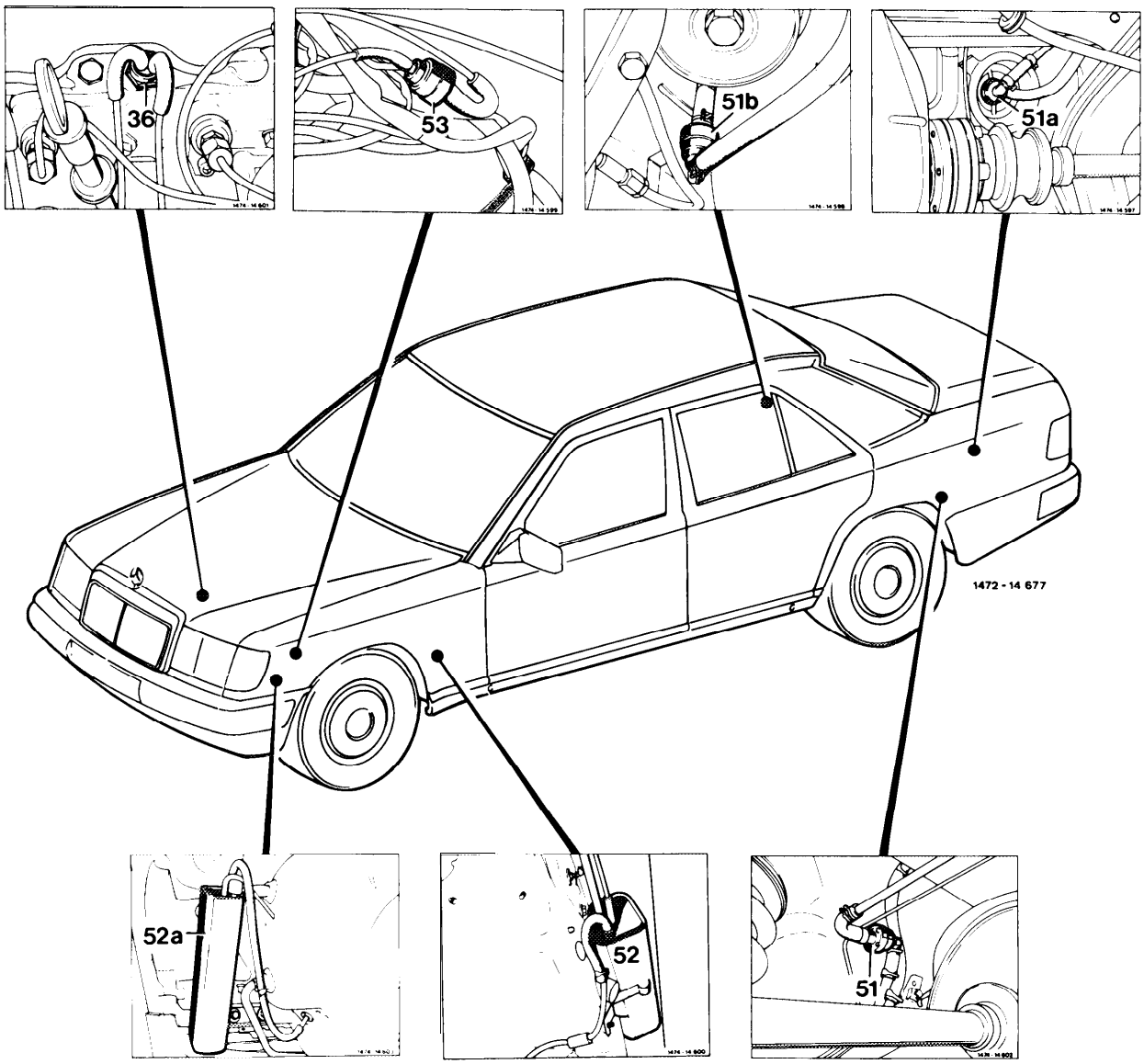


If the throttle valve is further opened, the two extraction bores (b) in the intake pipe assembly, which end in a common passage, become active one after the other, in this way extracting the fuel vapors stored in the charcoal canister. The charcoal in the canister is regenerated.

The intake pipe assembly has vacuum and extraction connection.



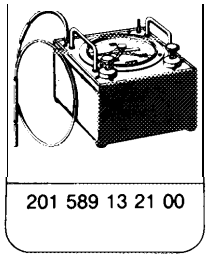
a Vacuum control bore
b Extraction bores



Engine operation temperature	approx. 80 °C engine oil temperature.
Purge valve (53, in the engine compartment front left)	pull off on the inner wing and slowly increase engine rpm to approx. 3000/min. No extraction at idle speed. Extraction commences with increasing speed.
Thermo valve 50 °C, red (36, in sensor strip)	check for continuity.

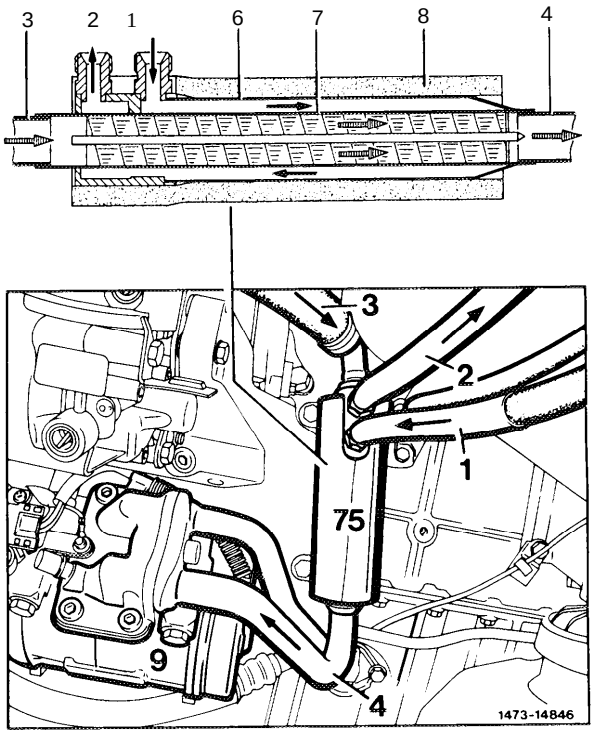
Vacuum lines (white/black and white/purple/black)	ensure proper connection to the intake pipe assembly and thermo valve (36). Check condition.
Breather valve (51, Model 107, 51 a, Models 124 sedan, 201, 126, 51 b 124 T-sedan)	connect tester 201 589 13 21 00 to the fuel tank connection and check function (gage pressure 30-50 mbar, vacuum 1-16 mbar).
Lines	from fuel tank (50) via breather valve (51). Check charcoal canister (52, remove bulkhead if necessary), purge valve (53) to the intake pipe assembly (black).
Charcoal canister (52, Models 124 126, 201; 52a, Model 107)	all connections must have free access to each other.

Special tool



201 589 13 21 00

(AUS), (J), (USA) (all models)



75 Fuel cooler
1, 2 Fuel return line
3, 4 Refrigerant return line
6 Outer pipe
7 Inner pipe
8 Insulating hose
9 Refrigerant compressor

A fuel cooler has been installed in order to reduce the formation of bubbles in the fuel system with high outside temperatures. This cooler is located in the coolant return line between evaporator and refrigerant compressor. The fuel cooler is attached to the engine.

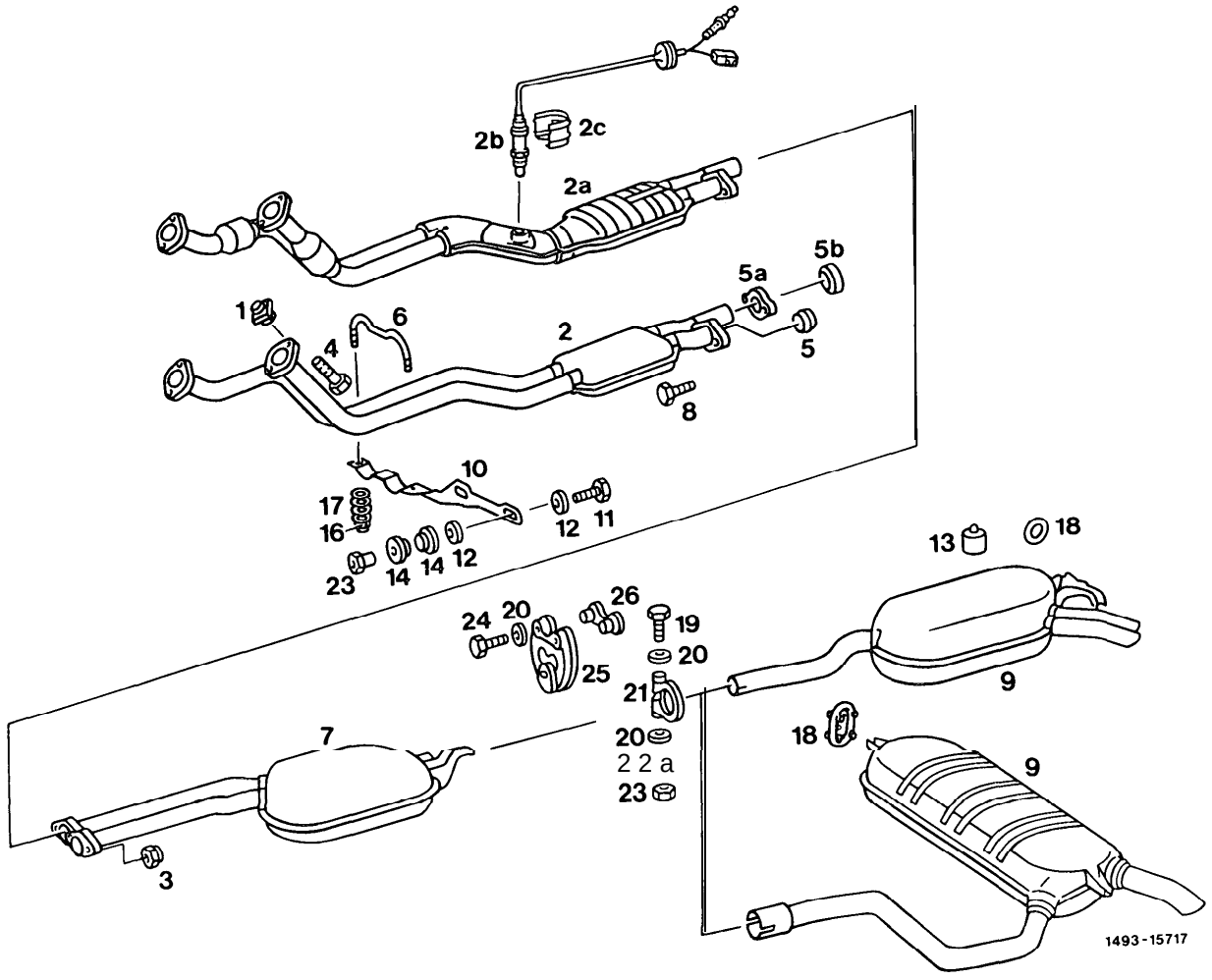
With the engine running, the excess fuel in the fuel distributor returns unpressurized through the fuel cooler into the fuel tank.

As long as the refrigerant compressor is switched on, heat is extracted from the fuel by means of the gaseous refrigerant flowing through the inner pipe of the fuel cooler.

Job No.

Removal, installation of exhaust system . . . . . 49 - 100

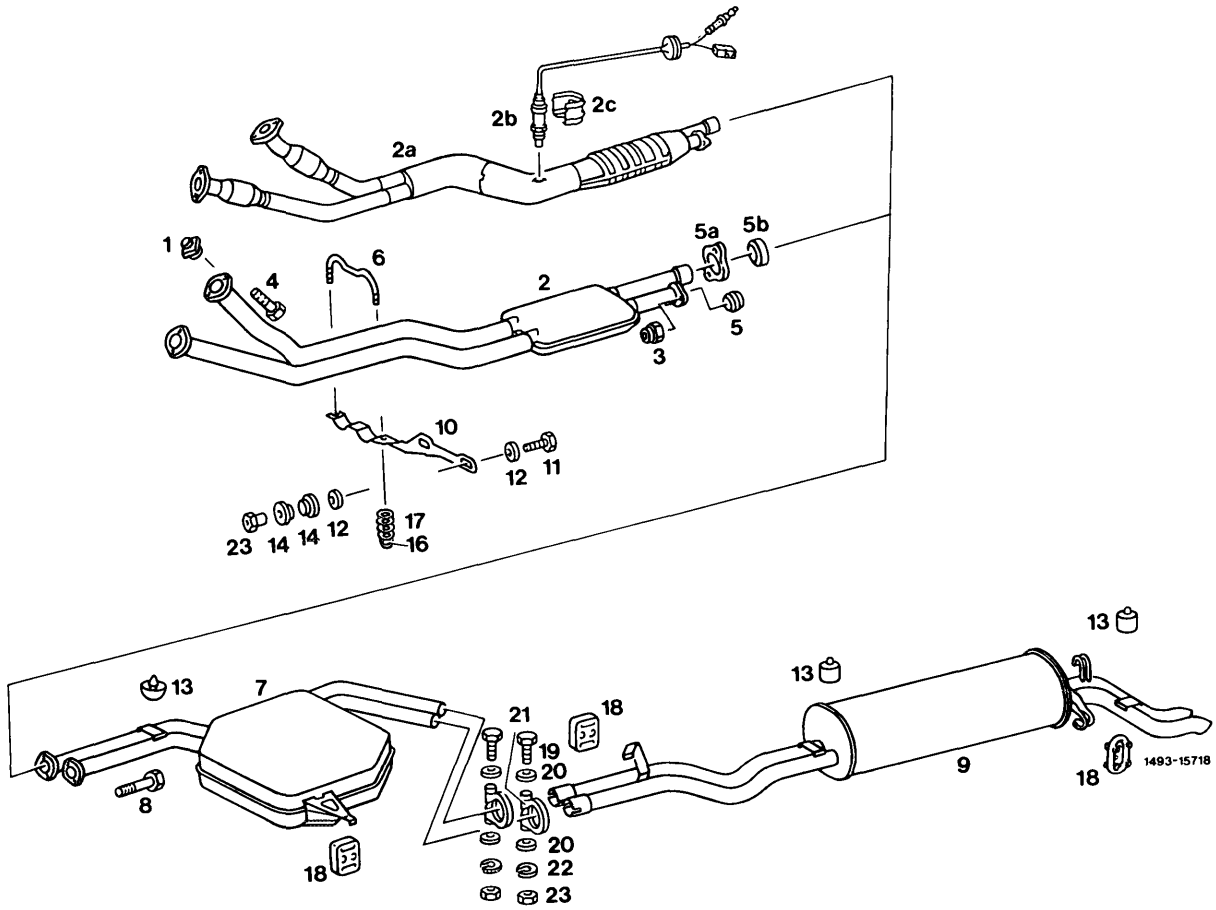
A. Model 124.026/030/050/090 124.226/230/290



Rivet nut in manifold (1)	renew - special tool: rivet screw 103 589 01 39 00, insert rivet nut in manifold and tighten rivet screw with 30 Nm.
Front exhaust pipe with front muffler (2)	uniformly tighten flange connection on manifold.
Front exhaust pipe with primary and underfloor catalytic converter (2a)	uniformly tighten flange connection on the manifold.
Oxygen sensor (2b)	install, ensure proper cable installation. Check lambda control (07.3-l 00).
Cover (2c)	ensure proper installation position.
Self-locking hexagon nut (3)	renew - tightening torque 20 Nm.
Hexagon-head screw (4)	renew - tightening torque 25 Nm.

Sintered sealing ring (5)	check for damage, ensure proper seating
Flange (5a)	check for reusability, renew if required.
Graphite sealing ring (5b)	renew.
Retaining U-bolt (6)	check for reusability.
Center muffler (7)	check for damage.
Hexagon-head screw (8)	renew.
Rear muffler (9)	check for damage.
Lateral support (10) with hexagon-head screw (11), washer (12) and rubber washer (14)	install, tightening torque 20 Nm.
Rubber buffer (13)	check for wear.
Self-locking hexagon nut (16)	renew, tightening torque 7 Nm.
Diaphragm spring (17)	renew.
Rubber ring (18)	check for wear and damage.
Hexagon-head screw (19), washer (20) and pipe clamp (21)	check for reusability, renew if necessary.
Spring washer (22)	renew.
Hexagon nut (23)	tightening torque 25 Nm.
Hexagon-head screw (24), mounting plate (25) and clamping plate (26)	check for damage and wear.

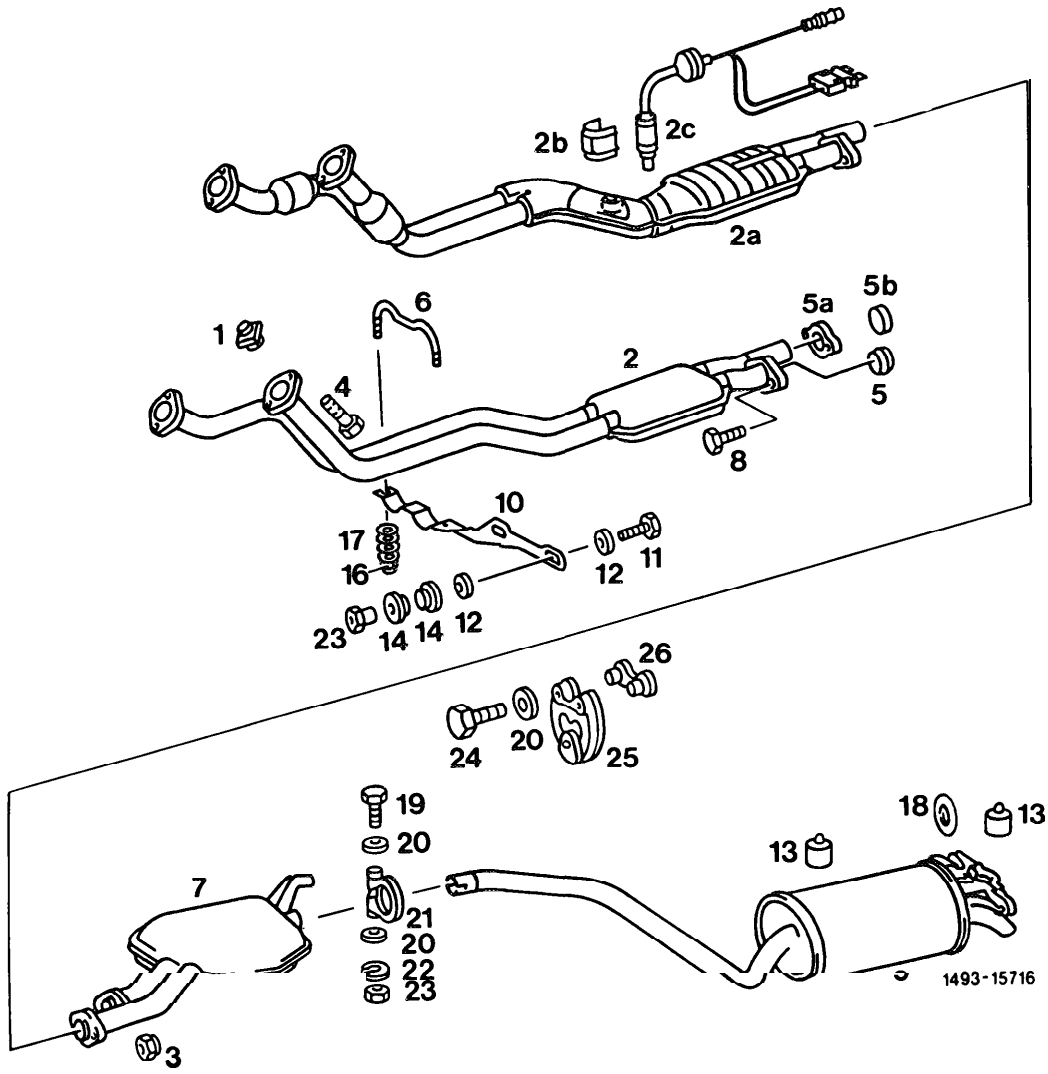
B. Model 126.02



Rivet nut in manifold (1)	renew - special tool: rivet screw 103 589 01 39 00, insert rivet nut in manifold and tighten rivet screw with 30 Nm.
Front exhaust pipe with front muffler (2)	uniformly tighten flange connection on the manifold.
Front exhaust pipe with primary and underfloor catalytic converter (2a)	uniformly tighten flange connection on the manifold.
Oxygen sensor (2b)	install, ensure proper installation of cables. Check lambda control (07.3-100).
Cover (2c)	ensure proper installation position.
Self-locking hexagon nut (3)	renew - tightening torque 20 Nm.
Hexagon-head screw (4)	renew - tightening torque 25 Nm.
Sintered sealing ring (5)	check for damage, ensure proper seating.
Flange (5a)	check for reusability, renew if required.
Graphite sealing ring (5b)	renew.

Retaining U-bolt (6)	check for reusability.
Center muffler (7)	check for damage
Hexagon-head screw (8)	renew.
Rear muffler (9)	check for damage.
Lateral support (10) with hexagon-head screw (11), washer (12) and rubber washer (14)	mount, tightening torque 20 Nm.
Rubber buffer (13)	check for wear.
Self-locking hexagon nut (16)	renew, tightening torque 7 Nm.
Diaphragm spring (17)	renew.
Rubber ring (18)	check for damage and wear.
Hexagon-head screw (19), washer (20) and pipe clamp (21)	check for reusability, renew if required.
Spring washer (22)	renew.
Hexagon nut (23)	tightening torque 25 Nm.

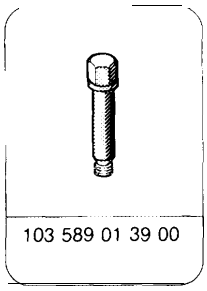
C. Model 201.029



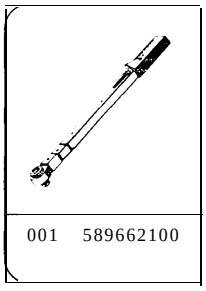
Rivet nut in manifold (1)	renew - special tool: rivet screw 103 589 01 39 00, insert rivet nut in manifold and tighten rivet screw with 30 Nm.
Front exhaust pipe with front muffler (2)	uniformly tighten flange connection on the manifold.
Front exhaust pipe with primary and underfloor catalytic converter (2a)	uniformly tighten flange connection on the manifold.
Oxygen sensor (2c)	mount, ensure proper installation of cables. Check lambda control (07.3-I 00).
Cover (2b)	ensure proper installation position.

Self-locking hexagon nut (3)	renew - tightening torque 20 Nm.
Hexagon-head screw (4)	renew - tightening torque 25 Nm.
Sintered sealing ring (5)	check for damage, ensure proper seating.
Flange (5a)	check for reusability, renew if required.
Graphite sealing ring (5b)	renew.
Retaining U-bolt (6)	check for reusability.
Center muffler (7)	check for damage.
Hexagon-head screw (8)	renew.
Rear muffler (9)	check for damage.
Lateral support (10) with hexagon-head screw (11), washer (12) and rubber washer (14)	mount, tightening torque 20 Nm.
Rubber buffer (13)	check for wear.
Self-locking hexagon nut (16)	renew, tightening torque 7 Nm.
Diaphragm spring (17)	renew.
Rubber ring (18)	check for damage and wear.
Hexagon-head screw (19), washer (20) and pipe clamp (21)	check for reusability, renew if required.
Spring washer (22)	renew.
Hexagon nut (23)	tightening torque 25 Nm.
Hexagon screw (24), mounting plate (25) and clamping plate (26)	check for damage and wear.

Special tools



103 589 01 39 00



001 589662100

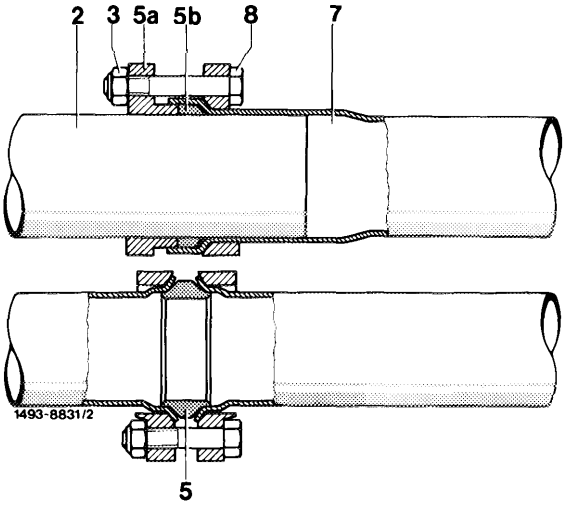
The removal and installation of the exhaust system is not fully explained but some particularly important points are described which must be observed during removal and installation or during partial renewal for instance of the rear muffler with plug connection.

Removal

1 Check suspension components for reusability and renew if required.

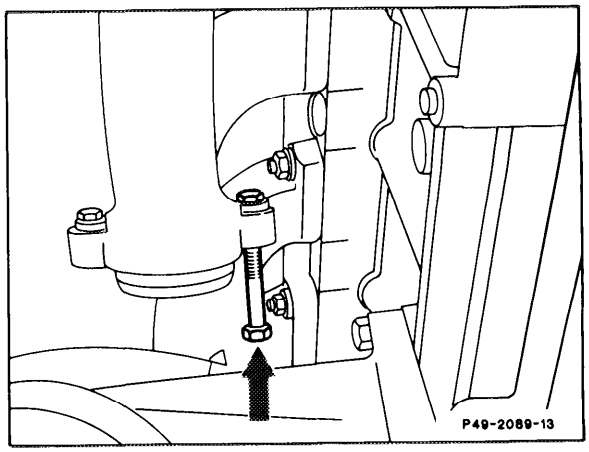
2 Prior to assembling the exhaust system ensure that the flanges to the exhaust manifold are not warped. Straighten flanges if necessary.

3 If required, clean cone-shaped pipe connections (2 and 7) and sintered sealing ring (5) of combustion residue or corrosion by means of emery cloth.



2 Front exhaust pipe
3 Self-locking hexagon nut
5 Sintered sealing ring
5a Flange
5b Graphite sealing ring
7 Center exhaust pipe
8 Hexagon-head screw

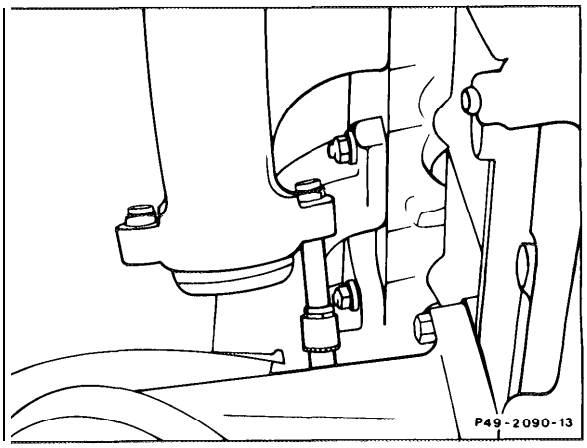
4 Use a suitable hexagon-head screw to drive rivet nuts out of the bores in the exhaust manifold. The hexagon-head screw should only be screwed in by hand.



Installation

5 Insert new rivet nut in the hole of the exhaust manifold. Screw in rivet screw and tighten with a tightening torque of 30 Nm.

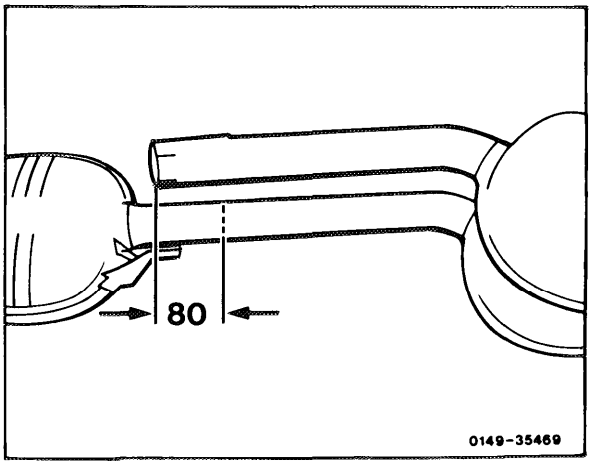
6 Remove rivet screw.



Renewal of rear muffler

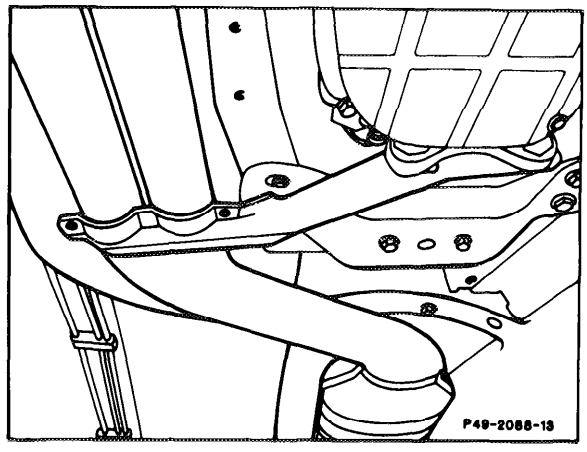
7 Place new rear muffler with plug connection accurately over the removed exhaust system and mark off pipe length of the new rear muffler on the removed system.

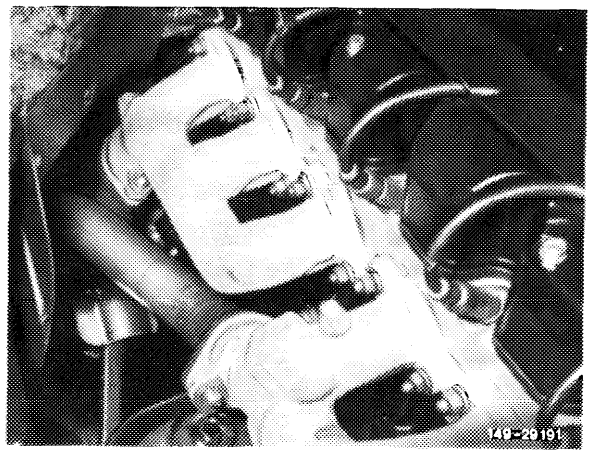
Cut the pipe (interrupted line) 80 mm from the mark (-10 mm tolerance) in the direction of the rear muffler so that a plug-in depth of 70-80 mm is ensured.



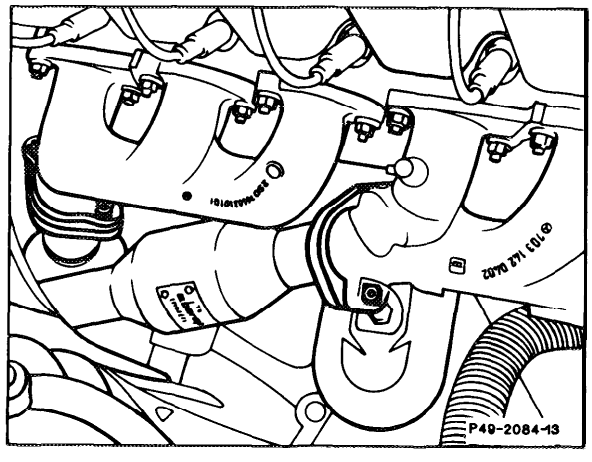
8 Always replace self-locking hexagon nuts and graphite sealing ring on the exhaust flange connection.

9 Uniformly tighten the flange connection on the manifold while the front exhaust system rests on the lateral support on the transmission (except Model 107.041). Tightening torque of the self-locking hexagon nuts is 30 Nm.



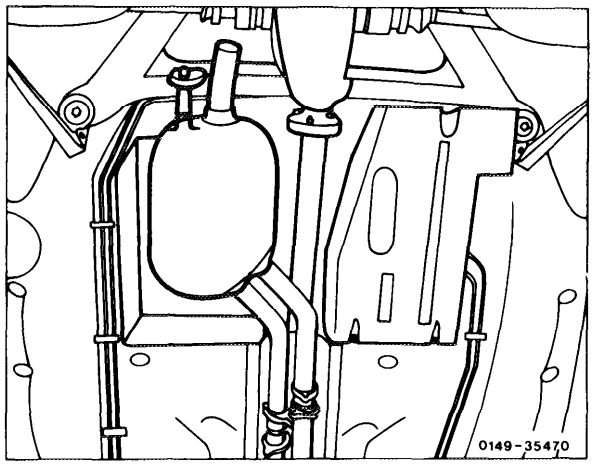


Arrangement of front exhaust pipe RÜF

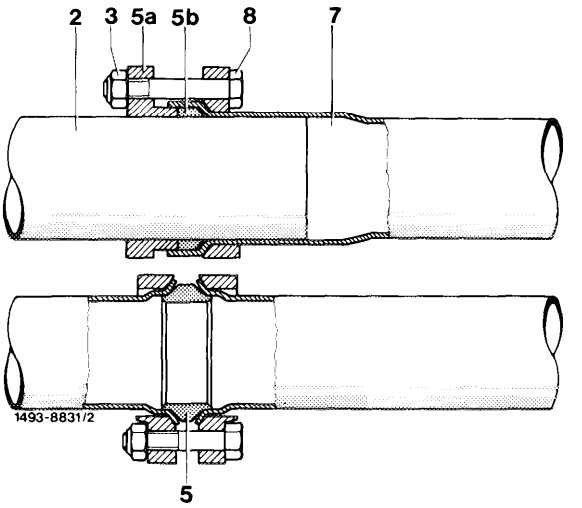


Arrangement of front exhaust pipe CAT

10 Mount center exhaust system with center muffler while suspending the exhaust system in the rear suspension rubber on the rear axle carrier at the same time (arrow).

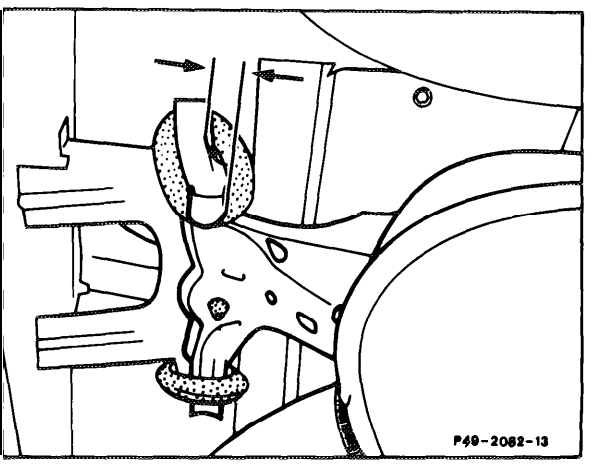


11 Mount sintered graphite sealing ring (5, 5b) on the flange connection and ensure proper seating. Tightening torque of the self-locking hexagon nuts is 20 Nm.



2 Front exhaust pipe
3 Self-locking hexagon nut
5 Sintered sealing ring
5a Flange
5b Graphite sealing ring
7 Center exhaust pipe
8 Hexagon-head screw

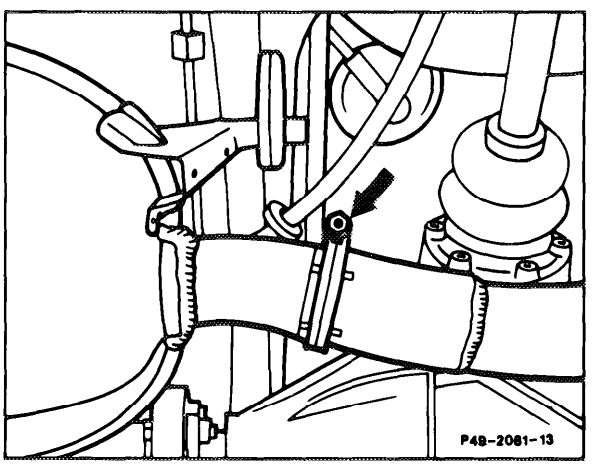
12 Install rear muffler so that the retaining brackets of the rear muffler are located approximately 10 mm from the brackets on the frame floor, so that the proper installation position is ensured if the exhaust system is elongated (arrows).



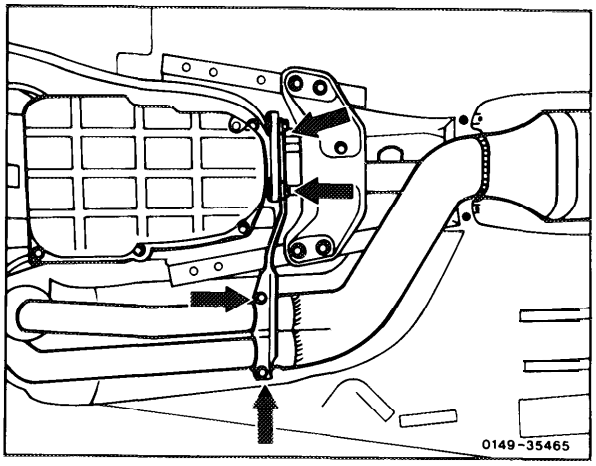
Note
The above refers only to mufflers in repair version with plug connection between center and rear mufflers.

13 Connect rubber rings with suitable hook to the rear muffler.

14 Centralize exhaust pipe clamp between center and rear muffler and tighten hexagon nut with 25 Nm (arrow).

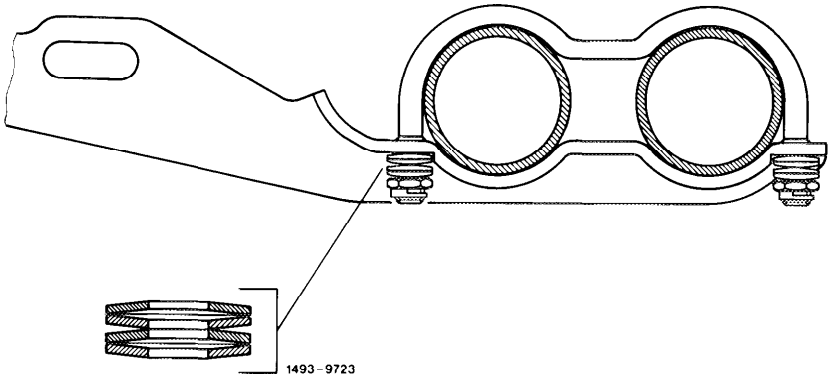


15 Mount exhaust lateral support without tension. Tightening torque of the self-locking hexagon nuts on the U-bolt is 7 Nm, the hexagon-head screws of the lateral support on the transmission 20 Nm (arrows).



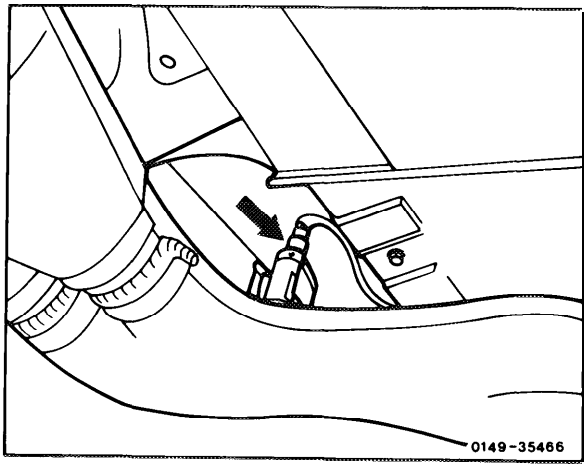
Note

Install 4 diaphragm springs on each side on the retaining U-bolt so that the concave sides of the springs face one another (as shown in the figure).



16 On vehicles with catalytic converter, mount oxygen sensor with shielding plate (arrow). For this purpose, coat thread with paste 000 989 88 51.

17 Run engine and check exhaust system for leaks.



Service Manual
Engine 601

Mercedes-Benz
service

Mercedes-Benz of North America, Inc.
One Mercedes Drive
Montvale, NJ 07645

Caution

Our service manuals contain descriptions of important assembly, adjustment and inspection jobs. Special tools required in performing certain service jobs are identified in the manual and recommended for use. Any part numbers given are only used for identification and easier differentiation between individual components, and are not intended for ordering purposes.

All procedures, illustrations and specifications contained in these manuals were based on the latest information available at the time of publication. If your Mercedes-Benz model differs from the specifications contained in the manual you select, consult your authorized Mercedes-Benz dealer.

Remember, the proper performance of services is essential for both the safety of the mechanic and the efficient operation of the vehicle. The procedures in these manuals are described in such a manner that the service may be performed safely and accurately.

However, it is always assumed that the reader is familiar with basic automotive repair procedures and Mercedes-Benz vehicles.

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Introduction

This Service Manual is the product of existing technical publications. Special care has been taken to provide accurate information on removal, disassembly, assembly, inspection, installation, and adjusting procedures, backed with the technical data necessary to do the job.

The material in this manual is divided according to the Mercedes-Benz Component Group System as outlined on the GROUP INDEX page. This page will quickly direct the reader to the Major Component Group. Each Major Component Group begins with a JOB INDEX listing all jobs within that group.

Mercedes-Benz of North America, Inc. recommends that repairs to, and maintenance of, Mercedes-Benz automobiles be performed only by Mercedes-Benz trained personnel at authorized Mercedes-Benz dealerships.

The information contained in this special publication is ordinarily issued by Mercedes-Benz of North America, Inc., in conjunctionwith supplementary service literature and special tools supplied only to its authorized dealers. The repair and maintenance procedures outlined herein are procedures to be used by trained Mercedes-Benz **service and dealership personnel.** Supplementary service literature will not be provided with this publication, but may be contained in reprints of this Service Manual.

Please note that this manual has been compiled from various sources, some of which cover models other than the subject of this book. Always refer to the engine and vehicle identification table for model and component information.

The information contained in this manual was accurate to the best of our knowledge at the time the manual was approved for publication. However, the right is reserved to make production, design and specification changes at any time, without notice and without obligation to give notice. Any such changes will not be contained in this manual.

Mercedes-Benz of North America, Inc. assumes no liability for any damage to person or property caused by the utilization of this publication to effect maintenance or repair work on Mercedes-Benz automobiles.

MERCEDES-BENZ OF NORTH AMERICA, INC.
Technical Publications

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Crankshaft assembly	03
Engine timing, valves	05
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00 General,technical data

	Job No.
Instructions for use of service manual	00-005
Engine and vehicle identification	010
Vehicle identification number locations	015
Technical data	020

Complete Service Manual coverage for late model year Mercedes-Benz vehicles requires four individual manuals:

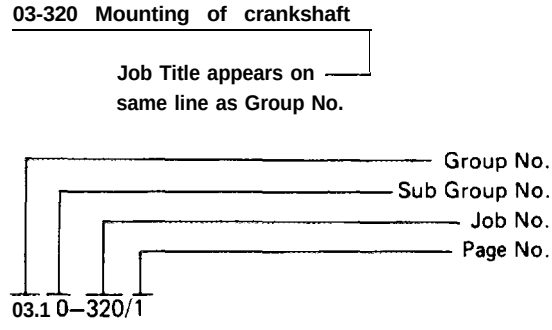
Service Manual, Engine
Service Manual, Transmission
Service Manual, Chassis and body
Service Manual, Heating and air conditioning

Throughout these manuals, the vehicles are identified by their chassis and engine numbers. These numbers are made up of the first six digits of the respective serial number. For the actual location of chassis and engine numbers, see page 00–015/1. In case where the repair instructions apply to all versions, only the first three digits of the respective number are referenced

For example, engine 601 applies to all 601 engines. However, engine 601.921 would only apply to the engine used in model 190 D-2.2.

Location of specific repair instructions

First locate the Group No. in the Group Index. Individual groups are separated by an easily visible dividing page, which is followed by the job index page. Then check the job index for the exact job required. The first page of a typical job description looks like this:



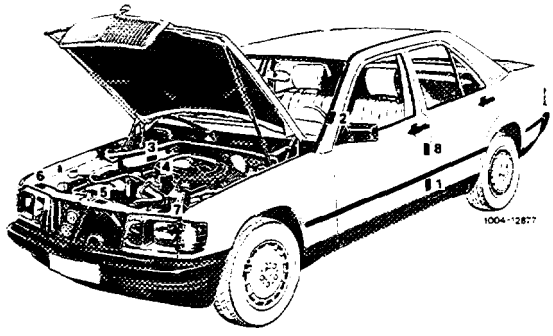
Technical data, tightening torques and tools are listed at the beginning of each job.

All dimensions are in metric units, unless otherwise indicated. Any part numbers given are only used for identification and easier differentation between individual components, and are not intended for ordering purposes.

00 Engine and vehicle identification

This manual applies to the following passenger cars, starting model year 1984:

Model	USA Model Year From	To	Chassis Type	Engine Type
190 D-2.2	1984		201.122	601.921



1 Certification Tag [left door pillar)
2 Identification Tag (left window post)
3 Chassis No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag
8 Emission Control Tag
Catalyst Information

Engine		
Model		201.122
Engine		601.921
Operation		4-cycle diesel, ME prechamber design
Number of cylinders		4
Cylinder arrangement		In-line, 15" inclination
Bore/stroke	mm	87192.4
Total effective piston displacement	cc	2197
Compression ratio		22
Firing order		1 - 3 - 4 - 2
Maximum speed, no load	rpm	4900-5100
Engine output	kW/rpm SAE net bhp/rpm	54/4200 72/4200
Maximum torque	Nm/rpm SAE net. lbf-ft/rpm	130/2800 96/2800
Crankshaft bearings		5
Valve arrangement		Overhead
Camshaft arrangement		1 overhead camshaft
Oil cooler		–
Cooling		Water circulating pump, thermostat with bypass line, finned tube radiator, fan with electromagnetic clutch
Lubrication		Forced-feed lubrication via gear-type pump
Oil filter		Combined main and bypass filter
Air cleaner		Dry air cleaner with paper cartridge

Electrical system

Battery	Voltage Capacity	12 v 72 Ah
Starter	Bosch	EV 12 V 2.2 kW
Alternator	**Bosch**	**KI-14 V 55A 20[1])**

[1]) As of model year 1985, a Bosch alternator 980 W 114 V 70 A) is installed

Filling capacities

Model				**201.122**
Engine				**601.921**
Fuel tank/reserve			approx. l	55/7.5
Engine	**Initial filling**	**Engine oil**	approx. l	**7.3**
	During oil and filter change	**Engine oil**	approx. l	**6.5**
	Oil **pan up to marks on oil dipstick**	**Engine oil**	max./min. l	5.0/3.0
	Air-oil cooler	**Engine oil**	approx. l	–
Cooling system with heater		**Coolant**	approx. l	**8.5**
Coolant pump				**maintenance-free**
Brake system		**Brake fluid**	approx. l	**0.35**
Manual transmission		**ATF**	approx. l	**1.5**
Automatic transmission		ATF **Initial filling/ Oil change**	approx. l	6.6/5.9
Rear axle hypoid gear oil		**SAE 90**	approx. l	**0.7**
Power steering		**ATF or manual transmission oil**	approx. l	**0.6**

01 Crankcase and cylinder head

	Job No.
Engine	
Checking compression pressure.	01–010
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Evaluating cylinder bores	020
Removal and installation of engine (oil capacity)	030
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8. (USA) California starting 1984	
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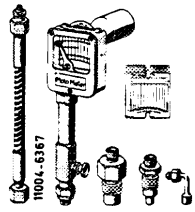
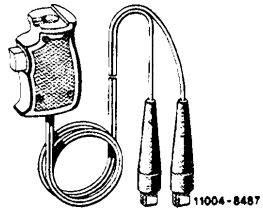
Removal and installation of cylinder head	415
Removal and installation of prechambers	417
Facing cylinder head parting surface	418
Pressure-testing cylinder head	420

01-010 Checking compression pressure

Test values with engine at operating temperature in bar gauge pressure	
Compression pressure, normal	24-30
Minimum compression pressure	approx. 15
Permissible difference between individual cylinders	max. 3

Tightening torques	Nm
Coupling nuts of injection lines (reference value)	1 O-20
Injection nozzles in prechambers	70 + 10

Special tools

Compression pressure recorder with accessories	 11004-6367	001 5894721 00
Contact handle for rotating engine (component of compression pressure recorder 001 589 46 21 00)	 11004-8487	001 5894621 08
Box end wrench element, open, 14 mm, 1/4" drive, for coupling nut of injection line	11004-10520	000 589 770300

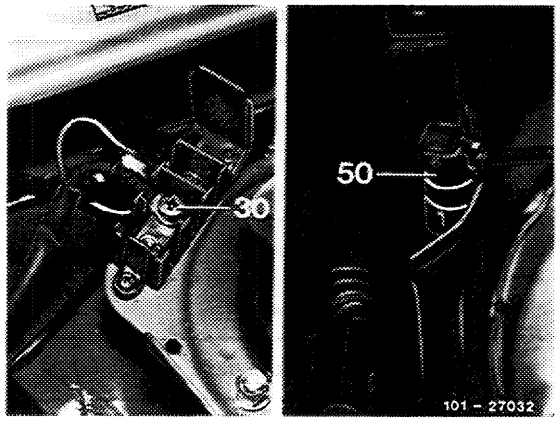
Note

Check compression pressure at 80 °C coolant temperature. Compression pressure can be checked only via prechambers. If minimum compression pressure is less than specified, check cylinders for leaks (01–015).

Checking

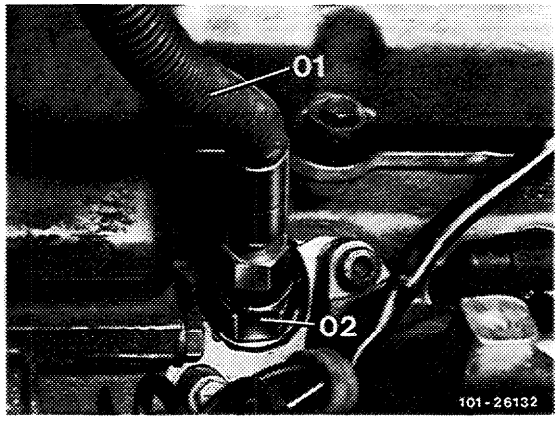
1 Remove injection nozzles (07-230).

2 Connect contact handle for rotating engine to cable connector, terminal 30 and 50, on fire wall.



3 Rotate engine several times with transmission in idle position, so that residue and soot are thrown out.

Attention!
While rotating engine, push stop lever downwards by means of an extension, so that the injection pump is not injecting.



Compression pressure recorder, connected to prechamber

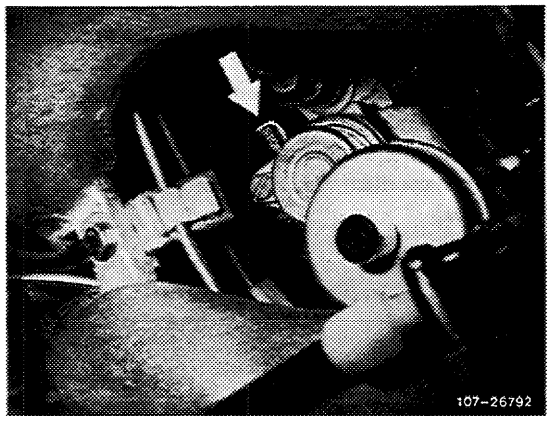
01 Compression pressure recorder
02 Connection

4 Screw adapter (component of compression pressure recorder) into prechamber. Connect compression pressure recorder.

5 Rotate engine 8 times for checking engine.

Attention!
While rotating engine, push stop lever downwards by means of an extension, so that the injection pump is not injecting.

6 Install new nozzle reeds prior to installing injection nozzle.



01-015 Checking cylinders for leaks

Data

Total pressure loss	max. 25 %
On valves and cylinder head gasket	max. 10 %
On pistons and piston rings	max. 20 %

Tightening torques	Nm
Coupling nuts of injection lines (reference value)	**1 O-20**
Injection nozzles in prechambers	70+10

Conventional tools

Cylinder leak tester	e.g. Bosch, EFAW 210 A SUN, CLT 228
Couplings or connections	e.g. Bosch order no. 1 687 010 016

Checking

1 Run engine up to operating temperature.

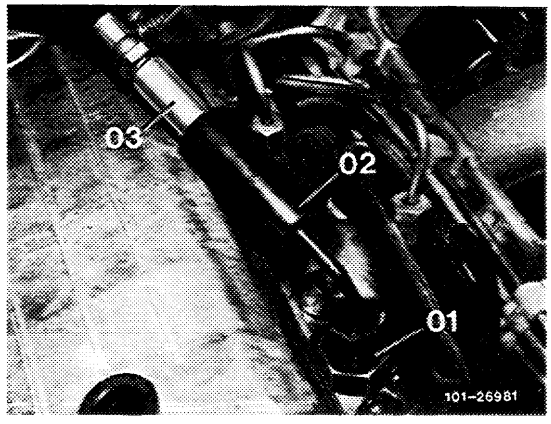
2 Remove injection nozzles (07-230).

3 Remove air cleaner cover.

4 Remove oil filler cap.

5 Remove radiator closing cap and fill up with coolant.

6 Screw adapter (01) and angle piece (02) into prechamber of 1 st cylinder.



01 Connection
02 Angle piece
03 Connecting hose

7 Set piston of 1st cylinder to ignition TDC.

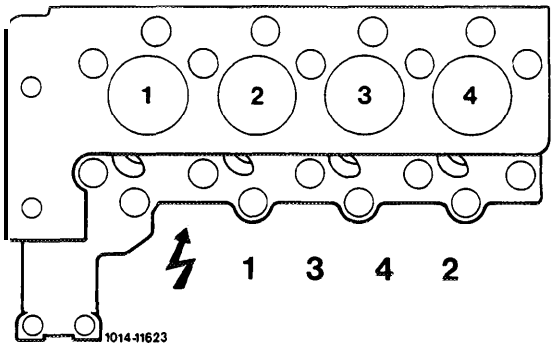
8 Connect cylinder leak tester to a compressed air system, calibrate tester.

9 Screw connecting hose (03) of tester to screw-in member. Make sure that crankshaft is not rotating **while screwing in hose.**

10 Read pressure loss on tester.

11 Check by listening whether the pressure escapes via intake manifold, exhaust, oil filler cap, pre-chamber of adjacent cylinder or radiator cap.

12 Check all cylinders in ignition sequence.



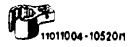
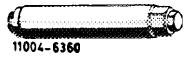
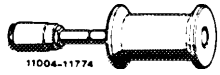
Note: There is a possibility that the piston ring gaps of the individual pistons are directly one above the other, so that the test result will be misrepresented.

When in doubt, continue running vehicle and check cylinders for leaks once again later on.

01-020 Evaluating cylinder bores

Tightening torques	Nm
Coupling nuts for injection lines (reference value)	1 O-20
Hex. head bolt for cylinder head cover	10
Threaded ring for prechamber in cylinder head	100 ± 10
Injection nozzle in prechamber	70 + 10

Special tools

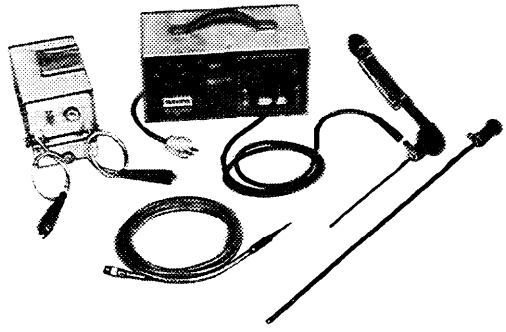
Box end wrench element, open, 14 mm, 1/4" drive, for coupling nut of injection line	 11011004-105201	000 589 77 03 00
Wrench element for threaded ring of prechamber	 11004-6360	615589000700
Impact puller for prechamber	 11004-11774	601 589 06 33 00

Conventional tool

Cylinder illuminating lamp	e.g. Karl Storz GmbH, D-7200 Tuttlingen Motoskop TW (cold light) with lens probes 103 26 CW (570 mm) and 103 26 CT (210 mm)

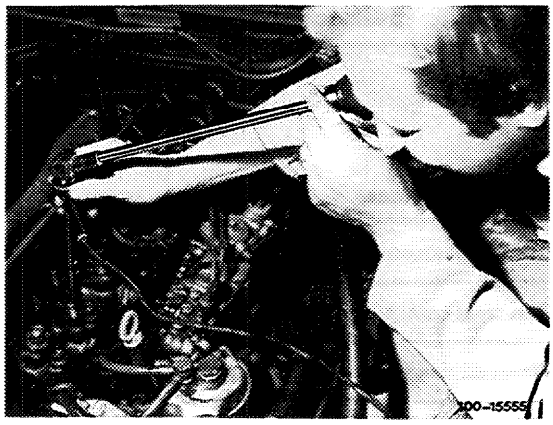
Note

The visual checkup can be made by means of a cylinder illuminating lamp with cylinder head mounted. Remove prechambers for this purpose (01-417).



103-15713

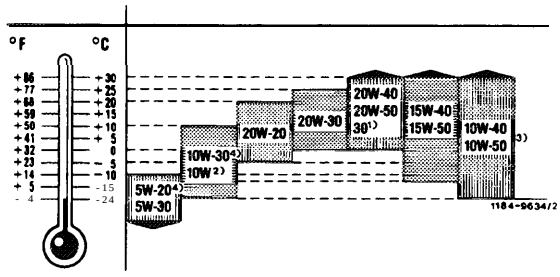
When evaluating scored or streaky cylinder running surfaces, it is often hard for workshop to decide whether the damage is already significant and requires removal or repair of engine, or whether the marks are insignificant. The following information will help to make an expert and correct decision.



The first difference on cylinder running surfaces is between "optical streaks" and "seizure streaks". In most cases, "optical streaks" are about 3 mm wide and are caused by ring gap, on which honing traces are still visible; with "seizure streaks", however, the honing traces are no longer seen.

With "streaks in direction of land" (in direction of piston pin) shaft streaks or seizures are not possible, since there is no contact between piston skirt and cylinder liner.

Specified viscosity classes according to SAE during lasting ambient temperatures



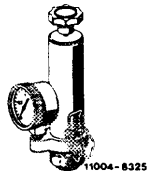
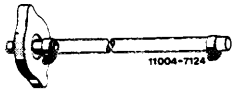
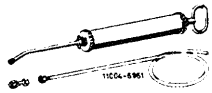
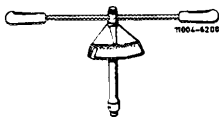
1) SAE 40 may be used during lasting outside temperatures above + 30 °C (+ 86 °F).
2) Do not use.
3) All-season oil.
4) For oils identified on sheets 226.1 and 227.1 of Specifications for service products with footnote1), the following applies:
SAE 5 W-20 below + 10 °C
SAE 10 W-30 in temperate zones all seasons

Oil capacity in liters (for approved engine oils refer to Specifications for service products)

Engine (total filling capacity during complete refill)	**7.3**

Tightening torques	**N m**
Oil drain plug to oil pan	**25**
Nuts for oil filter cover	**20-25**
Screws for engine carrier on engine mount, front	**35 + 10**

Special tools

Tester for cooling system and radiator cap	 11004-8325	**001 589 48 21 00**
Radiator cap with hose for leak test	 11004-7124	**605 589 00 25 00**
Syringe for removing oil	 11004-6961	**112589007200**
Torque wrench, double-arm, 3/8" square, 8-32 Nm	 11004-4208	**001 589 51 21 00**
Torque wrench, single-arm, emitting signal with plug-in ratchet, 1/2" square, 25-130 Nm	11004-10056	**001 589 66 21 00**

Conventional tools

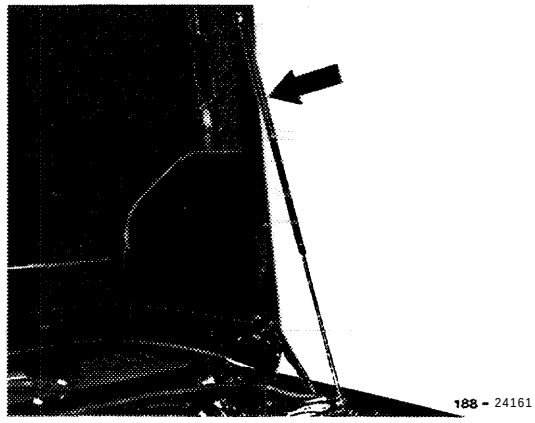
Socket wrench 7 mm on flexible shaft for hose clamps with worm drive	**e.g. Hazet, D-5630 Remscheid order no. 426-7**
Engine hoist no. 3180	**e.g. Backer, D-5630 Remscheid, Herderstraße**

Note

Remove and install engine with transmission.

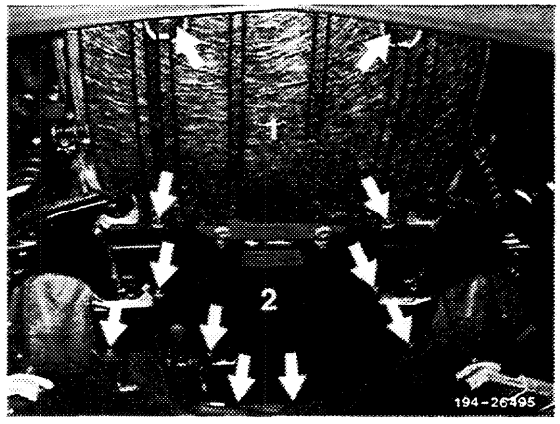
Removal

1 **Put engine hood in vertical position.**
For this purpose, the engine hood can be set vertically (90°) by simply pushing hood up, In vertical position, the engine hood is secured by means of a detent lever.

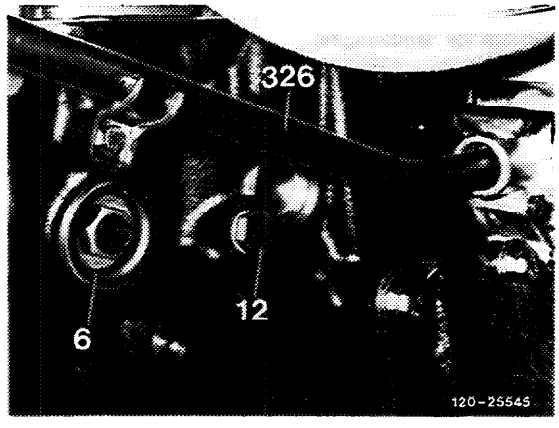


Engine hood in vertical position

2 Completely remove noise capsule below. For this purpose, unscrew sheet-metal screws (arrows).

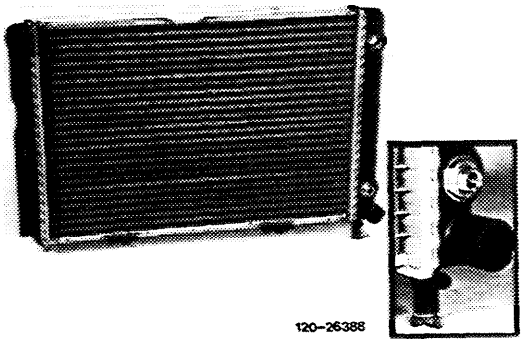


3 Completely drain coolant (20–010).



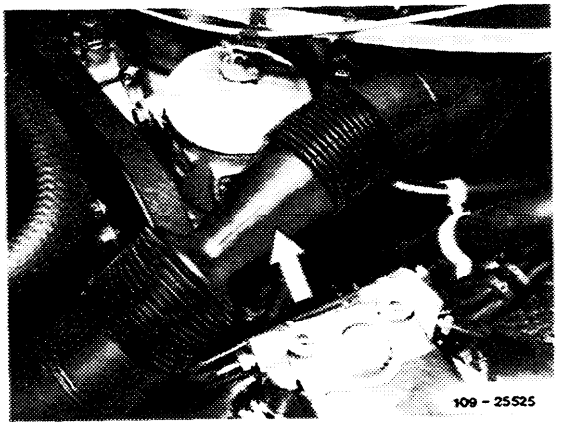
12 Drain plug of cylinder crankcase

To facilitate collection of coolant, plug an extension hose to drain connection of radiator.

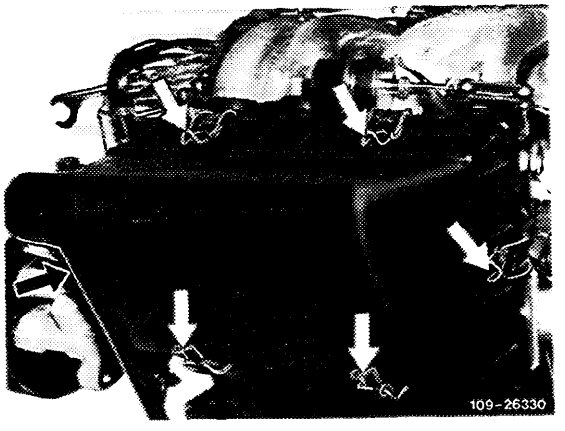


Drain plug on radiator

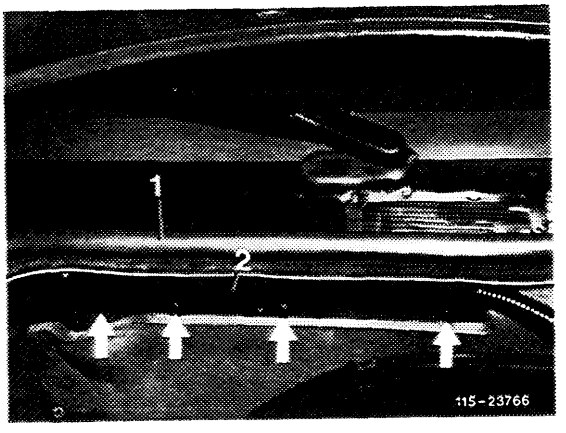
4 Remove air hose (arrow).



5 Remove air cleaner cover (arrows).

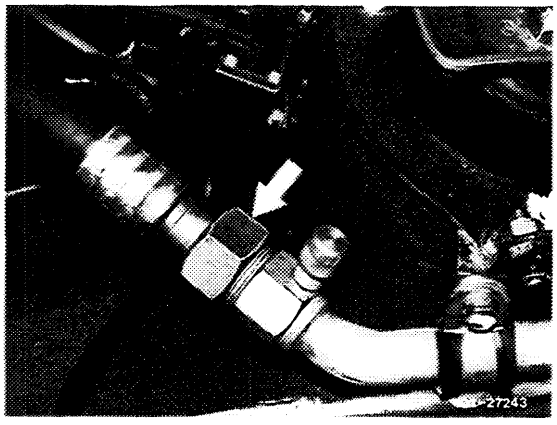


6 Disconnect battery positive line. For this purpose, pull off rubber strip (1) above bulkhead. Remove clips (arrows). Swivel holder (2) in upward direction and place battery positive cable over engine.

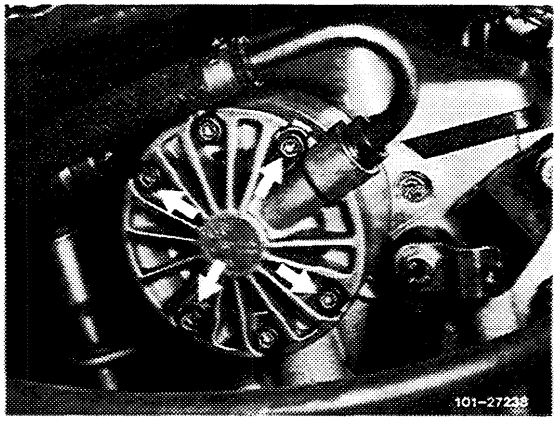


7 Remove radiator (20-420).

8 On vehicles with air-conditioning system, drain system (83–516), disconnect refrigerant hoses (arrow) and close free ends of refrigerant hoses with plastic plugs.

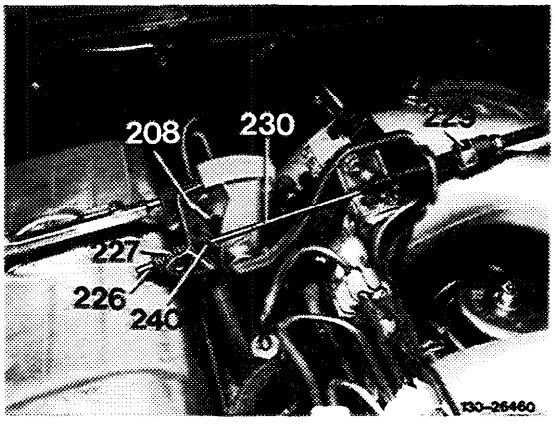


9 On vehicles with level control, unscrew hex. socket screws (arrows) and put pressure oil pump with connected lines aside. Remove driver.



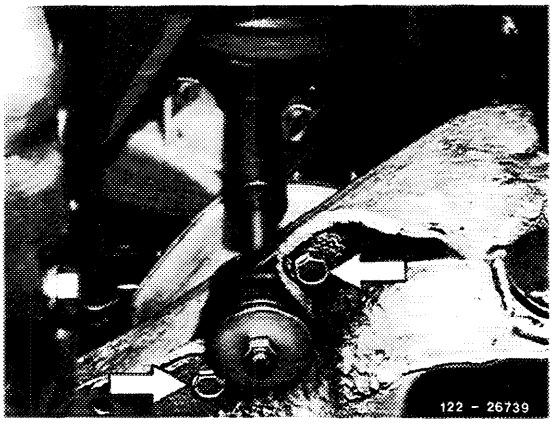
10 Draw oil from reservoir of power steering pump with syringe for oil removal and disconnect hoses.

11 Disconnect bowden wire (230) while pushing out slotted guide piece (240) on angle lever and remove bowden wire.

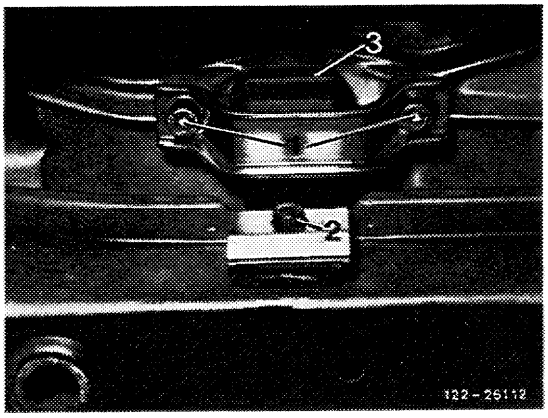


12 Disconnect all coolant, vacuum, oil, fuel and electric lines leading toward engine.

13 Unscrew engine shock absorber on cross member, while unscrewing fastening screws (arrows) for this purpose.



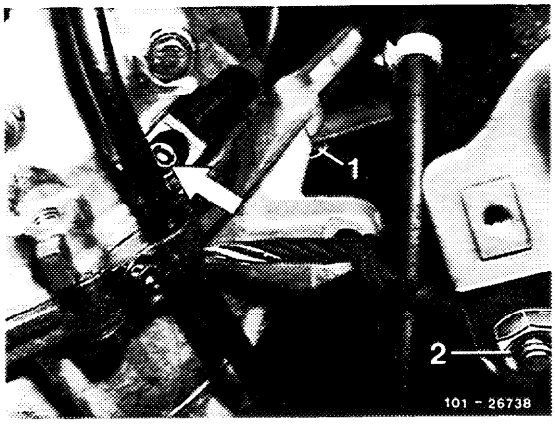
14 **Remove engine stop. For this purpose, unscrew adjusting screw (2) as well as hex. head screws (1) and remove engine stop with holder.**



15 Remove the lower of the two starter fastening screws (1) and put holder with tachometer shaft aside. Disconnect ground connecting line (2).

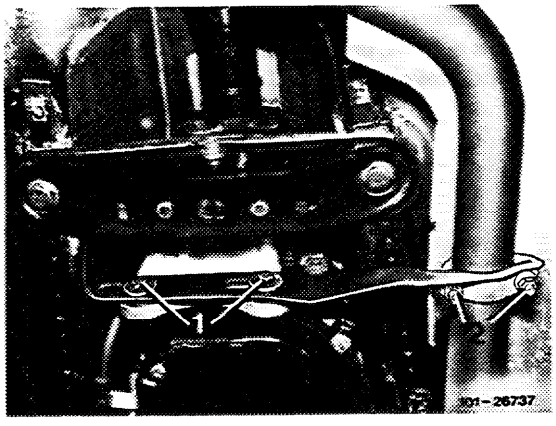
On vehicles with rpm sensor, unscrew line on oil pan (arrow).

16 Unscrew exhaust system on flange of exhaust manifold.



17 Unscrew fastening screws for exhaust lateral support (1), loosen nuts (2) and swivel holder in downward direction.

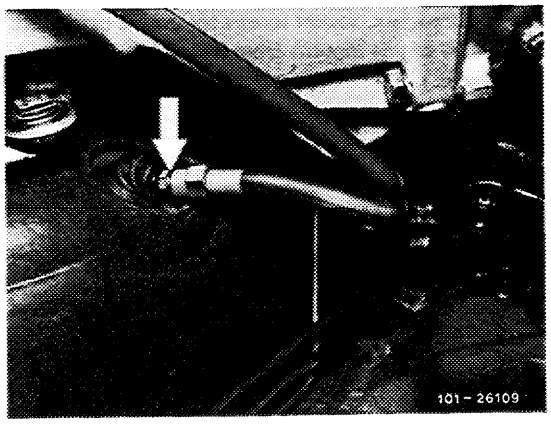
18 Unscrew propeller shaft on transmission, loosen nut of slide piece as well as fastening screws for propeller shaft intermediate bearing and slide propeller shaft back as far as possible. Also unscrew heat guide plate on vehicle floor.



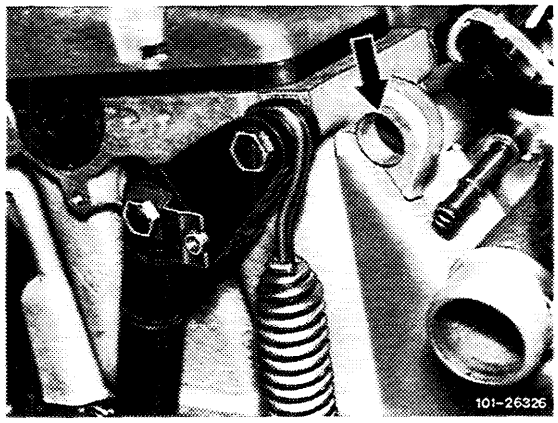
19 Unscrew drive shaft for tachometer on rear transmission cover.

20 Separate oil line from clutch master cylinder to slave cylinder (arrow).

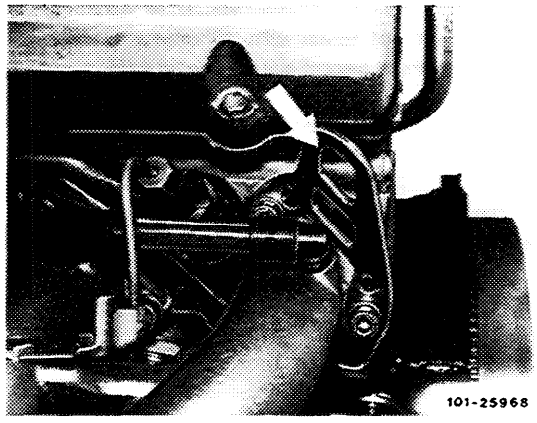
21 Remove shift rods from transmission shift levers while removing clip locks for this purpose.



22 Engage ropes of engine hoist on suspension eyes of engine (arrows). Tighten ropes.

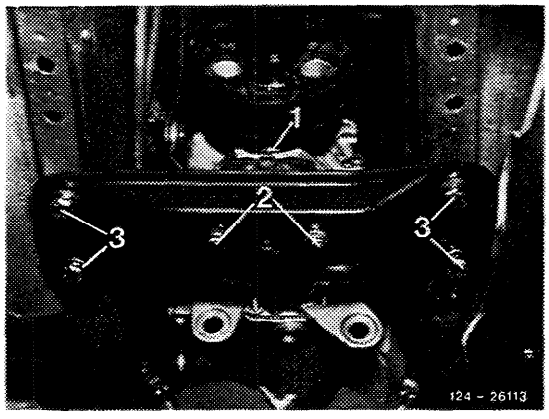


Suspension eye front



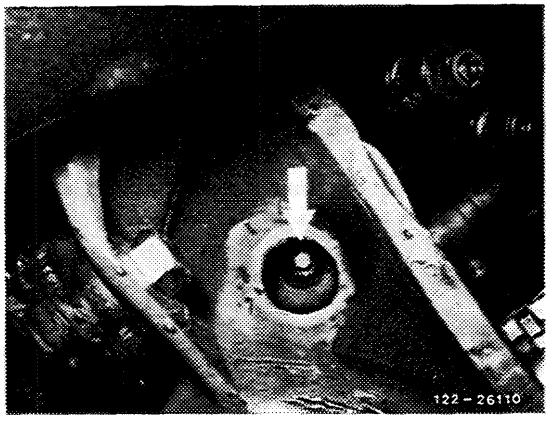
Suspension eye rear

23 Remove rear engine carrier with engine mount. For this purpose, unscrew hex. nut (1) and screw out hex. head screws (3).

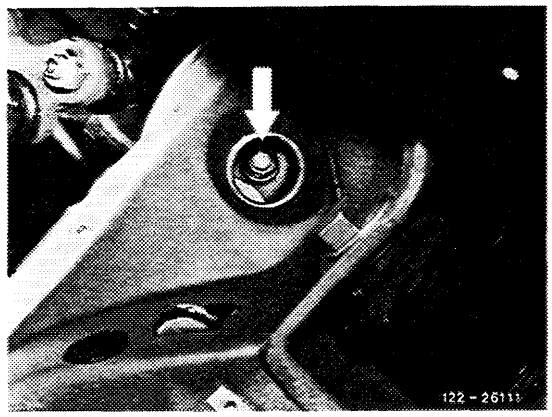


Rear engine carrier
shown on S-speed transmission

24 Unscrew hex. socket screws for engine carrier on both front engine mounts from below (arrow).



Hex. socket screw for engine carrier left



Hex. socket screw for engine mount right

25 Lift out engine with transmission in diagonal position of approx. 45".

Installation

26 Check engine mounts, engine shock absorbers, oil and fuel hoses and renew, if required.

27 Prior to flanging on manual transmission, check condition of radial ball bearing in crankshaft and of throw-out bearing of clutch; renew, if required.

28 To install engine, reverse removal procedure. Pay attention to specified torques of fastening screws and nuts.

Check installation position of shielding plates on engine mounts.

29 Screw on propeller shaft and adjust (41–020).

30 Adjust engine stop (22–220).

31 Check oil level in engine and transmission and correct, if required.

32 On vehicles with air conditioning, fill system (83–514).

33 Check all drain plugs for specified tightening torque.

34 Clean air cleaner element and renew, if required.

35 Check for leaks with engine running.

A. Standard version and (USA) Federal starting 1984

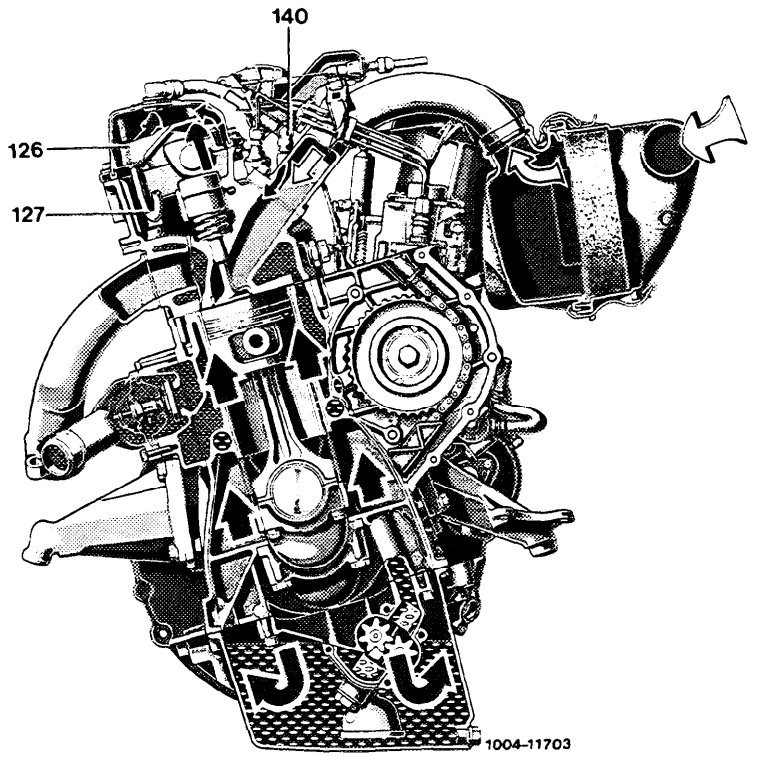
Engine601.911

The closed engine breather requires no service.

Depending on intake manifold vacuum, the engine blow-by gases are flowing through oil separator (126) in cylinder head cover and a hose line to distributing pipe (140) on intake manifold.

From here they are uniformly distributed to all the cylinders and fed to the combustion chambers together with the intake air.

The oil separated in oil separator (126) flows back to cylinder head through return pipe (127).



126 Oil separator
127 Return pipe
140 Distributing pipe
⇦ Fresh air
⇦ Blow-by gases

B. (USA) California starting 1984

Engine 601.921

Engine breather

The closed engine breather requires no service.

Operation

Depending on intake manifold vacuum, the engine blow-by gases are flowing through oil separator (126) in cylinder head cover and a hose line to distributing pipe (140) on intake manifold.

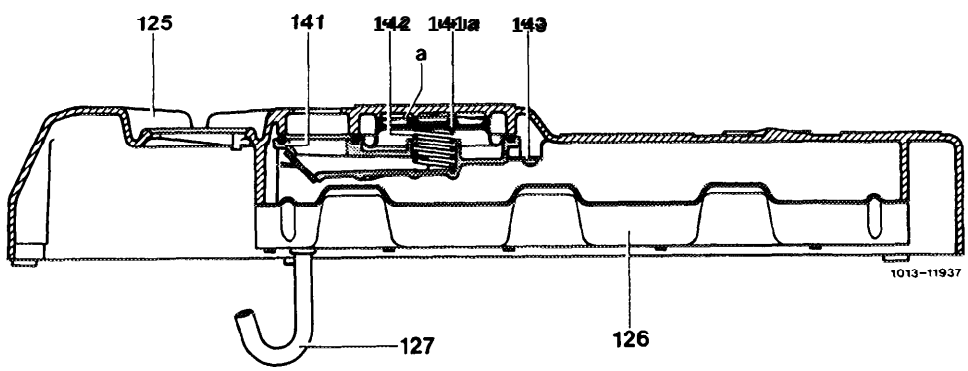
From here they are uniformly distributed to all the cylinders and fed to the combustion chambers together with the intake air.

The oil separated in oil separator (126) flows back to cylinder head through return pipe (127).

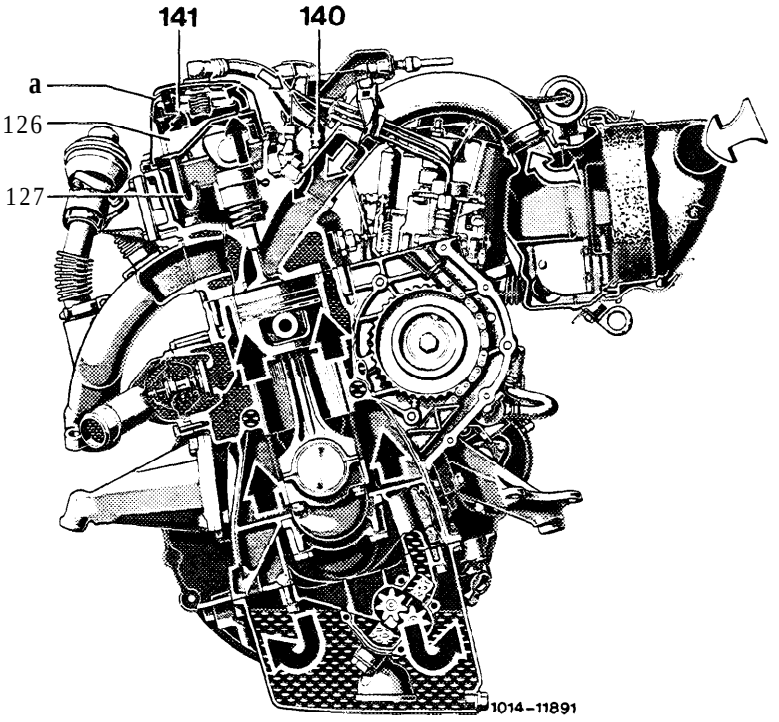
Since on engine in California version the vacuums are considerably higher under influence of throttle valve in intake system, the oil separator (126) is provided with a pressure control valve (141, diagram valve).

The valve prevents an excessive vacuum in cylinder crankcase and the resultant loss of oil (suction).

To vent diaphragm chamber in pressure control valve, the cylinder head cover is provided with a bore (a). Make sure that this bore is not closed or will not be closed by dirt or preservation compound.



125 Cylinder head cover
126 Oil separator
127 Return pipe
141 Diaphragm housing (pressure control valve)
141a Diaphragm
142 Spring
143 Holder
a Vent bore



126 Oil separator
127 Return pipe
140 Distributing pipe
141 Pressure control valve
a Bore 3 mm dia.

⇦ Fresh air
⇦ Blow-by gases

Data

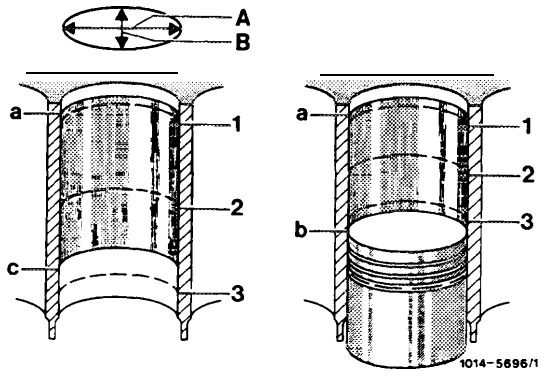
Engine[1]			601	
Version		Group Code letter	Piston dia.	Cylinder dia.
Std (standard)	Cylinder 1-4	A	86.970-86.976	87 .OOO-87.006
		X	above 86.975-86.983	above 87.006-87.012
		8	above 86.982-86.988	above 87.012–87.018
Max. wear limit in driving or transverse direction				0.10
Permissible out-of-round and conicity			when new	0.014
			wear limit	0.05
Permissible deviation, vertically in relation to crankshaft axis, with reference to cylinder height				0.05
Permissible roughness (ℜ 3 Z)				0.003-0.006
Permissible waviness				50 % of roughness

[1]) There are no repair stages for these engines.

Measu ri ng

Measure the cleaned cylinder bores with an internal measuring instrument at measuring points 1, 2 and 3 in longitudinal direction A (piston pin axis) and in transverse direction 8.

With piston installed the measuring point 3 is barely above piston, which should be at BDC.



A Longitudinal direction
B Transverse direction
a Upper reversing point of 1st piston ring
b BDC of piston
c Lower reversing point of oil scraper ring

Data

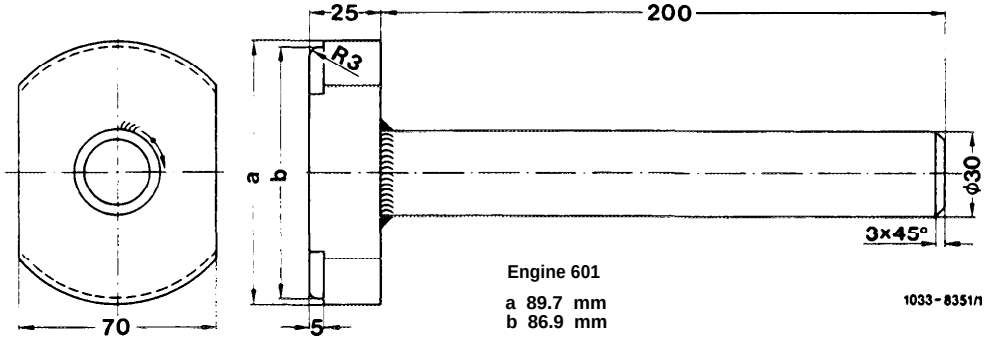
Engine[1])			**601**	
Version		**Group Code letter**	**Piston dia.**	**Cylinder dia.**
Std (standard)	**Cylinder I - 4**	**A**	**86.980-86.976**	**87.000-87.006**
		X	**above 86.975-86.983**	**above 87.006-87.012**
		B	**above 86.982-86.988**	**above 87.012-87.018**

Basic bore in cylinder crankcase for cylinder liner	**90.000 / 90.035**
Permissible out-of-round of basic bore in cylinder crankcase	**0.01**
Permissible out-of-round and conicity of cylinder bore	**0.01**
Permissible roughness of cylinder bore (R 3 Z)	**0.003-0.006**
Permissible waviness of cylinder bore	**50 % of roughness**
Honing angle	**25”**
Roughness of cylinder crankcase parting surface	**0.006-0.016**
Chamfer of cylinder bores	**refer to Fig.**

[1]) **There are no repair stages for these engines,**

Self-made tool

Mandrel for pressing out or knocking out cylinder liners



Note

Only approved cylinder liners may be installed on principle (refer to replacement parts data).

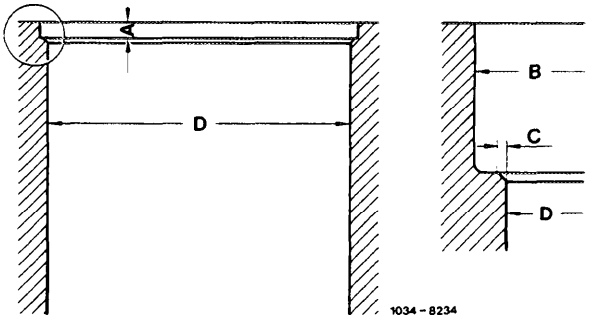
Renewing

1 **Press out cylinder liners with self-made mandrel and a press or knock out with a hammer.**

2 Thoroughly clean basic bore.

3 Measure basic bore (D) in cylinder crankcase.

When boundary dimensions (refer to Table) are exceeded, do no longer use cylinder crankcase.



A 4.3-4.6 mm
B 92.65-92.75 mm
C 0.25-0.35 mm
D 90.00-90.035 mm

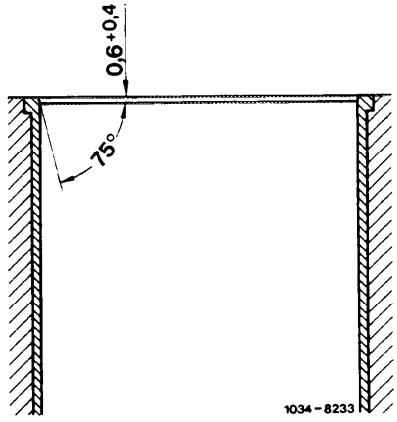
4 Position new cylinder liners. Place a steel plate of pertinent size on liner flange and press in bushing by means of a press or knock in by meanf of a hammer.

After pressing or knocking in, leave cylinder liner for an additional 7 seconds under press pressure (settling pressure) or apply a few settling blows with hammer.

5 Mill off or grind off the projecting flange of bushing. Remove as little as possible from cylinder crankcase parting surface. Guide milling cutter or grinding wheel centrally over cylinder bores.

6 Enlarge (bore) cylinder liners in two steps. For honing, leave an allowance of 0.03 mm in bores.

7 Chamfer cylinder liners.



8 Hone cylinder bores.

9 Measure cylinder bores and select matching pistons (01-I 10).

01-120 Facing cylinder crankcase parting surface

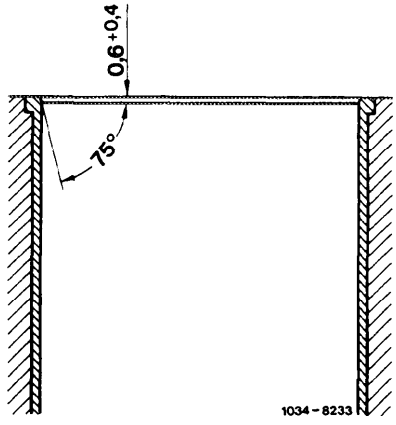
Data		
Height of cylinder crankcase when new		300-299.95
Minimum height following a required material removal		
Permissible unevenness of parting surface	in longitudinal direction	0.10
	in transverse direction	0.05
Permissible roughness of upper parting surface		0.006-0.016
Permissible deviation from parallel between upper and lower crankcase parting surface in longitudinal direction		0.1
Pressing off pressure with air under water in bar gauge pressure		1.5
Chamfer of cylinder bores		refer to Note
Distance between piston crown and cylinder crankcase parting surface	engine 601.911	+ 0.65 to + 1.05
	engine 601.921	+ 0.50 to + 0.90

Note

Prior to facing, check piston standout (projection). Do not exceed piston standout of 0.9 or 1.05 mm (03–316).

Chamfer cylinder bores after facing.

Check timing, if cylinder crankcase parting surface has been refinished (05–215).



01-130 Knocking out and inserting steel balls in main oil duct

Special tool

Knocking-in mandrel for steel ball	11004-11746	601 589 08 15 00

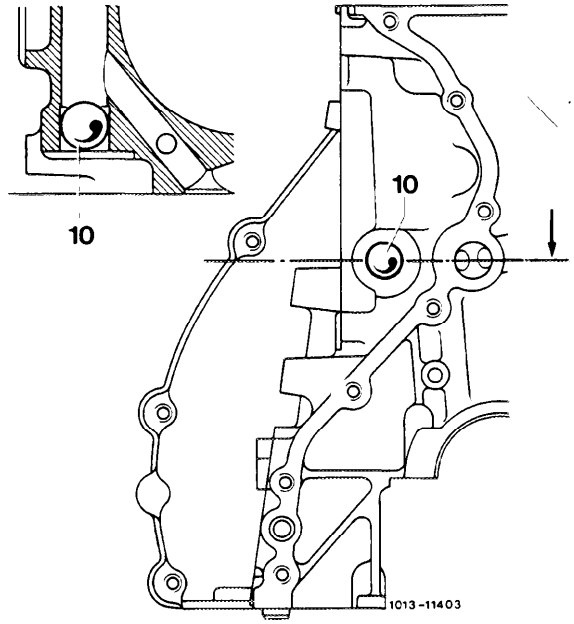
Note

The main oil duct is closed with steel balls, 17 mm dia. at the front, 15 mm dia. at the rear.

When reconditioning engine, the steel balls must be knocked out from the rear for cleaning main oil ducts.

Undamaged steel balls can be used several times without refinishing of ball seat.

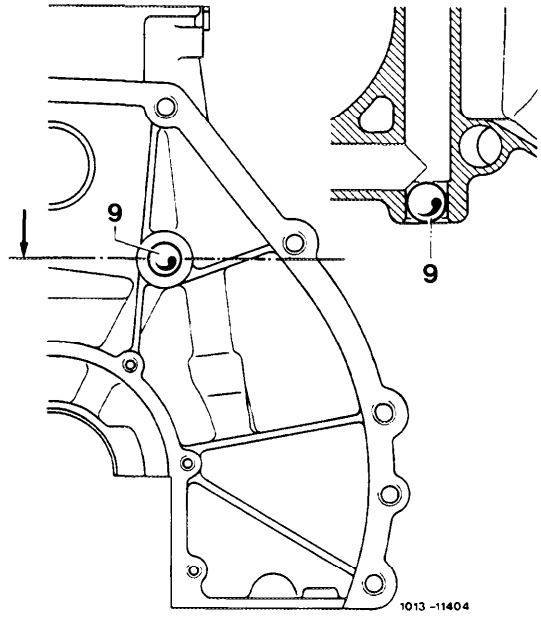
Renew damaged steel balls.



10 Steel ball, front

In the event of leaks, reseat steel balls in cylinder crankcase with a knocking-in mandrel for approx. 1 mm (dimension is indicated on knocking-in mandrel).

If the leaks are still not yet repaired, knock out both steel balls and close the respective main oil duct end with closing plug (front) M 18 x 1.5, part no. 000906 018000 or (rear) M 16 x 1.5, part no. 000906 0 16002.



9 Steel bail, rear

For this purpose, cut threads M 18 x 1.5, 10 mm deep, at main duct front. Thoroughly remove chips from oil ducts.

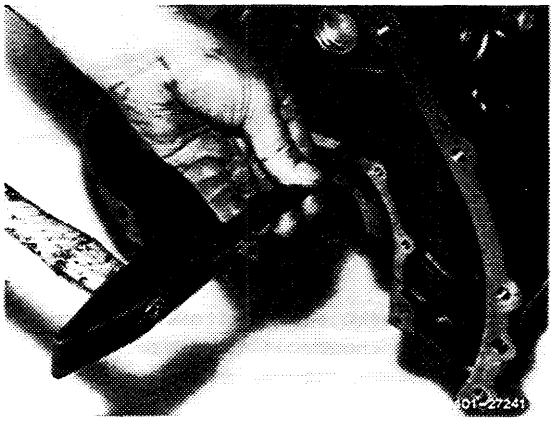
Coat closing plug M 18 x 1.5 with sealing glue Loctite 241, part no. 002 989 94 71 and screw in.

Cut threads M 16 x 1.5 mm approx. 14 mm deep into main oil duct on main oil duct rear.

Thoroughly remove chips from oil duct.

Coat closing plug M 16 x 1.5 with sealing glue Loctite 241, part no. 002 989 94 71 and screw in.

Main oil duct front and rear



Knocking out

1 **Remove coolant pump with housing** (20–230).

2 **Remove transmission and flywheel (03-410).**

3 **Knock out both steel balls from the rear to the front by means of a round steel bar (approx. 14 mm and approx. 550 mm long).**

Knocking in

4 **Thoroughly clean bore in pressing in range of steel ball.**

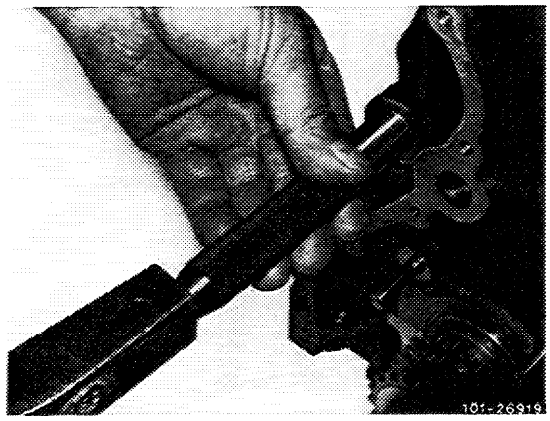
5 Coat spherical indentation on knocking-in mandrel with grease and place steel ball into indentation.

103-13405

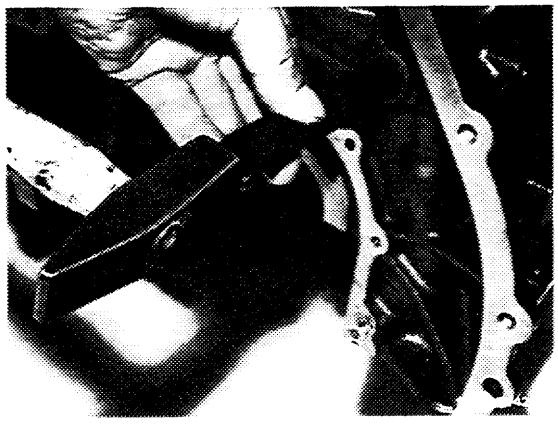
6 Position steel balls and knock in up to stop on mandrel.

7 Mount all removed or disassembled parts.

8 Run engine warm and check for leaks.



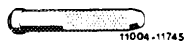
Knocking in steel ball, front



Knocking in steel bail, rear

01-140 Replacing core hole cover in cylinder crankcase

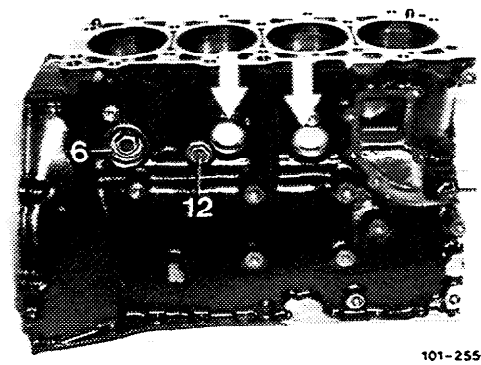
Special tools

Knocking-in mandrel for cover, 17 mm dia.	 11004-11745	601 589 07 15 00
Knocking-in mandrel for cover, 34 mm dia.	11004-9625	102589001500

Note

The core holes in cylinder crankcase are closed with sheet metal covers (17 mm dia. or 34 mm dia.).

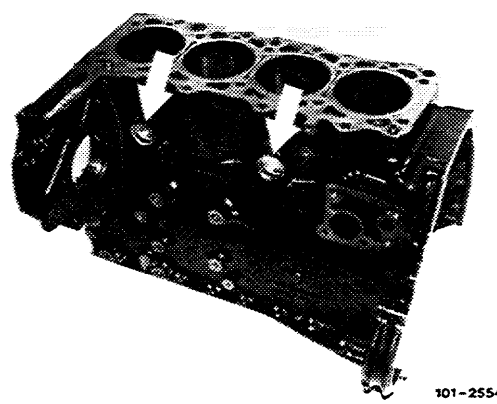
Be sure to replace leaking covers on principle.



Cylinder crankcase
Driving direction, right

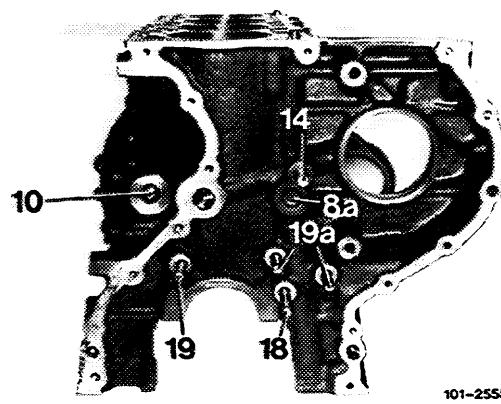
101-25547

At the right (driving direction) a closing plug (6, M 38 x 1.5) is retained. A coolant preheater can be placed into this core hole.



Cylinder crankcase
Driving direction, left

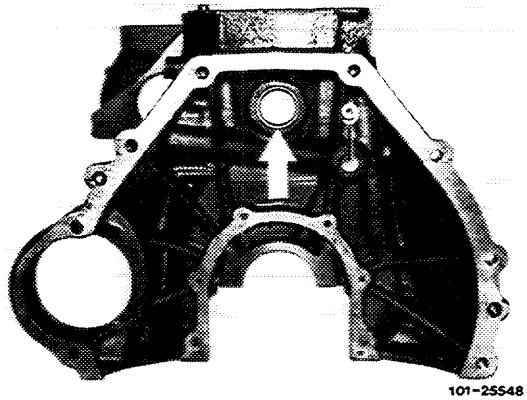
101-25546



Cylinder crankcase
Face, front

8a Core hole cover, front

101-25550

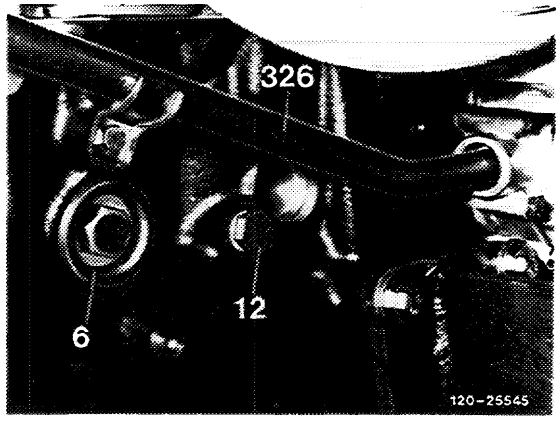


Cylinder crankcase
Transmission side
Arrow = core hole cover, rear

Renewing

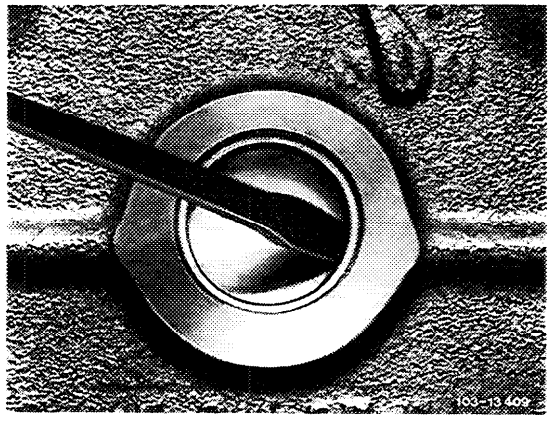
1 **Completely drain coolant (20-010).**

2 **Remove unit parts which prevent access (e.g. transmission, injection pump, etc.).**

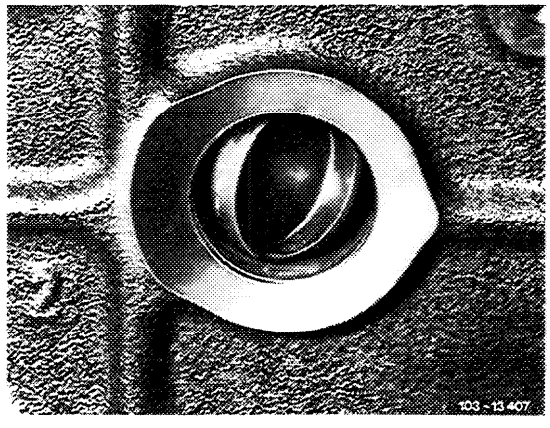


6 Closing plug
12 Drain plug on crankcase

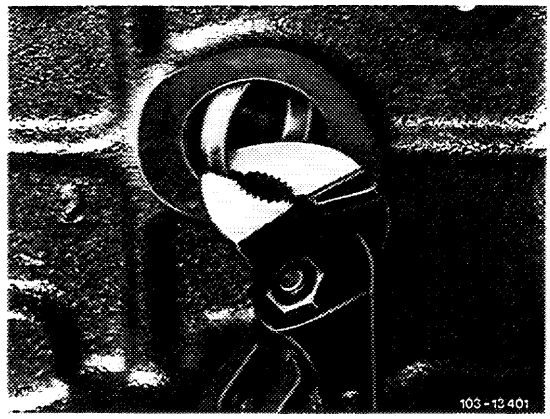
3 Position a chisel with narrow blade or a screwdriver in deep-drawn edge of closing cover.



4 Carefully knock in cover on one side until it has turned around its own longitudinal axis (approx. 90").

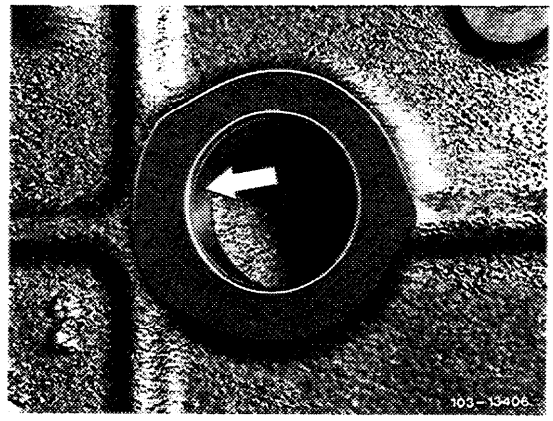


5 Position water pump pliers at flange of projecting part and pull out cover.



6 Thoroughly clean core hole from residue. Sealing surface must be free of grease (arrow).

7 Coat core hole with sealing glue Loctite 241, part no. 002 989 94 71.

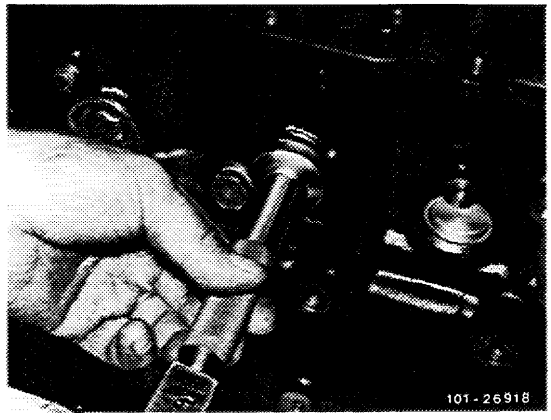


8 Knock in new closing cover by means of pertinent knocking-in mandrel.

9 Attach removed unit parts.

10 Fill in coolant (20–010).

Note: The sealing glue should cure approx. 45 minutes before filling in coolant.

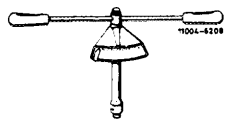
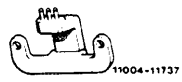


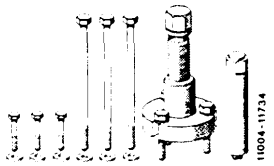
11 Run engine warm and check for leaks.

01-210 Removal and installation of timing housing cover

Tightening torques		Nm
Hex. head screw to crankshaft front		370 + 40
Screws M 8 x 12 for pulley to hub		25
Oil drain plug to oil pan		25
Oil pan to cylinder crankcase	M 6	10
	M 8	25
Central screw for fan to coolant pump		25
Adjusting screw for front engine stop		130
Engine carrier to engine mount front		35 + 10
Screws for cylinder head cover		10
Cylinder head screws M 8 (reference value)		25
Screws for timing housing cover	M 6	10
	M 8	25

Special tools

Torque wrench, double-arm, 3/8" square, 8-32 Nm		001 589 51 21 00
Torque wrench, single-arm, emitting signal with plug-in ratchet 1/2" square, 40-200 Nm		001 589 67 21 00
Torque wrench single-arm, with ratchet, 3/4" square, 150–800 Nm		001 589 74 21 00
Detent		601 589 02 40 00
Screwdriver with tommy handle for hex. socket screws 6 mm, 440 mm long		116589030700
Sleeve for pushing in radial sealing ring, front		601 589 03 14 00

Puller for flange on crankshaft		601 589 08 33 00
Box end-Allen wrench 13 x 14 mm		117589020700

Conventional tools

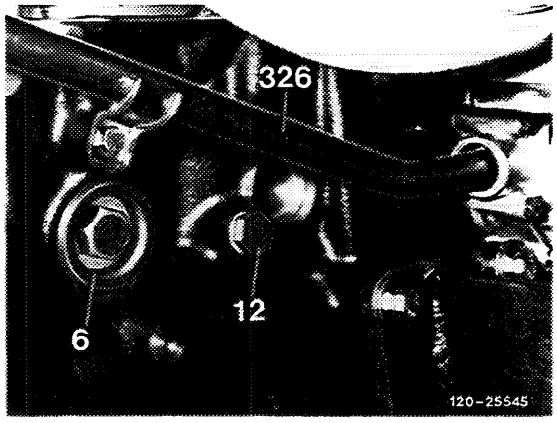
Connection 3/4'' square socket to 1/2'' square head	e.g. Hazet, D-5630 Remscheid order no. 1058 R. 1
Engine hoist no. 3180	e.g. Backer, D-5630 Remscheid, Herderstraße
Socket wrench 7 mm on flexible shaft for hose clamps with worm drive	e.g. Hazet, D-5630 Remscheid order no. 426-7

Removal

1 Completely remove noise capsule.

2 Drain engine oil.

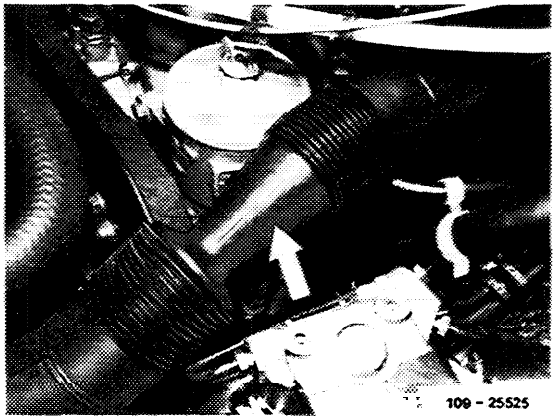
3 Completely drain coolant (20–010).



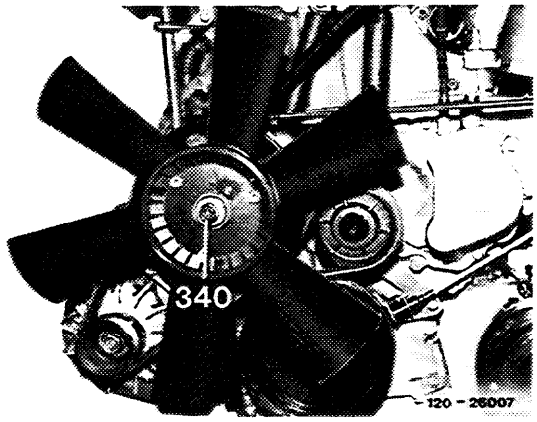
4 Remove air hose (arrow).

5 Remove radiator (20-420).

6 Disconnect negative terminal on battery.

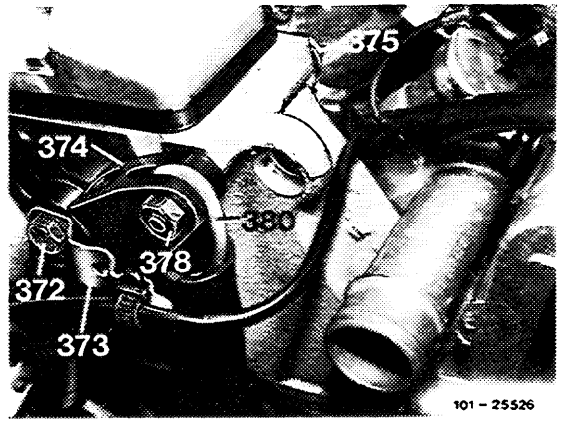


7 Unscrew collar screw (340) and remove fan.

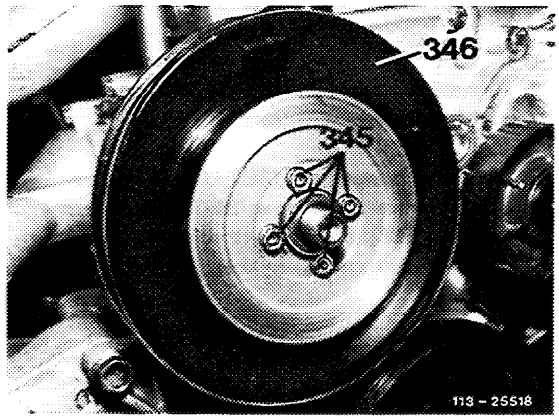


8 Slacken V-belt and remove. For this purpose, unscrew flange nut (378). Insert a mandrel into spring tensioning lever (374) and releave hex. screw (375) against draw spring (380) until spring can be pushed back in direction of intake manifold.

Release spring tensioning lever and remove V-belt.



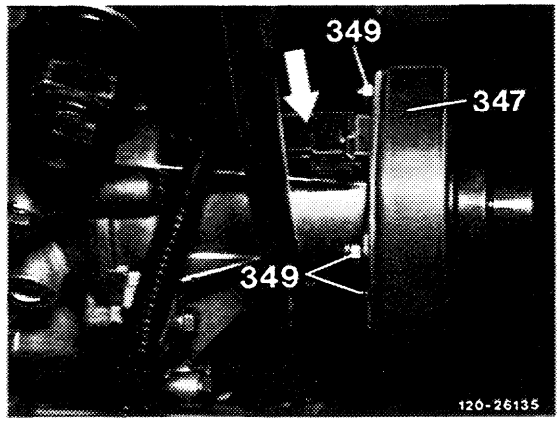
9 Unscrew hex. socket screws (345) of coolant pump pulley and **remove pulley** (346).

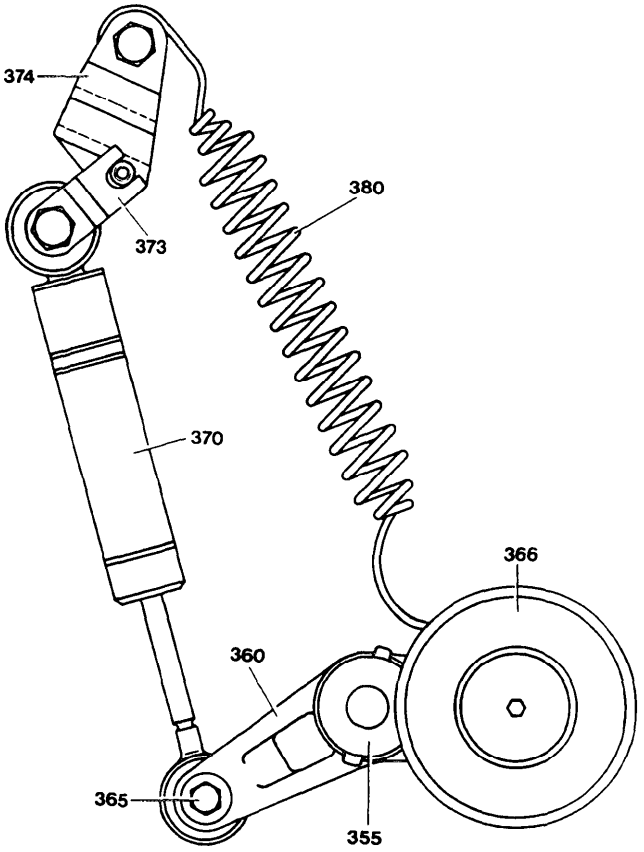


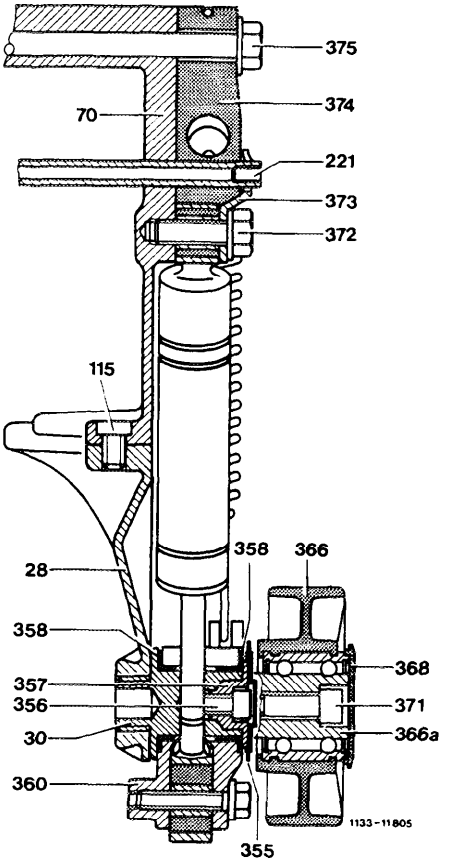
10 Pull cable from magnetic body (arrow).

11 Unscrew magnetic body (347) from magnet carrier on fastening nuts (349).

Note: The magnet carrier is glued to coolant pump housing and should not be pulled off.







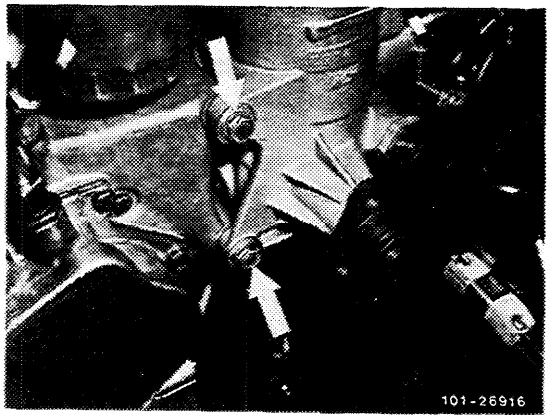
355 Closing cover M 6 x 25
356 Hex. socket screw
357 Lock washer
360 Tensioning lever
372 Hex. screw M 8 x 30
373 Holder

12 Completely remove V-belt tensioning device. Unscrew hex. screw (372) for this purpose.

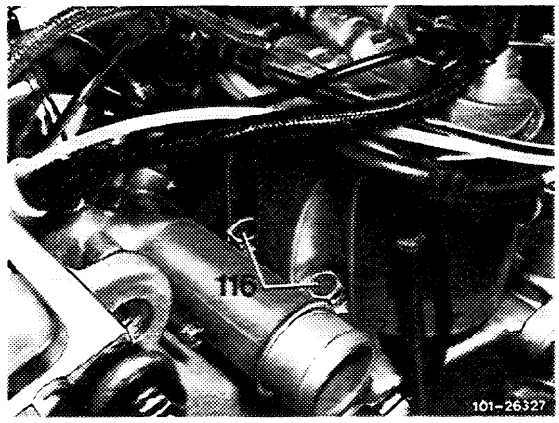
13 Remove closing cover (355). Unscrew screw **(356)** and remove lock washer (357). Remove tensioning lever **(360)** together with shock absorber and draw spring from bearing bolt.

14 On vehicles with power steering, unscrew pulley for high pressure pump.

15 Unscrew both hex. screws for high pressure oil pump fastening (arrows) and put high pressure oil pumps with lines connected aside.

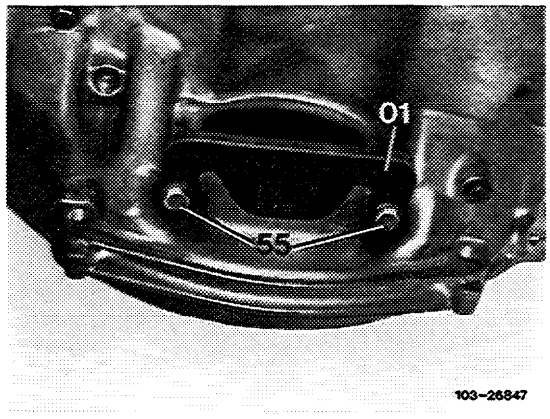


16 Unscrew the front screw of the two screws for fastening fuel filter (116).



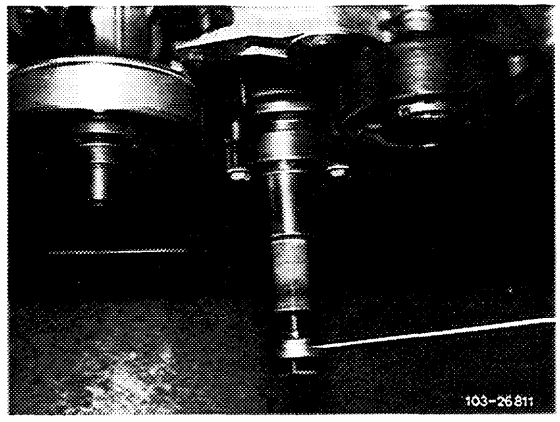
17 Unscrew crankshaft pulley.

18 Unscrew hex. screw for flange. For this purpose, mount detent, part no. 601 589 02 40 00, to oil pan.

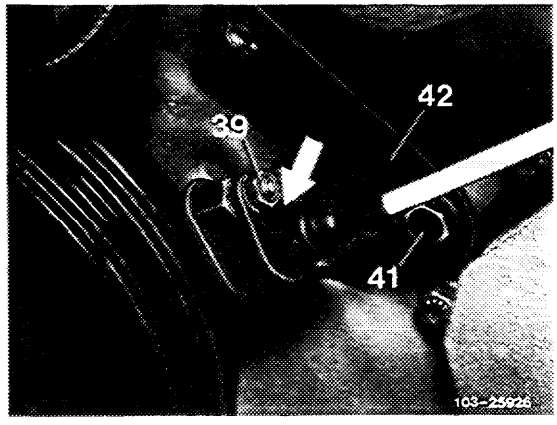


19 Pull off crankshaft flange manually.

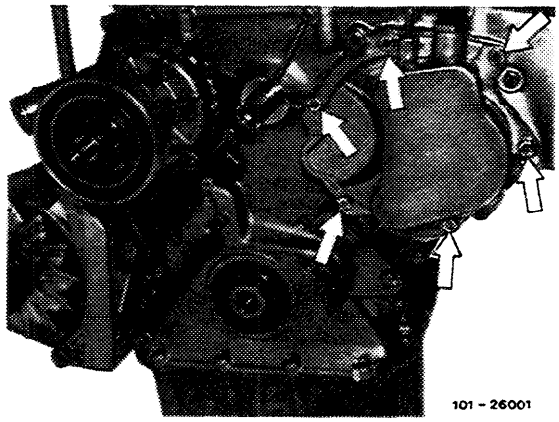
If hard to move, pull off crankshaft flange with puller, part no. 601 589 08 33.



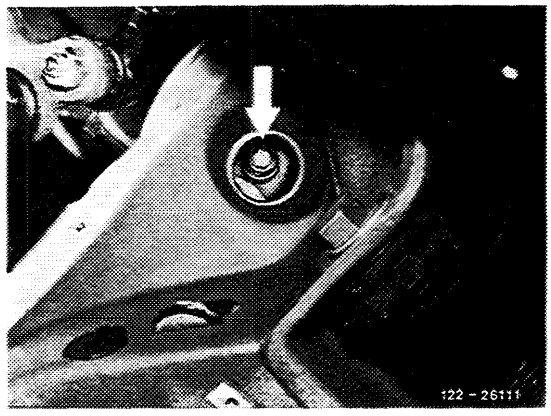
20 On vehicles with TDC transmitter, unscrew hex. nut (39), pull TDC transmitter line out of holder (42) and put aside.



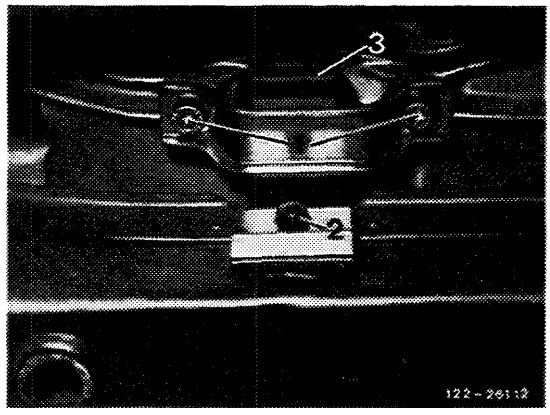
21 Unscrew vacuum pump (arrows).



22 Unscrew both fastening screws for engine carrier on engine mount (arrow).



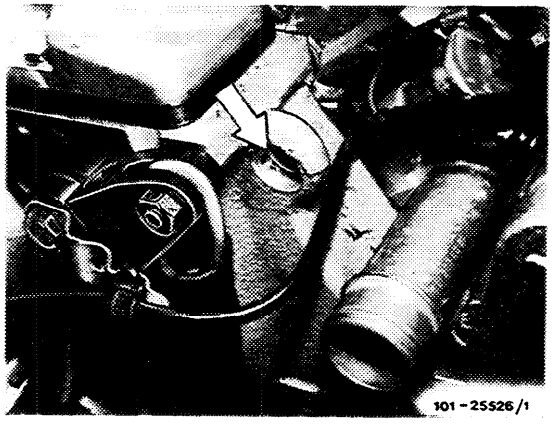
23 Unscrew engine stop on frame cross member. For this purpose, unscrew adjusting screw (2) as well as hex. screws (1).



24 Attach rope of engine hoist at front suspension eye (arrow) and lift engine with a crane.

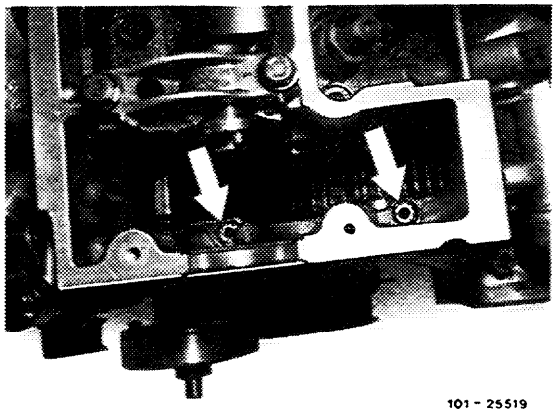
25 Unscrew fastening screws for oil pan front in range of timing housing cover. Loosen all remaining fastening screws.

26 Lower engine again into engine mounts.

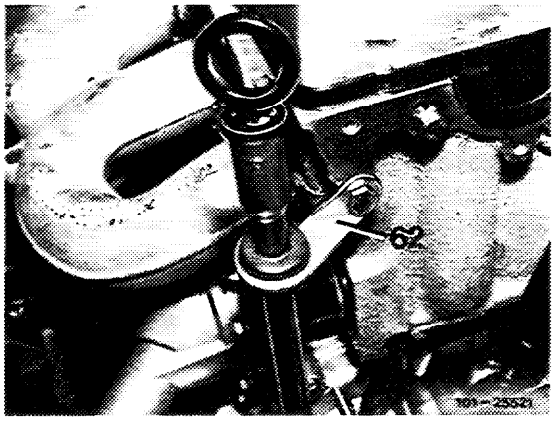


27 Remove cylinder head cover.

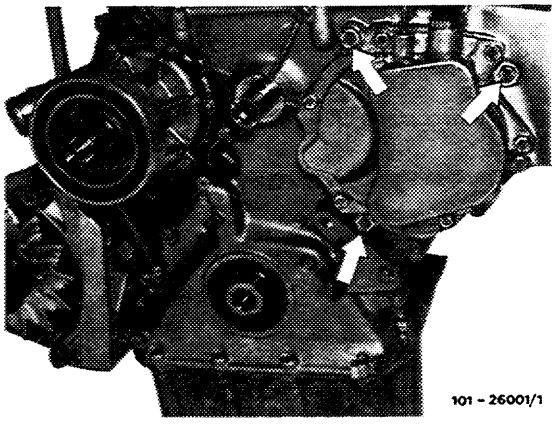
28 Unscrew the two cylinder head screws M 8 (arrows) in chain box with Allen wrench 6 mm, 440 mm long.



29 Unscrew holder for oil dipstick guide tube (62).



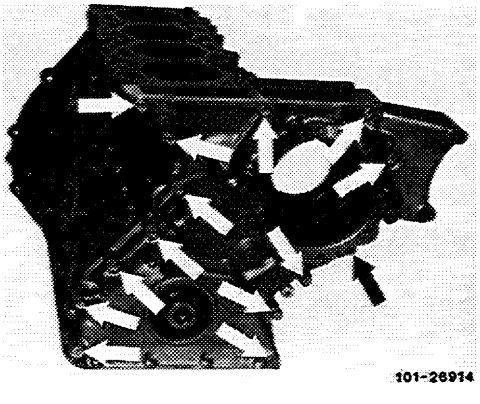
30 Unscrew fastening screws (arrows) for injection pump. Remove square nuts on flange of injection pump.



31 Unscrew remaining fastening screws for timing housing cover (arrows).

32 Remove timing housing cover.

Attention!
Do not damage cylinder head gasket. Renew damaged cylinder head gasket.



33 Clean parting surfaces.

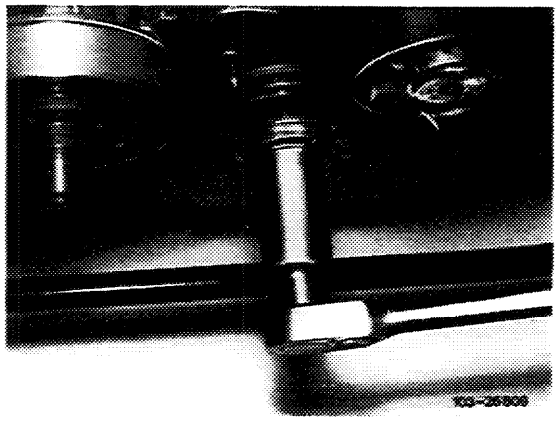
34 Coat timing housing cover parting surface with sealing compound "Curil T", part no. 001 98947 20.

35 Carefully position timing housing cover, while paying attention to cylinder head gasket,

36 Screw on timing housing cover. Pay attention to different screw lengths.

37 If the radial sealing ring has been removed, insert new radial sealing ring with sleeve, part no. 601 589 03 14 00.

38 For further installation proceed vice versa.



39 Adjust engine stop (22–220).

40 Check and correct oil level in engine.

41 Fill in coolant (20-010).

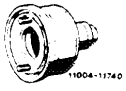
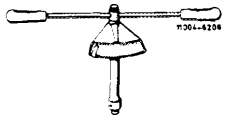
42 Pressure-test cooling system with tester.

43 Run engine, check for leaks,

Tightening torques

Fastening screws for end cover		10 Nm
Necked-down screws for flywheel and driven plate	initial torque	30 + 10 Nm
	angle of rotation torque	90-100”

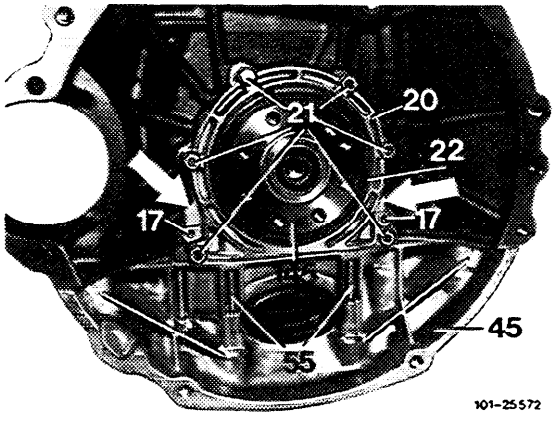
Special tools

Installation tool for rear crankshaft radial sealing ring and end cover		601 589 03 43 00
Torque wrench, double-arm, 3/8” square, 8-32 Nm		001 589 51 21 00
Torque wrench, single-arm, emitting signal, with plug-in ratchet, 1/2” square, 25-130 Nm		001 589 66 21 00

Note

The central installation position for crankshaft center is located by means of two clamping sleeves (17).

The end cover is sealed in relation to cylinder crankcase with sealing compound Loctite 573, part no. 001 989 45 20.



17 Clamping sleeve
20 End cover
21 Combination screw (M 6 x 22)
22 Radial sealing ring
55 Combination screw (M 6 x 85)
145 Crankshaft

Removal

1 Remove transmission (26-020 or 27–600).

2 Remove flywheel or driven plate (03-410).

3 Unscrew fastening screws (21 and 55) and force off end cover on both lugs (arrows).

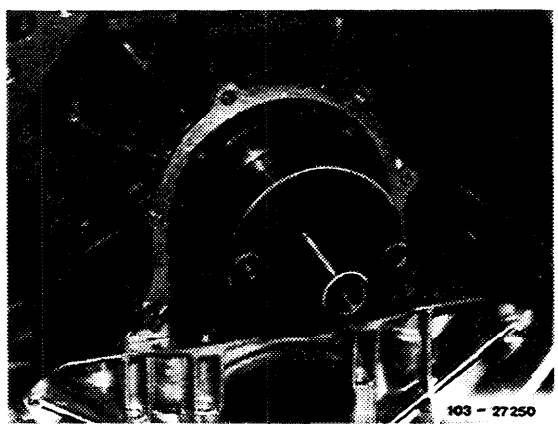
4 Clean sealing surfaces on cylinder crankcase and end cover.

5 Check whether radial sealing ring is damaged. Renew radial sealing ring.

Installation

6 Coat end cover on sealing surface uniformly with sealing compound "Loctite 573", part no. 001 989 45 20.

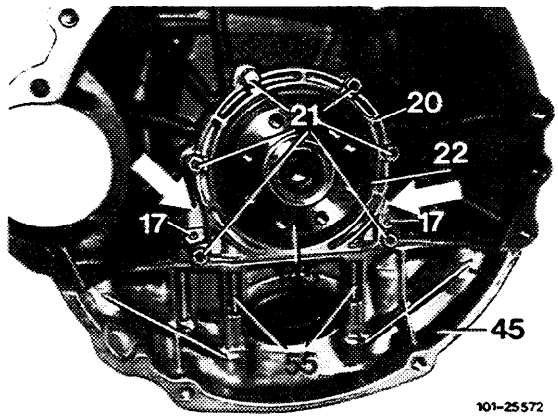
7 Slip end cover with pressed in radial sealing ring over screwed on assembly sleeve. Pay attention to oil pan gasket.



8 Tighten fastening screws (21 and 55) to 10 Nm.

Tighten fastening screws (55) first.

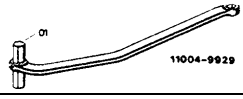
9 Run engine warm and check for leaks.



01-310 Removal and installation of oil pan

Oil capacity in liters	
Oil pan	5
Oil filter	1.5

Tightening torques		Nm
Oil drain plug to oil pan		25
Oil pan to cylinder crankcase	M 6	10
	M 8	25
Adjusting screw for front engine stop		130
Adjusting screw for rear engine mount		30
Engine carrier to engine mount front		35 + 10

Special tools		
Torque wrench with plug-in ratchet, 1/2'' square, 25-l 30 Nm		001 589 66 21 00
Torque wrench with plug-in ratchet, 1/2'' square, 40-200 Nm		001 5896721 00
Screwdriver with tommy handle for hex. socket screws 5 mm, 300 mm long		116589020700
Screwdriver with tommy handle for hex. socket screws 6 mm, 440 mm long		116589030700
Box end-Allen wrench 13 x 14 mm		117589020700

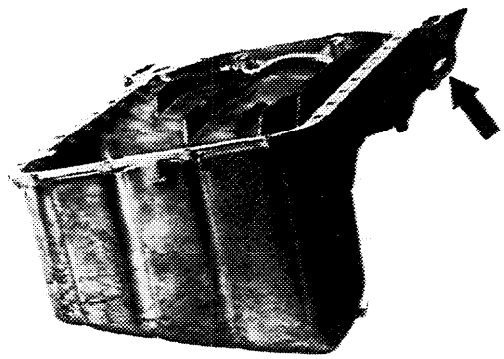
Conventional tool	
Engine hoist no. 3180	e.g. Backer, D-5630 Remscheid, Herderstraße

Note

The engines are provided with a light alloy oil pan. The pan is sealed in relation to cylinder crankcase by means of a gasket.

At the rear left (arrow) is the rpm sensor for refrigerant compressor shutoff, EG R (California version) and revolution counter.

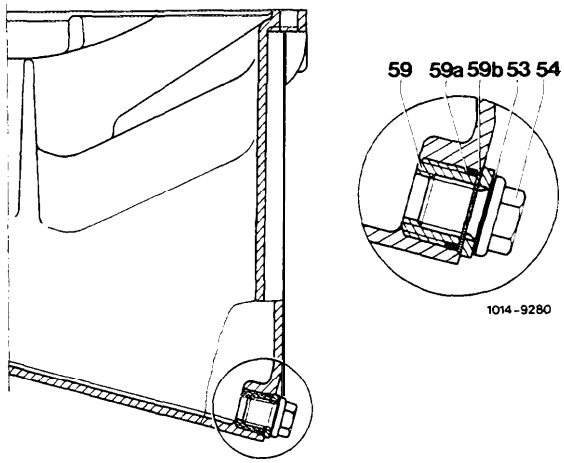
To make sure that the oil pan floor in range of oil pump strainer is horizontal with engine installed (engine installation position tilted 15" to the right), the oil pan floor has also a tilt of 15° in relation to cylinder crankcase parting surface.



101-26985

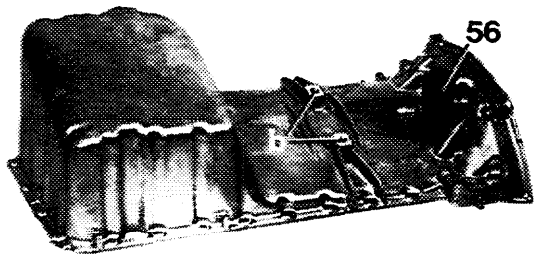
The oil drain plug (54, M 12 x 1.5) is attached at front left.

The threaded bushing is sealed by an O-ring (59a) and is locked against rotation by means of a toothed collar (59b), which digs into oil pan when inserted.



1014-9280

53 Sealing ring
54 Oil drain plug M 12 x 1.5
59 Threaded bushing
59a O-ring
59b Toothed collar



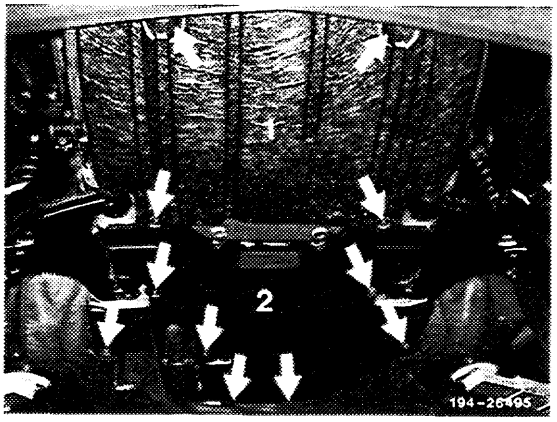
56 Closing cover
b Fastening points for engine stop

101-26986

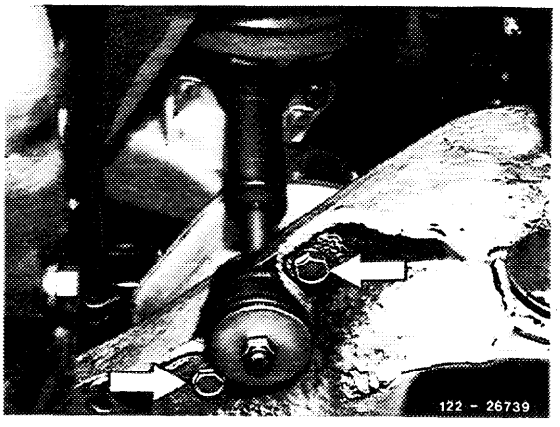
Removal

1 Remove noise capsule.

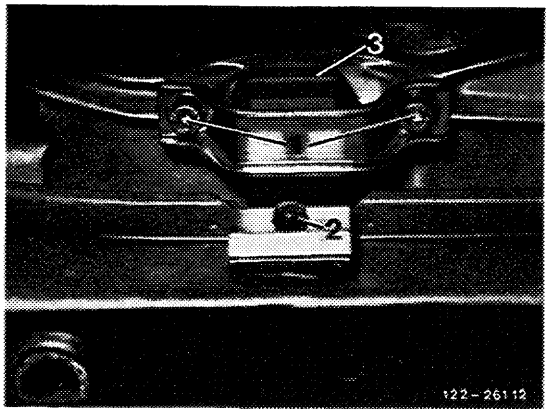
2 Drain engine oil.



3 Unscrew engine shock absorber on cross member. **Unscrew fastening screws (arrows) for** this purpose.

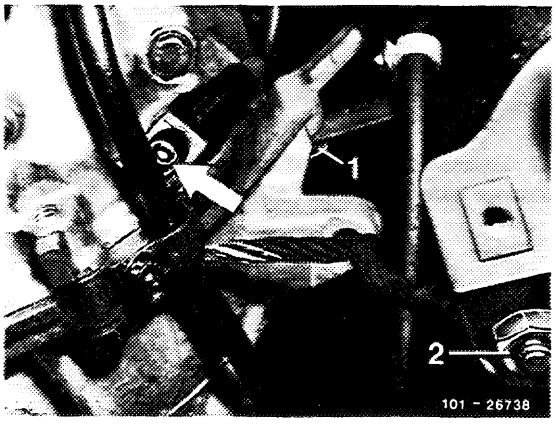


4 Remove engine stop. For this purpose, unscrew adjusting screw (2) as well as hex. screws (1) and engine stop with holder.

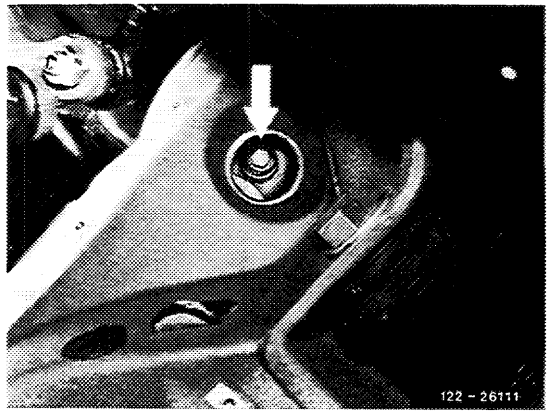


5 On vehicles with rpm sensor, disconnect line on oil pan (arrow).

6 Disconnect ground connecting line on transmission.



7 Unscrew hex. socket screws for engine carrier on both front engine mounts from below (arrow).



Hex. socket screw for engine carrier right

8 Unscrew torsion bar on side members right and left.

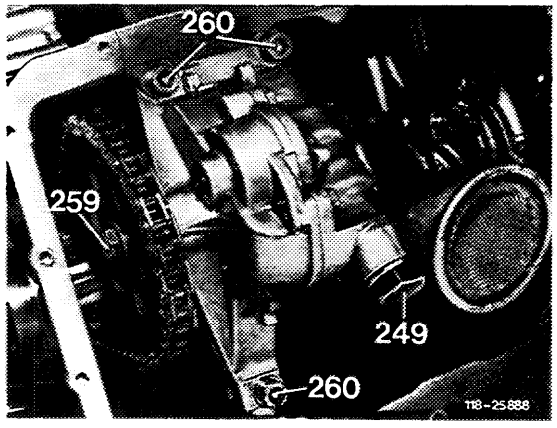
9 Engage rope of engine hoist at front suspension eye of engine (arrow).

Lift engine with a crane. Pay attention to fan and fan cover.

10 Unscrew oil pan.

11 Unscrew screw (259) on sprocket and remove sprocket from drive shaft.

12 Unscrew oil pump and remove. For this purpose, unscrew fastening screws (260).



13 Remove oil pan in forward direction. Pull torsion bar down for this purpose.

14 Clean parting surfaces.

Installation

15 Place oil pan over bogie.

16 Install oil pump (18-210).

17 Mount oil pan with new gasket.

18 Lower engine and screw engine carrier to engine mount.

19 Adjust engine stop (22-220).

20 Fill in engine oil.

21 Run engine warm and check for leaks,

22 For further installation proceed vice versa.

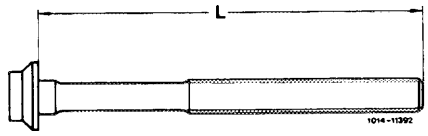
Tightening torques and angles of rotation for cylinder head screws on cold engine

Double hex. socket cylinder head screws (necked-down cylinder head screws)	1st stage	25 Nm	–
	2nd stage	40 Nm	–
	Setting interval	10 min	
	3rd stage	–	90°
	4th stage		90°

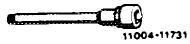
Tighten cylinder head screws M 8 with screwdriver with tommy handle.

Dimensions of double hex socket cylinder head screws

Thread dia.	Length when new	Max. length (renew)
M 10	80	83.6
M 10	102	105.6
M 10	115	118.6

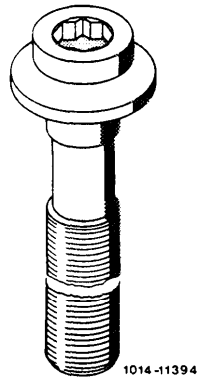


Special tools

Screwdriver element 1/2" square, 140 mm long for double hex. socket cylinder head screws M 10 on cylinder head		601 58900 1000
Screwdriver with tommy handle for hex. socket screws 6 mm, 440 mm long		116589030700
Torque wrench single-arm, emitting signal, with plug-in ratchet, 1/2" square, 25-130 Nm		001 589 66 21 00

Note

To obtain a uniform and high screw pre-tensioning force, double hex. socket — necked-down — cylinder head screws are installed with a machined flange. They have a tapered-down shank and are mounted without washers.



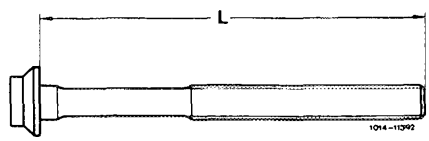
Retightening of cylinder head screws during inspection at 1000-1500 km or in the event of repairs after 1000-l 500 km is no longer required.

The double hex. socket cylinder head screws are tightened to initial torque and angle of rotation torque (refer to Table).

Since these cylinder head screws are subject to a lasting elongation after tightening, they must be renewed after the max. longitudinal dimensions named in Table shown below are exceeded.

Dimensions of cylinder head screws

Thread dia.	Lenghts when new (L)	Max. length (L) (renew)
M 10	80	83.6
M 10	102	105.6
M 10	115	118.6



Owing to the different lengths of cylinder head screws, attention must be paid to fit the bolts in the proper locations during assembly. Insert cylinder head screws according to the tightening diagram shown.

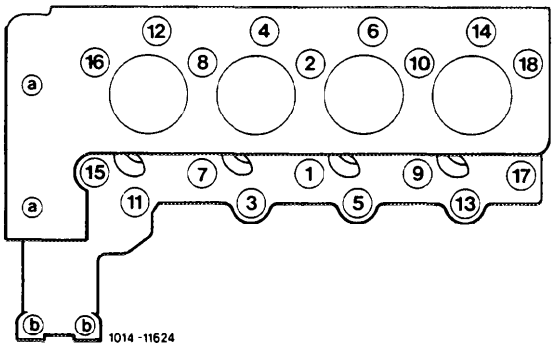
M 10 x 80 in bore 3, 5, 11, 13

M 10 x 102 in bore 2, 4, 6, 8, 10, 12, 14, 16, 18

M 10 x 115 in bore 1, 7, 9, 15, 17

M 8 x 30 in bore a

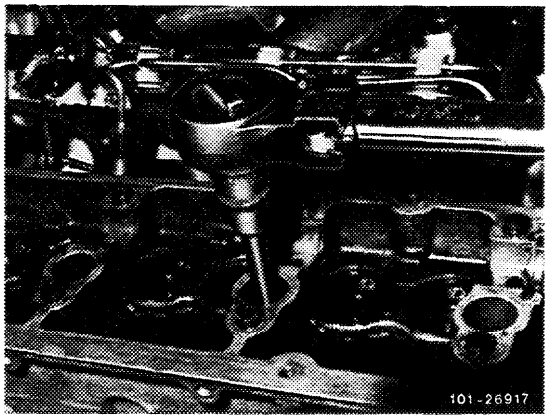
M 8 x 80 in bore b



Tighten cylinder head screws to initial torque and angle of rotation torque.

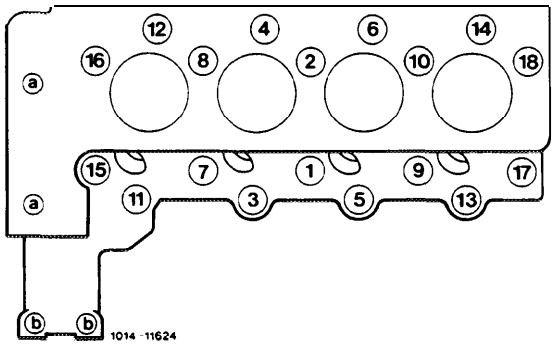
Estimate angle of rotation. For this purpose, place adjustable torque wrench in release position (locked) into plug-in ratchet. Position adjustable torque wrench with plug-in ratchet lengthwise in relation to engine and keep turning until it is transverse in relation to engine.

Do not use torsion bar torque wrench for angle of rotation.



Tighten cylinder head screws in steps in sequence of tightening pattern shown.

Do not release cylinder head screws after setting interval, but continue tightening.



After tightening according to tightening torque, a lo-minute setting interval must be maintained between the 2nd and the 3rd tightening step (refer to Table).

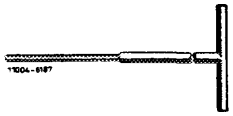
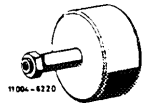
Timing at 2 mm valve lift

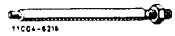
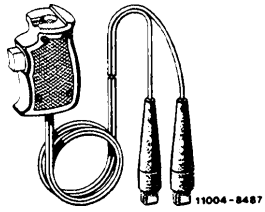
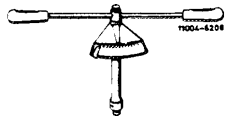
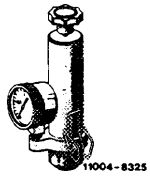
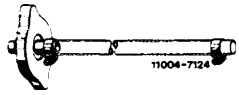
Engine	Camshaft code number[1])	Intake valve opens after TDC	Intake valve closes after BDC	Exhaust valve opens before BDC	Exhaust valve closes before TDC
601	05	with new timing chain			
		11°	17°	28°	15°
		with used timing chain (starting at approx. 20 000 km)			
		12°	18°	27°	14°

1) The camshaft code number is punched into flange of camshaft in range of TDC mark.

Tightening torques			Nm
Screws for cylinder head cover			10
Double hex. socket cylinder head screws (with cold engine)	initial torque	1st stage	25
		2nd stage	40
	setting interval	10 min	
	angle of rotation torque	3rd stage	90°
		4th stage	90°
Cylinder head screws M 8 (reference value)			25
Screw for camshaft timing gear			45
Chain tensioner			80
Coupling nuts for injection lines (reference value)			1 O-20
Hex. socket screws for intake manifold			10

Special tools

Screwdriver element 1/2'' square, 140 mm long for double hex. socket screws M 10 on cylinder head		601 589 00 10 00
Screwdriver with tommy handle for hex. socket screws 6 mm, 440 mm long		116589030700
Impact puller for bearing bolts (basic unit)		116589203300

Threaded bolt for impact puller M 6, 50 mm long		116589013400
Threaded bolt for impact puller M 6, 150 mm long		116589023400
Contact handle for rotating engine (component of compression pressure recorder 001 589 46 21 00)		001 589 46 21 08
Torque wrench, double-arm, 3/8'' square, 8-32 Nm		001 589 51 21 00
Torque wrench, single-arm, emitting signal, with plug-in ratchet 1/2'' square, 25-130 Nm		001 5896621 00
Box end wrench element, **open,** 14 mm, 1/4'' drive for coupling nut of injection line		000589770300
Tester for cooling system and radiator cap		001 589 48 21 00
Radiator cap with hose for leak test		605589002500

Conventional tool

Socket wrench hexagon 7 mm on flexible shaft for hose clamps with worm drive	e.g. Hazet, D-5630 Remscheid order no. 426-7

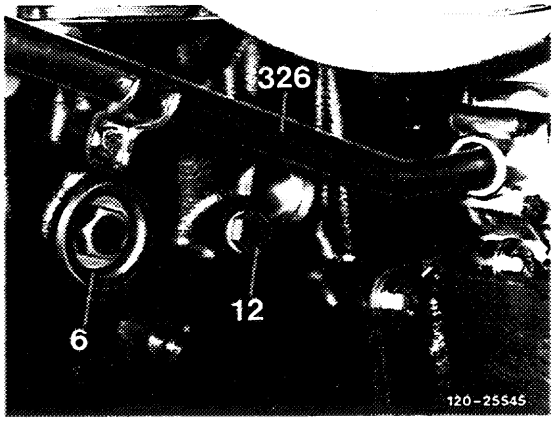
Note

Cylinder head should be removed with cooled down engine only. Remove together with exhaust manifold.

Removal

1 Set engine hood in vertical position.

2 Completely drain coolant (20-010).



12 Drain plug on cylinder crankcase

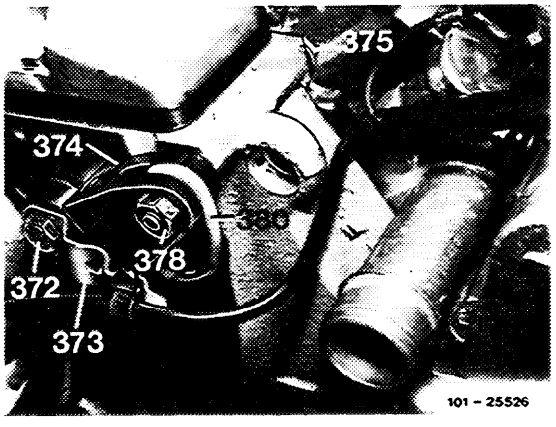
3 Disconnect negative line on battery.

4 Remove radiator (20-420).

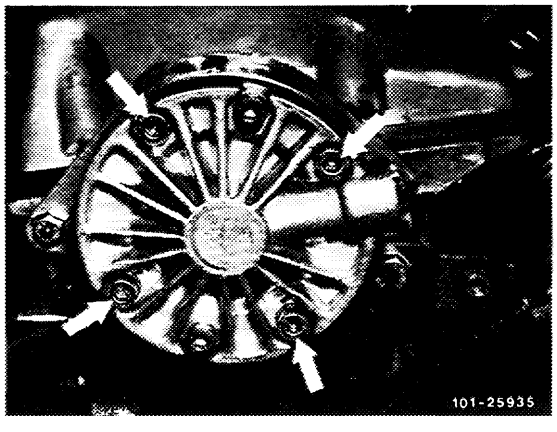
5 Completely remove air cleaner (09-410).

6 Slacken V-belt and remove. For this purpose, unscrew flange nut (378). insert a mandrel into spring tensioning lever (374) and relieve hex. screw (375) in relation to draw spring (380) until spring can be pushed back in direction of intake manifold.

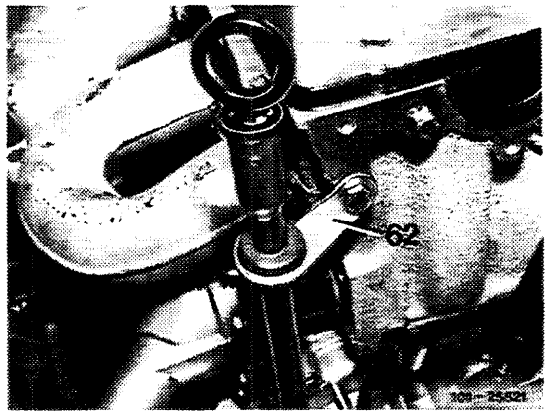
7 Unscrew hex. screw (372) for fastening shock absorber.



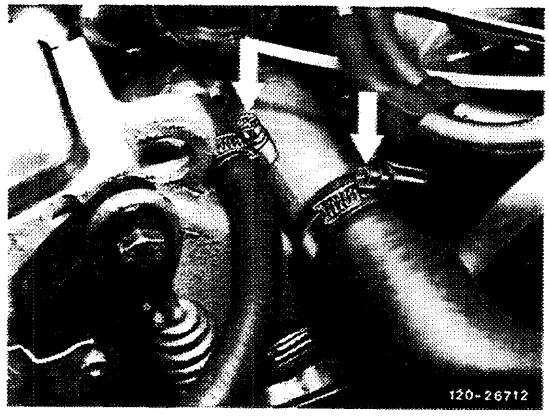
8 On vehicles with level control, unscrew hex. socket screws (arrows), place pressure oil pump with connected lines aside. Remove driver.



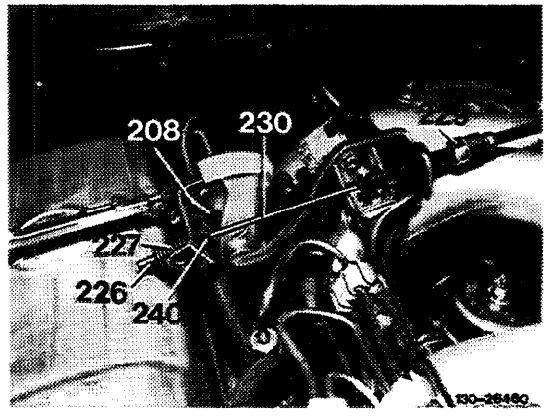
) Unscrew holder (62) for oil dipstick guide tube.



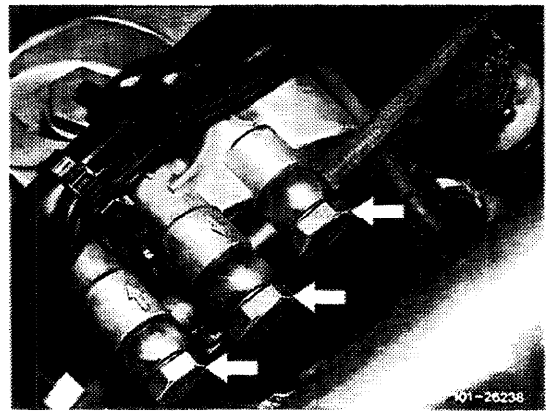
10 Disconnect coolant hoses (arrows) on coolant outlet connection and pull cable from temperature witch.



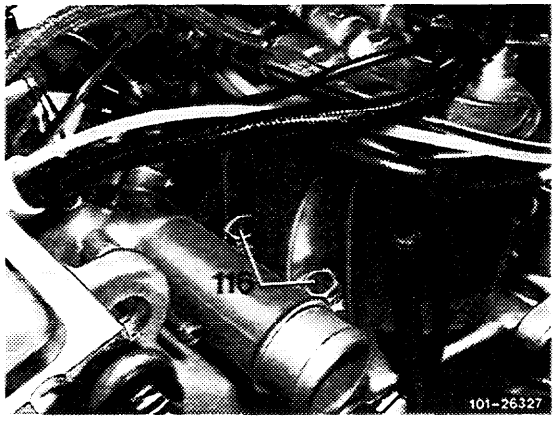
11 Disengage bowden *wire* (230) for engine regulation. For this purpose, push out slotted guide piece 240) on angle lever and remove bowden wire,



12 Pinch fuel lines and unscrew at fuel filter arrows).

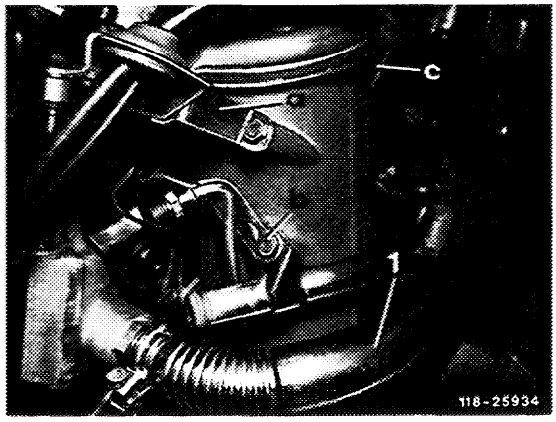


13 Unscrew both fastening screws (116) and remove fuel filter.



14 On engines with EGR, remove pipe line (1) between EGR valve and exhaust manifold.

15 Unscrew exhaust flange from exhaust manifold.



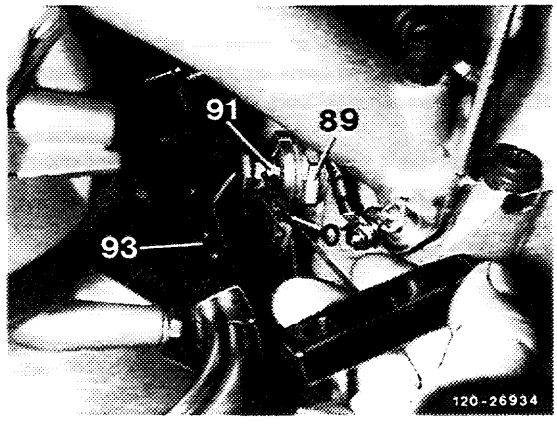
16 Remove injection lines.

17 Remove intake manifold.

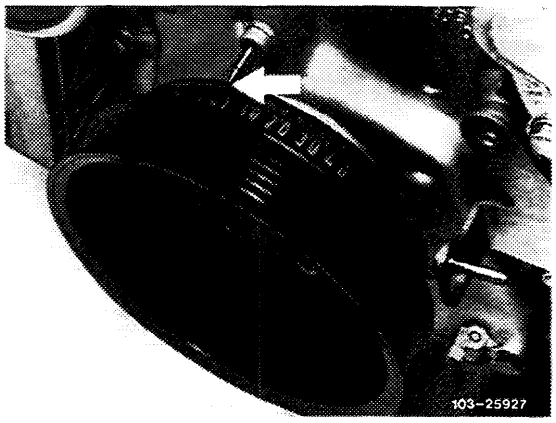
18 Remove cylinder head cover.

19 Pull off lock (91) for heater feed line (by means of a hook [01].

20 Unscrew pipe elbow (93) on oil filter and pull from connection (89).



21 Unscrew electric lines on pencil element glow plugs.

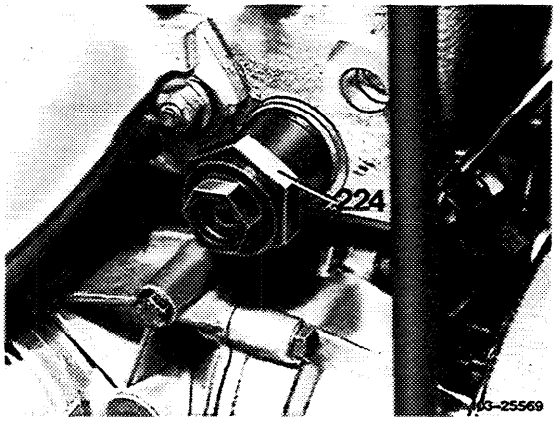


22 Set engine to ignition TDC of 1st cylinder.

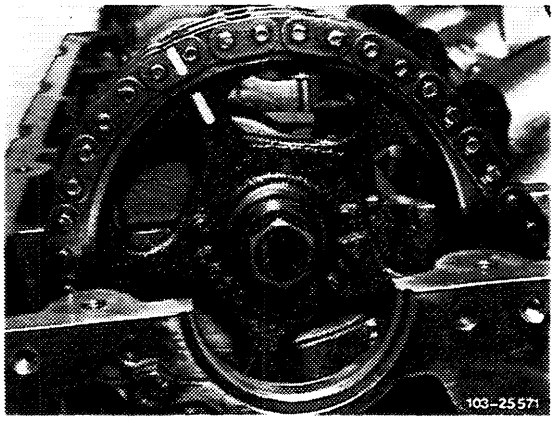
Attention!
Do not rotate engine at fastening screw of camshaft timing gear.

Do not rotate engine in reverse.

23 Completely remove chain tensioner (224) (05–310).



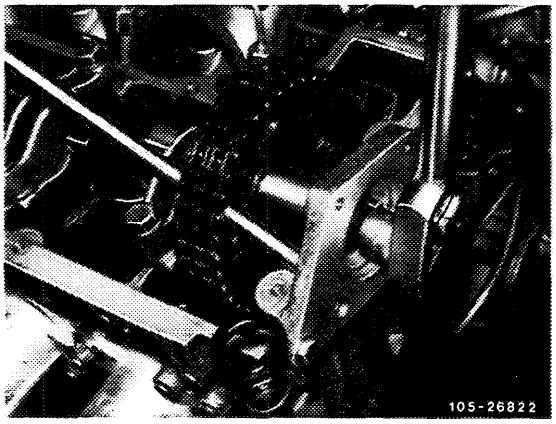
24 Mark camshaft timing gear and timing chain in relation to each other.



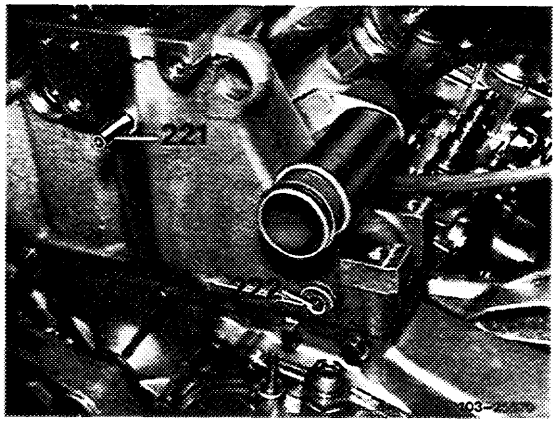
25 Remove camshaft (05–220). For this purpose, unscrew fastening screw of camshaft timing gear. Apply counterhold to camshaft timing gear by means of a screwdriver or steel bolt

Remove camshaft timing gear and lower timing chain into chain box.

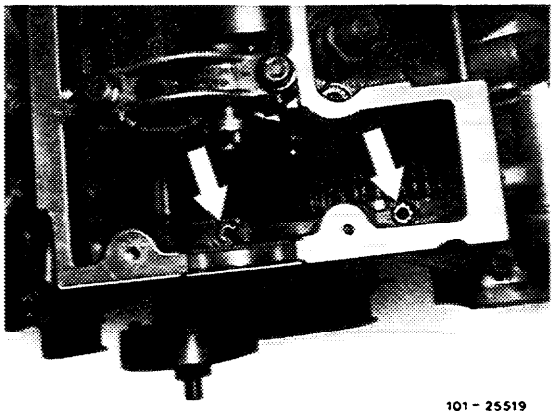
Note: Uniformly loosen all camshaft bearing caps.



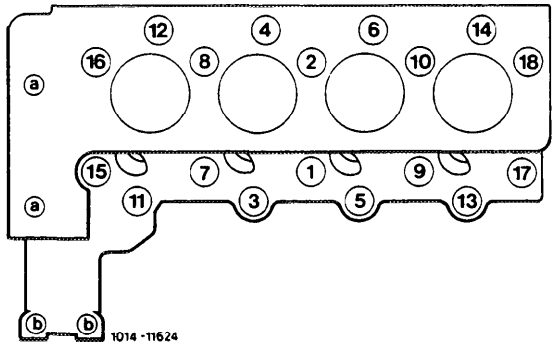
26 Knock out slide rail bolts (221 and 222) with impact puller and remove guide rail.



27 Unscrew both cylinder head screws M 8 (arrows) with screwdriver.



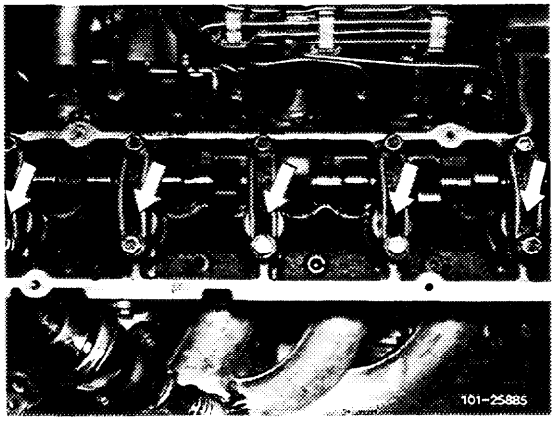
28 Loosen cylinder head screws in vice versa sequence of tightening diagram by means of screwdriver and unscrew.



Note: Cylinder head screws 2, 8, 10, 16 and 18 are located in shafts of camshaft bearing brackets (arrows).

29 Lift off cylinder head.

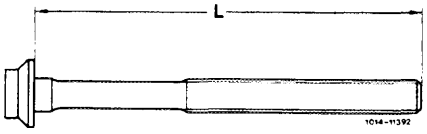
30 Clean cylinder crankcase and cylinder head parting surfaces.



31 Mount new cylinder head gasket.

32 Mount cylinder head. Pay attention to clamping sleeve for locating cylinder head.

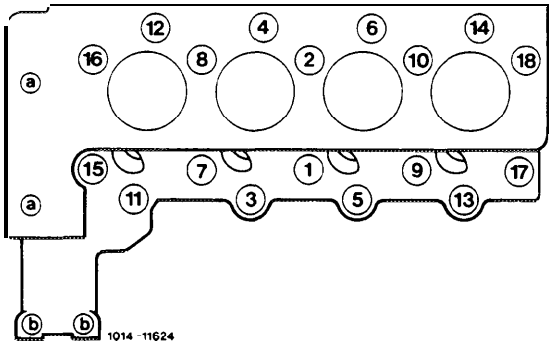
33 Measure length (L) of cylinder head screws. If the dimension named in Table is exceeded, use new cylinder head screws (01–405).



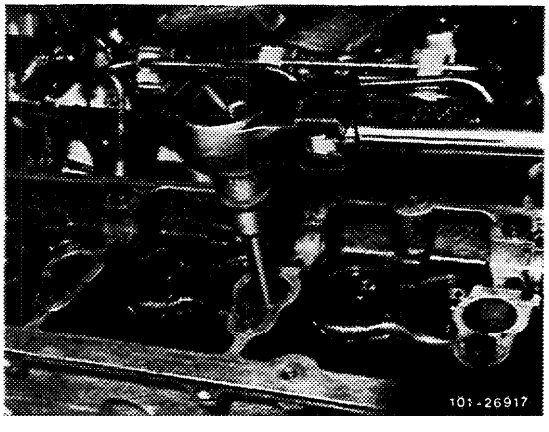
Thread dia.	Length (L) when new	Max. length (L)
M 10	80	83.6
M 10	102	105.6
M 10	115	118.6

34 Lubricate cylinder head screws on threads and on head contact surface and insert.

35 Tighten cylinder head screws in steps in sequence of tightening diagram, starting with screw 1.



Attention!
Tighten cylinder head screws to initial torque and angle of rotation torque (01-405).
Estimate angle of rotation. For this purpose, place adjustable torque wrench in release position (locked) into plug-in ratchet. Position adjustable torque wrench with plug-in ratchet lengthwise in relation to engine and keep turning until it is transverse in relation to engine.

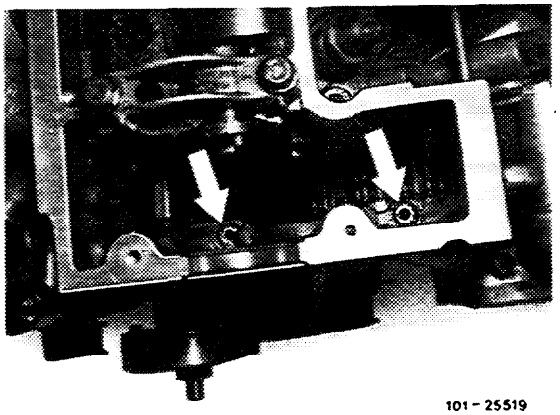


Do not use torsion bar torque wrench.

Tightening torques and angle of rotation torque of cylinder head screws

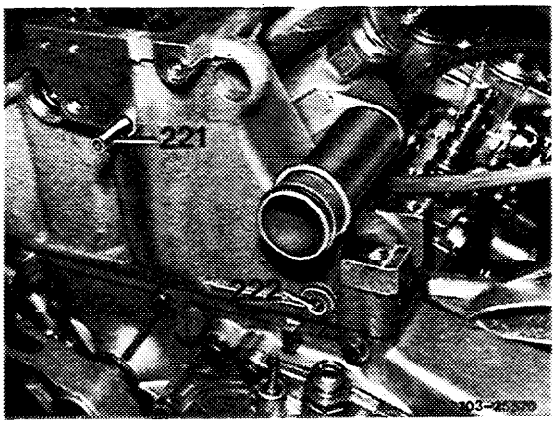
1st stage	**25** Nm
2nd stage	40 Nm
Setting interval	10 min
3rd stage	90°
4th stage	90°

36 Tighten screws M 8 (arrows) by means of screwdriver with tommy handle.



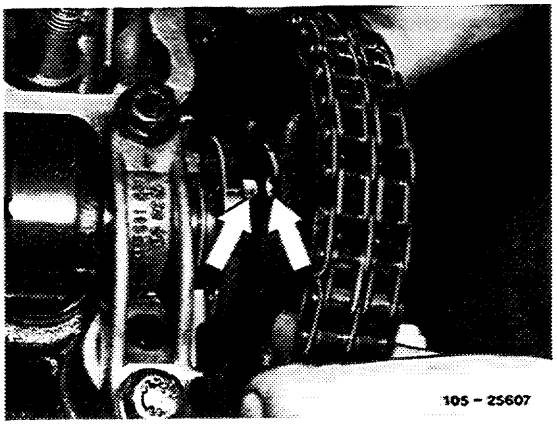
101 - 25519

37 Install guide rail for timing chain. For this purpose, insert slide rail bolts (221 and 222) into cylinder head.



38 Install camshaft, while paying attention to color mark.

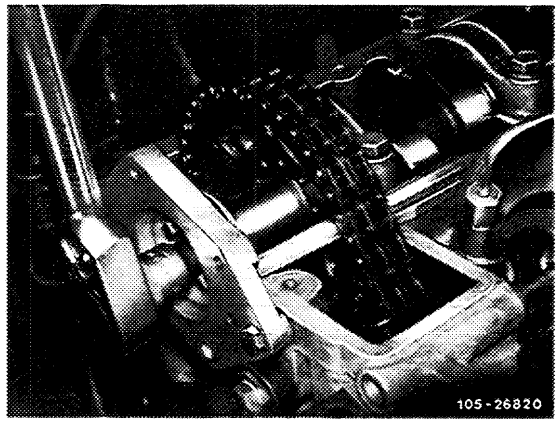
Note: The camshaft timing gear is centered by means of a cylindrical pin (arrows).



105 - 25607

39 **Position fastening screw of camshaft timing gear and tighten to 45 Nm.**

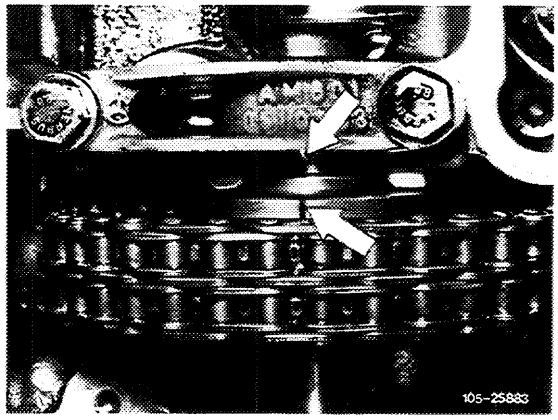
For this purpose, apply counterhold to camshaft timing gear with a screwdriver or steel pin.



40 Install chain tensioner and tighten to 80 Nm.

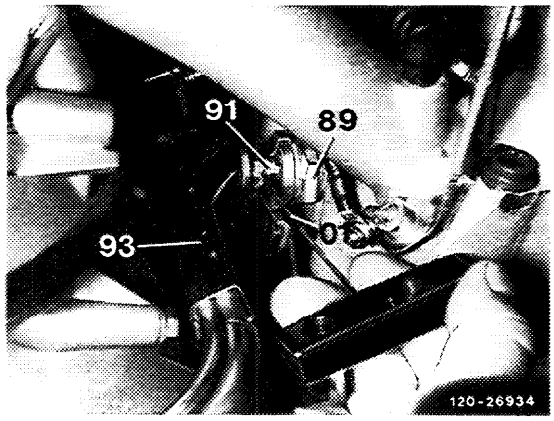
41 **Rotate engine and set to ignition TDC of 1st cylinder. Check adjusting marks.**

The notch in flange of camshaft must be in alignment with (cast-on) lug on cylinder head (arrow).



42 Mount electric lines for pencil element glow plugs.

43 Mount pipe elbow (93) with new O-ring.

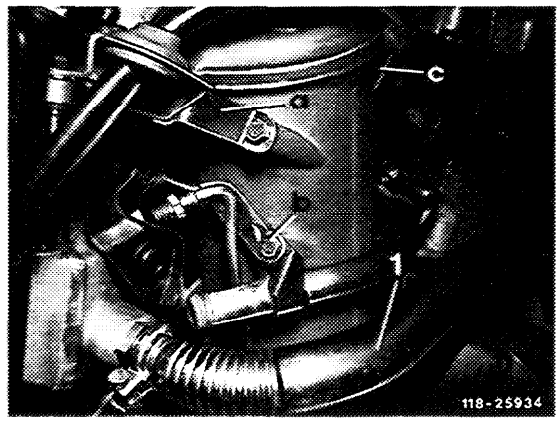


44 Install intake manifold.

45 Install injection lines.

46 Screw exhaust system to exhaust manifold.

47 On vehicles with EGR, install pipe line (1) between EGR valve and exhaust manifold.

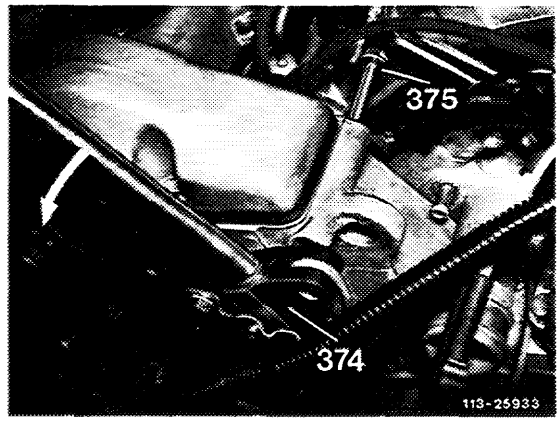


48 Install fuel filter and fuel lines,

49 Screw on holder for oil dipstick guide tube.

50 On vehicles with level control, mount pressure oil pump and driver.

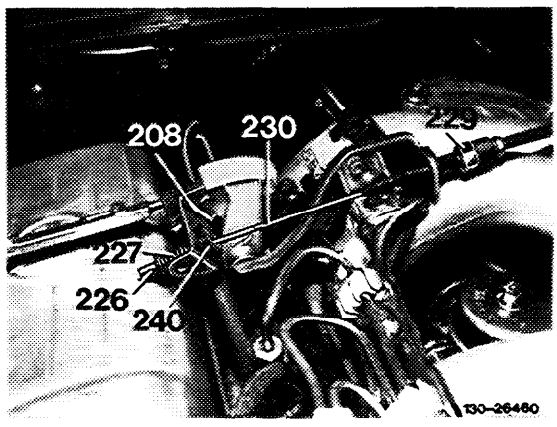
51 Mount tensioning device for V-belt. For this purpose, swivel spring tensioning lever (374) by means of a mandrel against force of draw spring (380) to the left until screw (375) can be pushed through spring tensioning lever. Position collar nut and tighten.



52 Mount cylinder head cover.

53 Engage bowden wire for engine regulation and adjust, if required (30-300).

54 Plug on cable for temperature switch.



55 For further installation proceed vice versa.

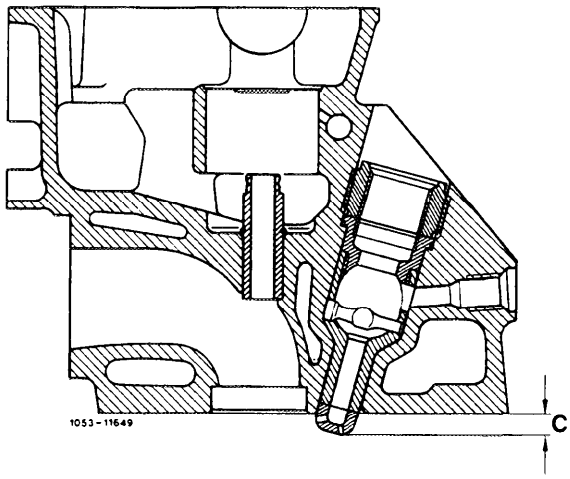
56 Fill in coolant (20-010) and pressure-test cooling system.

57 Run engine and check for leaks.

Note: Retightening of cylinder head screws is not required.

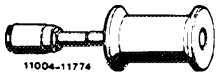
Data

hechamber standout on cylinder head
dimension "c" 7.6-8.1 mm



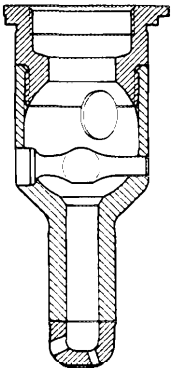
Tightening torques	Nm
Coupling nuts of injection lines (reference value)	1 O-20
Screws for cylinder head cover	10
Prechamber in cylinder head (threaded ring)	100 ± 10
Nozzle holder in prechamber	70 + 10

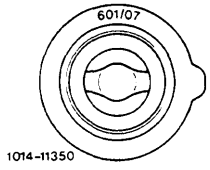
Special tools

Box end wrench element, open, 14 mm, 1/4" drive, for coupling nut of injection line	11004-10520n	000589770300
Wrench element for threaded ring of prechamber	11004-6360	615 589 00 07 00
Socket wrench element 27 mm, 1/2" square		001 589 65 09 00
Impact puller for prechamber	 11004-11774	601 589 06 33 00

Note

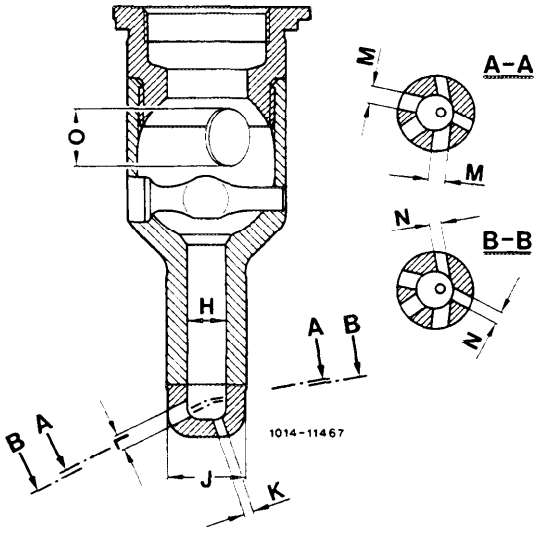
The prechamber is identified at upper flange with code number 601/07.





6 burner bores of different diameter are located on prechamber lower half (burner neck) at different levels and angle positions.

The firing duct (H) has a diameter of 7 mm and the burner neck (J) of 14 mm.



H Firing duct	7.0 mm dia.
J Burner neck	14.0 mm dia.
K Burner bore	1.5 mm dia.
L Burner bore	2.0 mm dia.
M Burner bore	3.2 mm dia.
N Burner bore	3.0 mm dia.
0 Bore for glow plug	10.0 mm dia.

In **addition, the prechamber floor is designed as a spherical depression.**

This spherical shape provides uniform wall thicknesses in range of burner bores.

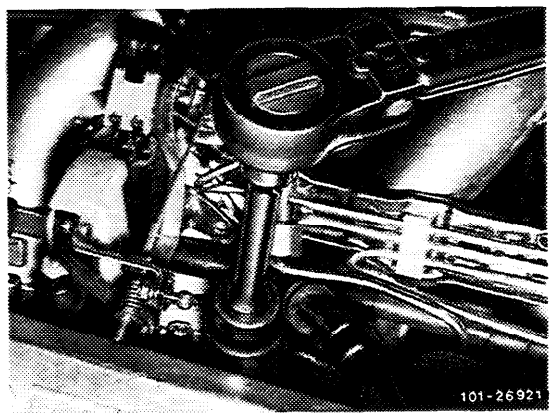
Removal

1 Unscrew injection lines from injection nozzles and loosen holder for injection lines on intake manifold.

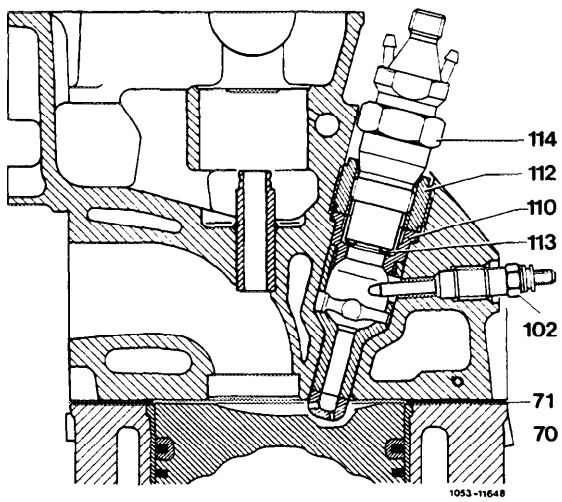
2 Pull fuel return flow hoses from injection nozzles.

3 Unscrew holder for bowden wire of engine regulation and put aside.

4 Unscrew nozzle holder complete with socket wrench element (27 mm).



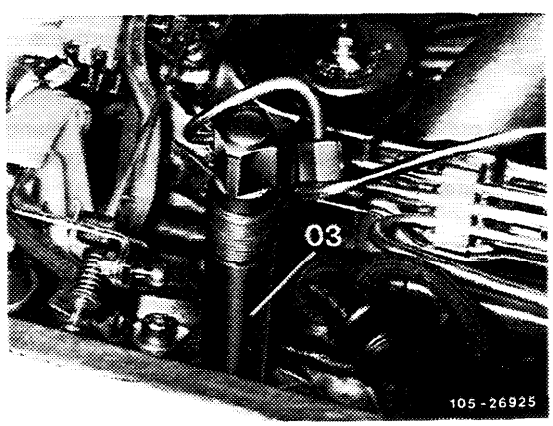
5 Remove pencil element glow plugs.



70 Cylinder crankcase
71 Cylinder head gasket
102 Pencil element glow plug
110 Prechamber
112 Threaded ring
113 Nozzle reed
114 Nozzle holder

6 Unscrew threaded ring (112) with pin wrench.

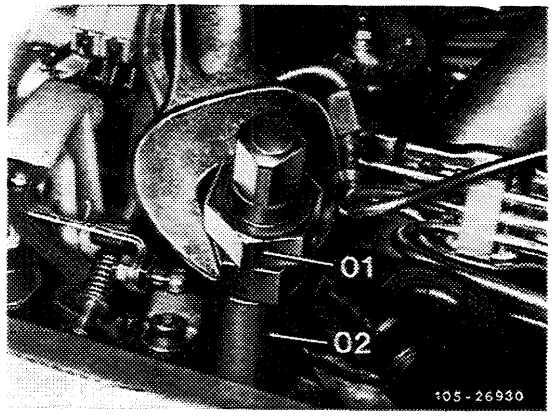
For this purpose, screw threaded member (03) into threaded ring, place sleeve (02) into grooves of threaded ring (arrows) and tighten with nut (01).



03 Threaded member

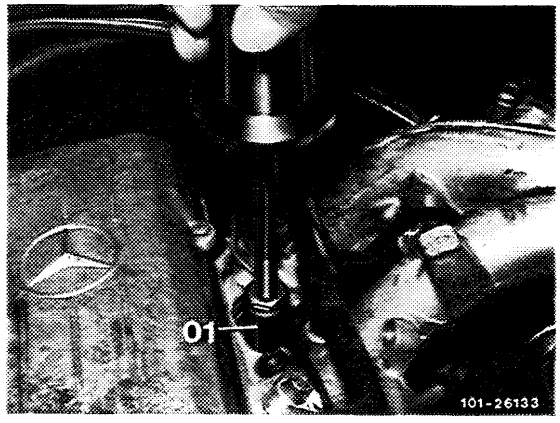
Sleeve (02) should be tight enough in grooves, so that it will not slip out of grooves when loosening threaded ring.

Insert wrench at hexagon of sleeve (02) and unscrew threaded ring.



01 Nut
02 Sleeve

7 Pull out prechamber with impact puller, part no. 601 589 06 33 00.



8 Cover bore in cylinder head.

Installation

Note: If the removed prechambers are again installed, check for perfect condition.

Ball pin should not be burnt or covered with scale.

In addition, if the burner tops are showing burn marks or cracks are showing in prechamber lower half, remove intake manifold and check inside for traces of oil.

If oil moistened spots are found, check vacuum pump for damage or renew vacuum control unit on injection pump.

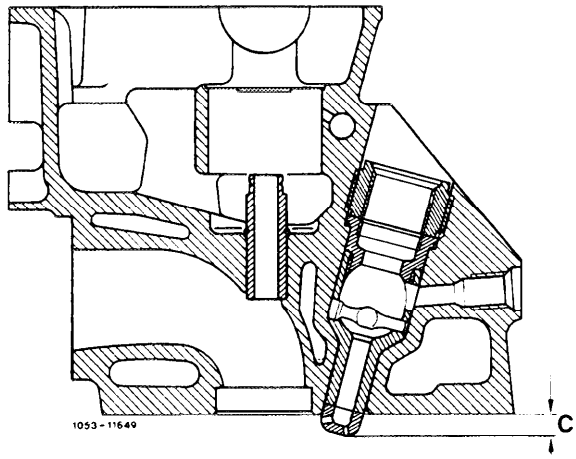
The vacuum lines (blackened by oil) are showing which of the two parts of the unit has failed.

If a cylinder head is faced at parting surface, the required distance (c) of 7.6-8.1 mm must be maintained.

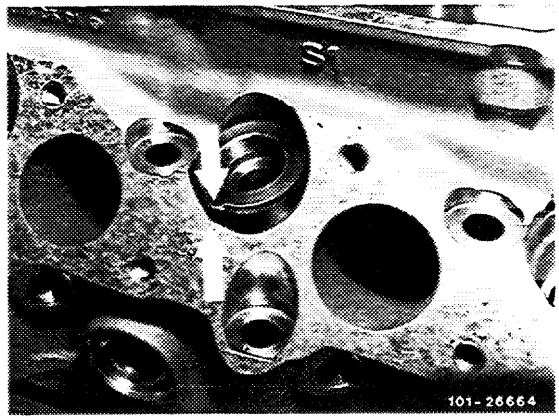
For this purpose, select appropriate sealing ring and insert between cylinder head and prechamber.

The following sealing rings are available:

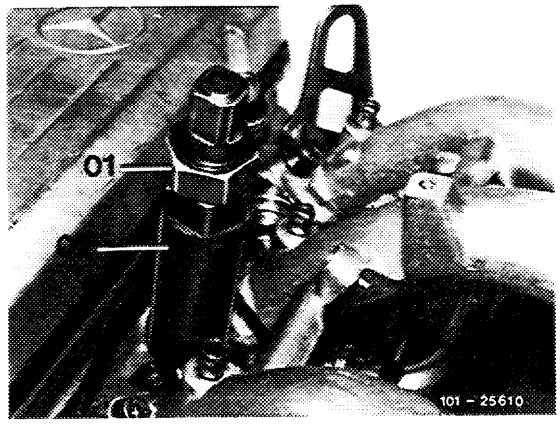
Thickness	Part no.



9 Position prechamber in such a manner that the lug is pointing toward recess in cylinder head (arrows).



10 Lubricate threaded ring (112 in Fig. item 5) and tighten with pin wrench to specified tightening torque (90-l 10 Nm).



11 Screw in glow plugs (102) and connect.

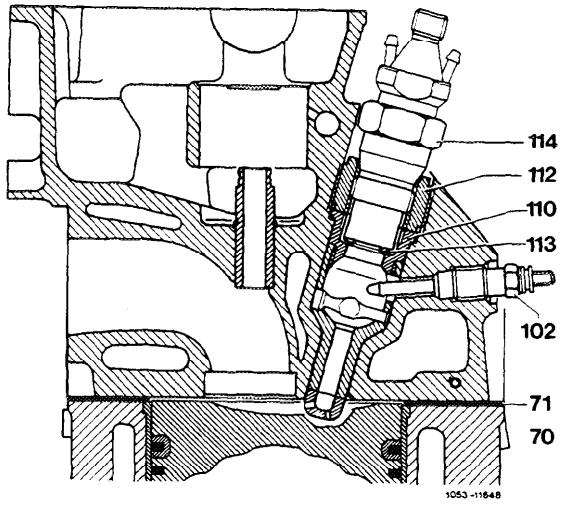
12 Insert new nozzle reed (113).

13 Completely screw in nozzle holder (114) and tighten to 70-80 Nm.

14 Plug fuel return hoses on injection lines.

15 Mount injection **lines.**

16 Screw on holder for bowden wire of engine regulation and adjust bowden wire, if required (30–300).



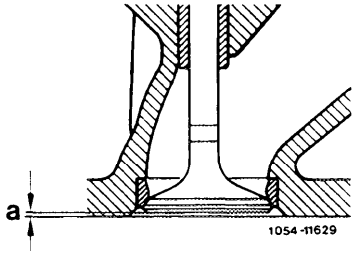
70 Cylinder crankcase
71 Cylinder head gasket
102 Pencil element glow plug
110 Prechamber
112 Threaded ring
113 Nozzle feed
114 Nozzle holder

Data

Total height of cylinder head		142-144
Minimum height after machining		
Permissible unevenness of parting surfaces	in longitudinal direction	0.08
	in transverse direction	0.0
Permissible deviation in parallel of upper parting surface in relation to lower surface in longitudinal direction		0.1
Roughness		0.016
Test pressure with air under water in bar gauge pressure		2

Minimum distance "a" with new valves and new valve seats

intake	+0.17 to -0.23
exhaust	+O. 12 to -0.28



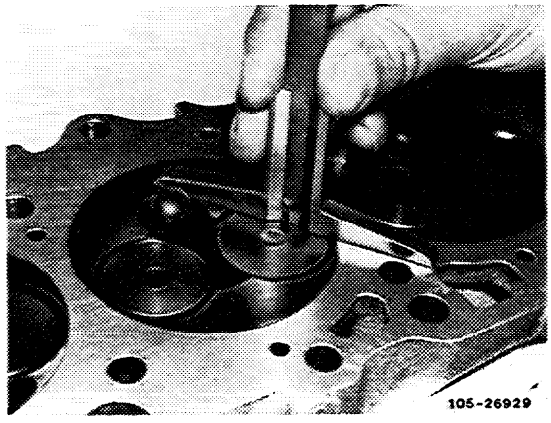
Max. distance "a" (depth) on new valves and machined valve seats	
intake	1.0
exhaust	

Facing

1 Face cylinder head parting surface.

2 Refinish valve seats until minimum distance "a" has been attained.

3 Check timing (05–215).

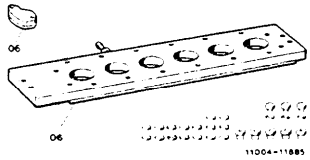
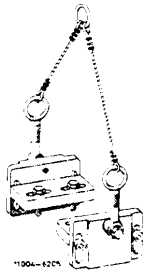


01-420 Pressure-testing cylinder head

Data

Test pressure with air under water in bar gauge pressure	2

Special tools

Pressure plate		601 589 00 25 00
Suspension device		115589346300

Conventional tool

Electrically heated water basin	e.g. Otto Dürr, D-71 23 Sachsenheim-Ochsenbach

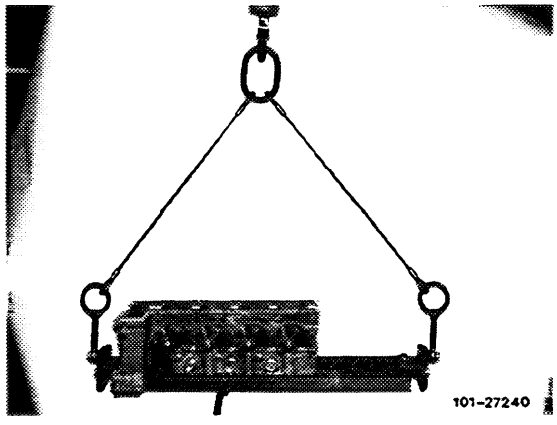
Pressure-testing

Pressure-test cylinder head if cracks (coolant losses) are suspected.

1 Screw pressure plate on cleaned cylinder head.

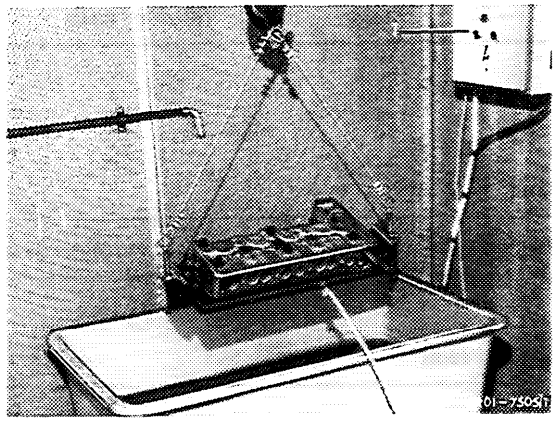
2 Close bores and connections.

3 Connect compressed air hose (1) and regulate compressed air to 2 bar gauge pressure.



4 Fasten cylinder head on suspension device and immerse into heated water basin (80 °C).

5 When air bubbles are rising, find leaking spot.



03 Crankshaft assembly

	Job No.
Crankshafts, connecting rods and pistons	
Checking, renewing and tightening connecting rod bolts	03-310
Reconditioning and squaring connecting rods	313
Removal and installation of pistons	316
Checking and reconditioning of crankshaft	318
Mounting of crankshaft	320
Replacing front crankshaft radial sealing ring	324
Replacing rear crankshaft radial sealing ring	327
Removal and installation of radial ball bearing in crankshaft	330
Removal and installation of crankshaft pulley at hub	341
Checking and correcting adjustment of TDC transmitter	345
Removal and installation of crankshaft timing gear.	350
Flywheel of driven plate and ring gear	
Removal and installation of flywheel and driven plate	410
Refinishing of flywheel	420
Renewing ring gear of flywheel	430

03-3 10 Checking, renewing and tightening connecting rod bolts

Dimensions of connecting rod bolt

Part no.	Thread dia.	Necked-down shank dia. c when new (Fig. item 1)	Minimum necked-down shank dia. c
601 038 01 71	M 9 x 1	7.4-o. 1	7.1

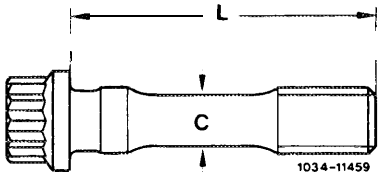
Tightening connecting rod bolt

Initial torque	30 + 5 Nm
Angle of rotation torque	90-l 00”

Checking

1 Measure minimum necked-down shank dia. prior to re-use.

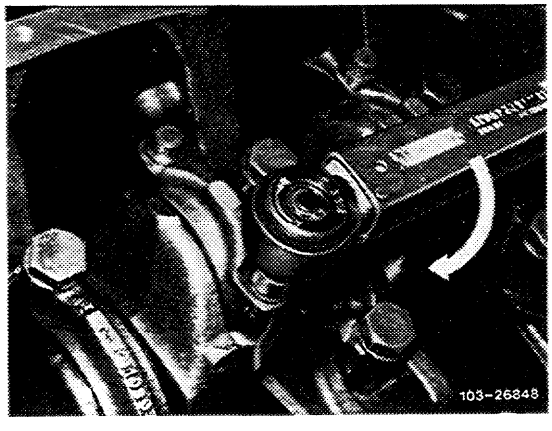
Note: If the minimum necked-down shank dia. of 7.1 mm is attained or less, renew connecting rod bolt.



Tightening

2 Lubricate threads and screw head contact area.

3 Tighten connecting rod bolt to 30 **Nm initial torque and 90–100° angle of rotation torque.**



Note: Estimate angle of rotation. For this purpose, place adjustable torque wrench **in release position** (locked) into plug-in ratchet. Position adjustable torque wrench with plug-in ratchet lengthwise in relation to engine and keep turning until it is transverse in relation to engine.

03-313 Reconditioning and squaring connecting rods

Data

Center of connecting rod bearing bore to center of connecting rod bushing bore	engine 601.911	148.97 149.03
	engine 60 1.92 1	144.97 145.03
Width of connecting rod (B) at connecting rod bearing bore and connecting rod bushing bore		23.835 24.165
Basic bore for connecting rod bearing shells		5 1.600 51.619
Basic bore for connecting rod bushing	standard dimension	29.500 29.521
	repair stage	
Connecting rod bushing OD	standard dimension	29.560 29.600
	repair stage	
Connecting rod bushing ID		27.018 27.024
Roughness of connecting rod bushing, inside		0.004
Permissible offset of connecting rod bearing bore in relation to connecting rod bushing bore with reference to 100 mm length		0.1
Permissible deviation of parallel axle alignment: Connecting rod bearing bore in relation to connecting rod bushing bore with reference to 100 mm length		0.045
Permissible difference in weight of complete connecting rods within one engine		5 g

Tightening torque

Connecting rod bolts	initial torque	30 + 5 Nm
	angle of rotation	90-l 00"

Special tool

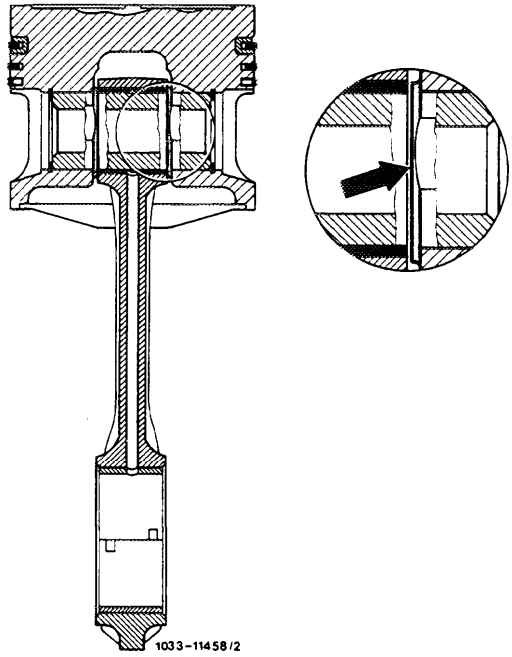
Torque wrench, single-arm, emitting signal, with plug-in ratchet, 1/2" square, 25-130 Nm		001 589 66 21 00

Conventional tool

Connecting rod straightener	e.g. Hahn & Kolb, D-7000 Stuttgart model BC 503

Note

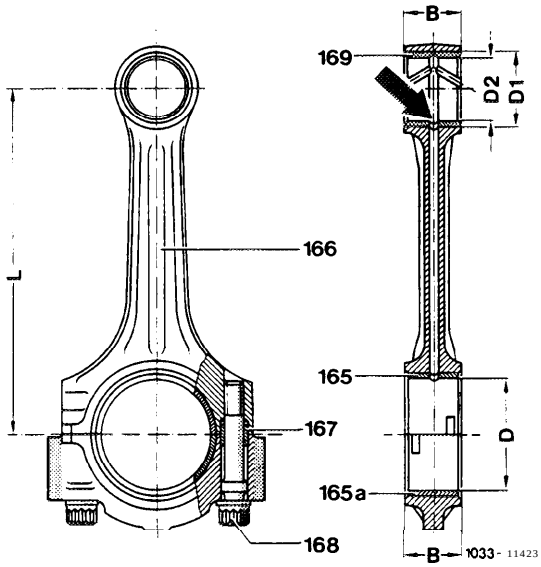
End play of connecting rods is not limited at crankshaft journals, but at piston pin eyes (piston-guided connecting rods). For this purpose, thrust surfaces (arrow) are cast onto piston pin eyes.



Connecting rod bearing and connecting rod bushing bores (B) are of similar width.

A weight compensation is attached at left and right on connecting rod bearing cap.

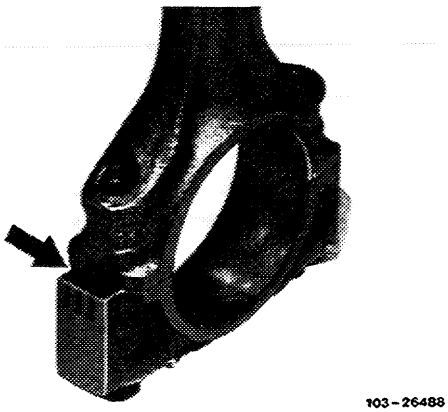
Only connecting rods of similar weight may be installed in one engine.



Connecting rods, which have become overheated as a result of bearing damage (blue coloring), may no longer be used.

Connecting rod and connecting rod bearing cap are marked together. There should be no transverse score marks and notches on connecting rod shaft.

As a spare part, connecting rods with machined connecting rod bushing are available.



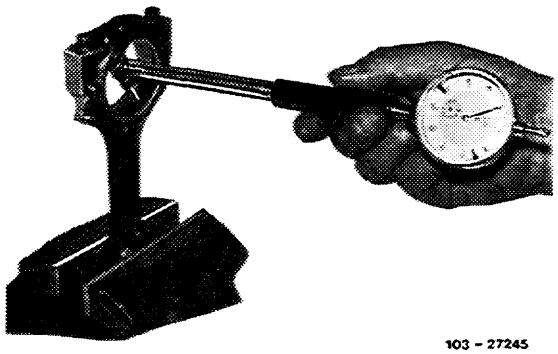
103-26488

Reconditioning

1 Check connecting rod screws and renew, if required (03-310).

2 Mount connecting rod bearing caps. For this purpose, lubricate threads and screw head contact surface and tighten to 30 + 5 Nm.

3 Measure connecting rod bearing basic bore. At a basic bore which exceeds the value of 51.619 mm or is conical, touch up bearing cap at its contact surface on a surface plate up to max. 0.02 mm.



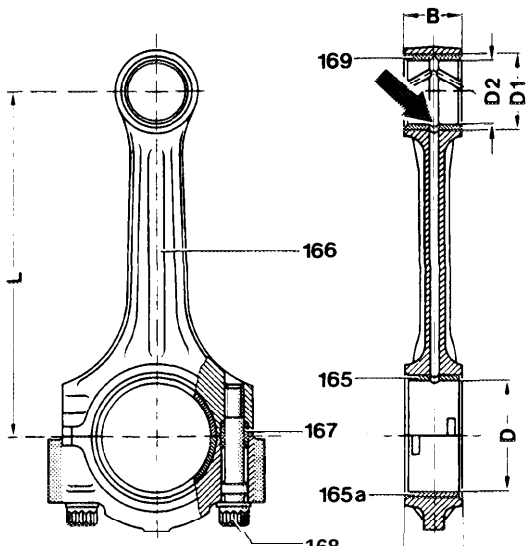
103 - 27245

4 Press in new connecting rod bushing in such a manner that the oil bores are in alignment (arrow).

Pressing-in pressure 2450 N.

5 Machine or ream connecting rod bushing.

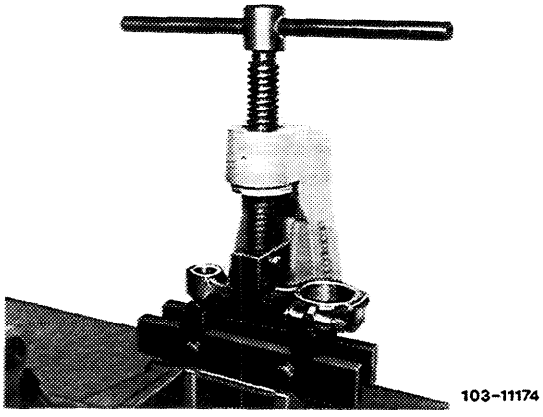
6 Touch up lateral thrust surfaces of connecting rod on surface plate.



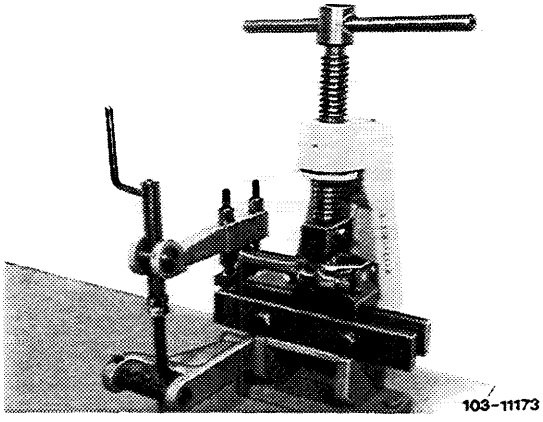
Squaring

7 **Square connecting rod with a connecting rod tester.**

8 **Align connecting rod bearing bore in relation to connecting rod bushing bore (parallel alignment).**



9 **Check offset of connecting rod bearing bore in relation to connecting rod bushing bore and correct, if required.**



Association piston – cylinder

Engine	Piston code number	Group code letter	Normal dimension std (standard) piston dia.	cylinder dia.
601.911	01	A	86.970-86.976	87 .OOO-87.006
		X	above 86.975-86.983	above 87.006-87.012
601.921	04	B	above 86.982-86.988	above 87.012-87.018

Piston standout

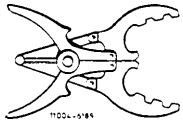
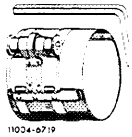
Distance between piston crown and cylinder crankcase parting surface	standout max. 0.96 standout min. 0.73

Test values		when new	wear limit
Piston clearance		0.017-0.043	0.12
Difference in weight of pistons in one engine		6 g	10 g
Piston pin dia.		26.995-27.000	
Piston pin clearance	in connecting rod bushing	0.018-0.029	
	in piston	0.004-0.015	
Connecting rod in piston (end play)		0.083-0.314	
Gap clearance of piston rings	groove 1	0.20-0.40	1.5
	groove 2	0.20-0.40	1.0
	groove 3	0.20-0.40	1.0
Side clearance of piston rings	groove 1	0.090-O. 120	0.20
	groove 2	0.050-0.080	0.15
	groove 3	0.030-0.065	0.1

Tightening torque

Connecting rod screws	initial torque	30 + 5 Nm
	angle of rotation torque	90-I 00"

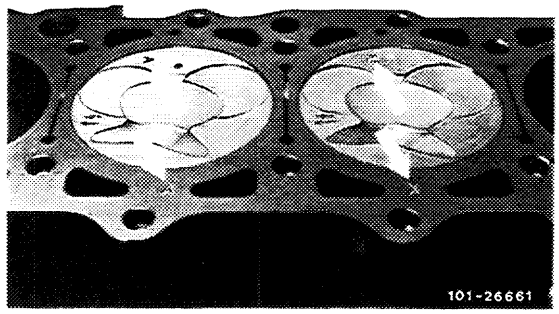
Special tools

Spreaders for piston rings		000 589 51 37 00
Clamping strap for piston rings		000 589 04 14 00

Note

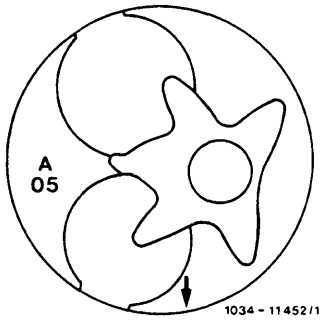
The group code letter A, X or B, the piston code number 05 or 06 and the driving direction arrow are punched into piston crown.

The group code letter is also punched into cylinder crankcase parting surface.

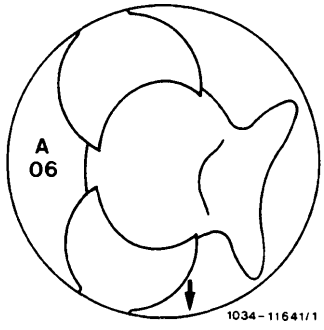


For repairs, only pistons with group code letters "X" are available, These pistons are also for installation in cylinder bores with group code letters "A" or "B".

In the event of repairs, hone cylinder bores according to dimensions of available pistons "X" plus piston clearance.



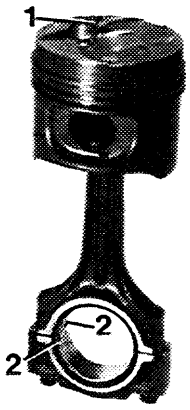
Engine **601.911**



Engine 601.921

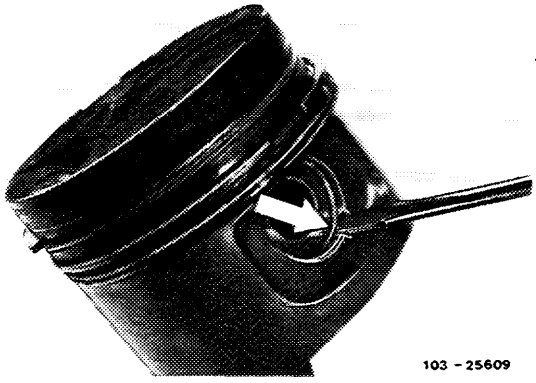
Removal

1 **Remove connecting rod with piston in upward direction.**

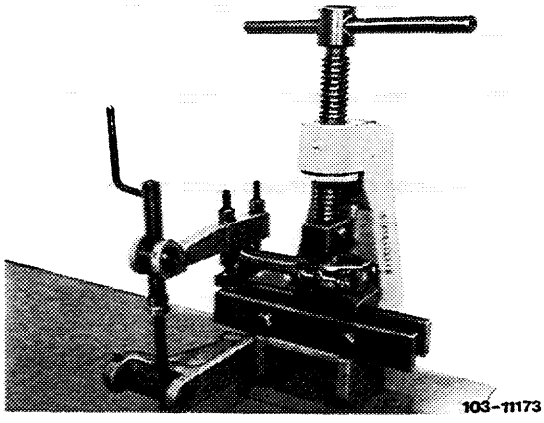


103-26983

2 **Remove piston pin circlip and push out piston pin.**


103 - 25609

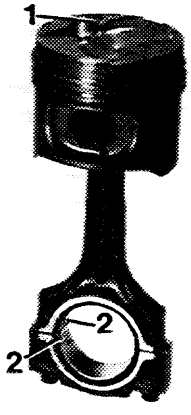
3 **Recondition connecting rod and square (03-313).**


103-11173

Installation

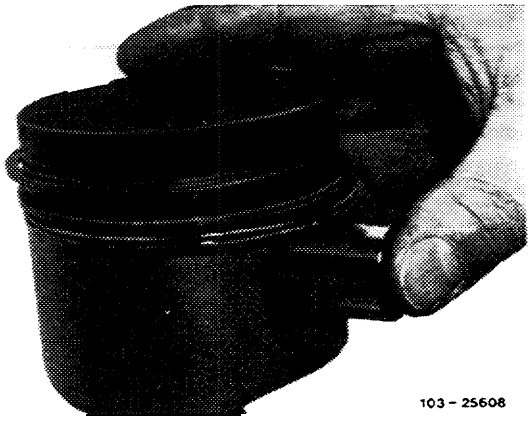
4 **Place piston on connecting rod in such a manner that arrow (1) points in driving direction and locking grooves (2) in connecting rod to lefthand engine side.**

Attention!
Do not heat pistons.



103-26983

5 Push in piston pins provided with engine oil manually.

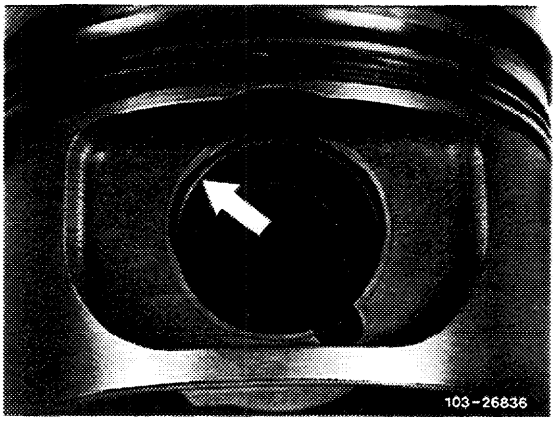


6 Insert piston pin circlip into groove.

Check piston rings for easy operation.

When installing used pistons, check piston rings for gap and side clearance.

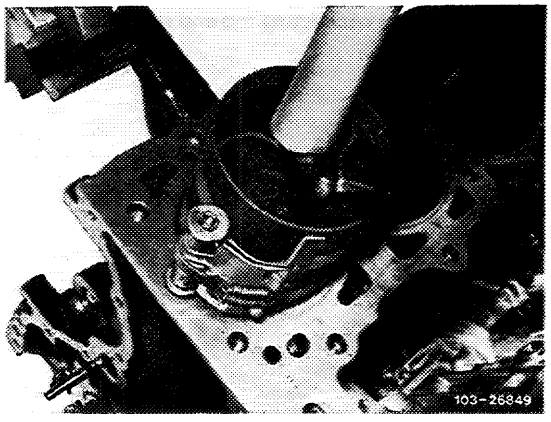
7 Lubricate cleaned cylinder bores, connecting rod bearing journals, connecting rod bearing shells and pistons.



8 Distribute gaps of piston rings uniformly along piston circumference.

9 Mount piston ring clamping strap and introduce pistons.

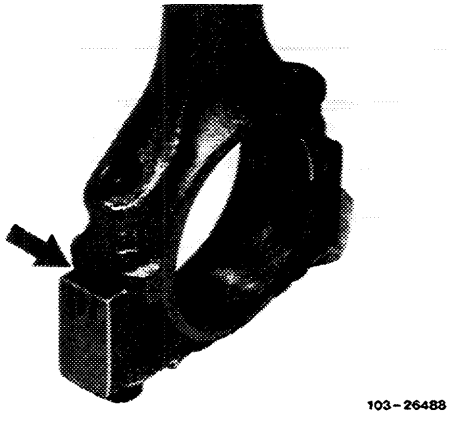
Arrow in piston crown should point in driving direction.



10 Mount connecting rod bearing caps with code numbers (arrow) in relation to each other on connecting rod. Lubricate threads and screw head contact surface of connecting rod screws and tighten to 30 Nm and 90–100° angle of rotation torque.

11 Rotate crankshaft and check clearance between connecting rod and crankshaft.

12 Measure distance between piston crown and cylinder crankcase parting surface in TDC position of pistons (refer to Table).



Data

Crankshaft normal dimension and repair stages	Crankshaft bearing journal dia.	Fitted bearing Associated thickness of thrust washers	Width of journal	Crankpin dia.	Crankpin width
Standard dimension	57.950 / 57.965	2,15	26.52 / 26.50	47.950 / 47.965	27.96 / 28.04
		2.20	26.62 / 26.60		
1st repair stage	57.700 / 57.715	2.25 or 2.35 or 2.40	26.72 / 26.70 or 26.92 / 26.90 or 27.02 / 27.00	47.700 / 47.715	up to 28.30
2nd repair stage	57.450 / 57.465			47.450 / 47.650	
3rd repair stage	57.200 / 57.215			47.200 / 47.215	
4th repair stage	56.950 / 56.965			46.950 / 46.965	

Permissible deviation of crankshaft journals and crankpins from true		0.005
Permissible conicity of crankshaft journals and crankpins		0.01
Permissible deviation of flywheel flange from true		0.02
Permissible axial runout of fitted bearing		0.02
Fillets	on crankshaft bearing journals	2.5 to 3.0
	on crankpins	3.0 to 3.5
Permissible deviation of crankshaft bearing journals from true when mounted in outer crankshaft bearing journals	journal II, IV	0.07
	journal III	0.10
Scleroscope hardness of crankshaft journals and crankpins		55-74
Permissible unbalance of crankshaft		15cmg

Special tool

Impact hardness tester		000 589 20 21 00

Note

When testing and reconditioning crankshafts, proceed in sequence of diagram shown below.

Diagram

*** Refer to section "Explanations concerning diagram".**

V = scrap.

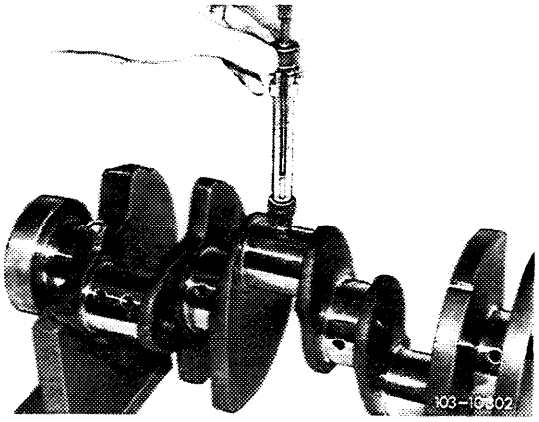
Visual checkup
Heavy damage?
yes
V
no
Crack test*
Cracks showing?
yes
V
no
Hardness test*
All bearing journals scleroscope hardness min. 60 on 2/3 of journal circumference
no
yes
Measure pin (journal) Dimensions in order?
no
yes
Lapping
Dimensional checkup Dimensions in order?
no
yes
Crankshaft, complete, balance, if possible
Check whether regrinding is still possible within last specified repair stage 4
no
V
no
V
yes
Crankshaft, straighten
Crankshaft, grind
Crack test Cracks showing?
no
Refer to lapping
Hardening+
Journal or pin with hardened fillets
Induction hardening facilities available?
no
yes
V
yes
Induc-tion hardening
Journal or pin without hardened fillets
Induction or flame hardening
Check hardness by etching*
Relieve crankshaft at 80 °C/176 °F for 2 hours
Refer to crank-shaft, straighten

Explanations concerning diagram

Crack test

Clean crankshaft. Bearing journals should be free of oil and grease.
Magnetize crankshaft and apply fluorescent powder (fluxing).
A color penetration method may also be used (immersion in bath or using spray can).

Agent: Paint or fluorescent powder,
cleaning agent,
developer



Hardness test

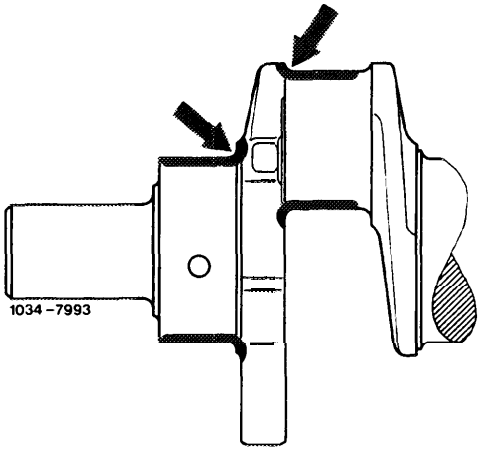
Test hardness with impact hardness tester (scleroscope hardness).

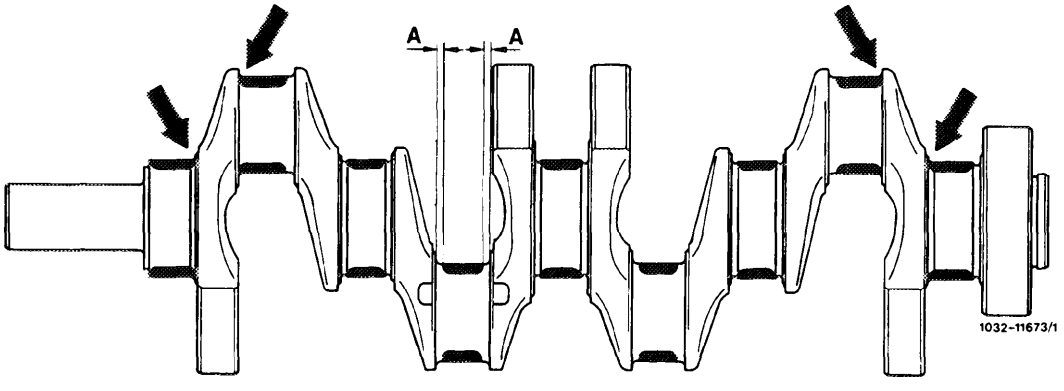
Minimum hardness of 55 should be available on 2/3 of journal (pin) circumference.

Hardening

Pins without hardened fillets can be inductance-hardened or flame-hardened. On the other hand, journals and pins with hardened fillets (arrows) should be inductance-hardened on principle. If this cannot be done, scrap crankshaft.

When hardening journals and pins without hardened fillets, the distance A between hardened runout and fillets radius (5-6 mm) must be maintained.





Checking the hardening results

For perfect hardening, check adjustment of hardening equipment by means of metallographic etching (grinding).

These tests can be made with test hardenings on scrapped crankshafts.

Check hardening by etching surface of journals or pins with a 2 % solution of alcoholic nitric acid (HNO_3).

No dark spots should appear on journal or pin surface.

Unhardened fillets will become dark.

Hardened fillets, on the other hand, should be as bright as the surface of pin or journal.

A journal or pin which has already passed metallographic inspection may be used for comparison.

Then carefully wash off nitric acid with alcohol.

Protection against corrosion

Crankshafts which are not immediately installed again should be lubricated with engine initial operation oil (SAE 30).

Data

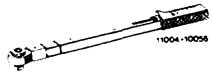
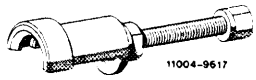
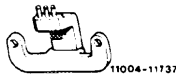
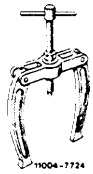
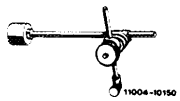
Crankshaft standard dimension and repair stages	Crankshaft bearing journal dia.	Fitted bearing Associated thickness of thrust washers	Crankshaft journal widths	Crankpin dia.	Crankpin width
Normal dimension	57.950 / 57.965	2.15	26.52 / 26.50	47.950 / 47.965	27.96 / 28.04
		2.20	26.62 / 26.60		
1st repair stage	57.700 / 57.715	2.25	26.72 / 26.70	47.700 / 47.715	up to 28.30
2nd repair stage	57.450 / 57.465	or 2.35	or 26.92 / 26.90	47.450 / 47.650	
3rd repair stage	57.200 / 57.215	or	or	47.200 / 47.215	
4th repair stage	56.950 / 56.965	2.40	27.02 / 27.00	46.950 / 46.965	

Basic bore and bearing play		Crankshaft bearings	Connecting rod bearings
Basic bore dia.		62.500 / 62.519	51.600 / 51.619
Basic bore width on fitted bearing		22.00 / 21.97	———
Connecting rod width		———	23.835 / 24.165
Permissible out-of-true of basic bore		0.01	
Permissible conicity of basic bore		0.01	
Bearing play, radial	when new	0.03 l-0.073 [1])	
	wear limit	0.08	
Bearing play, axial	when new	0.10-0.25	0.12-O-26
	wear limit	0.30	0.50

[1]) For radial clearance, try for mean value.

Bearing shells	Wall thickness crankshaft bearings	Width of bearing shells	Thickness of fitted bearing thrust washers	Wall thickness connecting rod bearings
Normal dimension	2.25	17.30-17.60	2.15 or 2.20	1.80
1st repair stage	2.37		2.25	1.92
2nd repair stage	2.50		or	2.05
3rd repair stage	2.62		2.35	2.17
4th repair stage	2.75		or	2.30
			2.40	

Tightening torques		Nm
Crankshaft bearing bolts		90
Connecting rod screws	initial torque	30 + 5
	angle of rotation torque	90–100°
Screw M 18 x 1.5 x 50 on crankshaft		370 + 40
Necked-down screws for flywheel or driven plate	Initial torque	30-40
	angle of rotation torque	90-l 00”

Special tools		
Torque wrench, singe-arm, with ratchet, 3/4'' square, 150-800 Nm		001 589 74 21 00
Torque wrench, single-arm, emitting signal, with plug-in ratchet, 1/2'' square, 25-130 Nm		001 589 66 21 00
Puller for crankshaft timing gear		601 589 07 33 00
Detent		601 589 02 40 00
Countersupport for internal puller		000589333300
Internal puller 14.5-18.5 mm for radial ball bearings		000589253300
Dial gauge holder for measuring end play		363589022100

Note

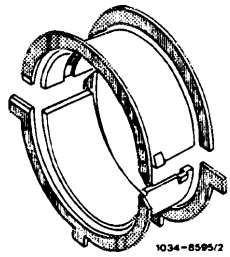
Engine removed and disassembled.

Main oil duct in cylinder crankcase open (01–130). Oil ducts in cylinder crankcase and in crankshaft carefully cleaned.

Check crankshaft for cracks, dimensional accuracy hardness and concentricity (93-318).

The 3rd crankshaft bearing is provided with thrust washers.

These thrust washers absorb the axial forces of crankshaft.

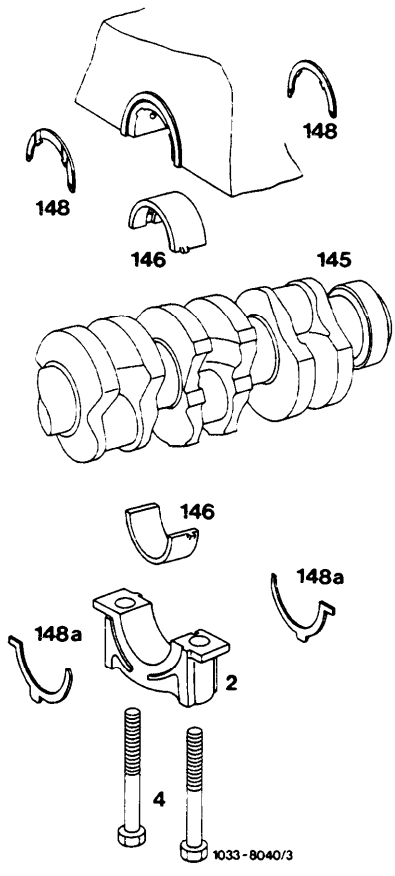


The thrust washers (148 and 148a) installed in cylinder crankcase and in bearing cap on both sides are of different shape.

As a torsion lock and to prevent assembly faults, the thrust washers in bearing cap are provided with two holding lugs, of which the outer one is installed off center.

When reconditioning crankshafts, regrind width of fitted bearing journals to one of the dimensions shown in Table (section "Data").

Associate thrust washers to respective journal or pin widths (Table).



2 Bearing cap
4 Screws M 12x60
145 Crankshaft
146 Bearing shell
148 Upper thrust washer
148a Lower thrust washer

Install thrust washers of the same thickness on both sides on principle.

Regrinding of thrust washers is not permitted.

As replacement parts, thrust washers are available in sets only. One set comprises an upper and a lower thrust washer (148 and 148a).

Thrust washer sets

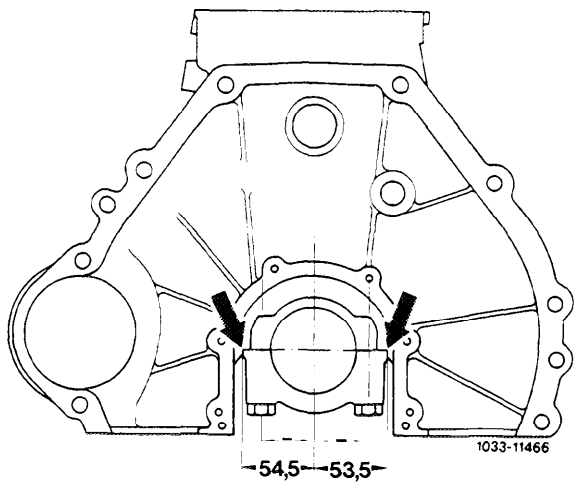
Thickness in mm	Set part no.
2.15	601 030 00 62
2.20	601 030 01 62
2.25	601 0300262
2.35	6010300362
2.40	601 030 04 62

Association of crankshaft bearings, installation of crankshaft

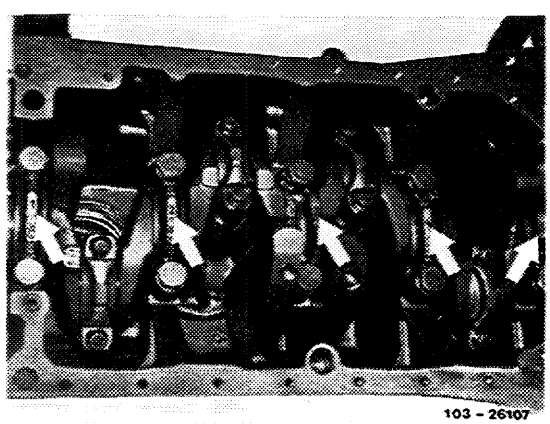
1 **Install crankshaft bearing cap.**

Note: All bearing caps are fitted laterally into crankcase (arrows) and are fastened with 2 screws M 12 x 60 each.

The pilot fit (arrows) is offset from center by 0.5 mm, so that the bearing caps can be mounted in one position only.



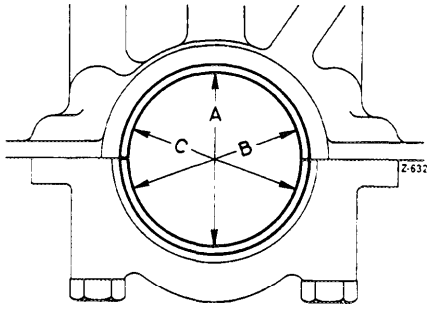
The bearing caps are additionally identified from the front to the rear with the code numbers 1, 2, 3, 4 and 5 (arrows), and should not be mixed up.



2 Lubricate screws for crankshaft bearing caps and tighten to 90 Nm.

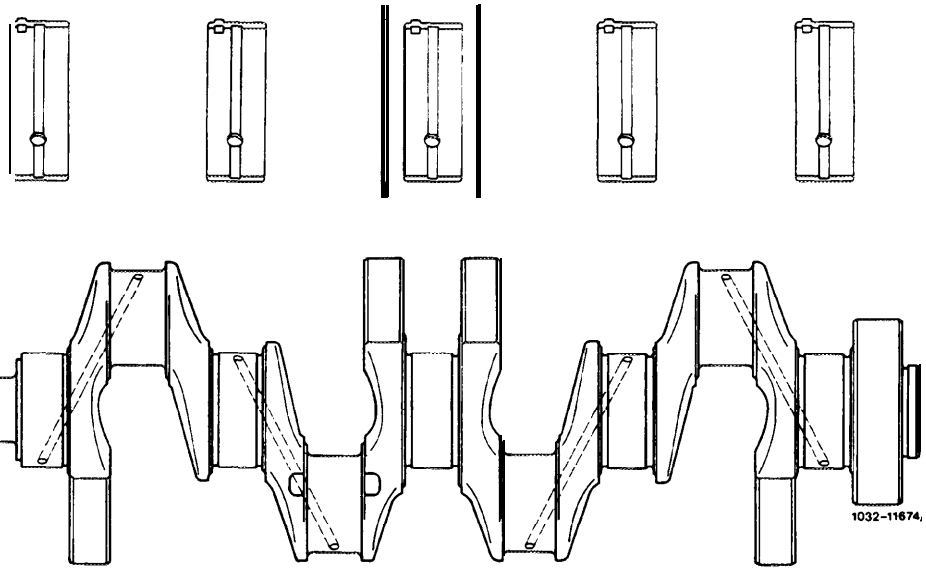
3 Measure basic bore in direction A, B and C on two levels (conicity).

If the specified value of a basic bore is exceeded, touch up bearing cap at its parting surface on a surface plate up to max. 0.02 mm.

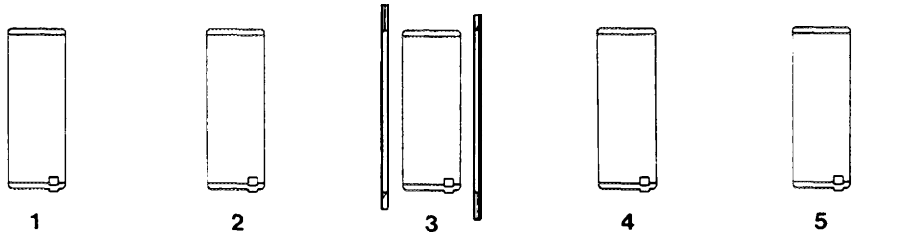


4 Insert crankshaft bearing shells, mount bearing caps, tighten screws to 90 Nm.

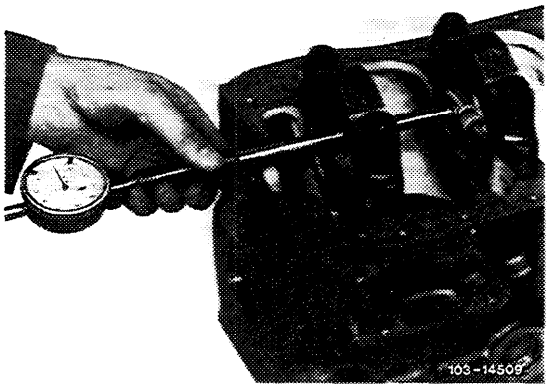
Housings



Caps

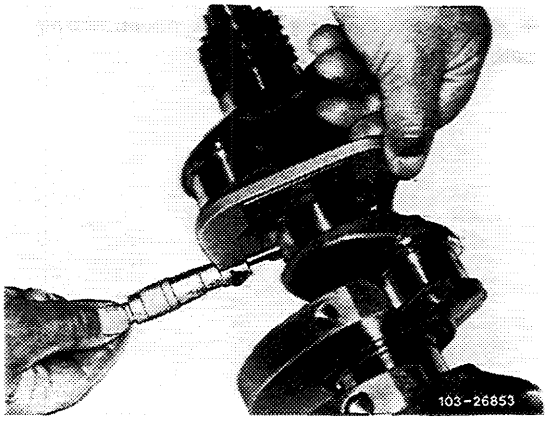


5 Measure bearing dia. and write down.

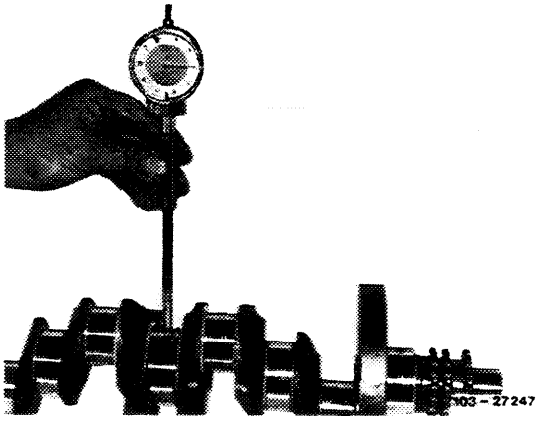


6 Measure crankshaft bearing journals, find crankshaft bearing radial play.

Note: The bearing play can be corrected by exchanging bearing shells, while trying for mean value of specified bearing play. Crankshaft bearing shells without color code are thicker than those with blue color code, while taking into account that the thickness of walls without and with color code may overlap.



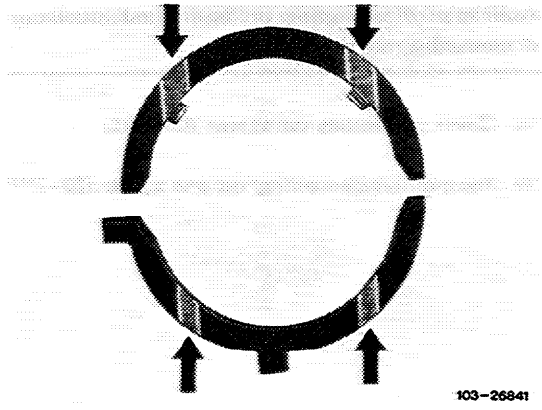
7 Measure width of fitted bearing journal and associate pertinent thrust washers (refer to Table, section Data).

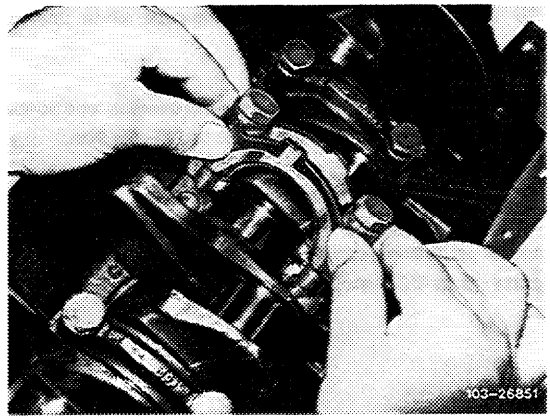


8 Lubricate bearing shells and crankshaft with engine oil and install crankshaft.

9 Provide thrust washers with oil and slip into grooves on fitted bearing (crankcase).

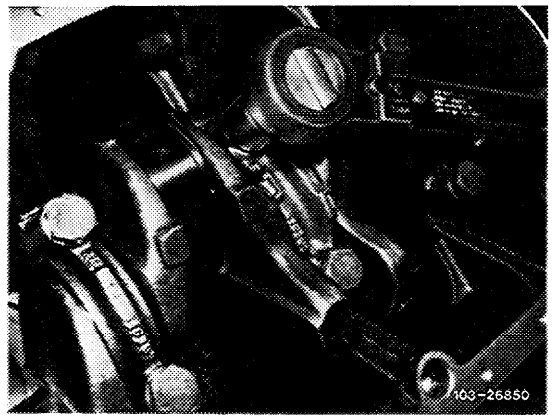
Attention!
Make sure that the two oil grooves (arrows) in thrust washers are pointing toward crankshaft webs.





10 Mount crankshaft bearing caps.

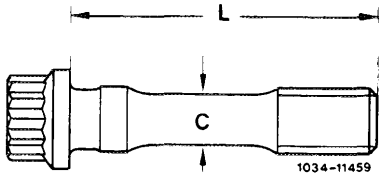
11 Tighten bearing caps to 90 Nm.



12 Measure crankshaft end play.

13 Rotate crankshaft manually and check for easy running.

Association of connecting rod bearing and installation of connecting rod



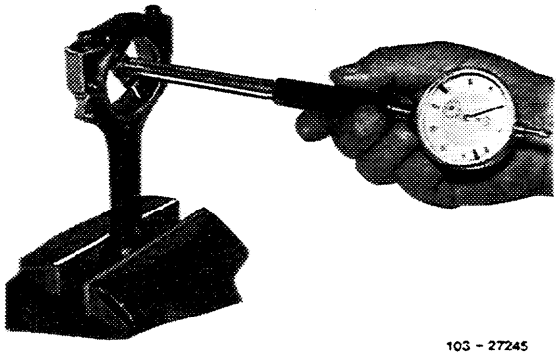
14 Check connecting rod screws (03-310).

15 Recondition connecting rod and square (03–313).

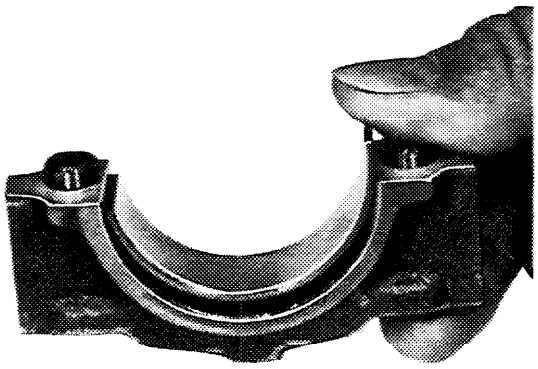
16 Mount connecting rod bearing caps, while paying attention to identification_

Lubricate connecting rod screws on threads and screw head contact surface and tighten to 30-40 Nm.

17 Measure basic bore in two directions. If one basic bore exceeds the specified value or if it is conical, touch up bearing cap at its parting surface on a surface plate up to 0.02 mm.



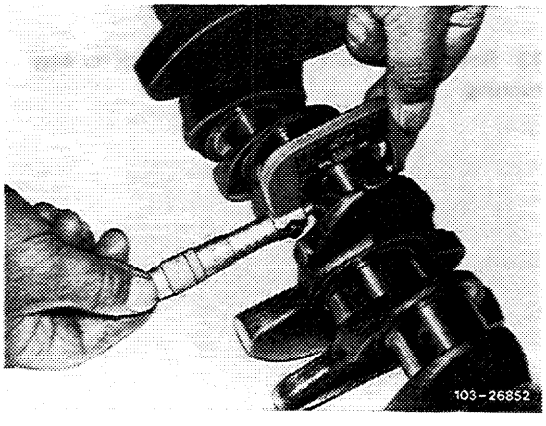
18 Insert connecting rod bearing shells, mount connecting rod bearing caps together with bearing shells and tighten connecting rod nuts to 30-35 Nm.



19 Measure bearing dia. and write down.

20 Measure crankpins, find connecting rod bearing radial play.

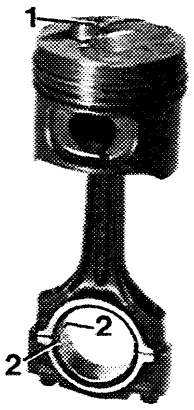
Note: The bearing play can be corrected by changing bearing shells, trying for medium value of specified bearing play. Crankshaft bearing shells without color coding are thicker than those with blue color coding, while taking into account that the thickness of wails without and with color coding may overlap.



21 **Attach piston to connecting rod (03–316).**

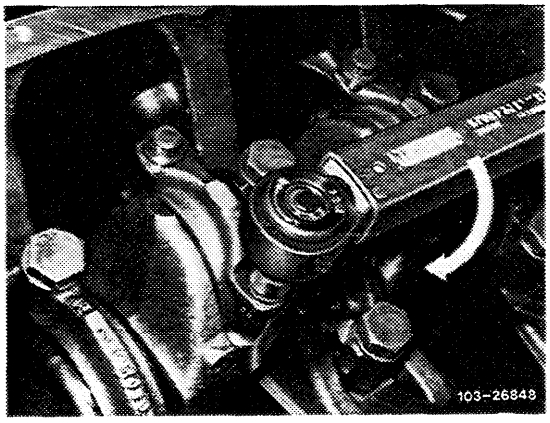
22 **Provide bearing shells, crankshaft, pistons and cylinder walls with engine oil, install connecting rod with piston (03–316).**

Pay attention to identification.



103-26983

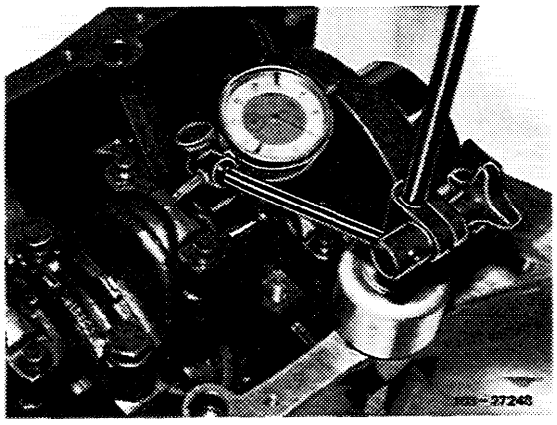
23 **Tighten connecting rod screws to 30 + 5 Nm initial torque and 90–100° angle of rotation torque.**



24 **Measure connecting rod bearing end play, while displacing connecting rod directly at piston pin. Check clearance of connecting rods in relation to crankshaft.**

Attention!
Disassemble oil pump and clean, renew, if required. Renew oil pressure relief valve. Disassemble oil filter and clean.

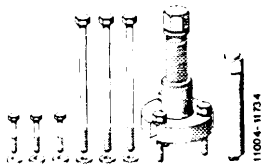
Install initial operation oil filter element. Change engine oil and oil filter element after 1000-1500 km



03-324 Replacing front crankshaft radial sealing ring

Tightening torques	Nm
Screw M 18 x 1.5 x 50 on crankshaft	370 + 40
Screws M 8 x 12 pulley to hub	25

Special tools

Torque wrench, single-arm, with ratchet, 3/4'' square, 150-800 Nm		001 5897421 00
Puller for hub		601 589 08 33 00
Detent		601589024000
Sleeve for pushing in radial sealing ring, front		601 589031400

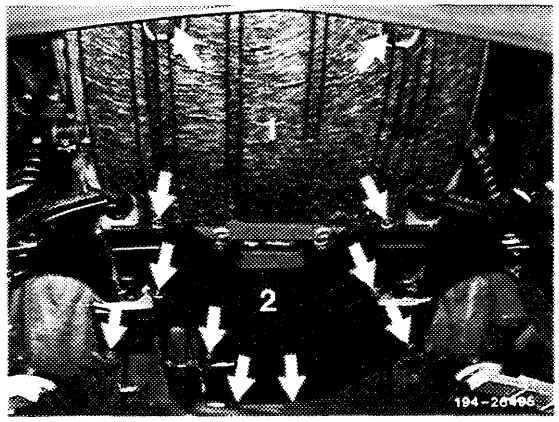
Conventional tool

Adapter 3/4'' square socket to 1/2'' square head	e.g. Hazet, D-5630 Remscheid order no. 1058 R-I

Removal

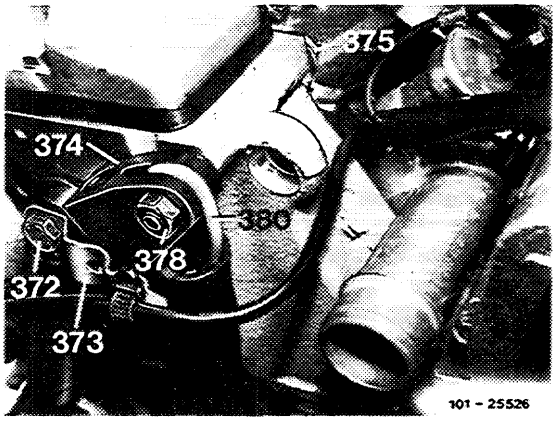
1 Remove noise capsule.

2 Remove radiator (20-420).

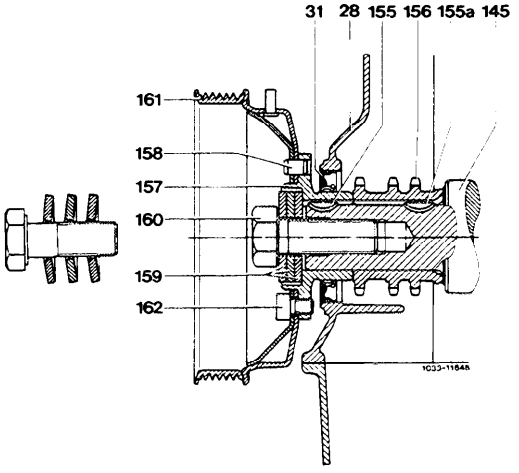


3 Slacken V-belt and remove. Unscrew flange nut (378) for this purpose. Insert a mandrel into spring tensioning lever (374) and relieve hex. screw (375) in relation to draw spring (380) until spring can be pushed back in direction of intake manifold.

Release spring tensioning lever and remove V-belt.



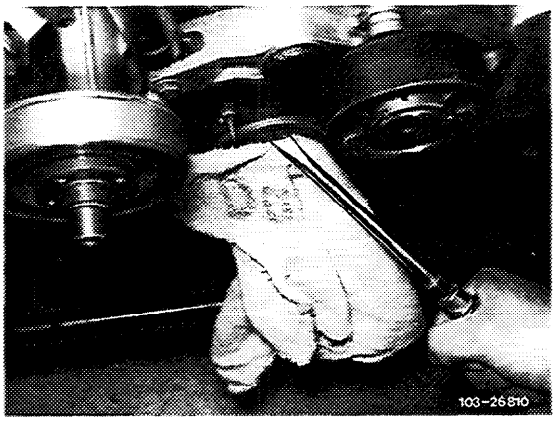
4 **Unscrew pulley (161) and pull off flange (157) (03-341).**



28 Timing housing cover
31 Radial sealing ring
145 Crankshaft
155 Woodruff key, hub
155a Woodruff key, sprocket
156 Sprocket
157 Hub
158 Cylindrical pin
159 Cup spring
160 Screw M 18 x 1.5 x 50
161 Pulley
162 Combination screw M 8 x 12

5 Push out radial sealing ring by means of a screwdriver. Make sure that crankshaft journal and mounting bore are not damaged.

6 Check hub (157) for score marks of radial sealing ring, renew hub, if required.

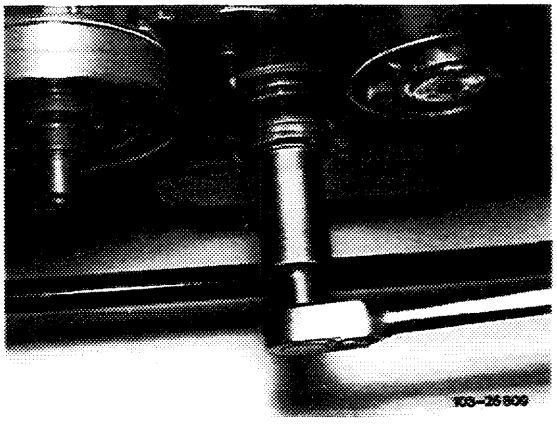


Installation

7 Deburr mounting bore for radial sealing ring and clean.

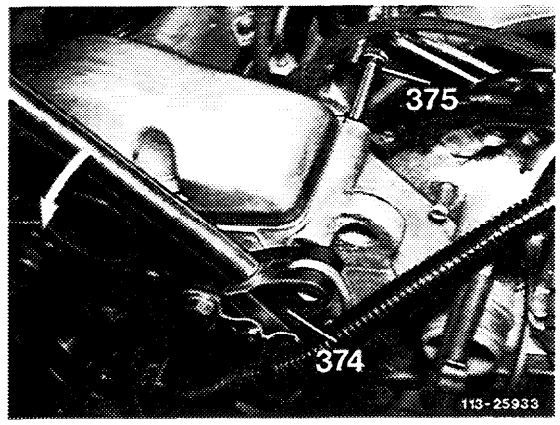
8 Moisten new radial sealing ring on sealing lip with oil and insert with inserting tool.

Attention!
The radial sealing ring should be accurately square in relation to crankshaft journal, since otherwise no perfect sealing will be obtained.



9 Install hub and pulley (03–341).

10 Mount V-belt and engage spring tensioning lever. For this purpose, swivel spring tensioning lever (374) with a mandrel against draw spring to the left until screw (375) can be slipped through spring tensioning lever. Position collar nut and tighten.

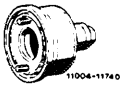


11 Install radiator (20–420).

12 Install **noise capsule.**

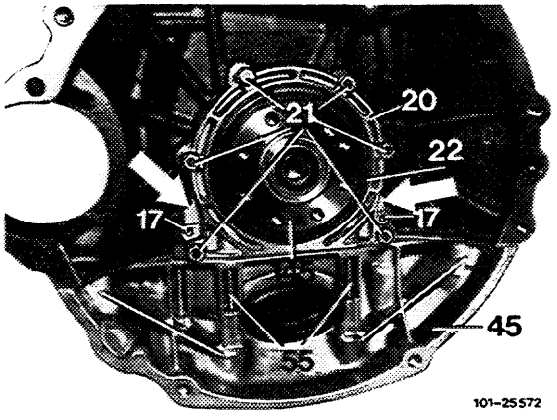
03-327 Replacing rear crankshaft radial sealing ring

Tightening torques		Nm
Necked-down screw for flywheel or driven plate	initial torque	30 + 10
	angle of rotation torque	90-l 00”

Special tools		
Detent	11004-11737	601589024000
Installation tool for rear crankshaft radial sealing ring	 11004-11740	601589034300

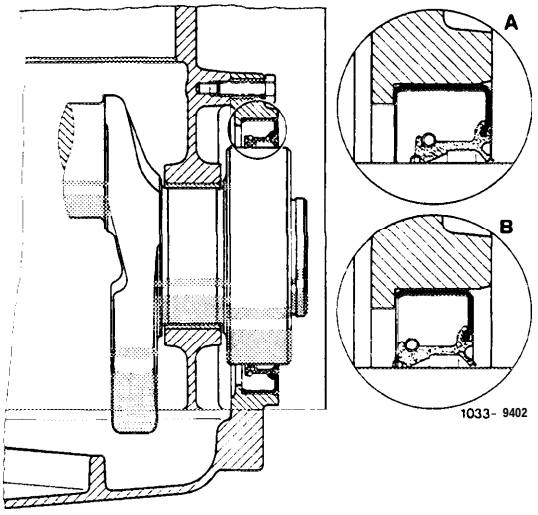
Note

The radial sealing ring (22) is seated in an end cover screwed to cylinder crankcase and oil pan and located by means of 2 clamping sleeves (17).



101-25572

The sealing lip of repair radial sealing ring is offset by 3 mm in inward direction, so that it cannot run in a groove which may have been generated by series-radial sealing ring on crankshaft flange.



1033- 9402

A Radial sealing ring (series)
B Repair radial sealing ring

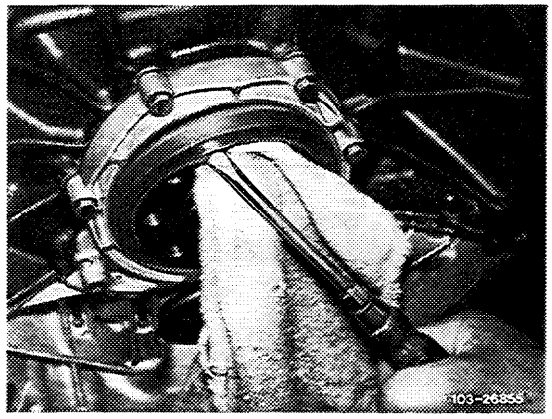
Renewing

1 **Remove transmission (26-020 or 27–600).**

2 **Remove flywheel or driven plate (03–410).**

3 **Push radial sealing ring out of end cover by means of a screwdriver.**

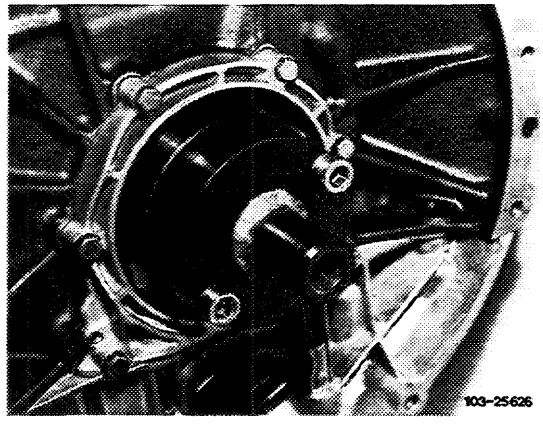
Make sure that the crankshaft flange and the end cover are not damaged. Cover crankshaft flange with a rag.



4 **Check running surface for radial sealing ring on crankshaft flange for damage.**

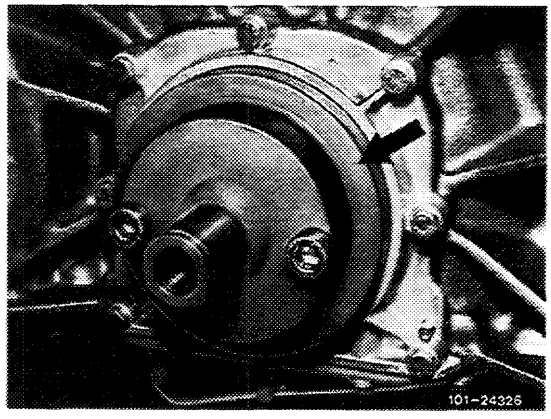
5 **Clean mounting bore for radial sealing ring and deburr, if required.**

6 **Screw inner part of installation tool to crankshaft flange.**



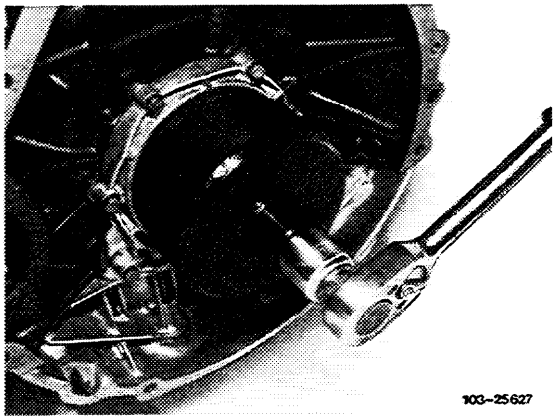
7 **Fill new radial sealing ring between sealing and dust lip with 1 g or 1 cc longterm grease. Do not fill in more oil, since otherwise the presence of leaks might be simulated.**

8 **Slip radial sealing ring (arrow) over inner part of installation tool.**



9 Push radial sealing ring up to stop into end cover by means of outer part of installation tool.

Attention!
Radial sealing ring should be seated accurately square in end cover for perfect sealing.



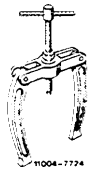
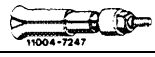
10 install flywheel or driven plate (03-410).

11 Check for leaks with engine running.

12 install transmission (26-020 or 27–600).

03-330 Removal and installation of radial ball bearing in crankshaft

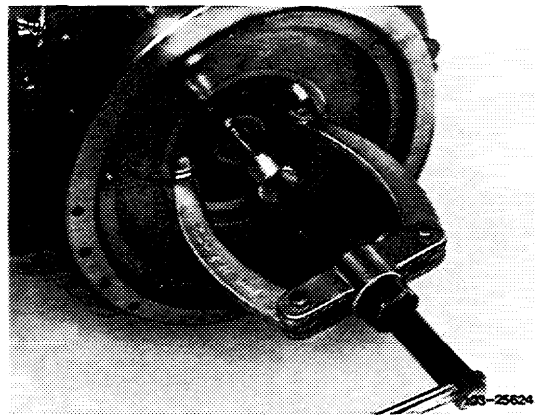
Special tools

Countersupport for internal puller		000589333300
Internal puller 14.5-18.5 mm		000589253300

Removal

1 Remove transmission (26–020 or 27-600).

2 Pull ball bearing out of crankshaft together with countersupport and internal puller.



Installation

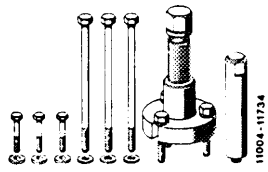
3 Coat new ball bearing with glue "Loctite 241", part no. 002 989 94 71 and knock into crankshaft on outer race by means of a suitable mandrel.

4 Install transmission (26-020 or 27–600).

03–341 Removal and installation of crankshaft pulley and hub

Tightening torques	Nm
Screw M 18 x 1.5 x 50 to crankshaft	370 + 40
Screws M 8 x 12 crankshaft pulley to hub	25

Special tools

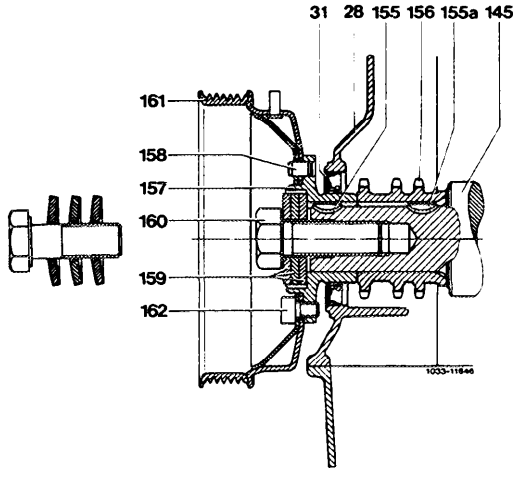
Torque wrench, single-arm, with ratchet, 3/4'' square, 150-800 Nm		001 5897421 00
Detent		601 589 02 40 00
Puller for hub		601589083300

Conventional tool

Adapter 3/4'' square socket to 1/2'' square head	e.g. Hazet, D-5630 Remscheid order no. 1058 R-l

Note

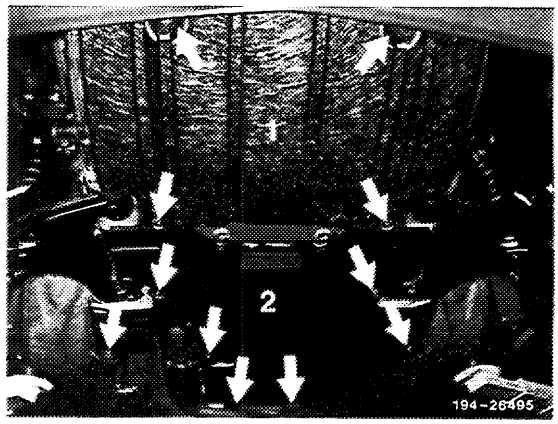
Engines 601 have no vibration damper and no balancing disk.



28 Timing housing cover
31 Radial sealing ring
145 Crankshaft
155 Woodruff key for hub
155a Woodruff key for sprocket
156 Sprocket
157 Hub
158 Cylindrical pin
159 Cup spring
160 Screw M 18 x 1.5 x 50
161 Crankshaft pulley
162 Combination screw M 8 x 12

Removal

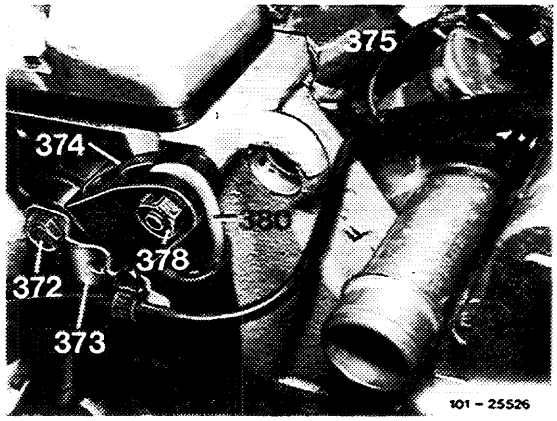
Remove noise capsule below.



2 Remove radiator (20–420).

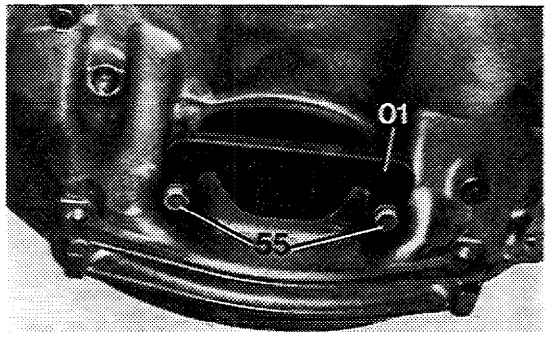
3 Slacken V-belt and remove. For this purpose, unscrew collar nut (378). Insert a mandrel into spring tensioning lever (374) and releave hex. screw (375) opposite to draw spring (380) until spring can be pushed back in direction of intake manifold.

Release spring tensioning lever and remove V-belt.



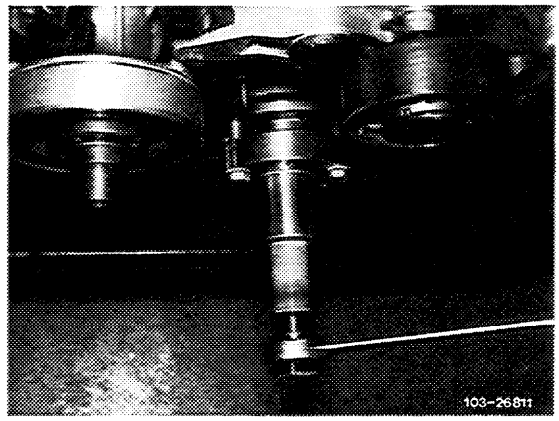
4 Remove crankshaft pulley.

5 Unscrew screw (160) on crankshaft. For this purpose, fasten detent, part no. 601 589 02 40 00, to oil pan.



6 Pull hub (157) from crankshaft journal.

Pull off hard-to-move hubs with puller.

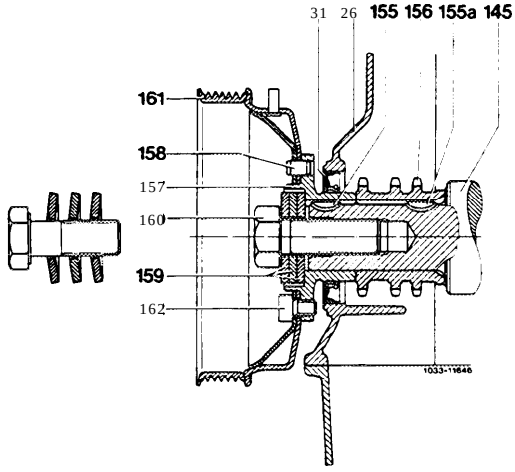


Installation

7 Slip hub (157) on crankshaft journal and tighten screw (160) to 370 + 40 Nm.

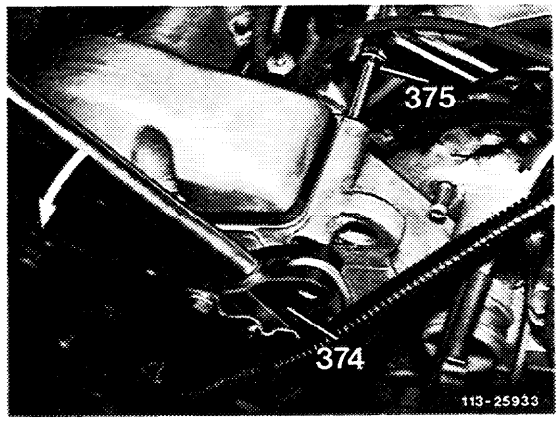
Make sure that woodruff key (155) and groove are in alignment.

Note: Install the three cup springs (159) with crown toward screw head.



8 Mount V-belt pulley, while paying attention to centering by means of cylindrical pin (158).

9 Mount V-belt and engage spring tensioning lever. For this purpose, swivel spring tensioning lever (374) with a mandrel against draw spring to the left until screw (375) can be slipped through spring tensioning lever. Position collar nut and tighten.

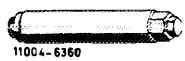
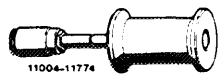
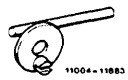
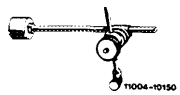
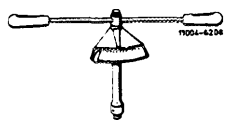


10 Install radiator (20-420).

11 Install noise capsule.

Tightening torques	Nm
Screws for cylinder head cover	10
Coupling nuts for injection lines (reference value)	1 O-20
Prechamber in cylinder head (threaded ring)	100 ± 10
Nozzle holder in prechamber	70 + 10

Special tools

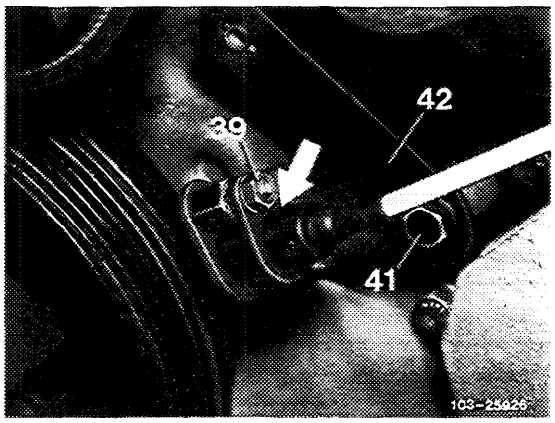
Box end wrench element, open, 14 mm, 1/4" drive, for coupling nut of injection line	11004-105201	000 589 77 03 00
Wrench element for threaded ring of prechamber	 11004-6360	615589000700
Socket wrench element 27 mm, 1/2" square	11004-6193	001 589 65 09 00
Impact puller for prechamber	 11004-11774	601 589 06 33 00
Locating device for holder of TDC transmitter	 11004-11883	601 589 06 21 00
Measuring instrument for TDC and 20° after TDC	11004-11884	601 589 07 21 00
Dial gauge holder	 11004-10150	3635890221 00
Torque wrench, double-arm, 3/8" square, 8-32 Nm	 11004-6206	001 589 51 21 00

Conventional tool

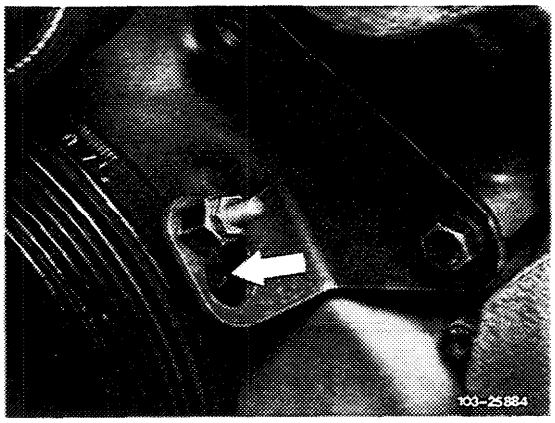
Dial gauge A 1 DIN 878	e.g. Mahr, D-7300 Esslingen order no. 810

Note

The TDC-transmitter with holder is fastened to timing housing cover (arrow).



The pin in crankshaft pulley must be accurately under TDC transmitter (arrow) in crankshaft position 20" after TDC.



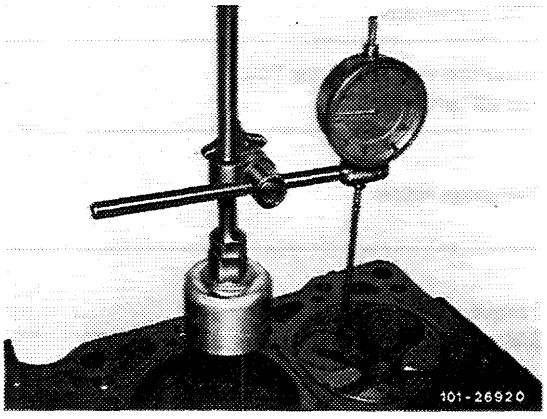
Adjustment of adjusting slide must be checked and corrected, if required:

a) When renewing adjusting slide.

b) When renewing crankshaft with hub or crankshaft pulley.

c) When completing partial engines.

With cylinder head removed, the measuring pin of the dial gauge can be set directly on piston crown. For this purpose, place magnetic dial gauge holder on cylinder crankcase parting surface.

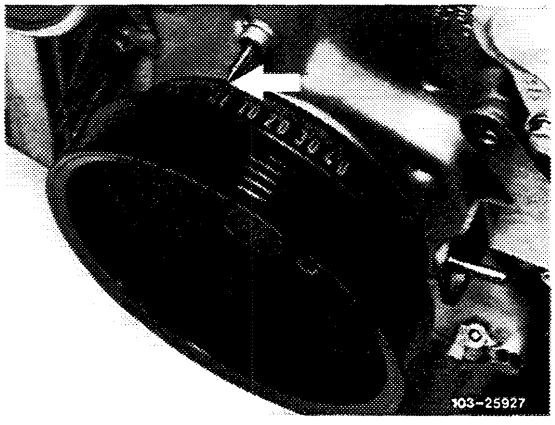


Checking

1 Remove radiator (20–420).

2 Remove cylinder head cover.

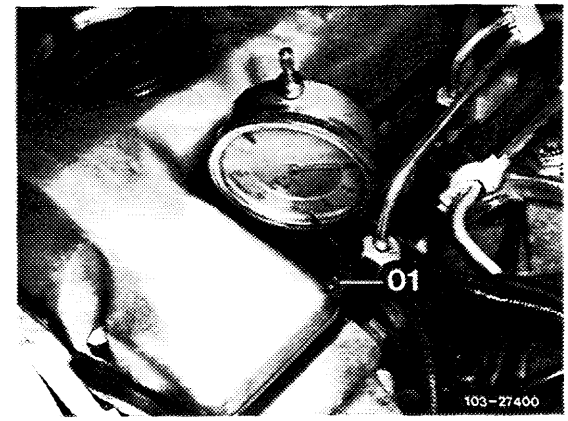
3 Set piston of 1st cylinder to ignition TDC of 1st cylinder.



4 Remove prechamber of 1st cylinder (01–417).

5 Screw measuring instrument into prechamber duct.

6 Place dial gauge at 2 mm preload on test mandrel.



7 Slowly rotate crankshaft in direction of rotation of engine until large needle of dial gauge stops (TDC position).

8 Loosen dial gauge and place measuring arm under 5 mm preload into test mandrel. Turn dial gauge scale until large needle points to zero.

9 Slowly turn crankshaft in direction of rotation of engine until on engine 601.911 the dial gauge has moved back by 3.22 mm and on engine 601.921 by 3.65 mm.

10 Place locating device into adjusting slide.

Pin in crankshaft pulley must engage in groove of locating device.

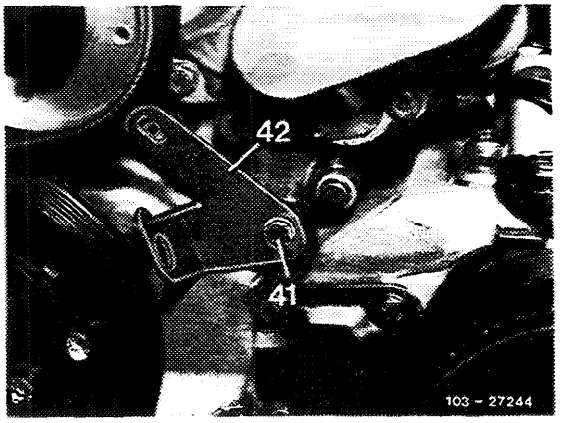
If pin is not engaging, correct position of adjusting slide.

Correcting

11 **Loosen adjusting slide (42) on screw (41) and displace until pin in pulley engages in groove of locating device.**

12 Screw down adjusting slide.

13 Remove dial gauge and measuring instrument.



14 Install prechamber (01—417).

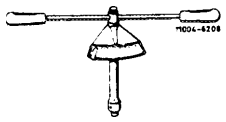
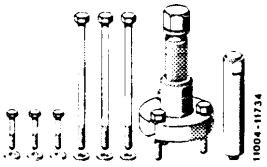
15 Install valve cover.

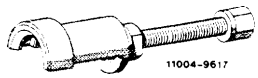
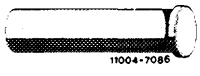
16 Install radiator.

17 Run engine, check for leaks.

Tightening torques		Nm
Screw M 18 x 1.5 x 50 to crankshaft		370 + 40
Screws for cylinder head cover		10
Screws M 8 x 12 for crankshaft pulley to hub		25
Oil drain plug to oil pan		30
Oil pan to cylinder crankcase	M 6	10
	M 8	25
Central screw for fan on coolant pump		25
Adjusting screw for front engine stop		130
Screws for engine carrier to engine mount		35 + 10
Cylinder head bolts M 8		25
Screws for timing housing cover	M 6	10
	M 8	25

Special tools

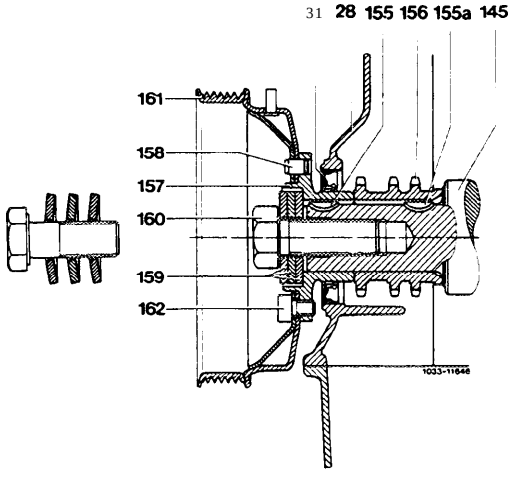
Torque wrench, double-arm, 1/4'' square, 8-32 Nm		001 589 51 21 00
Torque wrench, single-arm, emitting signal, with plug-in ratchet, 1/2'' square, 40-200 Nm		001 589 67 21 00
Torque wrench, single-arm, with ratchet, 3/4'' square, 150-800 Nm		001 589 74 21 00
Puller for hub		601 589 08 33 00

Puller for crankshaft timing gear		601 589 07 33 00
Knocking-in mandrel for crankshaft timing gear		116589071500
Screwdriver with tommy handle for hex. socket screws 6 mm, 440 mm long		116589030700

Conventional tool

Adapter 3/4" square socket to 1/2" square head	e.g. Hazet, D-5630 Remscheid order no. 1058 R-l

Layout crankshaft front



28 Timing housing cover
31 Radial sealing ring
145 Crankshaft
155 Woodruff key, hub
155a Woodruff key, sprocket
156 Sprocket
157 Hub
158 Cylindrical pin
159 Cup spring
160 Screw M 18x 1.5 x 50
161 Crankshaft pulley
162 Combination screw M 8 x 12

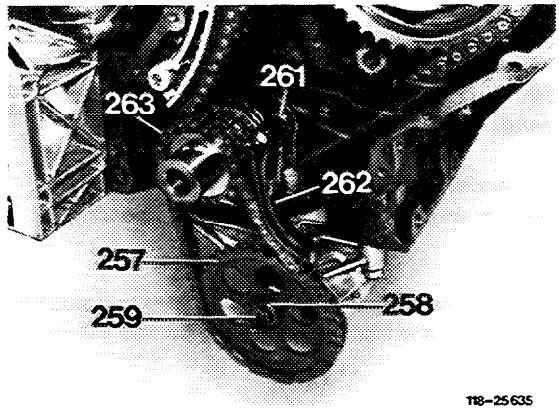
Removal

1 Remove timing housing cover (01-210).

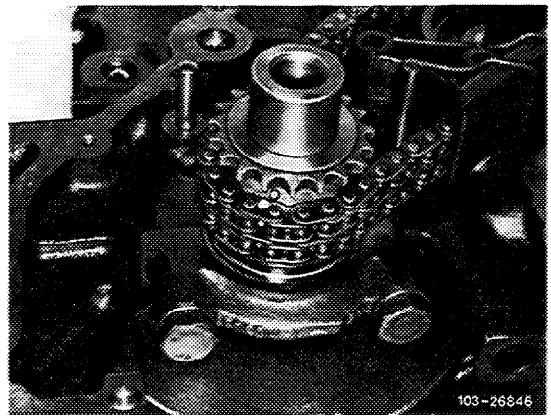
2 Pull off clamp (262) and torsion spring (261).

3 Unscrew fastening screw (259) and remove oil pump sprocket (257).

4 Remove chain for oil pump drive.

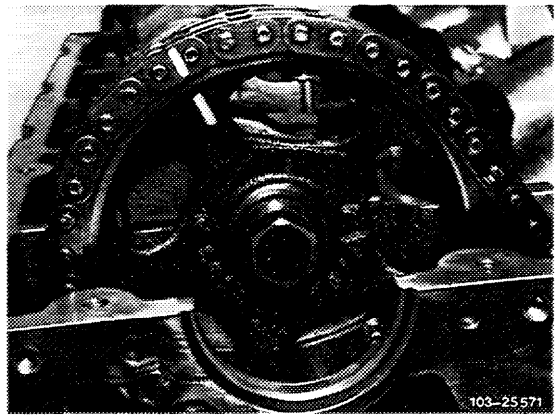


5 Mark timing chain and crankshaft timing gear in relation to each other.



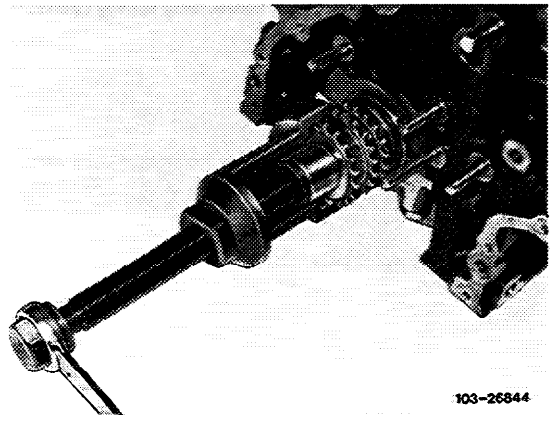
6 Mark timing chain and camshaft timing gear in relation to each other

7 Remove camshaft timing gear and let timing chain sag.



8 Pull off crankshaft timing gear with puller.

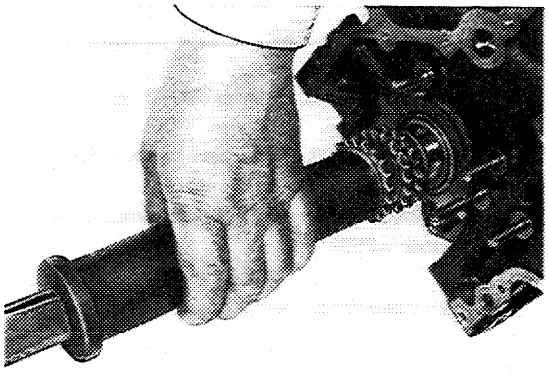
9 Check woodruff key in crankshaft for condition and renew, if required.



10 Transfer color mark from old to new crankshaft timing gear.

11 Knock crankshaft timing gear with knocking-in mandrel on crankshaft. Pay attention to woodruff key.

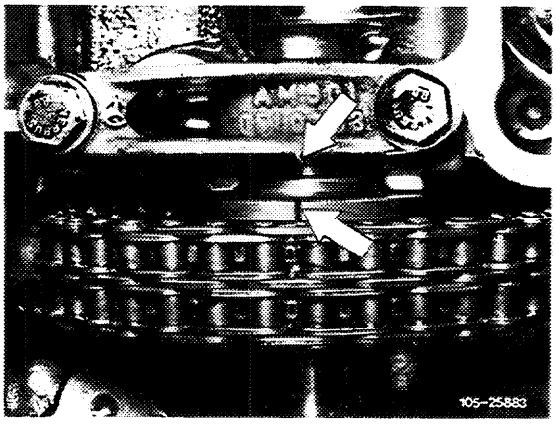
Note: For better location when knocking in crankshaft timing gear, the front woodruff key for hub can be inserted.



103-26843

12 Mount camshaft timing gear and timing chain, paying attention to marks.

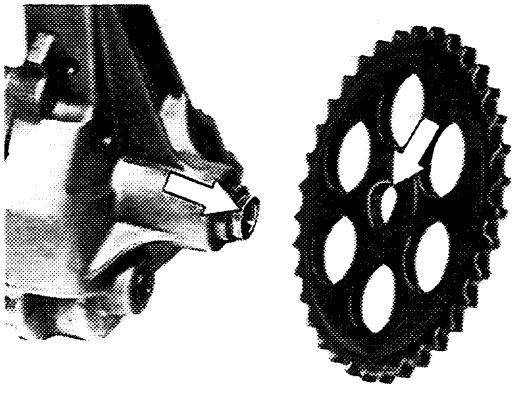
13 Keep turning crankshaft and check adjusting marks at TDC position of engine (arrows).



105-25883

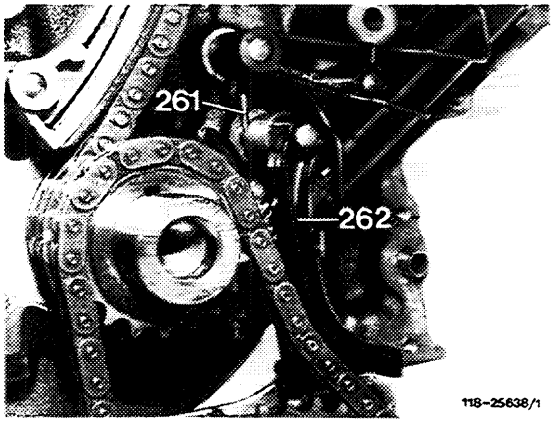
14 Mount chain for oil pump drive together with oil pump sprocket.

Note: Mount sprocket in such a manner that its crown is pointing toward oil pump and the three contact surfaces on the oil pump shaft coincide with those on the sprocket (arrows).



118-26004

15 Install clamp (262) and tensioning spring (261).



118-25638/1

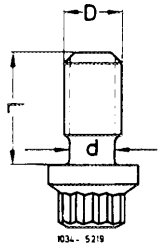
16 Install timing housing cover (01–210).

17 For further installation proceed vice versa.

18 Run engine and check for leaks.

Necked-down screw

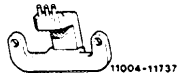
		manual transmission	automatic transmission
Part no.		1020320071	601 03201 71
Thread dia. D		M 10 x 1	
Necked-down dia. d	when new	8.5–0.2	
	min. dia.	8.1	
Length L	when new	22 ± 0.2	26 ± 0.2
	max. length	22.5	26.5



Tightening torque

Initial torque	30 + 10 Nm
Angle of rotation torque	90–100"

Special tools

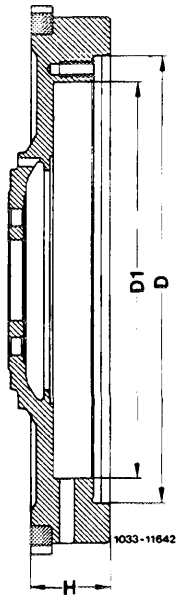
Detent		601 589 02 40 00
Torque wrench, single-arm, emitting signal, with plug-in ratchet, 1/2'' square, 25-l 30 Nm		001 589 66 21 00

Note

Weight and dimensions of flywheels of engines with manual transmission are similar.

Flywheels and driven plates of engines with automatic transmissions are identical on all angines.

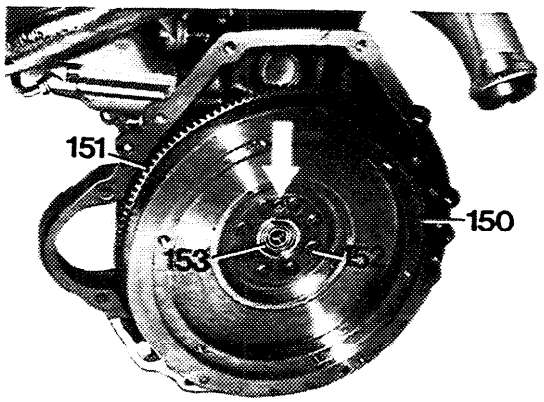
Flywheels can be replaced without static or dynamic balancing.



Engine 601

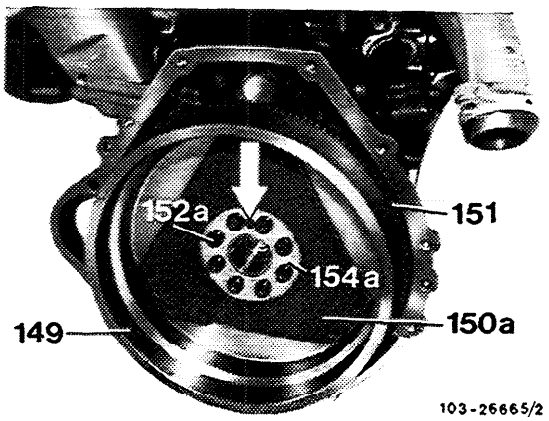
D 254.5 mm
D1 223 mm
H 57 m m

Fasten flywheel and driven plate to crankshaft in such a manner that the unused bores (arrow) on flywheel or on driven plate and spacing washer are in alignment with unused bore on crankshaft flange.



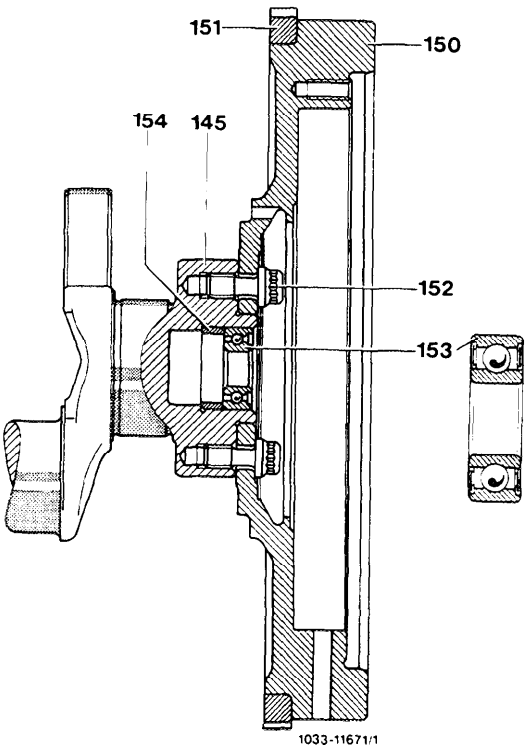
Vehicles with manual transmission

103-26328



Vehicles with automatic transmission

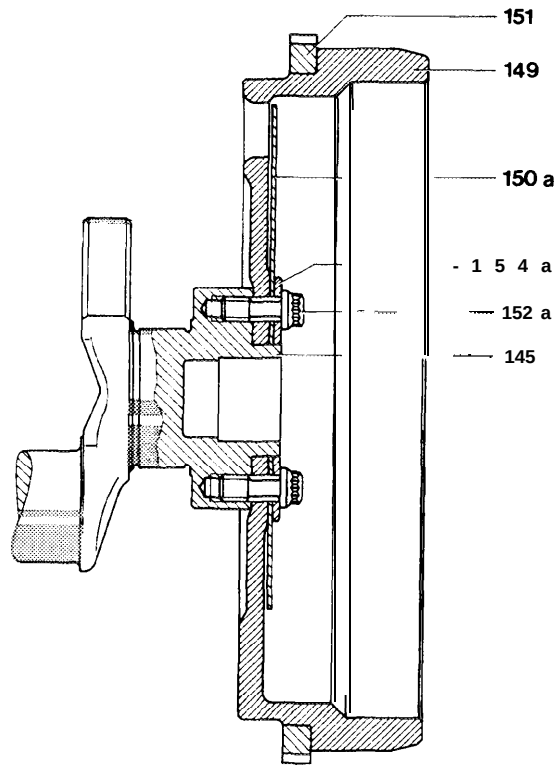
103-26665/2



1033-11671/1

Layout of flywheel for manual transmission

145 Crankshaft
150 Flywheel
151 Ring gear
152 Necked-down-screw
153 Ball bearing
154 Spacing ring



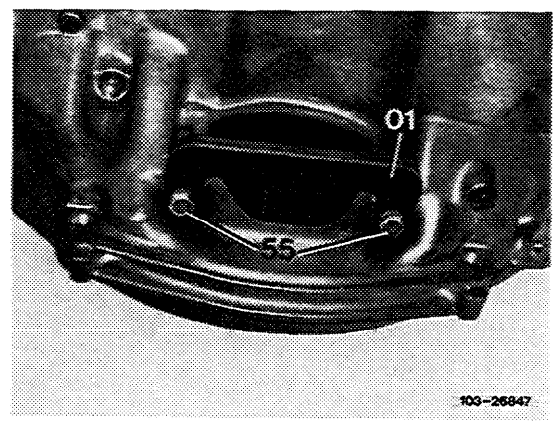
Layout of flywheel and driven plate for automatic transmission

145 Crankshaft
150a Driven plate
152a Necked-down screw
154a Spacing washer

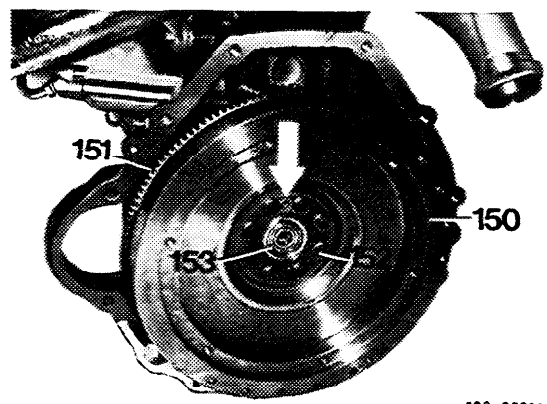
Removal

1 Remove **transmission (26-020 or 27–600).**

2 Fasten detent (arrow) to oil pan below.

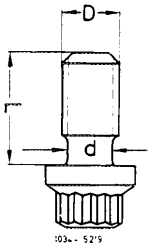


3 Unscrew necked-down screws (152) and remove flywheel, driven plate and spacing washer.

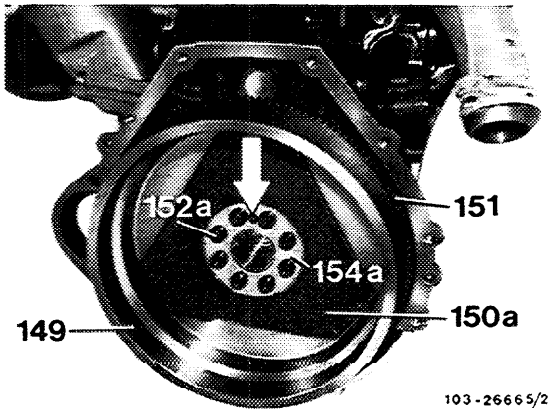


4 Measure necked-down dia. of necked-down screws.

If minimum dia. is attained, install new necked-down screws.



5 Position flywheel, driven plate and spacing washer on crankshaft journal in such a manner that the bores (arrow) are in alignment.



6 Screw in necked-down screws and tighten to 30 Nm initial torque and 90–100° angle of rotation torque.

03-420 Refinishing of flywheel

Data

Engine		601
Distance a		22.4-22.6
Distance b	when new	16.6
	during repairs	up to
Permissible deviation from axial runout on clutch surface or clutch flange-on surface		0.05 mm

Note

Flywheels for manual transmissions which are showing burnt spots, score marks or cracks on clutch surface, must be refinished by precision turning.

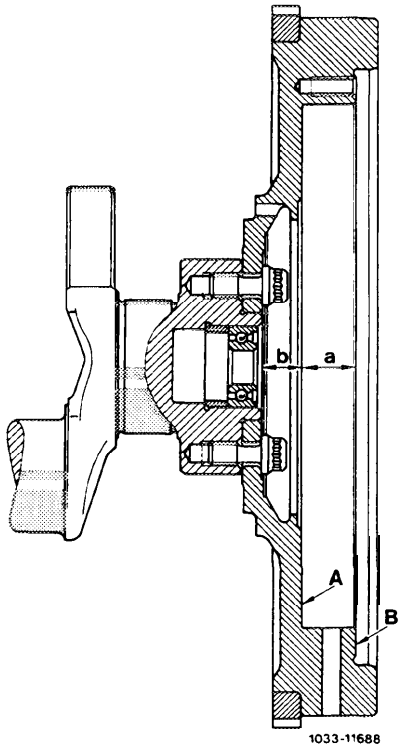
If score marks or cracks are deeper than the max. permissible material allowance, replace flywheel.

If the clutch surface A is refinished, also refinish fastening surface B by the same dimension to maintain distance a.

In the event of repairs, do not machine below dimension b.

For refinishing, clamp flywheel well, so that the permissible axial runout of 0.05 mm is not exceeded.

No cavities and chatter marks should be seen on clutch surface after refinishing.



03-430 Renewing ring gear of flywheel

Data	
Axial runout on ring gear	max. 0.4
Centering flange dia. for ring gear	275.00-275.05
Shrinking-on temperature	220 °C
Annealing color	yellow

Conventional accessory

Temperature measuring chalk color no. 2815/220 (white) Thermochrom	e.g. AW Faber-Castell, D-8504 Stein beiNürnberg

Note

The ring gear is hardened. To protect hardness, the temperature for heating up ring gear should not exceed 220 °C at any point. This can be done reliably **only** by **means of a hot plate or a heating oven.**

An open flame may be used as an exception only. The flame should touch only the inside of the ring gear.

Following renewal of ring gear, the flywheel need not be balanced.

Renewal

1 Drill into old ring gear and break up with a chisel, or heat quickly and immediately remove.

2 Clean mounting surface of ring gear on flywheel.

3 Uniformly heat new ring gear on a hot plate or in a heating oven. For this purpose, use temperature measuring chalk in accordance with instructions whenever possible.

4 Mount heated ring gear immediately on flywheel.

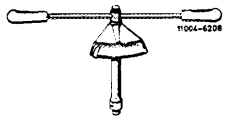
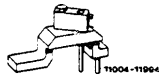
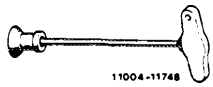
05 Engine timing, valves

	Job No.
Camshaft and valves	
Checking and replacement of hydraulic valve clearance compensating elements	05–211
Checking camshaft timing	215
Removal and installation of camshaft	220
Removal and installation of valve springs	250
Checking valve springs	260
Replacing valve stem seals	270
Checking and machining valves	280
Replacing valve seat rings	290
Machining valve seats	291
Timing chain, chain tensioner, tensioning and slide rails	
Removal and installation of chain tensioner	310
Replacing timing chain	320
Removal and installation of tensioning rail	330
Removal and installation of slide rails	341
A. Removal and installation of slide rail (220) in cylinder head	
B. Removal and installation of guide rail (218)	
Drive for hydraulic oil pump	
Removal and installation of drive for hydraulic oil pump	437

05-211 Checking and replacement of hydraulic valve clearance compensating elements

Tightening torques	Nm
Bolts for cylinder head cover	10
Bolt for camshaft timing gear	45
Bolts for camshaft bearing caps	25

Special tools

Torque wrench, double arm, 3/8″ square, 8-32 Nm		001 589 51 21 00
Torque wrench with plug-in ratchet 1/2″ square, 25-l 30 Nm		001589662100
Measuring bridge for residual stroke		601 589 08 21 00
Vacuum lifter for valve tappet		601589053300

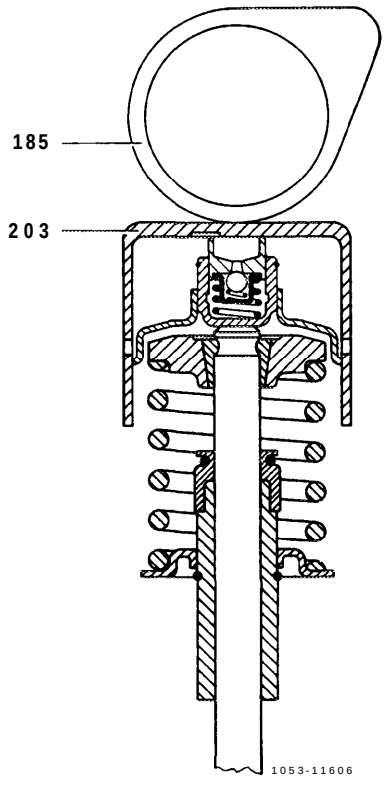
Note

Store valve tappet in upright position only (open end up).

Install removed valve tappets again at the same spot.

The basic position of valve tappets cannot be corrected.

In the event of complaints about noise, perform the following test jobs:



185 Camshaft
203 Valve tappet

Checking

1 **Run engine for approx. 5 minutes at 3000/min.**

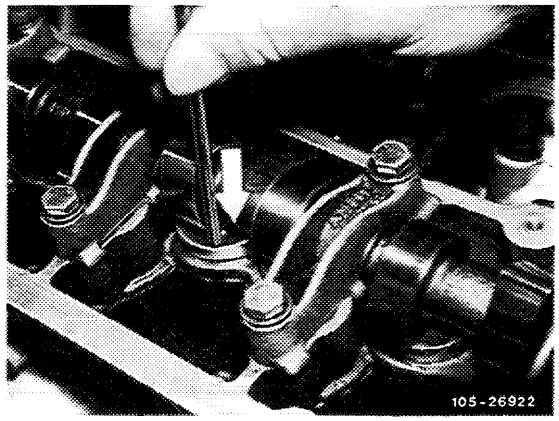
2 Remove cylinder head cover.

3 Set cam of respective valve tappet on base circle (cam tip should point upwards).

4 Use a mandrel to push against valve tappet or try to move valve tappet manually.

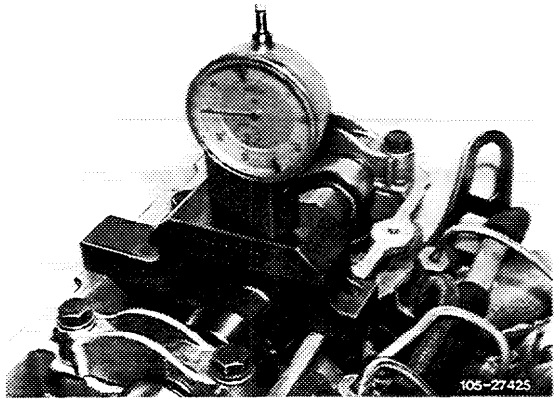
If, compared with others, the valve tappet drops quickly, or in the event of play in relation to base circle of cam, perform jobs item 6 and starting item 8.

If a valve tappet has play, or if the sinking time is too short, check basic position (item 5–7).



5 Measure and write down dimension "X" (cylinder head parting surface to valve tappet). For this purpose, place measuring bridge over valve tappet about to be checked on cylinder head parting surface.

Note: If required, measure dimension "X" on all valve tappets.



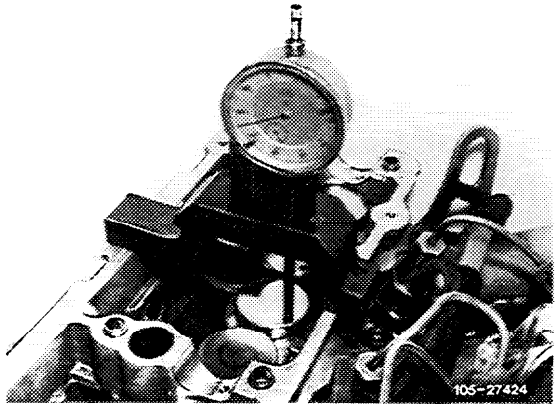
6 Remove fan and fan cover.

7 Remove camshaft (05-220).

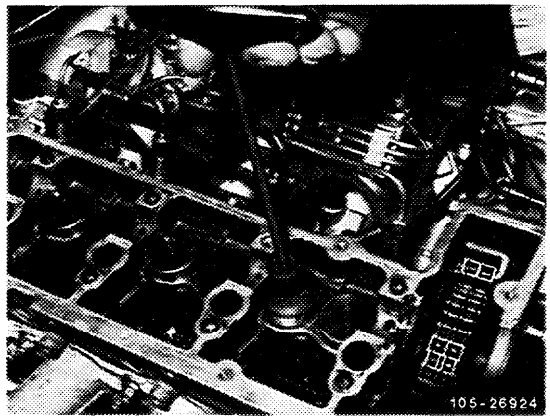
8 Measure dimension "Y" (cylinder head parting surface to valve tappet).

The difference between dimension "X" and "Y" is the initial stroke ≙ installation position.

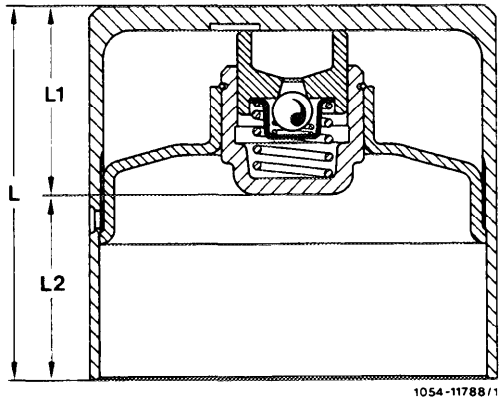
Nominal value: Value when new 0.25-l .6 mm, value with used engine 0.25-2.5 mm.



9 If valve tappet sinks quickly or if the nominal dimension is not attained or exceeded, lift out valve tappet by means of vacuum lifter.

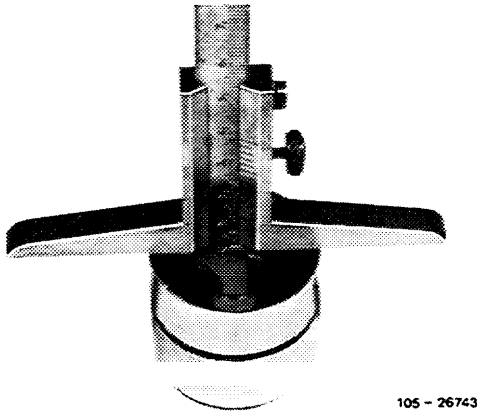


10 Measure dimension "L" on valve tappet and write down.

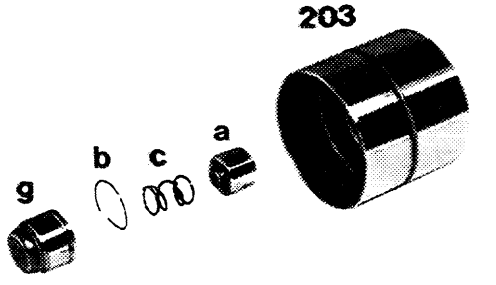


11 Measure dimension "L 2" on valve tappet.

Dimension "L I" (difference between L and L 2) should be 18-19 mm.



12 If dimension "L 1" is higher or lower, remove guide sleeve. For this purpose, pull guide sleeve (g) out of valve tappet (203) by means of rotary movements with pliers. Do not damage guide sleeve.

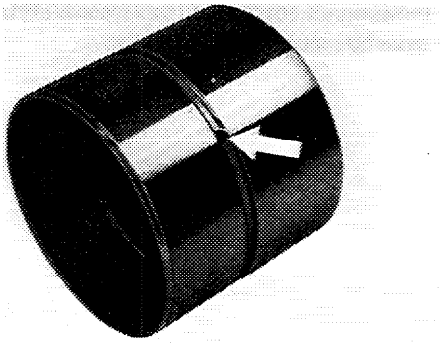


203 Valve tappet
a Thrust pin with ball and cage
b Circlip
c Compression spring
g Guide sleeve

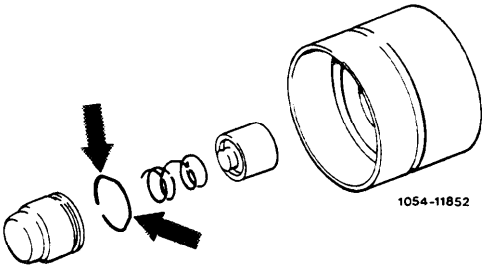
13 Pull thrust bolt (a) out of guide sleeve (g) and remove compression spring (c).

14 Blow out all components with compressed air.

Blow through valve tappet at oil feed bore (arrow).



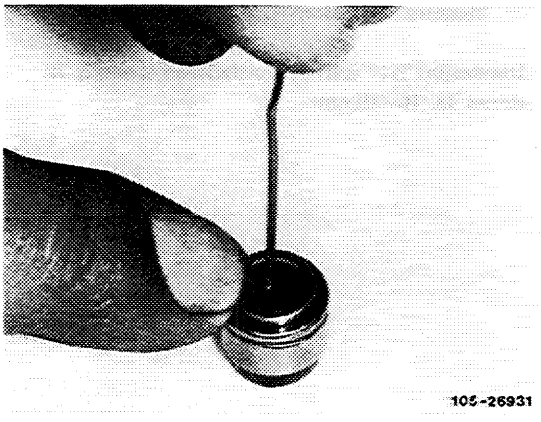
15 Remove circlip (b) from guide sleeve (g), slightly rebend at edges (arrows) and mount again on guide sleeve.



16 Assemble guide sleeve (g), compression spring (c) and thrust pin (a) in correct sequence.

17 Fill thrust pin with engine oil. Press on ball valve with a suitable pin and vent work chamber by pumping movements of thrust pin, close ball valve and add oil, if required. Then, no more oil should flow out at ball valve under slight pressure.

If oil flows out, renew complete valve tappet.



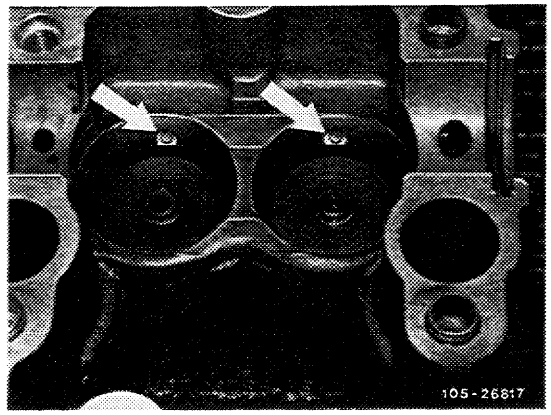
18 Fill valve tappet (203) with engine oil and install vented thrust pin with guide sleeve into valve tappet.

Push guide sleeve into valve tappet until circlip engages.

19 Check dimension "L 1", refer to item 9 and 10.

20 Check oil supply in cylinder head. For this purpose, unscrew closing plug of oil duct on cylinder head rear.

Blow with compressed air into oil duct, while checking outlet bore on seat for valve tappet for passage.



21 Lubricate valve tappet and install, pay attention to sequence.

22 Install camshaft (05–220).

23 Install cylinder head cover.

24 Install fan and fan cover.

25 Run engine at 3000/min.

05-215 Checking camshaft timing

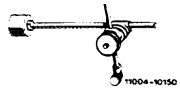
Timing at 2 mm valve lift

Engine	Camshaft code number[1])	Camshaft opens after TDC	Intake valve closes after BDC	Exhaust valve opens before BDC	Exhaust valve closes before TDC
		with new timing chain			
601	05	11°	17°	28°	15°
		with used timing chain (after approx. 20 000 km)			
		12°	18°	27°	14°

[1]) The camshaft code number is stamped into collar adjacent to TDC notch.

Tightening torque	Nm
Bolts for cylinder head cover	10

Special tools

Dial gauge holder	 11004-10150	363 589 02 21 00
Box-end wrench element, open 14 mm, 1/4" drive for coupling nut on injection line	11004-105201	000589 77 0300

Conventional tool

Dial gauge A 1 DIN 878	e. g. Mahr, D-7300 Esslingen Order No. 810

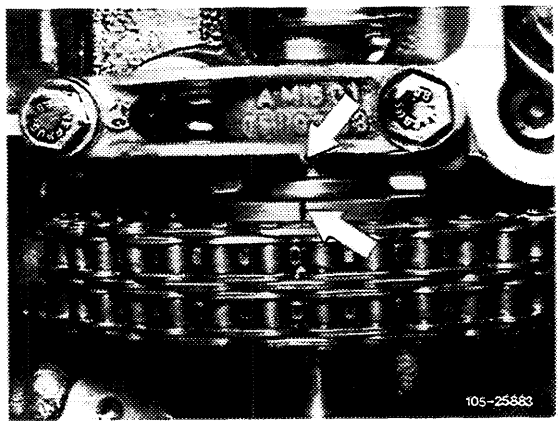
Note

During assembly jobs alignment of marks (arrows) in ignition TDC position of 1st cylinder is adequate.

In special cases, e. g. in the event of complaints about output, perform the following checkup with regard to begin of opening at intake valve of 1st cylinder.

Timing is measured at 2 mm tappet travel.

Corrections are not possible at the moment.



Checking

1 **Remove cylinder head cover.**

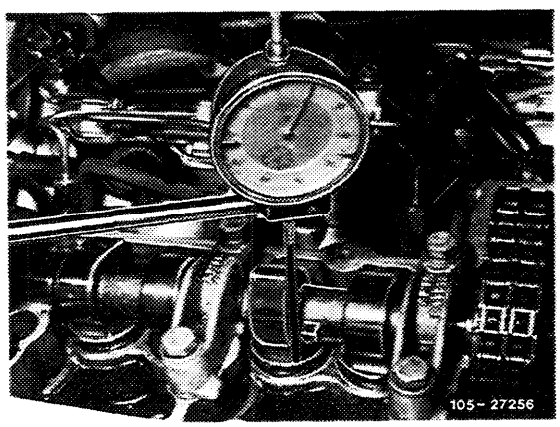
2 Remove injection nozzles (07.1-230).

3 Turn crankshaft until cam tip of 2nd cam is pointing upwards.

Attention!
Do not rotate engine on screw of camshaft timing gear. Do not rotate engine in reverse while measuring, since this would result in considerable measuring faults.

4 Tighten dial gauge holder on cylinder head (above 1st cylinder intake valve).

5 Position dial gauge with extension and fasten in such a manner that the sensor pin is seated on valve tappet (arrow) under a preload of 3 mm (small needle of dial gauge).



Turn dial of dial gauge until large needle points to ''0''.

Attention!
Sensor pin of dial gauge should be seated accurately vertical on valve tappet.

6 Continue turning crankshaft in direction of rotation of engine until small needle of dial gauge has moved back by 2 mm (valve lift) to 1 mm.

In this position, the value on balancing disk should be the same as the specified value "intake valve opens".

7 Install injection nozzles (07 l-230).

8 Install cylinder head cover.

Timing at 2 mm valve lift

Engine	Camshaft code number[1])	Intake valve open after TDC	Intake valve closes after BDC	Exhaust valve opens before BDC	Exhaust valve closes before TDC
601	05	with new timing chain			
		11°	17°	28°	15°
		with used timing chain (after approx. 20 000 km)			
		12°	18°	27°	14°

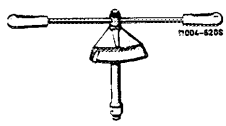
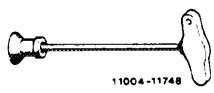
[1]) The camshaft code number is stamped into collar adjacent to TDC notch.

Data

Permissible runout of center bearing journal and of camshaft timing gear seat when mounting camshaft in outer bearing points	Camshaft code number		05
	Camshaft timing gear seat		0.020
	2nd bearing point		0.030
	3rd bearing point		0.025
Scleroscope hardness of cams		when new	64-75
		limit value	
Diameter of camshaft bearing journals			30,944–30,950

Tightening torques	Nm
Bolts for cylinder head cover	10
Bolt for camshaft timing gear on camshaft	45
Bolts for camshaft bearing caps	25

Special tools

Torque wrench with plug-in ratchet, 1/2" square, 25-l 30 Nm		001 589 66 21 00
Torque wrench, double arm, 3/8" square, 8-32 Nm		001 589 51 21 00
Vacuum lifter for valve tappet		601 589 05 33 00

Note

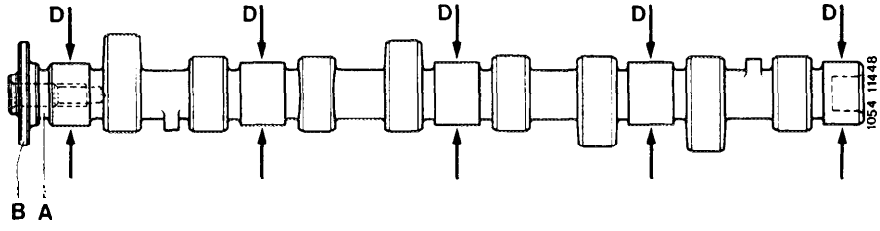
The camshaft is a chill casting and mounted in five bearings.

The diameter (D) of all five bearing points is 31 .O mm.

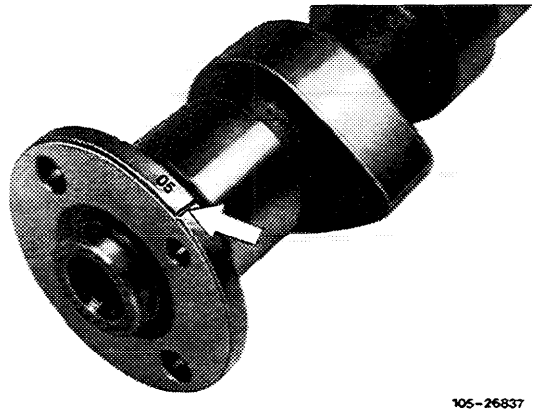
Groove (A) serves to locate the camshaft axially by means of a circlip inserted in cylinder head.

A cyl. pin on collar (B) serves to locate the camshaft timing gear.

A Groove for axial locating
B Stop for camshaft timing gear and mounting of cyl. pin
D Bearing points



The code number is stamped into flange adjacent to TDC notch (arrow).



TDC mark (arrow) and code number

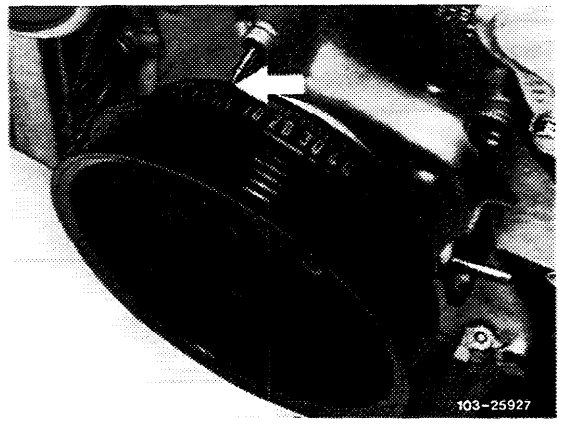
Removal

1 **Remove cylinder head cover.**

2 **Set crankshaft to ignition TDC of 1st cylinder.**

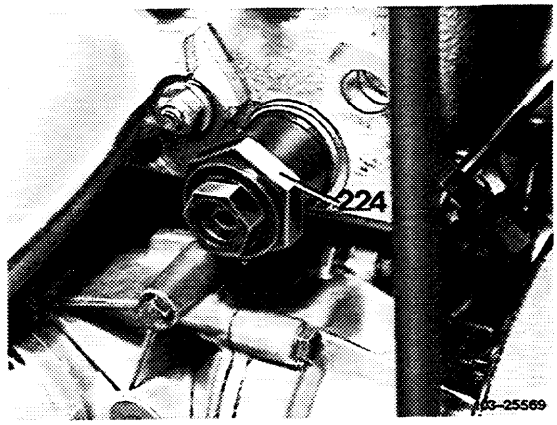
Attention!
Do not rotate engine on fastening screw of camshaft timing gear.

Do not rotate engine in reverse.

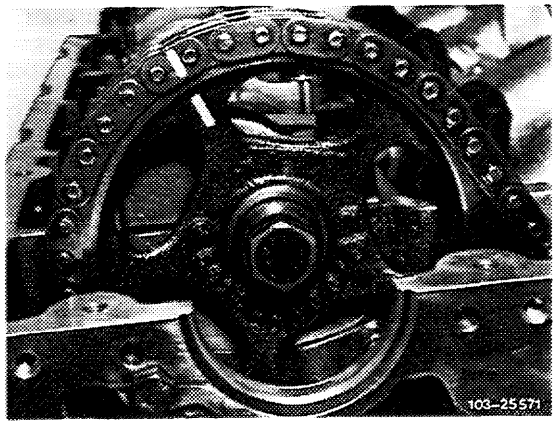


TDC mark on pulley

3 Remove chain tensioner (244) (05-340).

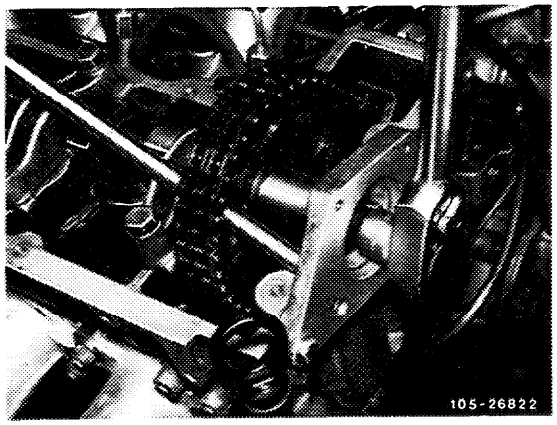


4 Mark camshaft timing gear and timing chain in relation to each other.



5 Remove camshaft timing gear.

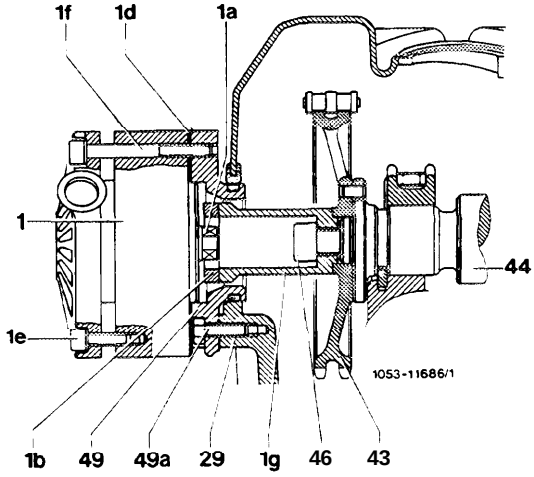
To loosen screws, apply counterhold on camshaft with a mandrel.



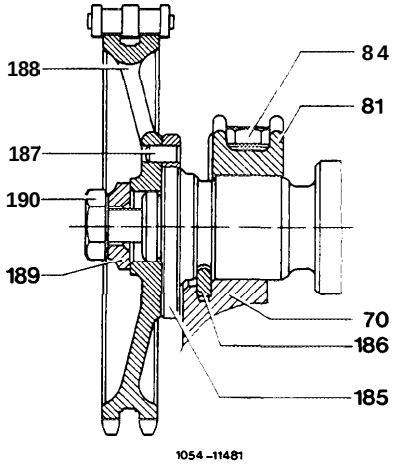
6 On vehicles with level control, the camshaft timing gear and the driver sleeve are fastened with a hex. socket screw. Remove driver sleeve. For this purpose, unscrew pressure oil pump and put aside with lines connected.

7 Uniformly loosen all camshaft bearing screws and remove camshaft bearing caps.

Note: To prevent tilting of camshaft under influence of spring-loaded valve tappets, loosen camshaft bearing screws and unscrew uniformly.



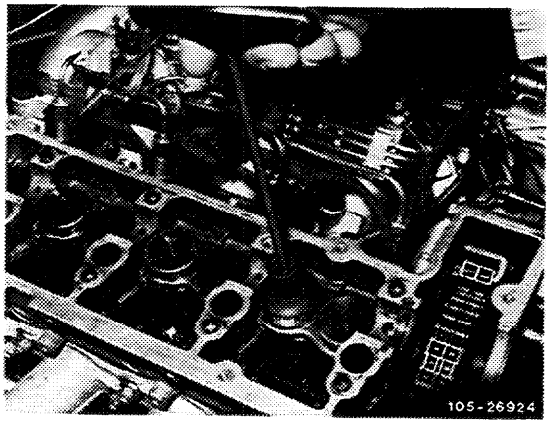
8 Remove camshaft in upward direction.



1054-11481

70 Cylinder head
81 Camshaft bearing bracket
185 Camshaft
186 Circlip for axial locating
187 Cyl. pin
188 Camshaft timing gear
189 Washer
190 Screw M 10 x 50

9 Remove circlip for axial locating (186) camshaft longitudinal alignment and check for condition.


105-26924

10 Pull out valve tappet by means of vacuum lifter 601 589 05 33 00.

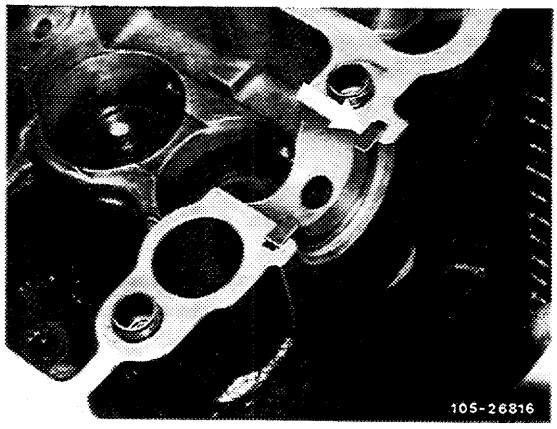
11 Check valve tappet for condition (visual checkup) and renew, if required.

Note: Install valve tappets at the same spot where they were installed before.

Installation

Note: If a new camshaft has been installed or if the cylinder head has been machined, check camshaft for easy operation.

12 Insert circlip for axial locating (arrow) in cylinder head.

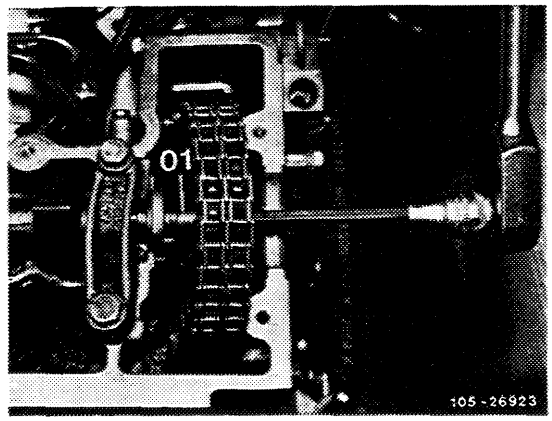

105-26816

13 Lubricate camshaft and place into cylinder head (without valve tappets).

14 Position camshaft bearing cap and tighten uniformly to 25 Nm. Pay attention to identification of bearing caps.

15 When checking for easy operation, the camshaft can be rotated by means of a hex. socket screw M 10 x 30, which is screwed in through camshaft timing gear instead of fastening screw.

If the camshaft can be rotated with an effort only, proceed as follows:



01 Hex. socket screw M 10 x 30

Loosen camshaft bearing caps individually. Then turn camshaft as required.

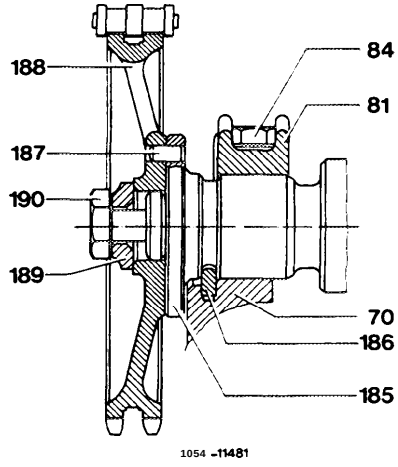
Repeat until tight bearing point has been found.

Remove camshaft and measure respective bearing point. Nominal 0.050-0.81 mm.

Check camshaft for runout.

16 Lubricate valve tappets and insert. Pay attention to sequence.

17 Lubricate camshaft and place into cylinder head, pay attention to circlip (186).



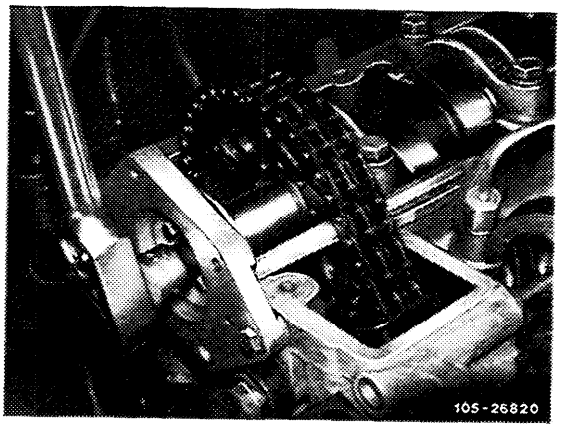
18 Install camshaft bearing caps.

Note: Be sure to tighten camshaft bearing caps uniformly, so that the camshaft is not loaded on one side only under influence of valve tappet counter-pressure.

19 Mount camshaft timing gear. Pay attention to color marks.

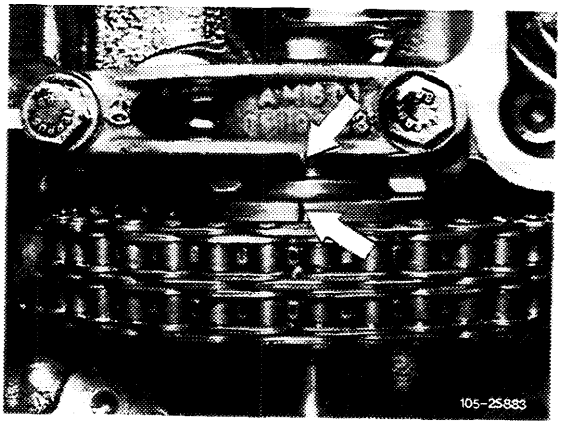
Tighten fastening screw for camshaft timing gear to 45 Nm. For this purpose, apply counterhold to camshaft timing gear by means of a screwdriver or *steel* pin.

20 Install chain tensioner.



21 On vehicles with level control, mount pressure oil pump and driver.

22 Set engine to ignition TDC of 1 st cylinder and check marks (arrows).



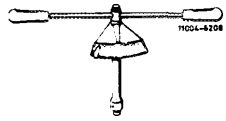
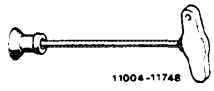
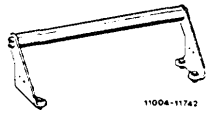
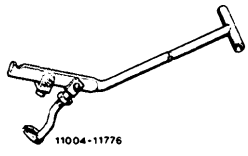
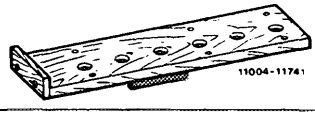
23 Mount cylinder head cover.

24 Run engine, check for leaks.

05-250 Removal and installation of valve springs

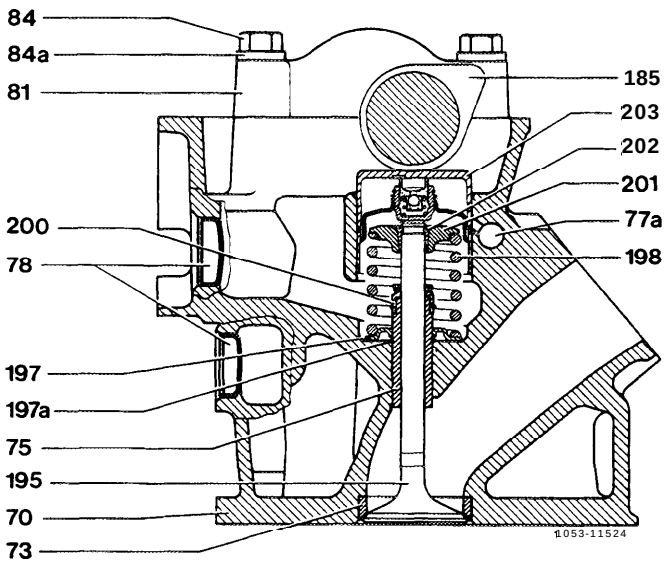
Tightening torques	Nm
Bolts for cylinder head cover	10
Screw for camshaft timing gear	45
Screws for camshaft bearing caps	25

Special tools

Torque wrench, double arm, 3/8" square, 8-32 Nm		001 589 51 21 00
Torque wrench with plug-in ratchet, 1/2" square, 25-130 Nm		001 589 66 21 00
Vacuum lifter for valve tappets		601589053300
Supporting bridge for valve spring depressor		601 589 02 59 00
Valve spring depressor for valve springs		601 5890261 00
Assembly board for clamping cylinder head		601 589 01 59 00
Magnetic lifter for valve cone halves		116589066300

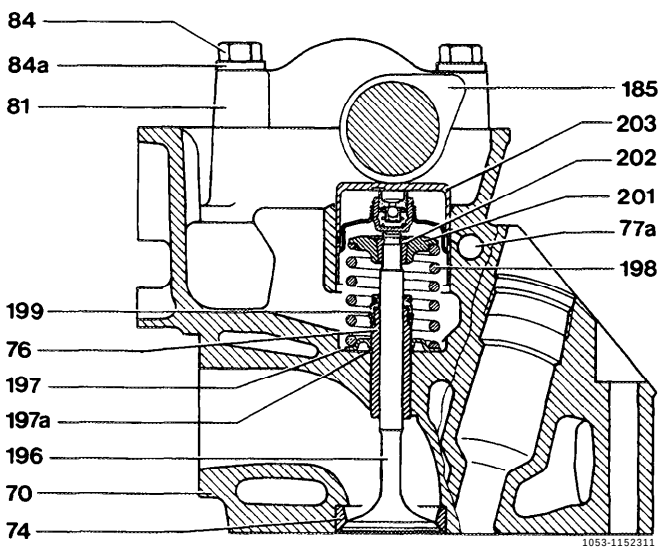
Valve arrangement intake side

70	Cylinder head
73	Valve seat ring intake
75	Valve guide intake
77a	Oil duct
78	Core hole cap
81	Camshaft bearing bracket
84	Hex. screw M 8 x 45
84a	Washer
185	Camshaft
195	intake valve
197	Thrust ring
197a	Locking ring
198	Valve spring
200	Valve stem seal intake
201	Valve spring retainer
202	Valve key
203	Valve tappet



Valve arrangement exhaust side

70	Cylinder head
74	Valve seat ring exhaust
76	Valve guide exhaust
77a	Oil duct
81	Camshaft bearing bracket
84	Hex. screw M 8 x 45
84a	Washer
185	Camshaft
196	Exhaust valve
197	Thrust ring
197a	Locking ring
198	Valve spring
199	Valve stem seal exhaust
201	Valve spring retainer
202	Valve key
203	Valve tappet



Note

Each valve has a single progressively acting valve spring (198).

For this reason, install spring only with color marks below.

Color marks:
yellow/green or purple/green

A thrust ring (197) inserted under valve springs is supported at cylinder head via torsion lock naps.

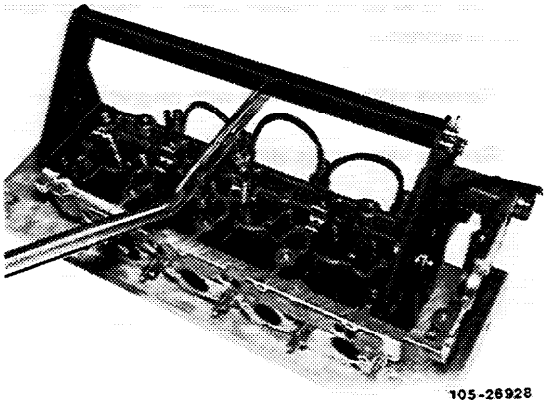
Similar to all engines, the counterbearing of the valve springs in upward direction are in the shape of valve spring retainers (201), which are fastened to the valves by means of valve cone halves (202).

With cylinder head removed, the valves can be removed as follows:

Clamp cylinder head with 4 cylinder head screws on assembly board 601 589 01 59 00.

Fasten supporting bridge 601 589 02 59 00 to cylinder head and remove valve springs by means of valve spring compressor and magnetic lifter.

Note: Install valve tappets again at the same spot from which they were removed before.


105-26928

Removal

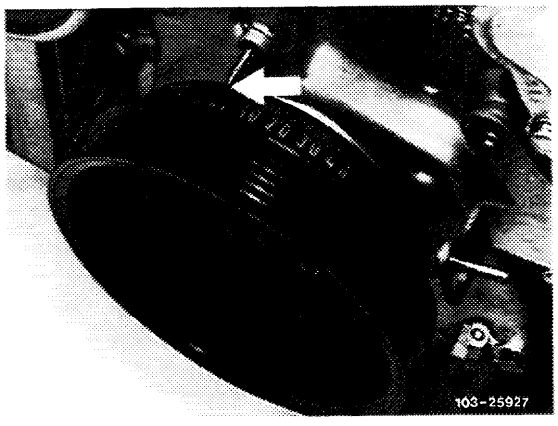
1 Remove camshaft (05–220).

2 Remove chain tensioner (05–310).

3 Remove fan and fan cover.

4 Lift out valve tappets with vacuum lifter.

5 Set piston of respective cylinder to ignition TDC.

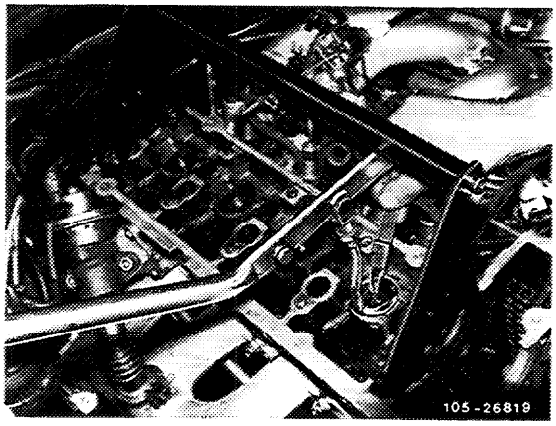

103-25927

Note: For rotating engine, lift timing chain so that chain cannot be pulled in downward direction.

The pistons are in TDC position when the following marks are under TDC indicator (arrow).

Mark	Piston at TDC
TDC	1 and 4
180° (notch)	2 and 3

6 Fasten supporting bridge for valve spring depressor on cylinder head.



7 Push valve spring retainer down by means of valve spring depressor.

8 Remove valve cone halves with magnetic lifter.

9 **Remove vale springs and valve spring retainers.**

10 Check valve spring (05–260).

Installation

11 Install valve spring with color dots in downward position.

12 Lubricate valve tappets and install, pay attention to sequence.

13 Install camshaft (05–220).

14 Install chain tensioner (05–310).

15 Mount cylinder head cover.

16 Install fan and fan cover.

Valve spring data

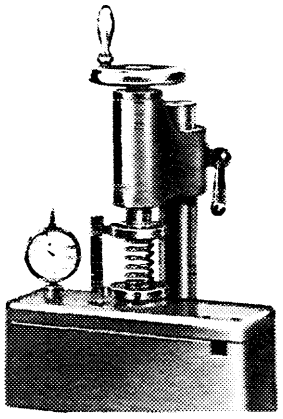
Part No.	Color code	OD mm	Wire dia. mm	Length unloaded mm	Spring force with preloaded length	when new N	limit value N
601 053 01 20	yellow/green or purple/green	33.2	4.25	50.8	27	720-770	648

Checking

1 Check valve springs with a valve spring tester or a spring test scale.

2 Check spring force at specified length.

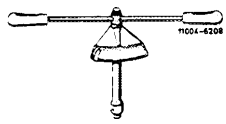
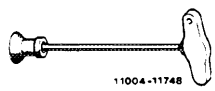
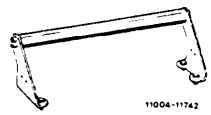
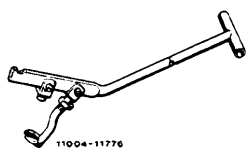
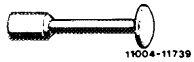
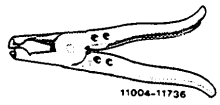
3 If less than limit value, renew valve springs.



R 05/6385

Tightening torques	NM
Bolts for cylinder head cover	10
Screw for camshaft timing gear	45
Screws for camshaft bearing caps	25

Special tools

Torque wrench, double arm, 3/8'' square, 8-32 Nm		001 589 51 21 00
Torque wrench with plug-in ratchet 1/2'' square, 25-l 30 Nm		001 589 66 21 00
Vacuum lifter for valve tappets		601 589 05 33 00
Support bridge for valve spring depressor		601 589 02 59 00
Valve spring depressor for valve springs		601 589 02 61 00
Magnetic lifter for valve cone halves		116589066300
Assembly mandrel for valve stem seal intake and exhaust		601 589024390
Valve sealing pliers		000 589 53 37 00

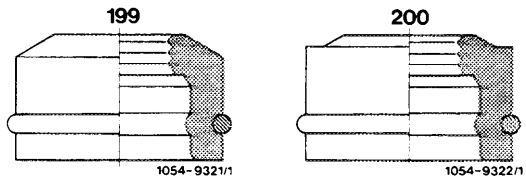
Note

The valve stem seals are supplied as a repair kit.

Different valve stem seals are installed during series production, refer to drawings.

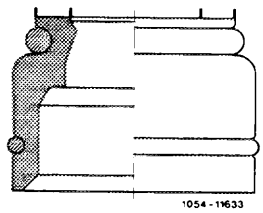
All versions are made of the same elastomere material.

I D's are different according to valve stems.



199 Valve stem seal exhaust
200 Valve stem seal intake

Another version is externally the same for intake or exhaust valves. They differ at ID and on wire rings, which are phosphated (black) on the versions named above and high-polish galvanized (yellow) at exhaust valve.



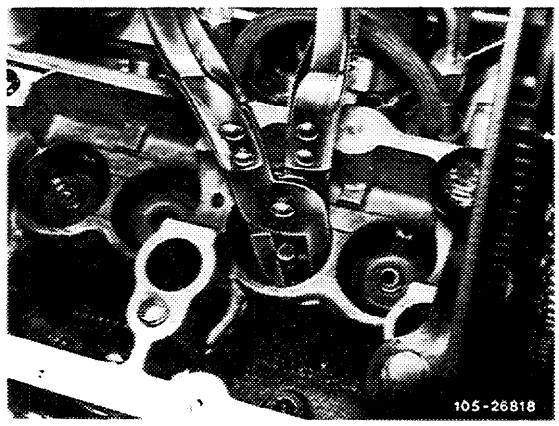
Valve stem seal

Renewing

1 **Remove valve springs (05–250).**

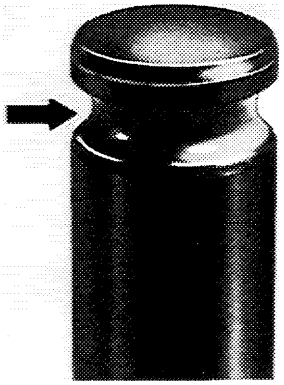
2 Pull off valve stem seals with pliers 000 589 53 37 00.

Attention!
Do not damage valve stem and valve guide.



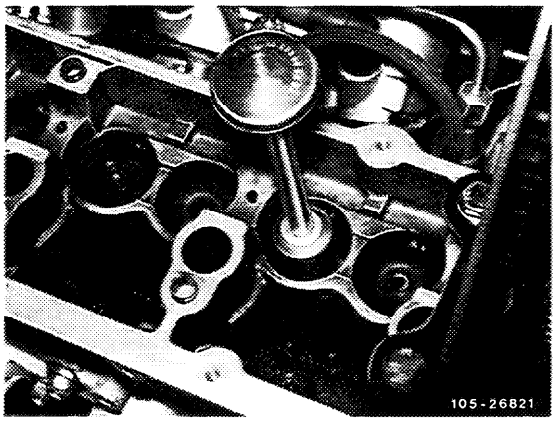
3 Deburr valve stem on groove (arrow).

4 Renew dented valve cone halves, spring retainers and thrust rings.



5 Lubricate valve stem seal and press on with assembly mandrel 601 589 02 43 00.

For this purpose, be sure to place an assembly sleeve (included in repair kit) on valve stem.



6 Install valve springs (05–250).

Data

Engine	Valve disk dia.	Height "h" of valve disk when new limit value		Adjusting angle „α" for machining valve	Valve stem dia. D1	Valve seat plating	Sodium charge	Valve length L
Intake valve								
601	37.90 38.10	0.5-0.7		45" + 15'	7.970 7.955	with	without	106 106.3
Exhaust valve								
601	34.90 35.10	0,5–0.6		45° + 15'	8.960 8.945	with	without	106.5 106.3

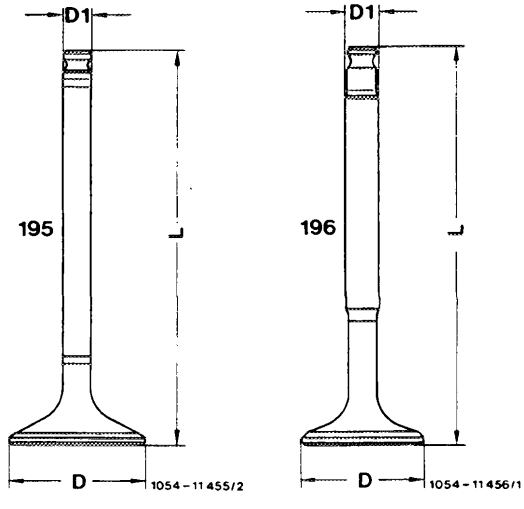
Width of valve seat	Intake 2.5	Exhaust 3.5
Permissible runout on valve stem and valve seat max.	0.03	

Conventional tools

Valve cone grinding machine or valve cone machining tool	e. g. Krupp, D-5309 Meckenheim Model VS e. g. Hunger, D-6000 München 70 Type VKDR 1, order No. 203.00.200

Identification on stem end

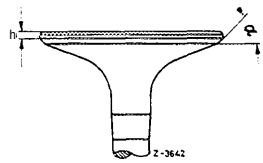
Engine	Intake valve	Exhaust valve
601	E 601 02	A 601 02



195 Intake valve
196 Exhaust valve

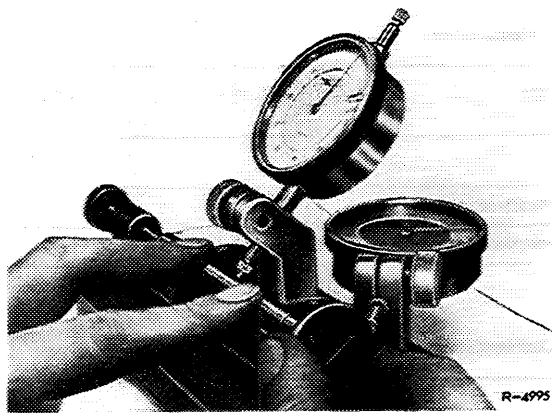
Checking and machining

1 **Clean valves and check visually.**



Renew valves with burnt valve disk, with insufficient height "h" of valve disk and with worn or scored valve stem.

2 Measure runout **on valve stem. If** runout **exceeds 0.03 mm, renew valve.**

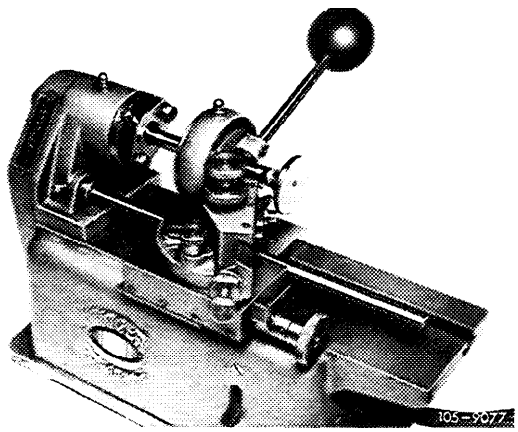


3 Machine valve seat.

Pay attention to operating instructions of machining unit and adjusting angle 45° + 15'.

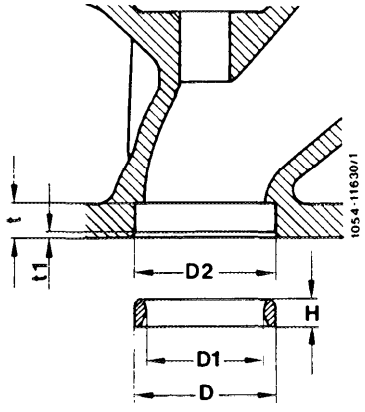
4 Measure runout **on valve seat and height "h" of valve disk.**

Renew valve, if limit values are not attained.



Data

		Intake	Exhaust
Overlap of valve seat rings in cylinder head		0.068-O. 100	
D 2	Normal dimension	40 .000 40.016	37 .000 37.016
	Repair stage max. up to		
D	Normal dimension	40.100 40.084	37.100 37.084
	Roughing dimension Repair stage		
D 1		33.400 33.600	30.400 30.600
H	Normal dimension and repair stages	6.97 7.00	6.97 7.00
t		9.35 9.25	
t l		2.37 2.25	2.44 2.25



Special tools

Check plug 8 mm dia. for intake valve guide		102 589 00 23 00
Check plug 9 mm dia. for exhaust valve guide		117589032300

Conventional tools

Cylinder head clamping device	e. g. Hunger, D-8000 Miinchen 70 Order No. 221.60.000
Ring seat turning tool, size 2	e. g. Hunger, D-8000 Miinchen 70 Order No. 220.03.110
Valve seat machining tool, type VDSNL 1/45/30	e. g. Hunger, D-8000 Miinchen 70 Order No. 236.03.308
Test set for valves	e. g. Hunger, D-8000 Miinchen 70 Order No. 2 16.93.300
Internal measuring instrument (measuring range 25-60 mm)	e. g. Mahr, D-7300 Esslingen Order No. 844
External micrometer (measuring range 25-50 mm)	e. g. Mahr, D-7300 Esslingen Order No. 40 S

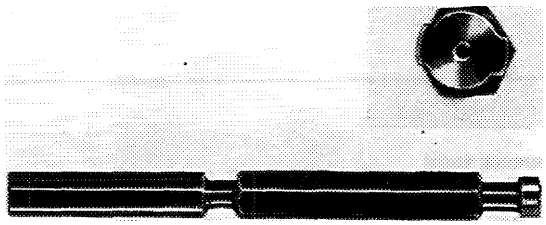
Note

For all valve seat ring versions each spare part is a repair valve seat ring with a larger OD.

Renewing

1 Unscrew old valve seat ring with ring seat turning tool.

Pay attention to operating instructions of turning tool.



105-22768

2 Check valve guides and renew, if required (05–285).

3 Measure basic bore D 1.

A new normal dimension valve seat ring can be used if the specified overlap is available.

If the minimum overlap is not attained, machine basic bore for valve seat ring.

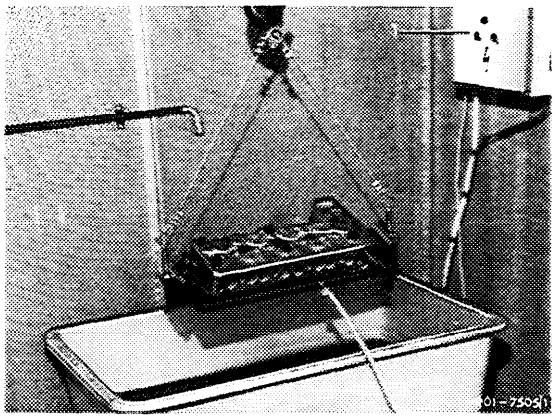
4 Machine basic bore D 1 with ring seat turning tool until the bore is just clean.

5 Measure machined basic bore.

6 Machine repair stage valve seat ring in such a manner that the specified overlap is obtained.

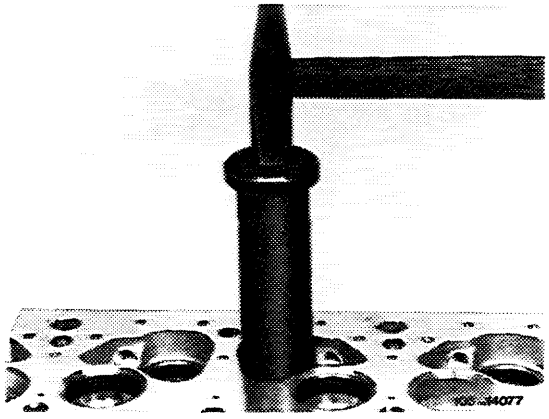
7 Heat cylinder head in water bath to approx. 80 °C.

8 Undercool valve seat ring with liquid nitrogen.



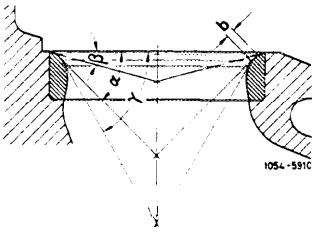
9 Knock in valve seat ring with a suitable guide mandrel.

10 Machine valve seats (05–291).



Data

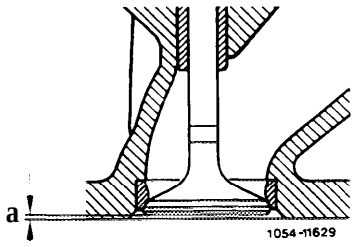
	Intake	Exhaust
Valve seat width b		
Valve seat angle α	45°	
Correction angle at top β	15°	
Correction angle bottom γ	60"	
Permissible out-of-true of valve seat	0.05	



Valve distance to cylinder head parting surface

Minimum distance a with new valves and new valve seats	Intake/Exhaust	-0.1 to -0.5
Max. distance a with refinished valve seats and reground valves	Intake	
	Exhaust	

The max. distance is reduced by the same dimension by which the cylinder head parting surface has been refinished.



Valve disk dia.	Intake	37.90 38.10
	Exhaust	34.90 35.10

Special tools

Check plug 8 mm dia. for intake valve guide		102589002300
Check plug 9 mm dia. for exhaust valve guide		117589032300

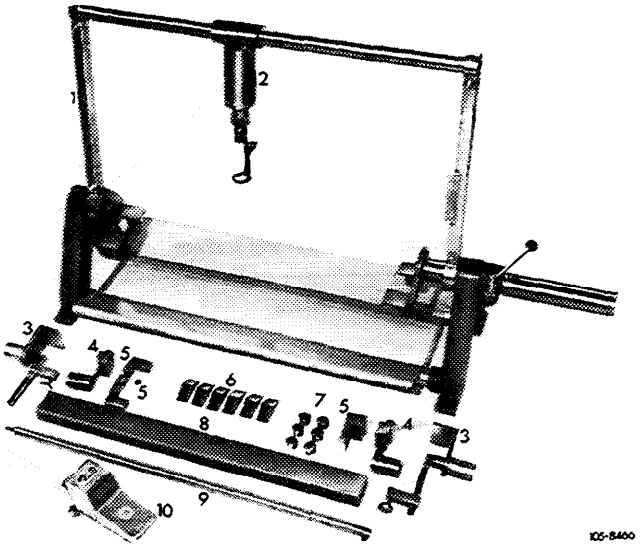
Conventional tools

Cylinder head clamping device	e.g. Hunger, D-8000 Miinchen 70 Order No. 221.60.000
Valve seat machining tool, type VDSNL 1/45/30	e. g. Hunger, D-8000 Miinchen 70 Order No. 236.03.308
Test set for valve seats	e. g. Hunger, D-8000 Miinchen 70 Order No. 216.93.300
60" correction bit No. 13 for correction angle, bottom	e. g. Hunger, D-8000 Miinchen 70 Order No. 216.64.622

Note

Clamp cylinder head into clamping device for disassembly and machining.

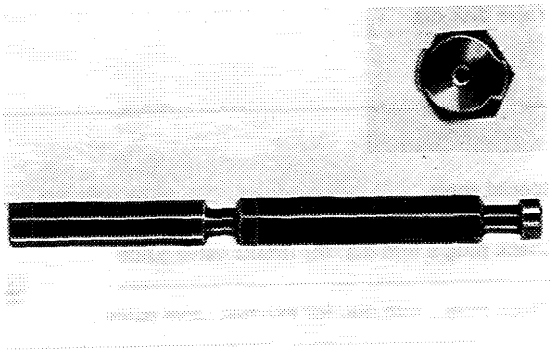
Machine valve seats with valve seat machining tool, with valve seat grinding machine or with valve seat milling cutter.



105-8400

Machining valve seats

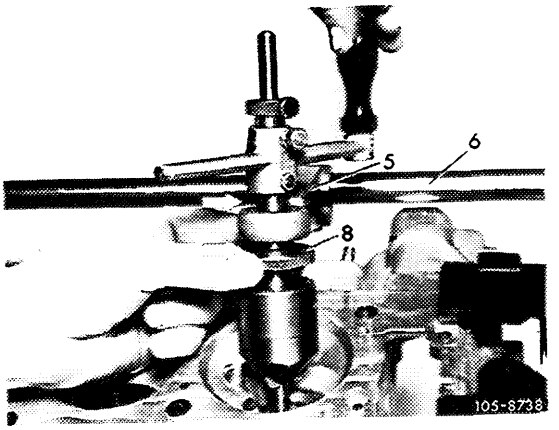
1 Check valve guides and renew, if required.



105-22768

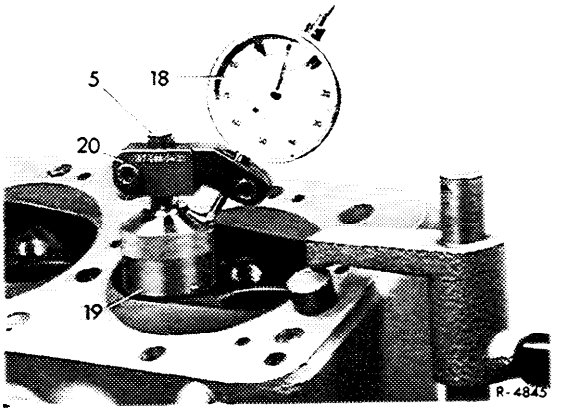
2 Machine valve seat (45°15') (refer to operating instructions of tool manufacturer).

Attention!
Loosen pilot only after runout of valve seat has been checked (item 3).



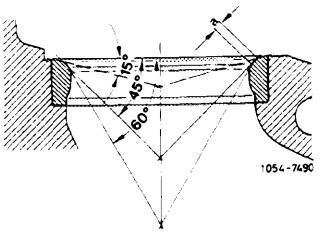
3 Check runout of valve seat.

For this purpose, slip fitted sleeve (19) with dial gauge holder (20) and dial gauge on pilot (5).



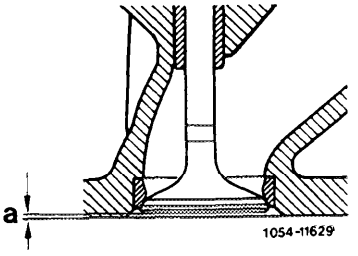
5 Pilot
18 Dial gauge
19 Fitted sleeve
20 Dial gauge holder

4 Measure valve seat width (b) and, if required, correct at top (β) with 15" and below (γ) with 60°.



5 Insert valves and measure distance a.

If required, renew valve seat ring (05–290).



05–310 Removal and installation of chain tensioner

Tightening torques	Nm
Chain tensioner in cylinder head	80
Closing plug for chain tensioner	60

Note

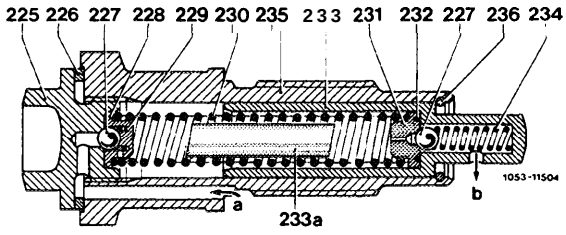
Install chain tensioner in filled condition on principle.

Suitably, completely renew chain tensioner complained about.

The hydraulic chain tensioner is supplied with pressure oil through an oil duct in cylinder head.

Check valve (227 and 228) and pressure limiting valve (227 and 231), together with compression spring (230), will keep the contact pressure of thrust pin (233) on tensioning rail approximately constant, independent of engine oil pressure.

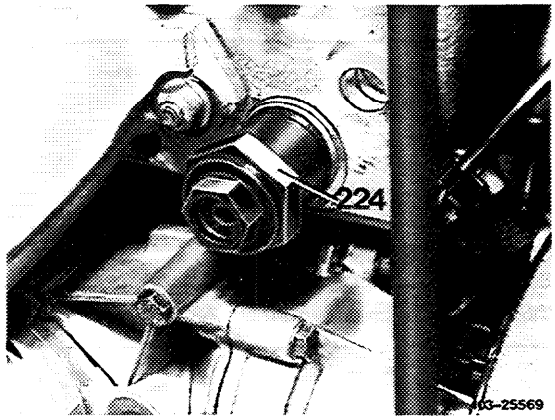
The filling pin (233a) contributes to faster venting when filling in oil.



225	Closing plug	233	Thrust pin
226	Aluminum seal A 25 x 30	233a	Filling member
227	Ball dia. 5 mm	234	Compression spring
228	Ball guide	235	Housing
229	Compression spring	236	Circlip B 16
230	Compression spring	a	Feed bore from cylinder head
231	Valve disk	b	To oil pan
232	O-ring		

Removal

1 Unscrew chain tensioner (224).



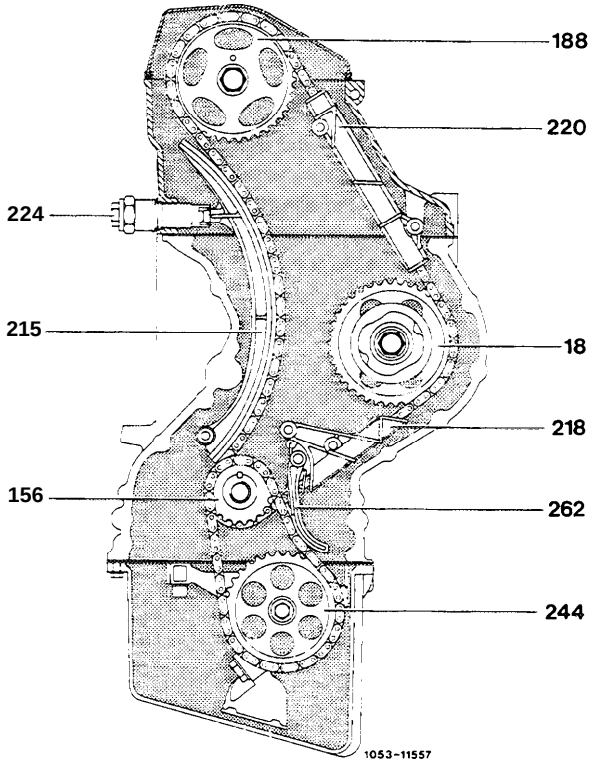
Installation

2 Fill chain tensioner. For this purpose, set chain tensioner with thrust pin in downward direction into engine oil SAE 10, with the oil extending over flange on hexagon. Press thrust bolt 7-10 times slowly down against stop with the assistance of a press or a column-type drill press.

Upon filling, compression of chain tensioner should be possible very slowly and uniformly only, and under considerable force.

3 Install chain tensioner with new sealing ring.

Thrust pin of chain tensioner should rest against lug of tensioning rail.

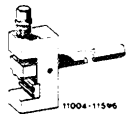
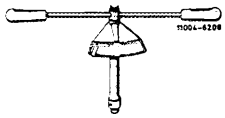


215 Tensioning rail
224 Chain tensioner

05-320 Replacing timing chain

Tightening torques	Nm
Bolts for cylinder head cover	10
Coupling nuts for injection lines (reference value)	1 O-20
Injection nozzles in prechambers	70 + 10

Special tools

Pressing-on tool		000 589 57 43 00
Torque wrench, double arm, 3/8'' square, 8-32 Nm		001 589 51 21 00
Box-end wrench element, open, 14 mm, 1/4'' drive for coupling nut on injection line		000 589 77 03 00

Note

A timing chain with connecting link is available for repairs.

If only an endless timing chain is available, the chain can be opened prior to installation (refer to item 3).

During an engine overhaul, an endless timing chain must be installed on principle.

Check sprockets for score marks and pitting.

Replacement part (repair timing chain with connecting link)

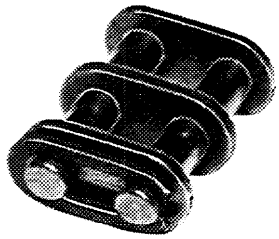
Designation	Part No.
Bushing chain with connecting link	001 997 16 94
Connecting link	000997 11 98

Repair timing chain

The connecting link is held in place by a locking spring.

The outer flanges are dyed blue.

The outer flange of connecting link is pressed on by means of pressing-on tool 000 589 57 43 00.



Connecting link with locking spring 105 - 25310

Renewing

1 Remove injection nozzles (07.1-230).

2 Remove cylinder head cover.

3 Remove chain tensioner.

4 Remove fan and fan cover.

5 Cover chain box with a cleaning rag and cut through both chain bolts on one link of timing chain by means of a grinding wheel.

6 Connect new timing chain with connecting link to old timing chain, while pushing out opened link (Fig. item 6).

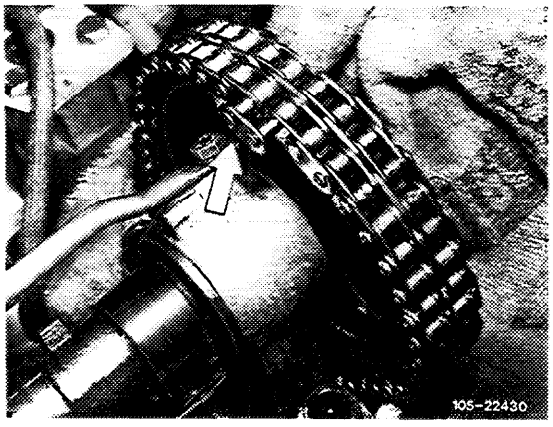
7 Slowly rotate crankshaft in rotating direction of engine, while simultaneously pulling up the old timing chain until the connecting link comes to rest against uppermost point of camshaft timing gear.

Attention!
Timing chain should remain in mesh while rotating camshaft and crankshaft timing gear.

8 Take off old timing chain and connect ends of new timing chain with a connecting link.

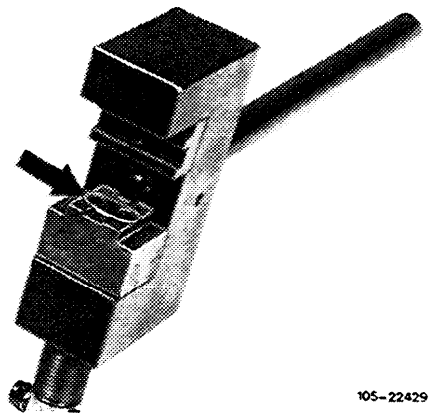
For this purpose, secure chain ends with wire on camshaft timing gear.

9 Insert connecting link from the rear into timing chain (arrow).

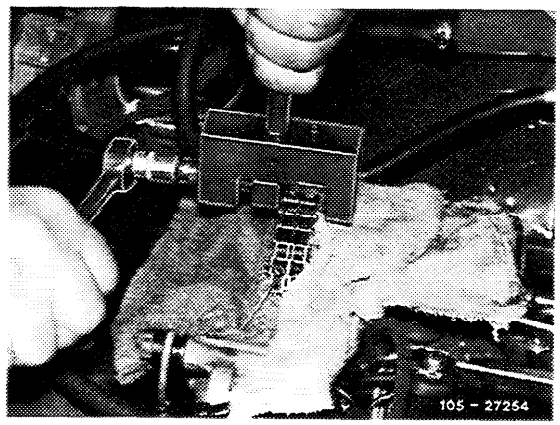


Shown on engine 615

10 Put separately enclosed outer flange of connecting link (with punched in IWIS identification) into pressing-on tool (arrow). The outer flange is held magnetically.

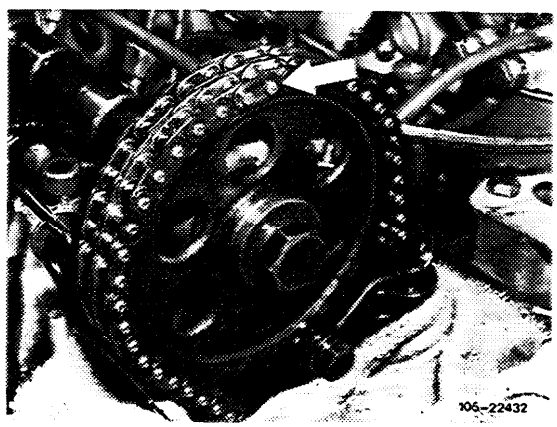


11 Place pressing-on tool on connecting link and press on flange up to stop, while holding pressing-on tool on vertical lever.



12 Force locking spring in opposite direction of engine rotation into grooves of chain pins (arrow).

13 Install chain tensioner.

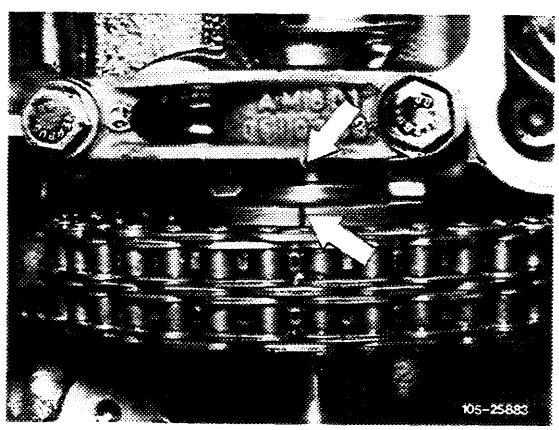


14 Rotate crankshaft and check adjusting mark in TDC position of engine.

Note: If the adjusting mark is not in order, check timing of crankshaft (05–215) and timing of injection pump (07.1-I 11).

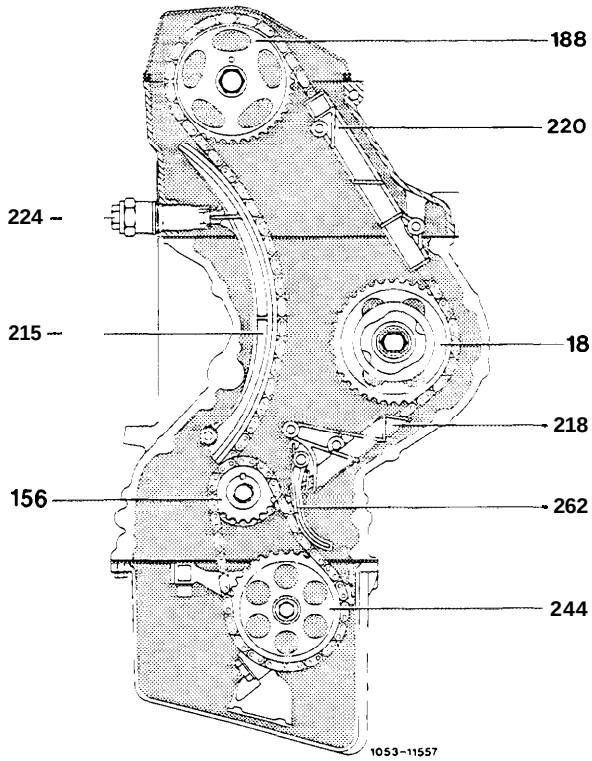
15 Install *cylinder* head cover.

16 Install fan and fan cover.



Note

The plastic coating of tensioning rail is not exchangeable.



18 Injection timer
156 Sprocket
188 Camshaft timing gear
215 Tensioning rail
218 Slide rail
220 Slide rail
224 Chain tensioner
244 Oil pump sprocket
262 Tensioning clamp

Removal

1 Remove cylinder head (01–415).

2 Remove timing housing cover (01–210).

3 Remove tensioning rail from bearing bolts.

Installation

4 Place tensioning rail on bearing bolt.

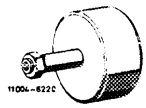
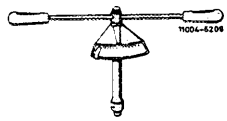
5 Install timing housing cover (01–210).

6 Install cylinder head (01-415).

7 Run engine and check for leaks.

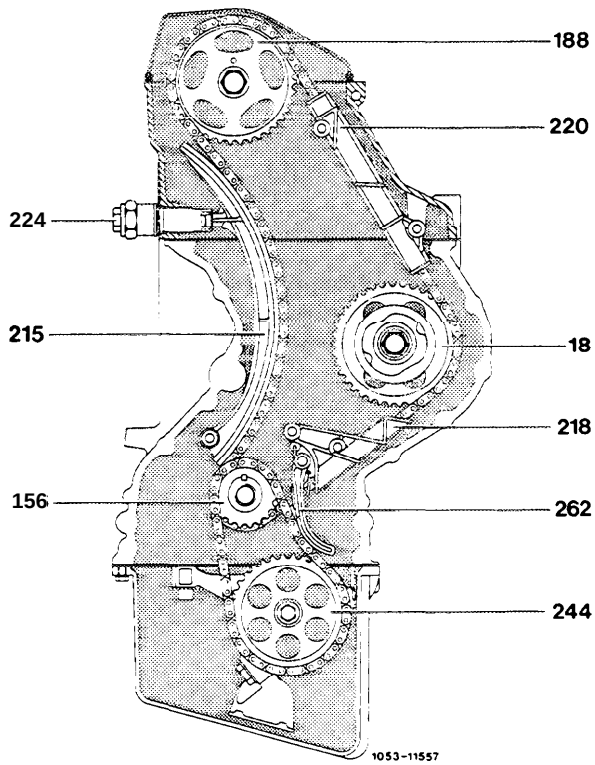
Tightening torques	Nm
Cylinder head cover	10
Screw for camshaft timing gear	45

Special tools

Impact puller for bearing bolt (basic unit)		116589203300
Threaded bolt M 6, 50 mm long for impact puller		116589013400
Torque wrench, double arm, 3/8'' square, 8-32 Nm		001 589 51 21 00
Torque wrench with plug-in ratchet, 1/2'' square, 25-130 Nm		001 589 66 21 00

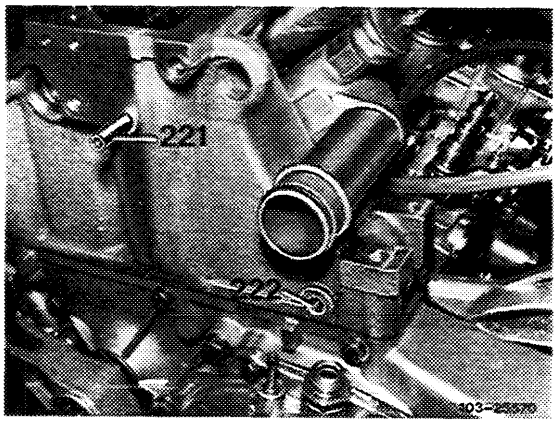
Note

Remove timing housing cover for removal and installation of slide rail (218).



18 Injection timer
156 Sprocket
166 Camshaft timing gear
215 Tensioning rail
218 Slide rail
220 Slide rail
224 Chain tensioner
244 Oil pump sprocket
262 Tensioning clamp

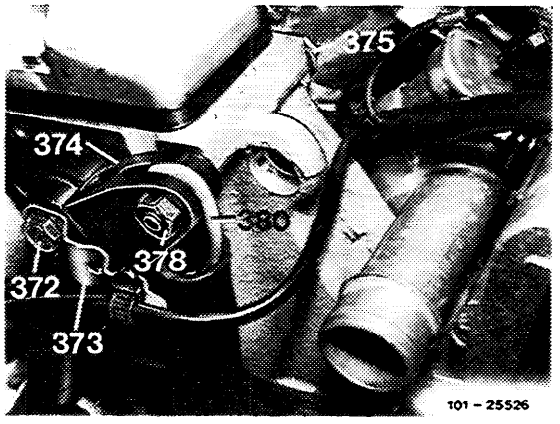
The longer bearing bolt (221), in cylinder head at top, serves for supporting slide rail as well as for spring tensioning lever of V-belt tensioning device.



A. Removal and installation of slide rail (220) in cylinder head

Removal

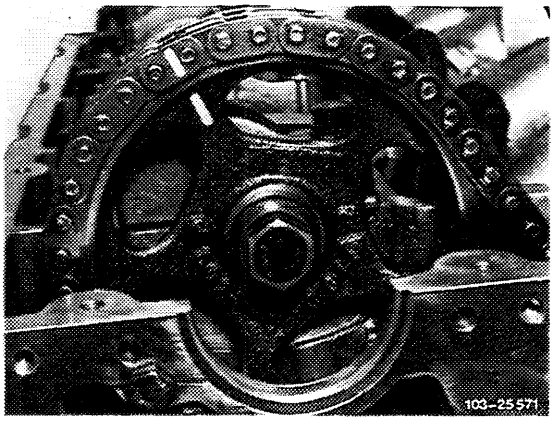
1 Slacken V-belt and remove. For this purpose, unscrew collar nut (378). Insert a mandrel into spring tensioning lever (374) and relieve hex. screw (375) against force of draw spring (380) until screw can be pushed back in direction of intake manifold. Release spring tensioning lever.



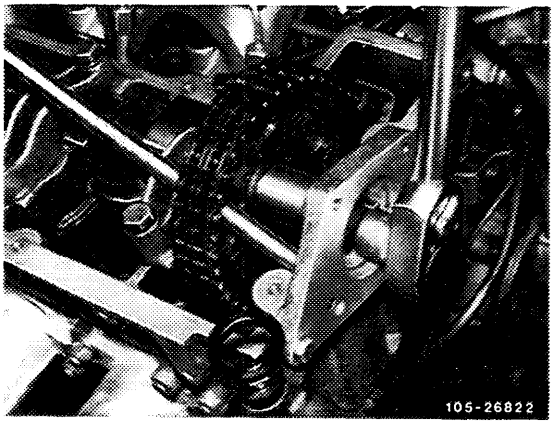
2 Unscrew screw (372) and remove holder (373) as well as spring tensioning lever (374).

3 Remove cylinder head cover.

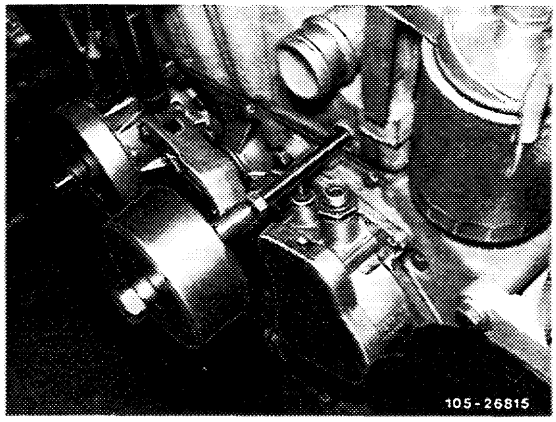
4 Mark timing chain and camshaft timing gear in relation to each other.



5 Unscrew camshaft timing gear and remove. For loosening hex. screw, apply counterhold to camshaft with a screwdriver or mandrel.



6 Knock out both bearing bolts with impact puller and remove guide rail.



Installation

7 Coat bearing bolt on collar with sealing compound.

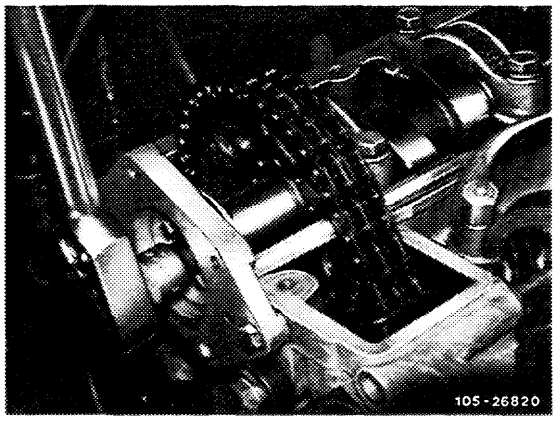
8 Insert slide rail and knock in bearing bolt with impact puller.

Apply counterhold to slide rail with screwdriver.

9 Mount camshaft timing gear. Pay attention to color marks.

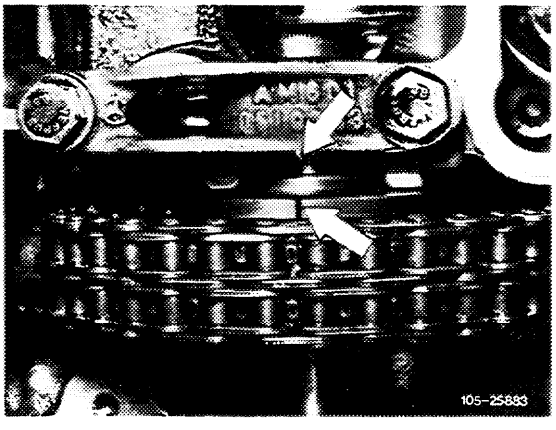
For assembly of camshaft timing gear, push back thrust bolt of chain tensioner.

Tighten fastening screw for camshaft timing gear to 45 Nm. For this purpose, apply counterhold to camshaft with a screwdriver or a mandrel.



10 Set engine to ignition TDC of 1st cylinder and check mark (arrows).

11 Mount cylinder head cover.

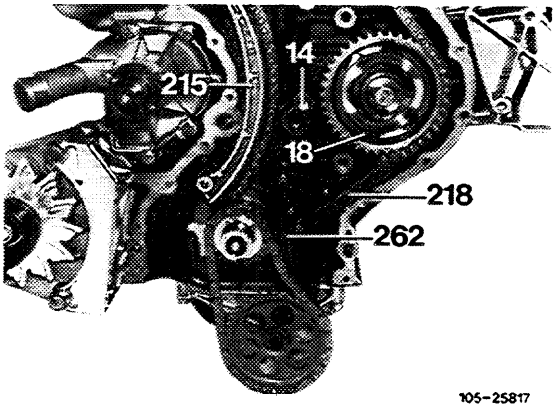


B. Removal and installation of guide rail (218)

1 Remove timing housing cover (01—210).

2 Pull out slide rail (218).

3 For installation proceed vice versa.

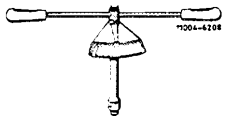


105-25817

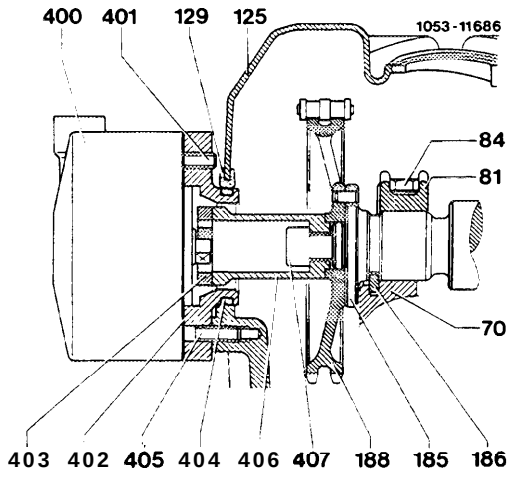
14 OH nozzle
18 Injection timer
215 Tensioning rail
218 Slide rail
262 Tensioning clamp

Tightening torques	Nm
Cylinder head cover	10
Hex. socket screw for camshaft timing gear	45
Hydraulic oil pump (level control) on fastening flange	15

Special tools

Torque wrench, double arm, 3/8" square, 8-32 Nm		001 589 51 21 00
Torque wrench with plug-in ratchet, 1/2" square, 25-l 30 Nm		001 589 66 21 00

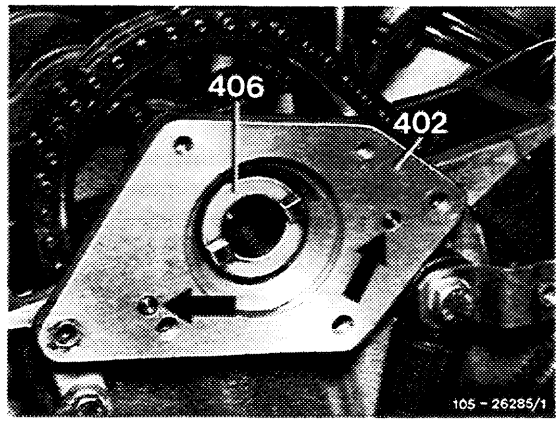
Note



70 Cylinder head
81 Camshaft bearing cap
84 Combination screw M 8 x 45
125 Cylinder head cover
129 Cylinder head cover gasket
185 Camshaft
186 Lockwasher
188 Camshaft timing gear
400 Hydraulic oil pump
401 Cyl. pin
402 Flange
403 Driven plate
404 O-ring
405 Hex. socket screw
406 Drive sleeve
407 Hex. socket screw

The hydraulic oil pump (400) is directly driven by camshaft (185) via drive sleeve (406) and is fastened to cylinder head by means of a flange (402).

The installation position of flange on cylinder head is fixed by means of two cyl. pins (arrows).



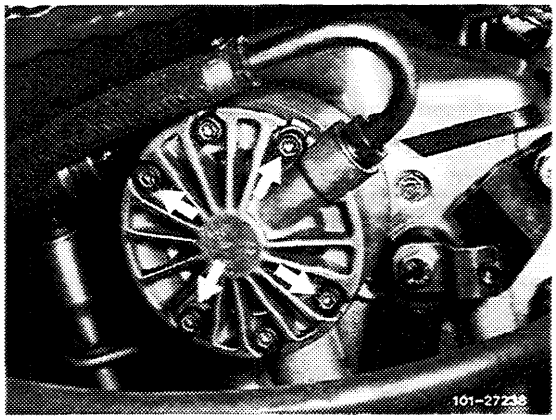
The camshaft timing gear (188) is fastened to camshaft together with drive sleeve (406) by means of a hex. socket screw (405).

The O-ring on flange (402) seals the half bore at front on cylinder head and in cylinder head cover.

Removal

Remove cylinder head cover.

2 Unscrew hex. socket screws (arrows) and put hydraulic oil pump aside with lines connected.



Remove driven plate.

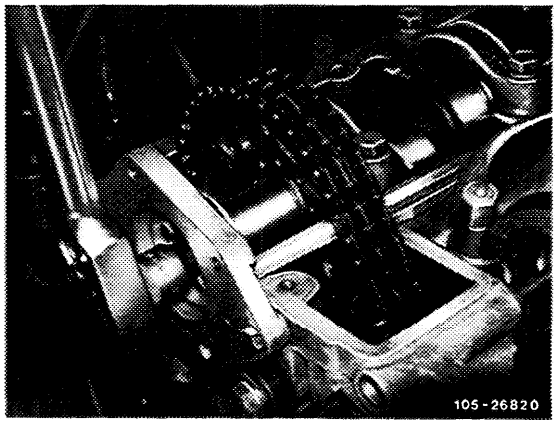
3 Unscrew hex. socket screw (405) for camshaft timing gear and drive sleeve and remove.

For loosening hex. socket screw, apply counterhold to camshaft with holding wrench.

Installation

4 For installation proceed vice versa to removal.

Tighten hex. socket screw for camshaft timing gear and drive sleeve to 45 Nm. For this purpose, apply counterhold with a screwdriver or a mandrel.



	Job No.
Survey engine – injection pump – injection nozzle – nozzle holder	07.1-001
Operation of injection system	010
A. Lubrication of injection pump	
B. Relief throttle in delivery valve holder	
C. Layout and operation of RSF governor	
D. Pneumatic idle speed increase	
E. Reference impulse verification (RIV)	
F. Fuel pump	
G. Function diagram low pressure circuit	
Operation of injection nozzles	011
A. Flat surface pintle nozzle (standard version)	
B. Hole-type pintle nozzle (USA)	
Operation of fuel preheater	012
Testing and adjusting jobs	
Adjustment of idle speed	100
Checking pneumatic idle speed increase	102
Checking engine output and exhaust gas on chassis dynamometer	104
Checking injection timing (high-pressure method)	109
Checking injection timing (position pickup-RIV-method)	111
Checking injection timing with digital tester (RIV-method)	112
Adjusting injection timing (high-pressure method) – following checkup.	115
Adjusting injection timing (position pickup-RIV-method) – following checkup	116
Adjusting injection timing with digital tester (RIV-method) – following checkup	117
Checking injection nozzles	135
A. Throttle pintle and flat surface pintle nozzle	
B. Hole-type pintle nozzle	
Disassembling, cleaning, assembling and adjusting injection nozzles (following checkup)	137
Checking fuel pump	145
Checking vacuum shutoff for leaks	150
Assembly jobs	
Removal and installation of injection pump	200
Renewing delivery valve seal	210
Renewing vacuum control unit	220
Removal and installation of injection nozzle	230
Removal and installation of fuel pump	235
Removal and installation of injection timer.	240
Renewing fuel filter	245

Standard version and (USA)

Engine	601.911 standard version	601.921 (USA)
Injection pump	PES 4 M 55 C 320 RS 152	
Governor	RSF 375/2250 M 53	RSF 375/2250 M 56
Fuel pump	FP/KG 24 M 150	
Injection nozzle	DN 0 SD 261/–	DN 0 SD 24-/
Nozzle holder	KCA 30 S 44	KCA 30 S 46

The injection system differs from that of engines 615, 616 and 617 as follows:

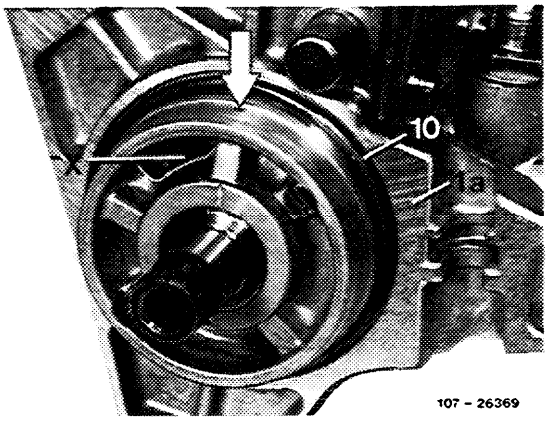
- Lubrication of injection pump.
- Relief throttle in delivery valve holder.
- Pneumatic idle speed increase.
- Reference impulse verification (RIV).
- Injection timing by means of adjusting device and injection pump flange.
- Injection system, self-venting.
- Fuel pump with higher delivery capacity, thereby eliminating hand pump.
- Overflow valve with throttle (orifice).
- Injection nozzle **as flat surface pintle** nozzle for standard version and as hole-type pintle nozzle for (USA).
- Injection timer mounted directly on injection pump shaft. Fastened by means of central bolt with **left-hand threads.**
- Fuel heater.

A. Lubrication of injection pump

The injection pump is connected to engine oil circuit by means of an oil bore (arrow).

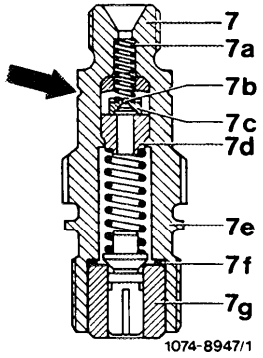
Oil return flow is by way of ring gap (x) between bearing and housing in cylinder crankcase.

An O-ring (10) is installed on flange (la) for sealing the clutch space between injection pump flange and crankcase.



B. Relief throttle in delivery valve holder

Relief throttles are installed in delivery valve holders of injection pump to reduce the hydro-carbon share in exhaust gas. An annular groove is located on delivery valve holder for identification (arrow). The relief throttle (7b) is a reed valve (7c) with an orifice of 0.6 mm dia., which opens in direction of injection nozzle. The valve seat (7d) is riveted into delivery valve holder.



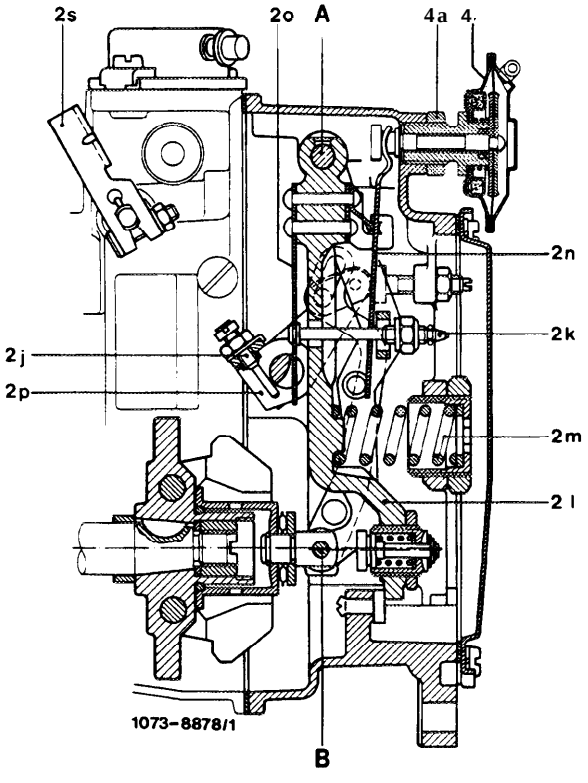
7 Delivery valve holder connection
7a Spring
7b Relief throttle
7c Reed valve
7d Valve seat
7e Delivery valve holder
7f Seal
7g Delivery valve

C. Layout and operation of RSF-governor

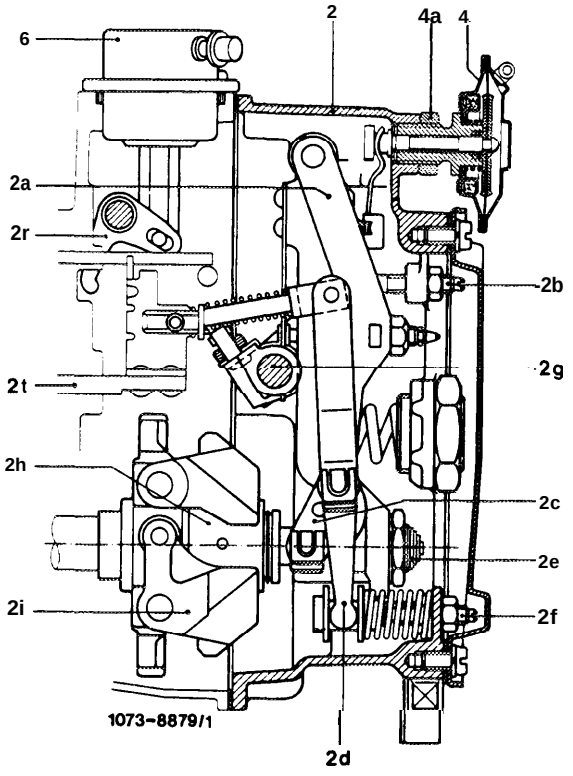
The governor is an idle speed-maximum speed governo with its regulating spring (2 m) measured and adjusted in such a manner that the governor will not govern in partial load range, apart from adaptation (refer to ,,Regulation during start and full load").

In partial load and full load range the control rod (2t) of injection pump is operated by accelerator pedal only, which is connected to adjusting lever (2g) of governor via regulating linkage.

The vacuum control unit (4) preloads the idle speed spring and adjusts the idle speed.



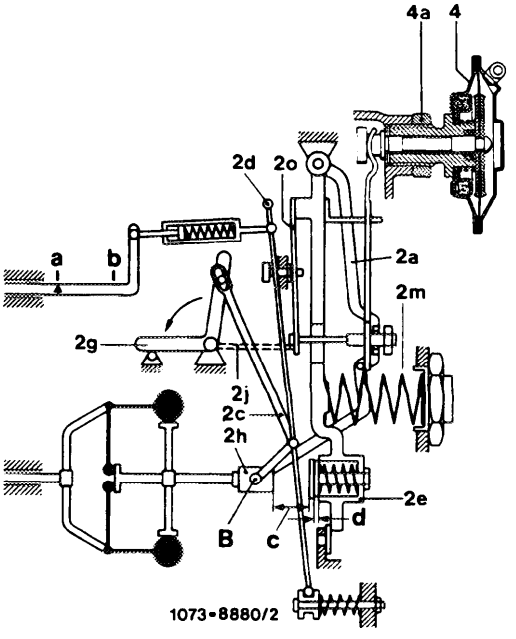
2 Governor
2a Guide lever
2b Stop screw for delivery at idle
2c Transfer lever
2d Regulating lever
2e Spring capsule (adaptation)
2f Full load adjusting screw
2g Adjusting lever
2h Sliding sleeve
2i Flyweights (pump-governor-group)
2j Idle speed auxiliary spring-shutoff
2k Adjusting screw for idle speed auxiliary spring (tickler)
2l Tensioning lever
2m Governor spring
2n Idle speed spring
20 idle speed auxiliary spring (tickler)
2p Linkage lever
2r Stop lever
2s Emergency stop lever
2t Controi rod
4 Vacuum control unit idle speed increase
4a Adjusting nut for idle speed
6 Vacuum control unit (stop)



Regulation during start and full load

If, with the engine stopped, the adjusting lever (2g) is placed against full load stop (fixed stop on governor housing), the transfer lever (2c) will swing around pivot „B'' and will take the regulating lever (2d) along in direction of start.

In full load position of adjusting lever (2g „full throttle") the idle speed auxiliary spring (2o, tickler) is forced away from guide lever under influence of idle speed auxiliary spring-shutoff (2j) A faster break away from starting position of governor will result.



a Start
b Stop
c Idle speed stage
d Adaptat ion

After running through idle speed stage (c), the sliding sleeve (2h) rests against spring capsule (2e) As a result, the control rod of the injection pump will be moved into full load position via transfer lever (2c) and regulating lever (2d).

When a given speed has been attained, excess pressure is applied to spring capsule (2e) for a given distance (d) (adaptation).

If the engine speed is still increasing, the force of the flyweights is sufficient to apply excess pressure to regulating spring (2m) (maximum speed breakaway).

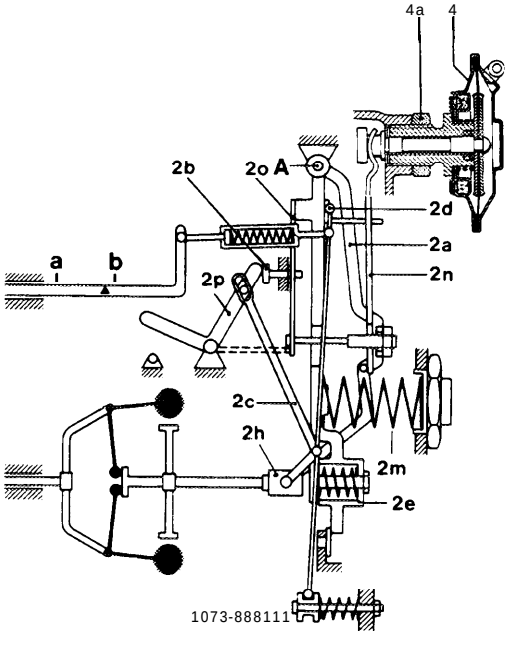
Start of breakaway depends on preload of regualting spring (2m).

Regulation at idle speed

Linkage lever (2p) rests against idle speed stop screw (2b). With increasing speed, the sliding sleeve (2h) runs through idle speed stage. Guide lever (2a) swivels around pivot ,,A" and is thereby acting against idle speed spring (2n).

At a given speed the guide lever (2a) rests against adjusting nut of idle speed auxiliary spring (20). The movement of the sliding sleeve (2h) is transmitted to control rod of injection pump via transfer lever (2c) and regulating lever (2d) in the same sense of direction. After running through idle speed stage, the sliding sleeve (2h) will rest against spring capsule (2e).

If the engine speed continues to increase (e.g. under influence of deceleration), excess pressure will first be applied to spring capsule (2e) and then to regulating spring (2m) as from a given speed. This will move the control rod into ,,stop position".



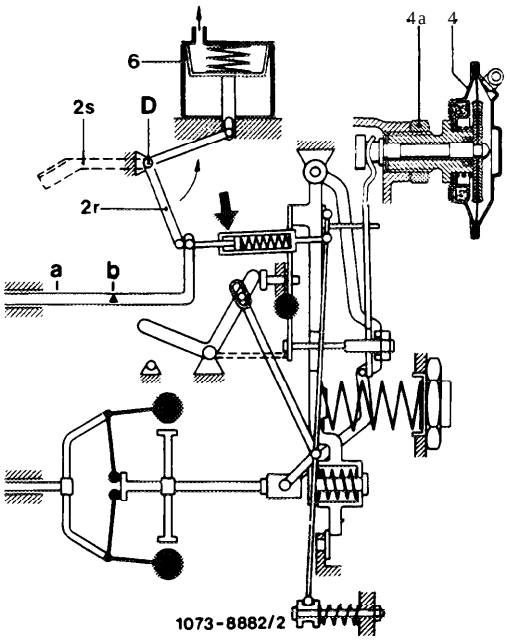
a Start
b Stop

Stop position of governor

The vacuum control unit (6) is provided with a vacuum by means of vacuum pump via steering lock of vehicle. As a result, the diaphragm of the vacuum control unit is attracted against the pressure of the diaphragm spring.

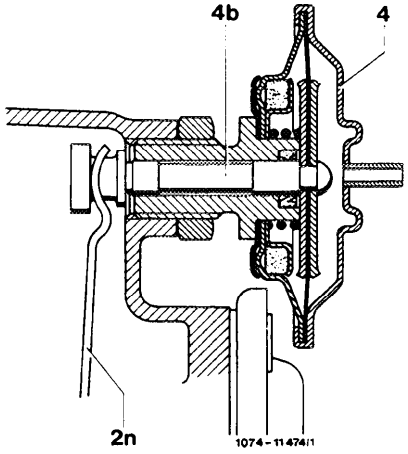
The vacuum control unit (6) is connected to a stop lever (2r). This lever will swivel around pivot „D" and will thereby pull the control rod of the injection pump into „stop position".

This will bridge the shunt spring of the regulating lever. Likewise, the control rod can be pulled from outer side of governor into „stop position" via emergency stop lever (2s).

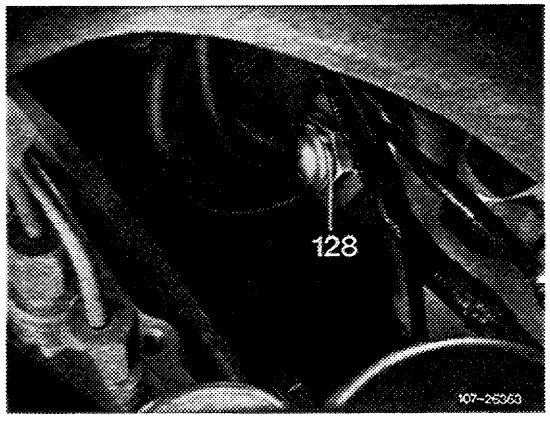


D. Pneumatic idle speed increase

Idle speed increase for rpm stabilization is effected up to approx. 17 °C coolant temperature, as well as on vehicles with automatic transmission when the refrigerant compressor is additionally connected also above approx. 17 °C coolant temperature.

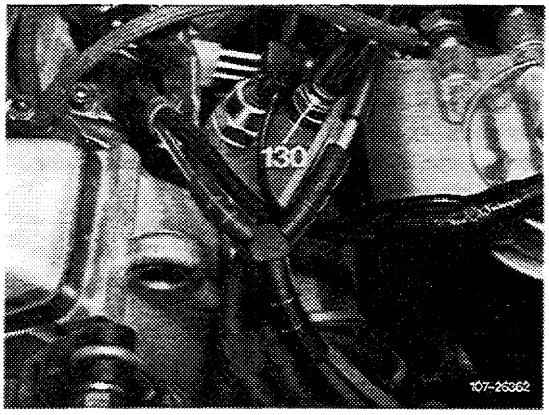


The vacuum control unit (4) attached to governor housing is activated via thermovalves (128 and 130) and switchover valve (127). If the vacuum control unit (4) is energized by a vacuum (approx. 500 mbar), the idle speed spring is attracted via plunger (4b) of vacuum control unit. The idle speed control characteristic is displaced and the idle speed is increased by approx. 100/min.



Coolant temperature < approx. 17 °C

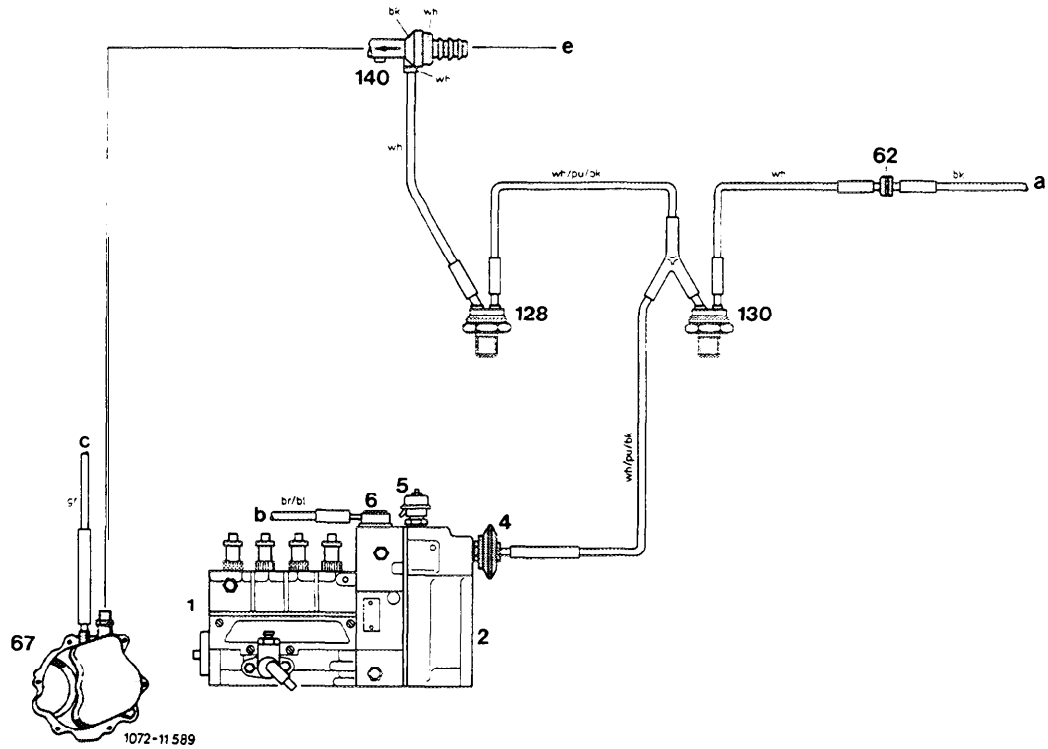
Thermovalve (128) is opened, thermovalve (130) is closed. On vehicles with automatic transmission the vacuum flows via switchover valve (127), and on vehicles with manual transmission directly to vacuum control unit (4).



Coolant temperature > approx. 17 °C

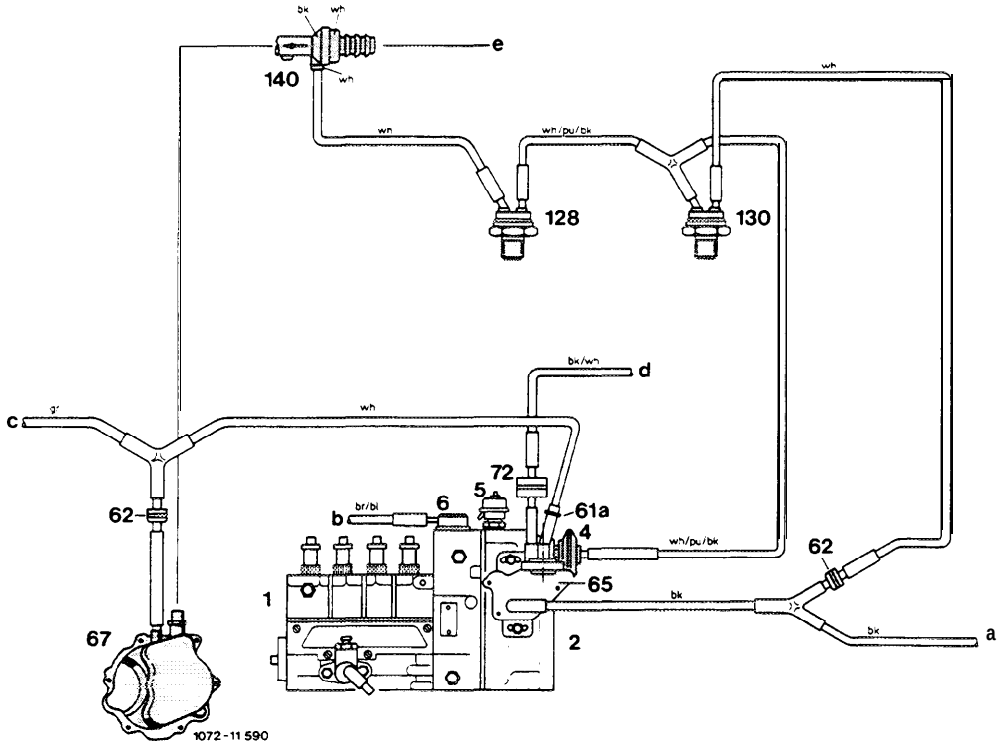
Thermovalve (128) is closed, thermovalve (130) is opened. The vacuum control unit is connected to atmosphere and the rpm increase is cancelled.

When the refrigerant compressor is additionally connected (vehicles with automatic transmission only) the switchover valve is energized and will switch. The vacuum flows through upper connection of switchover valve to vacuum control unit (4).



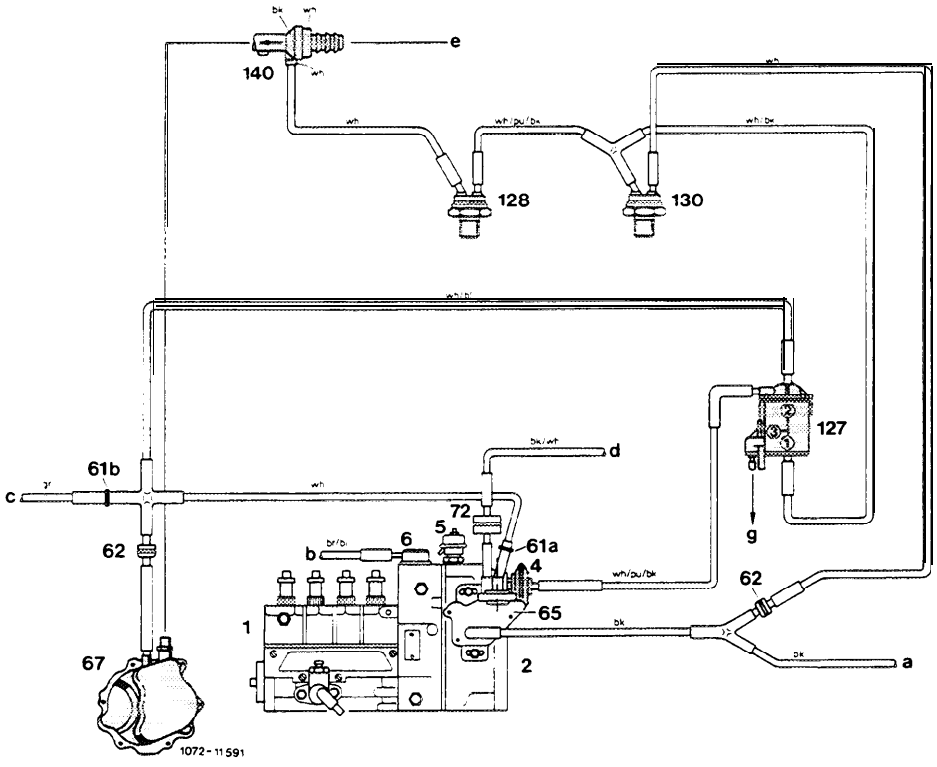
Function diagram idle speed increase with manual transmission, standard version and (USA) Federal

1	Injection pump	a	Vent line to vehicle interior	bk	= black
2	Governor	b	Key shutoff	bl	= blue
4	Vacuum control unit idle speed increase	c	Remaining consumers	br	= brown
5	ADA-capsule (altitude pressure compensator@	e	Brake unit	gr	= green
6	Vacuum control unit (stop)			pu	= purple
62	Vent filter			re	= red
67	Vacuum pump			wh	= white
128	Thermovalve closes at approx. 17 °C				
130	Thermovalve opens at approx. 17 °C				
140	Check valve brake unit				



Function diagram idle speed increase with automatic transmission, standard version

1	Injection pump	a Vent line to vehicle interior	bk = black
2	Governor	b Key shutoff	bl = blue
4	Vacuum control unit idle speed increase	c Remaining consumers	br = brown
5	ADA-capsule (altitude pressure compensator@	d Vacuum control unit automatic transmission	gr = green
6	Vacuum control unit (stop)	e Brake unit	pu = purple
61a	Orifice (blue)		re = red
62	Vent filter		wh = white
65	Vacuum control valve		
67	Vacuum pump		
72	Damper		
128	Thermovalve closes at approx. 17 °C		
130	Thermovalve opens at approx. 17 °C		
140	Check valve brake unit		

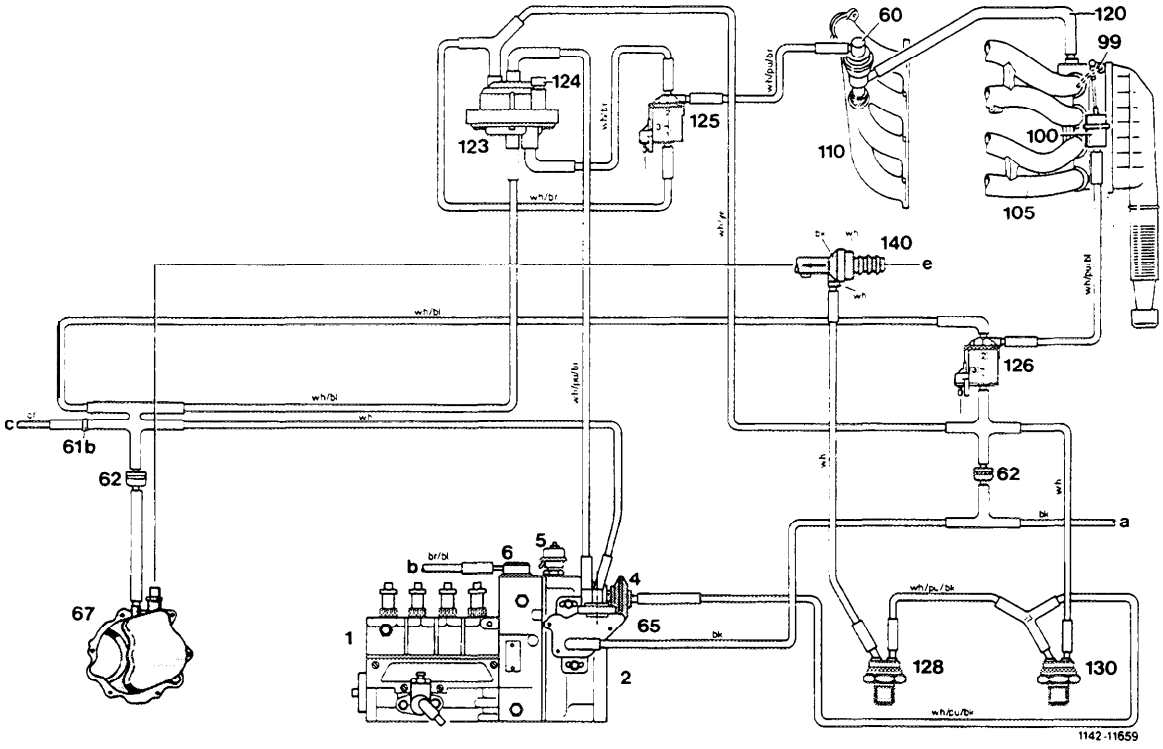


Function diagram idle speed increase with automatic transmission,@ Federal

1 Injection pump
2 Governor
4 Vacuum control unit idle speed increase
5 ADA-capsule (altitude pressure compensator)
6 Vacuum control unit (stop)
61a Orifice (blue)
61 b Orifice 0.5 mm dia. oranae
62 Vent filter
65 Vacuum control valve
67 Vacuum pump
72 Damper
127 Switchover valve, electric
128 Thermovalve closes at approx. 17 °C
130 Thermovalve opens at approx. 17 °C
140 Check valve brake unit

a Vent line to vehicle interior
b Key shutoff
c Remaining consumers
d Vacuum control unit automatic transmission
e Brake unit
g To refrigerant compressor

bk = black
bl = blue
br = brown
gr = green
pu = purple
re = red
wh = white

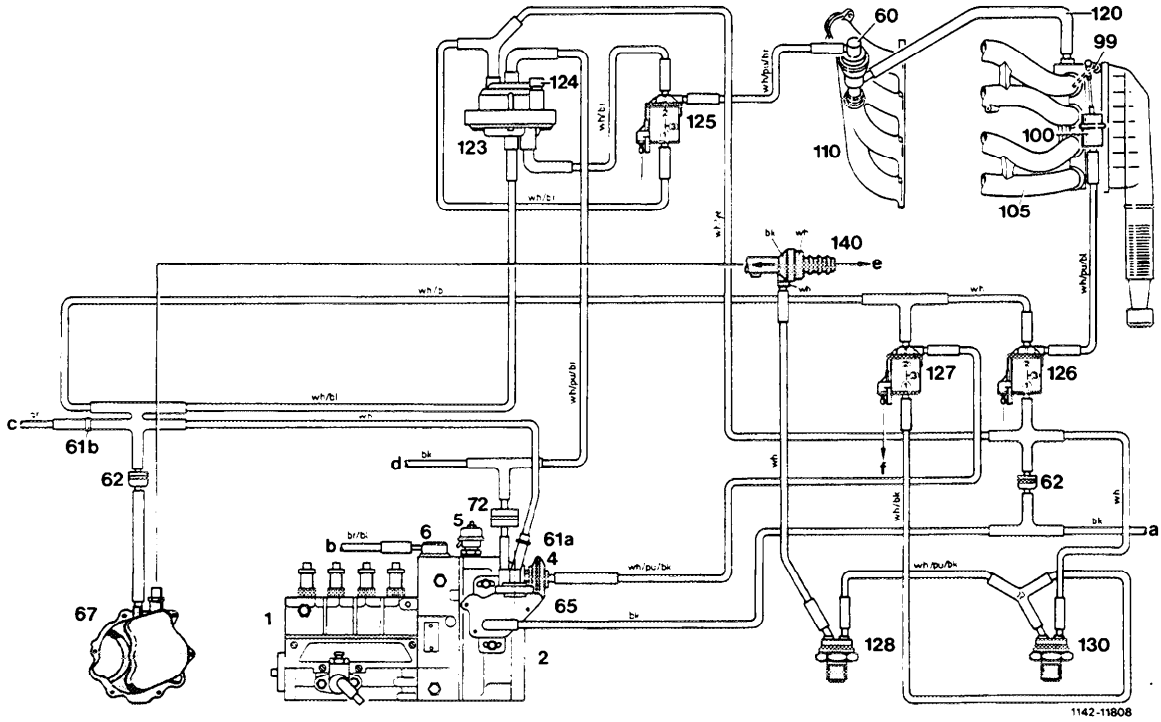


Function diagram idle speed increase with manual transmission, (USA) California

1 Injection pump
2 Governor
4 Vacuum control unit idle speed increase
5 ADA-capsule (altitude pressure compensator)
6 Vacuum control unit (stop)
60 EGR-valve
61 b Orif ice 0.5 mm dia. (orange)
62 Vent filter
65 Vacuum control valve
67 Vacuum pump
99 Pressure control flap
100 Vacuum control unit for (99)
105 Intake manifold
110 Exhaust manifold
120 EGR-line
123 Pressure converter
124 Adjusting screw for (123)
125 Switchover valve electric for EGR-valve
126 Switchover valve electric for pressure control flap
128 Thermovalve closes at approx. 17 °C
130 Thermovalve opens at approx. 17 °C
140 Check valve brake unit

a Vent line to vehicle interior
b Key shutoff
c Remaining consumers
d Vacuum control unit automatic transmission
e Brake unit
f To refrigerant compressor-control unit

bk = black
bl = blue
br = brown
gr = green
pu = purple
re = red
ye = yellow



Function diagram idle speed increase with automatic transmission, (USA) California

1 Injection pump
2 Governor
4 Vacuum control unit idle speed increase
5 ADA-capsule (altitude pressure compensator)
6 Vacuum control unit (stop)
60 EGR-valve
61 a Orifice
61 b Orifice 0.5 mm dia. (orange)
62 Vent filter
65 Vacuum control valve
67 Vacuum pump
72 Damper
99 Pressure control flap
100 Vacuum control unit for (99)
105 Intake manifold
110 Exhaust manifold
120 EGA-line
123 Pressure converter
124 Adjusting screw for (123)
125 Switchover valve electric for EGR-valve
126 Switchover valve electric for pressure control flap
127 Switchover valve electric for rpm increase
128 Thermovalve closes at approx. 17 °C
130 Thermovalve opens at approx. 17 °C
140 Check valve brake unit

a Vent line to vehicle interior
b Key shutoff
c Remaining consumers
d Vacuum control unit automatic transmission
e Brake unit
f To refrigerant compressor-control unit

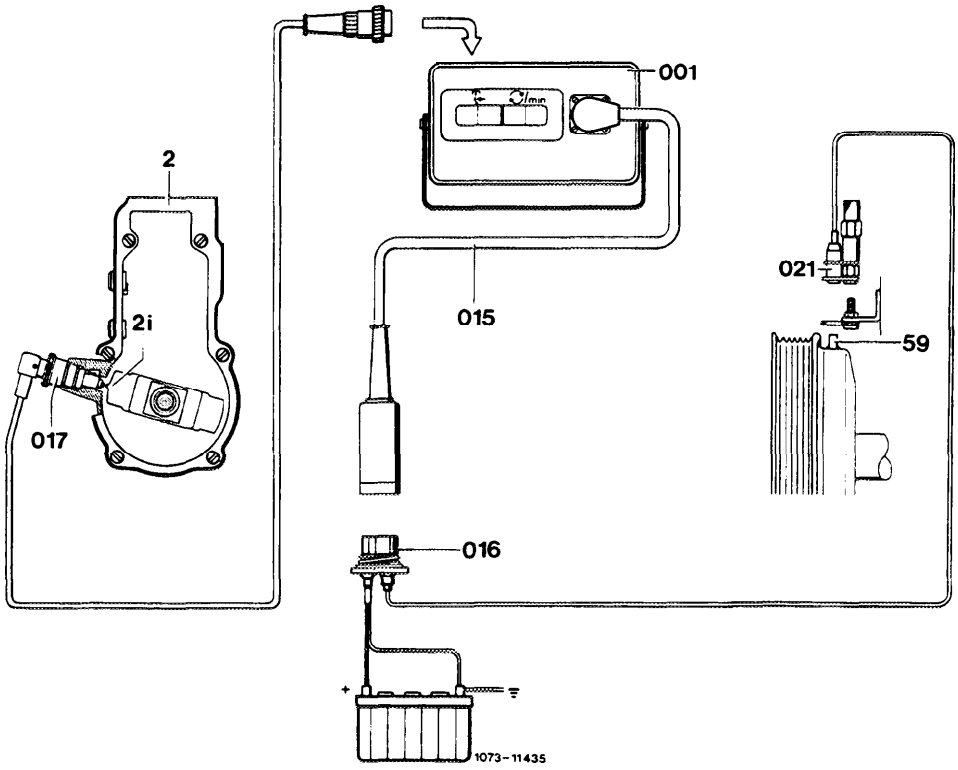
bk = black
bl = blue
br = brown
gr = green
pu = purple
re = red
ye = yellow

E. Reference impulse verification (RI V)

Measuring the association of injection pump in relation to engine requires two signals:

- TDC-impulse from crankshaft.
- Regulating impulse from injection pump.

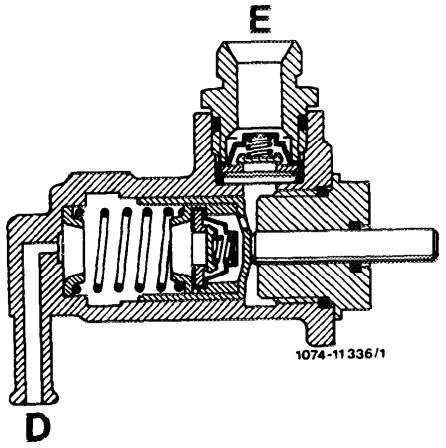
Both impulses are supplied by impulse transmitters. To obtain a measuring signal, the sensor pins must be moved past the impulse transmitters at a minimum speed (idle speed). A measuring instrument measures the chronological distance between the two impulses and converts the result into an angle value, which is then indicated.



001 Digital tester
2 Governor
2i Flyweight with sensor pin
015 Test cable
016 Socket
017 Reference impulse transmitter
021 TDC-impulse transmitter
059 Sensor pin

F. Fuel pump

An increased delivery capacity of fuel pump makes the fuel system self-venting. The manual delivery pump is no longer installed.

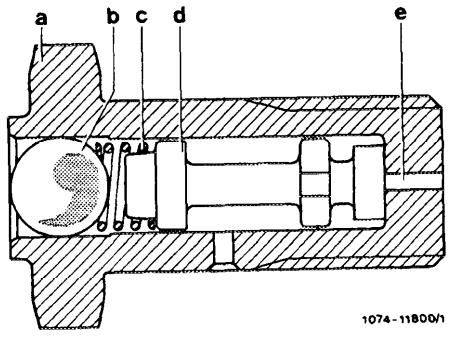


E Delivery end
D Suction end

Venting of injection pump requires an orifice in overflow valve.

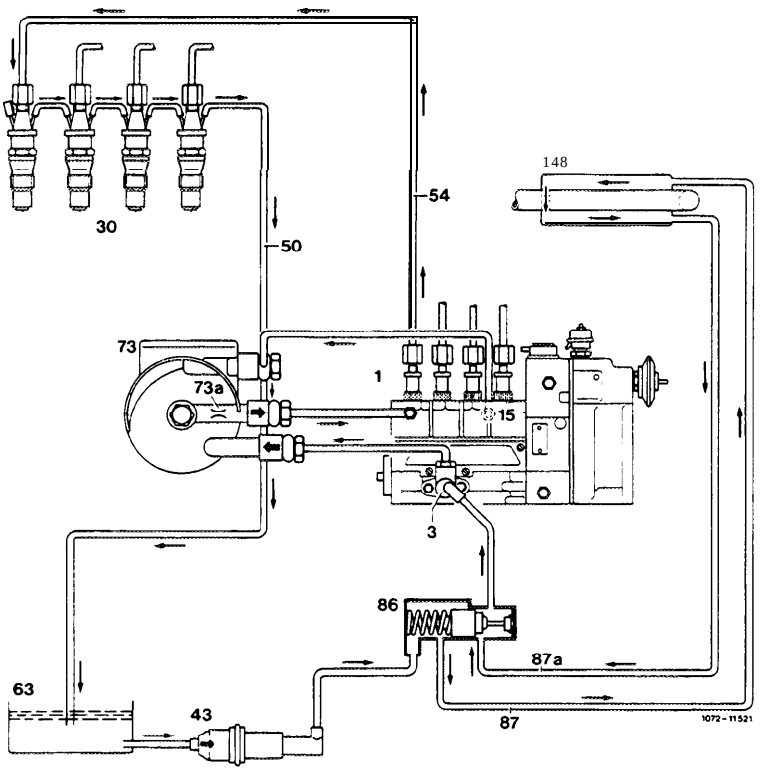
Overflow valve with 1.5 mm dia. orifice

The overflow valve prevents unfiltered fuel from entering injection pump.

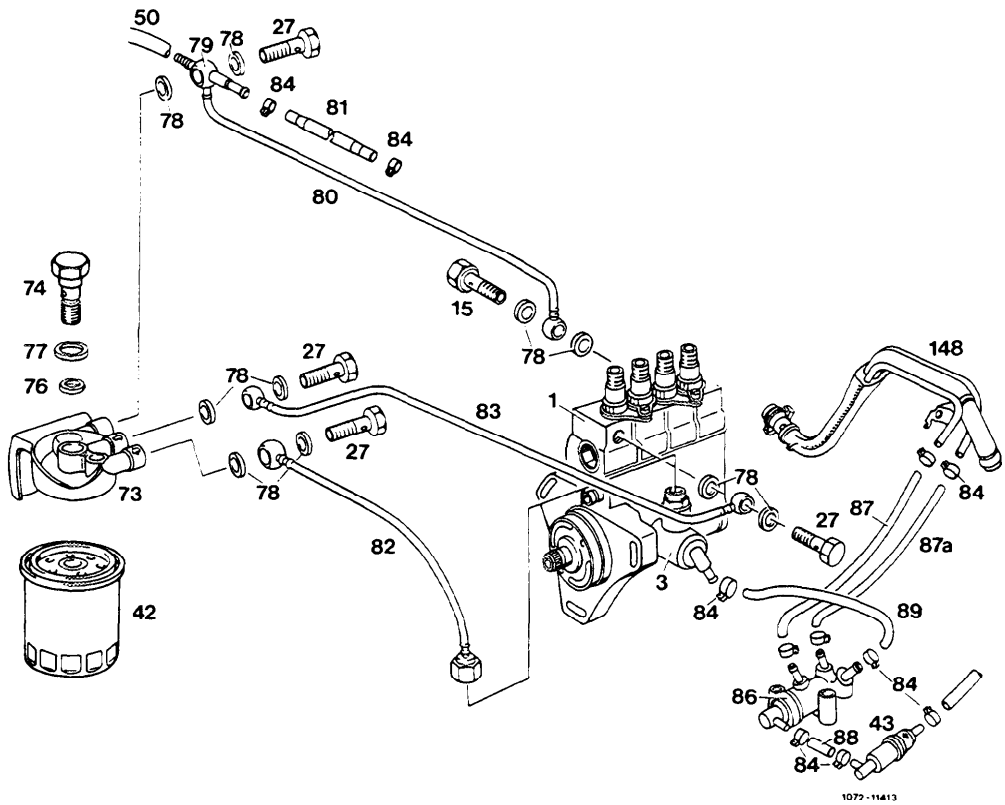


a Housing
b Ball
c Spring
d Slide
e Inlet

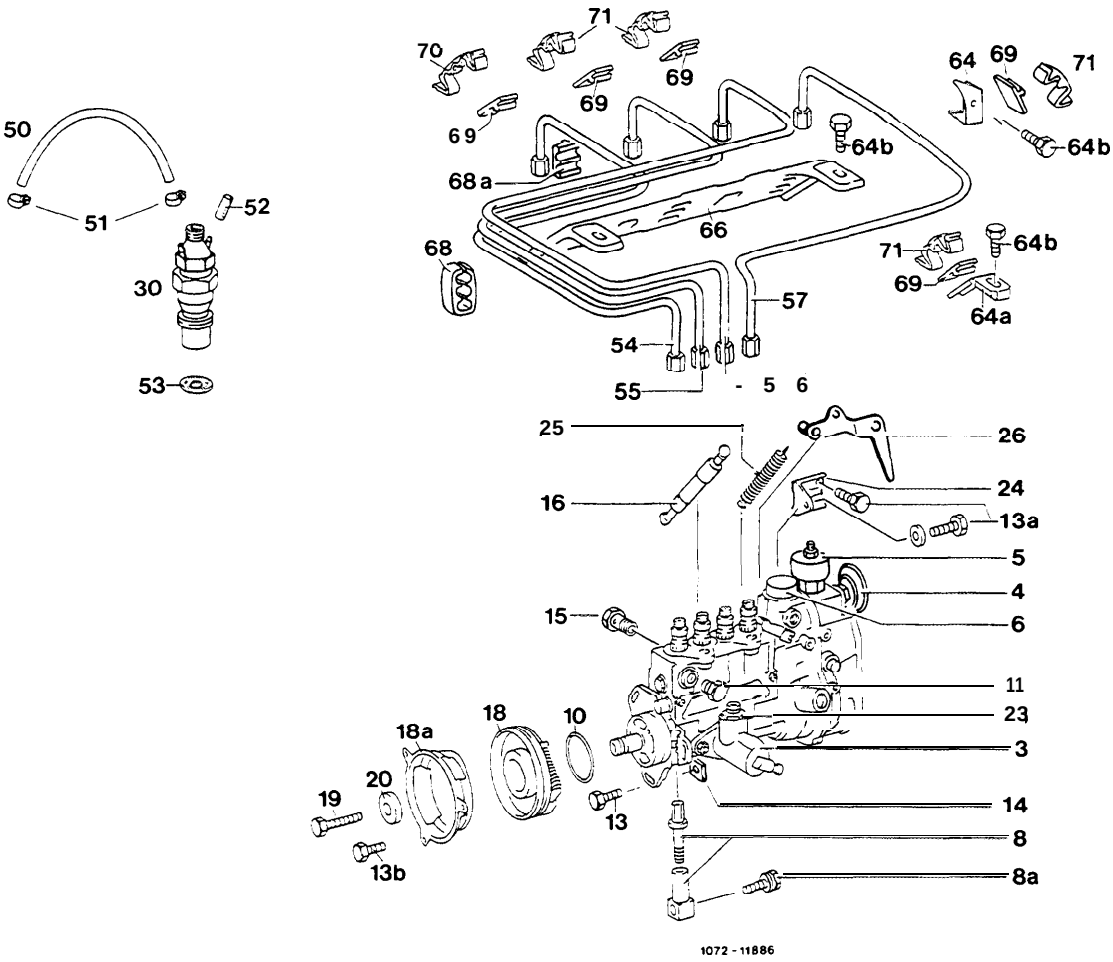
G. Function diagram low pressure circuit



1 Injection pump
3 Fuel pump
15 Overflow valve with orifice 1.5 mm dia.
30 Injection nozzles
43 Fuel prefilter
50 Leak oil hose
54 Injection line cylinder 1
63 Fuel tank
73 Fuel filter top
73a Orifice in fuel filter top 0.8 mm dia.
86 Fuel thermostat open, position up to +8°C, fuel is preheated
87 Supply line – cold fuel
87a Return line – preheated fuel
148 Heater feed line with fuel heat exchanger



Injection pump
3 Fuel pump
15 Overflow valve with orifice 1.5 mm dia.
27 Hollow screw
42 Fuel filter
43 Fuel prefilter
50 Leak oil hose
73 Fuel filter top
74 Hollow screw fuel filter
76 O-ring
77 Sealing ring fuel filter
78 Sealing ring
79 Rung-type fitting
80 Return line
81 Expanding screw
82 Inlet fuel filter
83 Inlet injection pump
84 Hose clamp
86 Fuel thermostat
87 Supply line fuel-heat exchanger
87a Return line fuel-heat exchanger
88 Supply line fuel thermostat
89 Suction line fuel pump
148 Heater feed pipe with fuel heat exchanger



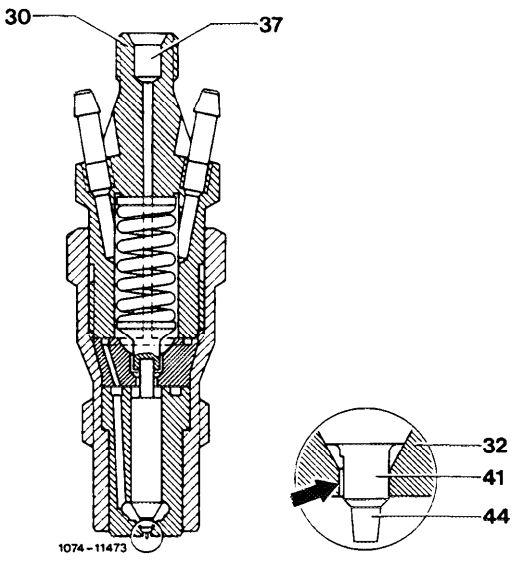
1072 - 11886

3 Fuel pump
4 Vacuum control unit idle speed increase ,,PLA''
5 ADA-capsule (altitude pressure compensator)
6 Vacuum control unit (stop)
8 Injection timing-adjusting device
10 O-ring (seal)
11 Closing plug – RIV
13 Fastening screw front
13a Fastening screw rear
13b Screw for assembly basket
14 Cage nut
15 Overflow orifice 1.5 mm dia. injection pump
16 Damper
18 Injection timer
18a Injection timer-assembly basket
19 Center fastening screw ,,lefthand threads"
20 Washer
23 Pressure connection-delivery pump
24 Holder, injection pump rear
25 Spring
26 Adjusting lever
30 Injection nozzle, complete
50 Leak oil hose
51 Hose clamp
52 Closing plug
53 Nozzle reed
54 Injection line 1
55 Injection line 2
56 Injection line 3
57 Injection line 4
64 Holder, cylinder 4, nozzle end
64a Holder, cylinder 4, pump end
64b Screw
66 Holder, lines
68 Plastic clip
68a Plastic clip
69 Rubber base
70 Plastic holder for 3 lines
71 Plastic holder for 2 lines

A. Fiat surface pintle nozzle (standard version)

Bosch designation DN 0 SD 261/-

Differs from pintle nozzle fy a flat surface (arrow) on throttle pintle (41). This will improve throttle effect.

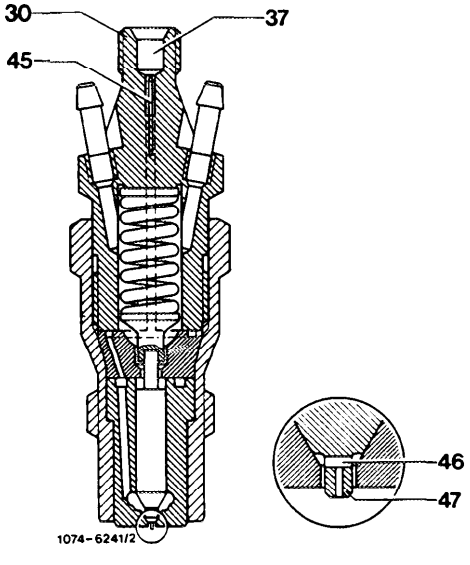


30 Injection nozzle, complete
32 Nozzle body
37 Nozzle holder top
41 Throttle pintle
44 Injection pintle

B. Hole-type pintle nozzle USA

Bosch designation DN 0 SD 240/

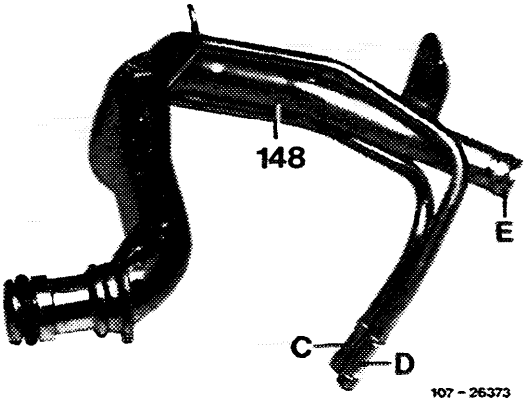
Differs from pintle nozzle by a transverse and lengthwise bore (46 and 47) in throttle pintle. A service-free bar filter (filter cartridge) (45) is inserted in nozzle holder top (37).



30 Injection nozzle, complete
37 Nozzle holder top
45 Bar filter (filter cartridge)
46 Transverse bore
47 Lengthwise bore

A fuel heat exchanger (148) is installed in feed line of heater to preheat the fuel.

Full preheating up to +8 °C. The required fuel is guided through fuel heat exchanger.

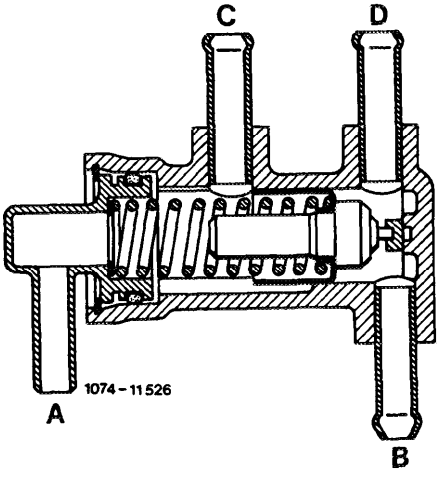


Fuel heat exchanger

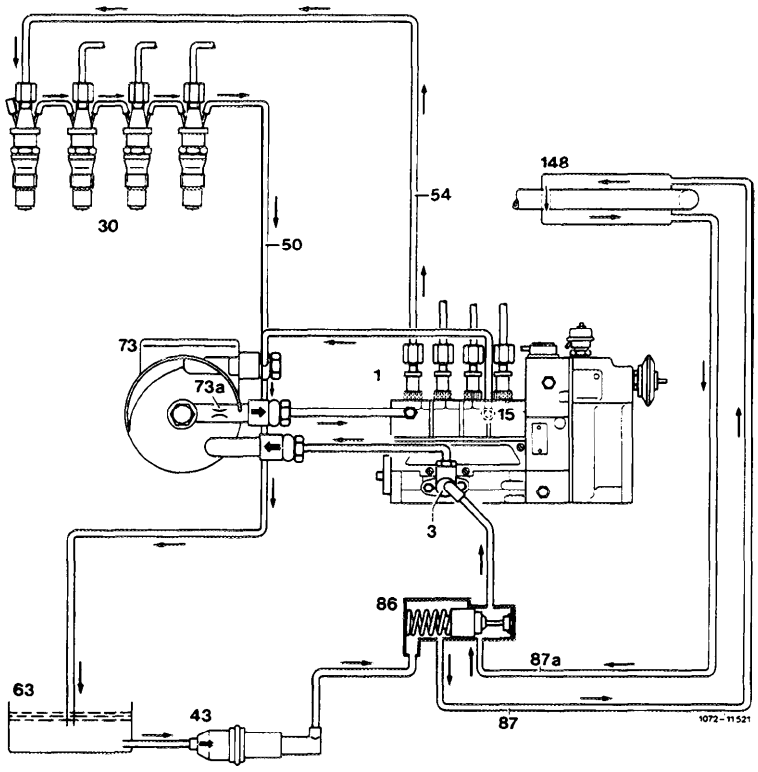
c Supply
D Return flow
E Heater feed

Mixed operation from +8 °C to +25 °C. The required fuel flows partially via fuel heat exchanger.

Above +25 °C the fuel heat exchanger is shorted by a thermostat. No more fuel will flow through fuel heat exchanger.

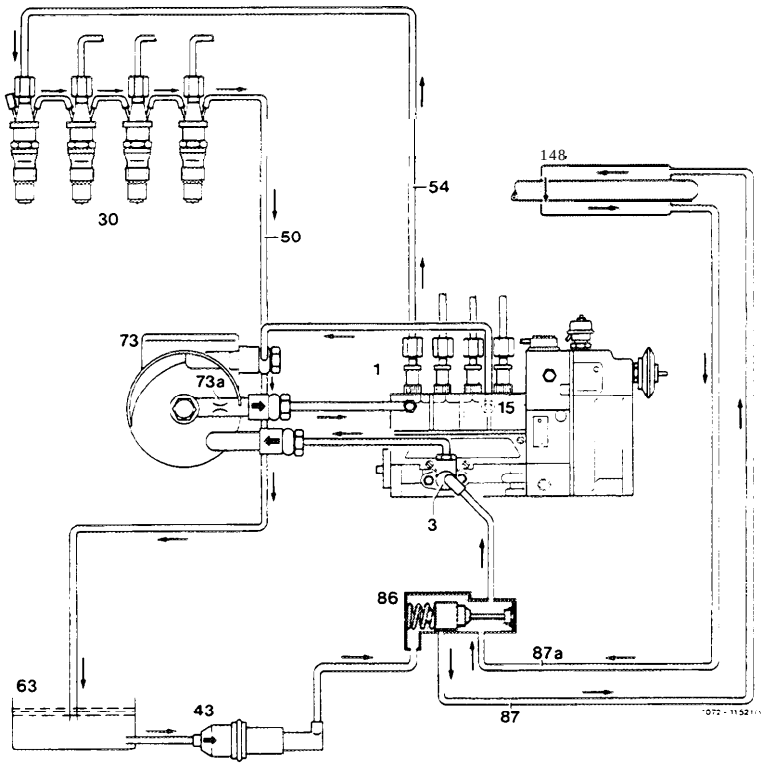


A Supply from fuel tank
B Suction line to fuel pump
C Supply to heat exchanger
D Return flow to fuel heat exchanger



Function diagram fuel preheating up to +8 °C

Injection pump
3 Fuel pump
15 Overflow valve with orifice 1.5 mm dia.
30 Injection nozzle
42 Fuel filter
42a Orifice in fuel filter top 0.8 mm dia.
43 Fuel prefilter
50 Leak oil hose
54 Injection line cylinder1
63 Fuel tank
86 Fuel thermostat
87 Supply line (cold fuel)
87a Return line (preheated fuel)
148 Fuel heat exchanger



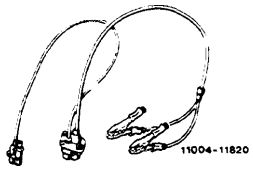
Function diagram fuel preheating above +25°C

1 Injection pump
3 Fuel pump
15 Overflow valve with orifice 1.5 mm dia.
30 Injection nozzles
42 Fuel filter
42a Orifice in fuel filter top 0.8 mm dia.
43 Fuel prefilter
50 Leak oil hose
54 Injection line cylinder 1
63 Fuel tank
86 Fuel thermostat closed
87 Supply line (cold fuel)
87a Return line (preheated fuel)
148 Fuel heat exchanger

07.1-100 Adjustment of idle speed

Job no. of work units or standard texts and flat rates data 07-2053

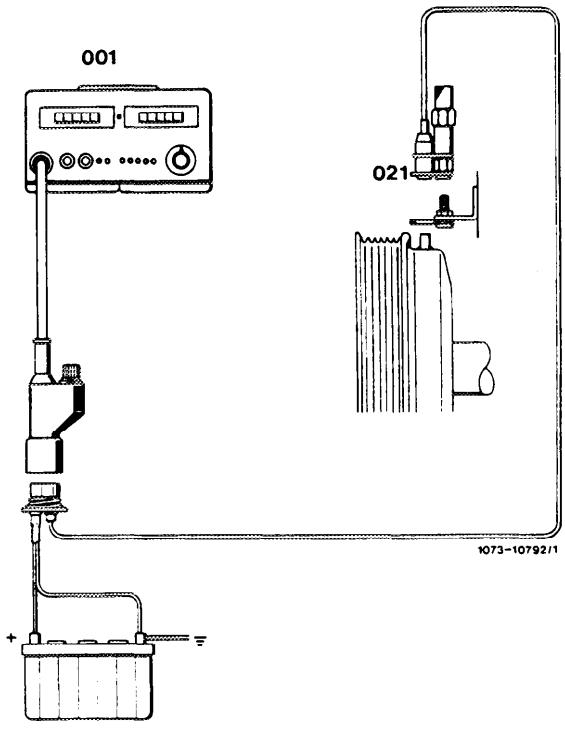
Test value	
Idle speed	750 ± 50/min

Special tool		
TDC-impulse transmitter		601 589 04 21 00

Conventional tool		
Digital tester	e.g. Bosch, MOT 001.03	
	e.g. Sun, DIT 9000	

Adjustment

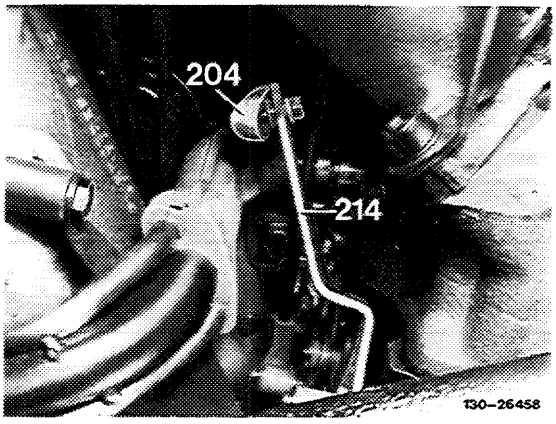
1 Connect digital tester (001) and impulse transmitter (021).



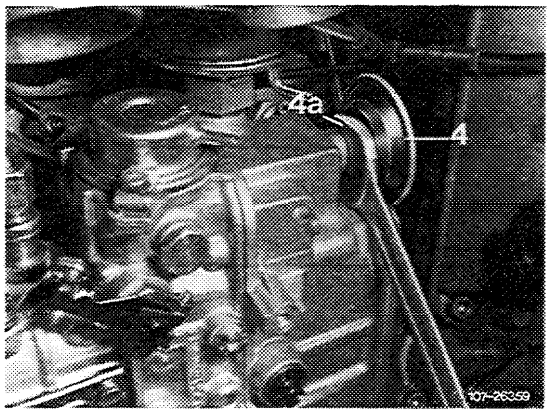
2 Check regulation for easy operation and condition.

3 Run engine to 60-80 °C coolant temperature.

4 Disengage connecting rod (204) on transfer lever (214)



5 Check idle speed 750 450/min, adjust by turning vacuum control unit (4), if required, loosen counter-nut (4a) for this purpose.



6 Engage connecting rod (204) free of tension.

7 Switch on all auxiliary units and check engine for smooth running.

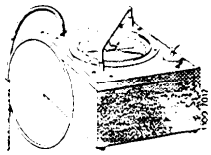
07.1-102 Checking pneumatic idle speed increase

Job no. of work units or standard texts and flat rates data 07–2009.

Test values

Idle speed increase	**min** 100/min **at approx. 500 mbar**
Permissible pressure drop of system	**from 500 to 400 mbar** **approx. 1 min**

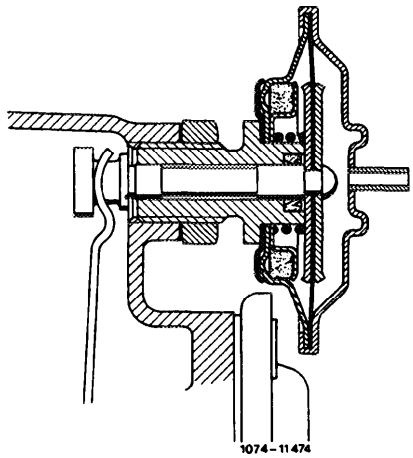
Special tool

Test unit O-1000 mbar for vacuum		**116589252100**

Note

Prior to performing this job, check idle **speed adjustment.**

Renewing of vacuum control unit on injection pump can be made at a Bosch service station only, since renewal of vacuum control unit requires disassembly of governor and subsequent adjustment on a Bosch injection pump test bench.



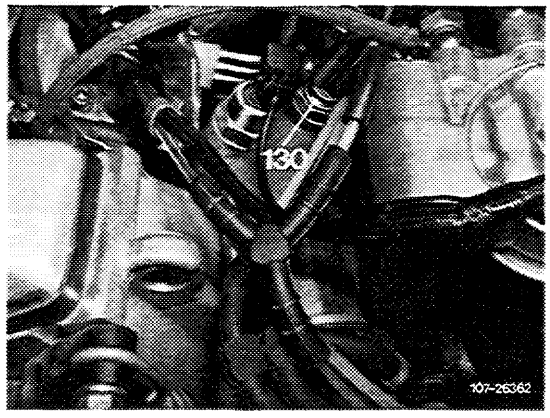
Engine at idle.

Connect vacuum tester to straight connection of thermovalve (130) **and energize with 500 mbar. Engine speed increases by approx. 1 OO/min.**

In order	Not in order

Check thermovalves (128 and 130). Make sure that thermovalve (128) has no **passage. Thermovalve** (130) **must have passage. Renew thermovalve, if required.**

Check vacuum lines according to function diagram.



Engine stopped.

Check vacuum control unit (4) for leaks.

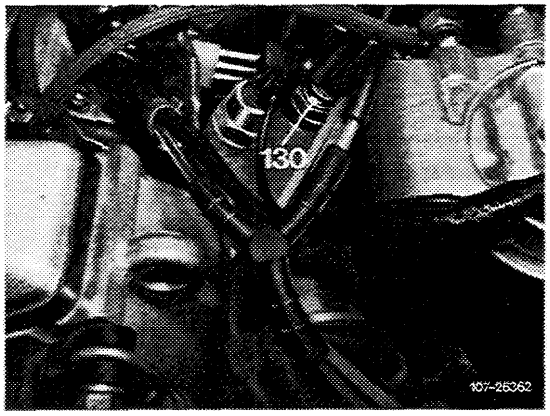
Energize vacuum tester, connection as above, with approx. 500 mbar. Vacuum value may drop approx. 100 mbar in 1 minute.

Vacuum value in order	Vacuum value not in order

Check vacuum lines and connections for damage, renew vacuum control unit, **if required.**

Check vent line for passage. Engine stops. Pull vacuum line from straight connection of thermo-valve (130) and connect with vacuum tester. Operate hand pump, but do not build up a vacuum.

Vent line in order	Vent line not in order



Renew vent filter (62), blow out vacuum line.

End of test

07.1-104 Checking engine output and exhaust gas on chassis dynamometer

Job no. of work units or standard texts and flat rates data 07-1200.

Scope

Fill in data sheet.
Check fluid levels in engine, radiator and automatic transmission.
Remove and install air cleaner cover.
Connect digital tester according to connection diagram.
Check regulating system for easy operation and for condition and lubricate.
Check full throttle stop of accelerator pedal and adjust.
Run engine oil temperature under partial load to 75-85 °C.
Check idle speed, adjust.
Check pneumatic idle speed increase.
Check max. speed under no load condition.
Check tire pressure of rear wheels.
Cool engine with blower.
Check performance – perform tachometer checkup.
Exhaust gas (emission) test under load.

Test values

Performance reference values and exhaust gas (emission) value

Engine	Rpm	Full load performance[1]) in kW (HP)		
		Manual transmission,	Automatic transmission	
	1/min	3rd speed	driving position „S"	Exhaust gas (emission) value % CO
601.911	4500	40 (54)	37 (50)	max. 0.25

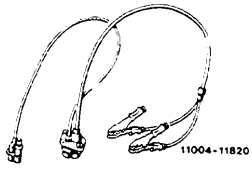
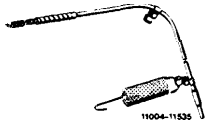
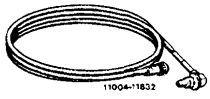
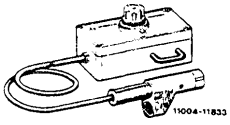
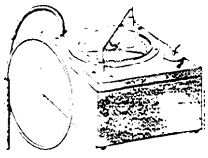
Note: During performance measurements be sure to include the different influencing factors.

[1]) **The test values are minimum performances; the permissible losses for power steering of approx. 1.5 kW(2 HP) are already deducted.**

Injection timing at 750 ±50/min	15° ±1° after TDC[2])
Idle speed	750 ±50/min
Idle speed increase min. 100/min	at approx. 500 mbar

[2]) **RI-value – indirect injection timing.**

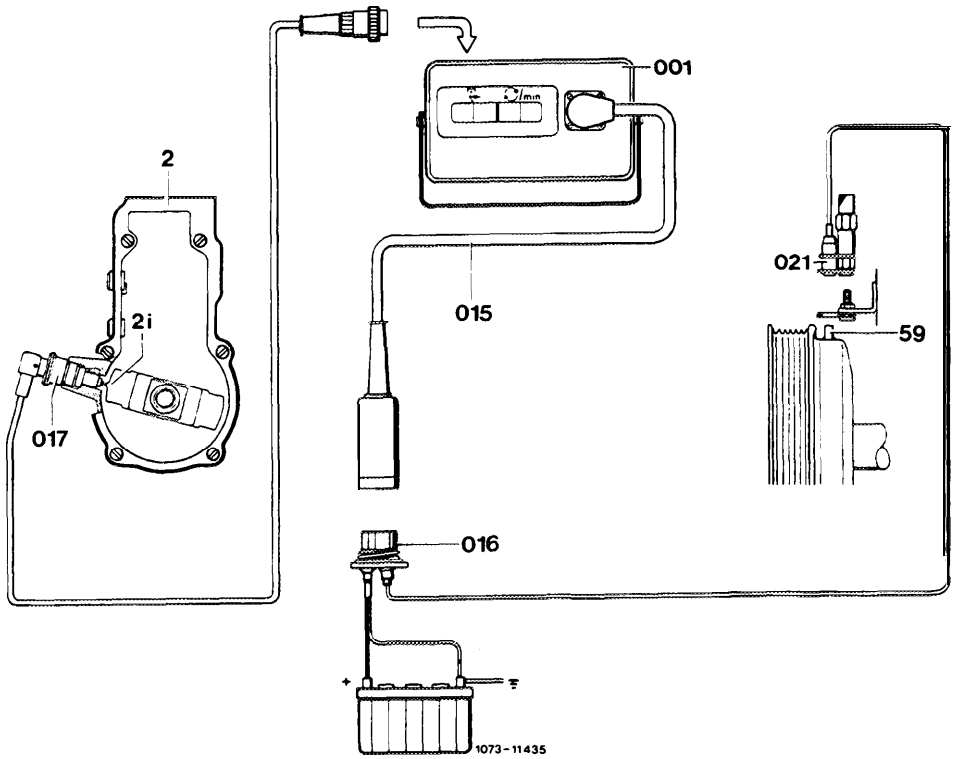
Special tools

Oil telethermometer		116589272100
TDC-impulse transmitter		601 589 04 21 00
Exhaust gas probe, flexible		126 589 11 63 00
R I-transmitter		617 589 1021 00
Adapter (for available digital testers)		617 5890921 00
Tester 0–1000 mbar for vacuum		116 589 25 21 00

Conventional testers

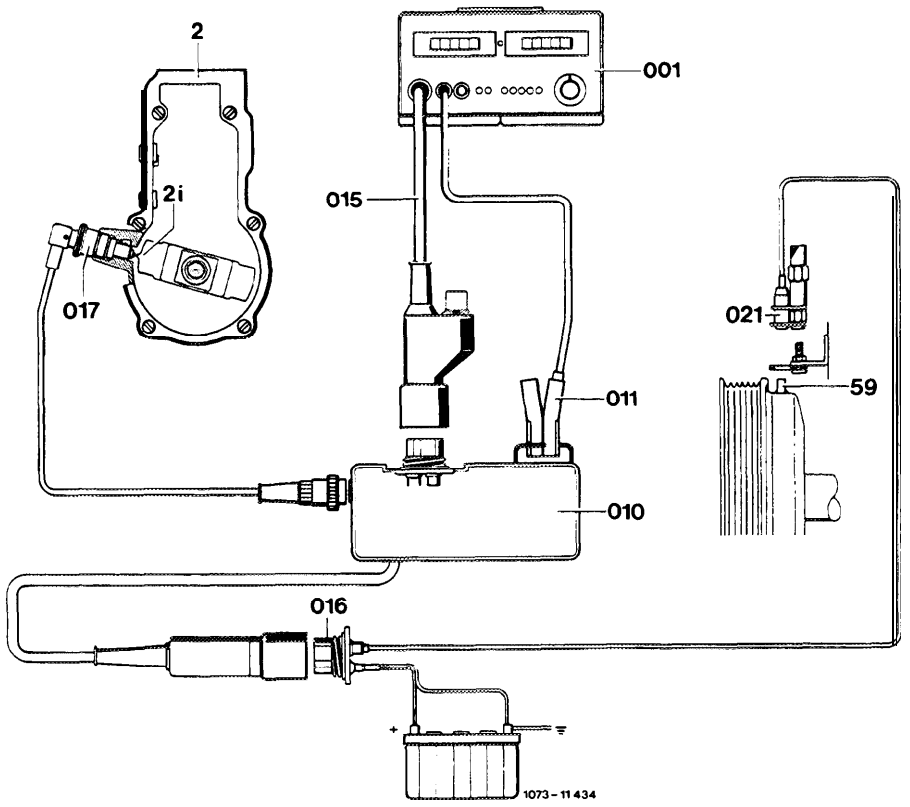
CO-measuring instrument

Digital testers	e.g. Bosch, ETD 019.00
	e.g. Sun, DIT 900
	e.g. AVL, Diesel-Tester 875



Connection diagram for test instruments without adapter, e.g. Bosch ETD 019.00, Sun DIT 9000, AVL Diesel-Tester 875

001 Digital tester
2 Governor
2i RI-transmitter pin
015 Test cable with plug
016 Diagnosis socket
017 R l-transmitter
021 TDC-impulse transmitter
59 TDC-transmitter pin



Connection diagram for available testers with adapter, e.g. Bosch 001.03, Hartmann & Braun EOMT 3

001 Digital tester
2 Governor
2i RI-transmitter pin
010 Adapter
011 Trigger clamp
015 Test cable with plug
016 Diagnosis socket
017 RI-transmitter
021 TDC-impulse transmitter
59 TDC-transmitter pin

Checking

1 Fill in data sheet.

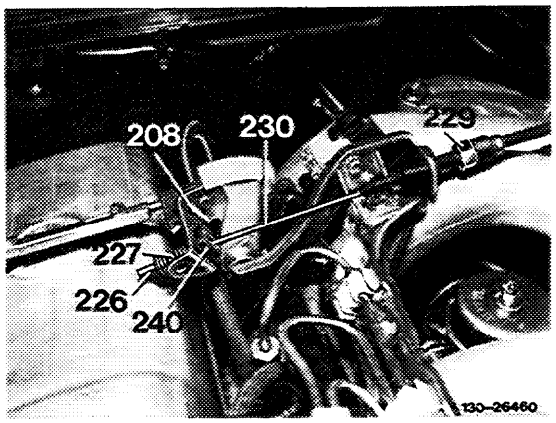
2 Check fluid levels: in engine, radiator and automatic transmission and correct, if required.

3 Remove and install air cleaner cover.

4 Connect digital tester according to connection diagram.

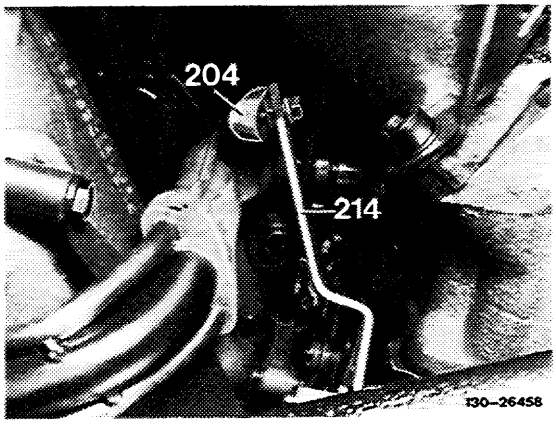
5 Check ragulating system for easy operation and condition and lubricate.

6 Check full throttle stop from direction of accelerator pedal, adjust by means of adjusting screw (229), if required.



7 Run engine oil temperature under partial load to 75-85 °C.

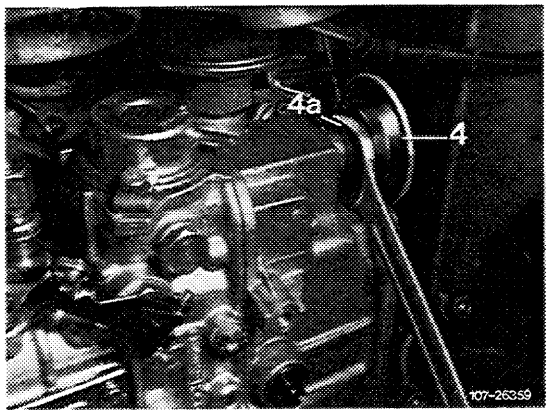
8 Disengage connecting rod (204) on transfer lever (214).



9 Check idle speed 750 ± 50/min, adjust by turning vacuum control unit (4), if required, loosen counternut (4a) for this purpose.

Engage connecting rod (204) free of tension.

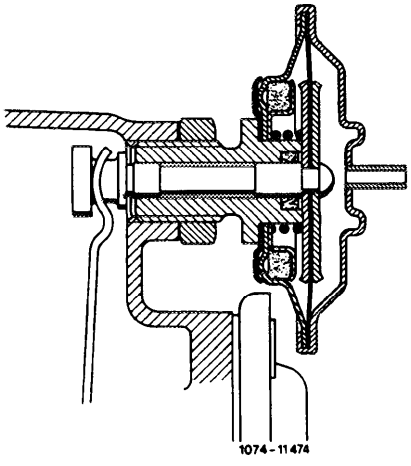
Switch on all auxiliary units and check engine speed.



10 Check pneumatic idle speed increase:

Attention!
Prior to performing this job, check idle speed adjustment.

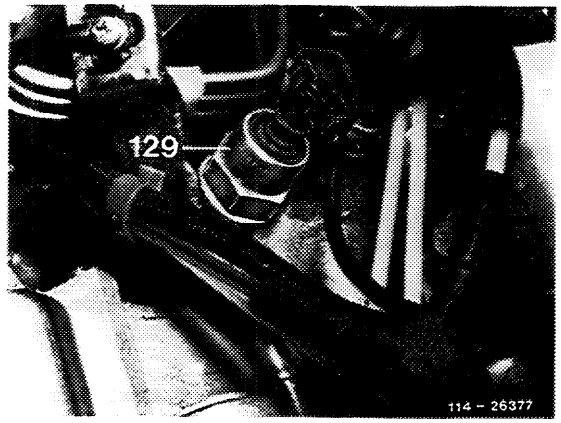
The vacuum control unit for idle speed increase on injection pump can be renewed only with injection pump removed.



Engine at idle.

Connect vacuum tester to straight connection of thermovalve (130) and energize with 500 mbar. Engine speed increases by approx. 100/min, check pneumatic idle speed increase, if required (07.1-102).

Note: The vacuum control unit idle speed increase on injection pump can be renewed only with injection pump removed.

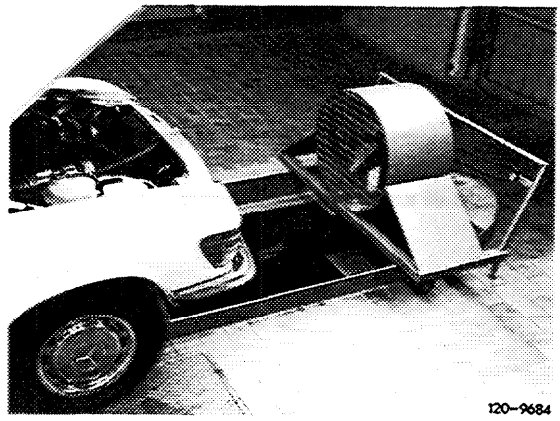


11 Secure front wheels. For this purpose, place chocks at a distance of approx. 100 mm in front of front wheels.

12 Check tire pressure of rear wheels and correct, if required.

13 Check trunk contents, remove heat-sensitive items.

14 Cool engine with blower.



15 Check full load performance.

Attention!
Run at full load only as long as required for reading the instruments.

16 Check exhaust gas (emission) value under load.

If the specified exhaust gas values under load cannot be attained in spite of fully including idle speed emission value tolerance, set injection pump on pump test bench to upper tolerance limit.

07.1-109 Checking injection timing (high-pressure method)

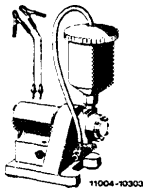
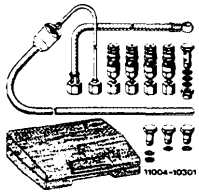
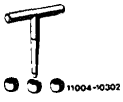
Job no. of work units or standard texts and flat rates data 07-8234.

Test value	
Injection timing	In compression stroke 24° before TDC

Attention!
While measuring, move regulating lever of injection pump to full load and pull off vacuum hose at vacuum control unit „Stop".

Tightening torque (reference value)	Nm
Injection line	1 O-20

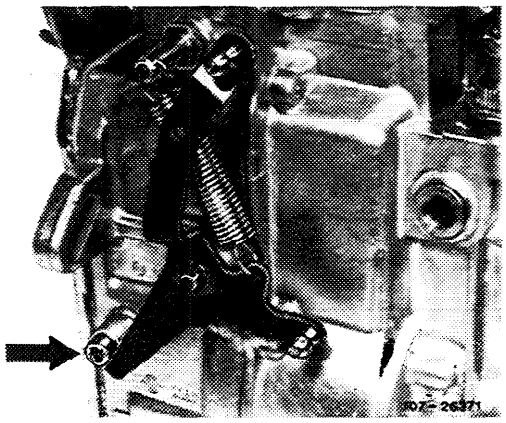
Special tools

Pump unit, complete	 11004-10303	617589007100
Connecting parts with storage case	 11004-10301	617589009100
Quick lock	 11004-10302	617589029100
Torque wrench with plug-in ratchet, 1/2" square, 25-l 30 Nm	11004-10056	001589662100
Box wrench element, open, 14 mm, 1/4" square for injection lines	11004-10520m	000589770300
Socket wrench element 27 mm, 1/2" square	11004-6193	001589650900

Testing

1 Clean injection lines in range of coupling nuts on injection pump as well as on fuel filter.

2 Set control rod of injection pump to full load.



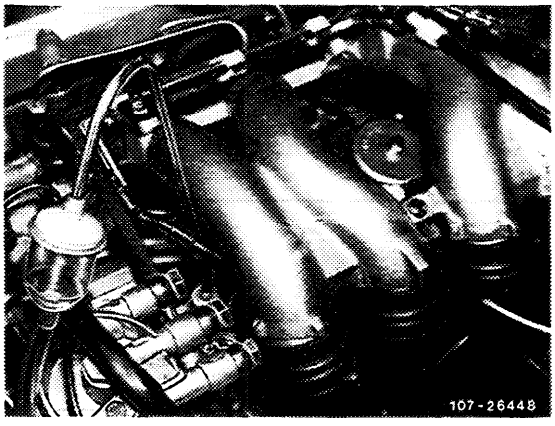
Adjusting lever on full load stop

3 Completely remove air cleaner.

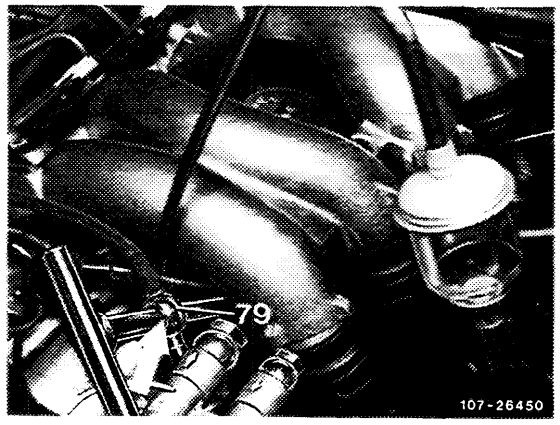
4 Pull off vacuum line on stop capsule.

5 Unscrew injection line from cylinder 1.

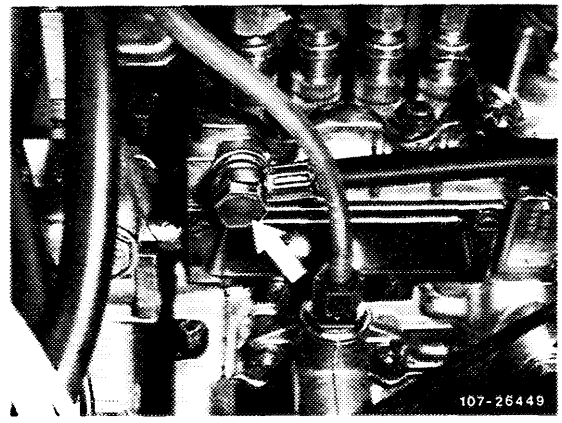
Screw test line with sight glass to injection pump and install return flow line to fuel tank of pump unit.



6 Close fuel return line from injection pump to fuel filter. Insert O-ring into ring fitting (79) of return flow line and firmly press in quick lock (arrow).



7 Connect supply line from pump unit to injection pump supply (arrow).



8 Connect connecting cable of pump unit to vehicle battery (red terminal positive, black terminal nagative).

9 Rotate crankshaft in direction of rotation of engine up to approx. 35° before TDC in compression stroke of first cylinder. Engage pump unit.

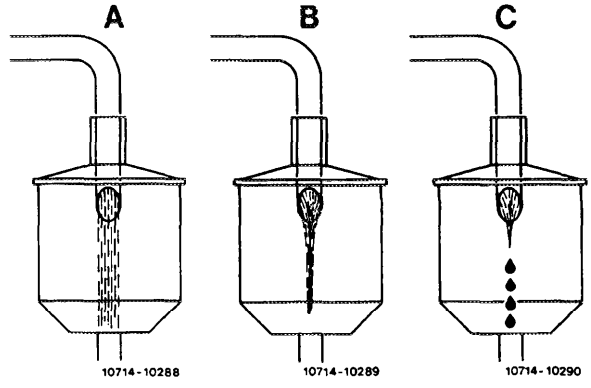
Attention!
Engage pump unit for measuring only. If an injection nozzle is leaking, fuel may enter combustion chamber.

10 Rotate crankshaft slowly in direction of rotation of engine while watching fuel jet in sight glass.

If fuel jet changes to chain-like drops, start of delivery (injection timing) has been attained.

In this position, read begin of delivery (injection timing) on graduated scale on belt tension.

Nominal value: 24° before TDC.

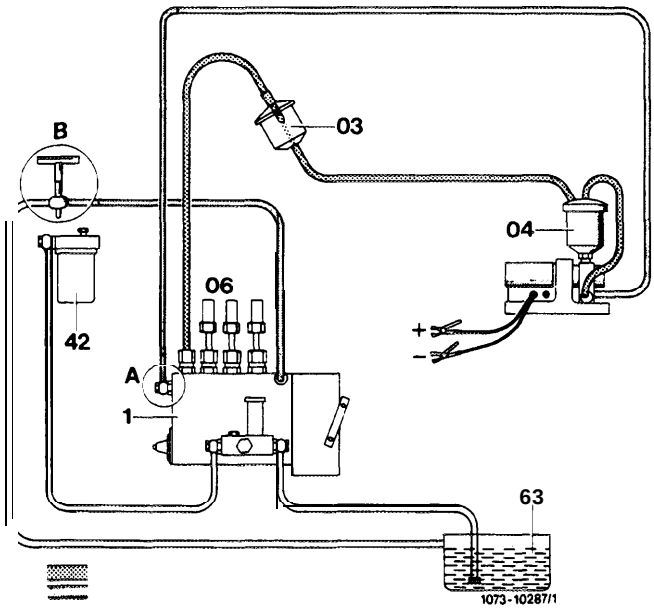


A Fuel jet, full
B Fuel jet, restricted prior to begin of delivery
C Chain-like drops begin of delivery

11 Disconnect pump unit. Assemble injection system. Mount air cleaner.

Note: When engine is started, the injection system will vent itself automatically.

12 Run engine and check all connections for leaks.



Connection diagram high-pressure overflow method

Return flow line
High-pressure approx. 34 bar

1 Injection pump
03 Sight glass
04 Pump unit
06 Pressure limiting valves (not required)
42 Fuel filter
63 Fuel tank

A Hollow screw, fuel supply from pump unit
B Fuel return flow line closed with quick lock or clamp

07.1-111 Checking injection timing (position pickup-RIV-method)

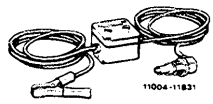
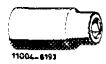
Job no. of work units or standard texts and flat rates data 07-8240.

Test values

	Test value	Adjusting value
RI-value (indirect injection timing)	15 ±1° after TDC	15° after TDC

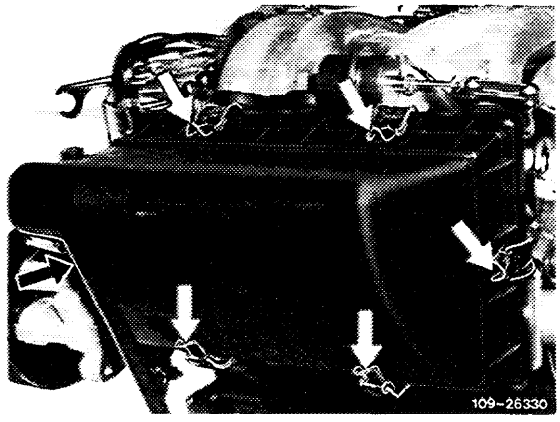
Tightening torques (reference values)	Nm
Closing plug on governor (measuring point)	30-35
Injection lines	1 O-20
Injection pump flange	20-25

Special tools

Torque wrench with plug-in ratchet, 1/2'' square, 25-130 Nm		001 5896621 00
Position indicator		617 589 08 21 00
Socket wrench element 27 mm, 1/2'' square		001 589 65 09 00

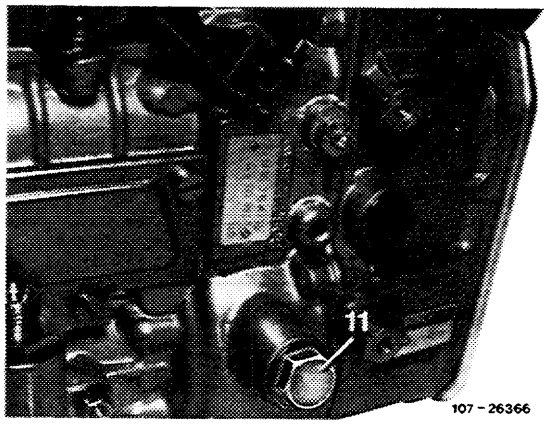
Checking

1 **Remove air cleaner top (arrows).**

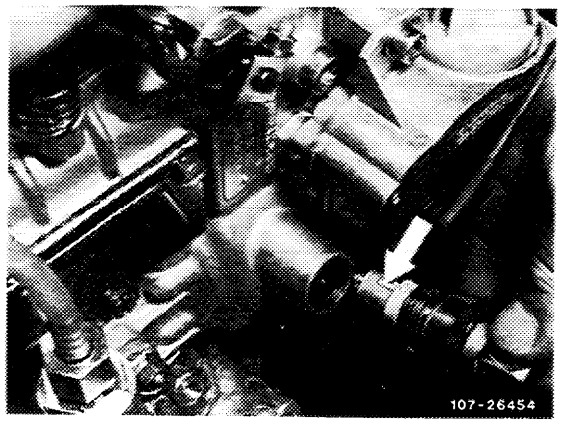


2 Remove closing plug (11).

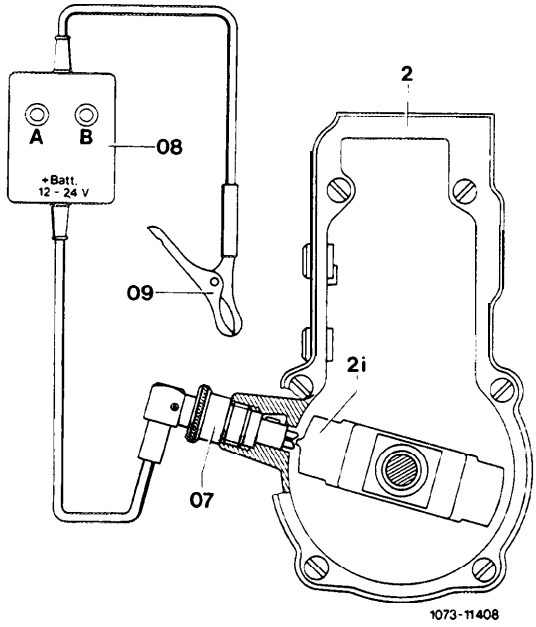
Attention!
Attach emerging oil.



3 Screw position indicator into governor housing. Make sure that the guide pin of positioning indicator (arrow) is extending in upward direction. Tighten coupling nut manually.



4 Connect position indicator according to connection diagram.

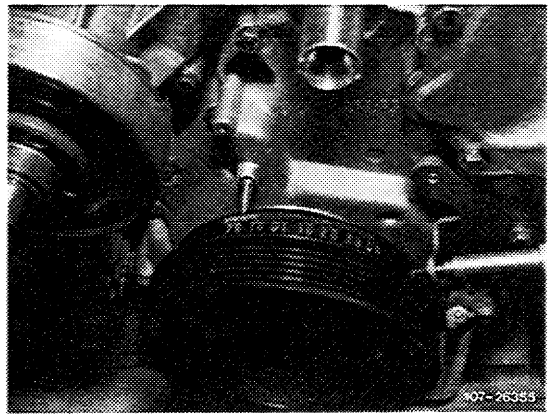


07 Position indicator
0 8 Indicator
09 Battery terminal (battery positive)

5 Rotate crankshaft with tool manually (in direction of rotation only), until lamp ,,A" lights up. Carefully continue rotating crankshaft until **both lamps** are lighting up ,,A + B". In this position, read RI-value (indirect injection timing) on graduated disk.

Nominal value: 15° after TDC

If only lamp ,,B" ist lighting up, repeat test.



6 Remove position indicator.

7 Screw in closing plug.

8 Mount air cleaner top.

9 Perform leak test with engine running.

10 Check engine oil level and correct, if required.

07.1-I 12 Checking injection timing with digital tester (RIV-method)

Job no. of work units or standard texts and flat rates data 07-8244.

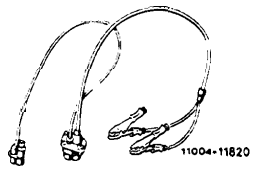
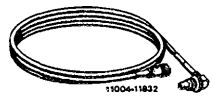
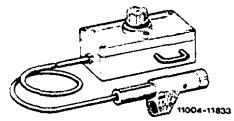
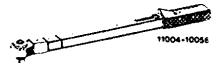
Test values

Rpm	750 ±50/min
RI-adjusting value[1])	15° after TDC
R I-test value	15° ± 1° after TDC

[1]) Indirect injection timing.

Tightening torques (reference values)	Nm
Closing plug on governor (measuring point)	30-35
Injection pump flange	20-25

Special tools

TDC-impulse transmitter	 11004-11820	601 589042100
R I-transmitter	 11004-11832	617589102100
Adapter (for available digital testers)	 11004-11833	617689092100
Torque wrench with plug-in ratchet, 1/2'' square, 25-l 30 Nm	 11004-10056	001 589 66 21 00

Conventional tools

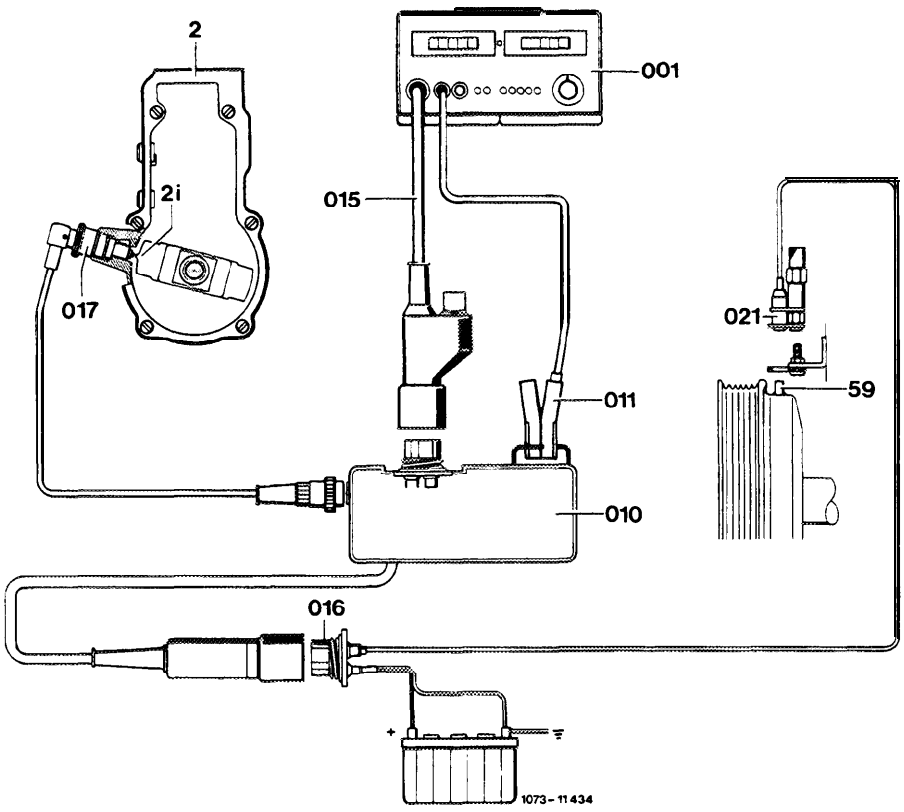
Application with adapter

Digital testers	e.g. Bosch, MOT 001.03
	e.g. Hartmann & Braun, EOMT 3

Application without adapter

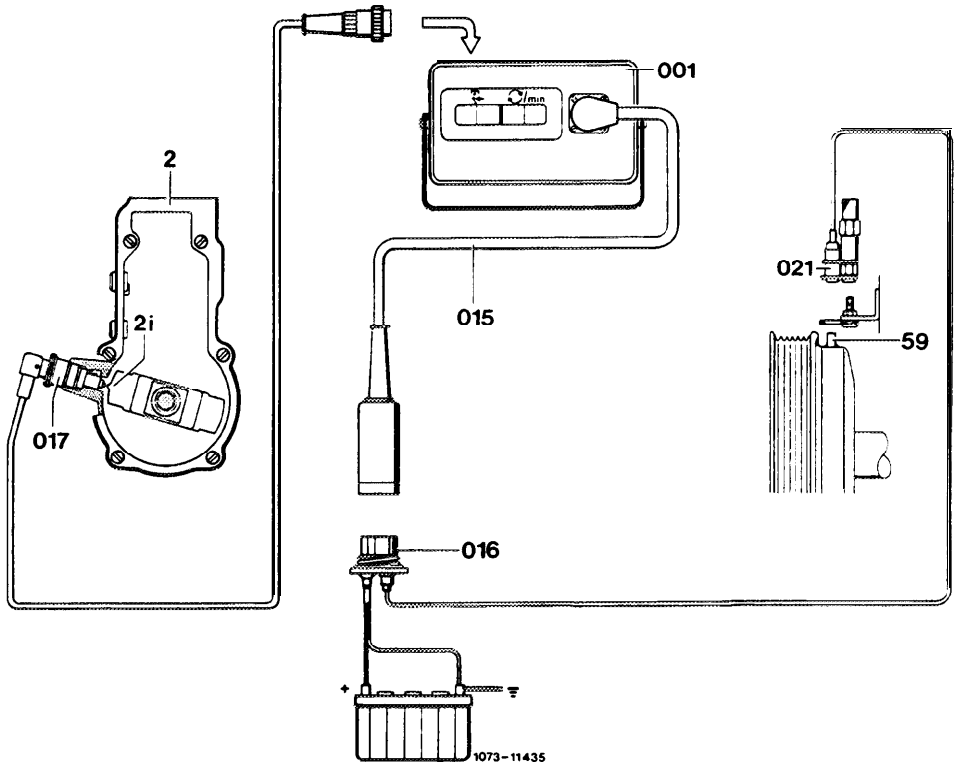
	e.g. Bosch, ETD 019.00
Digital testers	e.g. Sun, DIT 900
	e.g. AVL, Diesel-Tester 875

Connection diagram for available testers with adapter, e.g. Bosch MOT 001.03, Hartmann & Braun EOMT 3



001 Digital tester
010 Adapter
011 Trigger clamp
015 Test cable with plug
016 Diagnosis socket
017 RI-transmitter
021 TDC-impulse transmitter
2 Regulator
2i RI-transmitter pin
59 TDC-transmitter pin

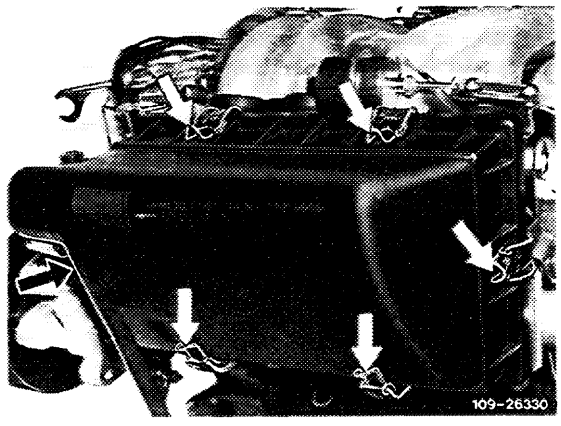
Connection diagram for testers without adapter,
e.g. Bosch ETC 019.00, Sun DIT 9000, AVL Diesel-Tester 875



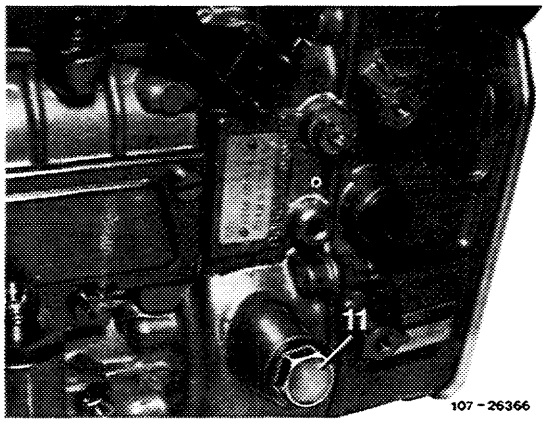
2 Regulator
2i RI-transmitter pin
001 Digital tester
015 Test cable with plug
016 Diagnosis socket
017 R I-transmitter
021 TDC-impulse transmitter
59 TDC-transmitter pin

Checking

Remove air cleaner cover (arrows),

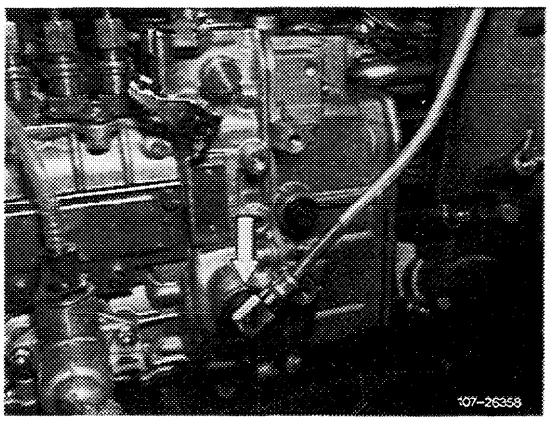


2 Remove closing plug from regulator.

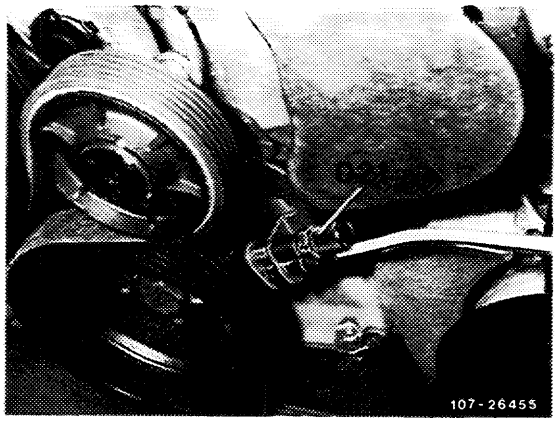


Attention!
Catch emerging oil.

3 Connect digital tester accord **ing to** connection diagram.



017 RI-transmitter on regulator (injection pump)



021 TDC-impulse transmitter on holder (engine)

4 Engine at idle. Read TI-value (indirect injection timing) at idle speed 750 ± 50/min on digital tester.

RI-nominal value: 15° after TDC at 750 ± 50/min.

5 Stop engine.

6 Disconnect digital tester.

7 Screw in closing plug on regulator.

8 Mount air cleaner top.

9 Perform leak test with engine running.

10 Check engine oil level, and correct, if required.

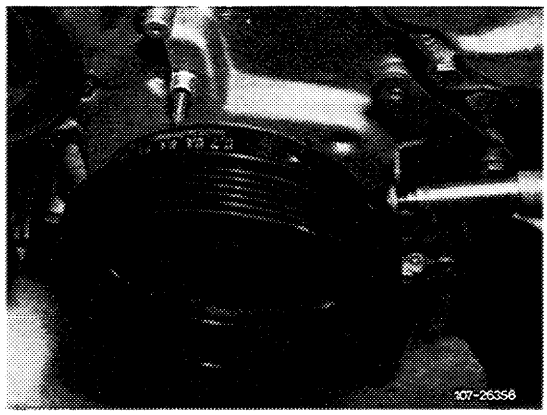
07.1-I 15 Adjusting injection timing (high-pressure method) — following checkup

Job no. of work units or standard texts and f tat rates data 07—8300.

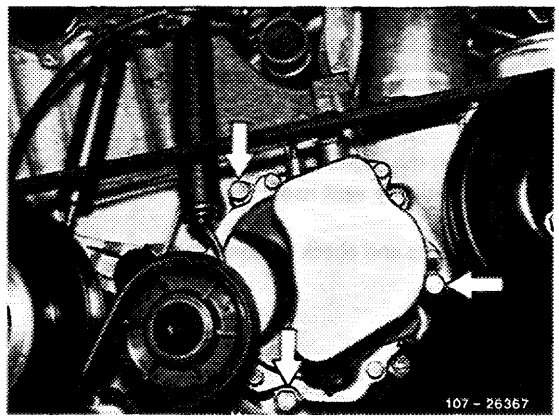
Note

Prior to adjustment, check injection timing on cylinder 1 (07.1-109).

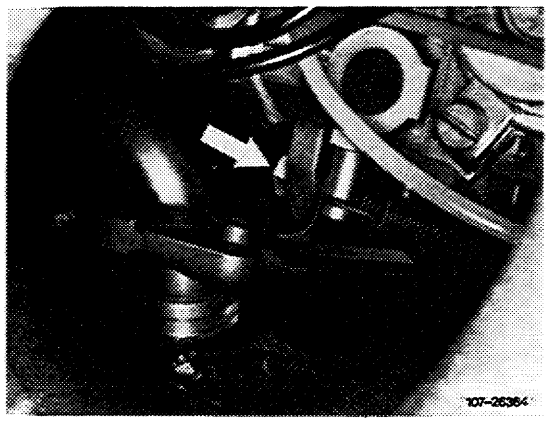
Adjusting



1 **Set crankshaft in direction of roation to 24° before TDC in compression stroke of 1st cylinder.**



2 **Loosen fastening screws (arrows) on injection pump flange and on supporting holder (arrow).**

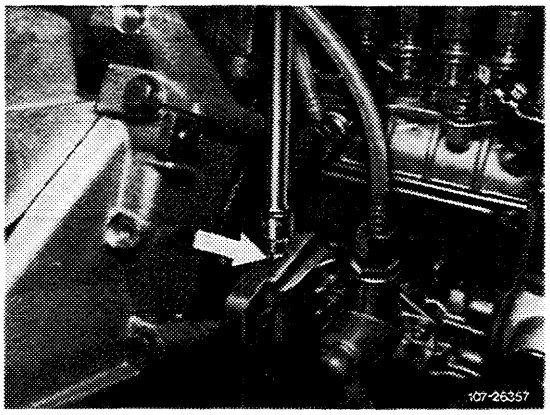


Fastening of supporting holde

3 Engage pump unit.

4 Swivel injection pump by turning adjusting screw on adjusting device, while watching fuel jet. If the fuel jet changes to chain-like drops, begin of delivery (injection timing) has been attained.

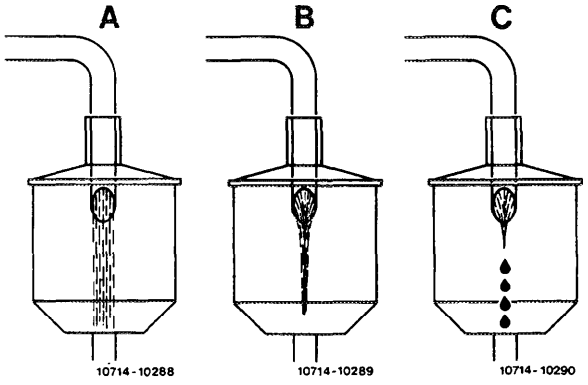
Nominal value: 24° before TDC.



Direction of rotation of adjusting screw

Clockwise = injection timing retarded
Counterclockwise= injection timing advanced

Note: If adjustment cannot be made any further, displace injection pump. Removal and installation of injection pump (07.1-200).



A Fuel jet full
B Fuel jet restricted
shortly before begin of delivery (injection timing)
C Chain-like drops begin of delivery (injection timing)

5 Disconnect pump unit.

6 Assemble injection system and check regulating linkage, adjust, if required (30-300).

Note: When the engine is started, the injection system will automatically vent itself.

7 Run engine and check all connections for leaks.

07.1-I 16 Adjusting injection timing (position pickup-RIV-method) — following checkup

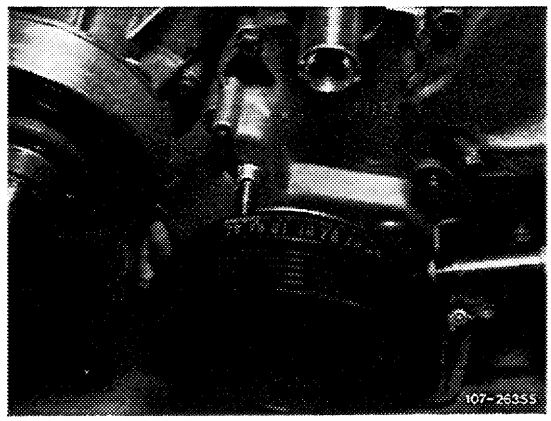
Job no. of work units or standard texts and flat rates data 07–8300.

Note

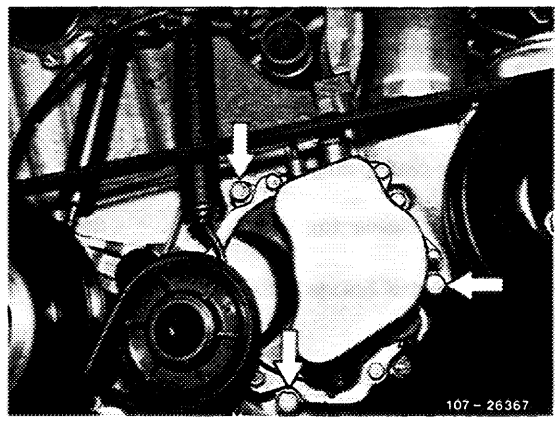
Prior to making adjustments, check begin of delivery (injection timing) (07.1-I 11).

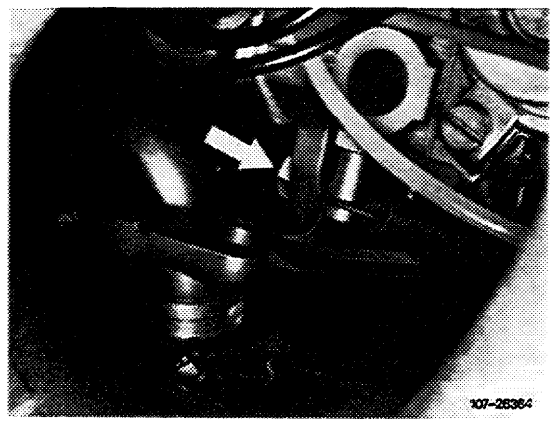
Adjustment

1 Set crankshaft in direction of rotation to 15° after TDC of first cylinder.



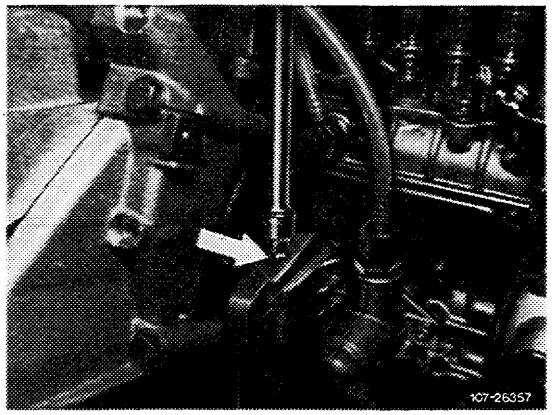
2 Loosen fastening screws (arrows) on injection pump flange and on supproting holder (arrow).





Screw on supporting holder

3 Swivel injection pump by turning adjusting screw on injection timing-adjusting device until both lamps are lighting up.



Direction of rotation of adjusting screw

Clockwise = injection timing retarded
Counterclockwise = injection timing advanced

RI-nominal value 15^{0} after TDC.

Note: If adjustment cannot be made any further, displace injection pump. Removal and installation of injection pump (07.1-200).

4 Tighten fastening screws on injection pump flange and on supporting holder.

5 Remove position indicator (position pickup).

6 Screw in closing plug.

7 Mount air cleaner top.

8 Check control linkage and adjust, if required (30–300).

9 Perform leak test with engine running.

10 Check engine oil level and correct, if required.

07.1-I 17 Adjusting injection timing with digital tester(R IV-method) — following checkup

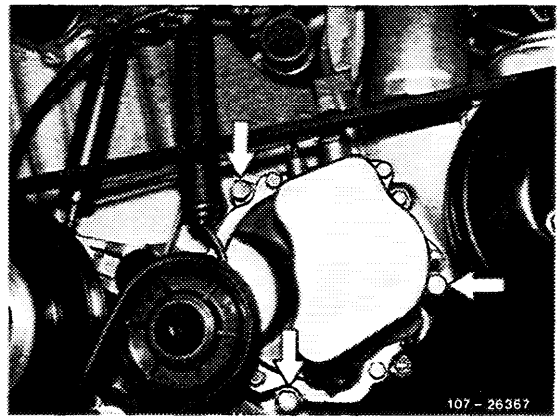
Job no. of work units or standard texts and flat rates data 07-8300.

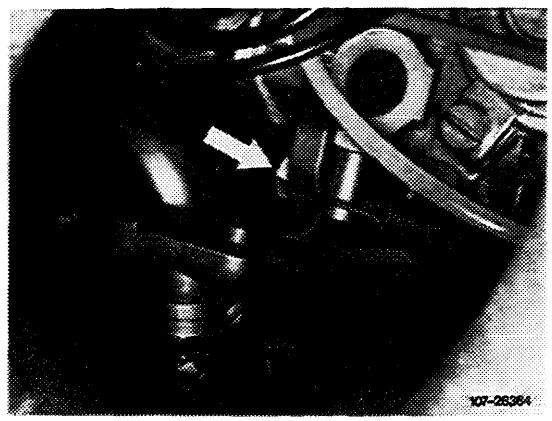
Note

Prior to making adjustments, check begin of delivery (injection timing) (07.1-I 12).

Adjusting

1 **Loosen fastening screws (arrows) on injection pump flange as well as on supporting holder (arrow).**





Screw on supporting holder

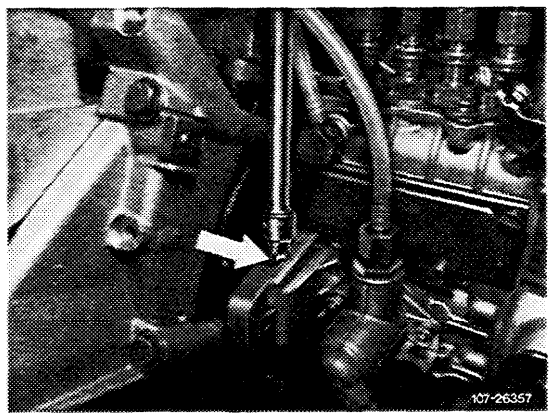
2 **Run engine at 750 ± 50/min at idle.**

3 Adjust RI-value (indirect injection timing) by turning adjusting screw on injection timing-adjusting device.

RI-nominal value: 15° after TDC at 750 ± 50/min.

Direction of rotation of adjusting screw

Clockwise = injection timing retarded
Counterclockwise = injection timing advanced



Note: If adjustments cannot be made any further, displace injection pump. Removal and installation of injection pump (07.1-200).

4 Stop engine.

5 Disconnect tester.

6 Screw in closing plug on regulator.

7 Mount air cleaner.

8 Check control linkage and adjust, if required (30–300).

9 Perform leak test with engine running.

10 Check engine oil level and correct, if required.

07.1-135 Checking injection nozzles

Job no. of work units or standard texts and flat rates data 07-6712.

Injection nozzles removed (07.1-230).

Test values

Injection nozzle	new	used
Opening pressure in bar	115-125	min. 100

Special tool

Cleaning unit		000 589 00 68 00

Conventional tools

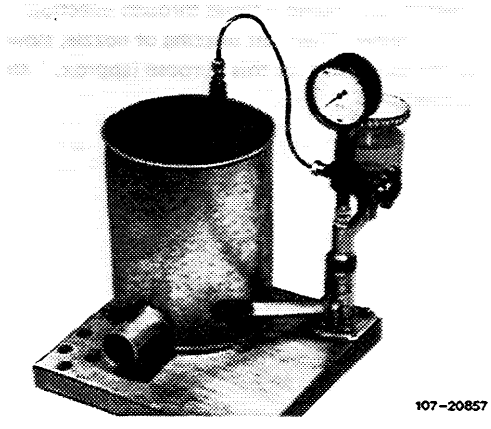
Tester EFEP 80 H	e.g. Bosch, D-7000 Stuttgart order no. 0 881 200 502
Cleaning needle 0.18 mm dia.	e.g. Bosch, D-7000 Stuttgart order no. KDEP 2900/4

Note

For testing, use clean test oil or filtered diesel oil only. When checking a nozzle, never place hand in jet of a nozzle. The jet will enter deeply and destroy the tissue. Fuel entering the blood may cause blood poisoning.

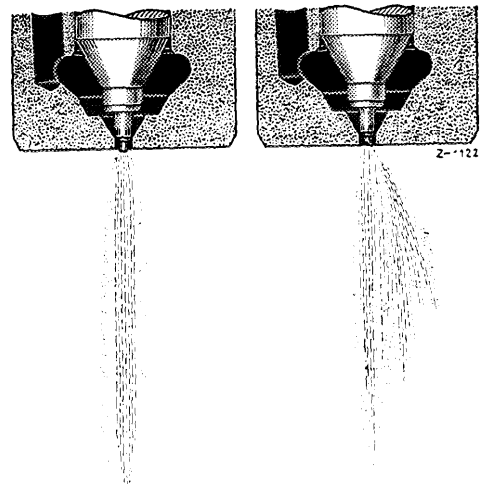
A. Throttle pintle and flat surface pintle nozzle

1 **Energetically pump 5 times through injection nozzle on tester. Then test buzzing of nozzle, slowly actuating hand lever for this purpose (approx. 1 stroke per second).**



107-20857

2 Test jet: During short, fast partial strokes (at least 2 strokes per second) the jet should be rather closed and tear off well.



A Jet pattern closed and well atomized
B Jet pattern torn up, too wide and spreading

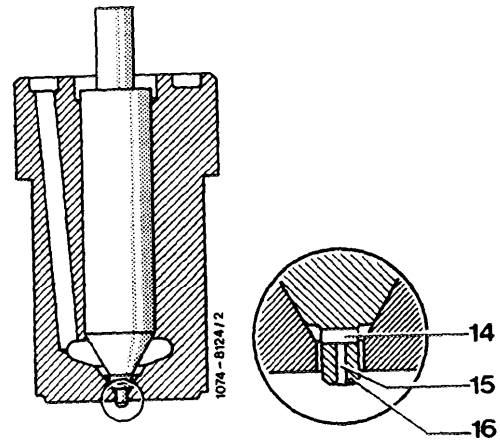
3 Check opening pressure: Nominal value 115-125 bar with new nozzle, min. 100 bar with used nozzles.

Move hand lever slowly downward (at least 1 stroke per second) and read opening pressure on pressure gauge.

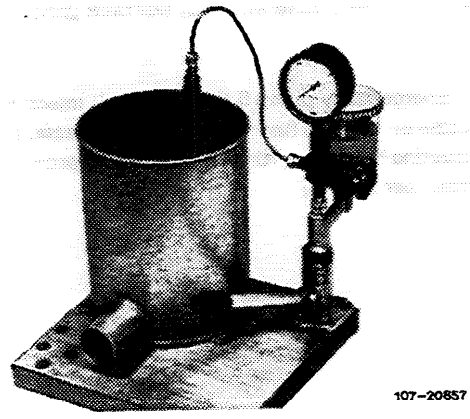
For this test, shutoff valve mut be open.

B. Hole-type pintle nozzle

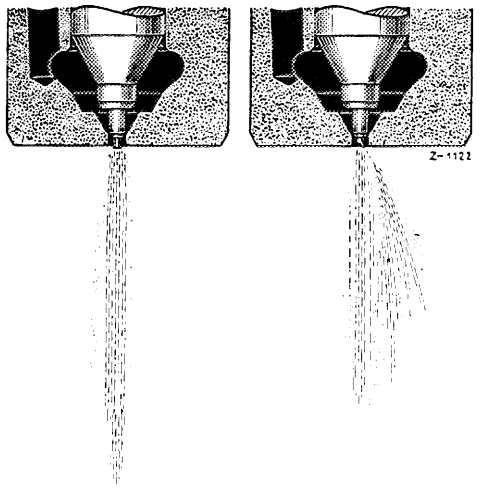
1 Prior to testing: Check longitudinal bore (15) with cleaning needle of 0.18 mm dia. for passage.



2 Energetically pump 5 times through injection nozzle on tester. Then test buzzing of nozzle, slowly actuating hand lever for this purpose (approx. 1 stroke per second).



3 Test jet: During short, fast partial strokes (at least 2 strokes per second) the jet should be rather closed and tear off well.

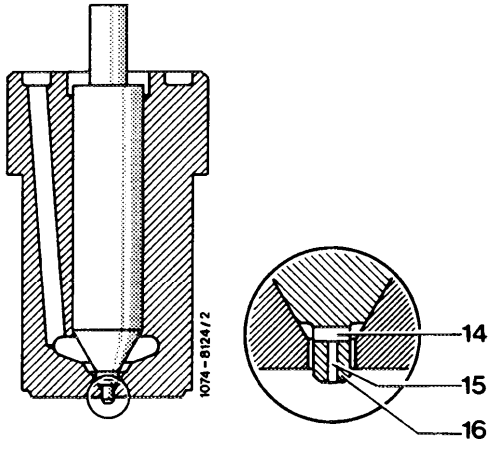


A Jet pattern closed and well atomized
B Jet pattern torn up, too wide and spreading

4 Generate initial jet by moving hand lever slowly in downward direction (4-6 s/stroke).

A vertical cord-like jet should come out of center bore (15).

Note: On new nozzles it is rather difficult to generate the initial jet, for this reason check longitudinal bore with cleaning needle of 0.18 mm dia. for passage.



5 Check opening pressure.

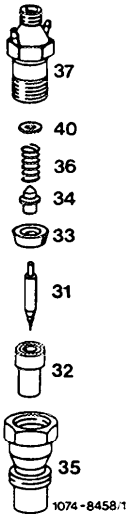
Nominal value: 115-1 25 bar with new nozzle, at least 100 bar with used nozzle.

Move hand lever slowly in downward direction (approx. 1 stroke per second) and read opening pressure on pressure gauge.

Shutoff valve must be open during test.

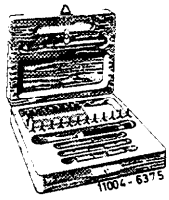
07.1–137 Disassembling, cleaning, assembling and adjusting injection nozzles (following checkup)

Job no. of work units or standard texts and flat rates data 07-6750.



31	Nozzleneedle..	Visual and slide test; on hole-type pintle nozzle clean center and longitudinal bore
32	Nozzle body	Remove combustion residue
33	Nozzle holder element	Touch up on surface plate
34	Thrustpin	Tip should point toward upper part
35	Nozzle holder lower part	70-80 Nm
36	Compression spring	
37	Nozzle holder upper part.	Clamp in protective jaws
40	Steel disk	Adjust for opening pressure. Nominal value 115-125 bar with new nozzle or nozzle to be newly adjusted, min. 100 bar with used nozzle. Opening pressure will be higher or lower depending on thickness of disk, 0.05 mm provide approx. 3 bar difference in pressure

Special tools

Torque wrench with plug-in ratchet, 1/2'' square, 25-130 Nm		001 589 66 21 00
Socket wrench element 27 mm, 1/2'' square		001 589 65 09 00
Cleaning unit		000 589 00 68 00

Conventional tool

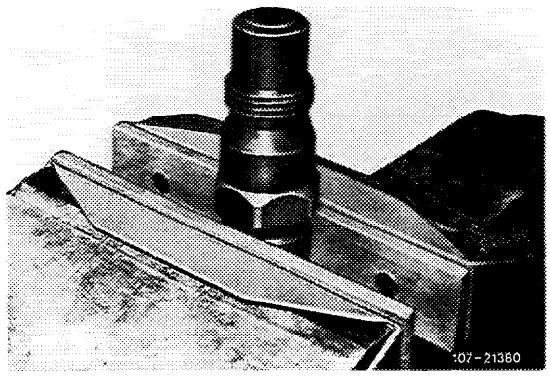
Cleaning needles 0.18 mm dia.	e.g. Bosch, D-7000 Stuttgart order no. KDEP 2900/4

Note

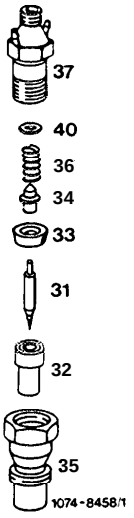
During disassembly, make sure that the nozzle body, the nozzle needle and the individual parts are not mixed up among each other.

Disassembly

1 Clamp injection nozzle holder upper part (37) with protective jaws into vice in such a manner that the leak oil line connections are not damaged.



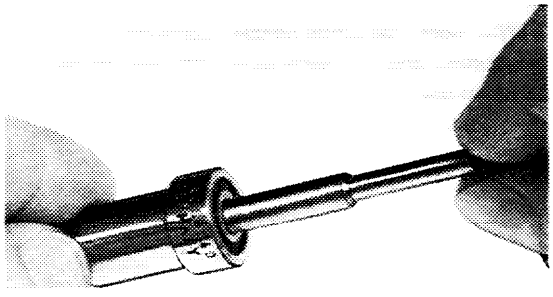
2 Disassemble injection nozzle.



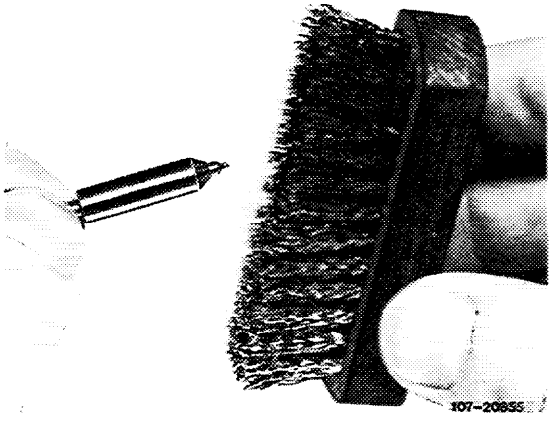
31 Nozzle needle
32 Nozzle body
33 Nozzle holder element
34 Pressure pin
35 Injection nozzle holder lower part
36 Compression spring
37 injection nozzle holder upper part
40 Steel disk for making adjustments

Cleaning and testing

3 Remove combustion residue on nozzle needle seat with cleaning cutter.



4 Clean nozzle needle and nozzle body with brass brush.

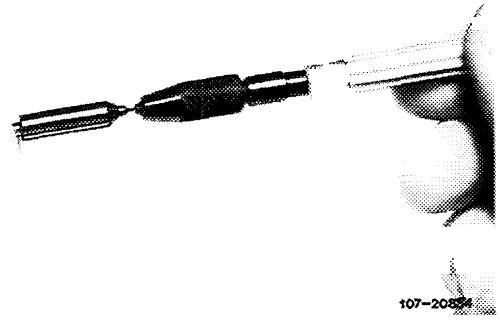


5 Visual and slide check.

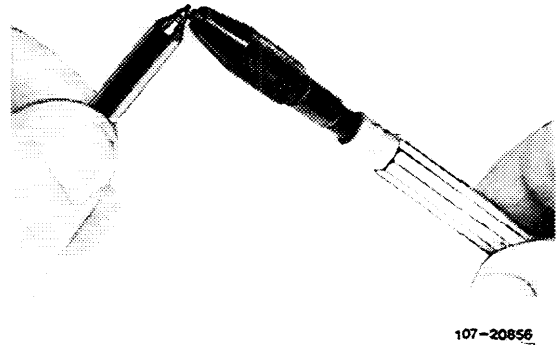
Immerse nozzle into filtered diesel fuel. With nozzle body held vertically, the nozzle needle should slide under its own weight in direction of nozzle seat.

6 Touch up nozzle holder element (33) on surface plate.

7 With hole-type pintle nozzle, additionally clean longitudinal and transverse bore with cleaning needle 0.18 mm dia.



Longitudinal bore

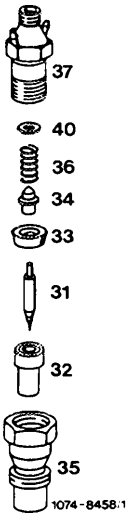


Transverse bore

Assembly

8 Assemble injection nozzle. Tightening torque for injection nozzle holder 70-80 Nm.

9 Check injection nozzle for function (07.1-135) and adjust, if required (07.1—137).



31 Nozzle needle
32 Nozzle body
33 Nozzle holder element
34 Pressure pin
35 Injection nozzle holder lower part
36 Compression spring
37 Injection nozzle holder upper part
40 Steel disk for making adjustment

Adjusting

10 Add **thicker** or thinner disks depending on opening pressure.

Thicker disk = increases opening pressure
Thinner disk = reduces opening pressure

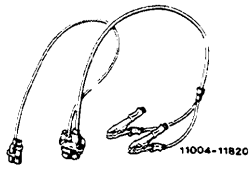
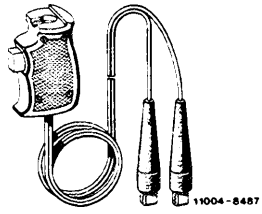
Disks are available from 1 .O to 1.8 mm thick, in steps of 0.05 to 0.05 mm. An increase of preload by 0.05 mm increases opening pressure by approx. 3.0 bar.

07.1-145 Checking fuel pump

Job no. of work units or standard texts and flat rates data 07-5700.

Test value	
Delivery at min. 200 rpm (stop lever pushed)	**min. 200 ml/30 s**

Special tools

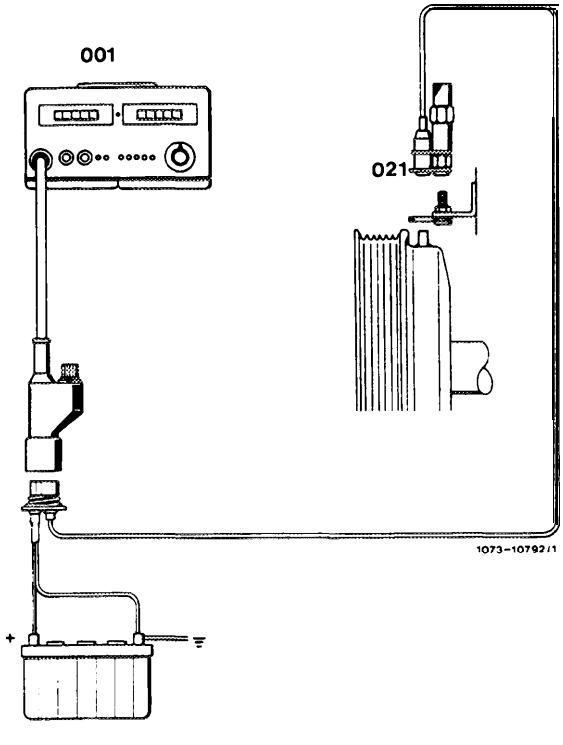
TDC-impulse transmitter	 11004-11820	**601 589 04 21 00**
Contact handle (for **starting)**	 11004-8487	**001 58946 21 08**

Conventional tools

Digital tester	**e.g. Bosch, MOT 001.03**
Measuring glass or measuring cup (min. 1 liter)	
Stop watch	

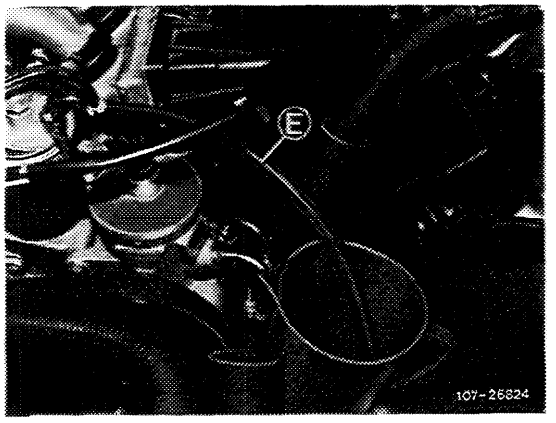
Testing

1 **Connect digital tester (001) according to connection diagram.**



001 Digital tester
021 TDC-impulse transmitter

2 Disconnect return flow line (E) and hold into measuring cup.



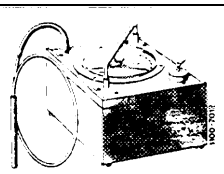
3 Move ignition lock into position ,,0'', injection pump will then be at ,,zero" delivery.

4 Start motor for 30 seconds with separate starting cable, with battery intact (10.0 V when starting) a delivery quantity of min. 200 ml must be attained. Renew delivery pump, if required.

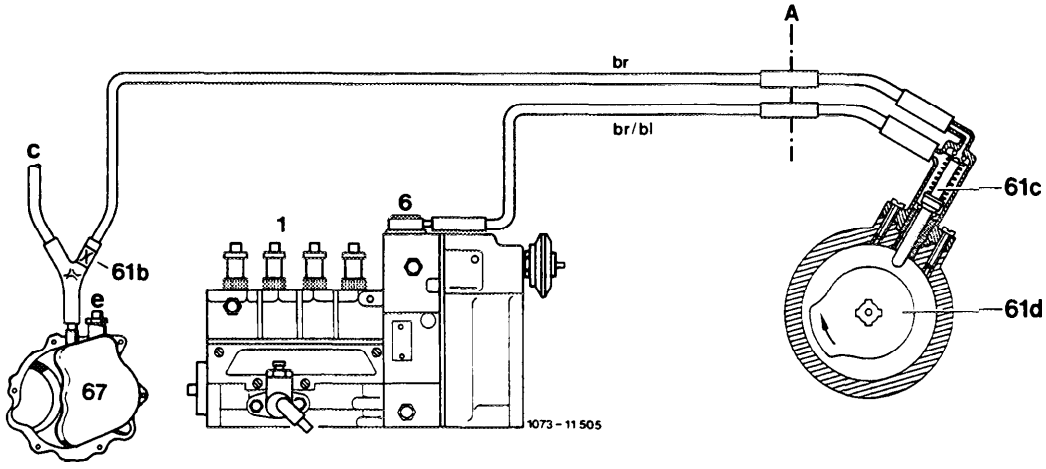
07.1-150 Checking vacuum shutoff for leaks

Job no. of work units or standard texts and flat rates data 07–8222.

Special tool

Vacuum tester		**116 589 25 21 00**

Function diagram



1 Injection pump
6 Vacuum control unit (stop)
61b Orif ice 0.5 mm dia.
61c Valve ignition starter switch
61d Cam disk ignition starter switch
67 Vacuum pump

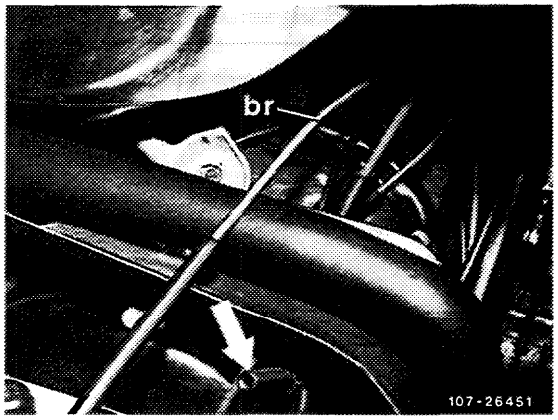
A Intermediate wall
c Remaining consumers
e To brake unit

bl = blue
br = brown

Testing

1 Set ignition key on steering lock to position ,,2''.

2 Pull suction line (brown) out of connection (arrow).

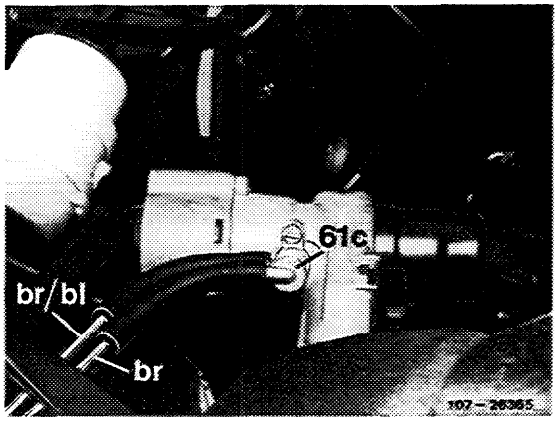


3 Connect tester and activate with vacuum.

If readout on pressure gauge is not changing, the valve for key starting system is tightly sealed.

If pressure gauge shows a vacuum drop, valve (61c) on steering lock is leaking.

Attention!
Prior to exchanging valve for key-starting system and the vacuum control unit of injection pump, check hose lines and their connections.

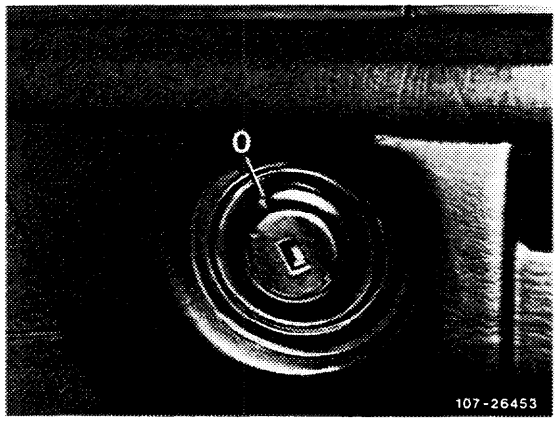


4 Renew valve for key-starting system on steering lock.

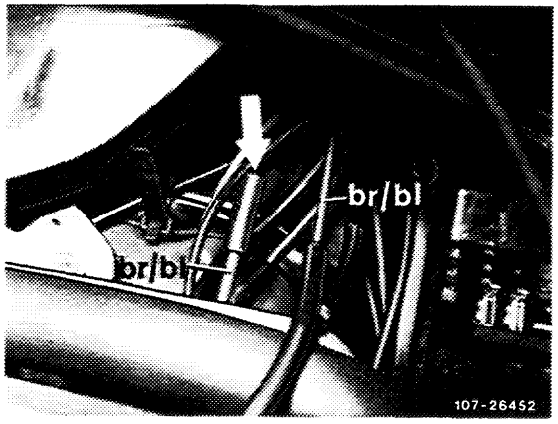
5 Turn ignition key on steering lock back to position ,,O".

If pressure gauge shows a vacuum drop, the vacuum control unit or the valve may be leaking.

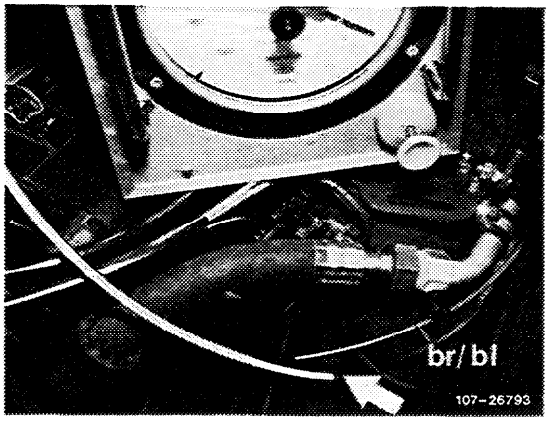
6 In such a case, disconnect tester on suction line.



7 Pull control line (brown/blue) from connection (arrow).



Layout standard version and (USA)



@California version

8 Connect tester to connection and activate with vacuum.

If pressure gauge shows a vacuum drop, the vacuum control unit of injection pump is leaking.

Attention!
Prior to exchanging vacuum control unit, check hose lines and their connections.

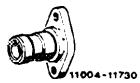
9 Renew vacuum control unit (07.1–220).

07.1-200 Removal and installation of injection pump

Job no. of work units or standard texts and flat rates data 07–8410.

Test value	
injection timing (indirect), position of engine	15° after TDC cylinder 1

Tightening torques (reference values)	Nm
Closing plug on regulator (measuring point)	30-35
Injection line	1 O-20
Injection pump flange	20-25
Central fastening bolt on injection timer (lefthand threads)	40-50

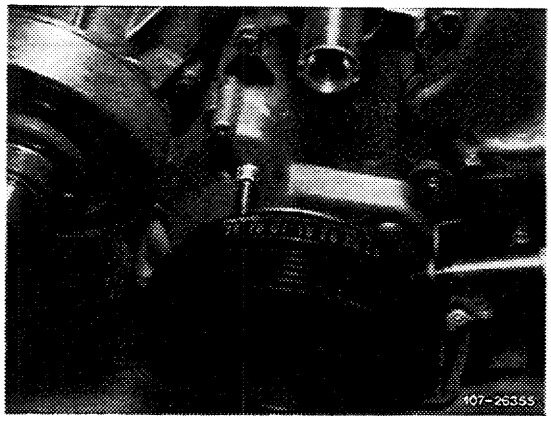
Special tools		
Torque wrench with plug-in ratchet, 1/2''square, 25-l 30 Nm	11004-10056	001 589 66 21 00
Locking screw	11004-11773	601 589 05 21 00
Socket wrench element 27 mm, 1/2'' square	11004-6193	001 589 65 09 00
Box wrench element open, 14 mm, 1/2'' square for injection lines	11004-105201	000 589 77 03 00
Serration wrench for rotating injection pump	 11004-11730	601 589 00 08 00

Removal and installation

1 Remove radiator shell and fan (20–335).

2 Completely remove air cleaner (09–400).

3 Rotate crankshaft in direction of rotation to 15° after TDC of 1st cylinder.



4 Disengage belt tensioner (13-340).

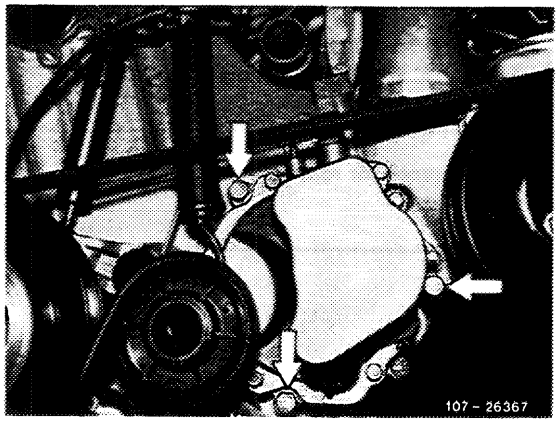
5 Remove chain tensioner (05-310).

6 Connect injection and fuel lines to injection pump.

7 Pull vacuum lines from vacuum control unit for idle speed increase, stop unit and vacuum control valve, if required.

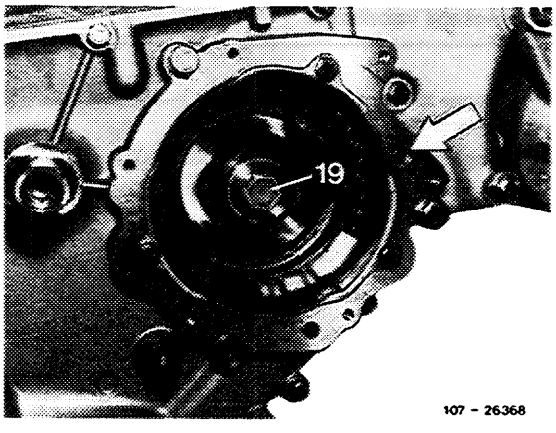
8 Disengage regulating linkage on adjusting lever.

9 Remove vacuum pump (43-610).

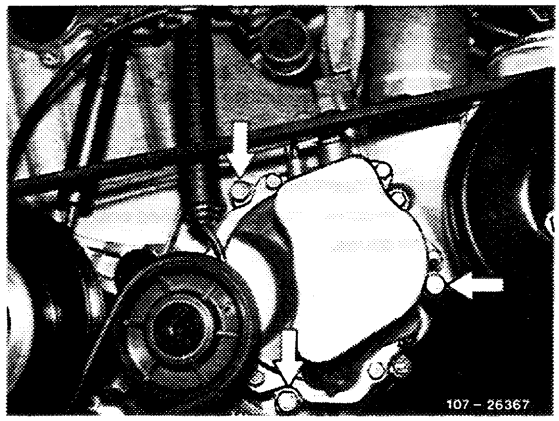


10 Loosen central fastening screw (19) (lefthand thread), apply counterhold to crankshaft for this purpose.

Attention!
LEFTHAND THREADS



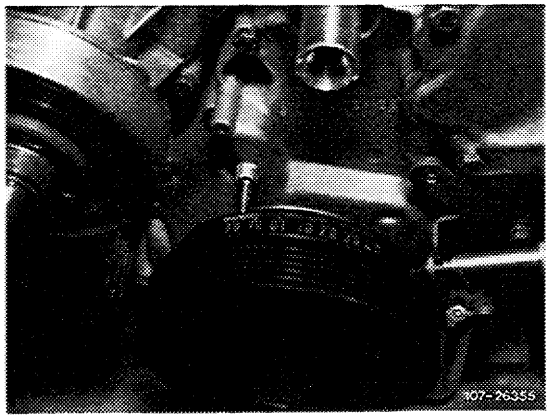
11 Unscrew fastening screws (arrows) and screw on supporting holder.



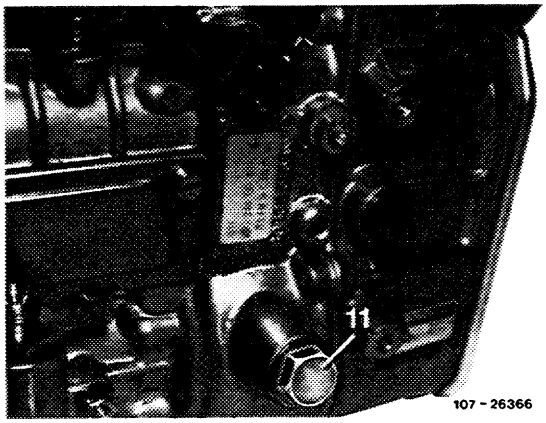
12 Pull out injection pump toward the rear.

Installation notes

13 Check whether engine is at 15° after TDC of first cylinder.

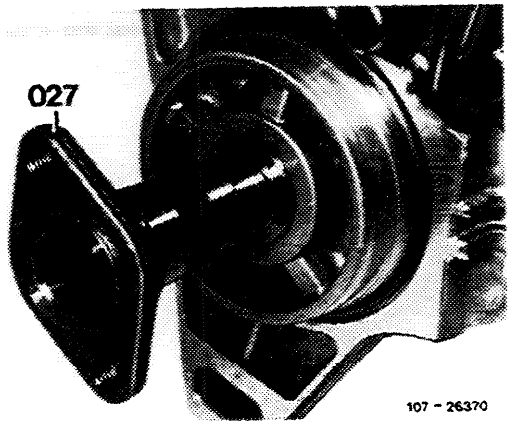


14 Remove closing plug (11).



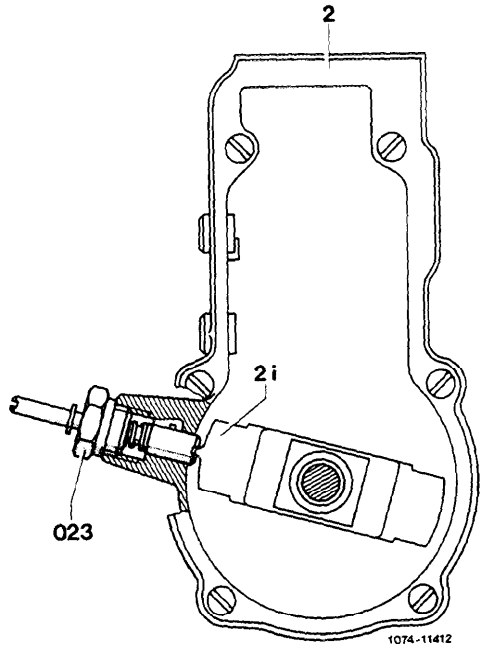
15 **Rotate injection pump with serration wrench (027) on injection pump camshaft until lug of regulator shows up on bore, slip in locking gauge (023) in this position until gauge is noticeably engaging.**

Attention!
Risk of damaging injection pump!
As soon as the injection pump is installed and tightened, remove locking gauge.



16 Assemble engine.

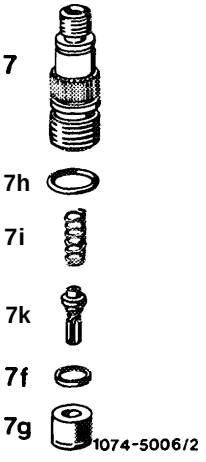
Note: When the engine is started, the injection system will automatically vent itself.



07.1-210 Renewing delivery valve seal

Job no. of work units or standard texts and flat rates data 07-8627

Removal and installation of air cleaner (09–400).



7 **Delivery valve holder** ..... **35 Nm**
7f **Copper seal** ..... **Renew**
7g **Delivery valve carrier** ..... **Note installation position**
7h **O-ring.** ..... **Lubricate prior to installation.**
7i **Compression spring**
7k **Delivery valve**

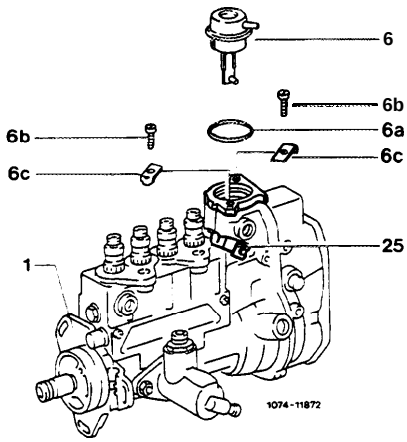
Special tool

Socket wrench element notched tooth 17 x 20, 1/2″ square	11004-8544	**617 589 01 09 00**

07.1-220 Renewing vacuum control unit

Job no. of work units or standard texts and flat rates data 07-8618

Removal and installation of air cleaner (09-400).



1 Injection pump

6 Vacuum control unit (stop). ..... Slightly lift during removal, tilt rearward toward engine end and pull out

6a O-ring

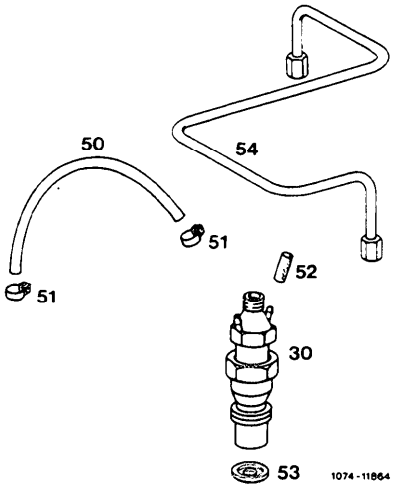
6b Screw

6c Holder

25 Emergency stop lever. ..... During installation, push and let connecting rod of vacuum control unit engage in rocker of emergency stop lever

07.1-230 Removal and installation of injection nozzle

Job no. of work units or standard texts and flat rates data 07-6810.

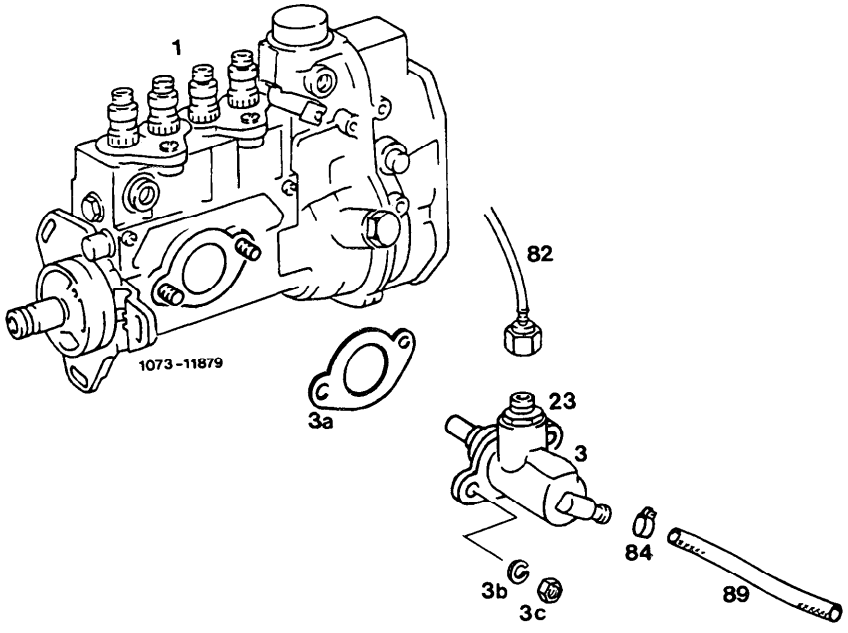


30 Injection nozzle ..... 70-80 Nm, use special tool 001 589 65 09 00
50 Leak oil hose
51 Hose clamp (S only)
52 Closing plug
53 Nozzle reed. ..... Renew
54 Injection lines cylinder 1 .....10–20 Nm (reference value)

07.1-235 Removal and installation of fuel pump

Job no. of work units or standard texts and flat rates data 07-5710.

Remove air cleaner cover (09–400).



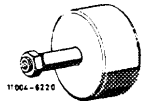
1 Injection pump
3 Fuel pump. . . . . During removal, catch emerging engine oil
3a Gasket
3b **Circlip,** 2 each
3c Nut, 2 each
23 Pressure connection
82 Fuel filter inlet
84 Clamp
89 Suction line

07.1-240 Removal and installation of injection timer

Job no. of work units or standard texts and flat rates data 07–8014.

Tightening torque	Nm
Central fastening screw on injection timer (lefthand threads)	40-50

Special tools

Socket wrench element 27 mm, 1/2'' square		001 589 65 09 00
Torque wrench with plug-in ratchet, 1/2'' square, 25-l 30 Nm		001 589 66 21 00
Impact puller		116589203300
Threaded bolt M 6		11658901 3400

Note

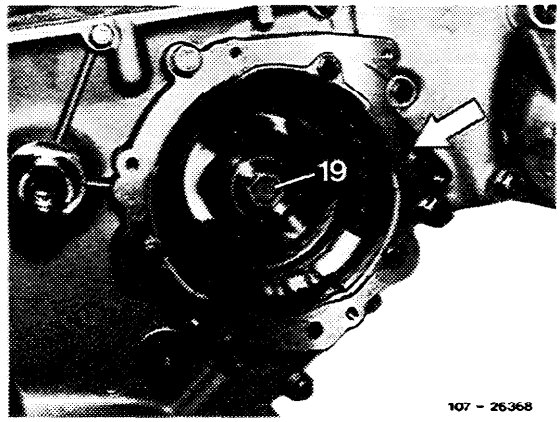
Injection pump removed, remove and install injection pump (07.1-200).

Removal and installation

1 Remove assembly basket.

2 Remove camshaft timing gear for slackening chain.

3 Pull out locking pin (arrow).



4 Push timing chain in outward direction, slip in sheet metal strip of approx. 0.2 mm for this purpose, and pull out injection timer.

5 Install injection pump.

6 Check injection timing with digital tester (07.1-l 12). adjust, if required (07.1-l 17).

07.1-245 Renewing fuel filter

Job no. of work units or **standard texts and flat rates data 07-5513.**

Note

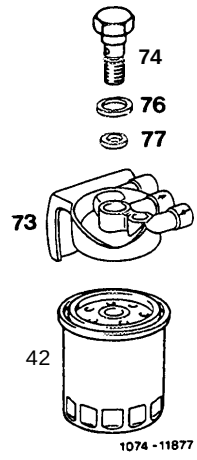
Fuel system will vent itself automatically when starting, owing to higher delivery capacity of fuel pump and throttles (orifices) in filter top, as well as on injection pump.

Function diagram, refer to 07.1-010 section ,,G".

Removal and installation

1 Disengage vacuum line on holder.

2 Loosen fastening screw (74) and remove filter (42) in downward direction.

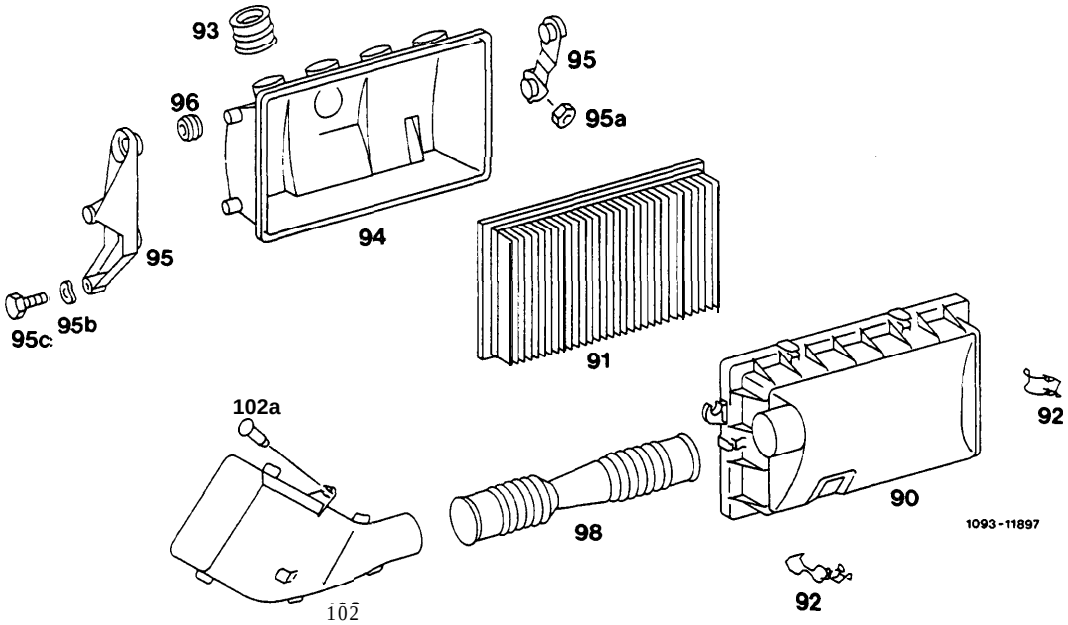


42 Filter
73 Fuel filter top
74 Screw
76 O-ring
77 Sealing ring (aluminum)

09 Air cleaner

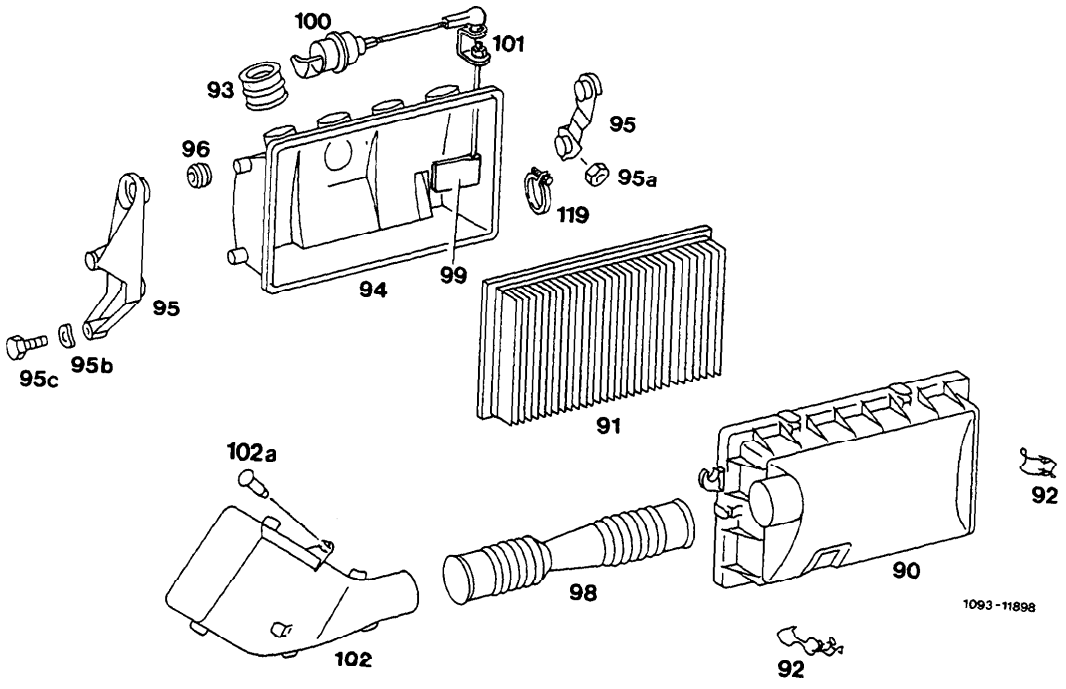
	Job No.
Removal and installation of air cleaner	09-400
A. Standard version and (USA) Federal	
B. @California	

A. Standard version and (USA) Federal



90 Air cleaner cover
91 Air cleaner element
92 Closing clip, 6 each
93 Sealing sleeve, 4 each
94 Air guide housing
95 Holder. 2 each
95a Nut
95b Washer
95c Screw
96 Rubber, 4 each
98 intake line
102 Intake scoop
102a Bolt

B. @California



90 Air cleaner cover
91 Air cleaner element
92 Closing clip, 6 each
93 Sealing sleeve, 4 each
94 Air guide housing

95 Holder, 2 each
95a Nut
95b Washer
95c Screw
96 Rubber, 4 each
98 Intake line
99 Pressure control flap

100 Vacuum control unit
101 Linkage pressure control flap
102 Intake scoop
102a Bolt
119 Clamp

13 Belt drive

	Job No.
Removal and installation of V-belt	13-340

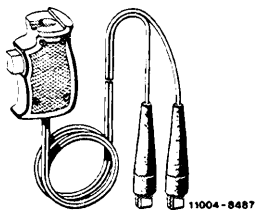
V-belt dimensions

Version	A Basic drive	B with power steering pump	C with power steering pump and refrigerant compressor
Length (mm)	1015	2050	2120
Part number	0079979092	601 9970292	0079978492

Belt tension (test value KG scale on measuring instrument)

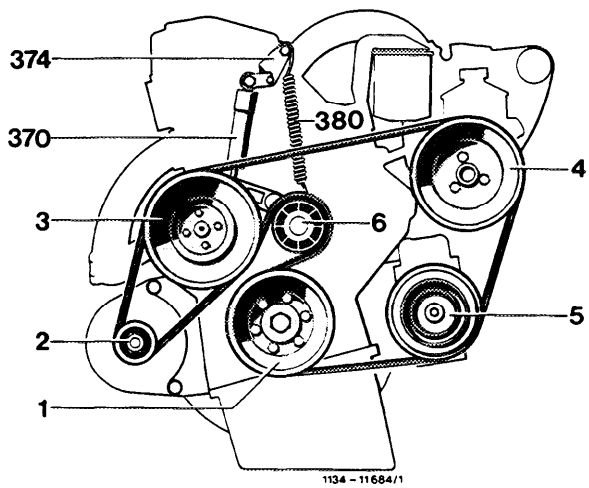
Tightening torque	Nm
Screw for fan	25

Special tools

Torque wrench with plug-in ratchet, 1/2" square, 25-l 30 Nm		001 58967 2100
Measuring instrument (Krikit)		001 589 69 21 00
Contact handle for rotating engine (component of compression pressure recorder 001 589 46 21 00)		001 589 46 21 08

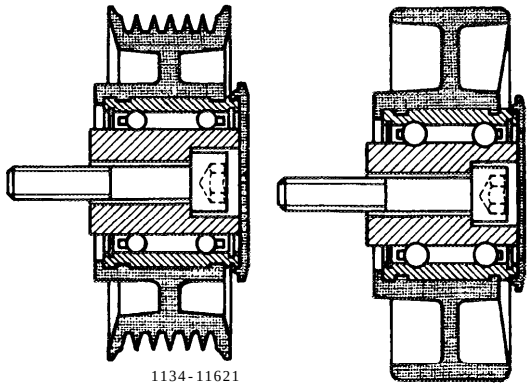
Note

The V-belt is tensioned by means of a draw spring (380) via tensioning roller (6). A shock absorber (370) prevents vibrations in belt drive.



1 Crankshaft pulley
2 Pulley, alternator
3 Pulley, coolant pump
4 Pulley, hydraulic oil pump for power steering
5 Pulley, refrigerant compressor
6 Tensioning roller
370 Shock absorber
374 Tensioning lever
380 Tensioning spring

The tensioning roller for belt drive version A has grooves on circumference in accordance with V-belt. For belt drive versions B and C the circumference of tensioning roller is flat.

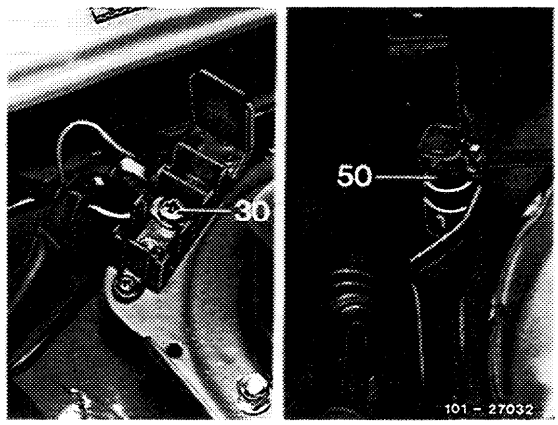


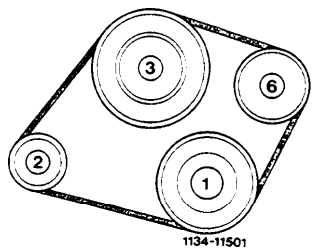
Checking

Mark belt at a well visible spot with chalk.

Connect contact handle to cable connector (terminal 30) and to coupling (terminal 50) (arrows). Rotate engine step by step while checking belt for damage. Complete inspection when identification shows up again (one rotation of engine).

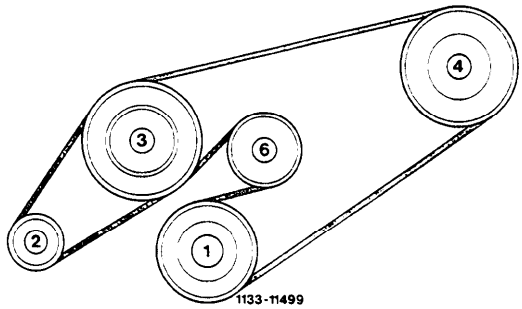
Renew cracked, burnt or worn out belts.





Version A
(standard version)

1 Crankshaft
2 Alternator
3 Coolant pump
6 Tensioning roller

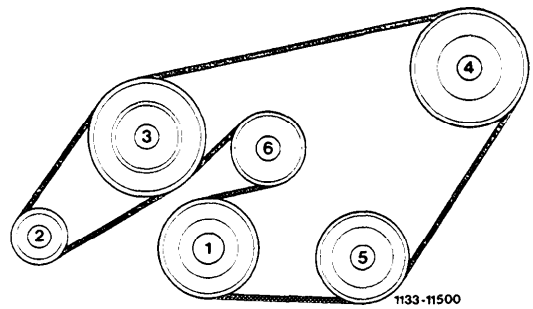


Version B

1 Crankshaft
2 Alternator
3 Coolant pump
4 Power steering pump
6 Tensioning roller

Version C

1 Crankshaft
2 Alternator
3 Coolant pump
4 Power steering pump
5 Refrigerant compressor
6 Tensioning roller



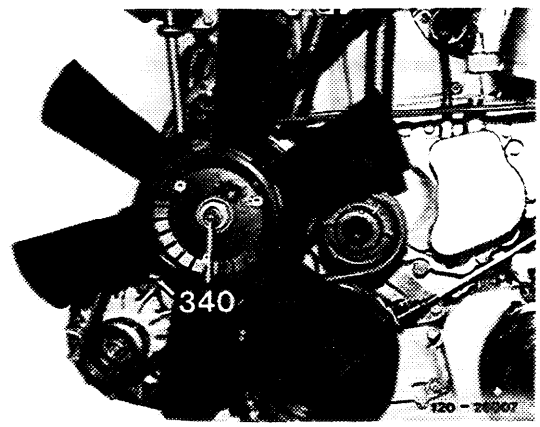
Removal

1 Disconnect vent line on fan cover.

2 Disengage fan cover and place over fan.

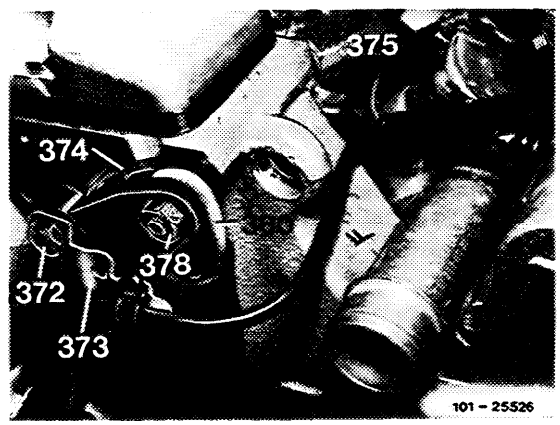
3 Unscrew center bolt (340) for fan and remove fan.

4 Remove fan cover.



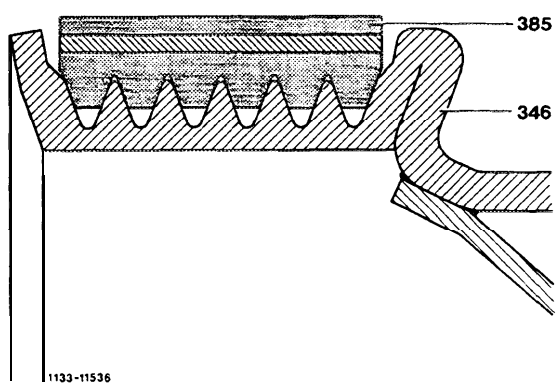
5 Slacken V-belt and remove. For this purpose, unscrew collar nut (378). Insert a mandrel (12-l 3 mm dia., approx. 300 mm long) or wheel nut wrench from vehicle tools into spring tensioning lever (374) and relieve hex. head screw (375) opposite to force of draw spring (380) to the extent that the screw can be pushed back in direction of intake manifold.

Release spring tensioning lever, push back tensioning roller and remove V-belt.



Installation

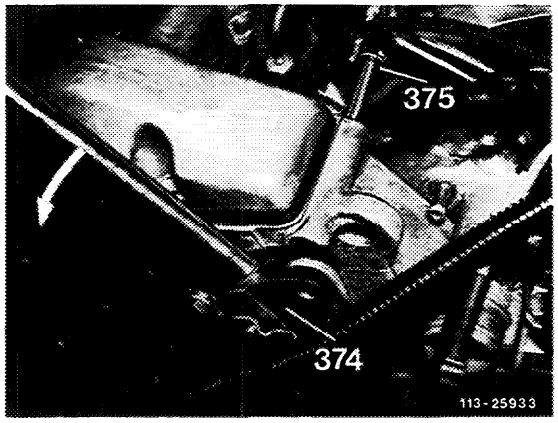
6 Check pulley profiles and tensioning device for damage and contamination (e. g. worn out bearing points of tensioning device, dents in pulleys etc.) and renew, if required.



346 Pulley
385 V-belt

7 Mount V-belt. Start at tensioning roller and finish at coolant pump. Do not use belt wax or similar products.

Swivel spring tensioning lever (374) by means of a mandrel against force of draw spring (380) to the left until the screw (375) can be slipped through spring tensioning lever and cylinder head. Position collar nut (378) and tighten.



8 Insert fan cover prior to mounting fan.

Tighten fan fastening screw to 25 Nm.

9 Mount fan cover.

10 Attach vent line.

11 Check belt alignment and tension.

Note: Measure tension with Krikit instrument 001 589 69 21 00. Test value (KG scale on measuring instrument).

14 Intake manifold, exhaust manifold, emission control system

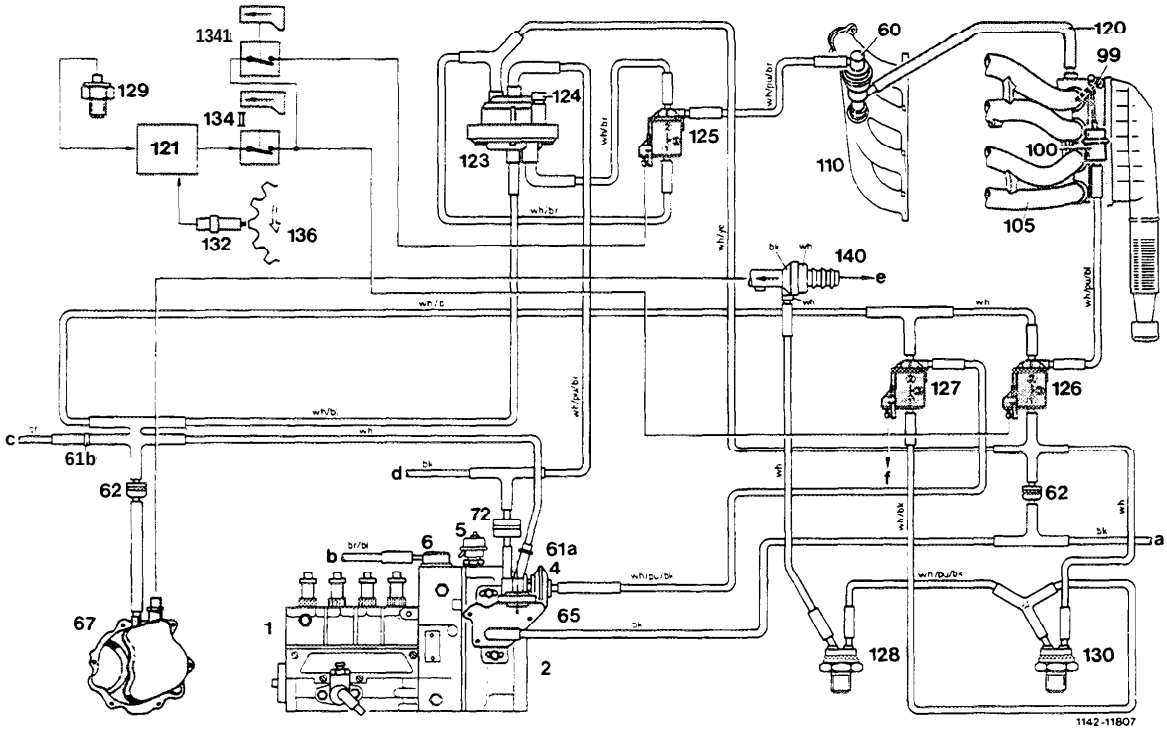
	Job No.
Operation of emission control system	14–050
A. General	
B. Components and operation	
C. Overall operation	
Checking emission control system	100
Removal and installation of intake manifold	180
Removal and installation of exhaust manifold	350
A. Standard version and (USA) Federal	
B. @California.	

14-050 Operation of emission control system

A. General

Starting model year 1984, engine 601.92 is provided with a pneumatically/electronically controlled EGR-system for California.

Engines in Federal version vehicles are not provided with EGR.

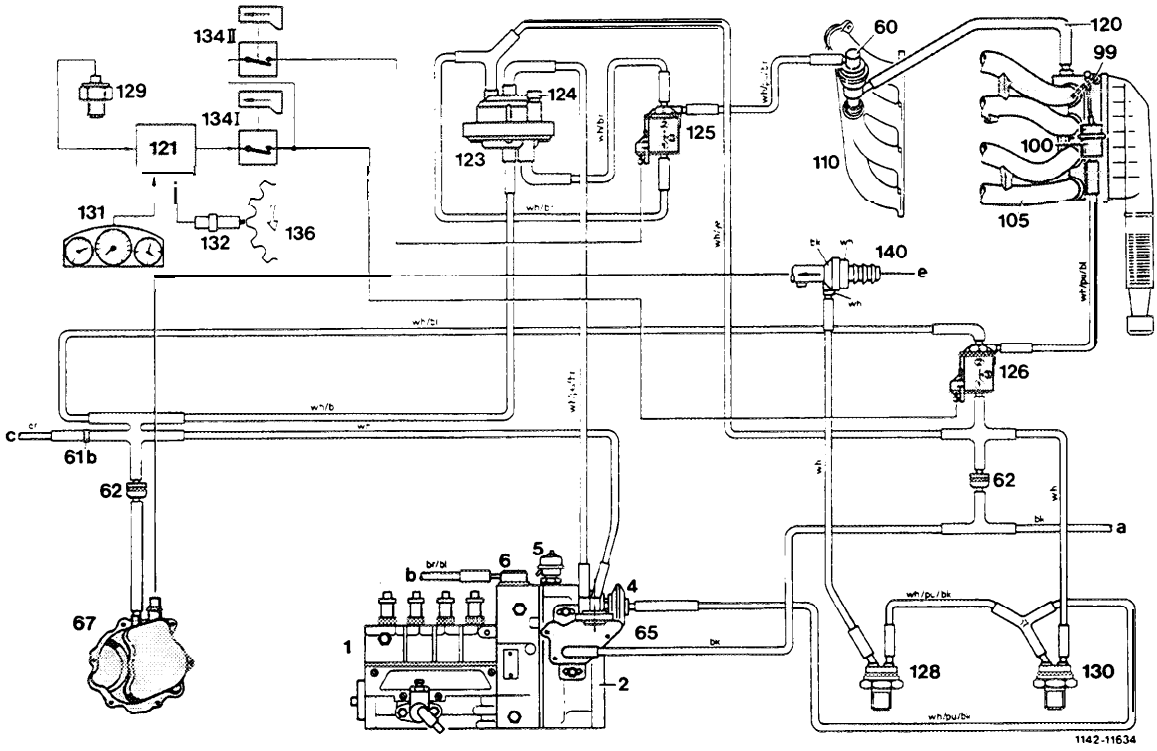


Function diagram with automatic transmission

1 Injection pump
2 Regulator
4 Vacuum control unit idle speed increase
5 ADA-capsule (altitude pressure compensation)
6 Vacuum control unit (stop)
60 EG R-valve
61 a Orifice
61 b Orifice 0.5 mm dia.
62 Vent filter
65 Vacuum control valve
67 Vacuum pump
72 Damper
99 Pressure control flap
100 Vacuum control unit for (99)
105 Intake manifold
110 Exhaust manifold
120 EGA-line
121 Control unit
123 Pressure converter
124 Adjusting screw for (123)
125 Switchover valve, electric for EGR-line
126 Switchover valve, electric, for pressure control flap
127 Switchover valve, electric, for rpm increase
128 Thermovalve closes at approx. 17 °C
129 Temperature sensor coolant 100 °C
130 Thermovalve opens at approx. 17 °C
132 Rpm sensor, engine
134/I Microswitch
134/II Microswitch
136 Starter ring gear
139 Orifice
140 Check valve brake unit

a Vent line to vehicle interior
b Key shutoff
c Remaining consumers
d Automatic transmission
e Brake unit
f To refrigerant compressor – control unit

bk = black
bl = blue
br = brown
gr = green
pu = purple
re = red
ye = yellow



Function diagram with manual transmission

1 Injection pump
2 Regulator
4 Vacuum control unit idle speed increase
5 ADA-capsule (altitude pressure compensation)
6 Vacuum control unit (stop)
60 EGR-valve
61 b Orifice 0.5 mm dia.
62 Vent filter
65 Vacuum control valve
67 Vacuum pump
99 Pressure control flap
100 Vacuum control unit for (99)
105 Intake manifold
110 Exhaust manifold
120 EG R-line
121 Control unit
123 Pressure converter
124 Adjusting screw for (123)
125 Switchover valve, electric, for EGR-valve
126 Switchover valve, electric, for pressure control flap
128 Thermovalve closes at approx. 17 °C
129 Temperature sensor coolant 100 °C
130 Thermovalve opens at approx. 17 °C
131 Rpm sensor, tachometer
132 Rpm sensor, engine
134/I Microswitch
134/II Microswitch
136 Starter ring gear
139 Orifice
140 Check valve brake unit

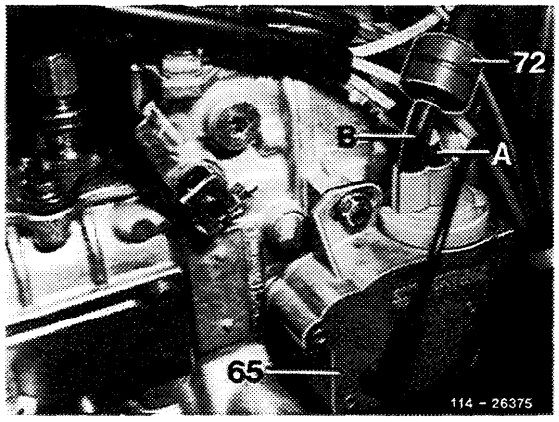
a Vent line to vehicle interior
b Key shutoff
c Remaining consumers
d Automatic transmission
e Brake unit
f To refrigerant compressor – control unit

bk = black
bl = blue
br = brown
gr = green
pu = purple
re = red
ye = yellow

B. Components and operation

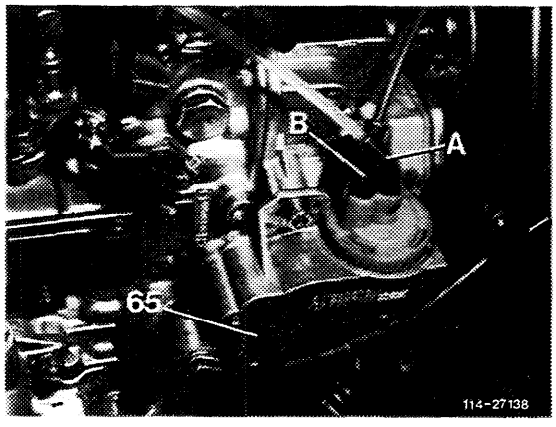
Vacuum control valve

The vacuum control valve is attached to injection pump and connected to adjusting lever by means of a driver. With supply vacuum connected (central connection) the valve modulates under increasing load a pressure with dropping characteristic. This modulated pressure is processed still further by pressure converter (also refer to group 27).



Layout automatic transmission

65 Vacuum control valve
72 Vacuum damper
A Control line
B Suction line

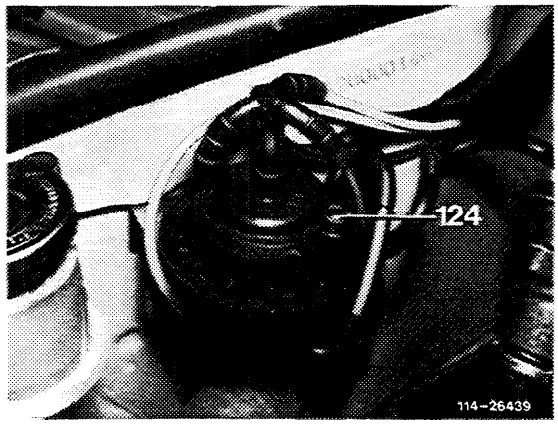


Layout manual transmission

65 Vacuum control valve
A Control line
B Suction line

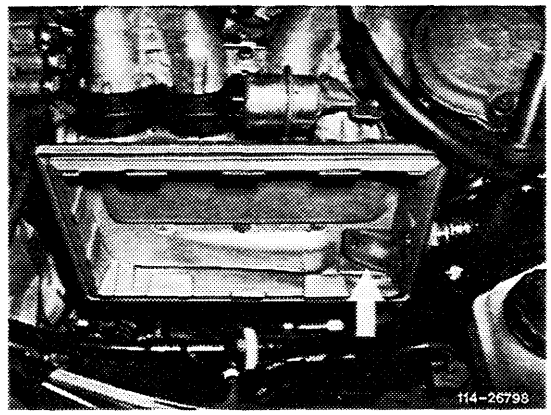
Pressure converter

The pressure modulated by pressure control valve is converted for EGR-system in pressure converter. The EG R-valve is activated **via** switchover valve (125). The modulated pressure can be continuously changed by means of adjusting screw (124) — under red protective cap — by approx. 100 mbar.



Air guide housing with pressure control flap

A pneumatically operated pressure control flap is located in air guide housing to increase the vacuum in intake manifold. When the engine is running in EGR-mode, the pressure control flap closes the fresh air duct. In closed condition, a minimum opening (arrow) remains between pressure control flap and air guide housing.



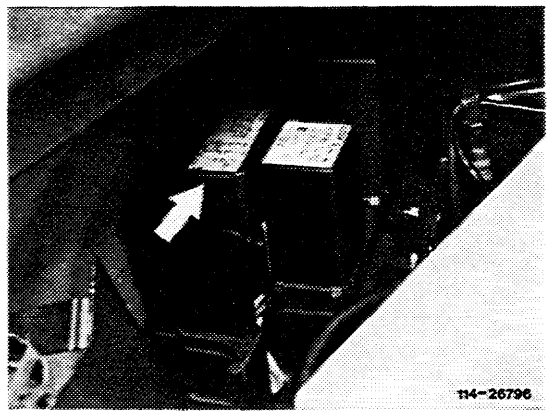
Pressure control flap closed

Note

Do not operate linkage on vacuum control unit for pressure control flap manually.

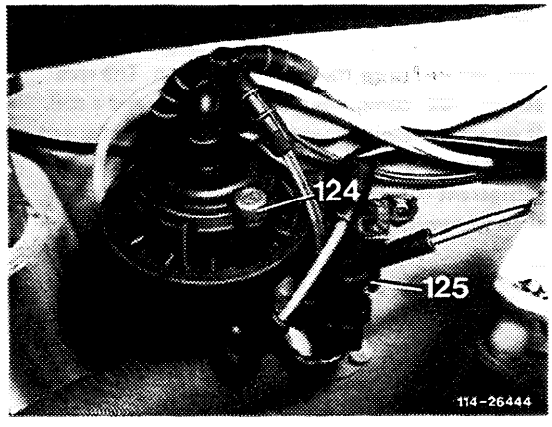
Control unit

Installed behind battery. After switching on ignition, the control unit is connected to battery voltage. Minimum working voltage approx. 11 Volts.



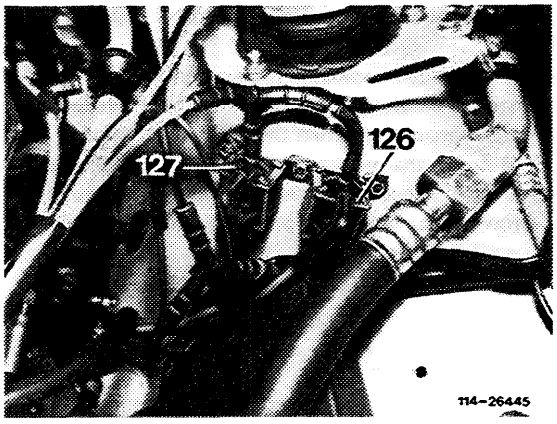
Electric switchover valve (125)

Valve releases the vacuum for EGR-valve under given operating conditions. Activation is by means of control unit in dependence of coolant temperature and engine speed, as well as speed and load-dependent on microswitch (134/1).



Electric switchover valve (126)

Releases vacuum for pressure control flap under given operating conditions. Activation is by means of control unit in dependence of coolant temperature and engine speed, as well as speed and load-dependent on micro-switch (134/II).

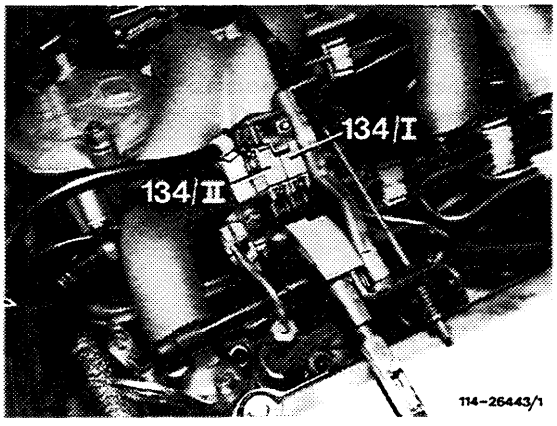


Microswitch (134/I)

Switches off EGR and refrigerant compressor prior to full load (refrigerant compressor only if air conditioning-comfort circuit is operating).

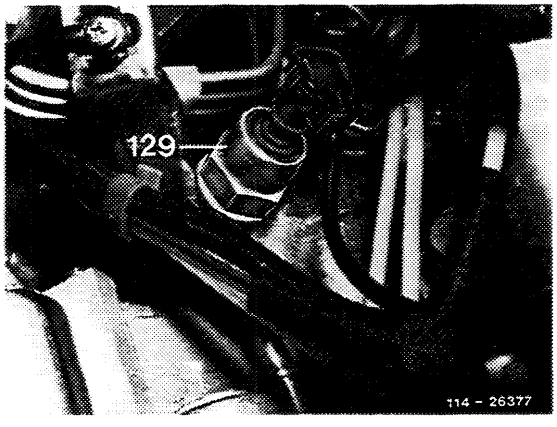
Microswitch (134/II)

Switches off pressure control flap prior to full load.



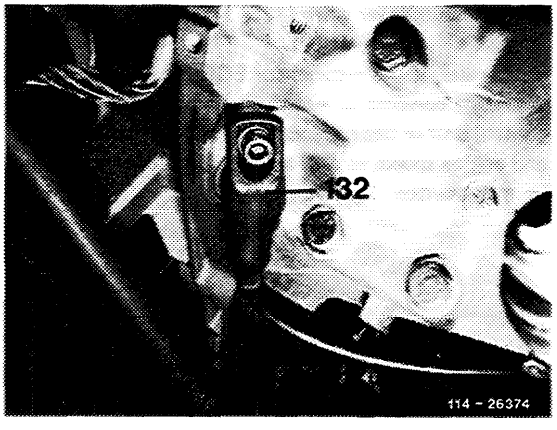
Temperature switch coolant 100 °C (129)

For thermic protection of engine, EG R is switched off as from 100 °C coolant temperature by temperature switch (129) via control unit.



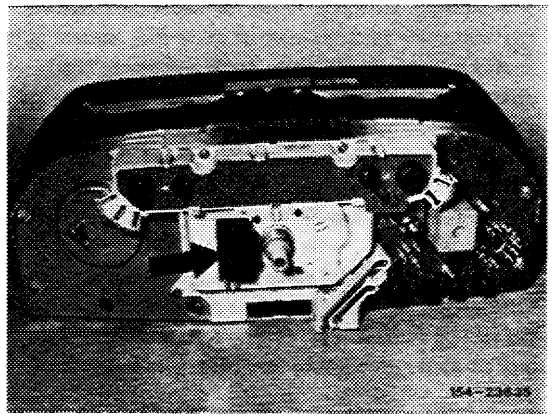
Rpm sensor engine (132)

Installed on flange toward transmission. The rpm sensor (132) comprises a magnetic core and a coil. It senses the engine speed and transmits that speed in the shape of an AC-voltage to control unit for refrigerant compressor. The transformed signal is then transmitted to control unit.



Rpm sensor on tachometer (manual transmission only).

The vehicle speed is sensed by rpm sensor (arrow) on tachometer. At a speed above 78 ± 8 km/h (48 mph) the switching unit will switch off EGR.



C. Overall function

EGR proceeds when the following items have been met:

- Engine speed
  > 1200 ±50/min
  < 2950 ±50/min
- Coolant temperature < 100 °C
- Load-dependent shutoff via microswitches shortly before full load.
  134/I EG R-valve
  134/II Pressure control flap
- Speed-dependent < 78 ± 8 km/h (48 mph) (on vehicles with manual transmission only)

Central connection (A) of vacuum control valve (65) is connected to vacuum from vacuum pump (67).

The modulated pressure from vacuum control valve outlet (B) is adapted to EGR-valve (60) in pressure converter (123).

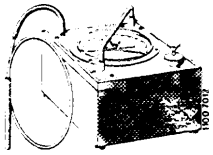
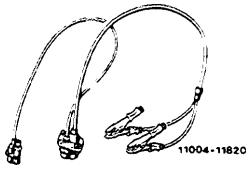
The pressure converter (123) regulates the pressure modulated by vacuum control valve (67) according to load condition (accelerator pedal position). The pressure control flap (99) is pneumatically operated and activated by control unit (121) via switchover valve (126). The full vacuum of vacuum pump (67) is then resting against vacuum control unit (100). The pressure control flap (99) will then close.

With pressure control valve closed, the vacuum in intake manifold increases. As a result, more exhaust gas will be recirculated. Engine rpm and speed are picked up by rpm sensor and processed by control unit.

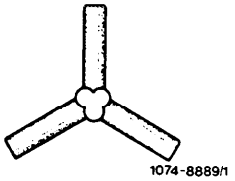
The pressure control valve and the EGR-valve will be opened or closed, depending on operating condition of engine, via magnetic switchover valves (125 and 126).

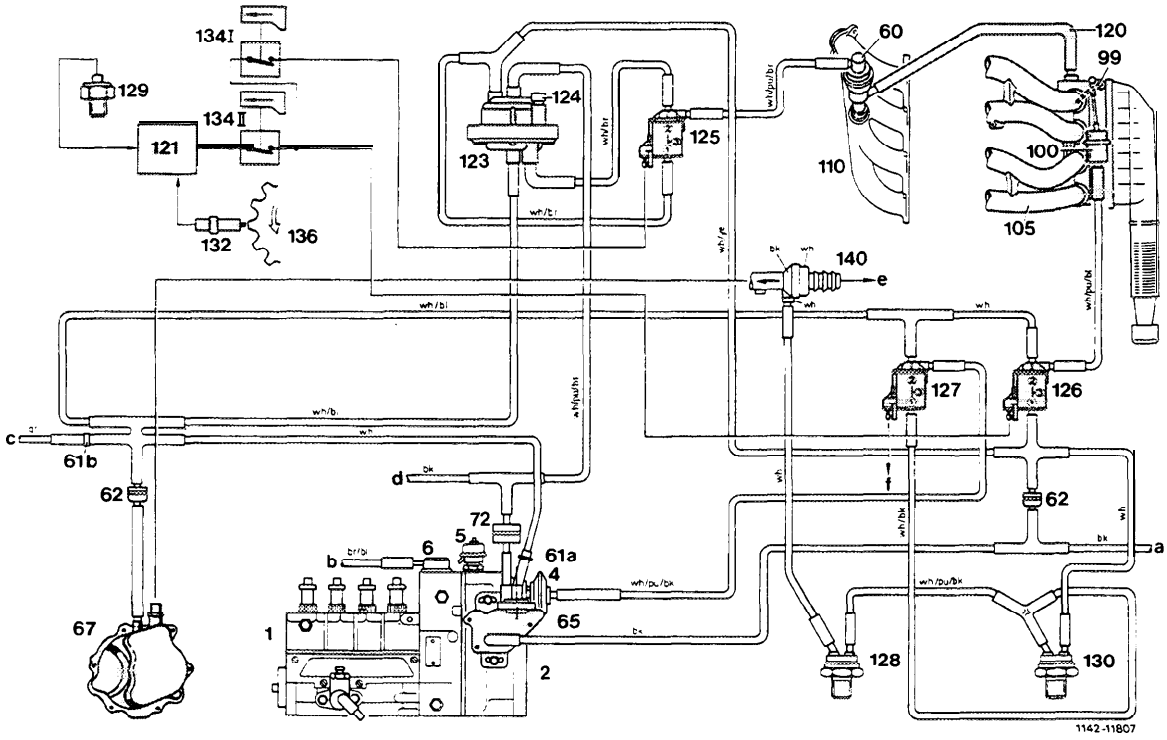
When exhaust gas is recirculated, a part of the exhaust gases is guided into intake manifold via EGR-pipe and EGR-valve and sucked up again.

Special tools

Tester O-1000 mbar for vacuum		**116589252100**
TDC-impulse transmitter		**601 5890421 00**

Conventional tools

Digital tester	**e.g. Bosch, MOT 001.03**	
	e.g. Sun, DIT 9000	
Multimeter	**e.g. Sun, DMM-5**	
Distributor		117 078 01 45



Function diagram automatic transmission

1 Injection pump
2 Regulator
4 Vacuum control unit idle speed increase
5 ADA-capsule (altitude pressure compensation)
6 Vacuum control unit (stop)
60 EGR-valve
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61b Orifice 0.5 mm dia.
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127 Switchover valve, electric, for rpm increase
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129 Temperature sensor coolant 100 °C
130 Thermovalve opens at approx. 17 °C
132 Rpm sensor, engine
134/I Microswitch
134/II Microswitch
136 Starter ring gear
139 Orifice
140 Check valve brake unit

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b Key shutoff
c Remaining consumers
d Automatic transmission
e Brake unit
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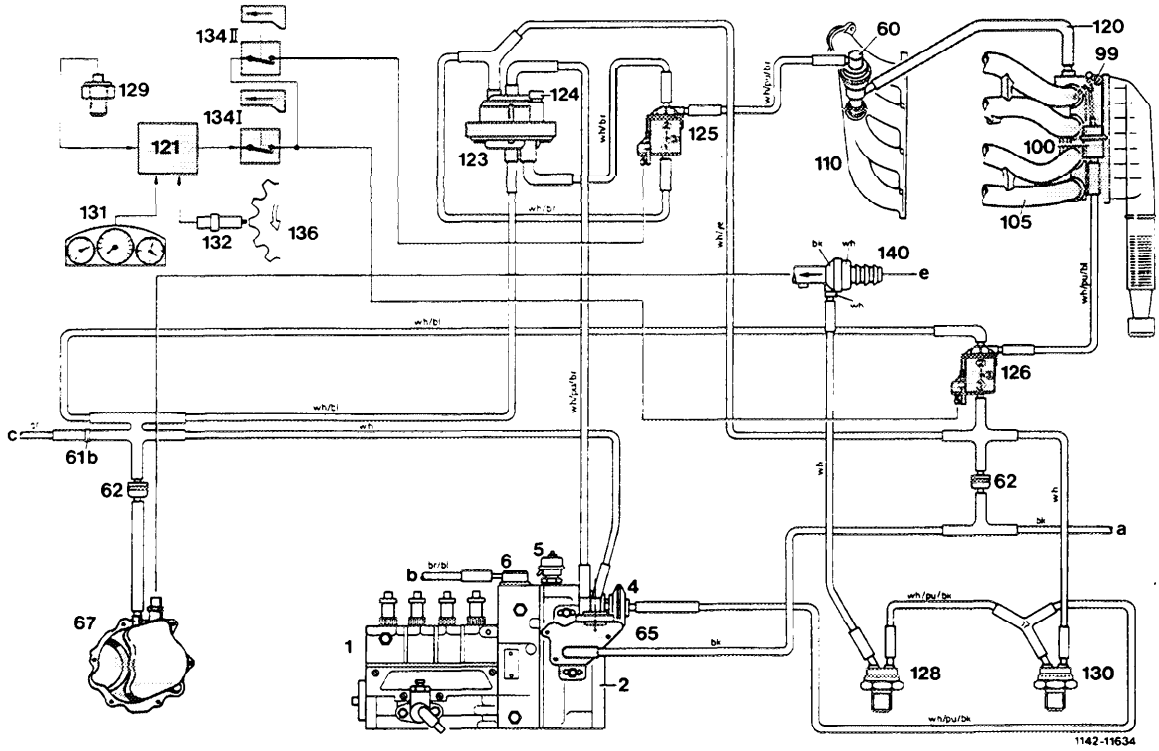

Function diagram manual transmission

1	Injection pump
2	Regulator
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5	ADA-capsule (altitude pressure compensation)
6	Vacuum control unit (stop)
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129	Temperature sensor coolant 100 °C
130	Thermovalve opens at approx. 17 °C
131	Rpm sensor, tachometer
132	Rpm sensor, engine
134/I	Microswitch
134/II	Microswitch
136	Starter ring gear
139	Orifice
140	Check valve brake unit
a	Vent line to vehicle interior
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e	Brake unit
f	To refrigerant compressor
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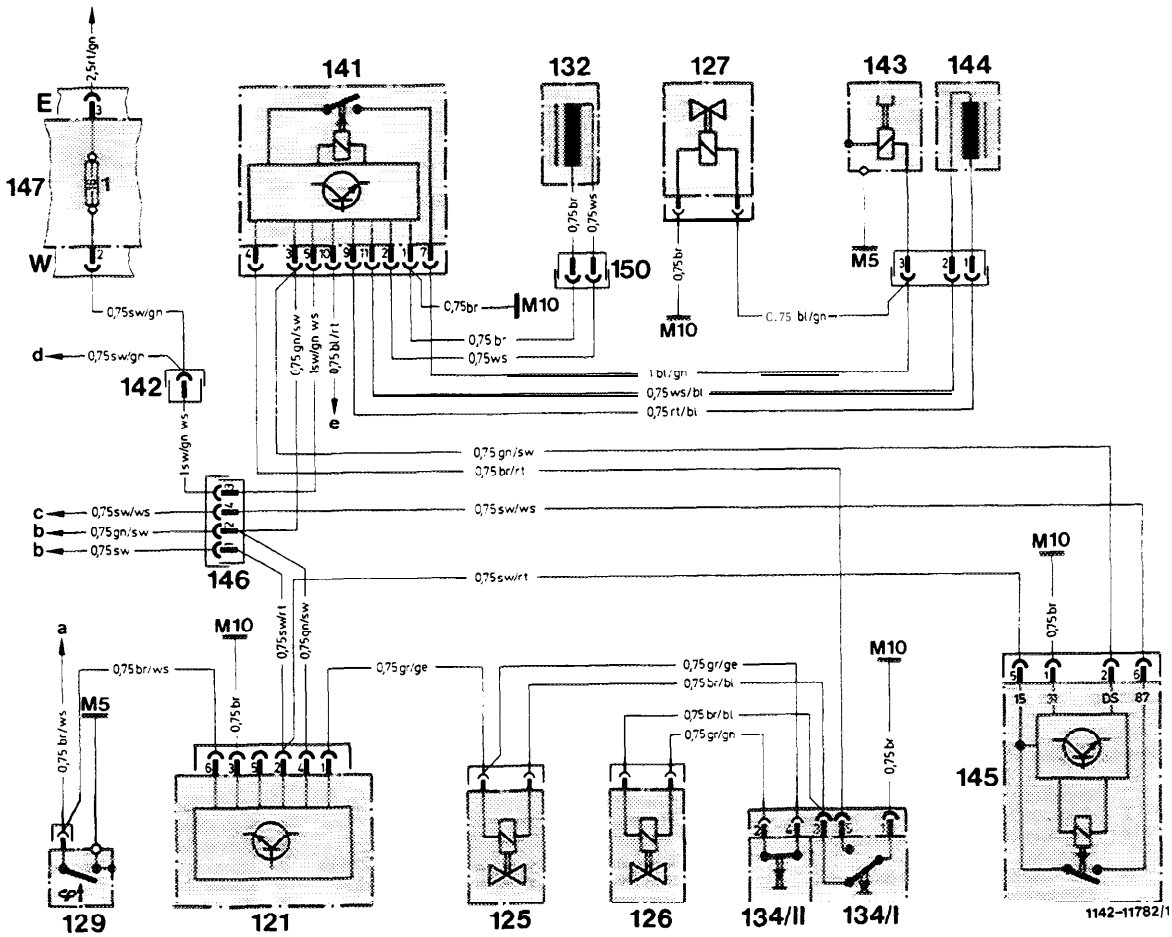


Electric wiring diagram EGR

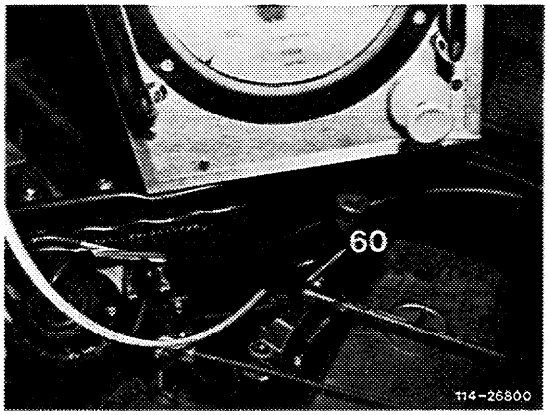
121 Control unit = EGR
125 Switchover valve EG R-valve
126 Switchover valve pressure control flap
127 Switchover valve refrigerating system
129 Temperature sensor coolant 100 °C
132 Rpm sensor, engine
134/I Microswitch EGR
134/II Microswitch pressure control flap
141 Control unit refrigerant compressor
142 Plug connection auxiliary fan
143 Electromagnetic clutch refrigerant compressor
144 Rpm sensor refrigerant compressor
145 Relay kickdown switch
146 Plug connection interior
147 Central electrics, coupling
E = plug connection 8-point
W = plug connection 4-point
150 Plug connection

a To electromagnetic clutch
b To plug connection revolution counter
c To kickdown switch (automatic transmission only)
d Relay auxiliary fan
e Pressure switch air conditioning
f Terminal 15 x preglow switch

Ground connection points
M 5 Ground, engine
M 10 Ground, battery

bl = blue (bl)
br = brown (br)
el = ivory (el)
ye = yellow (ge)
gn = green (gn)
gr = gray (gr)
na = natural (nf)
pi = pink (rs)
re = red (rt)
bl = black (sw)
pu = purple (vi)
wh = white (ws)

Quick test



Test EGR-valve (60) with engine stopped

Activate EG R-valve with approx. 300 mbar vacuum. Pull off vacuum line.

EGR-valve audibly closing.	EGR-valve not closing.

Renew EG R-valve.

End of test

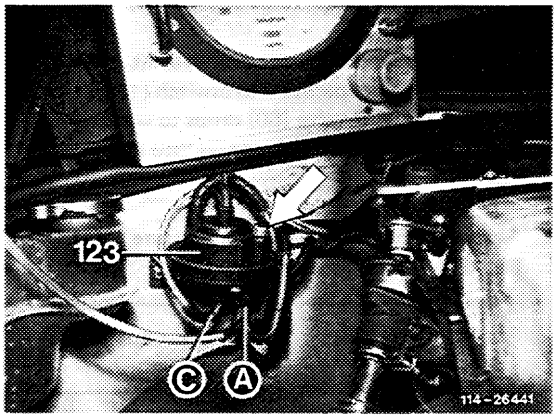
Test pressure converter (123) and pressure adjustment

Connect vacuum tester with Y-distributor to connection "A" and read vacuum value at idle speed.

Nominal values in mbar with:
manual transmission 320 ± 5
automatic transmission 350 ± 5

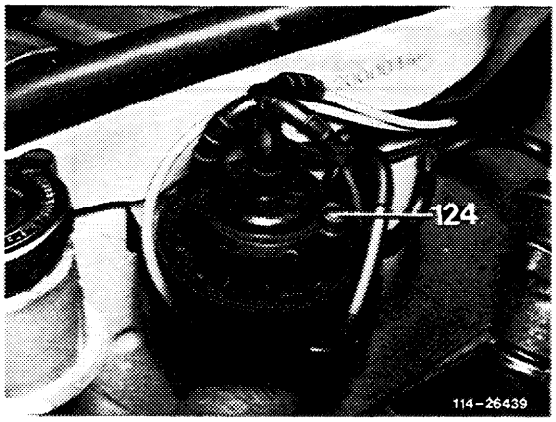
If the vacuum is above or below nominal value, adjust vacuum. For this purpose, pull protective cap (arrow) from pressure converter (123) and adjust by means of adjusting screw (124) with socket wrench element (4 mm) to specified nominal value.

Vacuum in order.	Vacuum not in order.



Check supply pressure on connection "C", renew pressure converter, if required. Check vacuum lines according to function diagram. Check vacuum pump (43–660).

End of test

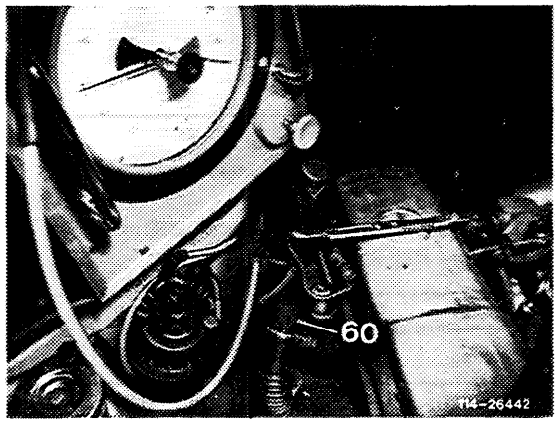


Checking vacuum control

Connect vacuum tester with Y-distributor to EGR-valve (60). Check vacuum values and position of pressure control flap (99). Read vacuum values at the following speeds:

1/min	mbar	Pressure control flap
750 ± 50	0	Basic position
1200 ± 50	150-350	Fully attracting
3000 ± 50	0	Basic position

Test values in order.	Test values not in order.



Check pressure supply as well as individual parts.

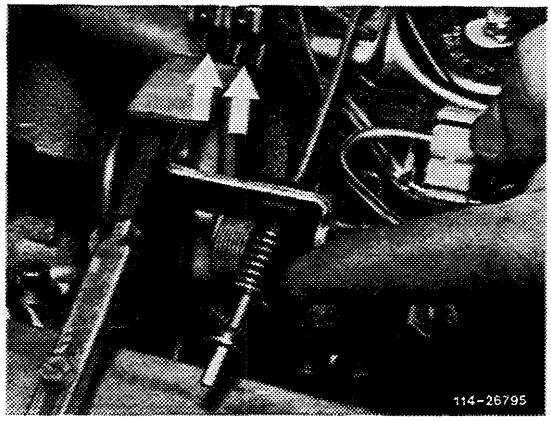
End of test

Testing microswitch (134/I and 134/II)

Connection vacuum tester as above. At 1200 ±50/min, operate microswitch (134/I), pressure on EGR-valve (60) drops to 0 mbar. Pressure control flap (99) moves into basic position.

Actuate microswitch (134/II), pressure control flap (99) moves into basic position.

Function in order.	Function not in order.



Check individual parts.

Testing individual parts

Testing vacuum control valve (65)

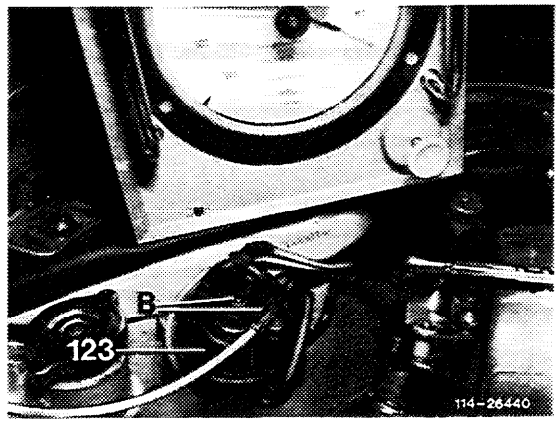
Connect vacuum tester with Y-distributor to connection "B" of pressure converter (123) and check vacuum at idle speed.

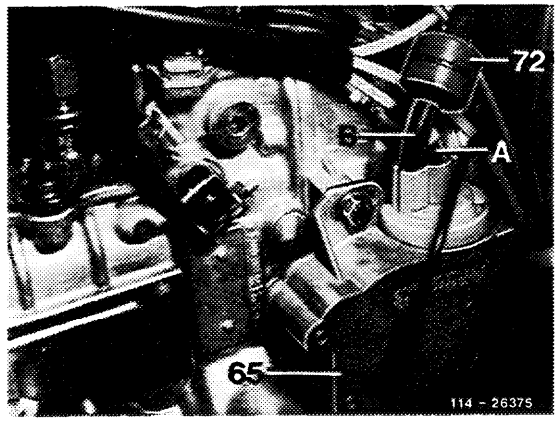
Nominal values:
At 750 ± 50: approx. 360-410 mbar
With engine stopped and regulating linkage on full load stop 0 mbar.

Test values in order.	Test values not in order.

Check vacuum lines according to function diagram. Check vacuum pump (43–660), adjust vacuum control valve and renew, if required (27–037).

End of test



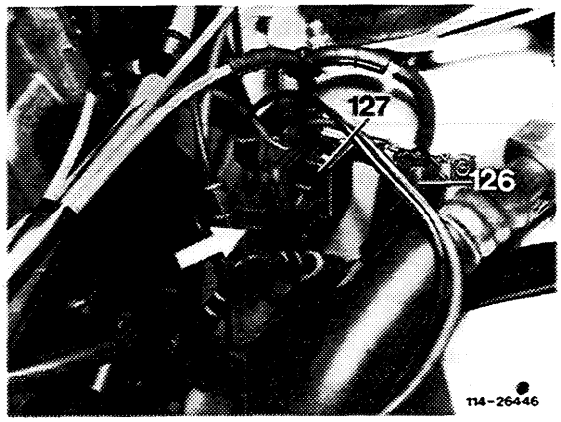


Testing switchover valves (125 and 126)

Connect voltmeter to plug connection of switch-over valves and measure voltage at 1200 ±50/min.

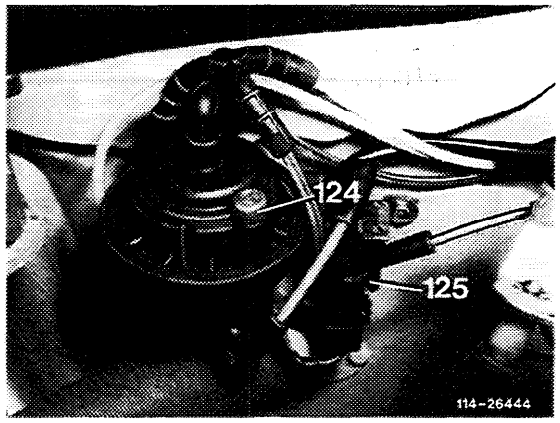
Nominal value: approx. 12 V.

Voltage in order.	Voltage not in order.



Check electric activation according to wiring diagram, renew control unit, if required.

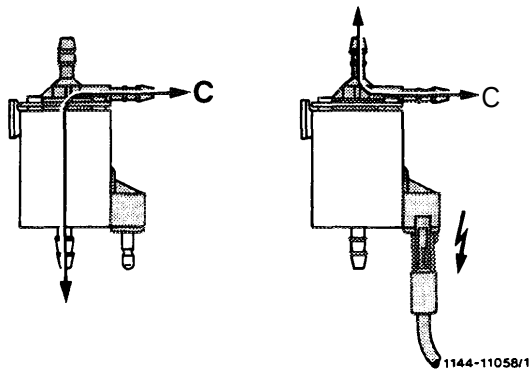
End of test



Connect vacuum tester with Y-distributor to connection "C" and check vacuum at 1200 ±50/min, with 12 V connected.

Switchover valve (125): approx. 350 ± 10 mbar
Switchover valve (126): approx. 700 ± 10 mbar

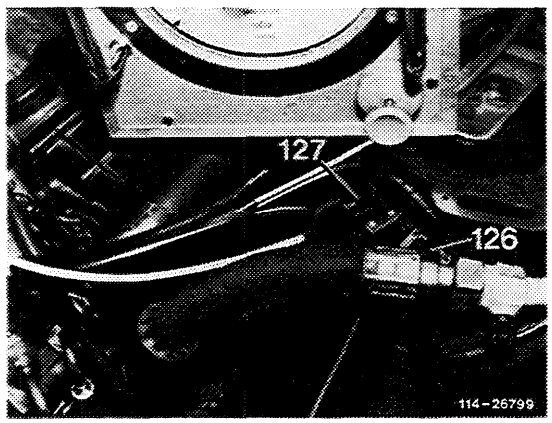
Vacuum value in order.	Vacuum value not in order.



Check vacuum pump (43–660), renew switchover valve, if required.

Check vacuum lines according to function diagram.

End of test



Checking rpm sensor for engine (132)

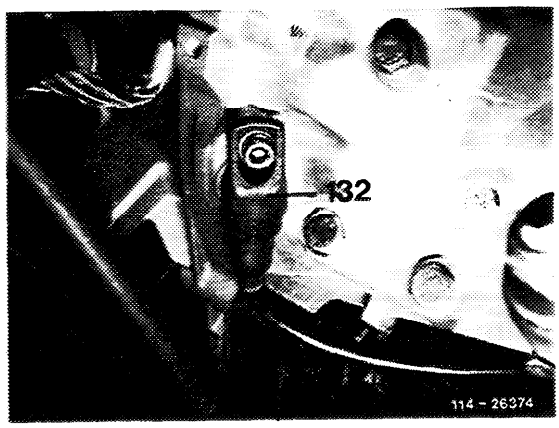
Engine stopped. Separate coupling (144) and test resistance with multimeter.

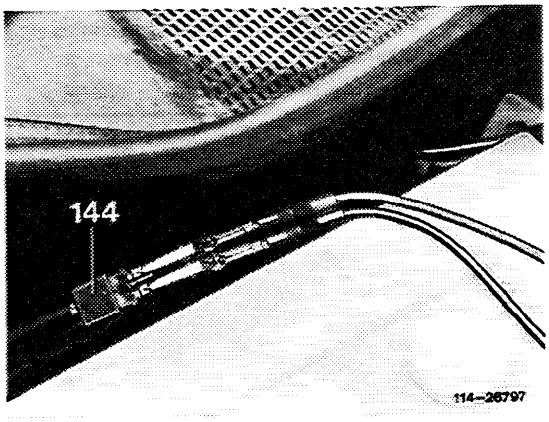
Readout: 1.9 ± 0.2 Ω

In order.	Not in order.

Renew rpm sensor.

End of test





Connection as above. Push button V~.
Read test values at the following engine speeds:

1/min	V~
700-800	>4[1])

Test values in order.	Test values not in order.

Renew rpm sensor.

End of test

[1]) With increasing speed, increasing voltage.

Testing TD-signal

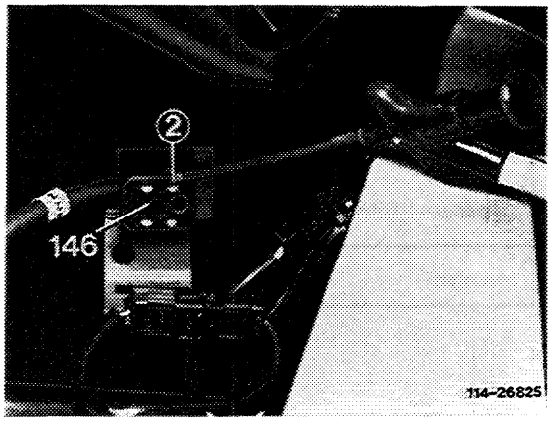
On jack 2 of 4-point plug connection (146) test TD-signal with multimeter button "V" at idle speed:

1/min	Volt
750 ± 50	approx. 0.35

Test values in order.	Test values not in order.

Check electric activation according to wiring diagram, check rpm sensor for engine, if required.

End of test



Testing EGR-protective circuit 100 °C

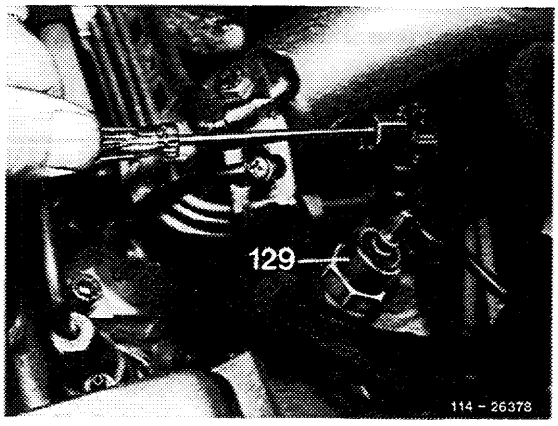
Connect vacuum tester with Y-distributor to EGR-valve. Run engine to 120/min, pull off plug on temperature switch (129) and hold against ground.

Vacuum 0 mbar on EGR-valve, fan clutch audibly attracting.

Function in order.	Function not in order.

Test electric activation, renew control unit, if required.

End of test



Testing rnicroswitch (134/I and 134/II)

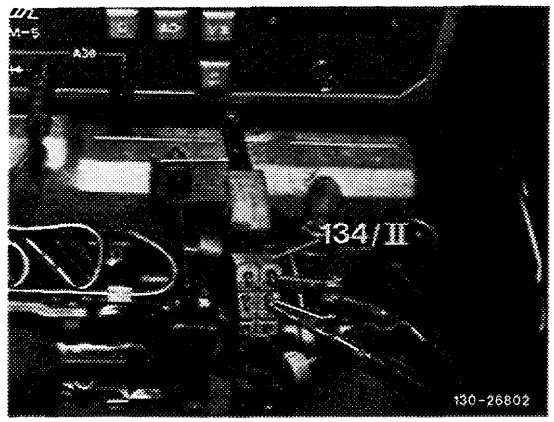
Engine stopped. Pull coupling from microswitch and test for passage with ohmmeter on terminal 2 and 4 or 1 and 3.

At idle: 0 Ω
At full throttle: ∞ Ω

Readout in order.	Readout not in order.

Renew microswitch

End of test



Testing full throttle contact on microswitch (134/I)

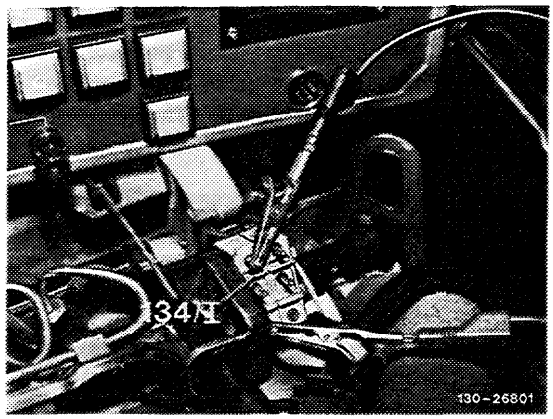
Engine stopped: Coupling on microswitch pulled off. Test with ohmmeter on terminal 1 and 5 for passage.

At idle: ∞ Ω
At full throttle: 0 Ω

Readout in order.	Readout not in order.

Renew microswitch.

End of test



Vehicles with manual transmission

Testing speed shutoff

Connect vacuum tester with Y distributor to EGR-valve. Operate vehicle on test bench or on road in 5th gear at partial load.

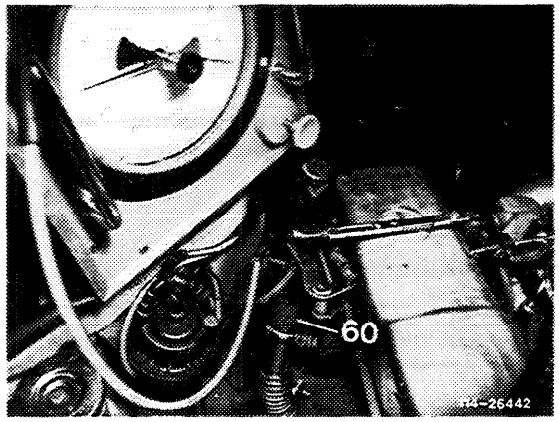
Read vacuum.

Readout

Speed
< 78 ± 8 km/h: approx. 300 mbar
> 78 ± 8 km/h: approx. 0 mbar

Vacuum values

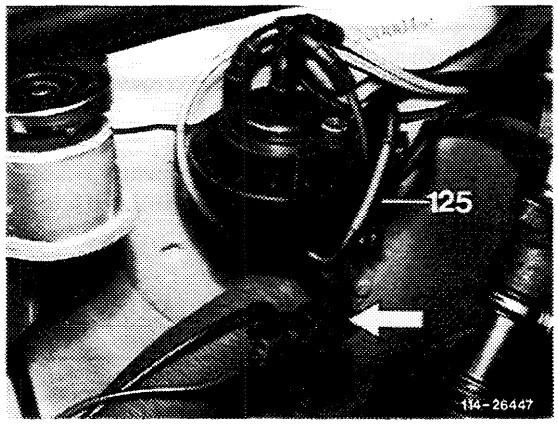
In order.	Not in order.



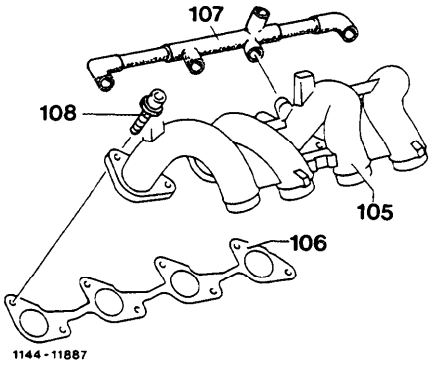
Test electrical activation of switchover valve (125). For this purpose, connect multimeter to plug (arrow) of switch-over valve and take vehicle again on test run.

If there is voltage (approx. 12 V) at a speed of > 78 ± 8 km/h, test electric activation of switchover valve according to wiring diagram. Renew defective parts, if required.

If there is no voltage, renew switchover valve.

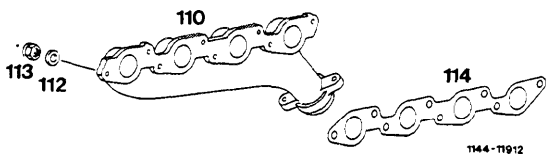


End of test



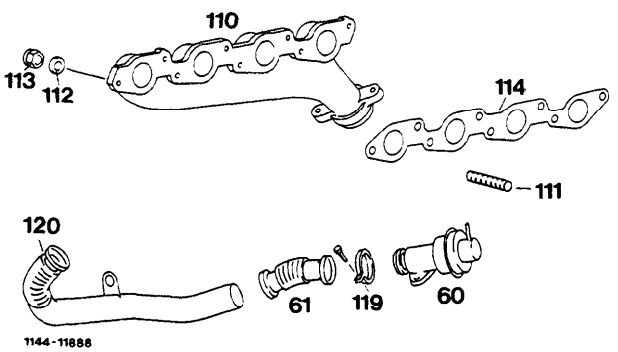
105 Intake manifold
106 Gasket
107 Engine breathing
108 Combination screw

A.Standard version and (USA) Federal



110 Exhaust manifold
111 Stud
112 Washer
113 Nut M 8, Cu
114 Gasket

B. (USA) California



60 EG R-valve
61 Corrugated tube
110 Exhaust manifold
111 Stud in cylinder head, 8 each
112 Washer, 8 each
113 Nut M 8, Cu, 8 each
114 Gasket
119 Clamp, 2 each
120 EGR-line

	Job No.
Preglow system	
Operation of preglow system	15–505
A. General	
B. Quick-start preglow system	
Checking preglow system	510
Removal and installation of glow plugs	515
Alternator	
Testing alternator with regulator in vehicle	600
Renewing fan assembly.	642
Starter	
Removal and installation of starter	700
B. Engine 601	

15-505 Operation of preglow system

A. General

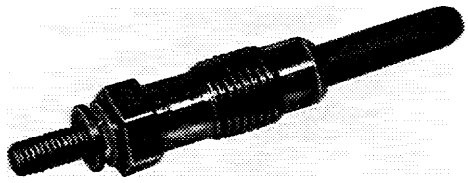
On diesel engine combustion proceeds by self-ignition of injected fuel into highly compressed and thereby highly heated combustion air.

In cold engine, the self-ignition temperature is not attained by compression alone. A preglow system is therefore required, which serves the purpose of increasing the temperature of the compressed air, thereby permitting the firing of the cold engine by the ignition (inflammation) of fuel particles on glow plugs.

The duration of preglowing depends on ambient temperature.

Design of quick-start pencil element glow plugs

The pencil element glow plugs are essentially comprising a housing with screw-in threads M 12 x 1.25 and a heater bar pressed into housing.

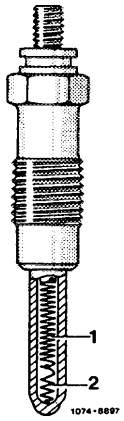


107-14793

The single-pole connecting bolt is screwed to housing by means of a non-releasable round brass nut.

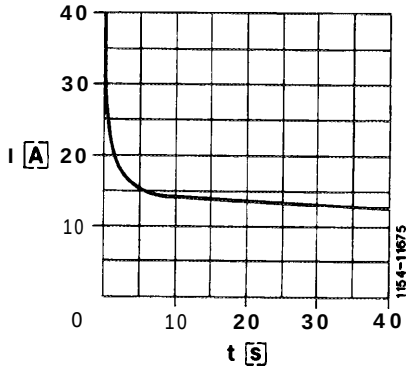
The pencil element glow plugs are designed for a voltage of 11.5 Volts and are operated as a parallel circuit.

The heating element comprises a heating and control winding connected in series:



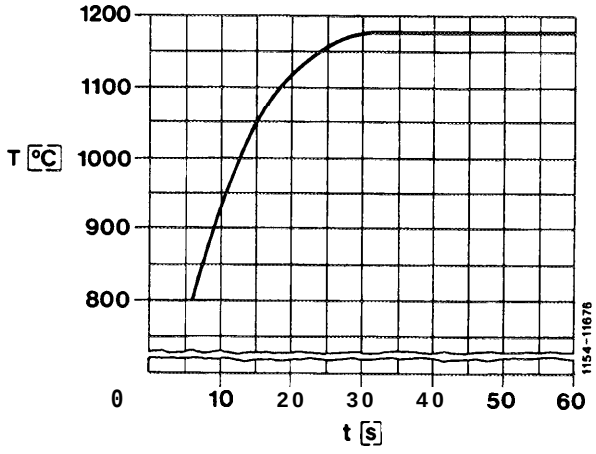
1 Control winding
2 Heater winding

When the glow system is switched on, a current of approx. 30 amps. will flow per glow plug.
The heater winding heats the glow plug very fast.
The control winding increases its resistance with increasing temperature and limits the current to approx. 8-15 amps. This will protect the glow plug against overload.



Current curve of quick-start pencil element glow plug

After a glow time of 9 seconds, a heater bar temperature of 900 °C will be attained. After 30 seconds, the max. temperature of 1180 °C.

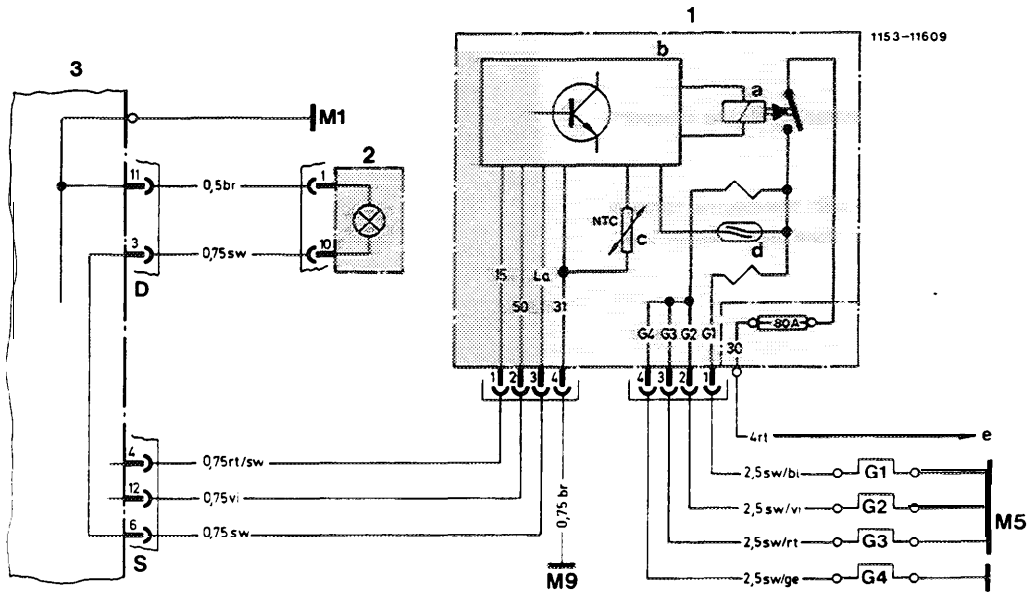


Temperature curve of quick-start pencil element glow plug

B. Quick-start preglow system

Note

The essential components of preglow system correspond with those of engines 615 and 616.



Wiring diagram

1 Preglow time relay
- **a Power relay**
- **b Electronic unit**
- **c Temperature sensor (NTC-resistor)**
- **d Reed relay**

2 Preglow indicator in instrument cluster
3 Central electrics
G1—G4 Pencil element glow plugs
M9 Ground, front left (at lamp unit)
M5 Ground, engine
MI Main ground behind instrument cluster
e Cable connector engine terminal 30

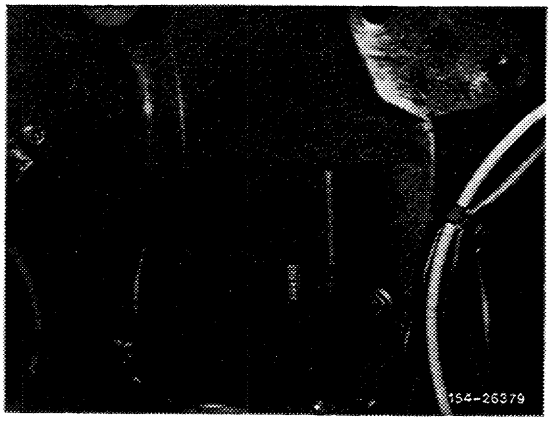
Quick-start pencil element glow plugs

Quick-start pencil element glow plugs are designed for a voltage of 11.5 Volts and are operated as a parallel circuit.

Preglow time relay

The preglow time relay is located in engine compartment at wheel house left.

Upon removal of protective cap, the electric connections, as well as the 80 amps. fuse are accessible.



The relay ambient temperature is picked up by way of an NTC-resistor in preglow time relay.

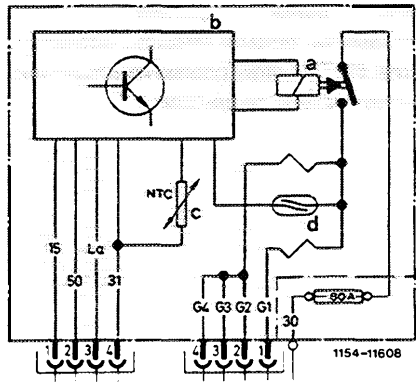
Functions of preglow time relay

The preglow time relay comprises the following functions:

- **Switching of glow current**
- **Ready-to-start indicator**
- **Safety shutoff**
- **Fault indication**

Note: With unfavorable tolerances of pencil element glow plugs or reed relay (d) it is permissible, that the fault indicator responds only if there are two defective pencil element glow plugs.

The fault indication (monitoring of pencil element glow plugs) proceeds by comparing current of pencil element glow plug G 1 with the current of the remaining pencil element glow plugs G 2-G 4 connected in parallel.

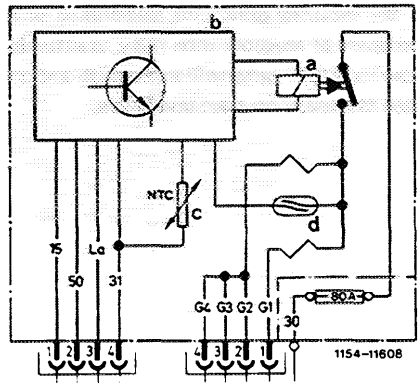


The currents of the two lines to pencil element glow plugs G 1 and G 2 to G 4 are conducted via two oppositely directed reed relay windings with different numbers of windings.

With current flow in both windings of similar size, the magnetic fields are cancelling each other and the reed contact is not responding.

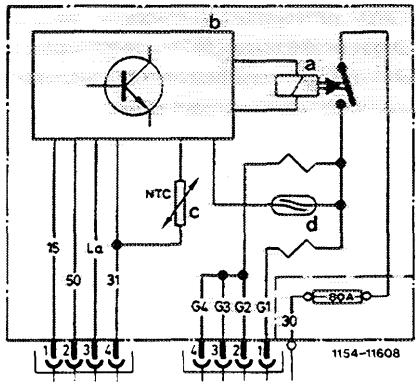
If the balance of the magnetic fields is interrupted by the loss of one or several pencil element glow plugs, the reed contact will close and the electronic circuit (b) is activated.

The preglow check lamp switches off immediately and will therefore not light up when preglowing starts.



Switching of glow current

When the key is moved into position "2" (preglow, driving), the preglow relay (voltage on terminal 15) is switched on. The power relay (a) closes the circuit from terminal 30 (positive) via fuse to pencil element glow plugs G 1 -G 4.



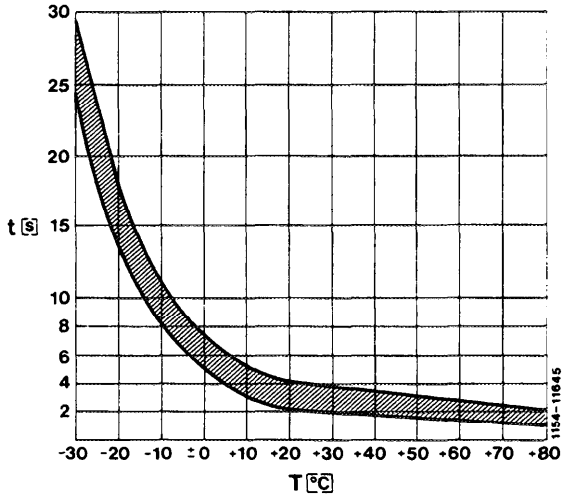
If the key is moved into position "3" (start), the power relay (a) remains attracted, activated by terminal 50. The glow process continues until the key is turned back to position "2".

Ready-to-start indication

The glow time is determined by means of a temperature sensor installed in preglow time relay.

When the glow system is switched on, the preglow indicator lamp in instrument cluster lights up.

When the required glow time, depending on ambient temperature of preglow time relay, is attained, the preglow indicator lamp will extinguish and thereby indicate the ready-to-start condition.

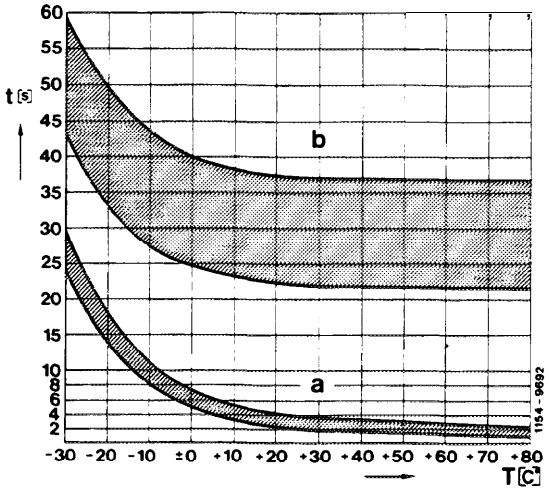


Preglow time

Safety shutoff

If there is no start following indication of ready-to-start condition within 20-25 seconds, the safety shutoff will interrupt the glow current. If another start follows, the glow system is again switched off for the duration of this starting procedure.

The safety shutoff is no longer fixed and is the result of the time up to ready-to-start condition (preglow indicator lamp extinguishes) plus 20-35 seconds.



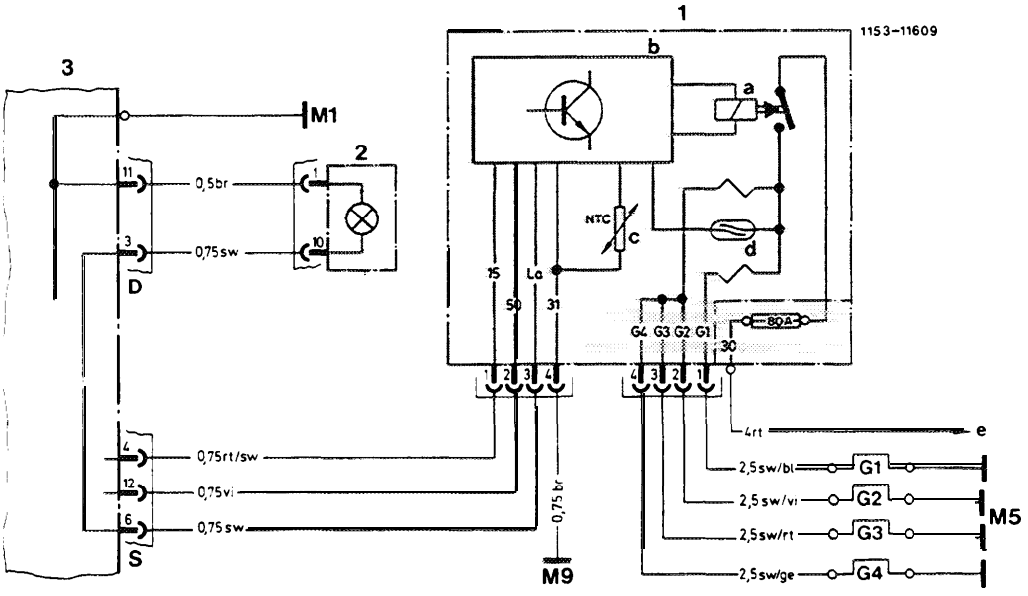
a Preglow time
b Safety shutoff

Fault indication

A fault in preglow system is indicated, when the preglow indicator lamp is not lighting up when the key is moved into position "2".

The following faults are indicated:

- **Interruption of line to connection terminal 30.**
- **Fuse 80 amps. defective.**
- **Power relay in preglow time relay defective.**
- **Interruption of one or more lines to pencil element glow plugs.**
- **Interruption of one or more pencil element glow plugs.**



Wiring diagram engine 601 in model 201

1 Preglow time relay
- **a Power relay**
- **b Electronic unit**
- **c Temperature sensor (NTC-resistor)**
- **d Reed relay**

2 Preglow indicator in instrument cluster
3 Central electrics
G1—G4 Pencil element glow plugs
M9 Ground, front left (at lamp unit)
M5 Ground, engine
MI Main ground behind instrument cluster
e Cable connector engine terminal 30

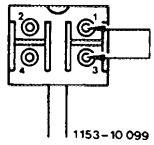
Testing

1 **Testing glow bulb and its line**

In the event of a complaint:

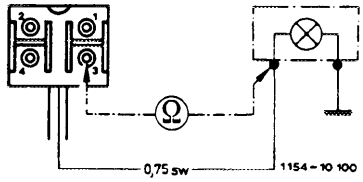
Preglow indicator lamp not lighting up when preglow system is switched on, in spite of possible start.

Pull 4-point coupling from preglow time relay, turn key into position ''2'', bridge jack 1 and 3 of coupling.



If preglow indicator lamp is not lighting up, test glow bulb and renew, if required.

If glow bulb is in order, test black line from coupling jack 3 of preglow time relay to preglow indicator lamp for interruption. Repair interruption.



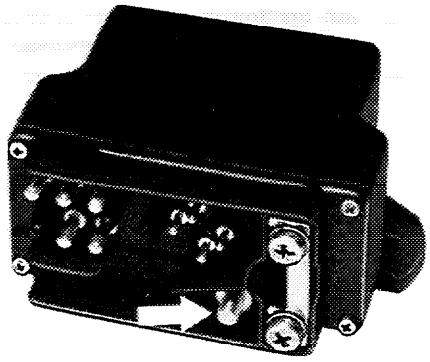
If preglow indicator lamp is lighting up, the preglow time relay is defective, renew preglow time relay.

2 Testing main circuit of preglow system for interruption

In the event of a complaint:

Preglow indicator lamp not lighting up, engine cannot be started.

Test voltage on terminal 30 of preglow time relay against ground by means of voltmeter.

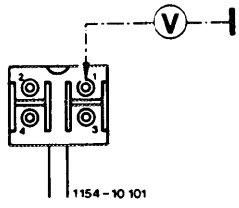


115-20011/1

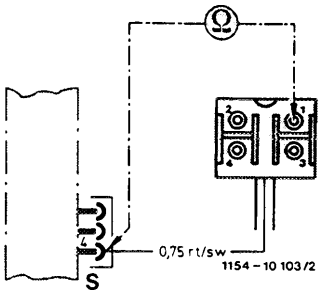
If there is no voltage, test red line from starter terminal 30 to preglow time relay terminal 30 for interruption and repair interruption, if required.

If voltage is available (approx. 12 Volts), test fuse 80 amps. for tight seat or interruption and renew, if required.

If no fault has been found so far, test voltage on jack 1 of 4-point coupling of preglow time relay against ground.



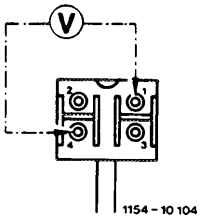
If there is no voltage with the preglow system switched on, test red/black line from central electrics coupling S jack 4 to coupling jack 1 of preglow time relay for interruption and repair interruption, if required.



If voltage is available (approx. 12 Volts), connect voltmeter to jack 1 (terminal 15) and jack 4 (terminal 31) and test voltage (should be approx. 12 Volts).

If no voltage is indicated, test brown line from jack 4 to ground for interruption and repair interruption, if required.

If no fault has been found so far, preglow time relay is defective, renew preglow time relay.



3 Testing pencil element glow plugs and their lines

In the event of a complaint:

Preglow indicator lamp not lighting up, engine firing poorly, one or several pencil element glow plugs or the lines to pencil element glow plugs may be interrupted.

In the event of a complaint:

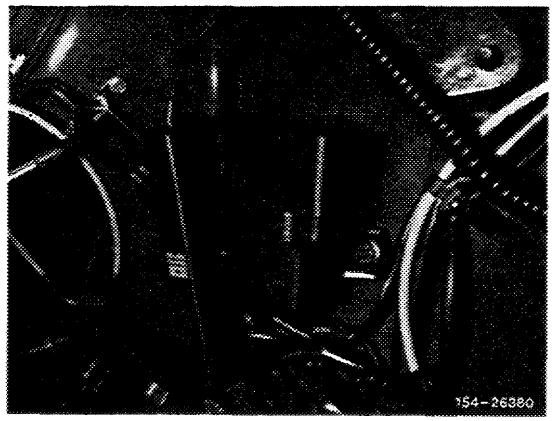
Preglow indicator lamp lighting up, engine fires poorly after attaining ready-to-start condition. An interruption of a pencil element glow plug or a line to pencil element glow plugs of cylinders 2-4, may be responsible, or a wrong power input of pencil element glow plugs in cylinders l-4.

Measure power input of pencil element glow plugs with DC clip-on.

For this purpose, place clip-on over individual lines on preglow relay.

Cylinder 1 = 2.5 black/blue
Cylinder 2 = 2.5 black/purple
Cylinder 3 = 2.5 black/red
Cylinder 4 = 2.5 black/yellow

Move key in steering lock to position "2". After 10–20 seconds the current input of each glow plug should then amount to 8-l 5 amps.



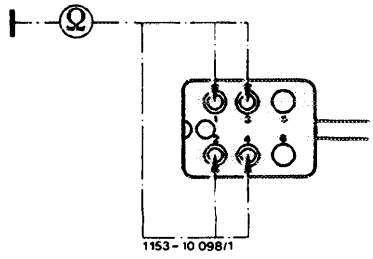
If value is higher than 15 amps., renew glow plug.

At a value below 8 amps., test electric line or glow plug with ohmmeter for interruption.

When testing for interruption, pull 6-point coupling from preglow time relay.

Measure resistance against ground (engine block) with ohmmeter connected one after the other to

jack 1 of coupling = pencil element glow plug cylinder 1
jack 2 of coupling = pencil element glow plug cylinder 2
jack 3 of coupling = pencil element glow plug cylinder 3
jack 4 of coupling = pencil element glow plug cylinder 4.



If resistance is measured, the respective pencil element glow plug or the line or connection are interrupted.

Repair interruption in supply line or renew glow plug.

Note: It is possible that the indicator lamp (under influence of unfavorable tolerances) indicates a fault only after failure of 2 pencil element glow plugs in cylinders 2-4.

To make sure that the fault indication in preglow time relay is not defective, disconnect in such a case 2 pencil element glow plugs of cylinders 2-4 and repeat preglow procedure.

If the indicator lamp is now indicating a fault (not lighting up), the preglow time relay is in order.

Tightening torques	Nm
Quick-start pencil element glow plugs	20
Electric line on glow plugs	4

Conventional tool

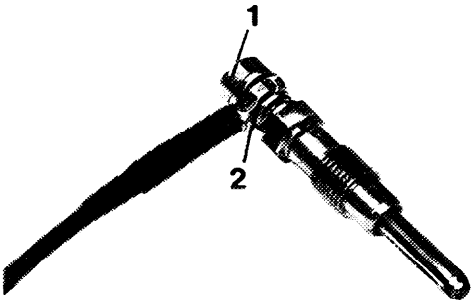
Ratchet 3/8'' with universal joint

Removal

1 Unscrew nuts from glow plugs with 3/8'' ratchet.

Nuts (1) are undetachably enclosed in cable shoes (2) of harness.

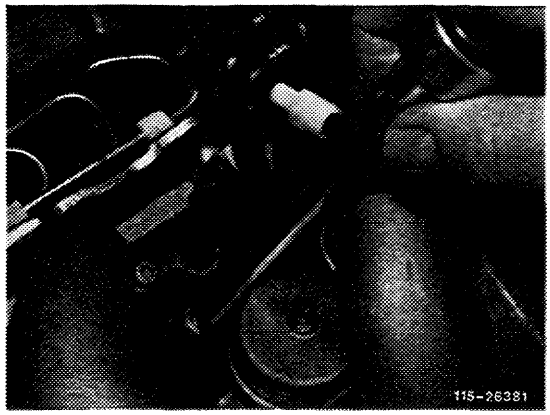
2 Unscrew glow plugs with 3/8'' ratchet.



115-26300

Installation

3 For installation proceed vice versa.



15-600 Testing alternator with regulator in vehicle

Test values

Regulating voltage — regulator

Regulating voltage (on battery) Volts (nominal value)	Engine speed 1/min	Battery load	Battery acid density kg/dm³ [1])	Regulating voltage measured after
13.0–14.5	3000	Compulsory consumers only (e.g. ignition)	normal min. 1.24 tropics min. 1.19	approx. 2 minutes

[1]) If battery state of charge is less than 1.24 kg/dm³ or 1.19 kg/dm³, the regulator will not operate in regulation range during test, but will fully excite alternator, that ist, a defective regulator with continuous full excitation will not be recognized.

Charging current of alternator

Engine	Alternator nominal output at 14V amps	Alternator speed 1/min	Engine speed 1/min	Charging current amps	Ratio engine-alternator
102	55	2000 6000	850 2550	36 55	2.35
102 (USA)	65	2100 6000	890 2550	43 65	2.35
601	55	2000 6000	790 2370	36 55	2.53

Note: When testing charging current at 6000/min of alternator, the voltage should not drop below 12.7 volts.

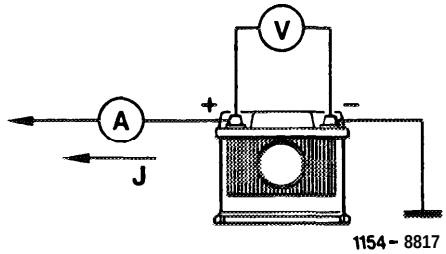
With engine stopped

1 Check battery and alternator connections, as well as grounding strap between engine and body for tight seat and perfect condition. In addition, check V-belt tension and pay attention to charge indicator lamp (required: ignition on = charge indicator lamp on; ignition off = charge indicator lamp off).

2 As a prerequisite for measuring regulating voltage, check acid density of battery in all cells.

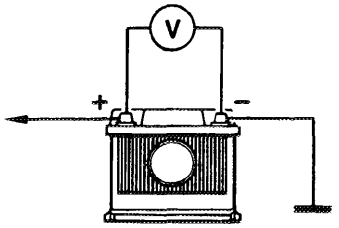
Required values: normal min. 1.24 kg/dm³
tropics min. 1.19 kg/dm³

3 If discharge is supected, test battery discharge current (all consumers switched off, pay attention to time clock and consumers with rest potential input).



With engine running

4 Pay attention to charge indicator lamp at idle and at increasing engine speed (up to approx. 3000/min) – light should go out.



1154-8818

5 Check regulating voltage. Acid density of battery should amount to at least 1.24 kg/dm³ or tropics 1.19 kg/dm³. Run engine at 3000/min. Load battery with compulsory consumers only (e.g. ignition). Read regulating voltage after approx. 2 minutes of operation.

Nominal value 13.0-14.5 volts.

6 Testing charging current

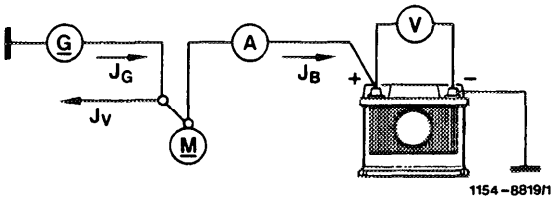
a) with ammeter

Run engine at idle to respective alternator speeds (refer to Table).

Load battery with installed consumers or with load resistance until max. charging current is attained. Regulating voltage should not drop below 12.7 volts

Note: If measuring proceeds according to connection diagram on battery, the previously supplied current for compulsory consumers, e.g. ignition, fuel pump, must be added to the battery current measured.

When using DC clip-on, the entire charging current can be measured on alternator.

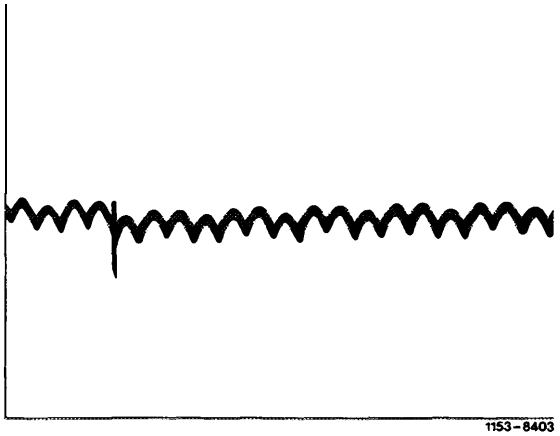


1154-8819/1

J_B Battery current
J_G Alternator current
J_V Consumer current

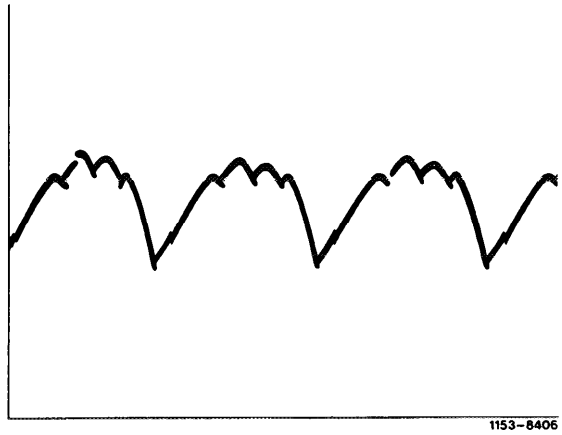
b) Diode test (harmony)

Evaluate harmony of regulating voltage (voltage flow) (measuring value or good/poor evaluation with oscilloscope). For this purpose, load battery with high beam at engine speed of 3000/min.


1153-8403

Alternator in order (voltage peaks possible – but without significance).

Alternator defective (example)

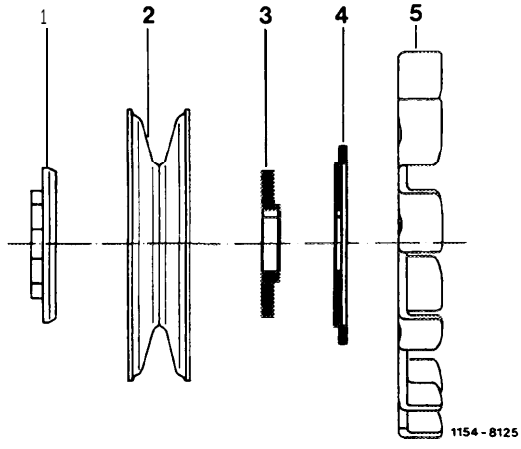


Tightening torques	Nm
Fastening nuts of fan assembly with divided pulley	35-45
Fastening nut of fan assembly with taper rib pulley	50 + 5

Note

The fan disk is subject to considerably varying stresses. The extent of these stresses depends mainly on driving conditions. This is why, when reconditioning or exchanging alternators after driving for more than 100000 km, the fan assembly will also be replaced.

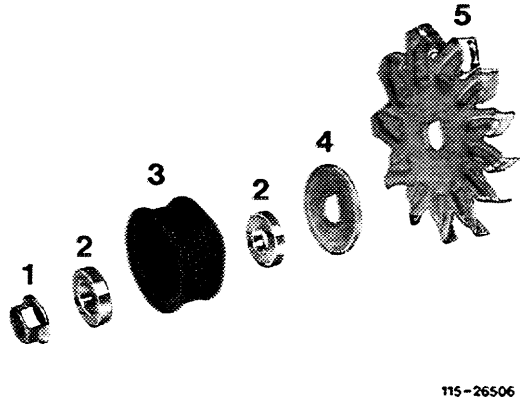
With divided pulley



1 Front groove disk
2 2-piece pulley
3 Rear groove disk
4 Supporting disk
5 Fan disk

With taper rib pulley

Holder, part no. 126 589 00 40 00 can be used for holding pulley, if fitted with a segment from taper rib pulley.



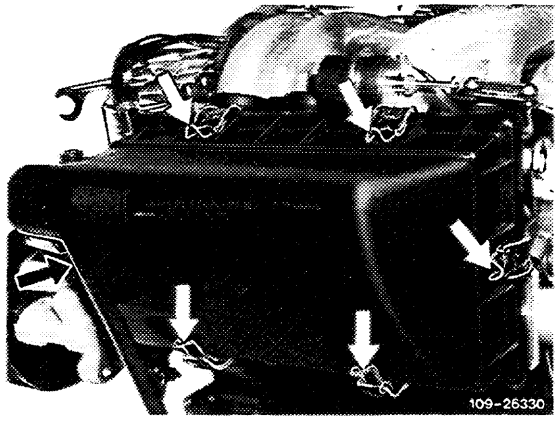
1 Flange nut
2 Spacing washer
3 Taper rib pulley
4 Supporting disk
5 Fan disk

B. Engine 601

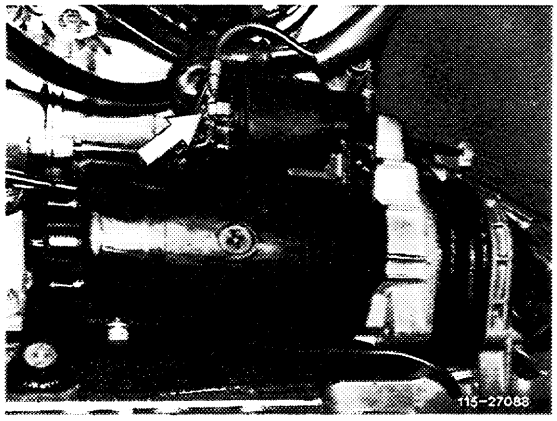
Removal

1 Disconnect negative terminal of battery.

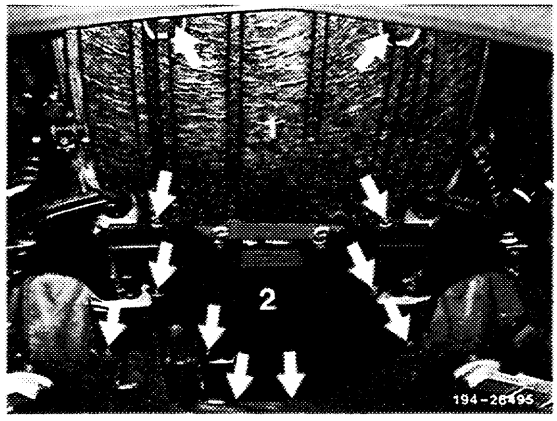
2 Completely remove air cleaner (09–400).



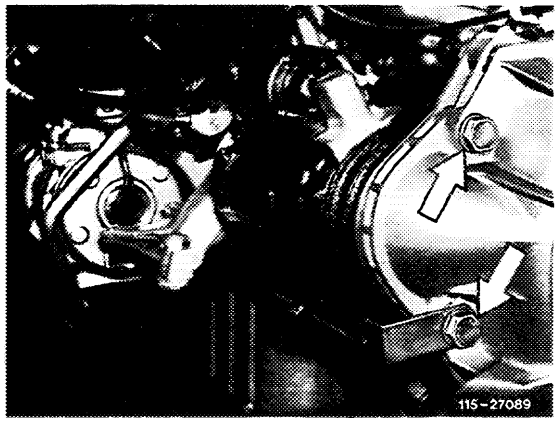
3 Disconnect electric lines terminal 30 and terminal 50 on starter.



4 Remove noise capsule rear (2).



5 Unscrew fastening screws of starter on transmission and remove starter in upward direction.

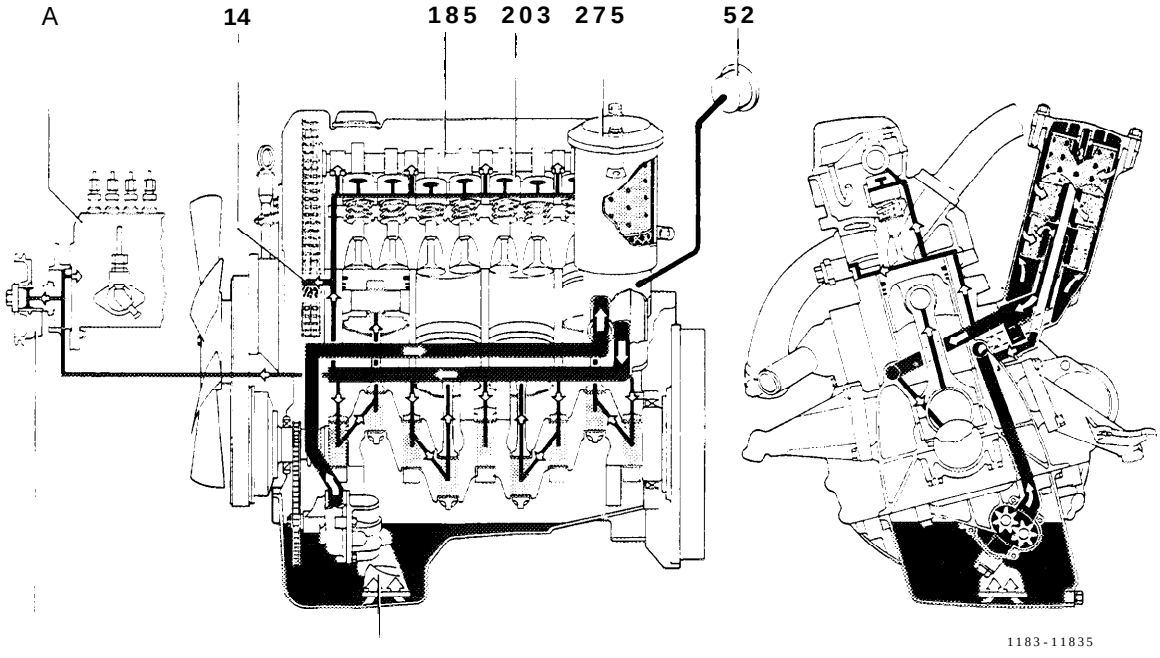


Installation

for installation proceed vice versa.

	Job No.
Oil circuit, oil consumption	
Oil circuit,oil pressure, pressure relief and bypass valve, oil filter	18-005
Oil filter	
Removal and installation of oil filter	110
Oil pump	
Removal and installation of oil pump	210
Removal and installation of oil pressure relief valve	215

Oil circuit



Oil circuit diagram

14 Oil spray nozzle	203 Valve tappet	A Injection pump
18 Injection (spray) timer	240 Oil pump	
52 Oil pressure gauge	275 Oil filter	
185 Camshaft		

Oil pressure

At operating pressure, the oil pressure at idle may drop to 0.3 bar gauge pressure.

Upon acceleration, the oil pressure should immediately rise again and attain at least 3 bar gauge pressure at 3000/min.

Opening pressures of valves	bar gauge pressure
Bypass valve filter element (differential pressure)	2
Return flow non-retun valve	0.2
Oil pressure relief valve in oil pump	4.7-5.3

Oil pressure relief valve

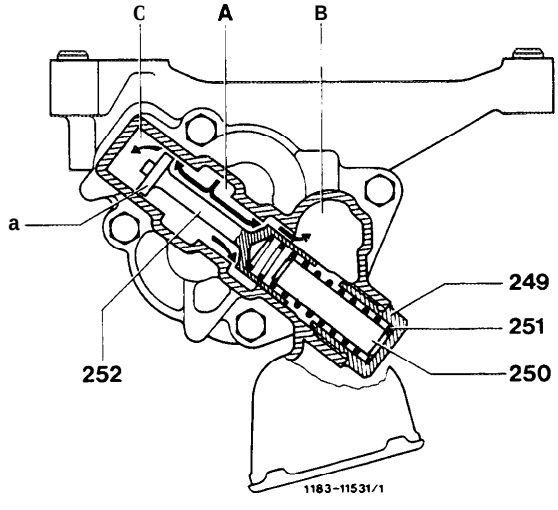
The oil pressure relief valve is integrated in oil pump.

The oil is drawn from lowest spot in oil pan via strainer to suction chamber (B). From here, the oil flows through gearwheels to pressure chamber (A) into main oil duct toward filter.

Pressure and suction chamber are connected to each other by means of pressure relief valve.

Starting from an oil gauge pressure of 4.7-5.3 bar the piston (252) is displaced against force of compression spring (251) and clears the de-activation (shutoff) hole (arrows) to suction chamber (B).

Simultaneously, oil flows across two flats on collar (a) into damping chamber (C). This oil opposes the piston movements set up by the pulsating oil pressure and will thereby dampen the piston.



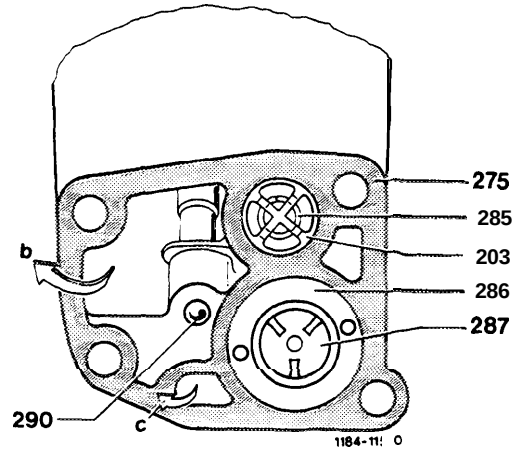
249 Closing plug
250 Guide bolt
251 Compression spring
252 Oil pressure relief valve

A Pressure chamber
B Suction chamber
C Damping chamber
a Collar

Bypass valve in oil filter

The bypass valve (285) opens when the differential pressure between contaminated and clean side of filter exceeds 2 bar.

This will happen when the filter element is heavily contaminated. The oil will then flow in uncleaned condition to engine.



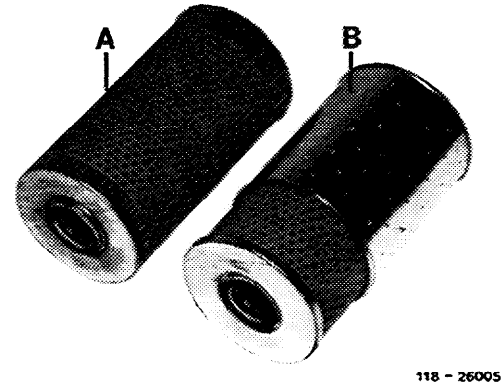
275 Oil filter housing
283 Spring retainer
285 Valve cone bypass valve
286 Valve seat return flow no-return valve
287 Valve cone return flow no-return valve
290 Ball 8 mm dia.
b To bearing points
c Finely filtered oil toward oil pan

Oil filter

The main flow and the bypass flow filter element are combined in a cartridge.

During inspection (1000-l 500 km) the initial operation oil filter element (A) must be replaced by combination oil filter element (B).

The combination oil filter element should then be cleaned every 10 000 km.



Attention!
Do not mix up the oil filter element and the O-ring of oil filter cap of engine 601 with those of engines 615,616 and 617.

The oil filter cap is fastened by means of two nuts.

The return flow pipe (276) is pressed into cap and has a check valve (277).

Unscrew cap (273) when changing oil filter elements and pull up a bit. As a result, the return pipe (276) fastened to cap clears a bore which connects ducts (b) and (c) with each other. The oil in oil filter will flow through duct (c) into oil pan.

Operation

The oil filter comprises the following main components:

a) Oil filter housing with bypass and return flow no-return valve.

b) Cap with return flow pipe, check valve and O-rings.

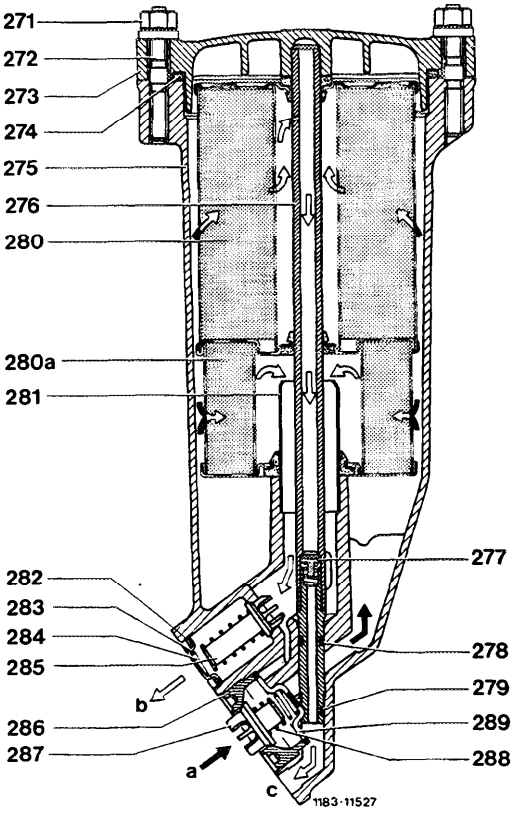
c) Combination oil filter element.

Coming from supply duct (a) the oil flows in through return flow no-return valve (286 and 287) in oil filter housing and from there directly to combination filter element.

After flowing through combination filter element the oil cleaned in main flow filter element (280a) flows through riser (281) and duct (b) to main oil duct and on to bearing points.

On the other hand, the oil finely filtered in bypass filter element (280) flows through return flow pipe (276) and duct (c) to oil pan.

To keep main flow and bypass flow separate, the combination filter element is provided with a rubber seal.



271 Nut M 8
272 Stud M 8
273 Cap
274 O-ring
275 Housing
276 Return flow pipe
277 Check valve
278 O-ring
279 O-ring
280 Oil filter element
280a Main flow filter section
281 Riser
282 Locking ring
283 Spring retainer
284 Spring
285 Valve cone bypass valve
286 Valve seat return flow no-return valve
287 Valve cone return flow no-return valve
288 Compression spring
289 Spring retainer
a To oil filter
b To bearing points
c To oil pan

Complaints about oil filter

If following a filter element change an oil pressure below 0.3 bar gauge pressure shows up at idle, observe the following:

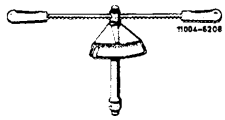
Forcible pushing-in of return flow pipe (276) during oil filter change may, under certain circumstances, force the sealing ring of oil filter element out of its holder into a position in front of riser (281). The oil supply proceeds then through bypass valve (285), which will lead to an oil pressure drop.

To prevent knocking out of sealing ring, introduce return flow pipe (276) into oil filter without using force.

18-110 Removal and installation of oil filter

Tightening torques	Nm
Nuts for oil filter cap	20-25
Screws for oil filter to cylinder crankcase	25

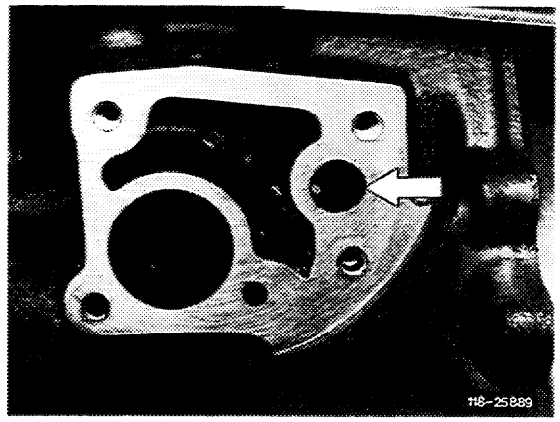
Special tools

Torque wrench, double arm, 3/8" square, 8-32 Nm		001 589 51 21 00
Box-end wrench element, open, 12 mm, 3/8" square		61758901 0300

Note

When removing oil filter it is quite possible that remains of gasket will stick to flange surface of cylinder crankcase.

To make sure that during their removal (e. g. by scraping) no such remains of gasket will enter the clean-oil duct (arrow) of cylinder crankcase, be sure to cover or close bore beforehand.

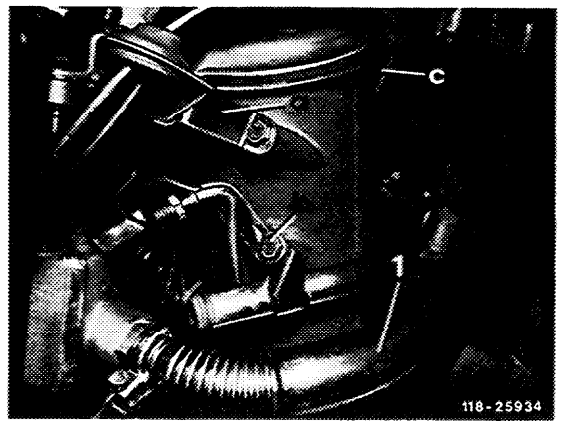


Removal

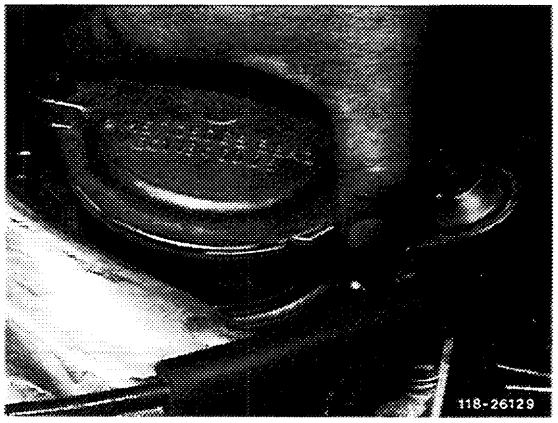
1 Completely remove air cleaner (09—400).

2 Unscrew holder (a) for starter cable, (b) for return flow line of heating system and (c) clamp for vacuum lines.

3 On vehicles with EGR, remove EGR line (1).



4 Unscrew oil filter cap and pull up a bi t, so that the oil flows back toward oil pan.

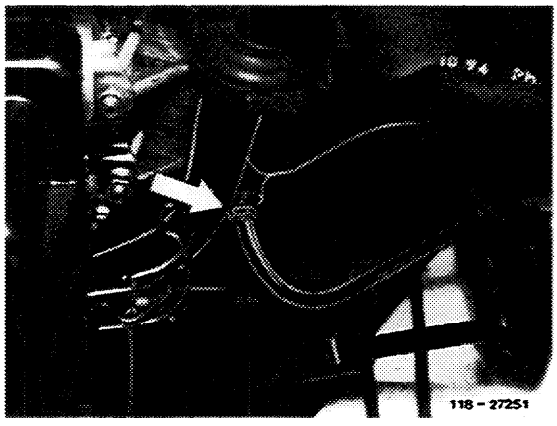


5 Unscrew line for oil pressure gauge (arrow).

6 Unscrew filter and remove.

7 Clean sealing surfaces on oil filter and cylinder crankcase.

For this purpose, close bores on cylinder crankcase.



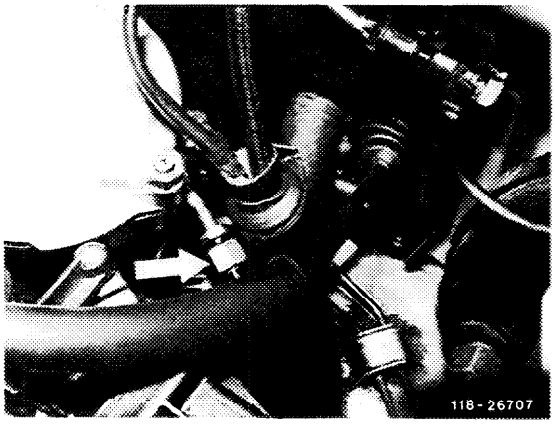
Line for oil pressure gauge engine 601.91 1

Installation

8 Position oil filter with new gasket and screw down.

9 Connect line for oil pressure gauge to oil filter.

10 If required, insert new oil filter element.



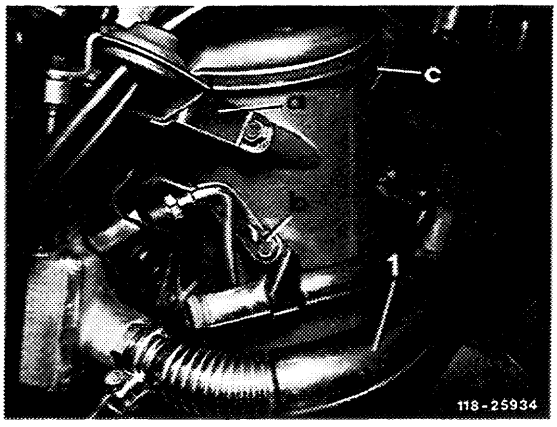
Line for oil pressure gauge engine 601.921

11 **Mount oil filter cap and tighten nuts to 20-25 Nm.**

12 **On vehicles with EG R, install EGR line (1).**

13 **Mount holder (a) for starting line, (b) for return flow line of heating system and (c) clamp for vacuum lines.**

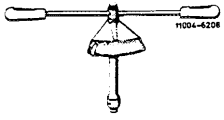
14 **Run engine at idle and check for leaks.**



18-210 Removal and installation of oil pump

Tightening torques		Nm
Oil drain plug on oil pan		30
Nuts for oil filter cap		20-25
Screws for oil pan on cylinder crankcase	M 6	10
	M 8	25
Screw for drive sprocket on oil pump		25
Screws for oil pump on cylinder crankcase		25

Special tool

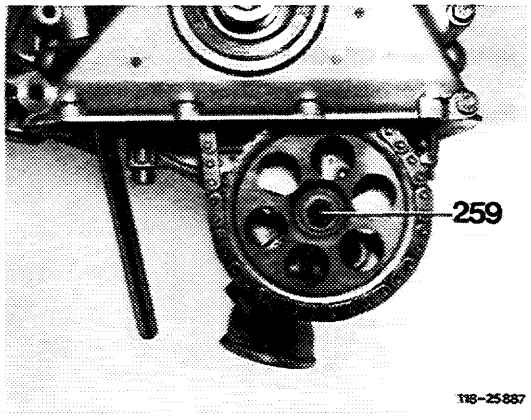
Torque wrench, double arm, 3/8'' square, 8-32 Nm		001 589 51 21 00

Removal

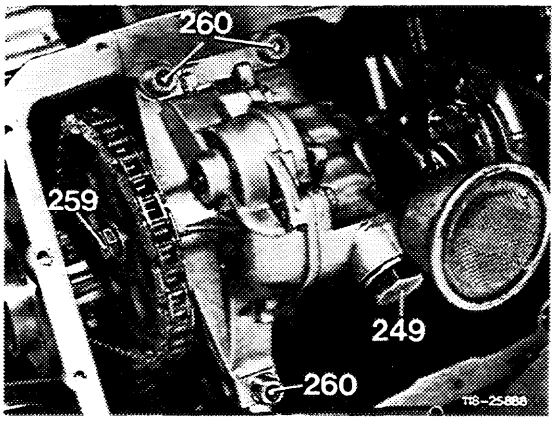
1 Remove engine (01–030).

2 Remove oil pan (01–310).

3 Unscrew screw (259) on sprocket and remove sprocket from drive shaft.

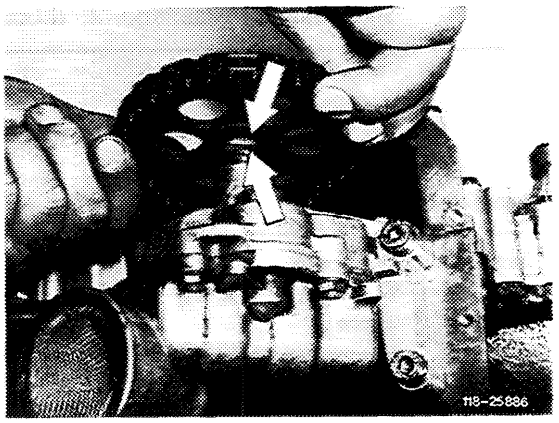


4 Unscrew screws (260) and remove oil pump.



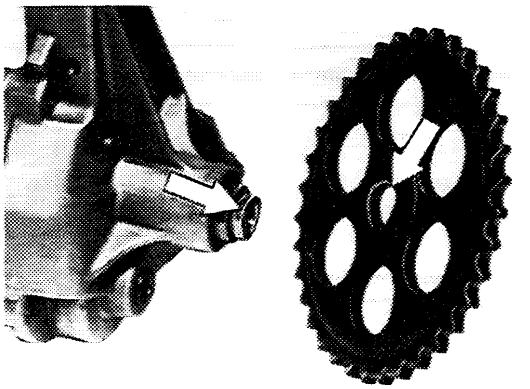
Installation

5 Install oil pump and tighten hex. socket screws to 25 Nm.



6 Engage sprocket in chain and set on drive shaft.

Note: Mount sprocket in such a manner that crown is facing oil pump and that the trochoid shape corresponds with that on oil pump shaft (arrows).



7 Install oil pan (01-340).

8 Install engine (01-030).

9 Run engine, check for leaks.

18-215 Removal and installation of oil pressure relief valve

Tightening torques	Nm
Closing plug for oil pressure relief valve	50 ± 5

Opening pressure	bar gauge pressure
Oil pressure relief valve in oil pump	4.7-5.3

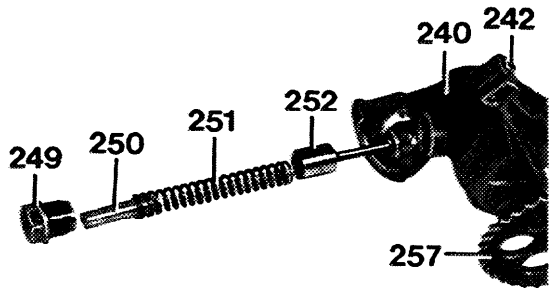
Removal

1 Remove engine (01-030).

2 Remove oil pan (01-310).

3 Unscrew closing plug (249) and remove compression spring (251) with guide pin (250) and piston (252).

Note. Closing plug is under pressure.



118 - 26006

240 Oil pump
242 Dowel sleeve
249 Closing plug
250 Guide pin
251 Compression spring
252 Piston
257 Sprocket

Installation

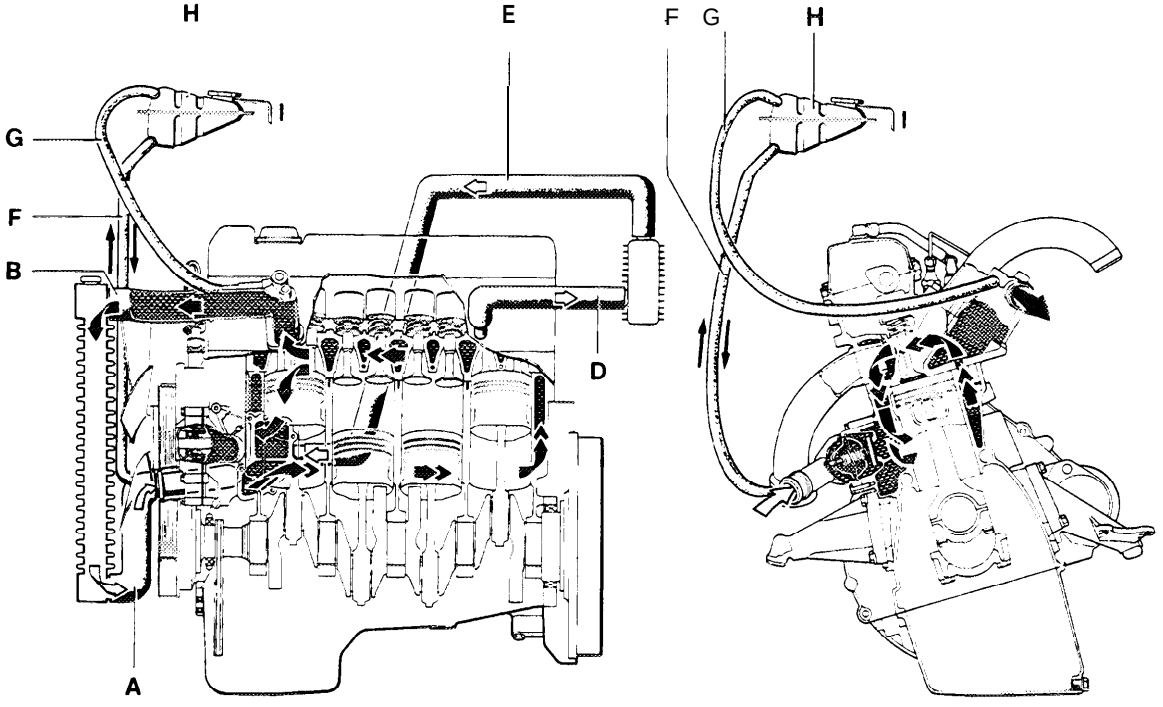
4 For installation proceed vice versa.

5 Run engine and check for leaks.

20 Engine cooling

	Job No.
Cooling system	
Coolant circuit and engine cooling	20-005
Draining and filling in coolant – antifreeze table	010
Cleaning cooling system	015
A.De-oiling	
B. Decalcification, derusting	
Coolant thermostat	
Removal and installation of thermostat	110
Coolant pump	
Removal and installation of coolant pump	210
Removal and installation of coolant pump housing	230
Fan coupling	
Magnetic fan coupling.	330
Removal and installation of magnetic fan coupling	335
Radiator	
Removal and installation of radiator	420
Repairing radiator	425
Checking expansion tank closing cap	430

Coolant circuit



A From radiator to coolant thermostat
B From outlet connection to radiator
D Inlet to heater (heat exchanger)
E Return flow from heater (heat exchanger)
F Filling hose
G Vent line
H Expansion tank
I Overflow pipe

Thermostat

Engine	Thermostat begins to open	fully opened
601	85”	100”

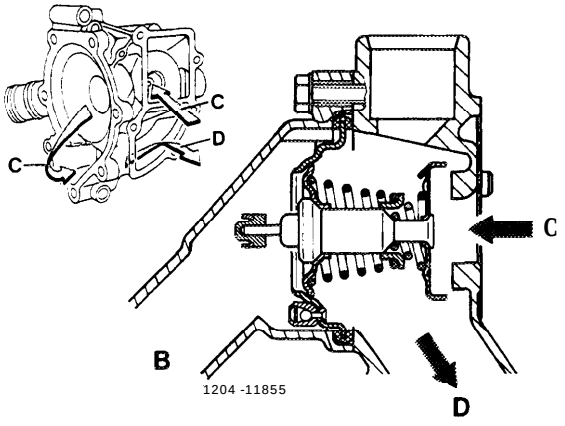
Note

These engines are provided with a thermostat which begins to open at 85 °C.

Operation

Warm-up period – coolant temperature up to approx. 85 °C.

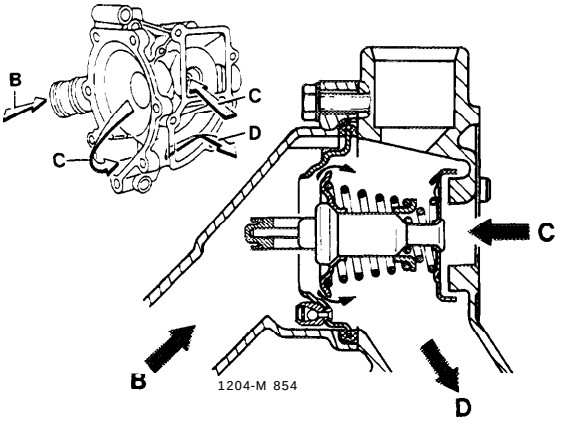
Up to a coolant temperature of approx. 85 °C the main valve is closed and the bypass disk is fully open. Inflow (B) from radiator is therefore interrupted. The coolant flows via bypass line (C) directly through coolant pump into cylinder crankcase (D).



D From crankcase (bypass line)
D To crankcase

Partial load operation – coolant temperature approx. 85 °C to max. 100 °C

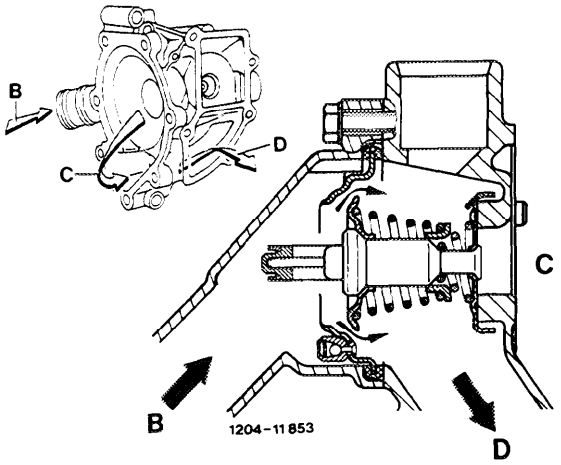
At coolant temperatures from approx. 85-100 °C the main valve as well as the bypass section are more or less opened depending on engine load. The coolant flows from radiator (B) and via bypass line (C) through coolant pump into cylinder crankcase (D).



B From radiator
C From crankcase (bypass line)
D To crankcase

Full load operation — high outside temperature (above 100 °C)

At coolant temperatures above approx. 100 °C the main valve is completely opened. The bypass line (C) is closed by bypass disk. All the coolant will flow through radiator.



The cooling system is automatically vented by ball valve in coolant thermostat when refilling while engine is operating.

Total filling capacities of cooling system with heater and mixing ratio

Antifreeze[1])/water[2]) in liters

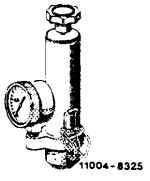
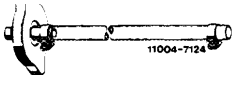
Total filling capacity of cooling system with heater	Mixing ratio antifreeze/water for antifreeze protection up to	
	-30 °C	-40 °C
8.5	3.75/4.75	4.5/4.0

[1]) Refer to Specifications for Service Products sheet 325.
[2]) Refer to Specifications for Service Products sheet 310 and 311.

Tightening torques

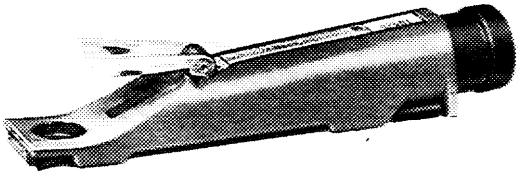
Drain plug	Radiator	1.5
	Cylinder crankcase	**30**

Special tools

Tester for cooling system	 11004-8325	001 589 48 21 00
Radiator cap with hose for leak test	 11004-7124	605 589 00 25 00

Conventional tool

Antifreeze tester
Prestone-VU-Check (Union Cabride)
e. g. Philipp Gather, D-4020 Mettmann 2



R -A789

Note

To prevent corrosion in cooling system, the concentration of the antifreeze should not drop below -20 °C antifreeze (30 % by volume).

If no antifreeze is available and if only water is filled in, be sure to add 1 % refining agent (anti-corrosion oil, 10 cc/l water).

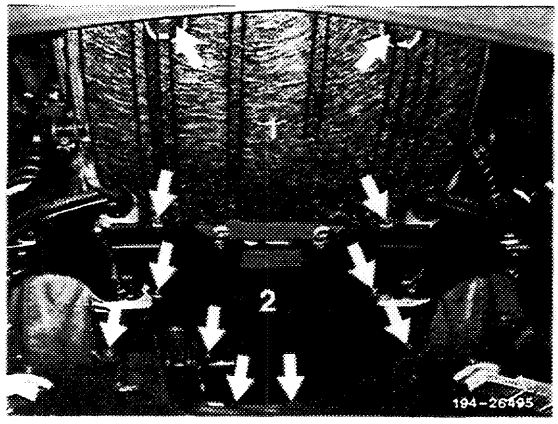
Attention!
To prevent corrosion damage on light alloy components, use only approved antifreeze compounds (Specifications for Service Products sheet 325) and refining agents (Specifications for Service Products sheet 311).

Draining

1 **Open cap on expansion tank in steps.**

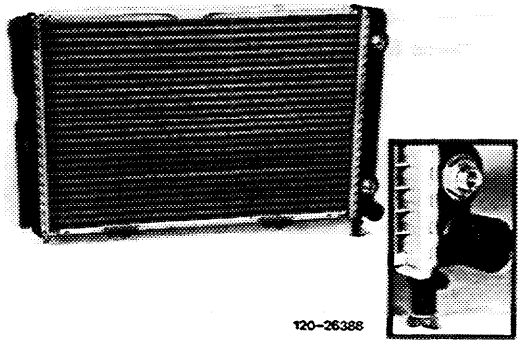
Attention!
Open cap only at coolant temperatures below 90 °C.

2 Completely remove noise capsule.



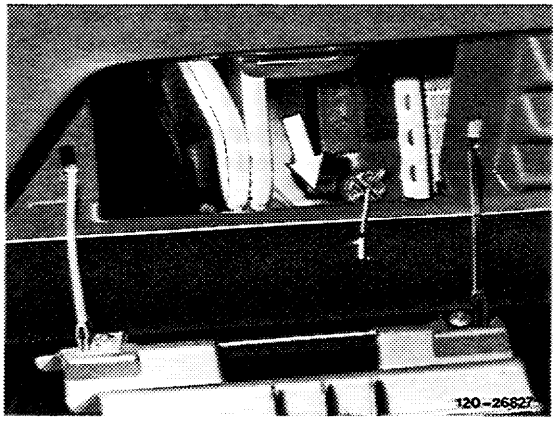
3 Open drain plug on radiator.

Note: For catching coolant, a pertinent extension hose may be plugged on drain connection.



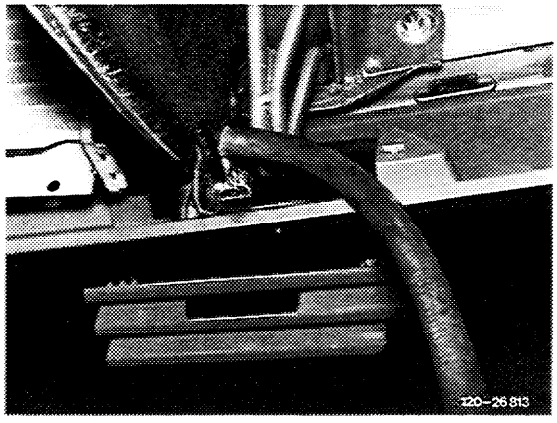
Drain plug on vehicles without air conditioning system

On vehicles with air conditioning, open flap for towing eye at front right in front skirt.



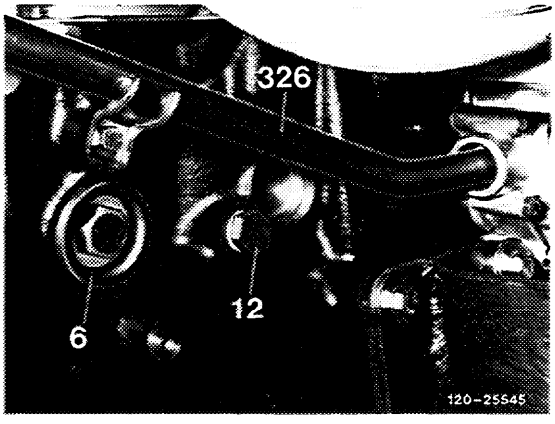
1 **Drain plug on vehicles with air conditioning**

Note: On vehicles with air conditioning, remove closing plug under righthand wheelhouse on noise capsule. An extension hose can be inserted through this opening and plugged on drain connection of radiator.



Extension hose, plugged on

4 Unscrew drain plug (12) on cylinder crankcase.

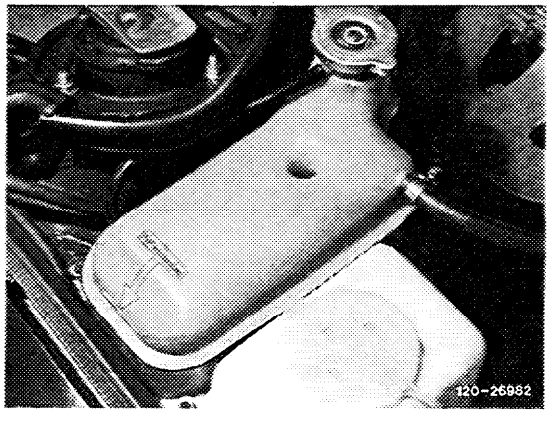


12 Drain plug on cylinder crankcase

Filling in

5 Set both heater switches on vehicles with and without air conditioning to max. heating capacity.

6 Slowly fill in coolant up to mark on expansion rank.



Mark on expansion tank

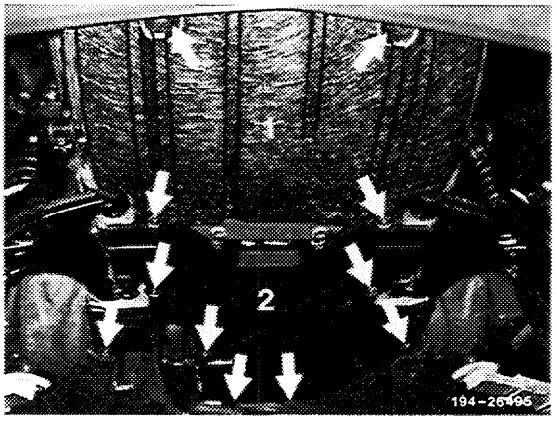
7 Run engine at intermittent acceleration until coolant thermostat opens (coolant temperature approx. 90-100 °C).

Note: Close filler neck on expansion tank starting at a coolant temperature of approx. 60-70 °C.

8 Check coolant level and fill up to specified mark, if required.

9 Pressure-test cooling system with tester.

10 Install noise capsule.



A. De-oiling
(required only if anti-corrosion oil had been filled in)

1 **Completely drain coolant (20-010).**

2 **Remove coolant thermostat (20-I 10).**

3 **On vehicles with and without air conditioning, set heater control to full capacity.**

4 **Fill cooling system with a 5 % solution of water and a neutral cleaning agent or with a mildly alcaline cleaner, such as P 3-Croni (supplier: Henkel) or Grisiron 7220 (supplier: Farbwerke Hoechst).**

Attention!
On these vehicles (light alloy radiator) do not use heavily alcaline cleaning agents such as P 3-Standard (supplier: Henkel).

5 **Run engine warm at medium speed up to approx. 80 °C (176 °F) and hold at this temperature for approx. 5 minutes.**

6 **Stop engine and let cooling system cool down to approx. 50 °C (122 °F).**

7 **Completely drain solution.**

8 **Immediately thereafter, fill cooling system twice with fresh water, run warm (approx. 5 minutes) and drain.**

B. Decalcification, derusting

Prior to decalcification and if anti-corrosion oil has been filled in, de-oil even if there is no visible oiling up.

1 **Fill cooling system with a 10 % (100 g/l) solution of citric acid (available from the chemical trade).**

2 Run engine warm at medium speed up to approx. 80 °C (176 °F) and hold for approx. 10 minutes at this temperature, while proceeding according to item 3 section A "De-oiling".

3 Stop engine and let cool down to approx. 50 °C (122 °F).

4 Completely drain decalcification solution.

5 Flush cooling system at least 3 times with fresh water while running engine for at least 5 minutes with each flushing charge.

Badly calcified cooling system may require a repetition of the treatment. Always prepare a fresh decalcification solution and repeat flushing steps.

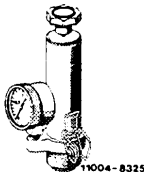
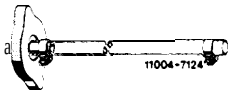
6 Install coolant thermostat with new sealing ring (20-110).

7 Fill in coolant (20-010).

20-I 10 Removal and installation of thermostat

Tightening torques		Nm
Screws for thermostat housing cover		10
Drain plug	Radiator	1.5
	Cylinder crankcase	30

Special tools

Tester for cooling system	 11004-8325	001 589 48 21 00
Radiator cap with hose for leak test	 11004-7124	605589002500

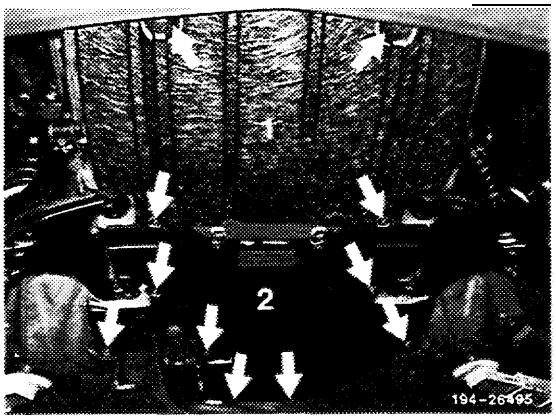
Removal

1 Open closing cap on expansion tank in steps.

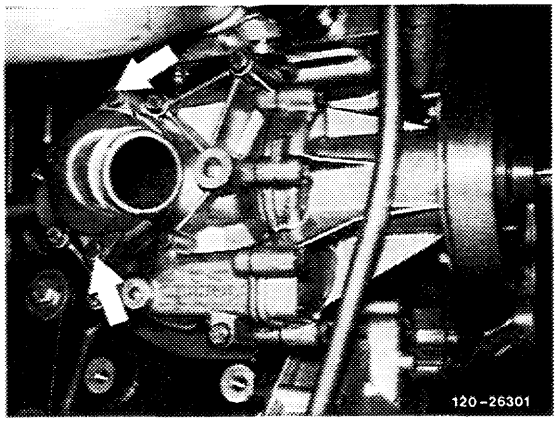
Attention!
Open closing cap only at coolant temperatures below 90 °C.

2 Remove noise capsule.

3 Drain coolant (20–010).



4 Unscrew thermostat housing cover and remove thermostat (arrows).

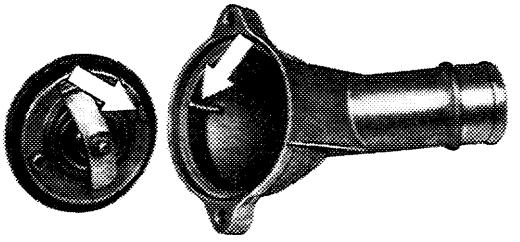


Installation

5 When installing a new thermostat, place new seal on thermostat housing.

6 Insert thermostat with sealing ring into cover in such a manner that the recess on thermostat corresponds with cast-on rib in cover (arrows).

7 Screw on cover and tighten to 10 Nm.

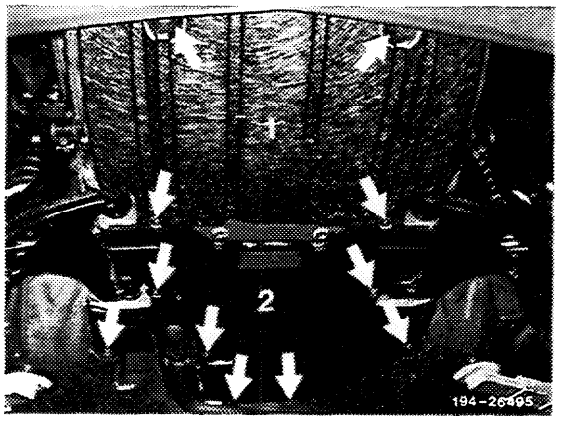


120-26839

8 Fill in coolant (20-010).

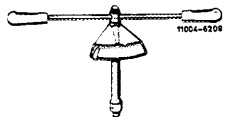
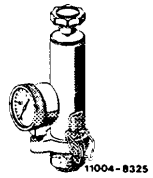
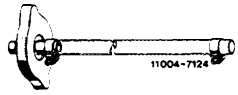
9 Pressure-test cooling system with tester.

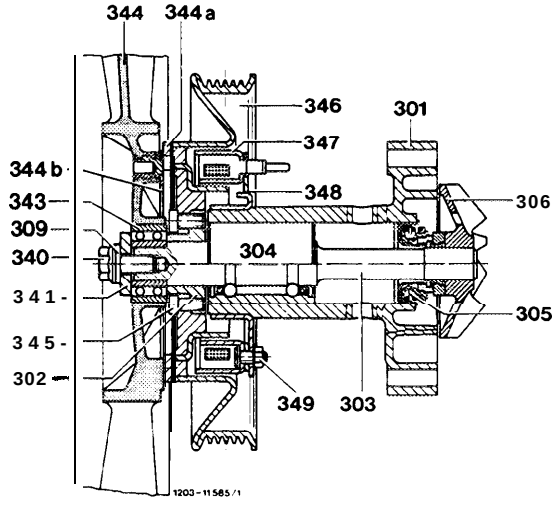
10 Install noise capsule.



194-26495

Tightening torques		Nm
Drain plug	Radiator	1.5
	Cylinder crankcase	30
Fan on coolant pump shaft (central bolt)		25
Pulley on coolant pump		10
Coolant pump on coolant pump housing		10

Special tools		
Torque wrench, double arm, 1/4'' square, 4-16 Nm		000 589 67 21 00
Torque wrench, double arm, 3/8'' square, 8-32 Nm		001 589 51 21 00
Tester for cooling system		001 5894821 00
Radiator cap with hose for leak test		605 589 00 25 00



Layout of magnetic fan coupling and coolant pump

301	Coolant pump housing	343	Ball bearing
302	Flange	344	Fan
303	Shaft	344a	Armature
304	Bearing	344b	Leaf spring
305	Cassette seal	345	Screw M 6 x 12
306	Impeller	346	Pulley
309	Washer	347	Magnet, body
340	Collar srew	348	Magnet carrier
241	Disk	349	Hex. nut

Removal

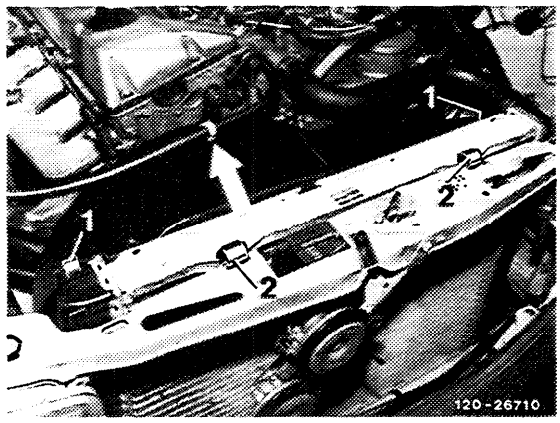
1 Completely. drain coolant (20–010).

2 Disengage overflow hose on fan cover (arrow).

3 Disengage fan cover and place over fan.

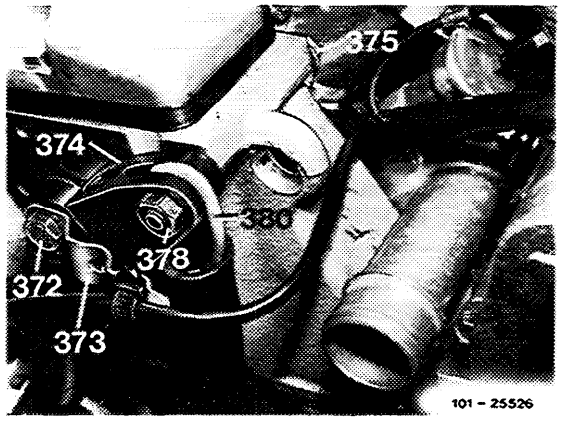
4 Unscrew collar screw (340) for fan and remove fan.

5 Remove fan cover.

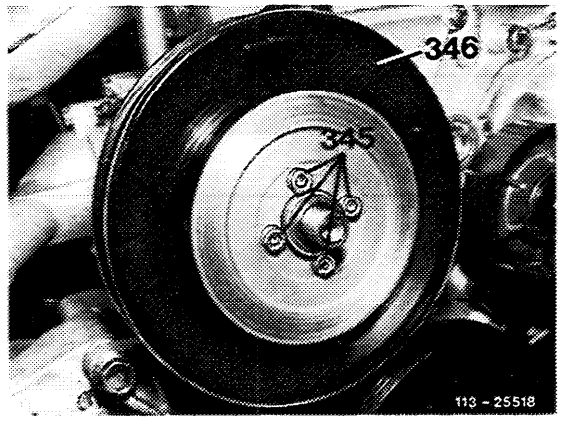


6 Slacken V-belt and remove. For this purpose, unscrew collar nut (378). Insert a mandrel into spring tensioning lever (374) and relieve hex. screw (375) against force of draw spring (380) until screw can be pushed back in direction of intake manifold.

Release spring tensioning lever and remove V-belt.

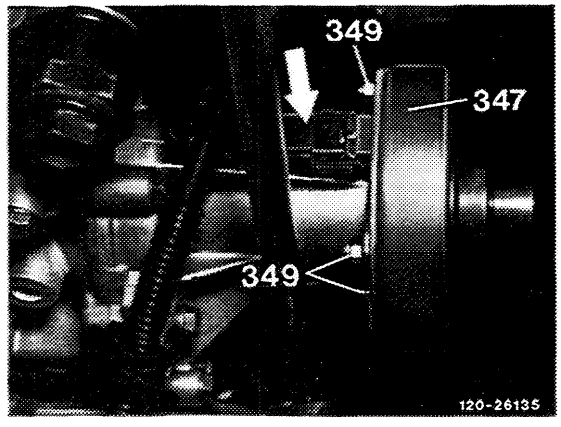


7 Unscrew fastening screws (345) and remove pulley (346).

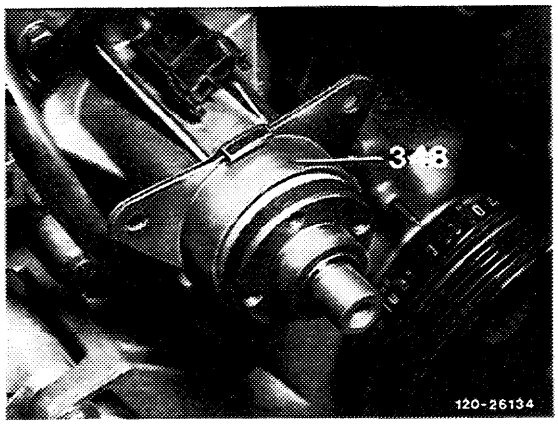


8 Pull cable from body of magnet (arrow).

9 Unscrew hex. nuts (349) and remove magnet carrier (347).



Note: Magnet carrier (348) is glued to coolant pump housing and may not be pulled off.



10 Unscrew coolant pump housing.

11 Clean sealing surfaces.

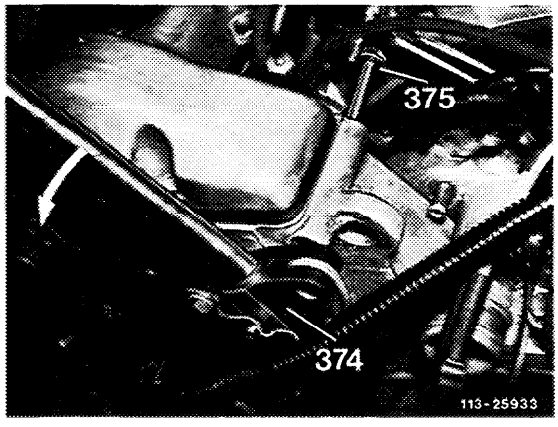
Installation

12 Insert coolant pump with new gasket and tighten combination screws to 10 Nm.

13 Mount magnetic body and plug on cable.

14 Mount pulley and tighten fastening screws to 10 Nm.

15 Mount V-belt and engage spring tensioning lever. For this purpose, swivel spring tensioning lever (374) with a mandrel against force of draw spring to the left until the screw (375) can be slipped through spring tensioning lever. Screw on collar nut and tighten.



16 Place fan cover over coolant pump.

17 Mount fan and tighten center screw to 25 Nm.

18 Fasten fan cover and attach overflow hose.

19 Fill in coolant (20-010).

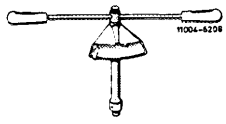
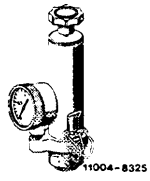
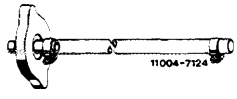
20 Pressure-test cooling system with tester.

21 Install noise capsule.

20-230 Removal and installation of coolant pump

Tightening torques		Nm
Drain plug	Radiator	1,5
	Cylinder crankcase	30
Fan to coolant pump (collar screw)		25
Pulley to coolant pump		10
Coolant pump to coolant pump housing		10
Coolant pump housing to cylinder crankcase		10
Alternator to carrier		45
Carrier for alternator to cylinder crankcase		25

Special tools

Torque wrench, double arm, 1/4" square, 4-16 Nm		000589 67 2100
Torque wrench, double arm, 3/8" square, 8-32 Nm		001 589 51 21 00
Torque wrench with plug-in ratchet, 1/2" square, 25-130 Nm		001 589 66 21 00
Tester for cooling system		001 589 48 21 00
Radiator cap with hose for leak test		605589002500

Conventional tool

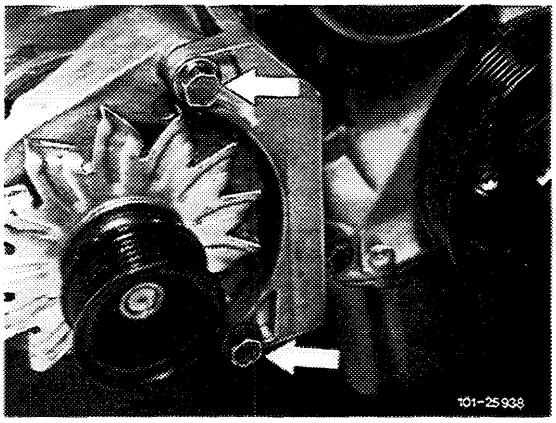
7 mm socket wrench hex. head on flexible shaft for hose clamps with worm drive	e. g. Hazet, D-5630 Remscheid Order No. 426-7

Removal

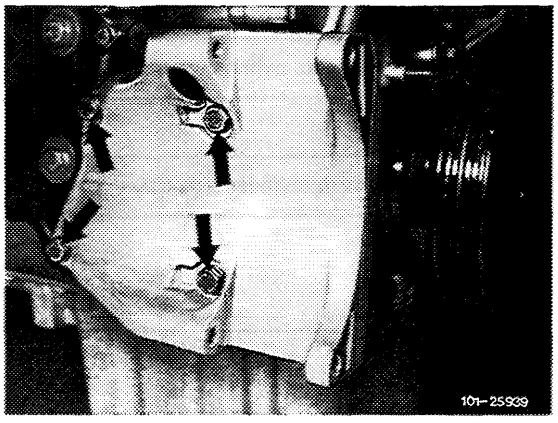
1 Remove coolant pump (20–210).

2 Disconnect negative terminal on battery.

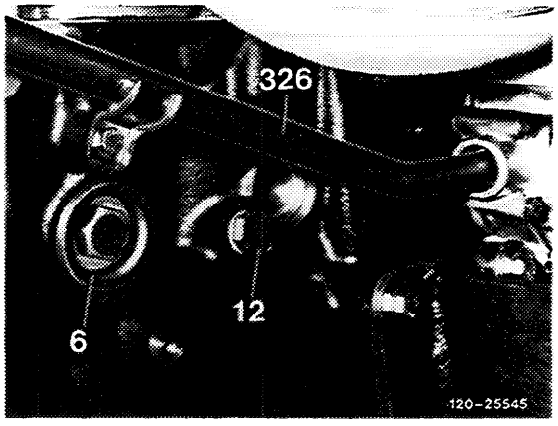
3 Unscrew alternator (arrows) and put aside.



4 Unscrew carrier for alternator (arrows).



5 Unscrew return line (326) on cylinder crankcase and pull out of coolant pump housing.



6 Unscrew coolant pump housing.

7 Clean sealing surfaces.

8 Renew O-ring on return line (326).

9 Plug coolant pump housing on return line, screw with a seal to cylinder crankcase and tighten to 10 Nm.

10 Screw return line (326) to cylinder crankcase.

11 Mount carrier for alternator and tighten screws to 25 Nm.

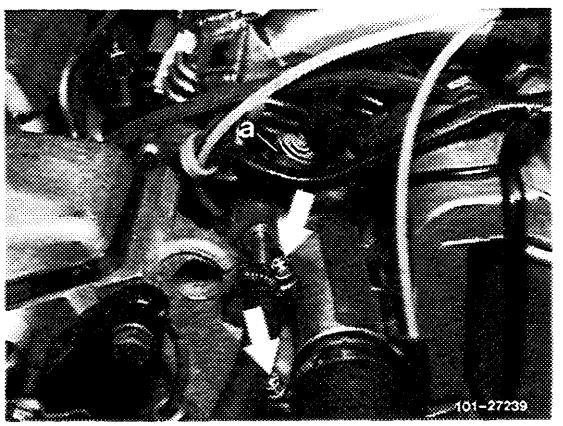
12 Mount alternator and tighten screws to 45 Nm. Connect negative terminal to battery.

13 Install coolant pump (20-210).

14 Fill in coolant (20-010).

15 Pressure-test cooling system with tester.

General

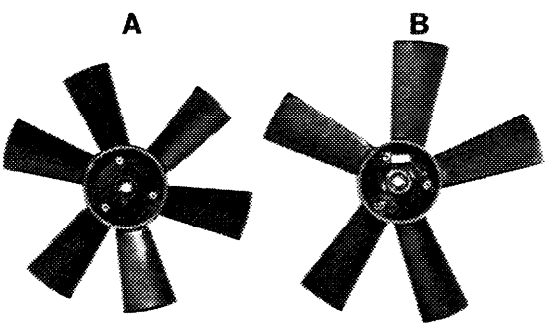


The engines are provided with an electromagnetic fan coupling which is controlled in dependence on temperature.

The coupling is switched on or off by means of a 100 °C temperature switch, which is screwed into outlet connection (a).

The electromagnetic fan coupling is service-free.

Fan



The fan (344) is seated on a shank on coolant pump bearing and is fastened by means of a collar screw M 8 x 18.

Fan (A) has 6 blades and a diameter of 380 mm.

On vehicles with air conditioning the fan (B) has 5 blades and a diameter of 430 mm.

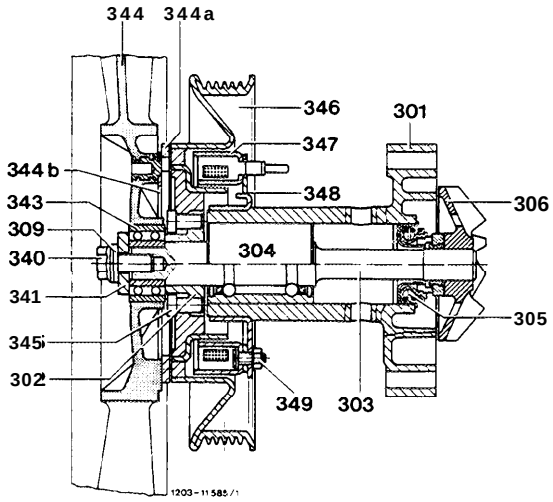
The armature (344a) and the ball bearing (343) are attached to or in fan, respectively.

The ball bearing is sealed on both sides with covering disks.

Body of electromagnetic fan coupling

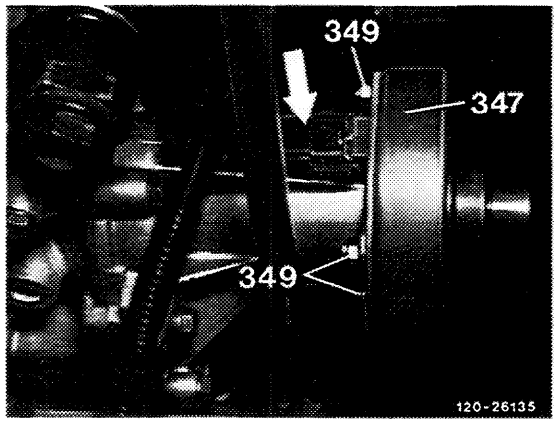
The body of the magnet (347) is fastened to magnet carrier with 3 nuts (349).

The magnet carrier is glued to coolant pump housing.



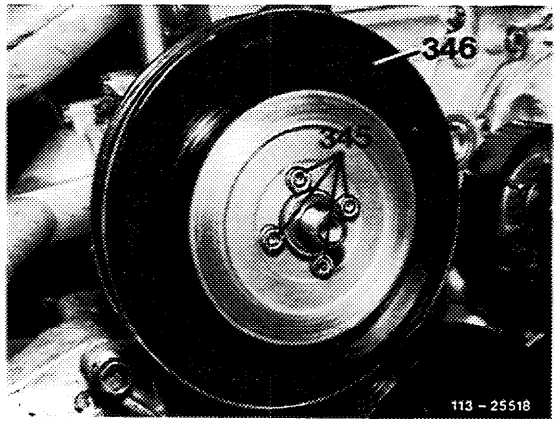
301	Coolant pump housing	344	Fan
302	Flange	344a	Armature
303	Shaft	344b	Leaf spring
304	Bearing	345	Hex. socket screw M 6 x 12
305	Cassette seal		
306	impeller	346	Pulley
309	Washer	347	Magnet, body
340	Collar screw	348	Magnet carrier
341	Disk	349	Hex. nut
343	Bearing		

The electric line is connected to body of magnet by means of a coupling (arrow).



Pulley (346) is seated on coolant pump shaft (303) in front of magnet body.

The pulley (346) is screwed to flange of coolant pump by means of 4 hex. socket screws (345).



Operation

The fan is switched on only with the ignition engaged and at a coolant temperature of above 98-102 °C.

The body of the magnet (347) is constantly connected to positive via fuse No. 10 terminal 15.

Below 98-102 °C coolant temperature the fan is switched off and will run along only under influence of headwind or bearing friction.

At the latest, starting from 102 °C coolant temperature, negative is connected via temperature switch (1) in runout socket (330).

The armature (344a) is attracted by magnet body (347) and presses against face of pulley (346).

The fan is now rigidly connected to pulley and runs along in accordance with coolant pump speed.

If the coolant temperature drops below 98-93 °C, the temperature switch opens and the armature (344a) is lifted from pulley (346) by leaf springs (344b).

On vehicles with air conditioning, the fan and the electric auxiliary fan is switched on by way of a double contact relay which is activated by the temperature switch 52 °C on receiver dehydrator.

When the air conditioning system is switched off, a temperature switch 100 °C in runout connection will again switch fan on or off.

20-335 Removal and installation of magnetic fan coupling

Tightening torques	Nm
Fan to coolant pump (collar screw)	25
Pulley to coolant pump	10
Magnet body to magnet carrier (reference value)	10

Special tool

Torque wrench with plug-in ratchet, 1/2'' square, 25-l 30 Nm		001 589966 21 00

Removal

1 Disconnect vent line on fan cover.

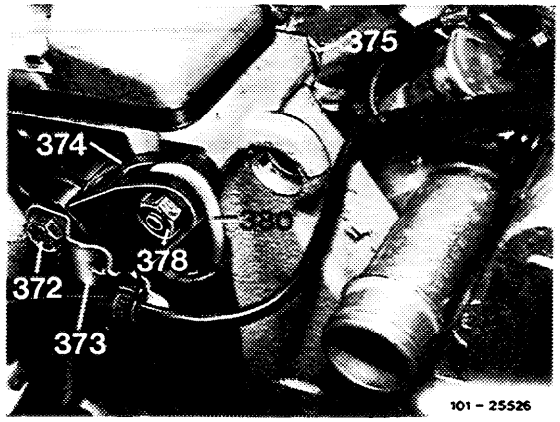
2 Disconnect fan cover and place over fan.

3 Unscrew collar screw for fan and remove fan.

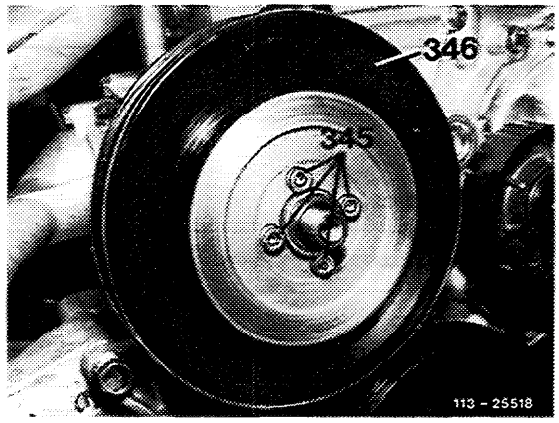
4 Remove fan cover.

5 Slacken V-belt and remove. For this purpose, unscrew collar nut (378). Insert a mandrel into spring tensioning lever (374) and relieve hex. screw (375) against force of draw spring (380) until screw can be pushed back in direction of intake manifold.

Release spring tensioning lever and remove V-belt.

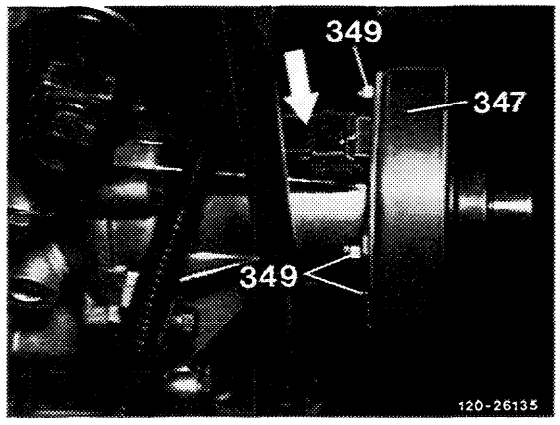


6 Unscrew fastening screws (345) and remove pulley (346).

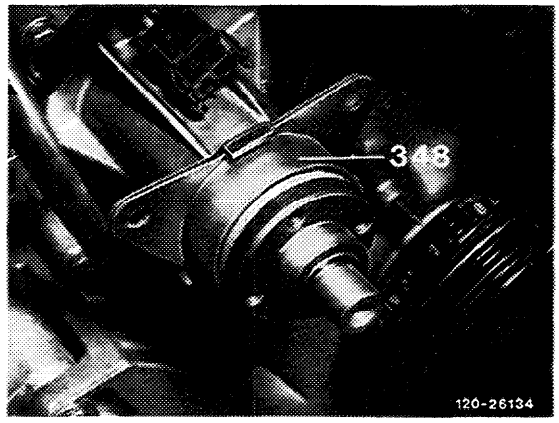


7 Pull coupling of electric line from magnet body (arrow).

8 Unscrew magnet body (347) from magnet carrier on fastening screws (349).



Note: Magnet carrier (348) is glued to coolant pump housing and may not be pulled off.



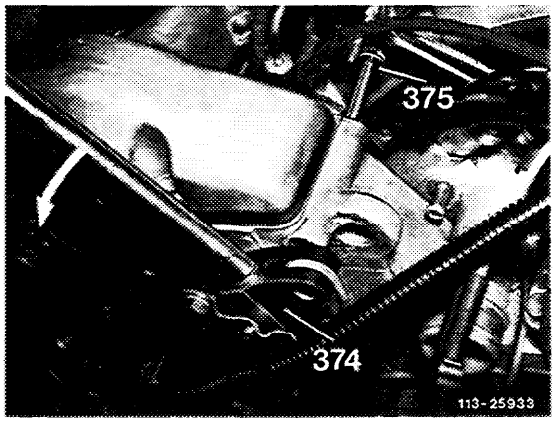
Installation

9 Mount magnet body and plug on cable.

10 Mount pulley and tighten fastening screws to 10 Nm.

11 **Mount V-belt. Pay attention to layout of unit.**

Swivel spring tensioning lever (374) with a mandrel (arrow). against force of draw spring to the left until the screw (375) can be slipped through spring tensioning lever. Screw on collar nut and tighten.



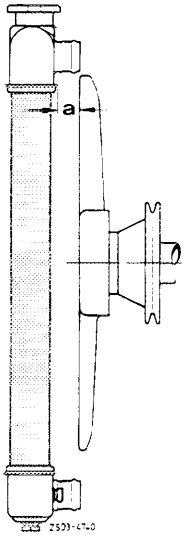
12 **Insert fan cover and place over coolant pump.**

13 **Mount fan and tighten collar screw to 25 Nm.**

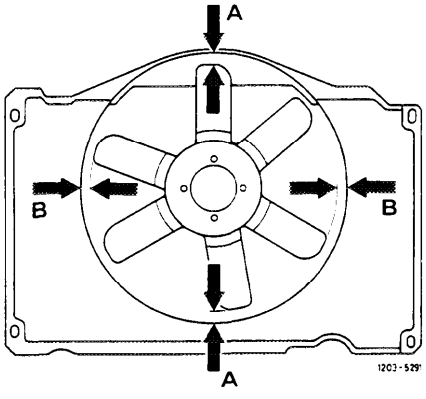
14 **Fasten fan cover and attach vent line.**

Installation dimensions for radiator, fan and fan cover

	Fan distance "a" to radiator, approx. mm	Fan distance to fan **cover,** approx. mm A	B
	90	25	20



Radiator/Fan

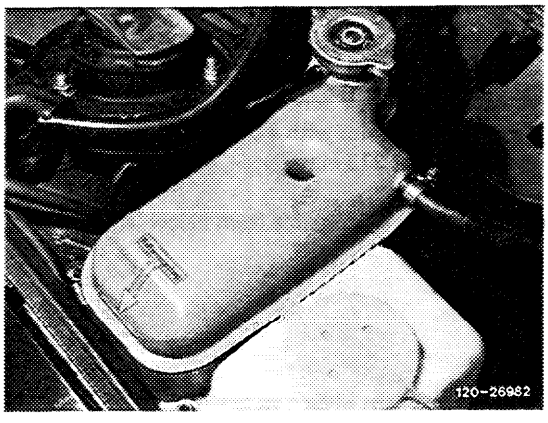


Fan cover/Fan

Radiator and expansion tank

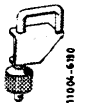
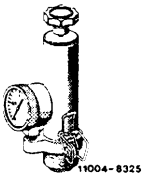
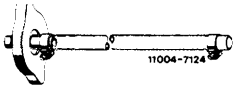
These vehicles are **provided** with an expansion tank which is attached to wheelhouse at the right.

Different radiators **are** installed depending on vehicle equipment (without or with air conditioning).



Tightening torques		Nm
Drain plug	Radiator	1.5
	Cylinder crankcase	30

Special tools

Torque wrench with plug-in ratchet, 1/2'' square, 25-l 30 Nm		001 589 66 21 00
Clamp for hose lines		000589403700
Tester for cooling system		001 589 48 21 00
Radiator cap with hose for leak test		605589002500

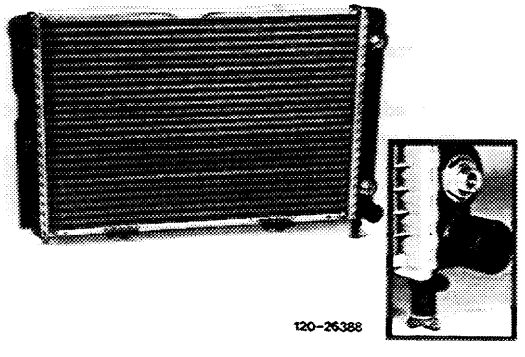
Conventional tool

7 mm socket wrench hex. head on flexible shaft for hose clamps with worm drive	e. g. Hazet, D-5630 Remscheid Order No. 426-7

Note

Vehicles without air conditioning are provided with a cross flow radiator with a core depth of 34 mm and a height of 373 mm.

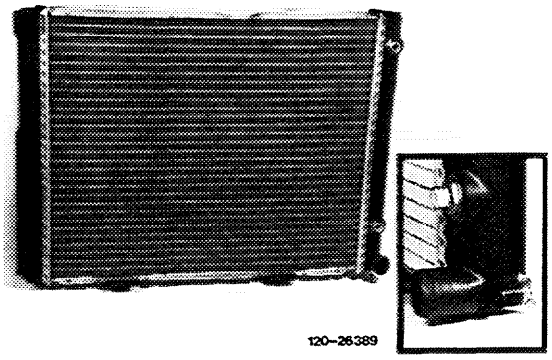
The drain plug is accessible from below (enlarged cutout).



Radiator for vehicles without air conditioning

Vehicles with air conditioning are also provided with a cross flow radiator, the radiator has a core depth of 42 mm and is 29 mm higher. The cooling capacity is thereby increased.

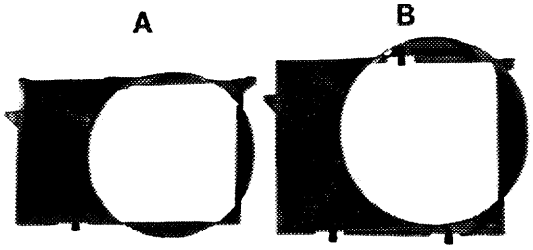
The drain plug is accessible from the front via flap in front-end skirt (enlarged cutout).



Radiator for vehicles with air conditioning

Fan cover

There are two fan cover versions in accordance with different radiators.



120 - 26740

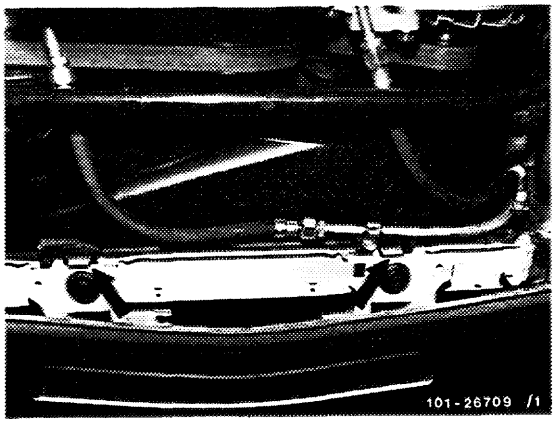
Version "A"

On vehicles without air conditioning (low radiator).

Version "B"

On vehicles with air conditioning (high radiator).

The fan covers are plugged below into one or two holding lugs on radiator (arrows) and are fastened to radiator at top or laterally with holding clamps.



Removal

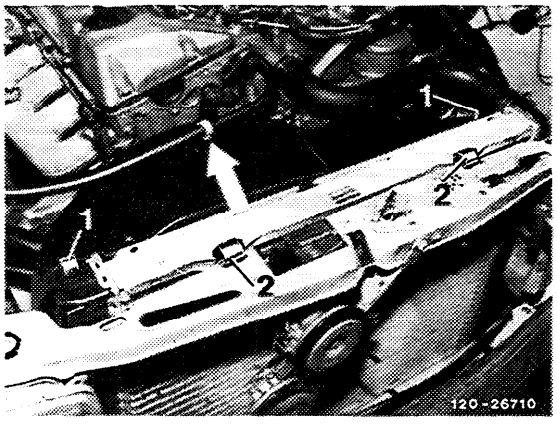
1 Drain coolant (20–010).

2 On vehicles with automatic transmission, disconnect oil lines from or to transmission and unscrew on radiator.

3 Disconnect coolant hoses on radiator.

4 Pull out flat contour springs (1) for fan cover, slightly lift fan cover and place over fan.

5 Pull out flat contour springs (2) for radiator and lift out radiator.

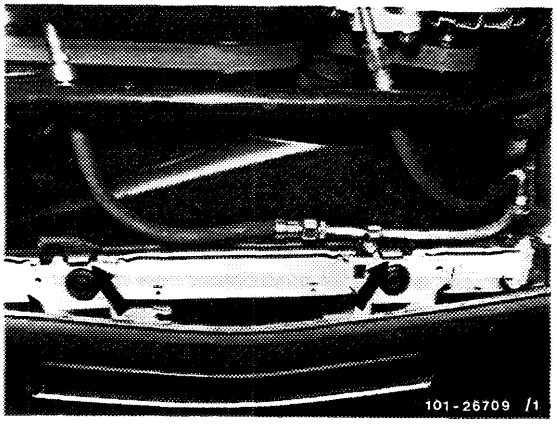


Installation

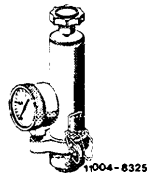
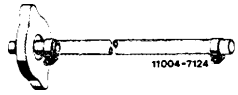
6 For installation proceed vice versa to removal.

Note that the fastening mounts of the radiator are correctly introduced into rubber grommets of lower holder and the holders of the fan cover into holding lugs on radiator (arrows).

7 Fill in coolant (20–010), pressure-test cooling system with tester and check for leaks.



Special tools

Tester for cooling system		001 589482100
Radiator cap with hose for leak test		605 589 00 25 00

Conventional tool

7 mm socket wrench hex. head with flexible shaft for hose clamps with worm drive	e. g. Hazet, D-5630 Remscheid Order No. 426-7

Note

Since light alloy radiators with plastic water tanks cannot be repaired by soldering, a sealing compound has been developed and approved.

The compound can also be used to seal radiators made of heavy-metal (nonferrous metal radiator).

The sealing compound is a product on a silicone rubber base, which remains permanently elastic in its final condition. Temperature stability extends from -50 °C to +200 °C.

Owing to different accessibility on radiator (e. g. more difficult in core than on water tank) the sealing compound is available in a diluted and an undiluted shape.

The different sealing compound versions and the priming fluid are included in a repair kit, part No. 123 989 00 20.

Designation	Purpose
Priming fluid	Preparation of wash primer.
Sealing compound, undiluted	For sealing easily accessible areas.
Sealing compound, diluted	For sealing poorly accessible areas (e. g. laterally on cooling pipes).

Sealing compound and priming fluid have a shelf life of approx. 1 year, provided they are always closed airtight.

Cloudy priming fluid should no longer be used.

Individually, the sealing compound serves to seal the following parts or areas in coolant circuit:

a) Plastic water tanks (3 and 4).

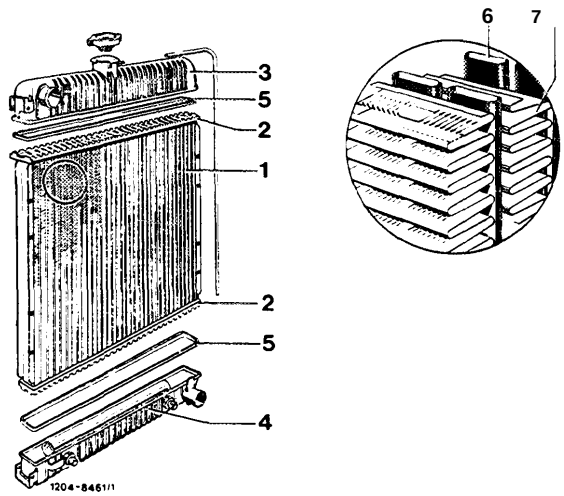
b) Heavy-metal water tanks (holes up to 1.5 mm dia.).

c) Light and heavy-metal cooling pipes (6).

d) Pipe plate (2).

e) Beaded flange (connection between radiator core and water tank).

f) Heat exchanger of heating system.



1 Radiator core
2 Pipe plate
3 Water box, top
4 Water box, bottom
5 Gasket
6 Cooling pipes
7 Ribs

Damages spots on water tanks, which are exposed to increased stress caused by e. g. torn or broken fastening lugs, cracks in fillets of connections, fractures and very long or wide cracks on top should not be repaired, since the sealing compound can accept very light loads only.

Plastic water tanks of radiators made by Behr can be exchanged by means of special tools or fixtures in Behr radiator repair shops or Inter-Radia service stations.
If required, consult the nearest Behr repair shop or Inter-Radia service station for such a possibility and if such a repair can be made.

If there is no such a possibility, renew radiator.

On heavy-metal radiators with plastic water tanks, soldering on core may be performed only at a distance of 20 mm from water tank, since otherwise the high soldering temperature will damage the gasket (5) and the water tank (3 or 4). Seal leaks which are closer to water tank with sealing compound only.

If the leaking spot can be clearly located in installed condition, the radiator need not be removed. In such a case, it will be enough to drain the coolant and, after sealing, to pressure-test the cooling system with tester (1.0-l .2 bar gauge pressure).

When handling priming fluid and sealing compound observe the following:

The priming fluid is easily inflammable (adhere to safety rules, dangerous materials class A 1).

Up to complete interlacing (bonding) of sealing compound, acetic acid will be released. For this reason, avoid skin contact. Clean affected parts immediately with water and soap. Rinse eyes with water, see a doctor, if required.

Sealing

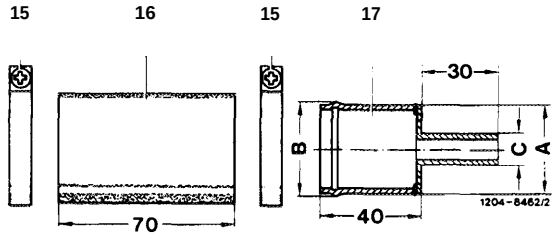
1 **If the leaking point cannot be accurately localized in installed condition, remove radiator (20-420).**

2 Clean radiator.

3 Close hose connections with self-made closing caps.

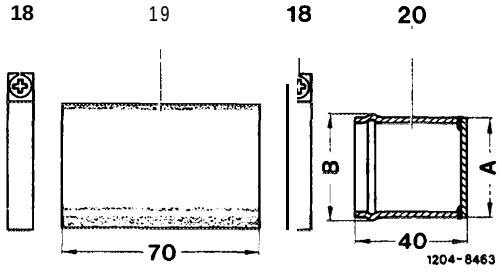
Required parts for upper hose connection:

15 2 clamps L 36-46, part No. 976026 036000
16 Length of hose, part No. 201 501 38 82
17 Reduction piece made of two lengths of pipe
A 35 mm dia.
B 39 mm dia.
C 12 mm dia.



Required parts for lower hose connection.

18 2 clamps L 36-46, part No. 916026 036000
19 Length of hose, part No. 201 501 38 82
20 Cap made of length of pipe
A 35 mm dia.
B 39 mm dia.



4 Close connections of gear oil cooler with plastic caps or plugs made of old oil cooler lines. For this purpose, saw off oil cooler lines directly behind nipple and close with solder.

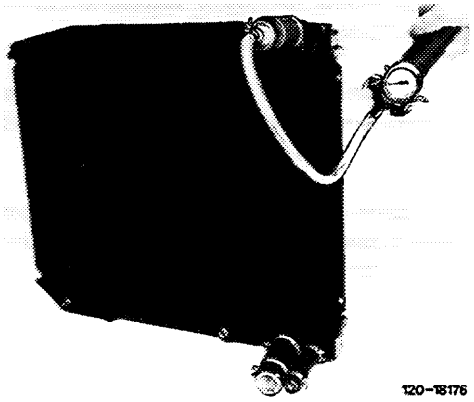
5 Connect tester to radiator.

6 Place radiator into a water bath.

7 Pressurize radiator with tester and watch where air bubbles are rising.

8 Mark leaking point.

9 Remove radiator and reduce pressure.



10 Blow radiator dry with compressed air.

11 Clean spot to be sealed with a conventional cleaning agent (e. g. Tri or bentine). Always clean a spot slightly larger than the area to be sealed (e. g. clean cracks approx. 20-30 mm beyond ends of cracks).

There is no need to remove paint. Then blow respective radiator area dry with compressed air.

There should be no more dust and grease residue.

12 Apply priming fluid with a brush uniformly and very thinly.

Similar to cleaning, apply priming fluid slightly beyond area to be sealed. To make sure that the priming fluid is not soiled in tank, pour the quantity required for repair into a separate vessel.

Attention!
Pay attention to safety rules!

13 Let priming fluid dry at ambient temperature for approx. 10 minutes.

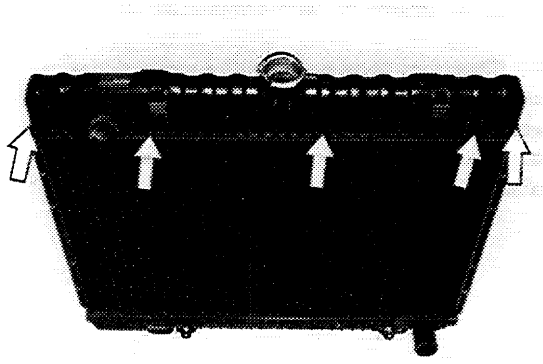
14 Position radiator in such a manner that the sealing compound cannot flow away from area to be sealed.

15 Depending on accessibility, apply sealing compound diluted or undiluted. Use brush, spatula or the like for distributing sealing compound.

Attention!
During application and distribution make sure that no air pockets will occur.

Similar to cleaning and priming, apply sealing compound beyon area to be sealed. If there are several leaking spots on beaded flange (arrows), it is recommended to seal the beaded flange all-around.

Seal leaks in core from both sides.



120-15953

At end of sealing procedure, close tube immediately. Up to complete interlacing (bonding) of sealing compound, acetic acid will be released. For this reason, avoid skin contact. Clean affected parts immediately with water and soap. Rinse eyes with water, see a doctor, if required.

16 Leave radiator alone for at least 3 hours to permit drying of sealing compound. Depending on quantity of applied sealing compound and size of spot to be sealed, complete interlacing (bonding) of sealing compound into a lasting elastic connection will be completed after max. 24 hours at ambient temperature.

17 Pressure-test radiator in water bath for approx. 5 minutes at 1.5 bar gauge pressure.

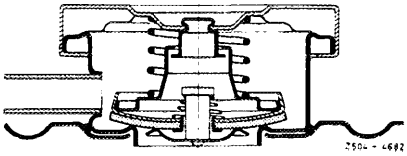
If leaks are still showing up, repeat pressure test as from item 7.

18 Remove tester and closing plugs.

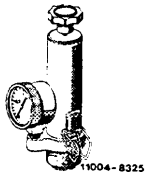
19 Upon re-installation of radiator, pressure-test cooling system with tester.

20-430 Checking expansion tank closing cap

Closing cap

Open pressure relief valve at	new radiator closing cap $1.2\ ^{+0.15}_{-0.1}$ bar gauge pressure	
	used radiator closing cap 1 .O-0.2 bar gauge pressure	
Vacuum valve opens at	0.1 bar gauge vacuum	

Special tools

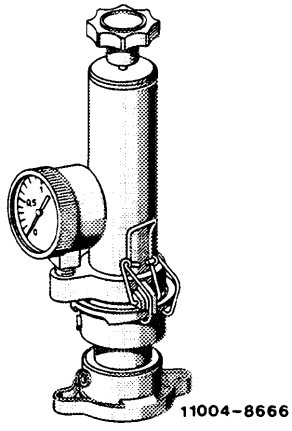
Tester for cooling system and radiator cap	 11004-8325	001 589 48 21 00
Double connection for closing cap	11004-8326	**000589736300**

Checking pressure relief valve

1 Fasten double connection to leak tester by means of holding clips.

2 Place expansion tank closing cap on double connection.

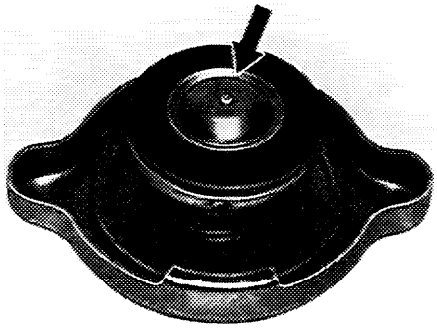
3 Check opening pressure by pumping.


11004-8666

Checking vacuum valve

Vacuum valve (arrow) should rest against rubber seal, which should permit easy lifting and should then snap back upon release.

Note: Replace corroded (slightly rusted) expansion tank closing caps.



120-14497

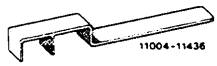
22 Engine suspension

	Job No.
Engine mounting	
Removal and installation of front engine mounts	22-211
Removal and installation of rear engine mount	212
Removal and installation of front engine stop	215
Adjusting engine stop	220
Removal and installation of engine shock absorber	240

22-211 Removal and installation of front engine mounts

Tightening torques	Nm
Screws for engine carrier on engine mount front	40
Screws for engine mount **on** front axle carrier	**25**
Screws for engine shock absorber on front axle carrier	10
Adjusting screw on front engine stop	130

Special tools

Torque wrench with plug-in ratchet, 1/2'' square, 25-130 Nm		001 589662100
Torque wrench with plug-in ratchet, 1/2'' square, 40-200 Nm		001 589 67 21 00
Gauge for adjusting front engine stop		201589042300

Note

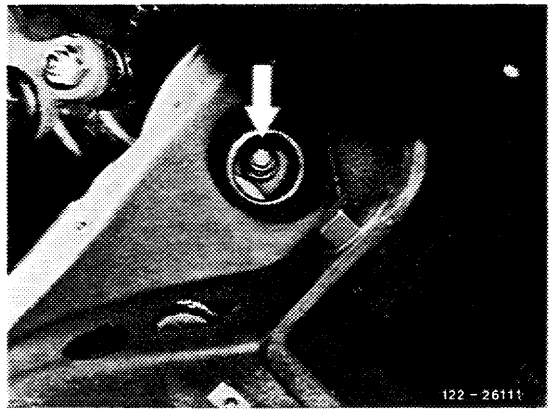
Shore hardness of engine mounts is alike.

Shielding plates are inserted between engine carriers and engine mounts.

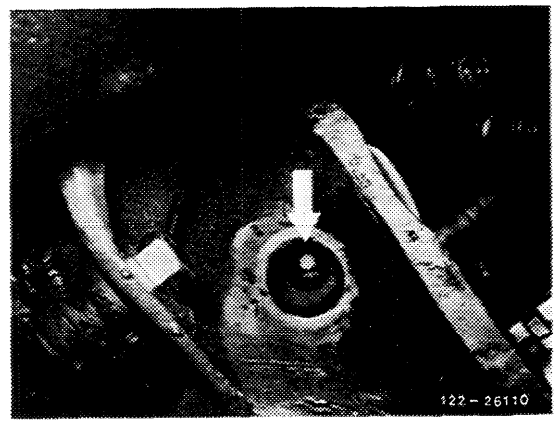
Removal

1 Remove noise capsule below.

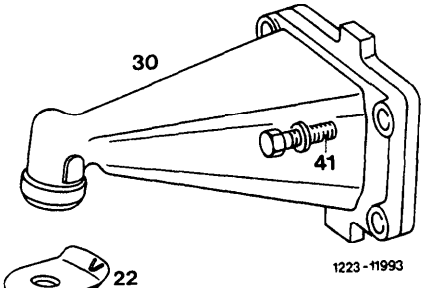
2 Unscrew hex. socket screws for engine carrier on engine mount from below (arrow).

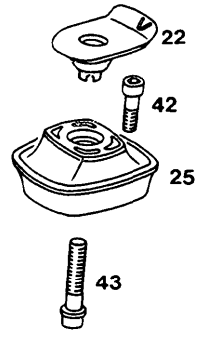


Hex. socket screw for engine carrier, right



Hex. socket screw for engine carrier, left

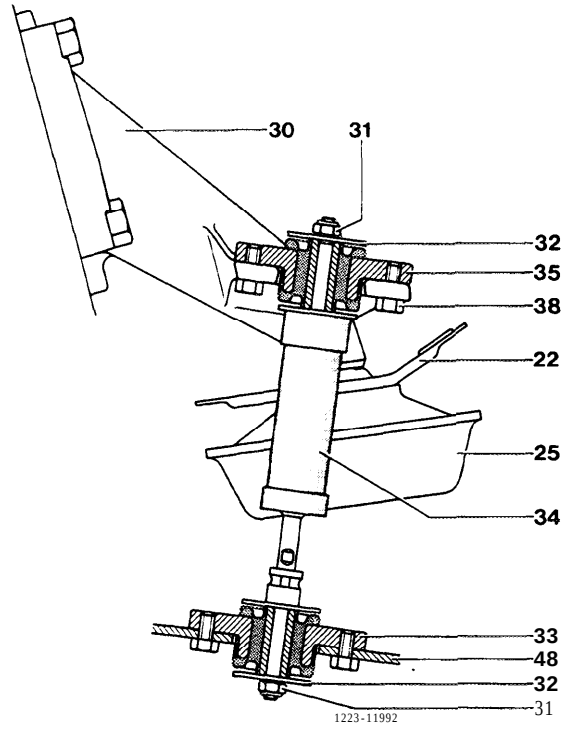




Engine carrier, right

22 Shielding plate
25 Engine mount
30 Engine carrier
41 Screw M 8 x 30
42 Combination screw M 8 x 18
43 Screw M 10 x 30

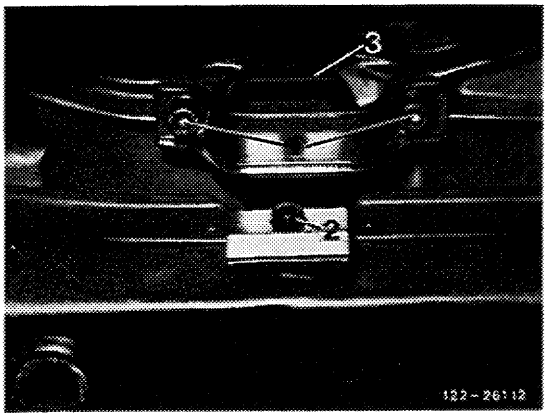
3 **Unscrew engine shock absorber below.**



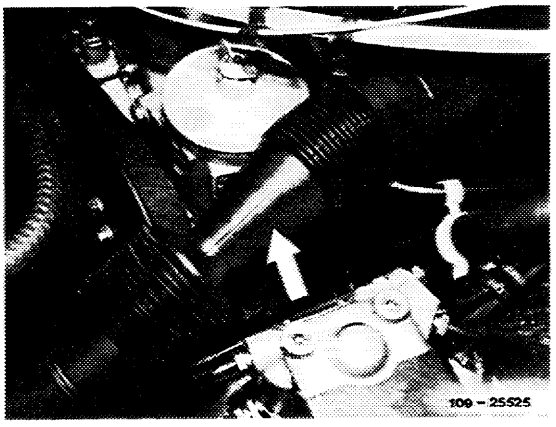
Engine carrier, left

22 Shielding plate
25 Engine mount
30 Engine carrier
31 Hex. nut M 6
32 Washer
33 Lower rubber mount
34 Engine shock absorber
35 Upper rubber mount
38 Hex. head screw M 6 x 18
48 Cross member

4 Unscrew hex. socket screws (1) for engine stop and remove holder.

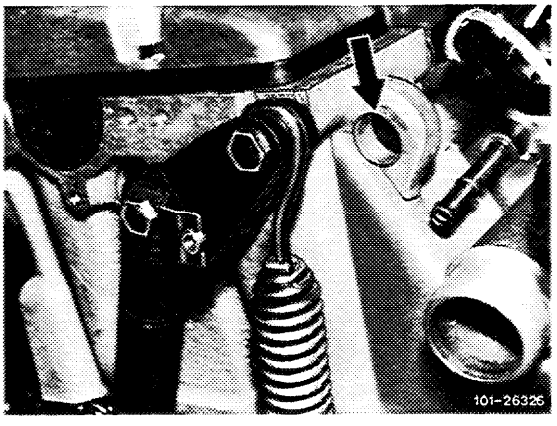


5 Remove adapter on air cleaner (arrow).



6 Attach ropes of engine hoist to front suspension eye (arrow) and lift engine with a crane.

When lifting, make sure that fan is not wiping against fan cover.



7 Remove both engine mount shielding plates.

8 Unscrew screws (42) and remove engine mounts.

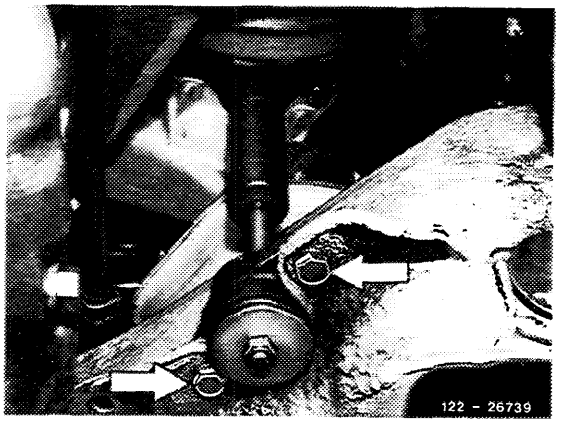
Installation

9 Install new engine mounts and screw down.

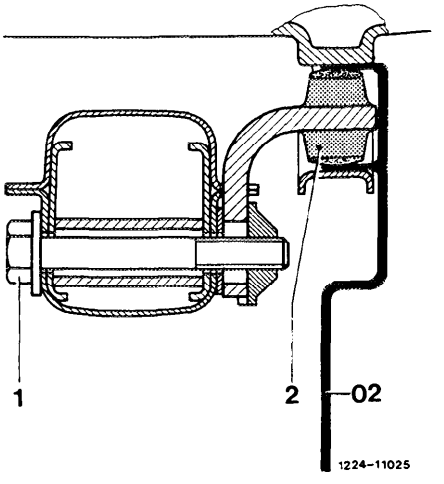
10 insert both shielding plates.

11 Lower engine and tighten hex. socket screws for engine carrier on engine mount to 70 Nm.

12 Screw engine shock absorber to front axle carrier and tighten screws to 10 Nm.



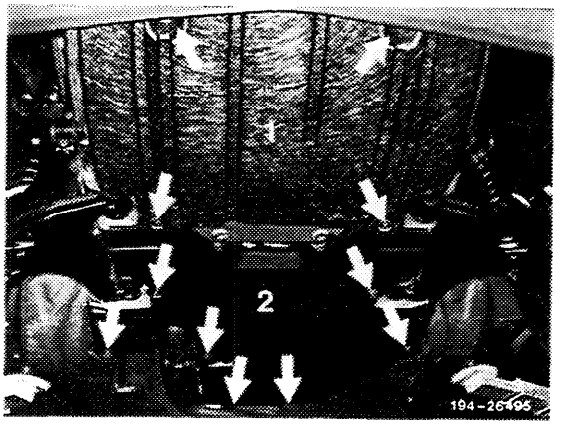
13 Mount holder for engine stop and adjust engine stop (22–220).



14 Install noise capsule.

15 Mount adapter for air cleaner.

16 Disengage engine hoist.



22-212 Removal and installation of rear engine mounts

Tightening torques	Nm
Screws for engine mounts on engine carrier	25
Adjusting screw for engine mounts	30
Nut for engine mount on transmission (reference value)	70

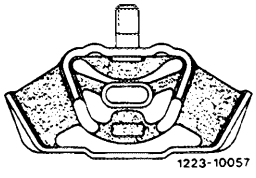
Special tool

Torque wrench with plug-in ratchet, 1/2'' square, 25-l 30 Nm		001 589 66 21 00

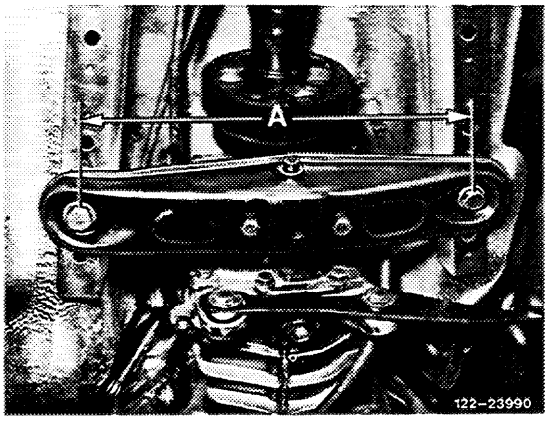
Note

An engine mount with stop is installed with all transmission versions.

B


1223-10057

The engine carriers are of different width (dimension A) depending on transmission version.



Removal

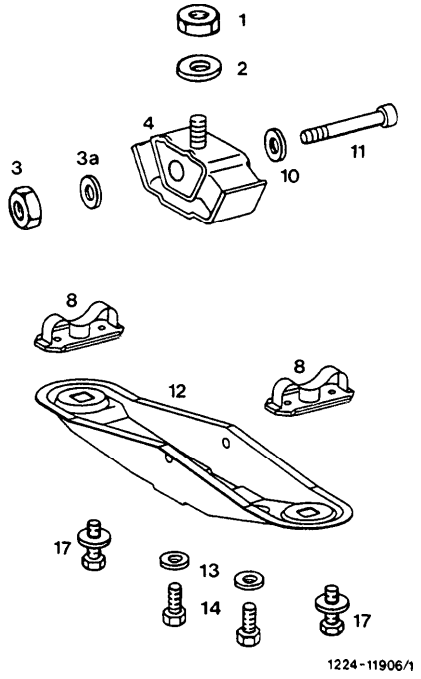
1 Remove noise capsule.

2 Unscrew nut (1).

3 Unscrew adjusting screw (11).

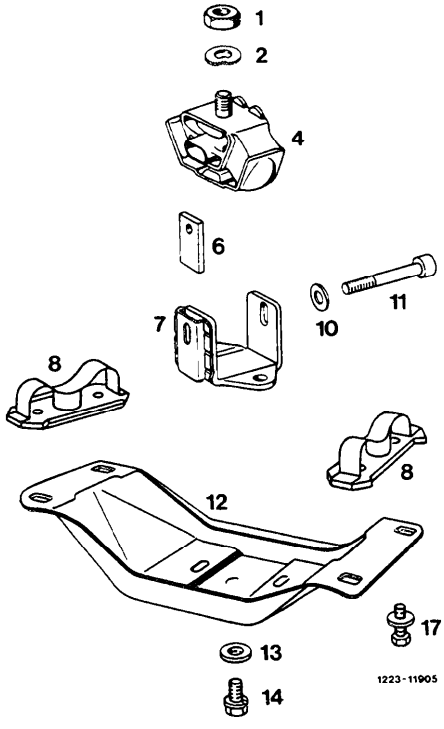
4 Unscrew screws (14).

5 Lift transmission with a pit lift and remove engine mount (4).



Vehicles with manual 4-speed or automatic transmission

1			
2	Lockwasher Nut M 12 x 1.5 B 12	10 11	Washer B 8.4 Adjusting screw
3	Nut M8	12	Engine carrier
3a	Washer 0.4	13	Washer B 8.4
4	Engine mount	14	Screw M 8 x 18
8	Cage nut	17	Combination screw M 10 x 22



Vehicles with 5-speed transmission

1	Nut M 12 x 1.5	10	Washer B 8.4
2	Lockwasher B 12	11	Adjusting screw
4	Engine mount	12	Engine carrier
6	Threaded plate	13	Washers B 8.4
7	Holder	14	Screws M 8 x 18
8	Cage nut	17	Combination screw M 10 x 22

6 On vehicles with manual 4-speed or automatic transmission, place engine mount in carrier (12) and lower transmission.

7 On vehicles with 5-speed transmission, place engine mount into holder (7).

8 Screw down engine mount with screws (14).

9 Screw on nut (1). Torque reference value 70 Nm.

10 Adjust engine stop (22–220).

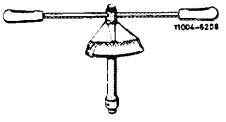
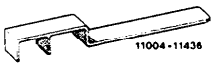
11 Mount adjusting screw (11) and tighten to 130 Nm.

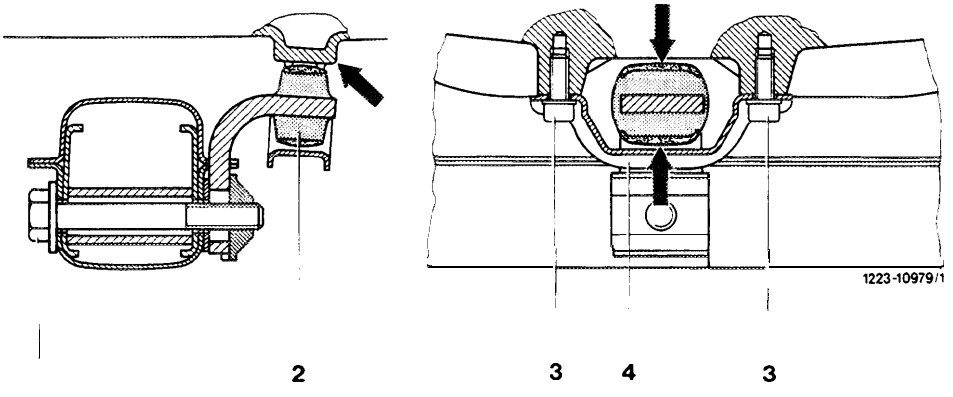
12 Install noise capsule.

22-215 Removal and installation of front engine stop

Tightening torques	Nm
Adjusting screw (1)	130
Hex. socket screws for holder on oil pan	25

Special tools

Torque wrench, double arm, 3/8" square, 8 -32 Nm		001 589 51 21 00
Torque wrench with plug-in ratchet, 1/2" square, 40-200 Nm		**001 589 67 21 00**
Gauge for adjusting front engine stop		201 589 04 23 00



1 Screw M 12 x 1.5 x 90
2 Stop clamp
3 Screws M 8 x 20
4 Clamp

Removal

1 Unscrew noise capsule.

2 Unscrew adjusting screw (1).

3 Unscrew hex. socket screws (3) and remove clamp (4) together with engine stop.

Installation

4 For installation proceed vice versa to removal.

5 Adjust engine stop (22-220).

6 Tighten hex. socket screws (3) to 25 Nm and adjusting screw (1) to 130 Nm.

7 Install noise capsule.

22-220 Adjusting engine stop

Tightening torques	Nm
Adjusting screw for front engine stop	130
Adjusting screw for rear engine mount	30

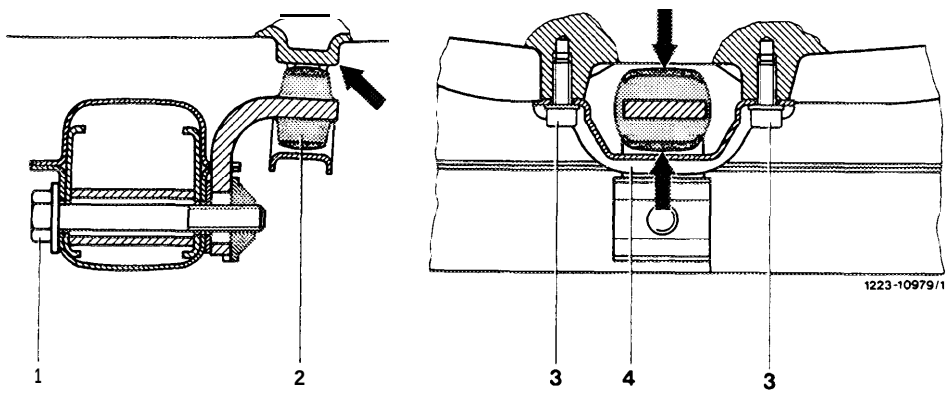
Special tools

Torque wrench with plug-in ratchet, 1/2" square, 25-l 30 Nm		001 589 66 21 00
Torque wrench with plug-in ratchet, 1/2" square, 40-200 Nm		001 589 67 21 00
Gauge for adjusting front engine stop		201 589 04 23 00

Note

Vehicle should rest on its wheels ready-to-drive.

Do not use grease or oil for engine stop.



1 Screw M 12 x 1.5 x 90
2 Stop clamp
3 Screws M 8 x 20
4 Clamp

Installation

1 Unscrew noise capsule.

2 Completely loosen adjusting screw (1) on front engine stop.

3 Loosen adjusting screw (11) on rear engine stop.

4 Insert adjusting gauge (02) on front engine stop.

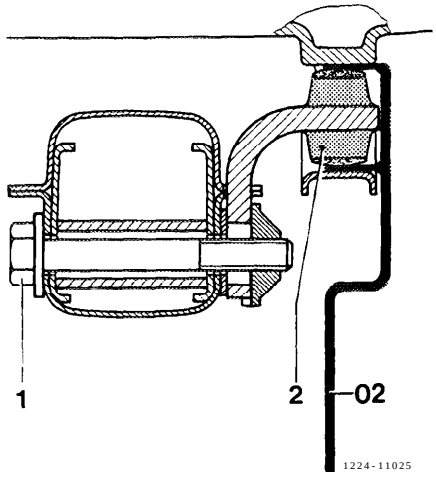
5 Move engine by lightly shaking crosswise manually.

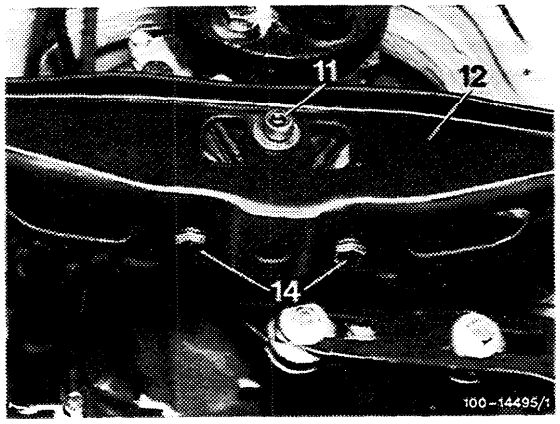
6 Tghten adjusting screw (11) on rear engine mount to 30 Nm.

7 Tighten adjusting screw (1) on front engine stop to 130 Nm.

8 Remove adjusting gauge (02).

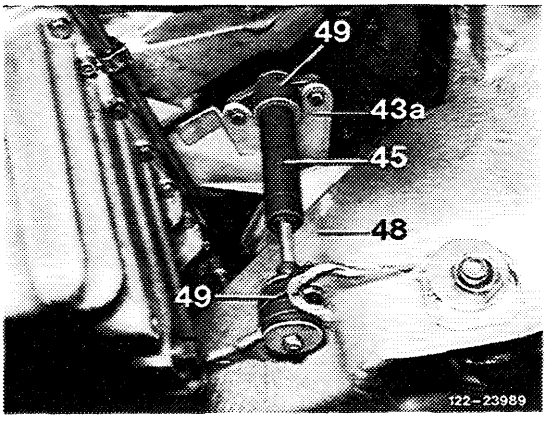
9 Install noise capsule.





Note

An engine shock absorber (45) is installed at the left on engine and side member above one rubber mount (49) each.

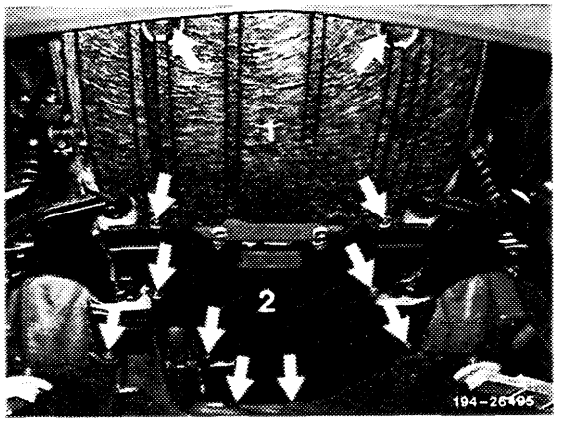


43a Engine carrier
45 Engine shock absorber
48 Side member
49 Rubber mount

Removal

1 Unscrew front noise capsule below (arrows).

2 Unscrew the two upper and lower hex. screws and remove engine shock absorber.



Installation

3 For installation proceed vice versa to removal.

30 Throttle control

	Job No.
Adjusting control linkage	30-300
Removal and installation of front wall bearing for accelerator lever	315
Removal, installation and adjustment of bowden cable	325
Removal and installation of accelerator pedal	330
Lubrication of control linkage and control shafts.	335

Adjusting value	
Length of connecting rod (204) from injection pump to transfer lever (214) [1]	146 ± 8 mm

[1]) For automatic transmission only.

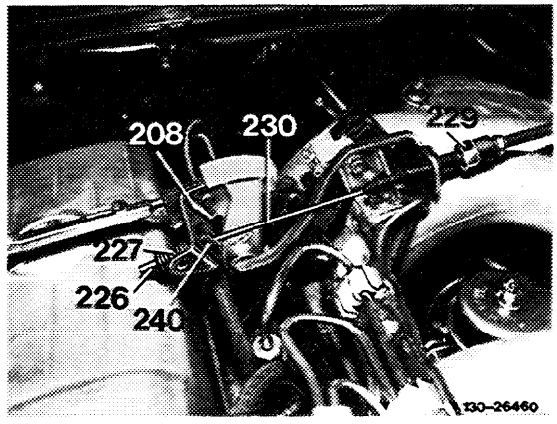
Note

Grease bearing points as well as ball sockets of linkage with Molykote Longterm 2.

Adjusting

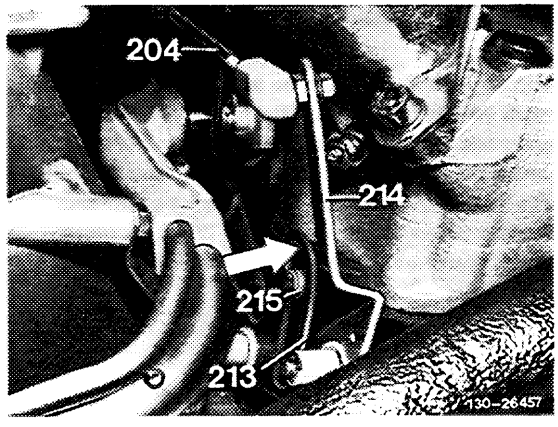
1 Check accelerator linkage for distortion, bowden cable for easy operation. Renew linkage or bowden cable, if required.

2 Disengage bowden cable (230). For this purpose, force out slotted guide piece (240) on angle lever and remove bowden cable.

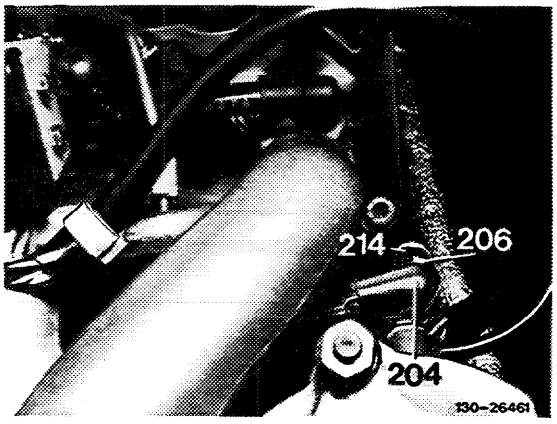


3 Vehicles with automatic transmission

Disengage connecting rod (204, adjustable) on transfer lever (214). Check whether adjusting lever of injection pump rests noticeably against idle speed stop. Engage connecting rod (204) free of tension. Make sure that roller (215) in guide block rests free of tension against end stop (arrow) and adjust, if required.



4 Pull to full load on angle lever (208), with adjusting lever of injection pump resting against full load stop. If required, displace adjustable ball head (206) in slot of transfer lever (214) and counterlock.



5 Vehicles with manual transmission

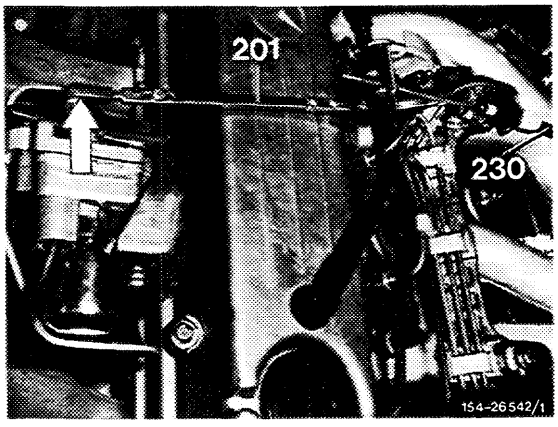
Check whether adjusting lever of injection pump rests noticeably against idle speed stop, disengage connecting rod (201) on cruise control/tempomat for this purpose.

6 Re-engage bowden cable (230).

7 Adjusting cruise control/tempomat

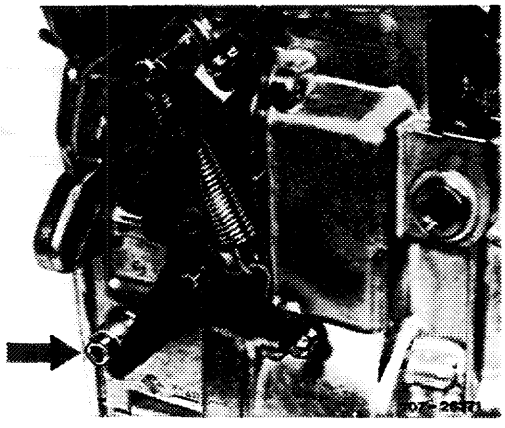
For this purpose, disengage connecting rod (201) on actuator (arrow). Push linkage into idle speed position.

Adjust connecting rod (201) in such a manner that it is 1 mm shorter than the actual max. distance. Engage connecting rod (201) and counterlock.

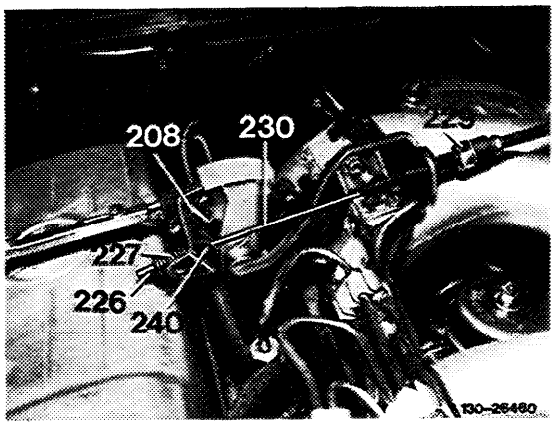


8 Checking full throttle stop

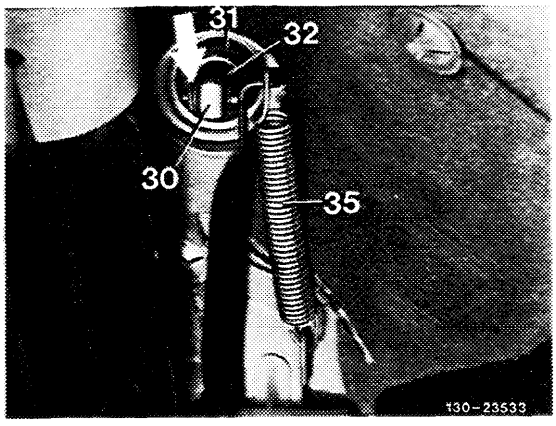
With engine stopped, step on accelerator pedal from inside vehicle down to full throttle stop or with automatic transmission down to stop on kickdown switch. Adjusting lever (arrow) should then noticeably rest against full load stop. Check by applying excess pressure to connecting rod (204). Readjsut adjusting screw (229) on bowden cable, if required.



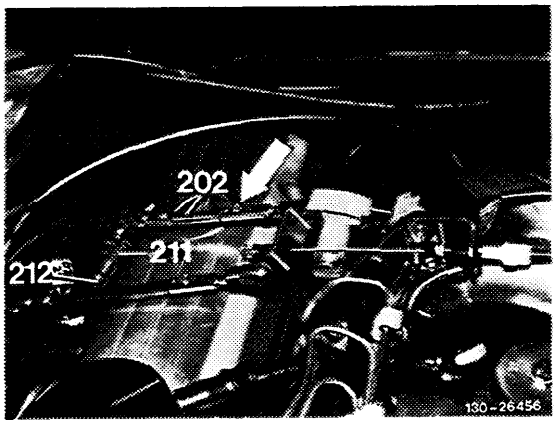
9 In idle position, nipple (226) of bowden cable (230) should rest free of tension against compression spring (227). If required, adjust bowden cable (230) from inside vehicle by means of adjusting nut (232).

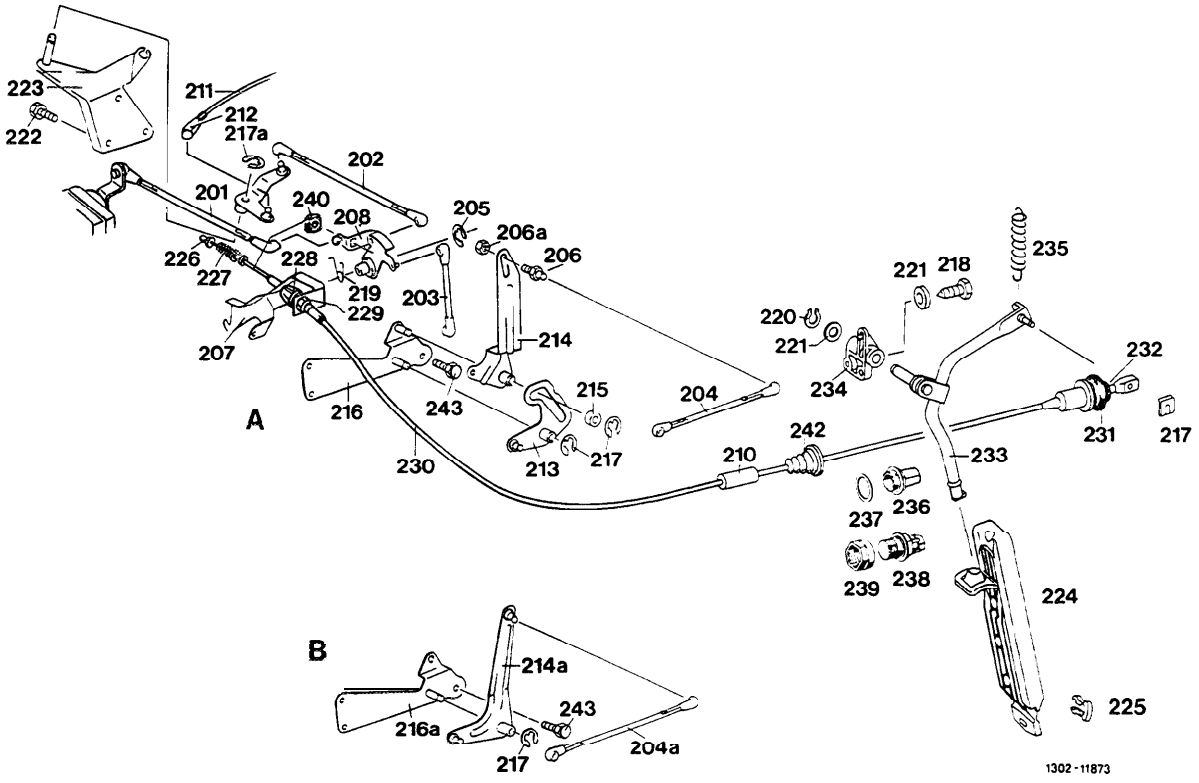


Attention!
Apply full throttle and let accelerator pedal slowly return to idle speed position. In this position, the roller in slotted lever should rest free of tension against end stop. Correct adjustment from inside vehicle with adjusting nut (232), if required.



10 Adjust control pressure cable, pushing off ball socket (212) for this purpose. Pull idle travel rod (202) apart up to stop. Pull control pressure cable (211) forward until slight resistance is felt. In this position, hold ball socket (212) above ball head and engage free of tension, adjusting idle travel rod (arrow), if required.





201	Connecting rod	215	Roller	229	Adjusting screw
202	idle travel rod	216	Holder automatic transmission	230	Bowden cable
203	Connecting rod	216a	Holder (manual transmission)	231	Rubber grommet
204	Connecting rod (automatic transmission)	217	Lock	232	Adjusting nut
204a	Connecting rod (manual transmission)	217a	Lock	233	Accelerator lever
205	Lock	218	Screw	234	Front wall bearing
206	Ball head	219	Spring	235	Return spring
206a	Nut	220	Lock	236	Full throttle stop
207	Holder	221	Washer	237	Washer
208	Regulating lever	222	Nut	238	Kickdown switch
210	Antichaf ing hose	223	Holder	239	Adjusting nut
211	Control pressure cable for automatic transmission	224	Accelerator pedal	240	Guide piece
212	Ball socket	225	Clip	242	Sealing sleeve
213	Slotted lever	226	Nipple	243	Screw
214	Transfer lever	227	Compression spring		
214a	Transfer lever (automatic transmission)	228	Plastic clip		

30-315 Removal and installation of front wall bearing for accelerator lever

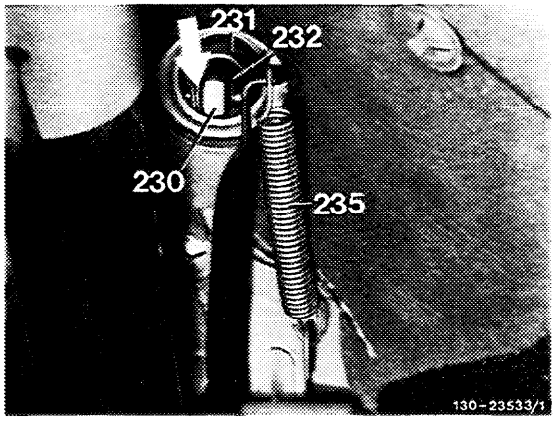
Removal and installation

1 Remove accelerator pedal (30–330).

2 Unscrew cover.

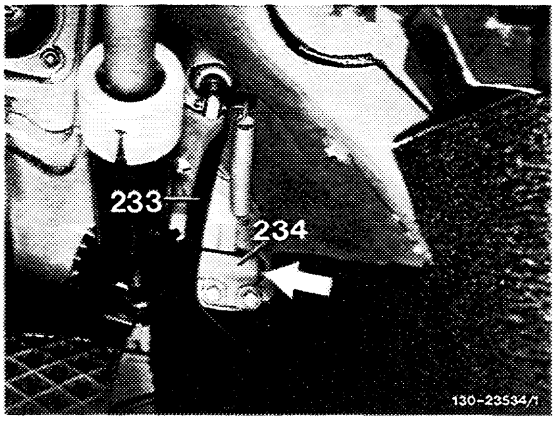
3 Remove bowden cable (230). Pull off lock (arrow) for this purpose.

4 Unscrew front wall bearing (234) and remove together with accelerator lever (233).



5 Disengage return spring (235).

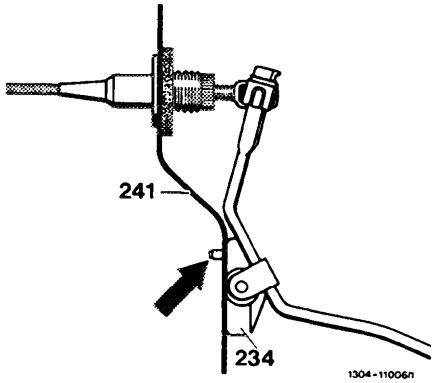
6 Remove front wall bearing (234) from accelerator lever (233). Pull off lock (arrow) for this purpose.



Installation note

Make sure that the lug (arrow) of front wall bearing (234) engages in bore on front wall (241).

Check regulating linkage and adjust, if required (30–300).

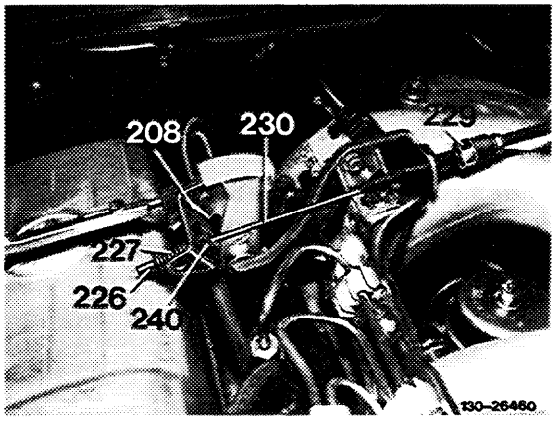


Removal and installation

1 Disengage bowden cable (230) on control lever (213). Compress and push out guide piece (arrow) for this purpose.

2 Slightly lift angle lever (208) and remove slotted guide piece (240) on angle lever.

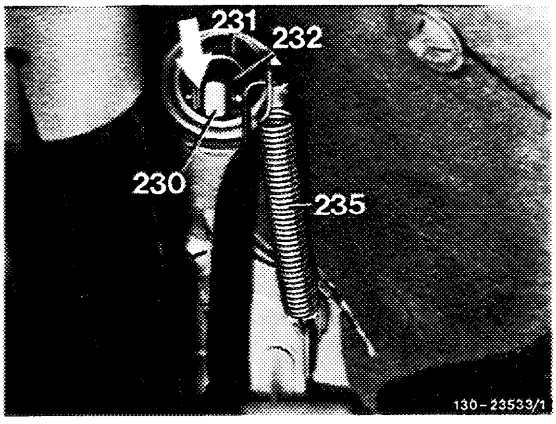
3 Compress black plastic clip (228) and remove bowden cable.



4 Remove lock (arrow) for bowden cable (230) inside vehicle.

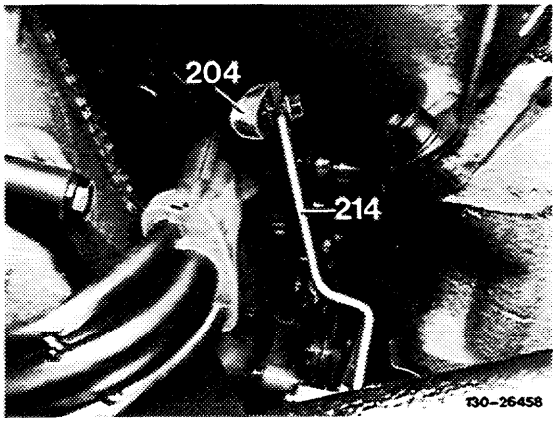
5 Push bowden cable (230) in outward direction. Make sure that the rubber buffer (231) is not pushed out.

6 Remove complete bowden cable from outside between front wall and accessories compartment wall.

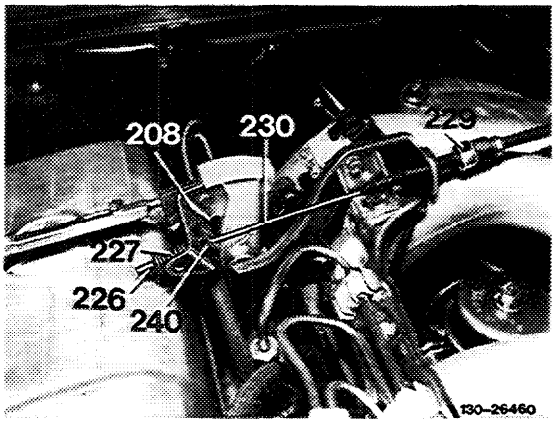


Adjusting

7 Check whether transfer lever (214) rests noticeably against inner idle speed stop of injection pump and adjust control linkage, if required (30–300).

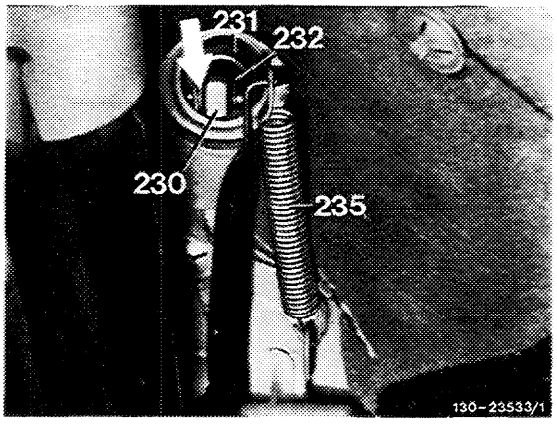


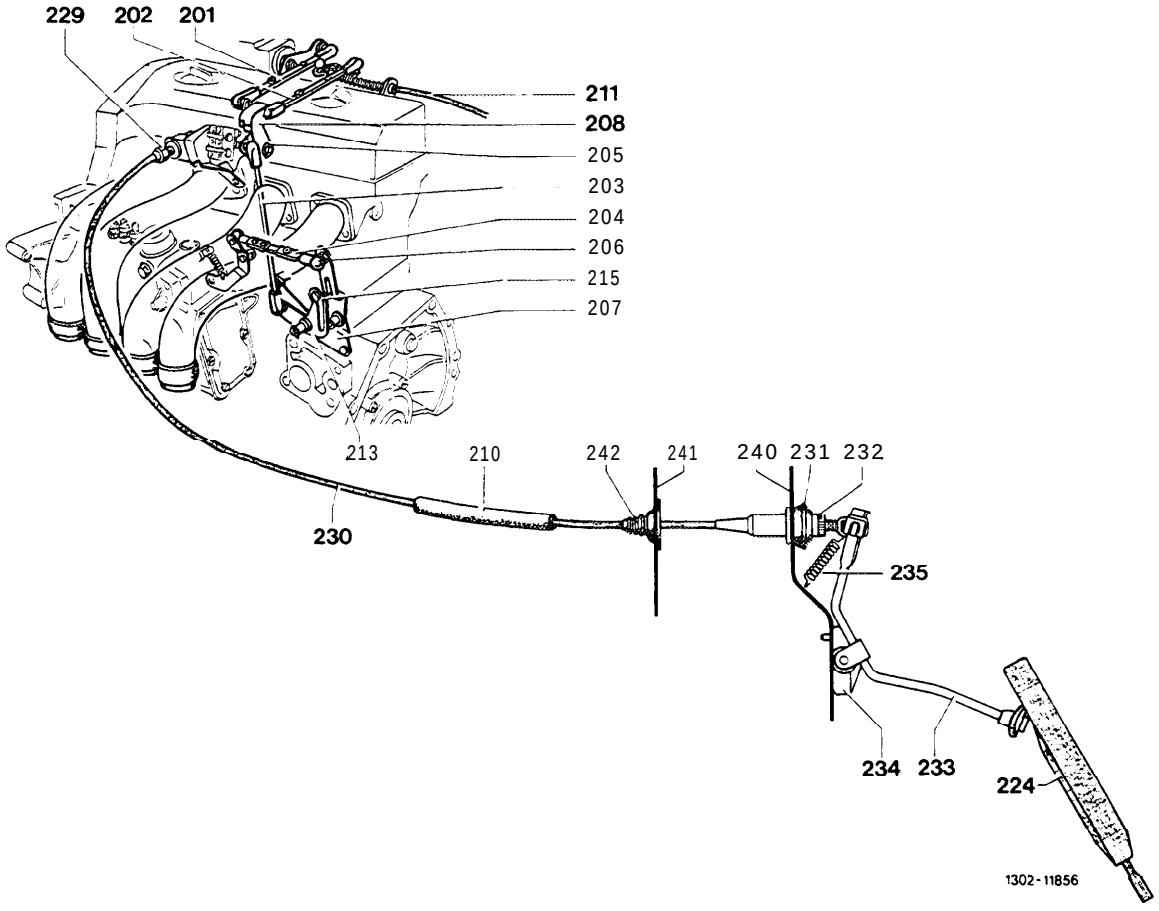
8 With engine stopped, step on accelerator pedal from inside vehicle down **to full load stop** or **with automatic transmission** down to stop on kickdown switch. Adjusting lever should then rest against full load stop of injection pump. Readjust adjusting screw (229) on bowden cable, if required.



9 Let accelerator pedal slowly return to idle speed position. In this position, roller in slotted lever should rest free of tension against end stop. If required, adjust bowden cable (230) with adjusting nut (232) from inside vehicle.

There should be no idle travel between nipple and spring following adjustment.





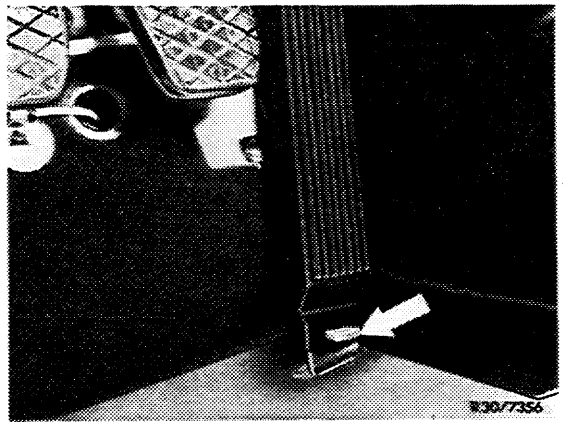
201 Connecting rod
202 Idle travel rod
203 Connecting rod
204 Connecting rod
205 Lock
206 Ball head
207 Holder
208 Angle lever
210 Anti-chafing hose

211 Control pressure cable control for automatic transmission
213 Slotted lever (automatic transmission only)
215 Roller
224 Accelerator pedal
229 Adjusting screw
230 Bowden cable

231 Rubber grommet
232 Adjusting nut
233 Accelerator pedal
234 Front wall bearing
235 Return spring
240 Front wall
241 Unit compartment wall
242 Sealing sleeve

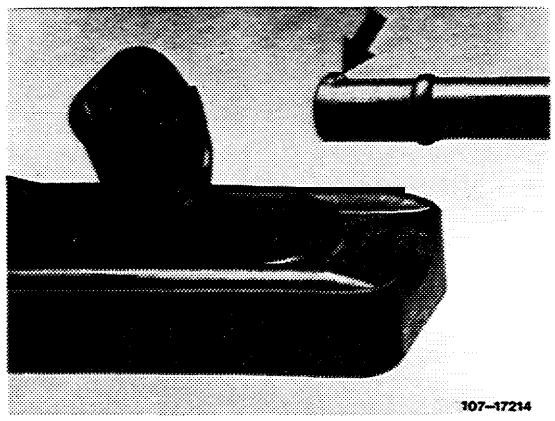
Removal

1 Compress expanding clip (arrow) behind accelerator pedal and pull out.



2 Slide accelerator pedal in upward direction and rotate by 180°.

3 Pull accelerator pedal down, lug (arrow) on accelerator lever should be in alignment with groove in accelerator pedal.



Installation

4 For installation proceed vice versa, making sure that the expanding clip is reliably engaging.

The connection from accelerator lever to accelerator pedal requires no service and need not be lubricated.

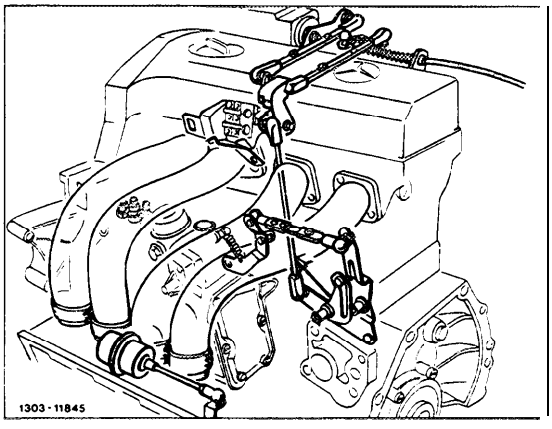
Lubricating

Following each engine wash and preservation of engine compartment, lubricate all bearing points, all control levers and joints of control linkage with an oil can.

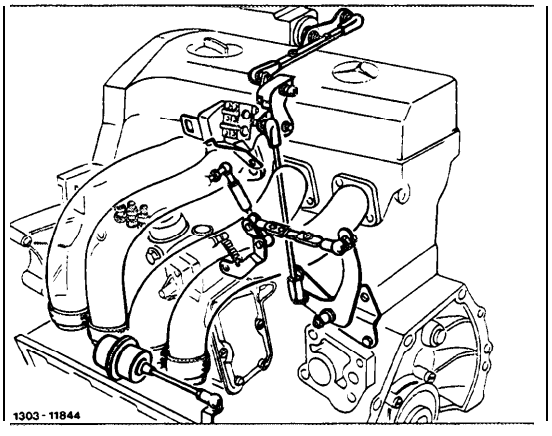
On USA version vehicles, use the following hydraulic oils only for this purpose.

BP-Aero-Hydraulik 1
Castrol DB Hydraulik Fluid
Esso Univers J-13
Mobil Aero HFA
Shell Aero Fluid 4

The bowden cable requires no service and need not be lubricated.



Layout manual transmission



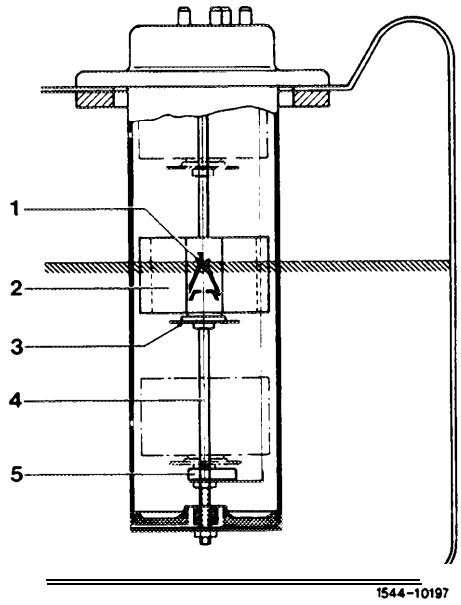
Layout automatic transmission

47 Fuel system

	Job No.
Operation of immersion tube transmitter for fuel readout	47-020
Operation of fuel tank positive and negative venting	030
Removal and installation of fuel tank	100
Removal and installation of immersion tube transmitter	120

When fuel level drops, the slide contact (1) on float (2) of immersion tube transmitter increases the resistance value, voltage is reduced and the indicating needle in instrument will therefore move back.

When fuel level drops still further, the reserve warning contact (5) in immersion tube transmitter, which switches to reserve warning lamp, is closed.

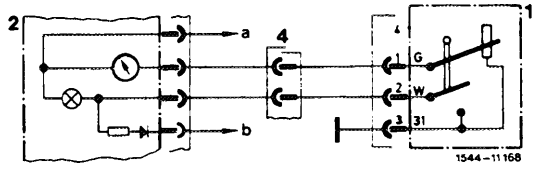


1 Slide contact
2 Float
3 Contact plate
4 Guide and contact rod
5 Reserve warning contact

The reserve warning contact lights up with ignition switched on (control function). Lamp will go out the moment the engine starts, provided there is more fuel in fuel tank than the reserve.

Note: During control function, the reserve warning lamp lights weaker, for reserve stronger.

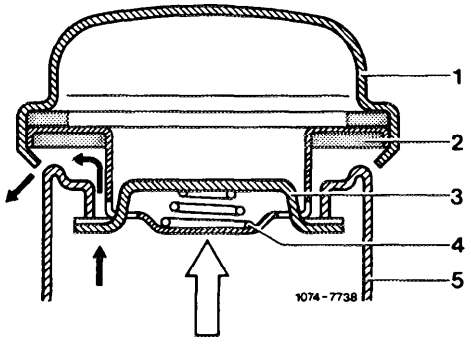
Check fuel readout (54-269).



1 Immersion tube transmitter
2 Fuel gauge
4 Cable connector
a To terminal 15
b To terminal 61

Closing cap

At a gauge pressure of 100-300 mbar the fuel evaporation vapors can escape through closing cap.

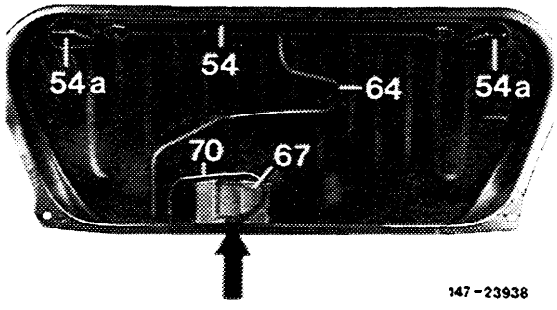


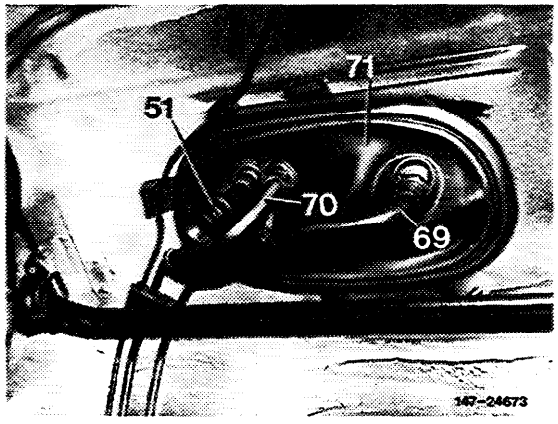
1 Closing cap
2 Sealing ring
3 Closing clip
4 Compression spring
5 Filler neck

Vent system

The vent system comprises a central tube (54) with one check vessel (54a) each at ends. The vent line (64) runs from central tube downward through fuel tank. The vent valve is plugged on at end of vent line (64).

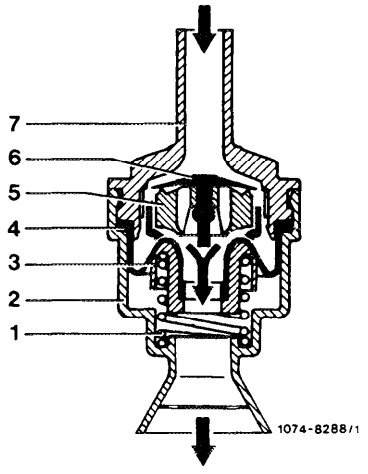
The steadying bowl (67) is installed on vehicles with gasoline injection engines only.





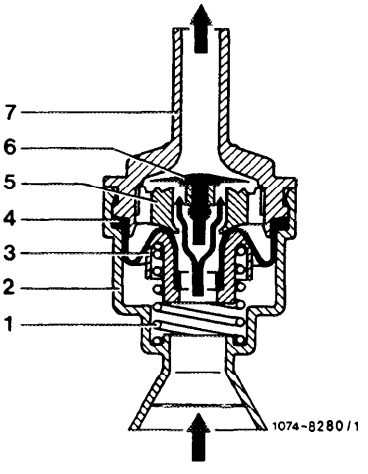
51 Vent valve
69 Suction hose
70 Return hose
71 Gasket

The vent valve permits establishing a pressure of 30-50 mbar in fuel tank. With a vacuum in fuel tank, the vent opens at l-l 6 mbar vacuum.



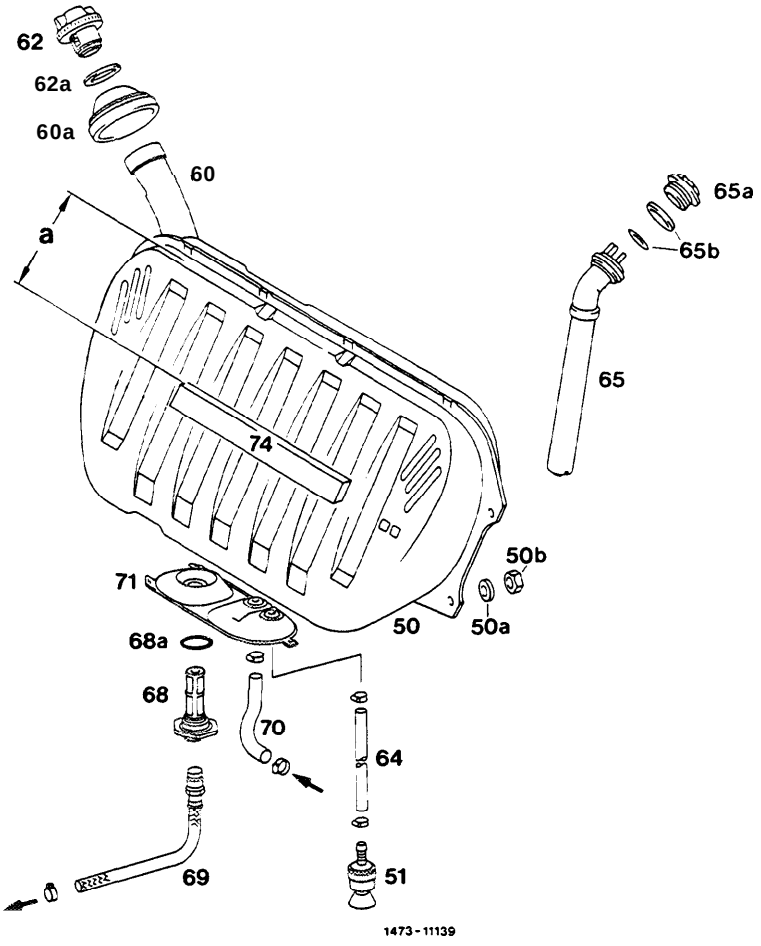
Vent valve opened at overpressure (gauge pressure)

1 Compression spring
2 Valve housing
3 Spring retainer
4 Negative vent valve
5 Valve plate
6 Positive vent valve
7 Connection



Vent valve opened at underpressure (vacuum)

47-I 00 Removal and installation of fuel tank

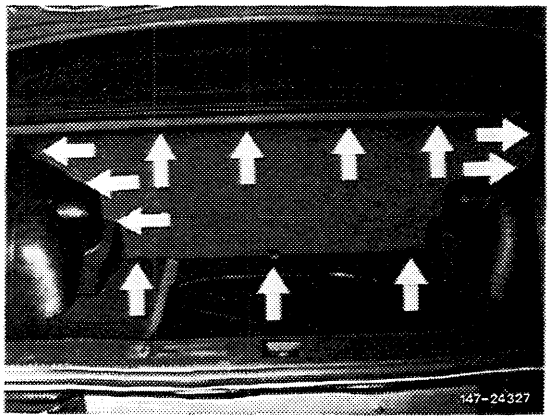


50	Fuel tank	.....	Pump off fuel (item 2)
50a	Washer, 4 each.	.....	Use large washers (risk of tearing)
50b	Nut, 4 each	.....	21 Nm
51	Vent valve		
60	Filler neck		
60a	Sealing sleeve.	.....	Pay attention to correct seat
62	Closing cap		
62a	Sealing ring		
64	Vent line		
65	Immersion tube transmitter		
65a	Sealing flange	.....	39 Nm
65b	Sealing rings	.....	Renew
68	Fuel filter.	.....	Clean, check for re-use, 39 Nm
68a	Sealing ring.	.....	Renew
69	Feed line	.....	Check for reuse, 28 Nm
70	Return line	.....	Check for re-use
71	Gasket	.....	Pay attention to correct seat on rear floor
74	Damping shim	.....	Item 9a
a	190 + 5 mm		

Filling capacities in liters

Full readout	approx. 55
Warning lamp — reserve	approx. 7.5

Attention!
When removing fuel tank, pay attention to safety rules.



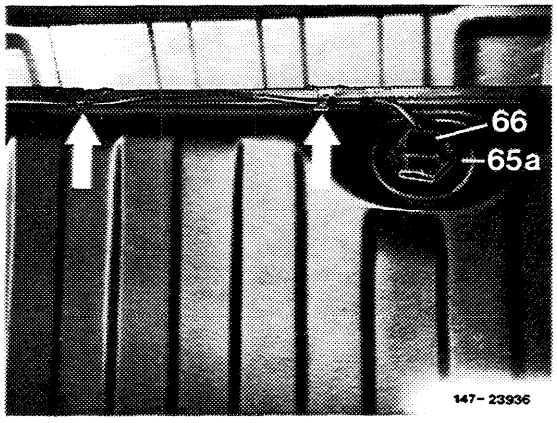
Removal

1 **Disconnect ground connecting line on battery.**

2 Drain fuel tank. Carefully pump off fuel, so that no residue remains in fuel tank.

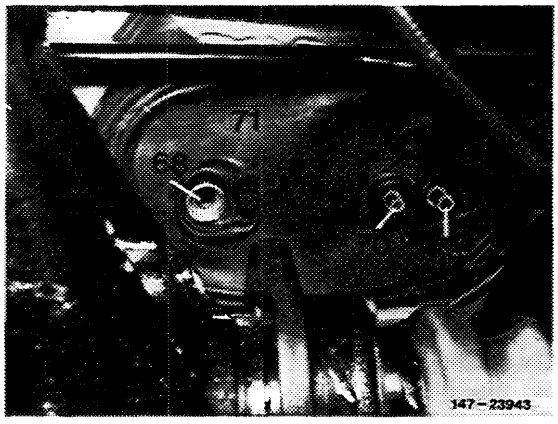
3 Loosen or disengage lining for fuel tank first below, then laterally and then on top (arrows). Remove trunk mat for this purpose.

4 Pull coupling (66) for fuel gauge from immersion tube transmitter. Disengage cable harness on holding clamps (arrows).



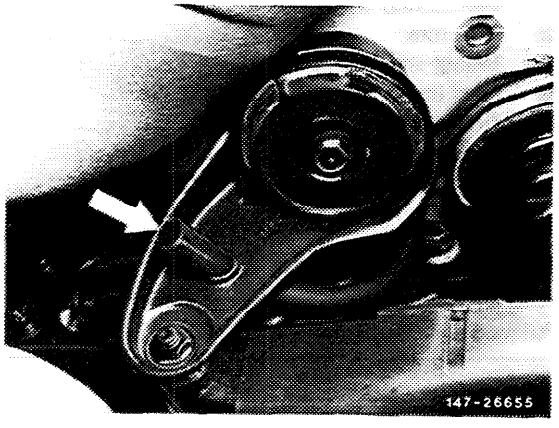
5 Loosen all connections on fuel tank and pull gasket (71) from pipe connection and fuel filter.

Note: Catch residual fuel, close lines and connections.

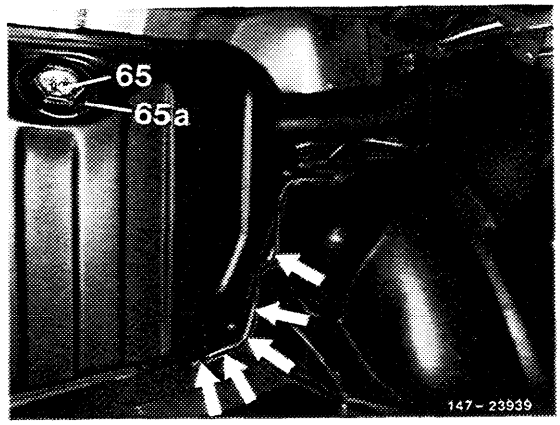


64 Vent line
68 Fuel filter
70 Return line
71 Gasket

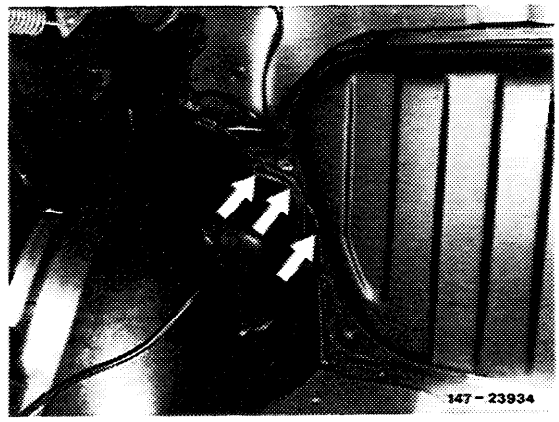
6 Slide back drain hose (arrow) for approx. 5 cm.



7 Unscrew fastening nuts for fuel tank and pull out drain hose (arrows) in upward direction in such a manner that hose can be installed behind edge of fuel tank. Slightly lift fuel tank for this purpose.



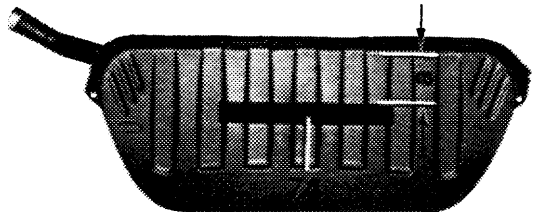
8 Lift fuel tank over side panelling (arrows) at the left.



Installation

9 Install fuel tank in vice versa sequence, paying attention to the following:

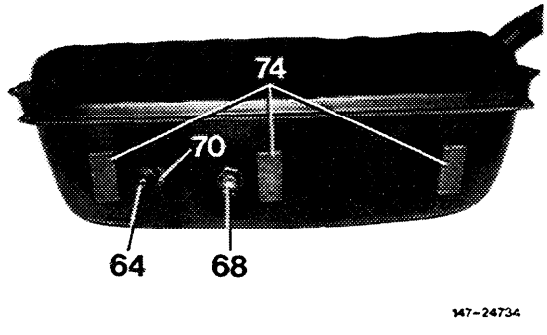
a) Check whether damping shims (74) are well fastened on fuel tank. Glue down with MB-Universal Glue, part no. 000 989 92 71, if required.



a 190^{+5} mm

b) Plug on coupling for fuel gauge and check for function. Engage cable harness in holding clamps provided.

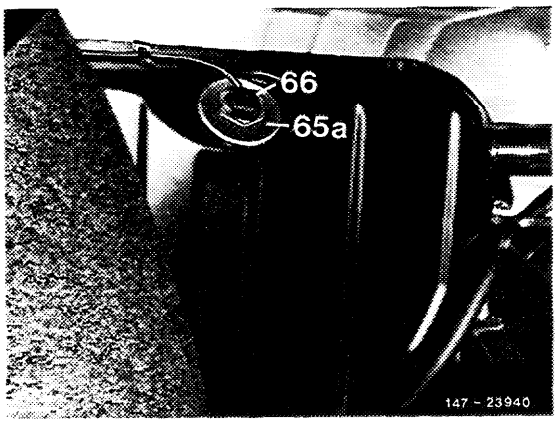
c) Check for leaks.



Tightening torque	Nm
Immersion tube transmitter	35-43

Note

Prior to removing immersion tube transmitter, pump off approx. 8 liters fuel from full fuel tank.



Removal

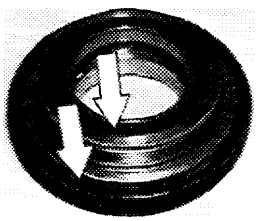
1 **Loosen or disconnect lining for fuel tank at first below, then laterally and on top.**

2 Pull coupling (66) for fuel gauge from immersion tube transmitter.

3 Unscrew sealing flange (65a).

4 Pull out immersion tube transmitter first in upward direction, then toward the rear. Let immersion tube transmitter run empty, if required.

Installation



147-23634

5 For installation proceed vice versa, paying attention to the following:

a) Renew both sealing rings (arrows).

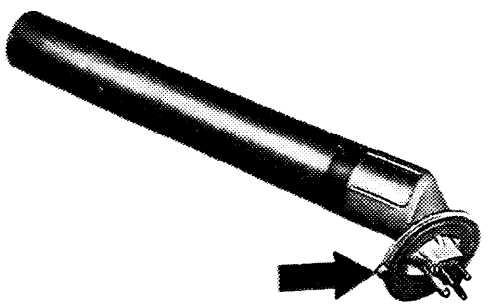
b) Prior to installation of immersion tube transmitter, remove locking pin.

c) Plug on coupling and check fuel gauge for function.

d) Insert immersion tube transmitter with lug (arrow) in downward direction into fuel tank.

e) Tighten sealing flange to 35-43 Nm.

f) Check for leaks.



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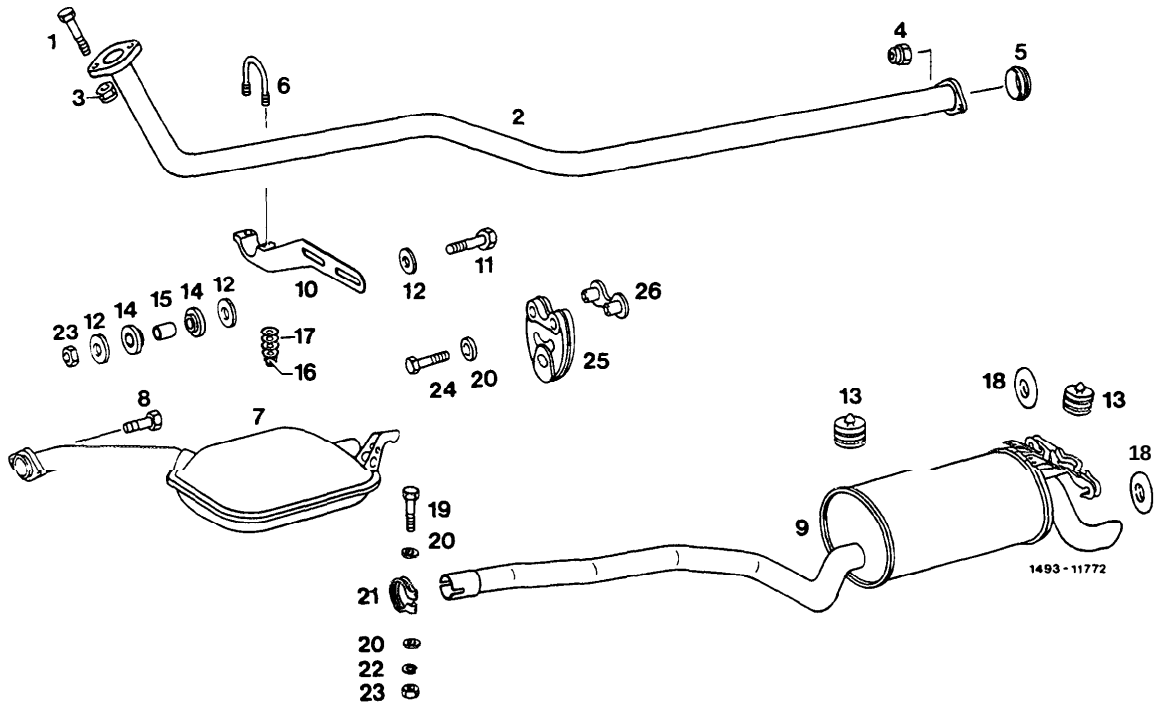
49 Exhaust system

	Job No.
Removal and installation of exhaust system	49-100



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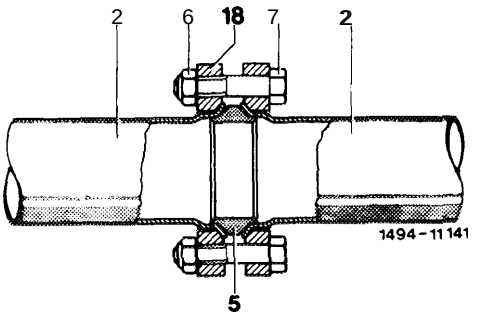
22	[illegible]	.....	[illegible]
23	[illegible]	.....	[illegible]
24	[illegible]	.....	[illegible]
25	[illegible]	.....	Check [illegible]

26 Clamping plate

Removal

1

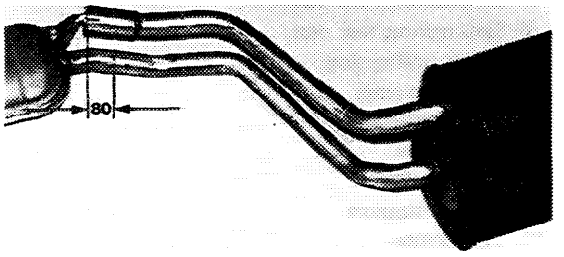
2 sure that the flange for exhaust manifold is not distorted and align flange, if required. Clean cone connections of pipes (2 22), if required, with



Installation

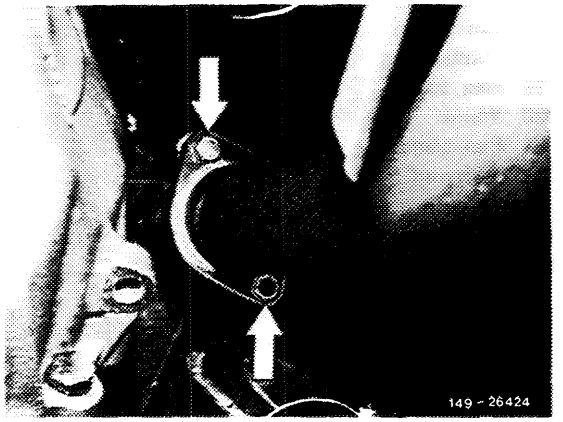
3 Place new rear muffler with plug connection accurately above removed system and mark pipe length of new rear muffler on removed installation.

Cut pipe 80 mm from mark (tolerance minus 10 mm) in direction of rear muffler to obtain a plug-in depth of 70-80 mm.

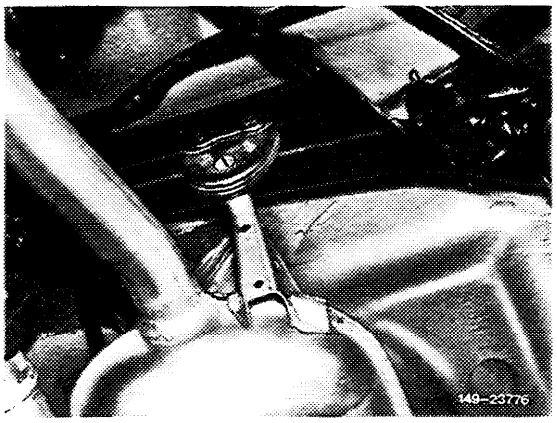


4 Always renew self-locking hex. nuts on principle.

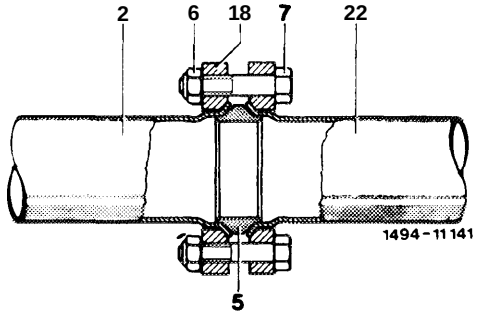
5 Uniformly tighten flange connection to manifold. Tightening torque of self-locking nuts 20 Nm.



6 Mount rear exhaust system with center and rear muffler, while simultaneously engaging exhaust system in mounting rubber on rear axle carrier.

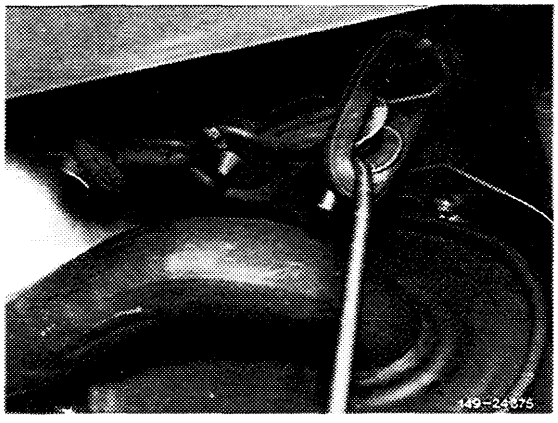


7 Mount sinter-sealing ring (5) on flange connection and pay attention to correct seat. Tightening torque of self-locking hex. nuts 20 Nm.



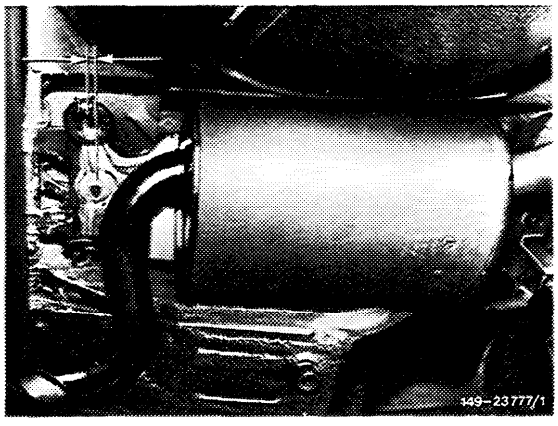
2 Front exhaust pipe
5 Sinter-sealing ring
6 Self-locking hex. nut
7 Hex. screw
18 Flange
22 Rear exhaust pipe

8 Engage rubber rings with suitable hooks to rear damper.



9 Mount rear damper in such a manner that the holding clamp of the rear damper is approx. 10 mm in front of holders on frame floor, so that the correct installation position is assured (arrows) in the event of an elongation of exhaust system.

Note: The above refers to mufflers in repair version with plug connection between center and rear muffler only.



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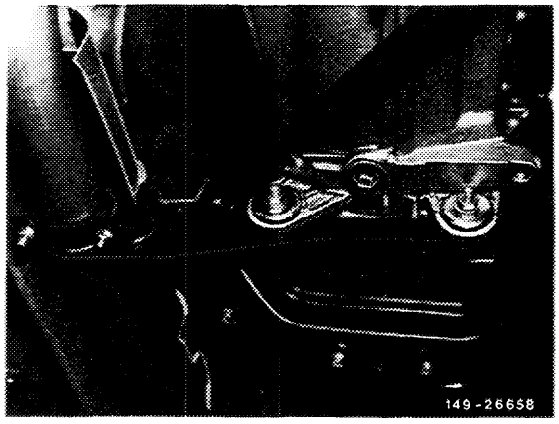

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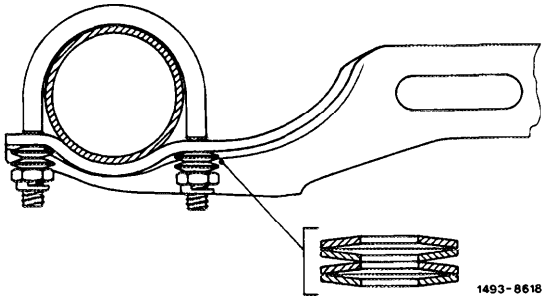

Mercedes-Benz

Service

Service Manual
Diesel Engines 602, 603

Mercedes-Benz of North America, Inc. · Montvale, NJ 07645

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Part number LZ S-2517-091

Introduction

This service manual is the product of existing technical publications. Special care has been taken to provide accurate information on removal, disassembly, inspection, installation, and adjustment procedures, together with the necessary technical data for the particular job.

The material in this manual is divided according to the Mercedes-Benz Component Group System as outlined on the GROUP INDEX page. This page will quickly direct the reader to the Major Component Group. Each Major Component Group begins with a JOB INDEX listing all jobs within that group.

Mercedes-Benz of North America, Inc. recommends that repairs to, and maintenance of Mercedes-Benz automobiles be performed by **trained Mercedes-Benz personnel** at authorized Mercedes-Benz dealerships.

The information contained in this special publication is ordinarily issued by Mercedes-Benz of North America, Inc., in conjunction with supplementary service literature and special tools supplied **only** to its authorized dealers. The repair and maintenance procedures outlined herein are intended for use by **trained Mercedes-Benz service and dealership personnel.** This manual can also be useful for Mercedes-Benz owners in diagnosing vehicle systems and performing repairs. Supplementary service literature will not be provided with this publication, but may be contained in reprints of this service manual.

Please note that this manual has been compiled from various sources, some of which cover models other than the subject of this book. Always refer to the engine and vehicle identification table for model and component information.

Special tools required in performing certain service jobs are identified in the manual and are recommended for use. Any part numbers given are only used for identification and easier differentiation between individual components, and are not intended for ordering purposes.

If your Mercedes-Benz model differs from the specifications contained in the manual you select, consult your authorized Mercedes-Benz dealer.

All procedures, illustrations and specifications contained in this manual were based on the latest information available at the time of publication. All rights are reserved to make production, design and specification changes at any time, without notice and without obligation to give notice. Any such changes will not be contained in this manual.

Caution!

The proper performance of service and repair procedures is essential for both the safety of the mechanic and the safe and efficient operation of the vehicle. The use of incorrect service procedures and tools may greatly increase the risk of personal injury and render the vehicle unsafe. The procedures in this manual are described in such **a** manner that the service may be performed safely and accurately.

However, it is a general assumption that the reader is familiar with basic automotive repair procedures and Mercedes-Benz vehicles. You should not attempt to use this manual if this is not the case.

Mercedes-Benz of North America, Inc. assumes no liability for any damage to person or property caused by the utilization of this publication to effect maintenance or repair work on Mercedes-Benz automobiles.

MERCEDES-BENZ OF NORTH AMERICA, INC.
Service and Parts Literature

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Vehicle identification number locations	– 015
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Complete Service Manual coverage for late model year Mercedes-Benz vehicles requires four individual manuals:

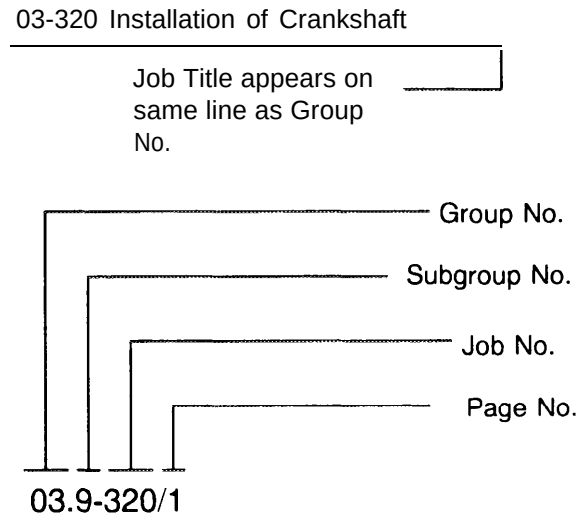
Service Manual, Engine
Service Manual, Chassis and Body
Service Manual, Automatic Climate Control
Electrical Troubleshooting Manual

Throughout these manuals, the vehicles are identified by their chassis and engine numbers. These numbers are made up of the first six digits of the respective serial number. For the actual location of chassis and engine numbers, see page 00-015/1. In cases where the repair instructions apply to all versions, only the first three digits of the respective number are referenced.

For example, chassis 124 applies to all 124 models. However, chassis 124.128 would apply only to model 3000 2.5 Turbo.

Location of specific repair instructions

First locate the Group No. in the Group Index. Individual groups are separated by an easily visible dividing page, which is followed by the job index page. The exact job required is found in the job index. The initial page of a typical job description appears as follows:



Technical data, tightening torques and tools are listed at the beginning of each job.

All dimensions are in metric units unless otherwise indicated. Any part numbers given are only used for identification and differentiation between individual components, and are not intended for ordering purposes.

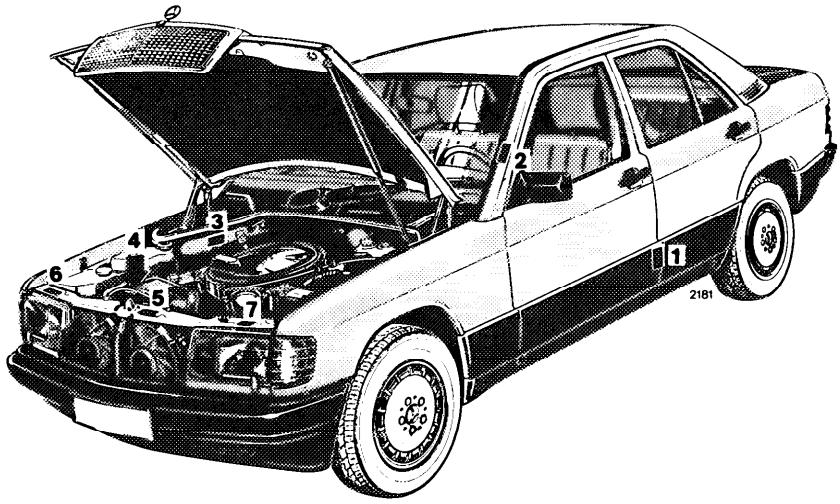
Special Instructions

⚠ **Warning**	Appears throughout service instructions indicating the possiblity of personal injury if procedures are not followed.
Caution!	Indicates possible equipment or vehicle damage if procedures are not followed.
Note	Provides helpful information for the described procedure.
Installation note	Provides detailed information during assembly.

Model Year	Model	Sales designation	Engine
1986	201.126	190 D 2.5	602.911
	126.125	300 SDL Turbo (Federal)	603.961
	126.125	300 SDL Turbo (California)	603.961
1987	201.126	190 D 2.5	602.911
	201.128	190 D 2.5 Turbo (Federal)	602.961
	124.133	300 D Turbo	603.960
	124.193	300TD Turbo	603.960
	126.125	300 SDL Turbo	603.961
1988	201.126	190 D 2.5 (Federal)	602.911
1989	201.126	190 D 2.5 (Federal)	602.911
1990	124.128	300 D 2.5 Turbo (Federal)	602.962
	126.135	350 SDL Turbo (Federal)	603.970
1991	124.128	300 D 2.5 Turbo (Federal)	602.962
	126.134	350 SD Turbo (Federal)	603.970
	126.135	350 SDL Turbo (Federal)	603.970

Model 201

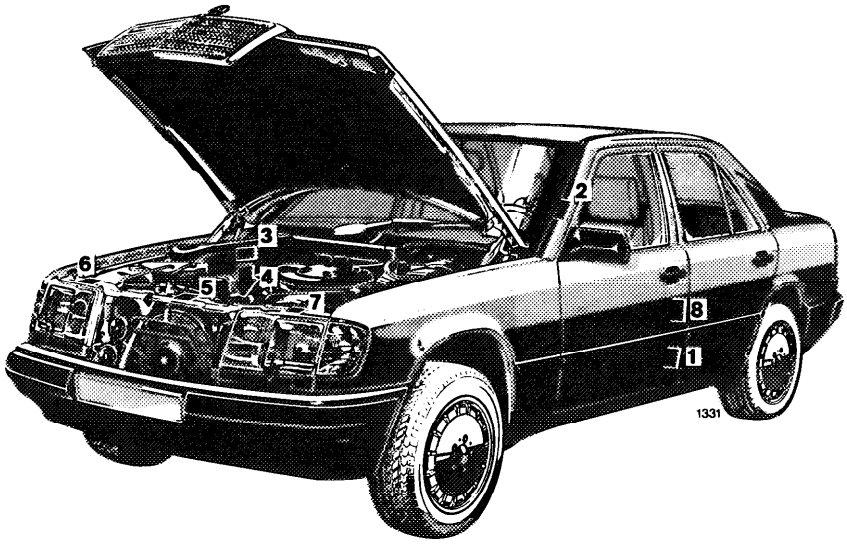
When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left windshield post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag

Model 124

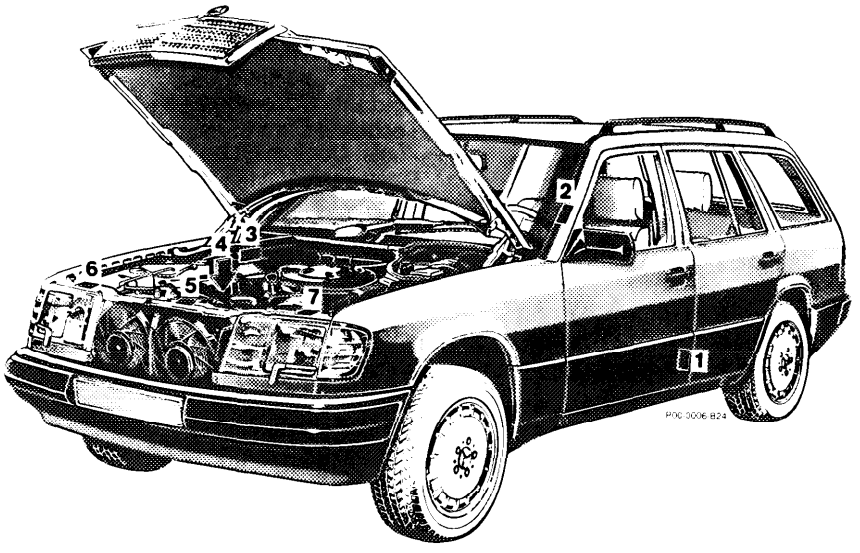
When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Information Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag
8 Emission Control Tag
Catalyst Information

Model 124 T

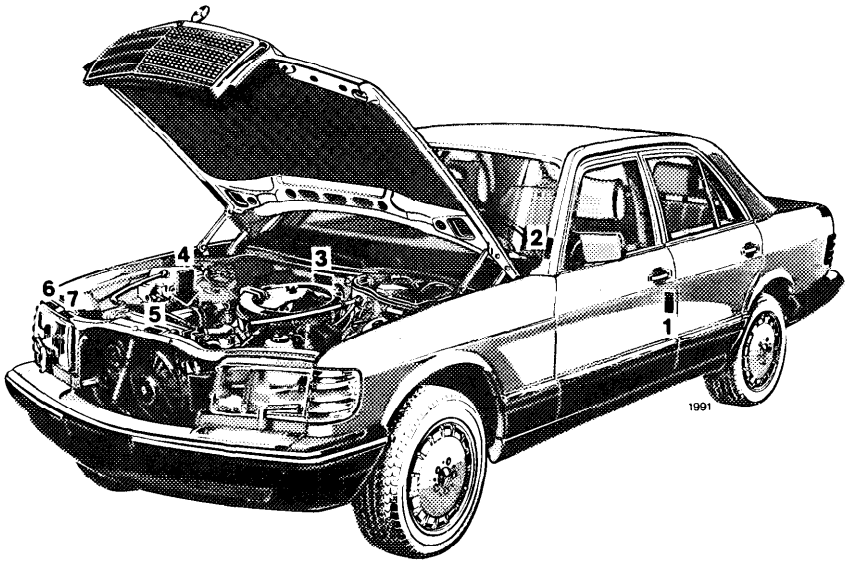
When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left windshield post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Informatron Tag
California version
Vacuum line routing for emission control system
7 Emission Control Tag

Model 126

When ordering spare parts, please specify chassis and engine numbers.



1 Certification Tag (left door pillar)
2 Identification Tag (left window post)
3 Vehicle Identification No.
4 Engine No.
5 Body No. and Paintwork No.
6 Emission Control Tag
7 Informatron Tag
California version
Vacuum line routing for emission control system

Diesel engines

Model	201.126	201.128	124.128	124.133 / 124.193
Sales designation	190 D 2.5	190 D 2.5 Turbo (Federal)	300 D 2.5 Turbo (Federal)	300 D Turbo 300 TD Turbo
Engine	602.911	602.961	602.962	603.960
Operation	4-cycle diesel, MB prechamber design	4-cycle diesel, MB prechamber design	4-cycle diesel, MB prechamber design	4-cycle diesel, MB prechamber design
Aspiration	Normal	Turbo	Turbo	Turbo
Number of cylinders	5	5	5	6
Cylinder arrangement	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination
Bore/stroke mm	87.0/84.0	87.0/84.0	87.0/84.0	87.0/84.0
Total effective piston displacement cc	2497	2497	2497	2996
Compression ratio	22.0 : 1	22.0 : 1	22.0 : 1	22.0 : 1
Firing order	1-2-4-5-3	1-2-4-5-3	1-2-4-5-3	1-5-3-6-2-4
Maximum speed rpm	5150 ± 150	5150 ± 150	4600 ± 50	5150 ± 150
Engine output (SAE)kW/rpm net bhp/rpm	69/4600 93/4600	92/4600 123/4600	90/4600 120/4600	107/4600 143/4600
Maximum torque Nm/rpm net lb-ft./rpm	165/2800 122/2800	228/2400 168/2400	223/2400 164/2400	265/2400 195/2400
Crankshaft bearings	6(multi-component, anti-friction bearings)	6 (multi-component, anti-friction bearings)	6 (multi-component, anti-friction bearings)	7 (multi-component, anti-friction bearings)
Valve arrangement	Overhead	Overhead	Overhead	Overhead
Camshaft arrangment	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft
Oil cooling	-	Oil-to-air cooler	Oil-to-air cooler	Oil-to-air cooler
Cooling	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator
Lubrication	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump
Oil filter	Full flow filter	Combination full flow and bypass filter	Combination full flow and bypass filter	Combination full flow and bypass filter
Air cleaner	Dry paper cartridge	Dry paper cartridge	Dry paper cartridge	Dry paper cartridge

Gasoline engines

Model	126.125	1126.125	126.134 /.135
Sales designation	300 SDL Turbo (Federal)	300 SDL Turbo (California)	350 SD / SDL Turbo (Federal)
Engine	603.961	603.961	603.970
Operation	4-cycle diesel, MB prechamber design	4-cycle diesel, MB prechamber design	4-cycle diesel, MB prechamber design
Aspiration	Turbo	Turbo	Turbo
Number of cylinders	6	6	6
Cylinder arrangement	In-line 15° inclination	In-line 15° inclination	In-line 15° inclination
Bore/stroke mm	87.0184.0	87.0/84.0	89.0/92.4
Total effective piston displacement cc	2996	2996	3449
Compression ratio	22.0 : 1	22.0 : 1	22.0 : 1
Firing order	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4
Maximum speed rpm	5150 ± 150	5150 ± 150	4250 ± 50
Engine output (SAE)kW/rpm net bhp/rpm	11 0/4600 14814600	1071'4600 143/ 4600	100/4000 133/4000
Maximum torque Nm/rpm net lb-ft./rpm	27312400 20112400	265/2400 195/2400	3 1 0/2000 22812000
Crankshaft bearings	7 (multi-component, anti-friction bearings)	7 (multi-component, anti-friction bearings)	7 (multi-component, anti-friction bearings)
Valve arrangement	Overhead	Overhead	Overhead
Camshaft arrangment	1 overhead camshaft	1 overhead camshaft	1 overhead camshaft
Oil cooling	Oil-to-air cooler	Oil-to-air cooler	Oil-to-air cooler
Cooling	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator	Coolant circulating pump, thermostat with bypass line, fan with visco fan clutch, finned tube radiator
Lubrication	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump	Pressure lubrication via gear type pump
Oil filter	Combination full flow and bypass filter	Combination full flow and bypass filter	Combination full flow and bypass filter
Air cleaner	Dry paper cartridge	Dry paper cartridge	Dry paper cartridge

Filling capacities

Model	201.126	201.128 (Federal)	124.128 (Federal)	124.133, 124.193	126.125 (Federal)
Sales designation	190 D 2.5	190 D 2.5 Turbo	300 D 2.5 Turbo	300 D Turbo 300 TD Turbo	300 SDL Turbo
Engine	602.911	602.961	602.962	603.960	603.961
Fuel tank/reserve approx. l	55/7.0	55/7.0	70/9.0	70/9.0 72/10.0	90/12.5
Engine oil initial filling approx. l	8.0	8.2	8.2	9.2	9.2
During oil and filter change approx. l	7.0	7.5	7.0	8.0	8.0
Marks on dipstick max./min. approx. l	5.5/3.5	6.0/4.0	6.0/4.0	6.5/4.5	6.5/4.5
Oil-to-air cooler with hoses	-	0.7	0.7	1.1	0.65
Cooling system with heater approx. l	8.0	8.0	9.0	10.0	12.5

Filling capacities (continued)

Model	126.125 (California)	126.134 /.135 (Federal)
Sales designation	300SDL Turbo	350 SD Turbo 350 SDL Turbo
Engine	603.961	603.970
Fuel tank/reserve approx. l	90/12.5	90/12.5
Engine oil initial filling approx. l	9.2	9.2
During oil and filter change approx. l	8.0	7.5
Marks on dipstick max./min. approx. l	6.5/4.5	6.5/4.5
Oil-to-air cooler with hoses	0.65	0.65
Cooling system with heater approx. l	10.0	10.0

Electrical system

Model	**201.126**	**201.128** (Federal)	124.128 (Federal)	124.133, **124.193**	**126.125 (Federal)**
Sales designation	190 D 2.5	190 D 2.5 Turbo	300 D 2.5 Turbo	300 D Turbo 300 TD Turbo	300 SDL Turbo
Engine	602.911	**602.961**	602.962	603.960	603.961
Battery Voltage Capacity	12 v 62 Ah (M.Y. 1986) 92 Ah (from M. Y. 1987)	**12 v** **92 Ah**	12 v	12 v 92 Ah	12 v 92 Ah
Starter Bosch	12 v 2.2 kW	12 V 2.2 kW	12 V	12V 2.2 kW	12 v 1.5 kW
Alternator	14 V 70 A	14 V 70 A	14 V 70 A	14 V 70 A	14V 80A

Electrical system

Model	126.125 (California)	126.134./.135 (Federal)
Sales designation	300SDL Turbo	350 SD Turbo 350 SDL Turbo
Engine	603.961	603.970
Battery Voltage Capacity	12 v 62 Ah	12 v 62 Ah
Starter Bosch	12 v 2.2 kW	12 v 1.7 kW
Alternator	14 V 70 A	14V 80A

Crankcase and Cylinder Head 01

Job No.

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Evaluating cylinder bores	– 020
Removal and installation of engine (oil capacity)	– 030
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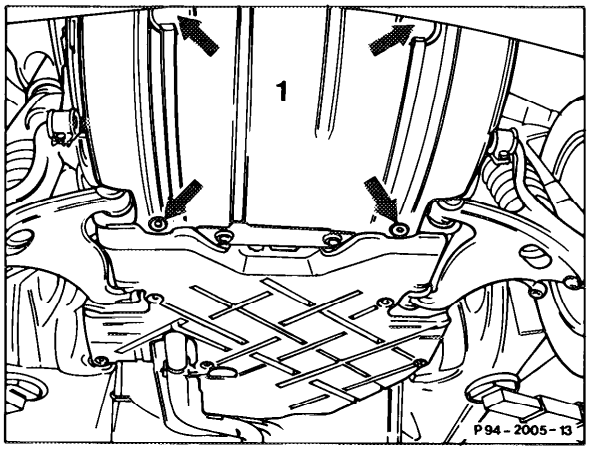
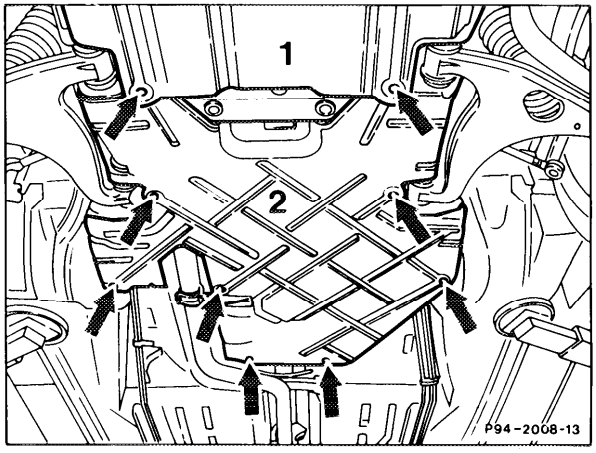
01-001 Engine and model survey

Engine version	Vehicle model	Sales designation	ε	No. Cyl.	Displacement (cm^3)	Bore / Stroke	output (SAE) Kw(hp)/rpm	Torque (SAE) Nm/rpm (net lb.-ft/rpm)
602.911	201.126	190 D 2.5	22.0	5	2497	84.0 / 87.0	6914600 (93 / 4600)	165 / 2800 (12212800)
602.961 Federal	201.128	190 D 2.5 Turbo	22.0	5	2497	84.0 187.0	92 / 4600 (12314600)	22812400 (16812400)
602.962 Federal	124.128	300 D 2.5 Turbo	22.0	5	2497	84.0 187.0	90 14600 (120 / 4600)	223 / 2400 (164 / 2400)
603.960	124.133 124.193	300 D Turbo 300 TD Turbo	22.0	6	2996	84.0 187.0	107 / 4600 (14314600)	265 / 2400 (195 / 2400)
603.961 Federal	126.125	300 SDL Turbo	22.0	6	2996	87.0 / 84.0	110 / 4600 (148 / 4600)	273 / 2400 (201 / 2400)
603.961 California	126.125	300 SDL Turbo	22.0	6	2996	87.0 184.0	107 / 4600 (143 / 4600)	265 / 2400 (195 / 2400)
603.970 Federal	126.134 126.135	350 SD Turbo 350 SDL Turbo	22.0	6	3449	89.0 / 92.4	100 / 4000 (133 / 4000)	310 / 2000 (228 / 2000)



Noise capsule at bottom of engine compartment, front (1)



Noise capsule at bottom of engine compartment, rear (2)

Noise capsule, front and rear (1, 2) . . . . . Remove sheet metal screws (arrows), reinstall and remove capsule, install.

Note
Install engine compartment capsule so that edges of side part of capsule engage in bottom part of capsule.

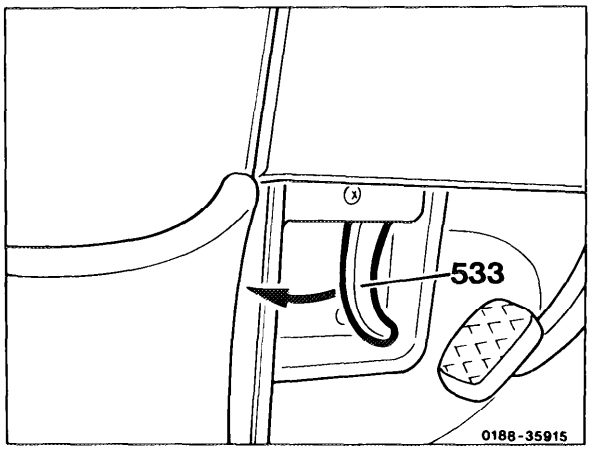
01-008 Opening hood, setting vertical, warnings

⚠Warning
There is risk of injury whenever the engine is running and the hood is open.

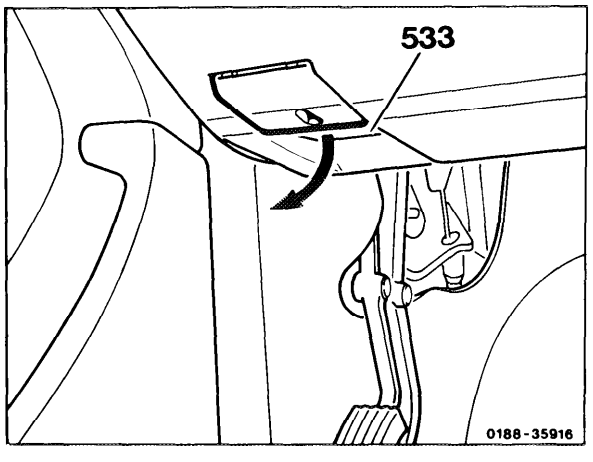
Opening hood

1 To unlock the hood, pull the lever (533) on the left below the instrument panel in the direction of the arrow. The hood opens to the safety hook stop.

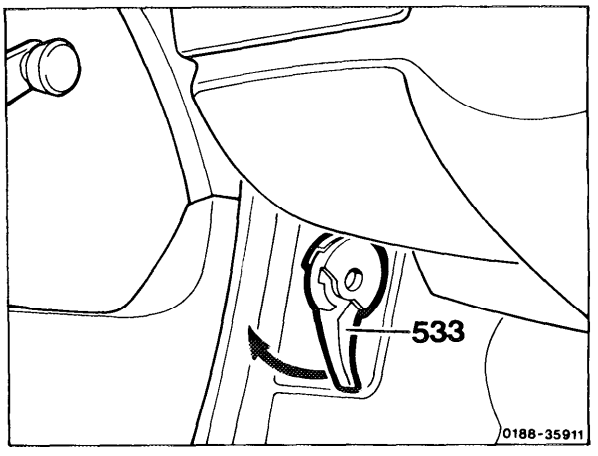
Model 126



Model 124



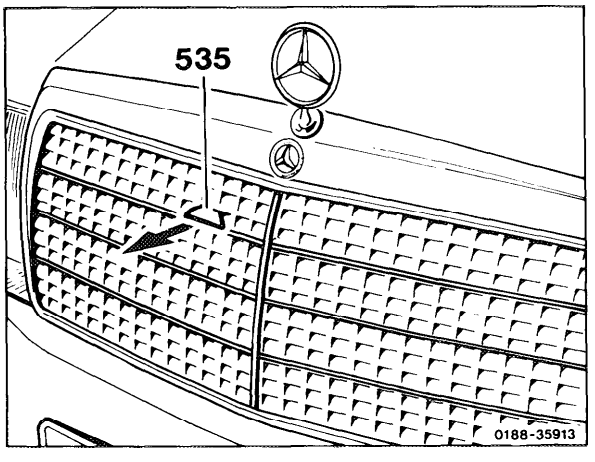
2 Close hood by pushing down forcibly.



Model 201

Model 124, 126, 201

3 Pull the handle (535) extending from the grille as far as the stop and open hood (it may be necessary to lift the hood slightly to release the handle).



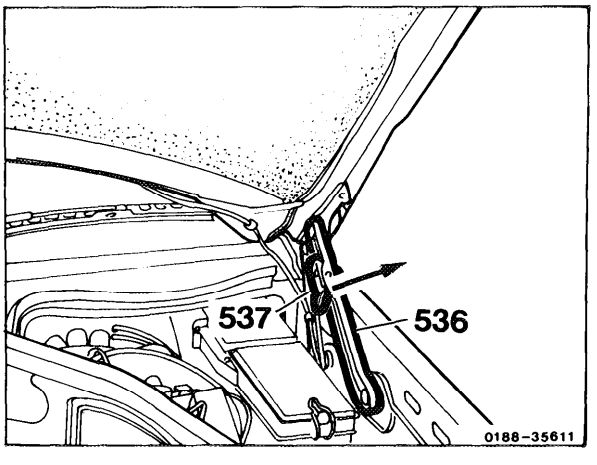
Note

Do not attempt to lift the hood with handle (535). The windshield wiper arm must not be pivoted forward when the hood is lifted.

Moving hood into vertical position

Model 124 (production up to August 1988)

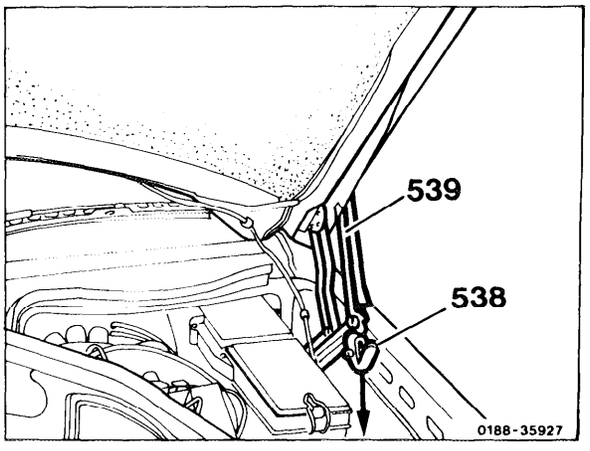
4 Push lock lever (537) on the left hood support (536) in direction of arrow. Lift hood slightly upward to keep the lock lever (537) from reengaging again.
Repeat the preceding at the right hood support and set the hood in a vertical position.



5 To close the hood, push in lock lever at the right hood support, and close the hood by pushing down forcibly.

Model 126

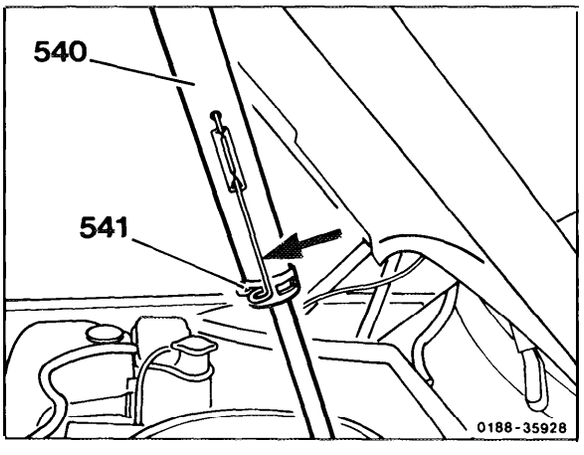
6 Push hood down slightly. Push lock lever (538) on the left hood support (539) down in the direction of the arrow. Push hood up slightly to keep the lock lever (538) from reengaging. Repeat the preceding at the right hood support and set the hood in a vertical position.



7 To close the hood, push the lock lever (538) at the left hood support in the direction of the arrow, and close the hood by pushing down forcibly.

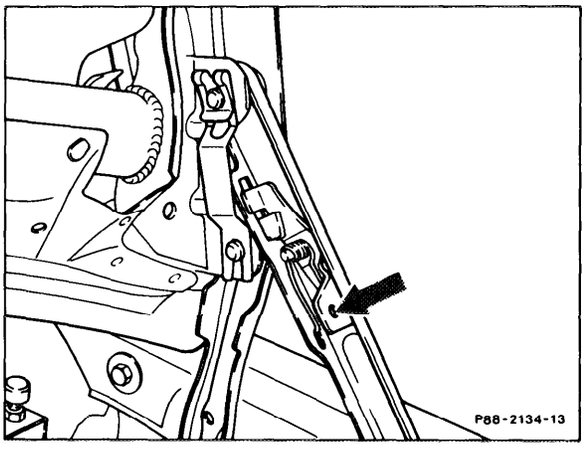
Model 201

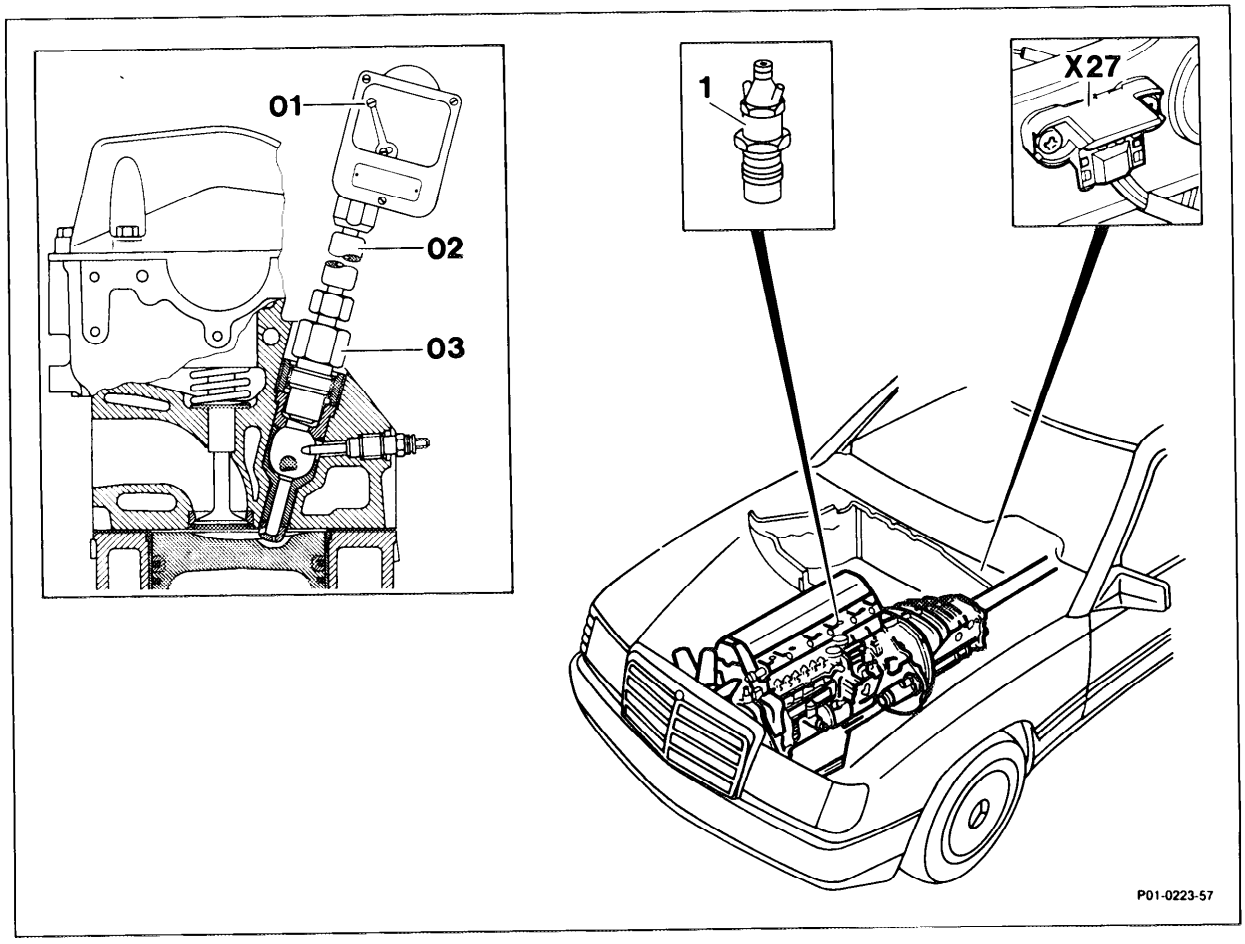
8 Pull lock (541) on hood damper (540) in direction of arrow and set the hood in a vertical position.



9 When the hood is set vertical, a lock engages on the left hood support.

10 Close hood. Push in the lock lever (arrow) and close the hood by pushing down forcibly.





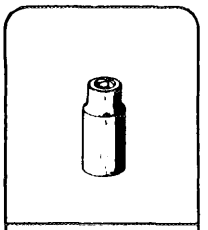
Engine	warm up to operating temperature (approx. 80 °C) (item 1).
	Note Check compression only with engine at operating temperature.
Nozzle holder (1)	remove, install (07-230).
Plug connector (X27)	for starter harness, disconnect, reconnect (items 3 - 4).
	Note The plug connector (X27) illustrated in the figure is installed on model 124. The installation point and version of the plug connector differs depending on the model.

Contact handle	for compression pressure recorder 001 589 78 21 00, connect, adapter line 124 589 36 63 00 (items 3 – 5).
Engine	turn over a number of times to clean out; the transmission must be in neutral and the shutoff lever on the injection pump pressed to “stop” (item 6).
Compression pressure recorder (01)	bolt appropriate adapter (03) and flexible connector (02) into precombustion chamber of cylinder to be checked (item 7).
Compression	check; shift transmission to neutral and turn engine over at least 9 revolutions with the shutoff lever on the injection pump pushed to “stop” (items 8 – 9).
	Note Check compression in remaining cylinders in same manner.
Measured compression values	compare with specified test values (item 10).
	Note If one or more cylinders do not have the minimum compression, determine cause.

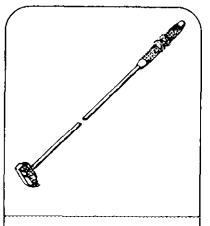
Test values with engine at operating temperature (approx. 80 °C)	bar
Compression pressure, normal	26 – 32
Minimum compression pressure	approx. 18
Permissible difference between individual cylinders	max. 3

Tightening torques	Nm
Union nuts on injection lines (reference value)	10-20
Nozzle holders in prechambers	70 + 10
Nozzle holders for angular injection	30

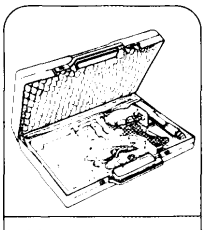
Special tools



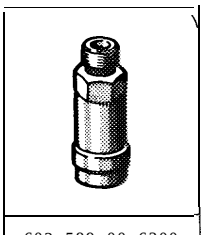
001 589 65 09 00



124 589 36 63 00
01



001 589 78 21 00
01



602 589 00 6300
ol

Testing

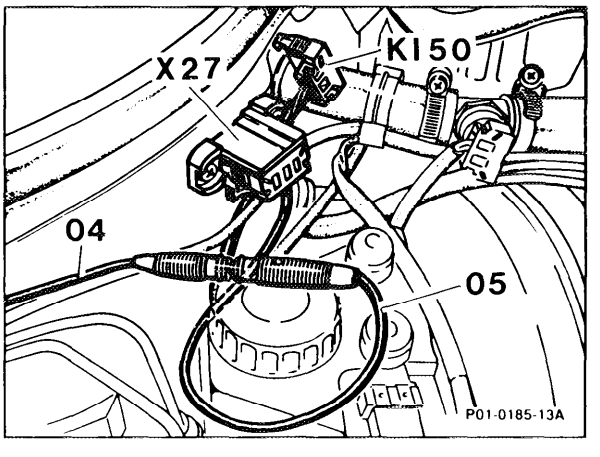
1 Warm engine up to operating temperature (approx. **80** °C).

Note
Check compression only with engine at operating temperature.

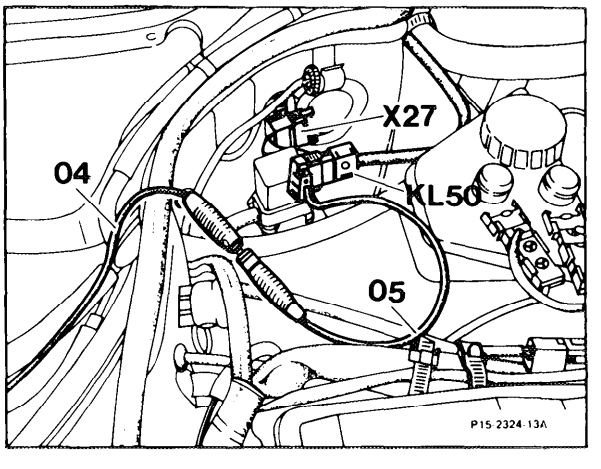
2 Remove all nozzle holders **(07-230).**

Models 124 and 126

3 Connect contact handle for compression pressure recorder 001 589 **78** 21 00; disconnect plug connector **(X27)** on left side of engine compartment and connect connection line **(04)** of contact handle to plug (Kl50) with adapter line (124 589 36 63 00 (05).



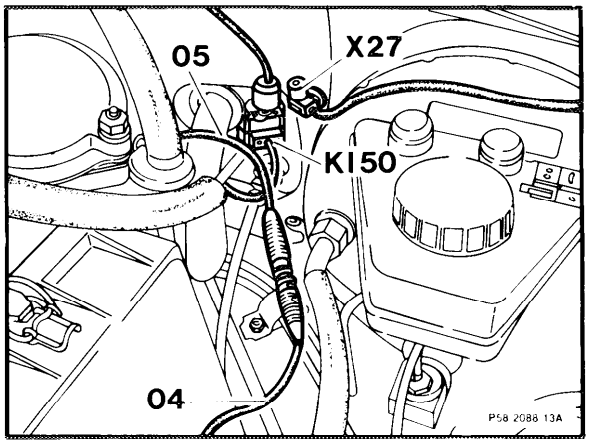
Model 124



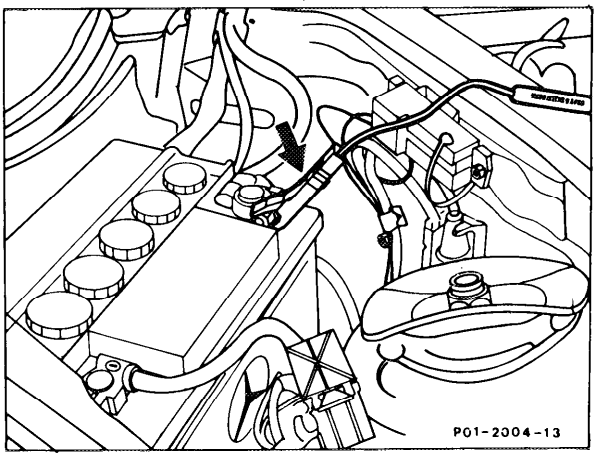
Model 126

Model 201

4 Connect contact handle of compression pressure recorder 001 589 78 21 00; disconnect plug connector (X27) on left side of firewall and connect connection line (04) of contact handle to plug (Kl50) with adapter line 124 589 36 63 00.



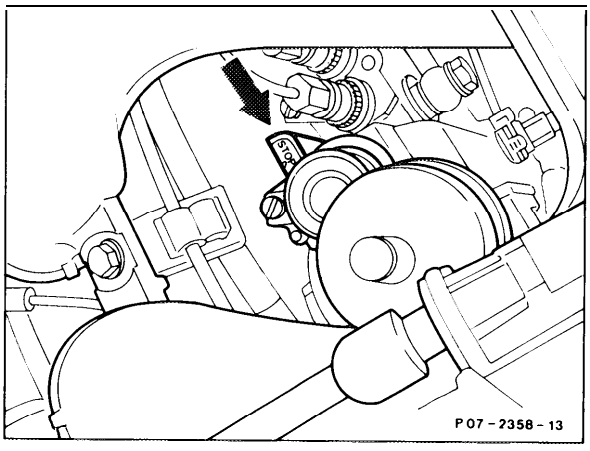
5 Connect second connection line from contact handle to positive pole (K130) on battery (arrow).



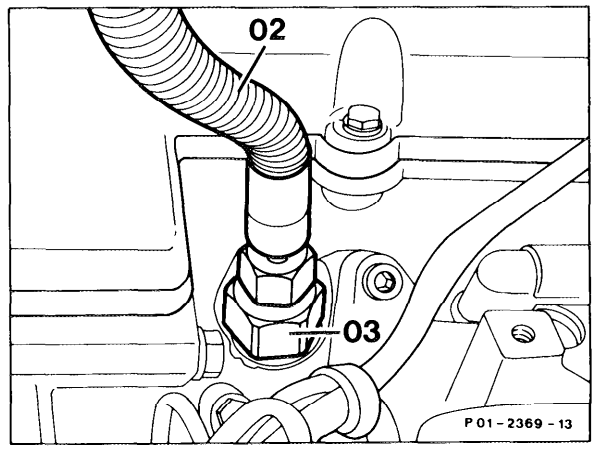
6 Crank engine a number of times with starter with transmission in neutral and shutoff lever on injection pump (arrow) pressed to “stop” to remove combustion residues in the precombustion chamber of the cylinder.

Note

Always hold shutoff lever on injection pump depressed when cranking engine. This prevents fuel from being pumped and therefore running out of the disconnected injection lines.



7 Bolt compression pressure recorder into pre-chamber of cylinder to be tested with appropriate adapter (03) and flexible connector (02).



Note
On engines with angular injection use adapter 602 589 00 63 00.

8 Crank engine at least 8 revolutions to test compression.

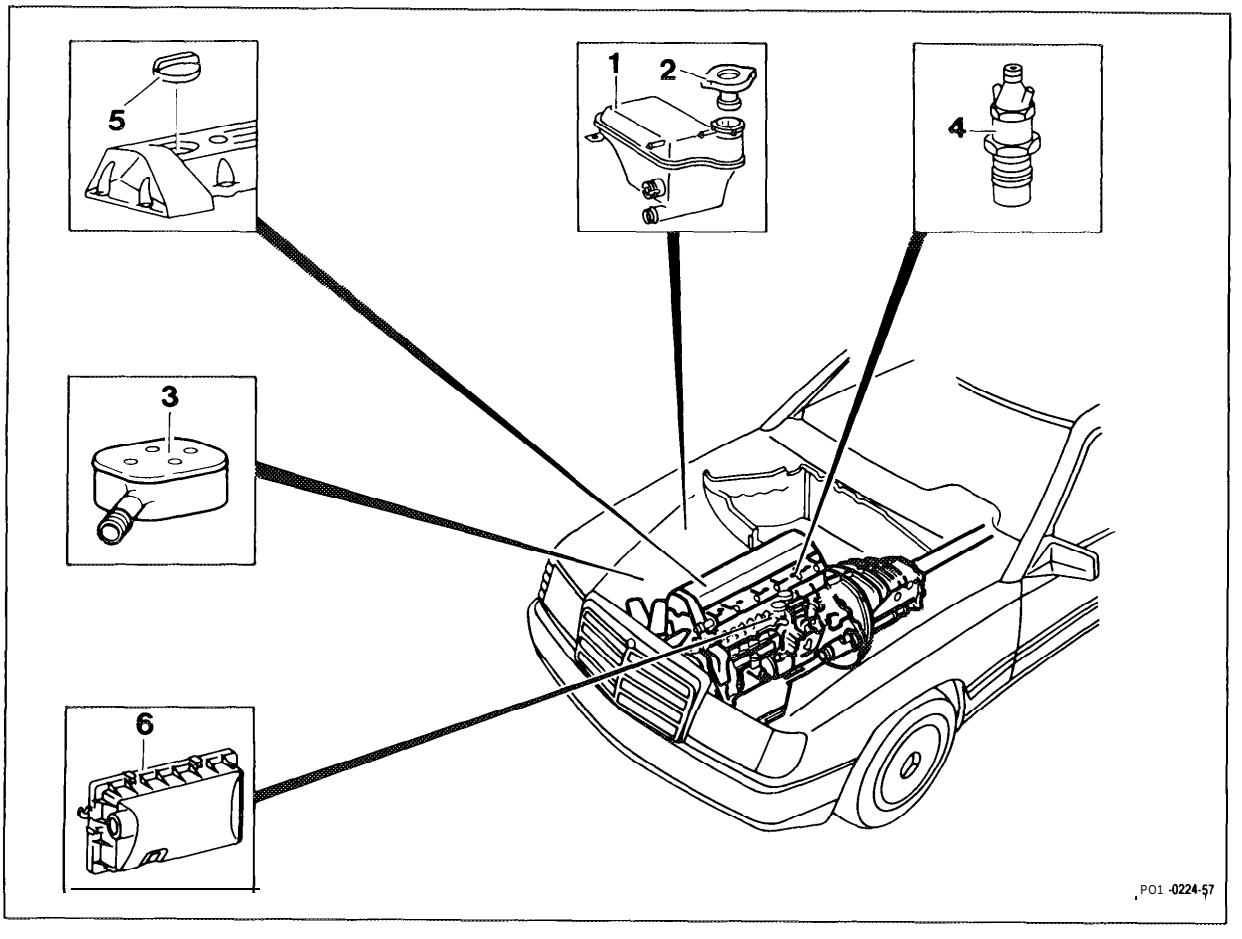
9 Perform test on remaining cylinders in same manner.

10 After completing the compression test compare pressures measured with specified values.

Note
If one or more cylinders do not have the minimum compression pressure, check cylinder for leakage (01-015) and determine cause.

11 Install in reverse order.

01-015 Checking cylinders for leaks



Engine	warm up to operating temperature (approx. 80 °C) (item 1).
Nozzle holders (4)	remove, install (07-230).
Coolant expansion tank (1)	**⚠ Warning** Open cap (2) on coolant expansion tank only at coolant temperatures below 90 °C. Remove cap (2), install. Add coolant, if necessary (items 3 – 4).
Air cleaner on naturally aspirated engines (6) and on Turbo-engines (3)	remove air cleaner cover, install (item 5).
Oil filler cap (5)	remove, install (item 6).

Engine	move piston of cylinder to be checked to TDC, ignition stroke, connect and calibrate cylinder leakage tester (items 7 – 9).
Cylinder	determine pressure loss (items 10 – 12).

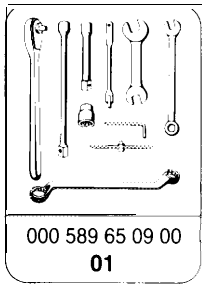
Note
Check other cylinders in firing order.

Permissible pressure loss

Total, engine	max. 25 %
Valves and cylinder head gasket	max. 10 %
Piston rings	max. **20** %

Tightening torques	Nm
Union nuts on injection lines (reference value)	10-20
Nozzle holders in prechambers	70 + 10
Nozzle holders for angular injection	30

Special tool



Commercially available tools

Cylinder leakage tester	e.g.	Bosch, EFAW 210 A Sun, CLT 228
Adapters and connectors	e.g.	Bosch Order no. 1 687 010 016

Testing

1 Warm engine up to operating temperature (approx. 80 °C).

2 Remove all nozzle holders (07-230).

⚠ Warning
Open cap on coolant expansion tank only at coolant temperatures below 90 °C.

3 Remove cap on coolant expansion tank.

4 Check coolant level in coolant expansion tank and add, if necessary.

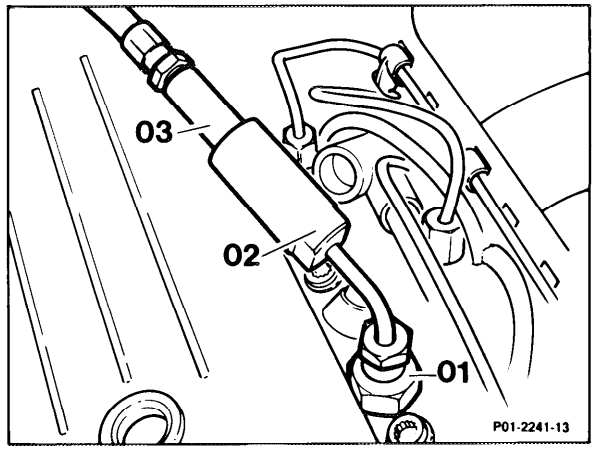
5 Open retaining strap on air cleaner cover on naturally aspirated engines or unscrew hex. head bolts on air cleaner cap on Turbo-engines, remove air cleaner cap and take out filter cartridge.

6 Remove oil filler cap.

7 Move piston in cylinder to be checked to TDC, ignition stroke.

8 Bolt appropriate adapter (01) with straight or angular connector (02) into precombustion chamber of cylinder to be checked.

9 Calibrate cylinder leakage tester and bolt connection hose (03) of tester onto connector (02).



10 Fill cylinder with compressed air and read off any pressure loss on tester.

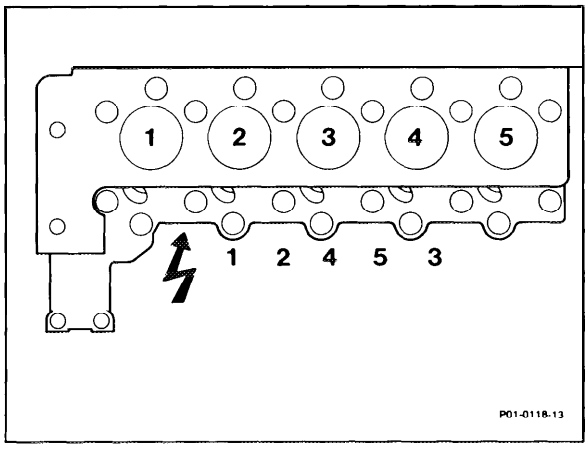
11 If pressure is lost, determine cause; check by listening whether pressure is exhausted through cylinder head gasket, intake manifold, exhaust, oil filler cap or prechambers of adjacent cylinder(s) and check for formation of air bubbles in coolant in coolant expansion tank.

Note

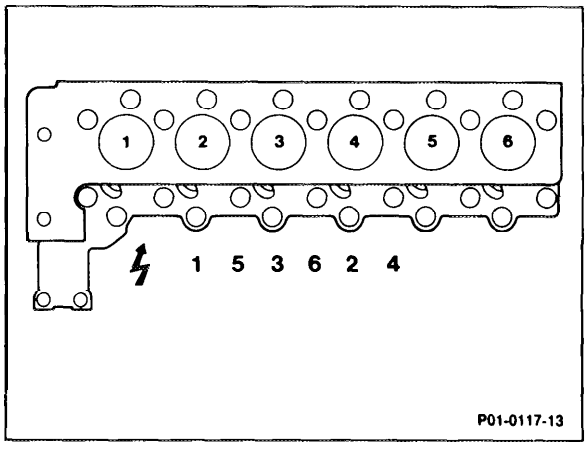
If pressure loss and air loss through the oil filler cap are present , the possible causes can be limited by spraying engine oil on the piston crown of the cylinder being tested. The oil seals the gap between the piston and cylinder. If pressure loss is no longer present for a short time, the cause is in all probability the piston, piston rings or cylinder running surface.

The position of the piston ring gaps can result in incorrect determination of the cause. If it is suspected that the pressure loss results from the piston ring gaps being positioned directly above one another, completely reassemble engine and repeat test after operating engine for a short time.

12 Perform test on other cylinders in engine ignition sequence.



Ignition sequence, engine 602

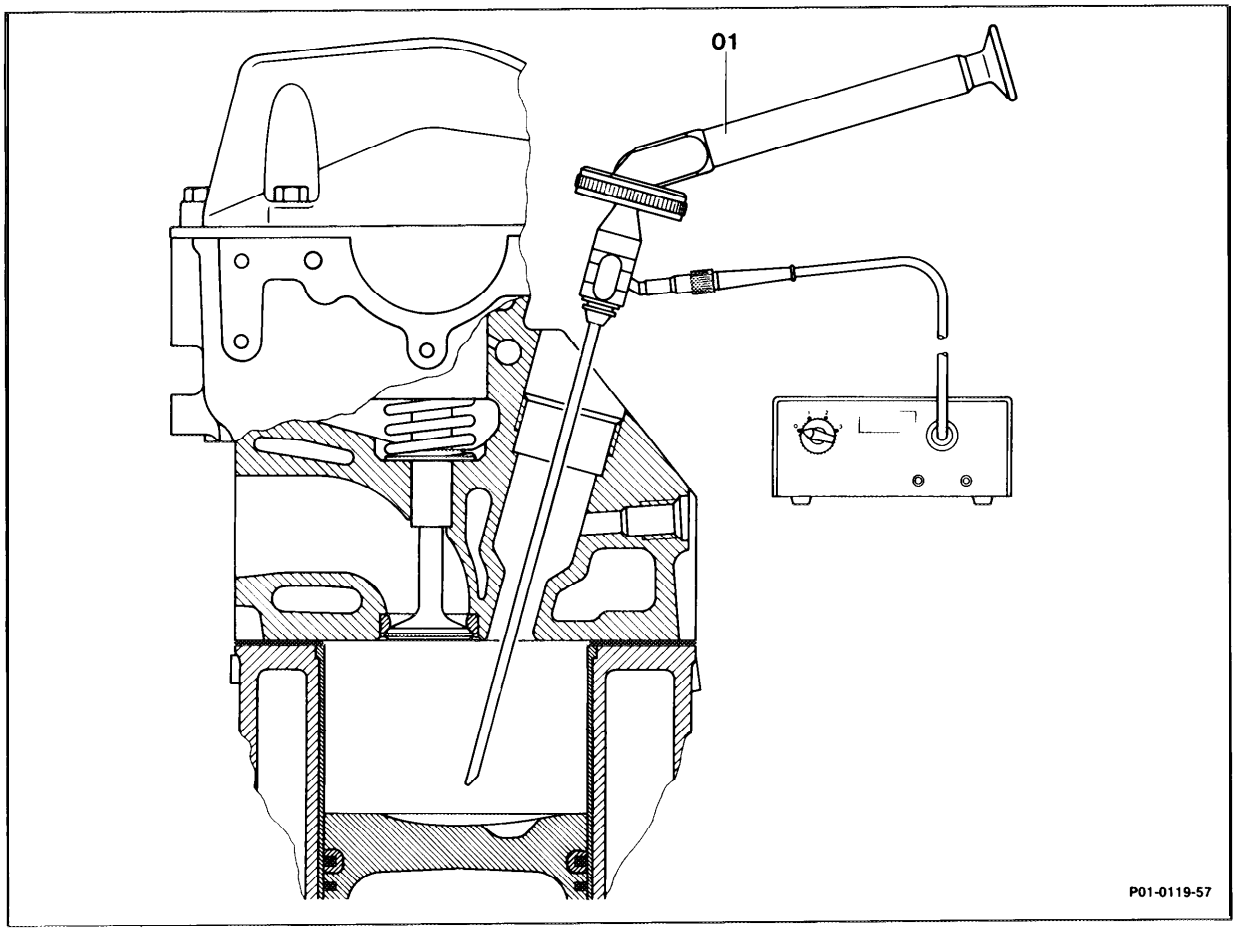


Ignition sequence, engine 603

13 Assemble in opposite order.

01-020 Evaluating cylinder bores

Preliminary operations:
Prechambers removed



Piston . . . . . in cylinder to be tested, move to bottom dead center.

Cylinder . . . . . illuminate cylinder with illumination unit and check visually for damage; for this purpose insert the probe (01) of the illumination unit through the precombustion chamber bore into the cylinder.

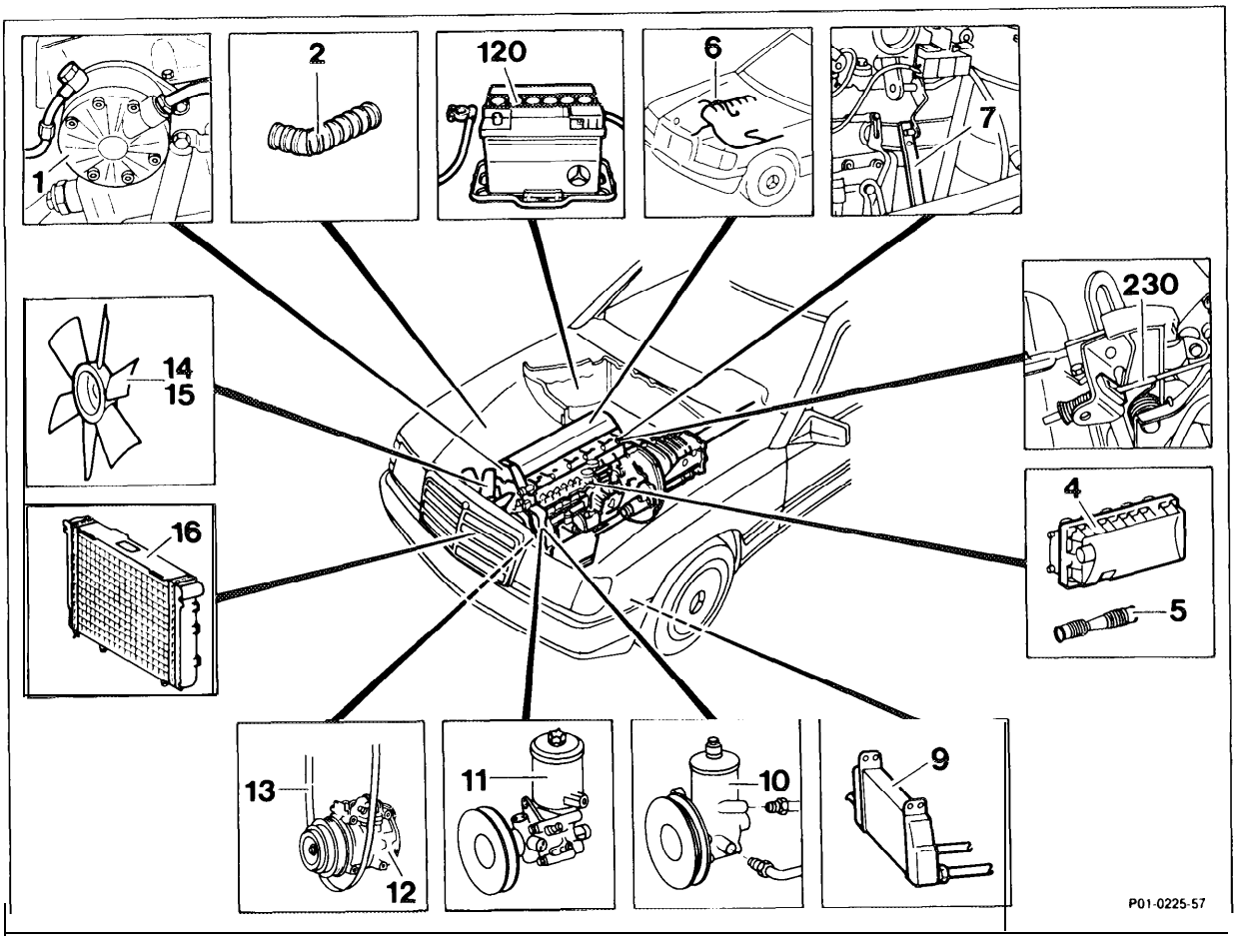
Note

When inspecting differentiate between " Optical stripes" and "Scoring". **"Optical stripes"** can result from the ring gap. if honing marks are still visible, the engine is okay. **"Scoring marks"** honing marks no longer visible, repair engine.

Commercially available tool		
Cylinder illumination unit	e. g.	Karl Storz GmbH, **D-7200** Tuttlingen Motoskop TW (cold light) with lens probes 103 26 CW **(570** mm) and 103 26 CT (210 mm)

Preliminary operations:
Noise capsule part at bottom of engine compartment removed (01-006).
Exhaust system removed (49-l 00).

A. Removal, installation, models 124, 126 and 201



Battery (120)	disconnect positive and negative terminals, reconnect (items 1 – 4).
Naturally aspirated engines:	
Air intake hose (5)	remove, attach (item 5).
Air cleaner cover (4)	remove together with filter cartridge, attach (item 5.1).
Turbo-engines:	
Intake hose (2)	to exhaust gas turbocharger, remove, attach (item 6).
Radiator (16)	remove, install (20-420).
Transmission oil lines	on vehicles with automatic transmission, unbolt, install and plug with clamps 000 589 40 37 00 (item 7).

Air conditioner:

Condenser	**Caution!** Attach protective plate immediately after removing radiator.
Coolant hoses	disconnect between engine and chassis, pull off, install (item 9).
Fan (14, 15)	remove, install, 25 Nm and 45 Nm (items 10 – 11). **Note** On vehicles with viscodrive fan clutch Use screwdriver socket 103 589 01 09 99, torque wrench 001 589 72 21 00 and holding tool 603 589 00 40 00.

Air conditioner:

Poly-V-belts (13)	remove, install (13-342).
Refrigerant compressor (12)	remove, install, 25 Nm (item 12). **Note** Do not unbolt the refrigerant lines on the compressor. Fasten compressor to chassis at side.
Vacuum hoses and fuel lines	remove between engine and chassis, disconnect, reinstall (item 13).

Models 124 and 126:

Control cable (230)	for engine control, unhook, hook in (item 14).

Model 201:

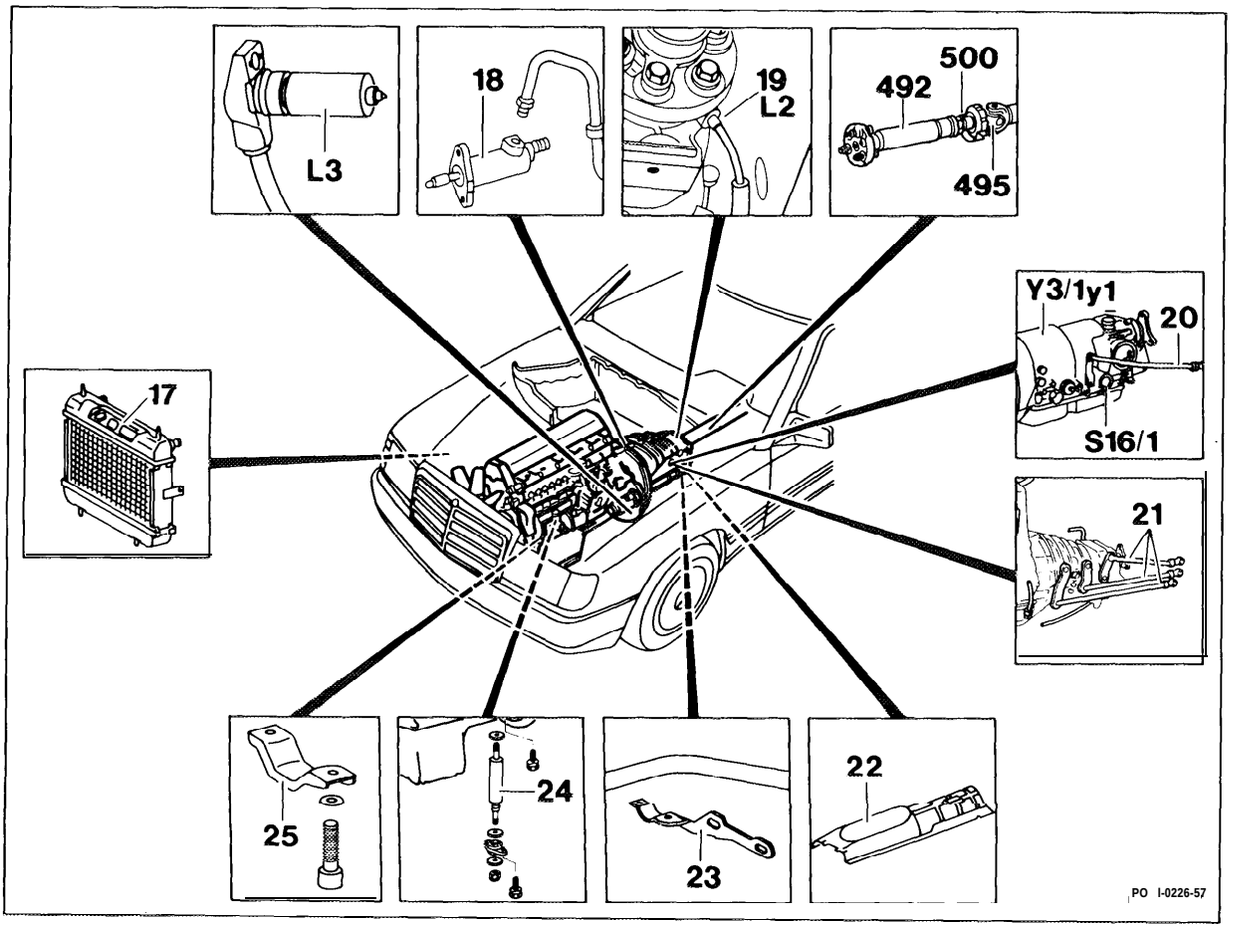
Engine control linkage (7)	unhook, hook in (item 15). **Note** Adjust control linkage (30-300).
Electrical connection lines	between engine and chassis, disconnect plug connectors and connections, reconnect (item 16).
Oil pressure switch and oil level sensor	disconnect plug connectors, reconnect (item 17).
Starter	unbolt connection lines, connect (item 18).
Alternator	disconnect plug connectors, reconnect (item 19).
Engine electrical harness (5)	remove, reattach (item 20).
Power steering pump (10)	evacuate oil out of power steering supply reservoir, use hand pump 112 589 00 72 00 and remove oil lines, reinstall, 30 Nm (items 21 – 22).

Vehicles with level control and/or ASD:

Oil pump (1) or tandem pump (11) . . . . . unbolt oil lines and hoses between engine and chassis, reinstall (item 23).

Turbo-engines or naturally aspirated engines with exhaust gas recirculation:

Air/oil cooler (9) . . . . . unbolt oil lines between cooler and engine, reinstall (item 24).



Turbo-engine with automatic transmission and trailer hitch in combination with air conditioner:

Transmission oil/air cooler (17) . . . . . oil lines and hoses between cooler and engine, remove, replace (item 25).

Model 201 (up to 03/85):

Mount for engine stop (25) . . . . . remove, install, 25 Nm (item 26).

Note

Check engine stop, adjust, 130 Nm (22-220), adjustment gauge 201 589 04 23 00.

Model 201 (up to 03/85):

Engine shock absorber (24), left	remove, install, 10 Nm (item 27).

Model 126:

Engine shock absorbers (24), left and right	remove, install, 10 Nm (item 28).

Manual transmissions:

Shift linkage (20)	unhook, hook in (item 29).
Clutch master cylinder (18)	remove hydraulic line, replace and bleed master cylinder (item 29.1).

Automatic transmissions:

Shift linkage (20)	unhook, hook in (30).
Starter lockout, back-up light switch (S16/1)	disconnect wires, reconnect (item 30).
Kickdown solenoid valve (Y3/1y1)	disconnect wire, reconnect (item 30.1).
Speedometer shaft (19) or inductive speedometer sensor (L2)	remove, reinstall (item 31).
Engine speed sensor (L3) and starter ground strap	remove, reinstall (item 32).
Lateral exhaust support (23)	remove, reinstall (item 33).
Heat baffle plates (22)	on center tunnel, remove, install (item 34).
Drive shaft (492)	remove, reinstall, 40 Nm and 60 Nm (item 35). **Note** Replace self-locking hex. nuts.
Drive shaft intermediate bearing (495)	loosen, tighten, 25 Nm (item 36).
Clamping nut (500)	on intermediate bearing, loosen, tighten, 30 – 40 Nm, open-end wrench 126 589 00 01 00 or 201 589 00 01 00 and torque wrench 001 589 66 21 00 (item 37).

Following installation:

Engine	check engine oil, add, if required or fill engine with new oil.
Cooling system	fill up and perform pressure test (20-017), pressure tester 124 589 15 21 00.
Engine	start and check engine oil and cooling system for leakage.

Engine oil capacities with oil dipstick code
(see "Service Product Specifications" for approved engine oils)

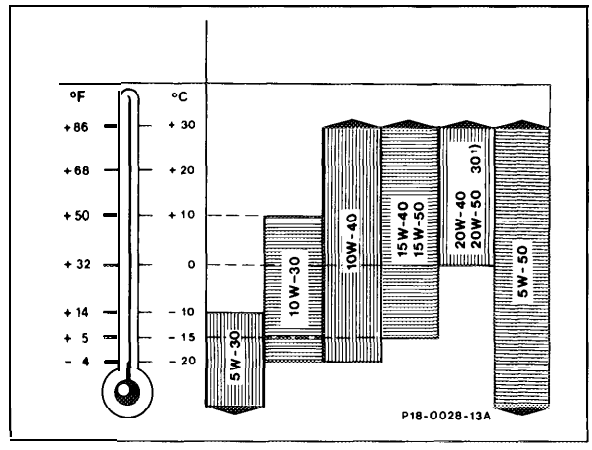
Engine	Model	Capacity for oil and filter change in liters	Color code, round handle	Color code, handle with bottle opener shape	Number code on handle
602.91	201	6.5 (6.9 U.S. qt.) 7 [2]) (7.4 U.S. qt.)	– –	– green[2])	602141)
602.96	124, 201	7.0 (7.4 U.S. qt.)	–	green[3])	–
603.96	124	7.5 (8.0 U.S. qt.)	–	black	
603.97	126	7.5 (8.0 U.S. qt.)	–	–	60316

[1]) 1st version, color code "red"
2nd version, color code "black"
3rd version, color code "brown"
[2]) Only for engines with exhaust gas recirculation and side part on oil pan
[3]) 1 st version, color code "black"

Specified viscosity classes for engine oil according to SAE for continuous ambient temperatures

Exact adherence to the SAE class specified for the various ambient temperatures would result in frequent oil changes. The temperature limits for the SAE classes should therefore be regarded as guidelines which may be exceeded for short periods.

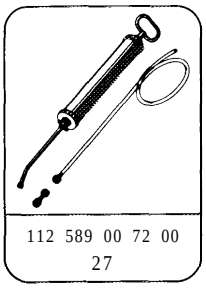
See " Service Product Specifications" for further information regarding specified viscosity classes and approved engine oils.



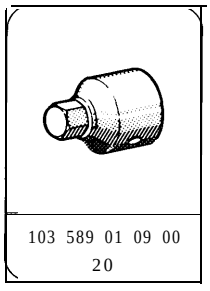
Tightening torques

		Nm
Oil drain plug in oil pan	M 12×1.5×13	30
	M 14×1.5×22	25
Hex. head bolt, magnetic fan clutch		25
Allen bolt, viscodrive fan clutch		45
Hex. head bolts, refrigerant compressor		25
Oil lines, power steering pump		30
Allen bolts, mount, engine stop, front		10
Adjustment bolt, engine stop, front		130
Hex. nuts, engine shock absorber		10
Hex. head bolts, engine shock absorber mount		10
Hex. nuts, drive shaft on transmission flange		40
Hex. nuts, drive shaft on transmission flange, engine 603.96		60
Hex. head bolts, drive shaft intermediate bearing		25
Clamping nut, drive shaft intermediate bearing		30 – 40
Hex. head bolts, cross member center piece		45
Hex. head bolts, engine support, rear		45
Hex. head bolts, engine mount, rear		25
Hex. nut, engine mount, rear		70
Adjustment bolt, engine mount (rubber) rear		30
Allen bolt, engine mount, front		40
Allen bolt, engine mount, front, model 126		70

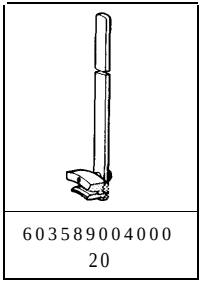
Special tools



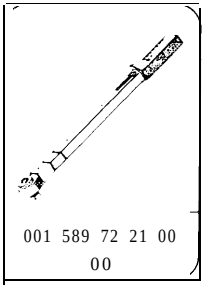
112 589 00 72 00
27



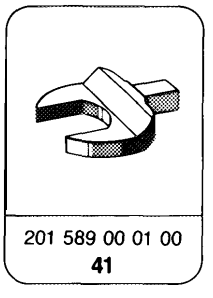
103 589 01 09 00
20



603589004000
20



001 589 72 21 00
00



201 589 00 01 00
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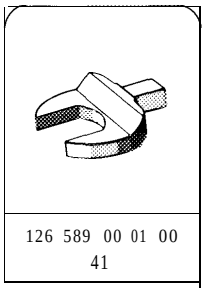
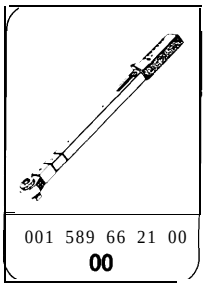
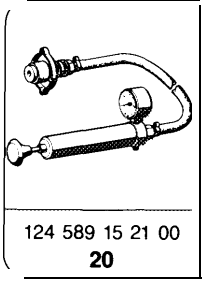


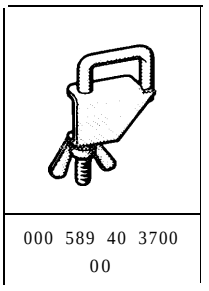
126 589 00 01 00
41



001 589 66 21 00
00



124 589 15 21 00
20



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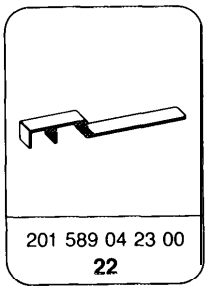


201 589 04 23 00
22

Commercially available tools

7 mm socket on flexible shaft for hose clamps with worm drive	e. g.	Hazet, D-5630 Remscheid Order no. 426-7
Engine hoist no. 3188 (self-braking)	e. g.	Backer, D-5630 Remscheid, Herderstraße

Self-made tools

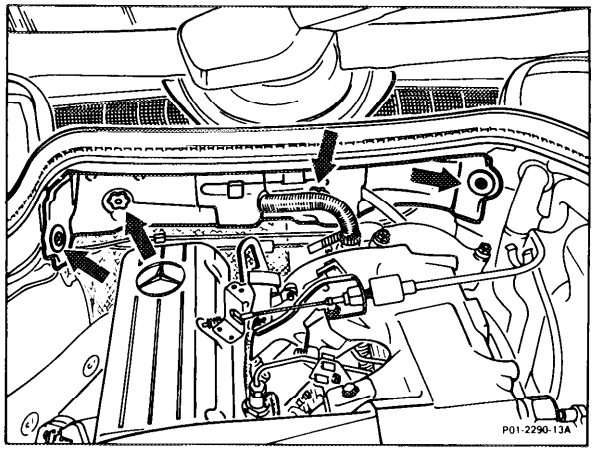
Guard plate for air conditioner condenser	Dimensions: approx. 480 × 600 × 1
Guard plate for unit compartment firewall	Dimensions: approx. 320 × 380 × 1

Removal, installation

1 Disconnect positive and negative cables on battery.

Models 124 and 126:

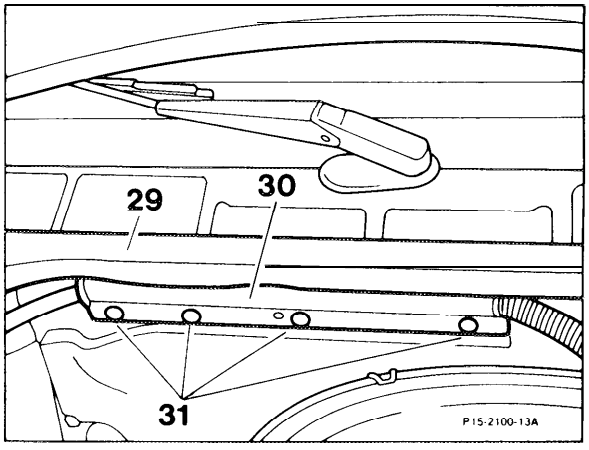
2 Remove cable cover on unit compartment firewall, for this purpose remove plastic screws (arrows) and remove cover.



Model 201:

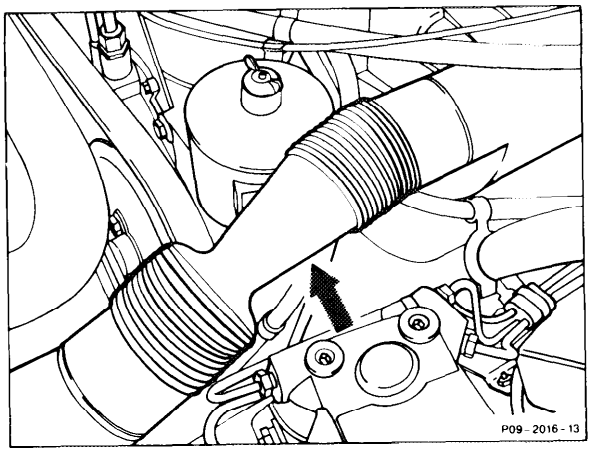
3 Remove cable cover on unit compartment firewall, for this purpose remove rubber sealing strip (29) over cable cover (30), disconnect clips (31) and fold cover upward.

4 Lay battery positive cable across engine.

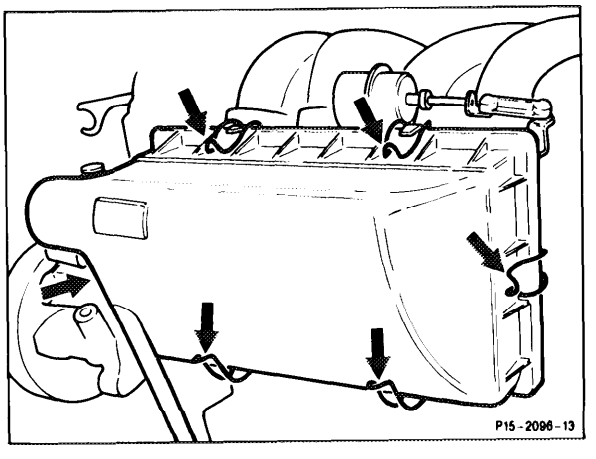


Naturally aspirated engines:

5 Remove air intake hose (arrow).



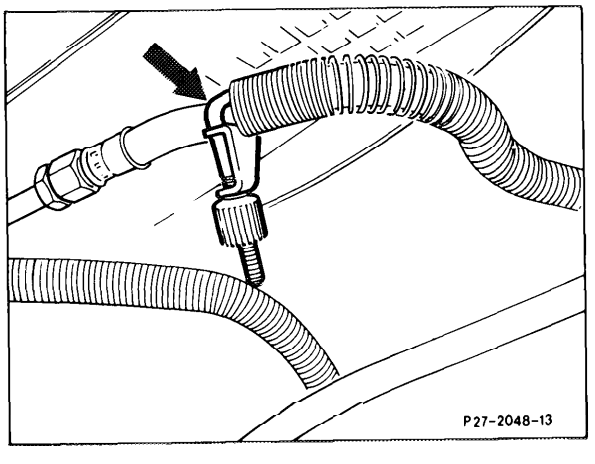
5.1 Open retaining clips on air cleaner cover and remove cleaner cover and filter cartridge.



Turbo-engines:

6 Remove intake hose to exhaust gas turbocharger.

7 On vehicles with automatic transmission plug oil cooler lines with clamps **000 589 40 37 00** (arrow).

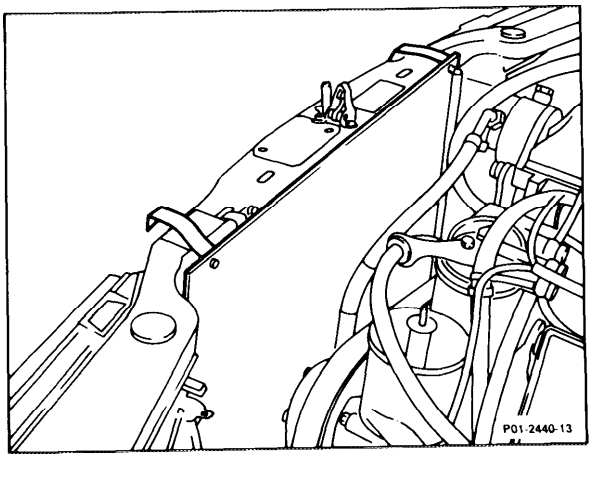


8 Remove radiator (20-420).

Caution!

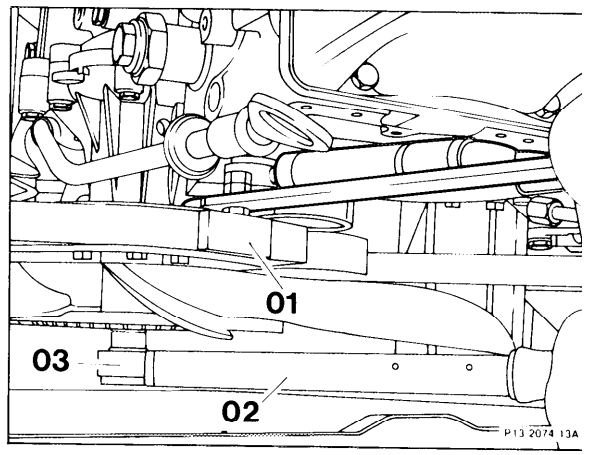
On vehicles with air conditioner attach guard plate to condenser immediately after removing radiator.

9 Loosen and remove all coolant hoses between engine and chassis.



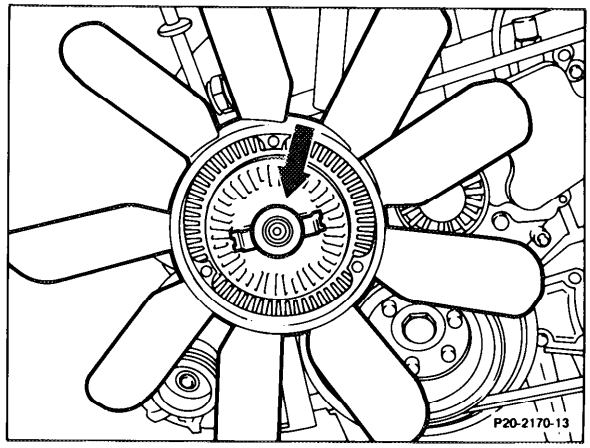
10 Remove fan with viscodrive fan clutch; hold V-belt pulley with counterholder (01) 603 589 00 40 00 and remove Allen bolt with socket (03) 103 589 01 09 00 and torque wrench (02) 001 589 72 21 00. Remove fan.

Installation note
Tightening torque 45 Nm.



Fans with magnetic fan clutch:
11 Remove fan; remove Allen bolt (arrow). Remove fan.

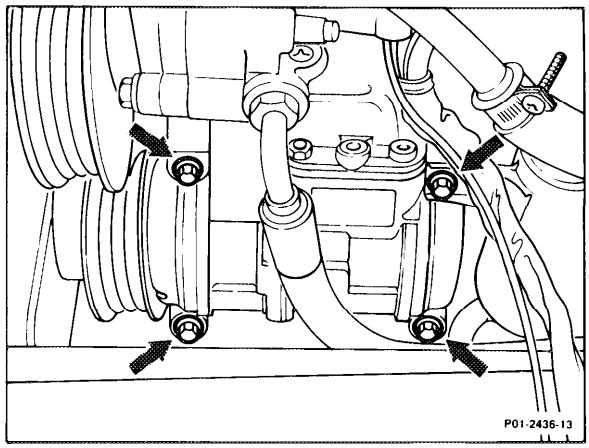
Installation note
Tightening torque 25 Nm.



Vehicles with air conditioning:
12 Remove poly V-belts (13-342), remove hex. head bolts (arrows) for refrigerant compressor and attach refrigerant compressor at side on chassis.

Note
Do not unbolt refrigerant lines on refrigerant compressor.

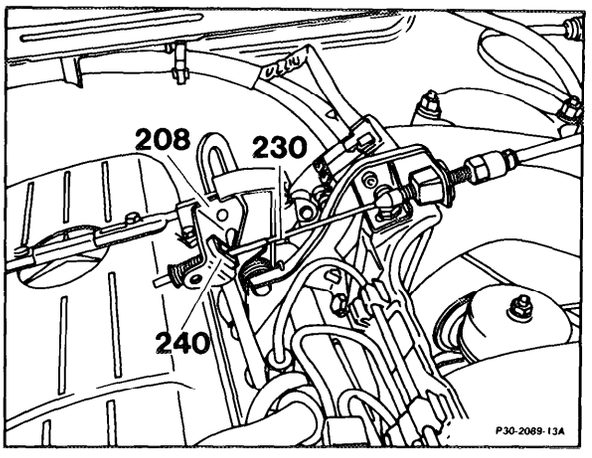
Installation note
Tightening torque for hex. head bolts on refrigerant compressor 25 Nm.



13 Loosen and disconnect all vacuum hoses and fuel lines between engine and chassis.

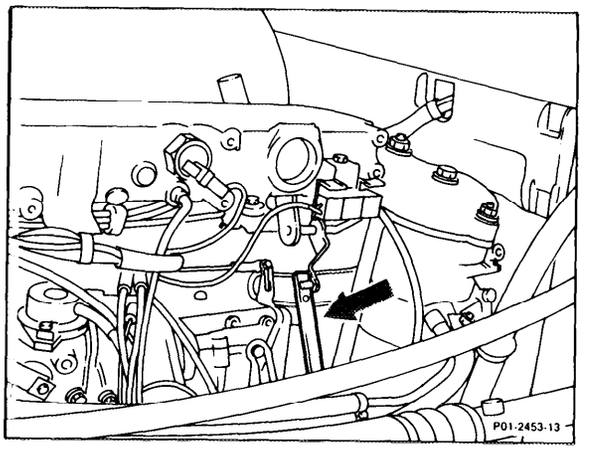
Models 124 and 201:

14 Unhook engine control; press out guide piece **(240)** on control lever **(208)** and remove control cable **(230).**



Model 126:

15 Unhook engine control linkage; unhook connecting rod (arrow) on control shaft.



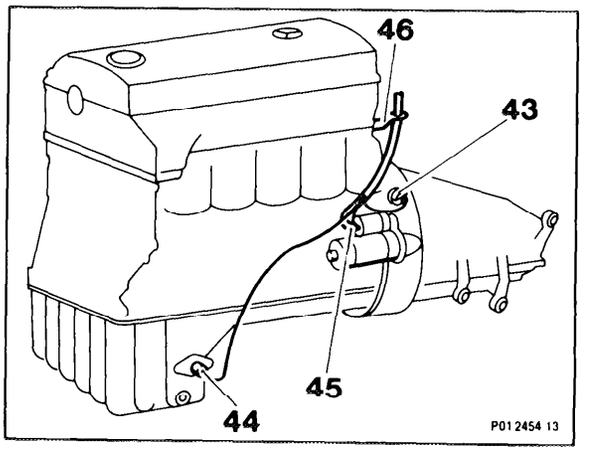
Installation note

Adjust control cable (30-300).

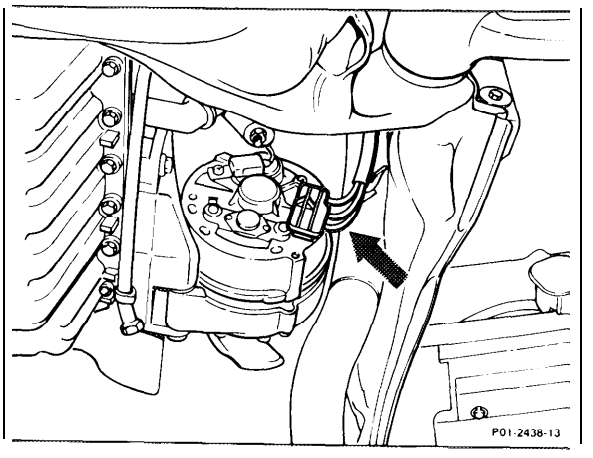
16 Disconnect all electrical lines between engine and chassis; for this purpose disconnect plug connectors and connections.

17 Disconnect plugs on oil pressure switch **(43)** and oil level sensor (44).

18 Remove connection cables on starter (45) and remove harness from holder (46) above starter.



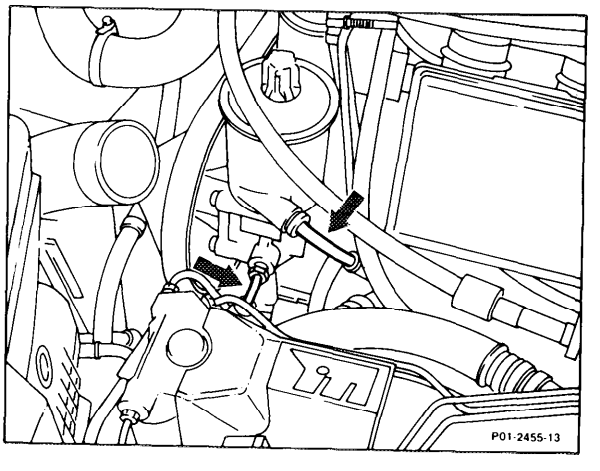
19 Disconnect plug connector (arrow) on alternator.



20 Completely remove engine wiring harness, for this purpose disconnect all clips and cable connectors.

21 Evacuate oil from supply reservoir for power steering pump or tandem pump using hand pump 112 589 00 72 00.

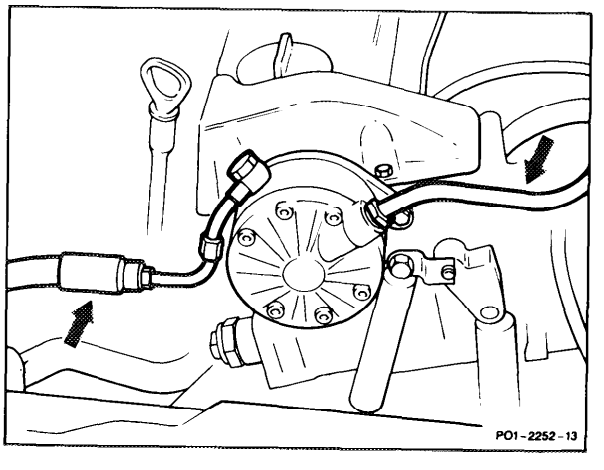
22 Unscrew oil lines for power steering on power steering pump (arrows) or on tandem pump.



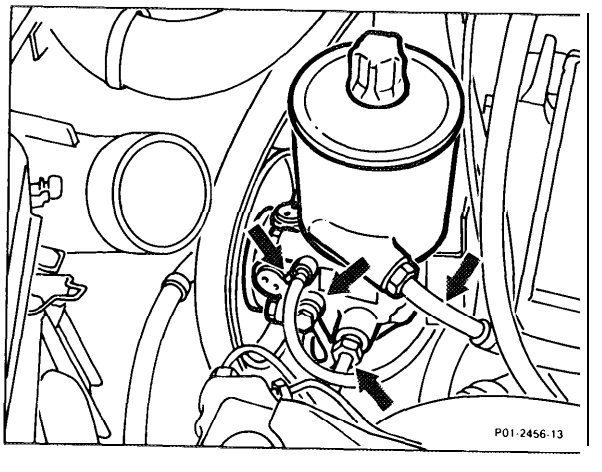
Power steering pump

Installation note
Tightening torque 30 Nm.
Replace oil which has leaked out.

Vehicles with level control and/or ASD:
23 Remove oil lines and hoses (arrows) for hydraulic pump or tandem pump between engine and chassis.

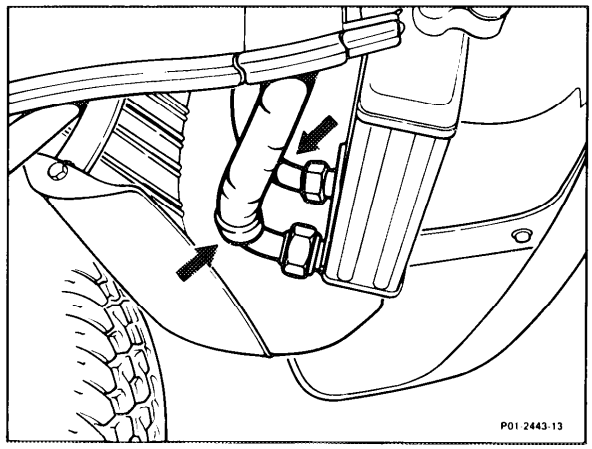


Hydraulic pump

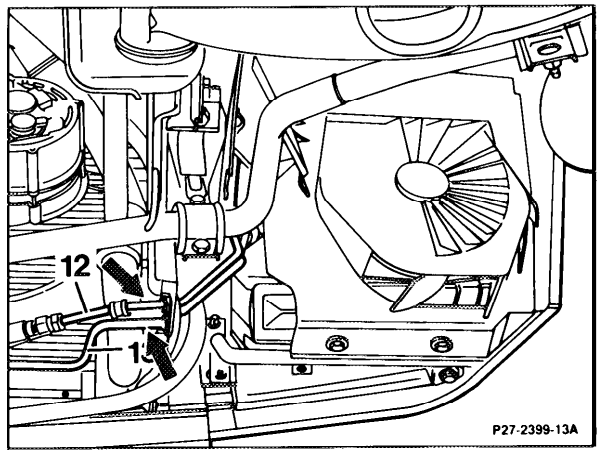


Tandem pump

Turbo-engines or naturally aspirated engines with exhaust gas recirculation:
24 Unbolt oil lines and hoses (arrows) for air oil cooler in left wheelhouse between radiator and engine.

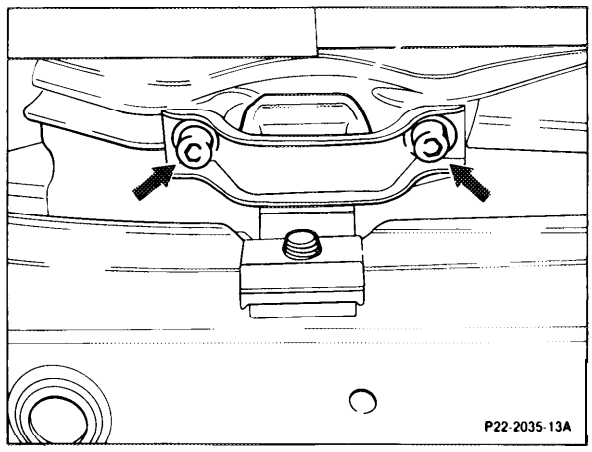


Turbo-engines with automatic transmission and trailer hitch in combination with air conditioning:
25 Unbolt oil lines and hoses (arrows) for transmission air oil cooler in right wheelhouse between radiator and engine.



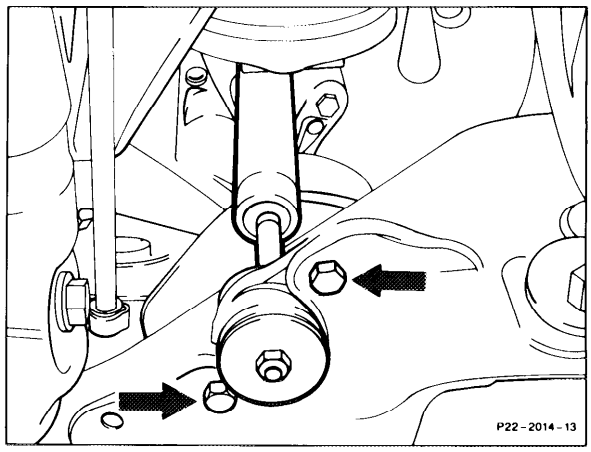
Model 201 (up to 03/85):
26 Remove Allen bolts (arrows) on mount for engine stop and remove mount.

Installation note
Tightening torque 25 Nm. Check engine stop with adjustment gauge 201 589 04 23 00 and adjust (22-220). Tightening torque for adjustment bolt 130 Nm.



Model 201 (up to 03/85):
27 Remove engine shock absorber, left, for this purpose remove hex. head bolts (arrows) on mount and remove engine shock absorber from frame cross member.

Installation note
Tightening torque 10 Nm.

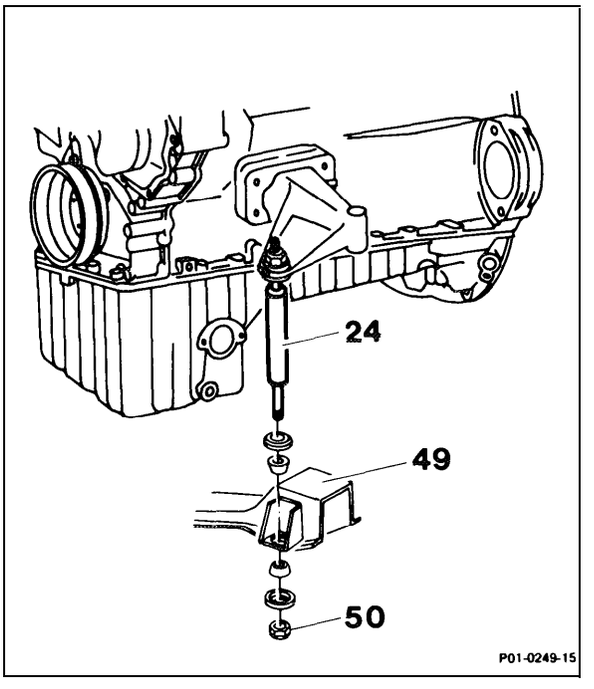


Model 126:

28 Unbolt engine shock absorbers (24) on left and right; for this purpose unscrew hex. nut (50) and press shock absorber upward out of mount on frame cross member (49).

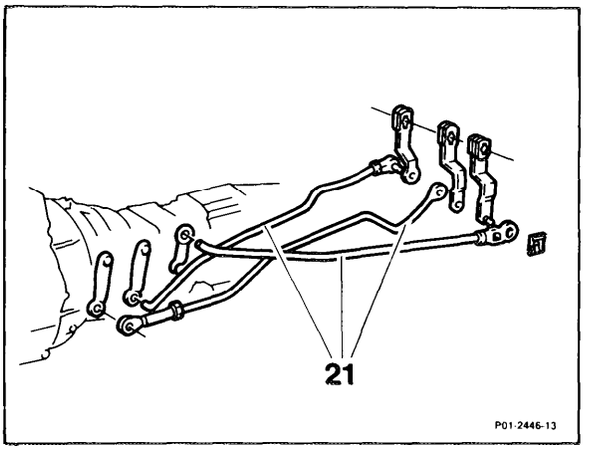
Installation note

Tightening torque 10 Nm.



Vehicles with manual transmission:

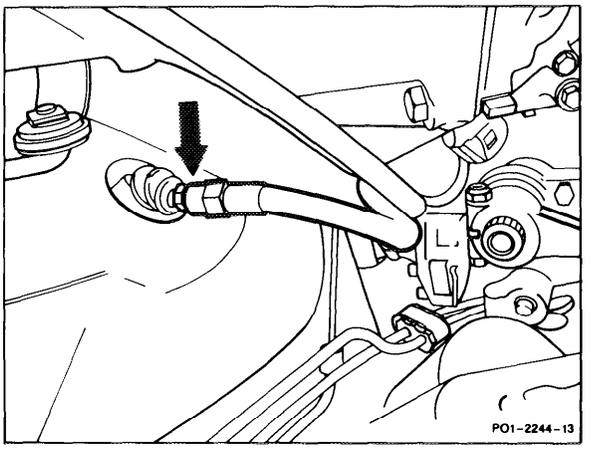
29 Unhook shift linkage (21) on transmission.



29.1 Unbolt hydraulic lines on clutch master cylinder (arrow).

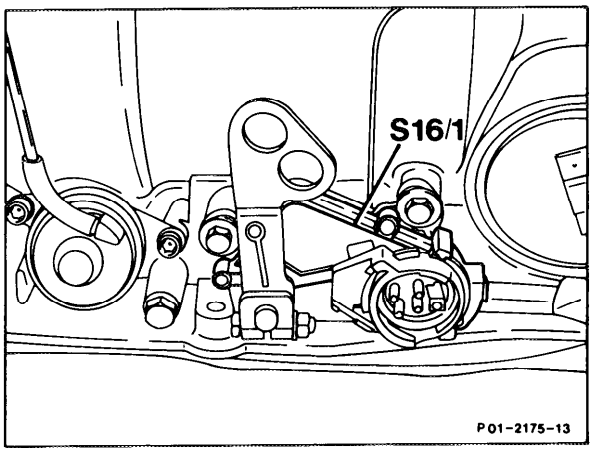
Installation note

Bleed clutch master cylinder.



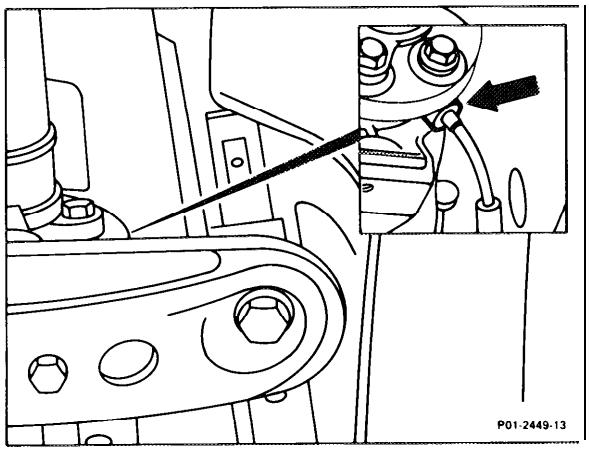
Vehicles with automatic transmission:

30 Unhook shift linkage on transmission and disconnect connector for starter lockout, back-up light switch (S16/1).

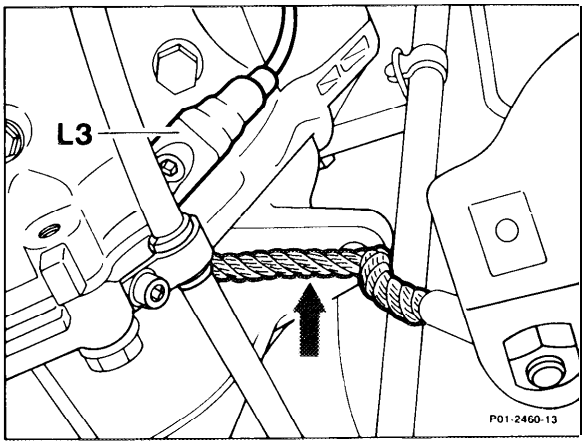


30.1 Disconnect connector for kickdown solenoid valve on right side of transmission.

31 Unbolt speedometer shaft or speedometer inductive sensor (arrow) and remove the two bottom hex. head bolts for the starter. Position speedometer shaft or connection wire to side.

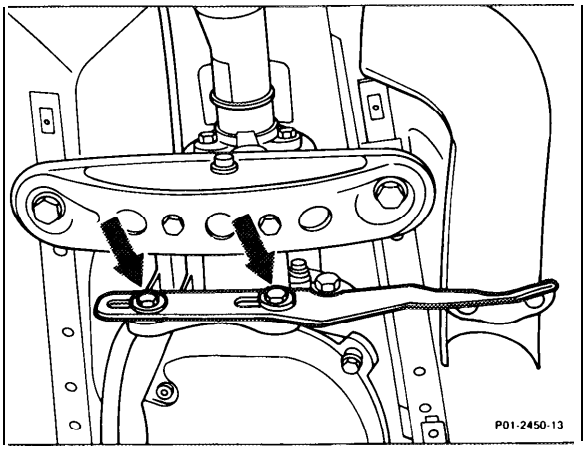


32 Unbolt engine speed sensor (L3) and starter ground strap (arrow) on chassis.

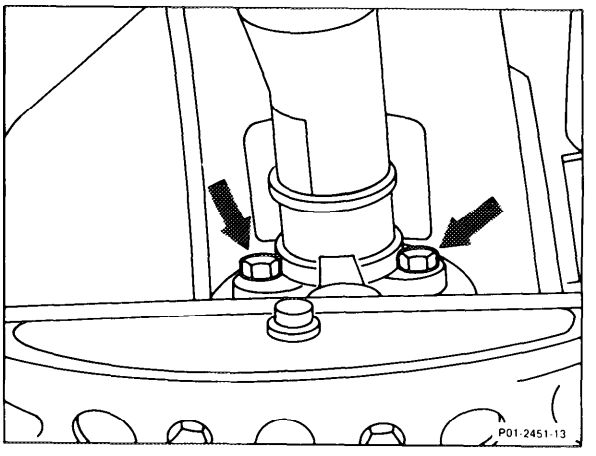


33 Remove hex. head bolts (arrows) for lateral exhaust support on transmission and remove support.

34 Unbolt heat baffle plates on center tunnel.



35 Remove hex. head bolts (arrows) for drive shaft on transmission flange and press drive shaft off of transmission flange.



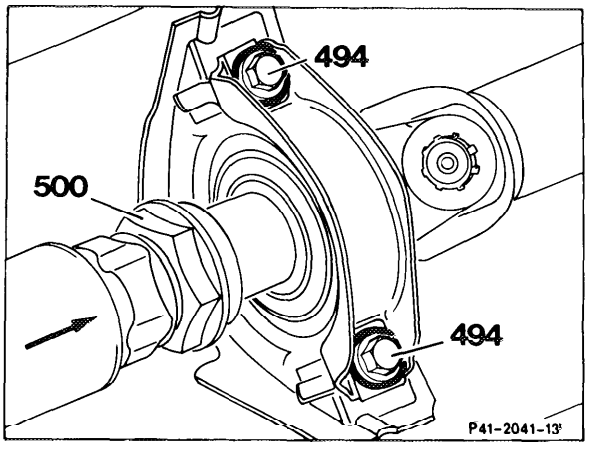
Installation note

Replace self-locking hex. nuts.

Tightening torque

Engine 602, 603.91	40 Nm
Engine 603.96	60 Nm.

36 Loosen hex. head bolts (494) on drive shaft intermediate flange.



Installation note

Tightening torque 25 Nm.

37 Loosen clamping nut (500) with open-end wrench

126 589 00 01 00 (SW46) or

201 589 00 01 00 (SW41) and

torque wrench 001 589 66 21 00.

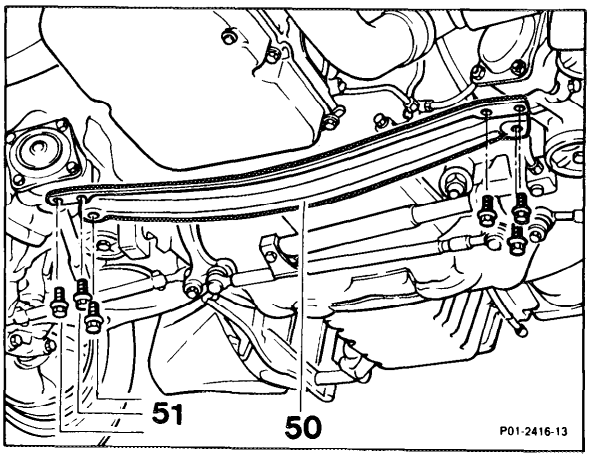
Push drive shaft back as far as possible (in direction of arrow).

Installation note

Tightening torque 30 – 40 Nm.

Model 126:

38 Unbolt hex. head bolts (51) on cross member center piece **(50)** and remove cross member center piece.



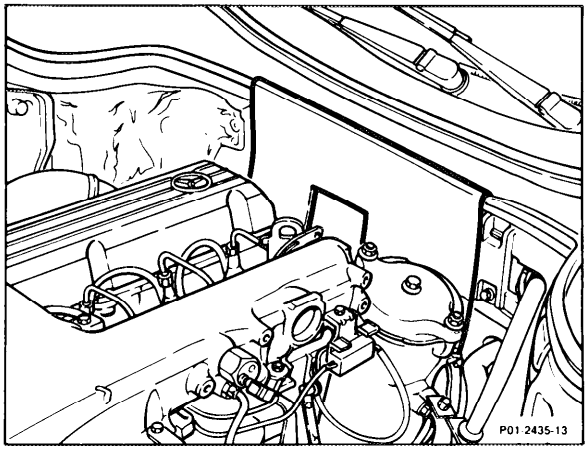
Installation note

Replace self-locking hex. head bolts.

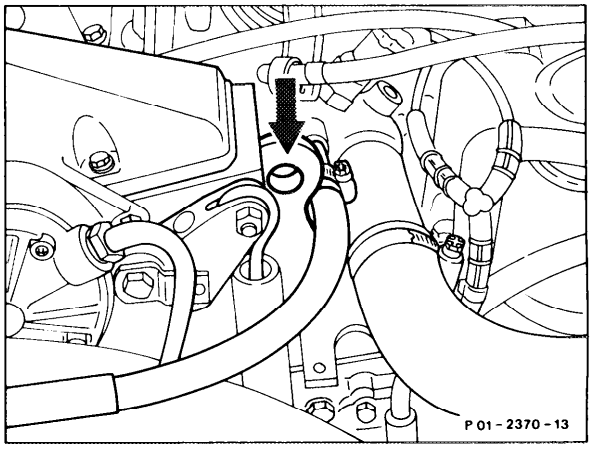
Tightening torque 45 Nm.

Caution!

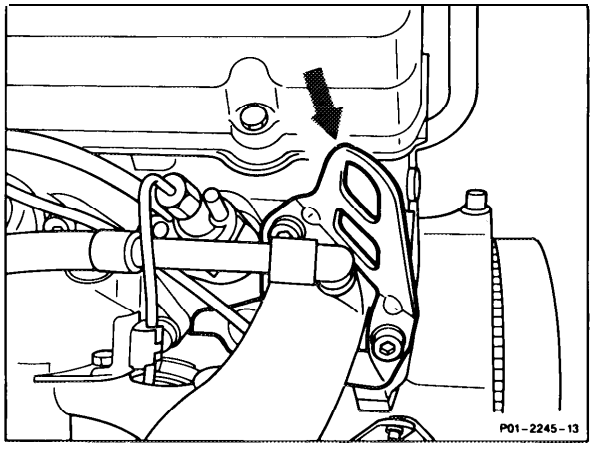
Attach guard plate on unit compartment firewall.



39 Fasten engine hoist cables to front and rear suspension eyes on engine. Align engine hoist so that engine is positioned horizontally.

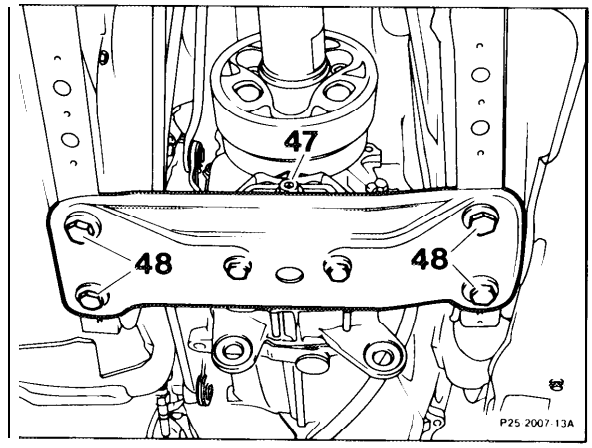


Suspension eye, front



Suspension eye, **fear**

40 Remove hex. head nuts (47) on mount for rear engine support. Remove hex. head bolts (48) and remove engine support with mount.



Installation note

Tightening torque

Hex. nuts	70 Nm
Hex. head bolts	45 Nm.

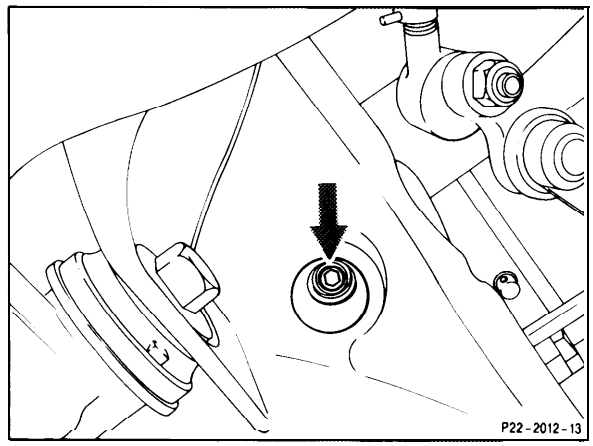
Check adjustment bolt on rubber mounts, tightening torque 30 Nm.

41 Remove Allen bolts for front engine mounts from frame cross member from bottom.

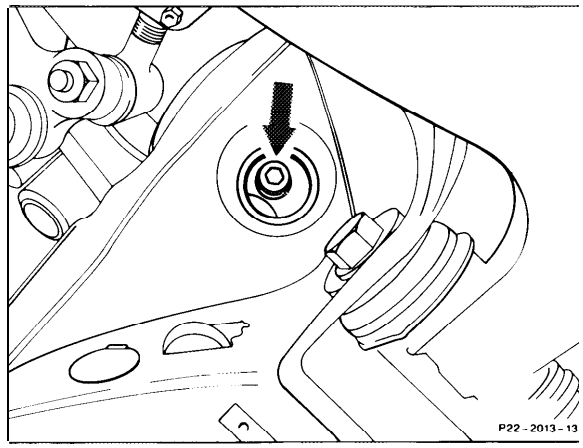
Installation note

Tightening torque

Model 124 and 201	40 Nm
Model 126	70 Nm.

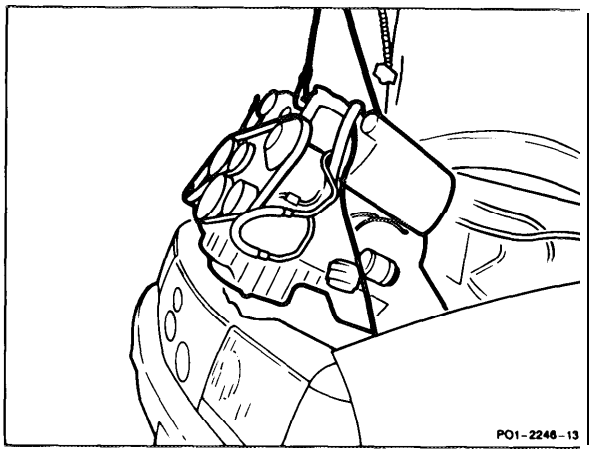


Allen bolt, engine mount, left



Allen bolt, engine mount, right

42 Lift engine with transmission at angle out of engine compartment, continuously correct angle with engine hoist, maximum angle approx. 45°.



⚠ Warning
When lifting engine pay attention to rear suspension eye on engine and engine oil filter.

43 Install in opposite order.

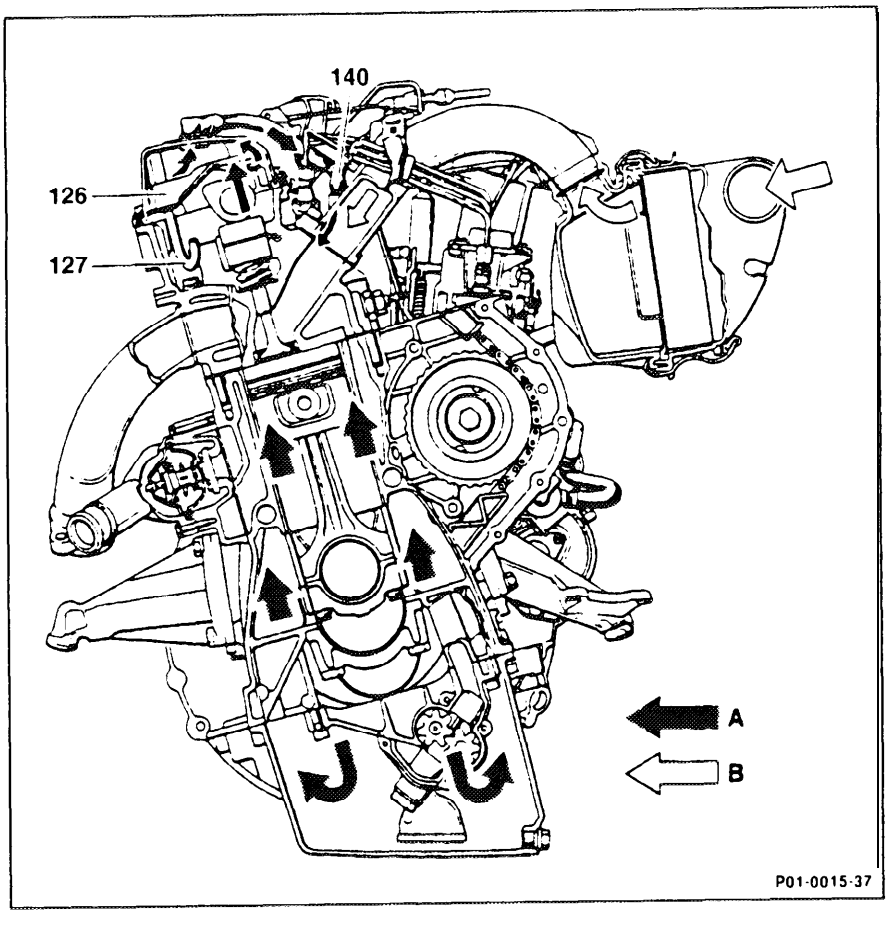
After installation:

44 Check engine oil, add, if required or refill engine oil and fill up cooling system.

44.1 Perform pressure test on cooling system (20-017), pressure tester 124 589 15 21 00.

44.2 Start engine and check engine oil and cooling systems for leakage.

A. Standard version



Crankcase ventilation, naturally aspirated engine, standard version
Engine 602

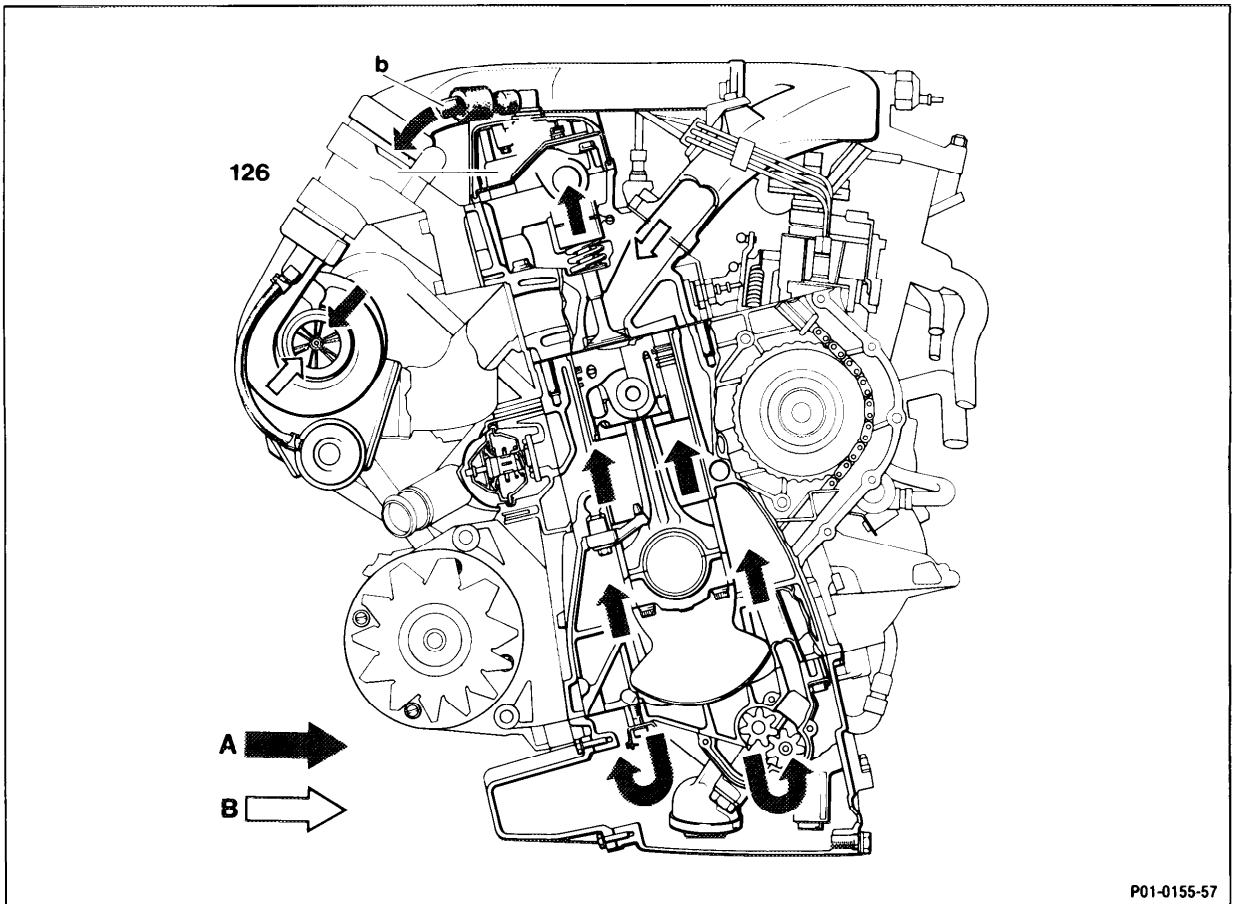
126	Oil separator
127	Return pipe
140	Distribution pipe
A	Blow-by gasses
B	Fresh air

The crankcase ventilation on standard version naturally aspirated engines is a closed, maintenance-free system.

The blow-by gasses from the crankcase flow through the oil separator (126) into the cylinder head cover and a hose to the distribution pipe (140) on the intake manifold depending on the intake manifold vacuum.

These gasses are distributed uniformly to all cylinders by the intake manifold and drawn into the combustion chambers together with the intake air.

The oil deposited in the oil separator runs back to the cylinder head through the return pipe (127).



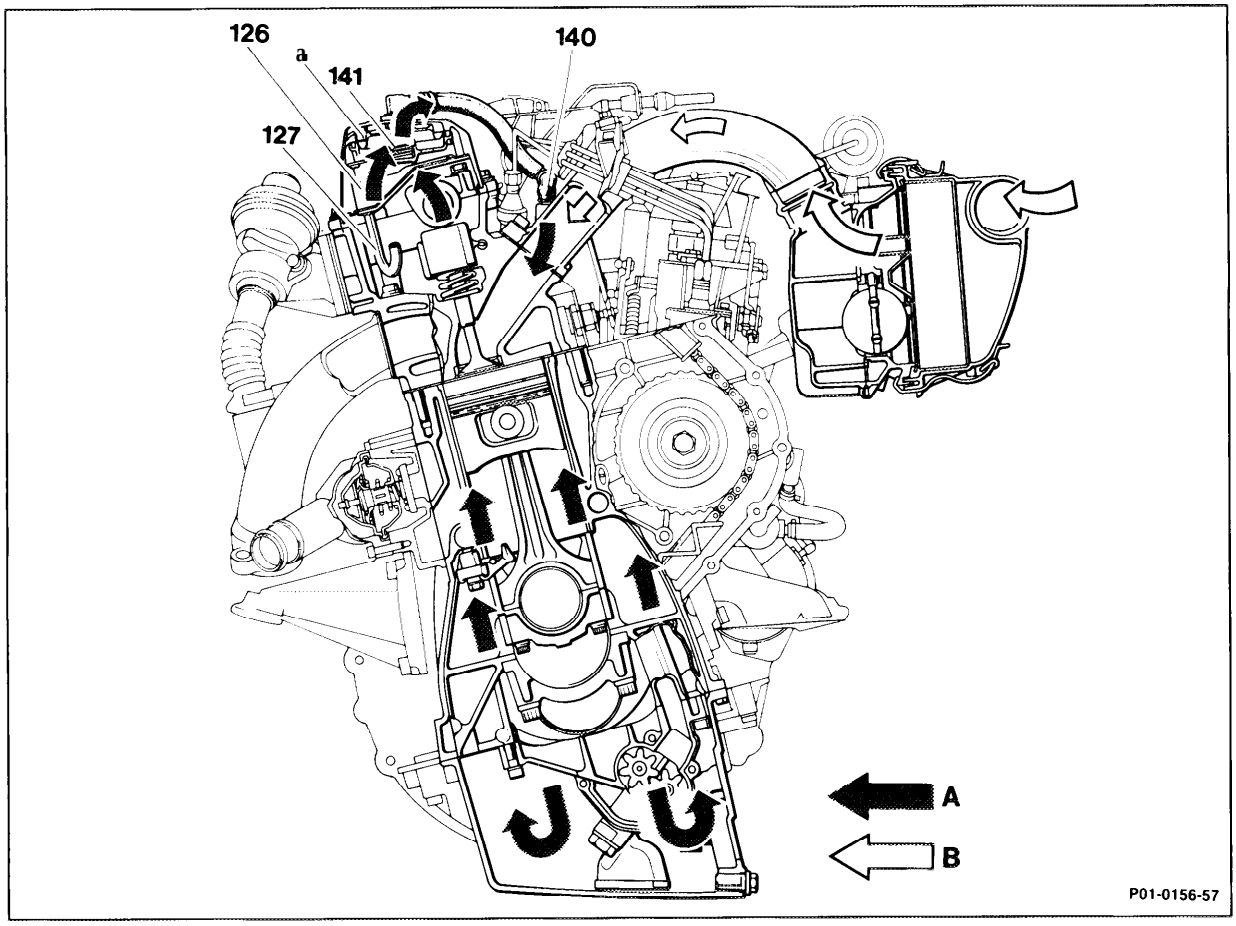
Crankcase ventilation, standard version turbo-engines
Engines 602.96, 603.96, 603.97

126	Oil separator
b	To arr cleaner housing
A	Blow-by gasses
B	Fresh air

The crankcase ventilation for the standard version turbo-engines corresponds to that of the naturally aspirated engine.

l-lowever on the turbo-engines, after removal of the engine oil, the blow-by gasses flow from the cylinder head cover to the intake hose.

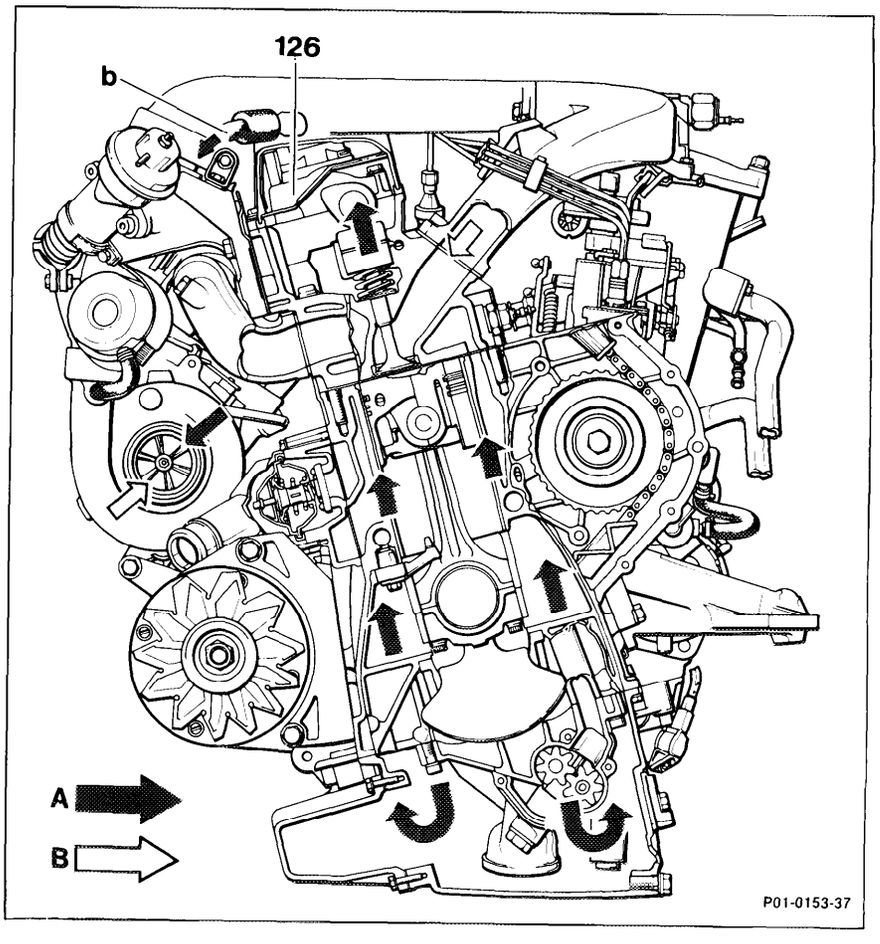
B. Naturally aspirated and turbo-engines with exhaust gas recirculation



Crankcase ventilation on engines with exhaust gas recirculation
Engine 602.91

126	Oil separator
127	Return pipe
140	Distribution pipe
141	Pressure control valve
a	Vent hole, dia. 3 mm
A	Blow-by gasses
B	Fresh air

Crankcase ventilation on engines with exhaust gas recirculation
Engines 602.96, 603.96, 97



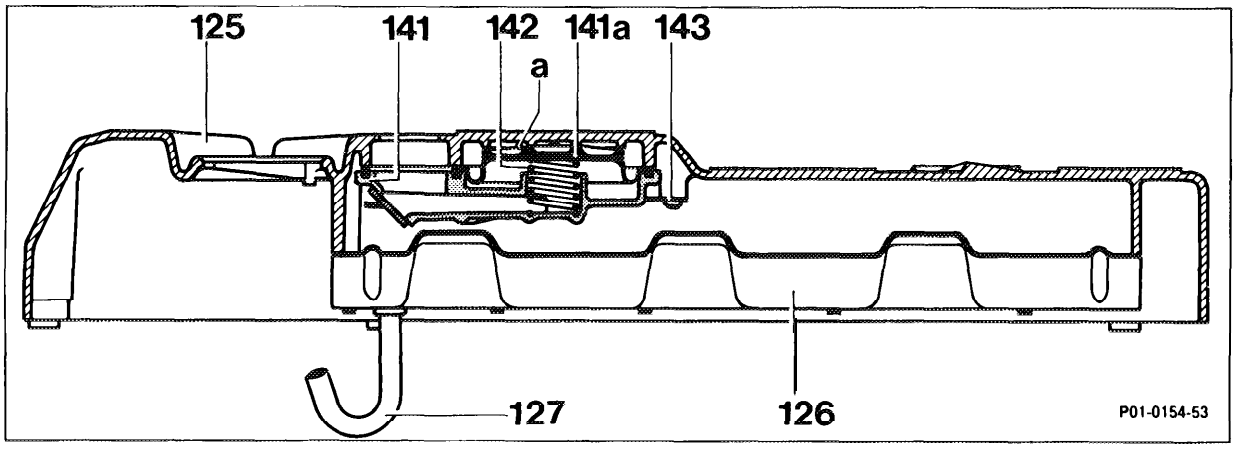
126 Oil separator
b To air cleaner housing
A Blow-by gasses
B Fresh air

The crankcase ventilation on naturally aspirated engines with exhaust gas recirculation differs from that of the standard version by addition of a built-in pressure control valve (141).

The pressure control valve is required because on engines with exhaust gas recirculation an additional throttle valve installed in the intake system results in significantly higher vacuums.

If the vacuum were too high, the engine oil would be sucked out of the crankcase.

The pressure control valve prevents this by keeping the vacuum constant above a certain value.

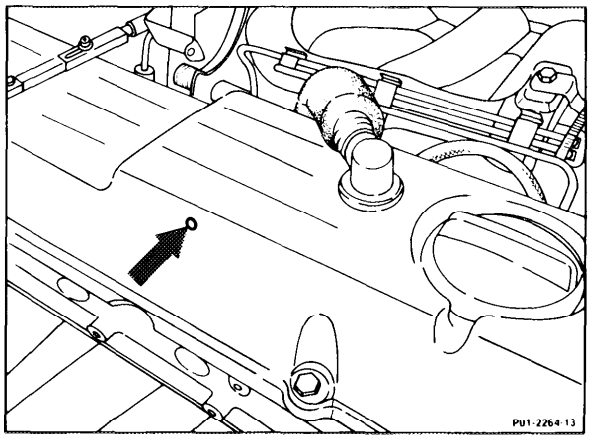


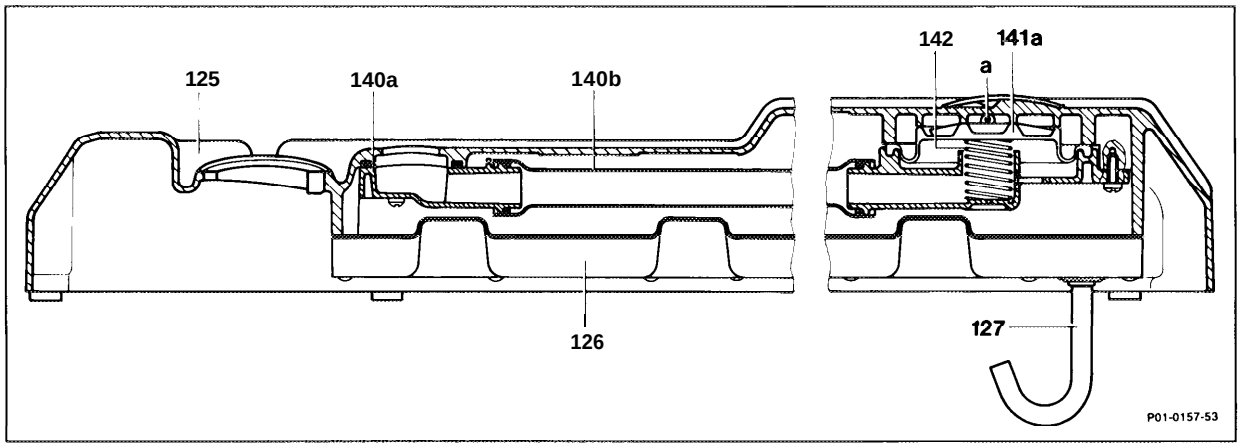
Pressure control valve
Engines 602.91, 603.91

125	Cylinder head cover	141a	Diaphragm
126	Oil separator	142	Spring
127	Return pipe	143	Holder
141	Pressure control valve	a	Vent hole

The pressure control valve is designed as a diaphragm-type valve and built into the oil separator in the cylinder head cover.

A hole is present in the cylinder head cover to vent the diaphragm chamber in the pressure control valve (arrow). This hole must not be plugged by dirt or preservation agents.





Pressure control valve, engines 602.96, 603.96

125	Cylinder head cover	140b	Intermediate section
126	Oil separator	141a	Pressure control valve
127	Return pipe	142	Spring
140a	Angle fitting	a	Vent hole

Turbo-engines with exhaust gas recirculation are also equipped with a pressure control valve (141 a). For space reasons this valve is installed in the rear section of the cylinder head cover.

Note

Because of increased pressure difference between the intake manifold and the crankcase, a stronger compression spring (142) with a higher spring rate was used. The following table indicates the vehicle and engine models in which the modified springs were first installed.in addition to engines 602.962 and 603.970 beginning model year 1990.

Production breakpoint: 01/88

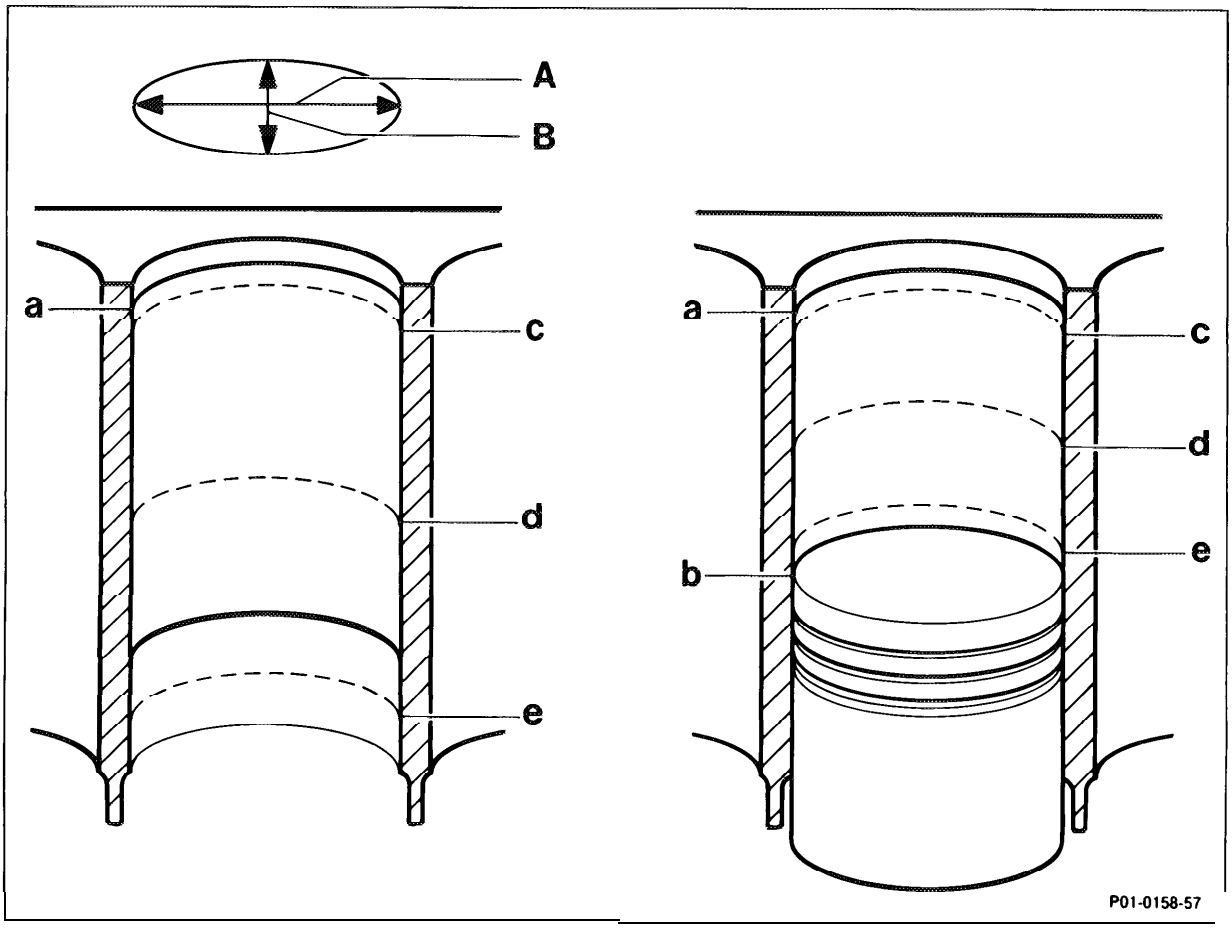
Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	–	0 17932	*	*
124.128	602.962	From Model Year 1990		*	*
126.134 126.135	603.970	From Model Year 1990		*	*
201.126	602.911	073017	014820	*	*

* not avarlable

01-110 Measuring, boring and honing cylinder bores

Preliminary operations:
Pistons removed (03-316).

A. Measuring
Engines with and without cylinder sleeves



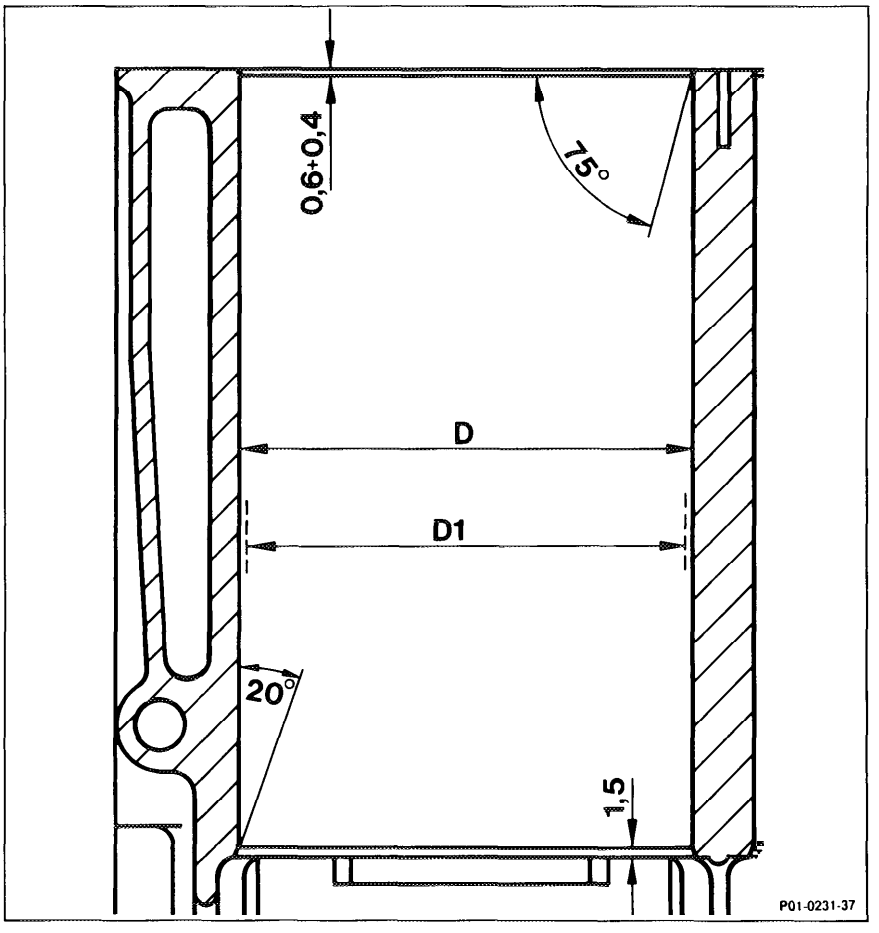
Cylinder bores ..... clean thoroughly.

Cylinder bore ..... Measure cylinder bore diameter with internal measuring instrument at 3 measuring points (c, d, e) in longitudinal direction (A) and transverse direction (B).

Note
Compare measured cylinder bore diameters with standard or repair stage specifications for engine (except for engines with cylinder sleeves).

Observe group ident. letters A, X or B stamped on the crankcase or piston crown. On used engines the difference between the diameter measured at point (c) and the original diameter is equal to the wear (max. permissible wear 0.2 mm).
The original diameter can be measured at the piston top land after it has been cleaned thoroughly (the top land is the area between the piston crown and the top surface of the block in the TDC position on ignition stroke).

B. Boring and honing
Engines without cylinder sleeves



Cylinder bore diameter (D) . . . . . measure.

Bore diameter (D_1)	determine and adjust boring tool. **Note** The bore diameter "D1" is the cylinder bore diameter "D" minus the material which will be removed by honing. The material removed by honing should not exceed max. 0.05 mm. Select repair stage diameter "D" according to engine model and group code letter A, X, B" (stamped in block).
Boring operation	perform according to operating instructions for boring tool used.
Cylinder bore	bevel at upper and lower edges of cylinder (see drawing for dimensions).
Honing operation	perform according to specified data.

Maximum permissible wear for cylinder bores

Measuring range “a” (upper reversal point of 1st piston ring) in longitudinal and/or transverse direction	0.2 mm

Standard and repair stage diameter "D" for cyl nder bores

Engine			602, 603	603.970
Version	Cylinder	Group code letter	Cylinder dia. D in mm	Cylinder dia. D in mm
Standard	1 – 4, 5, 6	A	**87.000 – 87.006**	**89.000 – 89.006**
		X	**over 87.006 – 87.012**	**over 89.006 – 89.012**
		B	over **87.012 – 87.018**	over 89.012 – 89.018
Repair stage [1] (+0,7 mm)		A	**87.700 – 87.706**	**89.700 – 89.706**
		X	**87.706 – 87.712**	**89.706 – 89.712**
		B	**87.712 – 87.718**	**89.712 – 89.718**

[1]) Does not apply for engines with cylinder sleeves. Cylinder sleeves must be replaced when the wear limit is reached.

Machining tolerances

Permissible out-of-round and conicity of cylinder bore	0.07 mm
Permissible roughness of cylinder bore (R3Z)	0.003 – 0.006 mm
Permissible waviness of cylinder bore	50 % of roughness
l-ioning angle	45”
Roughness of block parting surface	0.006 – 0.016 mm
Chamfer of cylinder bores	refer to figure

Introduction of engines without cylinder sleeves

Note

Beginning in 1987 the cylinder sleeves were eliminated partially on engines 602/603. The following tables show exactly when and on which model or engine the new version was introduced. Engine 603.970 was introduced into production without cylinder sleeves.
Installation of cylinder sleeves is not permissible.

Production breakpoint: 08/89

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
201.126	602.911	081638	016218	*	*

Production breakpoint:

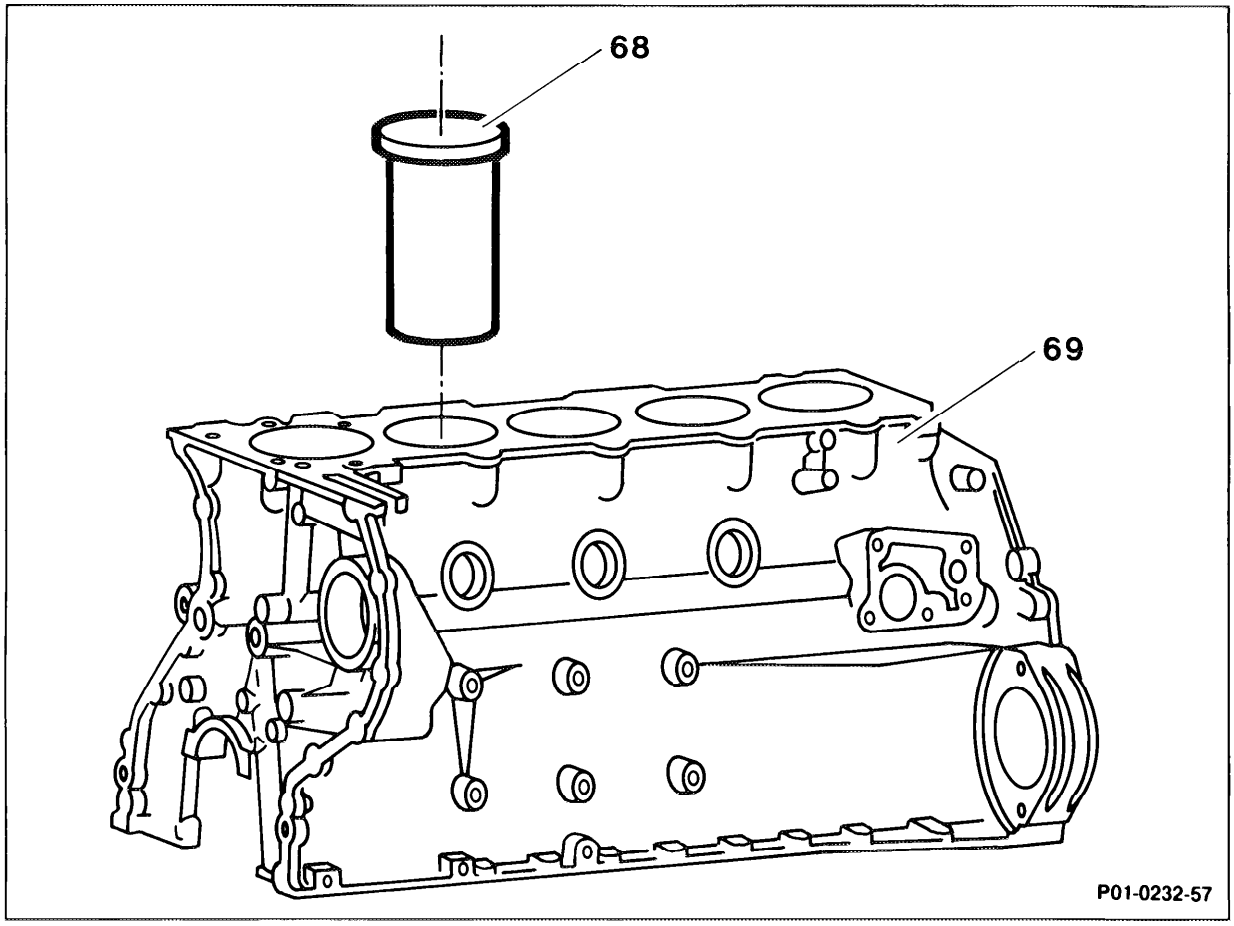
Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
201.126	602.911	083630	016502	*	*

Commercially available tool

Internal measuring instrument for 50 – 150 mm dia., with 0.01 mm increments and measuring point pressure relief	e.g.	Hommel Handel D-5000 Köln 71 Sunnen Grm-2125

01-115 Boring, honing and replacement of cylinder sleeves

Preliminary operations:
Pistons removed (03-316).



Cylinder bore	measure (01-l 10).
Cylinder sleeves (68)	press out, punch 603 589 00 15 00 (item 1).
Block (69)	clean basic bores for sleeves and check diameter (see table) with internal measuring instrument (items 2 and 3). **Note** If the permissible values are exceeded, replace block.
Cylinder sleeves	press in and maintain pressure for approx. 7 seconds to seat sleeve, punch 603 589 00 15 00 (item 4).

Cylinder bores	bore out to standard diameter "D" and hone, see Note in (01-l 10). Observe group code letters (A, X, B) (items 5 – 9).

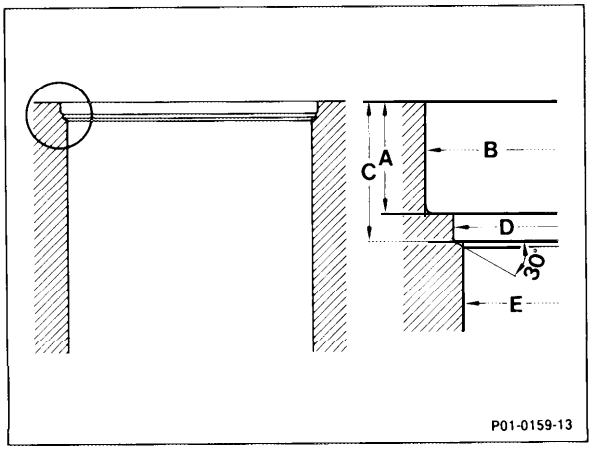
Diameter "D" for cylinder sleeves

Engine			**602, 603**
Version	Cylinder	Group code letter	Cylinder dia. D in mm
Standard [1]	1 – 4, 5, 6	A	87.000 – 87.006
		X	over 87.006 – 87.012
		B	over 87.012 – 87.018

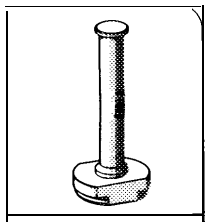
[1] There are no repair stages for engines with cylinder sleeves.

Dimensions for basic bore in block

Bore dia. "B"	92.650 – 92.750 mm
Bore dia. "D"	90.550 – 90.650 mm
Bore dia. "E"	90.000 – 90.935 mm
Depth "A" sleeve seat	3.8 – 4.0 mm
Depth "C" sleeve seat	4.77 – 5.23 mm
Permissible out-of-round of basic bore in block	0.01 mm
Permissible out-of-round and conicity of cylinder bore	0.07 mm
Permissible roughness of cylinder bore (R3Z)	0.003 – 0.006 mm
Permissible waviness of cylinder bore	50 % of roughness
l-loning angle	45"
Roughness of block parting surface	0.006 – 0.016 mm
Chamfer of cylinder bores	30"



Special tool



603 589 00 15 00
01

Commercially available tool

Internal measuring instrument for 50 – 100 mm dia., with 0.01 mm increments and measuring point pressure relief	e.g.	Hommel Handel D-5000 Köln 71 Sunnen Grm -2125

Replacement

1 Press out cylinder sleeves.

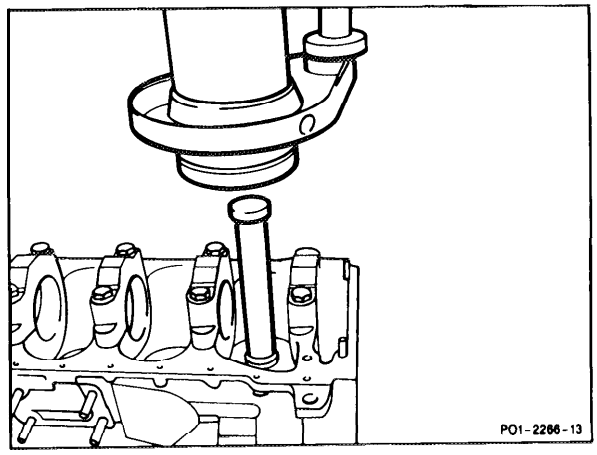
2 Thoroughly clean basic bore.

3 Measure basic bore (D) in block.

If the limits are exceeded (see table) the block cannot be reused.

4 Position new cylinder sleeves and press in with press.

After pressing in cylinder sleeves maintain pressure for approx. 7 seconds with press (setting pressure).



Boring and honing

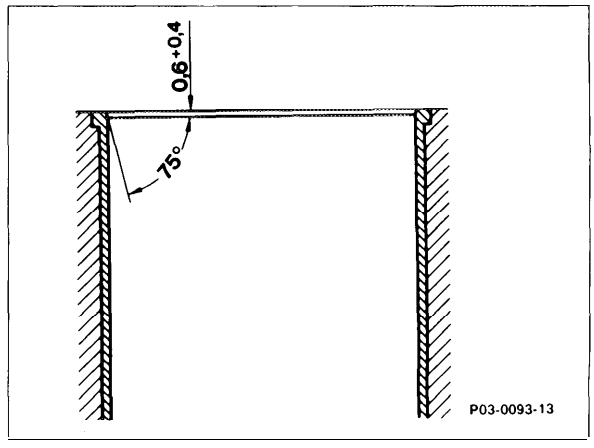
5 Mill or grind off projecting collar on sleeve. Remove as little material as possible from the block parting surface. Guide milling cutter or grinding wheel carefully over cylinder bores.

6 Bore out cylinder sleeves in two steps. Leave at least 0.03 mm additional material in the bores for honing.

7 Chamfer cylinder sleeves.

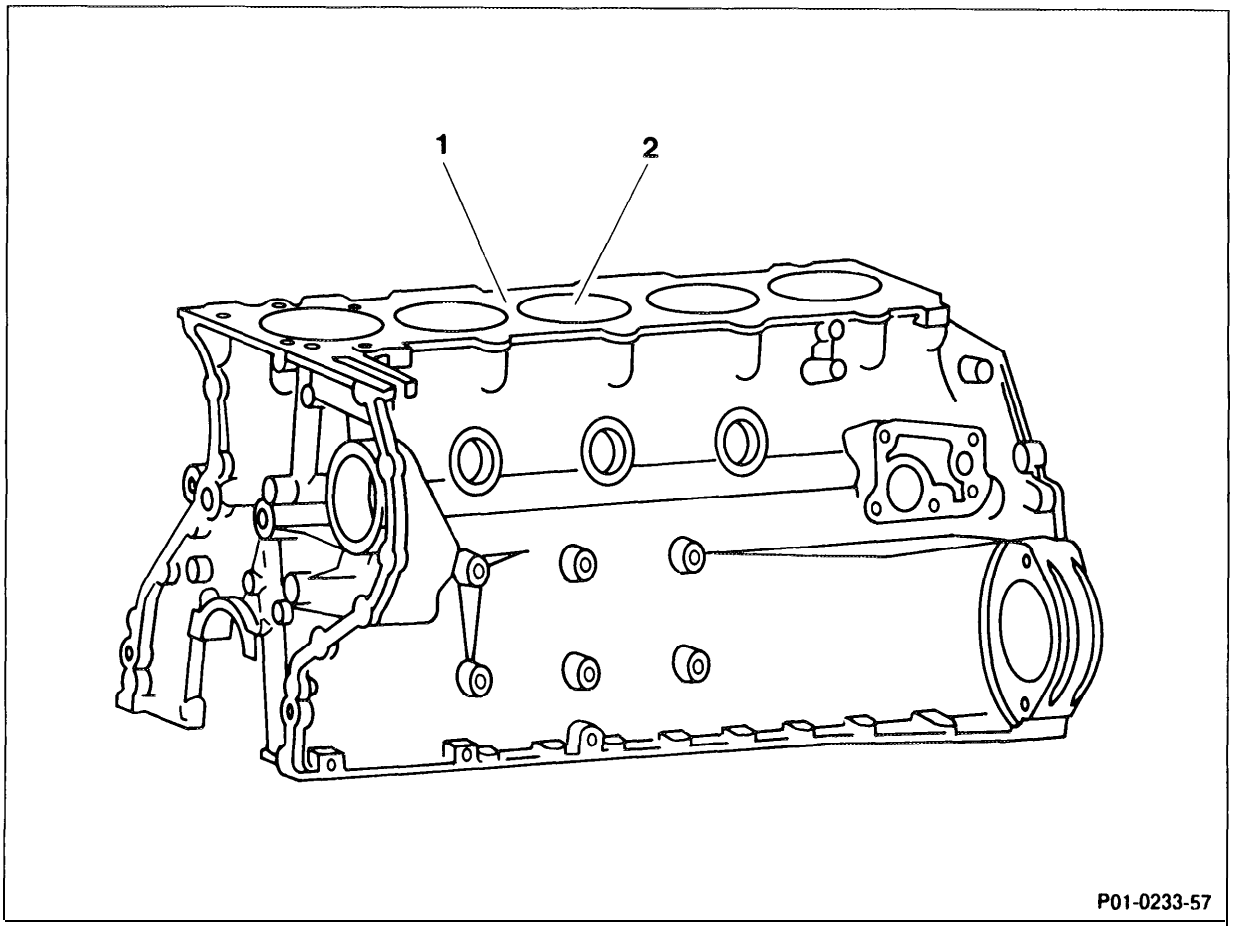
8 Hone cylinder bores.

9 Measure cylinder bores and select matching pistons (01410).



01-120 Planing crankcase parting surface

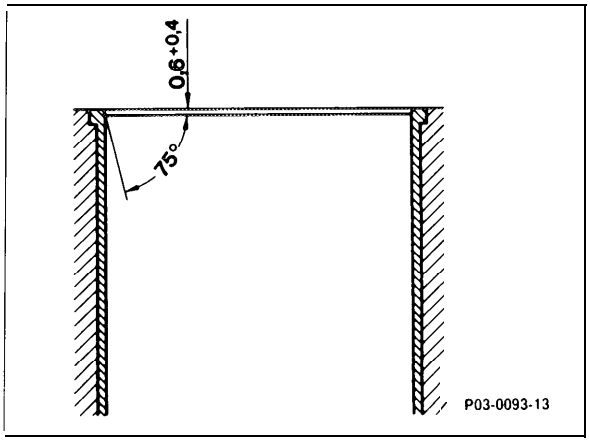
Preliminary operations:
Piston extension checked and pistons removed (03-316).



Parting surface (1)	plane according to operating instructions for planing tool used.
	Note Observe specified dimensions and machining data!
Cylinder bores (2)	chamfer at top of cylinder.
After reassembly	check engine timing (05-215).

Data

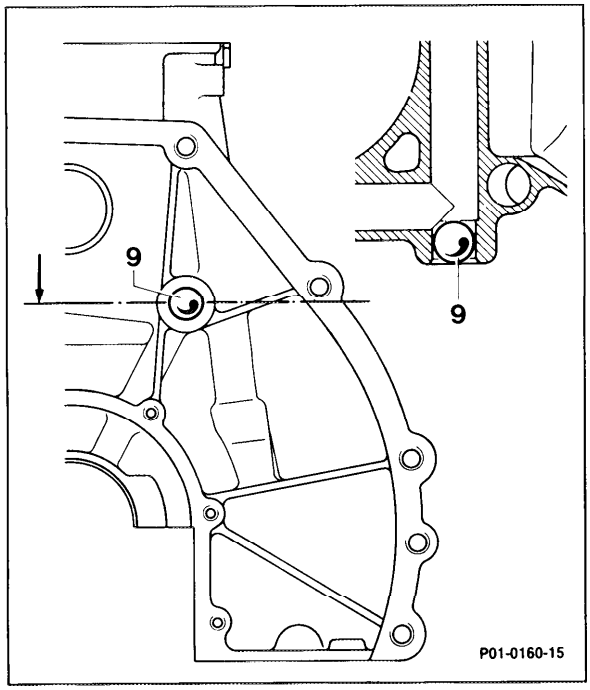
Height of block in new state from center of main bearing bore		234.97 – 235.03
Minimum height after required material removal from center of main bearing bore		234.60
Permissible unevenness of parting surface	in longitudial direction	0.06
	in transverse direction	0.06
Permissible roughness of upper parting surface		0.006 – 0.016
Permissible deviation in parallel between upper parting surface and lower parting surface in longitudinal direction		0.05
Chamfer of cylinder bores		see figure
Distance between piston crown and block parting surface		Projection max. 0.965 Projection min. 0.735



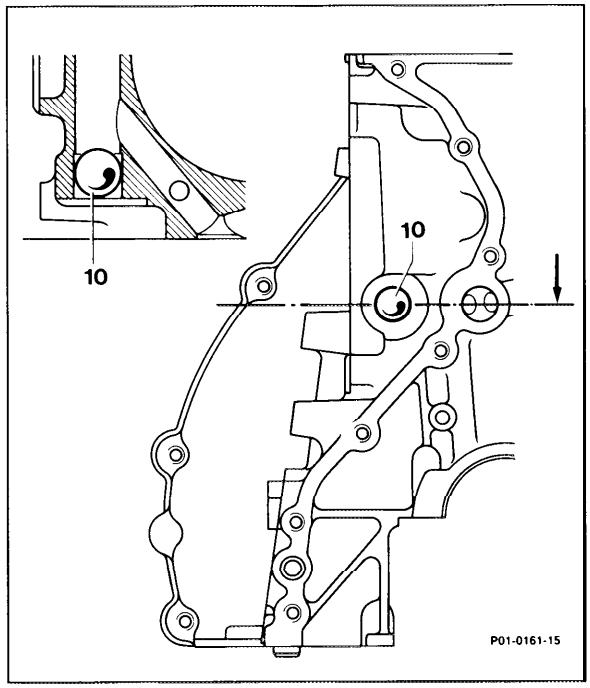
Cylinder bore chamfer

01-130 Removal and installation of steel balls in main oil duct

Preliminary operations:
Coolant pump removed with housing (20-230).
Flywheel removed (03-410).



Steel ball, rear, 15 mm dia. (9)



Steel ball, front, 17 mm dia. (10)

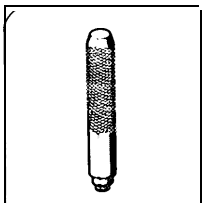
Steel balls (9, 10)	knock out, insert. Punch 601 589 08 15 00 (items 1 – 6).
	Note If not damaged the steel balls can be reinstalled a number of times. In the event of leakage reseat steel balls approx. 1 mm deeper (dimension marked on punch).
Leaky steel balls	replace with plug, remedy measures (items 7 – 9).
After reassembling engine	warm up engine and check for leakage in area of steel balls.

Tightening torque	Nm
Plug as replacement for steel balls	50

Replacement parts for steel balls	Part no.
Plug M 18 x 1.5 (front)	000 908 018 002
Plug M 16 x 1.5 (rear)	000 906 016 002
Gasket A 18	007 603 018 103

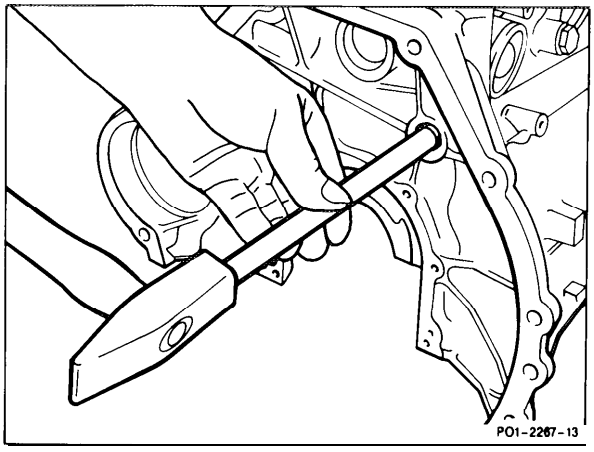
Sealant for replacement of rear steel ball	
Loctite 241	002 989 94 71

Special tool



601 589 08 15 00
01

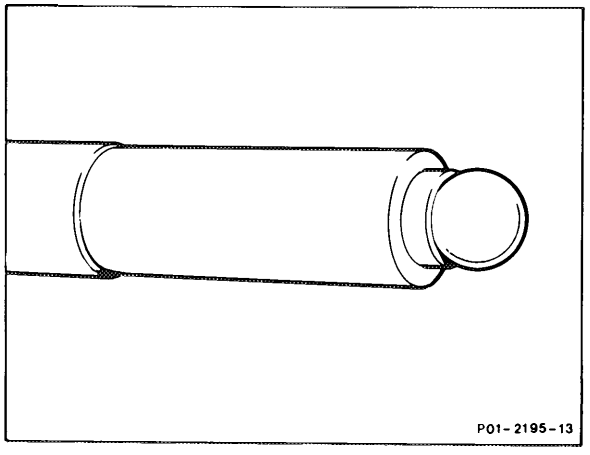
Knocking out



1 Knock out both steel balls from rear toward front with suitable steel rod.

Note
The steel balls can be reused a number of times. Replace damaged balls under all circumstances.

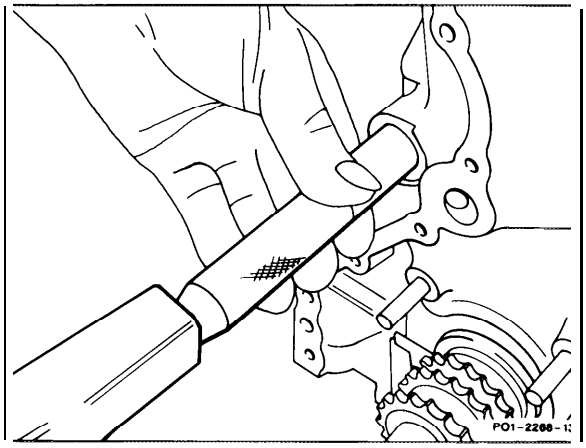
Inserting



2 Thoroughly clean seat for steel ball in engine block.

3 Insert steel ball with slight quantity of grease on punch 601 589 08 15 00.

4 Position steel balls on hole and drive in to specified stop on punch.



5 After reassembling engine, warm up engine and check for leakage in area of steel balls.

Note
If one of the steel balls does not seal sufficiently after inserting or if leakage is present following leakage test, replace steel ball with plug.

Replacing steel ball with plug

6 Knock steel ball out again.

7 Cut thread in hole for leaky ball.

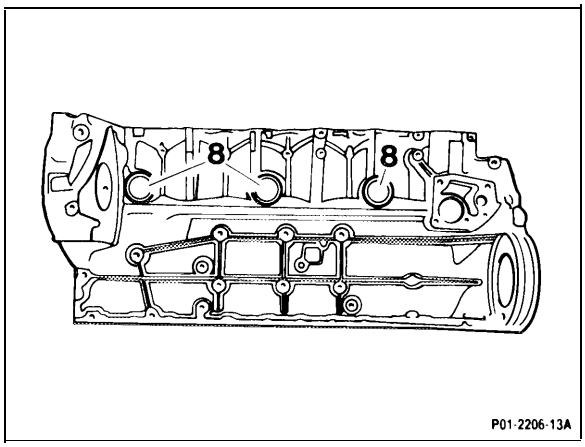
Note

Front bore M 18 × 1.5	10 mm deep
Rear bore M 16 × 1.5	14 mm deep

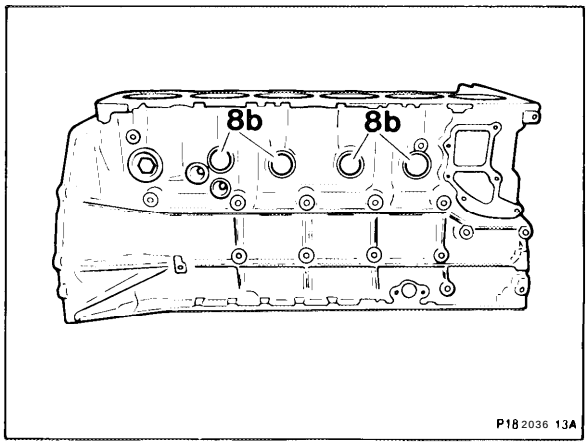
8 Thoroughly clean oil duct, screw in front plug with gasket and rear plug with sealant 002 989 94 71, tightening torque 50 Nm.

01-140 Replacement of freeze plugs in crankcase

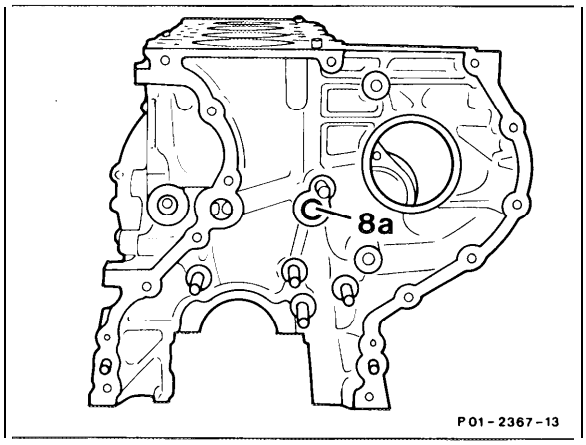
Preliminary operations:
Coolant drained (20-010).
Attachment parts in area of freeze plug removed.



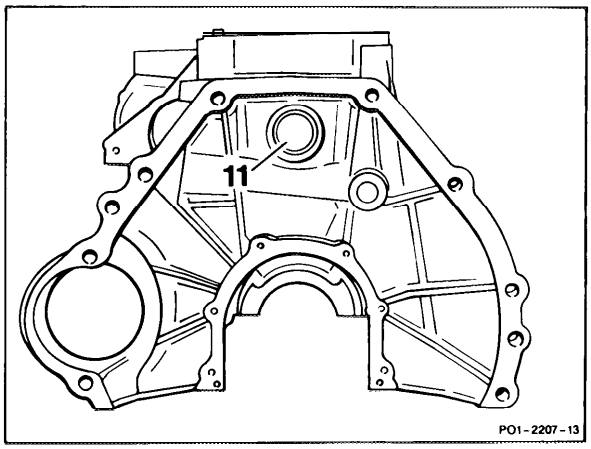
Freeze plug, left, 34 mm dia. (8)



Freeze plug, right, 34 mm dia. (8b)



Freeze plug, front, 17 mm dia. (8a)



Freeze plug, rear, 34 mm dia. (11)

Freeze plugs (8, 8a, 8b, 11) . . . . . remove, knock in. Installation punch
102 589 12 15 00, 17 mm dia. or punch
102 589 00 15 00, 34 mm dia. (items 1 – 6).

Note
Seal freeze plugs with sealant
002 989 94 71. Allow sealant to harden
for approx. 45 minutes.

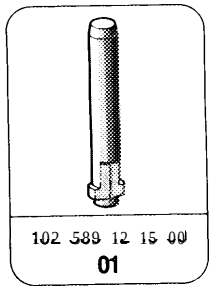
After reassembling engine ..... allow engine to warm up and check for leakage at newly installed freeze plug .

Note
The number of freeze plugs differs on the individual engine models. The figure shows engine model 603 as an example.

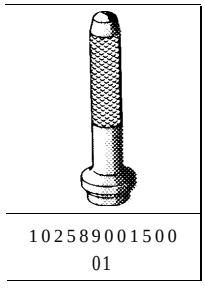
Engine	left, 34 mm dia.	right, 34 mm dia.	front, 17 mm dia.	rear, 34 mm dia.
602	3	3	1	1
603	3	4	1	1

Sealant	
Loctite 241	002 989 94 71

Special tools



102 589 12 15 00
01



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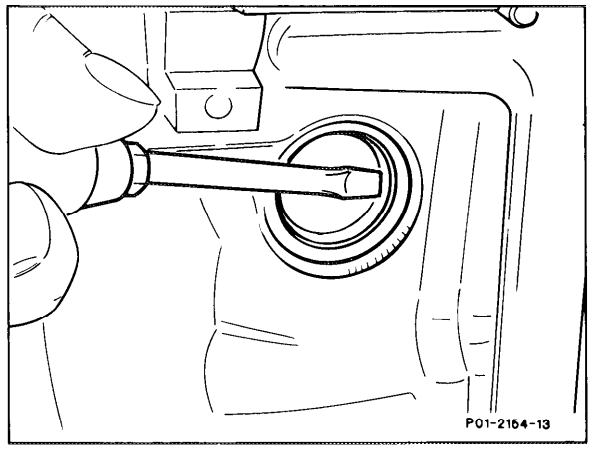
01

Removal

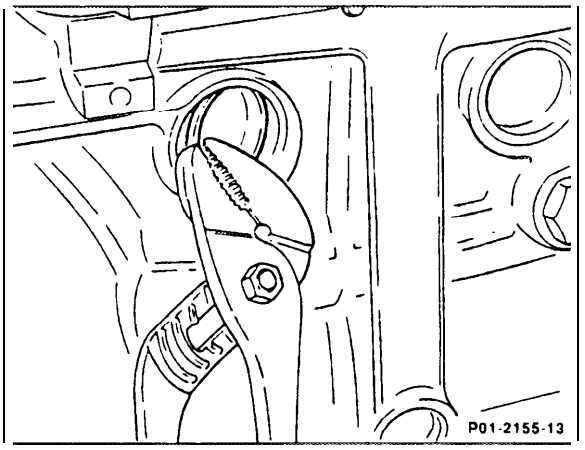
1 Position chisel with small blade or screw-driver in deep-drawn edge of freeze plug.



2 Carefully knock in freeze plug at one side until it rotates around its own longitudinal axis and can be gripped with a pair of pliers.

3 Pull out freeze plug.

4 Clean sealing surface; surface must be free of grease.

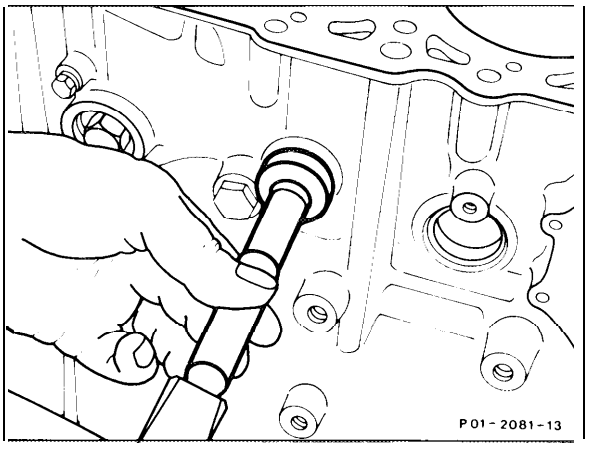


Installation

5 Coat sealing surface with sealant 002 989 94 71.

6 Knock in new freeze plug with install-ation punch 102 589 12 15 00 (17 mm dia.) or 102 589 00 15 00 (34 mm dia.).

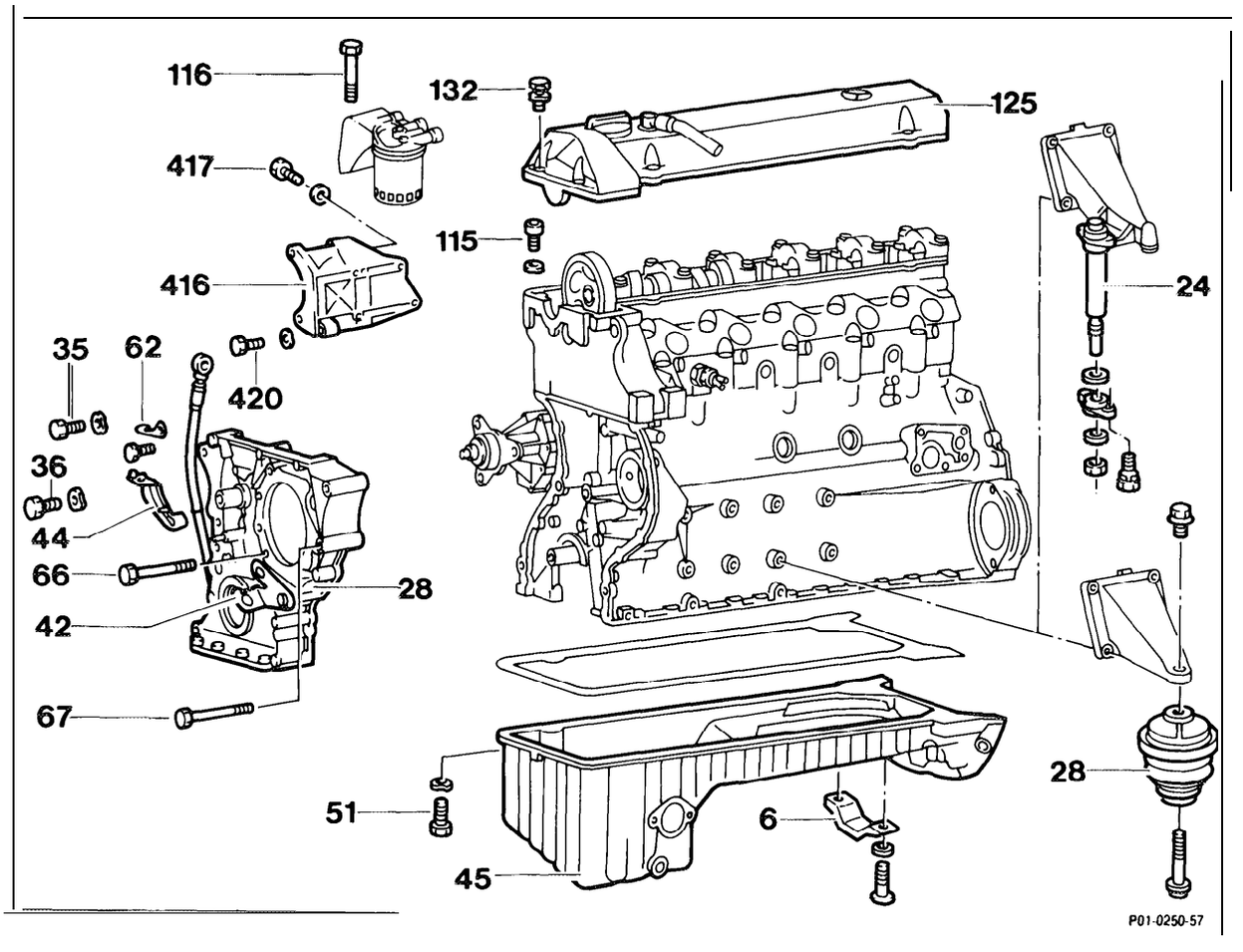
Caution!
Allow sealant to harden for approx. 45 minutes before filling coolant.



7 After reassembling engine, allow engine to warm up and check for leakage at new freeze plug installed.

01-210 Removal and installation of timing cover

Preliminary operations:
Engine compartment capsule, bottom section removed (01-006).
Radiator removed (20-420).
Magnetic or viscodrive fan clutch removed (20-335, 20-312).
Crankshaft pulley and hub removed (03-341).
Poly-V-belt tensioning device removed (13-345).
Piston vacuum pump removed (43-618).
Power steering pump or tandem pump removed (46-710).
Hydraulic pump on cylinder head removed (05437).
Alternator removed (15-510).
Engine oil drained.



Air conditioning:

Condenser .....

Caution!
Attach guard plate.

Cylinder head cover (125) .....

remove if not yet removed, install, 10 Nm (item 1).

Note
On turbo-engines the charge air pipe must be removed before removing the cylinder head cover.

Front hex. head bolt (116)	for fuel filter, remove, reinstall, 25 Nm (item 2).
Holder (62)	for oil dipstick tube, remove, reinstall, 25 Nm (item 3).
Hex. head bolts (417)	on mount (416) for alternator, remove, reinstall and remove mount, install, 45 or 25 Nm (item 4).
Holder for TDC sensor (42 or 44)	mark position and unbolt, reinstall (item 5).
	Note Check TDC sensor adjustment, readjust if required **(03-345).**
Model 201 (up to 03/85):	
Mount (6) for engine stop	remove, reinstall, 25 Nm (item 6).
Model 201 (up to 03/85):	
Engine shock absorber (24), left	remove, install, 10 Nm (item 7).
	Note Check engine stop, adjust, 130 Nm (22-220), adjustment gauge 201 589 04 23 00.
Model 126:	
Engine shock absorbers (24), left and right	remove, install, 10 Nm (item 8).
Front suspension eye on engine	hook in engine hoist (item 9).
Engine mounts (28), front, left and right	remove Allen bolts at bottom, reinstall, 40 and 70 Nm (item 10).

Engine	lower back on engine mounts with engine hoist (item 14).
Hex. head bolts (66, 67)	for mounting injection pump, remove, reinstall, 25 Nm (item 15).
Allen bolts (1 15)	in timing chain housing, remove, reinstall, 25 Nm (item 16).
Hex. head bolts (35, 36)	in timing case cover, remove, reinstall, 25 Nm (item 17).
Timing case cover (28)	remove, install (item 17).

Caution!
When removing timing case cover pay attention to cylinder head gasket and oil pan gasket. Avoid damaging. Replace damaged cylinder head gasket.

Note
Clean parting surface on timing case cover, seal cover with sealant 001 989 95 20.

Check crankshaft radial seal in timing case cover, remove if required, install, sleeve 601 589 03 14 00 (item 17).

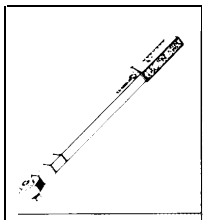
After installation	warm up engine and check for leakage (item 19).

Sealant

Hvlomar	001 989 25 20

Tightening torques		Nm
Allen bolts, mount, engine stop, front		10
Adjustment screw, engine stop, front		130
Allen bolt, engine mount, front		40
Allen bolt, engine mount, front, model 126		70
Hex. head bolts, cylinder head cover		10
Cylinder head bolts in timing chain case		25
Hex. head bolts, mount, alternator		45
Hex. head bolts, oil pan	M6	10
	M8	25
Hex. head bolts for mounting injection pump		25
Hex. head bolts for mounting timing case cover		25
Hex. head bolts for engine shock absorber mount		10
Hex. nuts, engine shock absorber		10

Special tools



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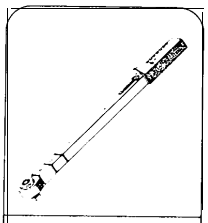

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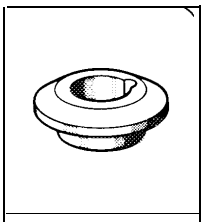

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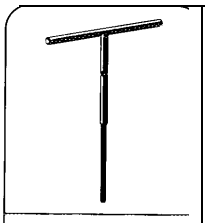

116 589 03 07 00
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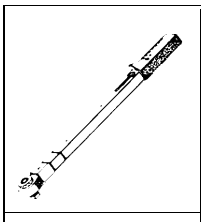

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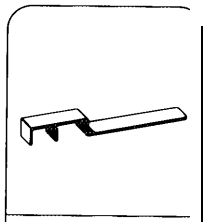

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Commercially available tools

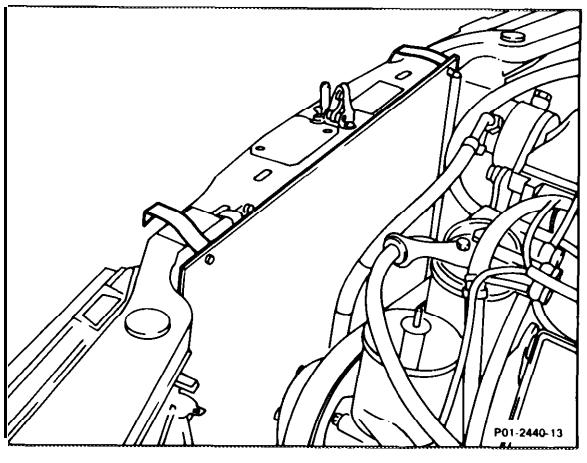
Connection 3/4" square ratchet to 1/2" square head	e.g.	Hazet, D-5630 Remscheid Order no. 1058 R. 1
Engine hoist no. 3188 (self-braking)	e.g.	Backer, D-5630 Remscheid, Herderstraße
7 mm socket on flexible shaft for hose clamps with worm drive	e.g.	Hazet, D-5630 Remscheid Order no. 426-7

Self-made tool

Guard plate for air conditioner condenser	Dimensions: approx. 480 x 600 x 1

Removal, installation

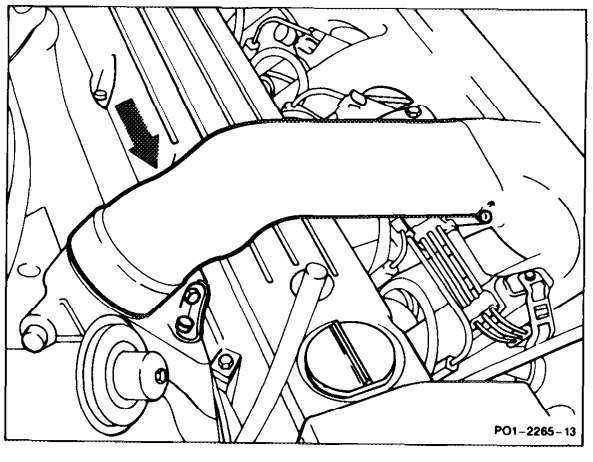
Caution!
On vehicles with air conditioning attach guard plate to condenser before starting work.



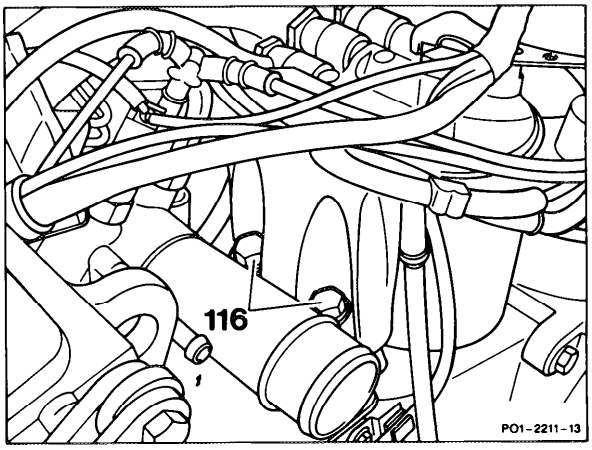
1 Remove cylinder head cover, if not already removed.

Installation note
Tightening torque 10 Nm.

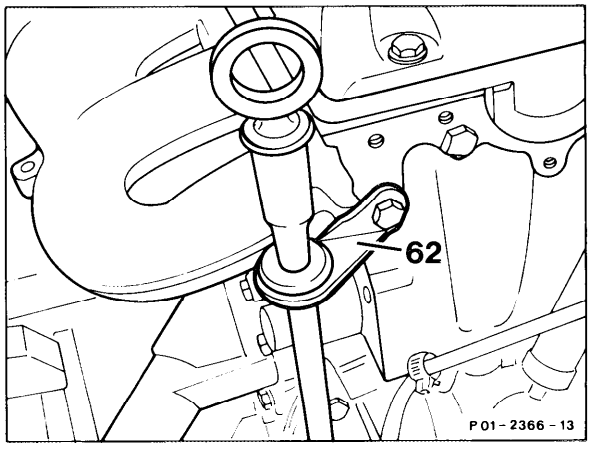
Note
On turbo-engines the charge air pipe (arrow) must be removed before removing the cylinder head cover.



2 Remove hex. head bolts (116) at front of fuel filter.



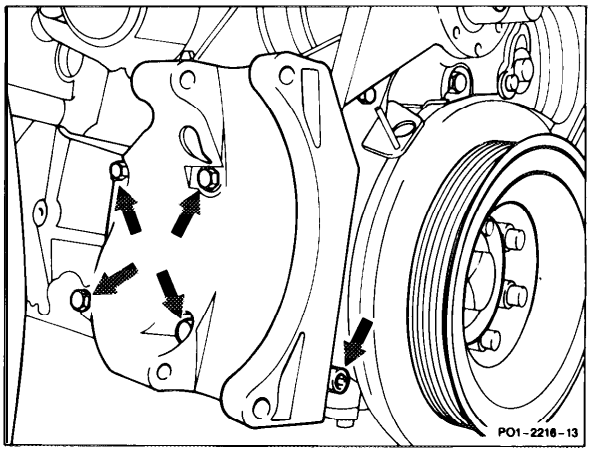
3 Unbolt holder (62) for oil dipstick tube, 25 Nm.



4 Remove hex. head bolts (arrows) on mount for alternator and remove mount.

Installation note

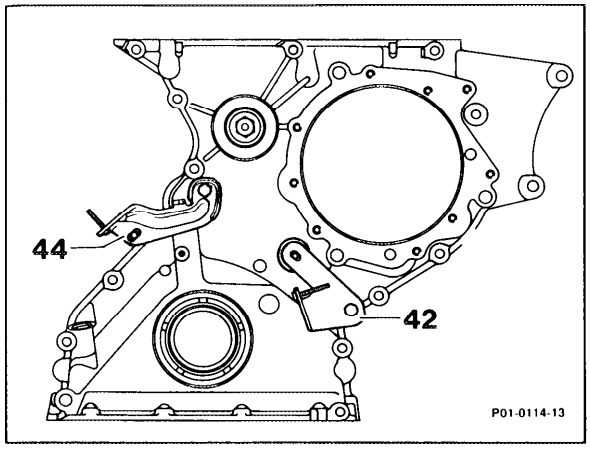
Tightening torques	
Mounting bolts for mount	45 Nm
Mounting bolt on timing case cover	25 Nm.



5 Mark position of mount for TDC sensor (42 or 44) and unbolt mount.

Installation note

Check TDC sensor and adjust if required (03-345).

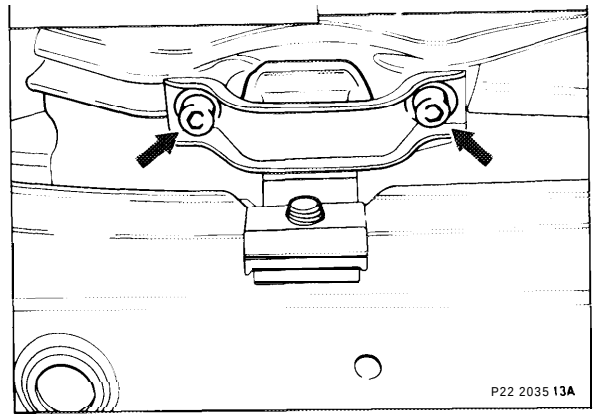


Model 201 (up to 03/85):

6 Remove Allen bolts (arrows) on mount for engine stop at front and remove mount.

Installation note

Tightening torque 25 Nm.
Check engine stop with adjustment gauge 201 589 04 23 00 and adjust (22-220).
Tightening torque for adjustment bolt 130 Nm.

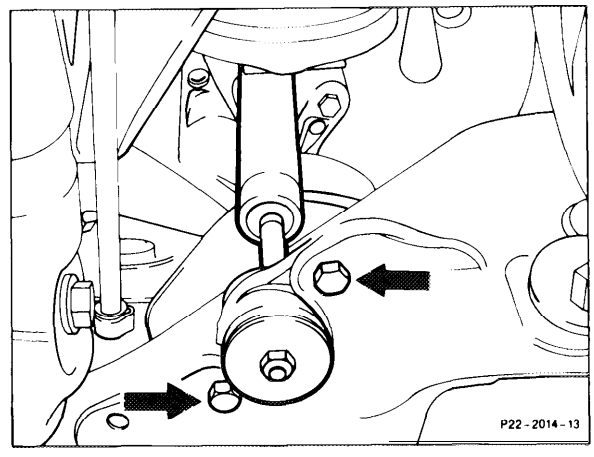


Model 201 (up to 03/85):

7 Remove engine shock absorber on left; remove hex. head bolts (arrows) on mount and remove engine shock absorber from frame cross member.

Installation note

Tightening torque 10 Nm.

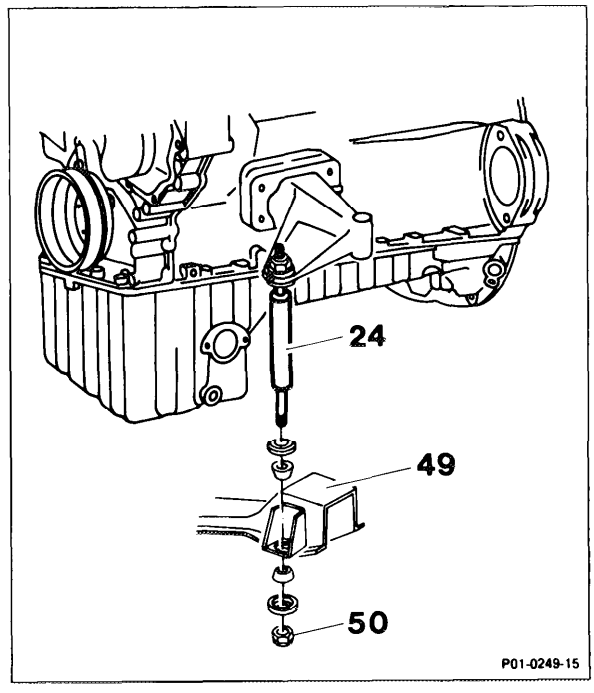


Model 126:

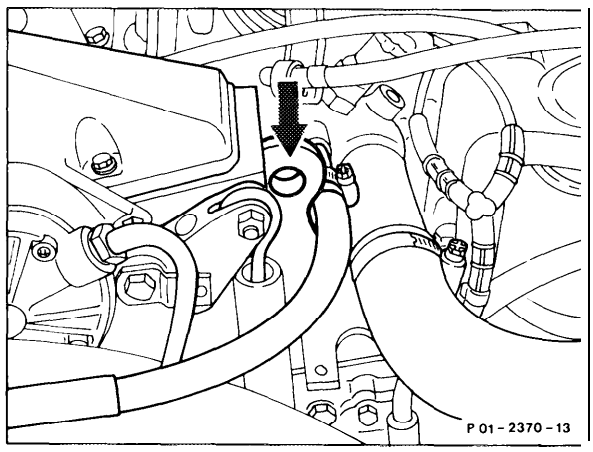
8 Remove engine shock absorbers (24) on left and right; unscrew hex. nuts (50) and press shock absorber upward out of mount on frame cross member (49).

Installation note

Tightening torque 10 Nm.



9 Attach engine hoist cable to front suspension eye (arrow).

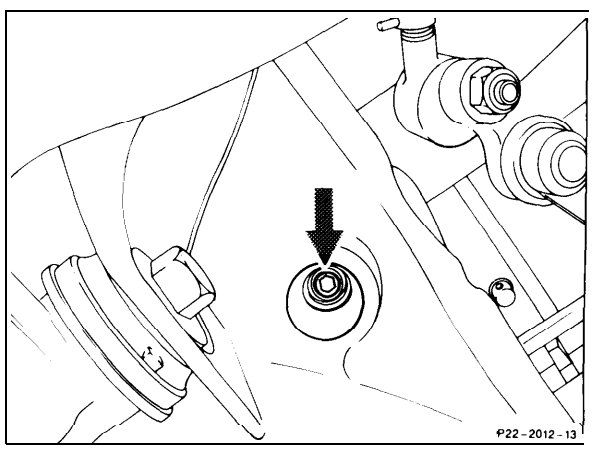


10 Remove Allen bolts for front engine mount from frame cross member from bottom.

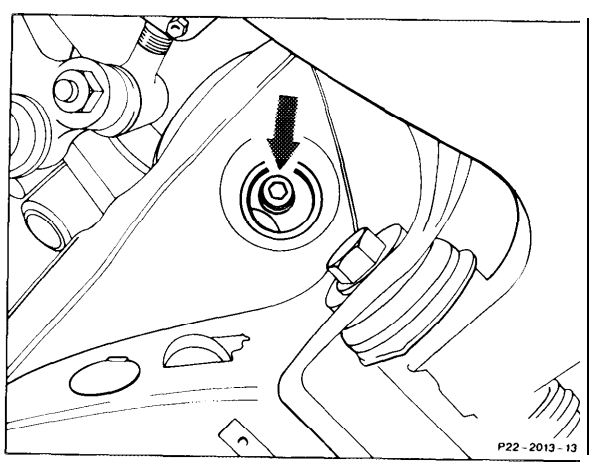
Installation note

Tightening torque

Model 124 and 201	40 Nm
Model 126	70 Nm



Allen bolt, engine mount, left



Allen bolt, engine mount, right

12 Hoist engine with engine hoist until hex. head bolts in oil pan are accessible in area of timing case cover.

13 Remove hex. head bolts in oil pan in area of timing case cover and loosen remaining bolts.

Installation note

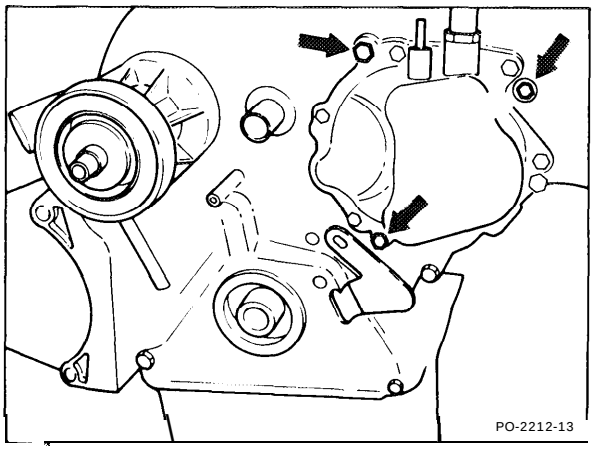
Tightening torque M6 10 Nm,
M8 25 Nm.

14 Lower engine back onto front engine mounts.

15 Remove hex. head bolts (arrows) for mounting injection pump. Remove square nuts on injection pump flange.

Installation note

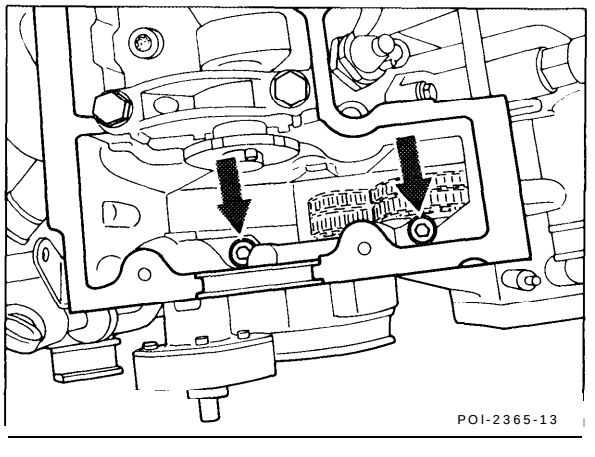
Tightening torque 25 Nm.



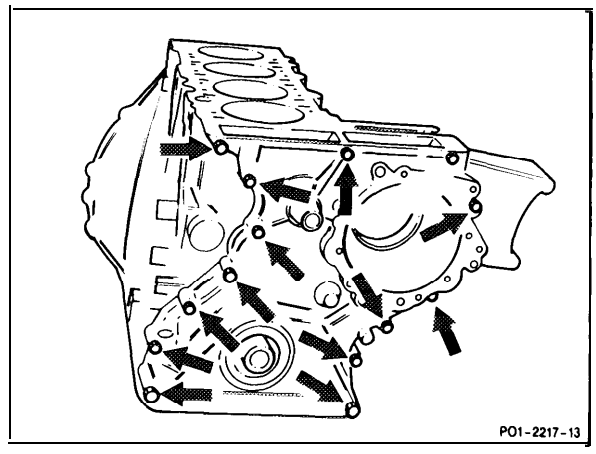
16 Remove Allen bolts (arrows) in timing chain case.

Installation note

Tightening torque 25 Nm.

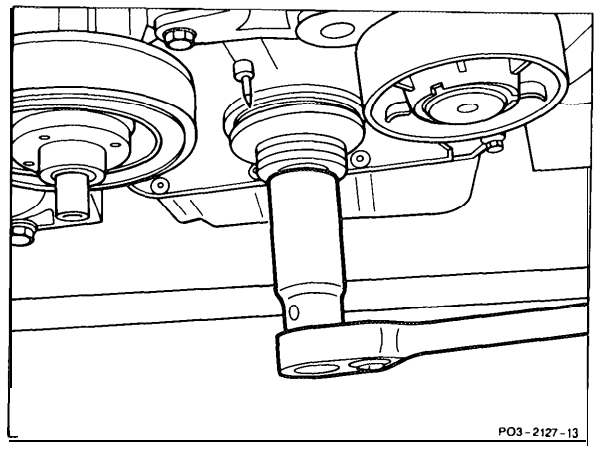


17 Remove all remaining hex. head bolts (arrows) in timing case cover and remove timing case cover.



Caution!
When removing timing case cover be careful of cylinder head gasket and oil pan gasket. Avoid damaging. Replace damaged gaskets.

Installation note
Clean gasket residues off of parting surface on timing case cover.
Check crankshaft radial seal in timing case cover and replace, if required, installation sleeve 601 589 03 14 00.
Coat parting surface of timing case cover with sealant 001 989 25 20. Tightening torque 25 Nm.

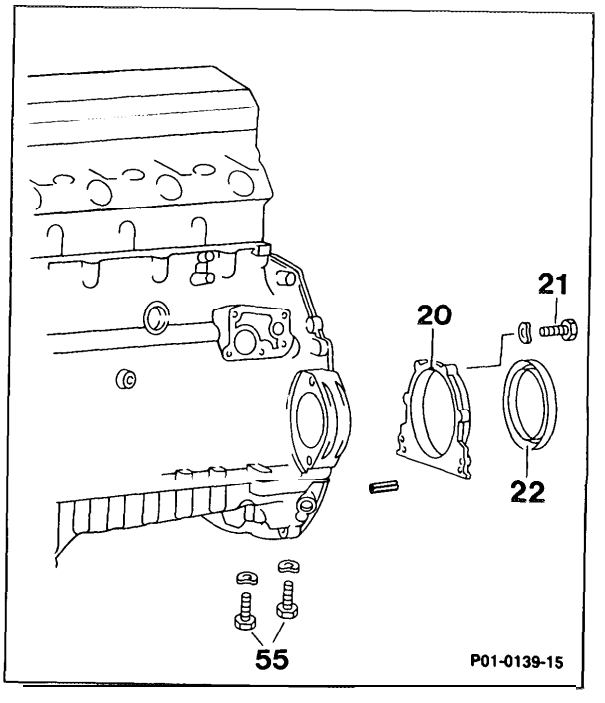


18 Assemble in opposite order.

19 After installation warm up engine and check timing case cover for leakage.

01-222 Removal and installation of end cover

Preliminary operations:
Flywheel removed (03-410).



Hex. head bolts (55)	in oil pan, remove, reinstall, 25 Nm (item 1).
Hex. head bolts (21)	Hex. head bolts (21) in end cover (20), remove, reinstall, 10 Nm (item 2).

Note
Coat threads of hex. head bolts with sealant 002 989 20 10.

End cover (20) ..... press out together with crankshaft radial seal (22), press in, installation sleeve 601 589 03 43 00 (item 3).

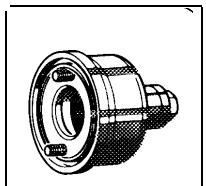
Note
Avoid damaging oil pan gasket.

Note
Clean gasket residues off of parting surface on end cover and coat parting surface of cap with sealant 002 989 00 20 10. Check crankshaft radial seal and remove if required, install, installation sleeve 601 589 03 43 00.

Sealant	
Omnifit	002 989 00 20 10

Tightening torques	Nm
Hex. head bolts, end cover	10
Hex. head bolts, oil pan	25

Special tools



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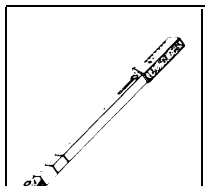

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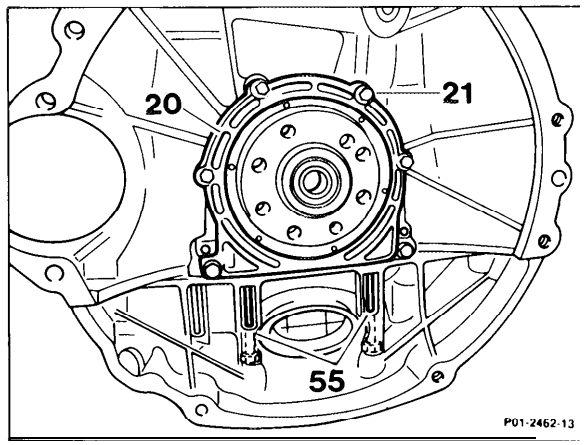
Removal, installation

1 Remove the two hex. head bolts (55) in the oil pan.

Installation note
Tightening torque 25 Nm.

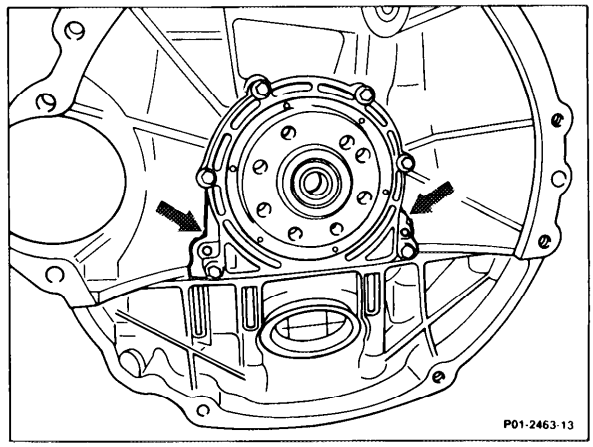
2 Remove hex. head bolts (21) in end cover (20).

Installation note
Coat threads on hex. head bolts with sealant 002 989 00 20 10.
Tightening torque 10 Nm.

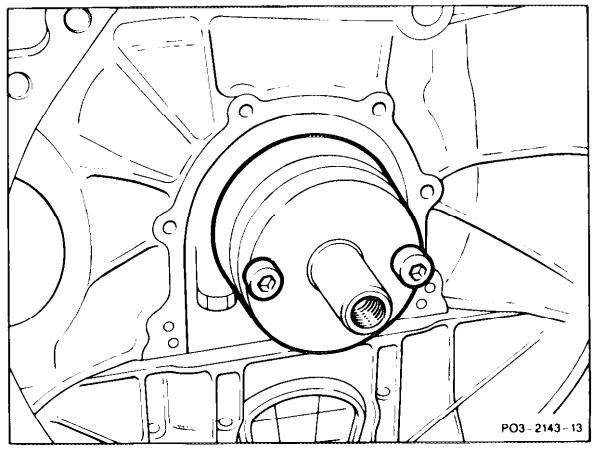


3 Press end cover off of crankcase at tabs (arrows) and remove crankshaft radial seal from crankshaft journal.

Note
When pressing the end cover on and off avoid damagingthe oil pan gasket.



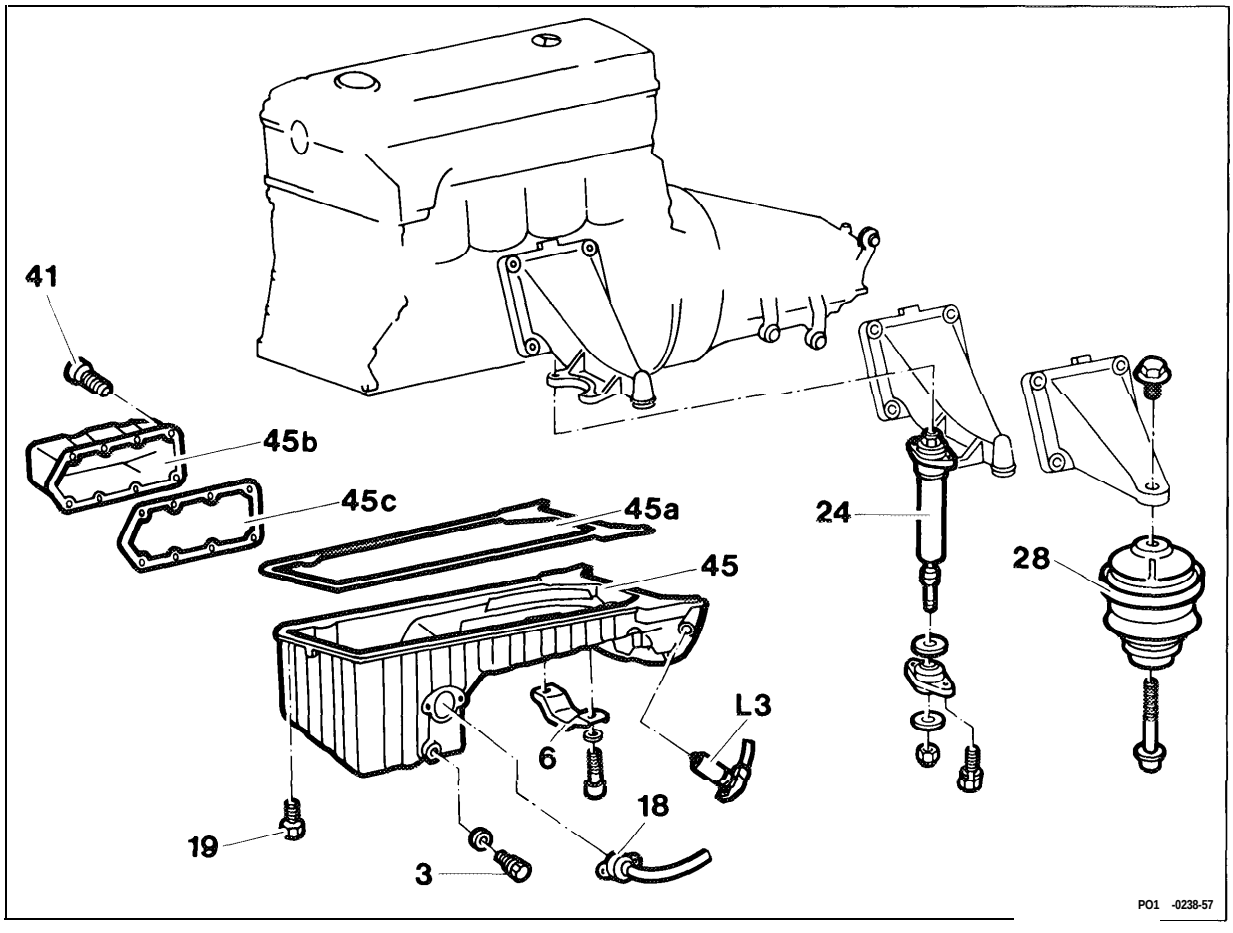
Installation note
Clean gasket residues off of parting surface on end cover. Check crankshaft radial seal and replace if required. Coat parting surface on end cover with sealant 002 989 00 20 10 and slide end cover together with radial seal over attached installation sleeve 601 589 03 43 00.



01-310 Removal and installation of oil pan

A. Model 124, 126 and 201

Preliminary operations:
Bottom section of engine compartment noise capsule removed (01-006).
Model 124 and 201:
Torsion bar on front axle removed .
Models 124, 201 .126 and 201 .128:
Steer. rod, left and steer. shock absorber, right rem..
Fan cowl loosened.



Battery	disconnect negative cable, reconnect (item 1) .
Engineoil	drain, fill (item 2).

Note
Tightening torque for oil drain plug (3) 25 or 30 Nm. Observe specified oil capacity.

Model 201 (up to 03/85):

Mount, engine stop (6)	remove, install, 25 Nm (item 3). **Note** Check engine stop, adjust, 130 Nm (22-220), adjustment gauge 201 589 04 23 00.

Model 201 (up to 03/85):

Engine shock absorber (24), left	remove, install, 10 Nm (item 4).

Model 126:

Engine shock absorbers (24), left and right	remove, install, 10 Nm (item 5).
Engine speed sensor (L3) and ground strap	remove, reinstall (item 6).
Oil level sensor (18)	disconnect plug, reconnect (item 7).

Automatic transmission

Oil lines	between transmission and oil cooler or transmission air/oil cooler, unbolt at oil pan, install and remove at radiator, reinstall (item 8). **Note** Plug oil lines before removal, clamp 000 589 40 37 00.

Oil pan with attached side sections:

Oil pan side section (45b)	remove, install (item 9). **Note** Replace gasket (45c) for oil pan side section. Tightening torque for hex. head bolts (41) 10 Nm.
Front suspension eye on engine	hook in engine hoist, unhook (item 10).
Front engine mounts (28), left and right	remove Allen bolts from bottom, reinstall, 40 and 70 Nm (item 11).
Engine	hoist with engine hoist, lower back on engine mounts (item 12).
Hex. head bolts (19)	remove from oil pan (45), reinstall (item 13). M6 bolts 10 Nm, M8 bolts 25 Nm. **Note** Observe different lengths of hex. head bolts.

Oil pan (45) , ...	remove from crankcase together with oil pan gasket (45a), install (item 14). **Note** Remove oil pan toward front of vehicle while turning crankshaft slightly if required. Clean gasket residues from parting surface of oil pan. Replace oil pan gasket (45a).
After installation	warm up engine and check for leakage (item 16).

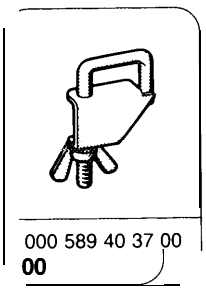
Oil capacities with oil dipstick code
(see "Service Product Specifications" for approved engine oils)

Engine	Model	Oil quantity for oil and filter change in liters	Color code Round handle	Color code Handle with bottle opener shape	Number code on handle (color red)
602.91	201	6,5 7 [2])	– –	– green[2])	60214[1]) –
602.96	124, 201	7	–	green[3])	–
603.96	124	7,5	–	black	–
603.97	126	7,5	–	–	60316

[1]) 1 st version color code "red"
2nd version color code "black"
3rd version color code "brown"
[2]) Only for engines with exhaust gas recirculation and side section on oil pan
[3]) 1st version color code "black"

Tightening torques		Nm
Oil drain plug on oil pan	M 12×1,5×13	30
	M 14×1,5×22	25
Allen bolts, mount, engine stop, front		10
Adjustment bolt, engine stop, front		130
Hex. nuts, engine shock absorber		10
t-tex. head bolts, engine shock absorber mount		10
Hex. head bolts, oil pan side section		10
Hex. head bolts, oil pan	M 6	10
	M 8	25
Allen bolt, engine mount, front		40
Allen bolt, engine mount, front, model 126		70

Special tools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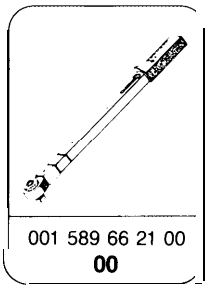
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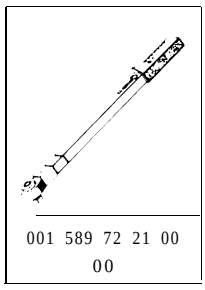
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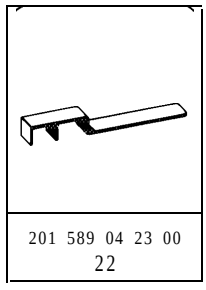
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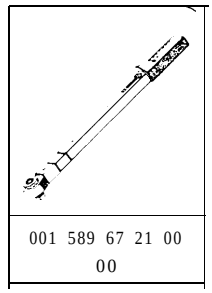
22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Commercially available tool

Engine hoist no. 3188 (self-braking)	e.g.	Backer D-5630 Remscheid Herderstraße

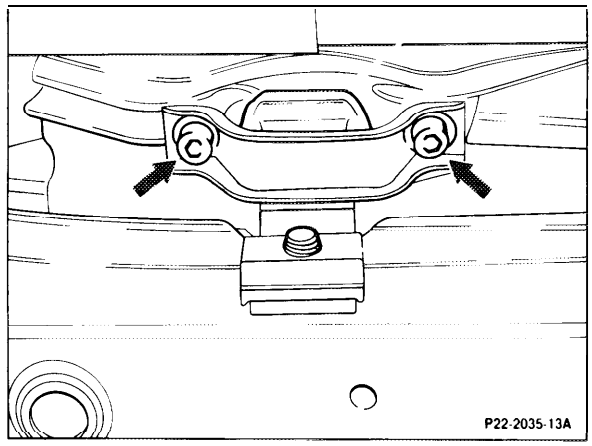
Removal, installation

1 Disconnect negative cable from battery.

2 Drain engine oil.

Installation note
Tightening torque for oil drain plug
M 12 × 1.5 × 13 30 Nm
M 14 × 1.5 × 22 25 Nm.
Observe specified oil capacity when filling engine.

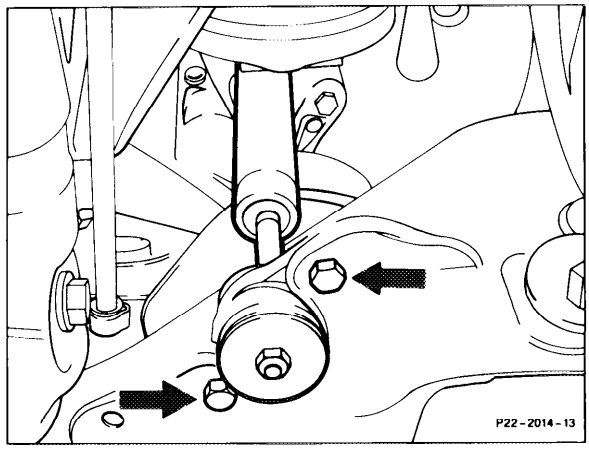
Model 201 (up to 03/85):
3 Remove Allen bolts (arrows) on mount for front engine stop and remove mount.


P22-2035-13A

Installation note
Tightening torque 25 Nm.
Check engine stop with adjustment gauge 201 589 04 23 00 and adjust (22-220).
Tightening torque for adjustment bolt 130 Nm.

Model 201 (up to 03/85):

4 Remove engine shock absorber, left; remove hex. head bolts (arrow) on mount and remove engine shock absorber from frame cross member.

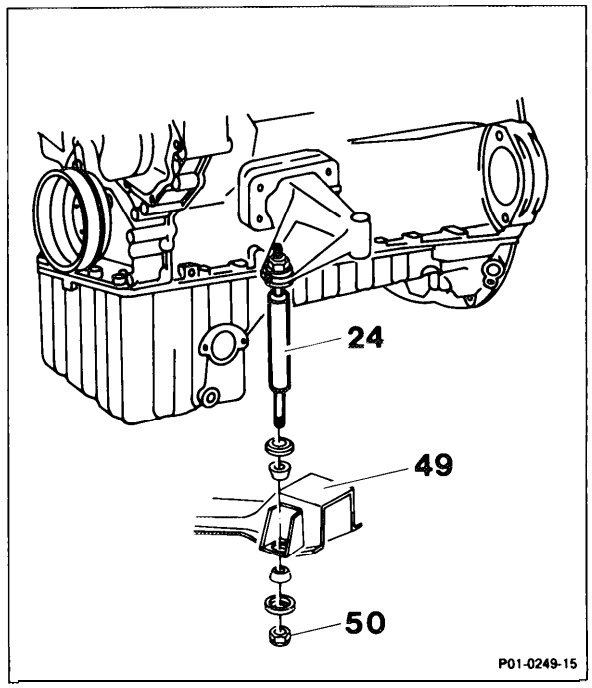


Installation note

Tightening torque 10 Nm.

Model 126:

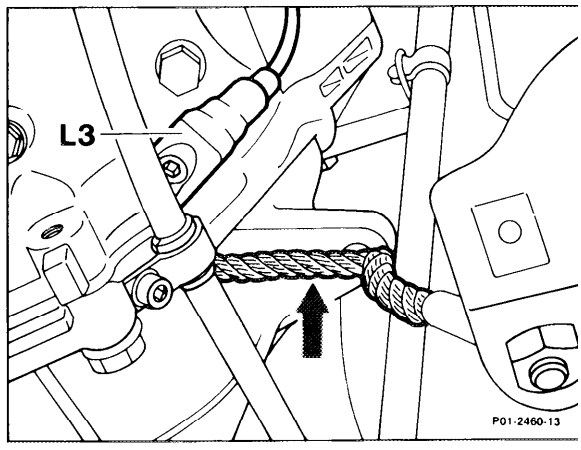
Remove engine shock absorbers (24), left and right; unscrew hex. nut (50) and press shock absorber upward out of mount on frame cross member (49).



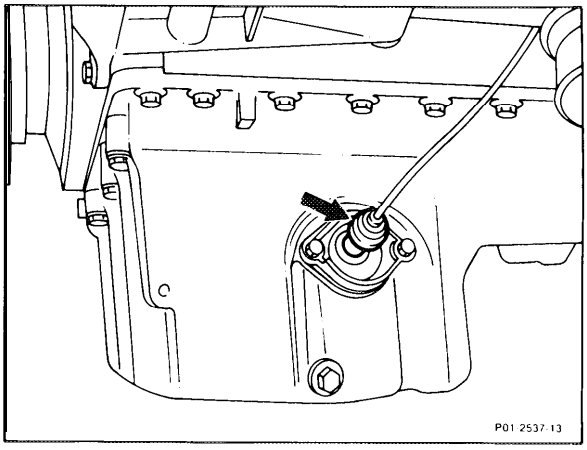
Installation note

Tightening torque 10 Nm.

6 Unbolt engine speed sensor (L3) and ground strap for starter (arrow) on chassis.

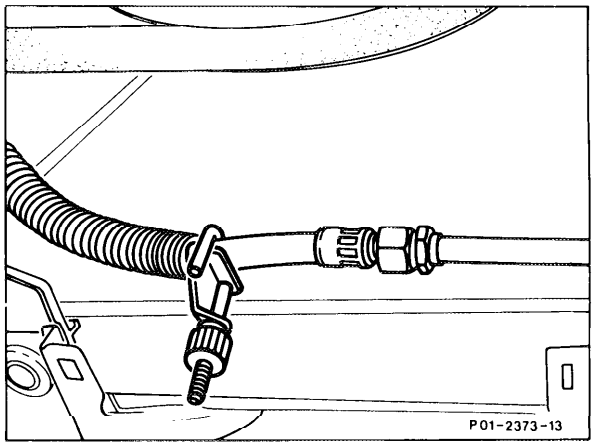


7 Disconnect plug from oil level sensor (arrow).



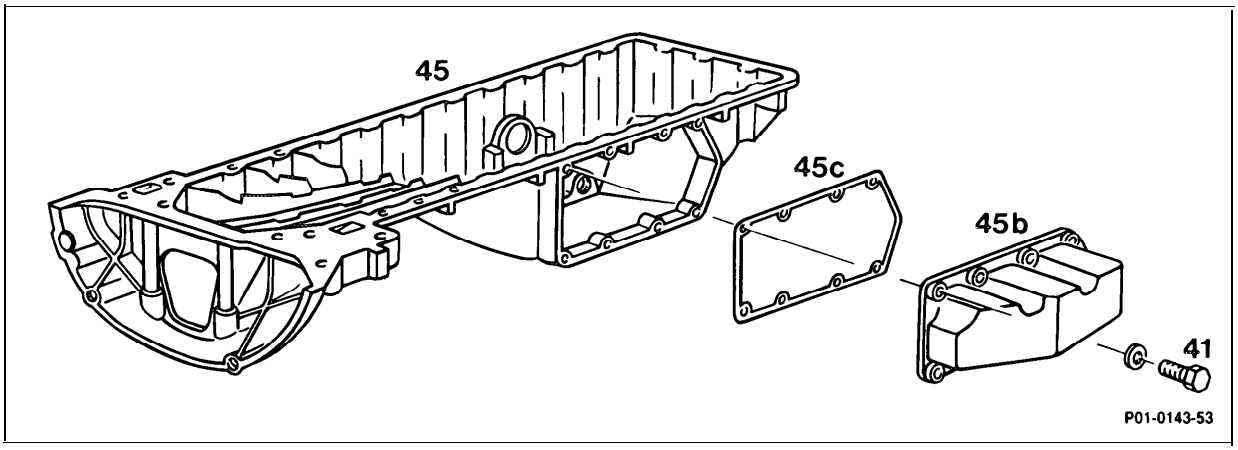
Vehicles with automatic transmission:

8 Clamp oil lines between transmission and oil cooler or transmission air/oil cooler, clamp 000 589 40 37 00, screw oil lines off of oil pan and radiator.



Installation note

Check transmission oil level, add if required.



Oil pan with attached side section:

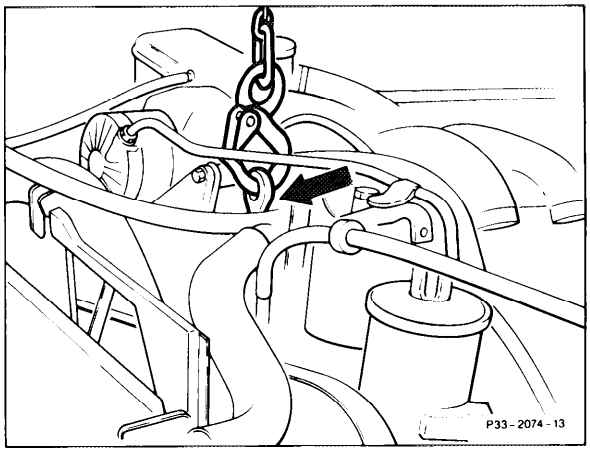
9 Remove hex. head bolts (41) and remove oil pan side section (45b) together with gasket (45c).

Installation note

Replace gasket (45c).

Tightening torque 10 Nm.

10 Attach engine hoist cable to front suspension eye on engine (arrow).

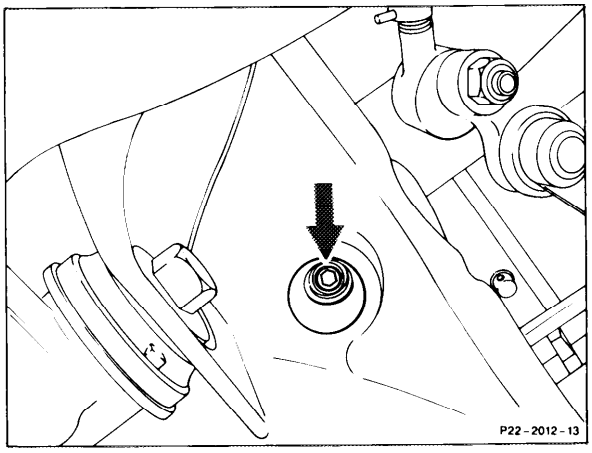


11 Remove Allen bolts for front engine mount from frame cross member from below.

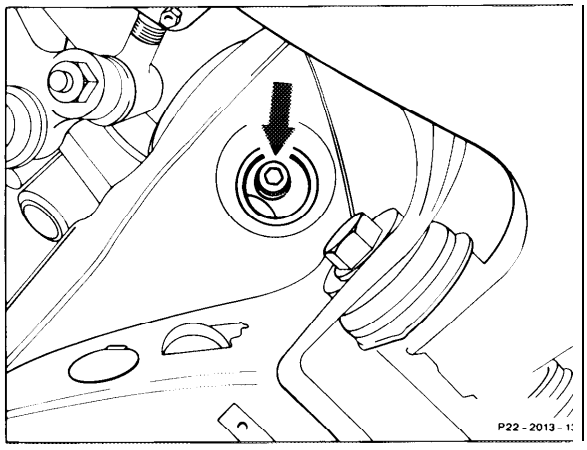
Installation note

Tightening torque

Model 124 and 201	40 Nm
Model 126	70 Nm.



Allen bolt, engine mount, left



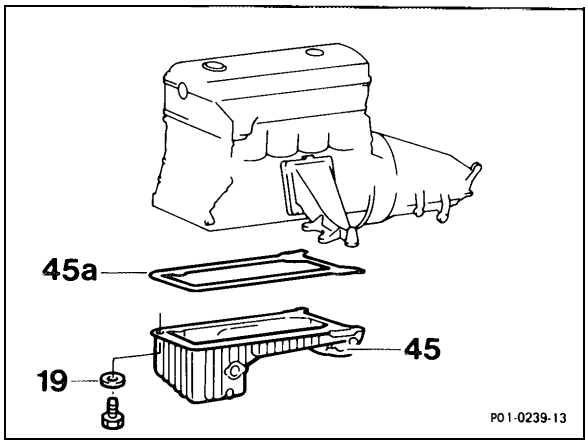
Allen bolt, engine mount, right

12 Lift engine at front with engine hoist as far as possible.

13 Remove hex. head bolts (19) of oil pan (45).

Installation note
Observe different lengths of hex. head bolts.
Tightening torque M6 10 Nm,
M 8 25 Nm.

14 Remove oil pan (45) from crankcase together with oil pan gasket (45a); remove oil pan toward front of vehicle, turn crankshaft slightly if required.



Installation note
Clean gasket residues off of parting surface on oil pan. Replace oil pan gasket.

15 Assemble in opposite order.

16 After assembly warm up engine and check oil pan for leakage.

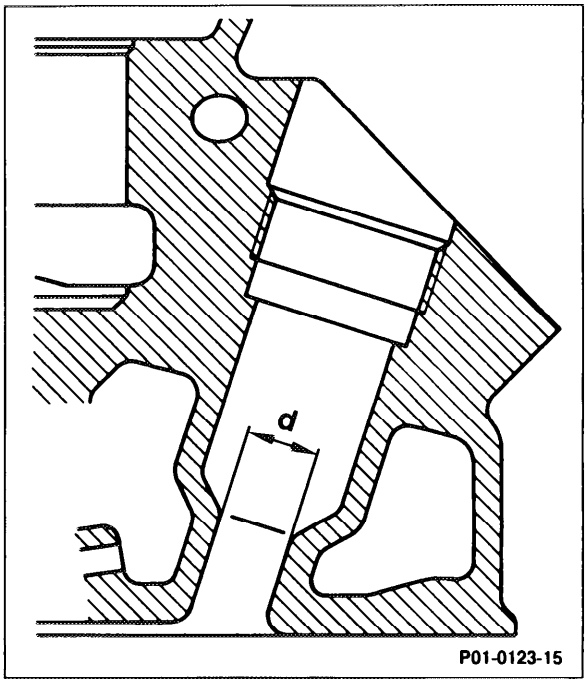
01400 Repair notes for cylinder heads and cylinder head gaskets

A. Engine 602, 603

Differentiation of cylinder heads for naturally aspirated and turbo-engines

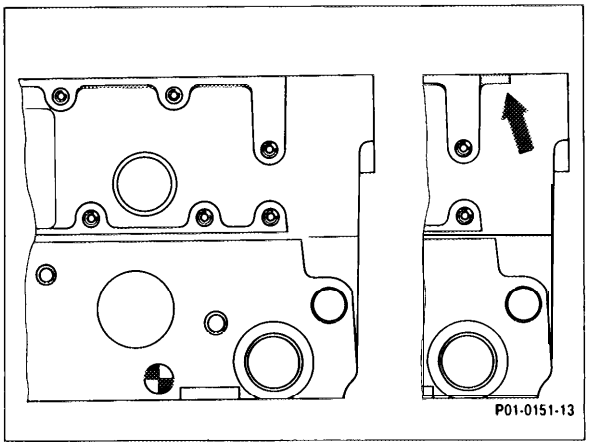
The cylinder heads for turbo-engines 602.96, 603.96 and 603.97 are reinforced at the water jacket due to the higher combustion pressures.

On turbo-engines the diameter (d) of the pre-combustion chamber bore is 15 mm, on naturally aspirated engines 14 mm.



The cylinder heads on turbo-engines are provided with an identification strip. This identification strip (arrow) is located on the parting surface for the cylinder head cover at the front right.

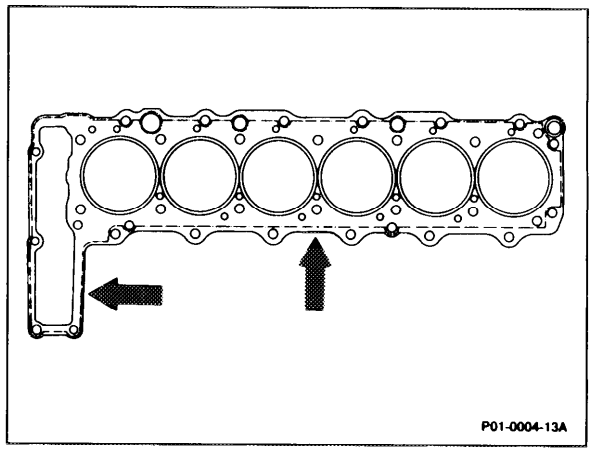
Caution!
Do not mix up cylinder heads for turbo-engines and naturally aspirated engines.



The cylinder head gasket for the turbo-engines has stainless steel inserts around the combustion chambers (arrow).

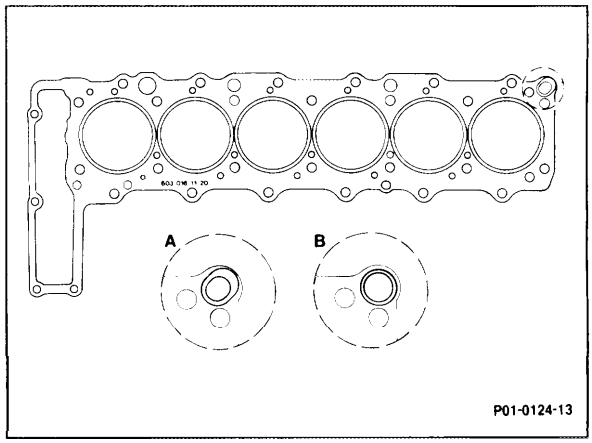
The combustion chamber inserts on the standard gaskets installed on naturally aspirated engines consist of normal sheet steel.

Only the cylinder head gaskets with stainless steel inserts are available as replacement parts for both the naturally aspirated and turbo-engines.



Cylinder head gasket with Viton sealing ring

A Viton sealing ring is inserted at the rear oil return passage to prevent oil leakage.



A 1st version with sheet metal jacket
B 2nd version with Viton sealing ring

Production breakpoint: 03/87

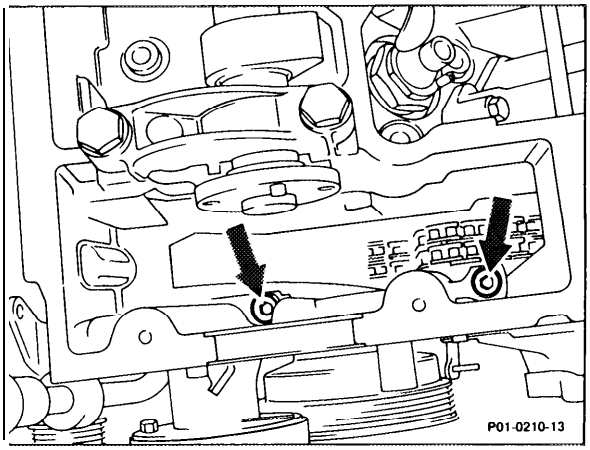
Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	–	011489	*	*
126.125	603.961	–	010966	*	*

* not available

Modifications in area of timing chain case

For production reasons the height of the bridge in the cylinder head in the area of the timing chain case was increased to 32 mm (previously 12 mm).

This modification made it necessary to change the dimensions of the two cylinder head bolts (arrow). The new bolt length is M 8 x 50 (previously M 8 x 30).



Production breakpoint: 09/87

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
201.126	1602.911	1052292	011264	*	*

* not available

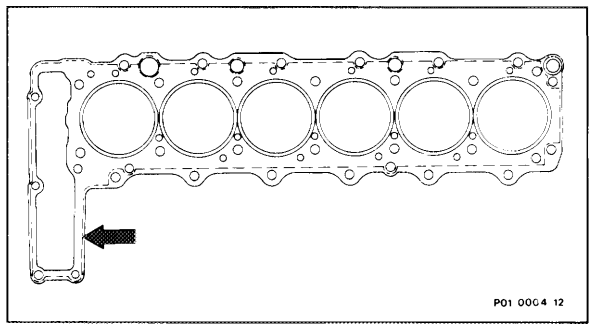
Production change for protection against cracks in water jacket

The bolt flutes on the exhaust side have been reinforced and the recesses (hollows) between the coolant ducts on the outlet side filled to prevent cracks in the cylinder head water jacket.

The baseplate on the intake side was reinforced from previously 11 mm to 14 mm.

Cylinder head gasket for improved sealing

The cylinder head gasket has been equipped with circumferential silicone sealing strips (arrow) on both sides and a Viton sealing ring at the oil return passage at the rear right to better prevent water and oil leakage.



Production breakpoint: 10/88

Model	Engine	Engine end no. manual transmission	Engine end no. automatic transmission	Vehicle ident. end no. A	Vehicle ident. end no. F
124.133 124.193	603.960	–	019043	*	*

* not available

Production breakpoint: 05/89

Model	Engine	Engine end no. manual transmission	Engine end no. automatic transmission	Vehicle ident. end no. A	Vehicle ident. end no. F
124.128	602.962	–	002254	*	*
201.128	602.961	–	006028	*	*

* not available

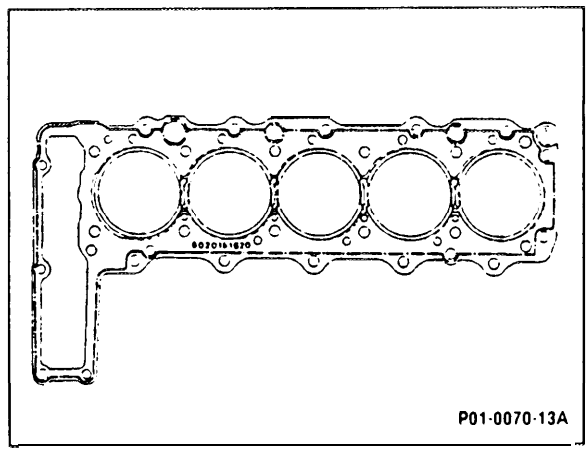
Production breakpoint: 09/89

Model	Engine	Engine end no. manual transmission	Engine end no. automatic transmission	Vehicle ident. end no. A	Vehicle ident. end no. F
201.126	602.911	1083460	016487	*	*

* not available

Cylinder head gasket, engines 602, 603 (except for engine 603.970)

The combustion chamber insert (dotted line) has been modified at the 1st cylinder on the cylinder block side.



Production breakpoint: 01/90

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.128	602.962	-	004055	*	*
201.126	602.911	087394	017068	*	*
201.128	602.961	-	007574		

* not avadable

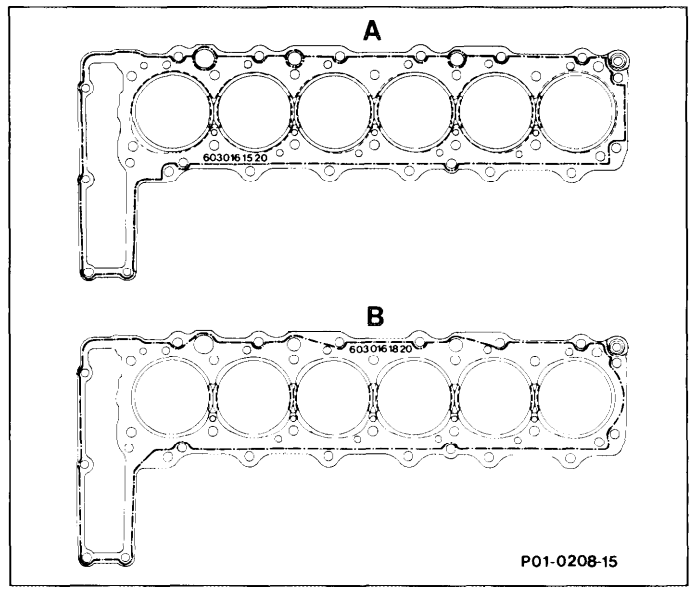
Production breakpoint: 02/90

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.133	603.960	–	025726	*	*
124.193	603.963	-			

* not avadable

Cylinder head gasket, engine 603.970

Combustion chamber insert modified.
Silicone sealing strip position changed on both sides.



A. 1st version (Gotze)
B. 2nd version (Elring)

Production breakpoint: 01/90

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
126.135	603.970	–	000047	*	*

* not available

Improvement to passage supports in water jacket

The passage supports in the cylinder head water jacket were improved on the turbo-engines.

Production breakpoint: 12/88

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.128	602.962	–	000753	*	*
201.128	602.961	–	004872	*	*

not available

Reinforcements at valve tappet guides and exhaust passages

The reinforcements at the valve tappet guides and exhaust passages have been reinforced. Modified cylinder heads can be recognized by the cast no. on the intake side, see table.

Engine	previous cast no.	new cast no.
602	602 016 03 01	602 016 07 01
602 Turbo	602 016 06 01	602 016 08 01
603 Turbo	603 016 15 01	603 016 17 01

Production breakpoint: 07/89

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	–	022706	*	*

* not available

Production breakpoint: 09/89

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
201.126	602.911	083167	016457	*	*

* not available

Combustion chamber recess

The size of the combustion chamber recess (d) was increased to reduce the thermal load in the cylinder head.

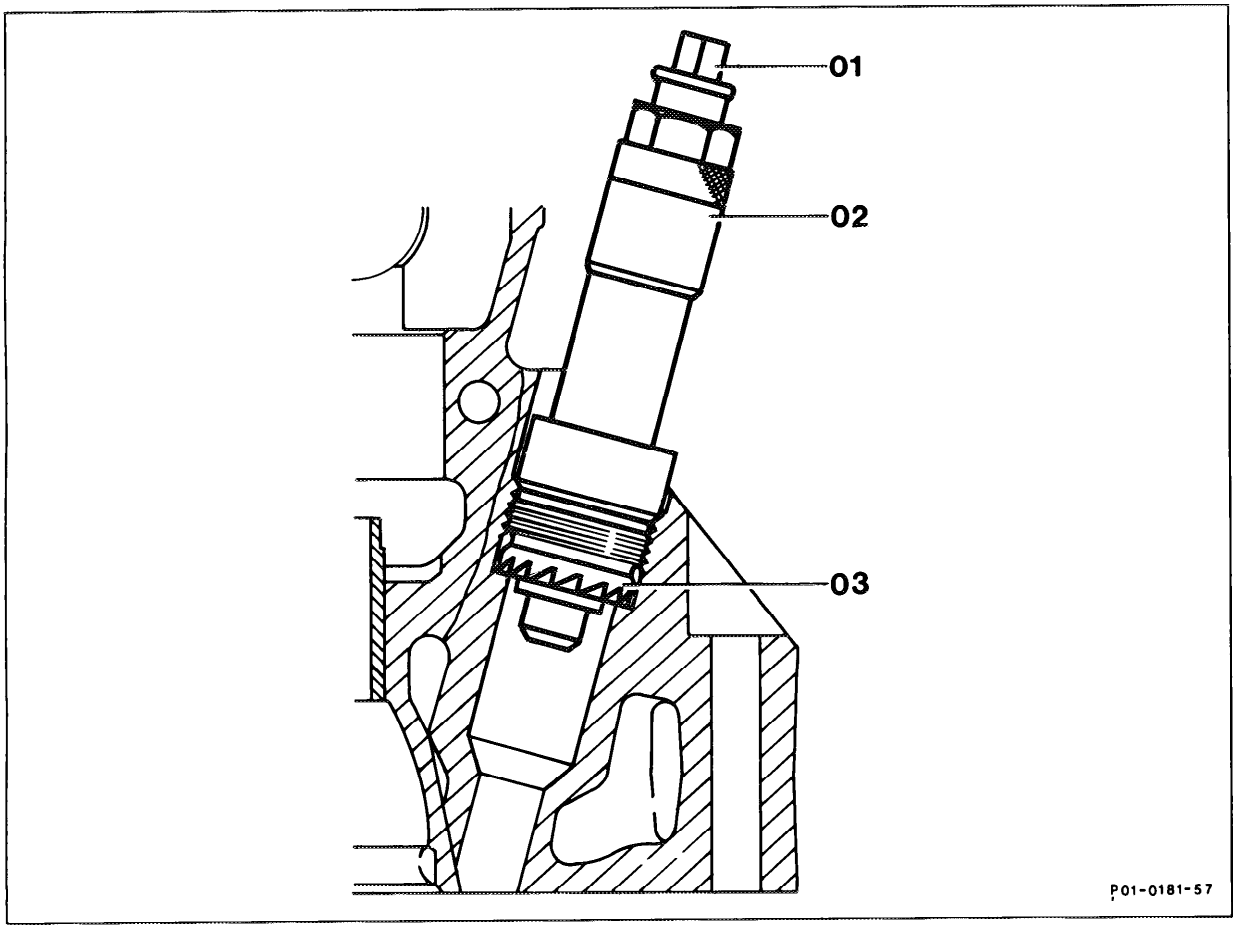
Production breakpoint: 06/88

Model	Engine	Engine end no.		Vehicle ident. end no.	
		manual transmission	automatic transmission	A	F
126.1	1603.970	from start of production		*	*
201.126	1602.911	(065342	013489	*	*
201.128	602.961	–	003172	*	*

* not available

01410 Refinishing prechamber sealing surface

Preliminary operations:
Nozzle holder removed (01-417).
Prechamber removed (01-417).



Prechamber mounting bores	plug or seal off toward combustion chamber (item 2).
Countersinking tool 601 589 00 66 00 (01, 02, 03)	bolt into precombustion chamber mounting bore to be refinished down to stop (items 3 – 4).
Interval "X"	measure between top of shaft (01) and top of sleeve (02) (item 5). **Note** When the cylinder head is installed, measuring interval "X" replaces measuring the projection dimension "C".

Prechamber sealing surface	refinish, use countersinking tool 601 589 00 66 00 with tap wrench, turn clockwise approx. 5 revolutions while exerting slight pressure (item 6). **Caution!** Do not lift countersinking tool while refinishing.
Interval "X"	measure again (item 7). **Note** The difference between the 1st and 2nd measurements corresponds to the material removed and therefore the thickness of the required spacer ring.
Countersinking tool	unscrew and clean chips out of mounting bore (item 8).
Engine	turn over with starter to throw out any chips which may have got into the combustion chamber (item 9).
Spacer ring	select according to difference in measurements and install (item 10). **Note** **See** table for thicknesses of available spacer rings.
Refinished precombustion chamber	mark with punch in area of mounting bore (item 1 1).

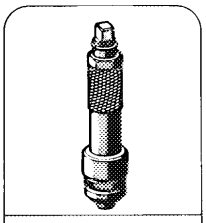
Data

Precombustion chamber projection dimension "C"	7.6 – 8.1 mm

Parts

Designation		Part no.
Spacer ring	0.3 mm	601 017 04 60
	0.6 mm	601 017 02 60
	1.0 mm	601 017 03 60

Special tool

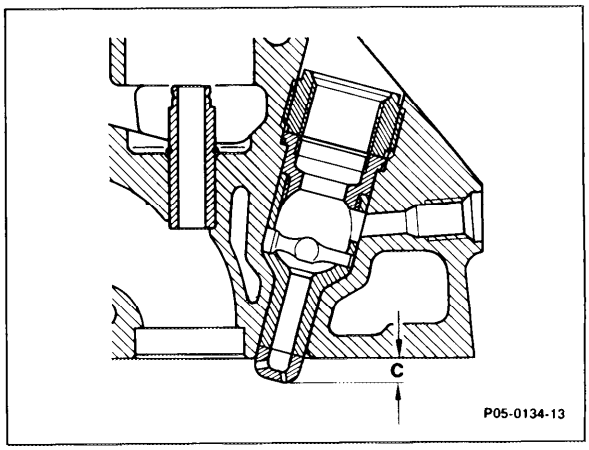


601 589 00 66 00
01

Refinishing

Note

Refinish prechamber sealing surface when damaged or leaking. The first refinishing operation on the prechamber sealing surface can be performed with the cylinder head removed or installed. If the sealing surfaces have already been refinished once before, this can be recognized by the markings (punch marks) in the area of the prechamber mounting bores or on the spacers installed. In this case it is necessary to remove the cylinder head to refinish again. The prechamber projection dimension "C" (7.6 – 8.1 mm) can only be measured precisely with the cylinder head removed. Maintenance of this projection dimension ensures that the necessary distance between the prechamber and piston crown is present when the piston is in the TDC position.



Cylinder head removed:

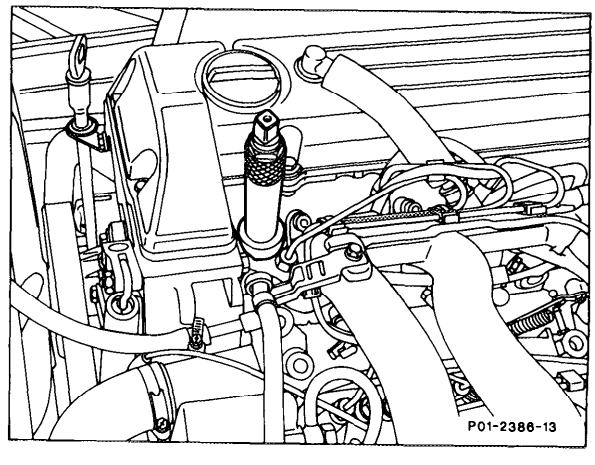
1 When the cylinder head is removed the scope of work for refinishing is the same except for items 5 and 7. Instead of items 5 and 7 measure the projection dimension (c).

Cylinder head installed:

2 Plug or seal off prechamber mounting bores toward combustion chamber (e.g. with rag), so that chips cannot get into the combustion chamber.

3 Remove protective sleeve from countersinking tool 601 589 00 66 00.

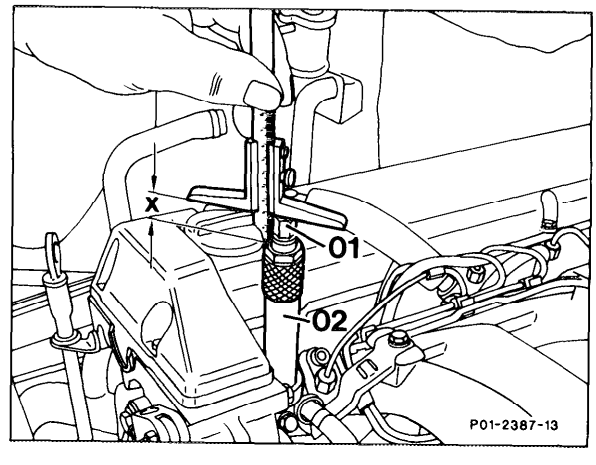
4 Install countersinking tool 601 589 00 66 00 into the prechamber mounting bore to be refinished down to the stop.



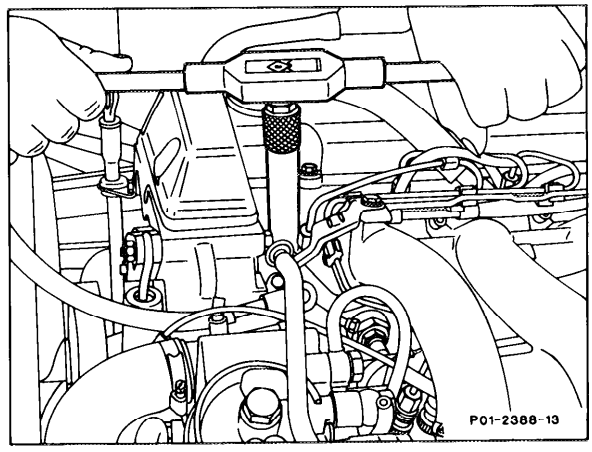
5 Measure interval "X" between top of shaft (01) and top of sleeve (02) and note value.

Note

When the cylinder head is installed, measuring the interval "X" replaces measuring the projection dimension “C”.



6 Attach tap wrench to countersinking tool 601 589 00 66 00 and turn countersinking tool clockwise approx. 5 rotations while exerting light pressure.



Caution!
Do not lift countersinking tool while refinishing.

7 Measure dimension "X" again. The difference between the first and second measurements corresponds to the material removed.

Determine thickness of spacer ring:

Example:

Calculate material removed	
Dimension before refinishing	= 25.7 mm
Dimension after refinishing	= 25.5 mm
Material removed	= 0.2 mm

Note
In this example the thickness of the spacer ring to be installed is 0.3 mm. Select the spacer ring so that it is at least 0.1 mm thicker and max. 0.3 mm thicker than the amount of material removed.

8 Remove countersinking tool 601 589 00 66 00 and remove chips.

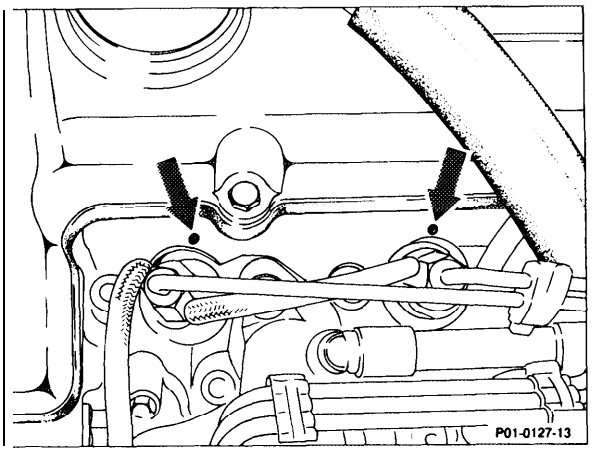
Note
If sealing surface is not completely flat, install countersinking tool again and refinish sealing surface again. Then repeat measurement, items 5 and 7.

9 Remove rag from precombustion chamber bore and turn over engine with starter to throw out any chips which may have got into the combustion chamber.

10 Insert proper spacer ring.

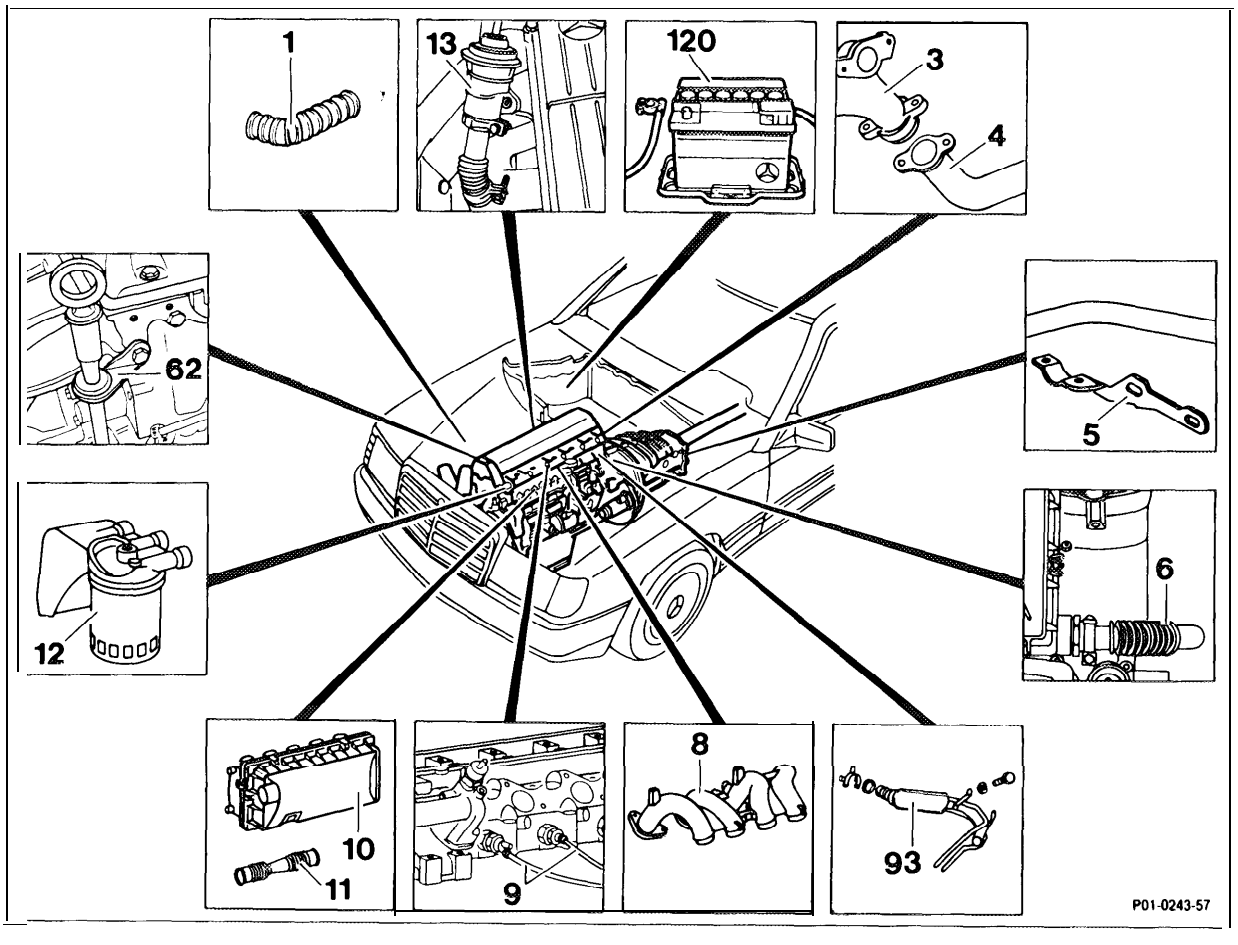
11 Mark cylinder head with punch mark above each prechamber seat refinished (arrows).

12 Install in reverse order.



01415 Removal and installation of cylinder head

Preliminary operations:
Camshaft removed (05220).
Nozzle holders removed (01-417).
Radiator removed (20-420).
Poly-V-belt tensioning device removed (13-345).



⚠Warning
Remove cylinder head only after engine has cooled off.

Battery (120) . . . . . disconnect negative cable, if not already disconnected (item 1).

Naturally aspirated engines:

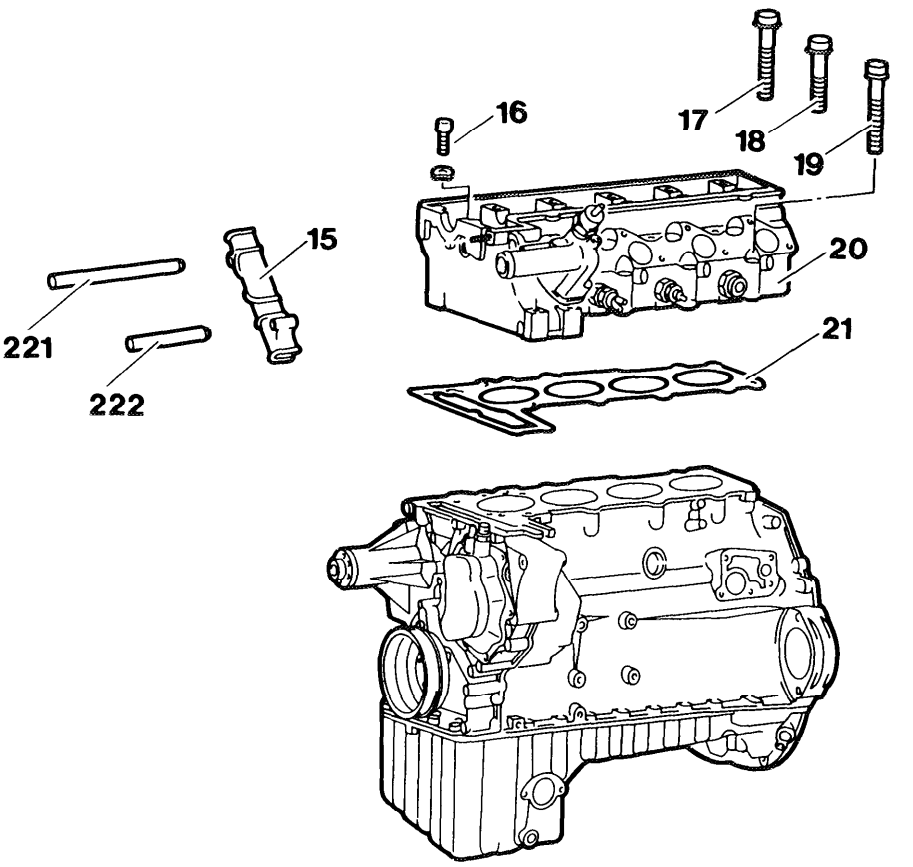
Air intake hose (11) and air cleaner cover (10) . . . . . if not already removed, remove together with filter cartridge, install (item 2).

Turbo-engines:

Intake hose (1) . . . . . to exhaust gas turbocharger, remove, install (item 3).

Fuel filter (12) . . . . . remove, install (items 4, 5, 35, 36).

Holder (62)	for oil dipstick tube, remove, reinstall (items 6, 34).
Engines with exhaust gas recirculation:	
Pipe (6)	between exhaust gas recirculation valve (13) and intake manifold or charging air manifold, remove, install (item 7).
Exhaust gas recirculation valve (13)	remove line to air guide housing, install (items 7, **33).**
Side exhaust support (5)	on transmission, unbolt, bolt on, 25 Nm (items 8, 32).
Exhaust pipe (4)	unbolt from exhaust manifold (3), bolt on, 25 Nm (items 9, 31).
Pipe elbow (7)	for heater feed, remove, install (items 10, 11, 29).
	Note Replace O-ring.
Glow plugs	unbolt connection lines (9), bolt on (items 12, 37).
Intake manifold (8) on naturally aspirated engines or charging air manifold on turbo-engines	remove, install, 25 Nm (14-180).



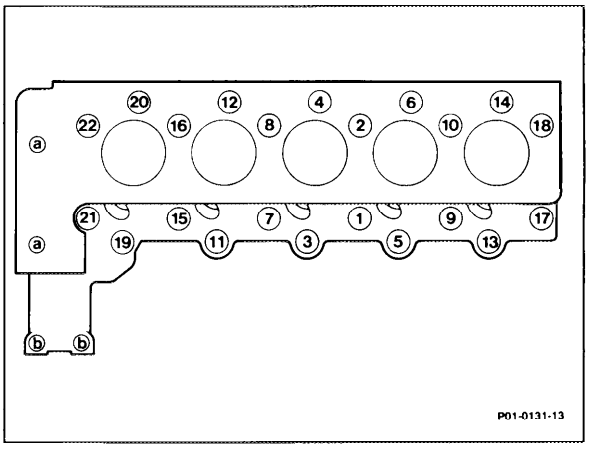
Slide rail bolts (221, 222)	on cylinder head, knock out, knock in, impact puller 116 589 20 33 00, threaded rod 116 589 02 34 00 and threaded insert 123 589 00 34 00 (items 14, 30).
	Note When installing coat collar on slide rail bolts with sealant.
Slide rail (15)	for timing chain, remove from timing chain case, install (items 15, 28).
Allen bolts (16)	in area of timing chain case, unbolt, bolt on, 25 Nm (items 16, 27).

Cylinder head bolts (17, 18, 19)	unbolt in opposite order of torquing diagram, check length of cylinder head bolts and replace if necessary. Bolt on according to torquing diagram, socket 601 589 00 10 00 (items 17, 20, 23 – 28).
	Note Observe different lengths of bolts and tightening specifications.
Cylinder head (20)	remove together with cylinder head gasket (21), install (items 18, 19, 21, 22).
	Note Clean parting surfaces on cylinder head and check for cracks. Install cylinder head with new gasket.
After assembling engine	check cooling and engine oil systems for leakage (item 38).

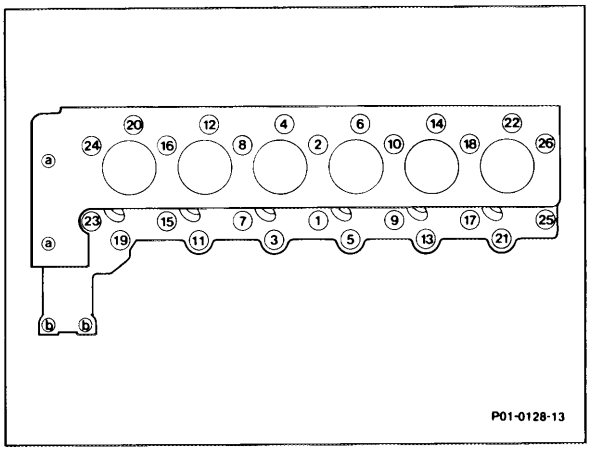
Tightening torques and rotation angles (tightening in stages)			Nm
Cylinder head bolts with 12-point Allen head (engine cold)	Initial tightening torque	Stage 1 Stage 2	15 35
	Rotation angle	Stage 3	90°
	Interval for setting	10 min	
	Rotation angle	Stage 4	90°
M 8 Allen bolts in area of timing chain case (reference value)			25
Exhaust pipe on exhaust manifold			25
Side exhaust support			25

Cylinder head bolt dimensions and maximum permissible lengths (L)

New state	Max. permissible length (L) in mm
M 10x80	83,6
M 10 × 102	1056
M 10 × 115	118,6

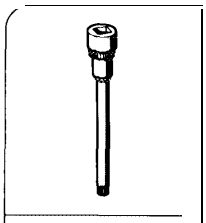


Tightening sequence, engine 602

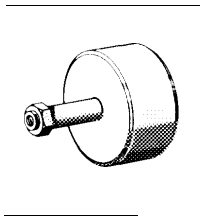


Tightening sequence, engine 603

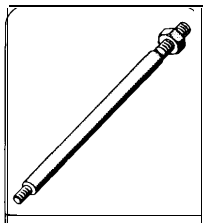
Special tools



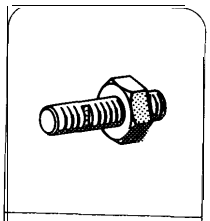
601 589 00 10 00
01



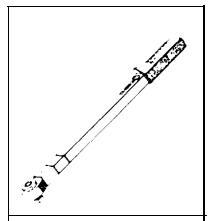
116589203300
05



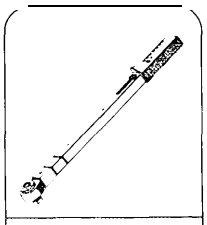
116589023400
05



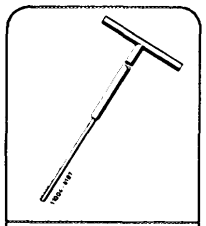
123 589 00 34 00
05



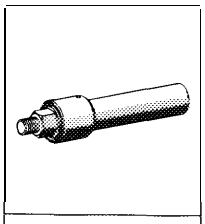
001 589 72 21 00
00



001 589 66 21 00
00



116 589 03 07 00



115 589 20 33 00
05

Commercially available tool

7 mm hex. socket on flexible shaft for hose clamps with worm drive	e.g.	Hazet, D-5630 Remscheid Order no. 426-7

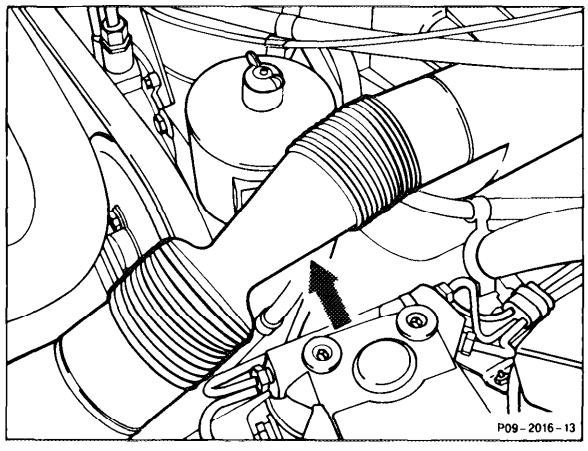
Removal

⚠ Warning
Remove cylinder head only when engine is cool.

1 Disconnect negative cable on battery.

Naturally aspirated engines:

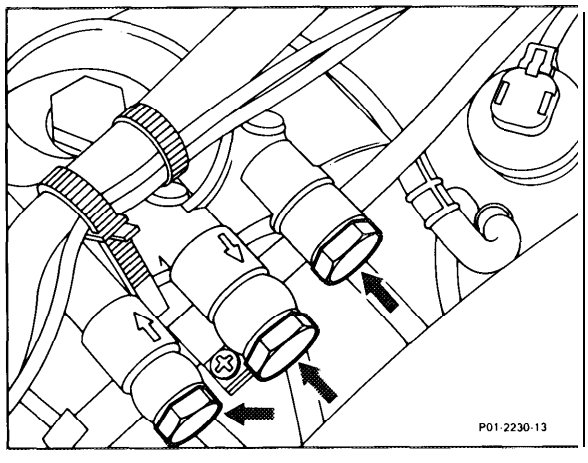
2 Remove air intake hose (arrow) and air cleaner cover together with filter cartridge, if not already removed.



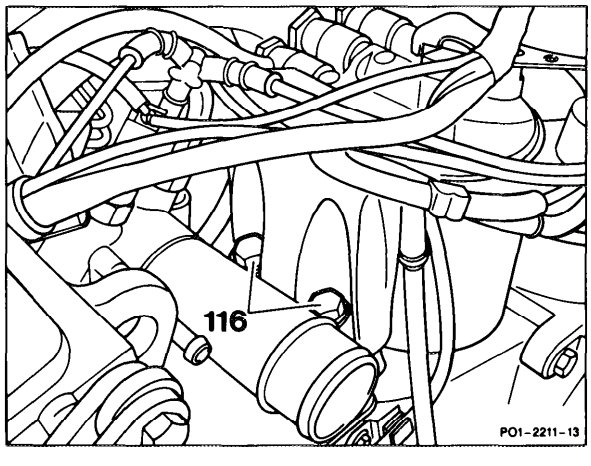
Turbo-engines:

3 Remove intake hose to exhaust gas turbocharger.

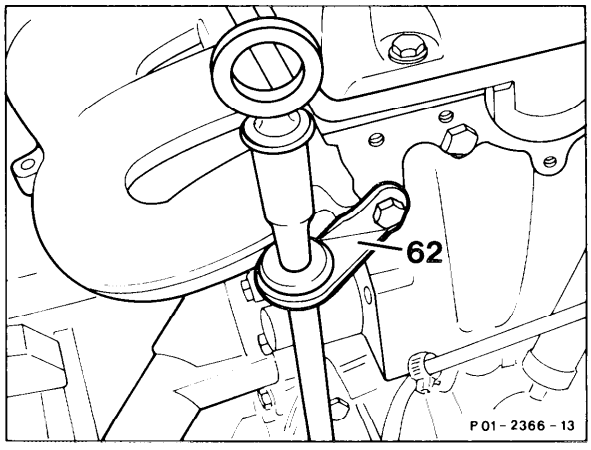
4 Disconnect fuel lines (arrows) from fuel filter and remove lines from fuel filter.



5 Unbolt hex. head bolts (116) from fuel filter and remove fuel filter from cylinder head.

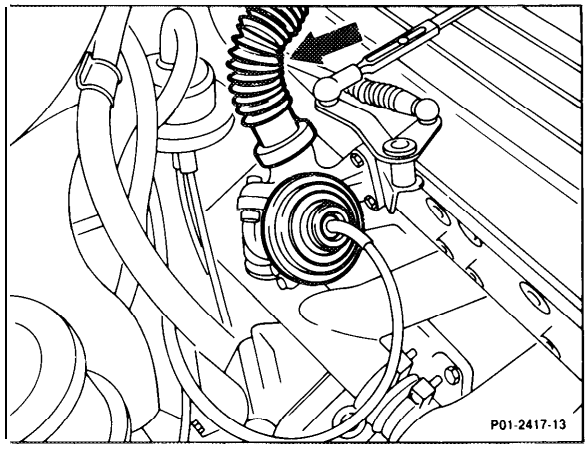


6 Unbolt holder (62) for oil dipstick tube from cylinder head.



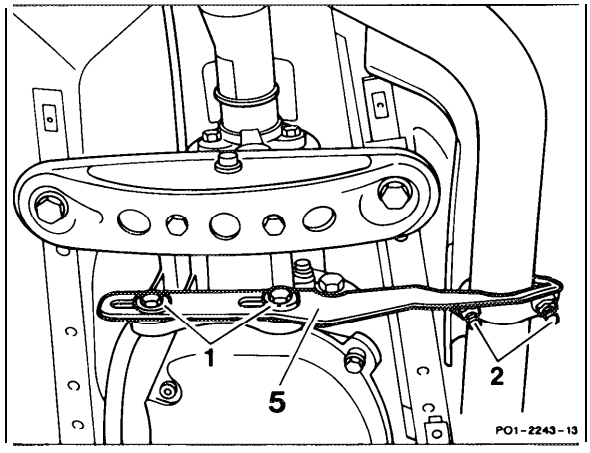
Engines with exhaust gas recirculation (naturally aspirated engines):

7 Remove line (arrow) from exhaust gas recirculation valve to air guide housing.

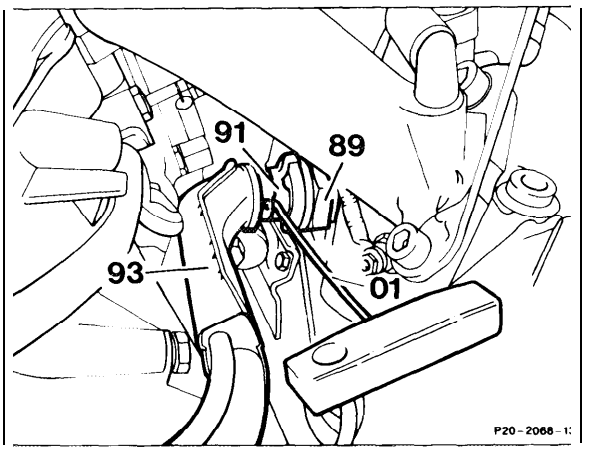


8 Unbolt hex. head bolts (1) for side exhaust support (5) from transmission. Loosen hex. nuts (2) on exhaust pipe.

9 Unbolt exhaust pipe at exhaust manifold.



10 Pull off retainer (91) for heater feed line with hook (01).



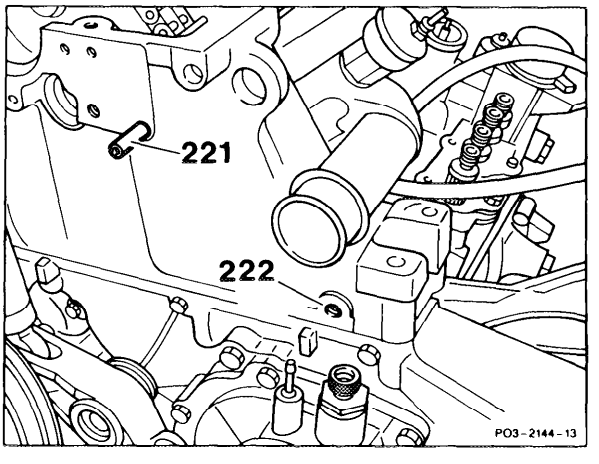
11 Unbolt pipe elbow (93) from oil filter and pull pipe elbow off of connection fitting (89).

12 Unbolt connection lines from glow plugs.

13 Remove intake manifold (naturally aspirated engines) or charge air manifold (turbo-engines) (14-180).

Note
Leave exhaust manifold mounted on cylinder head.

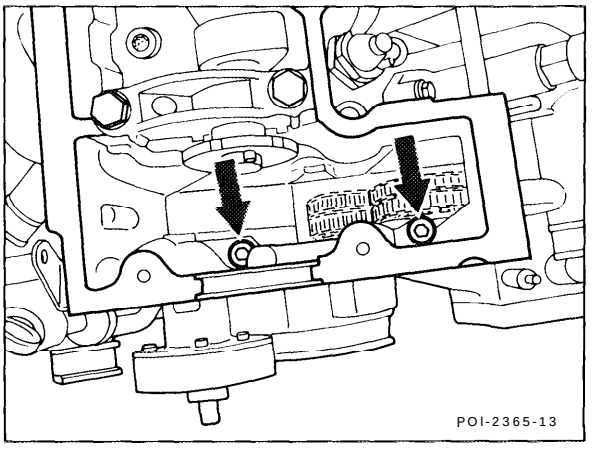
14 Knock slide rail bolts (221, 222) out of cylinder head with impact puller
116 589 20 30 00, threaded rod
116 589 02 34 00 and threaded insert
123 589 00 34 00.



Note
If the slide rail bolts are too tight, puller 115 589 20 33 00 can also be used.

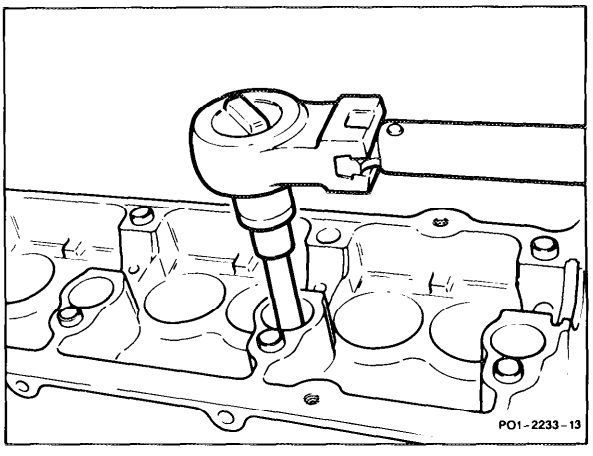
15 Remove slide rail for timing chain from timing chain case.

16 Remove M 8 x 30 Allen bolts (arrows) from the area of timing chain case.



Note
Longer bolts (M 8 x 50) are used in the area of the timing chain case on engine model 602.91 starting 09/87 or 10 87 respectively.

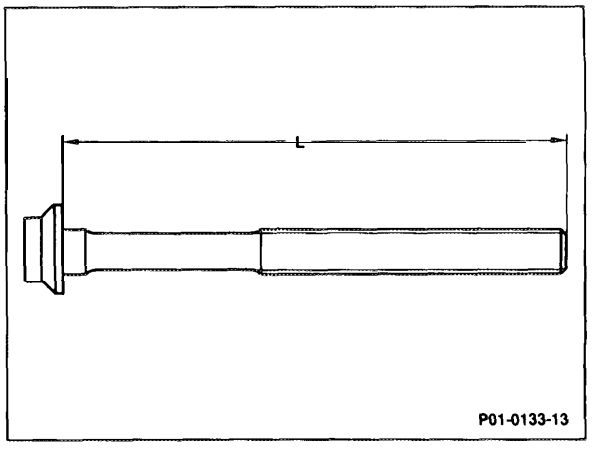
17 Unbolt cylinder head bolts in opposite order of torquing sequence using socket 601 589 00 10 00.



18 Remove cylinder head from cylinder block together with cylinder head gasket.

19 Clean parting surface on cylinder head and check for cracks.

20 Check length (L) of cylinder head bolts.



Note
If the length (L) exceeds the maximum dimension, use new cylinder head bolts for installation.

Installation

21 Position new cylinder head gasket on cylinder block.

22 Position cylinder head.

Note
When positioning the cylinder head use fitted sleeves for locating cylinder head.

23 Oil threads and head contact surface of cylinder head bolts.

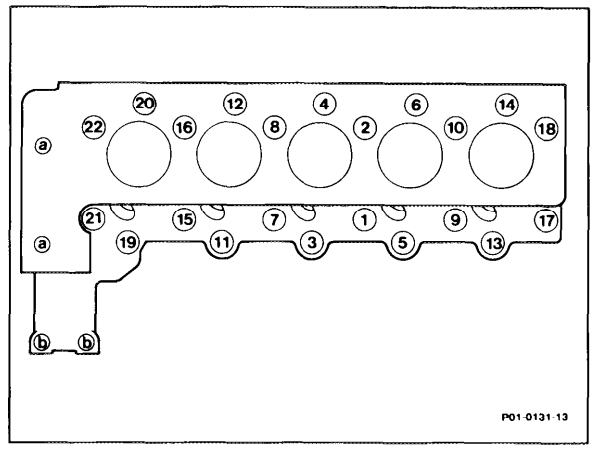
24 Install cylinder head bolts by hand making note of different bolt lengths and sizes, see tables below.

Note
Oil bolt head contact area.

Engine **602**

Bolt diagram

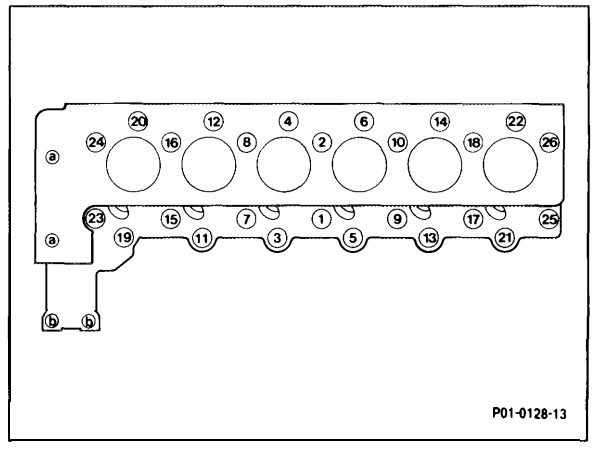
Hole	Bolt size
3,5, 11, 13, 19	M 10×80
2,4,6,8,10, 12, 14, 16, 18, 20, 22	M 10x102
1, 7, 9, 15, 17, 21	M 10x115
a (Timing case area)	M 8×30 or M 8×50
b (Fuel filter)	M 8×80



Engine 603

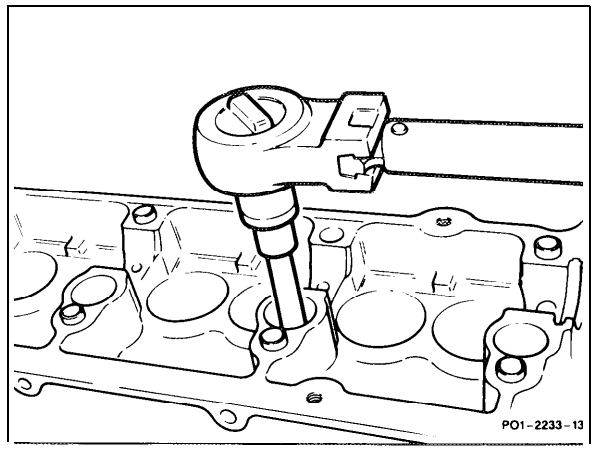
Bolt diagram

Hole	Bolt size
3,5, 11, 13, 19, 21	M 10x80
2,4,6,8,10, 12, 14, 16, 18, 20, 22, 24, 26	M 10×102
1, 7, 9, 15, 17, 23, 25	M 10×115
a (Timing case area)	M 8×30 or M 8×50
b (Fuel filter)	M 8×80



25 Tighten cylinder head bolts in stages in specified in the torquing sequence, use socket 601 589 00 10 00.

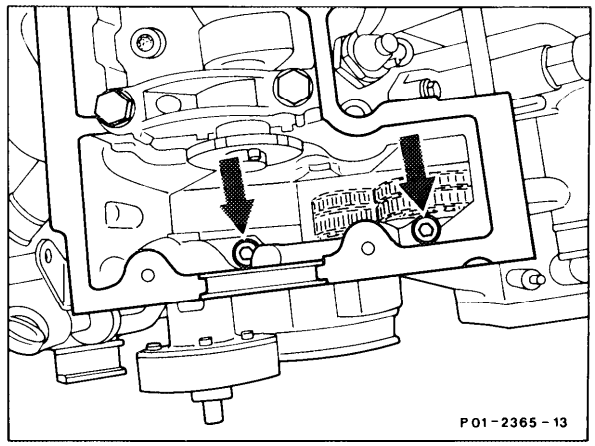
26 Torque cylinder head bolts in specified tightening sequence.



Tightening torques and rotation angles for cylinder head bolts

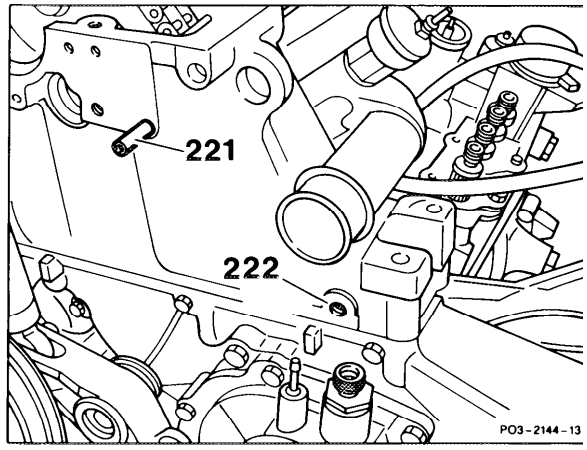
Stage 1	15 Nm
Stage 2	35 Nm
Stage 3	90”
Setting time	10 min
Stage 4	90”

27 Tighten Allen bolts (arrows) in area of timing chain case, tighten in specified sequence, tightening torque 25 Nm.

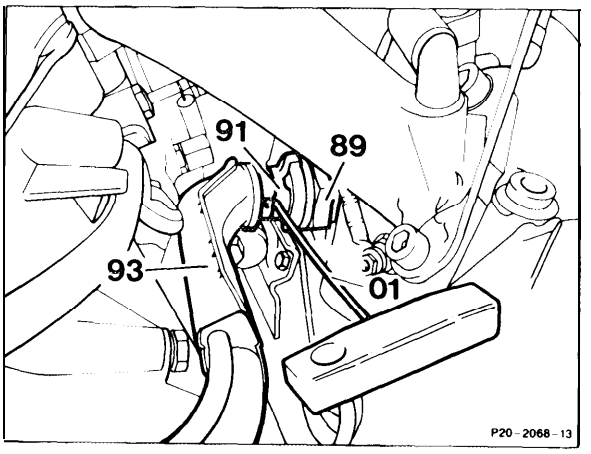


28 Install slide rail for timing chain in timing chain case and knock in slide rail bolts (221) 222).

Note
Coat collar on slide rail bolts with sealant.



29 Install pipe elbow (93) for heater feed line using new O-ring and slide onto connection fitting (89). Attach retainer (91) with hook (01).

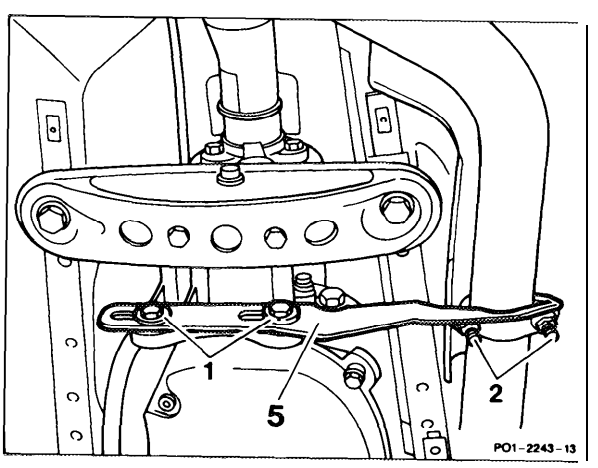


Note
Dip O-ring in coolant to facilitate installation.
Do not use grease or oil.

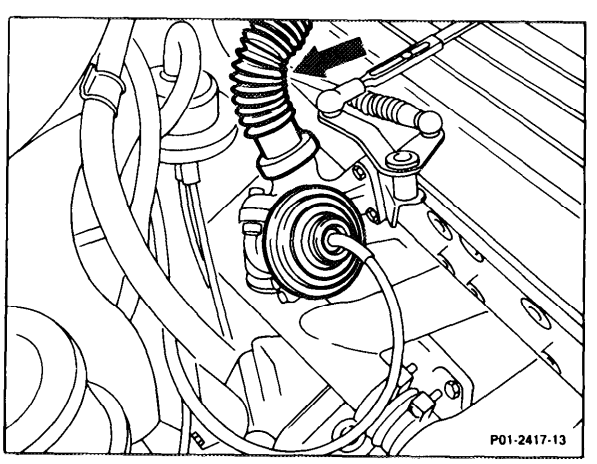
30 Install intake manifold (naturally aspirated engines) or charge air manifold (turbo-engines) (14-180).

31 Bolt exhaust pipe onto exhaust manifold, tightening torque 25 Nm.

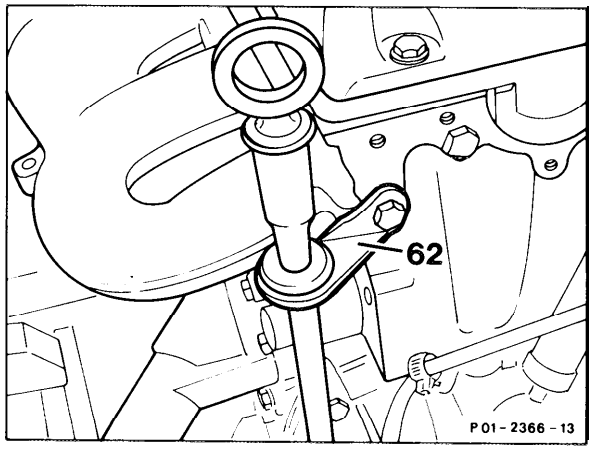
32 Bolt side exhaust support (5) onto transmission. Tighten hex. head bolts (1) and hex. nuts (2), tightening torque 25 Nm.



Engines with exhaust gas recirculation (naturally aspirated engines):
33 Attach line (arrow) from exhaust gas recirculation valve to air guide housing.



34 Bolt oil dipstick tube with holder (62) into cylinder head.



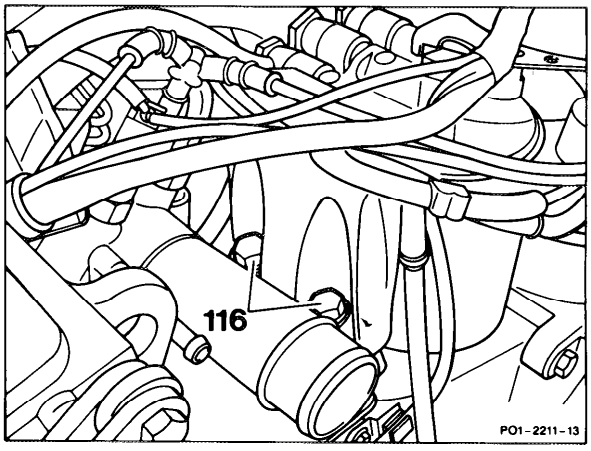
35 Install fuel filter, tighten hex. head bolts (116).

36 Connect fuel lines.

37 Bolt connection lines onto glow plugs.

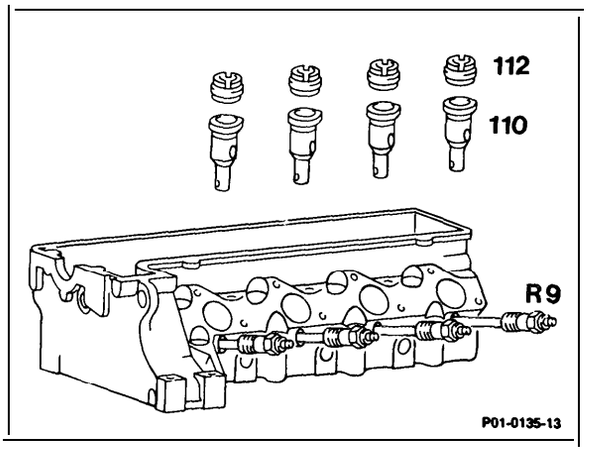
38 After assembling engine check cooling and oil system for leakage after warming up engine.

Note
It is not necessary to retorque the cylinder head bolts.

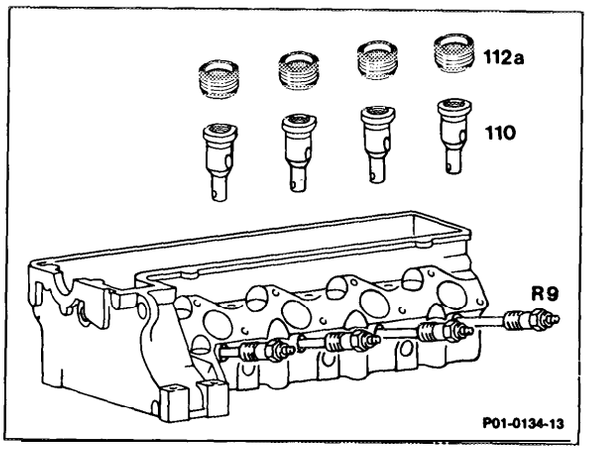


01-417 Removal and installation of prechambers

Preliminary operations:
Mount for engine control removed (30-300)
Nozzle holders removed (07.1-230).



Vertical injection
(example engine 601)



Angular Injection
(example engine 601)

Glow plugs (R9)	remove, reinstall, 20 + 2 Nm (item 1).
Vertical injection:	
Threaded ring (112)	remove, reinstall, 90 - 110 Nm, pin wrench 615 589 00 07 00 (item 2).

⚠ Warning
When screwing in or out assure that the pin wrench is seated in the grooves in the threaded ring.

Angular injection:

Threaded ring (112a) ..... remove, reinstall, 70 Nm, splined wrench 603 589 00 09 00 (item 3).

Prechamber (110) ..... knock out, install, impact puller 602 589 00 33 00 and check (items 4, 6).

Note
Install prechamber so that the lug on the collar of the prechamber is located in the recess in the cylinder head.

Prechamber mounting bore ..... in cylinder head, clean, check and cover (item 5).

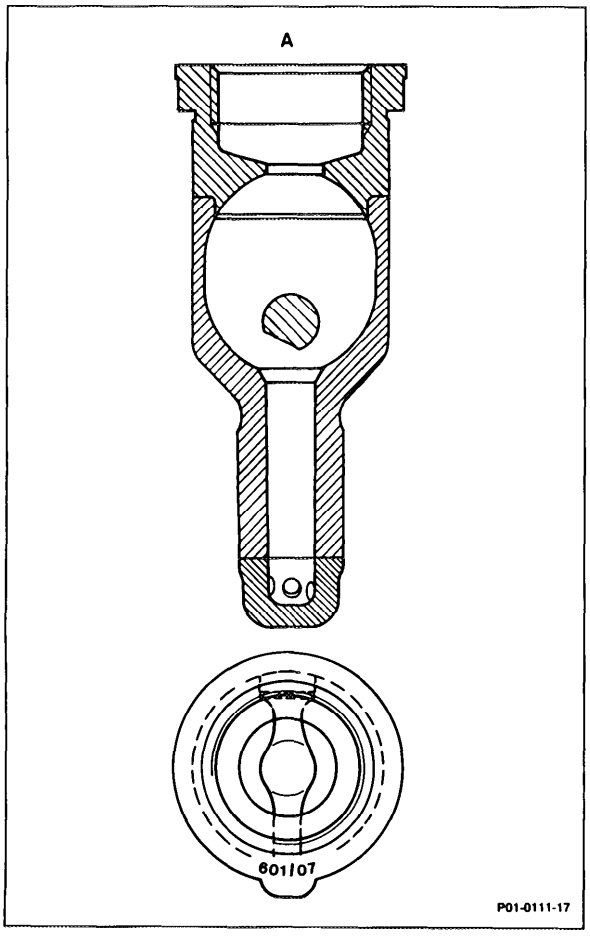
Note
Refinish prechamber sealing surface if required (01-410).

Prechamber survey

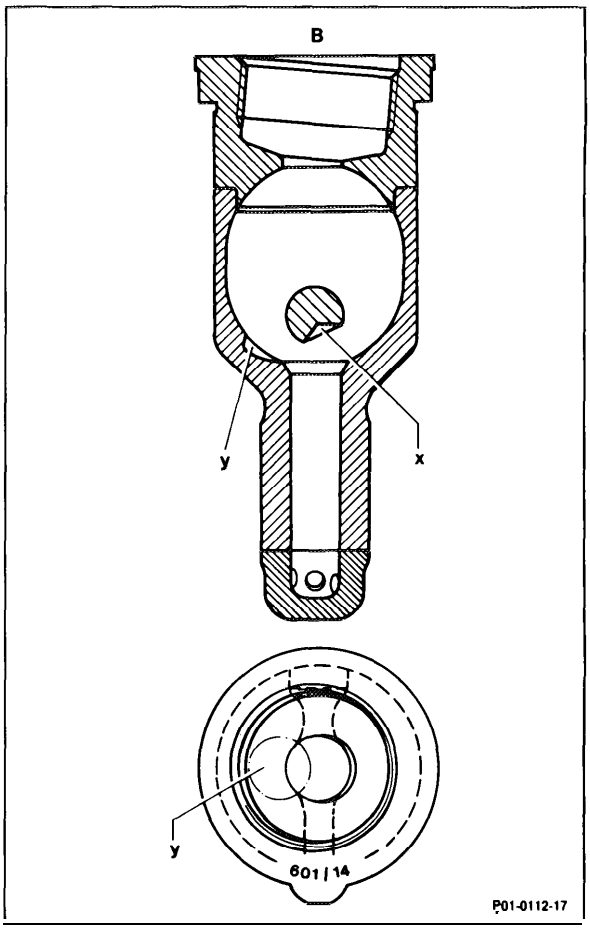
Engine	602.91[1])	603.96 up to 09/88	602.91[2]) 603.91[2]) starting 09/88	602.961 starting 09/88 602.962 Standard	603. 962[2]) 603.970[2]) starting 09/88
Code	601/07 or 17	601/09 or 23	601/25	601/26	601/30
Version	A[1])	A[1])	C[2])	C[2])	C[2])
Combustion neck OD (mm)	14	15	14	15	15

[1]) Without exhaust gas recirculation
[2]) With exhaust gas recirculation starting 02/89

Differentiation, vertical and angular injection

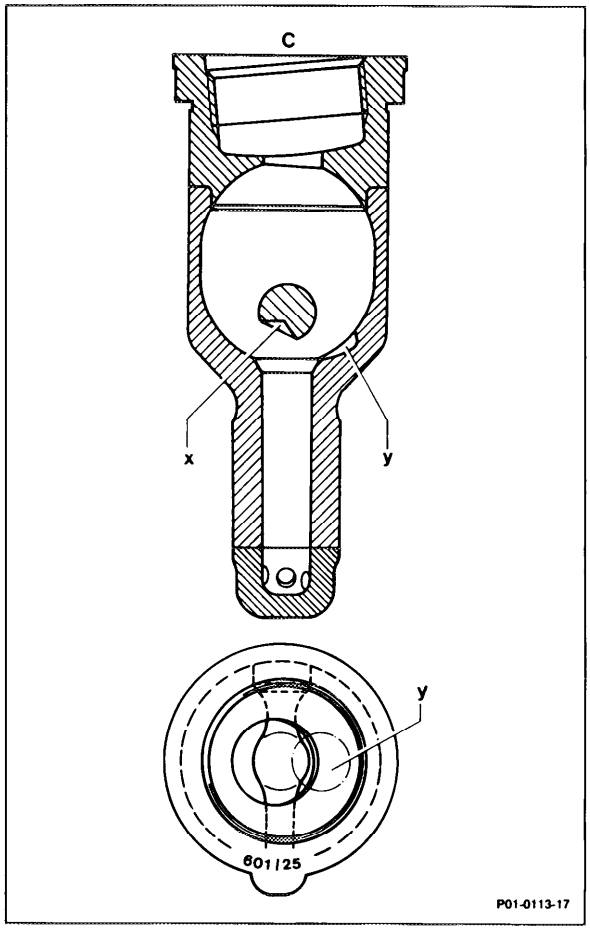


A Prechamber, vertical injection
Code 601107, 601117, 601/09, 601123



B Prechamber angular injection, inclined 5°
Code 601/14, 601 /15

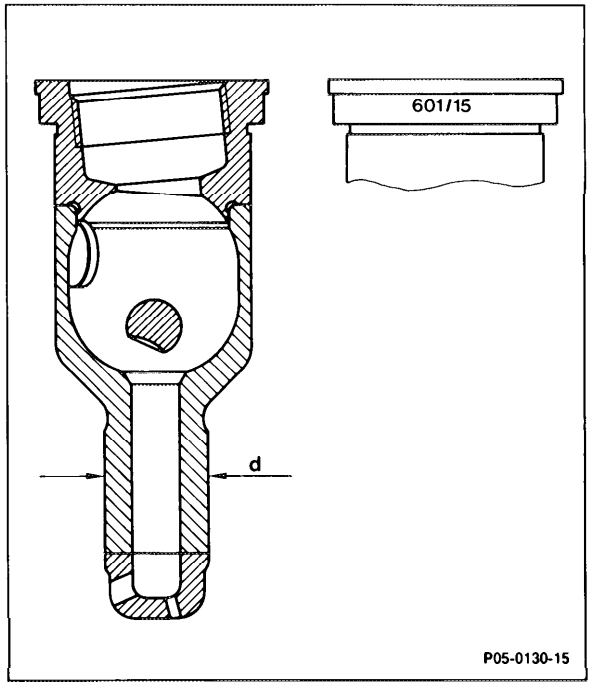
X Cone
y Recess



C Prechamber, angular injection
Inclined 5°, turned 180"
Code 601/25, 601 26, 601130

x Cone
y Recess

Differentiation, combustion neck diameter
The individual combustion neck diameters (d) differ on naturally aspirated engines and turbo-engines.

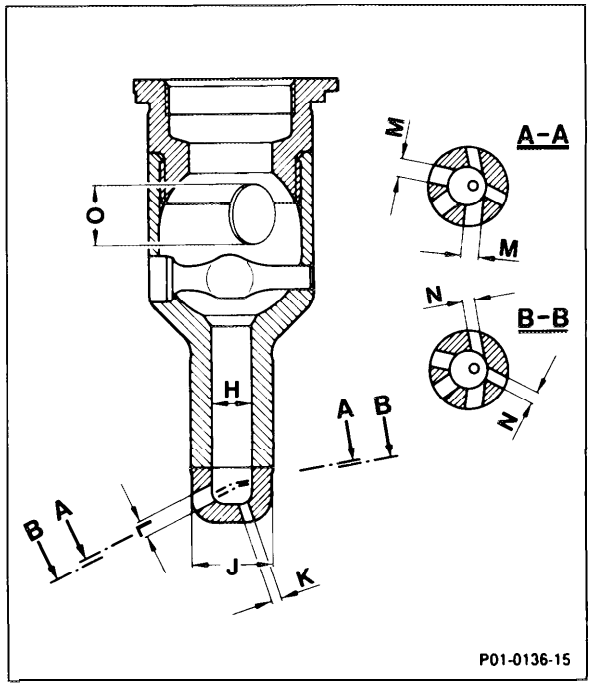


d = 14 mm naturally aspirated engines
d = 15 mm turbo-engines

Differentiation, combustion bores

6 combustion bores with different diameters are located in different planes and at different angles in the bottom section of the prechamber (combustion neck).

The injection angle is always 180°.

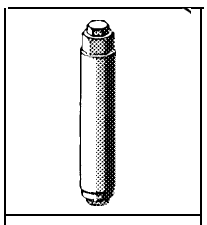


Combustion bore diameters (dia. in mm)

Prechamber code	601107 or 17	601/09 or 23	601/14/25	601/15/26	601/30
H Firing duct	7,0	7,0	7,0	7,0	7,0
J Combustion neck	14,0	15,0	14,0	15,0	15,0
K Combustion bore	1,5	1,5	1,8	1,8	1,8
L Combustion bore	3,2	3,2	3,0	3,0	3,0
M Combustion bore	3,0	3,0	3,0	3,0	3,0
N Combustion bore	2,0	2,0	2,5	2,5	2,5
0 Bore for glow plug	10,0	10,0	10,0	10,0	10,0

Tightening torques	Nm
Glow plugs	20 + 2
Threaded ring, vertical injection	90 – 110
Threaded ring, angular injection	70

Special tools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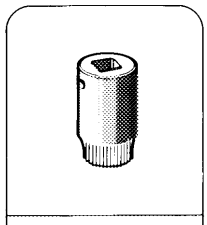
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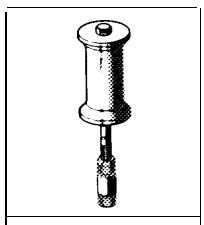
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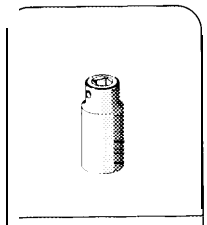
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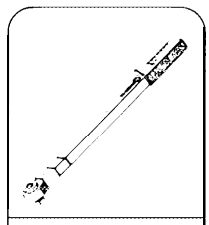
03 07 32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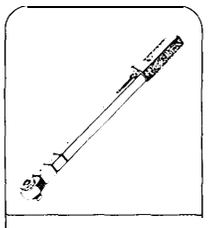
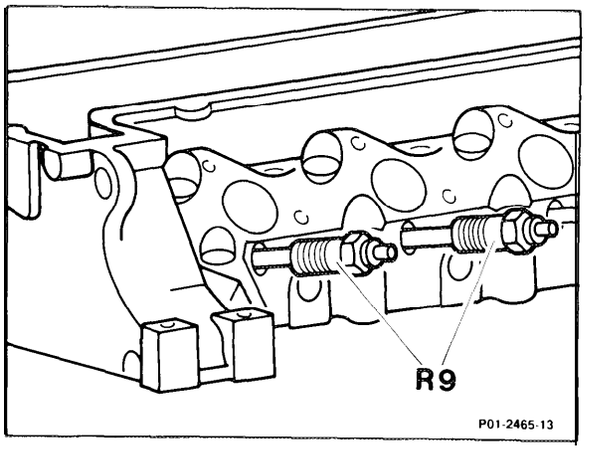


001 589 06 21 00

Removal, installation

1 Remove glow plugs (R9).

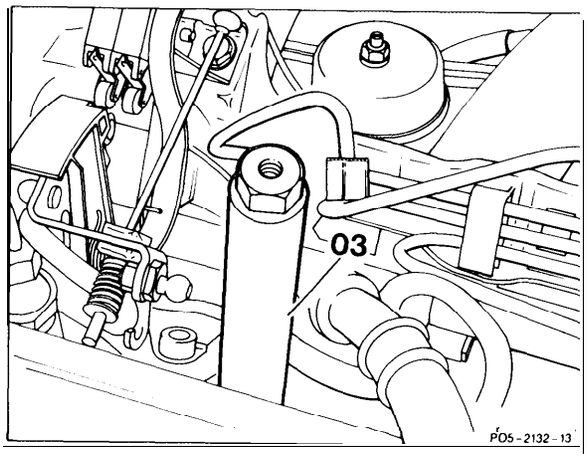


Installation note

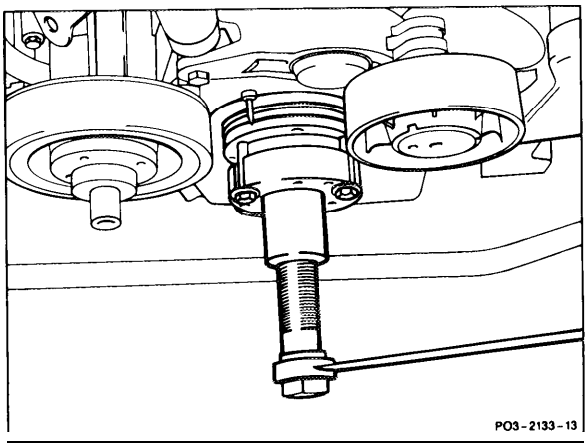
Tightening torque 20 + 2 Nm.

Vertical injection:

2 Bolt threaded end (03) of pin wrench 615 589 00 07 00 into threaded ring of prechamber.



2.1 Slide sleeve (02) of pin wrench over threaded end and insert into grooves in threaded ring.



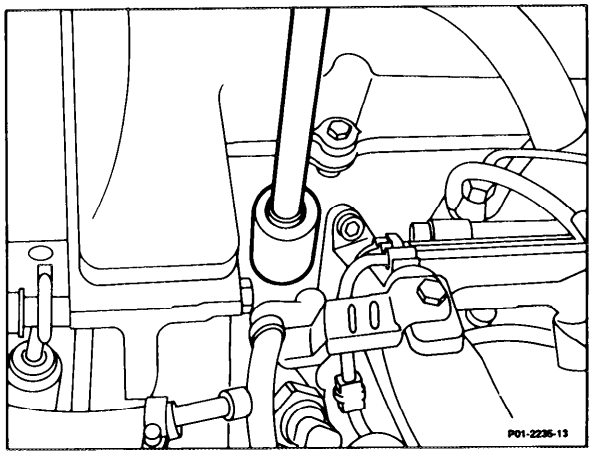
Caution!
The sleeve must be seated tightly in the grooves of the threaded ring.

2.2 Counter sleeve (02) with hex. head bolt (01).

2.3 Remove threaded ring with open-end wrench on hex. end of sleeve (02).

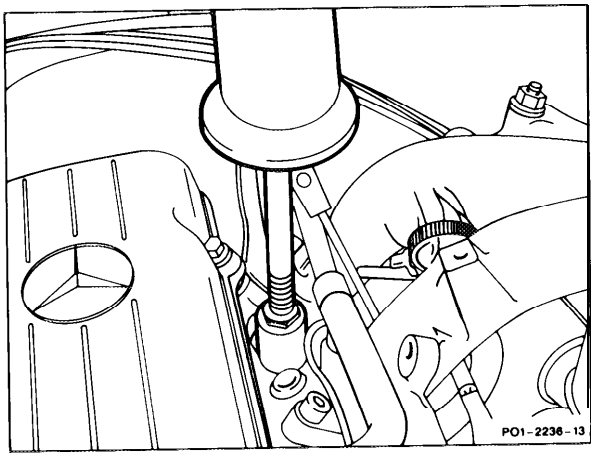
Installation note
Oil threaded ring.
Tightening torque 90 - 110 Nm.

Angular injection:
3 Remove threaded ring with splined wrench 603 589 00 09 00.



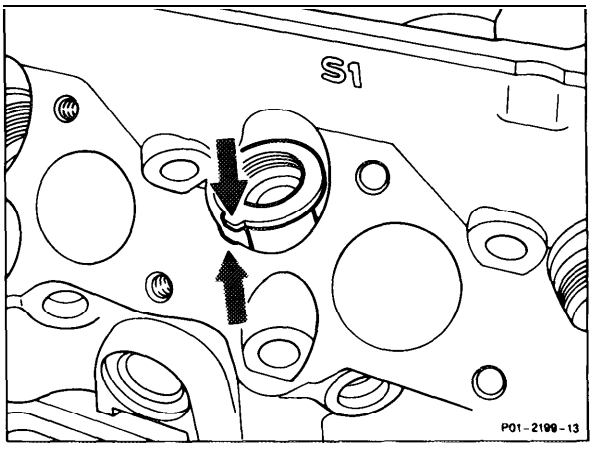
Installation note
Oil threaded ring.
Tightening torque 70 Nm.

4 Bolt impact puller 602 589 00 33 00 into prechamber and knock out prechamber.



Installation note

Insert prechamber into mounting bore so that lug on collar of prechamber fits in recess in cylinder head (arrows).



5 Clean mounting bore for prechamber in cylinder head, check and cover.

Note

Refinish prechamber sealing surface if required (01-410).

6 Check prechambers.

Note

The spherical pin must not be burned or scaly. If the combustion tips are burned or cracked in the bottom section of the prechamber, check the following:

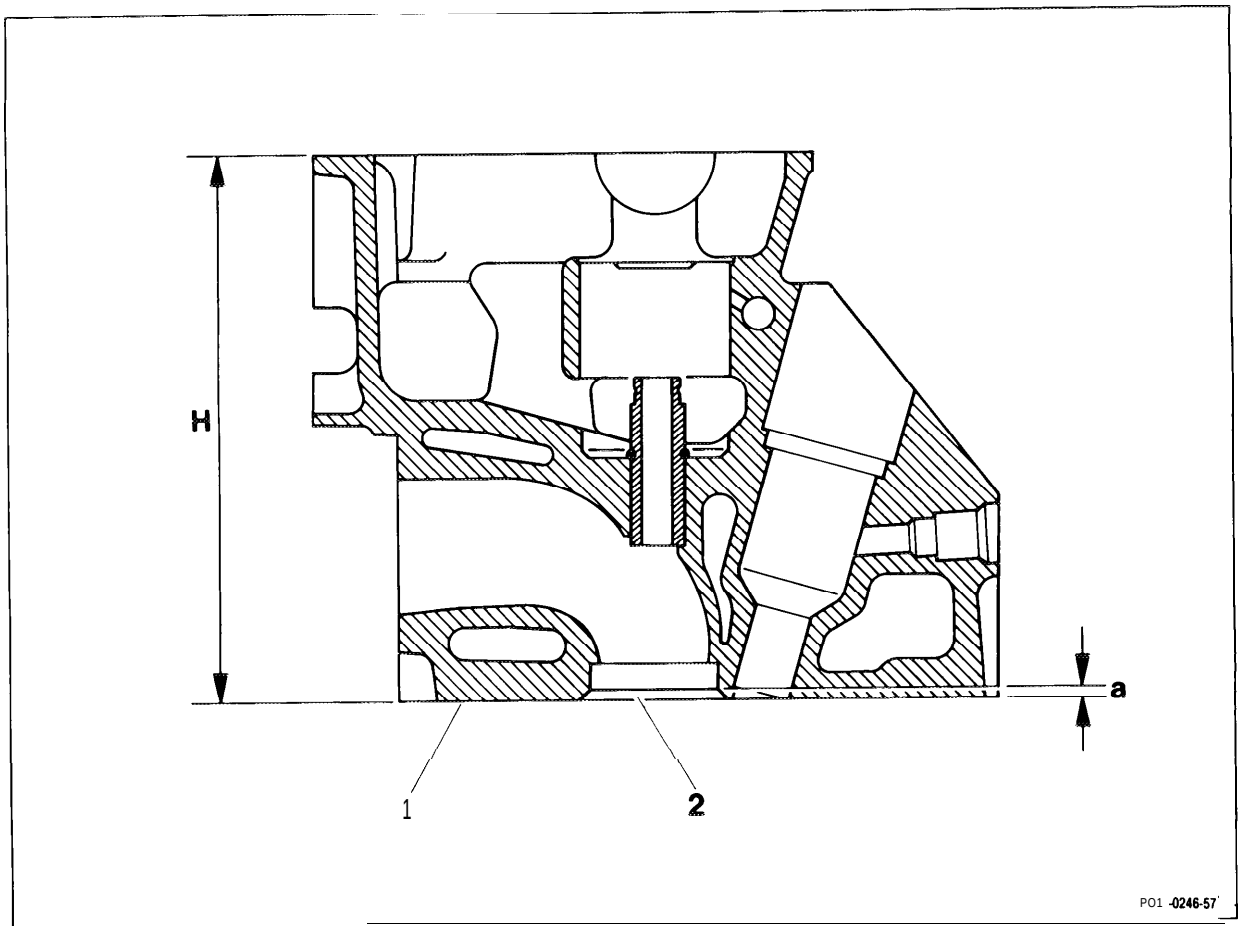
1. Oil level at oil temperature of approx. 80 °C. If the quantity of oil in the oil pan is too high, correct oil level.
2. Check piston vacuum pump for damage or replace vacuum box on injection pump.

To determine wich component is unfit for use, check vacuum lines (blackened with oil).

7 Install in opposite order.

01418 Facing **cylinder head mating surface**

Preliminary operations:
Valves removed.
Valve guides checked (05285).
Prechambers removed (01-417).
Cylinder head pressure-tested (01-420).



Mating surface (1)	plane according to operating instructions of tool manufacturer.
	Note Observe permissible minimum height (H) and machining data.
Valve seats (2)	refinish until minimum interval (a) is reached (05291).
After assembly	check engine timing (05215).

Data

Total height of cylinder head in mm [1])		142.9 – 143.1
Minimum height (H) after machining in mm		142.4
Material removal per facing operation in mm		0.5
Permissible unevenness of mating surface in mm	in longitudinal direction	0.08
	in transverse direction	0.0
Permissible deviation in parallel of upper mating surface in relation to lower surface in longitudinal direction in mm		0.1
Roughness in mm		0.004
Test pressure with air under water in bars gauge pressure in mm		2
Minimum distance (a) (recess) with new valves and new valve seats in mm	Intake	– 0.1 to – 1.0
	Exhaust	
Max. distance (a) (recess) with new valves and machined valve seats in mm	Intake	– 1.0
	Exhaust	

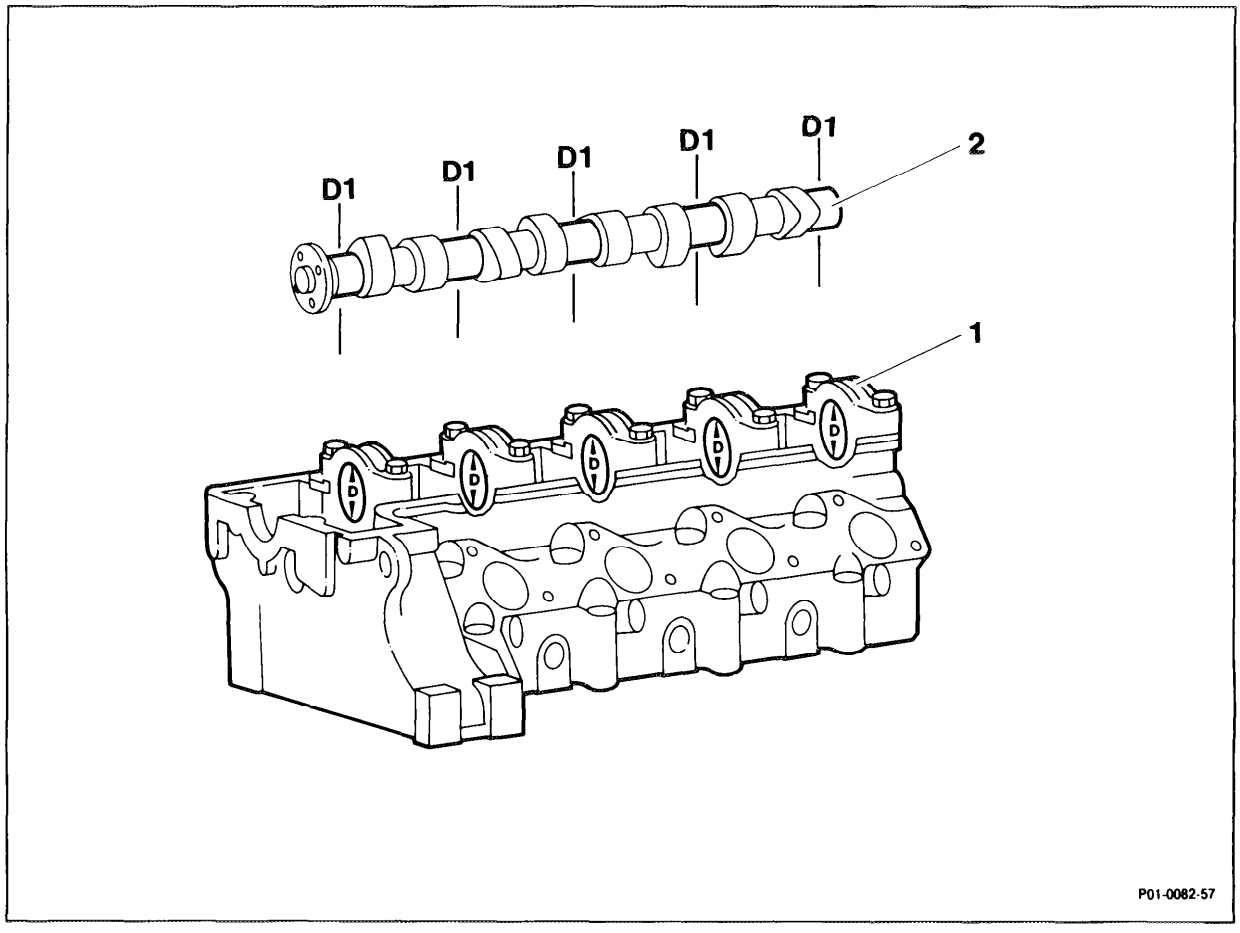
1) It is not permissible to machine the upper mating surface of the cylinder head.

Commercially available tools

Cylinder head clamping fixture	e.g.	Hunger, D-8000 München 70 Order No. 211.60.000
Valve seat machining tool, model VDSNL 1/45/30	e.g.	Hunger, D-8000 München 70 Order No.
Testing set for valve seats	e.g.	Hunger, D-8000 München 70 Order No. 216.93.300
65° correction blade No. 13 for bottom correction angle	e.g.	Hunger, D-8000 München 70 Order No. 216.64.622

01-419 Boring out camshaft bearing bores (repair stage)

Preliminary operations:
Cylinder head removed (01-415).
Camshaft removed (05220).
Valves removed.



Camshaft bearing caps (1) . . . . . remove, install, 25 Nm.

Camshaft bearing basic bores (D) . . . . . measure.

Note
It is only possible to rebore the camshaft bearing bores once to max. 0.5 mm oversize. Observe repair stage dimensions.

Camshaft bearing basic bores (D) . . . . . bore out according to operating instructions for tool used.

Caution!
When boring ensure that the mating surface at the rear of the cylinder head cover and the mount for the sealing plate at the front are not damaged.

After boring . . . . . remove burrs on mating surfaces of camshaft bearing caps (1) and mating surfaces on cylinder head.

Note
Edges with burrs can lead to poor lubrication during engine operation resulting in bearing damage.

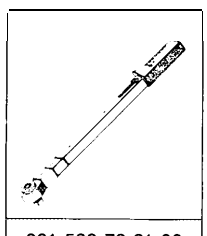
Install new camshaft (2) . . . . . with oversize bearing journals (D1), code for oversize camshaft (05-215 or 05220).

Data, camshaft bearings

Standard dimension	Camshaft bearing diameter D		30.95 – 31.04
	Journal diameter D1		29.934 – 30.95
Repair stage	Camshaft bearing diameter D		31.45 – 31.54
	Journal diameter D1		31.434 – 31.45
Camshaft bearing bores	Roughness		0.003 – 0.006
	Permissible out-of-round		0,012
		New value	Wear limit
Bearing play	radial	0.050, – 0.091	0.15
	axial	0.030 – 0.100	0.15

Note
If bearings have seized or are scored deeply, the camshaft bearings in the cylinder head can only be rebored once to a maximum of 0.5 mm oversize. After reboring replace damaged camshaft with new camshaft with oversize bearing journals.

Special tool


001 589 72 21 00
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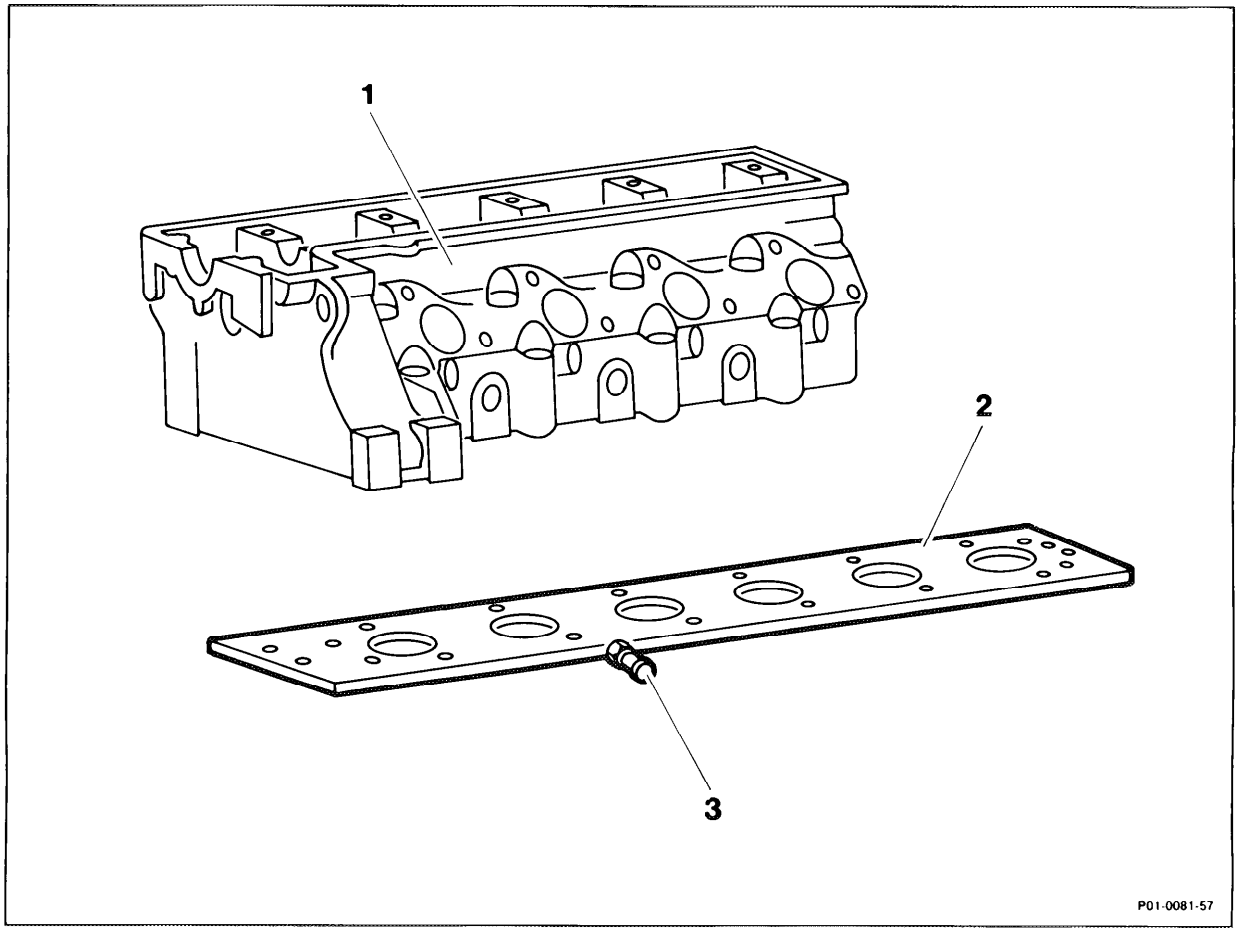
01-420 Pressure-testing cylinder head

Preliminary operations:
Cylinder head removed (01-4 15).
Camshaft removed (05-220).
Valves removed.
Valve shaft seals removed (05-270).
Cooling water return fitting removed.



Cylinder head (1)	clean.
Pressure plate (2)	bolt onto cylinder head with rubber sealing plate 601 589 00 25 00, unbolt.
Connection for cooling water return fitting and heater feed line	on cylinder head, plug tightly.
Compressed air	connect to fitting (3) on pressure plate and allow compressed air to flow into cylinder head at pressure of 2 bars.
Cylinder head (1) with pressure plate (2)	fasten to suspension device 115 589 34 63 00 and immerse in water preheated to approx. 80 °C.

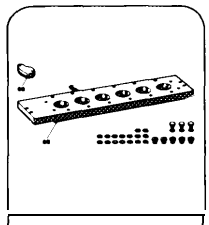
Cylinder head (1) . . . . . check for air bubbles exiting.

Note
Air bubbles indicate a leak, locate exit point for air bubbles more precisely if possible.

Data

Test pressure with air under water	2 bar

Special tools



601 589 00 25 00
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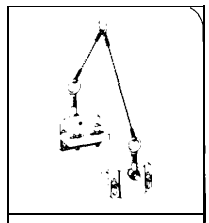


115 589 34 63 00
01

Commercially available tool

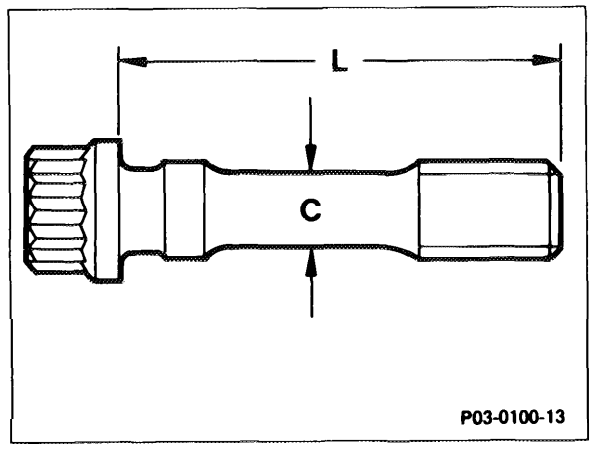
Electrically heated water basin	e.g.	Otto Dürr, D-7123 Sachsenheim- Ochsenbach

Crankshaft assembly 03

Job No.

Checking, replacing and tightening connecting rod bolts ..... 03 – 310
Reconditioning and squaring connecting rods ..... 03 – 313
Removal and installation of pistons ..... – 316
Modifications to pistons ..... -317
Checking and reconditioning crankshaft ..... – 318
Installation of crankshaft and connecting rod bearings ..... – 320
Modifications to crankshaft ..... – 321
Replacing front crankshaft radial sealing ring ..... – 324
Removal and installation of pilot bearing in crankshaft ..... – 330
Removal and installation of crankshaft pulley and hub ..... – 341
Checking and correcting adjustment of TDC sensor ..... – 345
Removal and installation of crankshaft sprocket ..... – 350
Removal and installation of flywheel and driven plate ..... – 410
Refinishing flywheel ..... – 420
Replacing ring gear ..... – 430

03-310 Checking, replacing and tightening connecting rod bolts



Stretch bolt dia. (dimension c)	measure, minimum dia. = 7.1 mm. If shaft dia. is less than 7.1 mm replace connecting rod bolts.
Threads on connecting rod bolts	oil.
Connecting rod bolts	initially tighten to 30 Nm and then tighten to rotation angle of 90 - **100".**

⚠ Warning
Do not use torque wrench with flexible shaft for rotation angle tightening.

Note
Estimate angle of rotation. For this purpose insert adjustable torque wrench in break position (locked) into ratchet.
Position adjustable torque wrench with plug-in ratchet lengthwise in relation to engine and continue to turn until it is transverse in relation to engine.

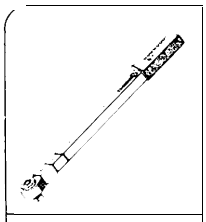
Dimensions

Part No.	102 038 00 71
Thread	M 9x1
Necked down shaft dia. (c) in new condition	7.4 – 0.1
Minimum necked down shaft dia. (c)	7.1
Length (L) in new condition	52 – 0.3

Tightening torques and rotation angles

Initial tightening torque	30 Nm
Rotation angle	90 – 100°

Special tool



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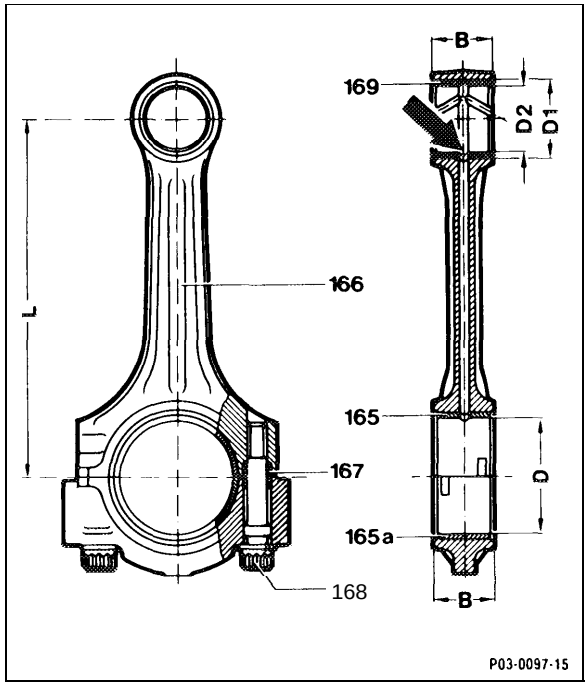
03-313 Reconditioning and squaring connecting rods

Preliminary jobs:
Pistons removed (03-316).



Connecting rod bolts (168) and sleeves (167) ...	oil.
Connecting rod bearing cap	attach without connecting rod bearing shells (165, 165a), remove, 30 Nm (item 1).
Basic bore (D)	measure, max. 51.619 mm, if dimension is exceeded, machine bearing cap down max. 0.02 mm (item 2).
Connecting rod bushing (169)	press in, approx. 2450 N and machine or ream out (items 3, 4).
Connecting rod (166)	touch up lateral thrust surfaces (item 5).
Connecting rod (166)	square with connecting rod tester (items 6 - 8).

Caution!
The connecting rod bearing bore and connecting rod bushing bore must be parallel to one another.

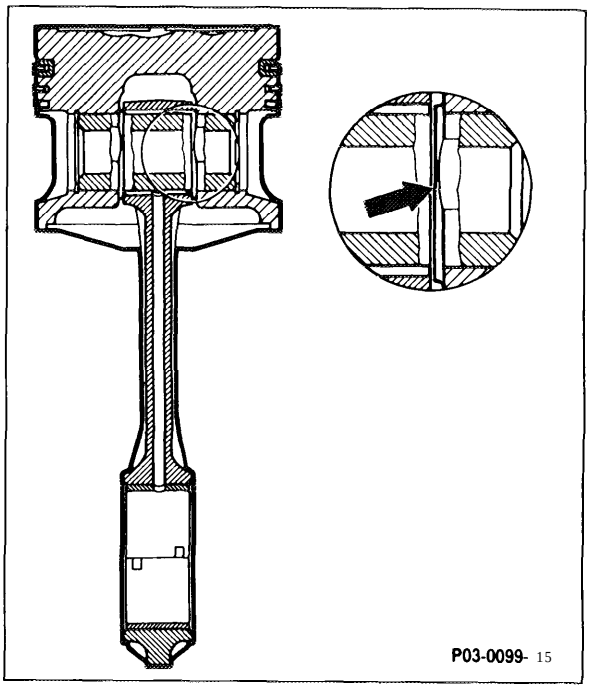
Data

Center of connecting rod bearing bore to center of connecting rod bushing bore (L)		Engine 602 603.96	148.97 149.03
		Engine 603.970	144.97 145.03
Width of connecting rod (B) at connecting rod bearing bore and connecting rod bushing bore		1 st version	23.974 24.026
		2nd version	22.000 21.948
Basic bore for connecting rod bearing shells			51.600 51.619
Basic bore for connecting rod bushing (D 1)		1 st version	29.500 29.521
		2nd version Engine 602.91	28.500 28.521
		Engine 603.96 602.96	30.500 30.525
Connecting rod bushing Ø		1 st version	29.560 29.600
		2nd version	28.575 28.600
		Engine 603.96	30.575 30.600
Connecting rod bushing Ø (D 2)	Engine 602.91	1 st version	27.018 27.024
		2nd version	26.000 26.000
	Engines 602.96, 603.96/97		28.000 28.000
Roughness of connecting rod bushing, inside			0.005
Permissible offset of connecting rod bearing bore in relation to connecting rod bushing bore with reference to 100 mm length			0.1
Permissible deviation of parallel axis alignment: Connecting rod bearing bore in relation to connecting rod bushing bore with reference to 100 mm length			0.045
Permissible difference in weight within engine			4 g

Note on connecting rod versions

The axial play of the connecting rods is limited by the piston pin eye (piston-guided connecting rods). For this purpose appropriate thrust surfaces (arrow) are cast on the piston pin eye.

Connecting rods for engines 602.96, 603.96/97 are not bored hollow.

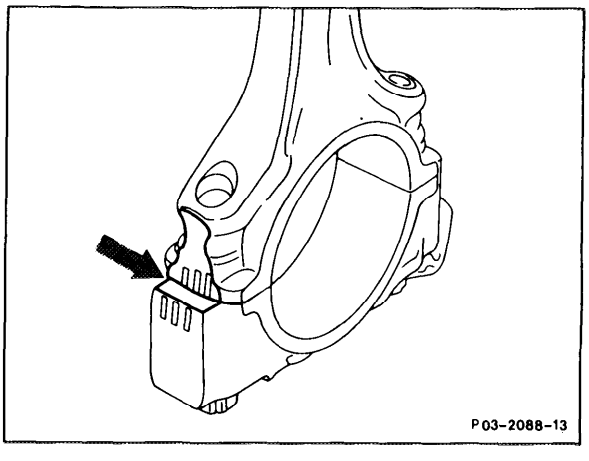


Overheated connecting rods

Connecting rods which have been overheated due to a damaged bearing (blue discoloration) cannot be reused.

Matching connecting rods and connecting rod bearing caps are marked (arrow). The connecting rod shafts should not have any transverse score marks or notches.

Replacement connecting rods are supplied with machined connecting rod bushings.



Connecting rod width

Connecting rod width (B) on engines 602 and 603 from start of production is 22 mm.

Engines 602.91, 603.91 starting 1 1/85

The connecting rods are heat treated before machining to reduce the tendency to warp.

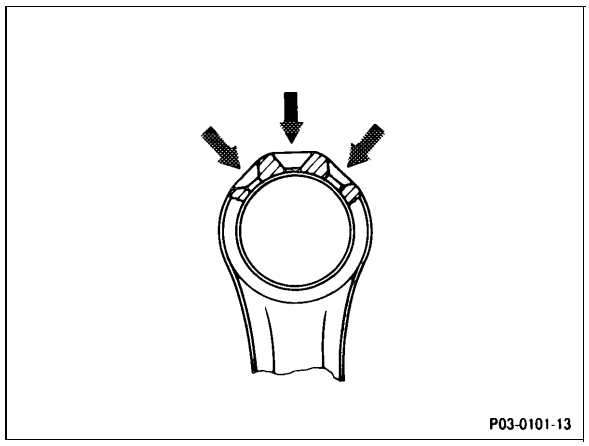
Production beakpoint: 1 1/85

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	009490	002235	268999	175981

* not registered

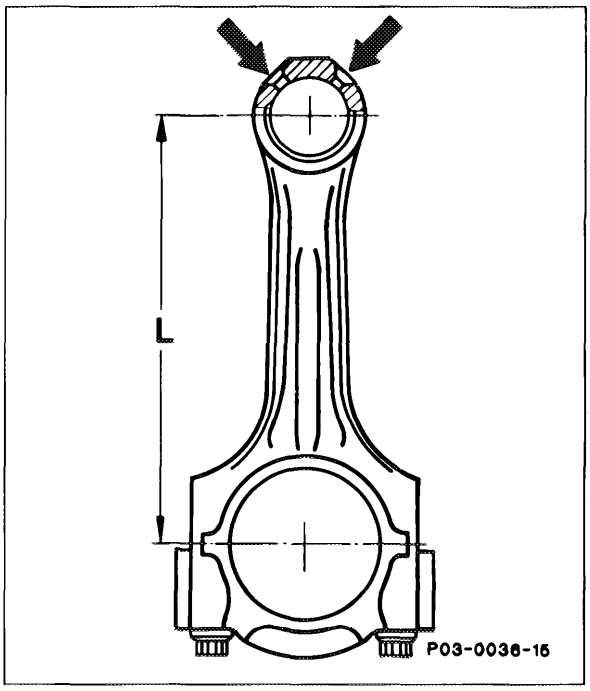
Engine 603.960 starting 01/88

On these engines there are 3 bores (arrows) with a dia. of 4.5 mm in the connecting rod eye for lubrication of the piston pin.



Engines 602.961, 602.962, 603.970 and 602.96, 603.96 starting 09/88

On these engines the connecting rod eye is now equipped with 2 bores (arrows) with a dia. of 4.5 mm.



Engines 602.91, 603.91

Shaft cross section of piston rods reduced (standardized with M 102) and material changed 49 Mn VS 3 (was CK 45 V 7 50).

Production breakpoint: 09-12/86

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	028194 – 034399	006787 – 008285	*	*

* not registered

Engine 602.91

Shaft cross section was changed back, material 49 Mn VS 3.

Production breakpoint: 12/86

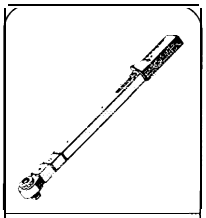
Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	034400	008286	*	*

* not registered

Tightening torque

Connecting rod bolts	Initial tightening torque	30 Nm
	Rotation angle	90 – 100"

Special tool



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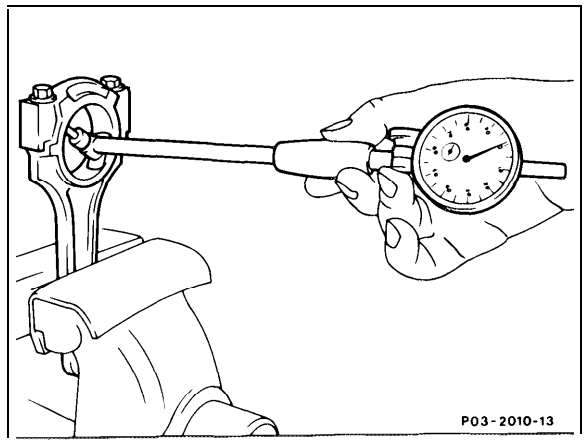
Commercially available tools

Connecting rod straightener	e.g .	Hahn & Kolb, D-7000 Stuttgart Model BC 503
Runout gauge	e.g .	Carl Mahr, D-7300 Esslingen Model 844 N

Reconditioning

1 Install connecting rod bearing cap without connecting rod bearing. For this purpose lubricate threads and bolt head contact surface and tighten to 30 Nm.

2 Measure connecting rod bearing basic bore. If the basic bore diameter exceeds the value of 51.619 mm or if it is conical, touch up bearing cap at contact surface on surface plate up to max. 0.02 mm.

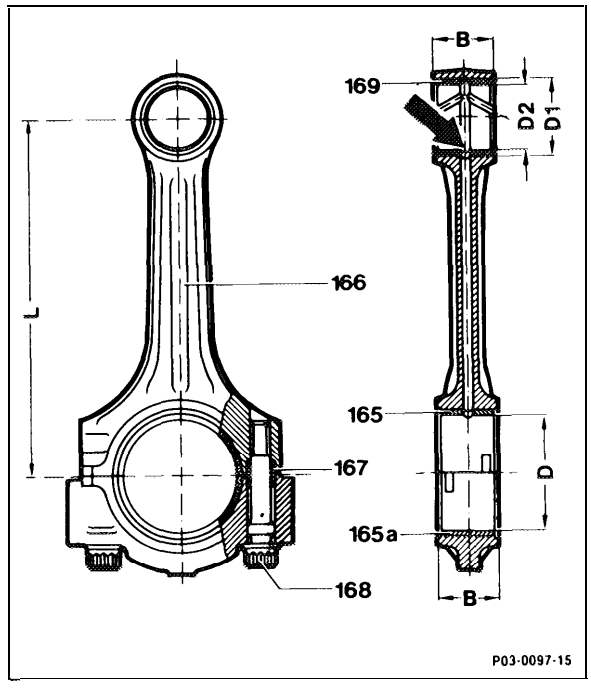


3 Press in new connecting rod bushing (169) such that oil bores are aligned (arrow). Pressing force 2450 N.

4 Machine or ream connecting rod bushing (169).

5 Touch up lateral thrust surfaces of connecting rod (166) on surface plate.

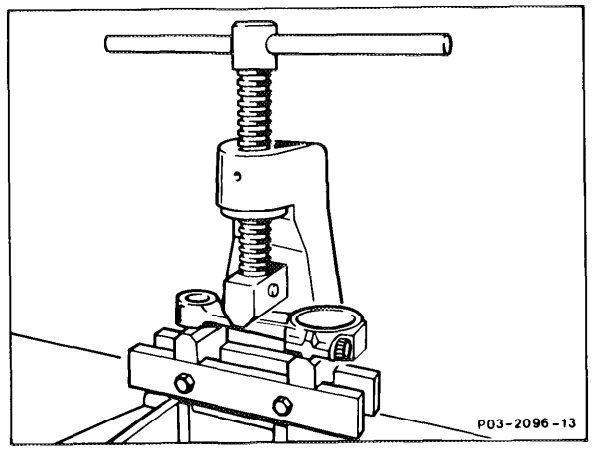
D1	Connectmg rod bushing basic bore
D2	Connectmg rod bushing Ø
165	Upper connecting rod bearing shell
165 a	Lower connecting rod bearing shell
166	Connecting rod
167	Sleeve
168	Connecting rod bolts
169	Connecting rod bushing
B	Connecting rod width
D	Basic bore
L	Center of connecting rod bearing bore to center of connecting rod bushing bore



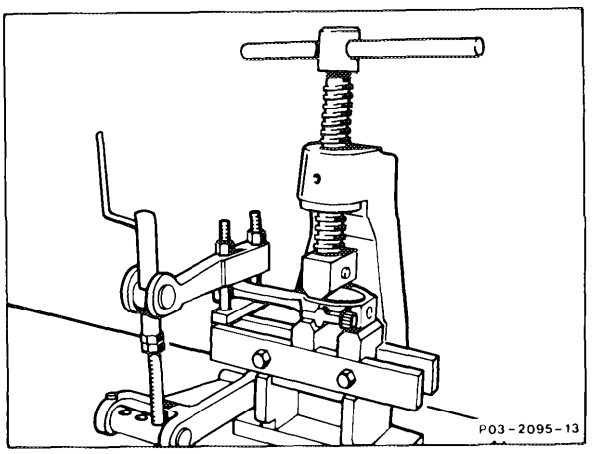
Squaring

6 Square connecting rod with connecting rod tester.

7 Align connecting rod bearing bore with connecting rod bushing bore (parallel alignment).

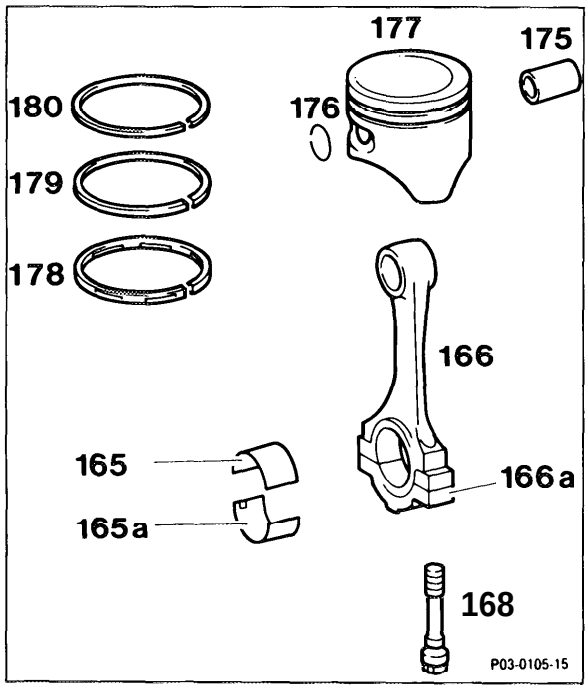


8 Check offset of connecting rod bearing bore in relation to connecting rod bushing bore and correct, if required.



03-316 Removal and installation of pistons

Preliminary jobs:
Engine removed (01-030).
Cylinder head removed (01-415).
Oil pan removed (01-310).



Cylinder	clean.
Connecting rod bolts (168)	remove, check (03-310), reinstall (items 2, 12).
	Caution! Do not mix up upper and lower connecting rod bearing shells (165, 165a).
Connecting rod bearing cap (166 a)	remove, oil connecting rod bearing, position connecting rod bearing cap (166 a) so that code numbers match on connecting rod (166) (item 11).
Piston (177)	remove together with connecting rod (166) toward top (item 2), check piston rings (178, 179, 180) for easy motion, check gap tolerance and axial play. Oil piston and cylinder.
	Caution! Do not heat piston.
	Attach clamping strap 000 589 04 14 00 and insert piston into cylinder bore (item 10). The arrow on the piston crown should point toward the front of the vehicle.

Piston pin retainer (176)	remove, install (items 3, 7).
Piston pin (175)	press out, oil, press in by hand (items 3, 6).
Piston (177)	remove from connecting rod (166) (item 3), position on connecting rod (166), the arrow should point toward the front of the vehicle and the retaining groove in the connecting rod toward the left side of the engine (item 5).
After installation:	
Crankshaft	turn and check clearance between connecting rod and crankshaft (item 13).
Piston (177)	move to TDC and measure distance between piston crown and crankcase mating surface (item 14). Projecting length max.: 0.965 mm Projecting length min.: 0.735 mm

Cross reference, pistons – cylinders

Engine	Piston code number	Group code letter	Piston dia.	Cylinder dia.
602.91	01, 05, 07, 08[1]), 15[2]), 16[3]), 17[3]), , 12[6]), 14[7])	A	86.970-86.976	87.000-87.006
602.96, 603.96	09[1]), 01'), 00[4]), 13[4])	B	upon 86.982-86.988	upon 87.012-87.018

[1]) Engines 602 and 603.96 from beginning of production.
[2]) Engine 602.91 starting 02/88.
[3]) Engine 602.91 starting 09/88.
[6]) Engine 602.91 03/88 up to 06/88.
[7]) Engine 602.91 06/88 up to 11/88.

Cross reference, pistons – cylinders

Engine	Piston code number	Group code letter	Piston dia.	Cylinder dia.
603.970	16	A	88,858–88,864	89,000–89,006
		X	88,863–88,871	89,006–89,012
		B	88,870–88,876	89,012–89,018

Piston projecting length

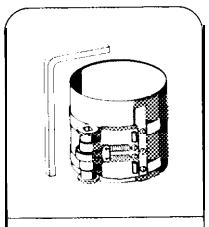
Distance between piston crown and crankcase parting surface	Projection max.0,965 Projection min.0,735

Test values			When new	Wear limit
Difference in weight between pistons in one engine				20 g
Piston pin diameter		Engines 602.91	1st version 2nd version	26.995-27.000 25.995–26.000
		Engines 602.961, 603.96		27.995-28.000
Distance, piston pin eye		1 st version 2nd version	22.05-22.35 24.1-24.3	
Piston pin clearance	in connecting rod bushing	1st version 2nd version	0.012–0.023 0.018–0.029	
	in piston		0.004–0.015	
Connecting rod in piston (end play)		1 st version 2nd version	0.126-0.274 0.050-0.402	
Piston ring gap clearance		Groove 1 Groove 2 Groove 3	0.25-0.45 0.20-0.40 0.20-0.40	1.0 1.0 1.0
Piston ring side clearance		Groove 1 Groove 2 Groove 3	0.090-O. 122 0.050-0.085 0.030-0.065	0.20 0.15 0.1

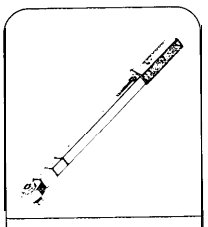
Tightening torque and rotation angle

Connecting rod bolts	Initial tightening torque	30 Nm
	Rotation angle	90 – 100”

Special tools



000 589 04 14 00
03 13



001 589 72 21 00
00

Standard tool

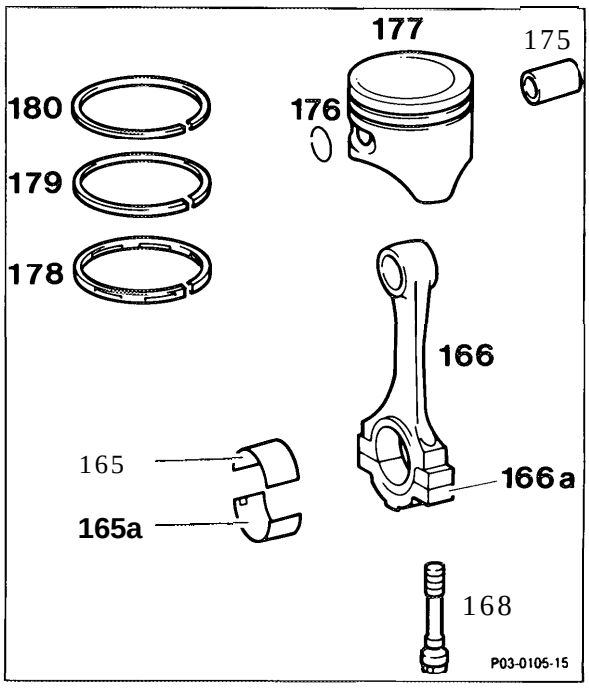
Dial gauge Al DIN 878	e.g.	Mahr, D-7300 Esslingen Order No. 810

Removal

1 Remove combustion residues in cylinder.

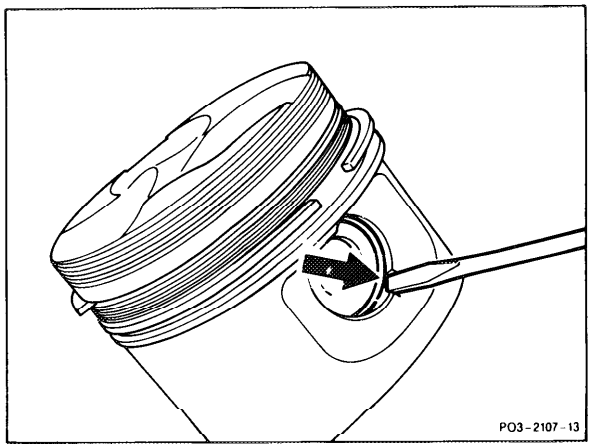
2 Remove connecting rod bolts (168), remove connecting rod bearing cap (166a) and remove connecting rod (166) together with piston (177) in upward direction.

Caution !
Do not mix up upper and lower connecting rod bearing shells (165, 165a).



175 Piston pm
176 Piston pm retainer
178 Piston ring
179 Piston ring
180 Piston ring

3 Remove piston pin retainer (arrow) and press out piston pin, remove piston from connecting rod.

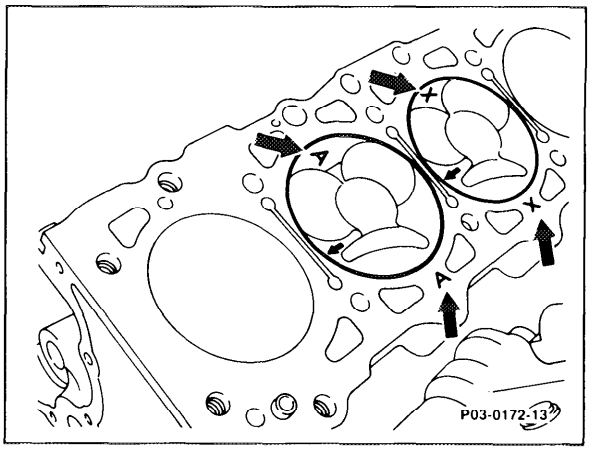


4 Recondition and square connecting rod (03-313).

Installation

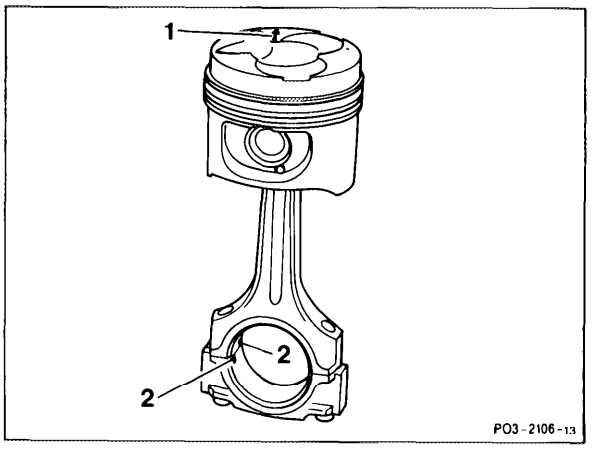
Note
The group code letters (arrows) are stamped on the crankcase mating surface. Only pistons with the group code letter "X" are available for repair. These pistons should also be installed in cylinder bores with group code letters “A” or "B".

When repairing hone cylinder bores according to dimensions of present pistons "X" plus piston clearance.

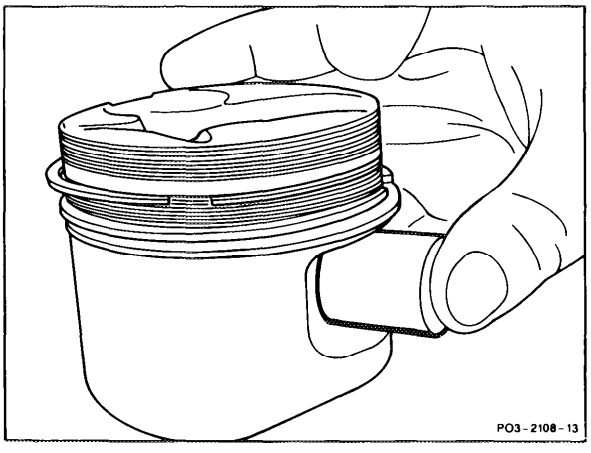


5 Position piston on connecting rod so that arrow (1) points toward front of vehicle and retaining grooves (2) in connecting rod point toward left side of engine.

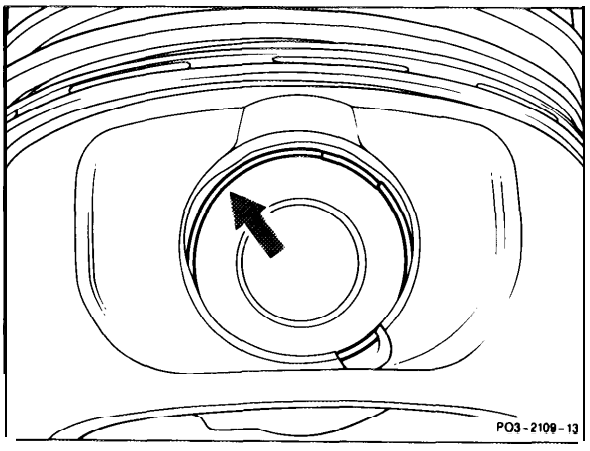
Caution !
Do not heat pistons.



6 Coat piston pins with oil and press in **by hand.**



7 Insert piston pin retainer into groove (arrow).

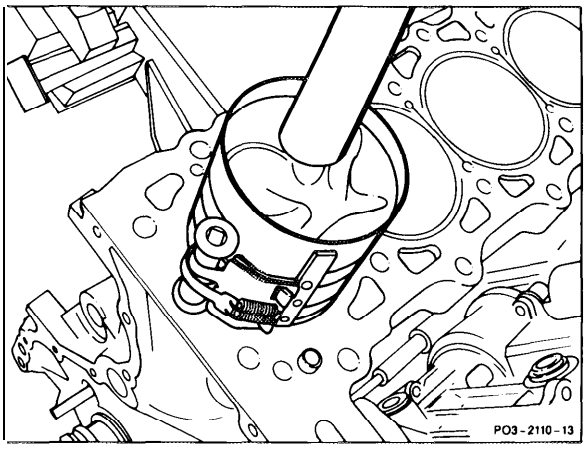


Check piston rings for easy motion.

When installing used pistons check gap and side clearance of piston rings.

8 Oil cleaned cylinder bores, connecting rod bearing journals, connecting rod bearing shells and pistons.

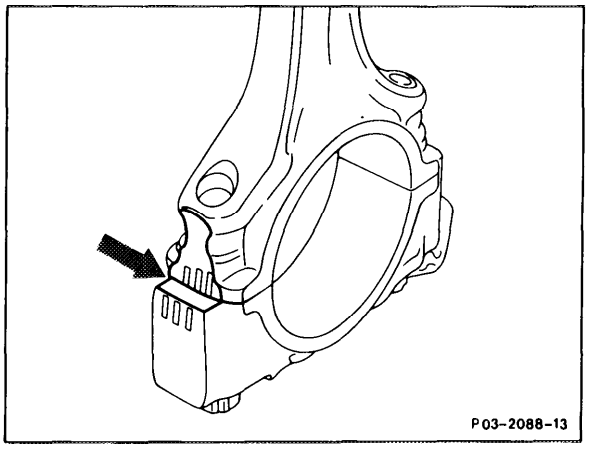
9 Turn piston rings so that gaps are distributed uniformly around circumference of piston.



10 Attach clamping strap 000 589 04 14 00 and install piston.

The arrow on the piston crown must point toward the front of the vehicle.

11 Position connecting rod bearing caps on connecting rods with codes (arrow) on same side.



12 Check connecting rod bolts, replace and tighten (03-310).

13 Turn crankshaft and check clearance between connecting rod and crankshaft.

14 Measure distance between piston crown and crankcase parting surface with pistons in TDC position (see table).

03-317 Modifications to pistons

Piston pin bearings, engine 602

Piston pin bore provided with angular oil pockets (previously flat oil pockets) for improved lubrication.

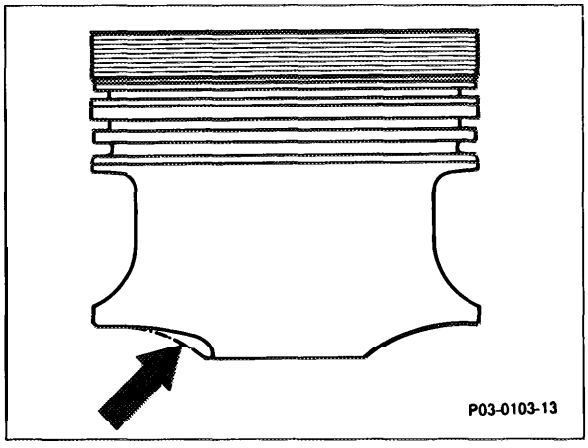
Production breakpoint: 08/85

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	003632	000648	*	141956

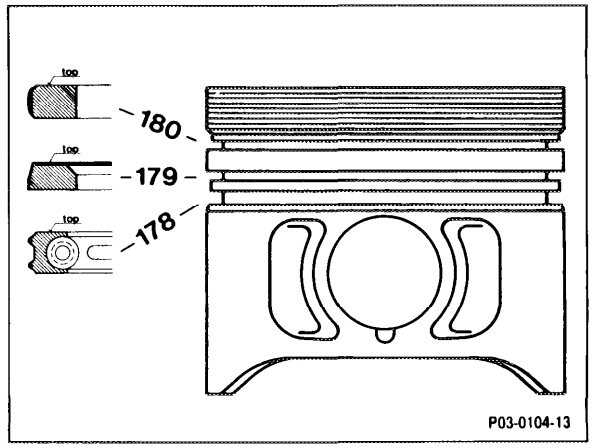
"not registered

Engine 602.91

The piston skirt has been provided with a larger recess (arrow) for better clearance on engines with oil injection nozzles or exhaust gas recirculation..



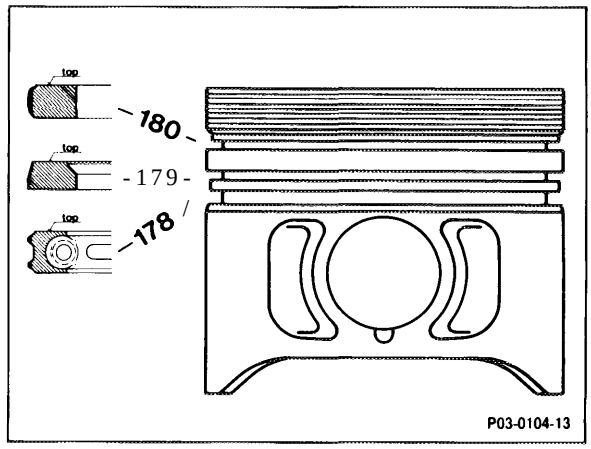
Each piston is equipped with two compression rings and one oil scraper ring. The first piston ring groove is provided with a Niresit ring carrier.



178 Bevelled ring with expander, 3 mm thick, running surface chrome-plated
179 Taper face ring with inside bevel, 2 mm thick, running surface chrome-plated
180 Rectangular ring, 2 mm thick, running surface chrome-plated

Engine 602.91 starting 09/89

The height of the ring groove for the rectangular ring (180) has been increased from 2.0 to 2.5 mm.



Piston code 16 (Mahle co.)
Piston code 17 (Alcan co.)

178 Bevelled rrng with expander, 3 mm thick, running surface chrome-plated
179 Taper face ring with inside bevel, 2 mm thick, running surface chrome-plated
180 Rectangular nng, 2.5 mm thick, running surface chrome-plated

These pistons can also be installed in engines with cylinder sleeves.

Engine 602.91

Temporary installation of pistons from Alcan co., piston code 12, KS co., piston code 14

Production breakpoint 03/88

(Piston code **12,** Alcan co.)

Model	Engine	Engine end No. manual transmission	Engine end No. automatic transmission	Vehicle ident end No. A	Vehicle ident end No. F
201.126	602.911	061160 to 061260	012853 to 012867	*	*

* not registered

Production breakpoint: 03/88

Piston code 12, Alcan co.)

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	061529 to 061588	–	*	*

* not registered

Production breakpoint: 04 - 06/88

(Piston code 12, Alcan co.)

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	062470 to 065290	013059 to 013475	*	*

* not regrstered

Production breakpoint: 06/88

(Piston code 14, KS co.)

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	065291 to 065513	013476 to 013501	*	*

* not registered

Production breakpoint: 06/88

(Piston code 14, KS co.)

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	065635 to 065871	013516 to 013549	*	*

* not registered

Production breakpoint: 1 1/88

(Piston code 14, KS co.)

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	**067047 to** 070443	**013749 to** 014296	*	*

* not registered

Production breakpoint: 06/88

(Piston code 14, KS co.)

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	065635 to 065871	013516 to 013549	*	*

* not registered

Production breakpoint: 1 1/88

(Piston code 14, KS co.)

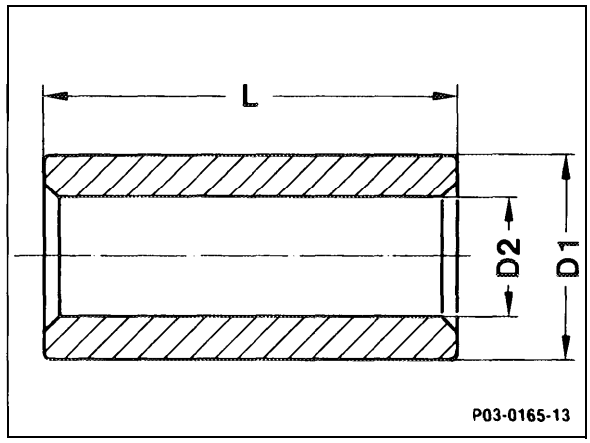
Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	067047 to 070443	013749 to 014296	*	*

* not registered

Engines 602.961, 603.96/97 starting 12/87 (turbo)

Piston pins

The size of the piston pin has been increased to reduce the surface pressure.



Engine 602.961, 603.96:

D1 = 28 mm
D2 = 13,5 mm
L = 70 mm

Engine 602.91:

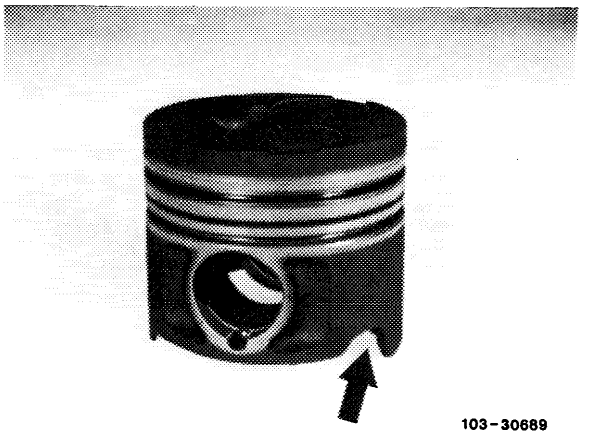
D1 = 26 mm
D2 = 14 mm
L = 55 mm

Pistons with angular channel

Due to the higher thermal load the pistons are cooled with oil via an annular channel in the piston crown. Moreover the piston pins are supplied with oil injected through the two bores (2.0 mm dia., arrows), ending in the annular channel.

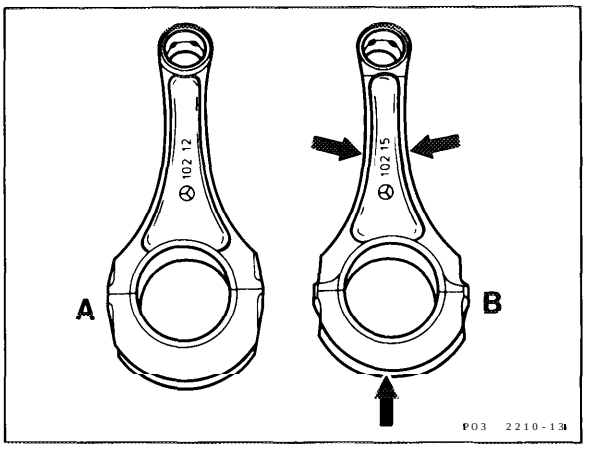
The required oil is supplied via injection nozzles located in the crankcase on the right side.

The annular channel is deleted on engine 603.970. Only the piston crown is supplied with oil.



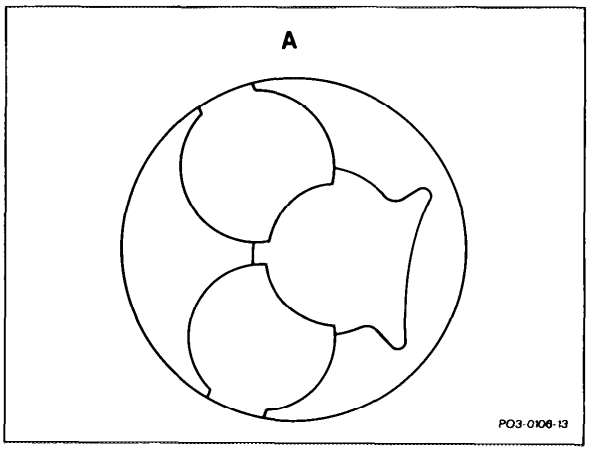
A **recess is** located on the piston skirt (arrow) for the oil injection nozzle.

The prechamber recess in the piston crown has a diameter of 18 mm (normally aspirated engine = 17 mm).

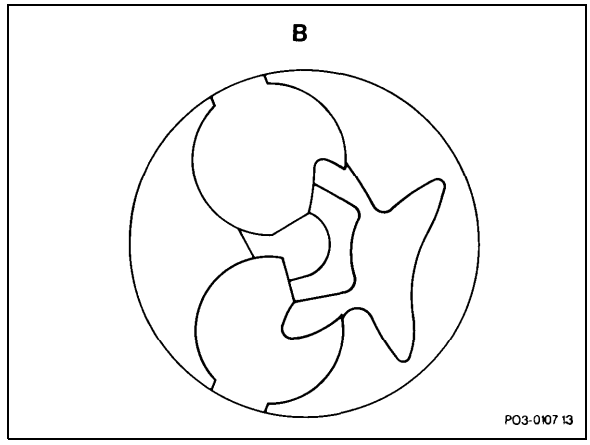


Piston crown

On **engines** 602.96 **and** 603.97 **from the start of production and on engine** 603.96 **starting** 08/88 'moose horn' recess pistons are installed (previously 'star' recessed pistons).
The piston **crown is coated with aluminum oxide on both piston versions.**



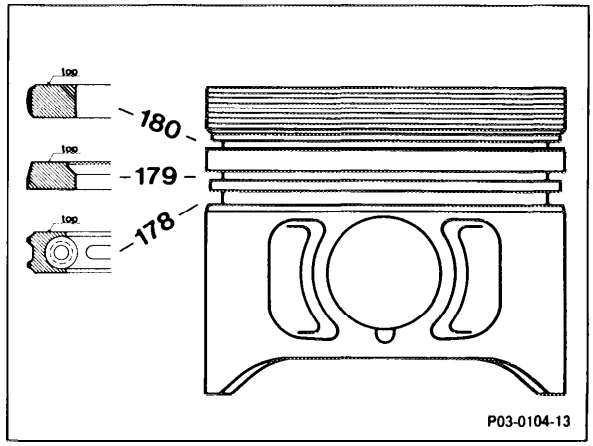
A. 'Moose horn' piston



B. 'Star' recessed piston

These pistons each have two compression rings and one oil scraper ring. The piston skirt is graphitized.

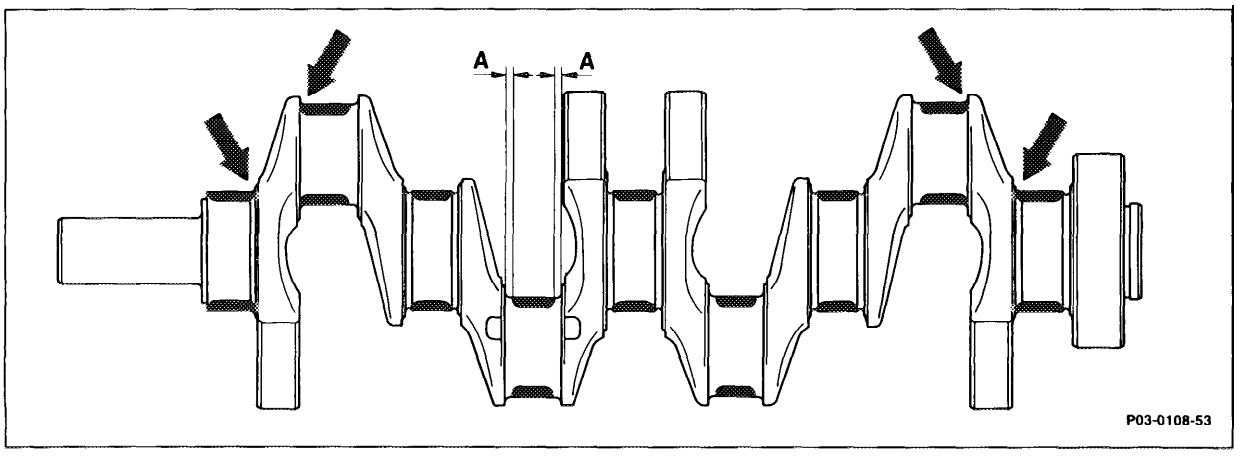
Piston codes: 00 Engine 602.96
13 Engine 603.96



178 Bevelled ring with expander, 3 mm thick, running surface chrome-plated
179 Taper face ring with inside bevel, 2 mm thick,
180 Rectangular ring with inside bevel, 2.5 mm thick, running surface molybdenum-coated

03-318 Checking and reconditioning crankshaft

Preliminary lobs:
Crankshaft removed.



Crankshaft	clean
Crack test	perform; apply fluorescent powder (magnaflux) or use penetration method.
Hardness test (scleroscope hardness)	perform with impact hardness tester 000 589 20 21 00.
Distance (A = 5 - 6 mm)	when hardening journals without hardened fillets, maintain distance A between hardened runout and fillet radius.
Journals	can be hardened inductively or with flame.

Caution!
Harden journals with hardened fillets (arrows) inductively only.

Data

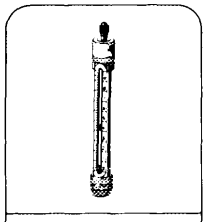
Crankshaft normal dimensions and repair stages	Crankshaft bearing journal dia.	Fitted bearing Associated thickness of thrust washers	Width of journal		Connecting rod bearing journal dia.	Connecting rod bearing journal width
Standard dimension	57.950 / 57.965	2.15	26.52" / 26.50	24.53[2] / 24.50	47.950 / 47.965	27.96 / 28.04
		2.20	26.62" / 26.60	24.63[2] / 24.60		
1st repair stage	57.700 / 57.715	2.25 or 2.35 or 2.40	26.72" / 26.70	24.73[2] / 24.70	47.700 / 47.715	– 28.30
2nd repair stage	57.450 / 57.465		or		47.450 / 47.650	
3rd repair stage	57.200 / 57.215		26.92" / 26.90	24. 93[2] / 24.90	47.200 / 47.215	
4th repair stage	56.950 / 56.965		or 27.02" / 27.00	25.03[2] / 25.00	46.950 / 46.965	

[1]) Up to 06/84
[2]) Starting 07/84

Test values

Permissible deviation of crankshaft main and rod journals in mm		0.005
Permissible conicity of crankshaft main and rod journals in mm		0.01
Permissible roughness of crankshaft main and rod journals (Ra) in mm		0.005 – 0.015
Permissible deviation of flywheel flange from true in mm		0.02
Permissible axial runout of fitted bearing in mm		0.02
Fillet radii in mm	on crankshaft main journals	2.5 – 3.0
	on rod journals	3.0 – 3.5
Permissible deviation of crankshaft main journals when mounted in outer crankshaft bearing journals in mm	Journal II. IV	0.16
	Journal III	0.25
Scleroscope hardness of crankshaft main and rod journals		55 – 74
Permissible unbalance of crankshaft		10 cmg

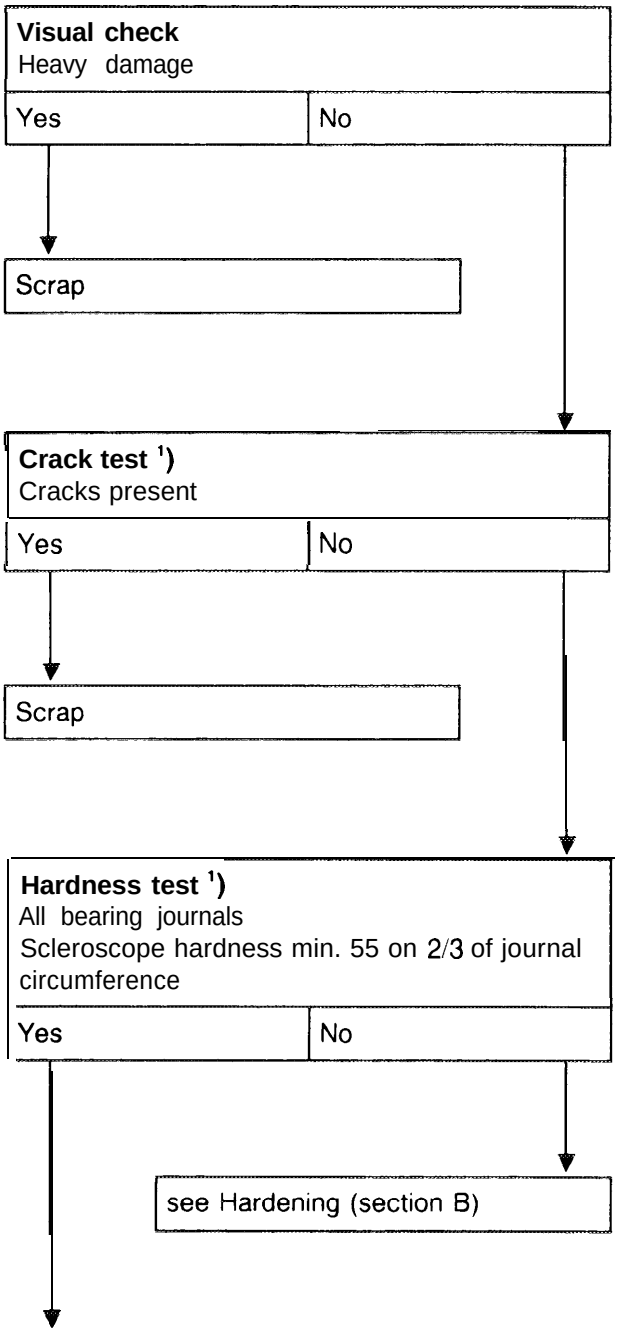
Special tool

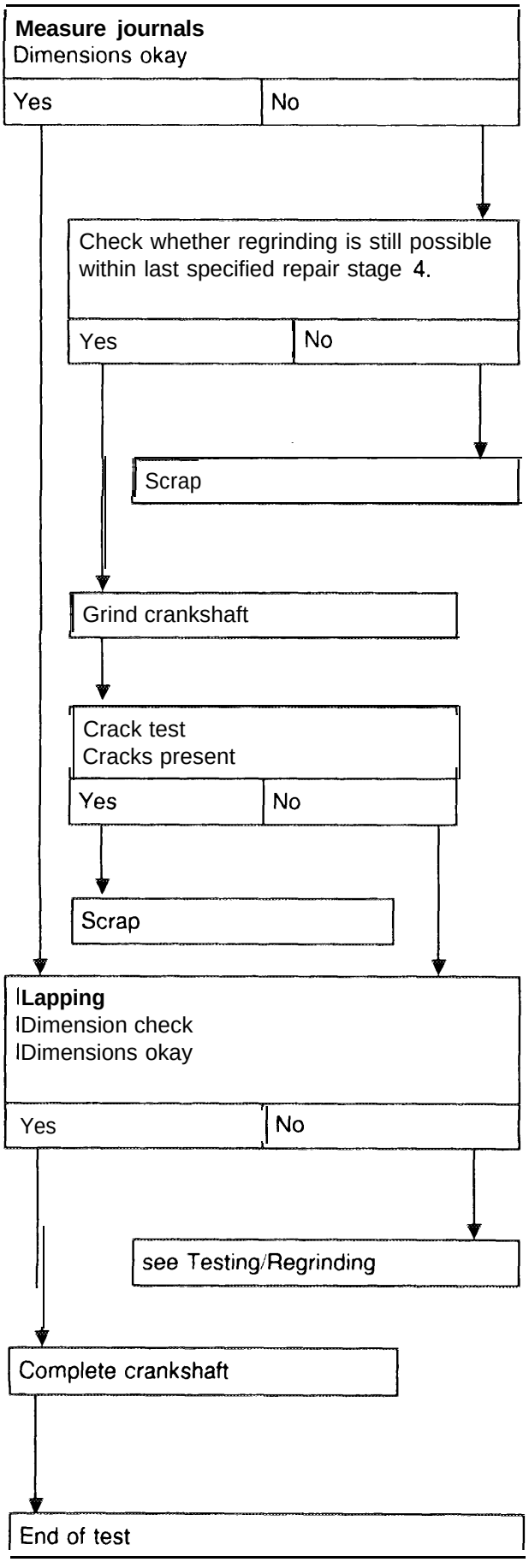


000 589 20 21 00
00 03

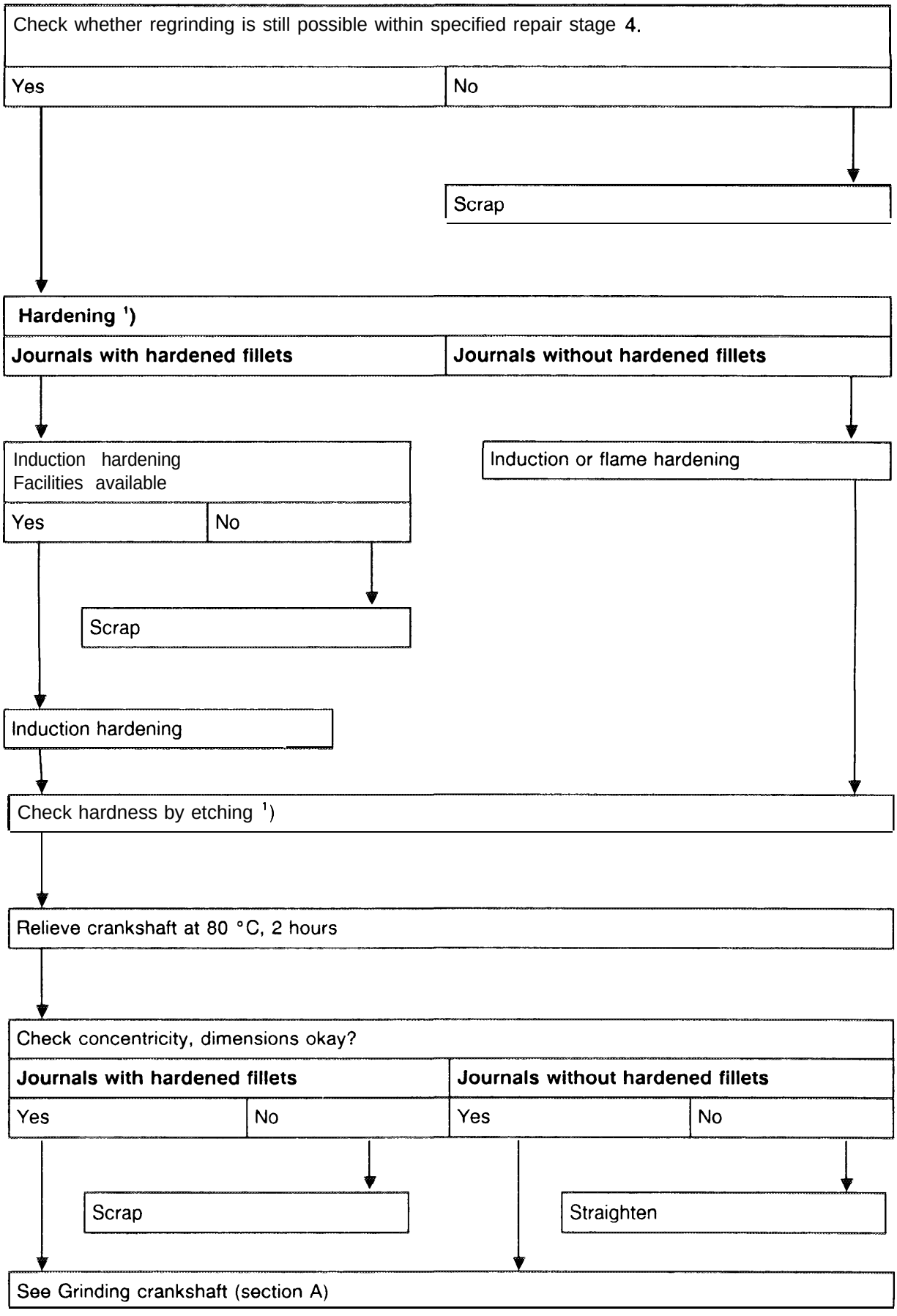
Note
When testing and reconditioning crankshafts, proceed in sequence shown in diagram below.

A. Testing, grinding

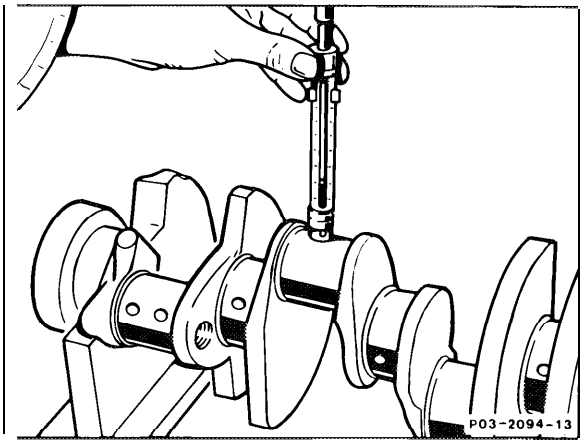



Measure journals
Dimensions okay
Yes
No
Check whether regrinding is still possible within last specified repair stage 4.
Yes
No
Scrap
Grind crankshaft
Crack test
Cracks present
Yes
No
Scrap
Lapping
Dimension check
Dimensions okay
Yes
No
see Testing/Regrinding
Complete crankshaft
End of test

B. Hardening


Check whether regrinding is still possible within specified repair stage 4.
Yes
No
Scrap
Hardening 1)
Journals with hardened fillets
Journals without hardened fillets
Induction hardening
Facilities available
Yes
No
Scrap
Induction or flame hardening
Induction hardening
Check hardness by etching 1)
Relieve crankshaft at 80 °C, 2 hours
Check concentricity, dimensions okay?
Journals with hardened fillets
Journals without hardened fillets
Yes
No
Yes
No
Scrap
Straighten
See Grinding crankshaft (section A)

[1]) Explanations on diagram



Crack test

Clean crankshaft. Bearing journals should be free of oil and grease.
Magnetize crankshaft and apply fluorescent powder (magnaflux).
A fluorescent penetration method may also be used (immersion in bath or using spray can).

Agent:
Paint or fluorescent powder,
cleaning agent,
developer

Hardness test

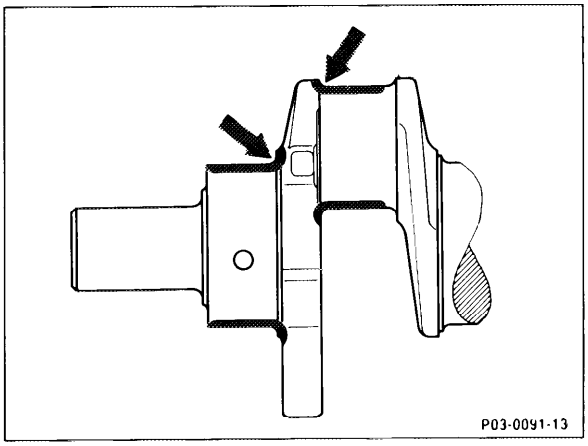
Test hardness with impact hardness tester 000 589 20 21 00 (scleroscope hardness).

The minimum hardness of 55 should be present on 2/3 of journal circumference.

Hardening

Journals without hardened fillets can be hardened inductively or flame-hardened.
Journals with hardened fillets (arrows) must always be hardened inductively.

If this is not possible, scrap crankshaft.



Checking hardening results

To achieve perfect hardening check adjustment of hardening equipment using microsections.

These can be obtained from scrapped crankshafts hardened for testing purposes.

Check hardening by etching the journal surface with a 2% solution of alcoholic nitric acid (HNO_3).

Dark spots should not appear on the journal surface.

Unhardened fillets will become dark.

In the case of hardened fillets they should appear as bright as the surface of the journals.

We recommend comparing the etching test with a journal tested via metallographic microsection.

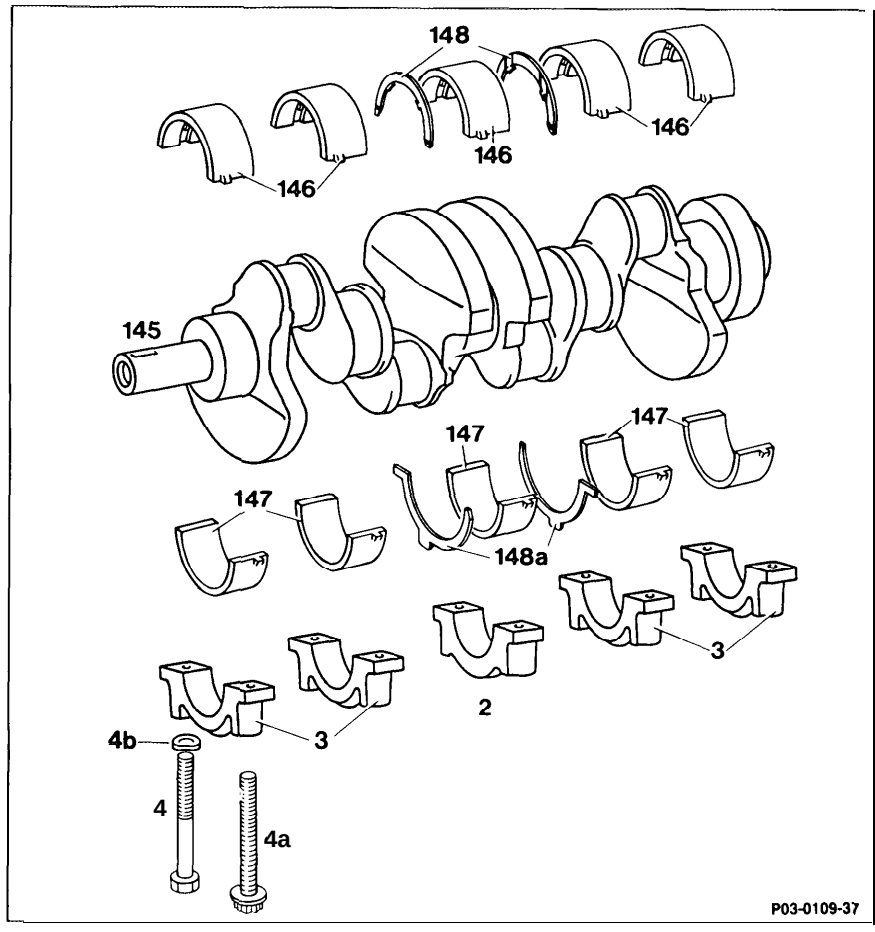
Then carefully wash off nitric acid with alcohol.

Corrosion protection

Crankshafts which are not installed again immediately should be lubricated with engine break-in oil (SAE 30).

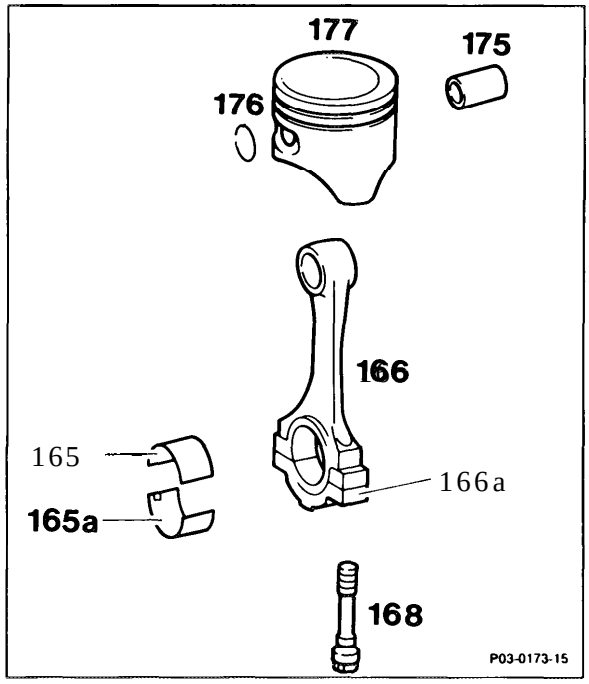
03-320 Installation of crankshaft and connecting rod bearings

Preliminary jobs:
Main oil passage in crankcase open (01-I 30).
Oil passages in crankcase and crankshaft cleaned.
Crankshaft tested (03-318).
Connecting rods reconditioned (03-313).



Crankshaft bearing caps (2, 3)	install without bearing shells, observe markings, tighten. Tightening torque or rotation angle: Crankshaft bearing bolt M 12 (4) 90 Nm Crankshaft bolt M 11 (4 a) 55 Nm, 90 - 100°.

Basic bores	measure conicity in directions A, B and C, min. 62.500 mm, max. 62.519 mm (item 3).
Crankshaft bearing caps (2, 3)	remove (item 4).
Crankshaft bearing shells (146, 147)	insert (item 4).
	Caution! Do not mix up upper and lower crankshaft bearing shells.
Crankshaft bearing caps (2, 3)	position in proper order, position washers (4 b) and tighten crankshaft bearing bolts (4 and 4a) (item 4). Tightening torque and tightening rotation angle crankshaft bearing bolts M 12 (4) 90 Nm crankshaft bearing bolts M 11 (4a) 55 Nm, 90 - 100° (item 4).
Crankshaft	measure bearing journals, determine bearing clearance (item 5).
Fitted bearing journal	measure width and match appropriate thrust washers (item 7).
Crankshaft bearing caps (2, 3)	remove crankshaft bearing bolts (4 and 4a), remove caps, remove lower bearing shells (147) and insert crankshaft (145) with thrust washers (148, 148a), position lower bearing shells (147) (items 8, 9). The oil grooves must point toward the crankshaft. Oil crankshaft, bearing shells and thrust washers.
Crankshaft bearing caps (2, 3)	position in correct order and tighten crankshaft bearing bolts (4 and 4 a) (items 10, 11). Tightening torque and tightening rotation angle crankshaft bearing bolts M 12 (4) 90 Nm, crankshaft bearing bolts M 11 (4a) 55 Nm, 90 - 100”.
Crankshaft (145)	measure end play, new value 0.100 - 0.254 mm; wear limit 0.30 mm.



Connecting rod bearing caps (166 a)	install without bearing shells and tighten, 30 Nm. Observe marking.
Basic bore for rod bearing	measure (03-313).
Rod bearing shells (165, 165 a)	insert, install rod bearing cap and tighten, rod bearing bolts (168) 30 Nm.
	Caution! Do not mix up upper and lower rod bearing shells.
Connecting rod bearing diameter	measure and note value (item 15).
Connecting rod bearing journals	measure, new value 47.950 mm, determine bearing clearance, wear limit 47.965 mm (item 16).
Connecting rod radial clearance	measure, new value 0.030 to 0.055 mm; wear limit 0.08 mm (item 16).
Pistons (177)	attach to connecting rod (166) together with piston pins (175) and piston pin retainers (176) and install (observe installation position) (03-316).

Pistons (177) and connecting rods (166)	install (arrow on piston crown toward front of vehicle) (03-316).
Connecting rod bearing end play	measure, new value 0.12 to 0.26 mm; wear limit 0.50 mm (item 20).
Oil pump and oil filter	disassemble and clean, renew oil pressure valve and install initial operation oil filter cartridge.

Data

Crankshaft standard dimensions and repair stages	Crankshaft bearing journal dia.	Fitted bearing Associated thickness of thrust washers	Width of journal		Connecting rod bearing journal dia.	Connecting rod bearing journal width
Standard dimension	57.950 / 57.965	2.15	26.52" / 26.50	24.53[2] / 24.50	47.950 / 47.965	27.96 / 28.04
		2.20	26.62" / 26.60	24.63[2] / 24.60		
1 st repair stage	57.700 / 57.715	2.25 or 2.35 or 2.40	26.72" / 26.70	24.73[2] / 24.70	47.700 / 47.715	– 28.30
2nd repair stage	57.450 / 57.465		or		47.450 / 47.650	
3rd repair stage	57.200 / 57.215		26.92" / 26.90	24.93[2] / 24.90	47.200 / 47.215	
4th repair stage	56.950 / 56.965		or 27.02" / 27.00	25.03[2] / 25.00	46.950 / 46.965	

1) Up to 06/84
2) Starting 07/84

Basic bore and bearing play in mm			Crankshaft bearing	Connecting rod bearing
Basic bore dia.			62.500 62.519	51.600 51.619
Basic bore width on fitted bearing	Engines 602 and 603		20.000 19.979	–
Connecting rod width	Engines 602 and 603		21.948 22.000	–
Permissible out-of-round of basic bore			0.01	
Permissible conicity of basic bore			0.01	
Bearing play, radial		New value	0.030 – 0.055[1])	
		Wear limit	0.08	
Bearing play, axial		New value	0.100 – 0.254	0.12 – 0.26
		Wear limit	0.30	0.50

[1]) For radial play, set to medium value.

Bearing shells

	Wall thickness Crankshaft bearing in mm	Width of bearing shells in mm	Thickness of fitted bearing thrust washers in mm	Wall thickness Connecting rod bearing in mm
Standard dimension	2.25	17.30 – 17.50	2.15 or 2.20	1.80
1st repair stage 2nd repair stage 3rd repair stage 4th repair stage	2.37 2.50 2.62 2.75		2.25 or 2.35 or 2.40	1.92 2.05 2.17 2.30

Engine 602.91

The tolerance range for the wall thicknesses of the connecting rod bearings was replaced starting 08/85 with three stages. The stages are indicated by a color code.

Only connecting rod bearing shells with the color code yellow are available as replacement parts.

Color code	Dimension
Red	1.804 to 1.808 mm
Yellow	1.808 tol.812
Blue	1.812 to1.816

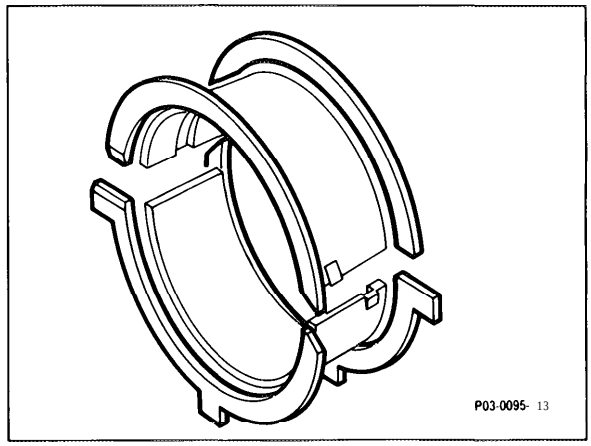
Engines 602.96, 603.96 and 603.96/97

Upper connecting rod bearing shells from Glyco with improved coating (cathode dust coating method).

Engines 602.96, 603.96/97

The groove for fixing the connecting rod bearing was modified to assure correct installation position.

Dimension A: 3.2 mm for all engines
Dimension B: 2.5 mm 602.96, 603.96197
3.5 mm 602.91



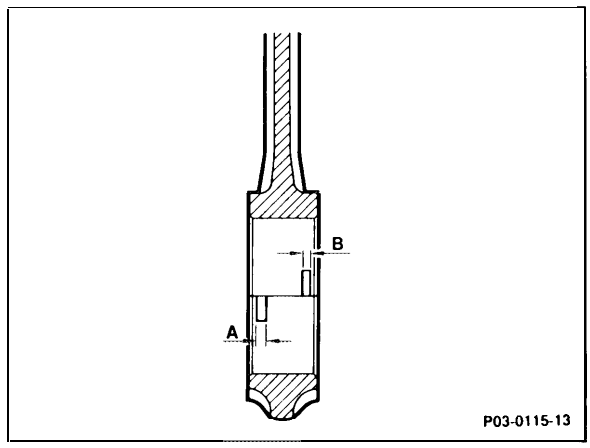
Production breakpoint: 05/86

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
124.133	603.960		001032		
124.193	603.960			266393	013772
126.125	603.961		002508	260197	-

[1]) Engines 602.96 and 603.97 from star-t of production

Note

The axial forces of the crankshaft are taken up by the thrust washers.

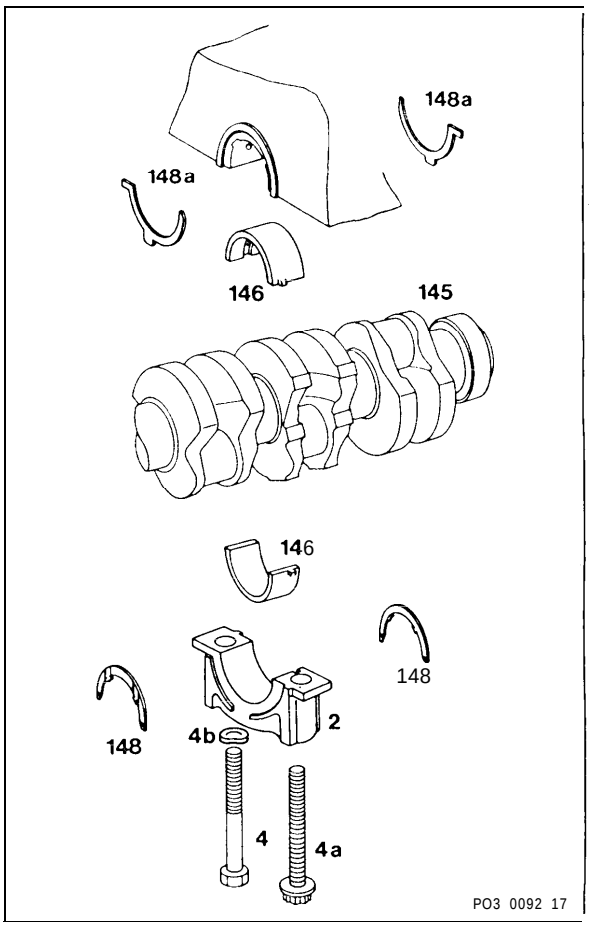


The thrust washers (148 and 148a) installed in the crankcase and in the bearing caps have a different shape.

The thrust washers in the crankshaft bearing caps each have two retaining lugs to prevent rotation and installation errors, whereby the lower retaining lugs are off-center.

When reconditioning crankshafts, regrind width of fitted bearing journals to one of the dimensions shown in the table (section “Data”).

Match thrust washers to respective journal width (table).



2	Bearing cap
4	Crankshaft bearing bolt M 12x60
4a	Crankshaft bearing bolt M 11 x 62
4b	Washer
145	Crankshaft
146	Bearing shell
148	Upper thrustwasher
148a	Lower thrust washer

Thrust washers of the same thickness must always be installed on both sides.

Do not regrind thrus? washers.

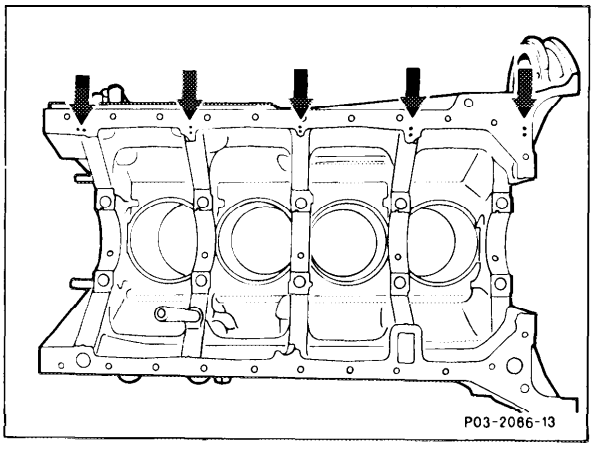
Thrust washers are available for replacement in sets only. One set consists of one upper and one lower thrust washer (148 and 148a).

Association of crankshaft bearing shells and crankcases

Crankshaft bearing shell [1]	Basic bores in crankcase		
	1 punch mark	2 punch marks	3 punch marks [2]
	Bearing shell association with color code		
Blue	Blue	Yellow	Yellow
Yellow	Blue	Yellow	Red
Red	Yellow	Yellow	Red

[1] Color dots on crankshaft cheeks or counterweights next to crankshaft Journals.
[2] Punch marks on parting surface of crankcase on oil pan side next to basic bore.

The standard dimension crankshaft bearing shells with color codes blue, yellow and red are available as parts.
They must be matched according to the table. This eliminates the necessity of measuring the bearing clearance.



Punch marks for matching crankshaft bearing shells

When ordering crankshaft bearing shells the code
52 for blue
54 for yellow
und 56 for red
must be indicated in addition to the part No.

Only the yellow version bearing shells are available for the connecting rod bearing shells.

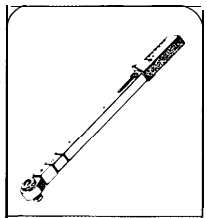
Thrust washer sets

Thickness in mm	Set Part No.
2.15	601 030 00 62
2.20	601 030 01 62
2.25	601 030 02 62
2.35	601 030 03 62
2.40	601 030 04 62

Tightening torques and rotation angle

Crankshaft bearing bolts	M 12		90 Nm
	M 11	Initial tightening torque	55 Nm
		Rotation angle	90 – 100”
Connecting rod bolts		Initial tightening torque	30 Nm
		Rotation angle	90 – 100”
M 18 x 1.5 x 50 bolts on crankshaft			320 Nm

Special tools



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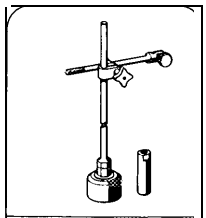

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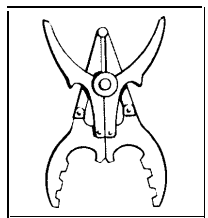

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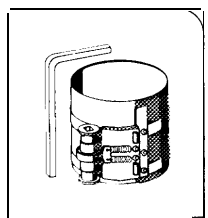
03



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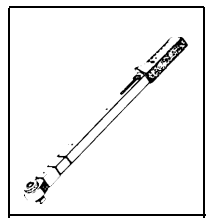
03 13



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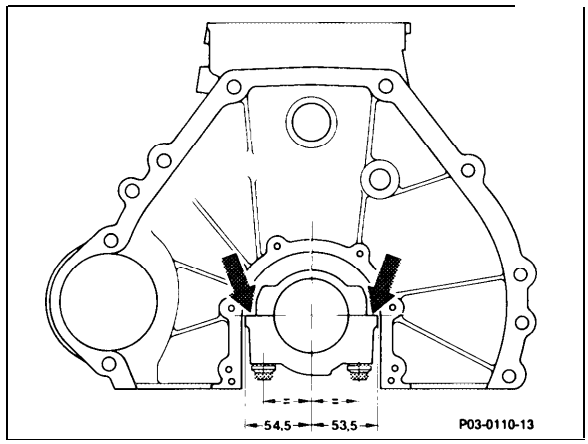
Commercially available tools

Connecting rod straightener	e.g.	Hahn & Kolb, D-7000 Stuttgart Model BC 503
Internal gauge	e.g.	Carl Mahr, D-7300 Esslingen Model 844 N
Micrometer screw	e.g.	Carl Mahr, D-7300 Esslingen
Dial gauge Al DIN 878	e.g.	Carl Mahr, D-7300 Esslingen Model 810

Installation of crankshaft and connecting rod bearings



1 Attach crankshaft bearing cap.

Note
All bearing caps are fitted laterally into crankcase (arrows) and are fastened with two M 12 x 60 or M 11 x 60 bolts each.

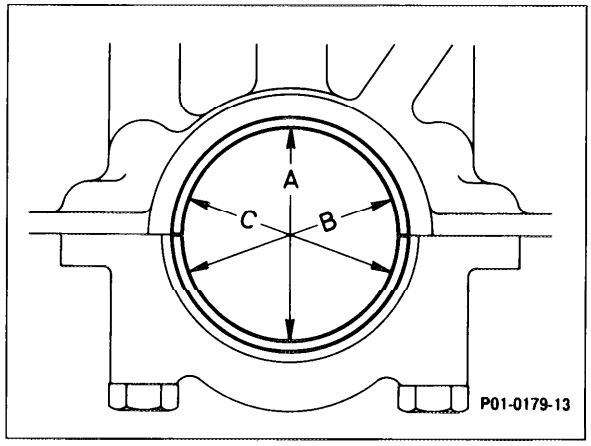
The pilot fit (arrows) is offset 0.5 mm from the center so that the bearing caps can be mounted in one position only.

The bearing caps are also identified from front to rear with the code numbers 1, 2, 3, 4 etc. and must not be mixed up.

2 Lubricate crankshaft bearing bolts for crankshaft bearing caps and tighten.

Tightening torque and rotation angle:

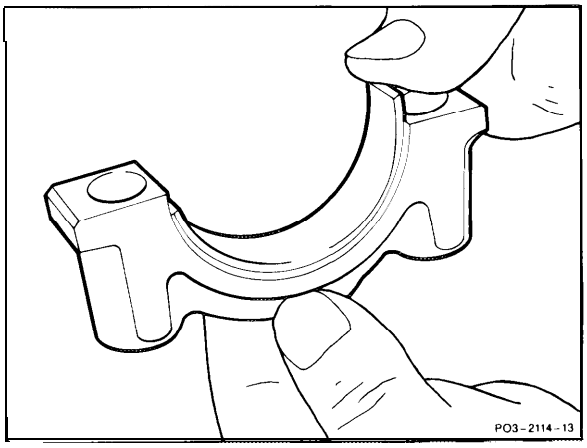
Crankshaft bearing bolts	M 12 90 Nm,
crankshaft bearing bolts	M 11 55 Nm,
	90 – 100”.



3 Measure basic bore in directions A, B and C at two levels (conicity).

If specified value for one basic bore is exceeded or conical, touch up bearing cap at parting surface on surface plate up to max. 0.02 mm.

4 Remove crankshaft bearing bolts, insert crankshaft bearing shells, install crankshaft bearing caps and tighten.

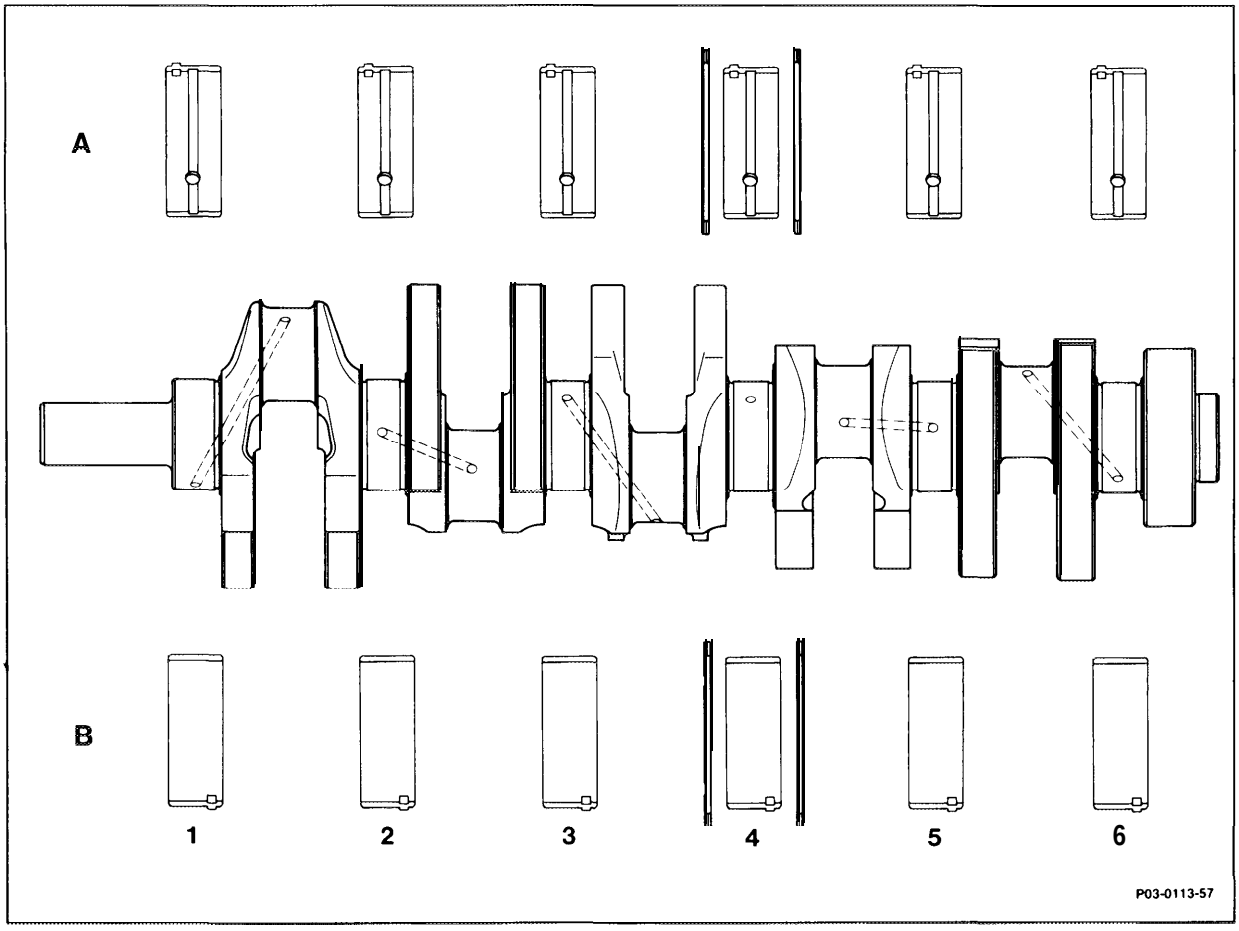


Tightening torque and rotation angle:

Crankshaft bearing bolts M 12 90 Nm
Crankshaft bearing bolts M 11 **55** Nm,
90 – 100".

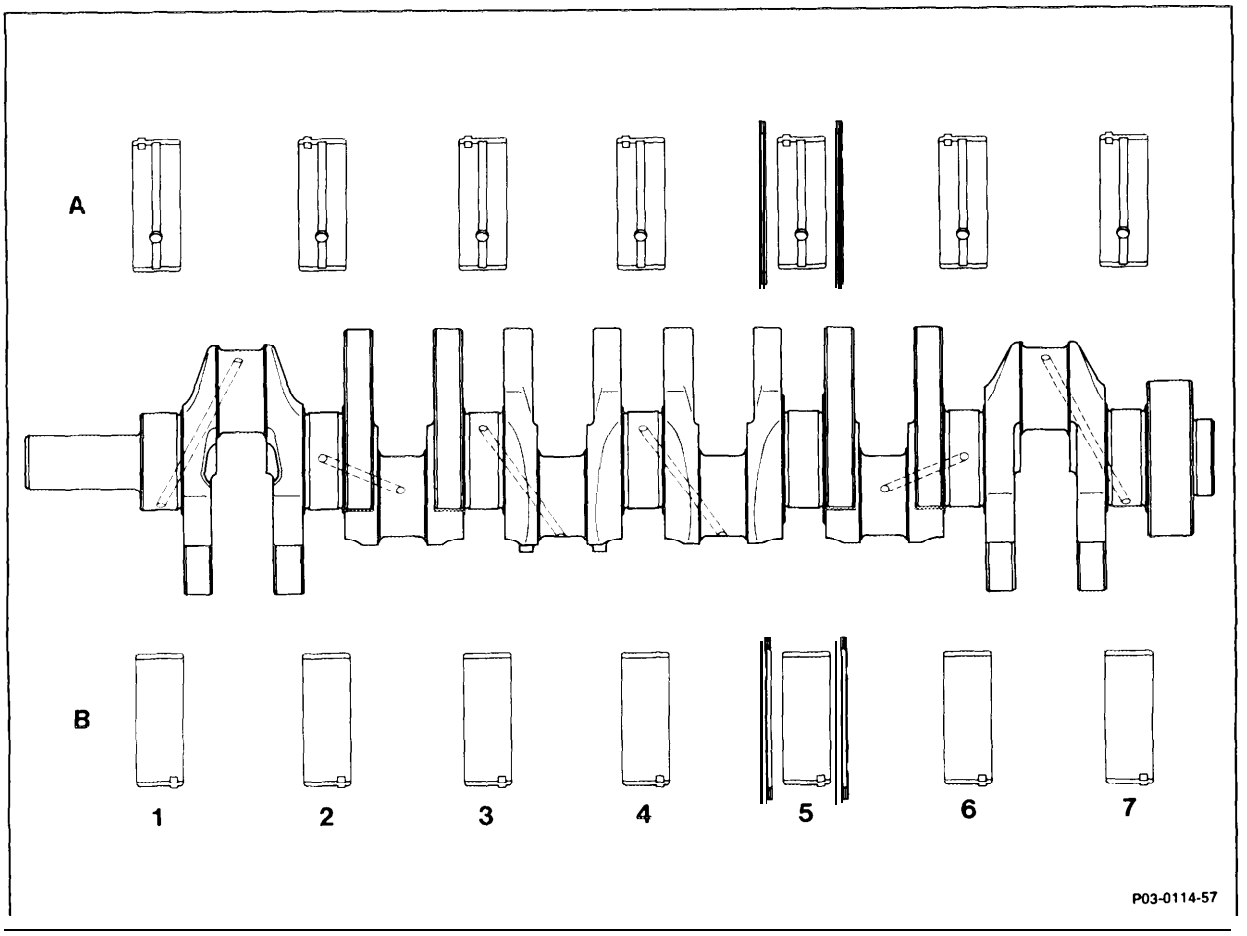
Caution!

Observe order of crankshaft bearing caps. Do not interchange upper and lower crankshaft bearing shells.



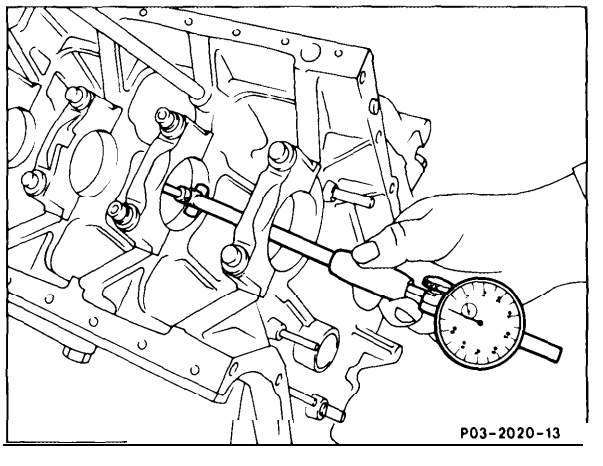
Engine 602

Fitted bearing: bearing 4



Engine 603
Fitted bearing: bearing 5
A Upper bearing shells, crankcase
B Lower bearing shells (cap shells)

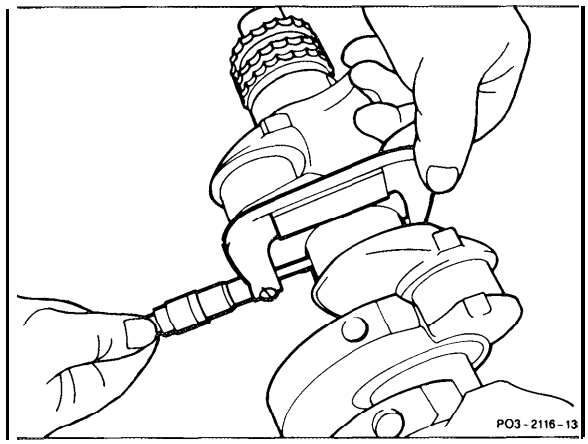
5 Measure crankshaft bearings and note values.



6 Measure crankshaft bearing journals, determine crankshaft bearing radial clearance.

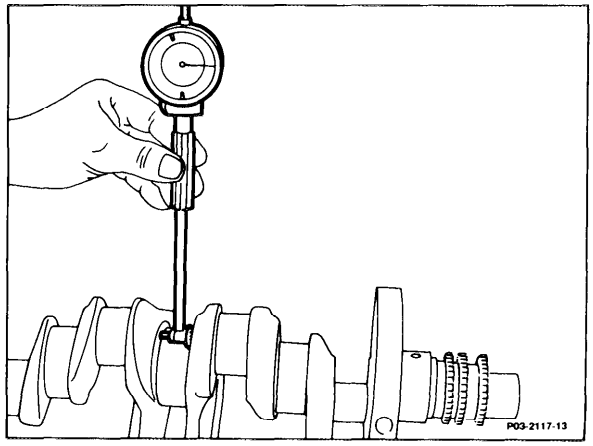
Note
The bearing clearance can be corrected by exchanging bearing shells. Attempt to achieve the mean value of the specified bearing clearance.

Caution!
Observe different wall thicknesses.



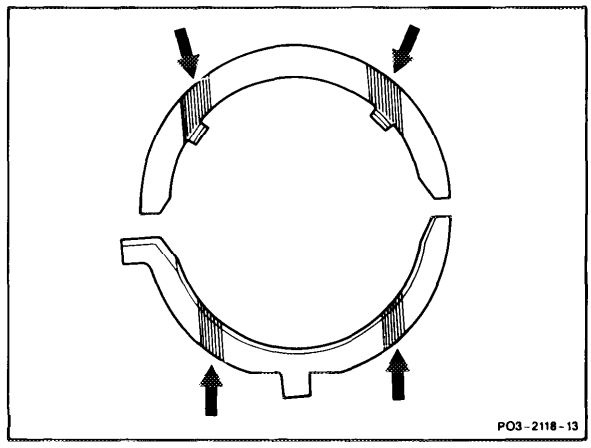
7 Measure width of fitted bearing journal and find proper thrust washers (see table, section Data).

8 Removecrankshaft bearing bolts, remove lower crankshaft bearing shell, oil crankshaft, position in crankcase and oil lower crankshaft bearing shell and reposition.



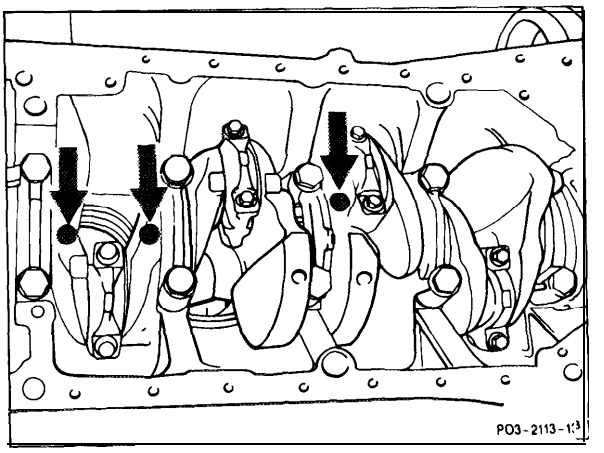
Caution!
The two oil grooves (arrows) in the thrust washers should point toward the crankshaft cheeks.

9 Oil thrust washers and slide into grooves at fitted bearing (crankcase).



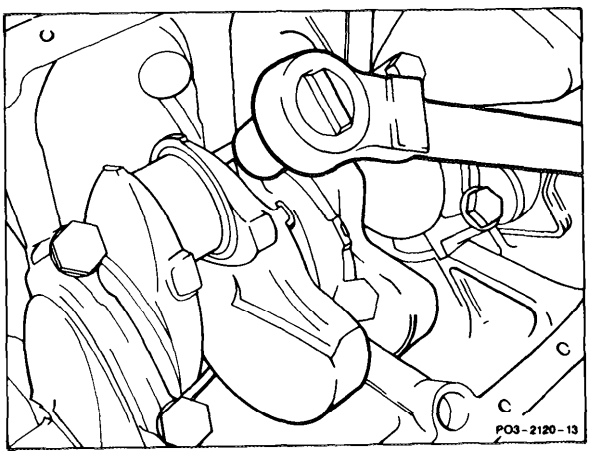
10 Position crankshaft bearing caps in proper order.

Note
The crankshaft bearing caps are marked with code numbers at the marking points (arrows).



11 Tighten crankshaft bearing caps.

Tightening torque and rotation angle:
Crankshaft bearing bolts M 12 90 Nm
Crankshaft bearing bolts M 11 55 Nm,
90 – 100".



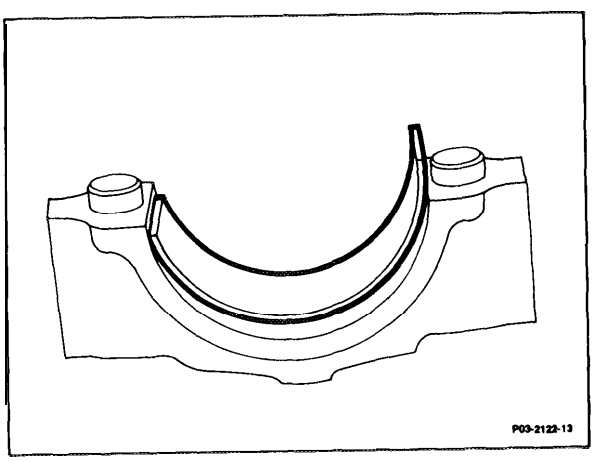
12 Measure crankshaft end play.

13 Turn crankshaft by hand and assure that it runs free.

Installation of connecting rod bearings and connecting rods

14 Insert connecting rod bearing shells, install connecting rod bearing caps with bearing shells and tighten connecting rod bolts to 30 Nm.

Connecting rod bearing shells are available only in the yellow version.



Note

The upper connecting rod bearing shells for engines 603.96 are made using a different material starting 05/86 due to the higher load.

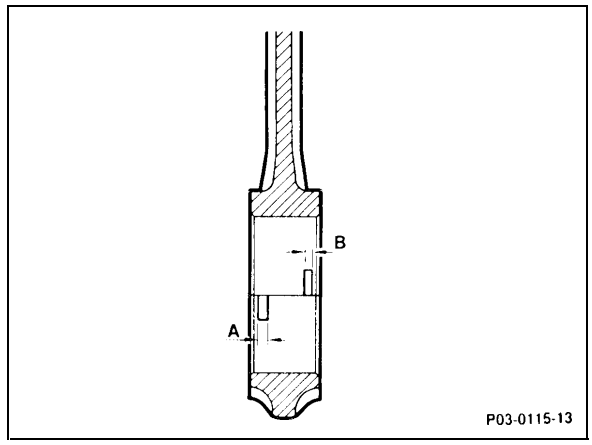
Caution!

Do not mix the upper and lower bearing shells. They can be recognized by the stamped-in part number.

Upper bearing shells	603 08 10
or	603 15 10
Lower bearing shells	601 04 11
or	601 08 11

The bore for lubrication of the piston pin has been eliminated.

Due to higher loads in engine 603.970, the upper connecting rod bearing shells are made of a different material than the lower shells.
To prevent misassembly, the upper locating groove is 0.7 mm narrower.

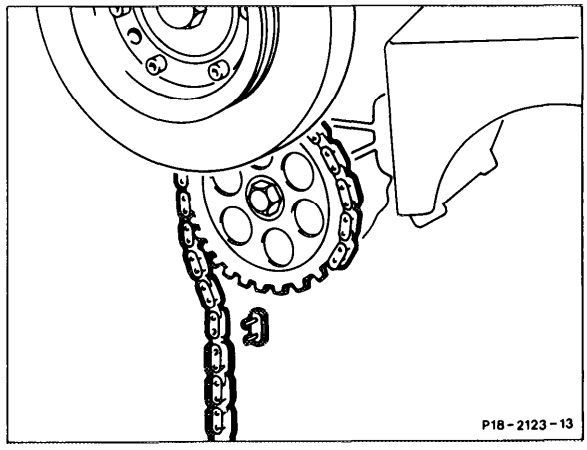


A 3.2 mm all engines
B 2.5 mm engines 603.96, 603.97
3.2 mm engine 602

15 Measure connecting rod bearing diameters and note.

16 Measure connecting rod bearing journals. Determine connecting rod bearing radial clearance.

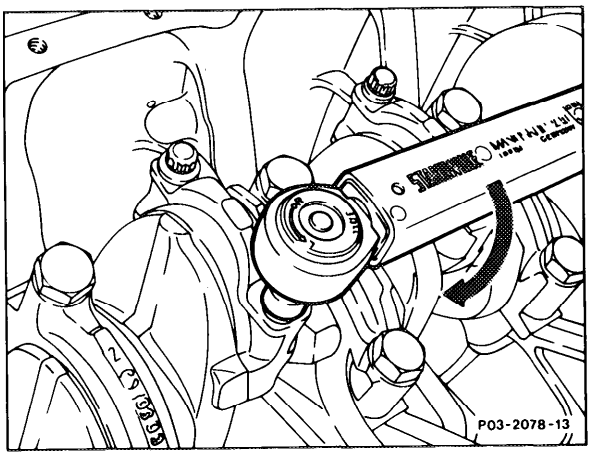
The bearing clearance can be corrected by changing the bearing shells, whereby it should be attempted to achieve the mean value of the specified bearing clearance. Observe different wall thicknesses.



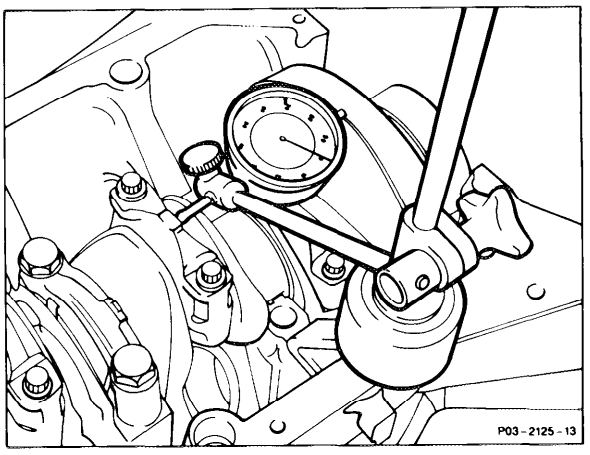
17 Install pistons on connecting rods (03-316).

18 Coat bearing shells, crankshaft, pistons and cylinder walls with engine oil, install connecting rods with pistons (03-316).

19 Tighten connecting rod bolts to initial torque of 30 Nm and then turn 90 - 100".



20 Measure connecting rod bearing end play while moving connecting rod directly at piston pin. Assure that connecting rod moves freely in relation to crankshaft. Use dial gauge holder 363 589 02 21 00.



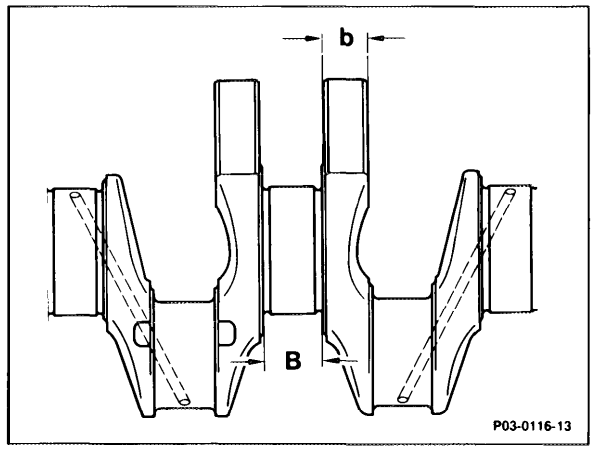
Caution!
Disassemble oil pump and clean, replace if required. Replace oil pressure valve. Disassemble oil filter and clean.

Install initial operation oil filter cartridge. Change oil filter cartridge and oil after 1000-l 500 km.

03-321 Modifications to crankshaft

Increased displacement engine 603.970

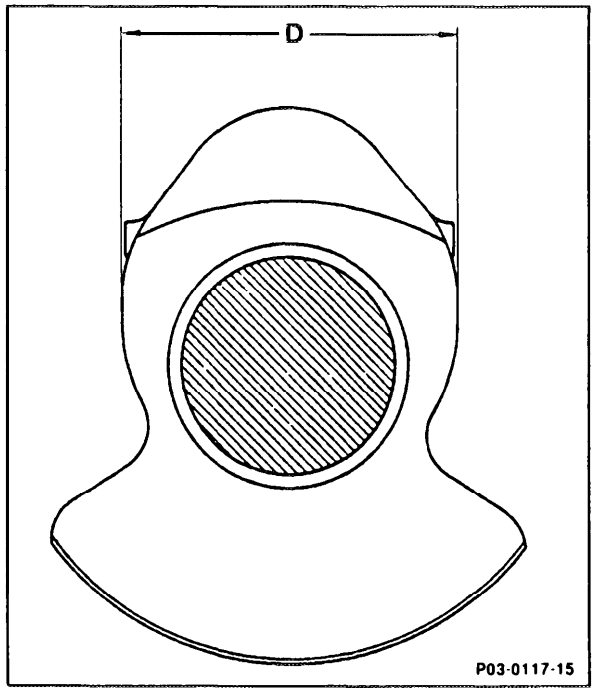
The stroke was increased to 94.2 mm and the web width (b) reduced to 21.75 mm to increase the displacement (3.5 l) on the 603.970 engines.



Engine 602.96 crankshaft webs

On engine 602.96 starting 12/87 the web width (D) was increased by 8 mm for a total of 90 mm.

D 90 mm (engine 602.961)



Engine 602.91 flywheel locating pin

Cylindrical pin in crankshaft for locating the flywheel and driven plate.

Production breakooint: 01/86

Model	Engine	Engine end No.		Vehicle ident end No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	010630	002533	276209	184189

• not registered

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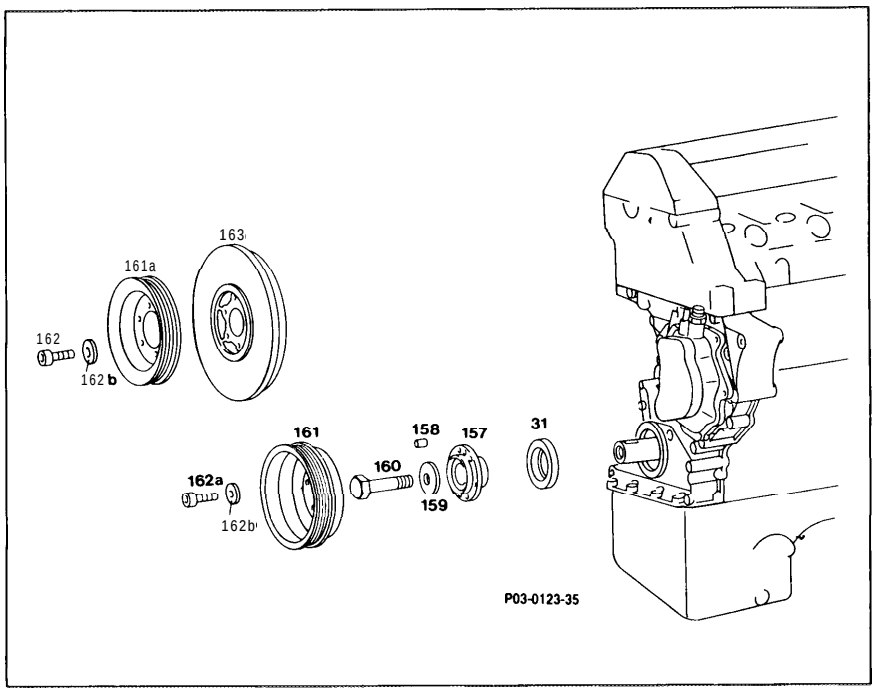
03-324 Replacing front crankshaft radial sealing ring

Preliminary jobs:
Radiator removed (20-420).
Poly-V-belt removed (13-342).



Engines 602, 603:

Crankshaft pulley (161 a) with vibration damper (163) and Allen screws (162) and washers (162 b) ..... remove, install (03-341) (item 2).

Note
The vibration damper for engine 602 is not interchangable with that from motor 603.
Do not interchange during repairs.

Hub (157) with hex. head bolts (160) and Belleville washers (159) ..... remove, install (item 3).

Note
The cylindrical pin (158) centers the crankshaft pulley and vibration damper.

Crankshaft radial seal (31)	.....	replace. Deburr and clean mounting bore. Coat sealing lip with oil and press in with special tool 601 589 03 14 00 (item 4).

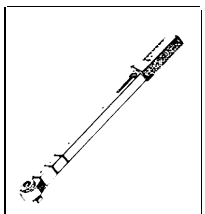
Note

The sealing ring for the repair crankshaft radial seal is offset 3 mm toward the inside so that it will not run in a groove left on the hub by the standard crankshaft radial seal.

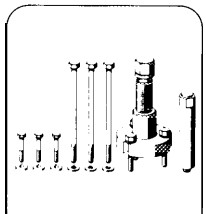
Part No. for repair crankshaft radial seal:
010 997 34 47 or 010 997 68 47.

Tightening torques	Nm
Allen bolts for crankshaft pulley	25
Mounting bolt for hub	320

Special tools

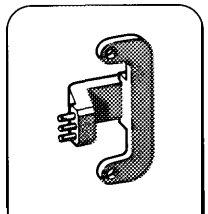


001 589 66 21 00
00

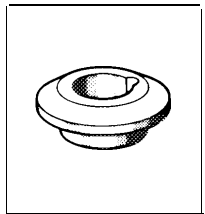


103 589 00 33 00
03

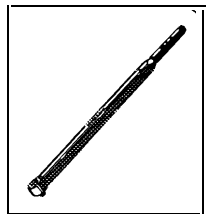
589 02
03



40 00



601 589 03 14 00
03



001 589 74 21 00
00

Commercially available too tool

Adapter 3/4" square socket to 1/2" square head	e.g.	Hazet, D-5630 Remscheid Order No. 1058 R-1

Replacement

Engine 601.921

1 Remove crankshaft pulley (03-341).

Engines 602, 603

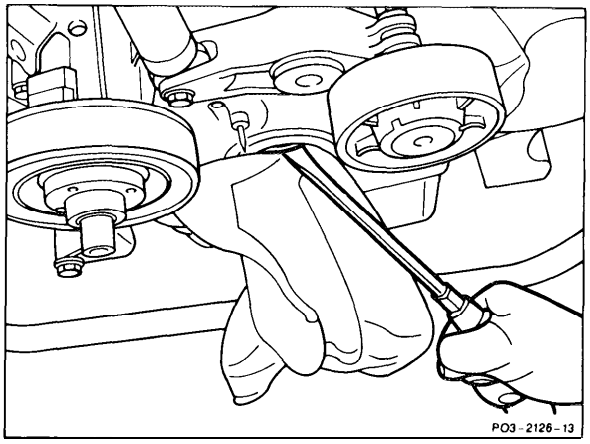
2 Remove crankshaft pulley with vibration damper (03-341).

Caution!
Do not interchange vibration dampers.

3 Remove crankshaft hub (03-341).

Note
The cylindrical pin centers the crankshaft pulley and vibration damper.

4 Press out crankshaft radial seal with screwdriver. Do not damage crankshaft journal or mounting bore.

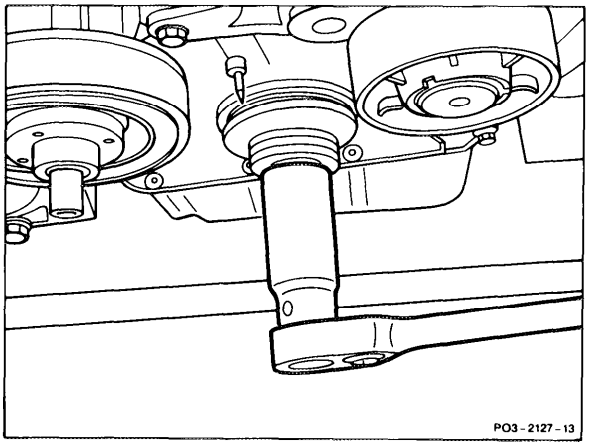


Installation note
Deburr and clean mounting bore for crankshaft radial seal.

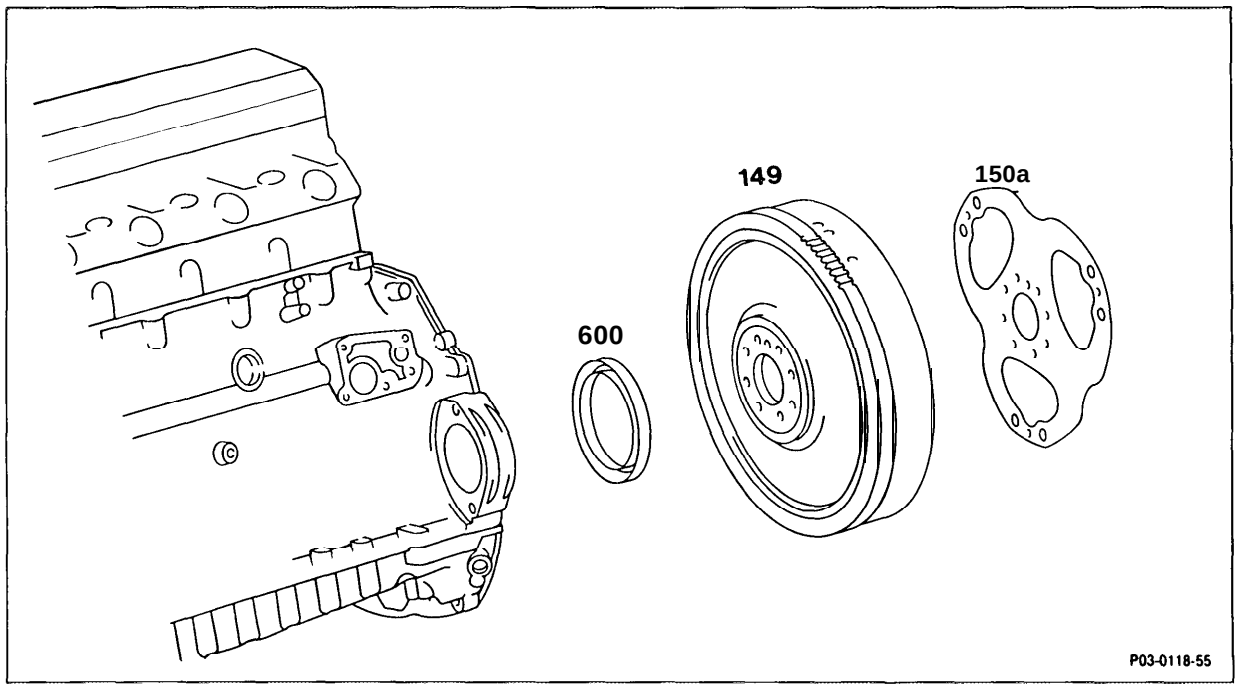
Coat sealing lip of new crankshaft radial seal with oil and press in with special tool 601 589 03 14 00.

Assure that the crankshaft radial seal is seated properly.

5 Reinstall in opposite order.



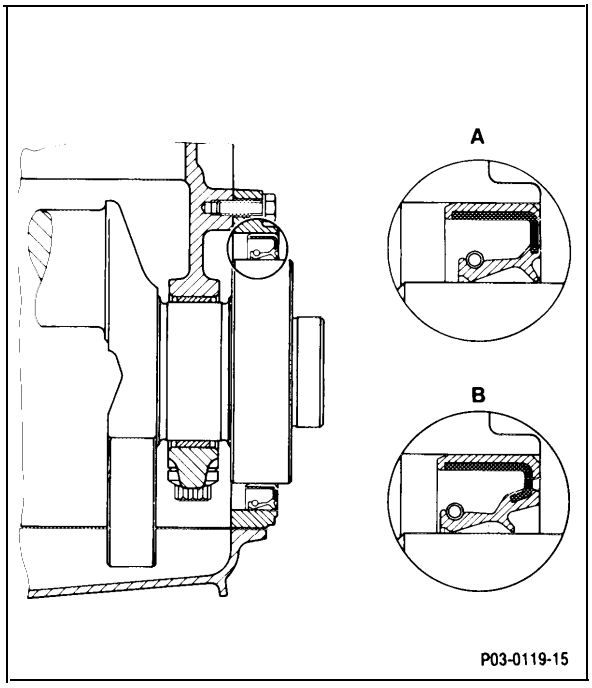
03-327 Replacing rear crankshaft radial sealing ring



Flywheel (149) and driven plate (150a)	remove, install, (03-410) (items 1, 9).
Crankshaft radial seal (600)	remove, replace. Check running surface on crankshaft flange, clean mounting bore, coat sealing lip of crankshaft radial seal with oil and press in with special tool 601 589 03 43 00 (items 2 • 8).
	Caution! Ensure that radial seal is seated properly.
Crankshaft radial seal (600)	check for leakage with engine running (item 10).

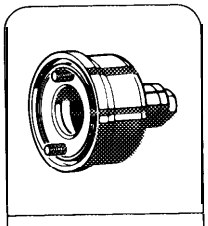
Note

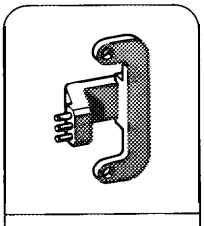
The sealing ring for the repair crankshaft radial seal is offset 3 mm toward the inside so that it will not run in a groove left on the hub by the standard crankshaft radial seal.

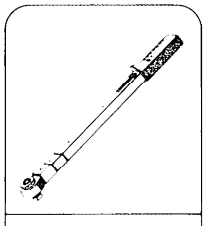


A Standard crankshaft radial seal
B Repair crankshaft radial seal

Special tools


601 589 03 43 00
03


601 589 02 40 00
03

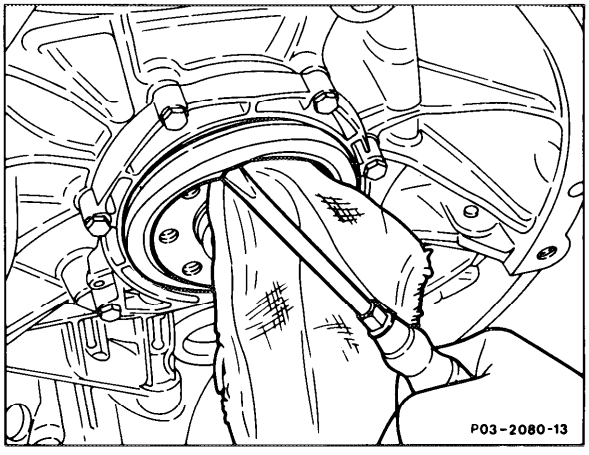

001 589 66 21 00
00

Renewal

1 Remove flywheel or flywheel and driven plate (03-410).

2 Press crankshaft radial seal out of end cover with screwdriver.

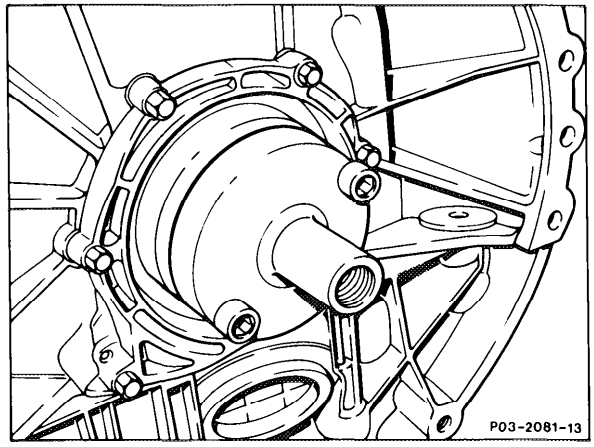
Do not damage crankshaft flange or end cover. Cover crankshaft flange with rag.



3 Check running surface for crankshaft radial seal on crankshaft flange for damage.

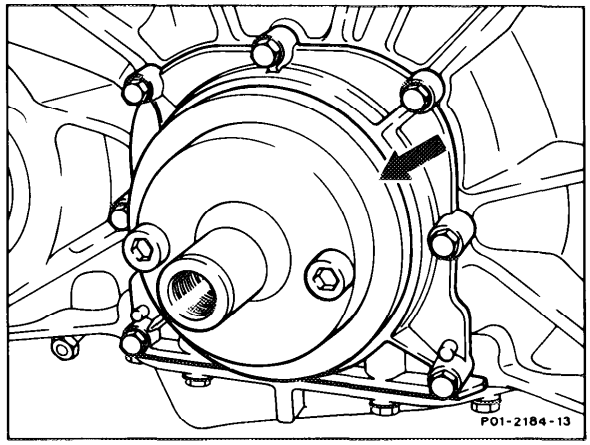
4 Clean mounting hole for crankshaft radial seal, deburr, if required.

5 Bolt inner part of installation tool 601 589 03 43 00 onto crankshaft flange.



6 Coat sealing lip of crankshaft radial seal and opposite running surface lightly with oil, do not use grease.

7 Slide crankshaft radial seal (arrow) over inner part of installation tool 601 589 03 43 00.

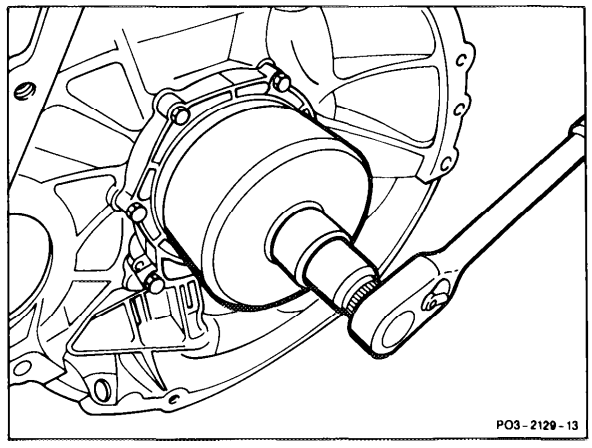


8 Press crankshaft radial seal against stop in end cover with outer part of installation tool 601 589 03 43 00.

Note
Assure that crankshaft radial seal is properly seated.

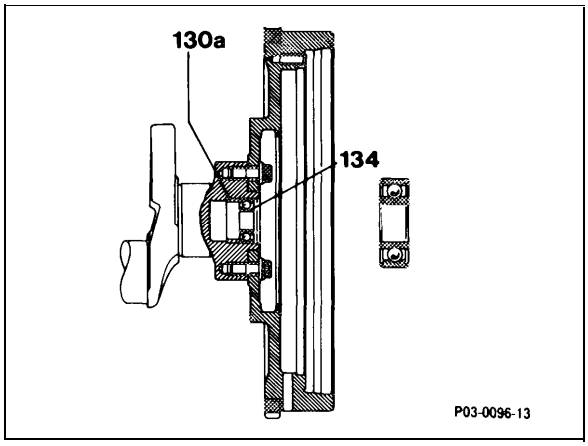
9 Install flywheel or flywheel and driven plate (03-410).

10 Check for leakage with engine running.



Note

For reasons of standardization the same radial ball bearing (134) as in engine 102 is installed. The ball bearing is sealed on both sides with Viton cover discs and cemented into the crankshaft.



130 a Spacer ring

Replacement parts

Designation	Part No.
Spacer ring	102 031 02 51
Locking ring	102 031 01 33
Ball bearing	115 980 01 15

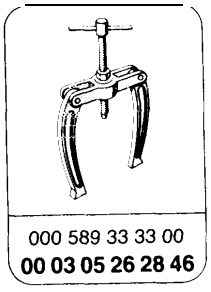
Engines 602, 603 from start of production.

For repair these parts can also be installed in engines produced earlier.

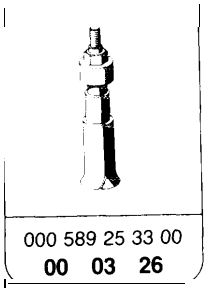
Cement

Loctite 241	002 989 94 71

Special tools



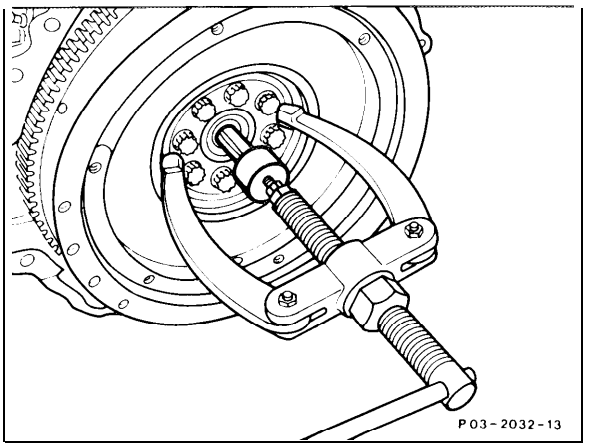
000 589 33 33 00
00 03 05 26 28 46



000 589 25 33 00
00 03 26

Removal, installation

1 Pull radial ball bearing out of crankshaft together with locking ring, use internal puller 000 589 25 33 00 and countersupport 000 589 33 33 00.

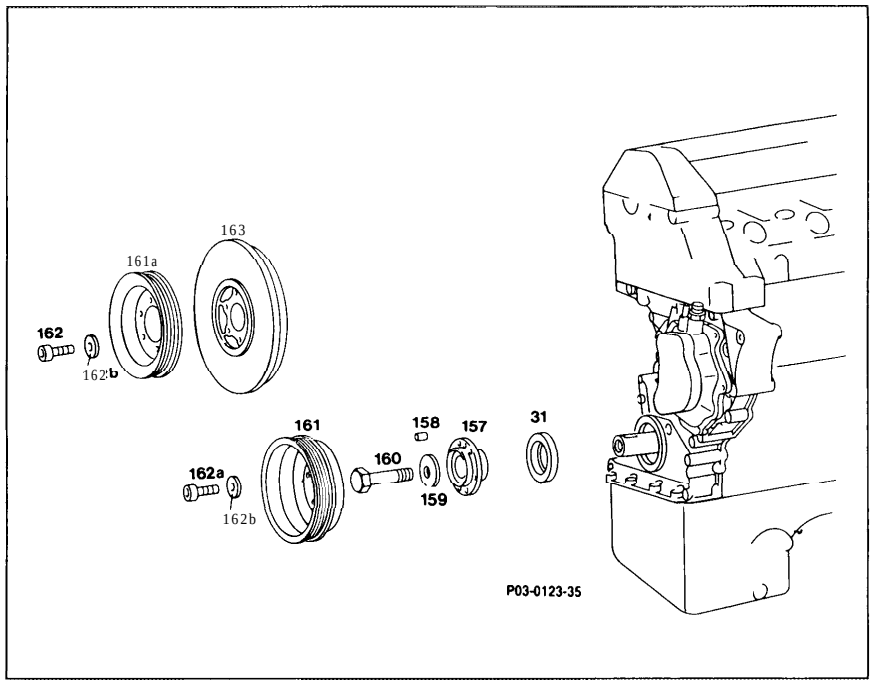


Installation note
Knock in spacer ring flush.

Coat new ball bearing with cement 002 989 94 71 and knock into crankshaft with suitable punch on outer race.

2 Install in opposite order.

03-341 Removal and installation of crankshaft pulley and hub



Engines 602, 603:

Crankshaft pulley (161 a) and vibration damper (163) .....

remove, install, use washers (162 b) and Allen screws (162), 25 Nm. Use lock 601 589 02 40 00 (items 1, 3).

Note

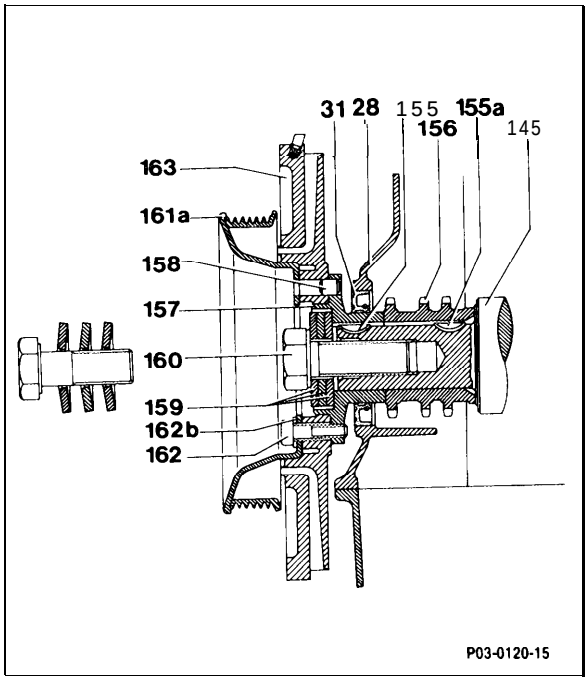
The crankshaft pulley and vibration damper are centered by the cylindrical pin (158).
Do not mix up vibration dampers.

Hub(157)	remove, install, hex. head bolt (160) 320 Nm. Install Belleville washer (159) with arched side toward crankshaft pulley. Use puller 103 589 00 33 00 (items 2 - 4).
Crankshaft radial seal (31)	replace (03-324) (item 5).

Engines 602 and 603

The scale and TDC pin are located in the vibration damper.

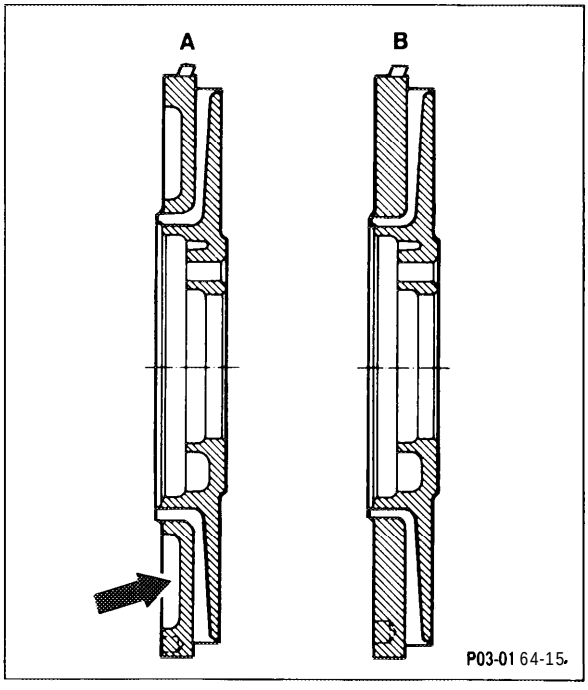
28 Timing case cover
31 Crankshaft radial seal
145 Crankshaft
155 Woodruff key
155a Woodruff key
156 Crankshaft sprocket
157 Hub
158 Cylindrical pin 8 x 8 mm
159 Belleville washer
160 Bolt M 18 x 1.5 x 50
161a Crankshaft pulley
Dia. 152 mm engines 601, 602
Dia. 173 mm engine 603
162 Allen bolt M 8 x 28
162b Washer B 8



Engine 602

The vibration damper on engine 602 has a 35 mm wide machined recess (arrow) on the front and are therefore lighter.

A Vibration damper, engine 602
B Vibration damper, engine 603



Engine 602.96

The vibration damper for engine 602.96 is a two-mass vibration damper. The diameter (D) was increased by 9 mm for a total of 228 mm (naturally aspirated engines, single-mass vibration damper 219 mm).

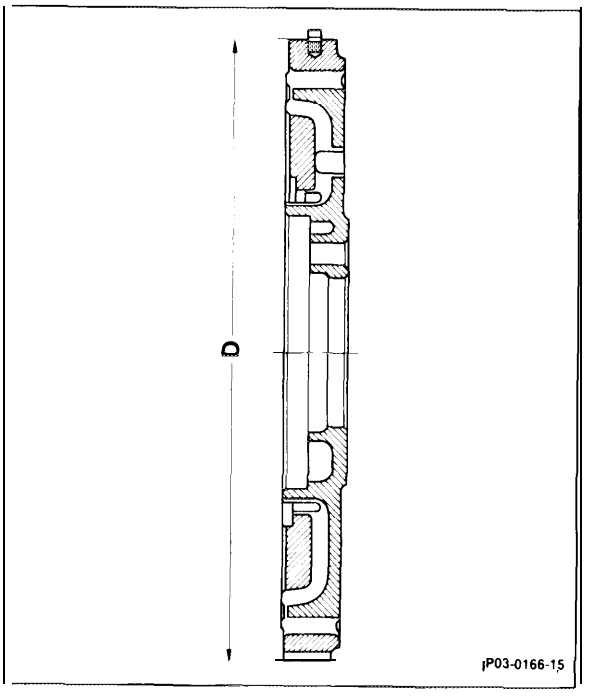
Caution!

These vibration dampers cannot be installed on engine 602.91.

Engine 603.96

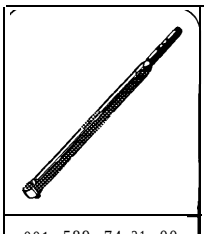
The vibration damper of engine 603.96 is a single-mass vibration damper and identical with that of the naturally aspirated engine except for the resonant frequency. Do not interchange.

Engine 603.96 Color: grey



Tightening torques	Nm
Allen bolts on pulley	25
Crankshaft flange bolt	320

Special tools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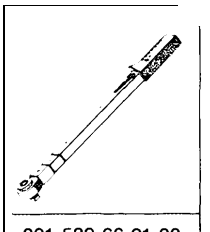
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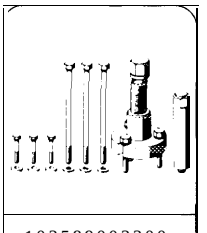
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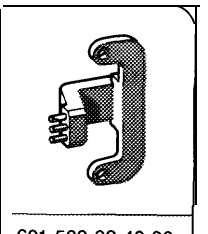
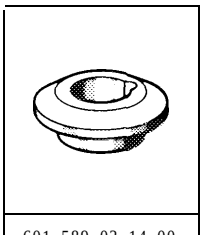

601 589 02 40 00
03


601 589 03 14 00
03

Commercially available tool

Adapter 3/4" square socket to 1/2" square head	e.g.	I-lazet , D-5630 Remscheid Order No. 1058 R-1

Engines 602 and 603

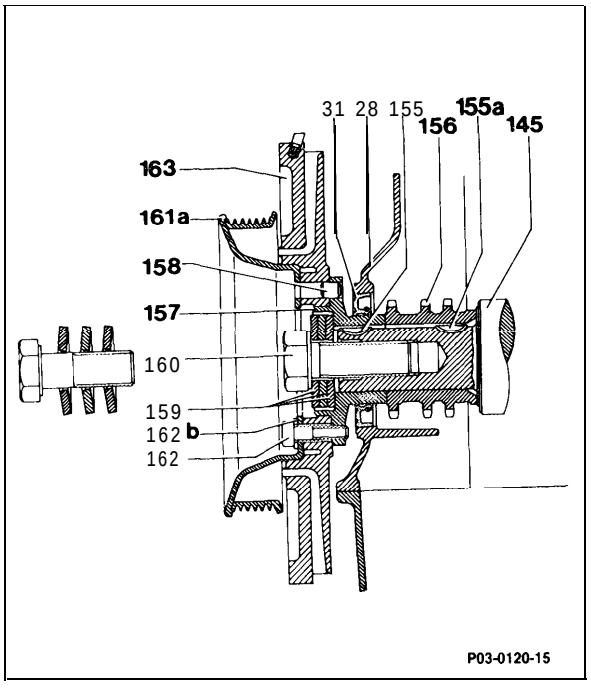
3 Unbolt crankshaft pulley (161a) and vibration damper (163) and remove.
Screw out hex. head bolt (160).

Installation note

Install Belleville washers (159) with arch toward crankshaft pulley (161 a). The crankshaft pulley (161 a) and vibration damper (163) are centered with the cylindrical pin (158).
Do interchange vibration damper (163).

Tightening torques

Hex. head bolt (160)	320 Nm,
Allen bolts (162)	25 Nm.

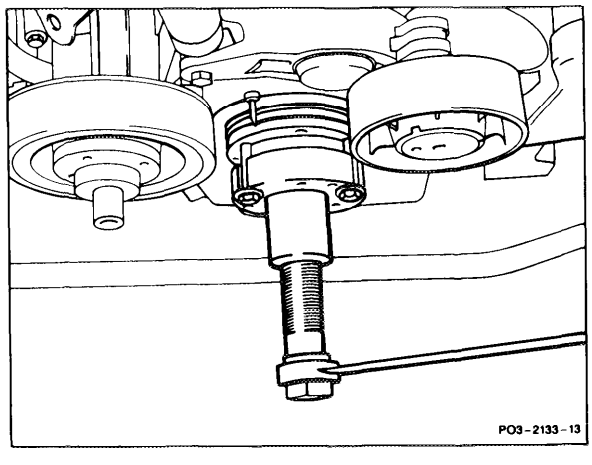


28 Timing case cover
31 Crankshaft radial seal
145 Crankshaft
155 Woodruff key
155a Woodruff key
156 Crankshaft sprocket
157 Hub
158 Cylindrical pin 8 x 8 mm
159 Belleville washers
160 Bolt M 18 x 1.5 x 50
161a Crankshaft pulley
Dia. 152 mm engines 601, 602
Dia. 173 mm engine 603
162 Allen screw M 8 x 28
162b Washer B 8

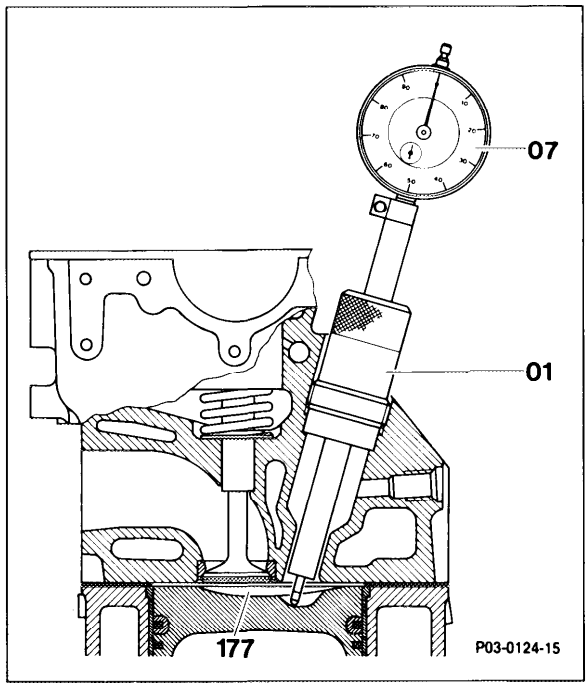
4 Pull hub off of crankshaft journal with puller 103 589 00 33 00.

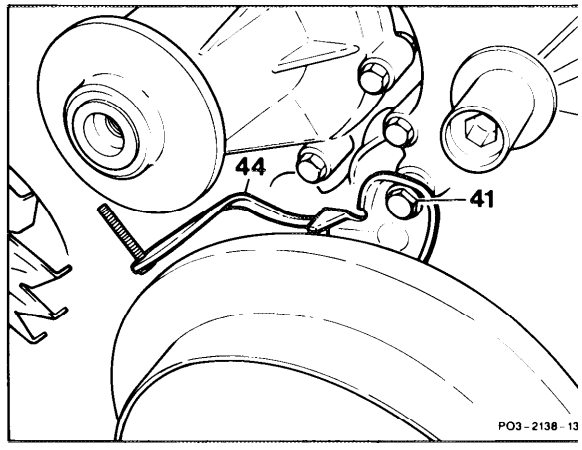
5 Replace crankshaft radial seal (03-324).

6 Install in opposite order.



03-345 Checking and correcting adjustment of TDC sensor



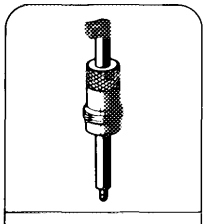


Holder for TDC sensor, engines 602 and 603 from start of production

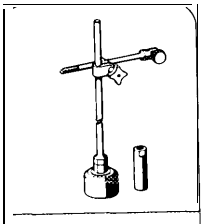
Cylinder 1 . . . . . turn to approx. 10° BTDC, ignition stroke (item 1).

Gauge (01)	boltinto preignition chamber bore and set dial gauge (07) on gauge to 5 mm pretension (item 2).
	Note If cylinder head is removed, position gauge pin of dial gauge directly on piston crown (177). Use dial gauge holder 363 589 02 21 00.
Engine	turn in running direction until dial gauge pointer stops moving (TDC position), set dial gauge scale to zero (item 3).
Engine	turn until dial gauge moves back 3.22 mm on engines 602 and 603 or until dial gauge moves back 3.65 mm on engines 601.921, 603.97 (item 4).
	Note Corresponds to crankshaft position of 20° ATDC.
Holder for TDC sensor (42) or (44)	install locating device 603 589 01 21 00 (item 5).
	Note The pin on the crankshaft pulley or on the vibration damper must catch in the groove on the locating device, if not, correct position of holder.
Holder for TDC sensor (42) or (44)	correct by loosening bolt (41), move holder for TDC sensor until pin on crankshaft pulley or vibration damper catches in locating device 603 589 01 21 00 and tighten bolt (41) (items 6 - 8).

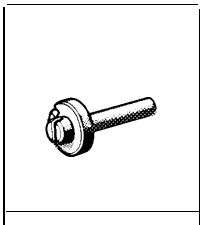
Special tools



601 589 07 21 00
03



363 589 02 21 00
00



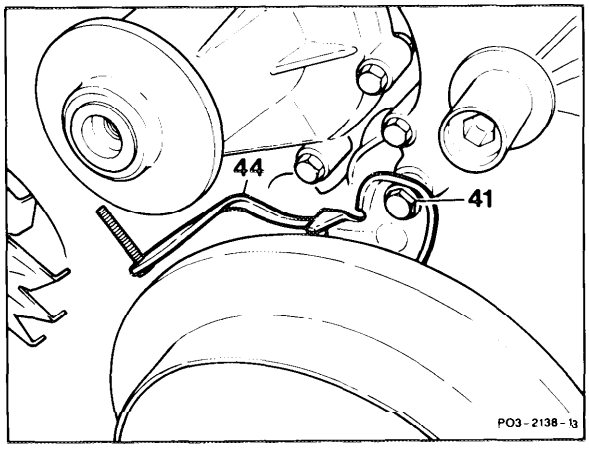
603 589 01 21 00
03

Commercially available tool

Dial gauge A 1 DIN 878	e.g.	Mahr, D-7300 Esslingen Order No. 810

Testing

Note
The holder for the TDC sensor is fastened to the timing case cover.



44 Holder TDC sensor, engines 602 and 603 from start of production

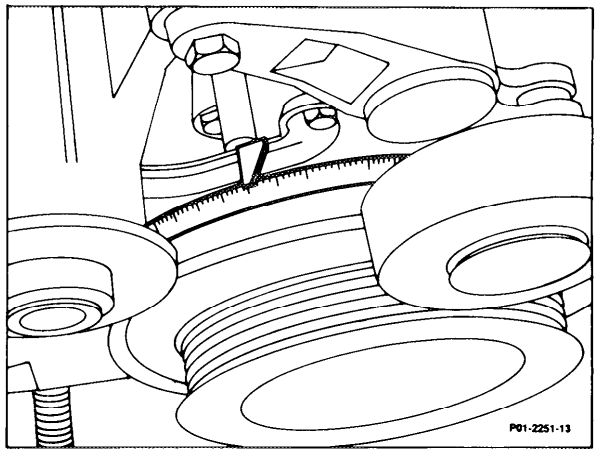
Check adjustment of holder and correct, if required:

a) When holder is replaced.

b) When crankshaft and hub, vibration damper and crankshaft pulley are replaced.

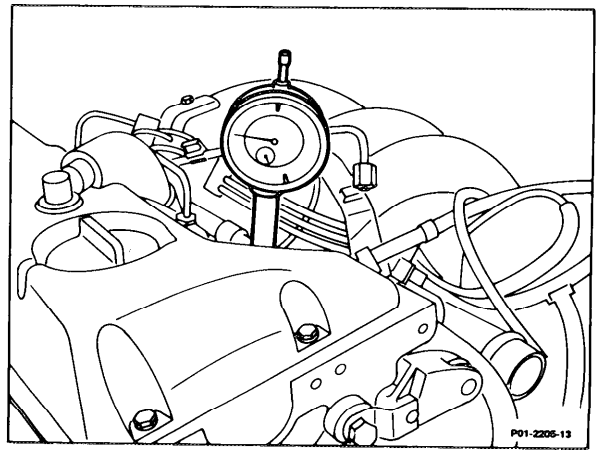
c) When timing case cover is removed, installed or replaced.

1 Position piston in cylinder 1 to approx. 10° BTDC, ignition stroke.

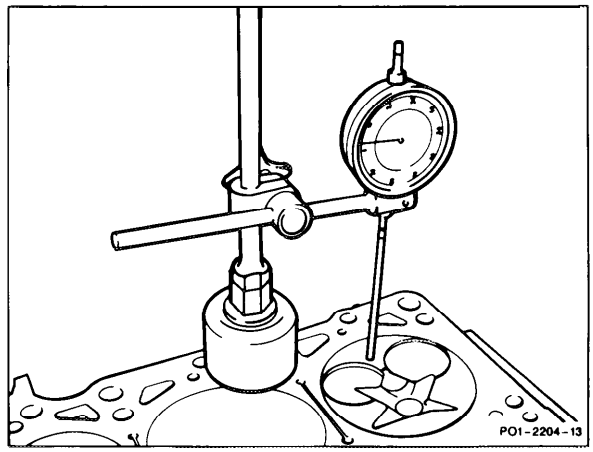


Holder for TDC sensor, engines 602 and 603 from start of production

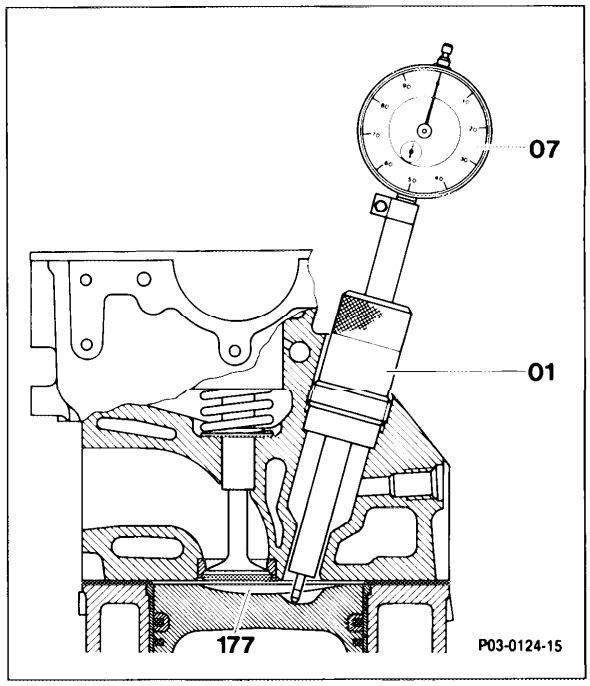
2 Bolt gauge 601 589 07 21 00 up to precombustion chamber bore and attach dial gauge to gauge with 5 mm pretension (small pointer on dial gauge).



If the cylinder head is removed, the measuring pin on the dial gauge can be positioned directly on the piston crown. Set dial gauge holder 363 589 02 21 00 on crankcase mating surface.



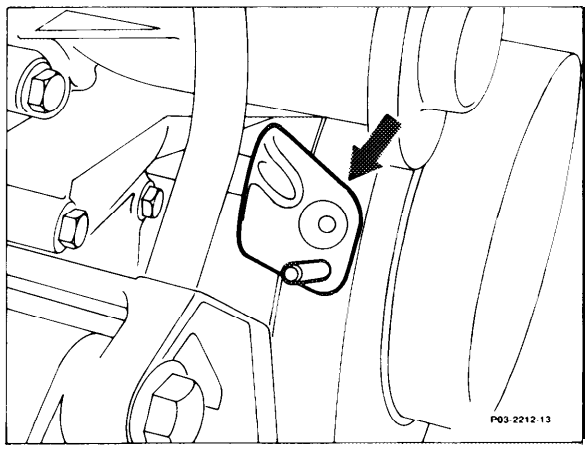
3 Turn crankshaft slowly in normal direction of rotation until large pointer on dial gauge (07) stops (TDC position). Turn dial gauge scale until large pointer points to zero.



01 Gauge
177 Piston crown

4 Turn crankshaft in normal direction of rotation slowly until the gauge moves back 3.22 mm on engines 602 and 603 or 3.65 mm on engine 603.97.

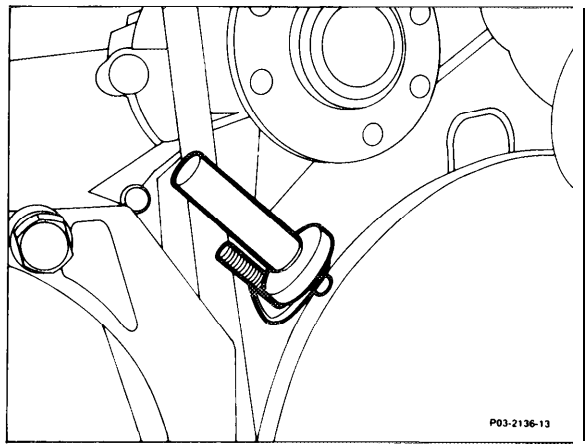
Note
After the dial gauge has moved back (crankshaft position 20° ATDC) the pin in the crankshaft pulley or in the vibration damper should be located exactly below the TDC sensor (arrow).



5 Position locating device 603 589 01 21 00 in holder for TDC sensor.

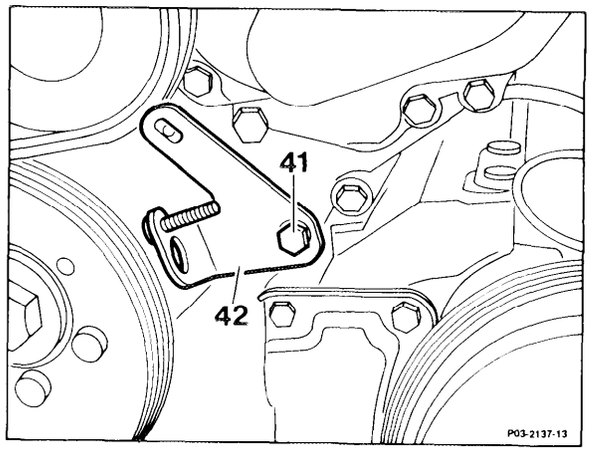
The pin on the crankshaft pulley or on the vibration damper must catch in the groove in the locating device.

If the pin on the crankshaft pulley or on the vibration damper does not catch, correct position of holder for TDC sensor.



Correcting

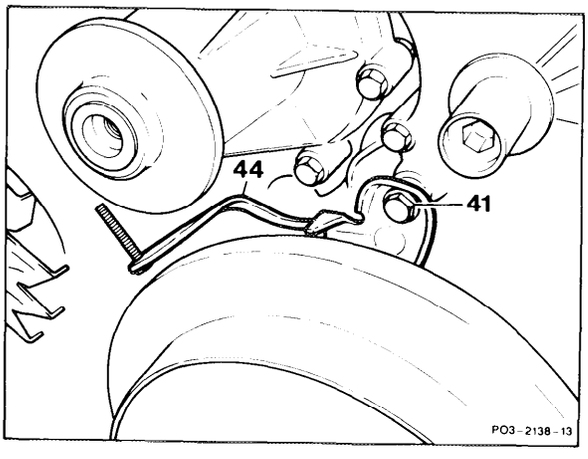
6 Loosen holder (42 or 44) with screw (41) and move until pin on crankshaft pulley or on vibration damper catches in the groove in the locating device 603 589 01 21 00.



42 Holder for TDC sensor, engine 601.921

7 Screw holder for TDC sensor down tight.

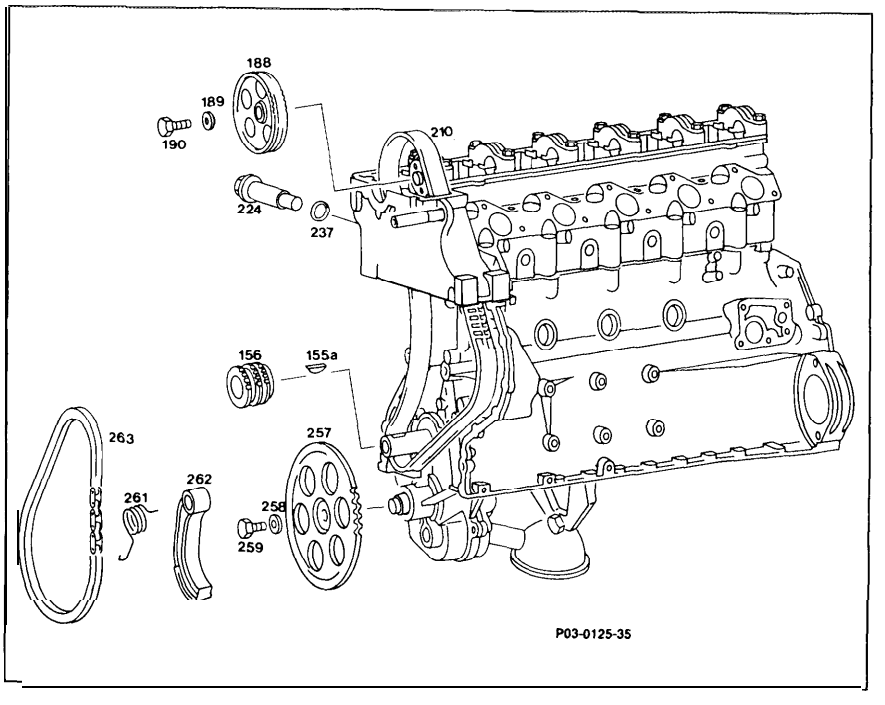
8 Remove dial gauge and gauge 601 589 07 21 00 and locating device 603 589 01 21 00.



44 Holder for TDC sensor engines 602, 603 from start of production

03-350 Removal and installation of crankshaft sprocket

Preliminary jobs:
Timing case cover removed (01-210).
Oil pan removed (01-310).
Vehicles with level control: Drive for oil pump removed (05-437).



Tensioning bracket (262)	remove together with torsion spring (261), install (items 1, 17).
Oil pump sprocket (257)	unbolt hex. head bolt (259) and remove together with washer (258) (item 2).
Chain for oil pump drive (263)	remove (item 3).
Chain tensioner (224)	remove, install. Replace sealing ring (237) (05-310) (items 4, 13).
Camshaft sprocket (188)	mark in relation to timing chain (210), remove retaining bolt (190) together with washer (189) and remove camshaft sprocket (items 6 - 8).
	Note Observe differences in bolts.
Crankshaft sprocket (156)	mark in relation to timing chain (210) (item 5).

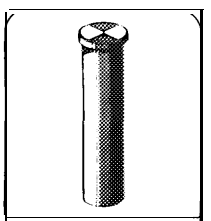
Crankshaft sprocket (156)	pull off with puller 601 589 07 33 00 and check retaining wedge (155a), replace, if required (items 9 - 10).
Crankshaft sprocket (156)	replace, transfer color code and knock onto crankshaft with installation punch 116 589 07 15 00 while paying attention to retaining wedge (155a) (items 11 - 12).
Camshaft sprocket (188)	position on mark, install timing chain and tighten. Remove hex. head bolts (190) and washers (189). Hex. head bolt 65 Nm, 12-point bolt 25 Nm/90° rotation angle (item 13).
Crankshaft	continue to turn and check adjustment markings at TDC position (item 15).
Oil pump sprocket (257)	install with chain for oil pump drive (263) and tighten hex. head bolt (259), 25 Nm (item 16).
	Note Install chain sprocket so that arch points toward oil pump.
Engine	allow to run and check for leakage (item 18).

Bolt for camshaft sprocket

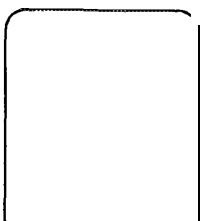
Starting 11/88 the bolt for mounting the camshaft sprocket was changed from an M 10 bolt to an M 11 stretch bolt on engines 602.91/96; 603.91196 and 603.970
(see 05-220).

Tightening torques and rotation angles	Nm	
Hex. head bolt for camshaft sprocket	65	
12-point bolt for camshaft sprocket	25	90”
Hex. head bolt for oil pump sprocket	25	

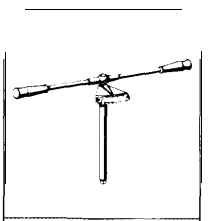
Special tools



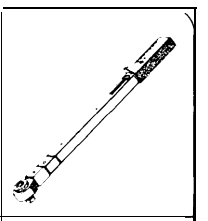
116 589 07 15 00
35



601 589 07 33 00



001 589 51 21 00
00



001 589 66 21 00
00

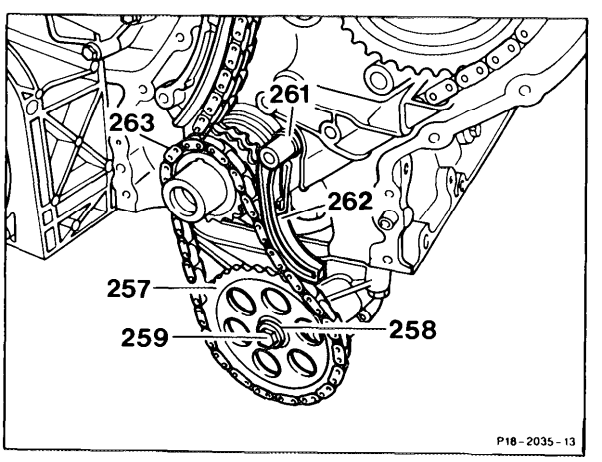
Removal

1 Remove clamping bracket (262) and torsion spring (261).

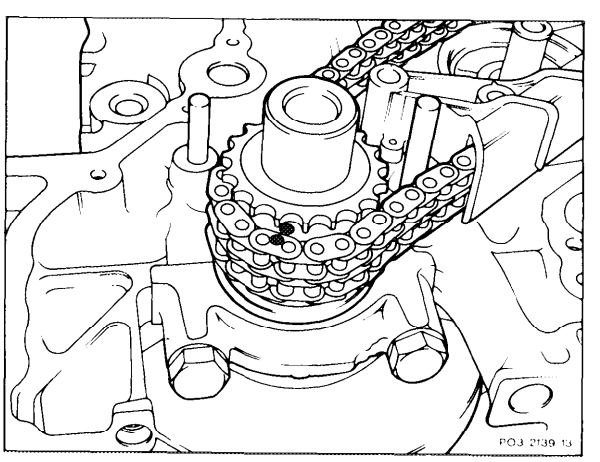
2 Remove hex. head bolt (259) with washer (258) and remove oil pump sprocket (257).

3 Remove chain for oil pump drive (263).

4 Remove chain tensioner (05-310).



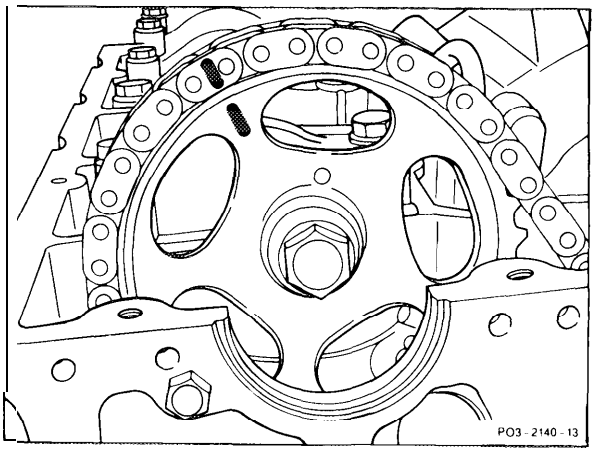
5 Mark position of timing chain and crankshaft sprocket in relation to one another.



6 Mark position of timing chain and camshaft sprocket in relation to one another.

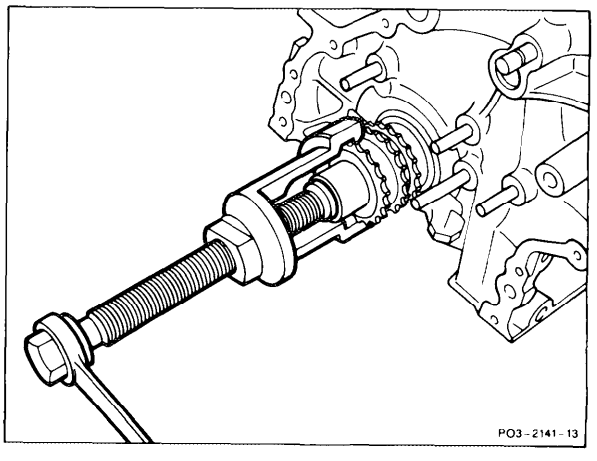
7 unbolt hex head bolt and remove with washer.

8 Remove camshaft sprocket and allow timing chain to sag.



9 Pull off crankshaft sprocket with puller 601 589 07 33 00.

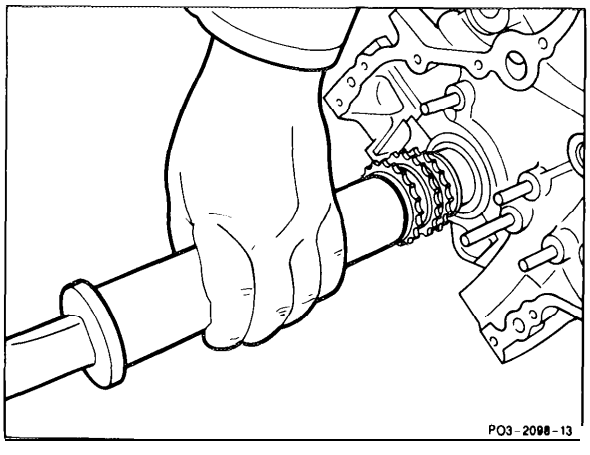
10 Check condition of retaining wedge in crankshaft, replace, if required.



Installation

11 Transfer color code from old crankshaft sprocket to new crankshaft sprocket.

12 Knock crankshaft sprocket onto crankshaft with installation punch 116 589 07 15 00. Pay attention to retaining wedge.



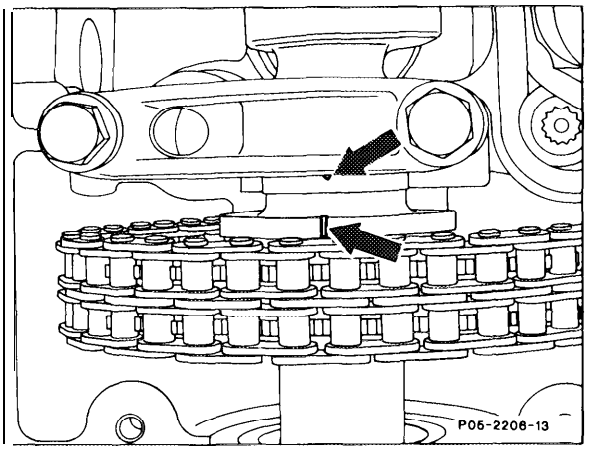
13 Install camshaft sprocket and timing chain making note of marking and tighten.

Tightening torque and rotation angle

Wex. head bolt	65 Nm,
12-point bolt	25 Nm, 90°.

14 Install chain tensioner and replace sealing ring (05-3 10).

15 Continue to turn crankshaft and check adjustment marking at TDC (arrows).

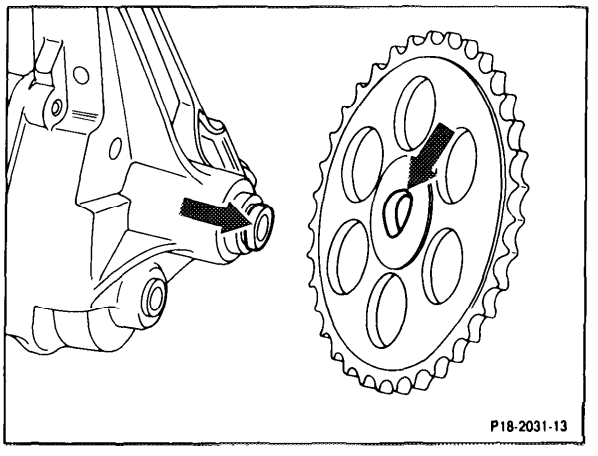


16 Install chain for oil pump drive together with oil pump chain sprocket and tighten.

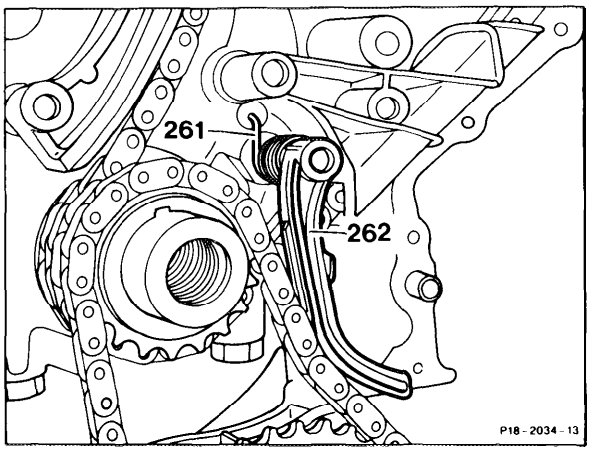
Note

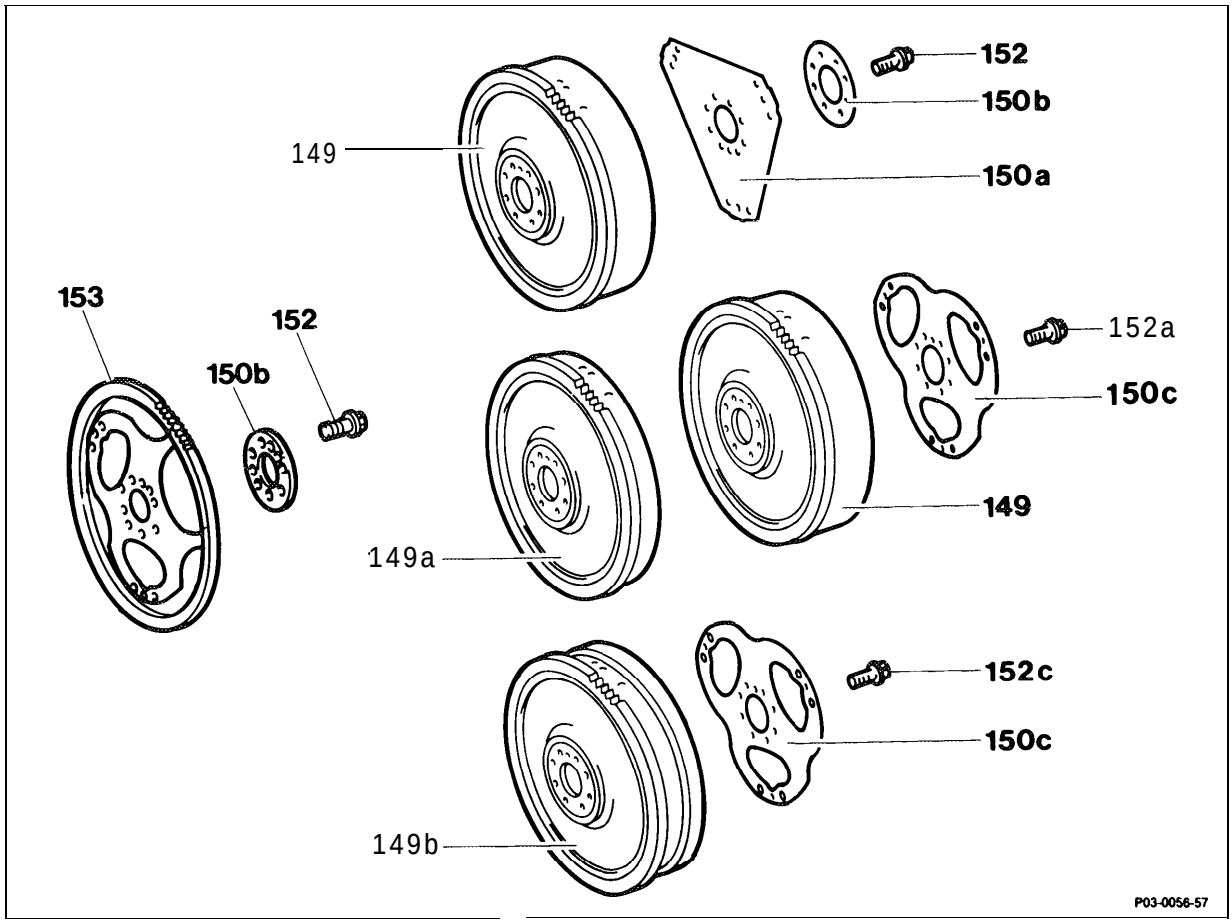
Install oil pump sprocket so that arch points toward oil pump (arrows).

Tightening torque 25 Nm.



17 Attach clamping bracket (262) and torsion spring (261).





Flywheel (149, 149a, 149b)	unbolt, reinstall. Position lock 601 589 02 40 00 in flywheel ring gear and remove flywheel together with driven plate (150a, 150c) and spacer disc (150b) (items 1, 2).
Driven plate (153) engine 603.970	unbolt, reinstall. Position lock 601 589 02 40 00 in teeth on driven plate and remove driven plate and spacer disc (150b) (items 1, 2).

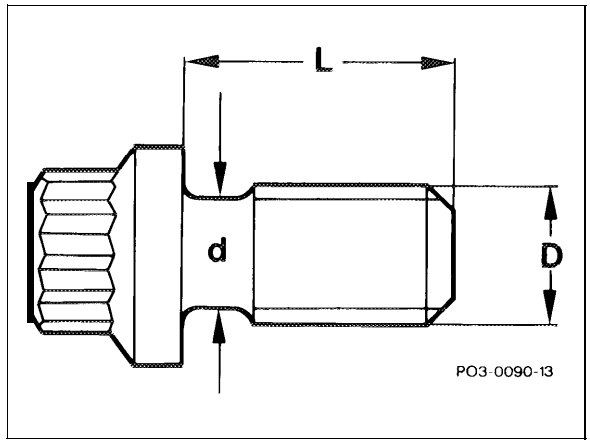
Stretch bolts (152, 152a) .....

check, max. length, 1 st version (152a) 26.5 mm, 2nd version (152) 22.5 mm, necked down shank diameter min. 8 mm, replace stretch bolts if required (item 2).
Initial torque 35 Nm,
rotation angle 90 – 100".

Stretch bolts (152c) on two-mass flywheel (149b) engine 602.91, ...

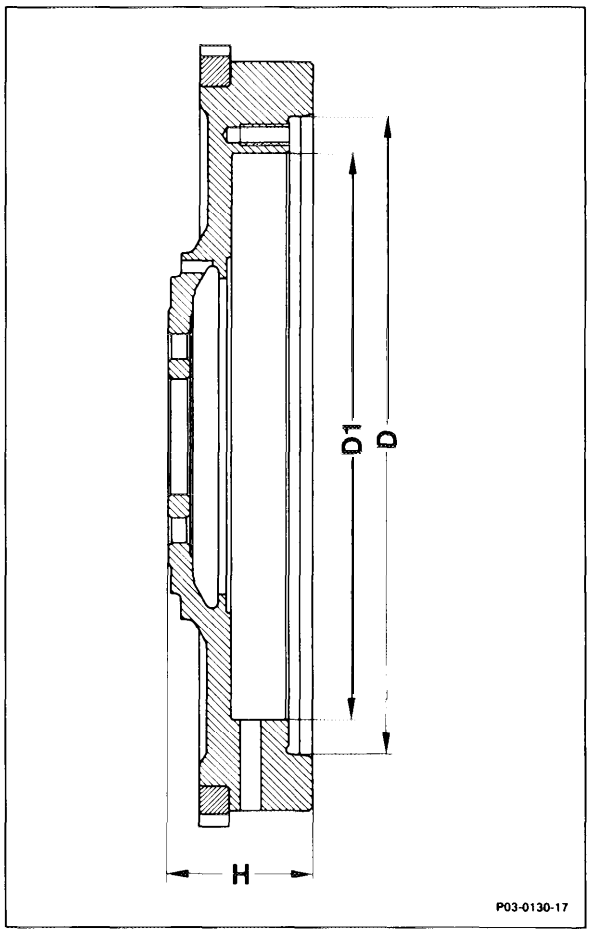
check, max. length 57.2 mm, necked down shank diameter min. 8.1 mm, replace stretch bolts if required (item 2).
Initial torque 40 Nm,
rotation angle 90 – 100".

Stretch bolts		152	152a	152c
		manual and automatic transmission Driven plate 2nd version	automatic transmission Driven plate 1 st version	manual transmission, two-mass flywheel
Part number		102 032 00 71	601 032 01 71	103 032 00 71
Thread D		M 10 × 1	M 10 × 1	M 10 × 1
Necked down shank dia. d	New state	8,5 – 0,2	8,5 – 0,2	8,5 – 0,2
	Min. dia.	8,0	8,0	8,1
Length L	New state	22 ± 0,2	26 ± 0,2	57 ± 0,2
	Max. length	22,5	26,5	–



Flywheels for manual transmissions

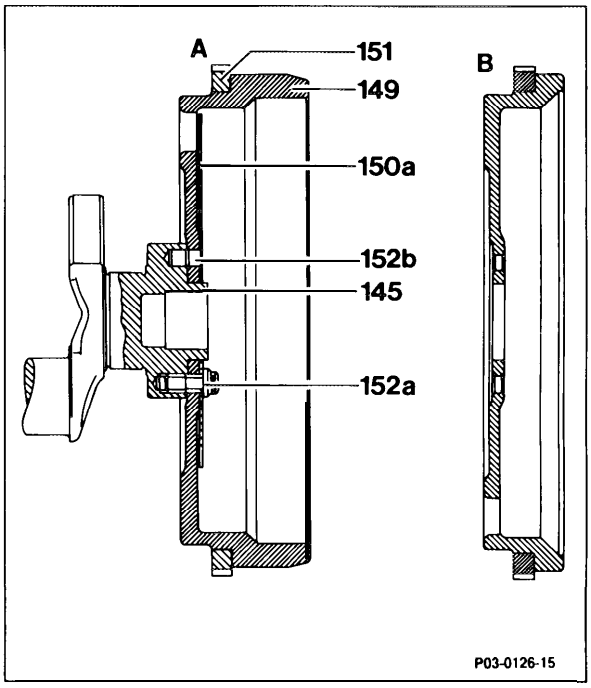
Engine 602



D	252.94–252,98	mm
DI	223.00-223.07	mm
H	57	mm

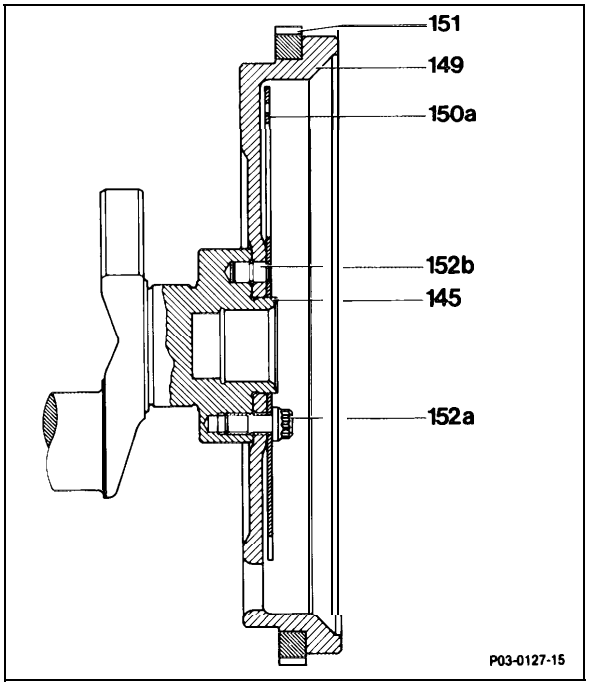
Engine 602.96

Engine 602.96 has **a** lighter flywheel than engine 602.91 with automatic transmission.



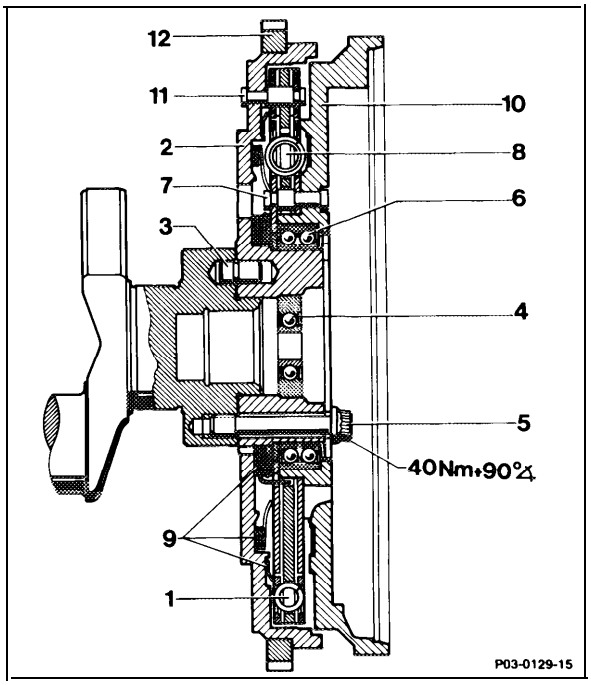
A	Flywheel, engine 602.91
B	Flywheel, engine 602.96
145	Crankshaft
149	Flywheel
150a	Driven plate
151	Ring gear
152a	Stretch bolt
152b	Cylindrical pm

Engine 603.96



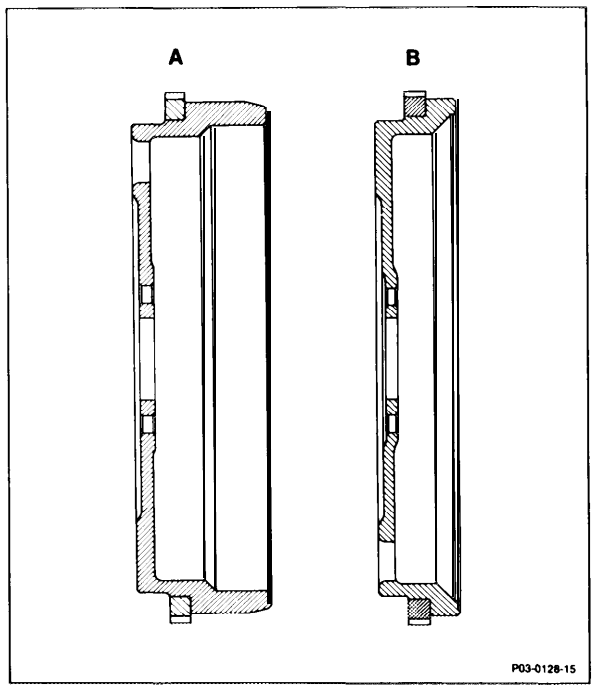
145	Crankshaft
149	Flywheel
150a	Driven plate
151	Ring gear
152a	Stretch bolt
152b	Cylindrical pm

Two-mass flywheels with manual transmissions, engine 602.91 starting 09/88.



Stop damper
2 Primary flywheel weight
3 Fitted pin
4 Radial ball bearing
5 Stretch bolt M 10 x 1 x 57
6 Self-aligning bearing
7 Spacer bolt
8 Torsion damper
9 Friction device
10 Secondary flywheel weight
11 Spacer bolt
12 Ring gear

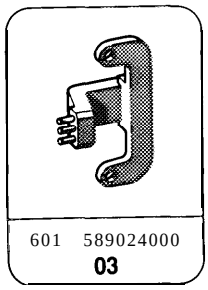
Flywheels with automatic transmissions

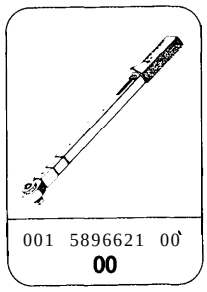


A Flywheel, engine 602
B Flywheel, engine 603

Tightening torques and rotation angles	Nm	
Stretch bolts for flywheel	35	90 – 100”
Stretch bolts for two-mass flywheel	40	90 – 100”

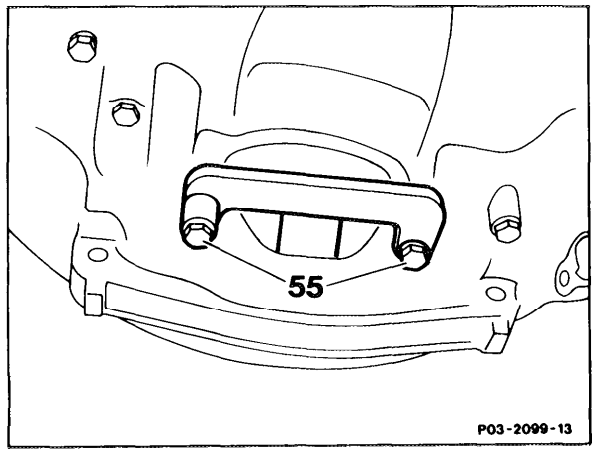
Special tools





Removal, installation

1 Remove hex. head bolts (55) and insert lock 601 589 02 40 00 into ring gear on flywheel and tighten with hex. head bolts (55).

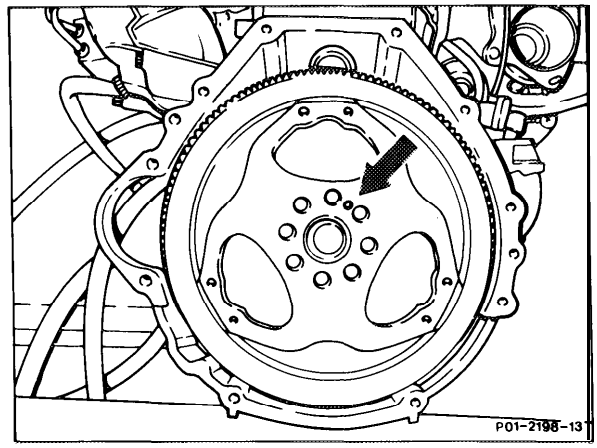


Installation note
Flywheels do not require balancing.

Flywheels are not interchangeable.

Engines 602, 603

Screw out stretch bolts and remove flywheel and driven plate.



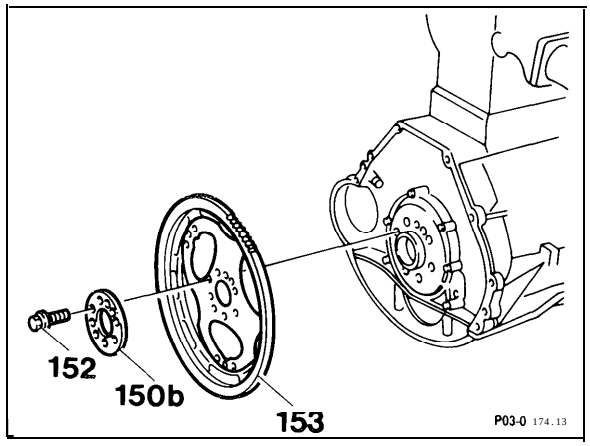
Installation note

The cylindrical pin (arrow) centers the flywheel, driven plate and spacer disc.
Check stretch bolts, max. length 22.5 mm, necked down shank dia. min. **8** mm, renew stretch bolts if required.

Tightening torque and rotation angle
Initial torque 35 Nm,
rotation angle 90 – 100".

Driven plate (engine 603.97)

Screw out stretch bolts (152), remove spacer disc (150b) and driven plate (153).



Installation note

Check stretch bolts, max. length 22.5 mm, necked down shank dia. min. 8 mm, replace stretch bolts if required.

Tightening torque and rotation angle
Initial torque 35 Nm,
rotation angle 90 – 100".

Two-mass flywheel with manual transmission, engine 602.91

Remove stretch bolts and remove two-mass flywheel.

Installation note

Check stretch bolts, max. length 57.2 mm, necked down shank dia. min. 8.1 mm, replace stretch bolts if required.

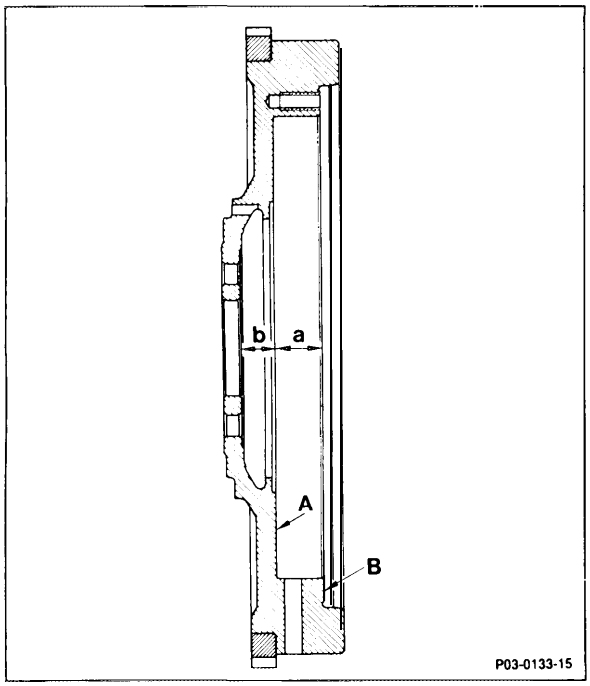
Tightening torque and rotation angle

Initial torque	40 Nm,
rotation angle	90-100°.

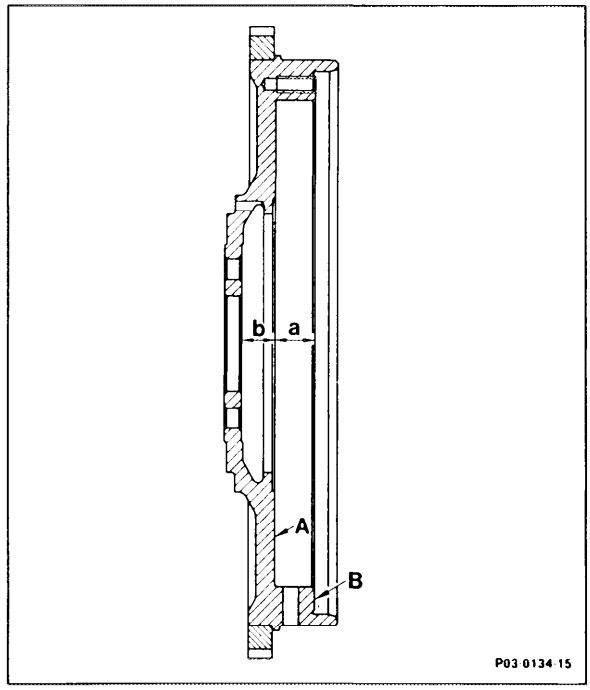
3 Install in opposite order.

03420 Refinishing flywheel

Preliminary lobs:
Flywheel and driven plate removed (03-410).



Engine 602



Engine 603 (except for 603.97)

Dimension (b) . . . . . measure, max. 17 mm, min. 15.6 mm.
If material removal causes dimension (a) to exceed max. causing dimension (b) to be less than 15.6 mm, replace flywheel.

Dimension (a) . . . . . measure, engine 602: 22.5 mm, engine 603: 19.4 mm. Maximum material removal 1 mm, if material removal is greater than 1 mm, replace flywheel.

Caution!
If the clutch surface (A) is refinished, the mounting surface (B) must be refinished by the same amount so that distance (a) is maintained.

Flywheel . . . . . refinish

Caution!
The two-mass flywheel cannot be refinished. Clamp flywheel in lathe so that permissible deviation from flat = 0.05 mm is not exceeded.

Data

Engine		602	603
Distance a		22.5 ± 0.1	19.4 ± 0.1
Distance b	in new state	16.6 ± 0.4	
	for repair	up to 15.6 ± 0.4	
Permissible deviation from flat on clutch surface or clutch attachment surface		0.05 mm	

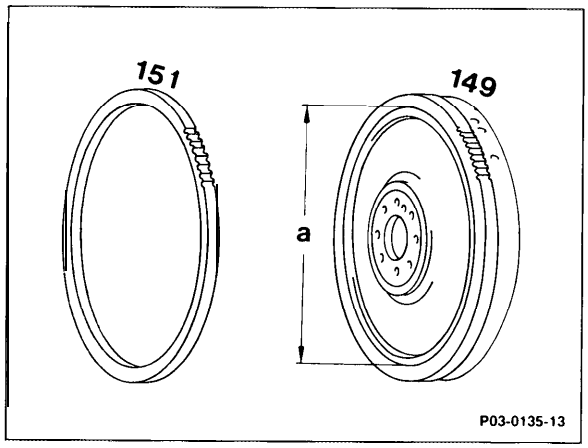
Note
Flywheels for manual transmissions with burned spots, scoring or cracks on the clutch surface should be refinished by precision turning.

If the scoremarks or cracks are greater than the maximum permissible material removal dimension, replace flywheel.

After machining the clutch surface should not have any porous spots or chatter marks.

03-430 Replacing ring gear

Preliminary jobs:
Flywheel and driven plate removed (03-410).



Flywheel (149)	check, centering flange dia. (a) for ring gear 275.00 + 0.05 mm. Clean mounting surface for ring gear on flywheel before installing ring gear.
Ring gear (151)	drill hole into old ring gear and break up with a chisel or heat quickly and then remove immediately. Heat new ring gear and install on flywheel. Temperature for shrink fit 220 °C. Lateral runout on ring gear max. 0.4 mm.

Standard accessories

Temperature measuring chalk Color No. 2815/220 (white) thermochrome	e.g.	AW Faber-Castell, D-8504 Stein bei Nurnberg

Caution!
The ring gear is hardened. For this reason do not exceed 220 °C at any point while heating with hot plate or heating furnace.

Use temperature measuring chalk in accordance with directions.

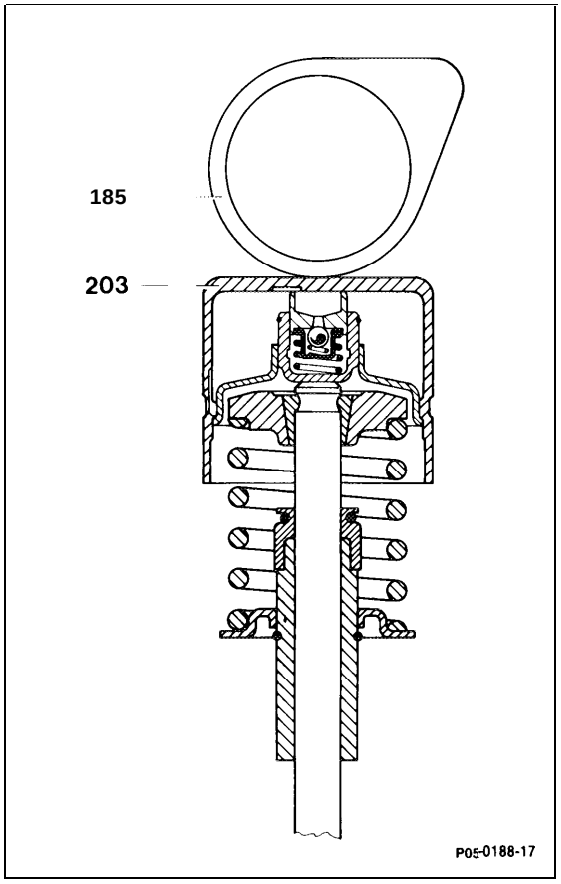
Use open flame only in exceptional cases. Apply flame to inside of ring gear only.

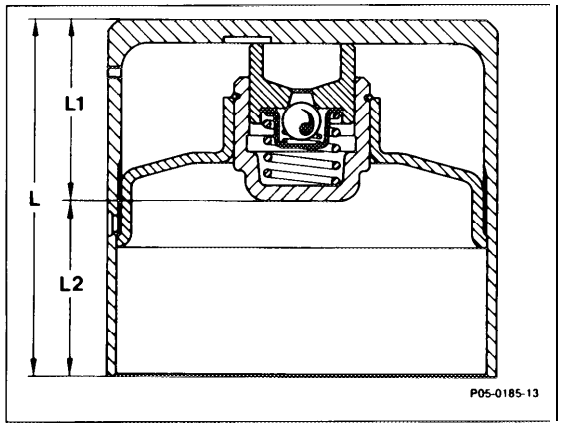
After replacing ring gear, it is not necessary to balance the flywheel.

Job No.

Checking and renewal of hydraulic valve clearance compensating elements ..... 05 – 211
Checking camshaft timing ..... – 215
Removal and installation of camshaft ..... – 220
Removal and installation of valve springs ..... – 250
Checking valve springs ..... – 260
Renewal of valve stem seals ..... – 270
Checking and machining valves ..... – 280
Checking and renewal of valve guides ..... – 285
Replacing1 of valve seat inserts ..... – 290
Machining valve seats ..... – 291
Removing and installing chain tensioner ..... - 310
Renewal of timing chain ..... – 320
Removal and installation of tensioner rail ..... – 330
Removal and installation of guide rail ..... – 341
Removal and installation of pressure oil pump drive ..... – 437

05-211 Checking and renewal of hydraulic valve clearance compensating elements





Engine	bring to operating temperature (80°C).
Engine oil level	check.

Caution!
Do not overfill.

Turbo engine:

Charge air pipe	remove, install.
Cylinder head cover	remove, install, 10 Nm.
Valve tappet (203)	check with a mandrel, to do this first check on the cylinder which is exactly on Ignition TDC (cam tips for inlet and exhaust valve point upwards).

Caution!
Unnecessary rotation of the engine causes the valve clearance compensating elements to sink.

A valve clearance compensating element must only be removed when an air gap >0.4 mm is established between cam and element. The engine must not be turned by the camshaft timing gear bolt.

If the valve tappet sinks quicker than the others, measure pre-stroke.

Pre-stroke . . . . . measure, reference value: 0.25 - 2.0 mm (Numbers 6 - 10).

With excessive pre-stroke:

Valve tappet (203) . . . . . remove, install in the same position again, magnetic lifter 102 589 02 61 00.

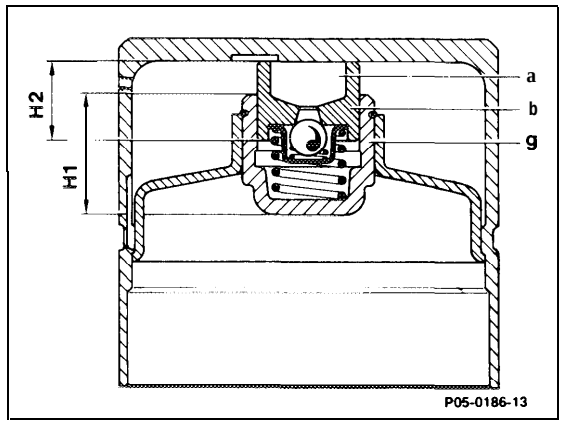
Dimension L1 . . . . . determine. The dimension L1 is the difference between the dimensions L and L2. Reference value 18 - 19 mm (Number 12 - 14).

Parts of the valve tappet . . . . . clean. The valve tappet must be replaced if oil loss cannot be eliminated.

Data	1st Design	2nd Design from 08 84	3rd Design from 01 90
Plunger "b" dimension H 2 (mm)	8.0	8.6	9.1
Guide sleeve "g" dimens. H 1 (mm)	12.5	13.2	13.2

Note

Hydraulic valve clearance compensating elements have been fitted with a larger oil reservoir chamber since the start of production on engines 602 and 603.

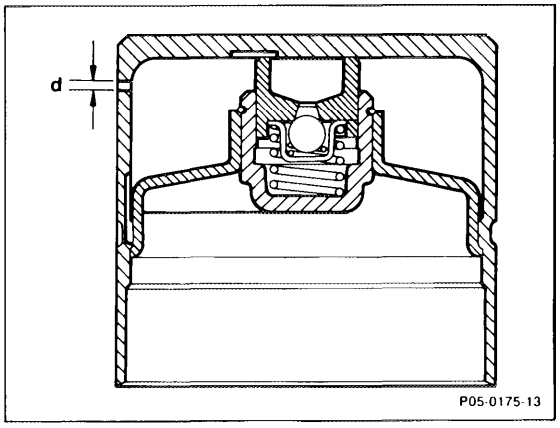


a Storage chamber

Break date: **08/84**

Model	Engine	Engine end No. Manual transmission	Engine end No. Automatic transmission	Vehicle identification end No. A	Vehicle identification end No. F
201.122	601.921	001712	004503	104388	028653

From 09/87 valve tappets have been installed with a ventilation bore (d = 0.2 mm), in order to prevent tappet rattle during short distance operation.



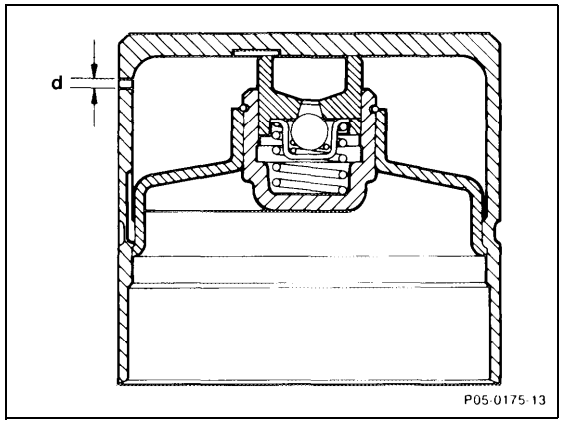
a Reservoir chamber
b Plunger
c Working chamber

Production breakpoint: **09/87**

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.133 124.193	603.960	–	013998	*	*
124.133	603.960	–	000433	*	*
201.126	602.911	050700	011065	*	*
201.128	602.961	–	001542	*	*

* not recorded

From 01/90 revised valve clearance compensating elements have been installed. These compensating elements have a reduced residual stroke, i.e. the stroke of the plunger (b) and the working chamber (c) have been reduced and the reservoir chamber (a) enlarged.
Less oil is needed in the working chamber due to the reduced stroke. Therefore the working chamber fills up more quickly after initial engine starting.



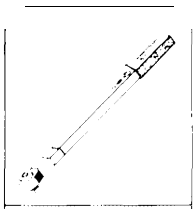
Production breakpoint: 01/90

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.128	602.962	001938	004158	*	*
124.133 124.193	603.960	–	025508	*	*
126.135	603.970	–	000057	*	*
201.126	602.911	087710	017102	*	*
201.128	602.961	001314	007602	*	*

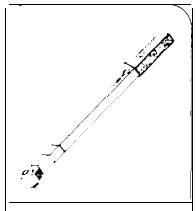
* not recorded

Tightening torque	Nm
Hexagon bolts for cylinder head cover	10

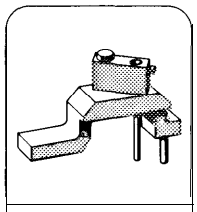
Special tools



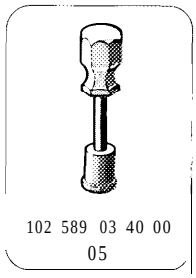
001 589 72 21 00
00



001 589 66 21 00
00



601 589 08 21 00
05



102 589 03 40 00
05

Conventional tool

Dial gauge	e. g.	Mahr D-7300 Esslingen Part No. 810

Checking

1 Run engine to operating temperature (80°C).

2 Check engine oil level, making absolutely sure it is not overfilled.

Turbo engine:

3 Remove charge air pipe.

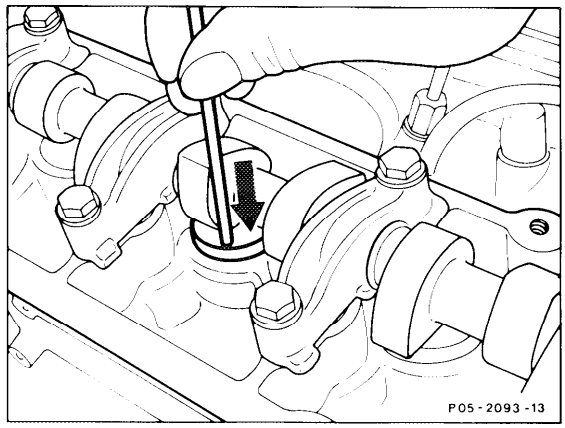
4 Remove cylinder head cover.

Caution!

Turning the engine unnecessarily causes valve play compensating elements to sink.
The engine must not be turned by the camshaft timing gear bolt.

5 First check the cylinder which is exactly on TDC. (Cam tips for inlet and outlet valves point upwards).

6 In order to check with a mandrel press lightly on the valve clearance compensating element and thus check the clearance. Continue turning the engine until the next cylinder in the firing order can be checked.
A valve clearance compensating element must only be replaced when a clearance of >0.4 mm is established between cam and element. If the valve tappet sinks quicker than the others, or has play at the cam base circle, the pre-stroke of the valve tappet must be measured.



Measuring pre-stroke

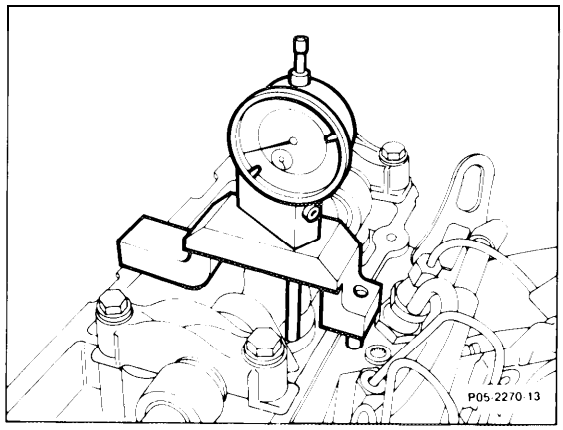
7 The basic setting of the dial gauge has to be undertaken before measurement. To do this insert the dial gauge in the measuring bridge 601 589 08 21 00 and push in until there is a preload of approx. 1 mm. The probe in the measuring bridge must be in the basic position (lower stop).

The basic setting must not be changed during measurement.

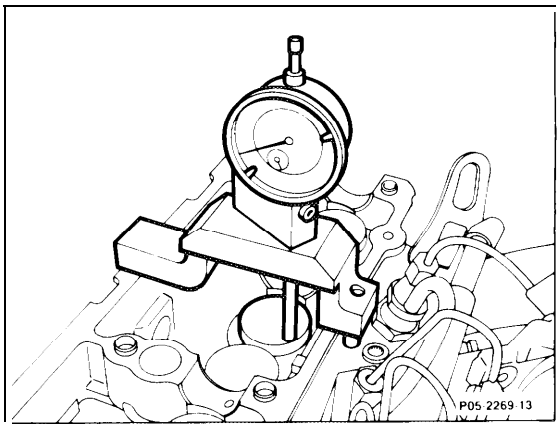
8 In order to measure and note dimension "X" (cylinder head mating surface to valve tappet), put measuring bridge on the cylinder head mating surface over the valve tappet.

Note

If required, measure dimension "X" on all valve tappets.



9 Remove camshaft (05220).



10 Measure dimension "Y" (cylinder head mating surface to valve tappet).

The difference between the dimension "X" and "Y" is the pre-stroke of the valve tappet.

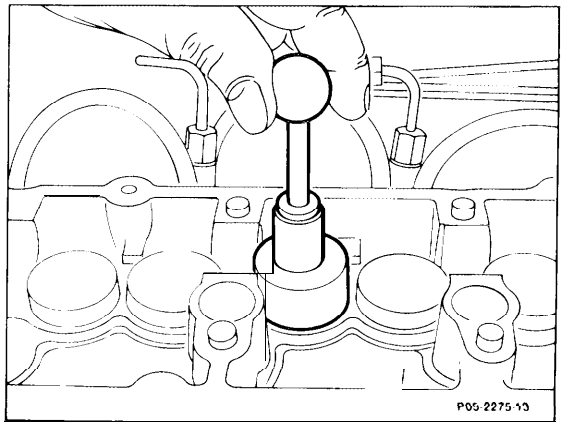
Reference value: 0.25 - 2.0 mm.

Example:

No. 1 Cylinder		A (exhaust)	E (Inlet)
Dimension "Y"	mm	2.82	2.98
Dimension "X"	mm	1.95	1.92
Pre-stroke	mm	0.87	1.06

11 If the valve tappet sinks too quickly or if the dimension differs from the reference value, lift out valve tappet with the magnetic lifter 102 589 03 40 00.

Note location of valve tappet.

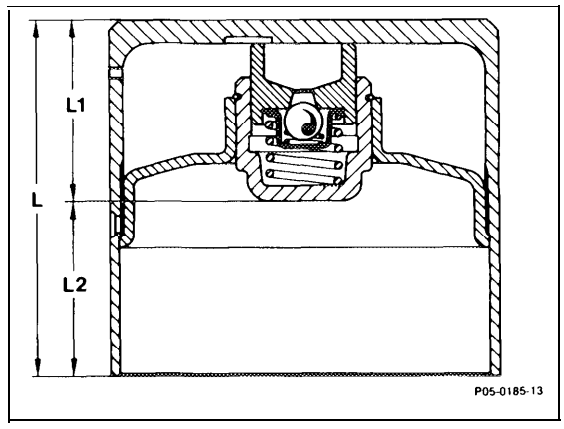


12 Measure dimension "L" on valve tappet.
13 Measure dimension "L2" on valve tappet.

The dimension L1 is the difference between L and L2.

Reference value: 18 - 19 mm

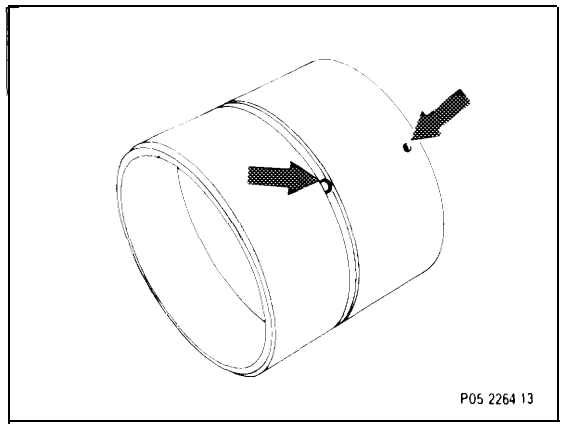
14 If the dimension "L1" is outside the reference value remove guide sleeve.
To do this pull out guide sleeve out of the valve tappet with rotary movements using pliers.
Do not damage guide sleeve.



15 Pull plunger out of the guide sleeve and remove compression spring.

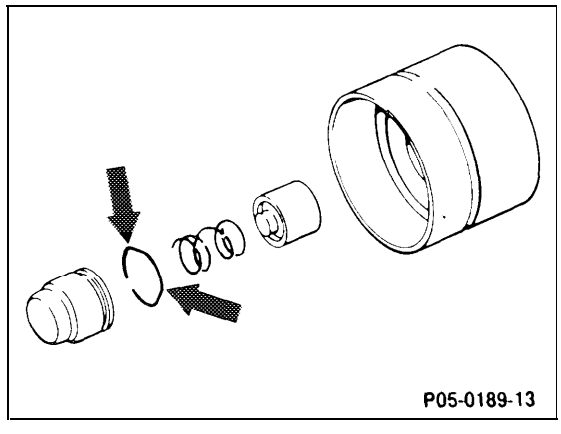
16 Blow through all individual parts with compressed air.

Blow air through valve tappet at the oil supply bore and ventilation bore (arrows).

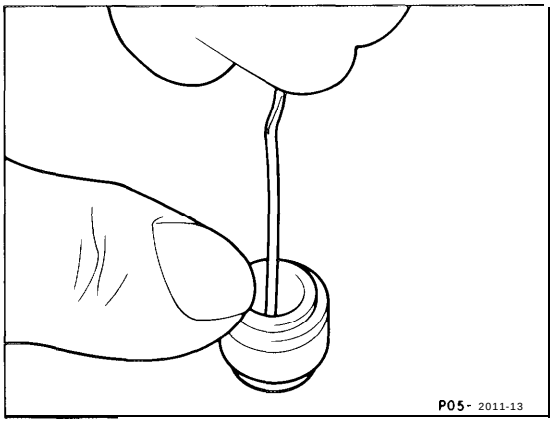


17 Remove snap ring from the guide sleeves and pinch slightly at the edges (arrows) and reassemble on the guide sleeve.

18 Install guide sleeve, compression spring and plunger in sequence.



19 Fill plunger with engine oil. Press off ball valve with a suitable pin and then ventilate the working chamber by pumping the plunger, close ball valve and possibly replenish oil. Then no oil should escape from the ball valve when it is gently compressed.



Note
If oil escapes, renew valve tappet.

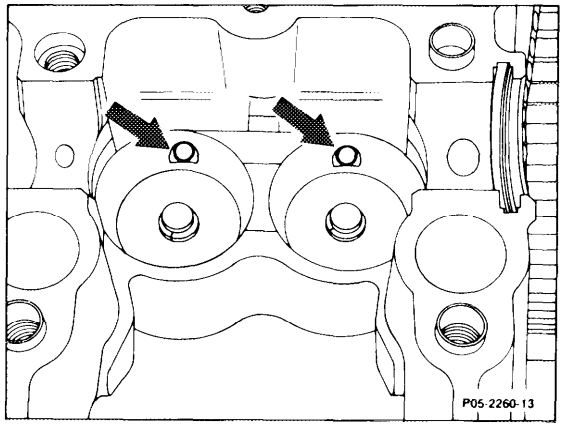
20 Fill valve tappet with engine oil and insert vented plunger with guide sleeve into the valve tappet.

Fit guide sleeve into valve tappet until the snap ring engages, press in, if necessary.

21 Recheck dimension "L1".

22 Check oil supply to cylinder head. **To** do this unscrew sealing plug of the oil channel in cylinder head.

Blow compressed air into the oil channel, while checking exit bores (arrows) at the seat for the valve tappet for air.



23 Lubricate valve tappet and install in the same position, noting sequence.

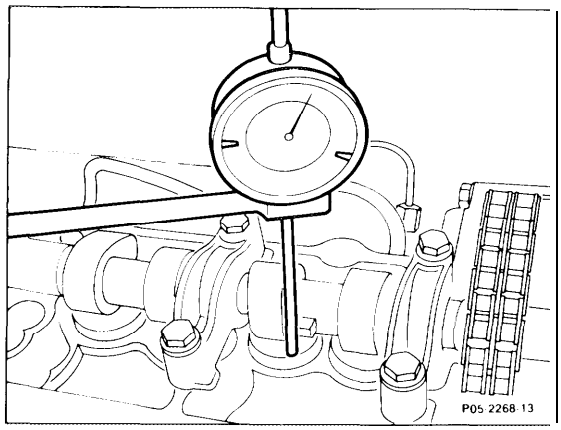
24 Install camshafts (05-220).

25 Install cylinder head cover, 10 Nm.

Turbo engine:
26 Install charge air pipe.

05-215 Checking camshaft timing

Preceding work:
Cylinder head cover removed.
Injection nozzles removed (07.1-230).
Charge air pipe removed (turbo engines).



Dial gauge holder 363 589 02 21 00 ..... attach, remove at the No. 1 cylinder inlet valve. Dial gauge with 3 mm preload on valve tappet.

Engine ..... turn in direction of rotation.

Caution!
Engine must not be turned by the camshaft.

With 2 mm valve stroke ..... engine must be at 12° after TDC.

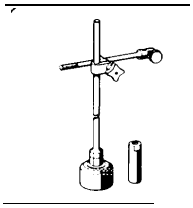
Timing

Engine	Camshafts Code number[1]	Inlet valve		Exhaust valve	
		opens after TDC	closes after BDC	opens before BDC	closes before BDC
602 603	06/10[3]/08[5]/12[6]	11° 12°[4]	17°	28°	15°
	07/11[3]/09[5]/13[6]				

[1] The camshaft code number is stamped in on the collar next to the TDC notch.
[2] Not used.
[3] With M1 1 thread from 11/88.
[4] On used camshafts.
[5] Repair camshafts with 0.5 mm larger bearing diameter and M10 thread.
[6] Repair camshafts with 0.5 mm larger bearing diameter and M1 1 thread.

Tightening torque	Nm
Bolts for cylinder head cover	10

Special tool



363 589 02 21 00
00

Conventional tool

Dial gauge A 1 DIN 878	e. g.	Mahr D-7300 Esslingen Part No. 810

Note

It is not possible to correct timing. The timing chain should be checked for elongation if the test values differ.
The timing chain is to be replaced with more than 4° at the crankshaft.

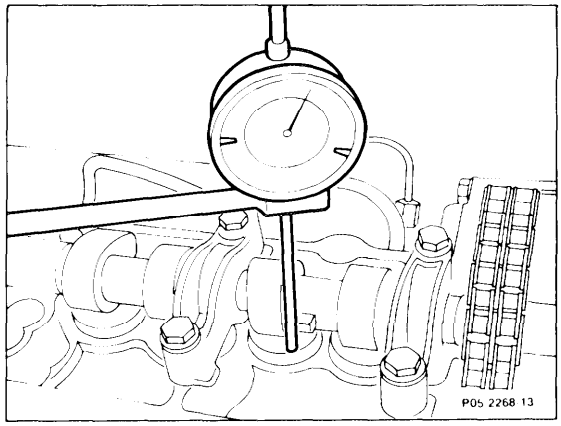
Checking

Caution!

The engine must not be turned by the camshaft timing gear bolt. Do not turn engine backwards during measurement, otherwise measuring errors result.

1 Turn crankshaft in direction of rotation of the engine until cam tip of the 2nd cam points upwards.

2 Fasten dial gauge holder 363 589 02 21 00 on the cylinder head (above the No. 1 cylinder inlet valve).



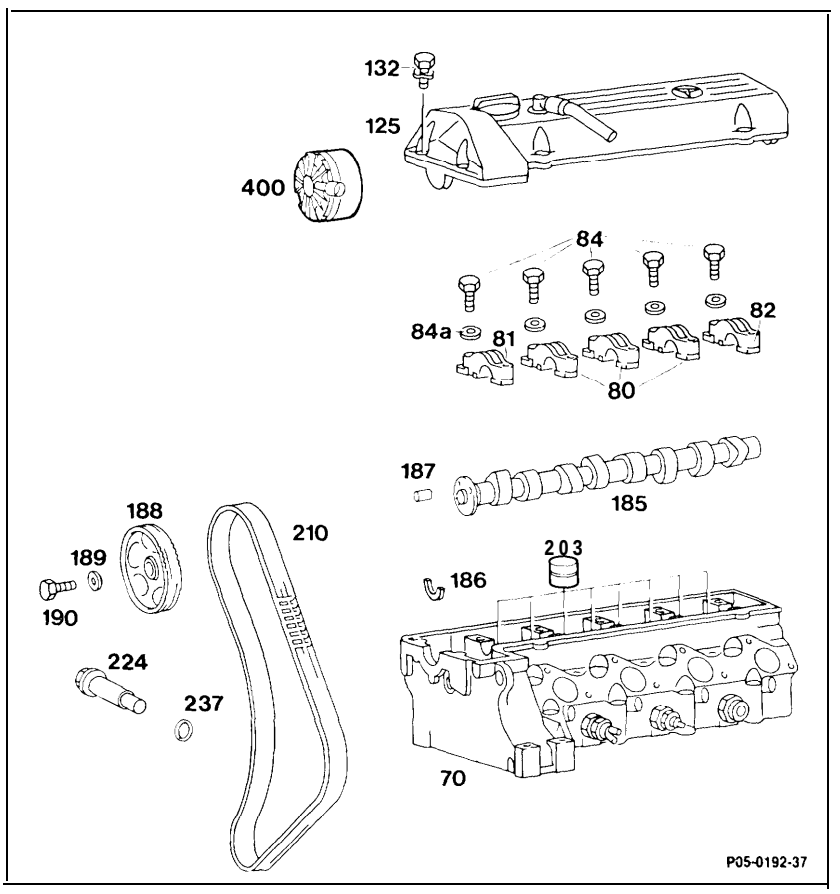
3 Insert dial gauge and extension and fasten so that probe pin sits on the valve tappet with a preload of 3 mm (small dial gauge pointer).

4 Turn dial gauge scale until the large pointer is on "0".

Caution!
The probe pin of the dial gauge must be exactly vertical to the valve tappet.

5 Turn crankshaft further in direction of rotation of engine, until the small pointer of the dial gauge has moved back by 2 mm to 1 mm.

In this position the marking at the crankshaft pulley or vibration damper must be at 11 - 12" after TDC. If this value is more than 12" the camshaft is to be replaced or the timing chain checked for elongation.



Turbo engine:

Charge air pipe	remove, install.
Cylinder head cover (125)	remove, install, 10 Nm.
Engine	position on ignition TDC of No. 1 cylinder.

Caution!
The engine must not be turned by the camshaft timing gear bolt.

Chain tensioner (224)	remove. install, replace sealing ring (237) (05310).

With self-levelling suspension:

Drive of the pressure oil pump (400)	remove, install (05437).

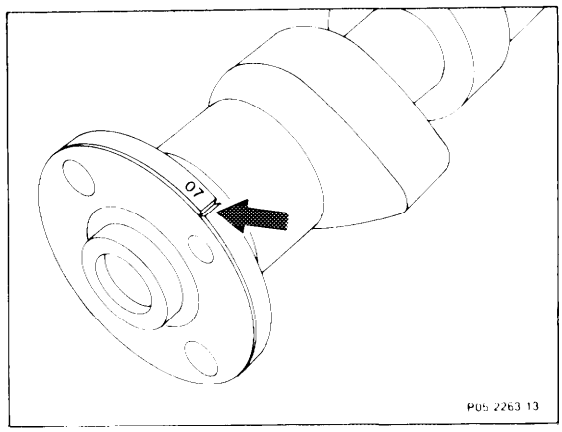
Camshaft timing gear (188)	mark at timing chain (210). Remove, install camshaft timing gear. Different bolts (190) and washers (189). Hexagon bolt, 65 Nm, bihexagonal head bolt, 25 Nm 90° angle of rotation.
	Caution! When assembling the camshaft timing gear ensure that the straight pin (187) is not pushed out towards the rear.
Camshaft bearing cap (80, 81, 82)	remove, install, note sequence, hexagon bolts (84) and washers (84a), 25 Nm.
	Caution! Note torquing diagram!
Camshaft (185)	remove, install. Check for ease of movement.
Lock washer (186)	check.
Valve tappet (203)	remove, install, check. Magnet lifter 102 589 03 40 00.
After installation	allow engine to run, check for leaks.

Data

Permitted eccentricity of center bearing pin and camshaft gear seat when accepting the camshaft in the outer bearing positions	Bearing position engine	602	603
	Camshaft timing gear seat	0.025	0.025
	2nd and 4th bearing position	–	–
	3rd bearing position	–	–
	2nd and 5th bearing position	0.030	–
	3rd and 4th bearing position	0.050	–
	2nd and 6th bearing position	–	0.030
	3rd and 5th bearing position	–	0.045
	4th bearing position	–	0.060
Scleroscope hardness of cam		70 – 82	70 – 82
Diameter of camshaft bearing pins (standard dimension)		30.945 / 30.934	
Diameter of camshaft bearing pins (repair stage + 0.5 mm)		31.445 / 31.434	

Camshaft code numbers

The code number is stamped on the flange next to the TDC notch (arrow).



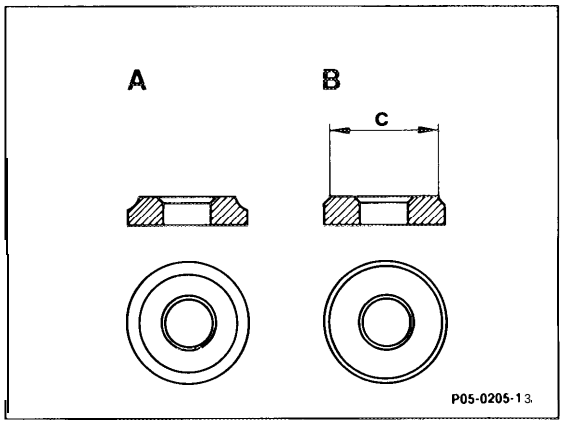
TDC marking (arrow) and code number

Engine	Thread for sprocket wheel	Camshaft code number
602, 603	M10	07, OS')
	M11	11, 13')

') Repair camshaft with 0.5 mm larger bearing Ø

Washer for camshaft timing gear bolt

A revised washer with a larger outer diameter (c) has been fitted in order to prevent the camshaft timing gear bolt loosening.



A 1 st Design
B 2nd Design

Production breakpoint: 12/86

Model	Engine	Engine end No.		Vehicle Identification end No.	
		Manual transmission	Automatic transmission	A	F
124.133 124.193	603.960		007763	*	*
126.125	603.961	–	007994	*	*
201.126	602.911	033213	008022	*	*
201.128	602.961	–	000200	*	*

* not recorded

Camshaft timing gear bolt

From 11/88 the camshaft timing gear fixing has been revised from a **MI 0** hexagon bolt to a **MI 1** bihexagon necked down bolt on all engines.

Tightening torques

Hexagon bolt (A) 65 Nm

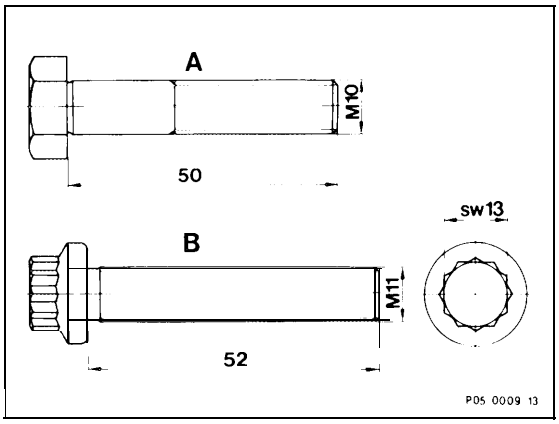
Bihexagon necked down bolt (B)

Pre-torque 25 Nm

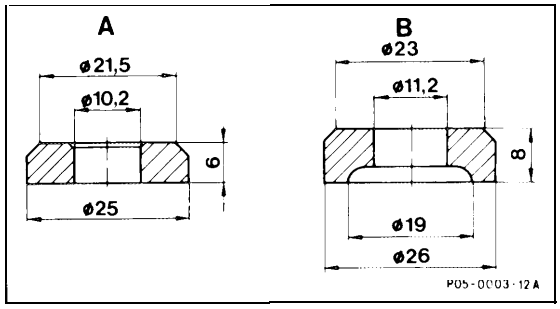
Torsion angle 90”

Caution!

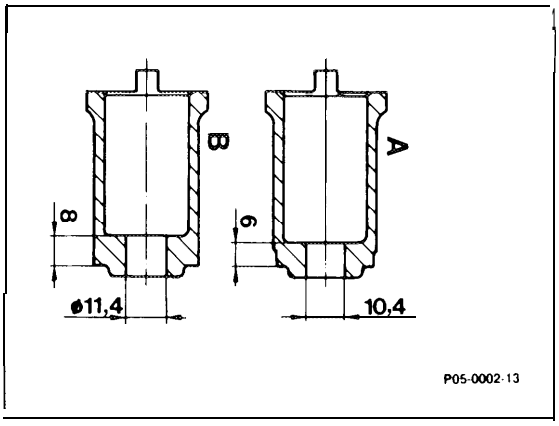
Note revised plain washer!



Use the plain washer (A) for the hexagon bolt, and plain washer (B) for the bihexagon necked down bolt.



Use carrier (A) for previous hexagon bolt, carrier (B) for bihexagon necked down bolt.



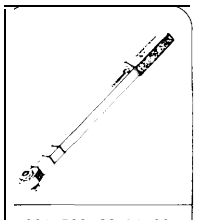
Production breakpoint: 1 **1/88**

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124	602.962 603.960	– –	000187 019336	*	*
201	602.911 602.961	070124 –	014216 004561	*	*

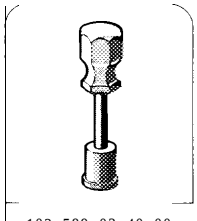
* **not recorded**

Tightening torques and angles of rotation	Nm	
Hexagon bolts on cylinder head cover	10	
Hexagon bolts on camshaft timing gear	65	
Bihexagonal head bolt on camshaft timing gear	25	90”
Hexagon bolts on camshaft bearing cap	25	

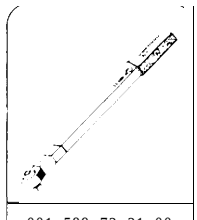
Special tools



001 589 66 21 00
00



102 589 03 40 00
05



001 589 72 21 00
00

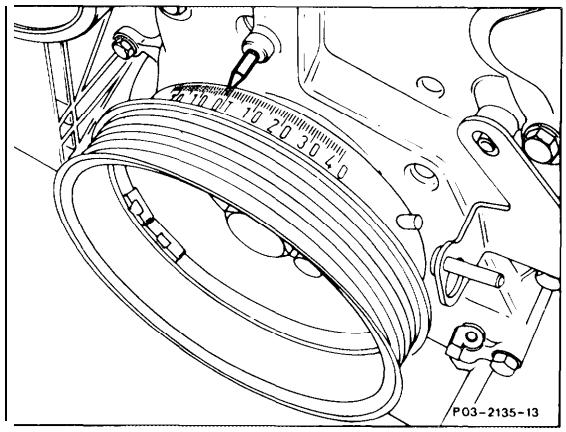
Removal

Turbo engine:

1 Remove, install charge air pipe.

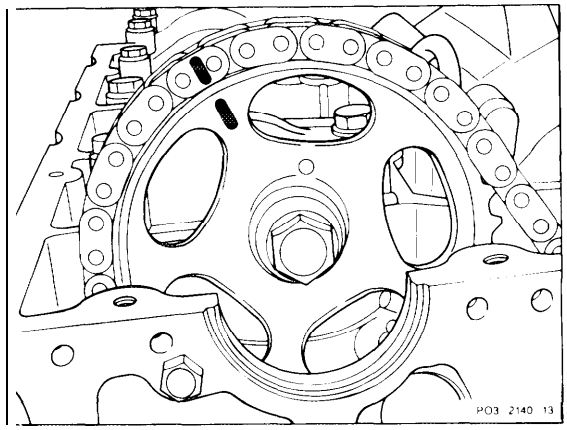
2 Remove cylinder head cover.

3 Position engine on ignition TDC of No. 1 cylinder (arrow).



Caution!
Do not turn engine by the camshaft timing gear bolt. Do not turn engine backwards.

4 Remove chain tensioner (05310).

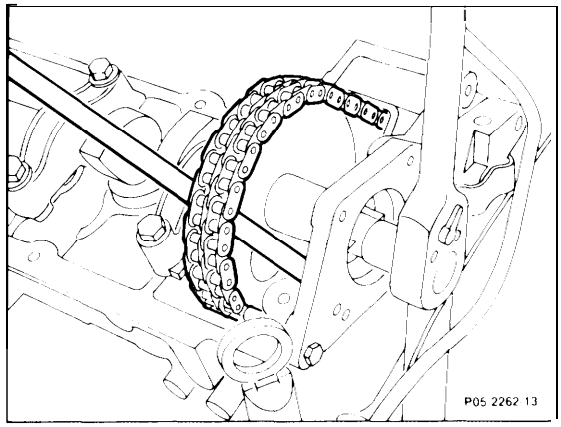


With self-levelling suspension

5 Remove pressure oil pump (05437).

6 Align camshaft timing gear and timing chain.

7 Unscrew hexagon bolt or bihexagonal head bolt on camshaft timing gear, whilst holding the camshaft with a mandrel.



8 Remove camshaft timing gear and allow timing chain to sag.

Note
The timing chain is prevented from twisting when the timing case cover is assembled.

Caution!
Note different bolt and washer.

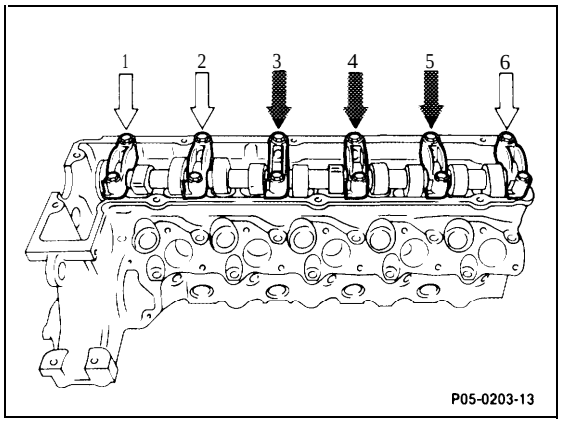
Caution!

9 **It** is absolutely essential to observe the following sequence during **removal and installation** in order to avoid damage to the camshaft:

Engine 602

Unscrew both hexagon bolts on camshaft bearing caps 1, 2 and 6 (dark arrows).

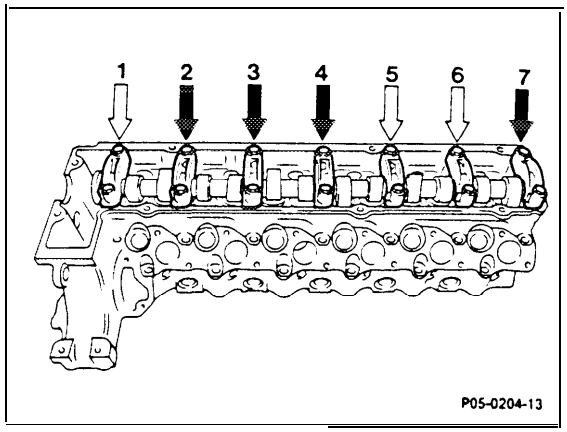
Loosen both hexagon bolts on camshaft bearing caps 3, 4 and 5 in increments of one turn respectively, until counterpressure is reduced (light arrows).



Engine 603

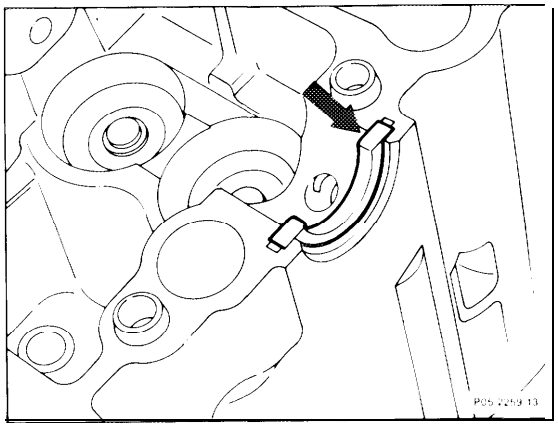
Unscrew both hexagon bolts on camshaft bearing caps 1, 5 and 6 (dark arrows).

Loosen both hexagon bolts on camshaft bearing caps 2, 3, 4 and 7 in increments of one turn respectively, until counterpressure is reduced (light arrows).



10 Remove camshaft upwards.

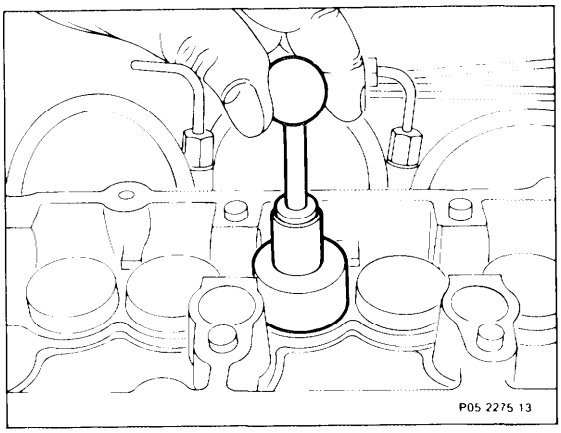
11 Remove lock washer for axial fixing (arrow) and check condition.



12 Pull out valve tappet with magnetic lifter 102 589 03 40 00.

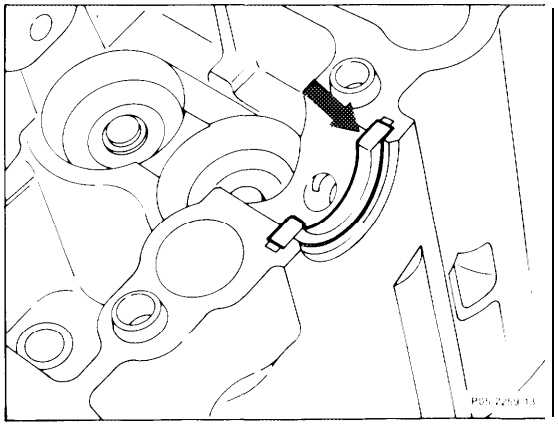
13 Check valve tappet for condition (visual inspection), replace if necessary.

Caution!
Install valve tappet in the same position again.



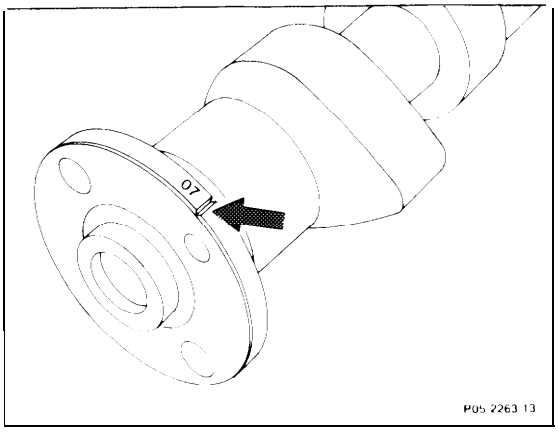
Installation

14 Insert lock washer for axial fixing (arrow) in cylinder head.



15 Lubricate camshaft and place on the cylinder head so that the TDC marking (arrow) points vertically upwards.

16 Install camshaft bearing caps. Note marking on bearing caps.



Assemble camshaft bearing cap bolts (light arrows) and torque alternately in increments of one turn respectively in accordance with torquing diagram, see work stage 9.

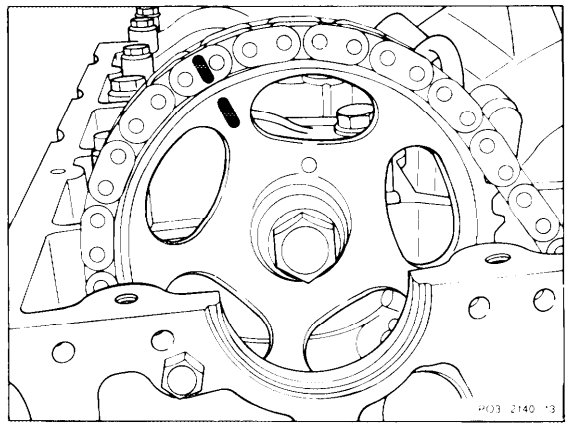
Engine 602; camshaft bearing caps 3, 4 and 5
Engine 603; camshaft bearing caps 2, 3, 4 and 7

The remaining camshaft bearing caps (dark arrows) can then be assembled at random.

Tightening torque 25 Nm.

17 Install camshaft timing gear according to marking and tighten. Check straight pin for correct seating.

Tightening torques and angle of rotation
Hexagon bolt 65 Nm,
Bihexagonal head bolt 25 Nm, 90°

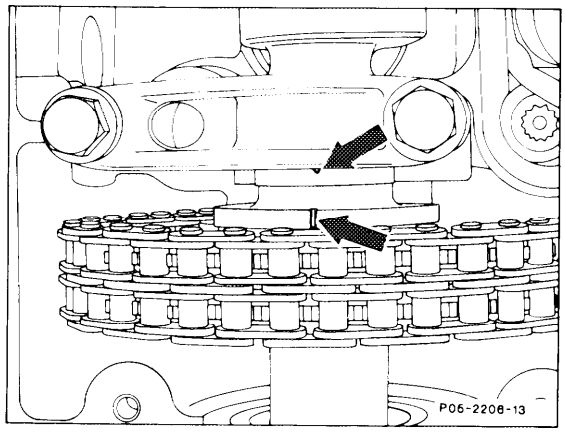


18 Install chain tensioner (05-310).

With self-levelling suspension:

19 Install pressure oil pump (05-437).

20 Position engine on TDC of the No. 1 cylinder and check markings (arrows).



21 Install cylinder head cover. Tightening torque 10 Nm.

Turbo engine:

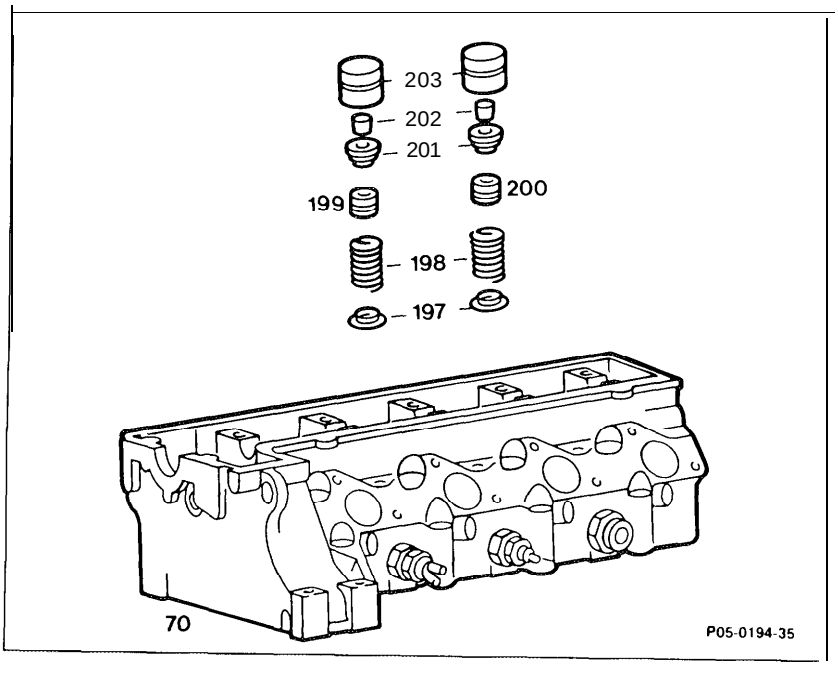
Install charge air pipe.

After installation:

22 Allow engine to run, check for leaks.

05-250 Removal and installation of valve springs

Preceding work:
Camshaft removed (05-220)



A. Cylinder head removed

Cylinder head (70)	....	clamp. Assembly table 601 589 01 59 00, support bridge 601 589 02 59 00.
Valve tappet (203)	....	remove, install. Magnetic lifter 102 589 03 40 00.
Valve springs (198)	....	remove, install, check (05-260). Lever press 601 589 02 61 00, magnetic lifter 102 589 03 40 00. Color marking downwards.
Valve stem seals (199, 200)	.....	replace (05-270).

B. Cylinder head installed

Valve tappet (203)	remove, install. Magnetic lifter 102 589 03 04 00.
Piston of cylinder concerned	position on TDC. Retaining gear 601 589 01 40 00.
Valve springs (198)	remove, install, check (05260). Support bridge 601 589 02 59 00, lever press 601 589 02 61 00. Magnetic lifter 116 589 06 63 00. Color marking downwards.
Valve stem seals (199, 200)	replace (05-270).

Since 03'86 the lower valve spring retainers have been revised. They are now the same as those on the engines 102 and 103 (standardization).

Production breakpoint: 03/86

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.133 124.193	603.960	–	000016	*	*
126.125	603.961	–	001093	*	*
201.126	602.911	015830	003949	*	215978

* not recorded

Since 08/88 the valve spring retainers are in bath nitrided material (previously case hardened). Standardization with engines 102 and 103.

Production breakpoint: 08/88

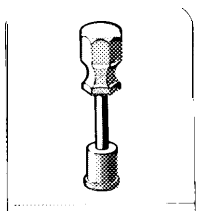
Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.133 124.193	603.960	-	018302	*	*
201.126	602.911	067330	013824	*	*
201.128	602.961	-	003806	*	*

* not recorded

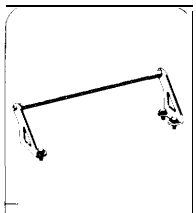
Note

Color markings of valve springs yellow green or violet/green or yellow blue or violet blue.

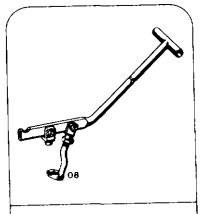
Special tools



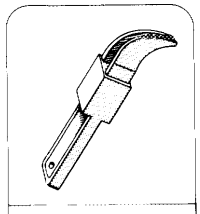
102 589 05 03 40 00



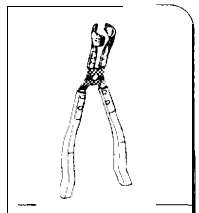
601 589 02 59 00
05



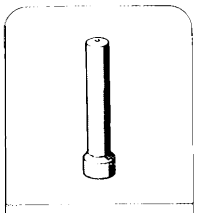
601 589 02 61 00
05



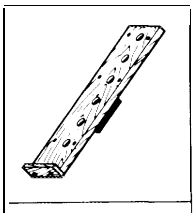
116 589 06 63 00
05



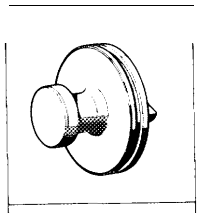
104 589 00 37 00
05



601 589 02 43 00
05



601 589 01 59 00
05



603 589 01 40 00
05

A. Cylinder head removed

Removal and installation

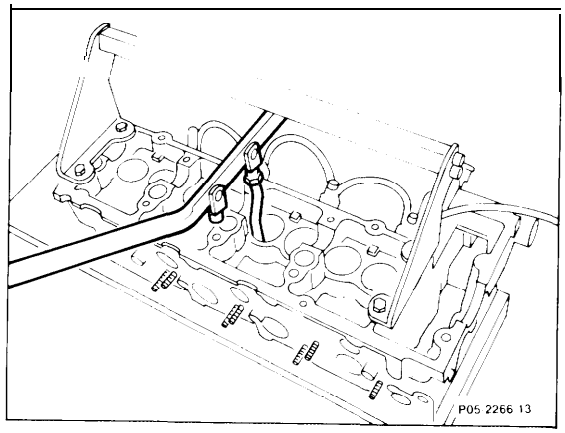
1 Clamp cylinder head on assembly table 601 589 01 59 00 with 4 cylinder head bolts.

2 Remove valve tappets. Magnetic lifter 102 589 03 40 00.

Installation note
Lubricate valve tappets. Note sequence.

3 Attach support bridge 601 589 02 59 00 to cylinder head.

4 Press valve spring retainers downwards with lever press 601 589 02 61 00.



5 Remove valve cotters with magnetic lifter 116 589 06 63 00.

6 Take out valve springs and valve spring retainers.

Installation note
Install valve springs with the color marking downwards.

7 Check valve springs (05260).

8 Replace valve stem seals (05270).

9 Installation takes place in the reverse sequence.

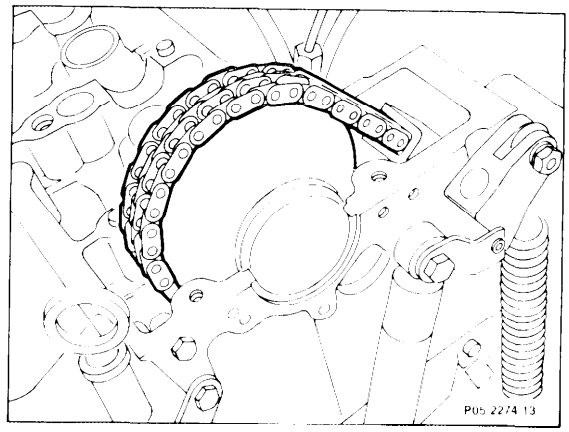
B. Cylinder head installed

Removal and installation

1 Remove valve tappets with magnetic lifter 102 589 03 40 00.

Installation note
Lubricate valve tappets, note sequence.

2 Place piston of the cylinder concerned on TDC.
Use retaining gear 603 589 01 40 00 instead of camshaft timing gear or camshaft in order to turn the engine.

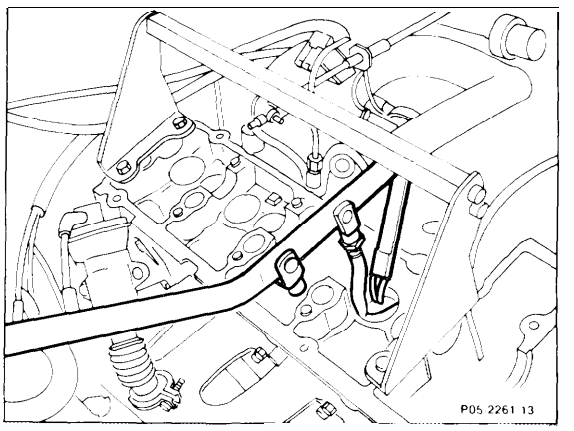


3 Attach support bridge 601 589 02 59 00 for lever press on cylinder head.

4 Press valve spring retainers downwards with lever press 601 589 02 61 00.

5 Remove valve cotters with magnetic lifter 116 589 06 63 00.

6 Remove valve springs and valve spring retainers.



Installation note

Install valve springs with the color markings downwards.

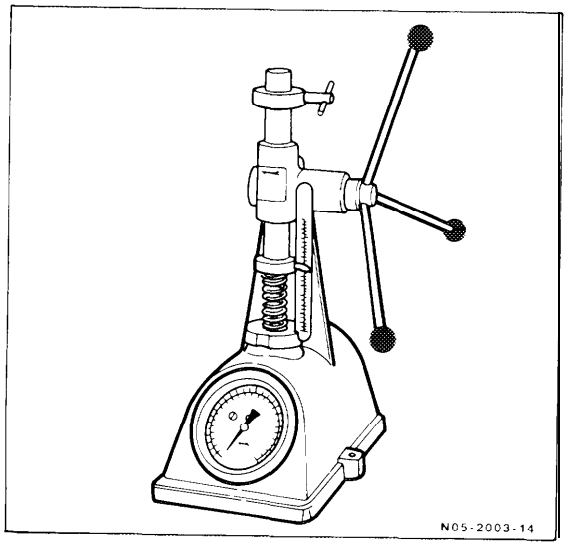
7 Check valve springs (05-260).

8 Replace valve stem seals (05-270).

9 Installation takes place in the reverse sequence.

05-260 Checking valve springs

Preceding work:
Valve springs removed (05-250).



Spring force ..... check at specified length. If limit is not achieved, replace valve spring.

Valve spring data

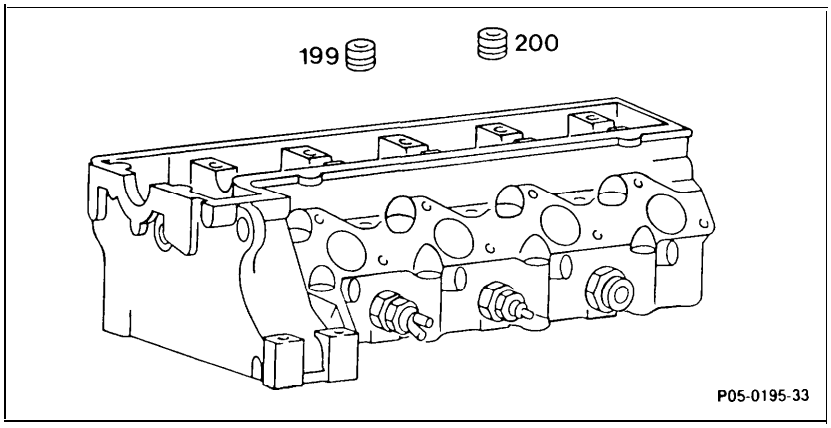
Part No.	Color marking	Outside Ø mm	Wire Ø mm	Free length mm	Spring force at preloaded length	New value N	Limit N
601 053 01 20 (1 st design)	yellow/green or violet/green	33.2	4.25	50.8	**27**	**710 – 790**	**648**
601 053 03 20 (2nd design)	yellow, blue or violet blue	33.1	4.20	50.0	27	680 – 740	612

Conventional tool

Spring test scales	e. g.	Berco Model CM130

05-270 Replacing of valve stem seals

Preceding work:
Valve springs removed (05-250).



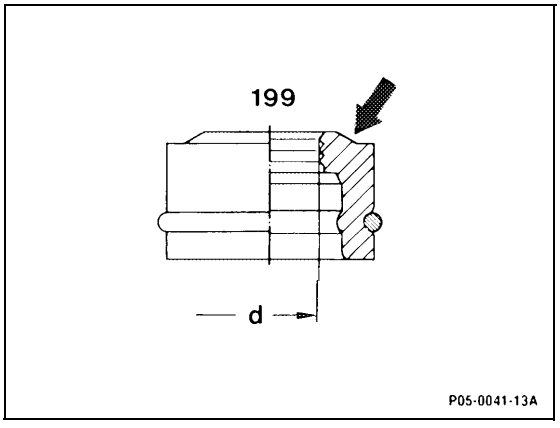
Valve stem seals (199, 200)	remove, install. Pliers 104 589 00 37 00, mandrel 601 589 02 43 00. Note color marking.
Valve stem	de-burr at groove.

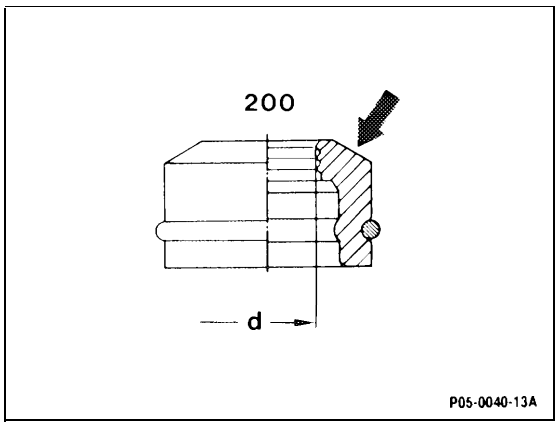
Valve stem seal designs

Distinguishing features:

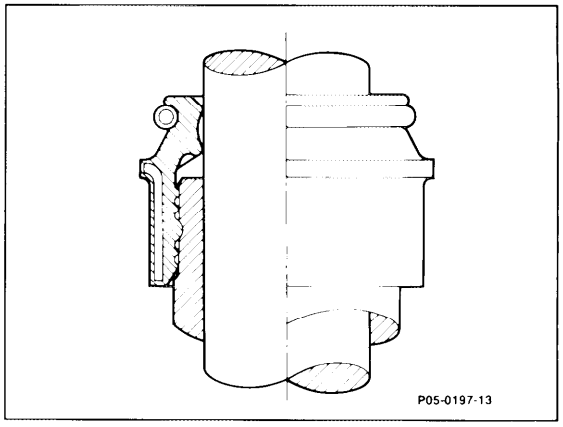
Intake valve stem seal (199)
Chamfer (arrow) shouldered
d = 7.3 mm
Wire ring: phosphated (black)
Color: brown

Exhaust valve stem seal (200)
Chamfer (arrow) straight
d = 8.2 mm
Wire ring: bright galvanized (yellow)
Color: brown





Valve stem seals with standardized exterior dimensions are installed due to automatic cylinder head assembly.



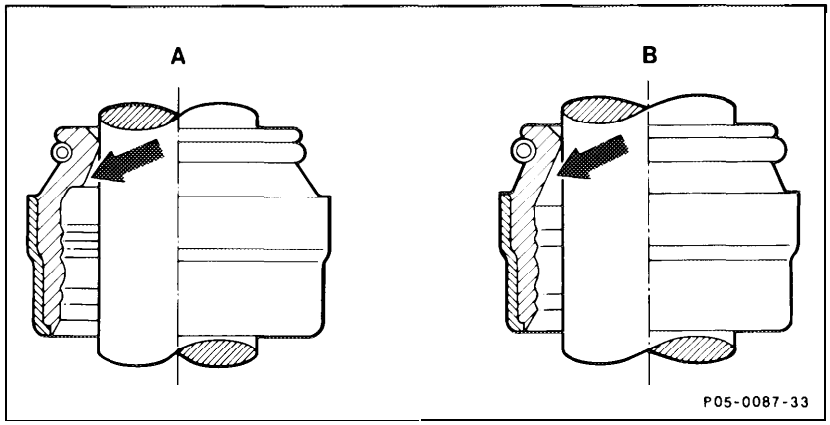
Production breakpoint: 1 1/85

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
201.126	602.911	009492	002235	*	*

* not recorded

Inlet valve stem seals without gas lip have been fitted since 09 89 and exhaust valve stem seals without gas lip since 04 90.

Viton material



A Intake valve stem seal
B Exhaust valve stem seal

Production breakpoint: 09/89 (Inlet)

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.128	602.962	000093	003020	*	*
124.133 124.193	603.960	–	023344	*	*
126.135	603.970	–	[1])	*	*
201.126	602.911	083331	016477	*	*
201.128	602.961	000177	007086	*	*

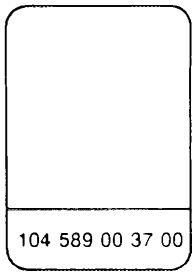
[1]) from st of production
* not rec led

Produktion breakpoint: 04/90 (Exhaust)

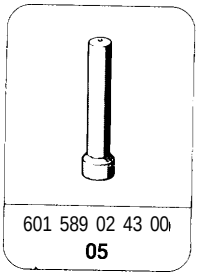
Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.128	602.962	003684	005147	*	*
124.133 124.193	603.960	–	026930	*	*
126.135	603.970	–	1)	*	*
201.126	602.911	090538	017538	*	*
201.128	602.961	002151	007954	*	*

1) from start of production
* not recorded

Special tools



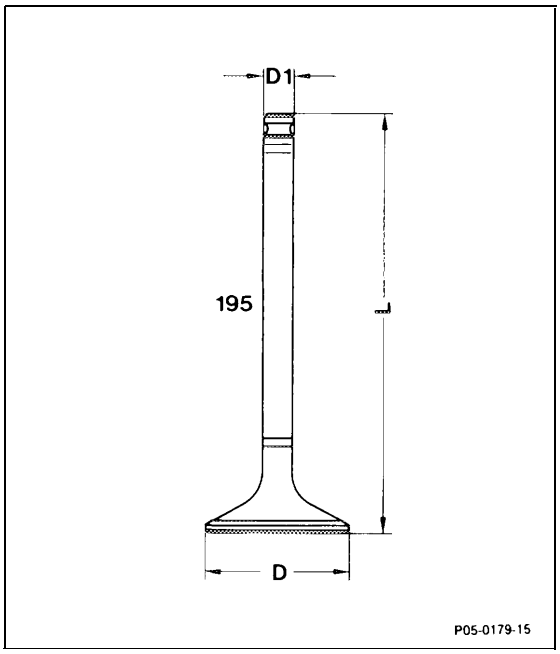
104 589 00 37 00

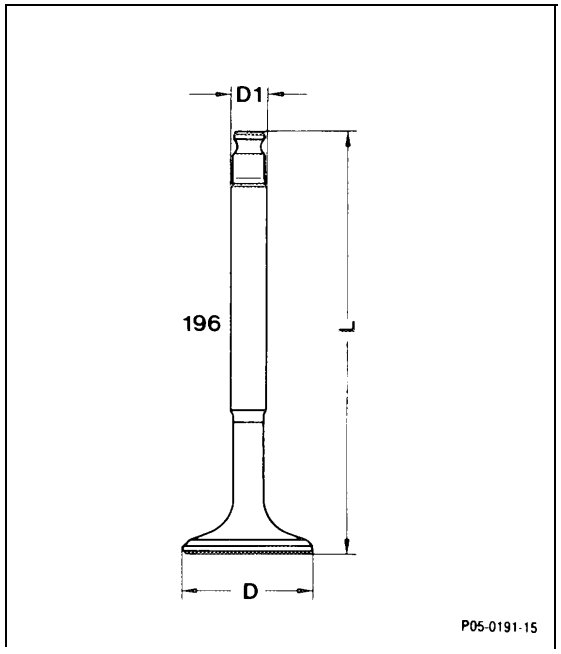


601 589 02 43 00
05

OS-280 Checking and machining valves

Preceding work:
Cylinder head removed (01-415).
Valve springs removed (05-250).
Valves removed.





Valves	
(Intake valve 195, exhaust valve 196)	clean, check visually.
Valve stem	check for eccentricity (max. 0.03 mm).
Valve seat	check for eccentricity (max. 0.03 mm), grind.
Dimensions and angles	check (table).

Data

		Intake valve		Exhaust valve	
Engine		602.91	602.96 603.96	602.91	602.96 603.96
Valve head Ø (D)		37.90 38.10	37.90 38.10	34.90 35.10	34.90 35.10
Height (h) of valve head	New value	1.75-2.05	1.75–2.05	1.75–2.05	1.75–2.05
	Limit	1.6	1.6	1.6	1.6
Setting angle (a) for machining the valve		45" + 15'	45° + 15'	45° + 15'	45° + 15'
Valve stem Ø (D 1)		7.970 7.955	7.970 7.955	8.960 8.945	8.960 8.945
Valve seat reinforcement		with	with	with	with
Sodium filled		without	with	without	with
Valve length (L)		106.6 106.2	106.6 106.2	106.6 106.2	106.6 106.2
Width of valve seat		2.0	2.0	12.0	2.0
Max. permitted eccentricity on valve stem and valve seat		0.03	0.03	0.03	0.03
Marking on end of stem		E 601 02	E 601 04	A 601 05	A 601 05

From 04/87 only exhaust valves with valve heads from revised material have been fitted.

Production breakpoint: 04/87

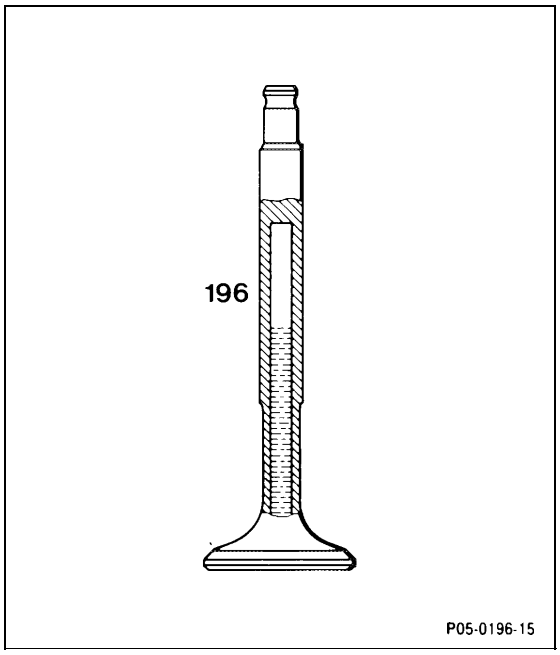
Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
201.126	602.911	040584-051637	009509-011200	374038- 407495	357034- 320983

Note
On turbo engines the surface of the inlet valve head is ground (non-machined on naturally aspirated engines).

The stem of the exhaust valve (196) is chrome-plated and filled with sodium on turbo engines.

⚠ Warning
Unserviceable sodium-filled valves must be neutralised before scrapping. They must therefore be collected by the respective departmental supervisor and dispatched to:

Mercedes-Benz AG
Werk Marienfelde
Daimlerstraße 145
Anlieferstelle KST 3153
Arbeitsvorbereitung TAI



196 Exhaust valve

The location of the hydraulic valve clearance compensating elements must be checked after machining or replacing the valves, and corrected if required (05211).

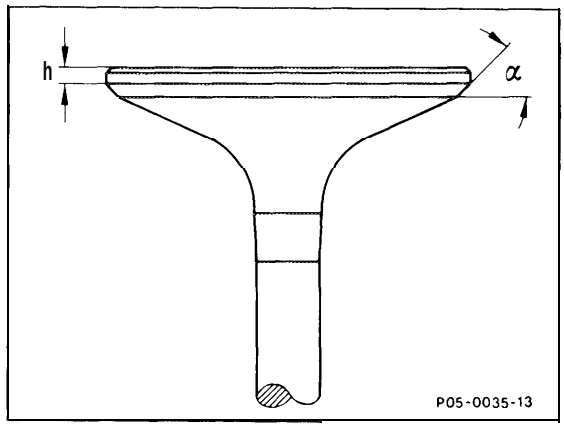
Conventional tools

Valve grinder or Valve poppet turning equipment	e. g.	Krupp, D-5309 Meckenheim Model VS
	e. g.	Hunger, D-8000 München 70 Model VKDR 1 Part No. 203.00.200
Dial gauge	e. g.	Mahr D-7300 Esslingen Part No. 810

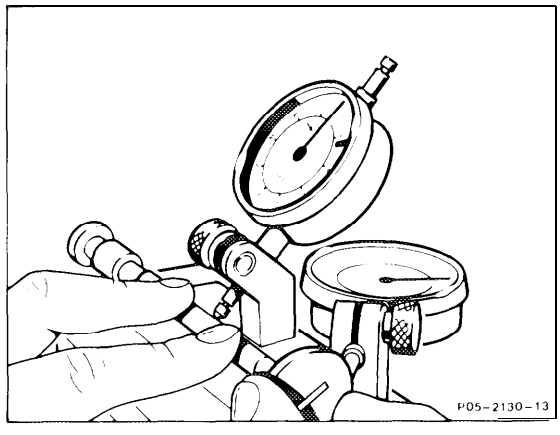
Checking and machining

1 Clean valves and carry out visual inspection.

Valves with a burnt valve head, with insufficient valve head height (h) and with worn or scored valve stem should be replaced.



2 Measure eccentricity on valve stem.
Replace valve if eccentricity exceeds 0.03 mm.

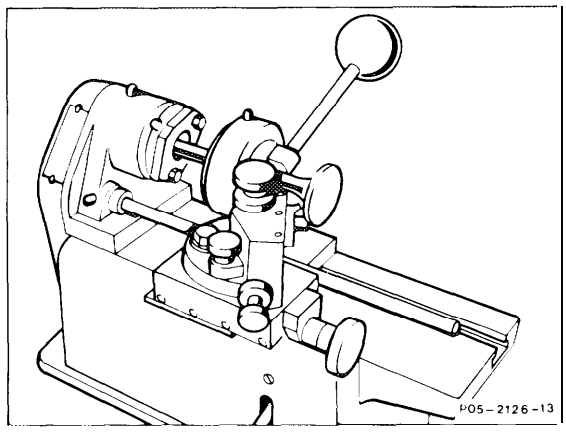


3 Machine valve seat.

Note operating instructions for the machining equipment and adjustment angle (a) 45” + 15’.

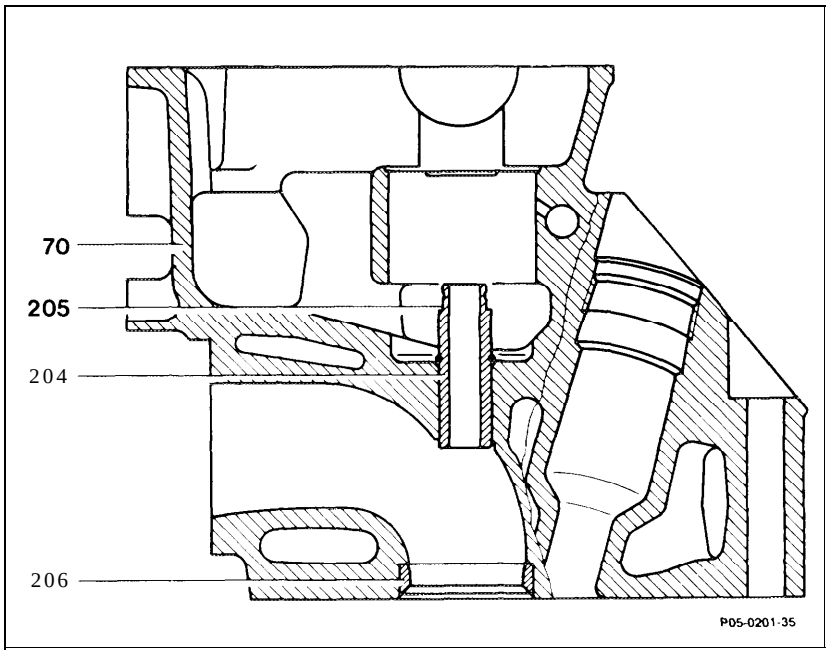
4 Measure eccentricity on valve seat and height (h) of valve head.

If eccentricity is more than 0.03 mm or the height (h) less than 1.6 mm, valve should be replaced.



05-285 Checking and replacing valve guides

Preceding work:
Cylinder head removed (01-415).
Valve springs removed(05-250).
Valves removed.



Checking

Seat for valve stem seal (205)	check. Replace valve guide (204) if valve stem seal is loose.
Valve guide (204)	clean. Cylindrical brush 000 589 10 68 00.
Valve guide (204) inside ∅	check. Plug gauge: 102 589 00 23 00 intake, 117 589 03 23 00 exhaust. Replace valve guide, if reject pin of plug gauge fits completely in the valve guide.

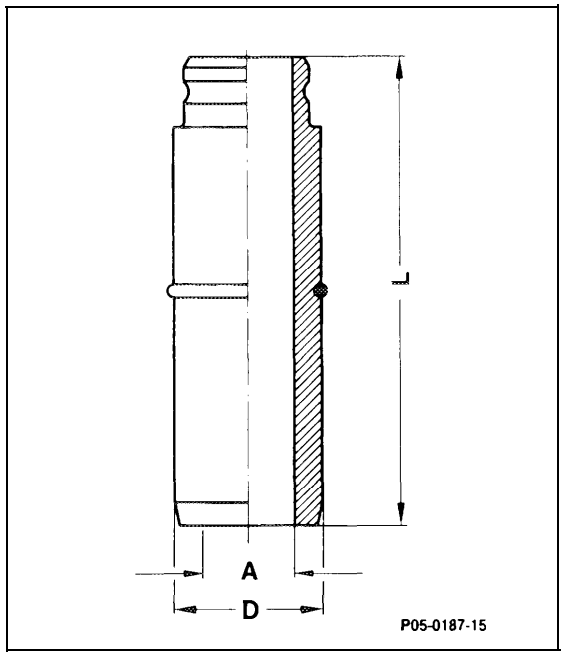
Replacement

Valve guide (204)	drive out, drive home. Drift: 103 589 03 15 00 intake, 103 589 02 15 00 exhaust. Punch: 601 589 06 15 00 intake, 601 589 02 15 00 exhaust. Ream, Reamers: 000 589 21 53 00 intake 000 589 10 53 00 exhaust

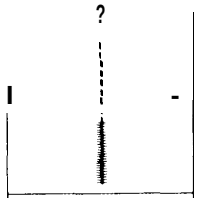
Basic bore of valve guide in cylinder head (70)	check. If required bore out to next repair stage. Broach (14.20 mm) 115 589 00 53 00. Guide sleeves: 102 589 00 63 00 intake, 102 589 08 63 00 exhaust. Broach (14.40 mm) 115 589 01 53 00 Guide sleeve 601 589 15 63 00.
Valve seat insert (206)	check for eccentricity (05-291).

Valve guides (grey cast iron)

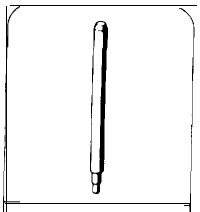
	Design and Part No.	Outside Ø (D)	Color marking	Basic bore in cylinder head	Overlap	Valve guide inside Ø (A)	Length (L)
Intake	Repair stage I 601 050 07 24	14,240-14,251	rot	14,200–14,211	0,029–0,051	8,000–8,030	39,5
	Repair stage II 601 050 08 24	14,440–14,451	weiß	14,400–14,411			
Ex-haust	Repair stage I 601 050 10 24	14,240–14,251	rot	14,200–14,211	0,029–0,051	9,000–9,050	37,7
	Repair stage II 601 050 11 24	14,440–14,451	weiß	14,400–14,411			



Special tools

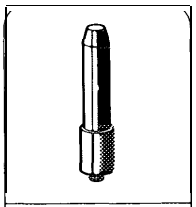


000 589 10 68 00
05

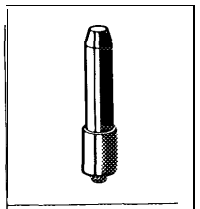


103 589 03 15 00
05

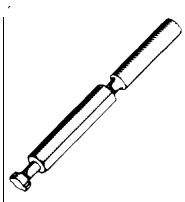
103 589 02 15 00
05



601 589 06 15 00
05



601 589 05 15 00
05



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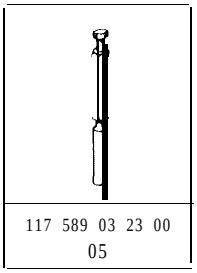
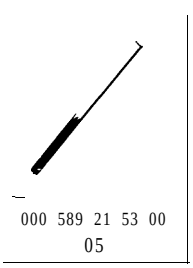
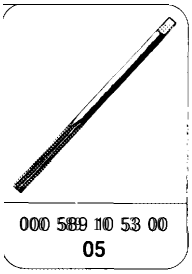


117 589 03 23 00
05



000 589 21 53 00
05



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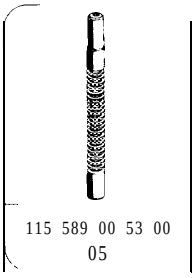
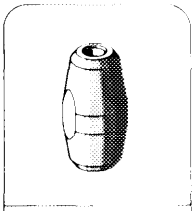
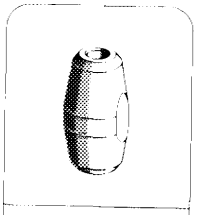
05



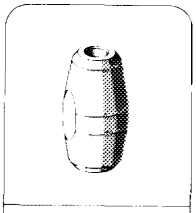
115 589 00 53 00
05



102 589 00 63 00
05



102 589 08 63 00
05



601 589 15 63 00
05

115 589 01 53 00
05

Conventional tool

Cylinder head clamping fixture	e. g.	Hunger, D-8000 München 70 Part No. 221.60.000

Broach base bore in cylinder head (Repair stage)

Decarbonize and clean cylinder head carefully, particularly the inside of the valve seat inserts. Select correct guide sleeve (2) and remove swarf from the tip of the broach (1) with a stiff plastic brush or similar tool.

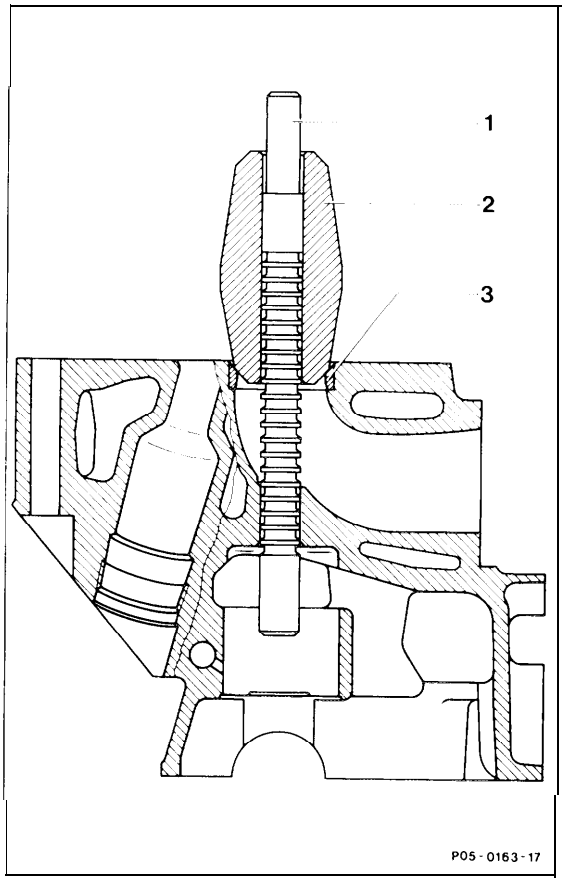
Note

The broach cutter must be cleaned before each broaching operating.
Provide guide sleeve, basic bore and complete broach with ample supplies of paraffin.

Insert broach into the guide sleeve so that when the guide sleeve rests on the valve seat insert (3) the first cutter of the broach is located in the base bore. In so doing note that the correct side of the guide sleeve is put on the valve seat. Centre guide sleeve by rotary movements in the valve seat insert.

Note

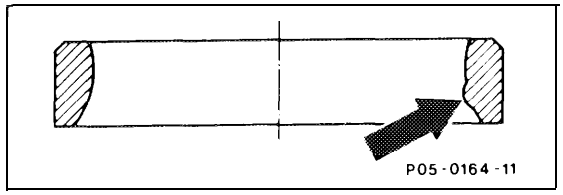
Drive the broach quickly through with an aluminium mandrel, approx. 130 mm long, and a plastic hammer of approx. 250 g.



1 Broach
2 Guide sleeve
3 Valve seat insert

Note

The high spot (arrow) on the intake valve seat inserts is to be removed before inserting the guide sleeve.



Inserting valve guide

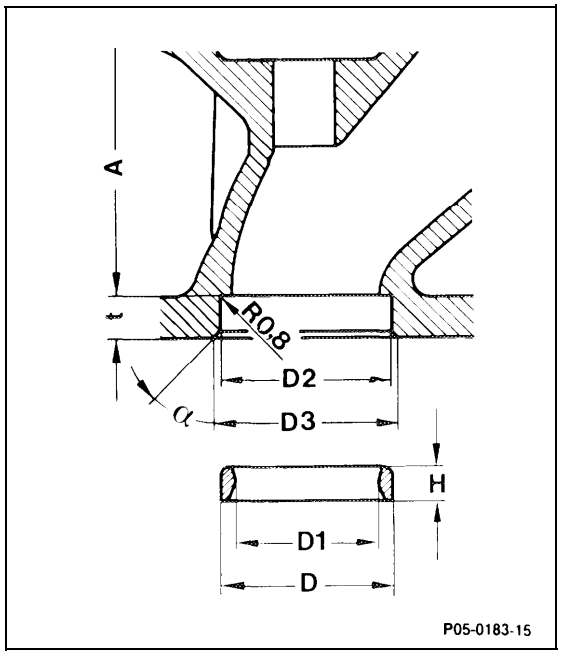
Drive home valve guides with punch and hammer, when the valve guides are not super-cooled and the cylinder head is not heated up. Coat valve guides with wax or oil before driving home.

Assignment of guide sleeve - valve seats

Valve seat	Guide sleeve Part No.	Basic bore ∅ in cylinder head
Intake Exhaust	102 589 00 **63 00**	14.2 mm
Intake Exhaust	601 589 15 **63 00**	14.4 mm

05-290 Replacing valve seat inserts

Preceding work:
Valve guides checked (05-285).



Valve seat insert	turn out valve seat insert with the lathe tool. Note operating instructions for the valve seat turning equipment.
Basic bore (D2)	check (table). Bore out to the repair stage, if required.
	Caution! Machine basic bore for the valve seat insert if minimum overlap is not achieved (Number 3).
Valve seat insert	supercool with liquid nitrogen and insert into basic bore.
	⚠ **Warning** Do not touch supercooled valve seat inserts with bare hands. Valve seat insert must be square to the cylinder head.
Valve seats	machine (05291).

Data

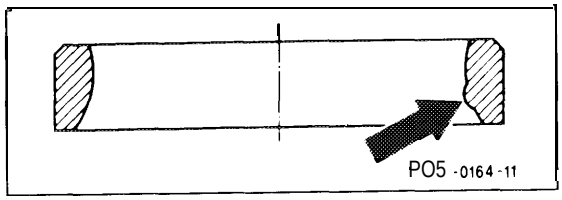
		Intake	Exhaust
Overlap of valve seat inserts in cylinder head		0.068 – 0.100	0.068 – 0.100
D 2	Standard dimension	40.000 40.016	37.000 37.016
	Repair stage max. up to	40.500 40.516	37.500 37.516
D	Standard dimension	40.100 40.084	37.100 37.084
	Repair stage	40.600 40.584	37.600 37.584
D 1		33.400 33.600	30.400 30.600
H	Standard dimension	6.955 7.045	6.955 7.045
	Repair stage	7.155 7.245	7.155 7.245
t (New value)		9.35 9.25	9.35 9.25
D 3		43.0 43.4	40.0 40.4
A (Thrs dimension is valid up to the upper edge of cylinder head on reworked cylinder head parting surface)		133.4	133.4
a		37" 30'	37" 30'

Note

Exhaust valve seat inserts are made from centrifugally cast material on the naturally-aspirated engines, and sintered metal on turbo engines.

The intake valve seat inserts are made from sintered metal on all engines.

The hardened valve seat inserts (sintered metal) had a high spot (arrow) on inside of the insert for a short time.



This high spot must be turned off in order to machine the valve seat insert. There is a repair valve seat insert with larger outside diameter as a replacement part for all valve seat insert designs. After replacing the valve seat inserts the location of the hydraulic valve clearance compensating elements must be checked and corrected, if necessary (05211).

Conventional tools

Cylinder head clamping fixture	e. g.	Hunger, D-8000 München 70 Part No. 221.60.000
Seat insert lathe tool, size 2	e. g.	Hunger, D-8000 München 70 Part No. 220.03-I 10
Valve seat turning equipment, model VDSNL 1 45 30	e. g.	Hunger, D-8000 München 70 Part No. 236.03.308
Test set for valves	e. g.	Hunger, D-8000 München 70 Part No. 216.93.300
65° correction steel No. 13 for lower correction angle	e. g.	Hunger, D-8000 München 70 Part No. 216.64.622
Internal-thread-measuring equipment (range 25 - 60 mm)	e. g.	Mahr, D-7300 Esslingen Part No. 844
External micrometer (range 25 - 50 mm)	e. g.	Mahr, D-7300 Esslingen Part No. 40 S

Replacement

1 Turn out old valve seat insert with lathe tool.

Note operating instructions for the tool.

2 Check valve guides, replace if required (05285).

3 Measure basic bore D2.

A new valve seat insert standard dimension can be used, when the specified overlap exists.

If the minimum overlap is not achieved, machine basic bore for valve seat insert.

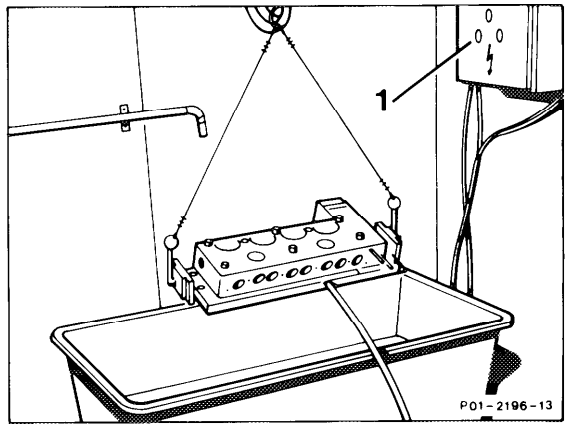
4 Turn basic bore D2 with the seat insert lathe tool so that the bore is properly cleaned up.

5 Measure machine base bore.

6 Turn valve seat insert repair stage so that the specified overlap is produced. Compensate height of reworked front face, if applicable.

7 Heat up cylinder head to approx. 80°C in water bath.

8 Supercool valve seat insert with liquid nitrogen.

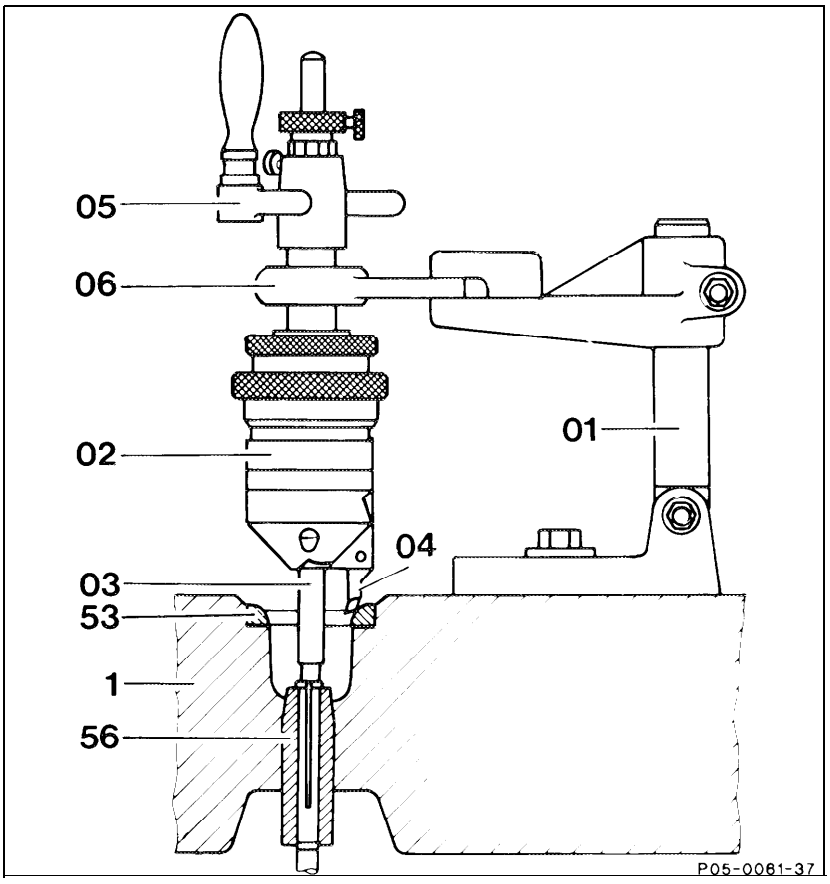


Drive home valve seat insert with suitable pilot bar.

10 Machining valve seats (05291).

05-291 Machining valve seats

Preceding work:
Valve guides checked (05-285).



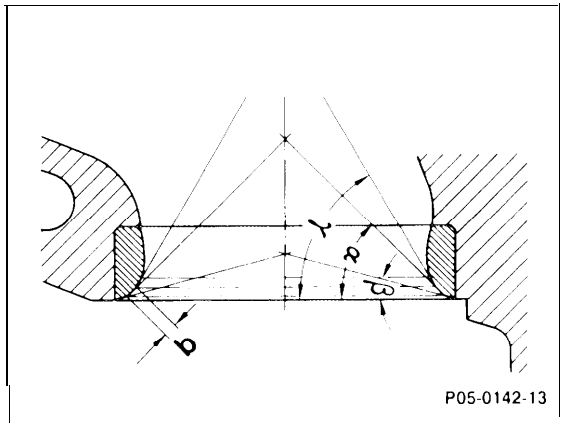
Valve seats (53)	machine in accordance with tool manufacturer's operating instructions. Refer to data for adjustments.

Note
Only loosen the pilot when eccentricity of the valve seat has been checked.

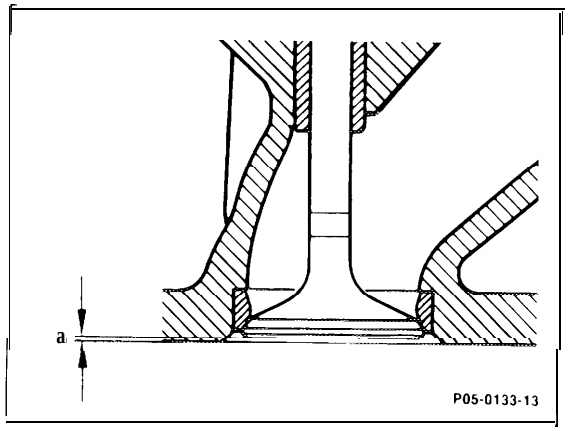
Eccentricity of valve seat	check (Number 2).
Valve seat width (b)	measure, correct if required (Number 3).
Valves	insert and measure distance (A).

Data

Valve seat	Intake	Exhaust
Valve seat width (b)	1.2 – 1.7	1.5 – 2.0
Valve seat angle (a)	45”	45”
Upper correction angle (β)	15°	15°
Lower correction angle (Y)	65°	65°
Permitted concentricity deviation of valve seat	0.03	0.03
Minimum gap (a) on new valves and new valve seats	0.1 – 0.5	0.1 – 0.5
Gap (a) on reworked valve seats and reground valves	– 1.0	– 1.0



The gap (a) reduces by the same amount as cylinder head parting surface has been reworked.



Conventional tools

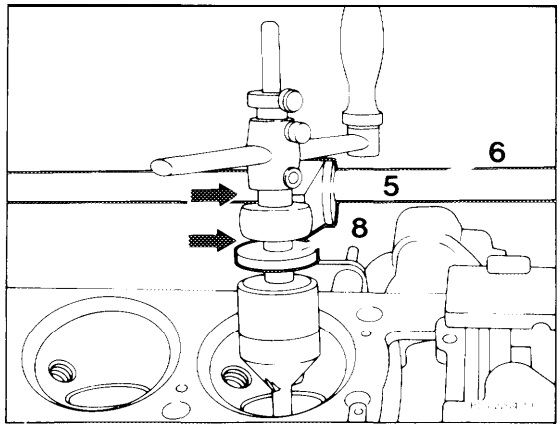
Cylinder head clamping fixture	e. g.	Hunger, D-8000 München 70 Part No. 211.60.000
Valve seat turning equipment, model VDSNL 1/45 30	e. g.	Hunger, D-8000 München 70 Part No. 236.03.308
Test set for valve seats	e. g.	Hunger, D-8000 München 70 Part No. 216.93.300
65° correction steel No. 13 for lower correction angle	e. g.	Hunger, D-8000 München 70 Part No. 216.64.622

Note
Clamp cylinder head in the clamp fixture for dismantling and machining. Machine valve seats with valve seat turning equipment, with valve seat grinder or valve seat miller. The location of the hydraulic valve clearance compensating elements must be checked after machining the valve seat Inserts and, if required corrected (05211).

Machining valve seats

1 Machine valve seat (45") (see tool manufacturer's operating Instructions).

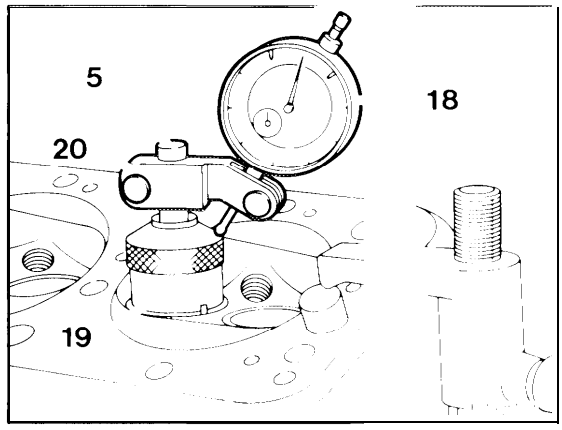
Caution!
Only loosen pilot (5) when eccentricity of the valve seat has been checked.



6 Clamping fixture
8 Forward feed operation

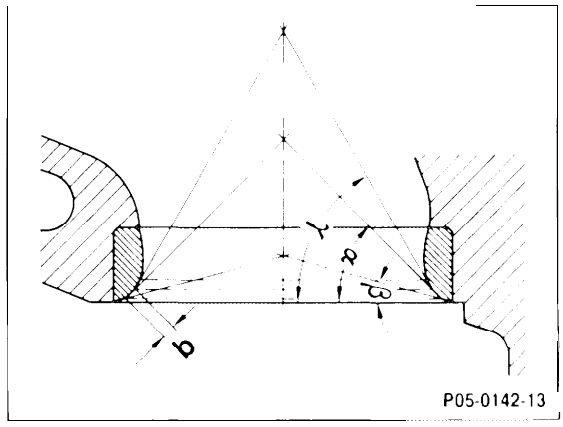
2 Check eccentricity of valve seat (max. **0.03** mm).

Slide fitting sleeve (19) and dial gauge holder (20) and dial gauge (18) onto the pilot (5).



3 Measure valve seat width (b) and, if required make a 15" adjustment at the top (β) and 65" adjustment at the bottom (γ).

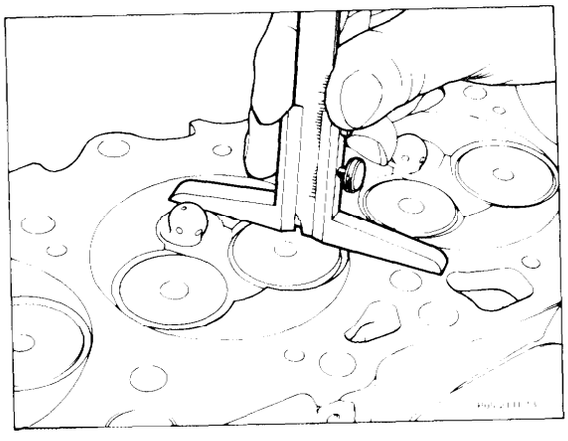
Valve seat width (b)
Intake: 1.2 - 1.7 mm
Exhaust: 1.5 - 2.0 mm.



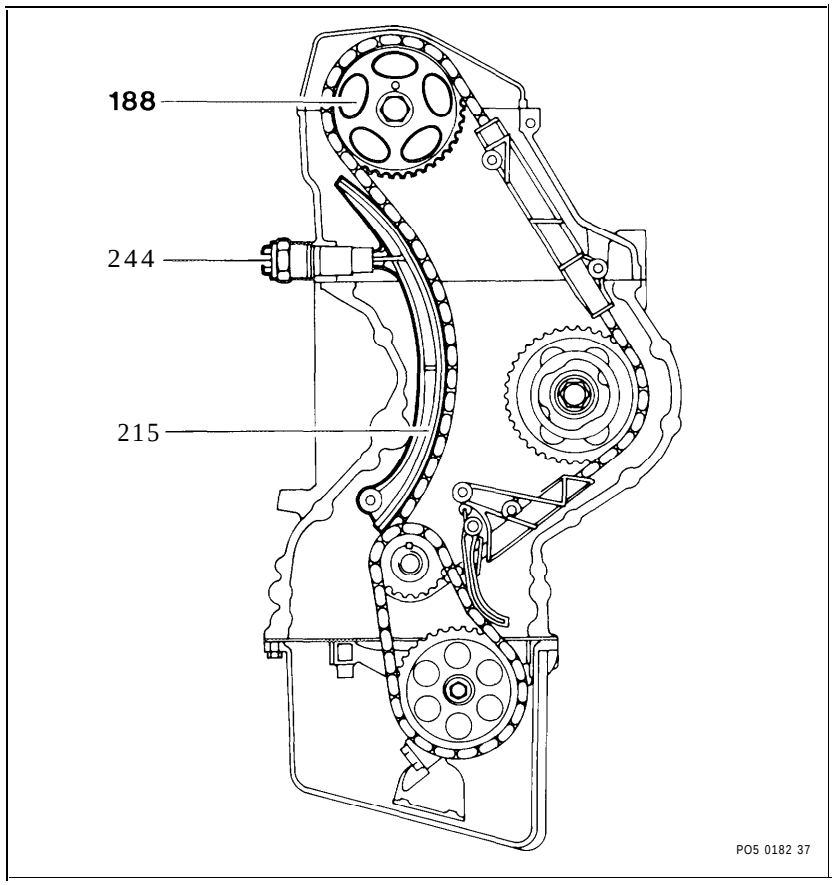
4 Insert valves and measure distance (a).

Distance (a) 0.1 - 0.5 mm.

If (a) IS outside tolerance, replace valve seat insert (05290).



OS-31 0 Removing and installing chain tensioner



Chain tensioner (224)	remove, install, 65 Nm. Replace sealing ring and install chain tensioner filled with SAE 10 engine oil.

Filling chain tensioner with engine oil:

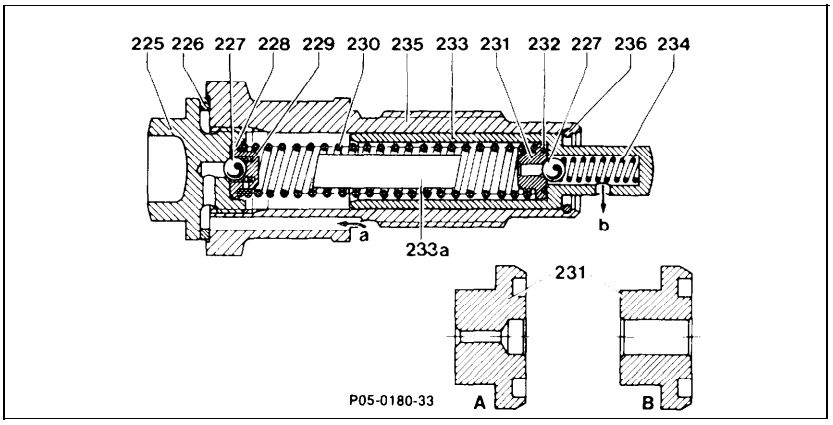
Place chain tensioner with the plunger bolt downwards in SAE engine oil until over the collar on the hexagon. Press plunger up to the stop 7 - 10 times slowly with the aid of a press or power drill.

It should be possible to compress the chain tensioner quite slowly, evenly and with little effort after filling with oil.

Note

A revised valve disk (231) has been fitted in the chain tensioner in order to avoid peak pressures of the chain tensioner on the tensioner rail.

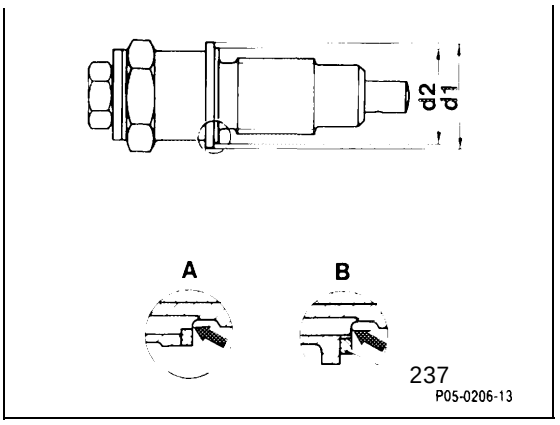
225	Sealing plug
226	Aluminium gasket A 25x30
227	5 mm Ø ball
228	Ball guide
229	Compression spring
230	Compression spring
231	Valve disk
232	0-rrng
233	Plunger
233a	Filler piece
234	Compression spring
235	Housing
236	B 16 snap ring
a	Supply bore from cylinder head
b	To oil pan
A	Former design
B	Current design



The outside diameter of the sealing surface on the chain tensioner housing has been enlarged by 2 mm. This necessitates a sealing ring (237) having dimensions of 27 x 32 mm (previously 25 x 30).

This revision prevents the formation of burrs on the sealing ring (picture, circular cut-out) when tightening the chain tenstoner.

This chain tensioner can also be installed in vehicles of earlier manufacture.



d1 32 mm
d2 27 mm

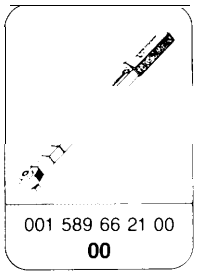
A Previous design
B Revised design

Production breakpoint: 07/87

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.133 124.193	603.960	–	013741	*	*
126.125	603.961	–	013507	*	*
201.126	602.911	047439	010643	*	*
201.128	602.961	–	001540	*	*

* not recorded

Special tool



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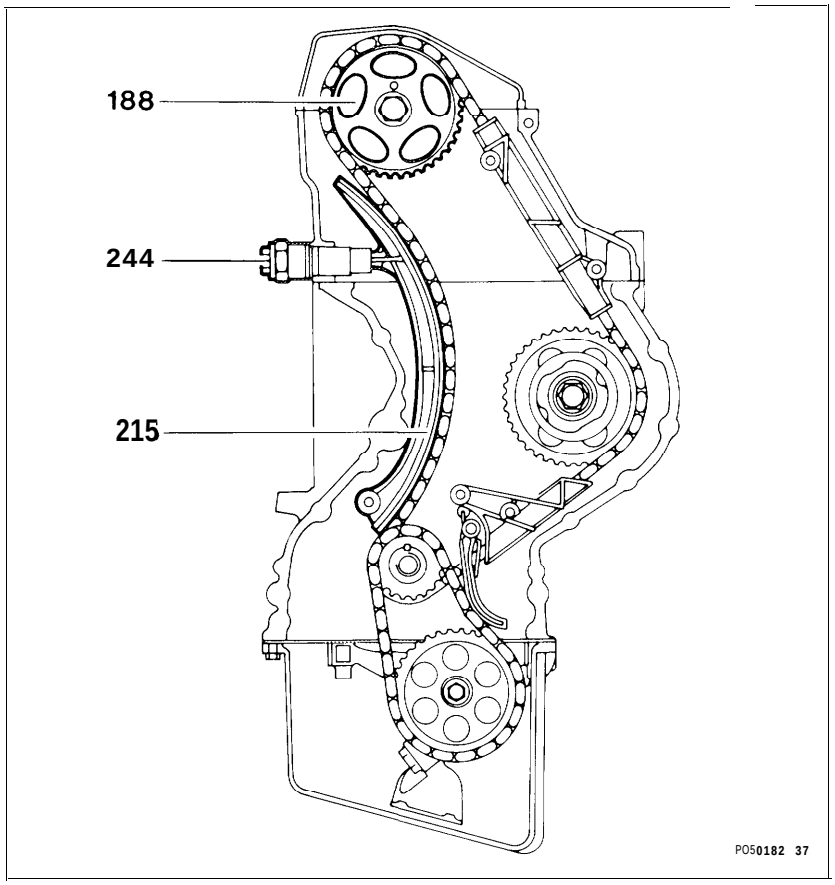
05-320 Renewal of timing chain

Preceding work:
Cylinder head cover removed.
Injection nozzles removed (07.1-230).
Fan and fan shroud removed (20-312 or 20-335).

Operation No. of Operatron Texts and Work Units, Standard Texts and Flat Rates . 05-7601



Chain tensioner (244)	Remove and install (05-310).
Camshaft timing gear (188) . . , ... , ... ,	check for scores and pitting (Number 2).
Timing chain	separate, mount new timing chain with connecting link to the old timing chain, turn engine and raise old timing chain and detach (Numbers 3 - 5).

Caution!
The timing chain must remain in engagement on the camshaft and crankshaft gear as the engine is turned.

Timing chain	..	insert connecting link from behind and rivet the link pins individually with assembly tool 000 589 58 43 00 (Numbers 6 - 10). Tightening torque of spindle 30 - 35 Nm.
Link pin rivet	....	check (Number 11).
After installation ...	....	turn crankshaft, check adjustment marking at TDC position (Number 13).

Note

Since 10 86 timing chains from an additional manufacturer have been fitted (Daido).

Identification: DID and 06BD on outer clip of the timing chain.

Production breakpoint: 1 0/86

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.133 124.193	603.960		005200-005645	351660-358256	024286-024446
126.125	603.961	–	**006408-006754**	290826-293731	*
201.126	602.911	029125-029709	007079-007246	335707-338278	287778-291247
201.128	602.961	–	000107-000107	335707-338278	*

* not recorded

Since 02 89 timing chains have increased clearance sleeves (Iwis Company).

Production breakpoint: 02/89

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.128	602.962	000008	001573	*	*
124.133 124.193	603.960	–	020941	*	*
201.126	602.911	074630	015102	*	*
201.128	602.961	–	005500	*	*

* not recorded

Since 09 89 timing chains (Daido Company) have been installed again.

Production breakpoint: 09/89

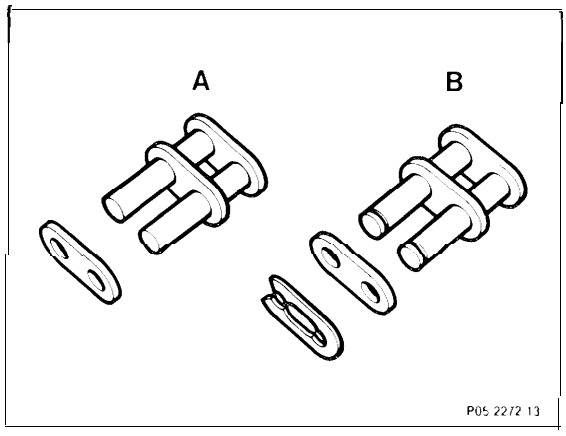
Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A B	F
124.128	602.962	000071	002989	068356	*
124.133 124.193	603.960	**–**	**023241**	**066158**	**122989**
126.135	603.970	–	*	488196	*
201.126	1602.911	1082936	016428	533524	666204
201.128	602.961	000121	007042	*	667950

* not recorded

Repair timing chain

Only a riveted design of connecting link (A) is available for the timing chain. Design (B) is not to be used.

The outer clips of connecting link (A) are colored blue and its link pins have no grooves.

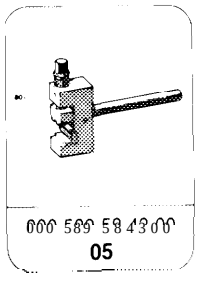


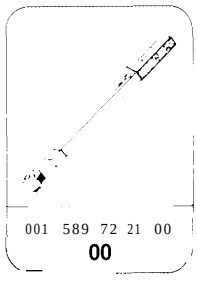
The outer clip of revised connecting link (A) must be pressed on and riveted with assembly tool 000 589 58 43 00.

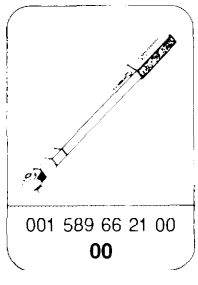
The former assembly tool 000 589 57 43 00 for connecting link with stop spring (B) can be modified with the conversion kit 000 589 58 43 80.

Part No. of the assembly tool is to be changed to 000 589 58 43 00.

Special tools







Renewal

1 Remove chain tensioner (05310)

2 Check camshaft timing gear for scores and pitting. Cover chain case with a cloth and grind off both link pins at a timing chain link.

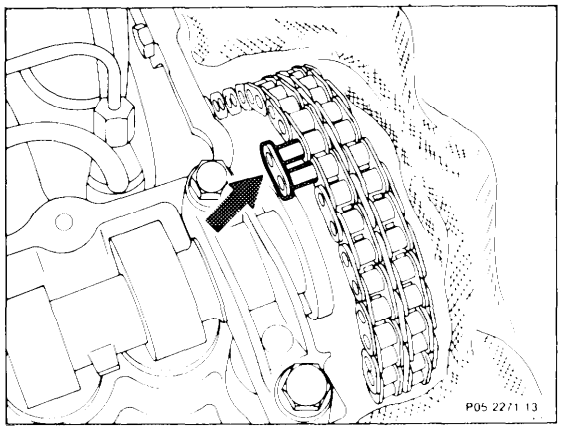
3 Mount new timing chain with connecting link on the old timing chain.

4 Slowly turn crankshaft in the direction of rotation of the engine, while simultaneously raising the old timing chain until the connecting link is located at the uppermost position of the camshaft timing gear.
Pull out the released end of the old timing chain evenly, to match pulling on the new timing chain.

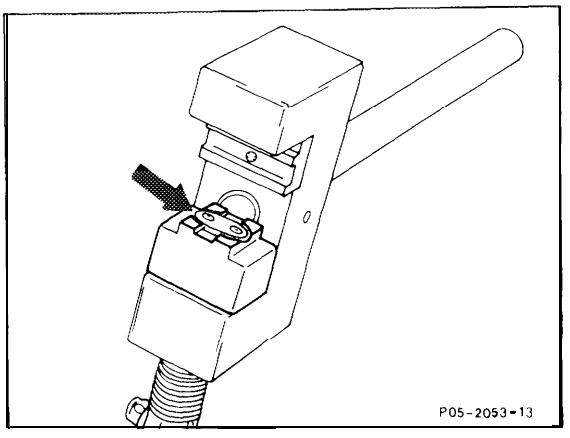
Caution!
The timing chain must remain engaged with the camshaft and crankshaft gear while engine is turned.

5 Detach old timing chain and connect the ends of the new timing chain with a connecting link. Secure ends of chain on camshaft timing gear with wire.

6 Insert connecting link in the timing chain from behind (arrow).

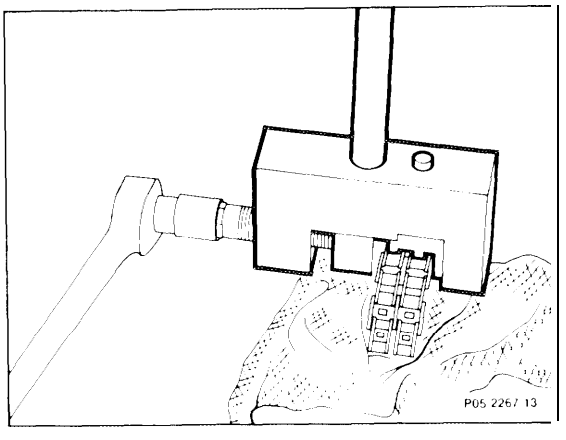


7 Place loose enclosed outer clip of the connecting link (with the IWIS marking stamped on) in assembly tool 000 589 58 43 00 (arrow). The outer clip is retained magnetically.

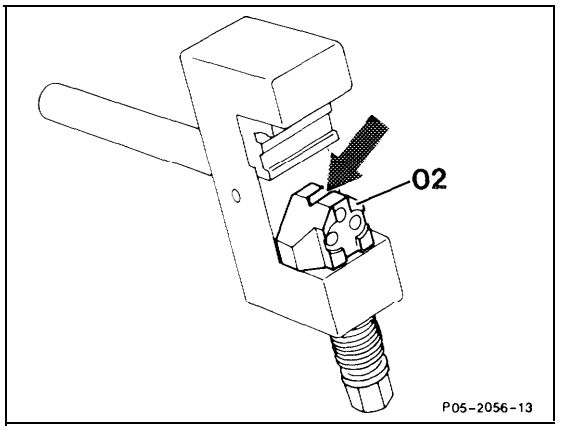


8 Put assembly tool 000 589 58 43 00 on connecting link and press on clip up to the stop.

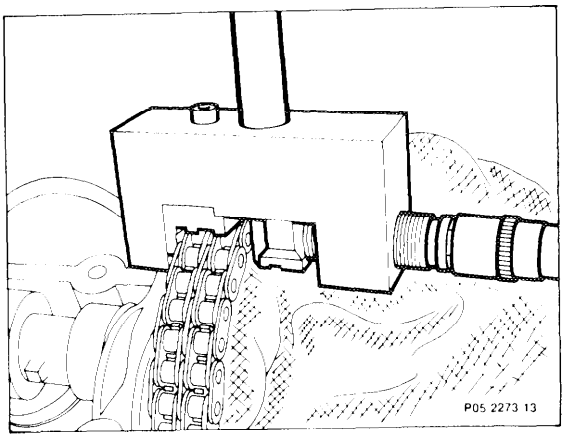
Caution!
Put clip on so that both rivet pins engage.



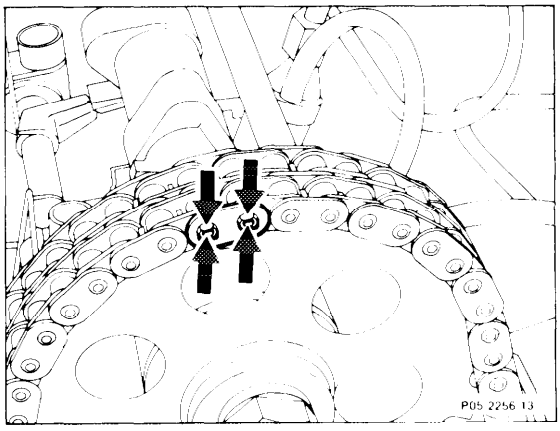
9 Turn punch (02) of assembly tool 000 589 58 43 00 so that the notch (arrow) points forwards.



10 Place assembly tool exactly over the center of the pins. Rivet the connecting link pins individually, whilst tightening spindle to approx. 30 - 35 Nm (Reference value).

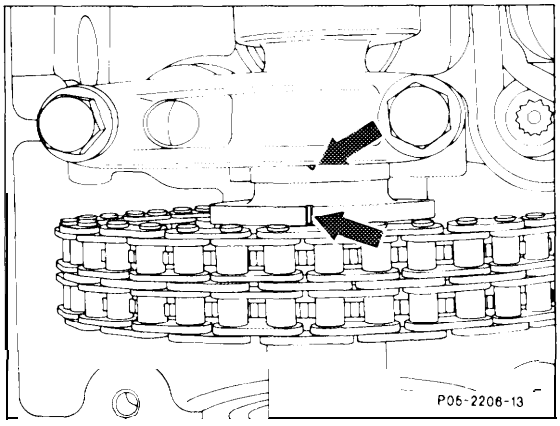


11 Check link pin rivet, if necessary re-rivet (arrows).



12 Install chain tensioner (05-310).

13 Turn crankshaft and check adjustment marking at TDC position of engine.

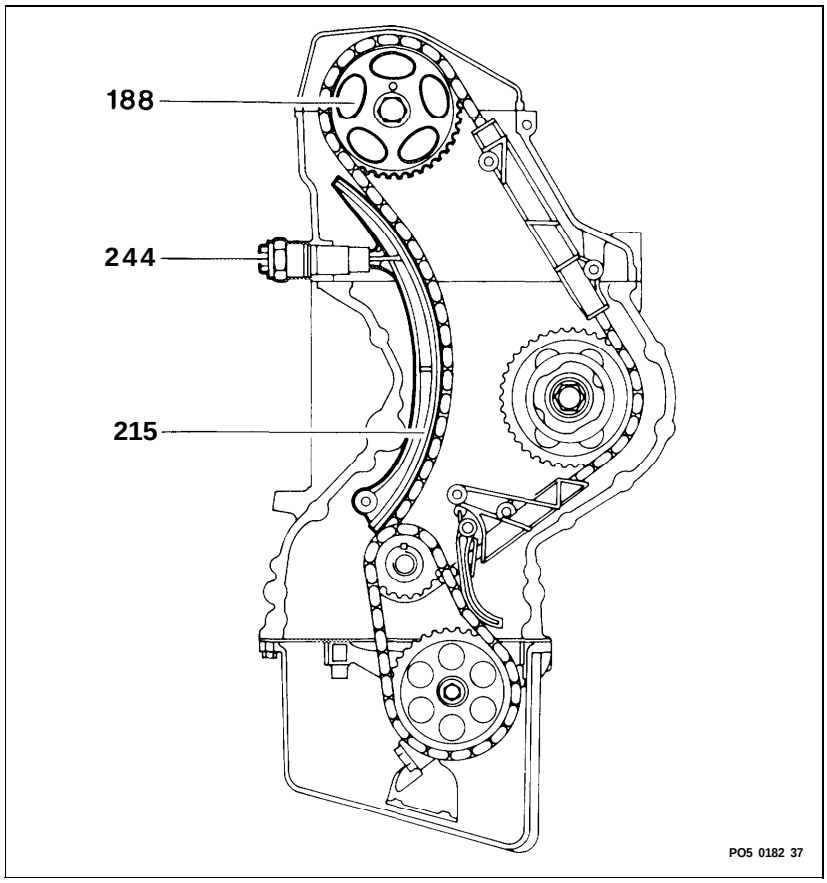


Note

If adjustment markings do not align, the camshaft timing (05-215) and start of delivery of the injection pump (07.1-I 11) must be checked.

05-330 Removal and installation of tensloner rail

Preceding work:
Cylinder head removed (01-4 15)
Timing case cover removed (01-210)
Chain tensioner removed (05-310).



Tensioner rail (215) ..... pull off, reinstall.

Note
Plastic support of the tensioner rail cannot be replaced.

Note

Since 08 86 unhardened straight pins have been fitted for the tensioner rail bearing.

Production breakpoint: **08/86**

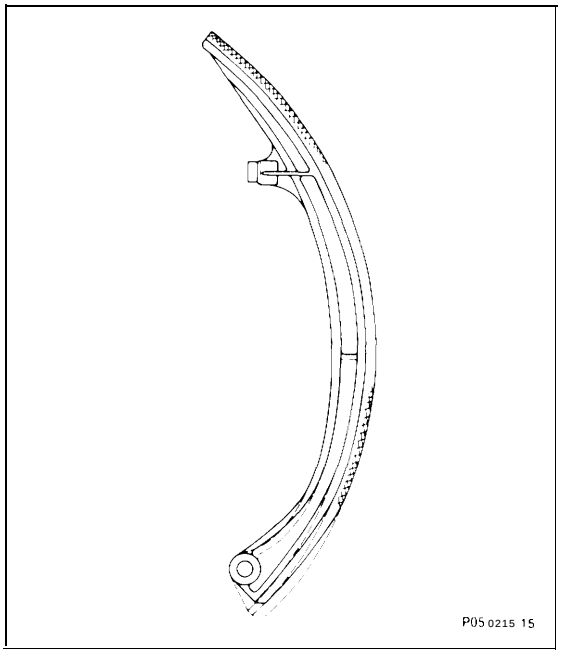
Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.133 124.193	603.960	–	003526	313431	019062
126.125	1603.961	–	004997	278305	*
201.126	602.911	025293	006190	332559	266086

* not recorded

Data

Since 09 86 the lead-in tangent (abutment surface) on the tensioner rail has been extended, thus reducing lining wear.

Dotted line shows former design.



Production breakpoint: 09/86

Model	Engine	Engine end No. Manual transmission	Automatic transmission	Vehicle identification end No. A	F
124.133 124.193	603.960	–	004863	342586	023347
126.125	603.961	–	006205	389319	*
201.126	602.911	028504	006859	333489	286635

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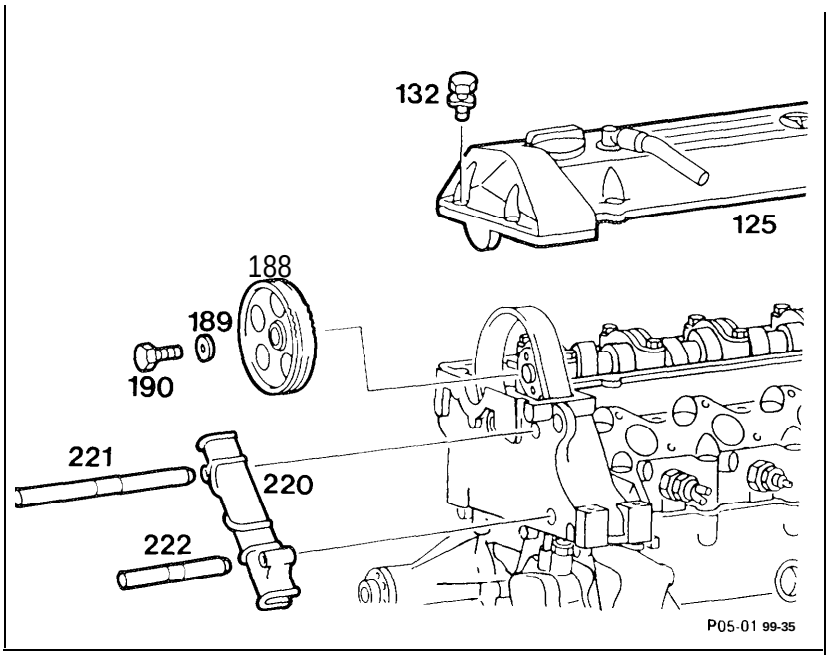
05-341 Removal and installation of guide rail

Preceding work:
Poly-V belt removed (13-345).
Chain tensioner removed (05-310)
Charge air pipe removed (turbo engines).

A. Removal and installation of guide rail in cylinder head

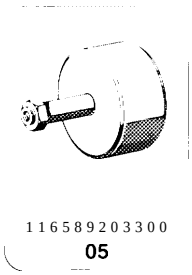


Cylinder head cover (125)	remove, install, bolt (132) 10 Nm.
With self-levelling suspension:	
Pressure oil pump drive	remove, install (05437).
Camshaft timing gear (188)	mark at timing chain. Remove, install camshaft timing gear. Different bolts (190) and washers (189) with different tightening torques. Hexagon bolt 65 Nm. Bihexagonal head bolt 25 Nm 90° (05220) (Numbers 3 - 5).

Bearing pins (221, 222)	.....	remove, install. Special tools 116 589 20 33 00 and 116 589 01 34 00. Check guide blade (220), replace if necessary. (Number 6). **Caution!** The extractor 115 589 20 33 00 can be used together with stud 115 589 01 34 00 if the bearing pins have seized.

Tightening torques and angle of rotation	Nm	
Hexagon bolts on cylinder head cover	10	
Hexagon bolt on camshaft timing gear	65	
Bihexagonal head bolt on camshaft timing gear	**25**	**90”**

Special tools



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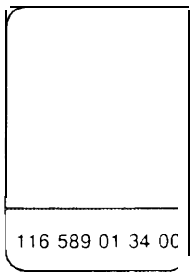
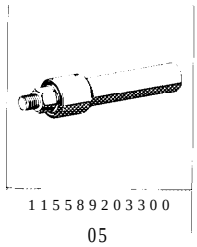


116 589 01 34 00



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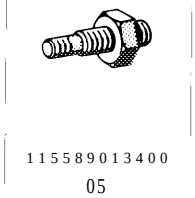

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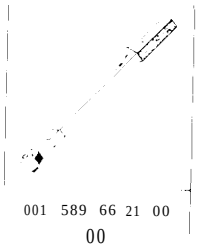

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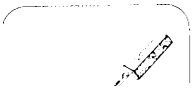

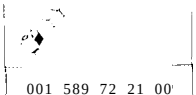

001 589 72 21 00
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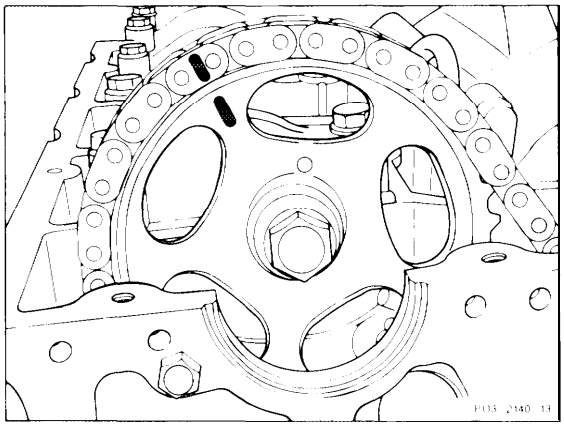
Removal

1 Remove cylinder head cover.

With **self-levelling** suspension:

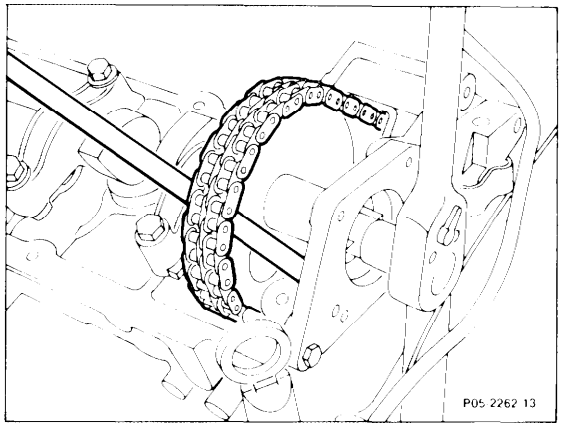
2 Remove pressure oil pump drive (05437).

3 Align timing chain and camshaft timing gear.



4 Remove hexagon bolt or bihexagonal head bolt on camshaft timing gear, while holding camshaft with a mandrel.

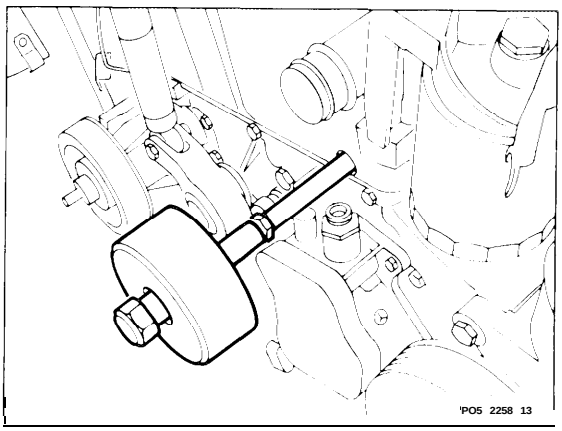
5 Remove camshaft timing gear and allow timing chain to sag.



Caution!

Note different bolt and washer (05220).

6 Drive out both bearing bolts with the Impact puller 116 589 20 33 00, and 116 589 01 34 00 and remove guide rail. Check guiderail and replace if necessary.



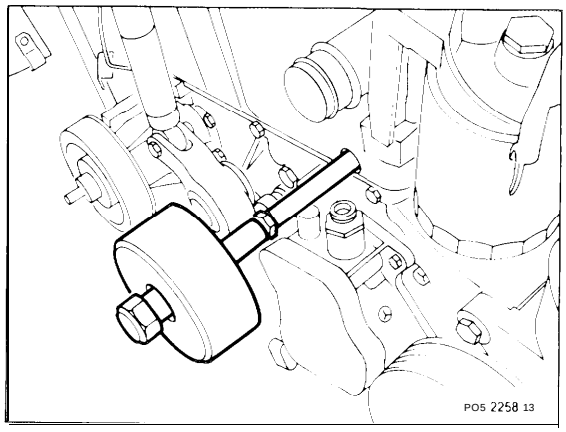
Caution!

Seized bearing bolts can also be pulled out with puller 115 589 20 33 00 and stud 115 589 01 34 00.

Installation

6 Coat bearing pin collar with sealing compound.

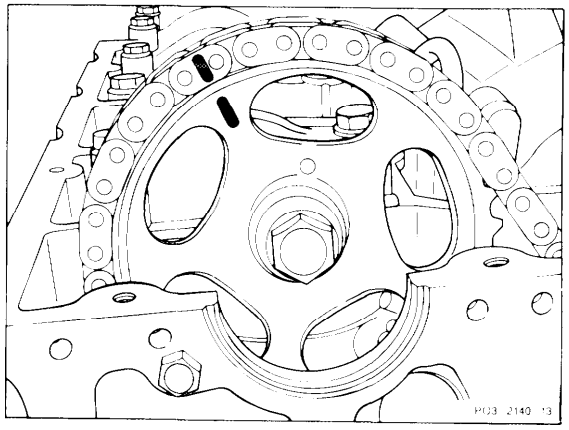
7 Insert guide rail and drive home bearing pin with impact puller 116 589 20 33 00 and 116 589 01 34 00.



8 Install camshaft timing gear according to the marking and tighten, noting the color markings.

Tightening torque and angle of rotation

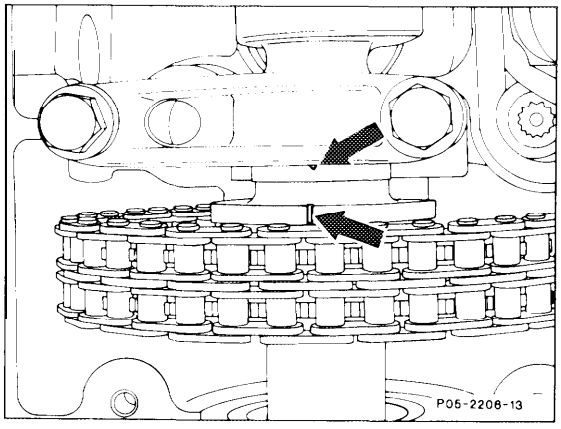
Hexagon bolt	65 Nm,
Bihexagonal head bolt	25 Nm, 90°.



9 Position engine on ignition TDC of No. 1 cylinder and check marking (arrows).

⚠ Warning

Do not turn engrne by camshaft timing gear bolt.



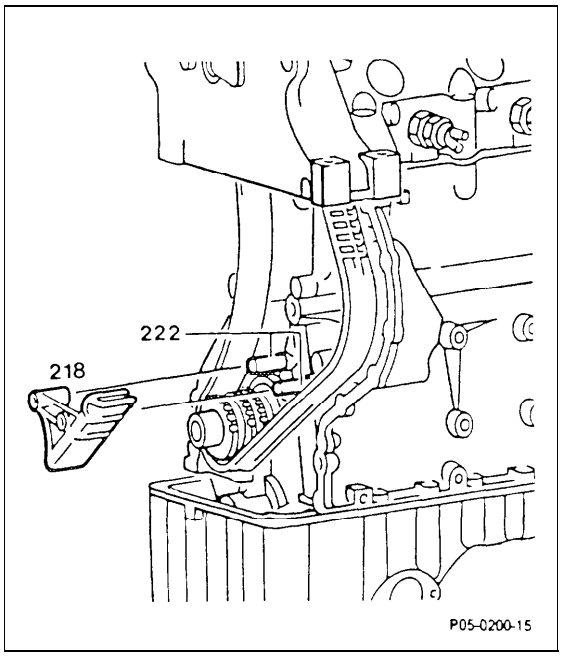
With self-levelling suspension:

10 Install pressure oil pump drive (05-437).

11 Install cylinder head cover, 10 Nm.

Preceding work:
Timing case cover removed (01-210).
Chain tensioner removed (05-310).

B. Removal and installation of guide rail in timing case



Guiding rail (218) . . . . . pull off from guiding blade bolt (222), put on. Check guiding rail, renew if necessary.

Note
Since 09 86 unhardened straight pins have been fitted for the guiding rail bearing.

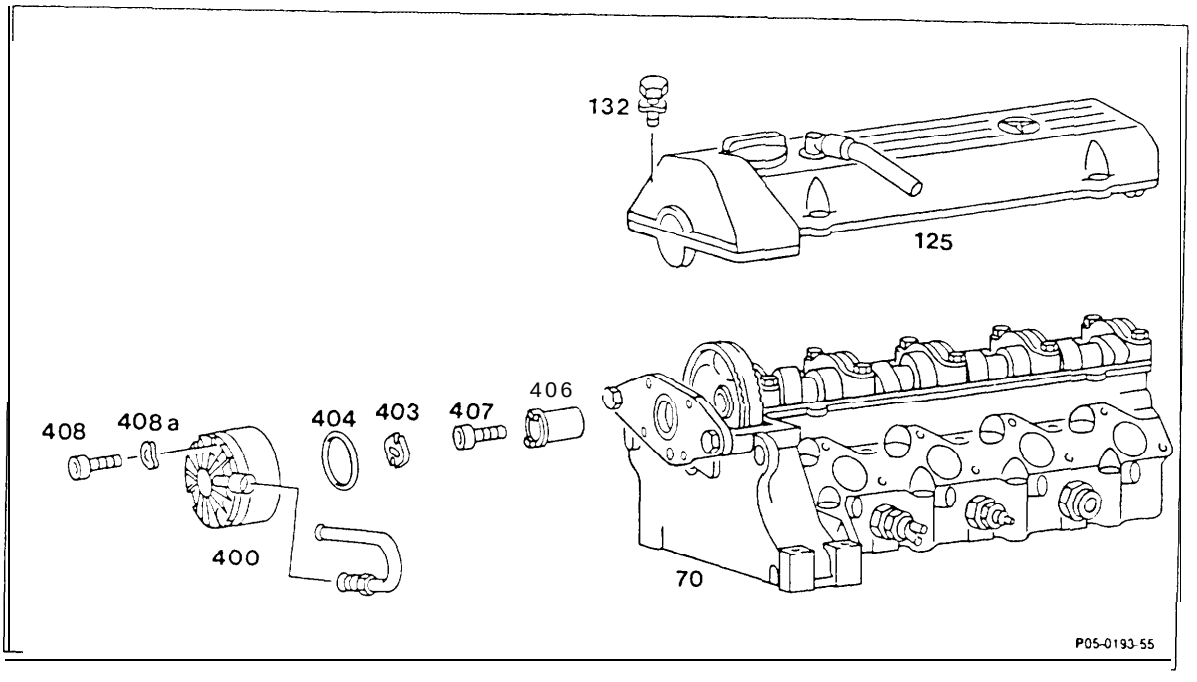
Production breakpoint: 08/86

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.133 124.193	603.960	–	003526	313431	019062
126.125	603.961	–	004997	278305	*
201.126	602.911	025293	006190	332559	266086

not recorded

05-437 Removal and installation of pressure oil pump drive

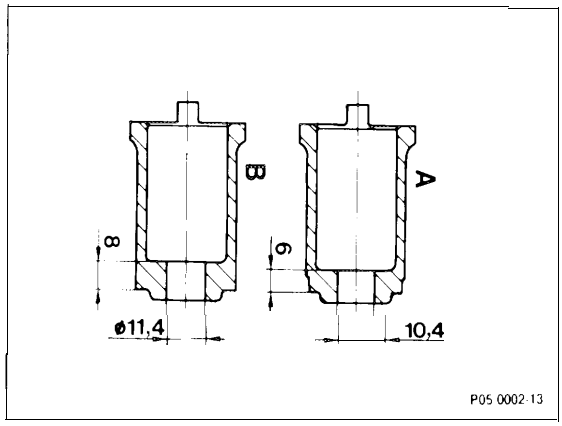
Preceding work:
Charge air pipe removed (turbo engines).



Cylinder head cover (125)	remove, Install, fixing bolt (132), 10 Nm.
Pressure oil pump (400)	unbolt, reinstall, fixing bolt (408) wrth washers (408a), 11 Nm, put pressure oil pump to one side with lines connected.
	Note Do not unbolt the upper and lower bolt with continuous thread (visible between housing and cover).
O-ring (404)	replace.
Carrier (403)	remove, install, check.
Bolt(407)	unbolt, reinstall. Note different bolt (05-220). Tightening torque and angle of rotation Hexagon bolt 25 Nm, Bihexagonal necked down bolt 25 Nm, 90”.
Carrier sleeve (406)	remove, install. Use grease when Installing. Note different design (05220).

Note

Since 11 88 the camshaft timing gear has been fitted with a bihexagonal necked down bolt M1 1 (previously hexagon bolt M10). The carrier has been revised as a result of this change.



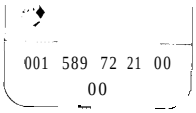
A Previous Design
B Revised Design

Production breakpoint: 1 1/88

Model	Engine	Engine end No. Manual transmission	Automatic transmission	Vehicle [illegible] end No. A
124	602.962 603.960 603.963		000187 019336	* *
201	602.911 602.961	070124 -	014216 004561	*

* not recorded

Special tool



001 589 72 21 00
00

Job No.

Survey - injection pumps	07.1 - 001
Survey -injectors	- 002
Explanation of injection pump type plate	- 003
Function - Injection system	- 010
Function - EGR	- 015
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Checking electronic idle speed control	- 103
Checking electronic idle speed control (ELR)	- 105
Checking, tuning engine	- 110
Checking start of delivery (Position sensor RIV-Method)	- 111
Checking start of delivery with digital tester (RIV-Method)	- 112
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Electrical wiring diagrams	- 400
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Engine	Injection pump Bosch designation	Part no.	Bosch combination number	Test values MB sheet Edition
Standard basic version from start of production				
602.91	PES 5 M 55 C 320 RS 153	602 070 05 01[1])	0 400 075 982[1])	2.5 e 1st edition
Standard - as of 02/89				
602.91	PES 5 M 55 C 320 RS 170	602 070 32 01[2])	0 400 075 953[2])	2.5 w 5 09/88
		602 070 33 01[2])	0 **400 075 952**[2])	**2.5 w 4** 09/88
		602 070 34 01[1])[2])	0 400 075 951[1])[2])	2.5 w 3 09/88

[1]) ELR - Electronic idle speed control
[2]) ADA - Atmospheric pressure-dependent full-load stop

Production breakpoint: January 1989

Model	Engine	Engine end no. Manual transmission	Engine end no. Automatic transmission
201.126	602.911	**073017**	**014820**

Transfer pump Bosch designation FP'KG **24** M 150 is identical on all engines.

Note
An accurate check and adjustment of the injection pump is only possible on an injection pump calibrating test stand.

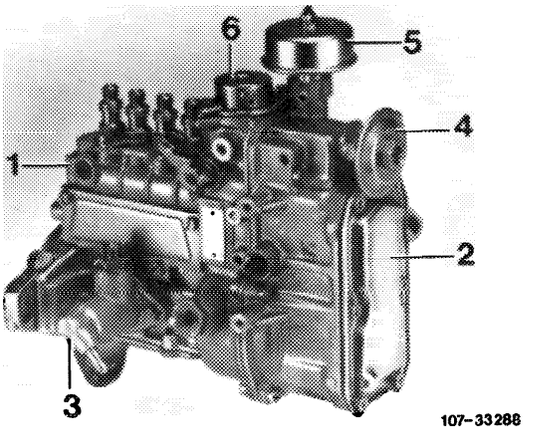
Engine		602.91
Injection nozzle	Bosch designation	DN 0 SD 265
	MB part no.	001 017 49 12
Injector holder	Bosch designation	KCA 30 S 44 KCA 27 S 55 [1])
	Combination MB part no.	002 017 26 21 002 017 34 21 [1])
Injection pressure or opening pressure in bar [2])	with new injectors	115 – 125
	with used injectors at least	100

[1]) With inclined injection.
[2]) The difference of the injection pressure among Injectors within the same engine may not be more than 5 bar gauge pressure.

07.1-003 Explanation of injection pump type plate

For example **PES 5 M 55 C 320 RS 158/1**

P	Pump
E	Self-driven
S	Front flange attachment
5	Number of cylinders
M	Pump size
55	Element diameter in 1/10 mm
C	Character of revision
320	Assembly number
R	Direction of rotation
S158/1	Special version

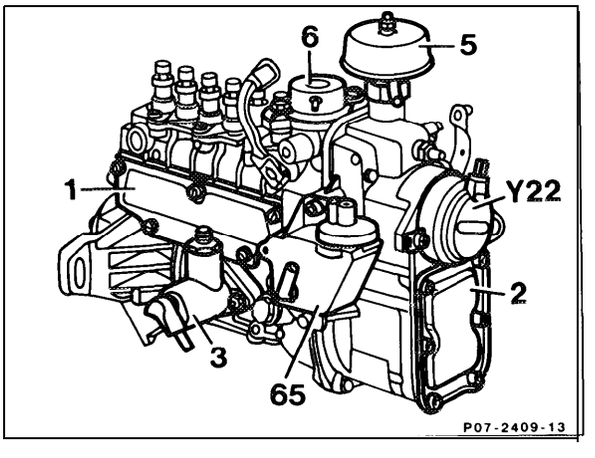


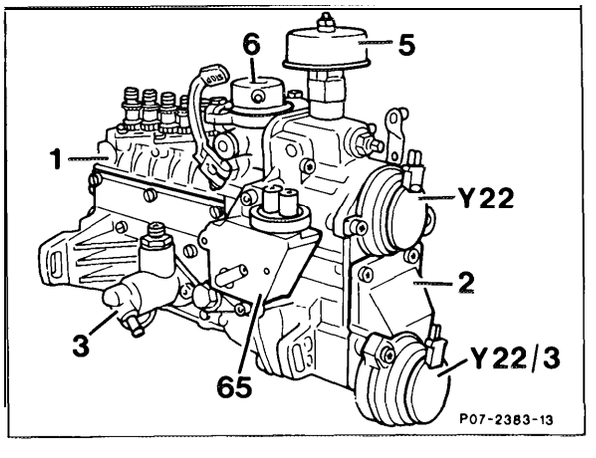
RSF- governor

R	Governor
S	Coil spring
F	Drive control

Arrangement of components

1	Injection pump
Ib	Type plate
2	Governor
3	Fuel pump
4	Vacuum unit idle speed Increase
5	ADA unit
6	Stop unit
65	Vacuum control valve
Y22	Electromagnetic actuator ELR





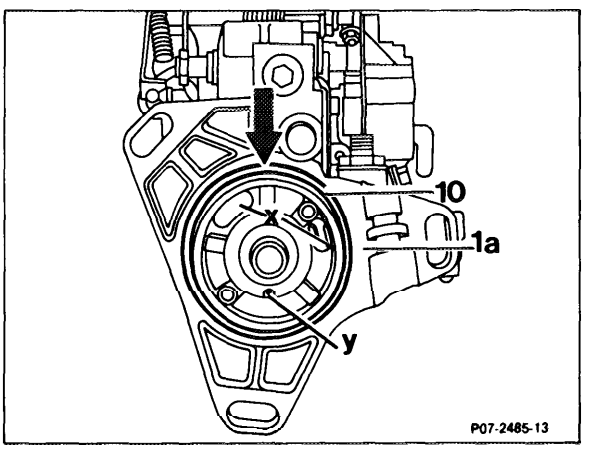
A. Lubrication of injection pump

The injection pump is connected to the engine oil circuit by way of an oil hole (arrow).

Ttie oil returns to the crankcase by way of the circular groove (x) between bearing and housing.

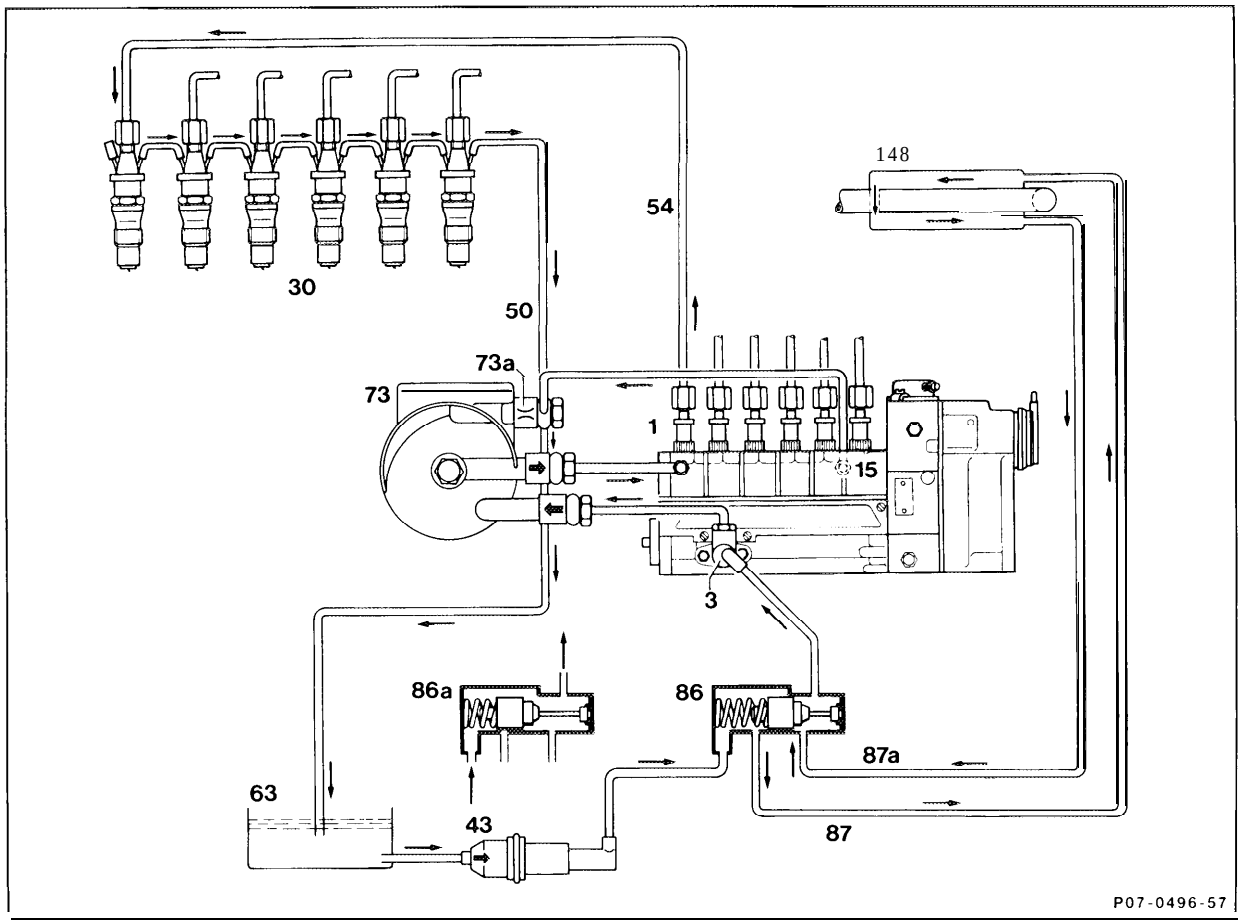
The O-ring (10) on the flange (la) seals.

The hole (y) serves to reduce the load exerted by the oil on the radial sealing ring.



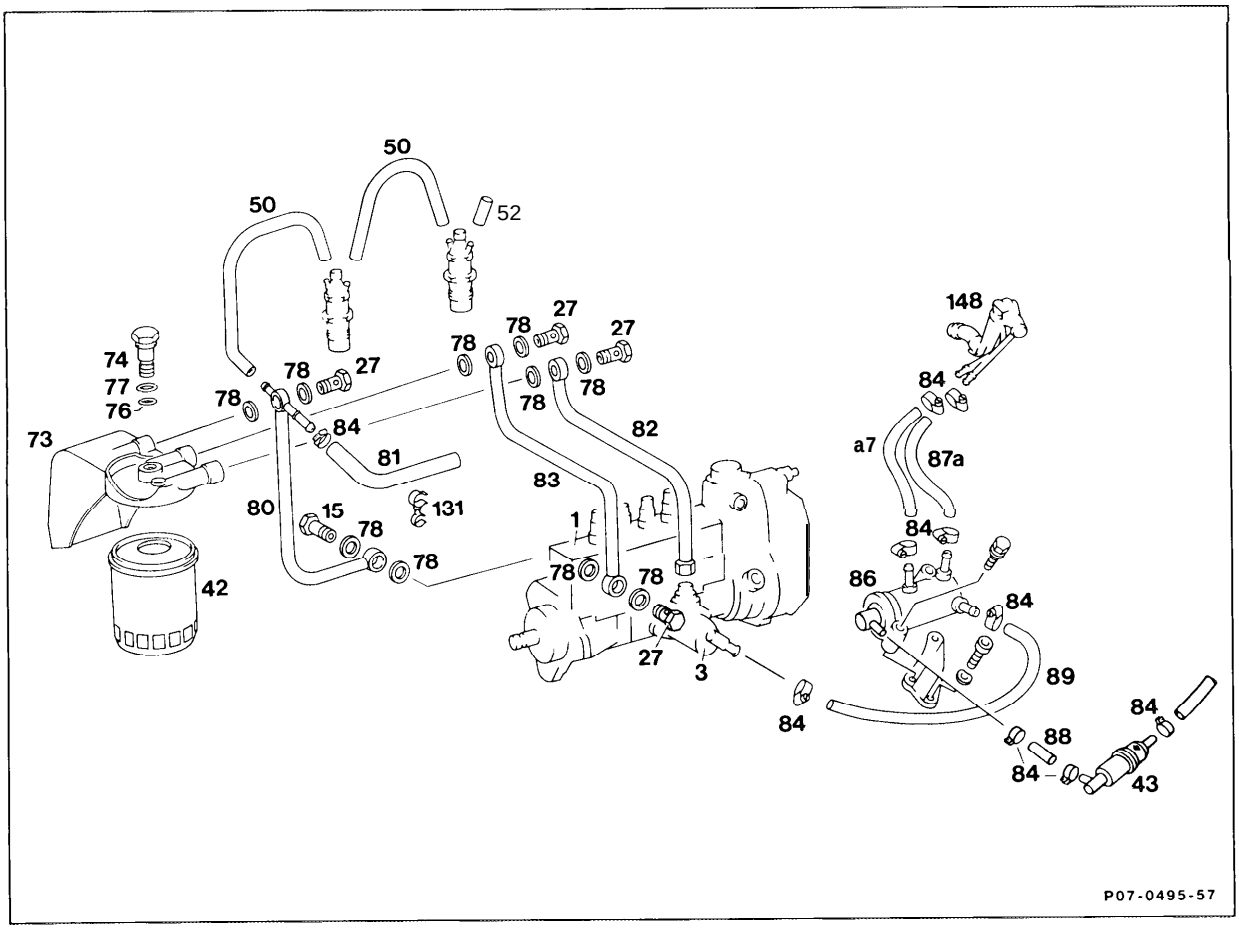
B. Fuel circuit

a) Fuel circuit diagram



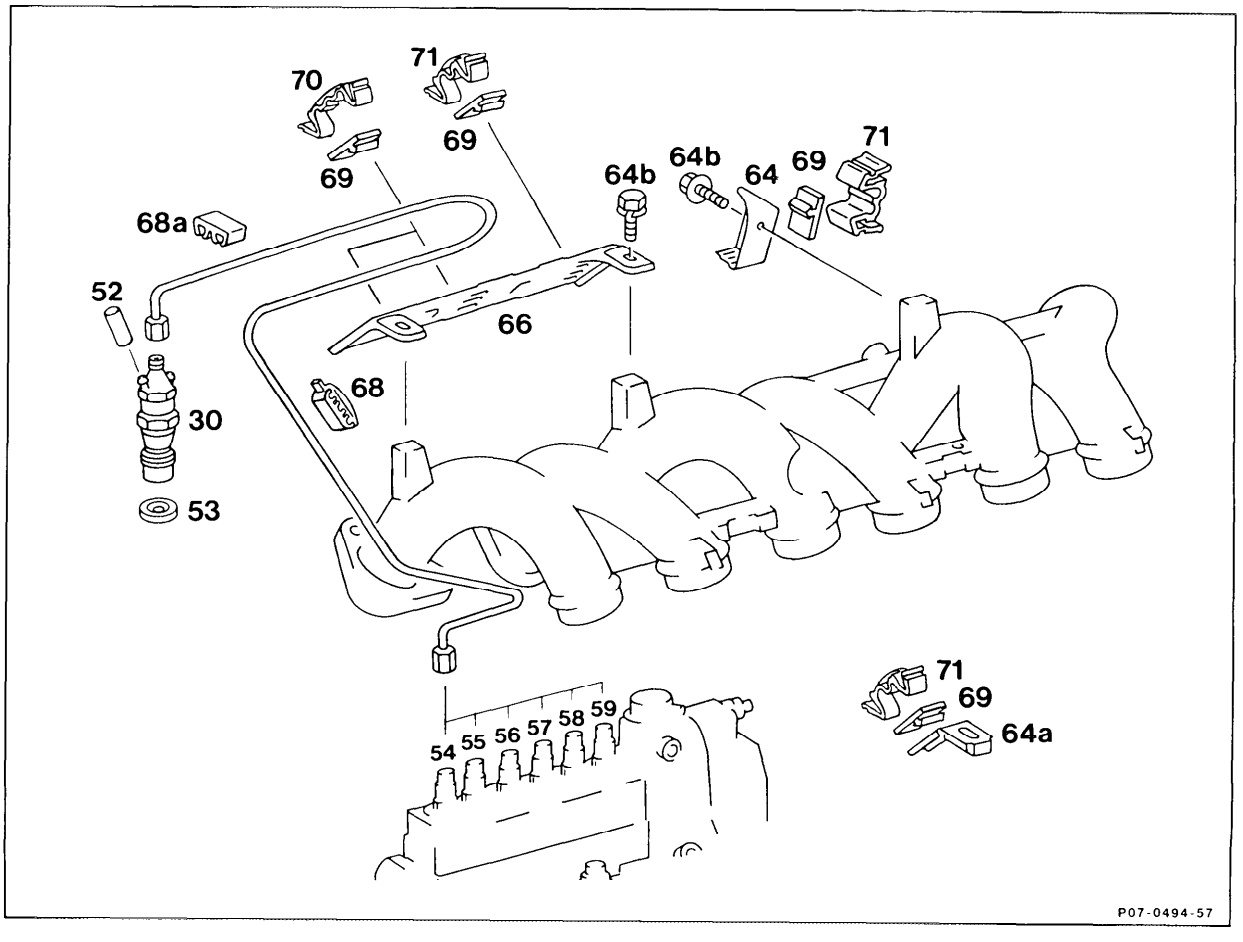
	Injection pump	73a	Choke orifice in fuel filter upper par-t 0.8 mm diameter
3	Fuel pump	86	Fuel thermostat open, position up to + 8 °C, fuel is preheated
15	Overflow valve with choke dia. 1.5 mm	86a	Fuel thermostat closed, as of + 25 °C, fuel is no longer preheated
30	Injection nozzles	87	Supply line - cold fuel
43	Fuel prefilter	87a	Return line - preheated fuel
50	Leak-off fuel hose	148	Heater supply pipe with fuel heat exchanger
54	Injection line cylinder 1		
63	Fuel tank		
73	Fuel filter upper part		

b) Low-pressure side



	Injection pump
3	Fuel pump
15	Over-flow valve with choke dia. 1.5 mm
27	Hollow screw
42	Fuel filter
43	Fuel prefilter
50	Leak-off fuel hose
51	Hose clamp
52	Screw plug
73	Fuel filter upper part
74	Hollow screw fuel filter
76	O-ring
77	Seal fuel filter
78	Sealing ring
79	Banjo fitting
80	Return line
81	Hose return
82	Supply fuel filter
83	Supply injection pump
84	Hose clamp
86	Fuel thermostat
87	Supply line fuel heat exchanger
87a	Return line fuel heat exchanger
88	Supply fuel thermostat
89	Suction line fuel pump
131	Fuel holder
148	Heater supply pipe with fuel heat exchanger

c) High-pressure side



	Injection pump
30	Injection nozzle complete
52	Screw plug
53	Nozzle plate
54	Injection line 1
55	Injection line 2
56	Injection line 3
57	Injection line 4
58	Injection line 5
59	Inlectron line 6
64	Holder, cylinder 4, nozzle side
64a	Holder, cylinder 4, pump side
64b	Screw
66	Holder, lines
68	Plastrc clip
68a	Plastic clip
69	Rubber backing
70	Plastrc holder for 3 lines
71	Plastic holder for 2 lines

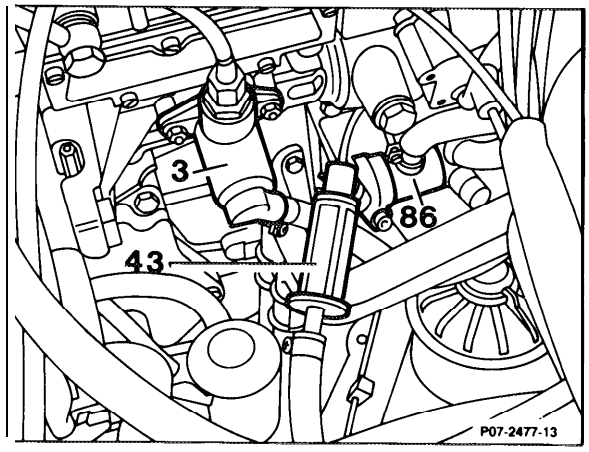
Note

Injection line cylinders 2 - 6 not shown in the figure.

Injection line cylinders 5 - 6 holders as of cylinder 4.

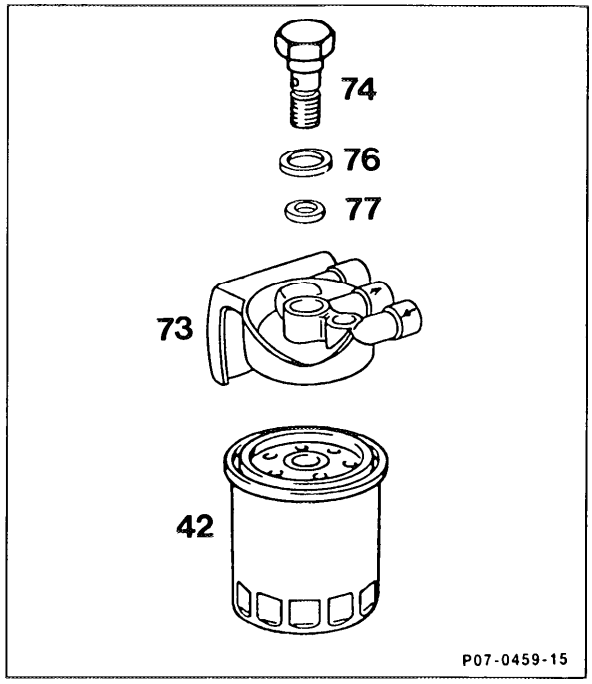
C. Fuel prefilter (43)

Installed in the suction line ahead of the fuel pump (3). The filter housing is made of transparent plastic material.
The mesh size is 0.6 mm (600 µm).



D. Fuel filter (42)

Installed in the delivery line between fuel pump and injection pump.
The paper filter element is integrated in a metal housing. The paper element has a mean pore size of 0.006-0.01 mm (6-10 µm).

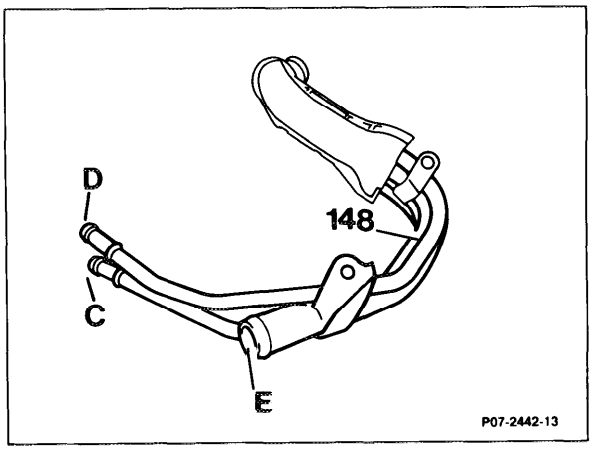


42	Filter
73	Fuel filter upper part
74	Screw
76	O-ring
77	Sealing ring (aluminum)

Note
Owing to the greater delivery capacity of the fuel pump and the chokes in the filter upper part and on the injection pump the fuel system is bled automatically during starting.

E. Fuel preheating (148)

A heat exchanger (148) for preheating the fuel is installed in the supply line of the heating system.



Heat exchanger

C Supply
D Return
E Heater supply
148 Heat exchanger

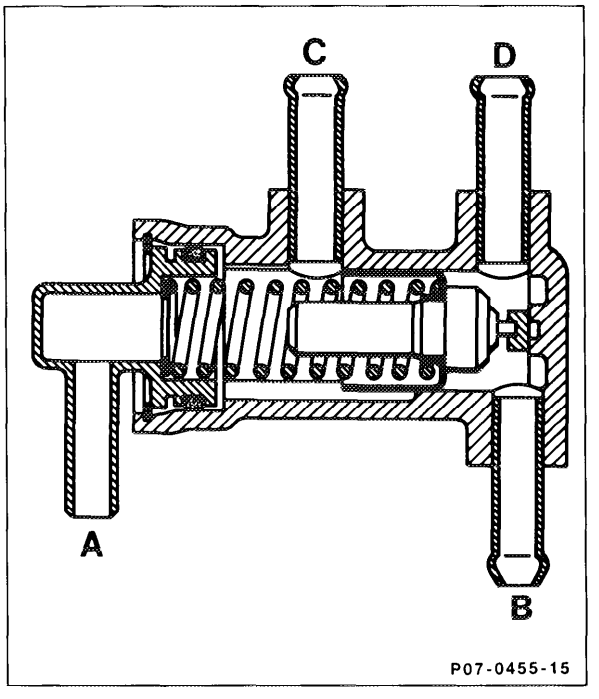
Function

Full preheating up to + 8 °C fuel temperature; the required fuel is drawn via the heat exchanger by the fuel pump.

From + 8 °C to + 25 °C mixed operation; the required fuel flows partially via the heat exchanger.

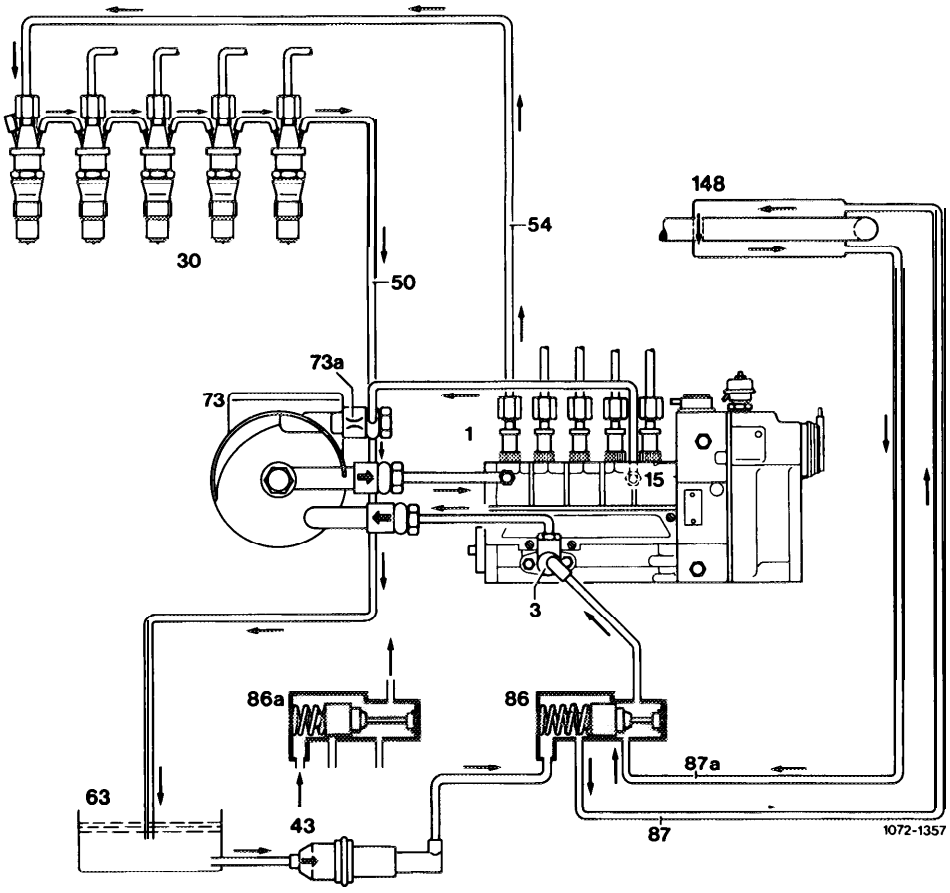
Above + 25 °C the heat exchanger is by-passed by the thermostat action: the fuel pump draws the fuel directly.

The fuel preheating allows trouble-free operation with winter diesel fuel usually up to approx. -25 °C outside temperature.



Fuel thermostat

A Supply from fuel tank
B Suction line to fuel pump
C Supply to heat exchanger
D Return from heat exchanger



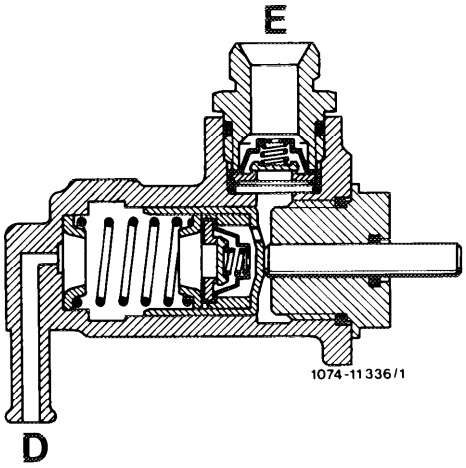
Function diagram fuel preheating

1	Injection pump	54	Injection line cylinder 1
3	Fuel pump	63	Fuel tank
15	Overflow valve with choke 1.5 mm dia.	73	Fuel filter upper part
30	Nozzle holder combination	73a	Choke orifice in fuel filter upper part
42	Fuel filter	86	Fuel thermostat up to + 8 °C
42a	Choke orifice in fuel filter upper part 0.8 mm diameter	86a	Fuel thermostat above + 25 °C
43	Fuel prefilter	87	Supply line (cold fuel)
50	Fuel bleed hose	87a	Return line (preheated fuel)
		148	Fuel heat exchanger

F. Fuel pump

The increased delivery capacity of the fuel pump ensures that the fuel system is bled automatically. The manual priming pump is no longer required.

Rate of delivery > 150 cm^3/30 s, with starter speed >150/min, in fuel return.

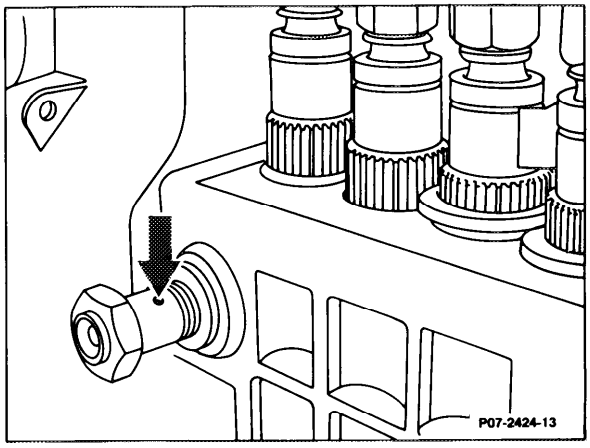


E Suction side
D Delivery side

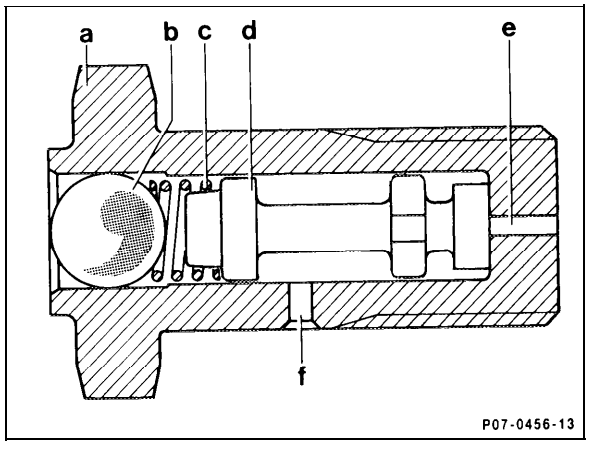
A choke in the overflow valve on the injection pump is required for bleeding the injection pump

Overflow valve with choke dia. 1.5 mm (arrow).

The overflow valve prevents unfiltered fuel from reaching the injection pump via the return line if the supply is clogged (e.g. filter).



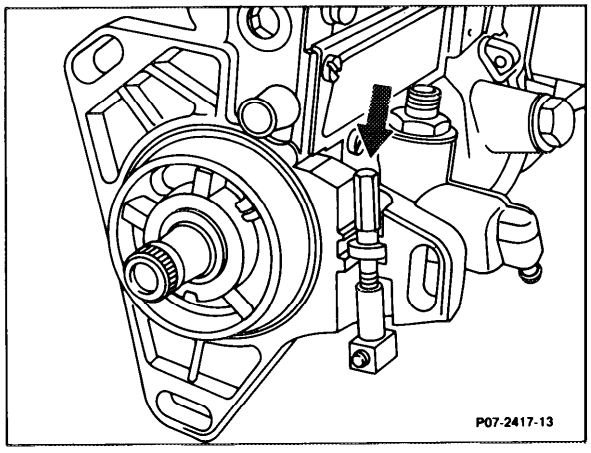
Choke with overflow valve



a Housing
b Ball
c Spring
d Plunger
e Supply
f Choke orifice dia. 1.5 mm

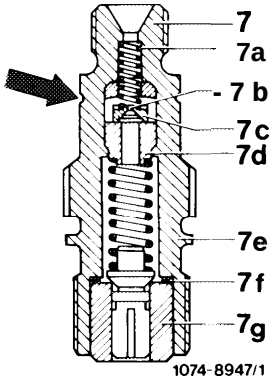
G. Start of delivery adjusting device

An adjusting device (arrow) is provided on the injection pump flange in order to allow adjustment of start of delivery with the engine running.

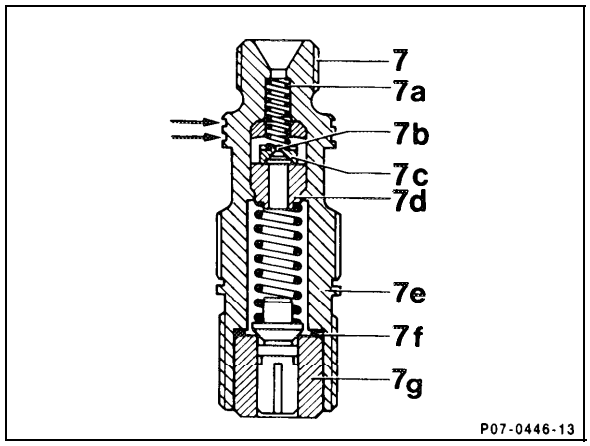


H. Relief chokes in delivery valve holder

In order to reduce the hydrocarbon content in the exhaust gas, relief chokes (7b) are installed in the delivery valve holders (7) of the injection pump. The delivery valve holders with relief choke are identified externally by one or two circular grooves (arrows). The relief choke (7b) is a plate valve (7c) with a choke orifice opening in the direction of the injector. The choke orifice for all engines is 0.45 mm diameter.
The valve seat (7d) is riveted into the delivery valve holder.

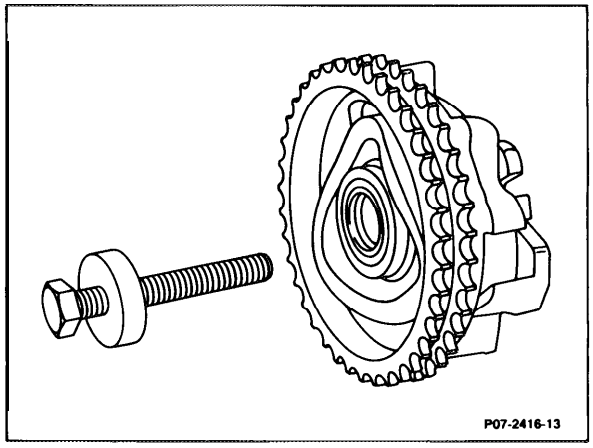


7 Delivery valve holder connection
7a Spring
7b Relief choke
7c Plate valve
7d Valve seat
7e Delivery valve holder
7f Seal
7g Delivery valve



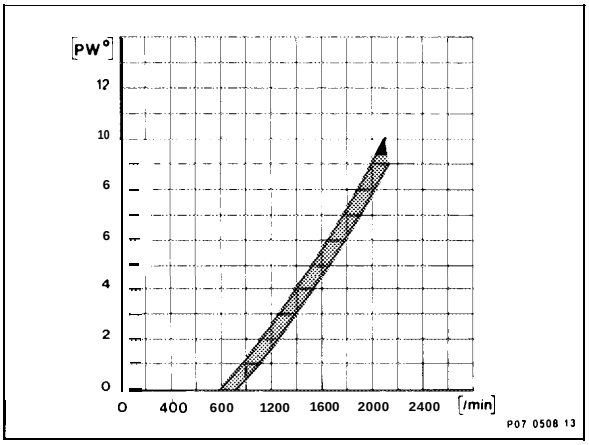
I. Injection thing device

The timing device is mounted on the injection pump shaft and secured with a left-hand threaded center bolt.



Timing device advance curve

n = 1 /min injection pump
PW° = Advance angle injection pump

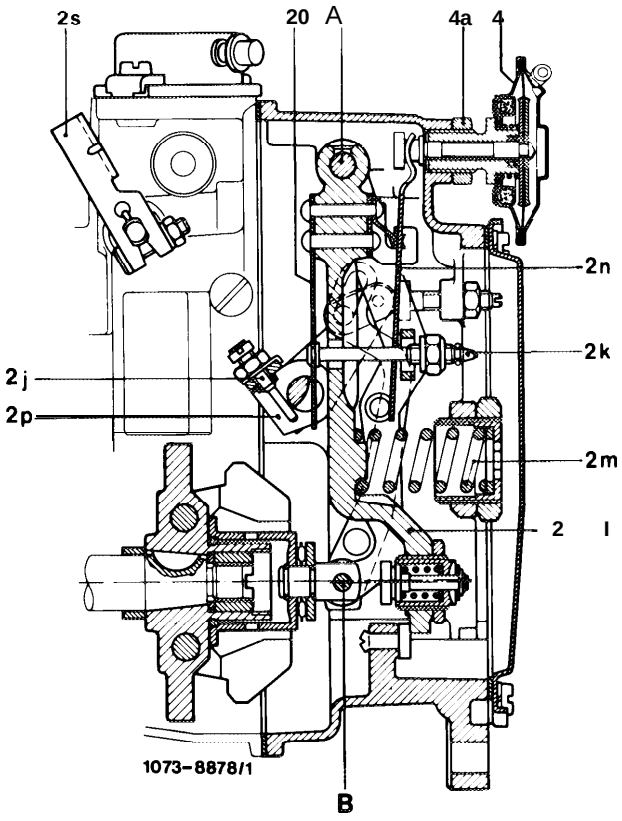


J. RSF governor, construction and mode of operation

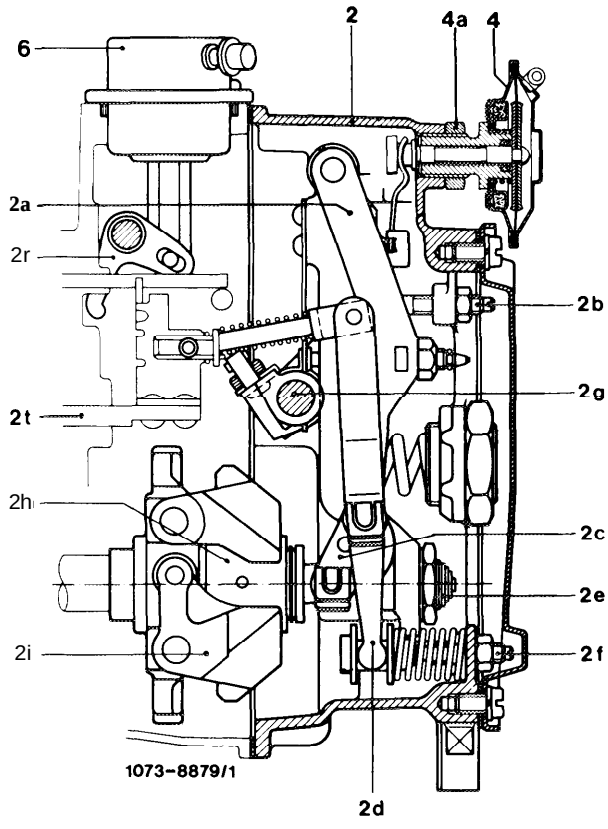
The governor is an idle speed/maximum speed governor whose control spring (2m) is dimensioned and adjusted such that, with the exception of torque control (see “Speed regulation during starting and full-load operation”), it does not regulate in the part load range.

In the part load and full-load ranges the control rod (2t) of the injection pump is only actuated by the accelerator pedal which is connected with the adjusting lever (2g) of the governor by way of the control linkage.

The vacuum unit (4) serves to preload the idle speed spring (2n) and adjust the idle speed.

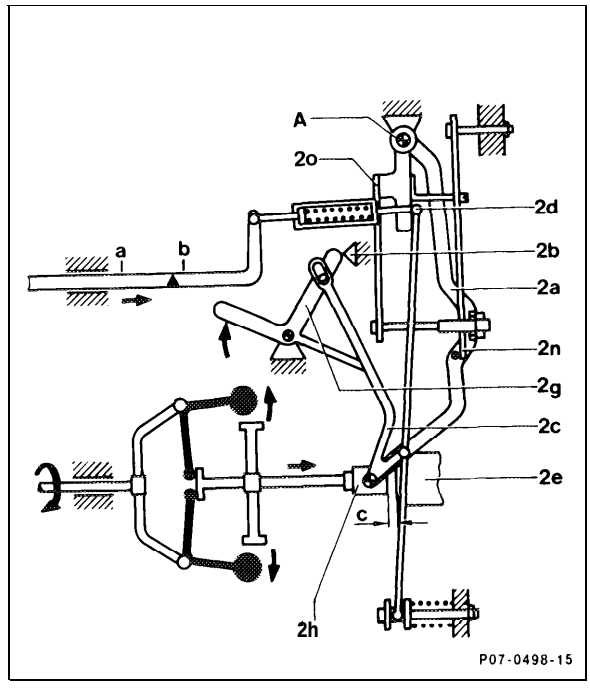


2 Governor
2a Guide lever
2b Stop screw for idle speed volume
2c Reverse-transfer lever
2d Fulcrum lever
2e Spring capsule (torque control)
2f Full-load adjusting screw
2g Control lever
2h Sliding sleeve
2i Flyweights (pump governor assembly)
2l Idle speed auxiliary spring shut-off
2k Adjusting screw for idle speed auxiliary spring (tickler)
2l Tension lever
2m Governor spring
2n Idle speed spring
2o Idle speed auxiliary spring (tickler)
2p Control lever
2r Stop lever
2s Emergency stop lever
2t Control rod
4 Vacuum unit idle speed increase
4a Idle speed adjusting nut
6 Vacuum unit (stop)



a) Idle speed regulation

The adjusting lever (2g) contacts the idle speed stop screw (2b). With increasing speed the sliding sleeve (2h) passes through the idle speed stage. The guide lever (2a) pivots around the fulcrum “A” in this way acting against the idle speed spring (2n).



a Start
b stop
c Idle speed stage

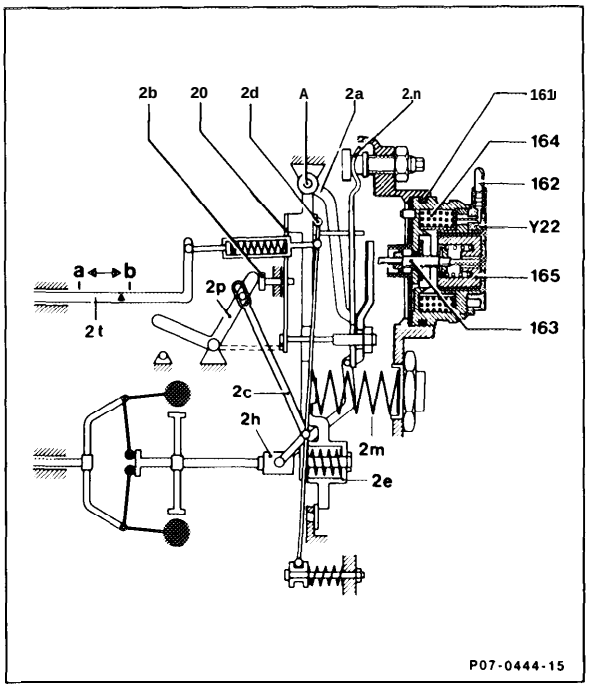
At **a** certain engine speed (approx. 600/min) the guide lever **(2a)** contacts the adjusting nut of the idle speed auxiliary spring (20). The movement of the sliding sleeve (2h) is transferred to the injection pump control rod in the same direction via the reverse-transfer lever (2c) and the control lever (2d). After passing through the idle speed stage the sliding sleeve (2h) contacts the spring capsule (2e).

If the engine speed continues to rise (e.g. while coasting), the spring capsule (2e) and then the governor spring (2m) are overcome at a certain speed. The control rod is then moved into “stop position” (deceleration shut-off).

b) Speed regulation with electromagnetic actuator

The stroke rod (163) contacts the guide lever (2a). The electromagnetic actuator (Y22) is supplied with a timed DC voltage in the frequency range of approx. 50 Hz from the control unit (electronic idle speed control).

If the engine speed drops (e.g. when engaging the driving position or power steering at the end limit), the electromagnetic actuator is given a higher voltage. As a result the stroke rod (163) will push against the guide lever (2a) and the control rod (2t) moves in the direction “a” **more volume.**



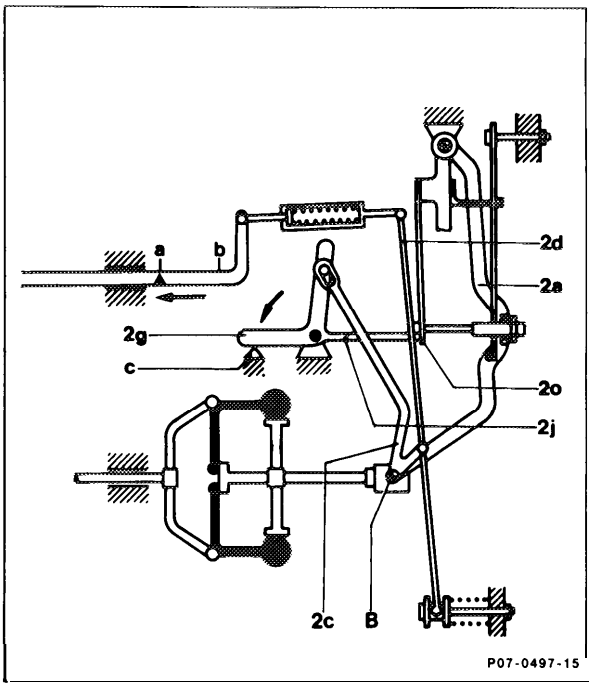
161 Sealing ring
162 Electrical connection
163 Stroke rod
164 Magnetic coil
165 Magnetic core

As soon as the engine speed rises, the voltage is reduced and the control rod (2t) moves in the direction "b" less **volume.**

c) Start position

If, with the engine stationary, the control lever (2g) contacts the full-load stop (c), the reverse-transfer lever (2c) pivots around the fulcrum "B", taking with it the fulcrum lever (2d) in the direction of start.

With the control lever (2g "full throttle") in full-load position the idle speed auxiliary spring (20, tickler) is pushed off the guide lever by the idle speed auxiliary spring shut-off (2j). This allows faster speed regulation from the starting position of the governor.



a Start
b Stop

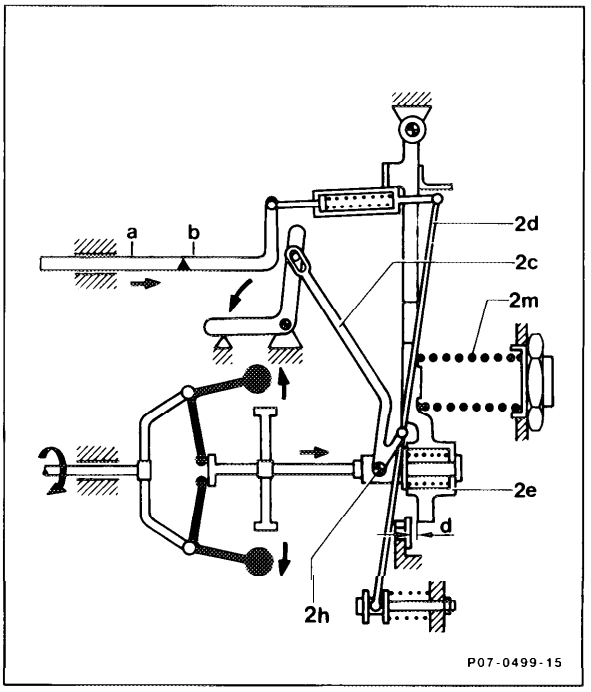
d) Maximum speed regulation/torque control

After passing through the idle speed stage (c) (see figure regulation at idle speed) the sliding sleeve (2h) contacts the spring capsule (2e). In this way the control rod of the injection pump is brought into full-load position via the reverse-transfer lever (2c) and the fulcrum lever (2d).

When a certain speed has been reached, the spring capsule (2e) is pushed on by a specified distance (d) (torque control).

If the speed of the engine rises again, the force of the flyweights is sufficient to overcome the control spring (2m) (maximum speed regulation).

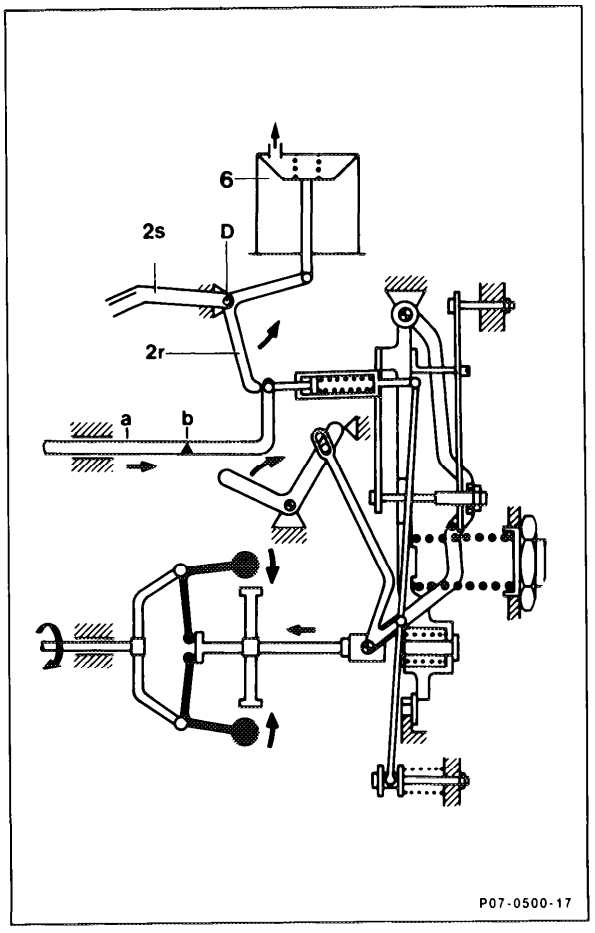
The start of the speed regulation is dependent on the preload of the governor spring (2m).



e) Shut off

The vacuum unit (6) is connected to vacuum from the vacuum pump via the glow starter switch of the vehicle. As a result, the diaphragm of the vacuum unit is pulled against the compression spring.

The vacuum unit (6) is connected with a stop lever (2r). This lever pivots around the fulcrum "D" pulling the control rod of the injection pump into the “stop position”. The bypass spring of the fulcrum lever is overcome in this process. Via the emergency stop lever (2s) the control rod can likewise be pulled into “stop position” on the outside of the governor.



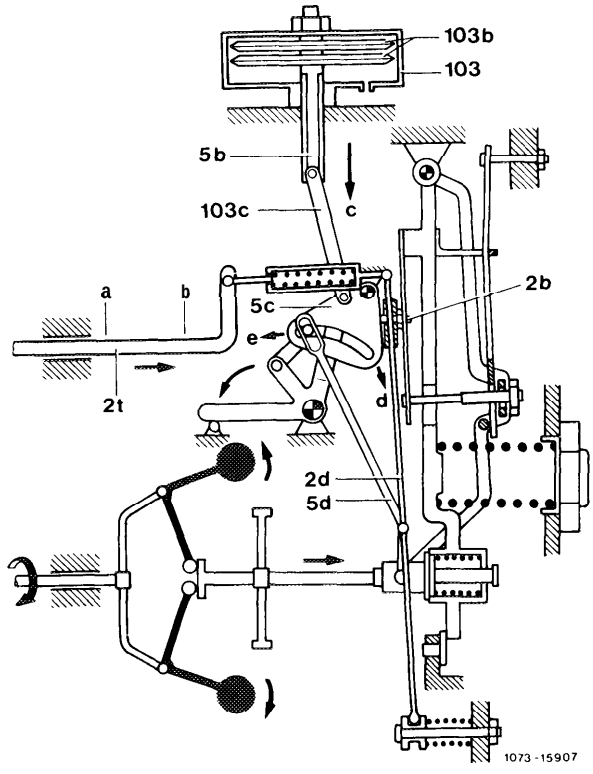
a Star-t
b Stop

K. Atmospheric pressure-dependent full-load stop (ADA)

The atmospheric pressure-dependent full-load stop serves to correct the low air density at higher altitudes.

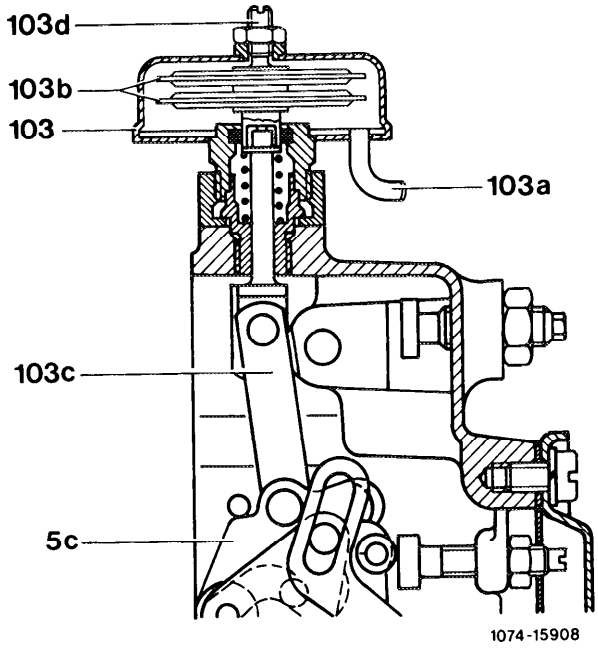
Mode of operation with a **reduction of pressure** with Increasing altitude. With diminishing pressure the aneroid boxes (103b) expand, pushing the ADA correction linkage (103c) in direction (c). The ADA guide pin (5b) continues to push the ADA correction linkage (103c) in the direction of (c), pivoting the ADA template (5c) in the direction of (d).
With the ADA template the toggle lever (5c) and the reverse-transfer lever (5d) pivot in the directions of (e) and (d). The reverse-transfer lever now pulls the control rod (2t) in stop direction (b) via the fulcrum lever (2d).
In this way the pressure drop causes a reduction of the full-load volume.

A **pressure rise** results in the process taking place in reverse order.



The atmospheric pressure-dependent full-load stop consists of aneroid boxes vertically installed in a housing, and which have been adjusted to a certain barometric level by means of an adjusting screw and counteracting spring-loaded threaded pin. Within the operating range of the aneroid boxes an expansion takes place with decreasing air pressure. The spring- loaded threaded pin on the lower side of the aneroid boxes and the connected levers transmit the changes in altitude to the control rod of the injection pump.

If the aneroid boxes expand, the control rod is pulled in the direction of “stop” and the delivery volume is reduced; if the altitude decreases, the control rod is moved into the direction of “additional volume”, resulting in an increase of the delivery volume.



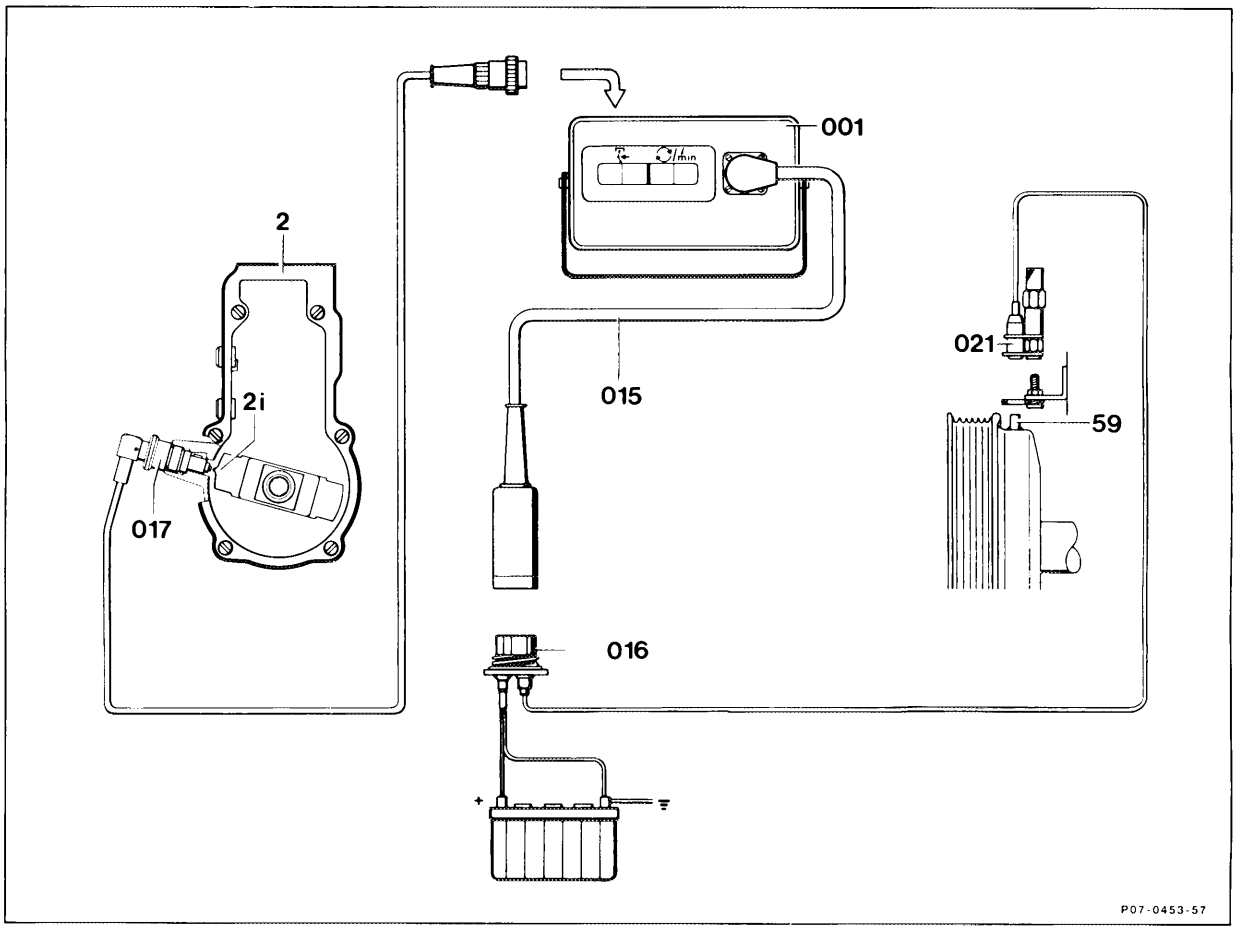
5c Template
103 Pressure box
103a Connectton for atmospheric connection line (for registering atmospheric pressure)
103b Aneroid boxes
103c Correction linkage
103d Adjusting screw (adjusted by manufacturer)

L. Governor impulse method (RIV)

In order to be able to register the relationship of the injection pump relative to the engine two signals are required:

- TDC impulse from the crankshaft
- Governor impulse from the injection pump

Both impulses are supplied by pulse generators. In order to obtain a measuring signal the sensor pins must be moved past the pulse generators with a minimum speed (idle speed). A measuring instrument measures the time interval of the two impulses, converting the result into an angular value which is then indicated.
Checking, adjusting start of delivery
(see 07.1-I 11/112/116/117).



001 Digital tester
015 Test cable
016 Socket
017 RIV generator (governor impulse)
021 TDC pulse generator
059 Sensor pin
2 Governor
2i Flyweight with sensor pin

M. Electronic idle speed control (ELR)

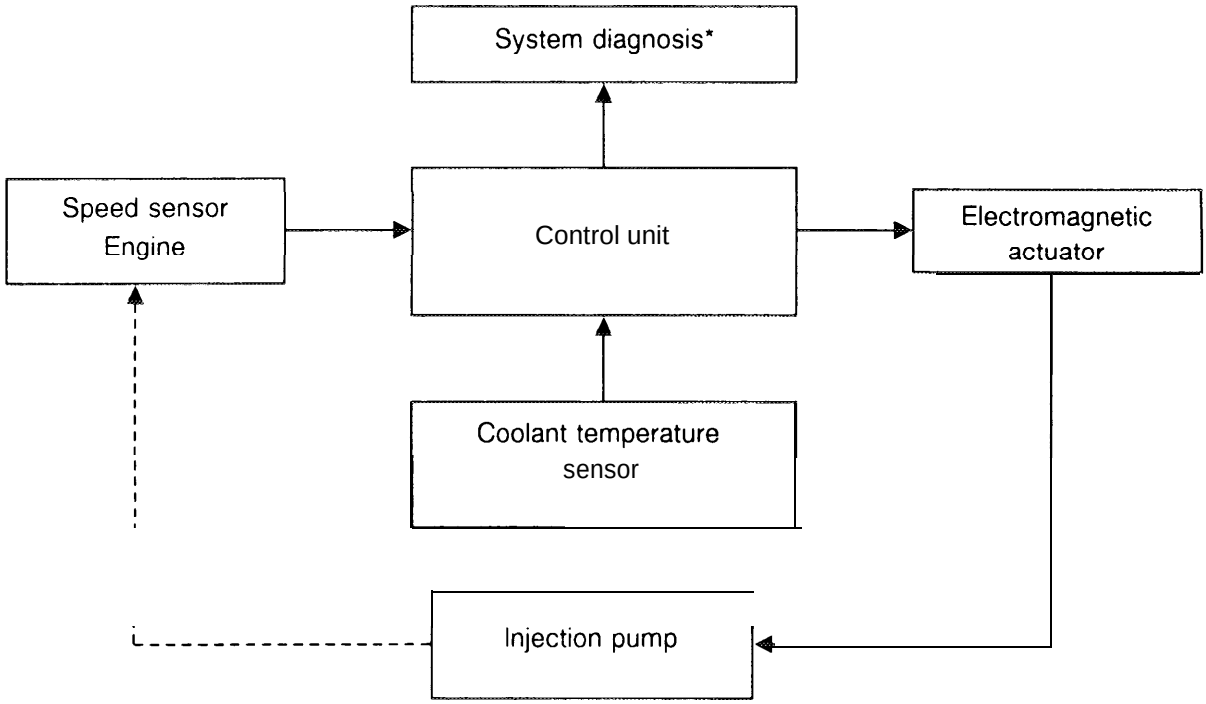
In addition to the mechanical governor an electronic idle speed governor is installed in engine 602 with air conditioner and automatic transmission.

The speed sensor (L 3) registers the engine speed (144 impulses/revolution) passing it on to the control unit (N8 or N8/1) in form of an AC voltage.

The control unit processes the speed signal and compares set value with actual value. The idle speed is kept constant by the electromagnetic actuator (Y22) independent of the load on the engine.

initiated by the temperature sensor (B 1 1/1), with coolant temperatures < 60 °C the idle speed set value is increased according to a predetermined characteristic.

Block diagram idle speed control



System diagnosis (as of approx. June 1988)*
With the self-testing program integrated in the control unit it is possible to test the ELR system.

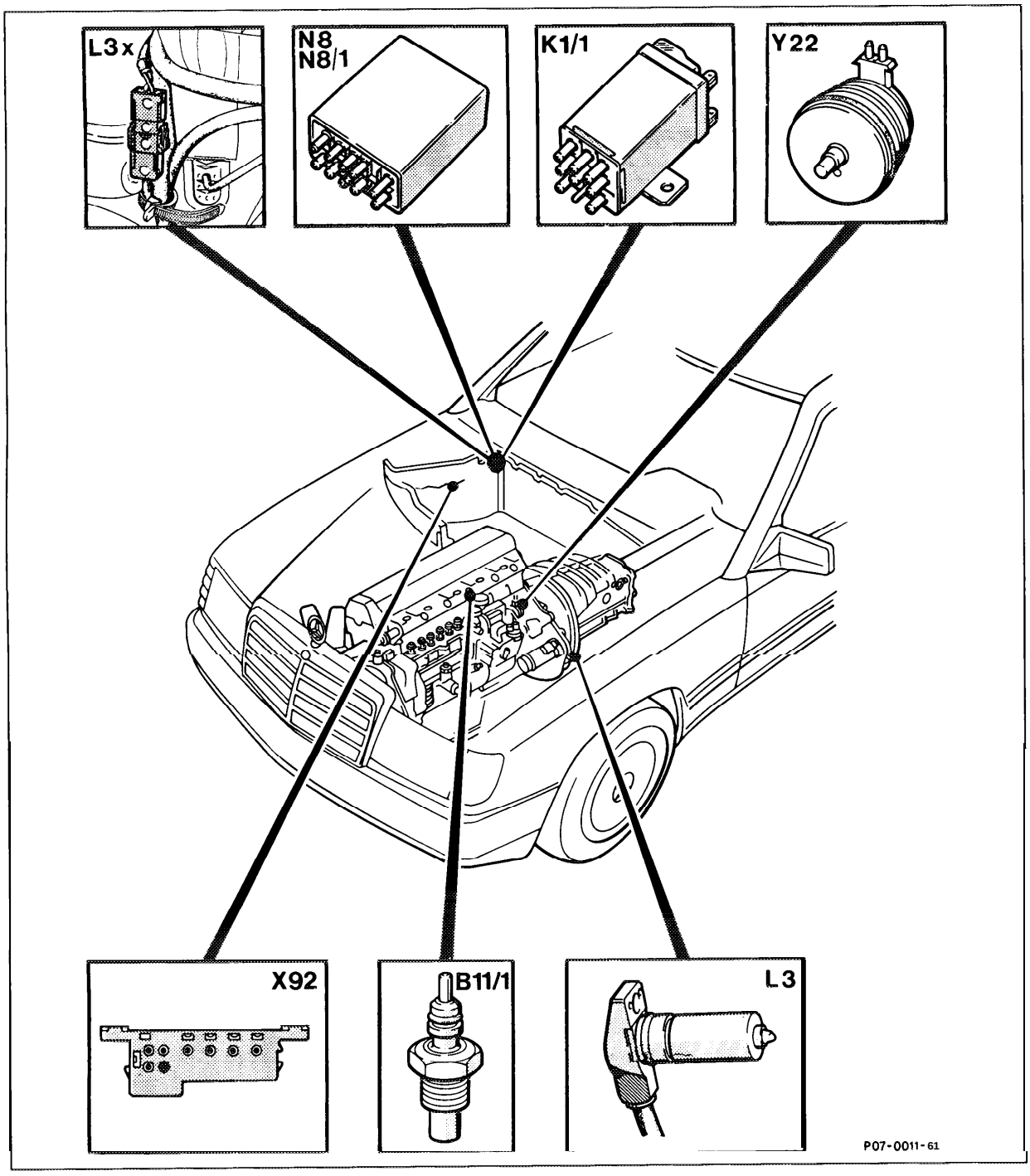
A signal can be called up by way of the test coupling (X92) giving specific information on faults of a component.
However, only permanent faults can be indicated. Faults of a temporary nature cannot be registered and indicated by the control unit.

The number of signals shows which component is faulty, or whether components in the control circuit are defective.

Impulse display	Component/Control circuit
1	All functions “in order”
2	Speed signal “fault”
3	Coolant temperature “fault”
6	Control circuit ELR “fault”

Arrangement of components

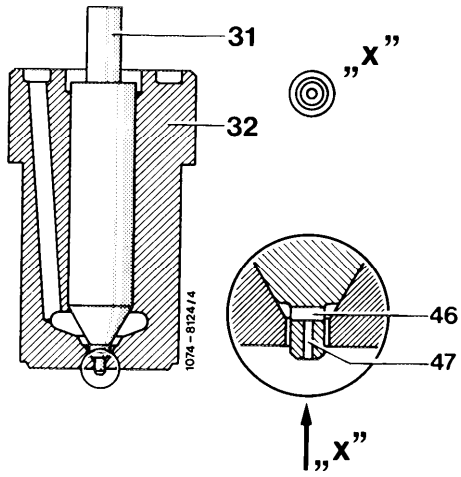
Electrical components



B11/1	Coolant temperature sensor	N8 or N8/1	Control unit ELR
K1/1	Overvoltage protection relay		
L3	Speed sensor	x92	Test coupling
L3x	Connector speed sensor starter ring gear	Y22	ELR electromagnetic actuator

b) Hole-type pintle nozzle

Bosch designation DN 0 SD 240/
This nozzle is distinguished from the pintle nozzle by transverse and longitudinal bores (46 and 47) in the throttling pintle.



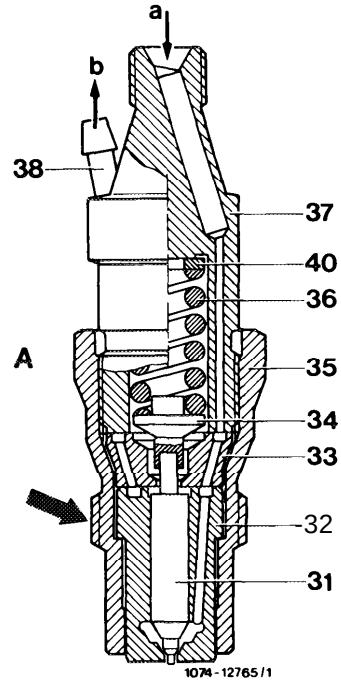
31 Nozzle needle
32 Nozzle body
46 Transverse bore
47 Longitudinal bore

Q. Nozzle holder

Bosch designation
KCA 30 S 44 (without edge-type filter)
(vertical injection)
KCA 30 S 46 (with edge-type filter)
(vertical injection)
KCA 27 S 55
(inclined injection)

The compression spring (36) in the holding body (37) presses on the nozzle needle (31) via thrust pin (34). The preload of the compression spring (36) and the shim (40) determine the opening pressure of the injection nozzle. The injection pressure can be adjusted by means of different shim thickness dimensions. Fuel flows to the nozzle seat via the respective supply bore (a) in the holding body (37), intermediate washer (33) and injection nozzle. During the injection process the injection pressure lifts the nozzle needle and the fuel flows through the circular groove on the throttling pintle into the prechamber.

After the injection pressure has dropped, the compression spring (36) forces the nozzle needle (31) back onto its seat; the injection process is completed.

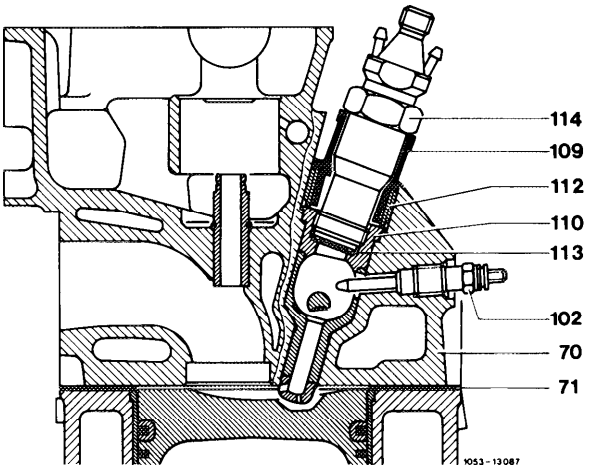


Nozzle holder for vertical injection

5° inclined injection

Engine 602 model years 1987 and 1988

The nozzle holder combination is screwed into the upper prechamber with an inclination of 5° with reference to the prechamber longitudinal axis. The inclined injection results in an even more intensive mixing of air with fuel.



70	Cylinder head
71	Cylinder head gasket
109	Sealing sleeve
110	Prechamber
112	Threaded ring
113	Sealing plate
114	Nozzle holder

5°/180° inclined injection

Production breakpoint: Standard version Januarv 1989

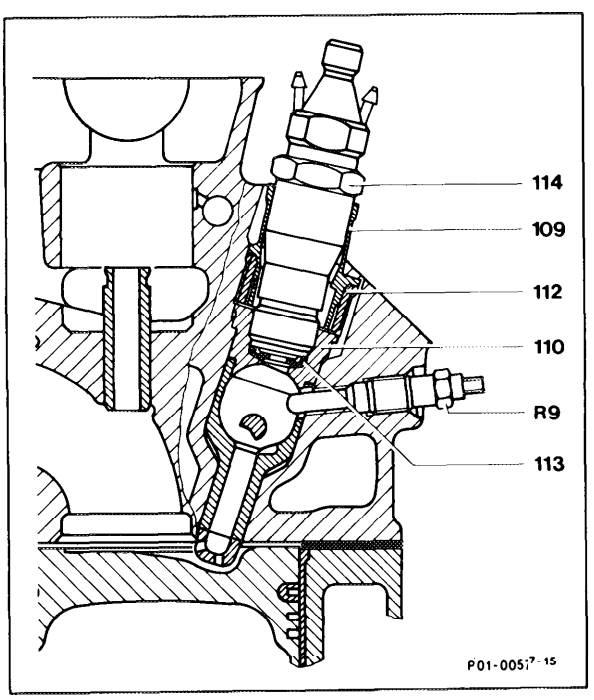
Model	Engine	Engine end no. Manual transmission	Engine end no. Automatic transmission
201.126	602.911		014820

Engine 602 and Code 830 as of model year 1989

The nozzle holder combination inclined by 5° is twisted by 180° and installed into the upper prechamber.

This has the following advantages:

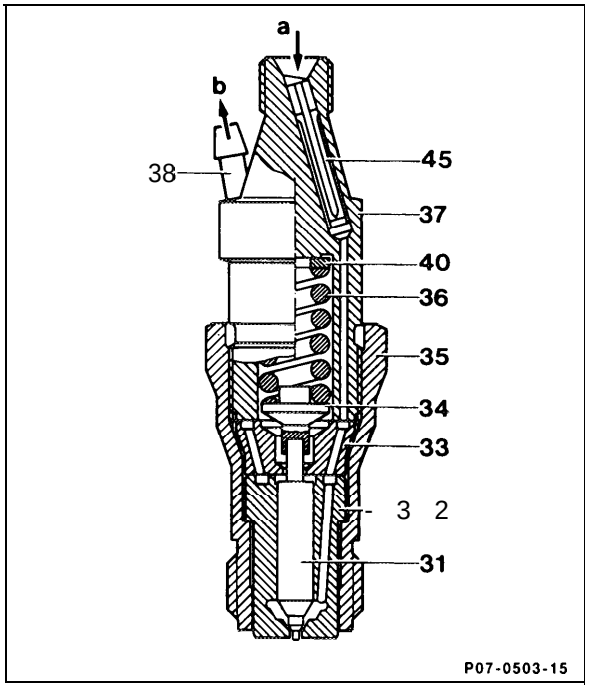
- Improved cold starting
- Improved mixing of air and fuel due to shortened glow plug (23 mm previously 27 mm) in connection with recess and spherical indentation in the ball pin.
- Particle reduction and improvement in the emission of hydrocarbons and carbon monoxide.



R9 Glow plug
109 Sealing sleeve
110 Prechamber
112 Threaded ring
113 Nozzle plate
114 Nozzle holder combination

31 Nozzle needle
32 Nozzle body
33 Intermediate washer
34 Thrust pin
35 Nozzle mounting nut
36 Compression spring
37 Holding body
38 Fuel bleed connection
40 Shim
45 Supply bore
a Fuel supply
b Leak-off fuel (return)

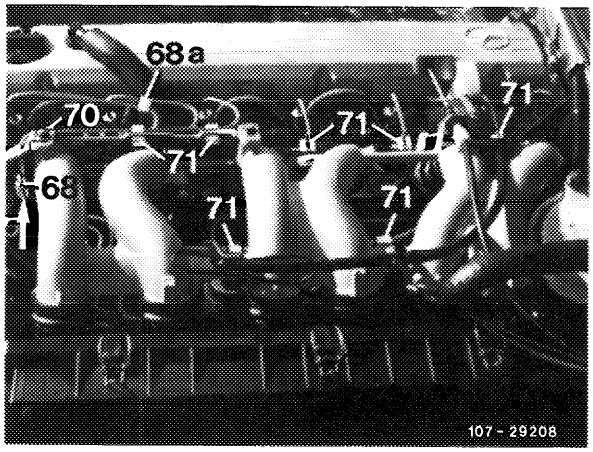
Nozzle holder for inclined injection



O. Injection lines

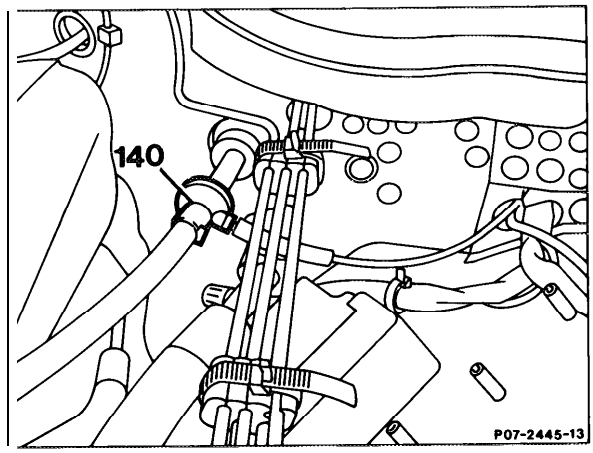
The injection lines are so designed that the injection pump can be pivoted with the engine running.

Note
Due to vibration the plastic clips 68 and 68a must be mounted as closely as possible to the radius of the injection lines (arrows). The plastic clips (71) must be fully engaged.



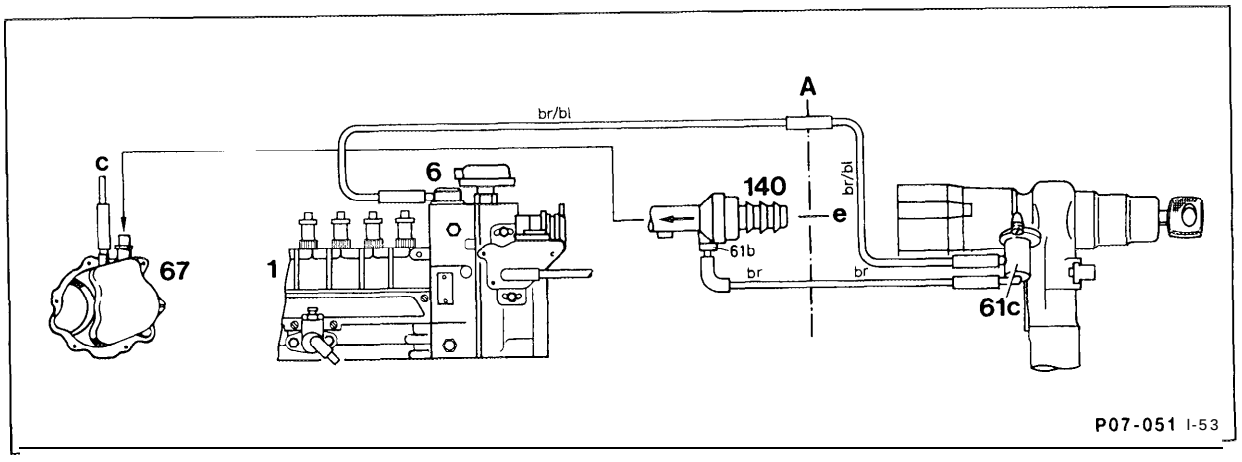
P. Vacuum shut-off with vehicle key (glow starter switch)

The vacuum for the key shut-off has been supplied by the check valve (140) of the main vacuum line since July 1987.



Production breakpoint: July 1987

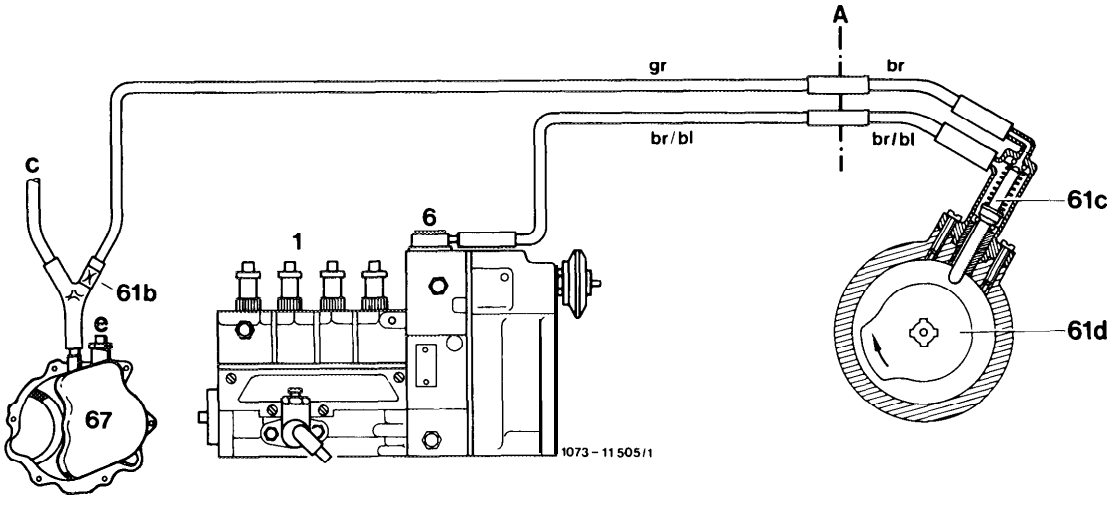
Model	Engine	Vehicle identification end no.	
		A	F
201.126	602.911	384857	383987



Vacuum line routing

1	Injection pump	A	Partition panel
6	Vacuum unit (stop)	c	Remaining users
61c	Valve glow starter switch	e	To brake booster
67	Vacuum pump		
140	Check valve/main vacuum line		

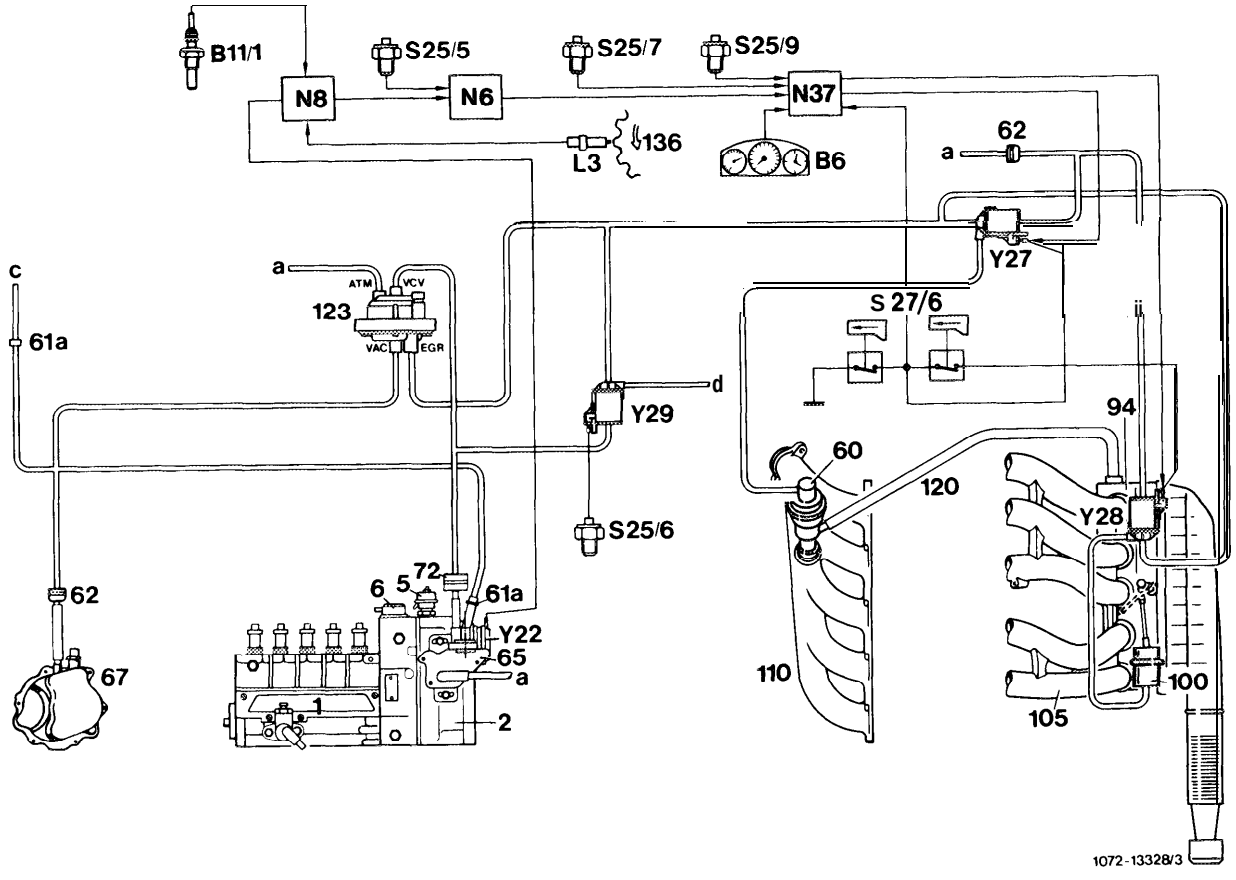
Key shut-off version prior to July 1987



Function diagram

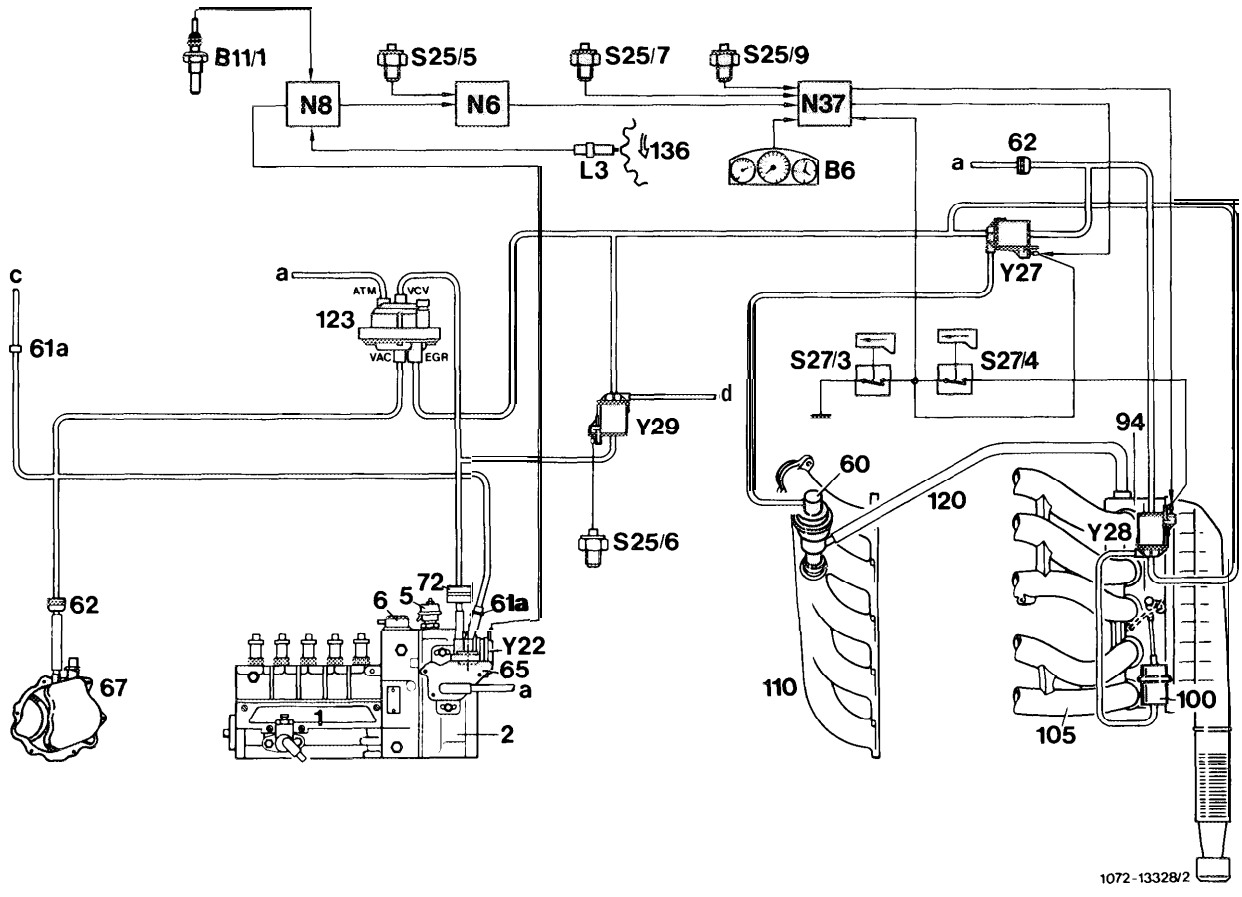
1	Injection pump	A	Partition panel
6	Vacuum unit (stop)	c	Remaining users
61b	Choke 0.5 mm orifice diameter	e	To brake booster
61c	Valve glow starter switch	bl	blue
61d	Cam glow starter switch (valve open)	br	brown
67	Vacuum pump		

Model 201.126 is equipped with an electronically-controlled exhaust gas recirculation system as of model year 1986.



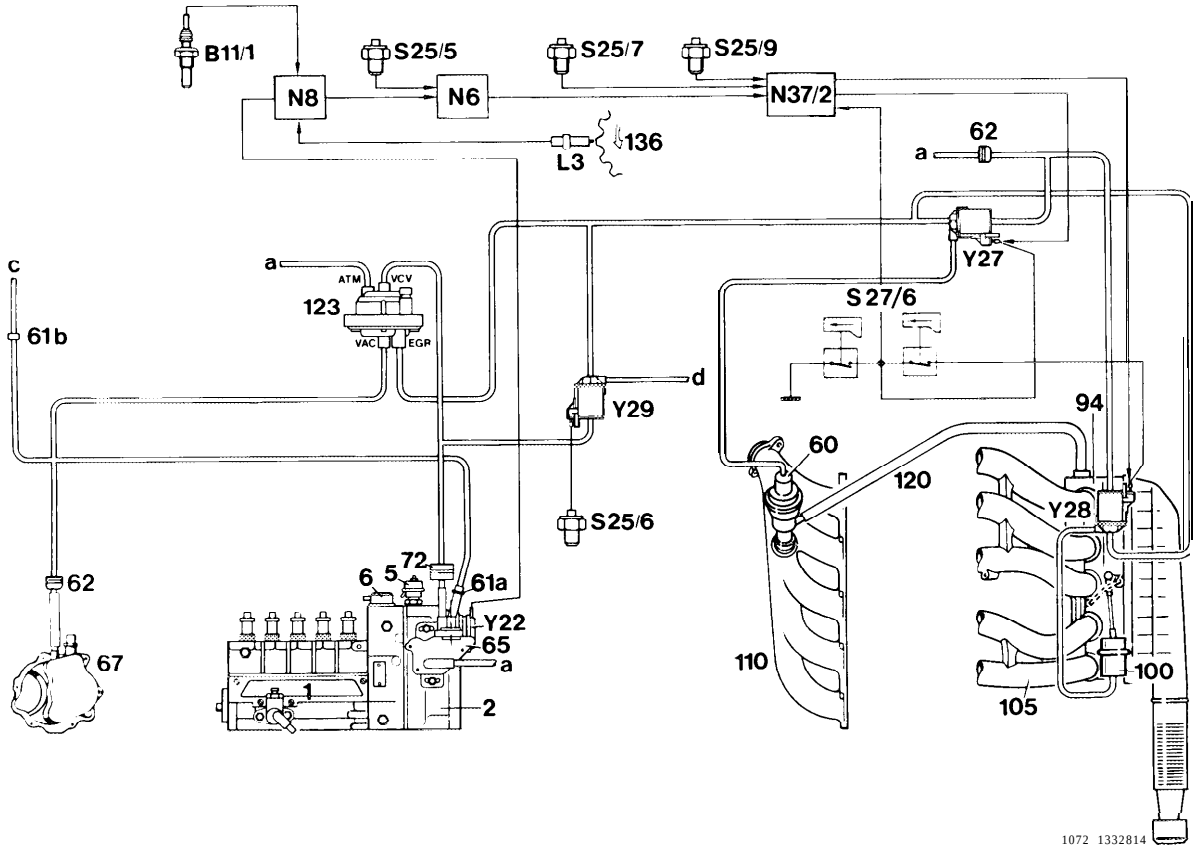
Engine 602 in model 201
as of model year 1986 1 st version
Function diagram exhaust gas recirculation

	Injection pump
2	Governor
5	ADA unit
6	Vacuum unit (stop)
61a	Choke, blue
61b	Choke, orange
62	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
94	Air guide housing
100	Vacuum unit/vacuum control flap
105	Intake pipe
110	Exhaust manifold
120	Exhaust gas recirculation line
136	Starter ring gear
B6	Hall-effect speed sensor
B11/1	Coolant temperature sensor
L3	Speed sensor starter ring gear
N6	Compressor shut-off control unit
N8	Idle speed control unit
N37	Control unit exhaust gas recirculation
S25/5	Temperature switch 1051115 °C
S25/6	Temperature switch 50 °C
S25/7	Temperature switch 25 °C EGR
S25/9	Temperature switch 97 °C EGR
527'6	Microswitch compressor shut-off/EGR
Y22	Electromagnetic actuator ELR
Y27	Switchover valve EGR
Y28	Switchover valve vacuum control flap
Y29	Switchover valve (automatic transmission)



Engine 602 in model 201
as of model year 1986 2nd version
Function diagram exhaust gas recirculation

	Injection pump
2	Governor
5	ADA unit
6	Vacuum unit (stop)
61a	Choke, blue
61b	Choke, orange
62	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
94	Air guide housrng
100	Vacuum unit/vacuum control flap
105	Intake pipe
110	Exhaust manifold
120	Exhaust gas recirculation line
136	Starter ring gear
B6	Hall-effect speed sensor
B11/1	Coolant temperature sensor
L3	Speed sensor starter ring gear
N6	Compressor shut-off control unit
N8	Idle speed control unit
N37	Control unit exhaust gas recirculation
S25/5	Temperature switch 105/115 °C
S25/6	Temperature switch 50 °C
S25/7	Temperature switch 25 °C EGR
S25/9	Temperature switch 97 °C EGR
S27/6	Microswitch compressor shut-off/
Y22	Electromagnetic actuator ELR
Y27	Swrtchover valve EGR
Y28	Swrtchover valve vacuum control flap
Y29	Swrtchover valve (automatic transmission)



Engine 602 in model 201

model year 1989

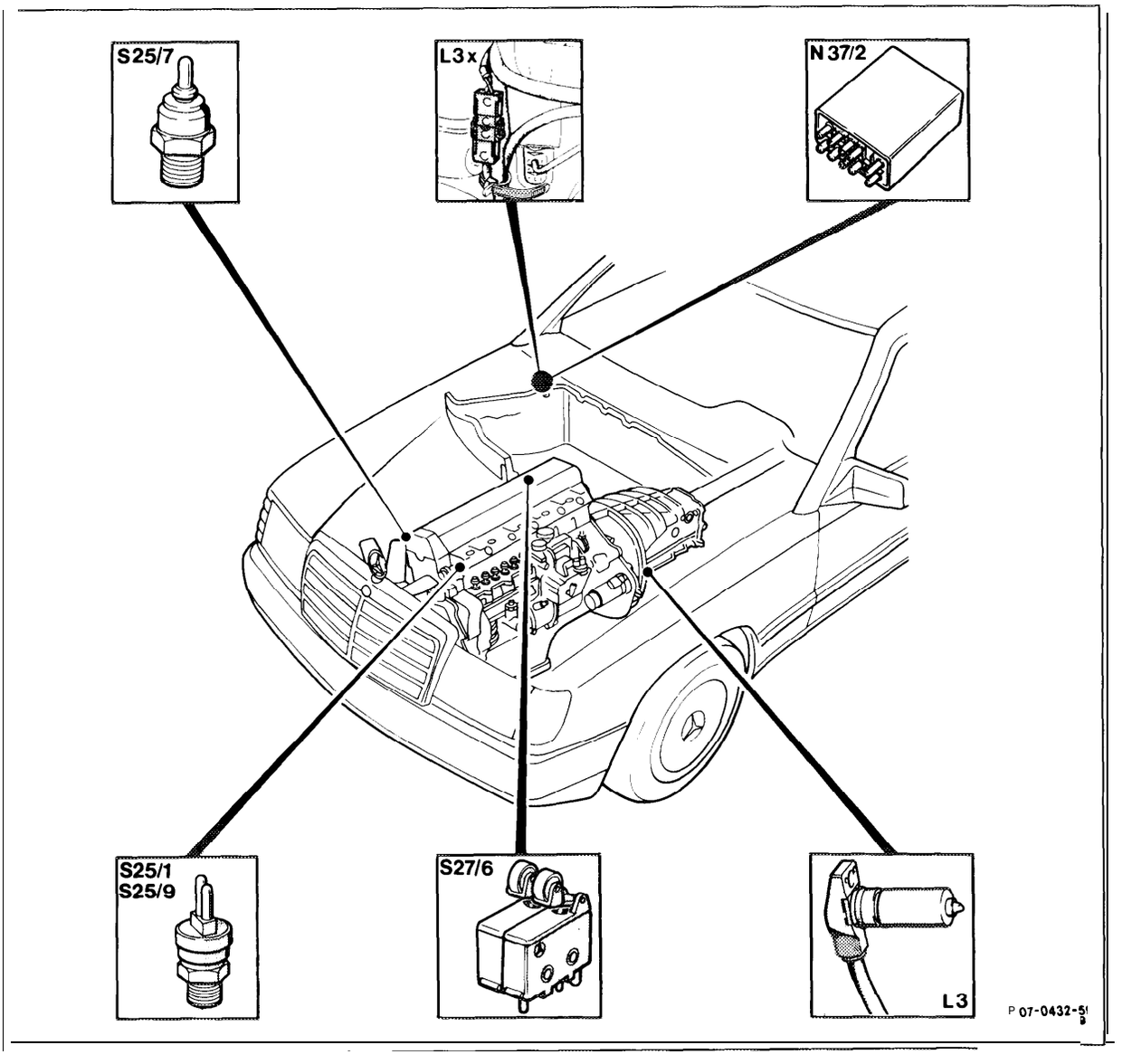
Function diagram exhaust gas recirculation

1	Injection pump
2	Governor
5	ADA unit
6	Vacuum unit (stop)
60	Exhaust gas recirculatron valve
61a	Choke, blue
61b	Choke
62	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
94	Air guide housing
100	Vacuum unit/vacuum control flap
105	Intake pipe
110	Exhaust manifold
120	Exhaust gas recirculation line
123	Vacuum amplifier
136	Starter ring gear

B1 I/I	Coolant temperature sensor
B11/7	Climate temperature sensor
L3	Speed sensor starter ring gear
N6	Compressor shut-off control unit
N8	Idle speed control unit
N37/2	Control unit exhaust gas recirculation
S25/5	Temperature switch 1 05/1 15 °C
S25/6	Temperature switch 50 °C
S25/7	Temperature switch 25 °C EGR
S25/9	Temperature switch 97 °C EGR
S27/6	Microswitch compressor shut-off/
Y22	Electromagnetic actuator ELR
Y27	Swrtchover valve EGR
Y28	Swrtchover valve vacuum control flap
Y29	Switchover valve (automatrc transmission)
a	Ventilation to vehicle interior
c	Remaining users
d	Vacuum unit automatrc transmission
	Vacuum connections on vacuum amplifier
VAC	- Vacuum from vacuum pump
v c v	- To vacuum control valve
ATM	- Ventilation to vehicle Interior
EGR	- Exhaust gas recirculation to exhaust gas recirculation valve

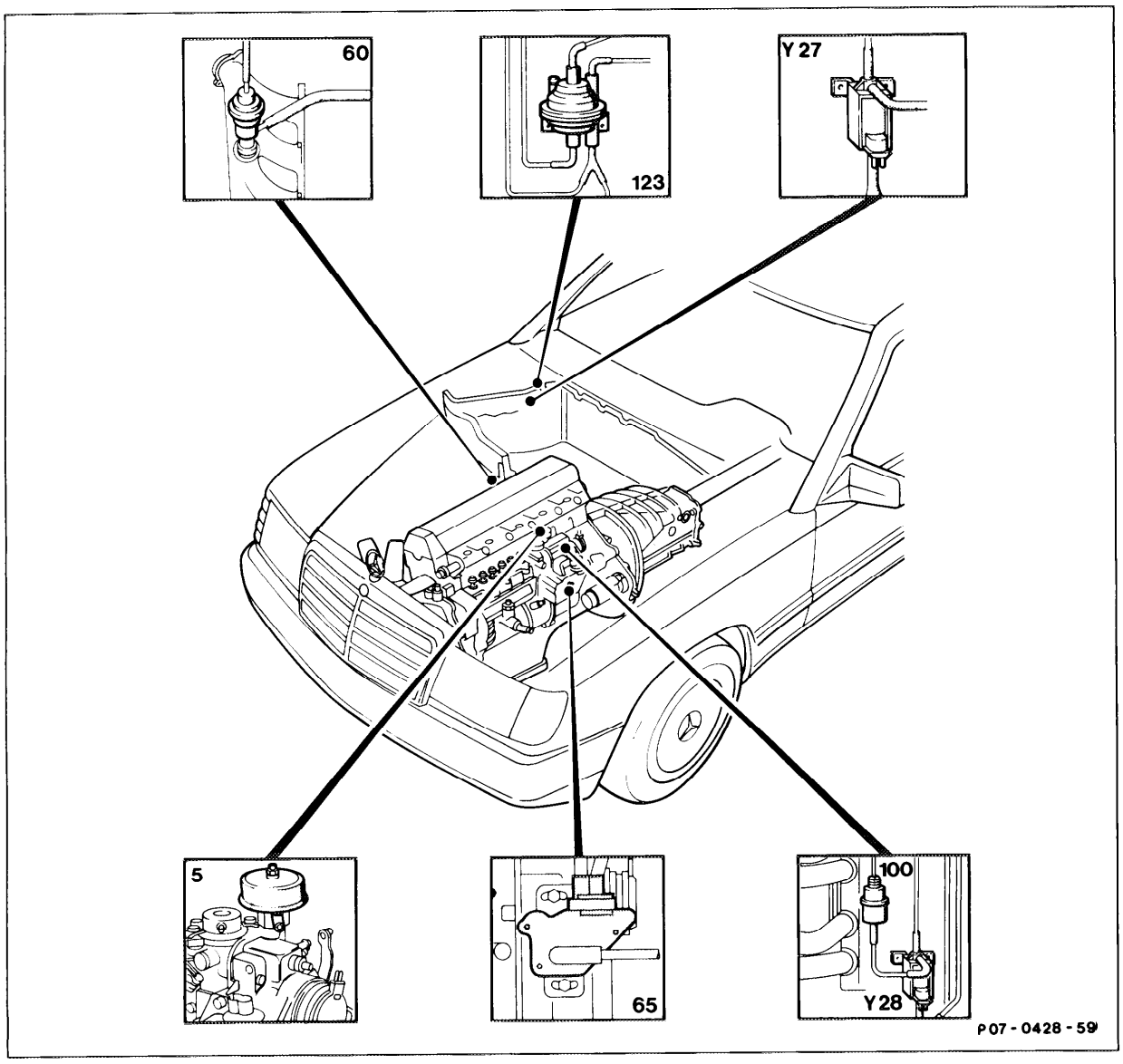
B. Components and function

Electrical components



L3	Starter ring gear speed sensor
L3x	Connector starter ring gear speed sensor
N37/2	Control unit exhaust gas recirculation
S25/1	Temperature switch 100 °C
S25/7	Temperature switch 25 °C
S25/9	Temperature switch 97 °C
S27/6	Microswitch compressor shut-off/EGR

Pneumatic components



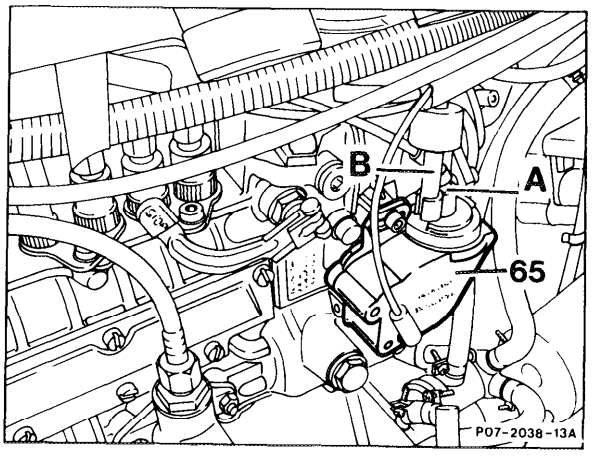
5	**ADA unit**
60	EGR valve
65	Vacuum control valve
100	**Vacuum** unit vacuum control flap
123	Vacuum amplifier
Y27	Switchover valve exhaust gas recirculation
Y28	Switchover valve vacuum control flap

C. Overall function

Vacuum control valve (65)

The vacuum control valve is attached to the injectton pump and connected to the control lever by means of a driver. Using available vacuum supply (central connection) it modulates decreasing pressure with increasing load.according to a.characteristic map.

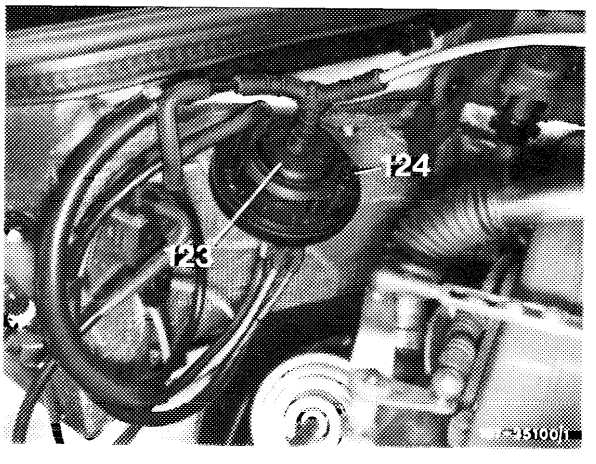
The vacuum control valves have a different characteristic depending on the engine and transmission design. They are identified by differently colored sealing caps and must not be interchanged (see 07. l-l 70).



65 Vacuum control valve
A Control line
B Suction line

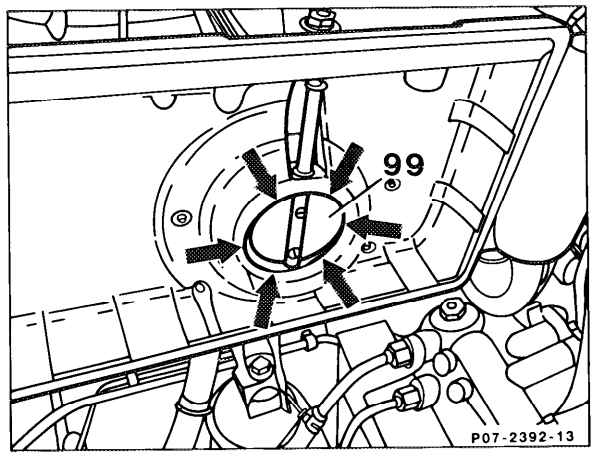
Vacuum amplifier (123)

(only with automatic transmission)
Attached to the unit wall.
The pressure modulated by the vacuum control valve is converted in the vacuum amplifier (123) for use in the exhaust gas recirculation system. By way of the switchover valves (Y27 and Y28) the exhaust gas recirculation valve and the vacuum control flap are activated.



Air guide housing with vacuum control flap (99)

A pneumatically actuated vacuum control flap (99) is provided in the air guide housing in order to increase the vacuum in the intake pipe. During engine operation with exhaust gas recirculation the vacuum control flap closes off the fresh air duct.



A minimum opening (arrow) between the vacuum control flap (99) and the air guide housing is maintained in a closed condition.

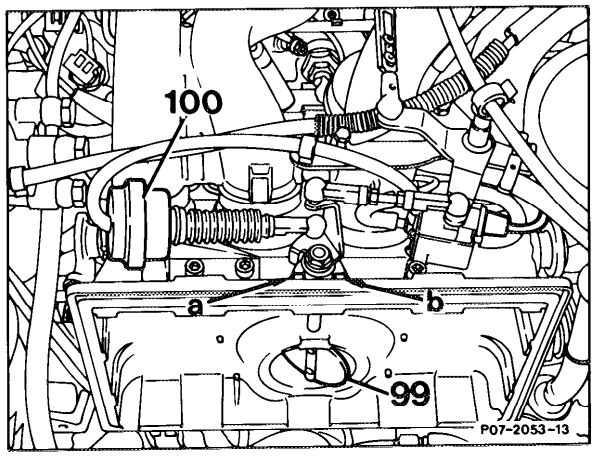
Note

The linkage on the vacuum unit for the vacuum control flap (99) may not be actuated manually.

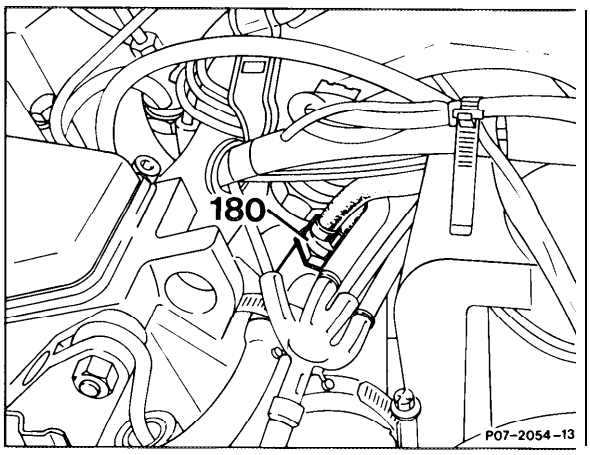
Mechanical pressure control flap (99) with pneumatic control group, temperature-dependent > 40 °C

The exhaust gas recirculation is optimised by a mechanical actuation of the pressure control flap (99), thus improving the degree of the exhaust gas recirculation rate.

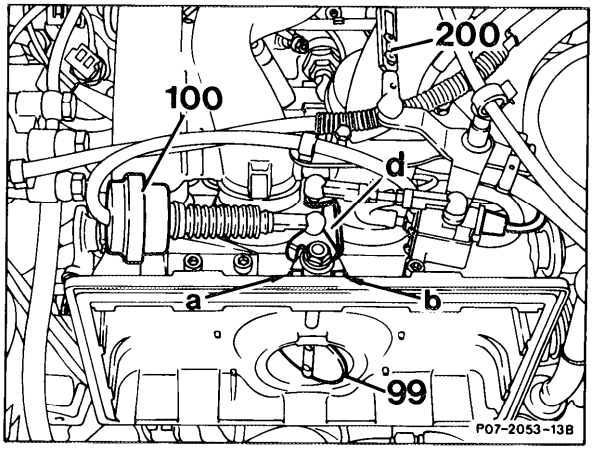
The pressure control flap (99) is always approximately 35° open in its initial setting (at idle speed).



When the coolant temperatures are > 40 °C between 1000 ± 50/min and 2500 ± 50/min the pressure control flap is pneumatically closed via the thermovalve (180) and is opened again mechanically via the accelerator depending on the load condition.
The pressure control flap is open at full throttle.



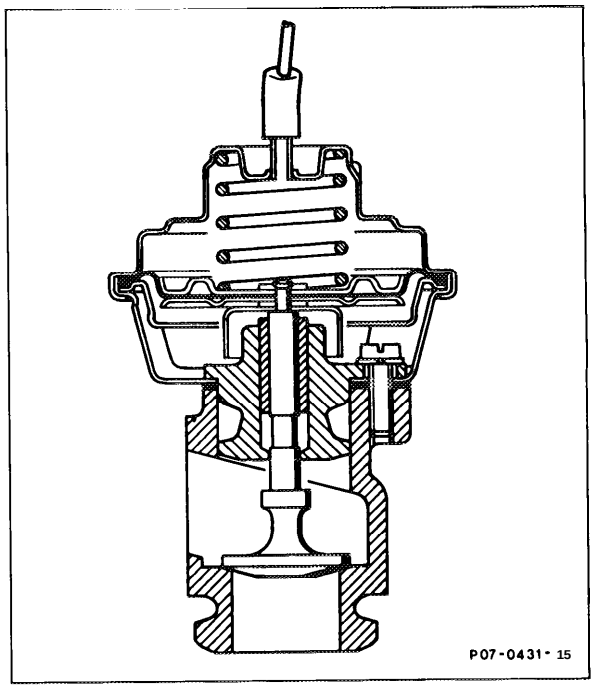
It became necessary to introduce a connecting rod (200) at the vacuum unit for the pressure control flap (due to the mechanical actuation of the pressure control valve (99)).



Exhaust gas recirculation valve

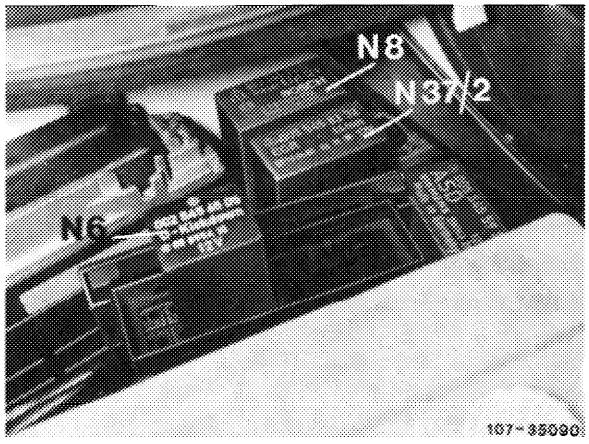
The exhaust gas recirculation valve is screwed into the side of the cylinder head. It is connected with the exhaust and the intake manifolds by way of the exhaust gas recirculation line.

The exhaust gas recirculation valve is activated by the modulated vacuum from the vacuum control valve and opens depending on the load condition.



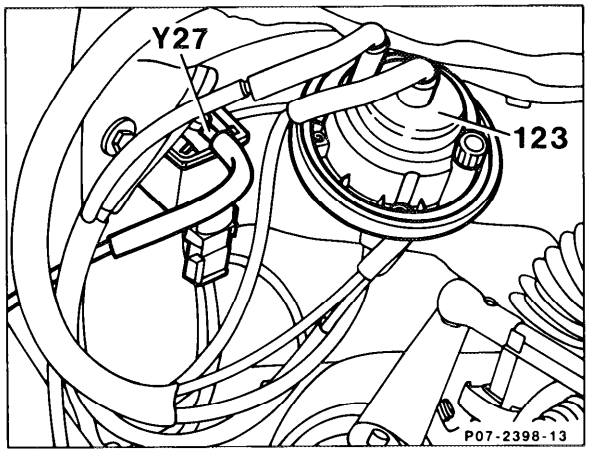
Control unit (N37 and N37/2)

This is installed behind the battery. Battery voltage is available on the control unit EGR (N37 or N37/2) after the ignition has been switched on. Minimum working voltage approx. 11 v.



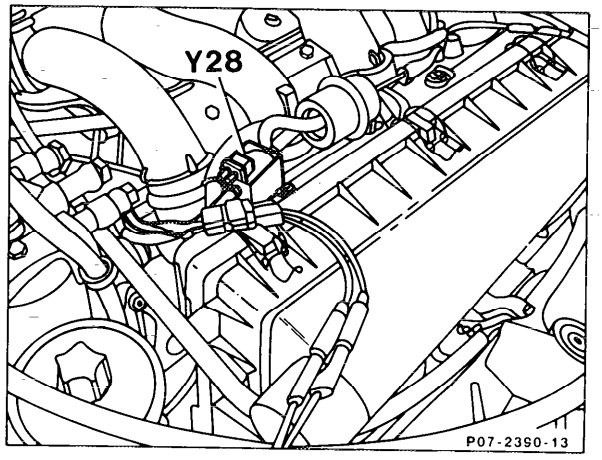
Electrical switchover valve (Y27)

This admits vacuum for the exhaust gas recirculation in certain operating conditions. The activation is by way of the control unit EGR (N37 or N37/2) as a function of coolant temperature and engine speed as well as speed and load-dependent on the microswitch (only with manual 5-speed transmission).



Electrical switchover valve (Y28)

This admits the vacuum for the vacuum control flap under certain operating conditions. The activation is by way of the-control unit EGR (N37 or N37/2) as a function of coolant temperature and engine speed as well as dependent on speed and load via the microswitch (S27 4).



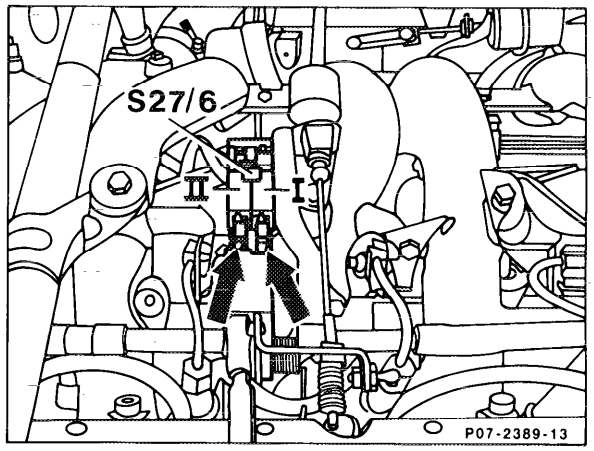
Microswitch (S27/6)

Microswitch I

Switches off the exhaust gas recirculation and the AC compressor before full load (A/C compressor only if climate comfort control is operative).

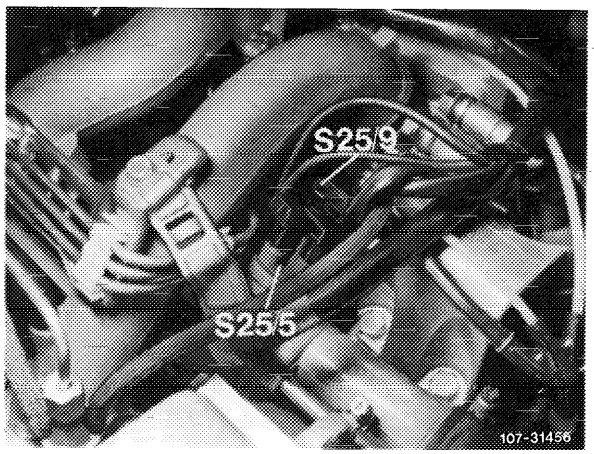
Microswitch II

Switches off the vacuum control flap before reaching full load.

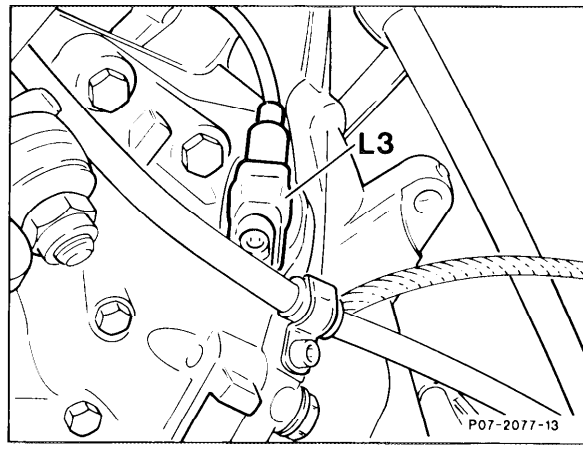


Coolant temperature switch 97° and ioo °C (S25/1, S25/4, S25/9)

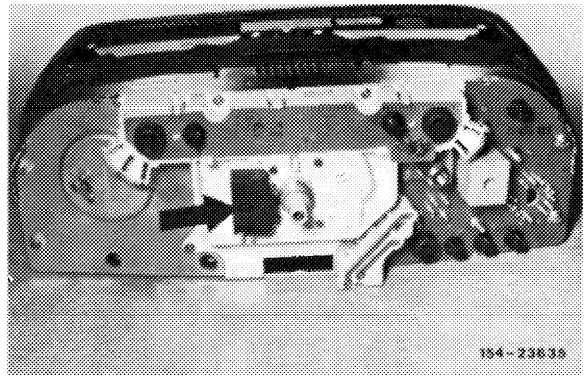
For thermal protection of the engine the temperature switch switches off the exhaust gas recirculation via the control unit EGR (N37 or N37/2) from a coolant temperature of approx 100 °C.



Starter ring gear speed sensor (L3)
This is attached to the flange of the transmission. The speed sensor (L3) consists of a magnetic core and a coil. It registers the engine speed, passing it on to the control unit EGR (N37 or. N37 2) in form of an AC voltage.



#all-effect speed sensor (B6)
(only with manual transmission)
The vehicle speed is taken off the speedometer by the Hall-effect speed sensor (arrow). At a speed above 87 km/h the exhaust gas recirculation is switched off by the control unit.



D. Overall function

Exhaust gas recirculation
Exhaust gas recirculation is effective if the following requirements have been met:

- **Engine speed**
  between 1200 ± 50/min and 2950 ± 50/min for model years 1986 through 1988.
  between 1000 ± 50/min and 2950 ± 50/min for model year 1989.

- **Coolant temperature** between 25 °C and 97 °C engine 602.

- **Speed** below 85 km h approx. 56 mph, (M.Y. 1986-8), approx. 53 mph (M.Y. 1989) only manual 5-speed transmission.

- **Accelerator pedal not in full load position** as the EGR valve is closed via the microswitch just before full throttle position.

- **Vacuum control flap** between 1000 ±50/min and 2500 ±50/min closed.

The control unit EGR (N37 or N37 2) registers the following input signals

- Engine speed
- Speed (only manual 5-speed transmission)
- Temperature
- Load (accelerator pedal position)

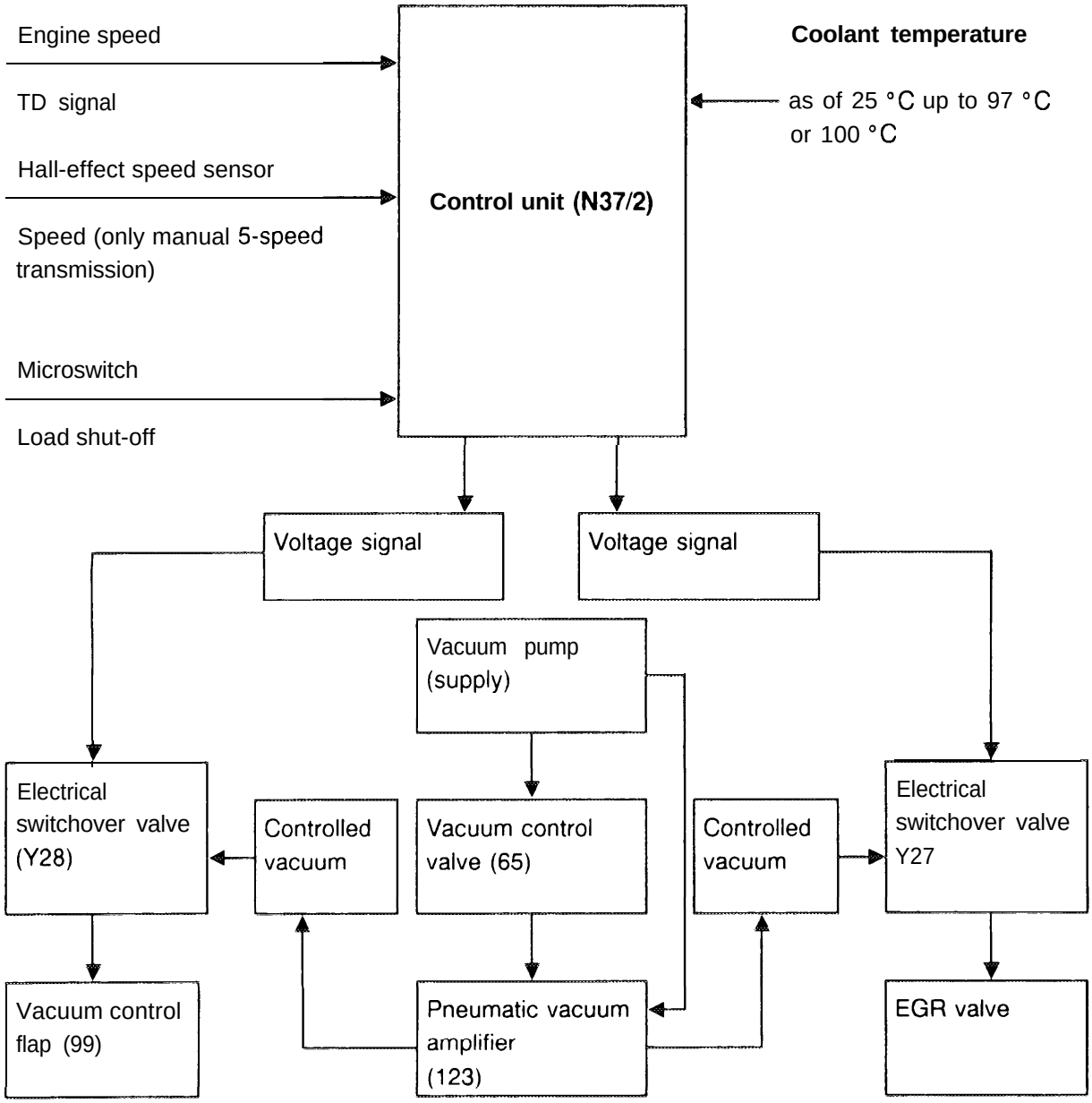
It sends a voltage signal to the switchover valves (Y27) and (Y28). Supply vacuum is available on the vacuum control valve (65) and the vacuum amplifier (123). The vacuum control valve (65) passes a modulated vacuum on to the vacuum amplifier (123). The transducer regulates the vacuum from the vacuum control valve according to the load condition. This controlled vacuum is then used to activate the EGR valve and the vacuum control flap. The vacuum control flap is closed from 1000 ±50/min to 2500 ± 50 min which increases the exhaust gas recirculating rate.

Note

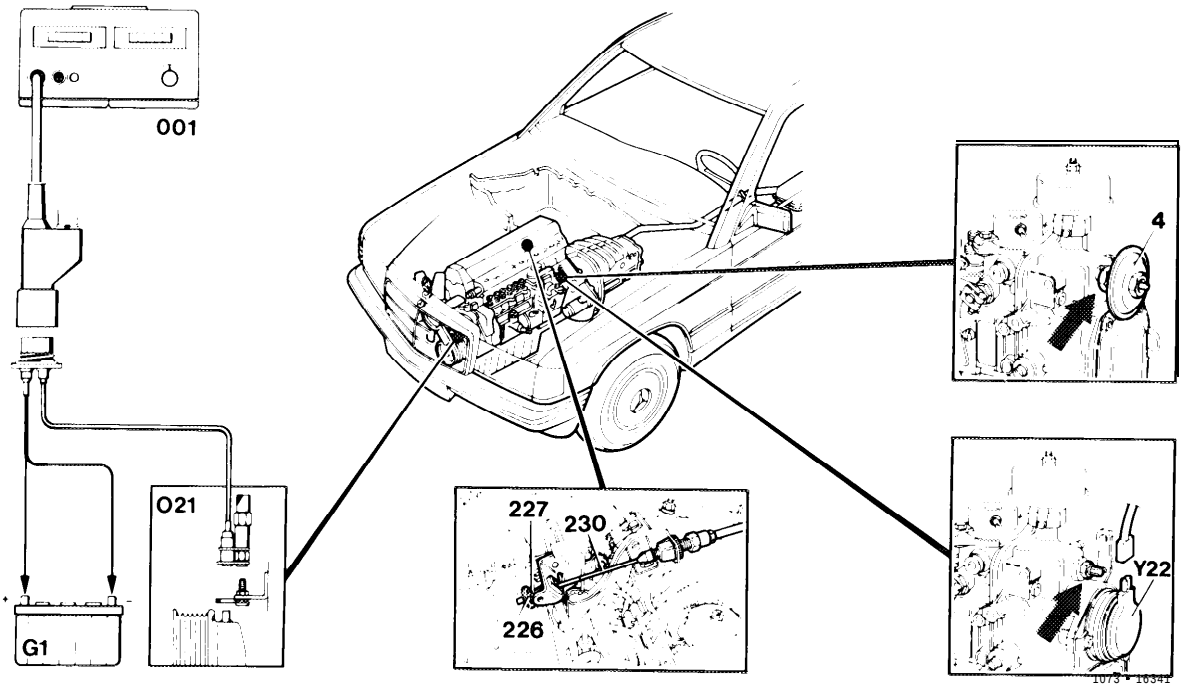
The vacuum amplifier is not installed in vehicles with manual transmission. The exhaust gas recirculation valve and the vacuum control flap are activated directly by the vacuum control valve.

From model year 1990 mechanical pressure control flap (99) with pneumatic control unit, temperature dependent via thermovalve > 40 °C.

Block diagram exhaust gas recirculation



07.1-100 Testing, adjusting idle speed

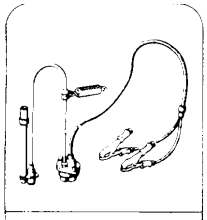


Digital tester (001) and pulse generator (021)	connect, disconnect..
Control	check for easy operation.
Idle speed stop on Bowden cable	check, spring retainer (226) must contact the compression spring (227) without preload.
Bring engine to	60-80 °C coolant temperature.
Double coupling of electromagnetic actuator (Y22)	pull off, refit.
Idle speed	check, adjust.
Smooth engine operation	check by switching on all additional units.

Test and adjusting values

Engine	Idle speed 1/min Electronic idle speed control (ELR)	
	with control	without control Plug on electromagnetic actuator pulled off
602	680 ± 20	620 ± 40

Special tools



603 589 00 21 00
07

Commercially available tools

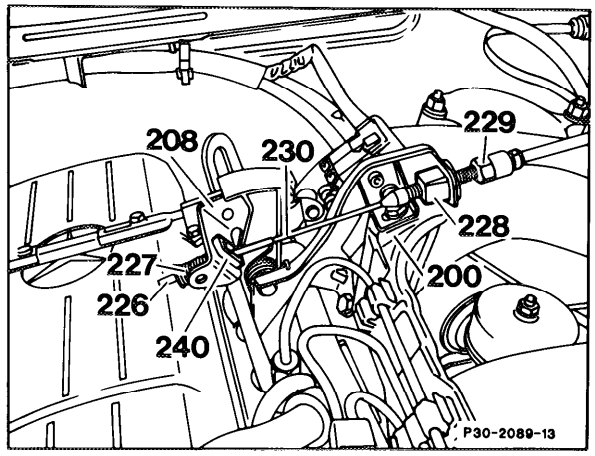
Digital tester	e.g. Bosch, MOT 002.01 Sun, DIT 9000

Adjusting

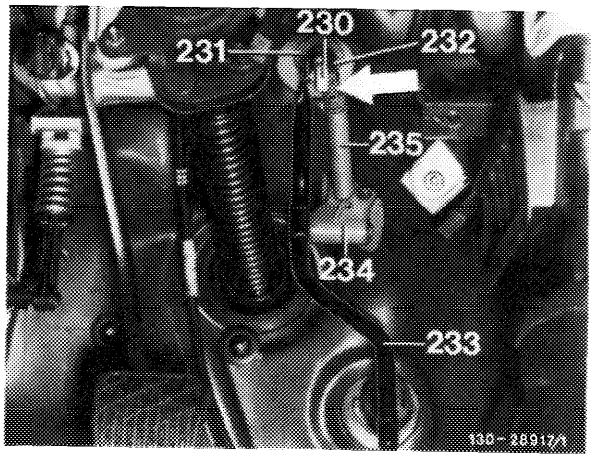
1 Connect digital tester (001) and pulse generator (020).

2 Check control for easy operation and condition.

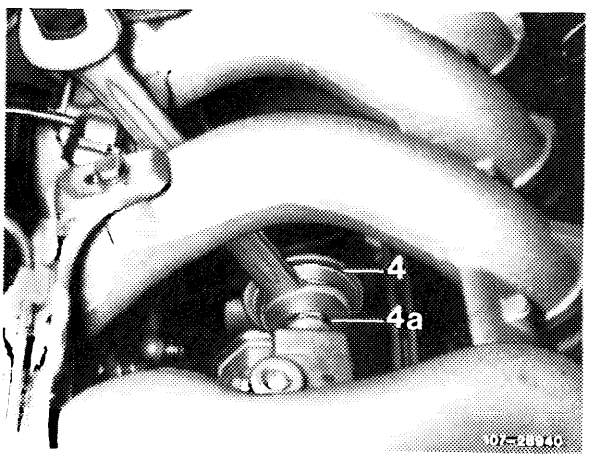
Check idle speed stop; in idle speed position the spring retainer (226) of the Bowden cable (230) must contact the compression spring (227) without preload.



Adjust adjusting nut (232) of Bowden cable (230) from the vehicle inside if required.

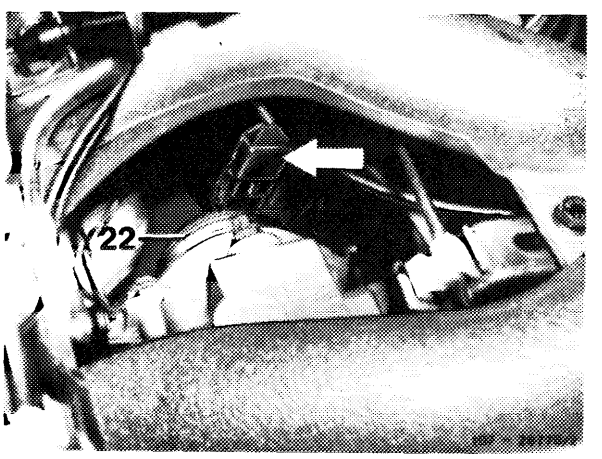


3 Run engine up to 60-80 °C coolant temperature.



Engine 602 with electronic idle speed control

4 Pull double coupling off electromagnetic actuator.

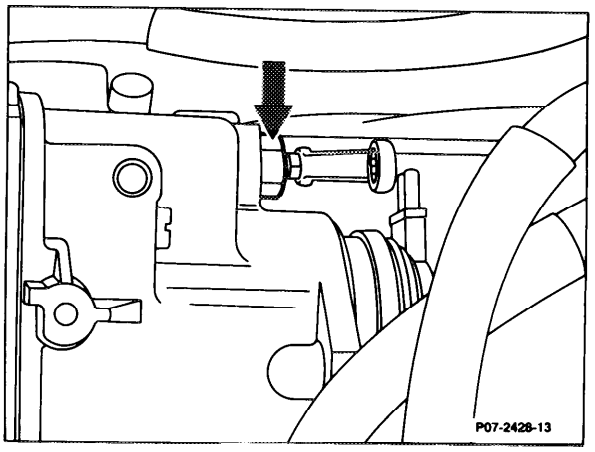


5 Loosen lock nut (arrow) and adjust idle speed

left = higher speed

right = lower speed

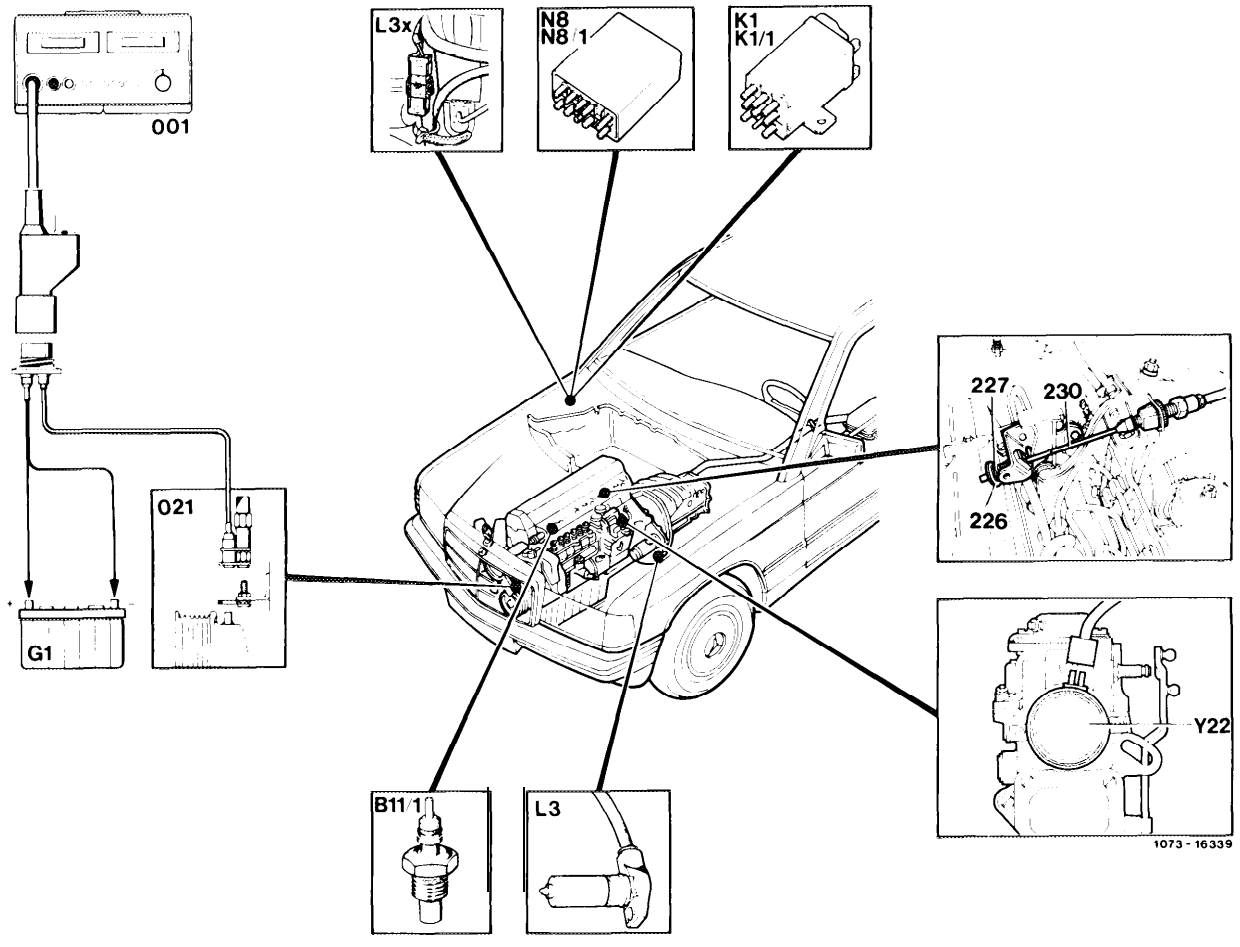
Test values see table Test and adjusting values



6 Switch on all additional equipment and ensure engine operates smoothly.

07.1-103 Checking electronic idle speed control

Engines without test coupling (X92)
(Engines with test coupling (X92) see 07.14 05 Checking ELR).



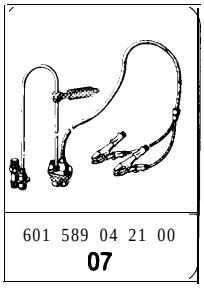
Digital tester (001) and pulse generator (021)	connect, disconnect.
Control	check for easy operation.
Idle speed stop on Bowden cable (230)	check, the spring retainer (226) must contact the compression spring (227) without preload.
Overvoltage protection (K1 or K1/1) and fuse	check, measure voltage between jacks 9 and 11 of the control unit coupling, set value approx. 12 V.
Engine	run to 60-80 °C coolant temperature.
Pull double coupling off electromagnetic actuator (Y22) and refit (at least for 3 s)	engine speed increases briefly.

Adjusting basic idle speed on injection pump	pull plug of electromagnetic actuator (Y22).
Speed sensor (L3) on coupling (L3x)	check, resistance 0.4-2.5 kΩ, engine at idle speed voltage > 4 V AC.
Coolant temperature sensor (B1 1 /1)	check, set value +20 °C 2.2 - 2.8 kΩ.
Electrical activation of the electromagnetic actuator (Y22)	check, engine idling, set value approx. 12 V.

Test and adjusting values

Engine	Idle speed 1/min Electronic idle speed control (ELR)	
	with control	without control Plug pulled off electrom. actuator
602.911	680 ± 20	620 ± 40

Special tools



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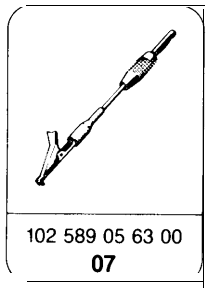

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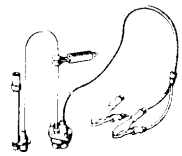


603 589 00 21 00
07

Commercially available tools

Multimeter	e.g. Sun, DMM-5
Digital tester	e.g. Bosch, MOT 002.01 Sun, DIT 9000

Note

Electrical wiring diagrams see job no. 07.1-400.

Testing jobs

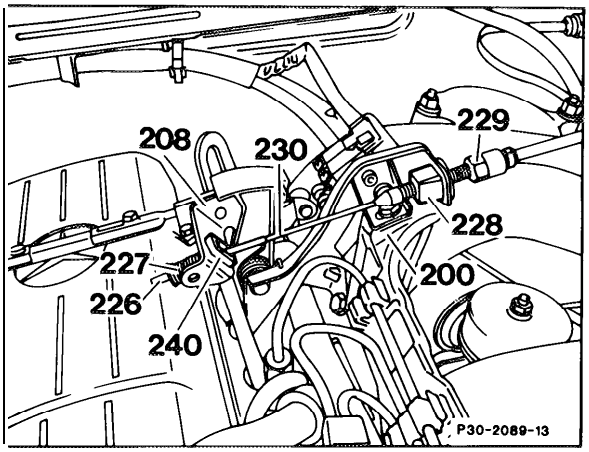
Connect digital tester (001) and pulse generator (021).

Check control for easy operation and condition.

Check idle speed stop on Bowden cable (230).

The spring retainer (226) of the Bowden cable (230) in idle speed position must contact the compression spring (227) without preload.

Run engine to 60-80 °C coolant temperature.



Checking overvoltage protection (K1 or K1/1)

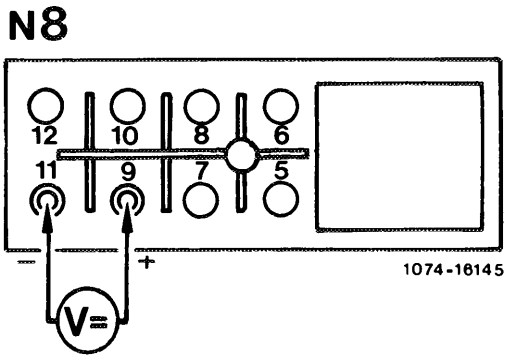
Switch on ignition, pull off control unit (N8 or N8/1) and check voltage between the jacks (9 and 11).

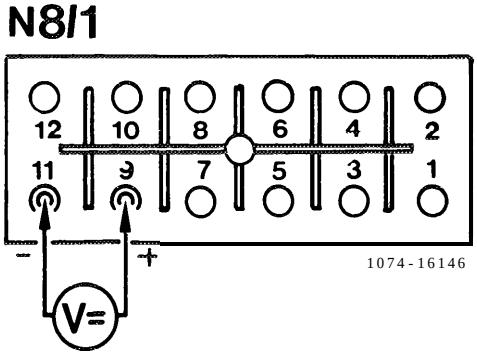
Display: approx. = 12 V

Yes	No

Check fuse on overvoltage protection. Check activation according to electrical wiring diagram.

End of test





Function check

Engine idling. Pull double coupling (arrow) off ELR electromagnetic actuator (Y22) for at least 3 sec. and refit. Engine speed increases briefly.

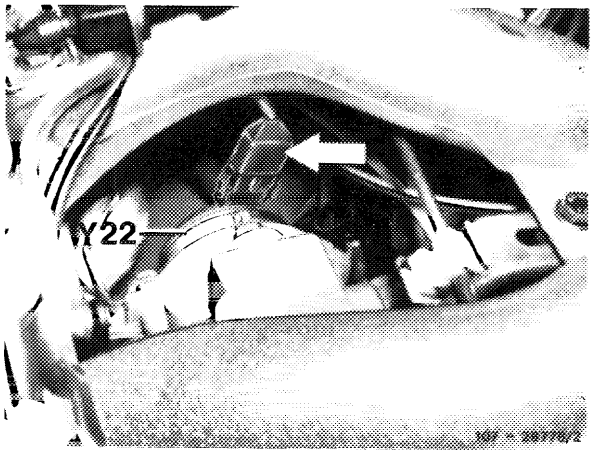
Yes | No

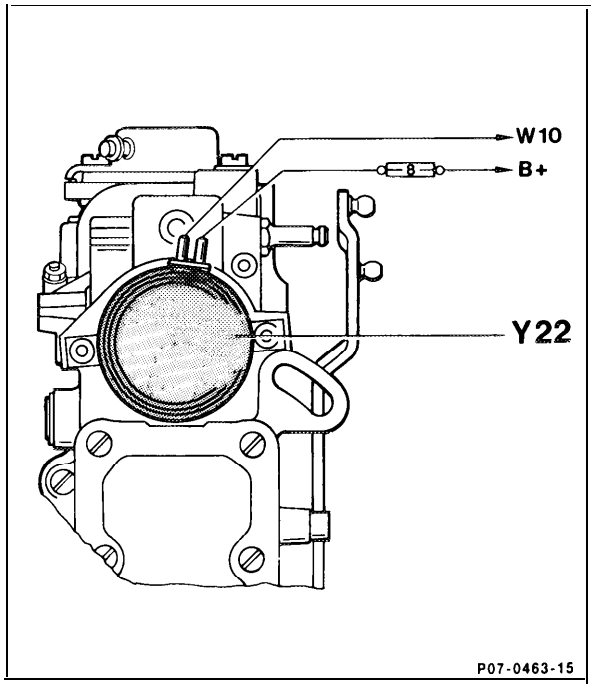
Briefly apply battery voltage (approx. 12 V) to ELR electromagnetic actuator (Y22). Idle speed increases.
Caution!
If battery voltage is applied for longer than 3 sec. the ELR electromagnetic actuator will be damaged.

Yes | No

Check individual parts.

Replace electromagnetic actuator (Y22).





Engine idling. Pull double coupling of electromagnetic actuator (Y22).
Check idle speed.

Set values:

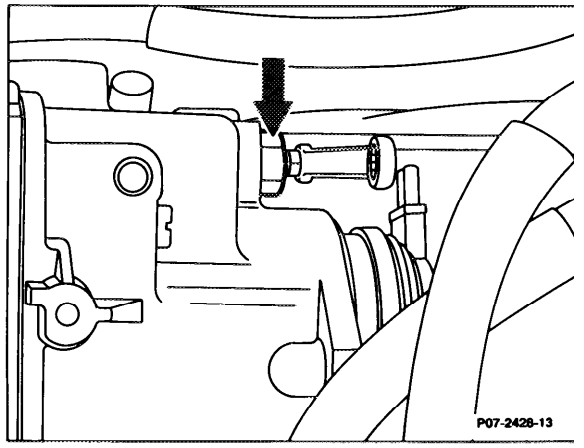
Engine	Idle speed/min
602.911	620 ± 40

Yes	No

End of test

Adjust idle speed by loosening lock nut (arrow).

left = higher
right = lower



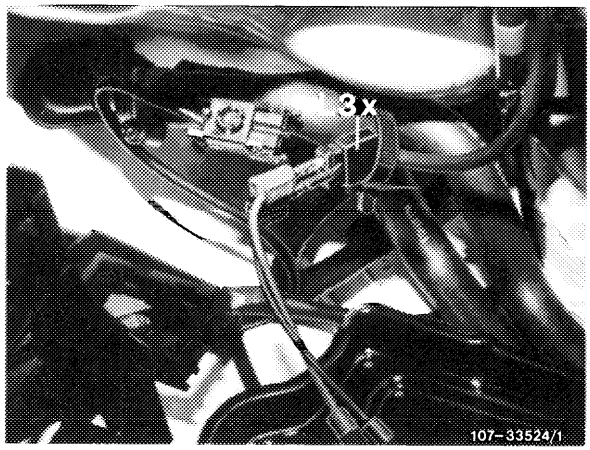
End of test

Checking speed sensor (L3)

Engine switched off. Remove plug connector (L3x). Connect multimeter and press key „Ω". Check resistance.

Display: 0.4-2.5 kΩ

Yes | No

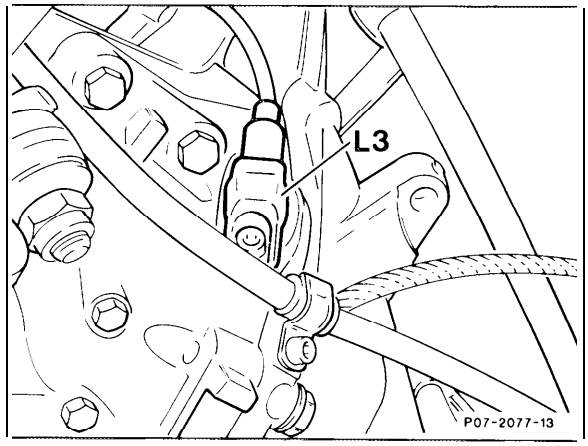


Replace starter ring gear speed sensor (L3).

Multimeter connectron as above, press key "V~". Run engine at idle speed.

Display: > 4 V AC
Voltage rises with speed.

Yes | **No**



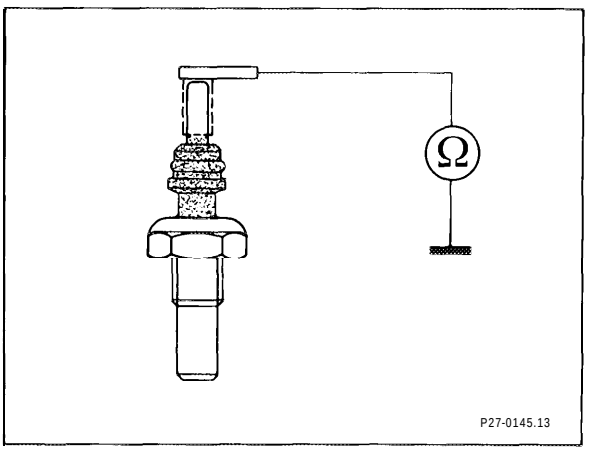
Inspect starter ring gear speed sensor for accumulation of dirt or metal chips, clean if required.

End of test

Checking coolant temperature sensor (B1 I/I)

Engine off. Remove plug from temperature sensor and measure resistance against ground.
Set values see diagram.
Measure resistance at two temperature measuring points.

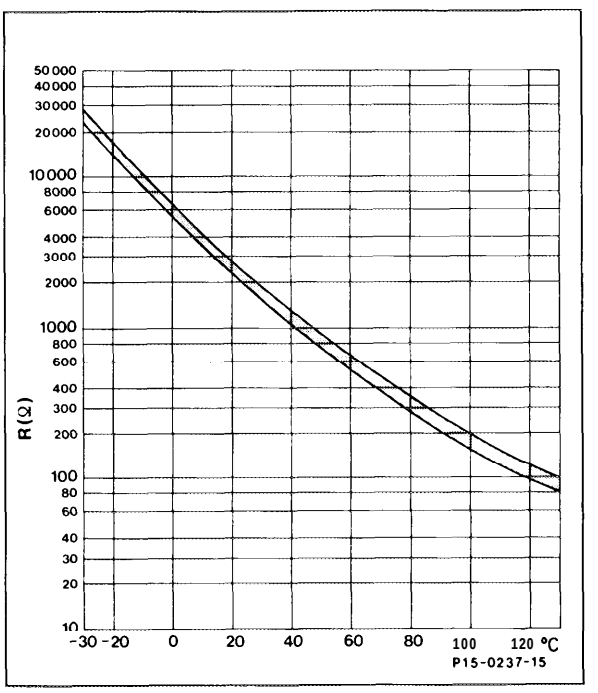
Example:
+ 20 °C = 2.2-2.8 kΩ
+ 80 °C = 290-370 Ω



Yes | No

No → Replace codant temperature sensor.

Replace codant temperature sensor. → End of test

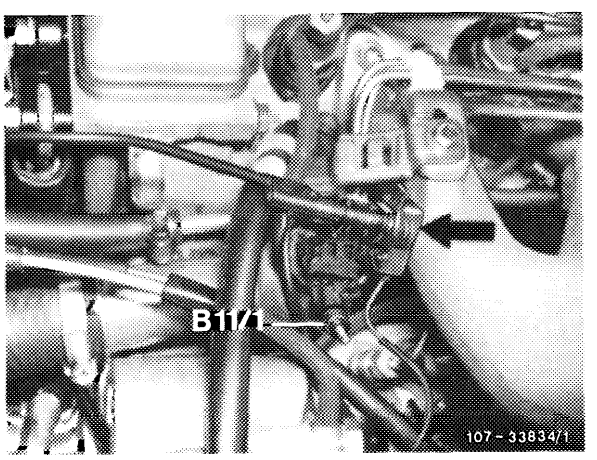


Measure voltage on I-pole coupling (arrow) "Ignition" on.

Display: approx. 5 V

Yes | No

No → Eliminate line interruption. Replace control unit (N8 or N8/1).



End of test

Checking electrical activation of electromagnetic actuator

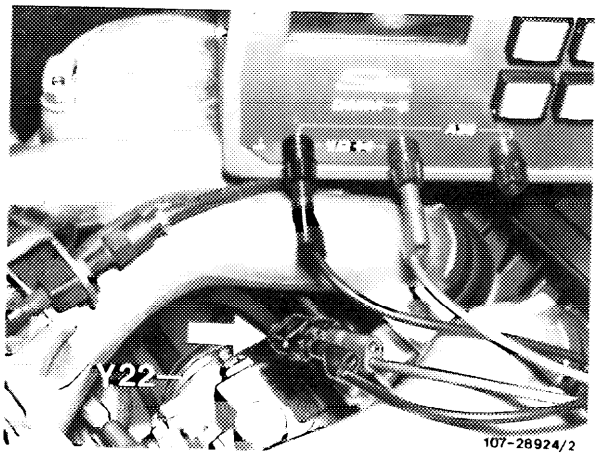
Engine idling. Remove double coupling (arrow) from electromagnetic actuator (Y22) and measure voltage with multimeter in key "V =".

Display: approx. = **12** V

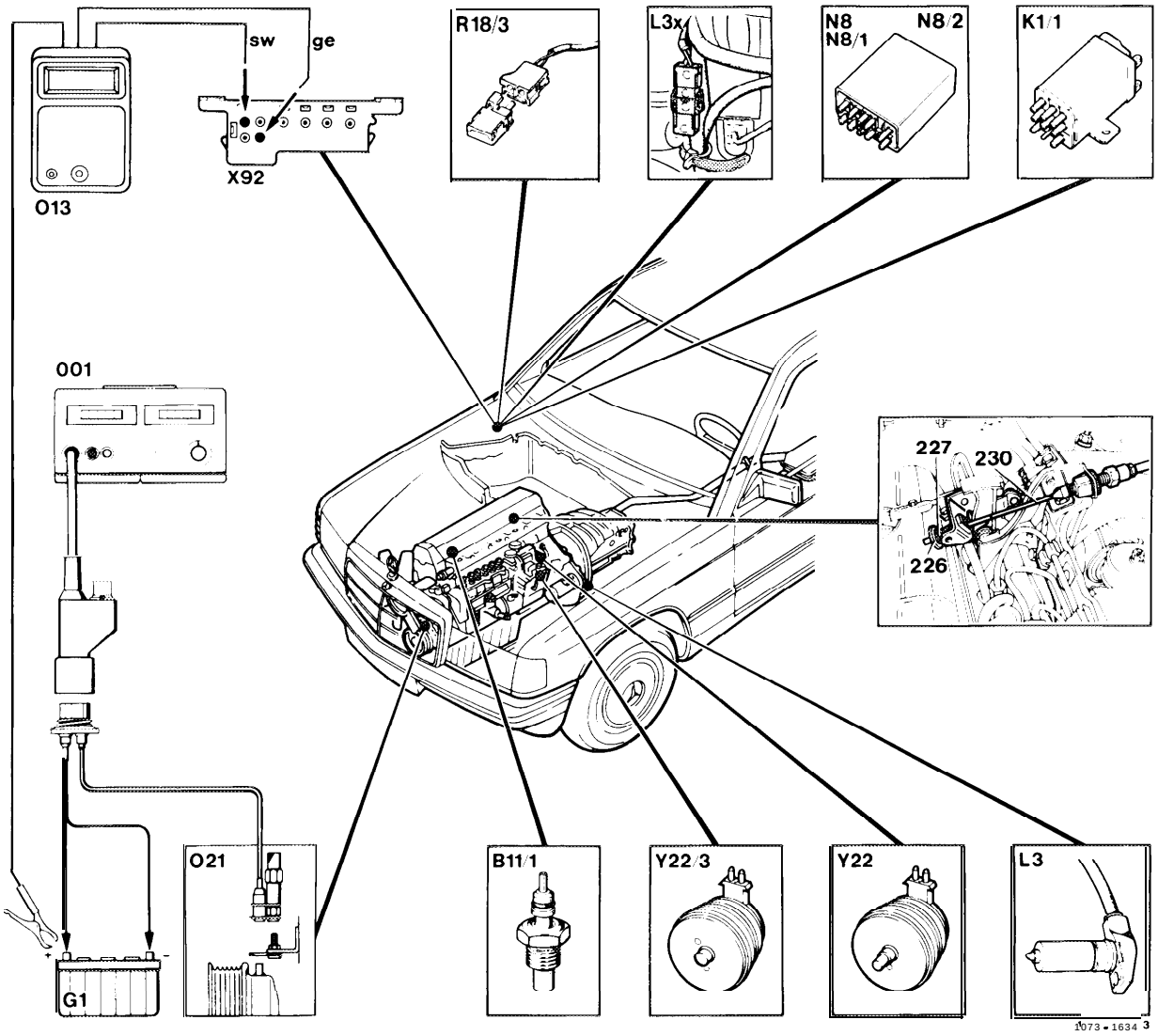
Yes	No

Check activation according to electrical wiring diagram, replace control unit (N8 or N8/1) if required.

End of test



07.1405 Checking electronic idle speed control (ELR)

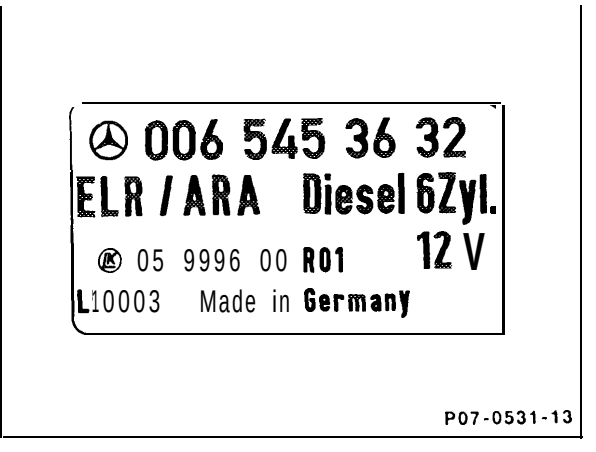


Digital tester (001) and pulse generator (021) ...	connect, disconnect.
Impulse counter (013) to battery (G1) and test coupling (X92)	connect.
Control for easy operation	check
Idle speed stop on Bowden cable (230)	check, the spring retainer (226) must contact the compression spring (227) without preload.
Overvoltage protection fuse	check.

Engine	run at coolant temperature to 60-80 °C.
Engine	run at idle speed.
Starting key of impulse counter (013)	actuate 2 to 4 seconds.
Display	read and note down.
Starting key	again actuate, if no new display appears no further fault is in the system.

Impulse display	Component/Control circuit
1	All functions “in order”
2	Speed signal " Fault”
3	Coolant temperature " Fault”
6	Control circuit ELR " Fault”

Only short-circuit faults are identified by control units with "RO1".
Control units with "RO2" are also able to identify interruption.
Production breakpoint: Control unit with "RO2" May 1988.



P07-0531-13

P07-0532-1

Impulse display “2”
Speed sensor (L3) on coupling (L3x) . . . . . check, speed signal voltage > 2.8 V AC
Resistance 0.4-2.5 kΩ
Engine at idle speed voltage > 4 V AC.

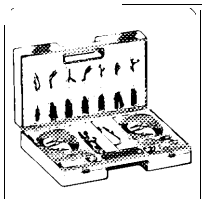
Impulse display "3"
Coolant temperature sensor (B1 1 / 1) . . . . . check, set value at + 20 °C 2.2-2.8 kΩ.

Impulse display "6"
Pull double coupling off ELR electromagnetic actuator (Y22) and refit (at least 3 s) ..... Engine speed rises briefly.
Idle speed without control, plug on electromagnetic actuator pulled off check, adjust if required. .... Set values see table.
If fitted, pull off individual adjustment plug (R18/3), glow starter switch in position "2" ..... check voltage. Set value: approx. 5 V.

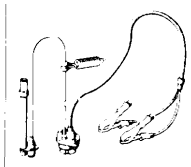
Test and adjusting values

Engine	Idle speed 1/min Electronic idle speed control (ELR)	
	with control	without control Plug pulled off electrom. actuator
602	680 ± 20	620 ± 40

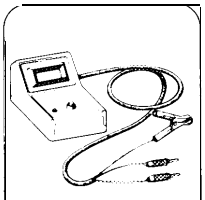
Special tools



201 589 00 99 00
15 54



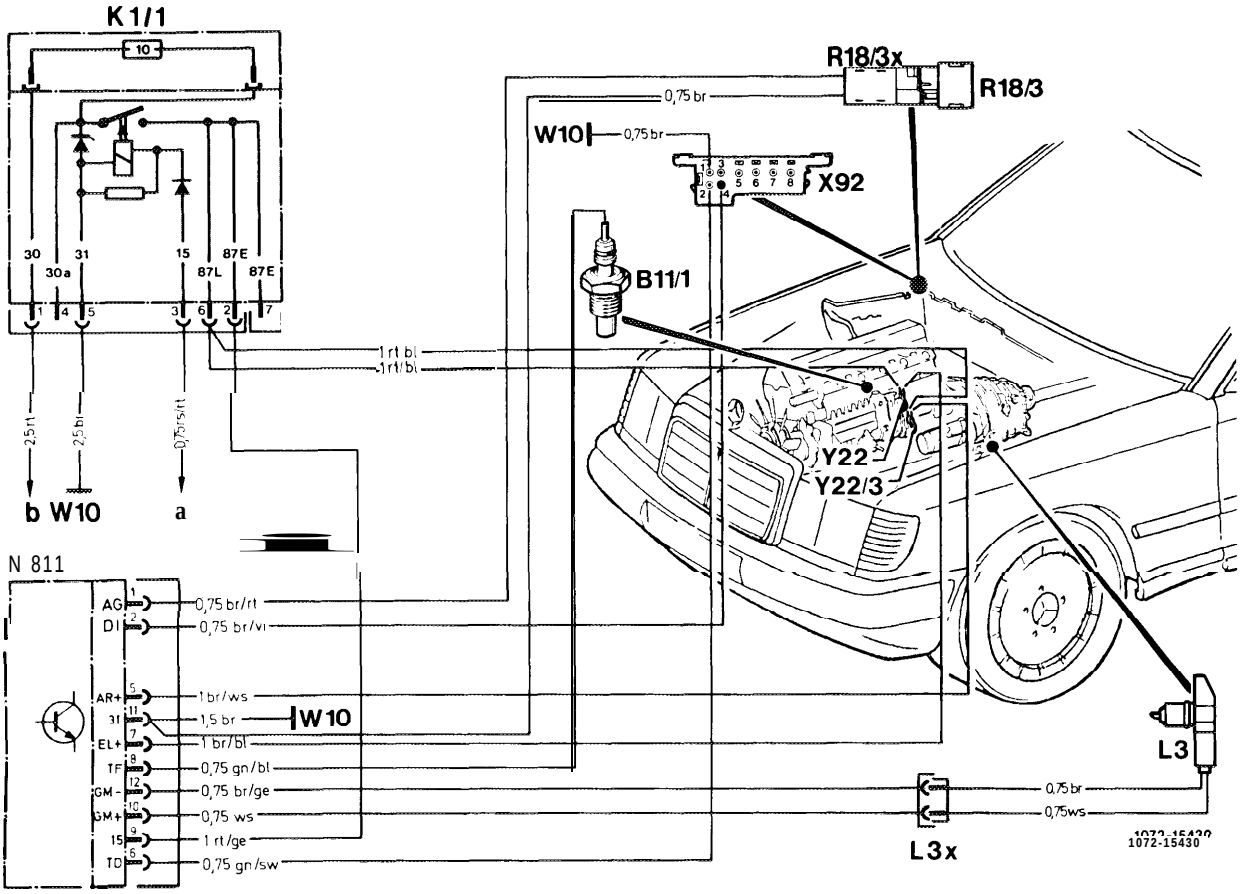
603 589 07 00 21 00



124 589 19 21 00
07 83

Commercially available tools

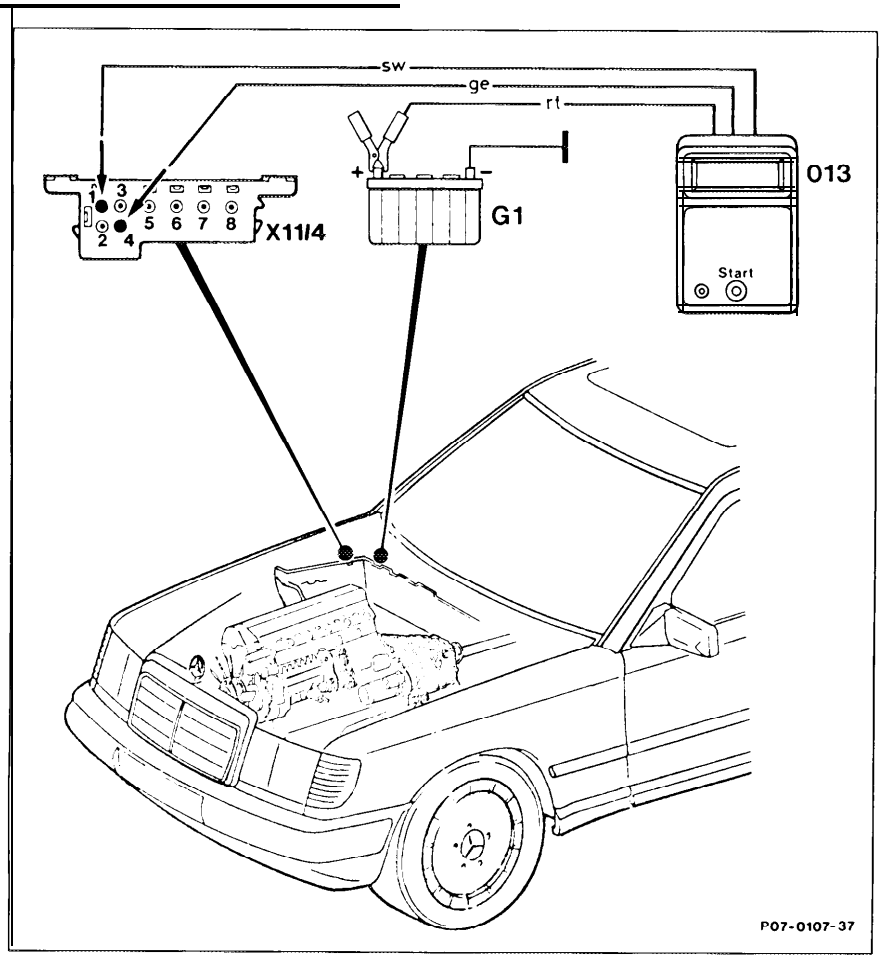
Multimeter	e.g. Sun, DMM-5
Digital tester	e.g. Bosch, MOT 002.02 Sun, DIT 9000



Function diagram idle speed control

B11/1	Temperature sensor (ELR)	R18/3x	Connector, individual adjustment plug
K1/1	Overvoltage protection relay	W10	Ground, battery, spring dome
L3	Starter ring gear speed sensor	x92	Test coupling
L3x	Connector, starter ring gear speed sensor	x22	Electromagnetic actuator ELR (only 603)
N8/1	Control unit (ELR)	Y22/3	Electromagnetic actuator ARA (non-U.S.)
	ELR only with 6 cylinders	a	Connector X26 jack 1 terminal 15
R 1 8/3	Individual adjustment plug (as required)	b	Terminal block (X7) terminal 30

Checking



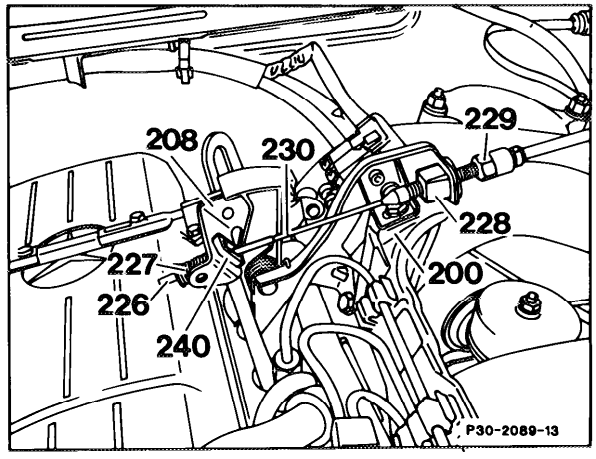
Connect digital tester (001) and pulse generator (021).

Connect impulse counter (013) to battery (Gl) and test coupling (X92).

- If the LED U-Batt appears after connecting, impulse counter and voltage supply for impulse counter are in order.

Note
LED U-Batt in the display field must light up, if not:

a) Check impulse counter fuse.
b) Check jack 1 of test coupling (X92) against battery plus (approx. 12 V).
c) Check jack 4 of test coupling (X92) against battery plus (approx. 12 V).



Check control for easy operation.

Check idle speed stop on Bowden cable (230).

The spring retainer (226) of the Bowden cable (230) in idle speed position must contact the compression spring (227) without preload.

Check fuse on overvoltage protection. Run engine to 60-80 °C coolant temperature.

Run engine at idle speed.

Actuate starting key of impulse counter (013) for 2 to 4 seconds.

Read display of impulse counter (013) and note down.

Again press start key for 2 to 4 seconds. If no further fault is in the system, no new display will appear.

Correct noted faults according to the test program or carry out individual parts test.

Notes on impulse display

Figures from 1 to 6 appear on the impulse counter display.

Figure 1 means that no fault has been registered in the electronic system. All other figures are allocated to a certain group of faults.

The number of impulses shows if and which component is faulty, or if components in the control circuit are defective.

Impulse display	Component/Control circuit
1	All functions “in order”
2	Speed signal “Fault”
3	Coolant temperature “Fault”
6	Control circuit ELR “Fault”

Checking individual components

Check overvoltage protection (K1/1)

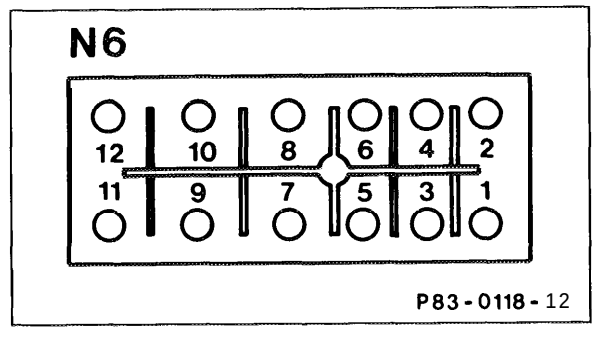
Switch on ignition, pull off control unit (N8 or N8/1) and measure voltage between the jacks (9 and 11).

Nominal voltage: approx. 12 V DC

Yes	No

Check fuse on overvoltage protection. Activation according to electrical wiring diagram.

End of test



Impulse display "2"

Checking speed sensor
Engine off. Pull off double coupling (L3x).
Connect multimeter to pins of double coupling and press key "Ω". Measure resistance.

Display: 0.4-2.5 kΩ

Yes | No

Replace starter ring gear speed sensor (L3).

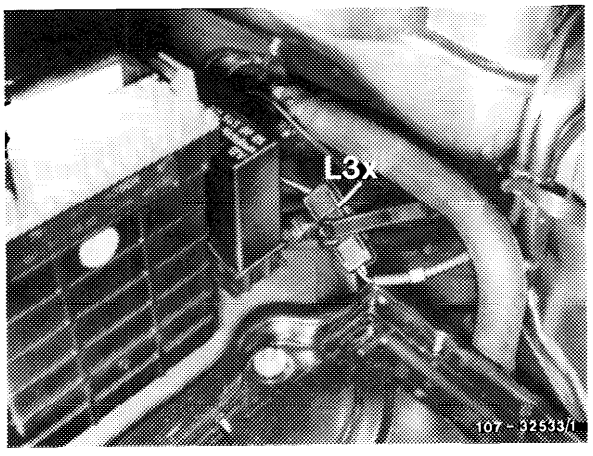
Multimeter connection as above, press key "V~". Run engine at idle speed.

Display: > 4 **V. AC**
Voltage rises with increasing speed.

Yes | No

Inspect starter ring gear speed sensor for accumulation of dirt or metal chips, clean if required.

End of test



Impulse display “3”

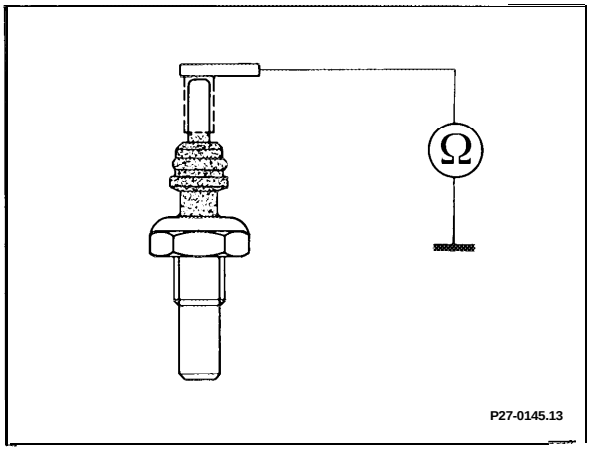
Checking coolant temperature sensor (B11/1)

Engine off. Pull plug off temperature sensor and check resistance to ground. See diagram and check resistance at two.temperatures.

Example:

+ 20 °C = 2.2-2.8 kΩ

+ 80 °C = 290-370 Ω



Yes | No

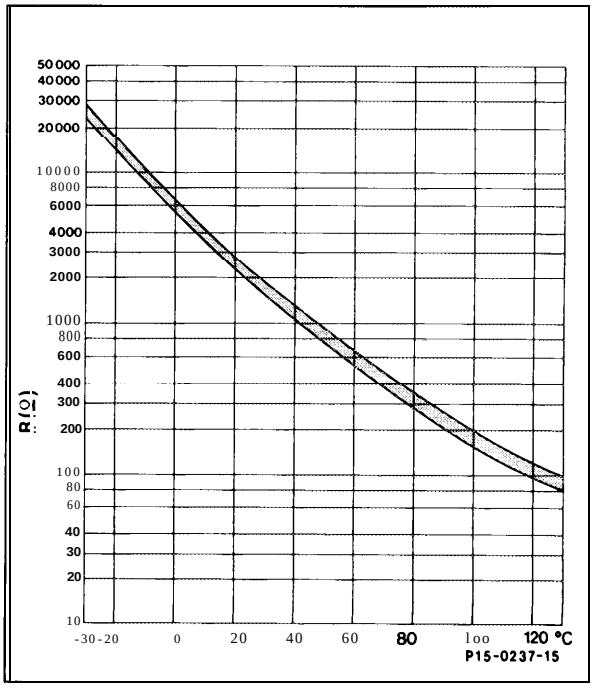
No → Replace coolant temperature sensor.

→ End of test

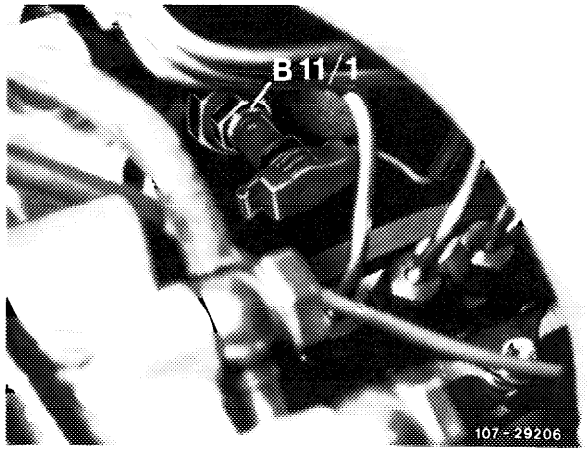
Check voltage on 1 -pole coupling “Ignition” On.

Display: approx. 5 V

Yes | No



No → Eliminate line interruption. Replace control unit (N8 or N8/1).



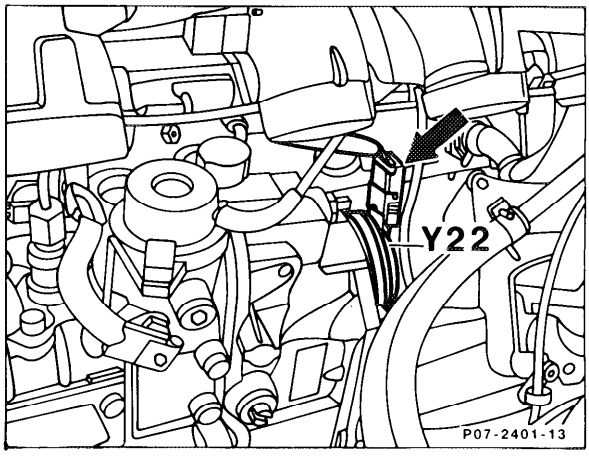
→ End of test

Impulse display "6"

Engine idling. Remove double coupling (arrow) from ELR electromagnetic actuator (Y22) for at least 3 sec. and reconnect.

Upon reconnecting, the idle speed should briefly increase above normal.

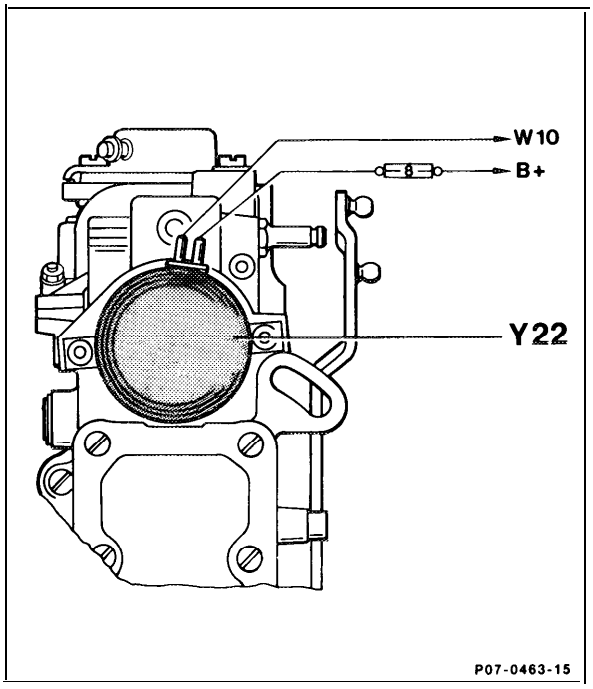
Yes | No



Apply battery voltage to ELR electromagnetic actuator (Y22) for a maximum of 3 sec..
Caution! If the voltage is applied for longer than 3 sec., the ELR electromagnetic actuator will be damaged.

Idle speed increases.

Yes | No



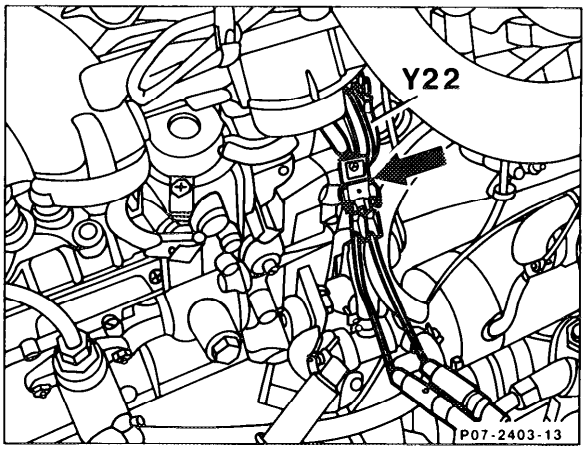
Replace electrom. actuator.

End of test

Engine idling. Remove double coupling (arrow) from electromagnetic actuator (Y22)..
Connect multimeter and set to "V = ".

Display: approx. 12 V

Yes | No

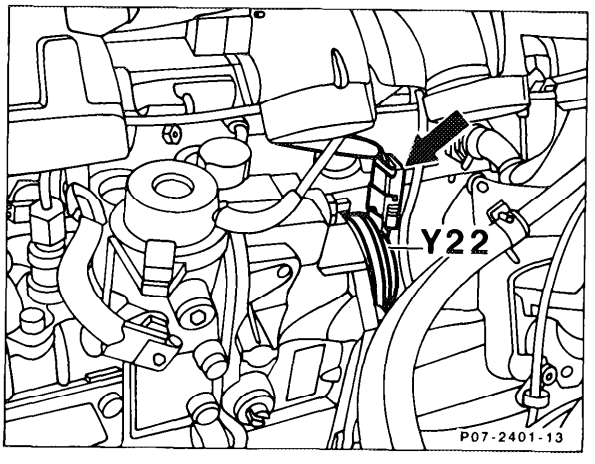


Check lines according to wiring diagram. Check fuse of overvoltage protection relay K1 1.

If lines are OK, replace control unit (N8/1).

End of test

Engine idling. Remove double coupling (arrow) from ELR electromagnetic actuator (Y22).



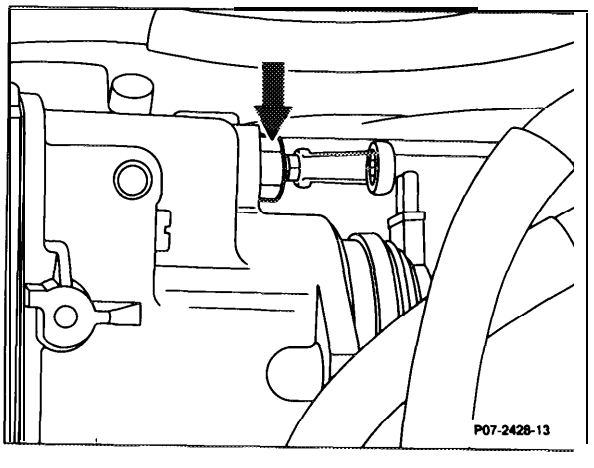
Check idle speed.

Set values:

Engine	Idle speed/min
602	620 ± 40

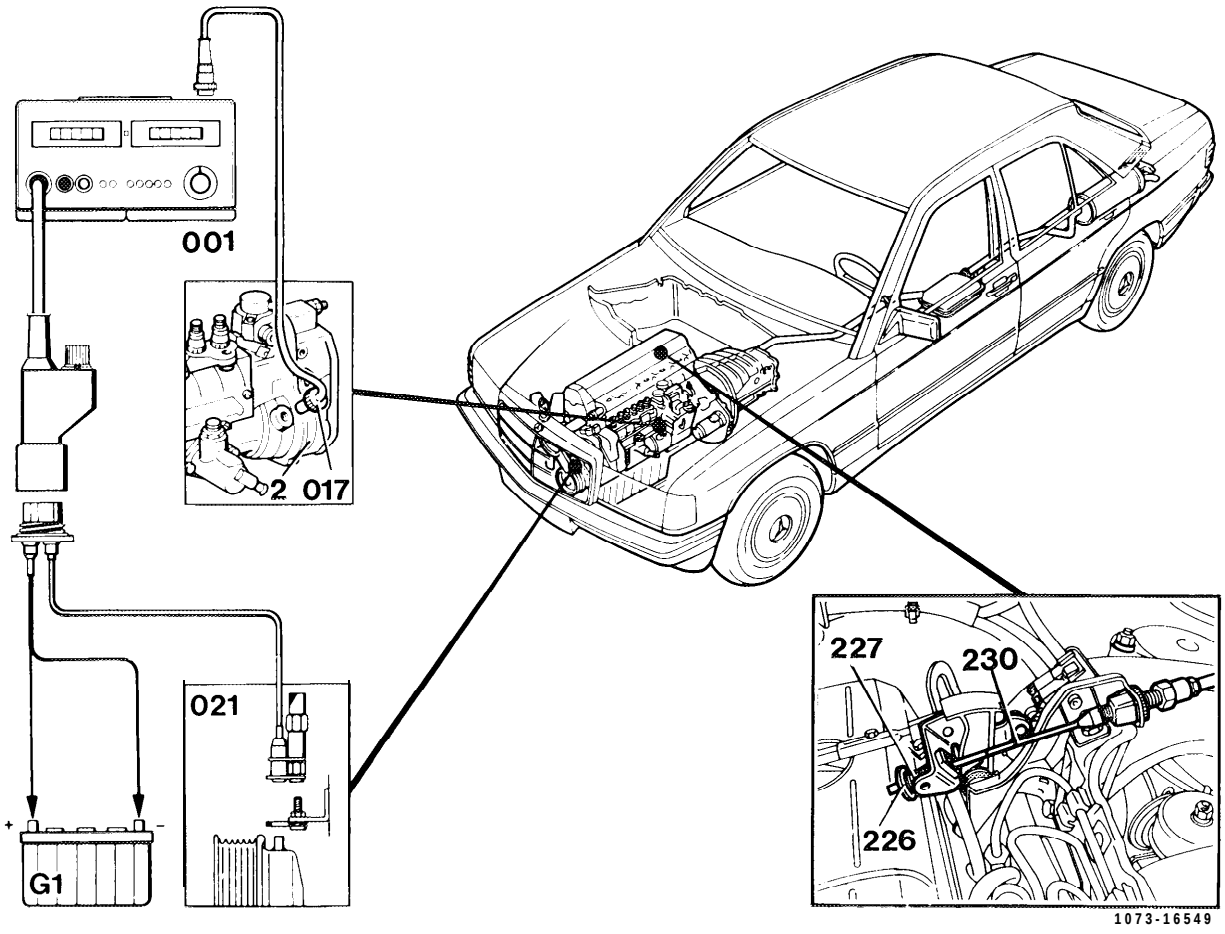
Yes	No

Loosen lock nut and adjust idle speed (arrow).
left = higher
right = lower



End of test

07.1-I 10 Checking, tuning engine



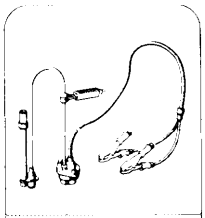
Test sheet	complete.
Coolant level	check, correct.
Engine oil level	check, observe oil condition (visual inspection).
Oil level in automatic transmission	check, correct.
Air cleaner	remove, reinstall.
Testers (001, 017)	connect
Pulse generator (021)	connect.

Control linkage	check for easy operation and condition. Lubricate pivots of reverse- transfer levers, ball sockets.
Full throttle stop on Bowden cable	check, adjust if required.
Idle stop on Bowden cable	check, adjust if required
Battery voltage	check. Set value: minimum 11.5 V.
Engine	run to 60-80 °C coolant temperature.
Air conditioner or automatic climate control	switch off.
Idle speed	check, adjust if required. Pull plug off electromagnetic actuator.
Start of delivery	check.
Maximum speed	check.
Injection timing device	check. Set value: approx. + 3° to + 5° after RIV at approx. 5 1 00/min.

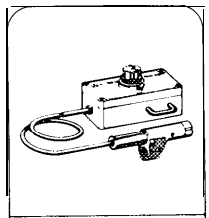
Test and adjusting values

Engine		602.911
Idle speed 1 /min	Electronic idle speed increase	680 ± 20
Maximum no-load speed		5150 ± 150
Start of delivery with digital tester	RI set value	-15° ± 1° ATDC

Special fools



603 589 00 21 00
07



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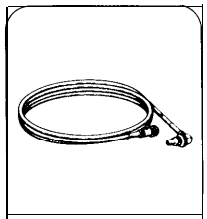
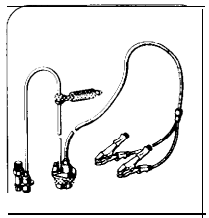
07



617 589 10 21 00
07



601 589 04 21 00
07

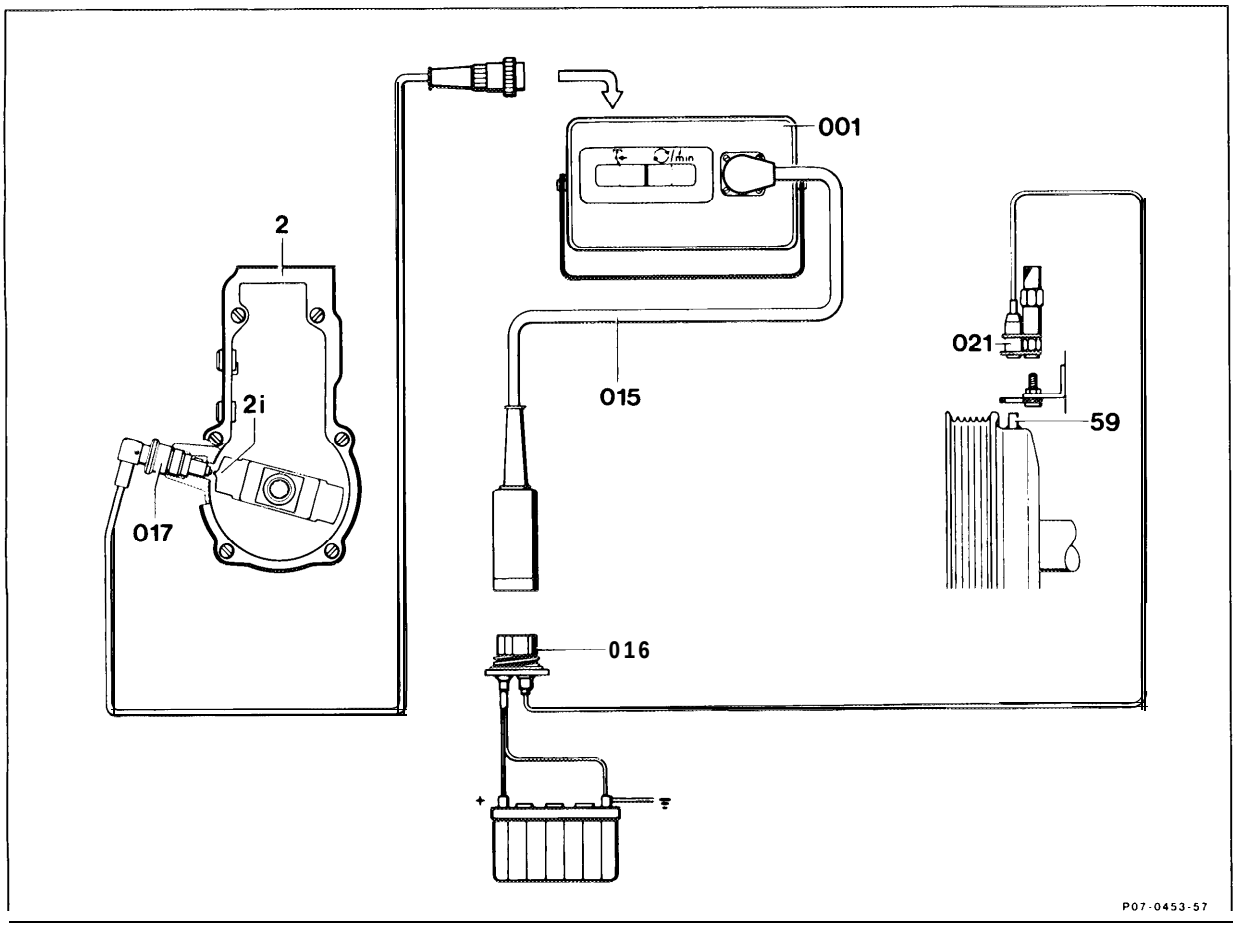
Commercially available testers

Use without adapter

Digital testers	e.g. AVL, Diesel-Tester 873
	e.g. Bosch, ETD 019.002 or MOT 350/500/501

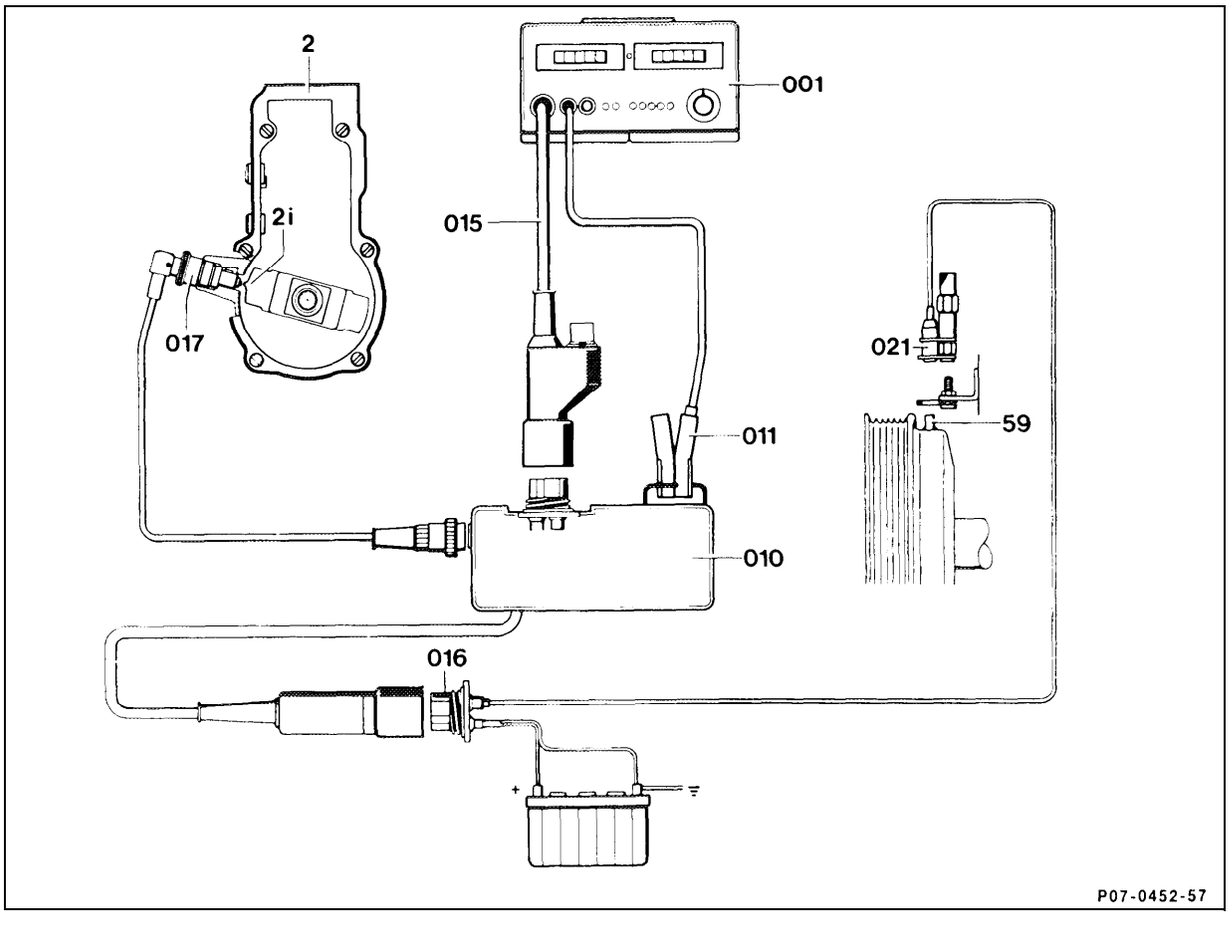
Use with adapter — **e.g.** Sun, DIT 9100

Digital testers — e.g. Bosch, MOT 001.03



Connection diagram for testers without adapter

001	Digital testers	021	TDC impulse sensor
015	Test cable with plug	59	TDC sensor pin
016	Diagnostic socket	2	Governor
017	Governor impulse sensor	2i	Governor Impulse sensor pin



Connection diagram for existing testers with adapter

001	Digital tester	017	Governor Impulse sensor
010	Adapter	021	TDC Impulse sensor
011	Alligator clamp	59	TDC sensor pin
015	Test cable with plug	2	Governor
016	Diagnostic socket	2i	Governor impulse sensor pin

Checking, tuning

1 Complete test sheet, enter measured values.

2 Check, correct coolant level.

3 Check engine oil, inspect oil condition.

4 Check oil level in automatic transmission.

5 Connect testers (001, 017) according to connection diagram.

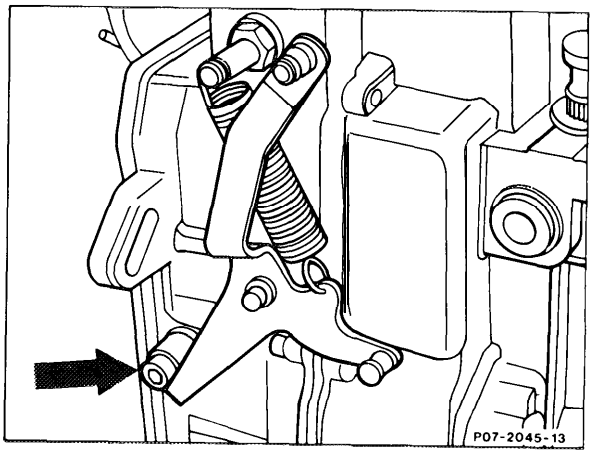
6 Connect pulse generator (021).

7 Remove, reinstall air cleaner element; check for contamination.

8 Check control for easy operation and condition and lubricate.

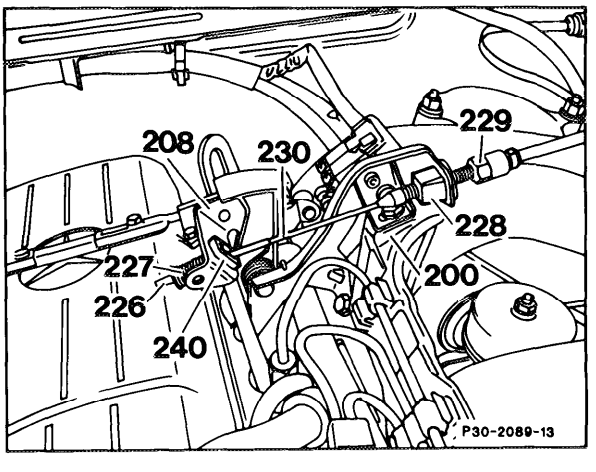
9 Check full load stop.

With engine off, fully depress accelerator pedal. The control lever must contact the full load stop (arrow).

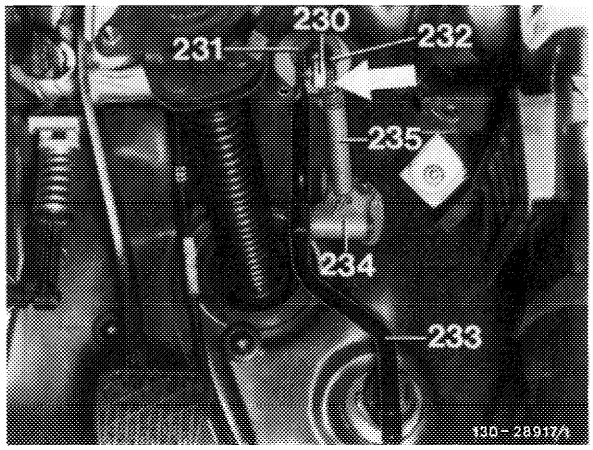


10 Check idle stop.

In idle speed position the spring retainer (226) of the Bowden cable (230) must contact the compress/on spring (227) without preload.



Adjust Bowden cable (230) with the adjusting nut (232) from the vehicle inside if required.



11 Check battery voltage.
Set value: at least 11.5 V.

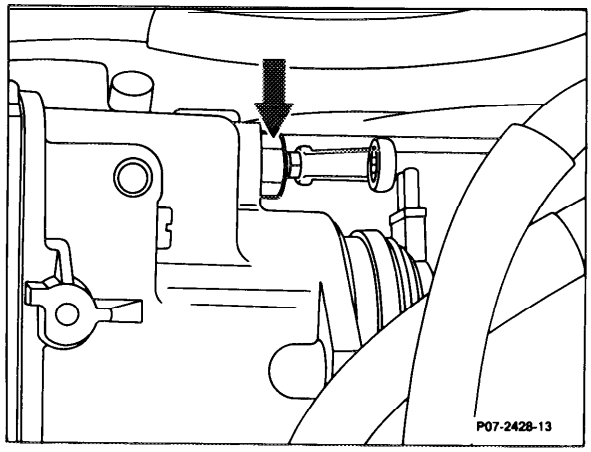
12 Run engine to a coolant temperature of 60-80 °C.

13 Switch off air conditioner and automatic climate control.

14 Check idle speed; read off start of delivery.
RI set value 15 ± 1 ° ATDC.

a) Engine 602 with electronic idle speed increase

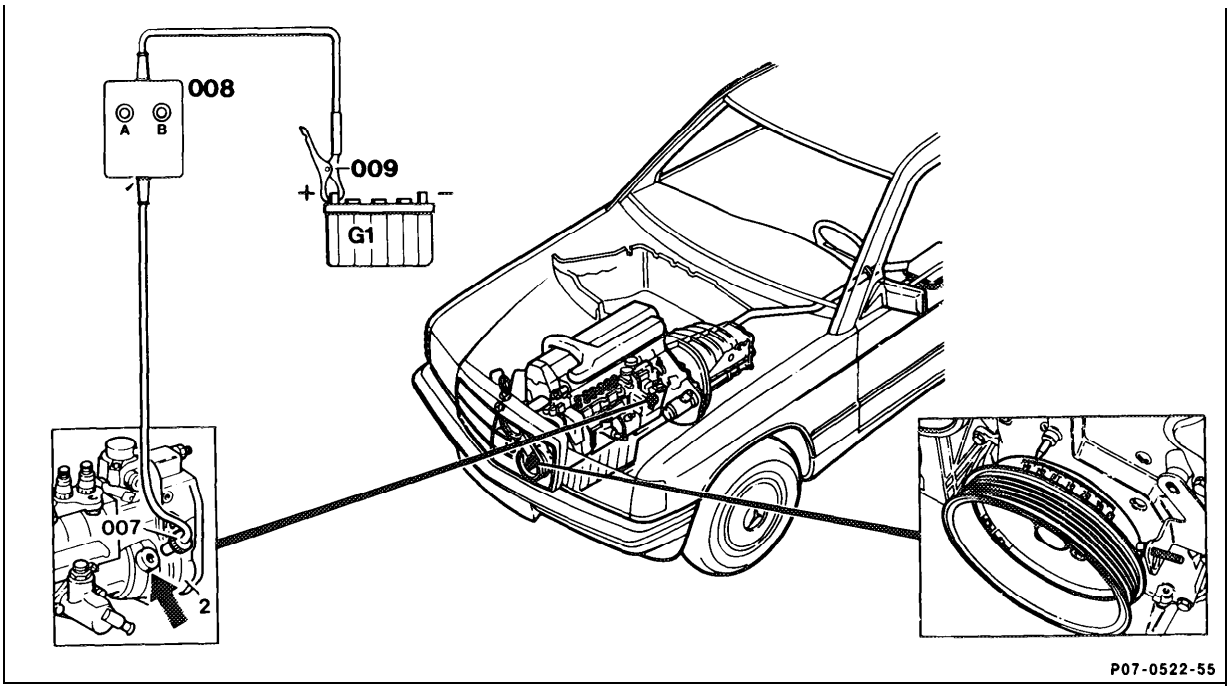
Pull double coupling off electromagnetic actuator. Loosen lock nut (arrow) and adjust idle speed.



15 Check maximum no-load speed.

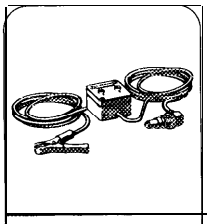
16 Check injection timing device without load.
Set value: 3" to 5° BTDC according to RIV at approx. 5 1 00/min.

07.1-I 11 Checking start of delivery (position sensor RIV method)



Governor housing screw plug (11)	unscrew, tightening torque 30-35 Nm.
Position sensor (007)	turn in.
Battery alligator clamp (009)	connect to battery +.
Manually turn crankshaft until	lamps A and B of the indicating instrument (008) light up simultaneously.
Read RI value (indirect start of delivery)	of the graduated scale, set value 15° ± 1 ° ATDC. Adjust start of delivery if required (07.1-I 16).

Special tools



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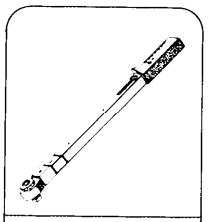
07



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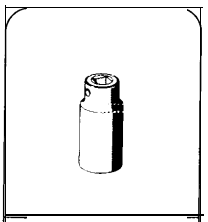
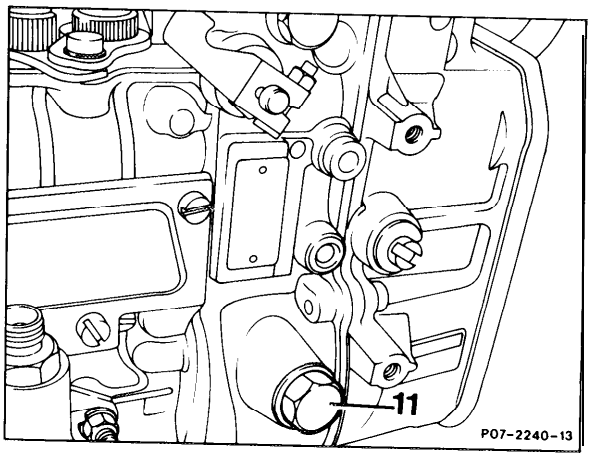


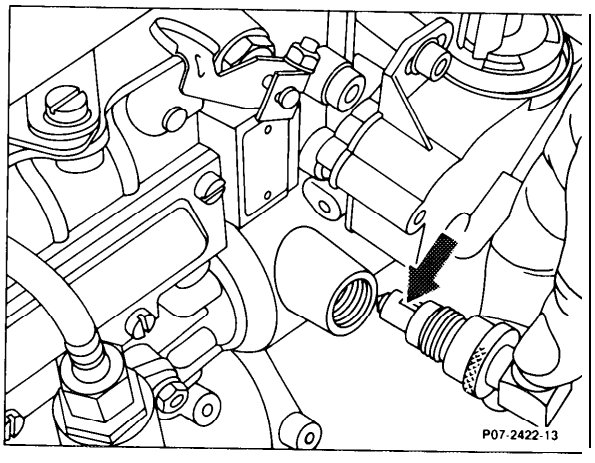
001 589 65 09 00
03 07 32

Checking

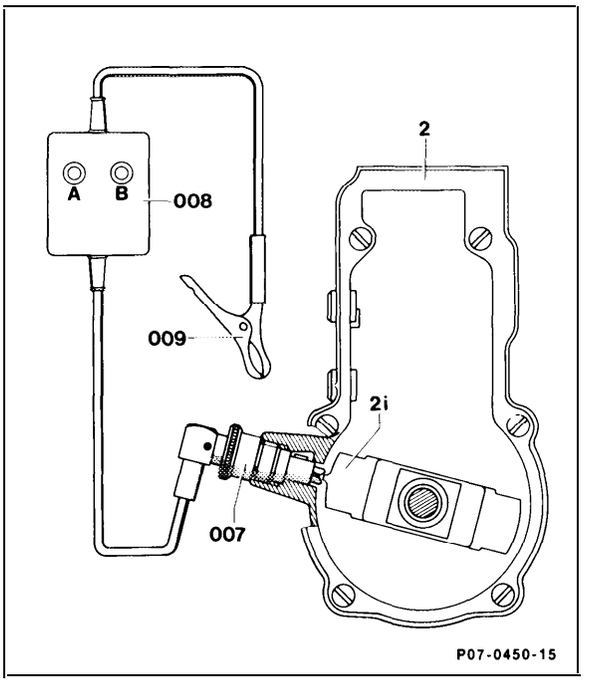
1 Remove screw plug (11).



2 Turn position sensor into the governor housing. Ensure that the guide pin of the position sensor (arrow) faces up. Tighten union nut by hand.



3 Connect position sensor according to connection diagram.

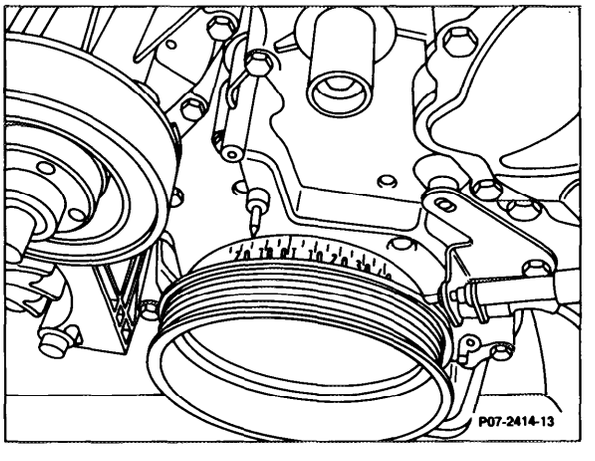


007 Position sensor
008 Indicating instrument
009 Battery alligator clamp (battery plus)
2i Flyweight (RIV sensor pin)

4 Use tool to turn crankshaft manually (only in direction of rotation) until lamp **"A"** lights up. Continue to turn until **both lamps "A + B"** light up. In this position read WI value (indirect start of delivery) off graduated scale.

RI set value: 15° ± 1° ATDC.

If only lamp "B" lights up, repeat test.



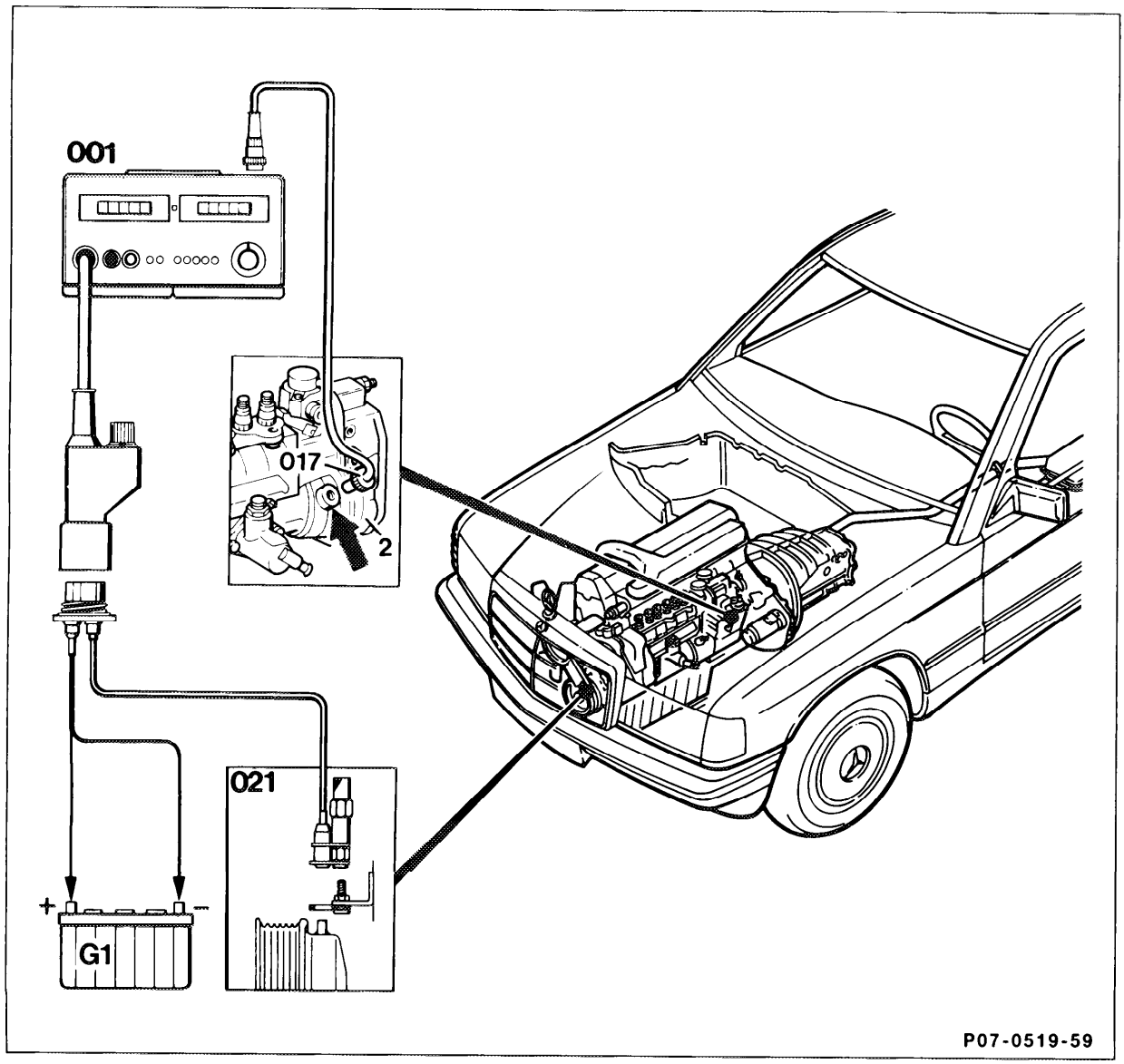
5 Remove position sensor.

6 Turn screw plug into governor housing (tightening torque 30-35 Nm).

7 Carry out leak test with engine running.

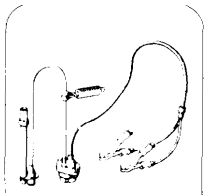
8 Check engine oil level and correct if required.

07.1-l 12 Checking start of delivery with digital tester (RIV method)



Remove screw plug (arrow) from governor housing (2)	unscrew. Tightening torque 30-35 Nm.
Testers (001, 017, 021)	connect, disconnect.
Run engine at idle speed	read RI value off digital tester at 15° ATDC. RI set value: 15° ± 1° ATDC. Adjust start of delivery if required (07.1.116 and 117).

Special tools



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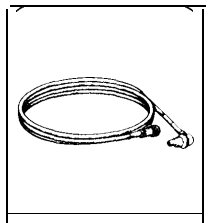

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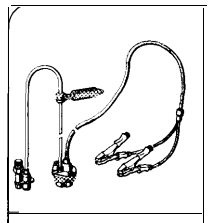
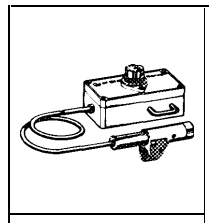


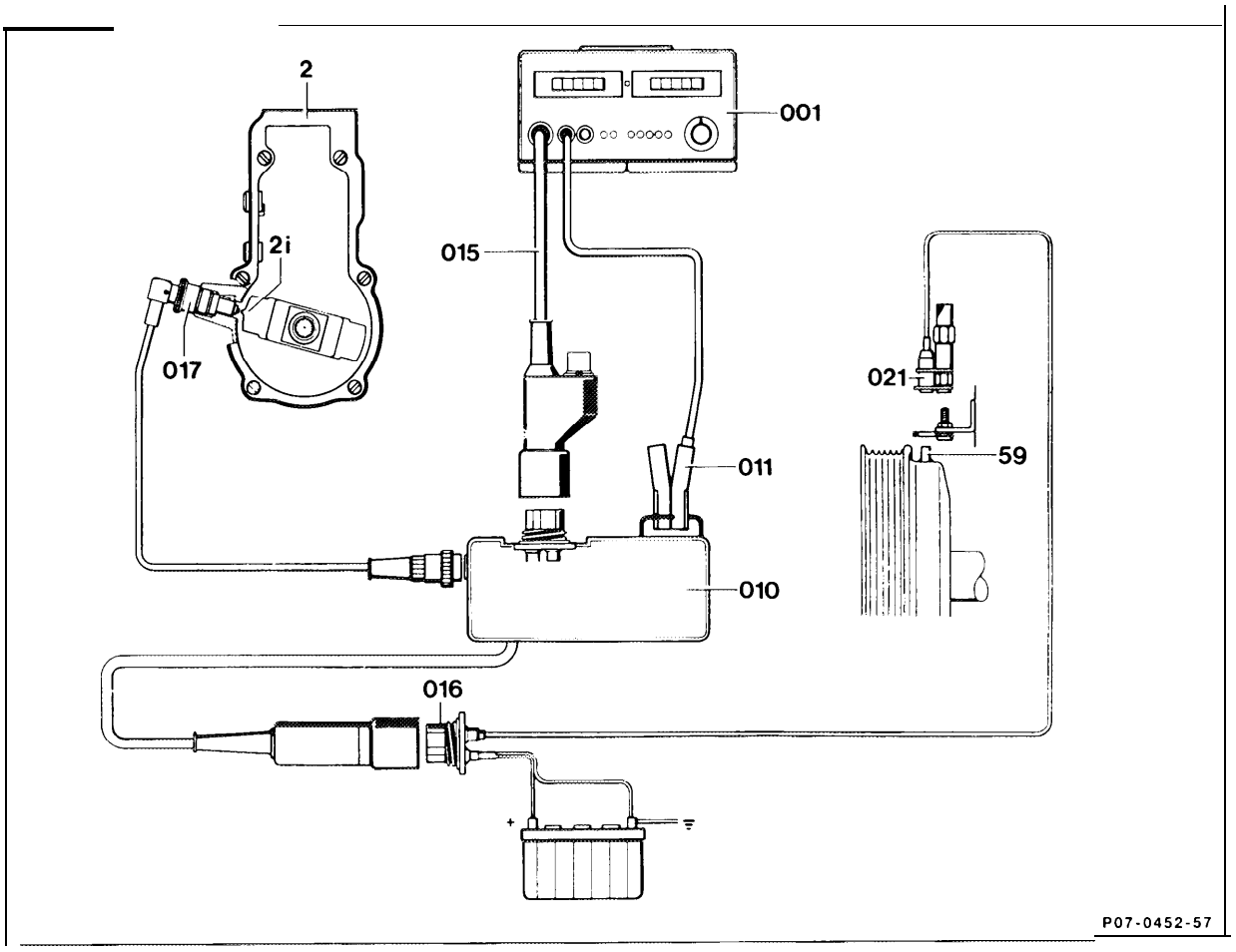
601 589 04 21 00
07



617 589 09 21 00
07

Commercially available tools

Use without adapter	
Digital testers	e.g. **AVL,** Diesel-Tester 873
	e.g. Bosch, ETD 019.002
	e.g. Sun, DIT 9100
Use with adapter	
Digital tester	e.g. Bosch, MOT 001.03

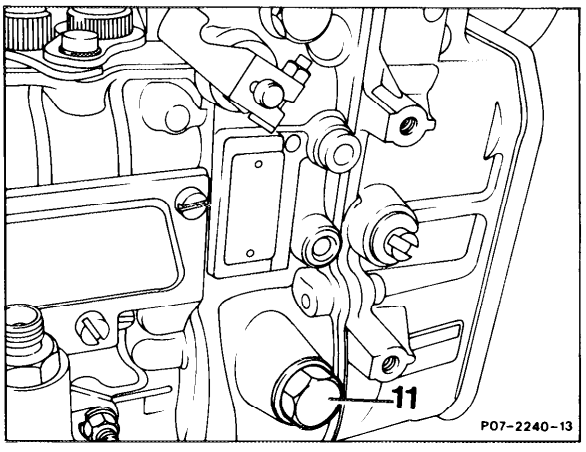


Connection diagram for existing testers with adapter

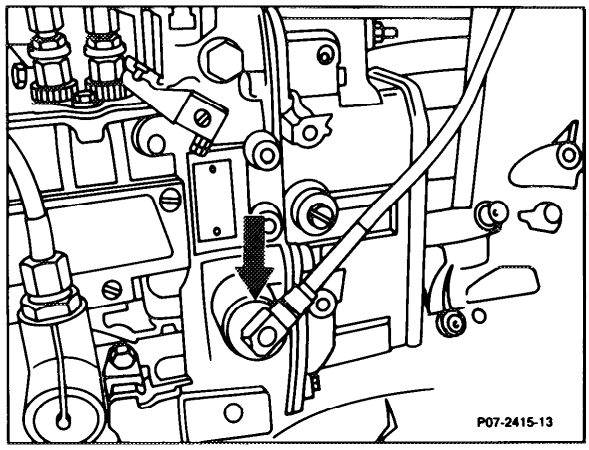
001	Digital tester	017	RIV sensor
010	Adapter	021	TDC pulse generator
011	Alligator clamp	2	Governor
015	Test cable with plug	2i	RI sensor pin
016	Diagnostic socket	59	TDC sensor pin

Checking

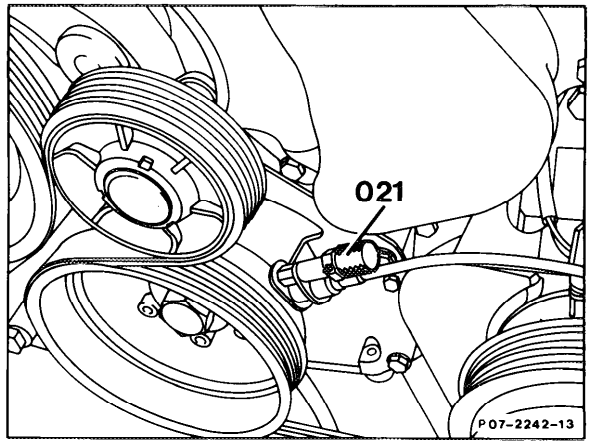
1 Remove screw plug (11) from governor housing.



2 Turn RIV sensor (017) into governor (injection pump).



3 Turn TDC pulse generator (021) into bracket (engine).



4 Connect digital tester according to connection diagram.

5 Engine idling. Read RIV value (indirect start of delivery) off digital tester at idle speed.

RI set value: 15° ± 1 °ATDC.

6 Switch off engine.

7 Disconnect digital tester.

8 Install screw plug in governor (tightening torque 30-35 Nm).

9 Carry out leak test with engine running.

10 Check engine oil level and correct, if required.

07.1413 Establishing fuel consumption by road test

1 Fill up vehicle tank in the presence of the customer with the vehicle on level ground.

2 Drive approx. 100 km (62 mi.), of this approx. 40 km (25 mi.) highway and approx. 60 km (37 mi.) back roads and city traffic.

3 After driving fill up again and calculate fuel consumption.

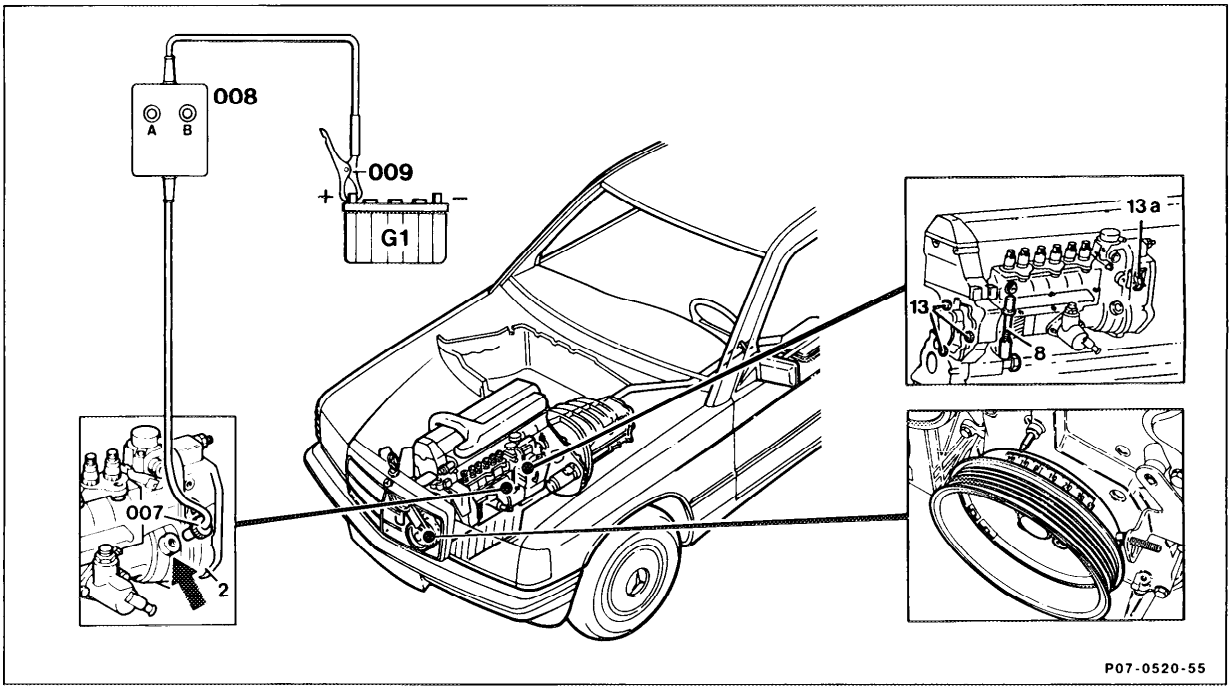
Example 1:
Fuel consumption in liters1100 km

$$= \frac{\text{Fuel quantity consumed in liters}}{\text{Kilometers driven}} \times 100$$

Example 2:
Fuel consumption in miles/gallon

$$\frac{\text{Miles driven}}{\text{Fuel quantity consumed in gallons}}$$

07.1-116 Adjusting start of delivery (position sensor RIV method)



Turn crankshaft in direction of rotation	to 15° ATDC of 1 st cylinder.
Loosen mounting screws (13 and 13a) on the injection pump flange and support bracket	tightening torque 20-25 Nm.
Indicating instrument (008) and clamp (009)	connect to B + .
Pivot injection pump by turning the adjusting screw at the adjusting device for start of delivery (8)	both lamps “A and B" must light up in the indicating instrument (008).

Direction of rotation of the adjusting screw

Right = start of delivery retarded
Left = start of delivery advanced

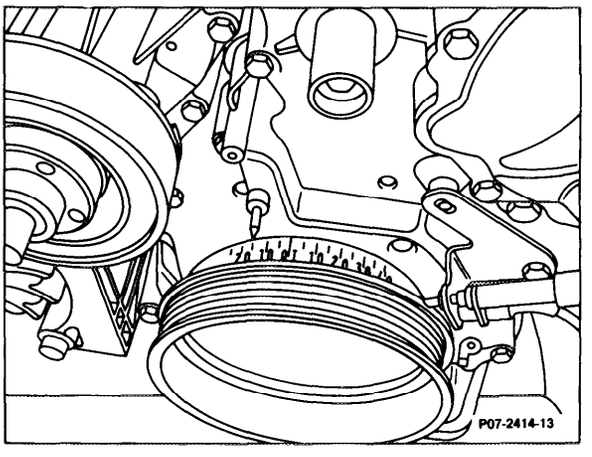
	RIV set value 15° ATDC.
Position sensor (007)	remove.
Screw plug (11)	turn in.
Control linkage	check, adjust if required (30-300).
Leak test with engine running	carry out.
Engine oil level	check, correct.

Note

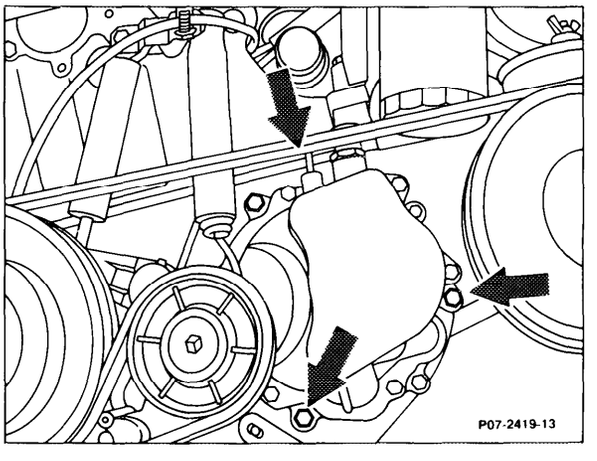
Before adjustment, check start of delivery (07.1-111).

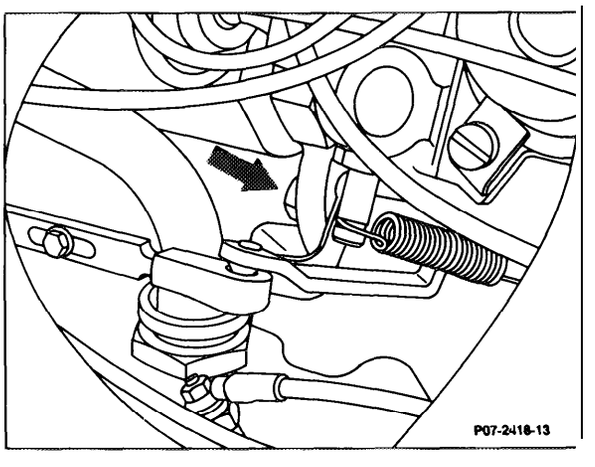
Adjusting

1 Turn crankshaft in direction of rotation to 15" ATDC of 1st cylinder.



2 Loosen mounting screws (arrows) on injection pump flange and support bracket (arrow).

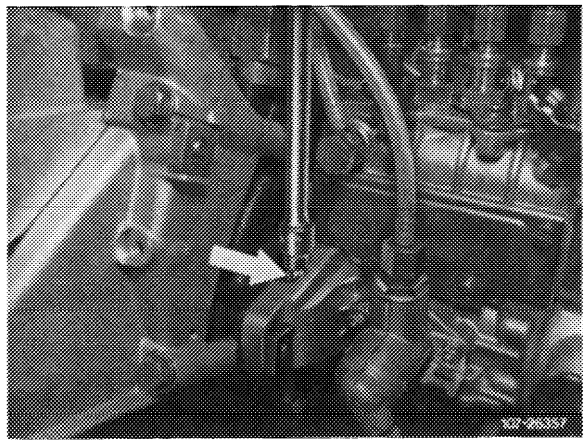




Screw on support bracket

3 Connect Indicating instrument (008) and clamp (009) to battery plus.

4 Pivot injection pump by turning the adjusting screw on the start of delivery adjusting device until both lamps light up.



Direction of rotation of the adjusting screw

Right = retarded start of delivery
Left = advanced start of delivery

RIV set value: 15° ± 1 ° ATDC

Note
If the adjusting range is inadequate, the injection pump must be repositioned. Injection pump, remove, reinstall (07.1-200).

5 Secure mounting bolts on injection pump flange and support bracket, tightening torque 20-25 Nm.

6 Remove position sensor.

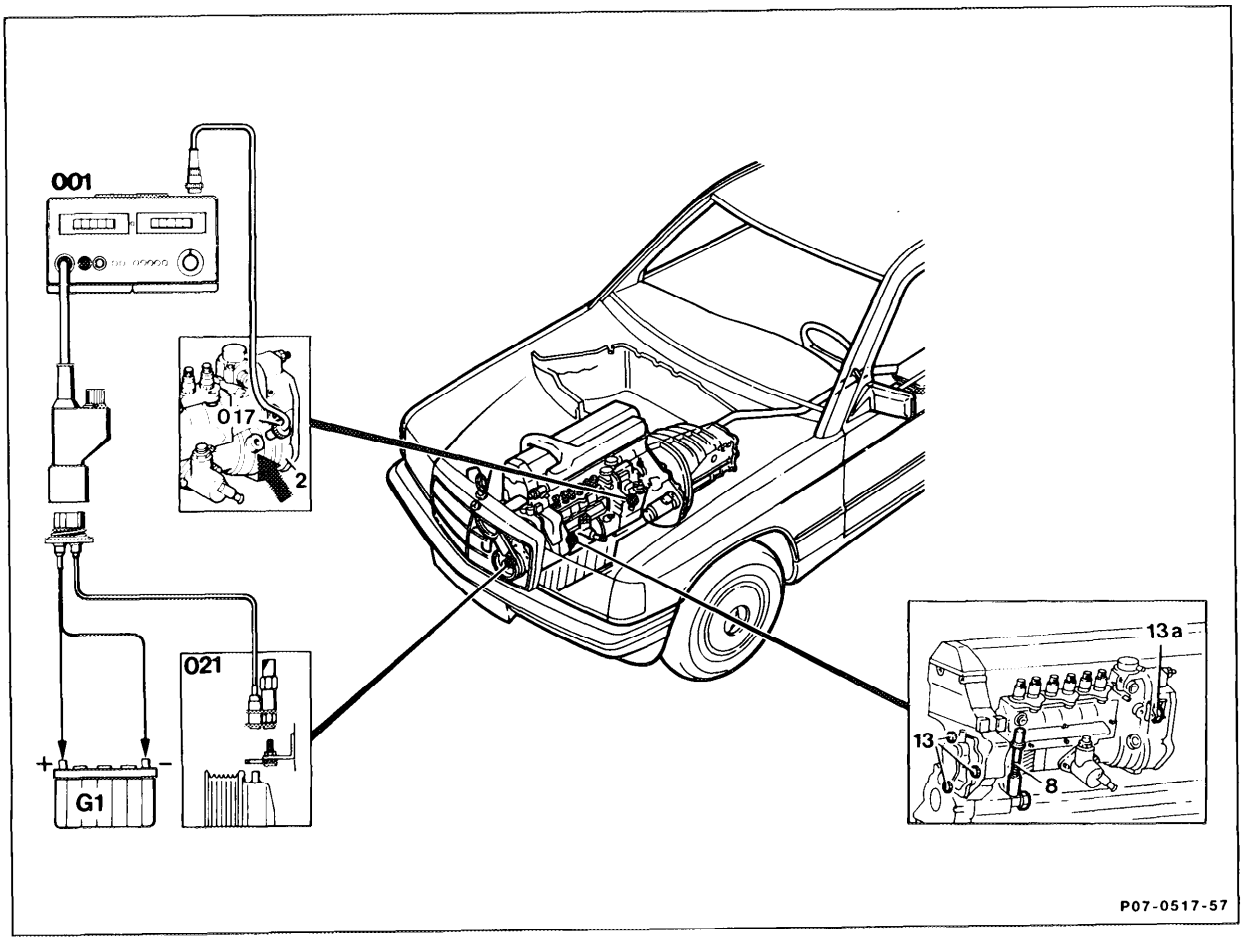
7 Install screw plug, tightening torque 30-35 Nm.

8 Check control linkage and adjust if required (30-300).

9 Carry out leak test with engine running.

10 Check engine oil level and correct if required.

07.1-117 Adjusting start of delivery with digital tester (RIV method)



Mounting screws (13 and 13a) on injection pump flange and support bracket	loosen.
Engine	run at idle speed.
RIV value (indirect start of delivery)	adjust by turning the adjusting device (8)

Direction of rotation of the adjusting screw (8)

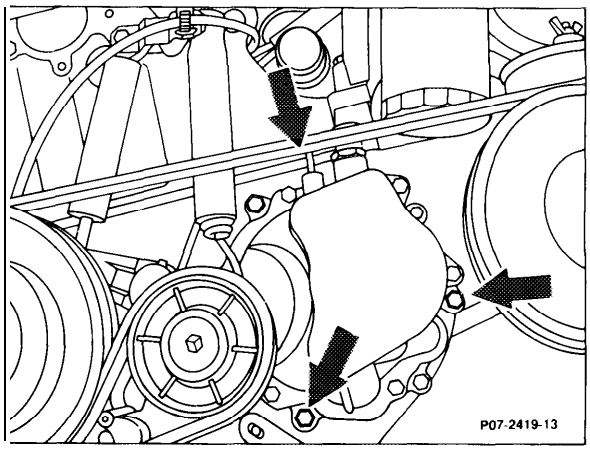
Right = start of delivery retarded
Left = start of delivery advanced

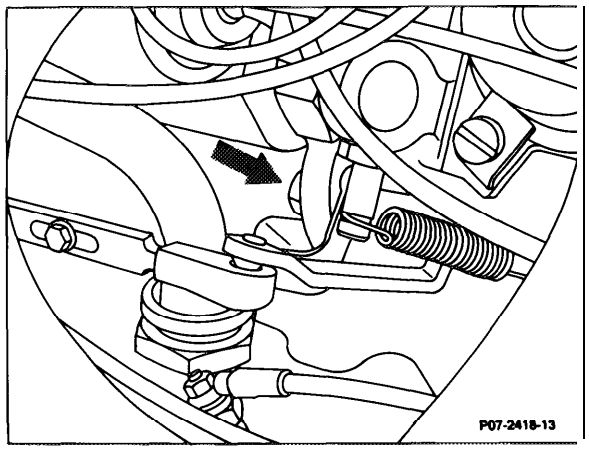
	RI set value 15° ± 1 ° ATDC.
Engine	switch off.
Mounting screws (13 and 13a) on injection pump flange and support bracket	secure tightening torque **20-25** Nm.
Testers	disconnect.
Screw plug (arrow) on governor	turn in, tightening torque 30-35 Nm.
Control linkage	check, adjust if required (30-300).
Leak test with engine running	perform.
Engine oil level	check.

Note
Before adjustment, check start of delivery (07.1-112).

Adjusting

1 Loosen mounting screws (arrows) on injection pump flange and support bracket (arrow).

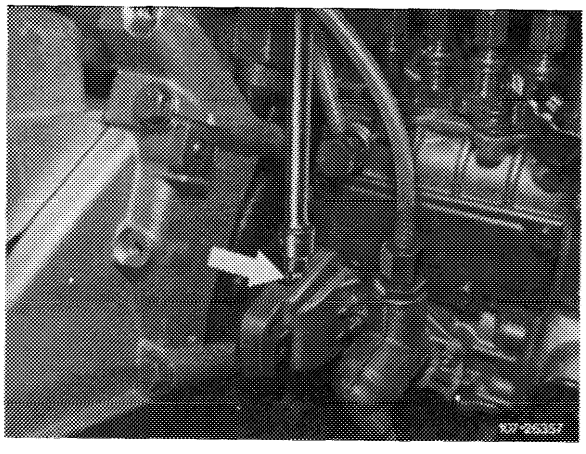




Screw on support bracket

2 Run engine at idle speed.

3 Adjust RIV value (indirect start of delivery) by turning the adjusting screw on the start of delivery adjusting device.



RIV set value: 15° ± 1 ° ATDC

Direction of rotation of the adjusting screw

Right = retards start of delivery
Left = advances start of delivery

Note
If the adjusting range is inadequate, the injection pump must be repositioned. Injection pump, remove, reinstall (07.1-200).

4 Switch off engine.

5 Disconnect tester.

6 Turn screw plug into governor, tightening torque 30-35 Nm.

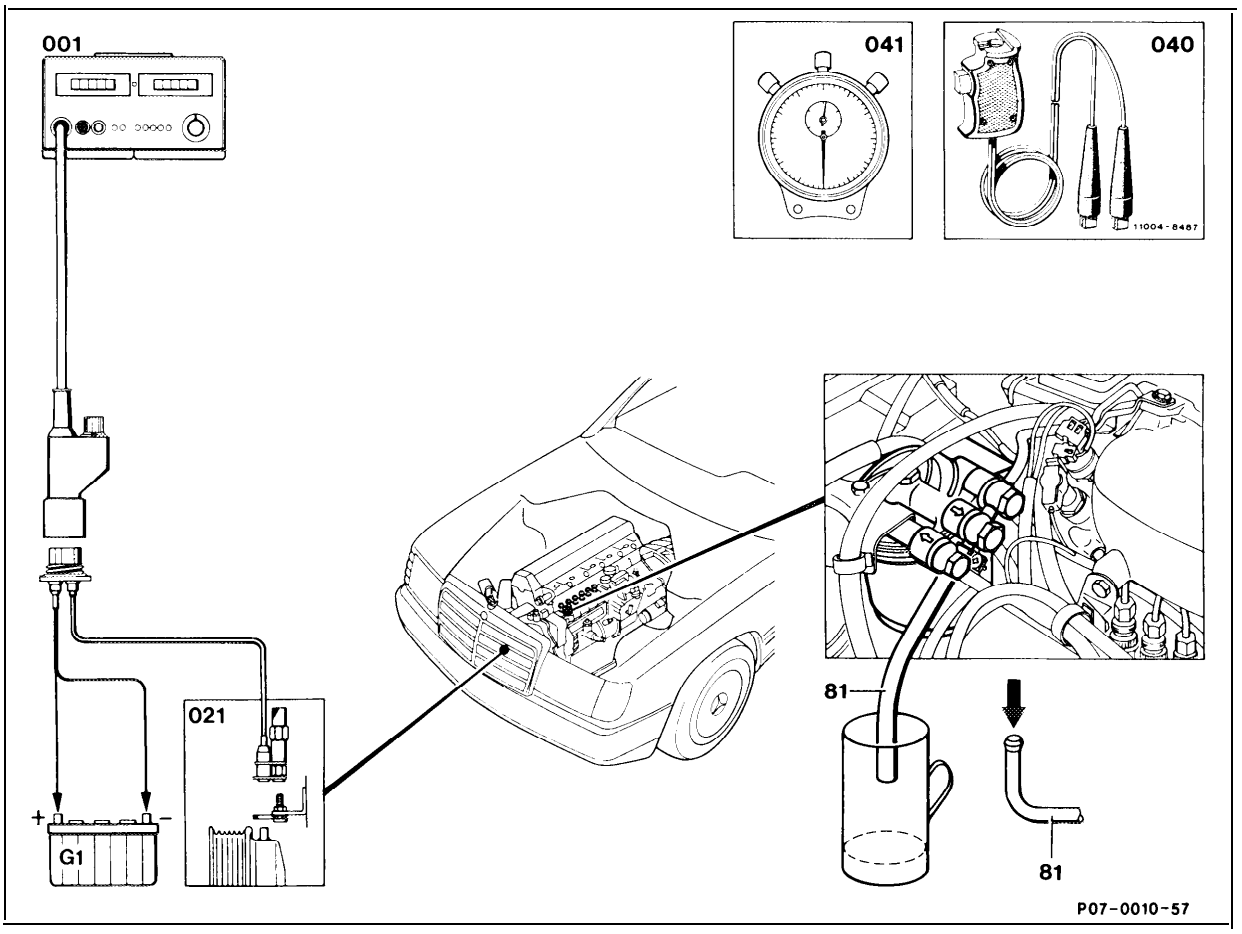
7 Secure mounting screws on injection pump flange and support bracket,tightening torque 20-25 Nm.

8 Check control linkage and adjust if required (30-300).

9 Perform leak test with engine running.

10 Check engine oil level and correct if required.

0X1-145 Checking fuel pump



Testers (001, 015, 016, 021)	connect
Return line (81)	disconnect and hold in the measuring cup approx. 1 l.

Note
The return to the fuel tank must be sealed.

Key in steering lock position	turn to "0", this means the injection pump is in zero delivery position.
Connect contact handle (040) to terminal 30 and terminal 50	and start engine for 30 seconds (starting voltage min. 10 V).

Set value

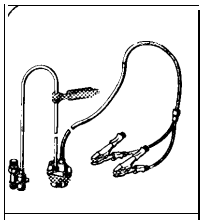
Transfer pump at least 150 $cm^3/30$ seconds. Replace fuel filter and/or transfer pump if required. Check fuel pressure (07. I-I 46).

Use . . . . . stop watch (041)

Test values

Engine	601, 602, 603
Rate of delivery at 150/min minimum	at least 150 $cm^3/30$ s
Test requirement	Glow starter switch in position "0"

Special tools



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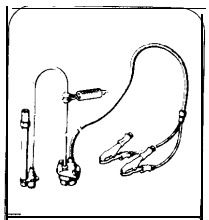
07



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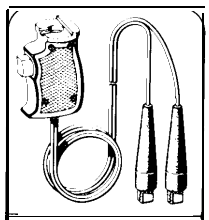
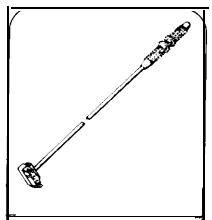
07



001 589 46 21 08



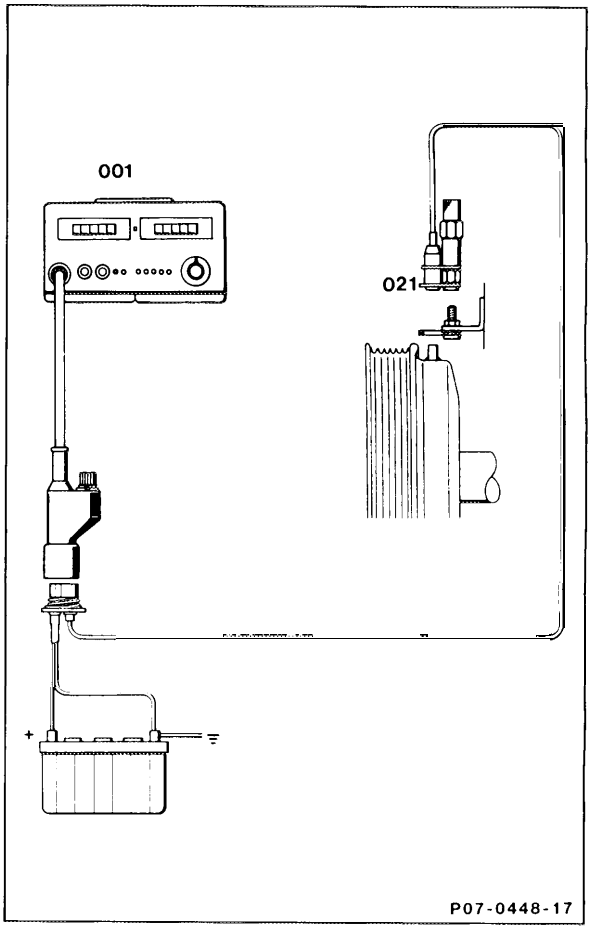
124 589 36 63 00
01

Commercially available tools

Digital tester	e.g. Bosch, MOT 001.03
Measuring glass or cup (at least 1 liter)	
Stop watch	

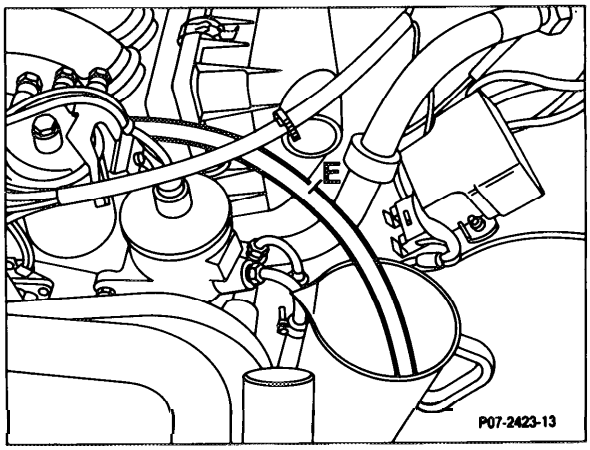
Checking

1 Connect digital tester (001) according to connection diagram.



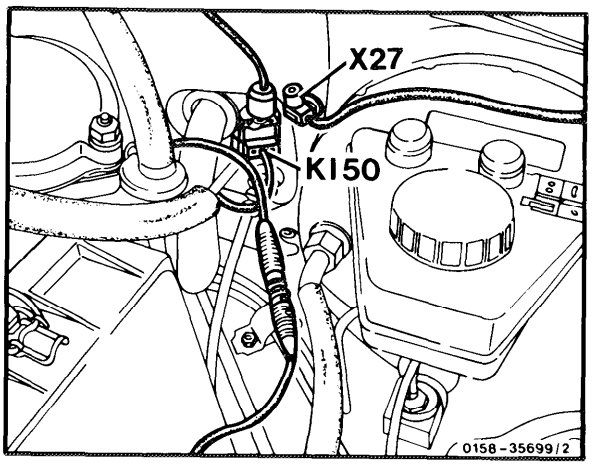
001 Digital tester
021 TDC pulse generator

2 Disconnect return line (E) and hold into the measuring cup.



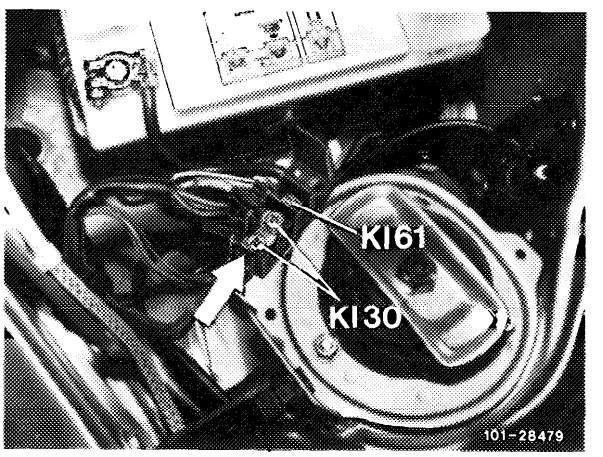
3 Turn ignition lock in position "0", the injection pump is now in “zero” delivery position.

4 Pull off coupling (X 27) and connect adapter line to terminal 50 (KI 50).



Model 201

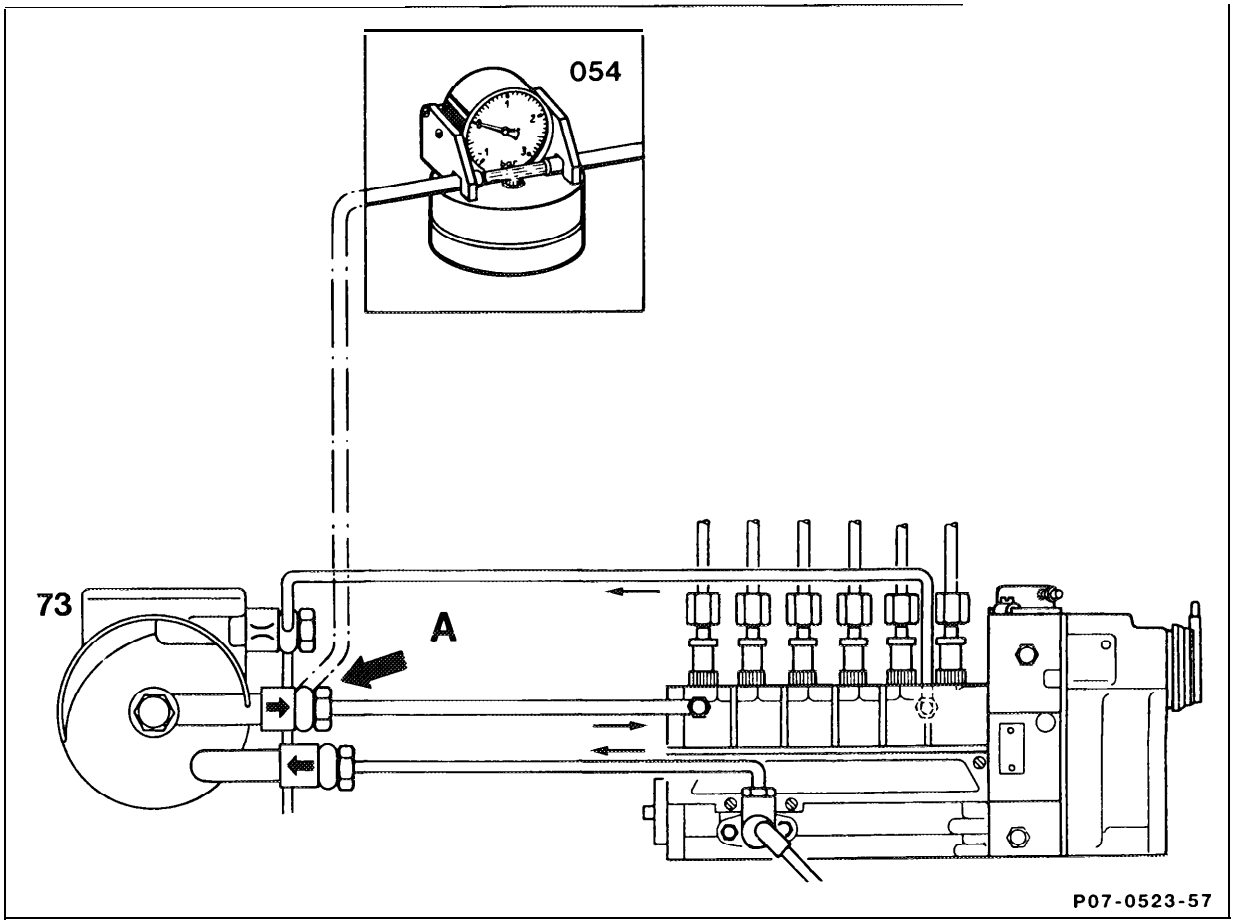
Connect contact handle to adapter line and to one of the terminals 30 (KI 30) on terminal block (arrow) and start engine for 30 seconds.
(Starting voltage at least 10 V)



Set value rate of delivery:
at least 150 cm^3 30 seconds

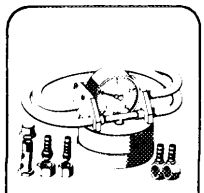
If the set value is not achieved, check fuel pressure (07.1- 146).

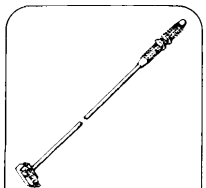
07.1-146 Checking fuel pressure (after checking delivery capacity)



Fuel line “A” from filter upper part (73) ..... unscrew,
connect tester (054).
Set values:
at idle speed **>** 0.3 bar
at full load **>** 0.5 bar
If the set values are not achieved:
Replace fuel filter.

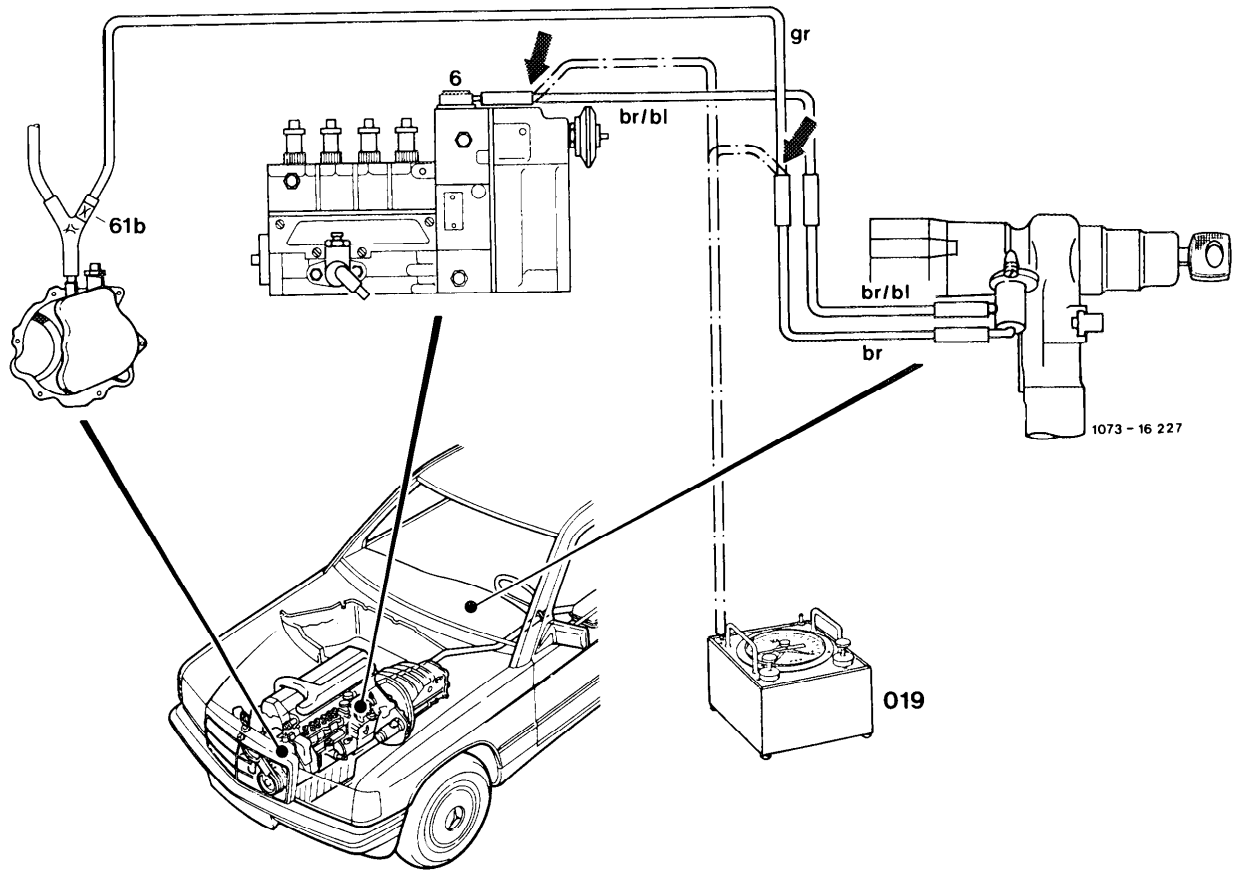
Special tools


617 589 04 21 00


124 589 36 63 00
01

07.1-150 Testing vacuum shut-off for leaks

1 st version

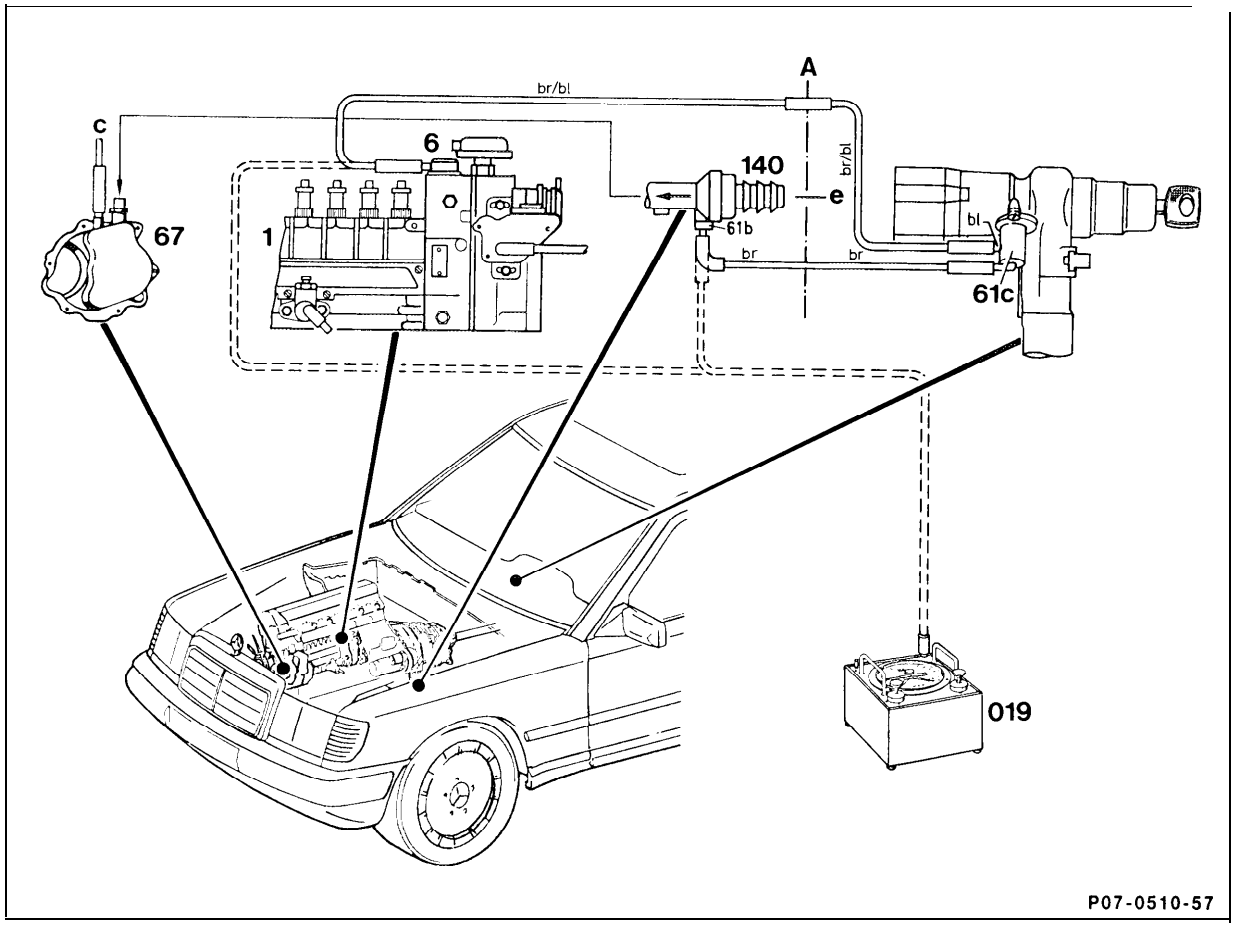


1	Injection pump	A	Partition panel
6	Vacuum unit (stop)	C	Remaining users
61b	Choke 0.5 mm orifice diameter	e	To brake booster
61c	Valve glow starter switch		
61d	Cam glow starter switch (valve open)		
67	Vacuum pump		

Glow starter switch	.....	turn to position “2”.
Vacuum tester (019)	.....	connect to suction line “brown” and apply vacuum of 400 + 50 mbar (max. pressure drop 6 mbar/min). Turn glow starter switch to position "0", the stop lever goes down or in stop position.
Vacuum tester (019)	.....	connect to vacuum unit (6) and apply vacuum of 300 + 50 mbar (max. pressure drop 5 mbar/min).

2nd version

Production breakpoint as of July 1987.



1	Injection pump	A	Partition panel
6	Vacuum unit (stop)	c	Remaining users
61c	Valve glow starter switch	e	To brake booster
67	Vacuum pump		
140	Check valve/main vacuum line		

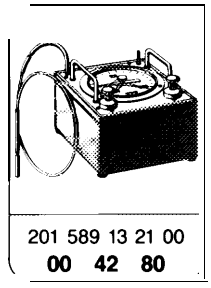
Glow starter switch	press to position "2".
Vacuum tester (019)	connect to suction line “brown” and apply vacuum of 400 + 50 mbar (max. pressure drop 6 mbar min). Turn glow starter switch to position "0", the stop lever goes down or in stop position.
Vacuum tester (019)	connect to vacuum unit (6) and apply vacuum of 300 + 50 mbar (max. pressure drop 5 mbar/min).

Permissible loss of vacuum mbar/min

Model	201
Entire system at 400 + 50 mbar vacuum	6’)
Individual parts at 300 + 50 mbar vacuum	5’)

1) Maximum pressure drop

Special tool

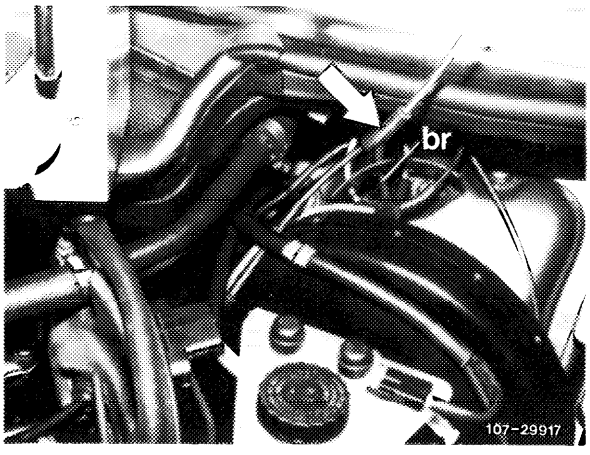


201 589 13 21 00
00 42 80

Testing

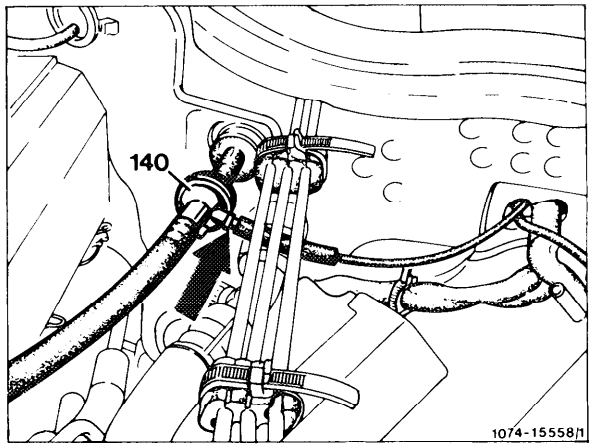
1 Turn ignition key on glow starter switch to position "2".

2 Pull suction line (brown) from connector (arrow).



Model 201

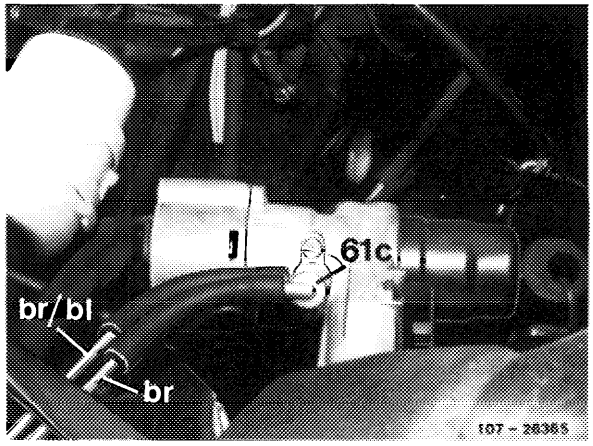
Vacuum supply directly from check valve of main vacuum line.
Model 201 as of July 1987



3 Connect tester and apply vacuum of 400 + 50 mbar.

If the display on the pressure gauge fails to change, the valve for the glow starter switch is leaking.

If a vacuum drop of more than 6 mbar min occurs on the pressure gauge, the valve (61c) on the glow starter switch is leaking.



Caution!
Before replacing the valve for the glow starter system and the vacuum unit of the injection pump, check hose lines and connections.

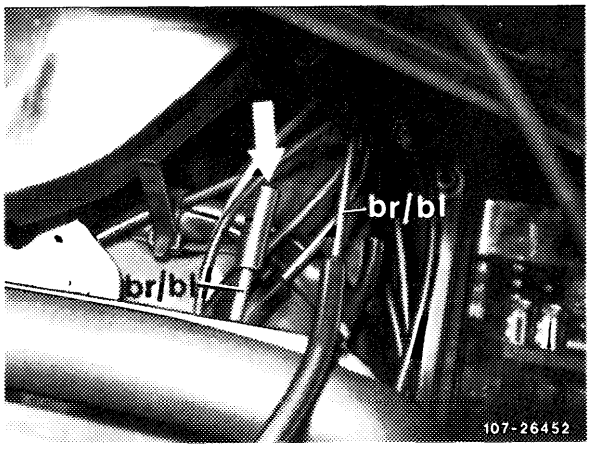
4 Replace valve on glow starter switch.

5 Turn ignition key on glow starter switch to position "0".

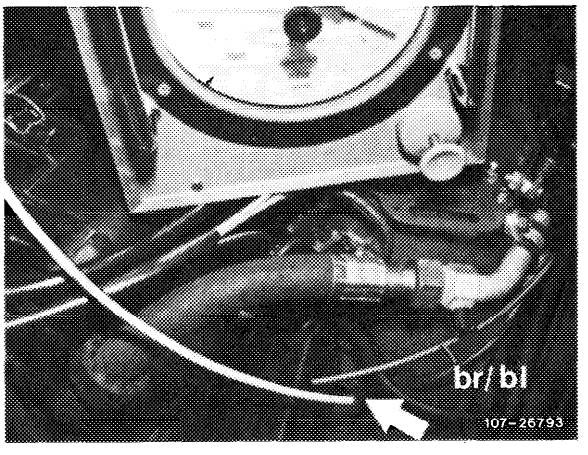
If a vacuum drop occurs on the pressure gauge, the vacuum unit or the valve may be leaking.

6 In this case, disconnect tester from suction line (brown).

7 Pull control line (brown blue) from connector (arrow).



Model 201
Standard version



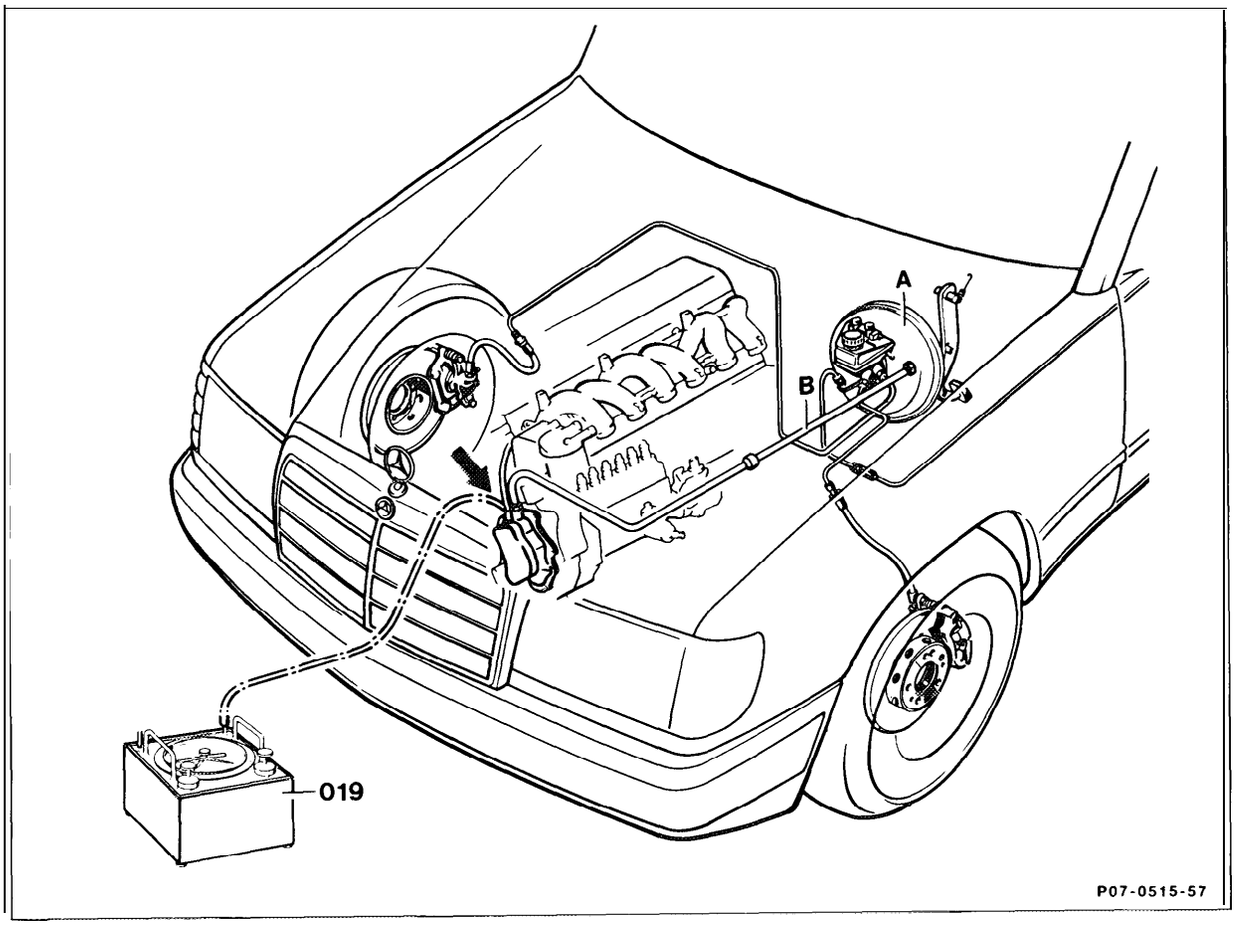
Model 201
California version

8 Connect tester to connector and apply vacuum of 300 + 50 mbar.

If a vacuum drop of more than 5 mbar/min occurs on the pressure gauge, the vacuum unit of the injection pump is leaking.

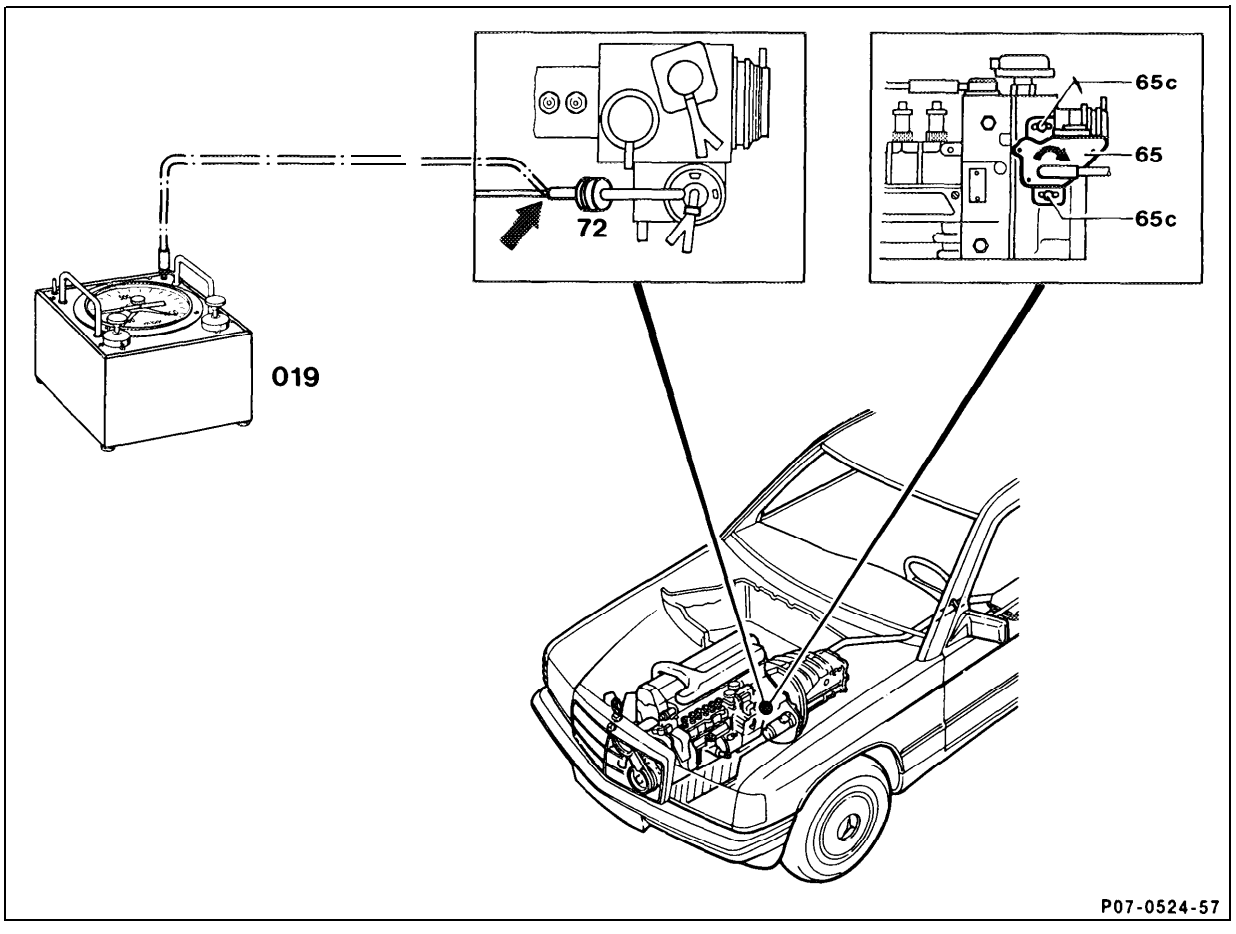
Caution!
Before replacing the vacuum unit, check hose lines and connectors.

9 Replace vacuum unit (07.1-220).



Engine temperature	< 20 °C (reference value)
Main vacuum line (B)	disconnect from brake booster (A), ventilate and reconnect.
Vacuum line on auxiliary user connection	disconnect and check choke orifice with 0.8 mm gauge for open passage.
Vacuum tester (019) to auxiliary user connection	connect and check vacuum at idle speed.
	Nominal value: 700 mbar after 30 s.
	If the vacuum value is not achieved, replace vacuum pump.

07.1470 Testing and adjusting vacuum control valve for automatic transmission



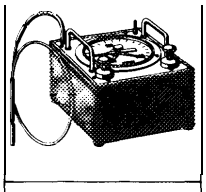
Vacuum tester (019) to damper (72) of vacuum line ..... connect and read vacuum at idle (set values and test values see next page).

With engine off, move control to full-throttle stop position.

Nominal value: 0 mbar, adjust vacuum control valve if required. Check vacuum lines, check vacuum pump, replace vacuum control valve.

Mounting bolts (65c) ..... loosen, fully open throttle until the control lever of the injection pump contacts the full-load stop. Turn vacuum control valve (65) in the direction of the arrow until resistance can be felt. In this position secure vacuum control valve.

Special tool



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00 42 80

Test and adjusting values, characteristics

Engine	Pressure control flap		Cap identification	Part no.	EGR valve identification	Vacuum adjustment mbar
	mech.	pneu.				
602 with EGR and automatic transmission	–	yes	black [1)]	123 300 10 33	blue	385 ± 25
602 with EGR and manual transmission	–	yes	green	123 300 12 33	blue	> 300
602	yes	–	yellow	124 300 03 33	brown	> 300

[1)] as of February 1987 with red cap

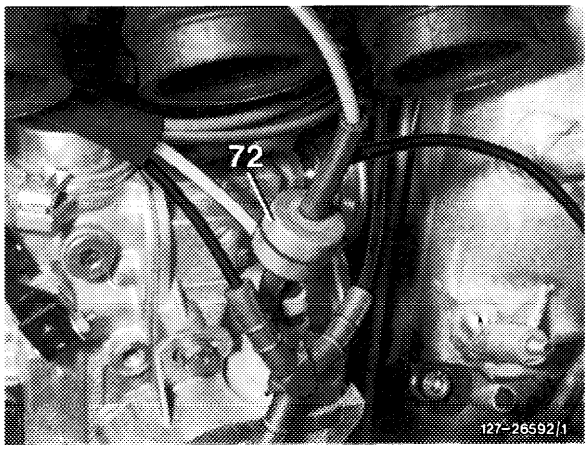
Checking

1 Pull off vacuum line, connect vacuum tester to damper (72) and check vacuum at idle.

Nominal values see table.

2 With the engine off, move control linkage into full throttle stop position. Check vacuum. Nominal value: 0 mbar.

3 If nominal values are not achieved:
a) Check vacuum control valve adjustment.
b) Check vacuum lines according to vacuum diagram, check vacuum pump, replace vacuum control valve if necessary.

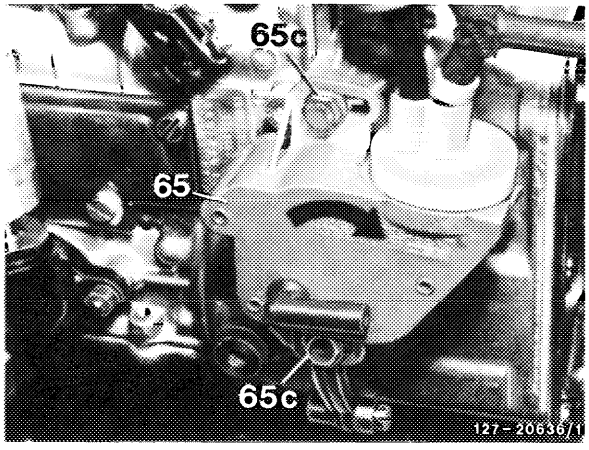


Adjusting

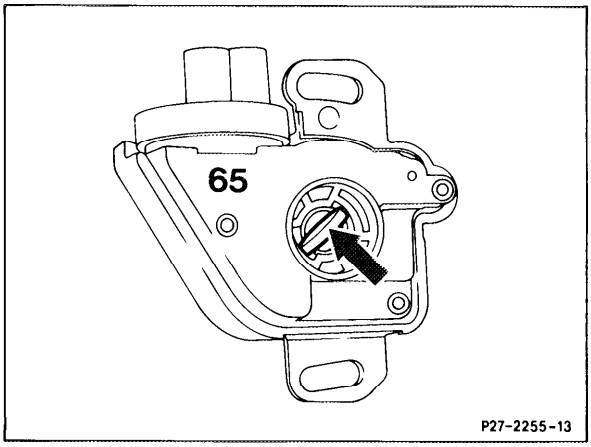
4 Loosen mounting screws (65 c).

5 Fully open throttle so that the control lever of the injection pump contacts the full load stop.

6 Turn vacuum control valve (65) in the direction of the arrow until resistance can be felt. In this position secure mounting screws.



A sealing boot (arrow) is installed together with the vacuum control valve to prevent dust and dirt from entering the vacuum control valve.



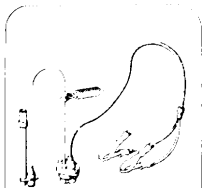
Repair instructions
Vacuum control valves differ for manual and automatic transmissions.

07.1-195 Testing exhaust gas recirculation

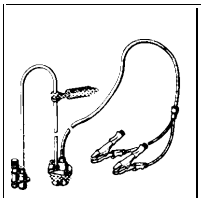
A. Performance test

B. Testing individual parts

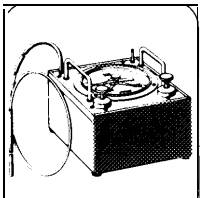
Special tools



603 589 00 21 00
07



601 589 04 21 00
07



201 589 13 21 00
00 42 80

201 589 00 99 00
15 54

Commercially available tools

Digital tester	Bosch, MOT 001.03
	e.g. Sun, DIT 9000
Multimeter	e.g. Sun, DMM-5

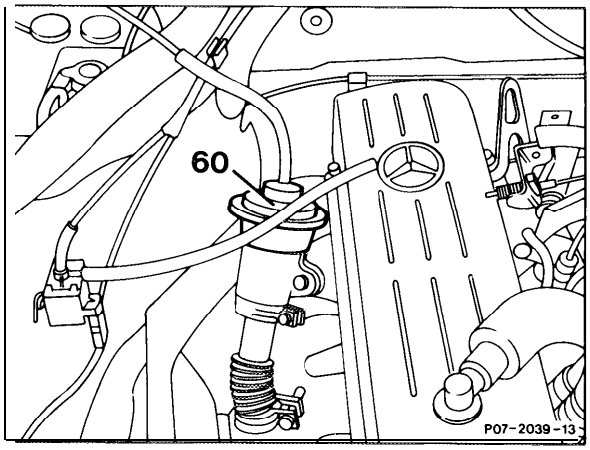
Note
Use Y-distributor, part no. 117 078 01 45 for vacuum tester.

Test condition
Coolant temperature 60-80 °C.

A. Performance test

Testing EGR valve (60) with engine off
Apply vacuum of approx. 300 mbar to EGR valve. Pull off vacuum line.

EGR valve audibly closes.	EGR valve does not close.

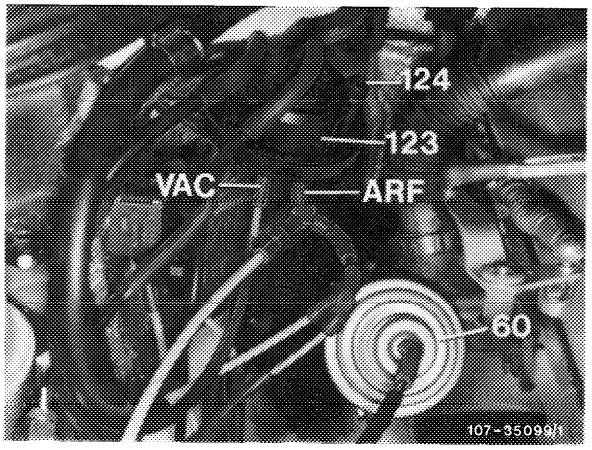


Test individual components
End of test

Testing vacuum amplifier (123) and vacuum adjustment

Connect vacuum tester with Y-distributor to connection "A" and read vacuum value with engine at idle. If the vacuum is above or below the nominal value, adjust vacuum. For this purpose pull off protective cap (124) and adjust with socket wrench insert (4 mm) according to specified Nominal value.

Nominal value: 350 ± 5 mbar.
as of model year 1986 may not be adjusted.



OK	Not OK

Check vacuum supply at connection "C", replace vacuum amplifier if necessary. Check vacuum lines according to vacuum diagram. Check supply vacuum on vacuum pump (07.14 60).

Nominal value: greater than 700 mbar

End of test

Testing vacuum control

Connect vacuum tester with Y-distributor to EGR valve (60). Check vacuum values and position of vacuum unit (100) and vacuum control flap. Take vacuum readings at the following engine speeds:

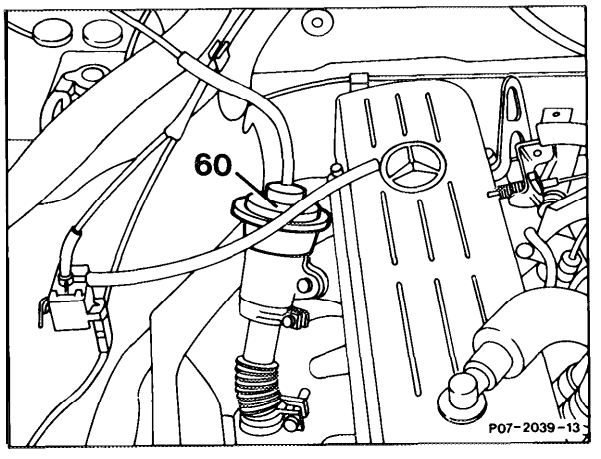
EGR Model Year 1986

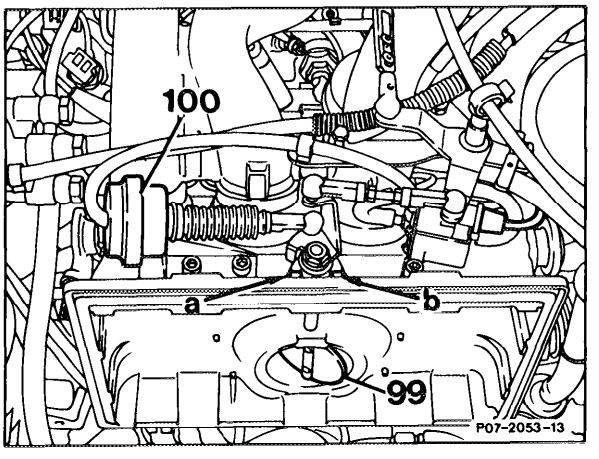
rpm	EGR valve mbar	Pressure control flap position
680 ± 20	0	**Not** activated
1200 ± 50	150 – 350	Fully activated
3000 ± 50	0	Not activated

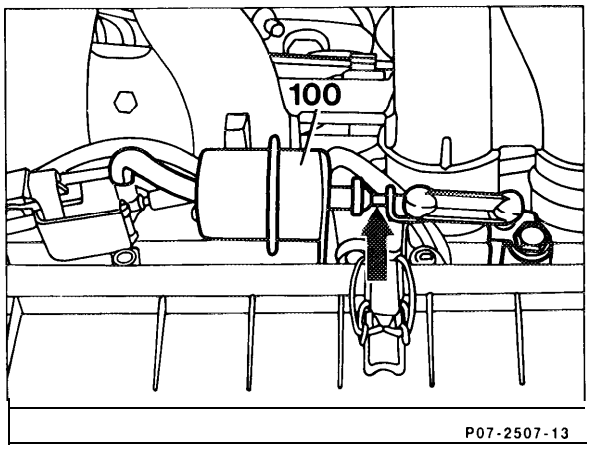
EGR Model Years 1987 through 1989

rpm	EGR valve mbar	Pressure control flap position
680 ± 20	Approx. 30	**Not** activated
1000 ± 50	150 – 360	Fully activated
2500 ± 50	150 – 360	Not activated
3000 ± 50	0	Not activated

OK	Not OK







Piston rod of vacuum unit retracted - pressure control flap closed (arrow).

Check vacuum supply and individual components.

End of test

Testing microswitch (S27/6, I + II)

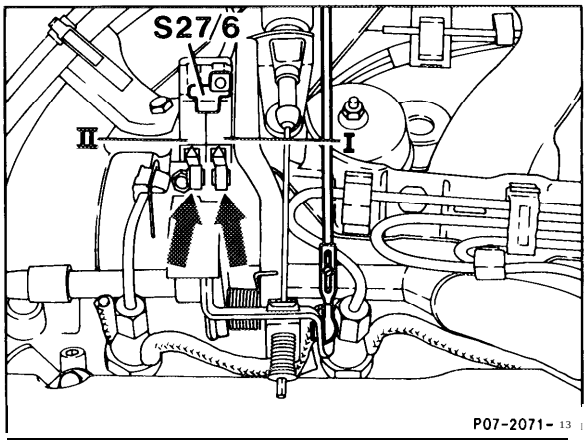
Connect vacuum tester with Y-distributor to EGR valve (60).

Run engine at 1200 ± 50 rpm (M.Y. 1986).
Run engine at 1000 ± 30 rpm (M.Y. 1987- 89)

Actuate microswitch (S27/6 I), the vacuum on the EGR valve (60) should drop to 0 mbar. The pressure control flap (in the air filter housing) should move into "not activated" position.

Actuate microswitch (S27/6 II), the pressure control flap (100) in the air filter housing should move into the "not activated" position.

OK	Not OK



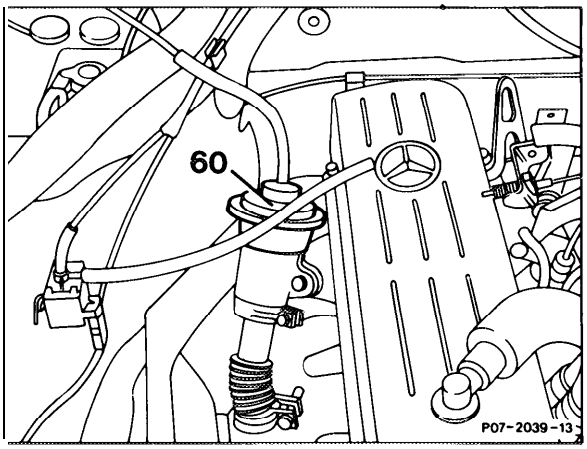
Check individual components.

B. Testing individual components

Testing EGR valve (60) with engine stopped

Apply approx. 300 mbar of vacuum to EGR valve (60). Pull off vacuum line.

EGR valve audibly closes .	EGR valve does not close.

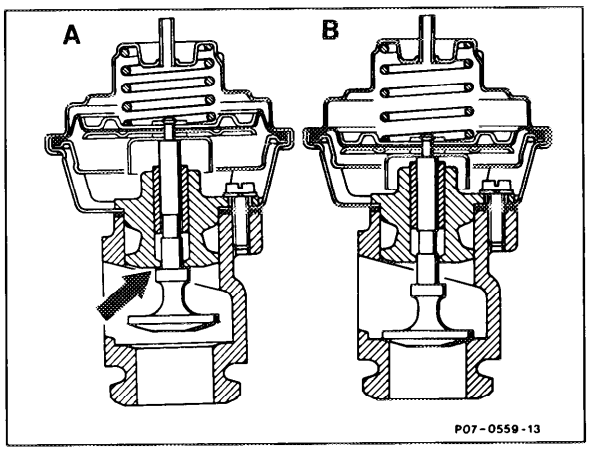


Remove EGR valve and apply approx. 300 mbar of vacuum with vacuum tester.

EGR valve lifts approx. 4 or 6 mm off the seat (end stop → arrow).

Pull off vacuum hose, the EGR valve must audibly snap back onto its seat

If one of these test steps is not successful, replace EGR valve.



A open
B closed

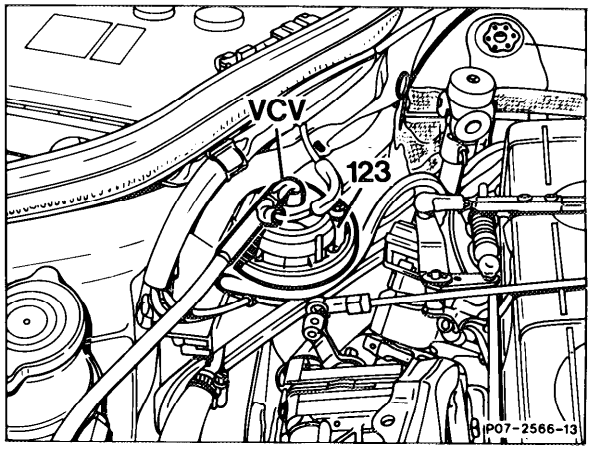
End of test

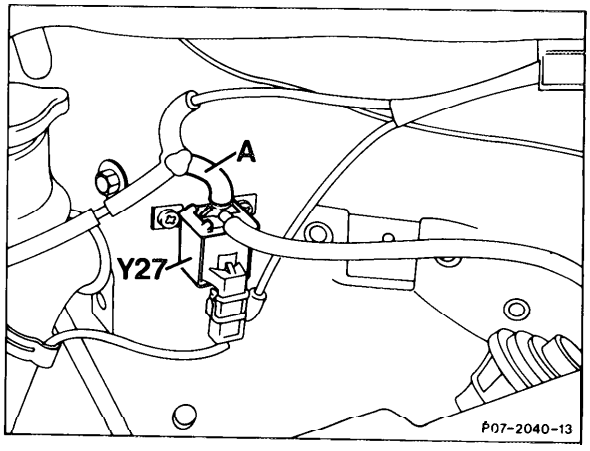
Testing vacuum control valve (65)

Connect vacuum tester with Y-distributor to connection "B" of vacuum amplifier (123) and check vacuum at idle.
Nominal values:
At 680 ± 20 rpm:
approx. 360-410 mbar (M.Y. 1986-1988)
above 300 mbar (M.Y. 1989)

With engine off and control linkage at full load stop: 0 mbar.

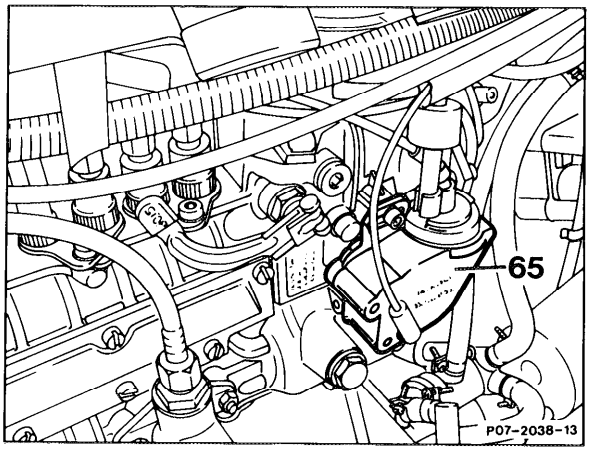
Test values correct.	Test values not in order.





Check vacuum lines according to vacuum diagram.
Check vacuum supply at vacuum pump.

Nominal Value:
greater than 700 mbar
Adjust vacuum control valve (65) (07.1-I 70), replace if necessary.



End of test

Testing switchover valves (Y27 and Y28)

Connect voltmeter to connector of switchover valve and measure voltage at 1000 ± 50 rpm for model years 1987 through 1989 and 1200 ± 50 for model year 1986.

Nominal value: approx. 12 V.

OK	Not OK

Check electrical actuation according to wiring diagram, replace EGR control unit (N37 or N37/2) if necessary.

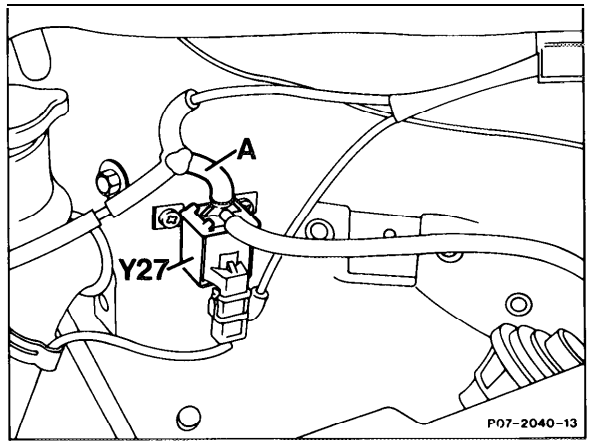
End of test

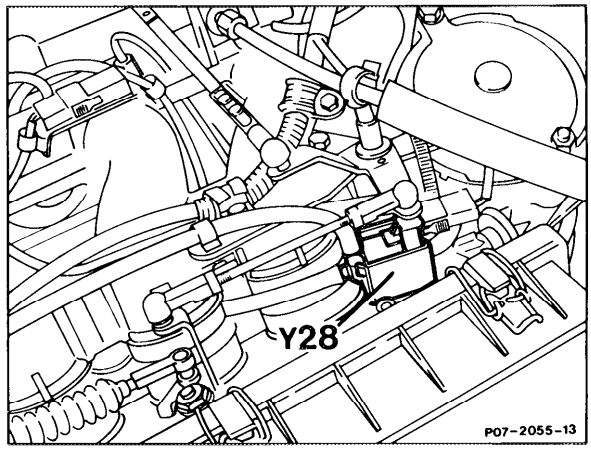
Connect vacuum tester with Y-distributor to connection "C" and check vacuum at 1000 ± 50 rpm (or 1200 ± 50 for 1986, 12 V applied) valves Y27 and Y 28

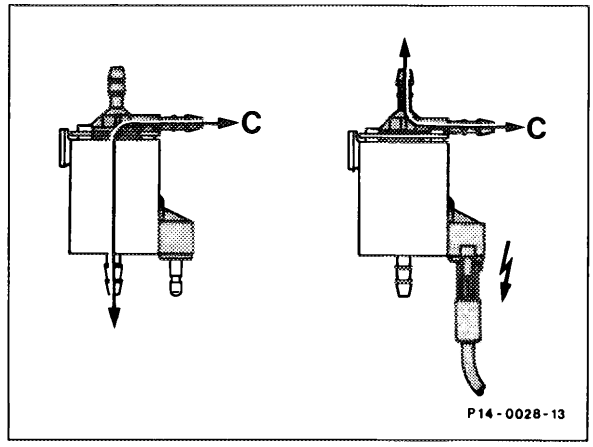
300-400 mbar

Check engine with mechanical actuation of the pressure control flap at 1000 ± 50 rpm (1200 ± 50 for M.Y. 1986), applying 12V.

Switchover valve (Y27) 350 – 400 mbar
Switchover valve (Y28) > 700 mbar



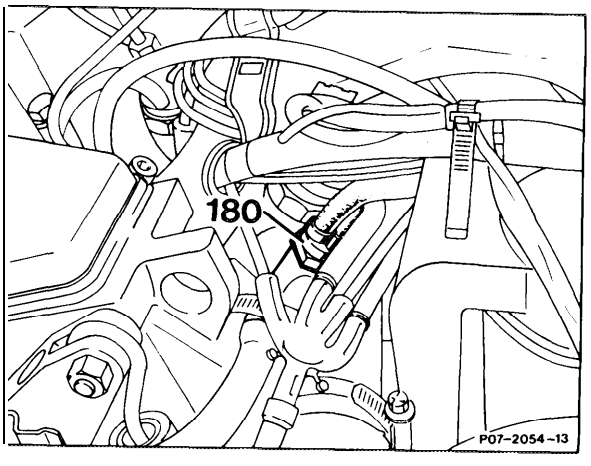




OK	Not OK

Check supply vacuum at the vacuum pump (07.1-I 60).
Nominal value greater than 700 mbar.

Check vacuum lines according to vacuum diagram.



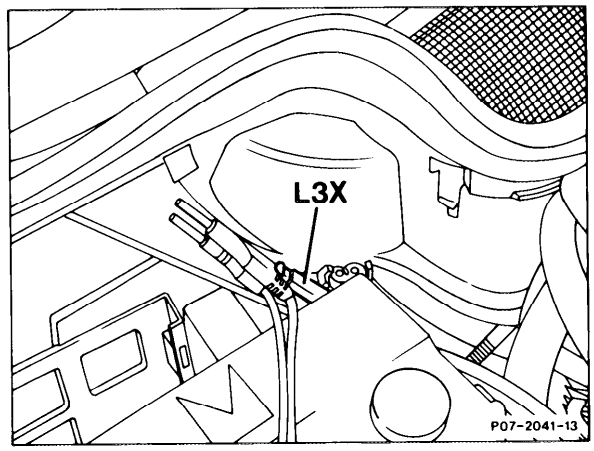
End of test

Testing rpm signal

Remove plug connector (L3X). Connect multimeter and press button "V~". Run engine at idle.

Reading: > 1.5 V~
Voltage rises with increasing speed.

OK	Not OK

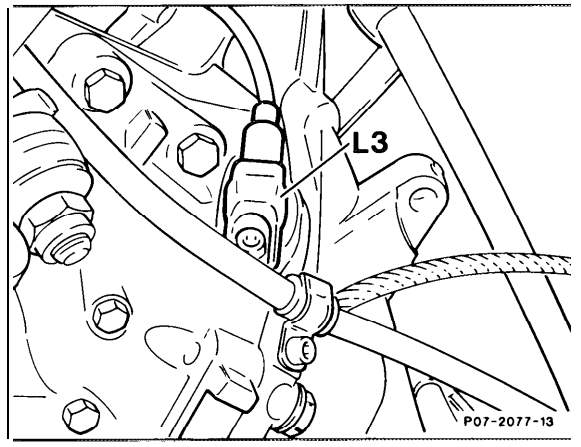


End of test

Remove starter ring gear speed sensor (L3). Connect multimeter as above and press "Ω" button on multimeter. Check resistance on pins of connector L3X.

Reading: 1.9 ± 0.2 kΩ

OK	Not OK



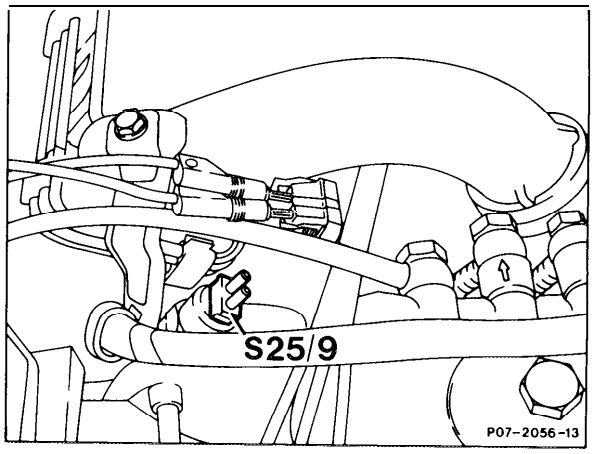
Inspect starter ring gear speed sensor (L3) for accumulation of dirt or metal chips, clean or replace if necessary.

Replace starter ring gear speed sensor (L3).

End of test

1) Measured at 20 °C ambient temperature. (The resistance changes by 4% for each 10 °C change in ambient temperature).

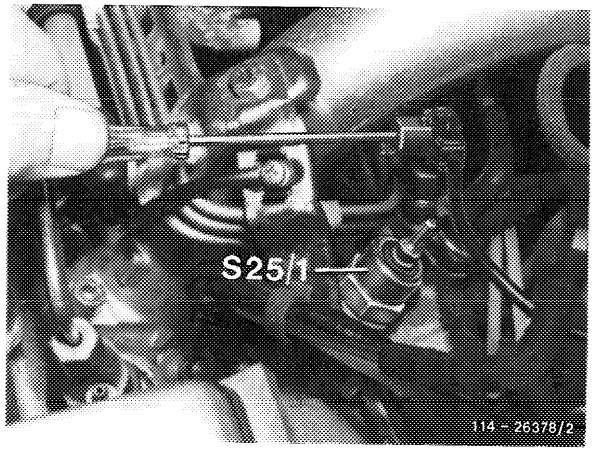
Testing activation of temperature switch (S25/9) 97 °C



Connect vacuum tester with Y-distributor to EGR valve.

Run engine at **1200** rpm (M.Y. 1986-1988)
Run engine at 1000 rpm. (M.Y. 1989)
Pull plug off temperature switch (S25/1) and bridge 2 terminal connection, except 1-pole version of temperature switch (S25/1), hold the plug against ground (engagement of electronic clutch should be heard).

Vacuum at EGR valve drops to 0 mbar.



OK	Not OK

Check electrical activation according to wiring diagram, replace EGR control unit (N37 or N37 2) if necessary.

End of test

Testing activation of 25 °C temperature switch (S25/7)

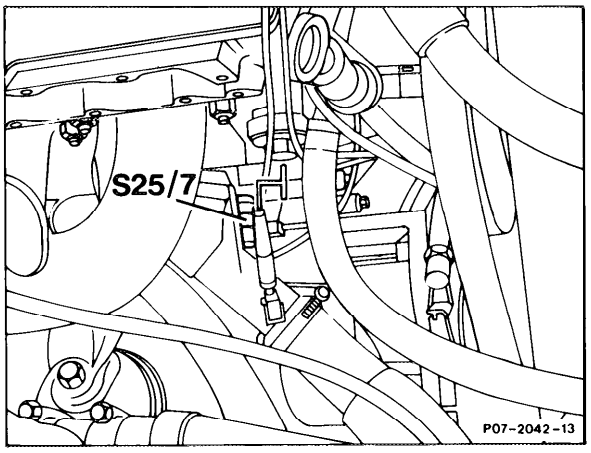
Connect vacuum tester with Y-distributor to EGW valve.
Engine temperature above 25 °C
Run engine at 1200 rpm (M.Y. 19864988)
Run engine at 1000 rpm (M.Y. 1989)
Pull plug off temperature switch and hold against ground.

Vacuum at EGR valve drops to 0 mbar.

OK	Not OK

Check electrical activation, according to wiring diagram, replace EGR control unit (N37 or N37/2) if necessary.

End of test



Testing microswitch (S27/3 and S27/4)
Model Years 1986 through 1988

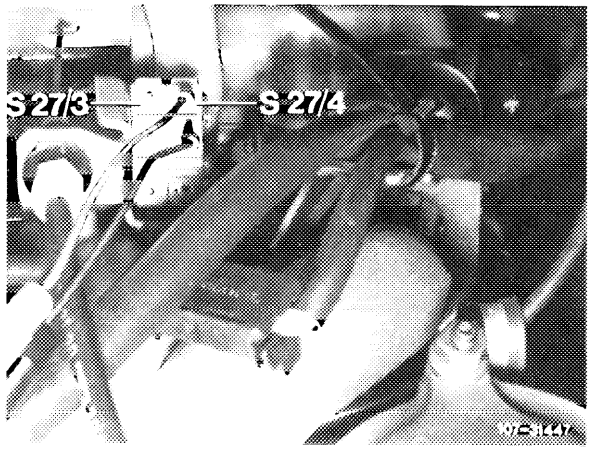
Engine off. Pull off connector on microswitch and test for continuity with ohmmeter between pin 2 and 4 or pin 1 and 3.

At idle : 0 Ω
At full throttle: ∞ Ω

OK	Not OK

Replace microswitch.

End of test.



Testing full throttle on microswitch (S27/3)
Model Years 1986 through 1988

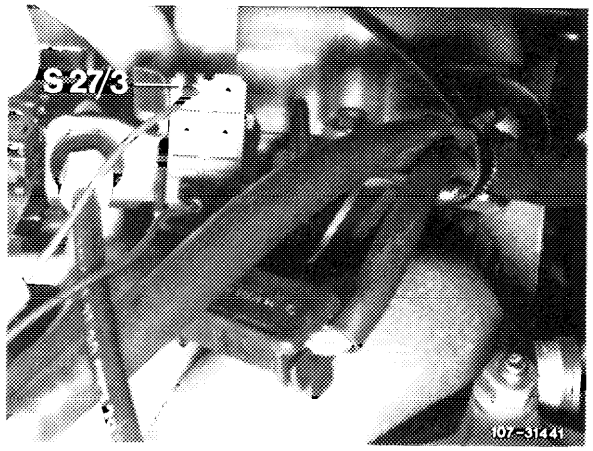
Engine off. Pull connector from microswitch. Test for continuity with ohmmeter between pin 1 and 5.

At idle: ∞ Ω
At full throttle: 0 Ω

OK	Not OK

Replace microswitch (S27/3).

End of test.



Testing speed shut-off
Model Years 1986-l 988

Connect vacuum tester with Y-fitting to actuator (100) for vacuum control flap. Drive vehicle on dynomometer or open road in 5th gear or "D" at partial load.
Read vacuum at the speeds listed below.

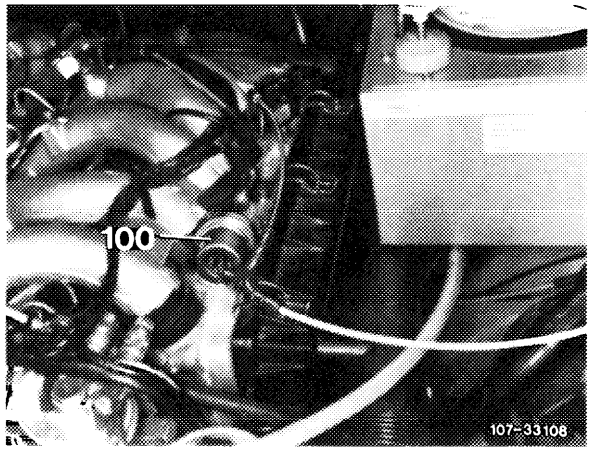
Model Year 1986

below 56 ± 5 mph:	approx.	700 mbar
above 56 ± 5 mph:	approx.	0 mbar

Model Years 1987, 1988

below 54 mph:	approx.	150 mbar
above 54 mph:	approx.	0 mbar

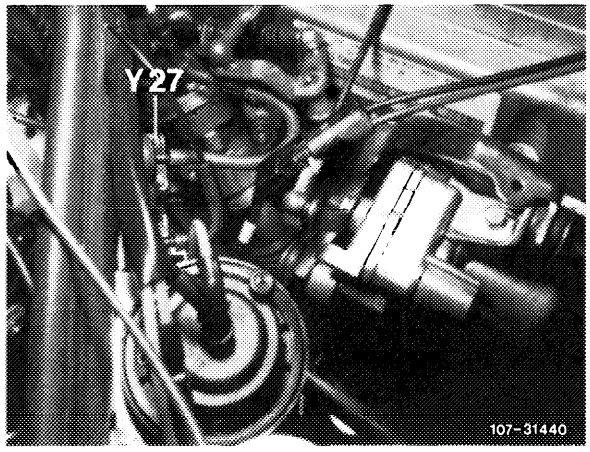
OK | Not OK



Model Year 1986
Pest electrical activation of switchover valve (Y27). For this purpose, connect multimeter to connector (arrow) of switchover valve and repeat test drive.

If voltage (approx. 12 V) is indicated at speeds above 56 mph (90 km/h), test electrical activation of switchover valve according to wiring diagram. Replace defective parts, if required.

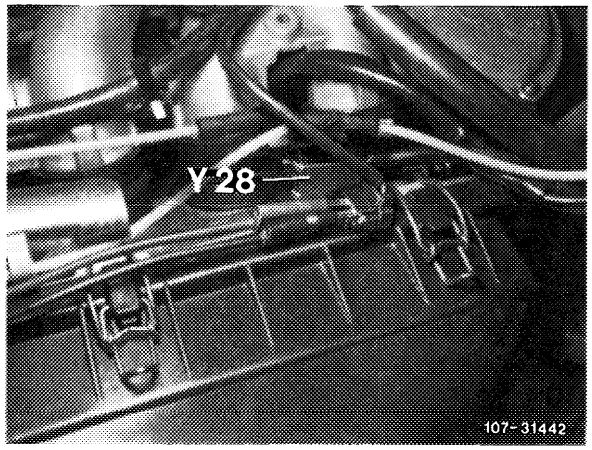
If there is no voltage, replace switchover valve.



Model Years 1987, 1988
Test electrical activation of switchover valve (Y28). For this purpose, connect multimeter to plug of switchover valve and repeat test drive.

If voltage (approx. 12 V) is indicated at speeds above 54 mph (87 km/h), test electrical activation of switchover valve according to wiring diagram. Replace defective parts, if required.

If there is no voltage, replace switchover valve.



End of test.

Testing microswitch (S27/6) Model Year 1989

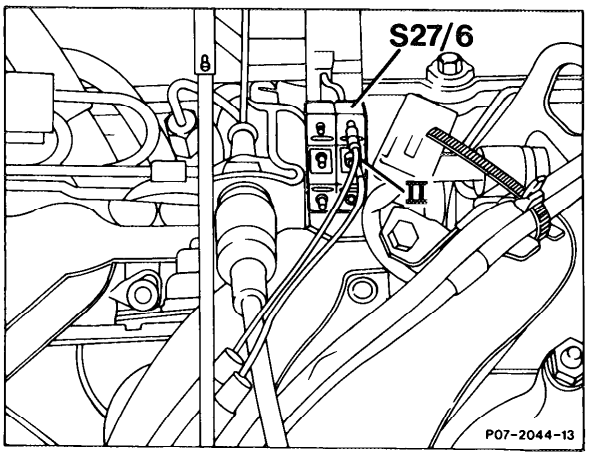
Engine off. Pull off connector on microswitch (S27/6) and test for continuity with ohmmeter between pin 2 and 4 and/or pin 1 and 3.

At idle : 0 Ω
At full throttle: ∞ Ω

OK	Not OK

Replace microswitch (S27/6).

End of test.



Testing full load contact on microswitch (S27/6) Model Year 1989

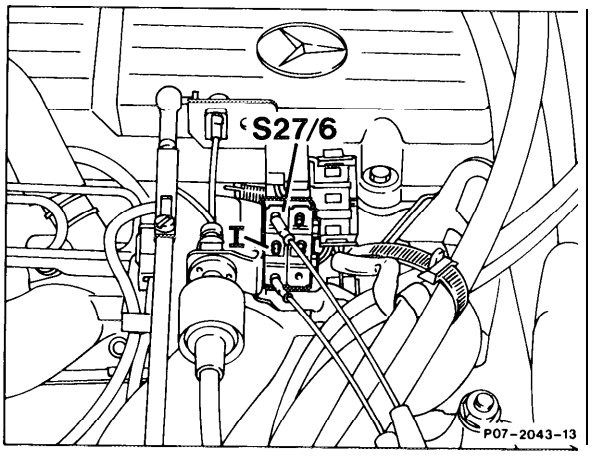
Engine off. Pull off connector on microswitch (S27/6, pos. I). Test for continuity with ohmmeter between pin 1 and 5.

At idle: ∞ Ω
At full throttle: 0 Ω

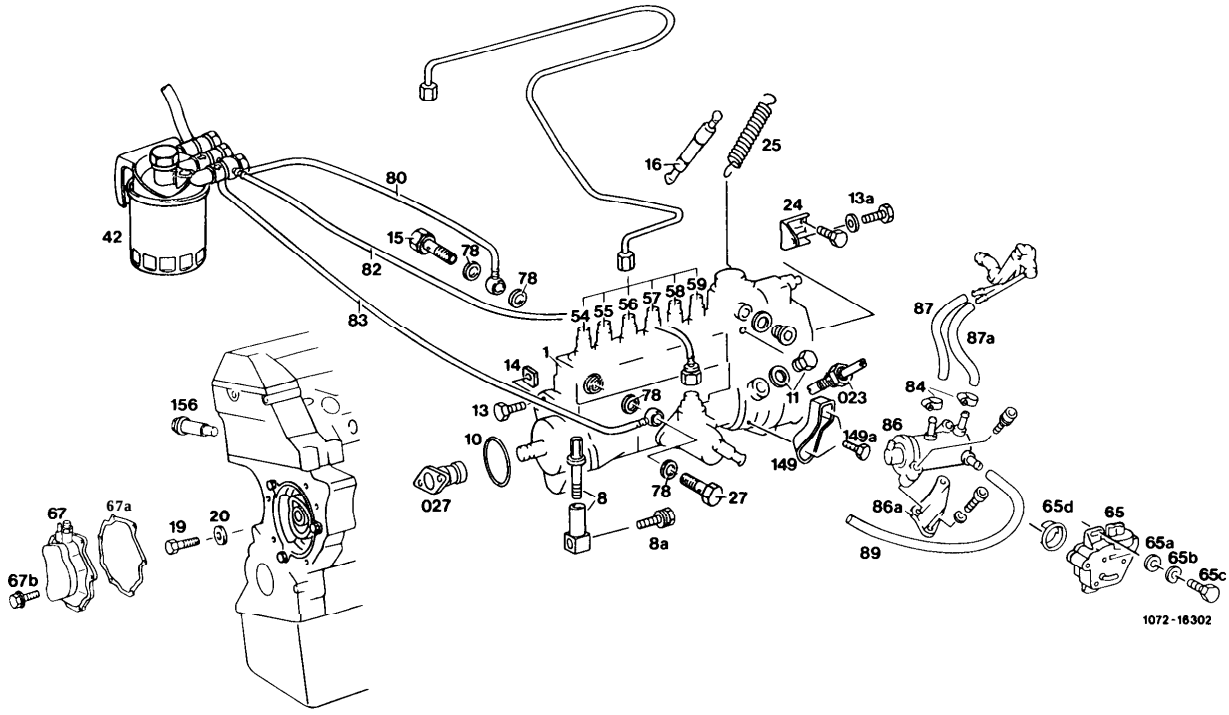
OK	Not OK

Replace microswitch (S27/6).

End of test.



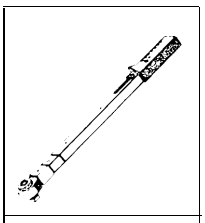
07.1-200 Removal, installation of injection pump



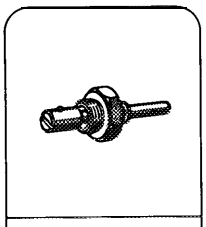
Noise capsule lower part	.....	remove, mount (94-0050).
Belt tensioning device	.....	remove, reinstall (13340).
Fan shroud and fan	.....	remove, reinstall (20-310/335).
Vacuum pump (67)	.....	remove, reinstall (43-610). Gasket (67a), replace.
Adjusting element of cruise control	.....	remove, reinstall (54541).
Assembly cage	.....	remove, reinstall Special tool 601 589 05 14 00 Note: Assembly cage deleted on all engines as of 09/89 (see 07.1-240).

Central mounting bolt (19)	remove, reinstall **'@left-hand thread"** Tightening torque 40-50 Nm.
Turn crankshaft in direction of rotation	to -15° ATDC of 1 st cylinder.
Chain tensioner (156)	remove, reinstall, tightening torque 80 Nm (05-310).
Control damper (16)	remove, reinstall (only manual transmission).
Injection lines (54-59)	on injection pump disconnect, connect, tightening torque 10-20 Nm., special tool 000 589 770 300
Fuel lines (80, 82, 83)	disconnect, connect.
Sealing rings (78)	replace.
Vacuum lines on stop unit	remove, fit.
Couplings on electromagnetic actuators	disconnect, connect.
Control linkage	disconnect, connect.
Vacuum control valve (65)	remove, reinstall, adjust (07.1-l 70).
Mounting bolts (13 and 13a)	remove, reinstall, tightening torque 20-25 Nm.
Combination screw (8a)	loosen.
Fuel thermostat (86)	remove, reinstall.
Injection pump	pull out to the rear while counterholding injection timing device.
O-ring (10)	replace, lubricate with oil for injection pump installation.
Check if engine	is positioned on -15° ATDC of 1 st cylinder, correct if necessary. **Caution!** Turn engine only in direction of rotation.
Screw plug (11)	remove.
Injection pump	turn in removed condition with splined wrench (027) and lock with locking bolt (023).
Start of delivery	check (07.1-l 12), adjust if necessary (07.1-l 17).

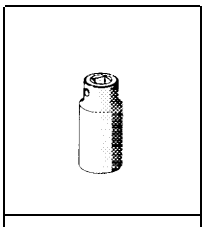
Special tools



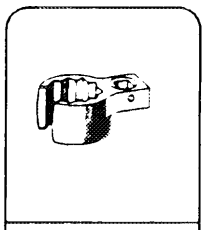
001 589 66 21 00
00



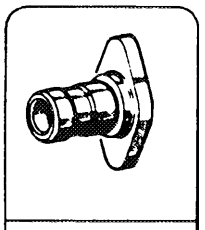
601 589 05 21 00
07



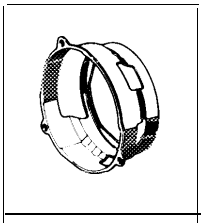
001 589 65 09 00
03 07 32



000 589 77 03 00



601 589 00 08 00



601 589051400
07

Note

Until the production breakpoints shown, a gasket with oil pocket must be installed when replacing the gasket (67a) of the vacuum pump.
As of the production breakpoint, a gasket without an oil pocket is installed.

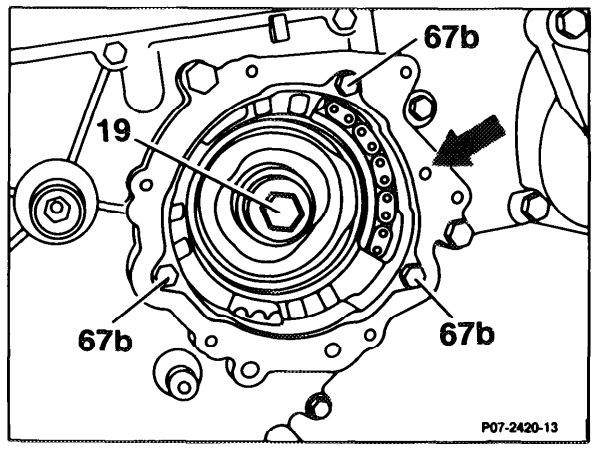
Engine model design.	Transmission	As of engine end no.
602.911	manual	019187
	automatic	004738

Removal, installation

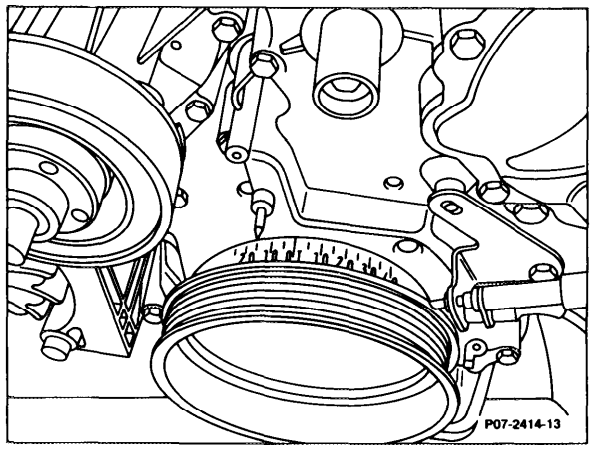
1 Remove assembly cage (arrow).

2 Loosen central mounting bolt (19), unbolt and hold crankshaft against rotation.

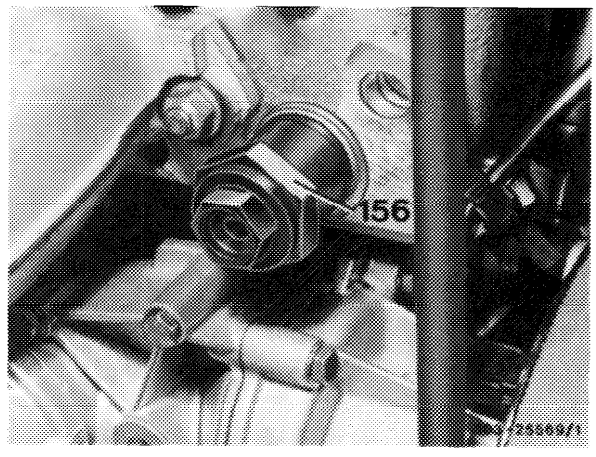
Caution!
LEFT-HAND THREAD



3 Turn crankshaft in direction of rotation to -15” ATDC of 1 st cylinder.

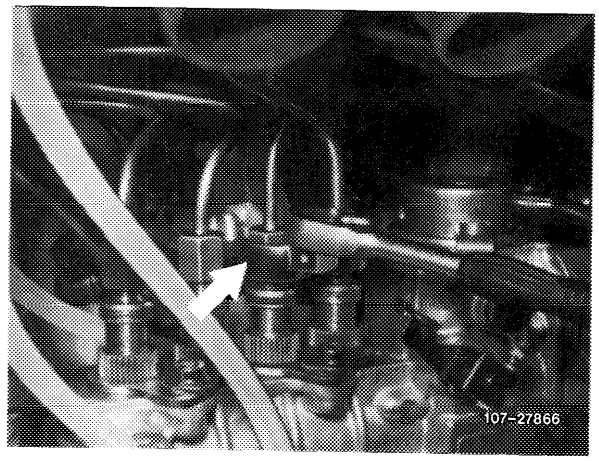


4 Remove chain tensioner (156) (05310).



Socket wrench insert
Special tool 001 589 65 09 00

5 Disconnect injection and fuel lines from injection pump.



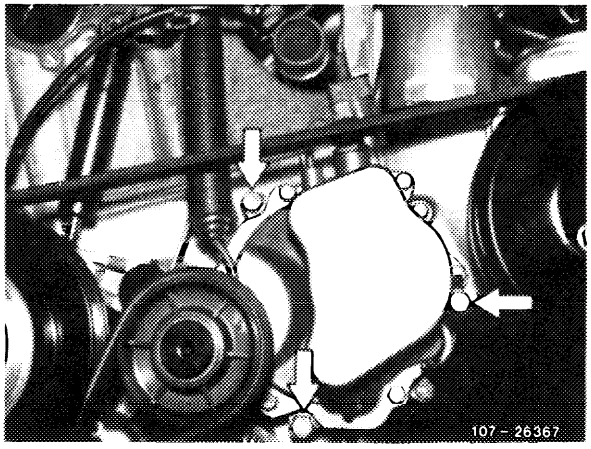
Socket wrench insert (arrow)
Special tool 000 589 77 03 00
with 1/4" ratchet

6 Pull off vacuum lines for idle speed increase, stop unit and vacuum control valve vacuum unit. Pull off ELR double couplings with electromagnetic actuators.

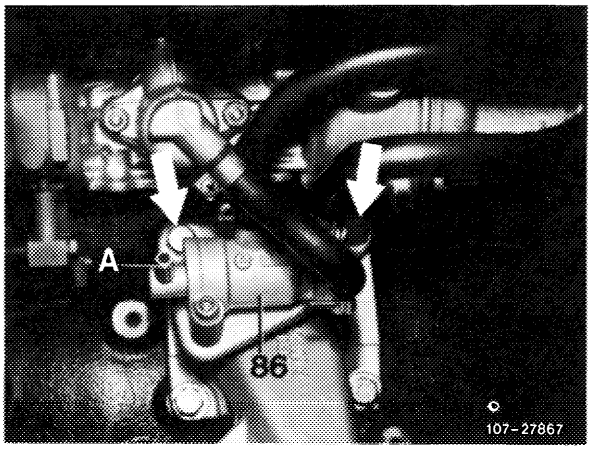
7 Disconnect control linkage on control lever as well as shock absorber and spring.

8 Remove vacuum control valve (only with automatic transmission or EGR).

9 Remove mounting bolts (arrows) and install bracket.

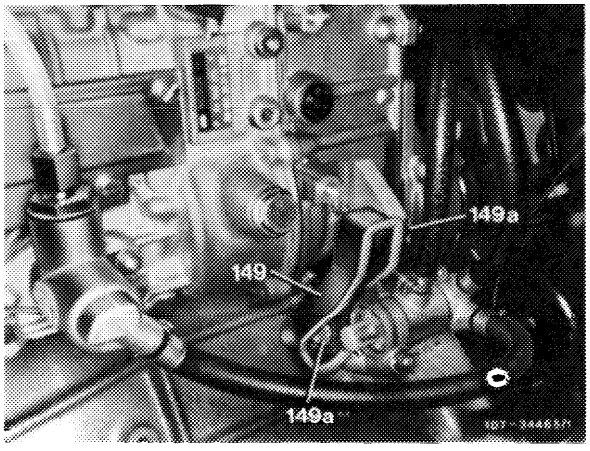


10 Completely remove fuel thermostat (86) by removing bolts (arrows).

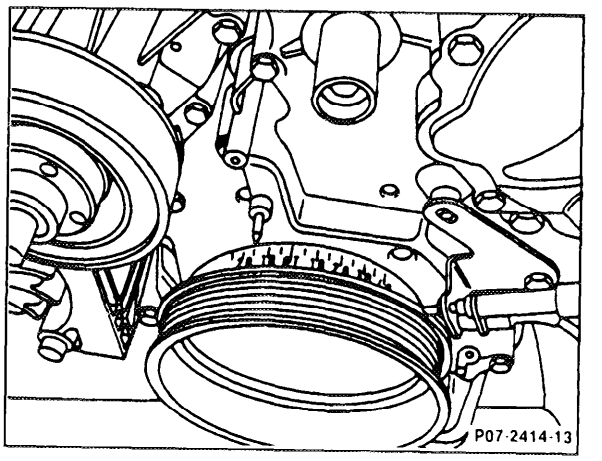


A = Supply from fuel tank

11 Pull injection pump out to the rear while holding the injection timing device.

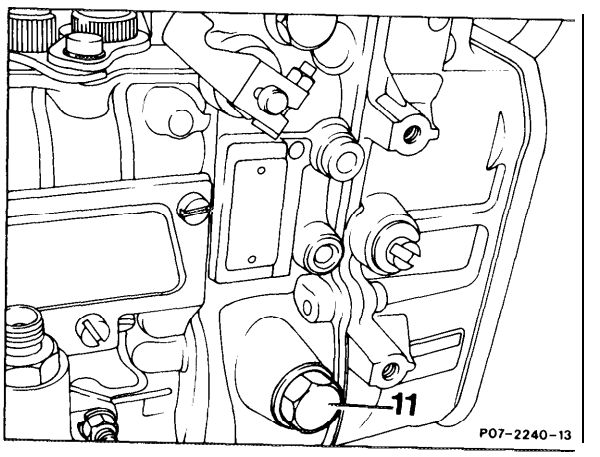


12 Check if the engine is positioned at -15° ATDC of 1st cylinder, correct if necessary.

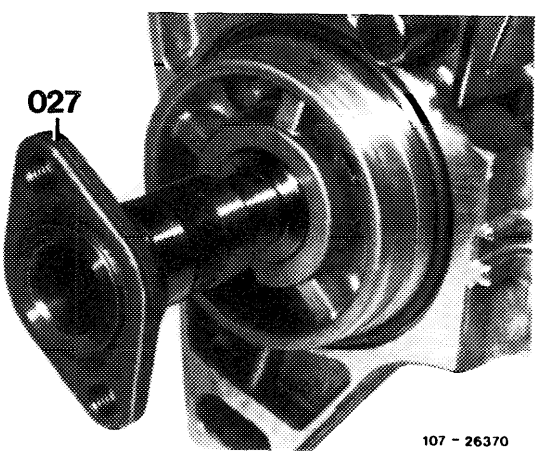


Caution!
Turn engine only in direction of rotation with the installed centering sleeve!

13 Remove screw plug (11).

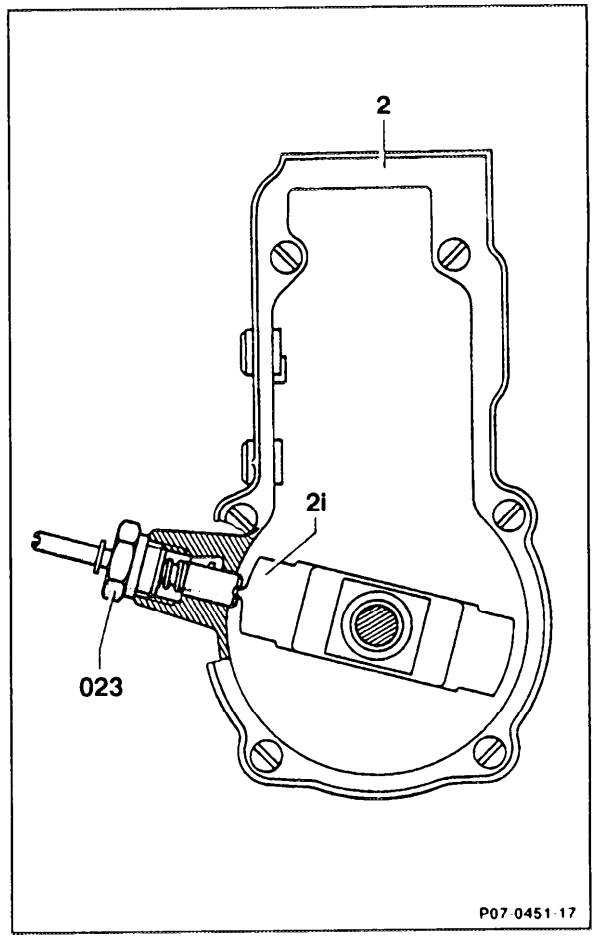


14 Turn injection pump with splined wrench (027) on the injection pump camshaft until the lug of the governor is visible in the hole, then insert locking bolt (023) in this position and engage in the lug, tighten by hand.



027 Splined wrench
Special tool 601 589 00 08 00

Caution!
Remove locking bolt (023) after installation of the injection pump to avoid damage to the injection pump during starting.



023 Locking bolt
Special **tool601** 589 05 21 00

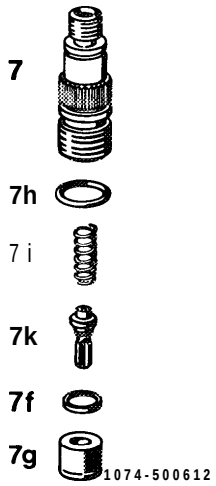
15 Reassemble engine in reverse order.

Note
Bleeding of the injection system is automatic when starting the engine.

16 Check start of delivery 07.1-l 12, adjust if required 07. l-l 17.

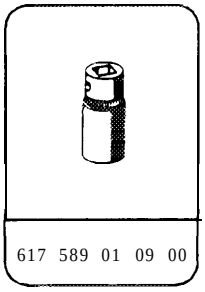
17 Install, adjust vacuum control **valve** 07.1- 170.

07.1-210 Replacing delivery valve seal

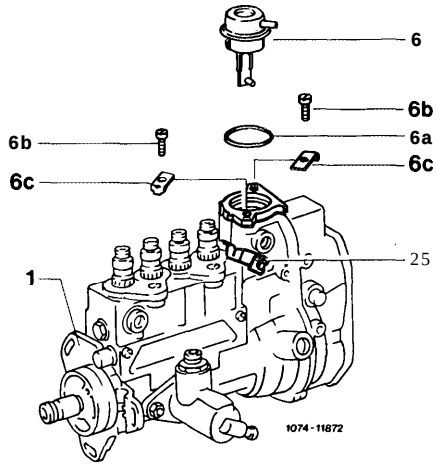


Air cleaner complete	remove, reinstall (09-400).
Delivery valve holder (7)	remove, reinstall, tightening torque 35 Nm, special tool 617 589 01 09 00.
Compression spring (7i)	
Copper sealing ring (7f)	replace.
Delivery valve (7k)	rinse in fuel before installation.
Delivery valve carrier (7g)	observe installation position.
O-ring (7h)	lubricate prior to installation.

Special tool

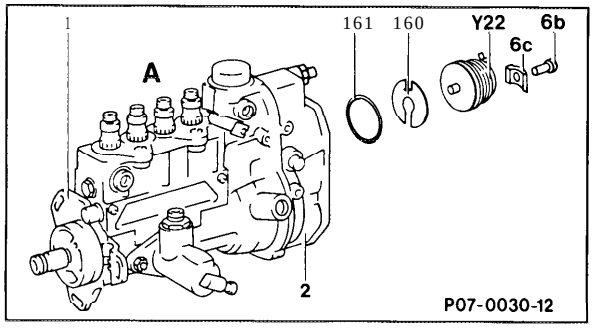


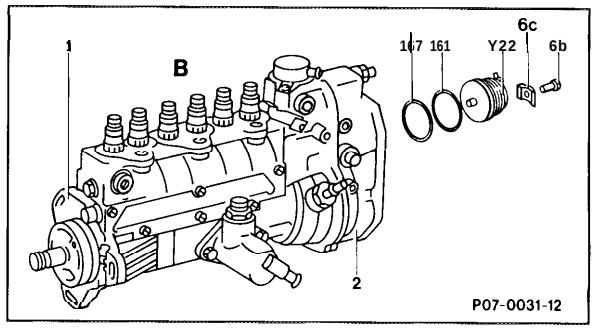
07.1-220 Replacing vacuum unit



Air cleaner complete	remove, reinstall (09-400).
ADA unit	remove, reinstall (engines with EGR).
Screw (6b)	remove, reinstall. For TORX screws use wrench "T30".
Bracket (6c)	remove, reinstall.
Vacuum unit (stop) (6)	slightly raise during removal, tilt backward to the engine side and pull out.
O-ring (6a)	remove, reinstall.
Emergency stop lever (25)	push during installation and allow vacuum unit connecting rod to engage in the toggle of the emergency stop lever.

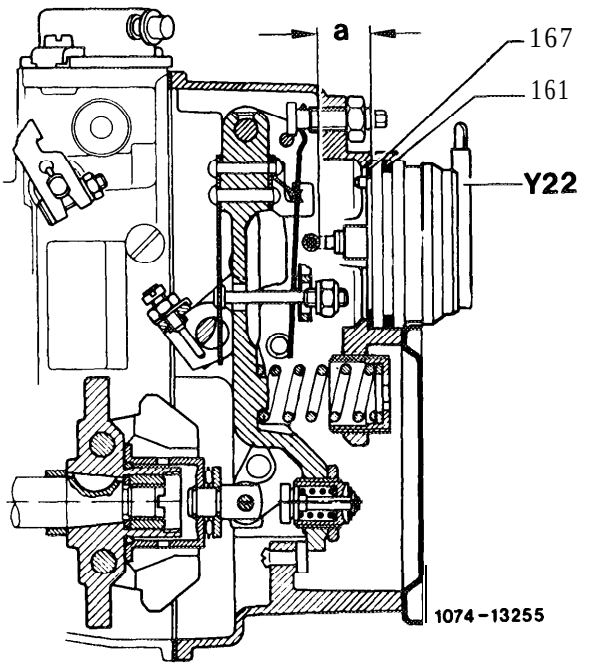
07.1-225 Replacing electromagnetic actuator (ELR)





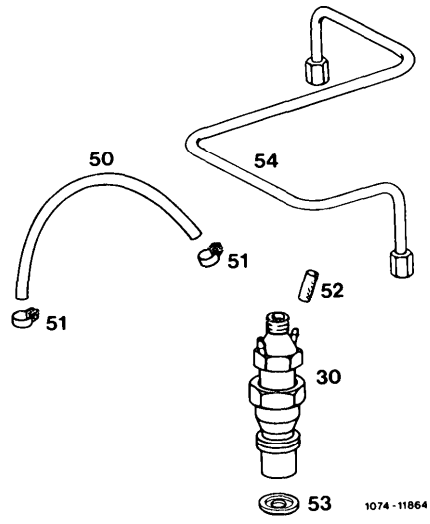
A	1 st version
B	2nd version
1	Injection pump
2	Governor
160	Intermediate plate

Air cleaner complete	remove, reinstall (09-400).
Screw (6b)	2 off remove, reinstall. For TORX screws use wrench "T30".
Bracket (6c)	2 off remove, reinstall.
Electromagnetic actuator (Y22)	remove, reinstall, electrical connection must face up.
O-ring (161)	replace.
Shim (167) (no replacement part)	for adjusting dimension “a”. (During repairs the previous shims must be reinstalled to ensure that the dimension “a” is correct).



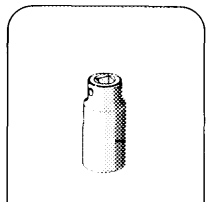
Dimension "a"
14.6-15.7 mm

07.1-230 Removal and installation of injectors



Fuel bleed hose (50)	pull off, fit.
Plug (52)	material (fabric),
Injection line cylinder no. 1(54)	10-20 Nm (reference value).
Injection nozzle (30)	70-80 Nm, special tool 001 589 65 09 00, with inclined injection 30 Nm.
Nozzle plate (53)	replace

Special tool

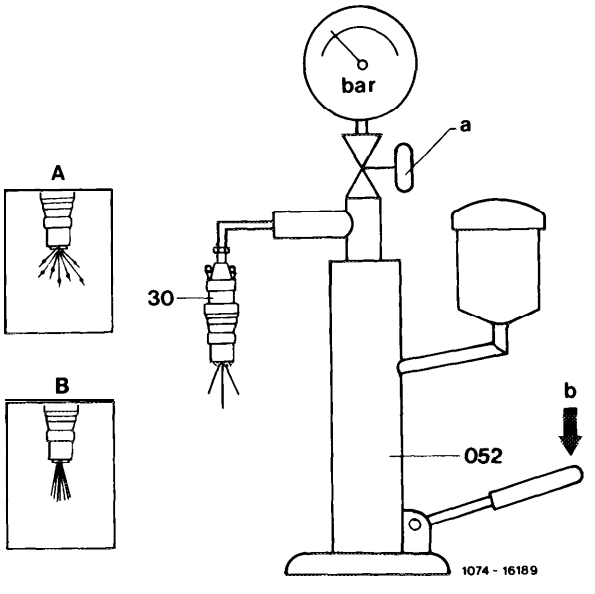


001 589 65 09 00
03 07 32

07.1-231 Checking injectors

Injection nozzles removed 07.1-230

A. Facet-type pintle nozzle
B. Hole-type pintle nozzle



Injection nozzle **(30)** ..... on tester (052) vigorously pump through 5 times, while keeping valve "a" closed.

Buzzing test ..... **slowly** actuate hand lever "b" approx. 1 stroke per second.

Spray pattern test ..... With rapid short strokes, approx. 2 strokes per second, the spray pattern should be closed and should break off well.

A - Spray pattern frayed "poor"

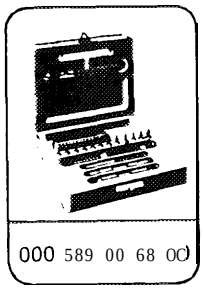
B - Spray pattern closed "good"

Pre-spray ..... check (only with hole-type pintle nozzles).

Shut-off pressure or opening pressure ..... check by opening valve "a" and slowly operating hand lever "b" at least 1 stroke per second.

Set value: 115-125 bar with new nozzles, mtn. 100 bar with used nozzles.

Special tool



Commercially available tools

Tester **EFEP 60** H	**e.g.** Bosch, **O-7000** Stuttgart Order no. 0 **681 200 502**
Cleaning needle 0.18 mm dia.	e.g. Bosch, D-7000 Stuttgart Order no. KDEP 2900/4

⚠ Warning

Use only clean test oil or filtered diesel oil for testing. On no account should the hand be brought in contact with the spray of a nozzle during testing. The spray enters deeply and destroys the tissue. The fuel entering the blood stream may lead to blood poisoning.

Production breakpoint: August 1989

Model	Engine	Engine end no. Manual transmission	Engine end no. Automatic transmission
201.126	602.911')	082780	016395
Identification	1) 2 green color dots 2) 2 violet color dots		

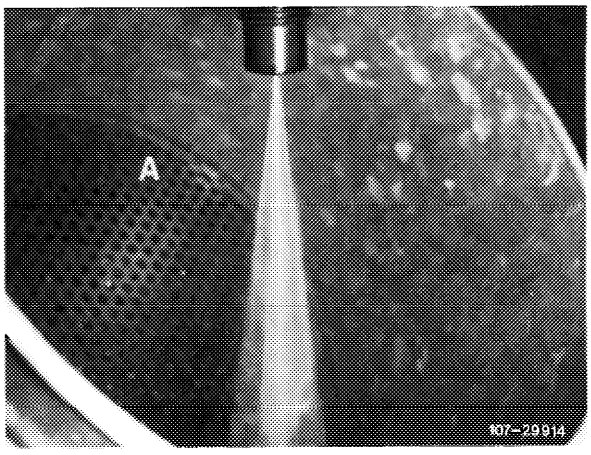
Since August 1989 engine 602 has been equipped with finely ground injection nozzles.

A. Facet-type pintle nozzle

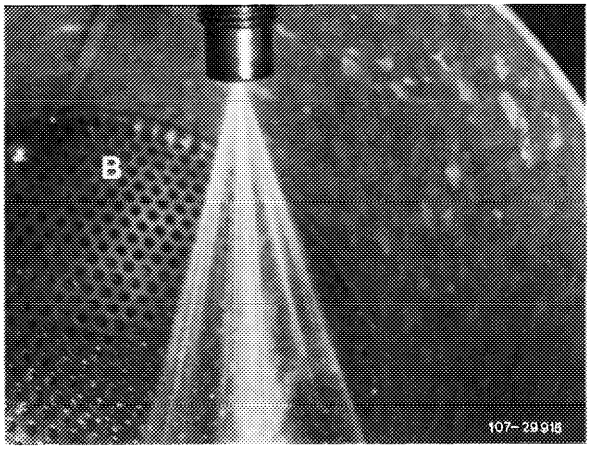
Checking

1 Vigorously pump injection nozzle 5 times with the tester. Then **check buzzing of the nozzle** by slowly actuating the hand lever (approx. 1 stroke per second).

2 **Checking spray:** With short rapid part strokes (at least 2 strokes per second) the spray pattern should be rather closed and break off well.



A Closed spray pattern, well atomized



B Broken spray pattern, too wide and frayed

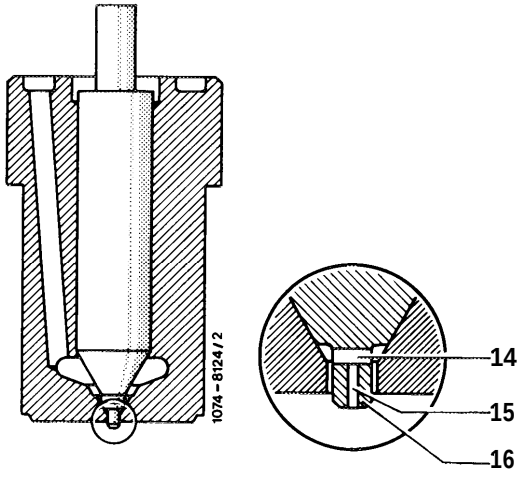
3 **Checking injection pressure:** Set value 115-125 bar with new nozzle, at least 100 bar with used nozzles.

Slowly move down the hand lever (at least 1 stroke per second) and read injection pressure off pressure gauge.

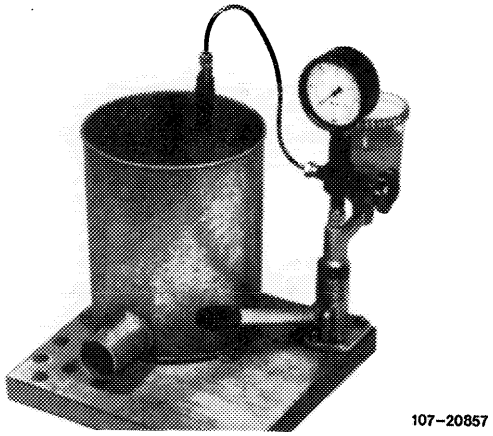
Shut-off valve must be open for this test.

B. Hole-type pintle nozzle

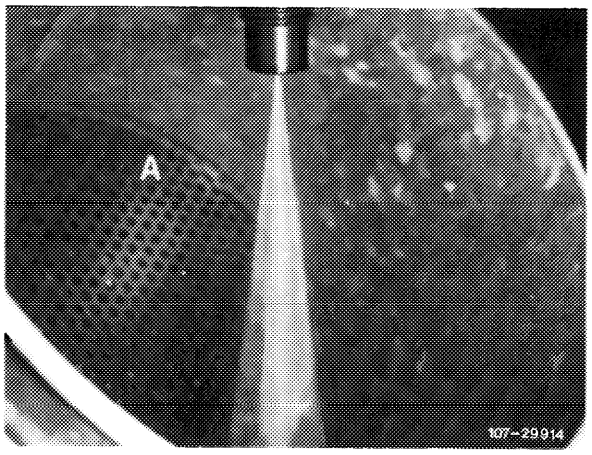
1 Before checking: Ensure that the longitudinal bore (15) is unobstructed by means of a cleaning needle 0.18 mm dia.



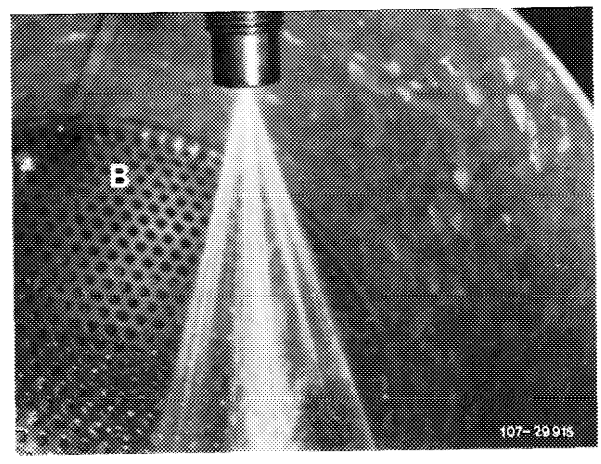
2 Vigorously pump injection nozzles 5 times on tester. After this carry out **buzzing** test by slowly actuating hand lever (at least 1 stroke per second).



3 **Spray test:** With short rapid part strokes (approx. 2 strokes per second) the spray should be rather closed and break off well.



A Closed spray pattern, well atomized

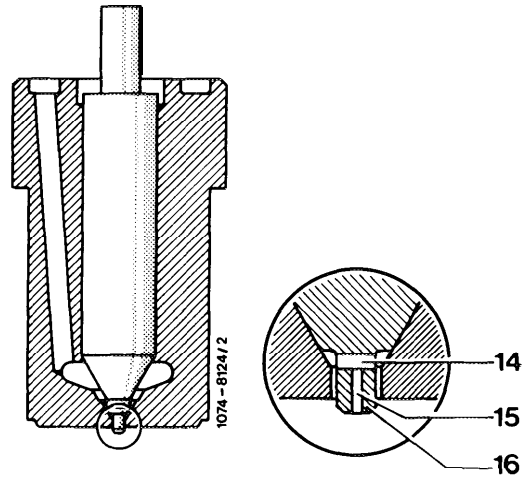


B Broken spray pattern, too wide and frayed

4 Create **pre-spray** by slowly moving the hand lever down (1 stroke 4-6 s).

A vertical string-type spray pattern should emerge from the center bore (15).

Note
On new nozzles the pre-spray is very difficult to create, therefore check longitudinal bore with cleaning needle 0.18 mm dia. for open passage.



5 Checking injection pressure:

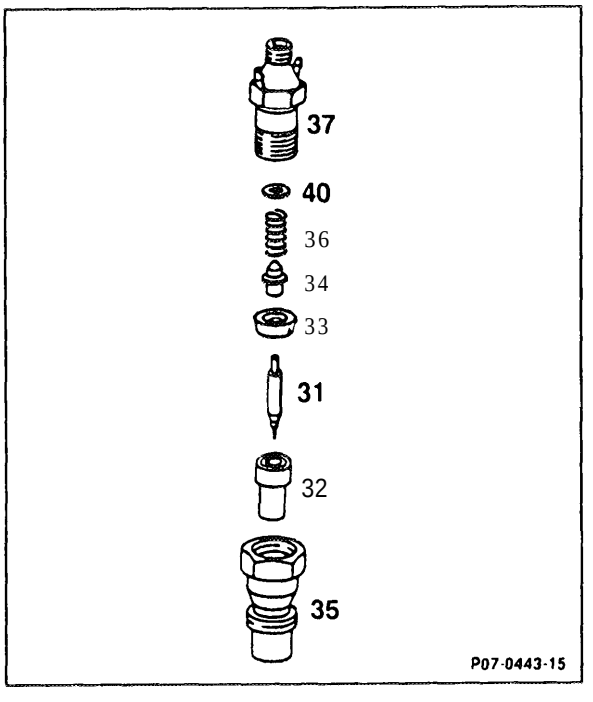
Set value: 115-1 25 bar with new nozzle, at least 100 bar with used nozzle.

Slowly move hand lever down (approx. 1 stroke per second) and read injection pressure off pressure gauge.

Shut-off valve must be open for testing.

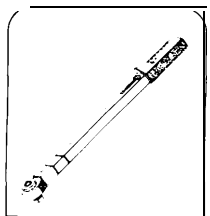
07.1-232 Reconditioning injectors

Injectors removed (07.1-230).

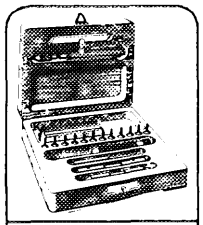


injector needle (31)	Visual and sliding test; on hole-type pintle injectors clean center and longitudinal bores; install in the same injector body.
Injector body (32)	remove combustion residue.
Intermediate plate (33)	polish on surface plate.
Thrust pin (34)	Tip must face to the upper part.
Injector clamping nut (35)	70-80 Nm.
Compression spring (36)	
Retaining body (37)	clamp in protective jaws.
Steel shim (40)	adjust to injection pressure. Set value 115-l 25 bar for new injector or injector to be newly adjusted, at least 100 bar for used injector. Depending on the shim thickness higher or lower injection pressure. 0.05 mm produce a pressure differential of approx. 3 bar.

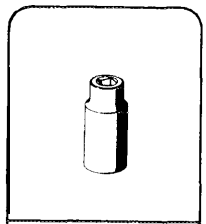
Special tools



001 589 66 21 00
00



000 589 00 68 00



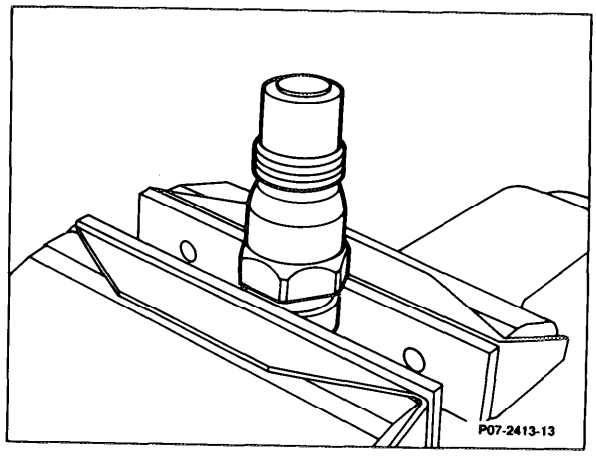
001 589 65 09 00

Commercially available tool

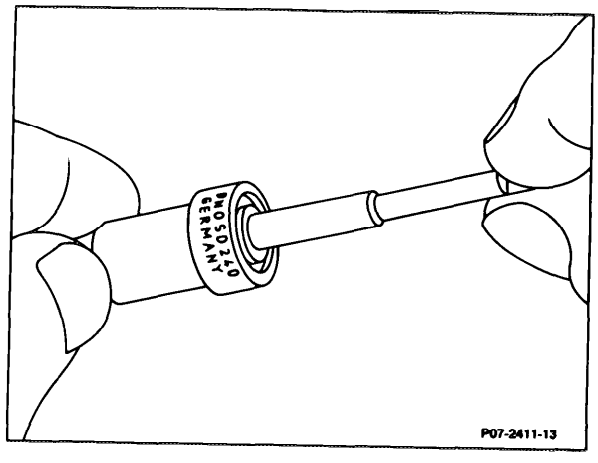
Cleaning needles 0.18 mm dia.	e.g. Bosch, D-7000 Stuttgart Order no. KDEP 2900/4

Reconditioning

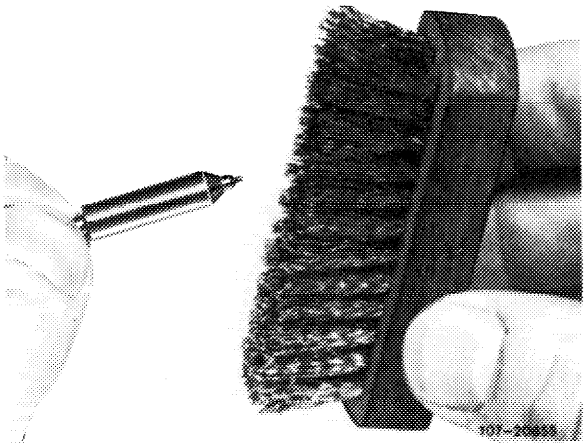
1 Dismantle by placing retaining body with protective jaws in the vise so that the bleed fuel connections are not damaged.



2 Clean, remove combustion residue on injector needle seat with the cleaning miller.

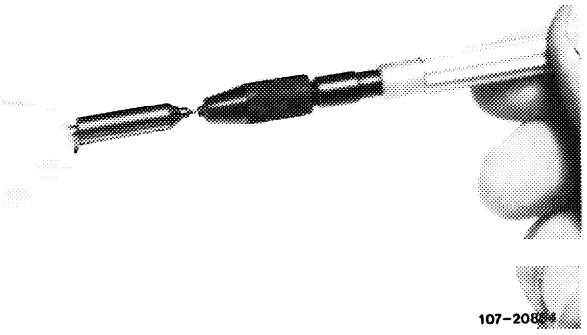


Clean injector needle and injector body with brass brush.



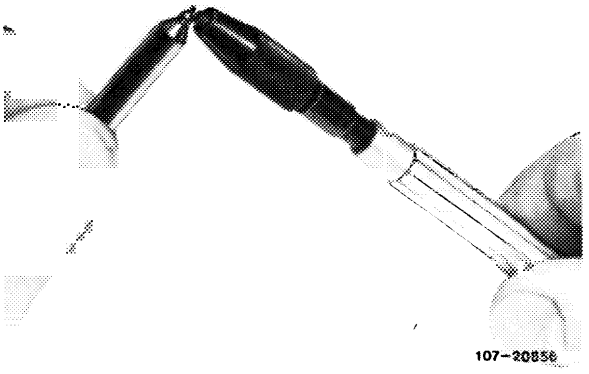
On the hole-type pintle injector additionally clean longitudinal and transverse bores.

Clean longitudinal bore with cleaning needle 0.18 mm dia.



Longitudinal bore

Clean transverse bore with cleaning needle 0.35 mm dia.

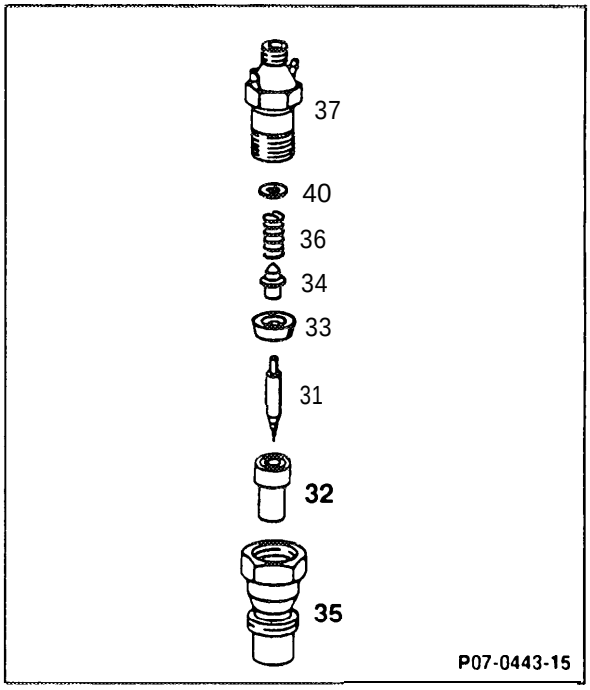


Transverse bore

3 Visual and sliding test.

Immerse injector in filtered diesel fuel. With the injector body held vertically, the injector needle should slide towards the injector seat by its own weight.

4 Polish intermediate plate (33) on both sides on the surface plate.

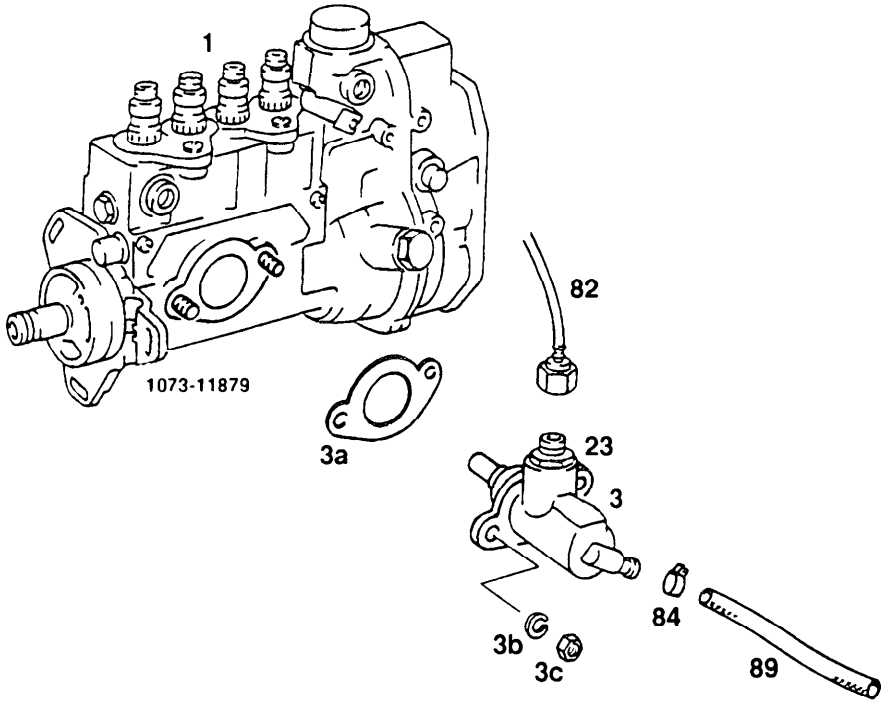


5 Assemble injector holder with injector. Depending on the shim thickness (40) higher or lower injection pressure; 0.05 mm correspond to approx. 3 bar pressure differential.

6 Check function of injector (07.1-231), adjust if required.

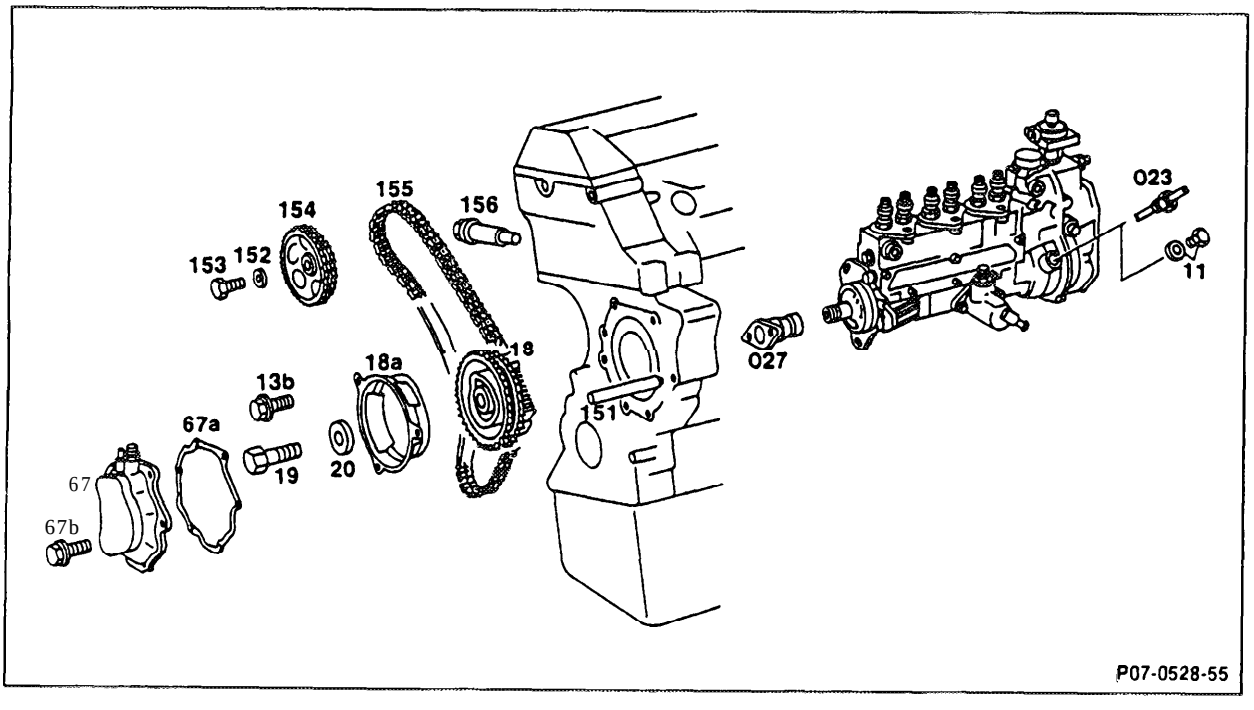
07.1-235 Removal and installation of fuel pump

Air cleaner cover removed (09-400).



Clamp (84)	open, close.
Suction line (89)	pull off, fit.
Supply fuel filter (82)	disconnect, connect.
Nut, 2 off (3c)	remove, reinstall.
Washer, 2 off (3b)	remove, reinstall.
Fuel pump (3)	collect engine oil running out during removal.
Gasket (3a)	replace
Delivery outlet (23)	
Injection pump (1)	

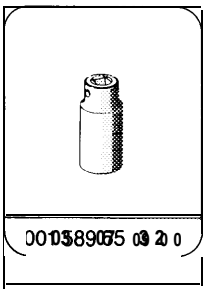
07.1-240 Removal and installation of injection timing device

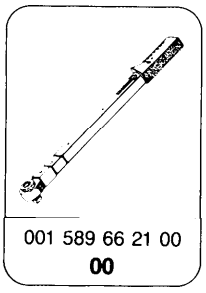


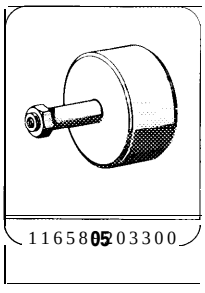
Vacuum pump (67)	remove, reinstall (43-610).
Gasket (67a)	replace. **Caution!** **2** versions, see table.
Combination bolt (67b)	dismount, mount.
Cylinder head cover	remove, install.
Camshaft sprocket (154) and injection timing device (18)	remove, reinstall, with paint mark relative to timing chain (155).
Central mounting bolt (19)	remove, tightening torque 40-50 Nm. **Caution!** Left-hand thread.
Washer (20), bolt - camshaft sprocket (153)	remove, tightening torque 45 Nm.
Washer - camshaft sprocket (152), engine	set to 15° ATDC.
Chain tensioner (156)	remove, reinstall (05-310), tightening torque 80 Nm.

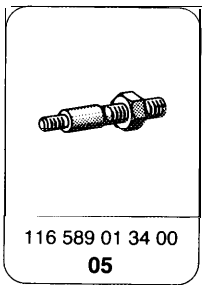
Camshaft sprocket (154)	remove, reinstall.
Locking pin (151)	remove with threaded pin part no. 116 589 01 34 00 and impact puller part no. 116 589 20 33 00.
Assembly cage (18a)	remove, reinstall. **Note:** The assembly cage (18a) and the fixing bolts (13b) are deleted on the engines, see table below.
Timing chain (155)	with sheet metal strip (approx. 0.5 x 70 x 120) force outward and pull out injection timing device (18) with combination pliers.
Screw plug with gasket (11)	remove from injection pump (1).
Injection pump (1)	turn with splined wrench (027) and lock with locking bolt (023). **Caution!** Remove locking bolt.
Engine	manually turn 1 revolution and check TDC mark crankshaft-camshaft.
Start of delivery	check (07.1-I 12), adjust if required (07.1-117).

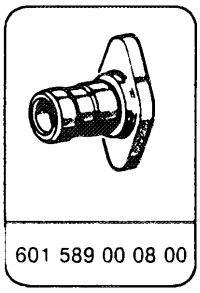
Special tools

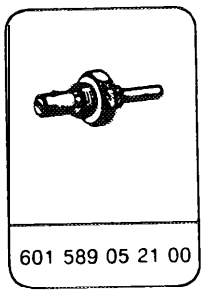












Note
Up to the production breakpoints mentioned it is necessary to install a gasket with oil pocket when replacing the gasket (67a) of the vacuum pump.
As of the production breakpoint a gasket without oil pocket has been installed.

Production breakpoint: May 1986

Engine model designation	Transmission	
602.911	manual	019187
	automatic	004738

Note
The assembly cage (18a) and the fixing bolts (13b) on the timing device drive are deleted on the 602 engine.

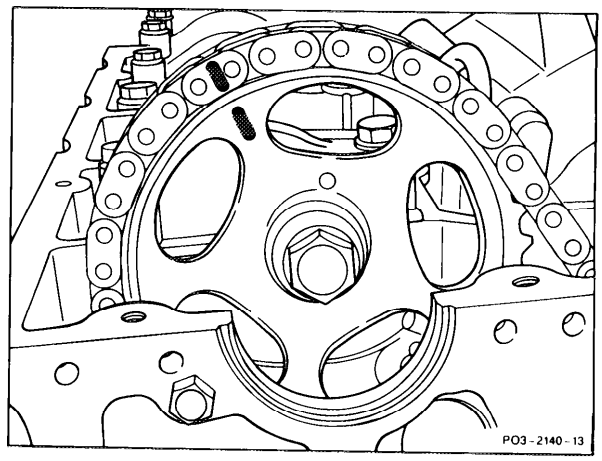
Production breakpoint: September 1989 (assembly cage deleted)

Model	Engine	Engine end no. Manual transmission	Engine end no. Automatic transmission
201.126	602.911	085358	016711

Removal, reinstallation

1 Remove cylinder head cover.

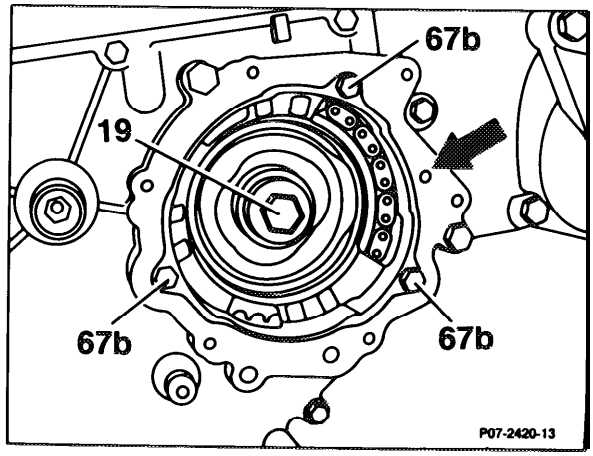
2 Mark camshaft sprocket and injection timing device with paint relative to the timing chain.



Camshaft sprocket

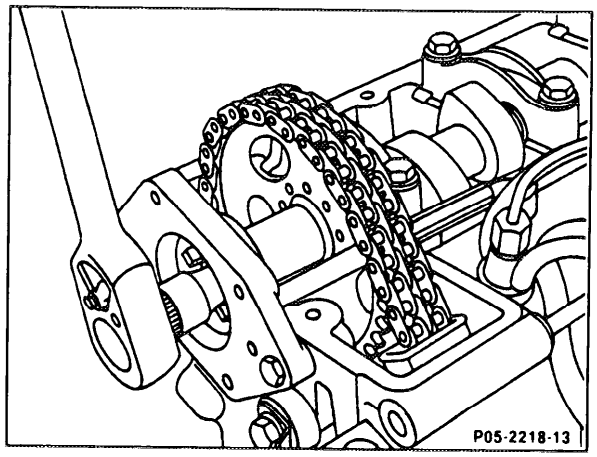
3 Remove center mounting bolt (19) by counterholding the crankshaft.

Caution!
LEFT-HAND THREAD

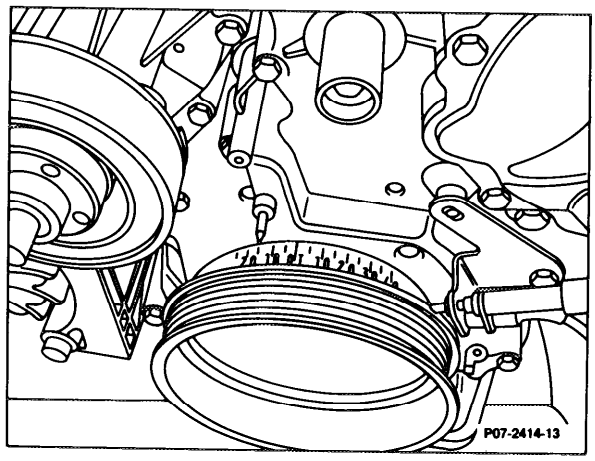


4 Remove camshaft sprocket bolt from camshaft while counterholding the crankshaft.

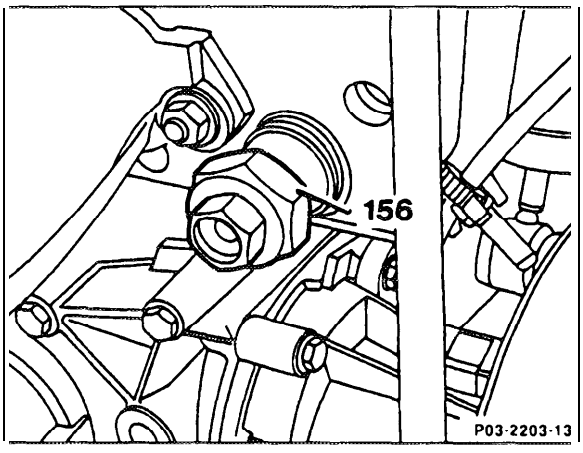
Tightening torque 45 Nm.



5 Turn engine to 15° ATDC of 1 st cylinder.



6 Remove camshaft sprocket and chain tensioner (156) to loosen the timing chain (05-310).

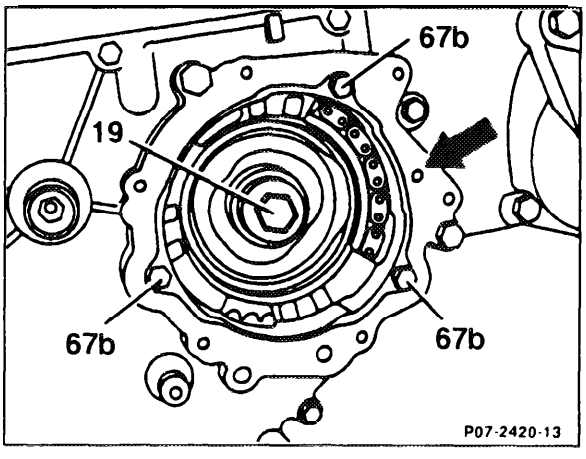


7 Pull out locking pin (arrow) and remove assembly cage.

Note

Assembly cage is deleted on all engines, see table.

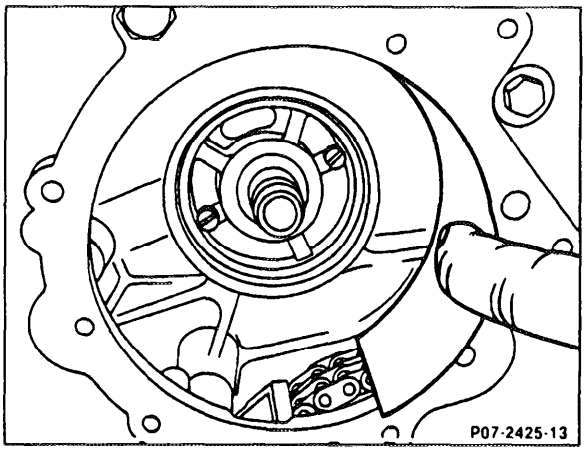
impact puller
Special tool 116 589 20 33 00
Threaded pin M 6
Special tool 116 589 01 34 00



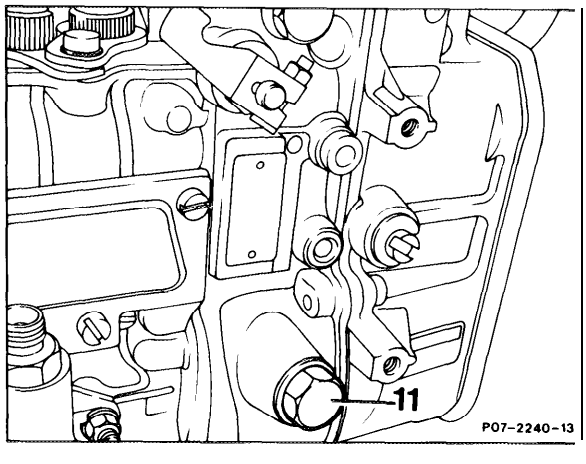
8 Force timing chain with sheet metal strip to the outside and pull out injection timing device with combination pliers.

Self-made sheet metal strip

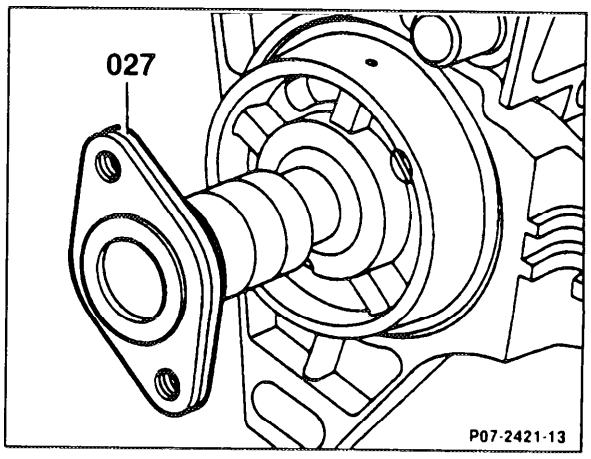
Thickness	approx.	0.5 mm
Length	approx.	140mm
Width	approx.	70 mm



9 Remove screw plug (11).



10 Turn injection pump with splined wrench (027) on the injection pump camshaft until the lug of the governor is visible in the bore. In this position insert locking bolt (023) and engage in the lug, then tighten union nut by hand.



027 Splined wrench
Special tool 601 589 00 08 00

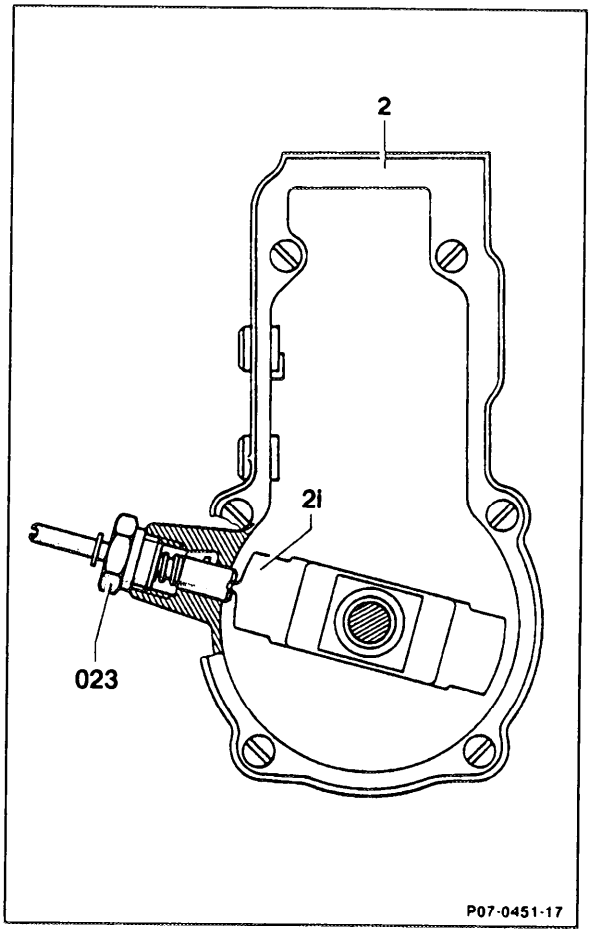
11 Install injection timing device. Secure central mounting bolt **(left-hand thread)** to 40-50 Nm (observe paint mark).

12 Remove locking bolt (023) in order to avoid damage to the injection pump during starting.

13 Reassemble engine.

14 Manually crank engine 1 revolution and recheck TDC mark of crankshaft and camshaft.

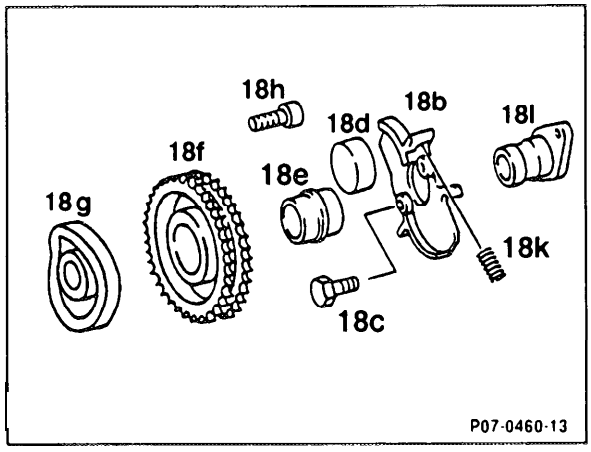
15 Check start of delivery with digital tester (07.1-l 12) and correct if required (07.1-l 17).



023 Locking bolt
Special tool 601 589 05 21 00

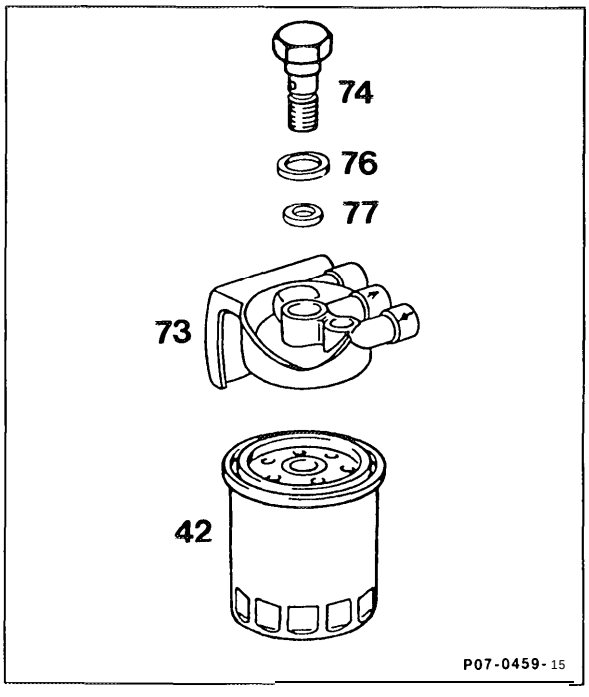
07.1-241 Reconditioning injection timing device

Injection timing device removed (07.1-240).



Bolt (18h)	2 off M 6 x 16, remove, reinstall, 15 Nm.
Drive hub (181)	remove, reinstall.
Bolt (18c)	2 off M 8 x 16, remove, reinstall, 25 Nm.
Cam (18g)	check wear.
Sprocket (18f)	check wear.
Bushing (18e)	remove, reinstall, check wear.
Segment flange (18b)	check wear.
Compression springs (18k)	2 off remove, reinstall.
Governor weights (18d)	2 off M 8 x 16 remove, reinstall, check wear.

07.1-245 Replacing fuel filter



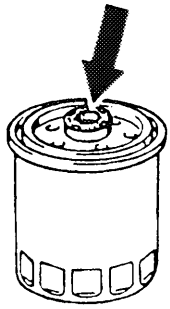
Bolt (74)	remove, reinstall.
O-ring (76)	remove, reinstall, replace.
O-ring (77)	remove, reinstall, replace.
Filter (42)	remove from the bottom, replace.

Fuel filter upper part (73)

Note
The fuel system is self-bleeding during starting. This is due to the increased delivery rate of the fuel pump and the restrictors in the filter upper part and the injection pump.

Run engine and check for leaks.

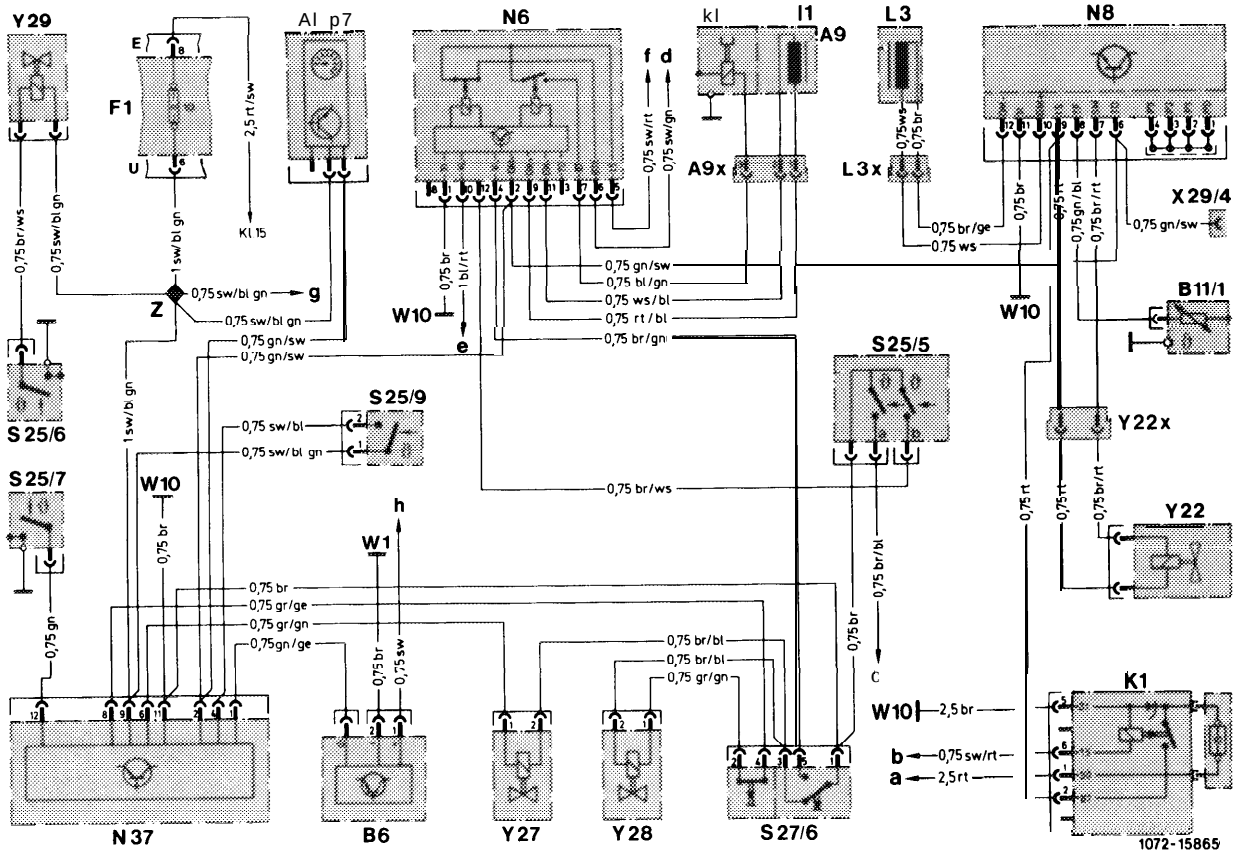
Function diagram see 07.1-010 section "O".



1074-12138

Fuel filter with additional sealing ring (arrow)

07.1400 Electrical wiring diagrams

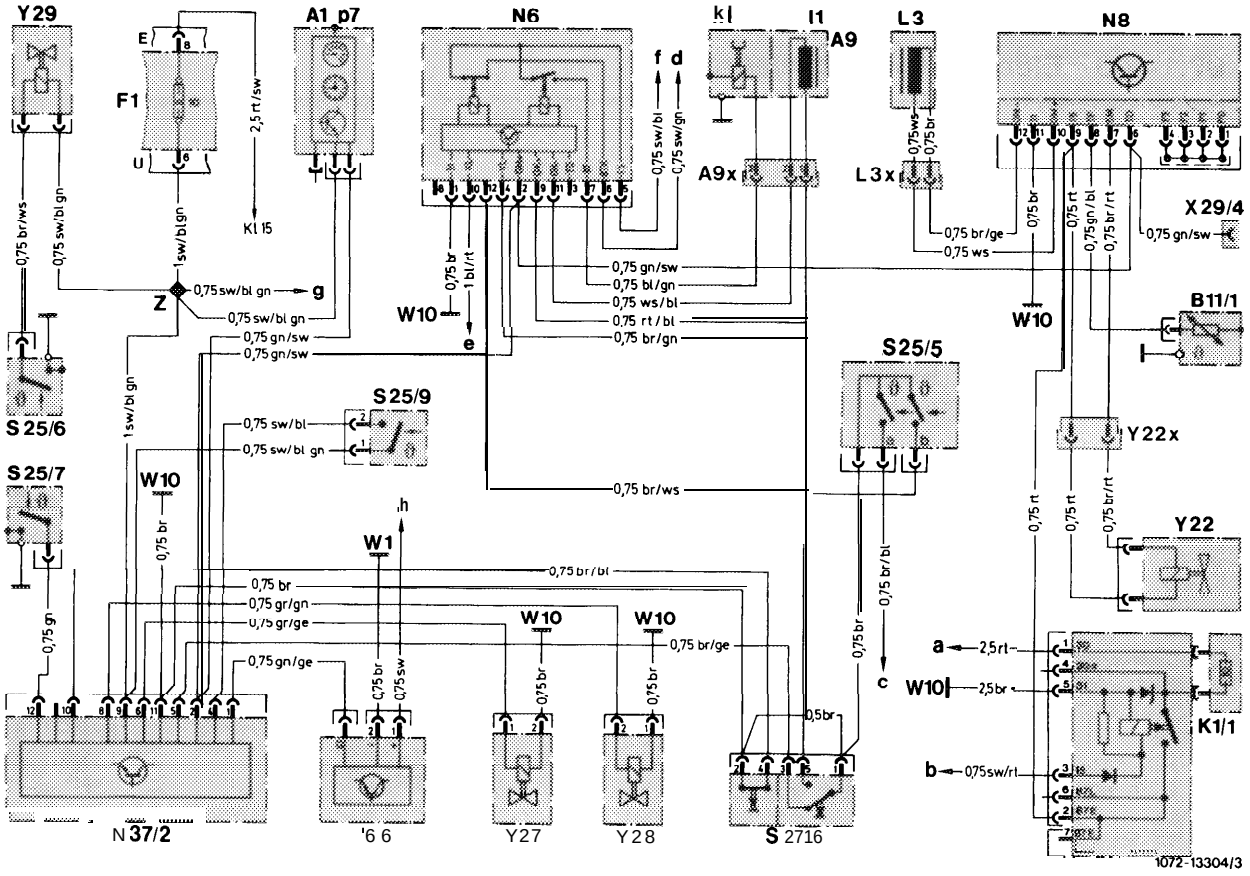


Engine 602 in model 201
model year 1986
Electrical wiring diagram exhaust gas recirculation

Al p7	Electronic clock/tachometer
A9	A/C compressor
A9 kl	Electromagnetrc coupling
A9 I1	Speed sensor
A9x	Connector A/C compressor
B6	Hall-effect speed sensor
B11/1	Coolant temperature sensor (ELR)
F1	Fuse/relay box
E	Coupling
U	Coupling
K1	Overvoltage protectton relay
L3	Speed sensor starter ring gear
L3x	Connector speed sensor starter ring gear
N6	Control unit compressor cutout
N8	Control unit ELR
N37	EGR control unit
S25/5	Temperature switch105/115 °C
S25/6	50 °C Temperature switch
S25/7	25 °C Temperature switch (EGR)
S25/9	97 °C Temperature switch (EGR)
S27/6	Microswitch compressor cut-out (EGR
x29/4	Test coupling TD
Y22	Electromagnetrc actuator (ELR)
Y22x	Connector (ELR electromagnetic actuator)
Y27	Switchover valve exhaust gas recirculation
Y28	Switchover valve vacuum control flap
Y29	Swrtchover valve vacuum transducer (automatic transmission)
Z	Soldered connector sleeve
a	Terminal block engine terminal 30/terminal 61 (battery)
b	Central electrics, coupling U jack 5
c	Relay fan, terminal 85, jack 5
d	Connector 1-pole tail lamp cable harness
e	Pressure switch(S31) AC compressor
f	Relay fan, terminal 86, jack 4
g	Washing nozzle heater left
h	Terminal block interior (X5/1)

Note

Unidentified grounding points are connected to engine ground or battery ground.

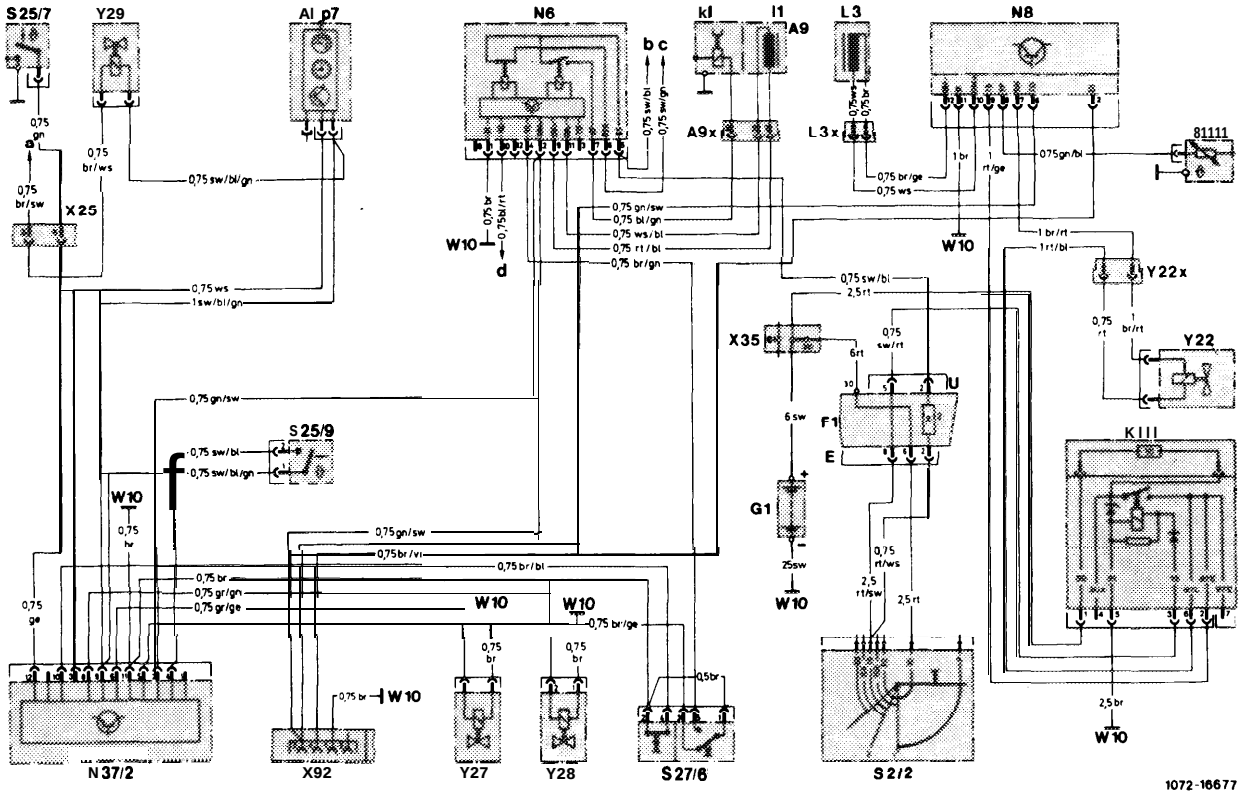


Engine 602 in model 201
model years 1987 and 1988
Electrical wiring diagram exhaust gas recirculation

AI p7	Electronic clock/tachometer
A9	A/C compressor
A9 kl	Electromagnetic coupling
A9 I1	Speed sensor
A9x	Connector A/C compressor
B6	Hall-effect speed sensor
B11/1	Coolant temperature sensor (ELR)
F1	Fuse/relay box
E	Coupling
U	Coupling
K1/1	Overvoltage protection relay
L3	Speed sensor starter ring gear
L3x	Connector speed sensor starter ring gear
N6	Control unit A/C compressor cut-out
N8	Control unit ELR
N37/2	Control unit exhaust gas recirculation
S25/5	Temperature switch 105/115 °C
S25/6	Temperature switch 50 °C
S25/7	Temperature switch 25 °C (EGR)
S25/9	Temperature switch 97 °C (EGR)
S27/6	Microswitch compressor cut-out (EGR)
x29/4	Test coupling TD
Y22	Electromagnetic actuator ELR
Y22x	Connector (ELR electromagnetic actuator)
Y27	Switchover valve exhaust gas recirculation
Y28	Switchover valve vacuum control flap
Y29	Switchover valve vacuum transducer (automatic transmission)
Z	Soldered connector sleeve
a	Terminal block engine terminal 30/terminal 61 (battery)
b	Central electrics, coupling U jack 5
c	Relay fan, terminal 85, jack 5
d	Connector 1 -pole tad lamp cable harness
e	Pressure switch (S31) A/C compressor
f	Relay fan, terminal 86, lack 4
g	Washing nozzle heater left
h	Terminal block interior (X5/1)

Note

Unidentified grounding points are connected to engine ground or battery ground.

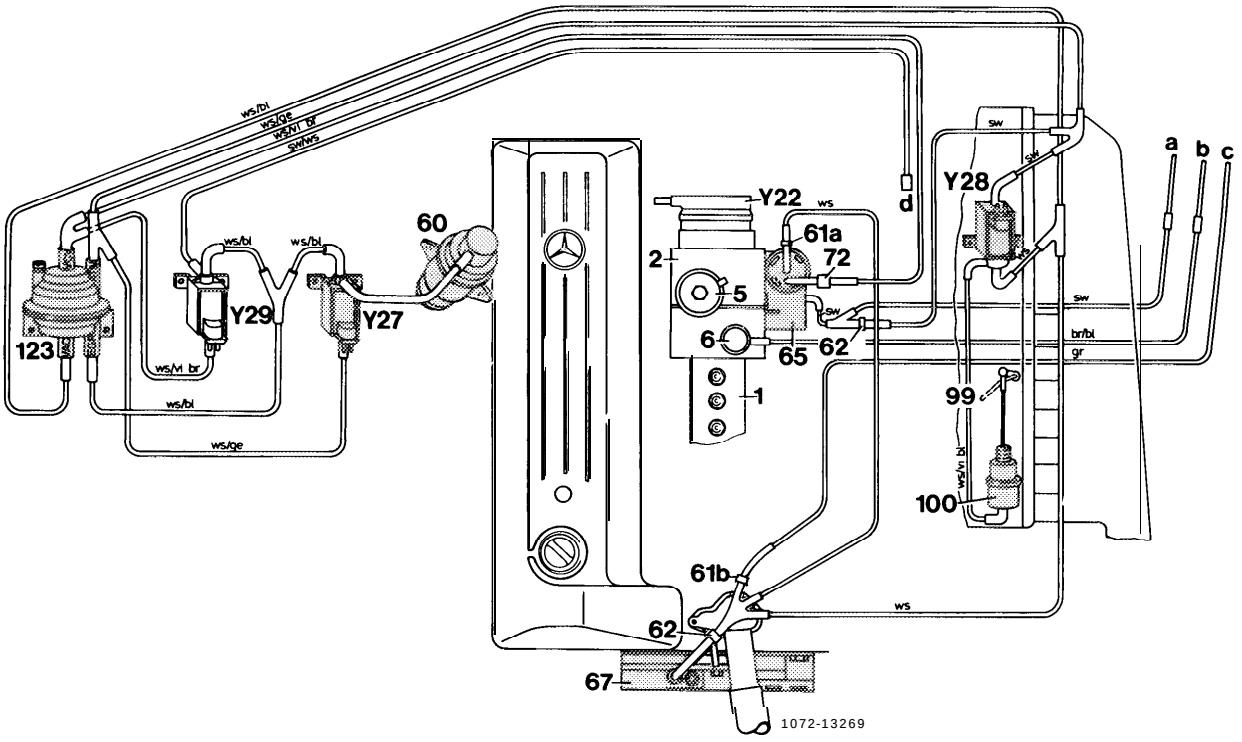


Engine 602 in model 201
model year 1989
Electrical wiring diagram exhaust gas recirculation

A9	A/C compressor
A9 kl	Electromagnetic coupling
A9 l1	Speed sensor
A9x	Connector A/C compressor
B1 l/l	Coolant temperature sensor (ELR)
F1	Fuse/relay box
G1	Battery
K1/1	Overvoltage protection relay 87E (7-pole)
L3	Speed sensor starter ring gear
L3x	Connector speed sensor starter ring gear
N6	Control unit A/C compressor cut-out
N8	Control unit ELR
N37/2	Control unit exhaust gas recirculation
S2/2	Glow starter switch
S25/7	Temperature switch 25 °C (EGR)
S25/9	Temperature switch 97 °C (EGR)
S27/6	Microswitch compressor cut-out (EGR)
W10	Ground, battery
X25	Connector, preglow winng harness
x35	Terminal block, battery terminal 30/61
X92	Diagnostic test coupling
Y22	Electromagnetic actuator ELR
Y22x	Connector (ELR electromagnetic actuator)
Y27	Switchover valve exhaust gas recirculation
Y28	Switchover valve vacuum control flap
Y29	Swltchover valve vacuum transducer
a	To temperature switch S25/6
b	To washer nozzle heating left R2/2
c	To connector engine cable harness X26/5
d	To pressure switch A/C compressor S31/1

Note

Unidentified grounding points are connected to engine ground or battery ground.

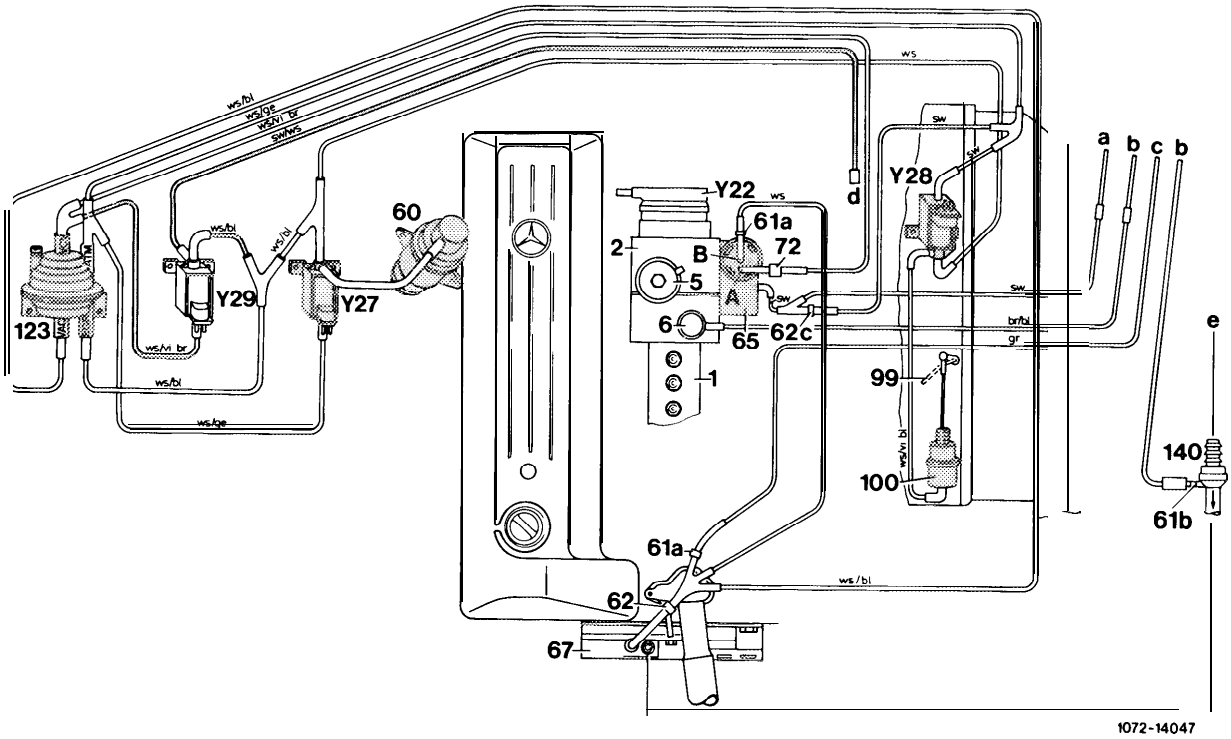


Engine 602 in model 201

Model year 1986

Vacuum circuit diagram exhaust gas recirculation

	Injection pump
2	Governor
5	ADA unit
6	Vacuum unit (stop)
60	EGR valve
61a	Choke blue
61b	Choke orange
62	Filter
62c	Ventilation filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
99	Vacuum control flap
100	Vacuum unit/vacuum control flap
123	Transducer
Y22	Electromagnetic actuator ELR
Y27	Switchover valve EGR
Y28	Swftchover valve vacuum control flap
Y29	Switchover valve (automatic transmission)
a	Ventilation to vehicle interior
b	Key cut-out
c	Remaining users
d	Vacuum unit automatic transmission



Engine 602 in model 201

Model years 1987 and 1988

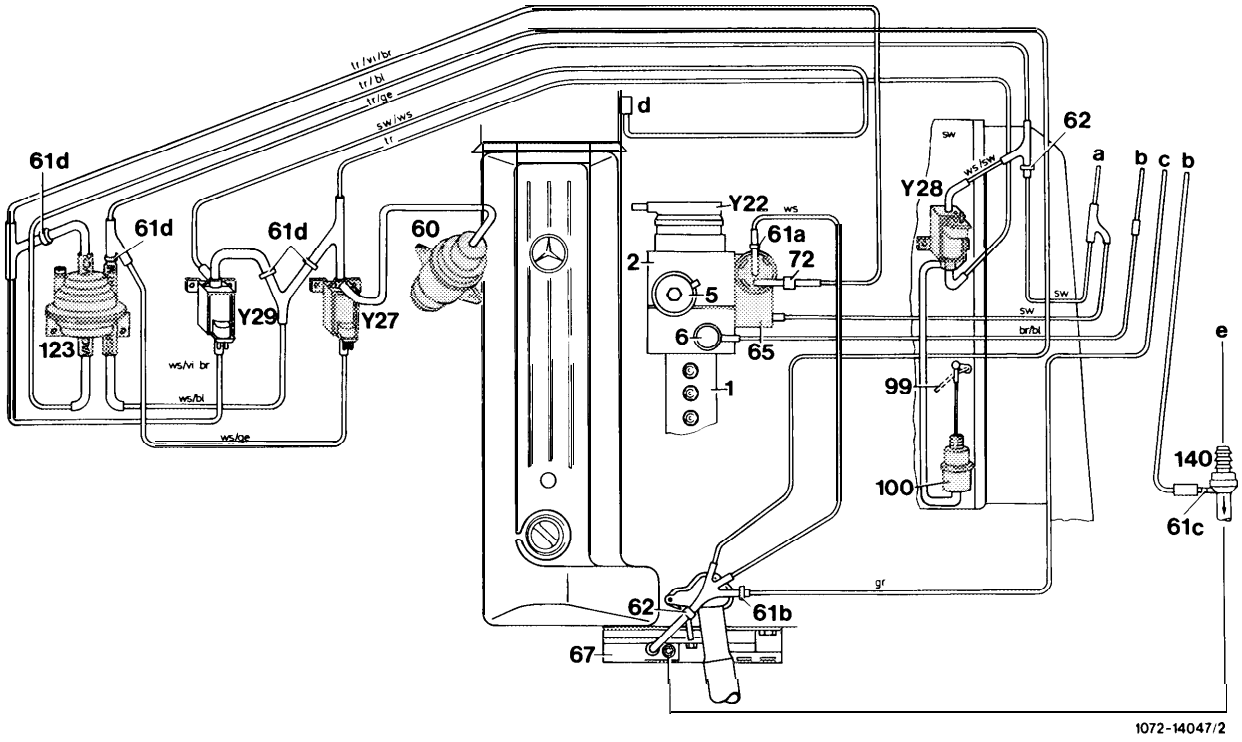
Vacuum circuit diagram exhaust gas recirculation

	Injection pump
2	Governor
5	ADA unit
6	Vacuum unit (stop)
60	EGR valve
61a	Choke blue
61b	Choke orange
62	Filter
62c	Ventilation filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
99	Vacuum control flap
100	Vacuum unit/vacuum control flap
123	Vacuum transducer
140	Check valve brake booster
A	Control line
B	Suction line

Y22	Electromagnetic actuator
Y27	Swrtchover valve EGR
Y28	Switchover valve vacuum control flap
Y29	Swrtchover valve (automatic transmission)
a	Ventilation to vehicle interior
b	Key cut-out
c	Remaining users
d	Vacuum unit automatic transmission
e	Brake booster

Vacuum connections on vacuum transducer

VAC	Vacuum from vacuum pump
v c v	To vacuum control valve
ATM	Ventilation to vehicle interior
EGR	Exhaust gas recirculation to exhaust gas recirculation valve



Engine 602 in model 201

Model year 1989

Vacuum circuit diagram exhaust gas recirculation

	Injection pump
2	Governor
4	PLA unit
5	ADA unit
6	Vacuum unit (stop)
60	EGR valve
61a	Choke blue
61b	Choke orange
61c	Choke 0.5 mm orifice diameter
61d	Connector
62	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
99	Vacuum control flap
100	Vacuum unit/vacuum control flap
123	Transducer
140	Check valve brake booster
Y22	Electromagnetic actuator ELR
Y27	Swrtchover valve EGR
Y28	Switchover valve vacuum control flap
Y29	Switchover valve (automatic transmission)
a	Ventilation to vehicle interior
b	Key cut-out
c	Remaining users
d	Vacuum unit automatic transmission
e	Brake booster
	Vacuum connections on vacuum transducer
VAC	Vacuum from vacuum pump
v c v	To vacuum control valve
ATM	Ventilation to vehicle interior
EGR	Exhaust gas recirculation to exhaust gas recirculation valve

Job No.

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Survey - injectors - Turbodiesel	07.1 – 002
Explanation of injection pump type plate - Turbodiesel	07.1 – 003
Function - injection system - Turbodiesel	07.1 – 010
Testing, adjusting idle speed - Turbodiesel	07.1 – 100
Testing electronic idle speed control with test connector (X92 and Xl 1/4) - Turbodiesel	07.1 – 105
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Testing startof delivery - digital tester (RIV method) - Turbodiesel	07.1 – 112
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07.1-001 Survey - injection pumps - Turbodiesel

Survey of injection pumps

Engine	Injection pump Bosch designation	Part No.	Bosch combination No.	Test data MB sheet	Issue
602.96	PES 5 M 55 C 320 RS 158	602 070 13 01	0 400 075 980	2.5 g	01.04.87
603.96	PES 6 M 55 C 320 RS 157	603 070 10 01	0 400 076 992	3.0 w	02.04.87
602.962 [1])	PES 5 M 55 C 320 RS 177	602 070 45 01	0 400 075 944		
603.970 [1])	PES 6 M 55 C 320 RS 178	603 070 32 01	0 400 076 968		

[1]) from 09/89.

Delivery pump Bosch designation
FP/KG 24 M 150 is identical on all engines.

Note

It is only possible to properly inspect and set an injection pump on an injection pump test stand. Test data on microfilm for the various injection pumps are available for repair shops which possess such a test stand.

07.1-002 Survey - injectors - Turbodiesel

Injection nozzles/Nozzle holder

Engine		602.96	603.96197 [3])
Injection nozzle	Bosch designation	DN 0 SD 265	DN 0 SD 265
	MB Part No.	001 017 49 12	001 017 49 12
Nozzle holder	Bosch designation	KCA 27 S 55[2])	KCA 30 S 44 KCA 27 S 55 [2])
	MB Part No.	002 017 40 21[2])	002 01728 21 002 01740 21 [2])
Ejection pressure or opening pressure in bar [1])	when injection nozzles are new	135-145	135-145
	when injection nozzles are used, at least	120	120

[1]) The difference in ejection pressure of the injection nozzles within an engine must not be greater than 5 bar gauge pressure.
[2]) With oblique injection.
[3]) Engine 603.97 only oblique injection.

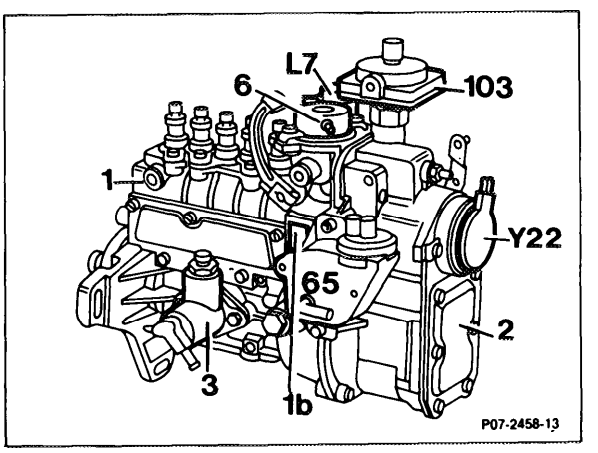
07.1-003 Explanation of injection pump type plate - Turbodiesel

e.g.	**PES 5 M 55 C 320 RS 158/1**
P	Pump
E	Self-driven
S	Face flange mounting
5	Number of cylinders
M	Pump size
55	Element diameter in 1/10 mm
C	Modification code letter
320	Installation index
R	Direction of rotation
S158/1	Special version

RSF	
R	Governor
S	Helical spring
F	Drive control

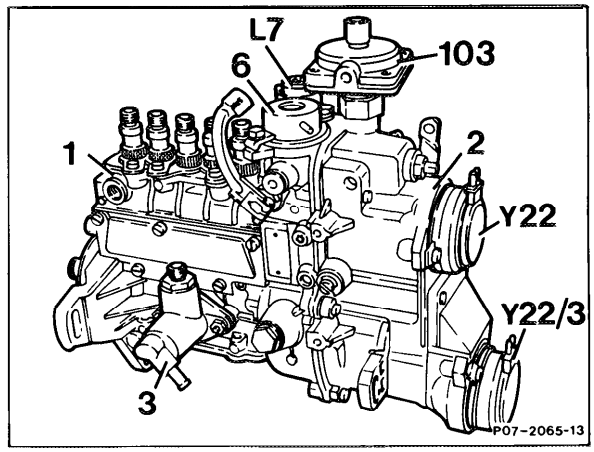
Location of components with ELR

1	Injection pump
1b	Type plate
2	Governor
3	Fuel pump
6	Stop unit
65	Vacuum control valve
103	ALDA unit
Y22	ELR actuator
L7	Control rod travel sensor (connector not operational with cap closed)



Location of components with ELR

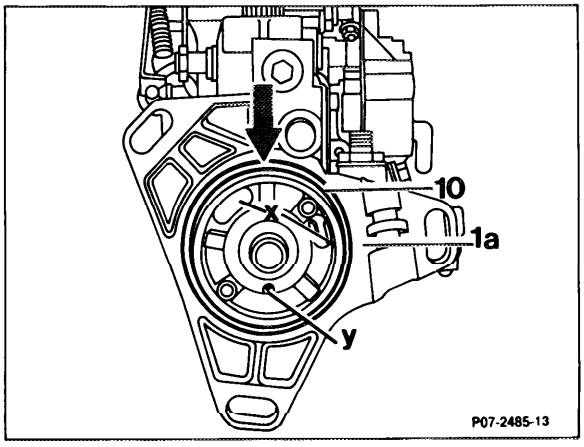
1 Injection pump
2 Governor
3 Fuel pump
6 Stop unit
103 ALDA unit
Y22 ELR actuator



A. Lubrication of injection pump

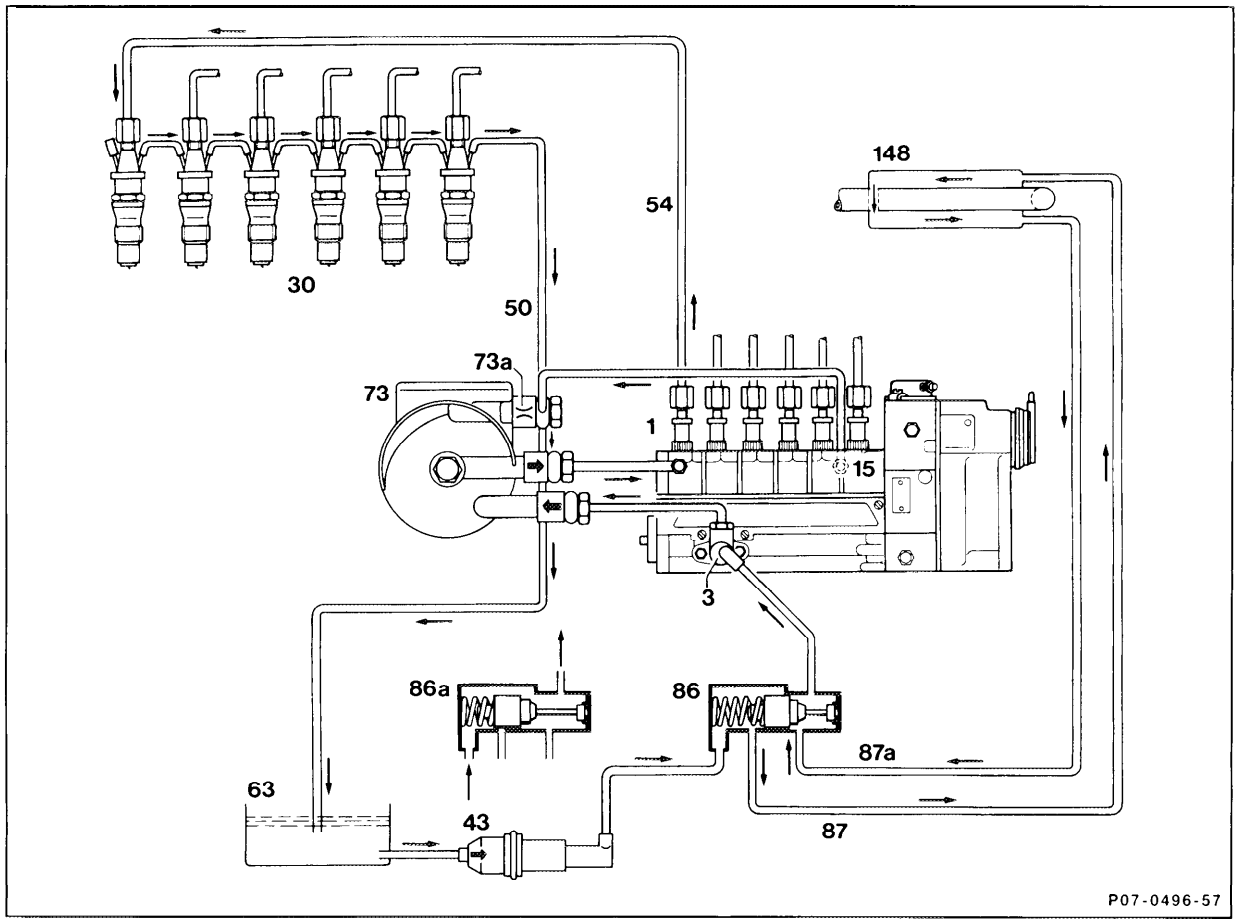
The injection pump is connected through an oil passage (arrow) to the engine oil circuit. The oil flows back into the crankcase through the annular gap (x) between bearing and housing.

The O-ring (10) on the flange (1 a) acts as a seal. The drilling (y) serves to relieve oil from the radial seal.



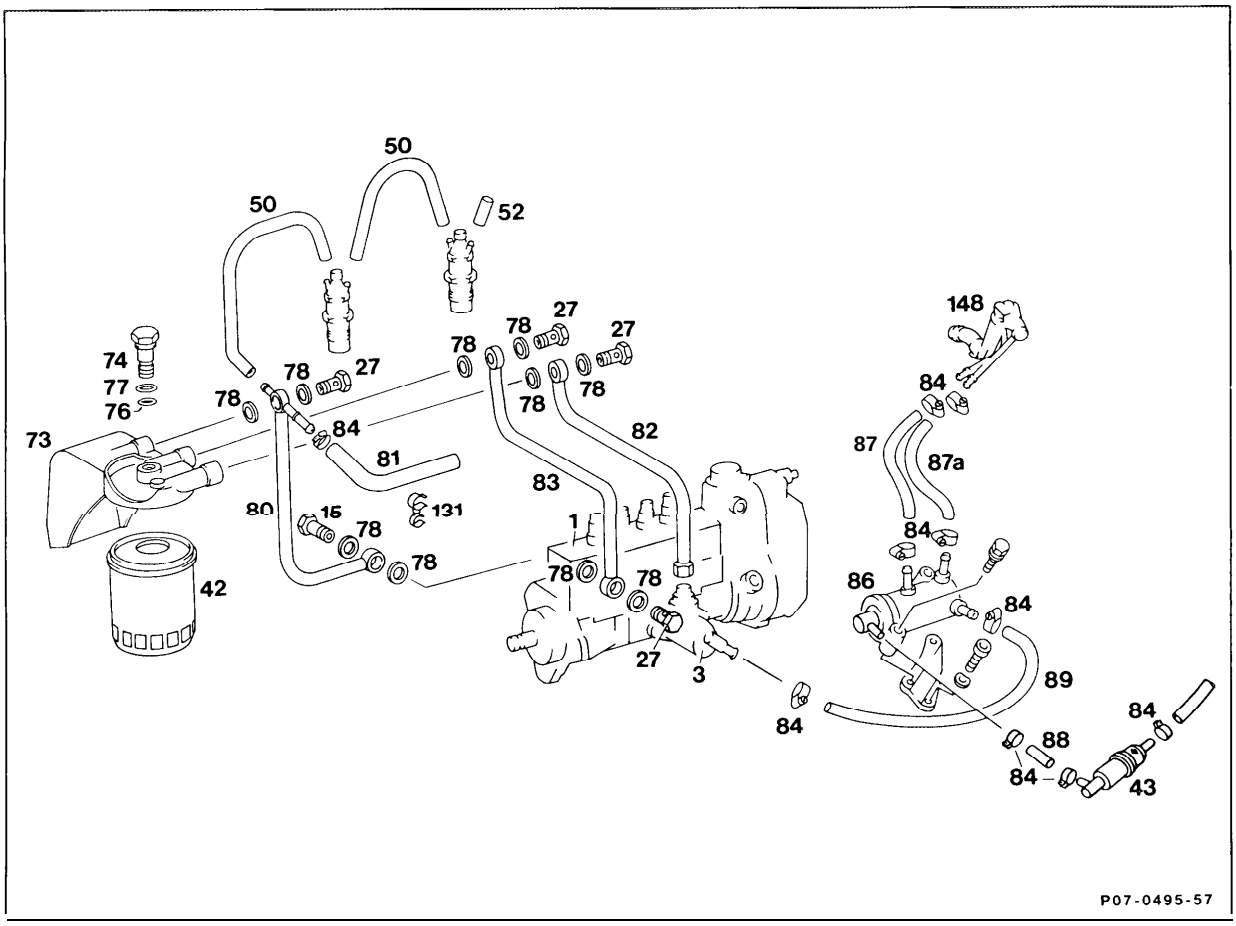
B. Fuel circuit

a) Fuel circuit diagram



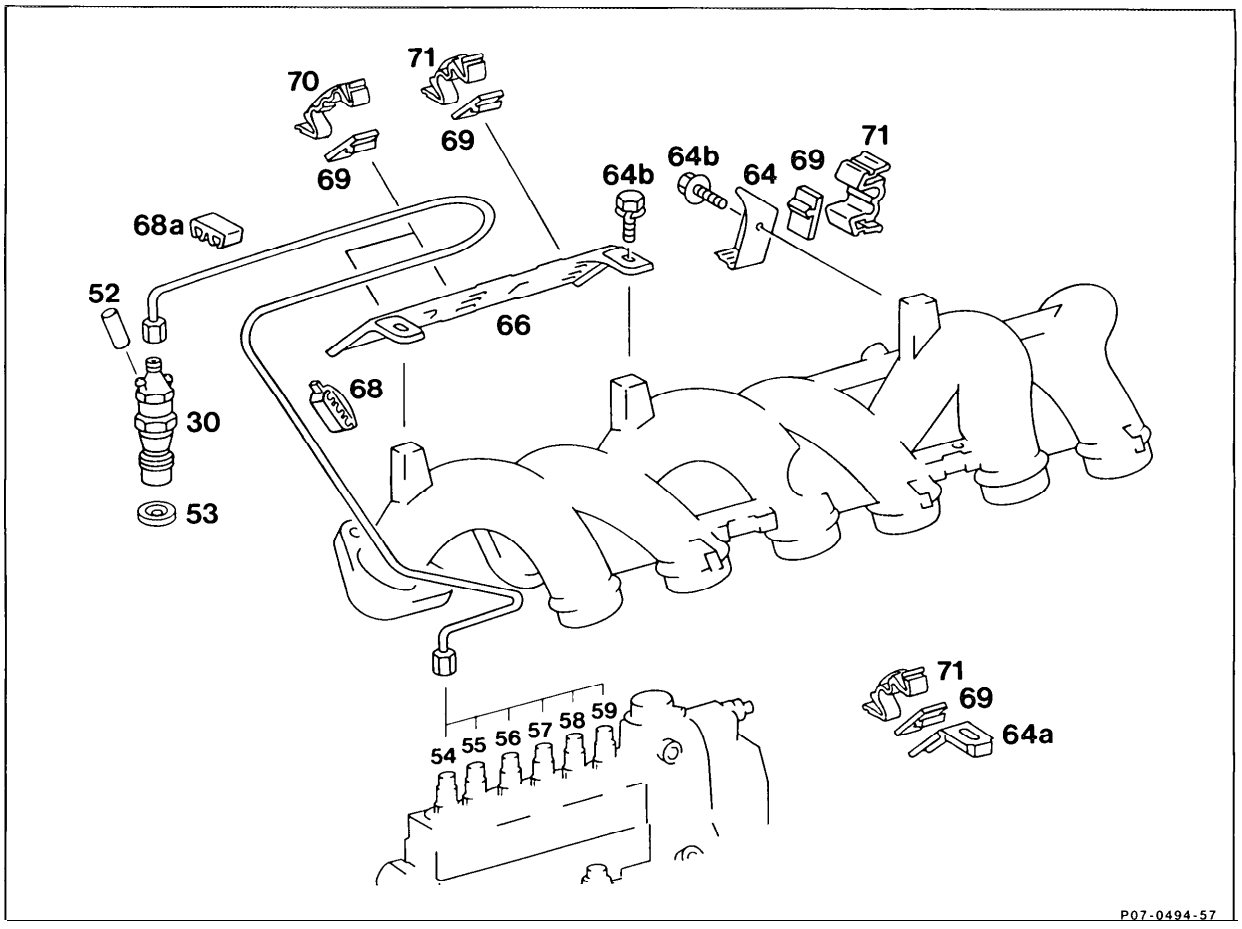
	Injection pump	73a	Restriction orifice in fuel filter top section Ø 0,8 mm
3	Fuel pump	86	Fuel thermostat open, position up to + 8 °C, fuel is preheated
15	Bypass valve with restriction Ø 1,5 mm	86a	Fuel thermostat closed, position from + 25 °C, fuel is no longer preheated
30	Injection nozzles	87	Inlet line - cold fuel
43	Fuel prefilter	87a	Return line - preheated fuel
50	Fuel leak-off hose	148	Heater inlet pipe with fuel heat exchanger
54	Injection line, No. 1 cylinder		
63	Fuel tank		
73	Fuel filter top section		

b) Low-pressure side



	Injection pump
3	Fuel pump
15	Bypass valve with restriction Ø 1,5 mm
27	Hollow screw
42	Fuel filter
43	Fuel prefilter
50	Fuel leak-off hose
52	Plug
73	Fuel filter top section
74	Fuel filter hollow screw
76	0-nng
77	Fuel filter seal
70	Seal
80	Return line
81	Fuel hose return line
82	Fuel filter inlet line
83	Injection pump inlet line
84	Hose clip
86	Fuel thermostat
87	Fuel heat exchanger inlet line
87a	Fuel heat exchanger return line
88	Fuel thermostat inlet line
89	Fuel pump suction line
131	Plastic holder
148	Heater inlet pipe with fuel heat exchanger

c) High-pressure side



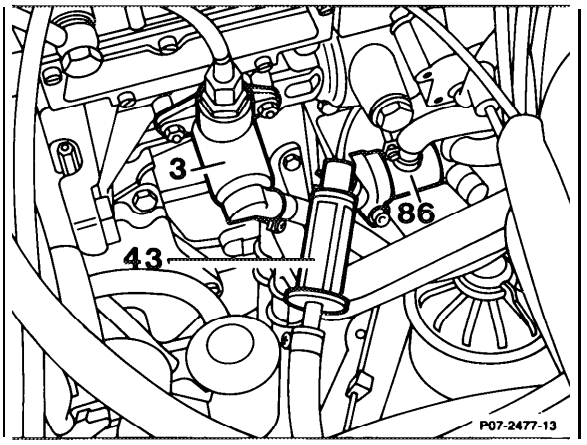
30	Injection nozzle - complete	64	Bracket, cylinder 4, nozzle end
52	Plug	64a	Bracket, cylinder 4, injection pump end
53	Nozzle shim	64b	Bolt
54	Injection line 1	66	Line mounting bracket
55	Injection line 2	68	Plastic clips for 3 lines
56	Injection line 3	68a	Plastic clips for 2 lines
57	Injection line 4	69	Rubber base
58	Injection line 5	70	Plastic holder for 3 lines
59	Injection line 6	71	Plastic holder for 2 lines

Note

Injection lines for cylinders 2-6 are not illustrated.
Bracket for injection lines of cylinders 5-6 as bracket of cylinder 4.

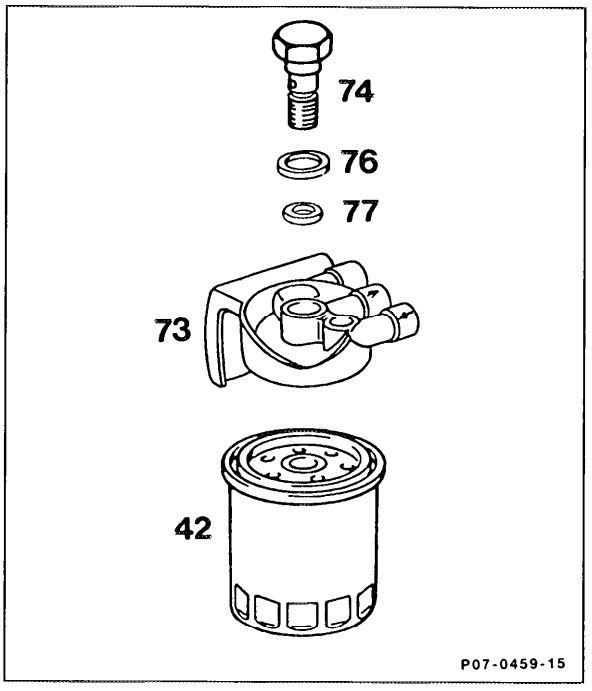
C. Fuel prefilter (43)

Installed in the suction line upstream of the fuel pump (3). The filter housing is of transparent plastic.
The mesh size is 600 µm (0.6 mm).



D. Fuel filter (42)

The fuel filter is installed in the pressure line between fuel pump and injection pump.
The paper filter element is integrated in a metal housing. The element has a mean pore width of 6-10 µm (0.006-0.01 mm).

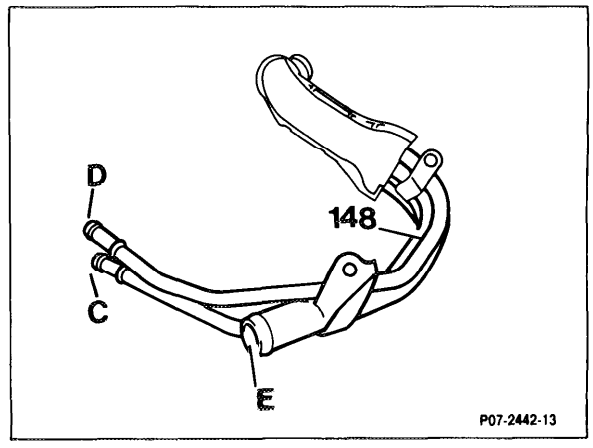


42	Filter
73	Fuel filter top section
74	Bolt
76	O-ring
77	Sealing ring (alu)

Note
When the engine is started, the fuel system is bled automatically due to increased delivery of the fuel pump and the restrictions in the top section of the filter as well as at the injection pump.

E. Fuel preheater (148)

A heat exchanger (148) is installed in the inlet line of the heater in order to preheat the fuel.



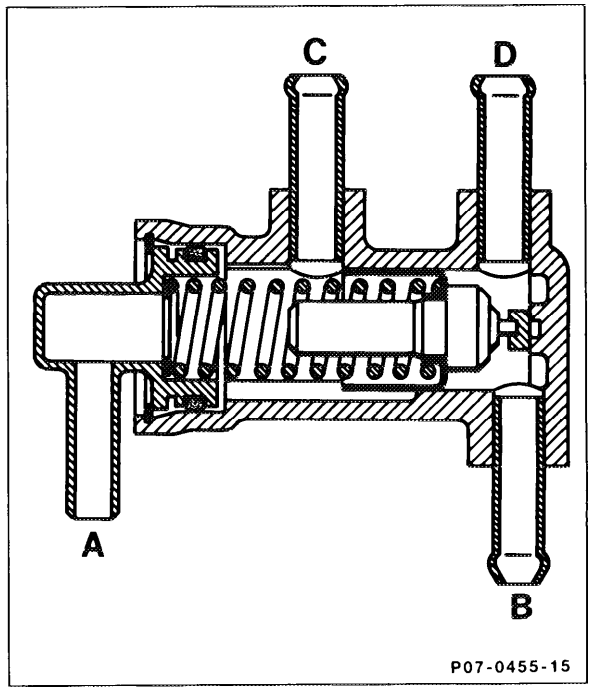
Heat exchanger
C Inlet line
D Return line
E Heater inlet
148 Heat exchanger

Function

Full preheating up to + 8 °C fuel temperature; the required fuel is drawn in through the heat exchanger by the fuel pump.

From + 8 °C to + 25 °C mixed operation; the required fuel flows partially through the heat exchanger.

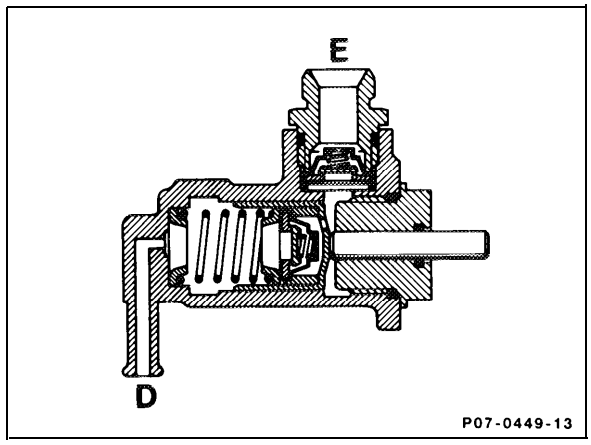
Above + 25 °C the heat exchanger is bypassed by the thermostat; the fuel is drawn in directly by the fuel pump. Fuel preheating ensures trouble-free operation with winter-grade diesel fuel as a rule down to approx. - 25 °C ambient temperature.



Fuel thermostat
A Inlet line from fuel tank
B Suction line to fuel pump
C Inlet to heat exchanger
D Return line from heat exchanger

F. Fuel pump (3)

As a result of the high delivery of the fuel pump, the fuel system is self bleeding, which eliminates the need for a hand priming pump. Delivery > 150 cm^3/30 s, at a starting speed >150/min, measured in the fuel return line.

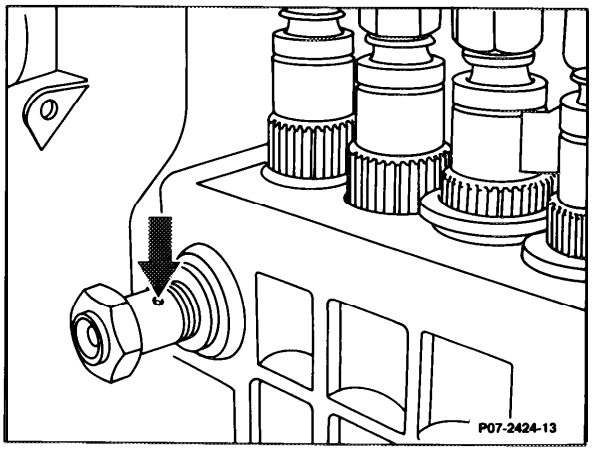


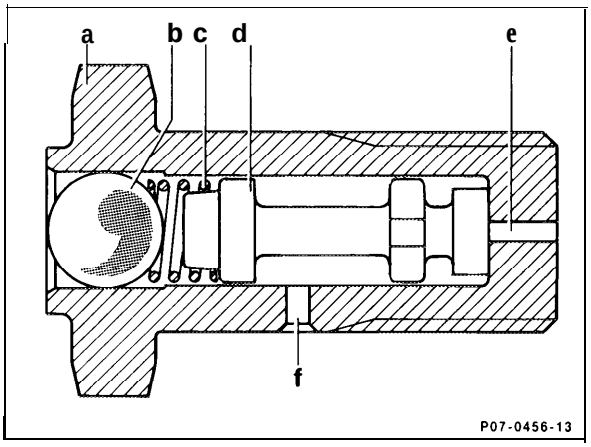
E Pressure side
D Suction side

A restriction in the bypass valve at the injection pump is required for bleeding the injection pump.

Bypass valve with restriction 1,5 mm dia. (arrow).

The bypass valve prevents unfiltered fuel flowing along the return line into the injection pump if the inlet line is clogged (e.g. filter).

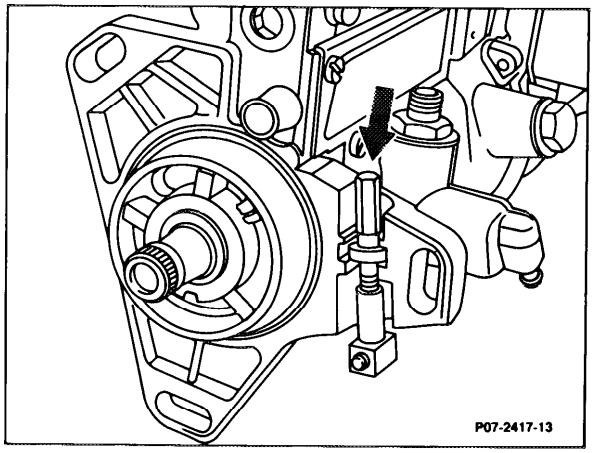




Restriction with bypass valve
a Housing
b Ball
c Spring
d Slide
e Inlet
f Restriction orifice 1 ,5 mm dia.

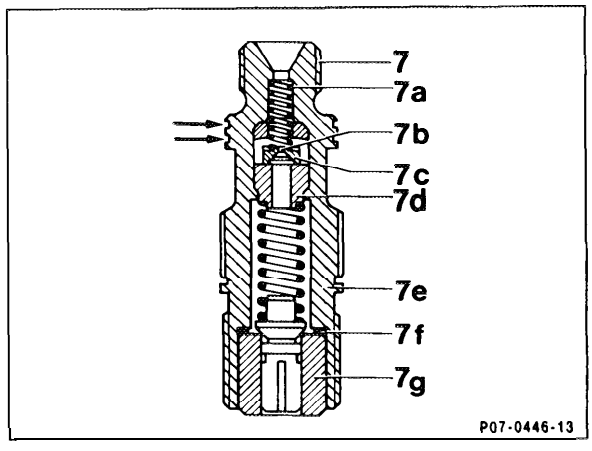
G. Start of injection adjusting equipment

An adjusting device (arrow) is attached to the injection pump flange in order enabling adjustment of the start of delivery while the engine is running.



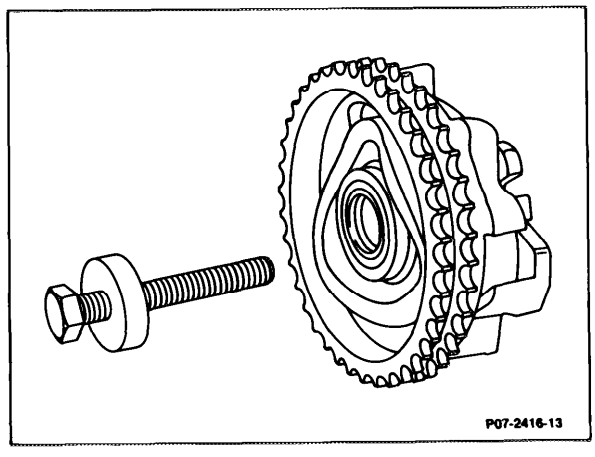
H. Reverse flow damping valve in delivery valve holder

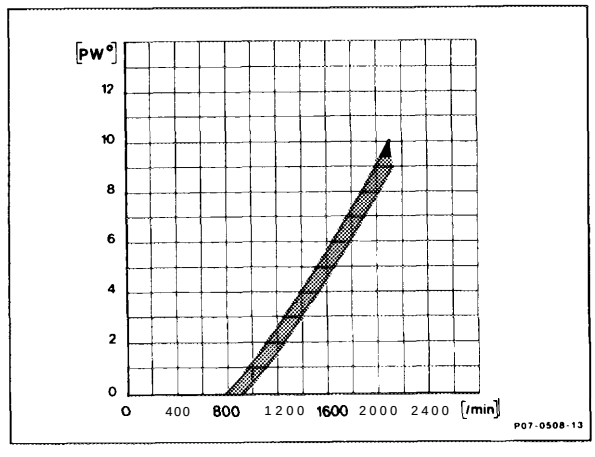
Reverse flow damping valves (7b) are installed in the delivery valve holders (7) of the injection pump in order to reduce the hydrocarbon content in the exhaust gas through prevention of afterspraying of the injection nozzles.
Two annular grooves act as identification marks on the delivery valve holder (7) (arrows). The reverse flow damping valve (7b) is a disc valve (7c) opening in the direction of the injection nozzle with a restriction orifice of 0.5 mm dia.. The valve seat (7d) is riveted into the delivery valve holder.



I. Timing device

The time device is mounted on the injection pump shaft and is attached with a central bolt having a **left-hand thread.**





Timing device adjustment curve
n = rpm of injection pump
PW° = Adjustment angle of injection pump

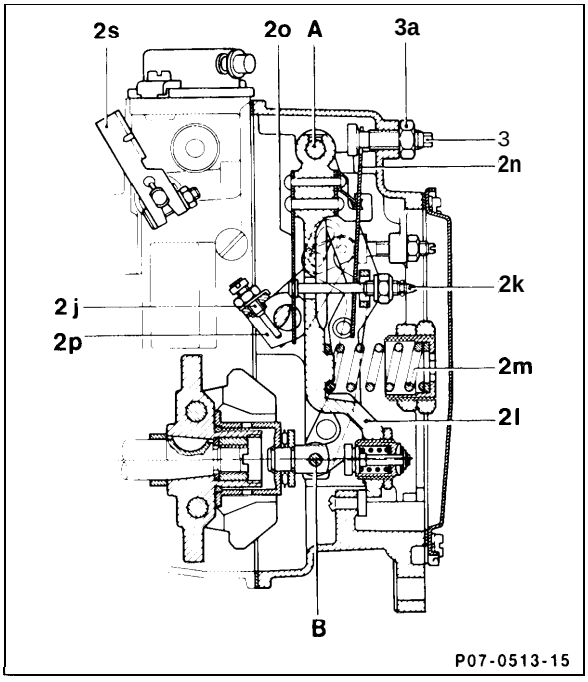
J. RSF governor

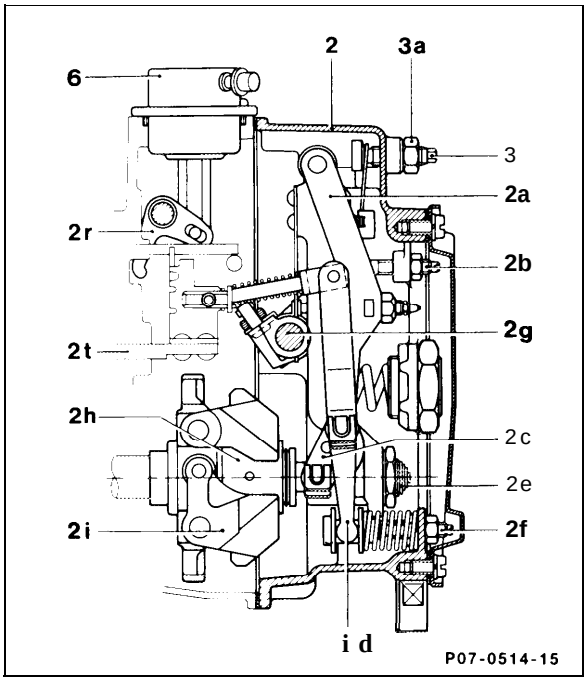
a) Design and operating principle

The governor is a minimum/maximum speed governor. Its governor spring (2m) is sized and set in such a way that it does not govern in the part load range, with the exception of torque control (refer to “Control when starting and at full load”).

In the part load and full load range, the control rod (2t) of the injection pump is operated only from the accelerator pedal, which is connected through the accelerator control linkage to the control lever (2g) of the governor.

The position spring (2n) is pretensioned and the position speed set by the adjusting screw (3).





2 Governor
2a Guide lever
2b Stop screw for position quantity
2c Relay lever
2d Fulcrum lever
2e Spring retainer (torque control)
2f Full load adjusting screw
2g Control lever
2h Sliding sleeve
2i Flyweights (pump governor group)
21 Position auxiliary spring cutoff
2k Adjusting screw for position auxiliary spring (position stabilizer)
2l Tensioning lever
2m Governor spring
2n Position spring
20 Position auxiliary spring (position stabilizer)
2P Steering arm
2r Stop lever
2s Emergency stop lever
2t Control rod
3 Adjusting screw for position speed
3a Locking nut
6 Vacuum unit (stop)

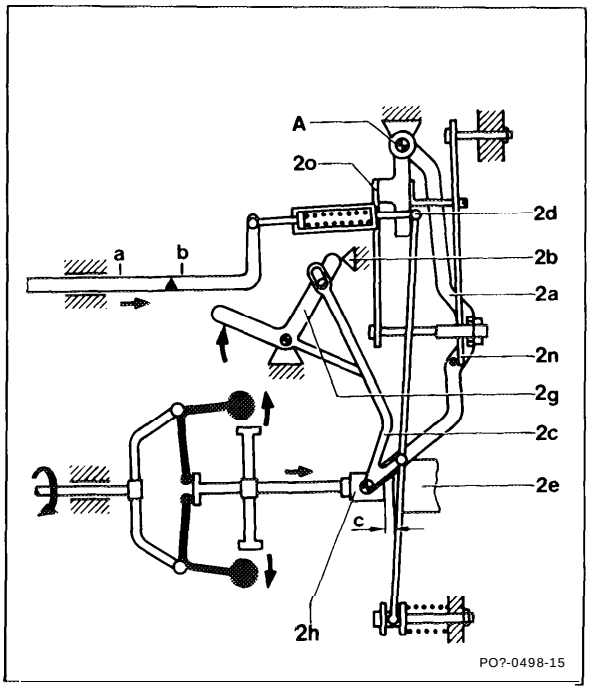
b) Control positions

Control lever (2g) rests against the idle stop screw (2b). As the engine speed increases, the sliding sleeve (2h) passes through the idle position. Guide lever (2a) swivels around the pivot point “A” and thus operates against the idle spring (2n).

At a certain engine speed, the guide lever (2a) moves against the adjusting nut of the idle auxiliary spring (20). The movement of the sliding sleeve (2h) is transmitted through the relay lever (2c) and fulcrum (2d) in the same direction to the control rod of the injection pump

After passing through the idle position, the sliding sleeve (2h) moves against the spring retainer (2e).

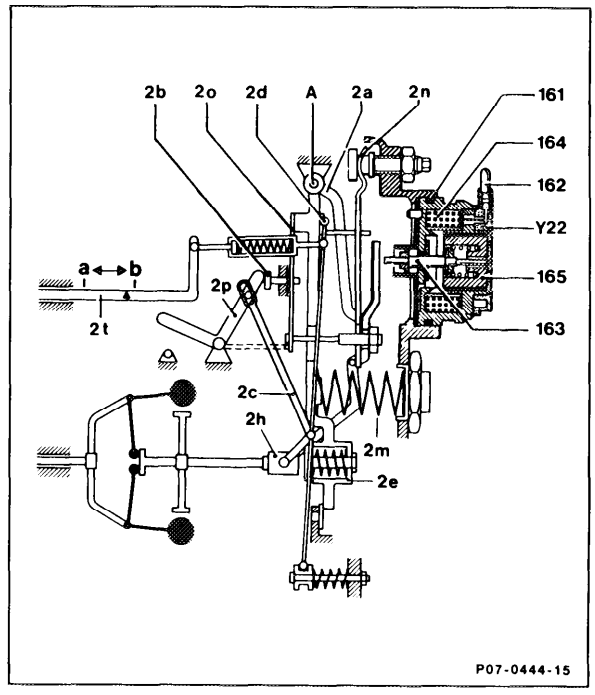
If the engine speed increases further (e.g. deceleration), above a certain engine speed, the spring retainer (2e) is over-compressed followed by the governor spring (2m) . The control rod is thus brought into the “stop position” (deceleration fuel cutoff).



a Start
b Stop
c Position stage

c) Control with actuator

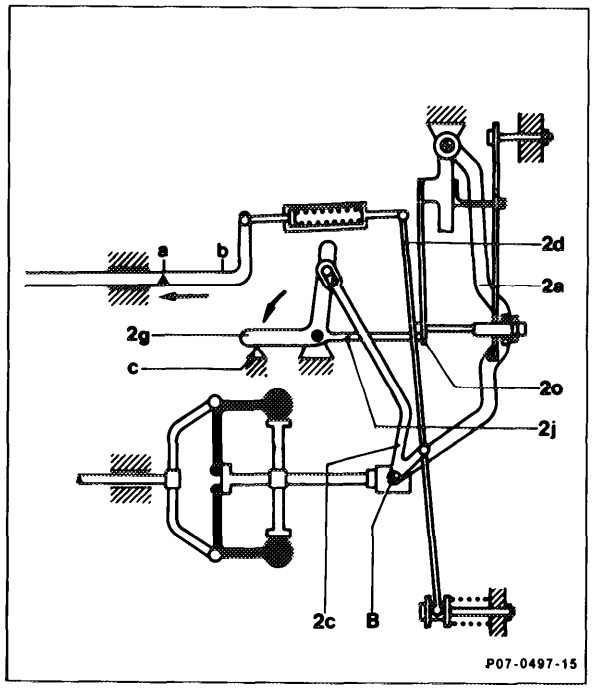
The lift rod (163) rests against the guide lever (2a). The actuator (Y22) is supplied by the electronic idle speed control unit with a clocked D.C. voltage in the frequency range of approx. 50 Hz. If engine speed drops (e.g. drive position engaged or power steering turned to full lock), the actuator is energized with a higher voltage. This causes the lift rod (163) to press against the guide lever (2a) and the control rod (2t) to move in the direction “a” **increased quantity.** As soon as the engine speed increases, the voltage is reduced and the control rod (2t) moves in the direction of "b" **reduced quantity.**



161 Seal
162 Electrical connection
163 Lift rod
164 Solenoid coil

d) Start position

If the control lever (2g) is moved against the full load stop (c) (fixed stop on governor housing) when the engine is not running, the relay lever (2c) moves around pivot point "B" and moves the fulcrum lever (2d) with it in the direction of Start. When the control lever is in the full load position (2g “Full throttle”) the idle auxiliary spring (20 idle stabilizer) is pressed away from the guide lever by the idle cutoff auxiliary spring (2j). This enables a more rapid cutoff from the start position of the governor.

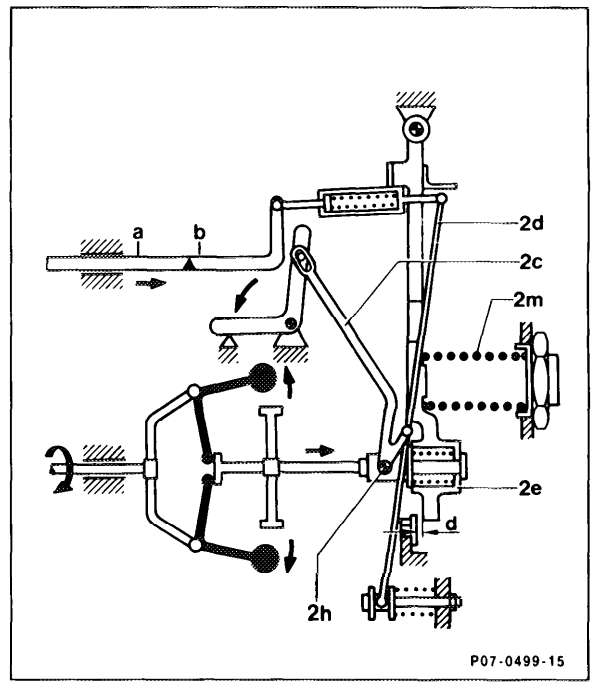


a Star-t
b stop

e) Full load speed regulatlon/ compensation

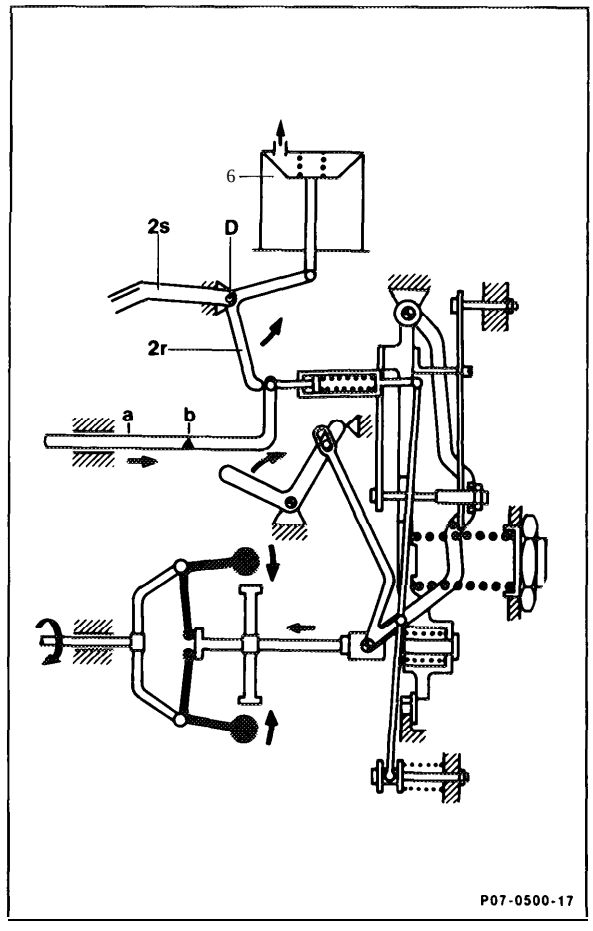
After passing through the idle step (c) (refer to ill. of control when at idle) the governor sleeve (2h) moves against the spring retainer (2e). This causes the relay lever (2c) and fulcrum lever (2d) to move the control rod of the injection pump into the full load position.
When a certain engine speed is reached, the spring retainer (2e) is over-compressed by a certain distance (d) (compensation).

If the engine speed continues to rise, the force of the flyweights is sufficient to over-compress the governor spring (2m) (full load speed regulation). The start of cutoff depends on the preload of the governor spring (2m).



f) Engine stop

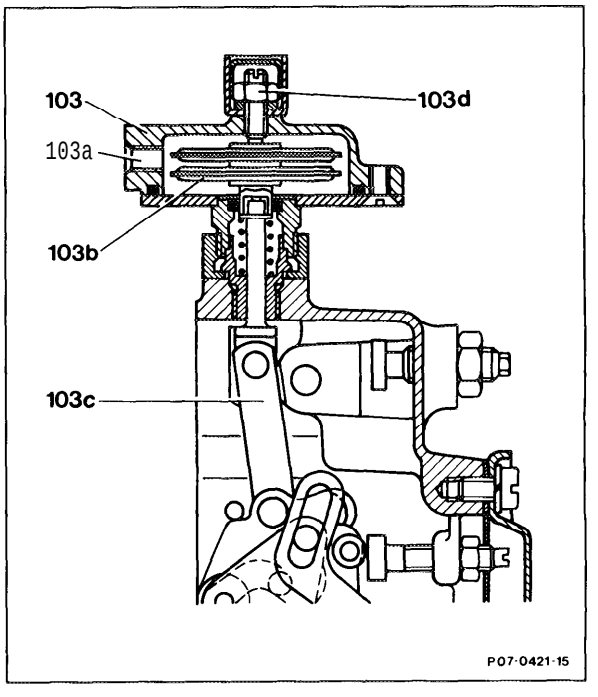
The vacuum unit (6) is pressurized with vacuum from the vacuum pump through the glow start switch of the vehicle. This causes the diaphragm of the vacuum unit to move against the compression spring.
The vacuum unit (6) is connected to a stop lever (2r), which swivels about the pivot point "D", pulling the control rod of the injection pump into "Stop" position. This causes the deflecting spring of the fulcrum lever to be over-compressed. The control rod can be pulled into the "Stop" position from the outer side of the governor in the same way by means of the emergency stop lever (2s).



a Start
b Stop

K. Intake manifold pressure compensator(ALDA)

The intake manifold pressure compensator (ALDA device) is comprised of a housing (103) with barometer unit (103b). The absolute pressure acts upon the barometer units through a port (103a) to the charge air pipe of the engine. Accordingly, the barometer units react to each pressure change with a change of length. All movements are transmitted to the compound lever of the governor and to the control rod.
As the absolute pressure drops, the barometer units expand. The correction linkage (103c) of the units is pressed downwards and acts on the compound lever to move the control rod in the direction of “reduced quantity”. As the absolute pressure rises, caused by a higher air and/or charge pressure, the movement is performed in the opposite direction - i.e. in the direction of ” increased quantity”. As the effect of the ALDA device diminishes, the more the control lever is moved in the idle direction. When the control lever is in the idle position, the effect is approximately zero.

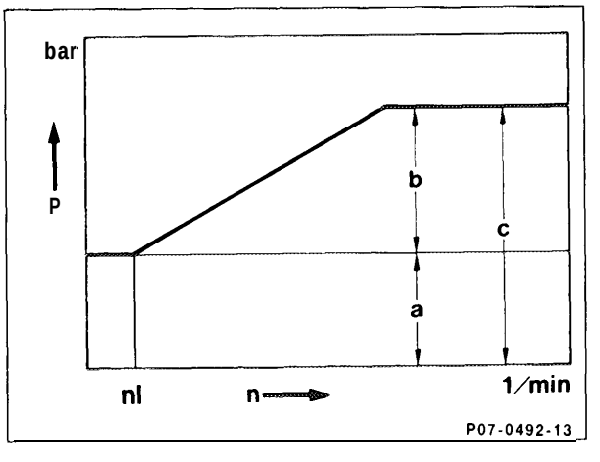


103d Adjusting screw
(factory-set by manufacturer)

Absolute pressure with charge operation

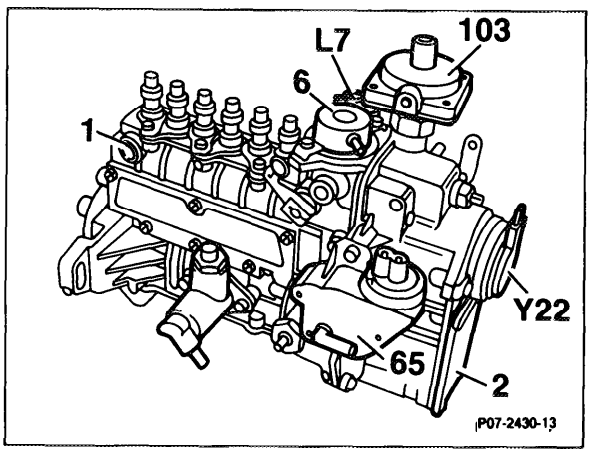
The intake air under atmospheric pressure is further compressed by the turbocharger. Atmospheric and charge pressure together produce the absolute pressure prevailing in the charge air pipe of the engine.

- nl Speed at the start of charge operation
- a Atmospheric pressure, corresponding to suction quantity
- b Charge pressure
- c Absolute pressure, corresponding to charge quantity
- n Engine speed
- p Pressure in bar

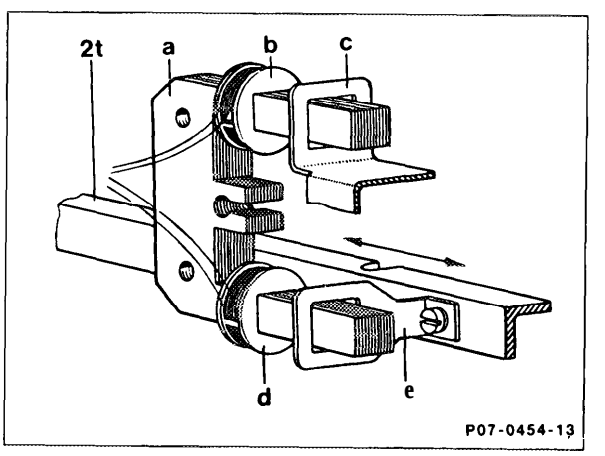


L. Control rod travel sensor (L7)

The control rod travel sensor is installed in the governor of the injection pump. It consists of an iron core, two coils (measured value and fixed value coil) and two short-circuit rings. It is connected to the electronic control unit by a 3-pin plug.
The coils (b) and (d) are attached to the iron core (a) which is fixed in the housing. The short-circuit ring (e) is connected to the control rod (2t) and is displaced with the control rod without touching on the bottom leg of the iron core. The fixed value coil (b) and the short-circuit ring (c) are attached to the top leg.



Function
The fixed value coil (b) with the short-circuit ring (c) represents a constant inductance. Depending on the change in position of the control rod (2t), the distance between the short-circuit ring (e) and measuring coil (d) changes. The variable inductance produced is then compared to the constant inductance. From this the electronic unit determines the control rod travel.



M. Reference impulse verification (RIV)

Two signals are required for checking start of delivery when the engine is running (dynamic).

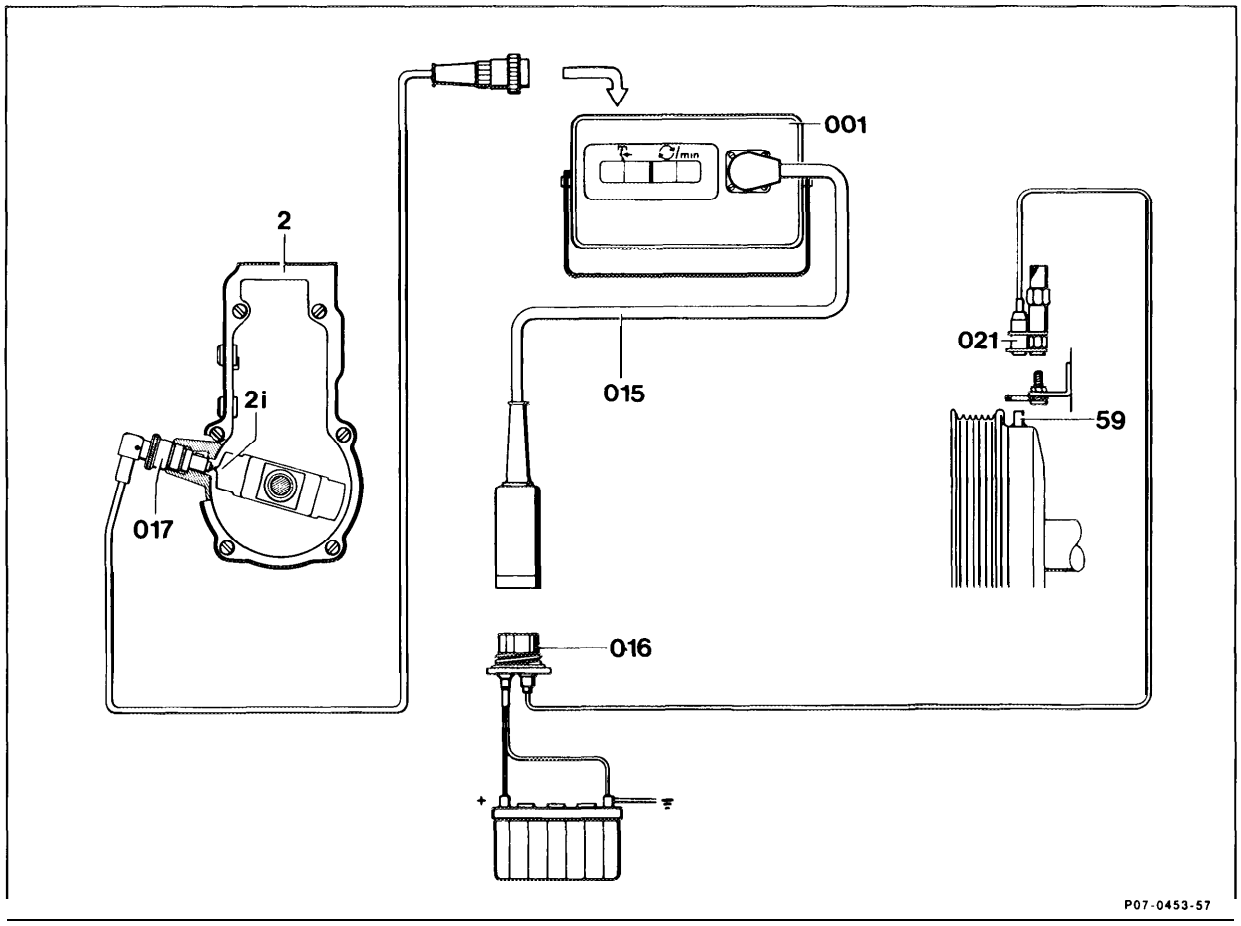
- TDC pulse from the crankshaft
- Reference impulse from the injection pump

Both pulses are supplied by pulse generators. To obtain a signal, the generator pins must be moved past the pulse generators at a minimum rate (position speed).

A measuring instrument measures the time gap of the two pulses and converts the result into an angular value, which is then indicated.

Note

The position sensor can be used, as for naturally aspirated engines, for checking the start of delivery when the engine is not running (stationary).



001	Digital tester	016	Diagnostic socket
2	Governor (Injection pump)	017	RI generator
2i	Flyweight with RI generator pin	021	TDC generator
015	Test cable	59	TDC generator pin

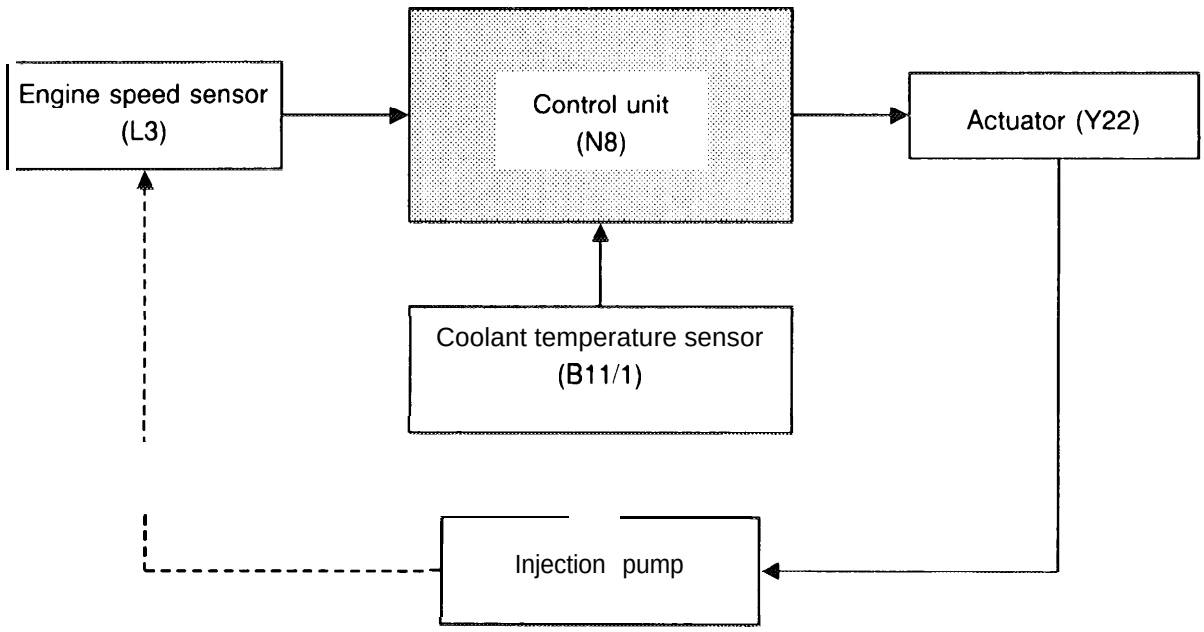
N. Electronic position speed control (ELF?)

Function

The engine speed sensor (L3) detects engine speed (144 pulses/revolution) and passes this to the control unit (N8) in the form of an alternating voltage.

This processes the speed signal and performs a set/actual value comparison. Position speed is maintained at a constant level by the actuator (Y22) irrespective of engine load.

Set position speed is raised in accordance with a specified characteristic curve by the temperature sensor (B11/1) at coolant temperatures < 60 °C.



System diagnostics (Engine 602)

The ELW system can be tested by means of the self-test routine integrated into the control unit. A signal can be retrieved with the test connector (X92 or XI 1/4), which provides concrete information regarding a component fault. The number of signals indicates whether and which component is faulty, or whether the components in the control loop are faulty.

Note

Engine 603 is fitted with the control unit having system diagnostics as of a later date.

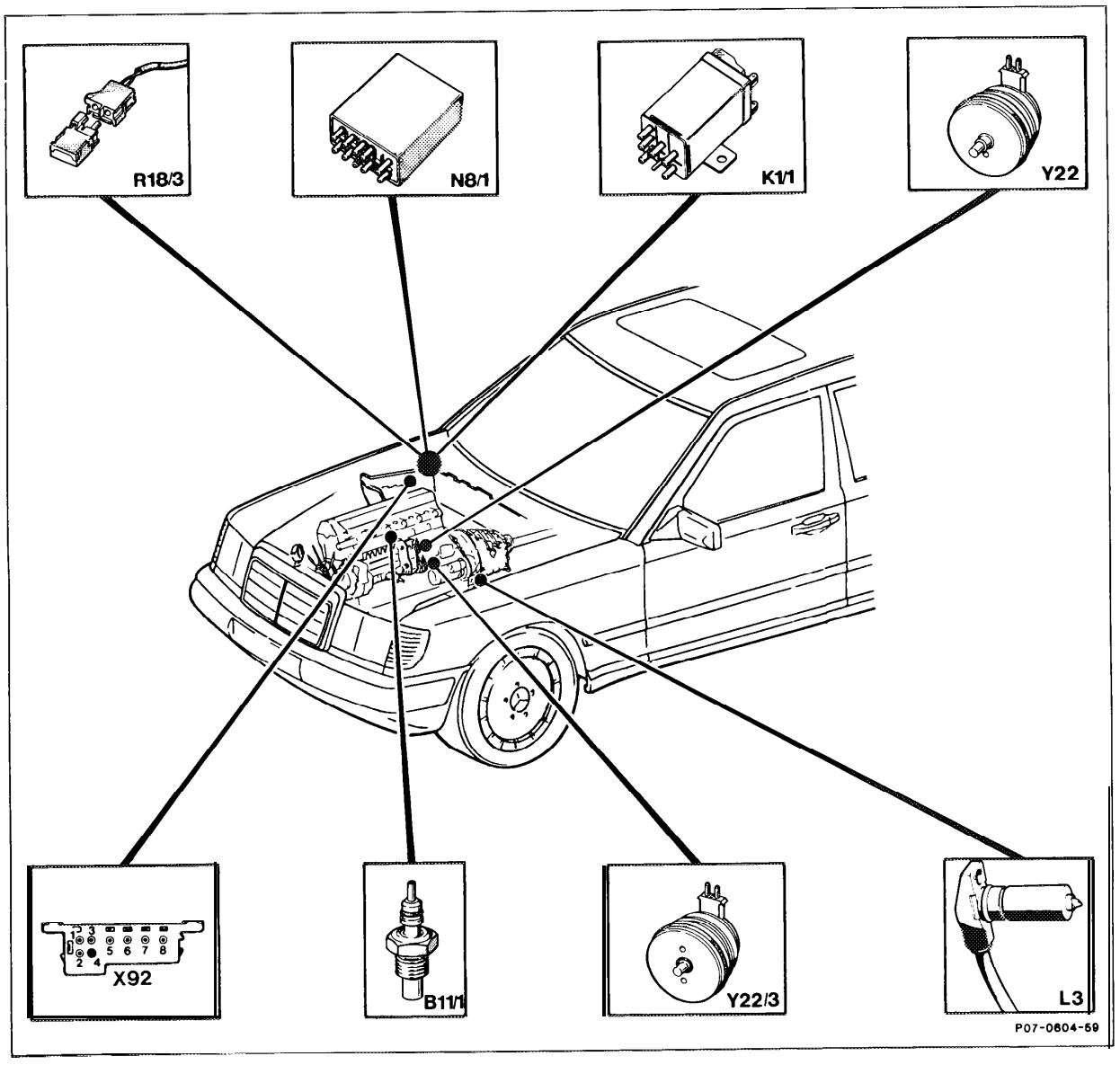
Production breakpoint:

Control unit with **"RO2"** 05188.

Pulse read out	Component
1	All functions “in order”
2	Engine speed signal “fault”
3	Coolant temperature “fault”
6	ELR control loop “fault” [1])

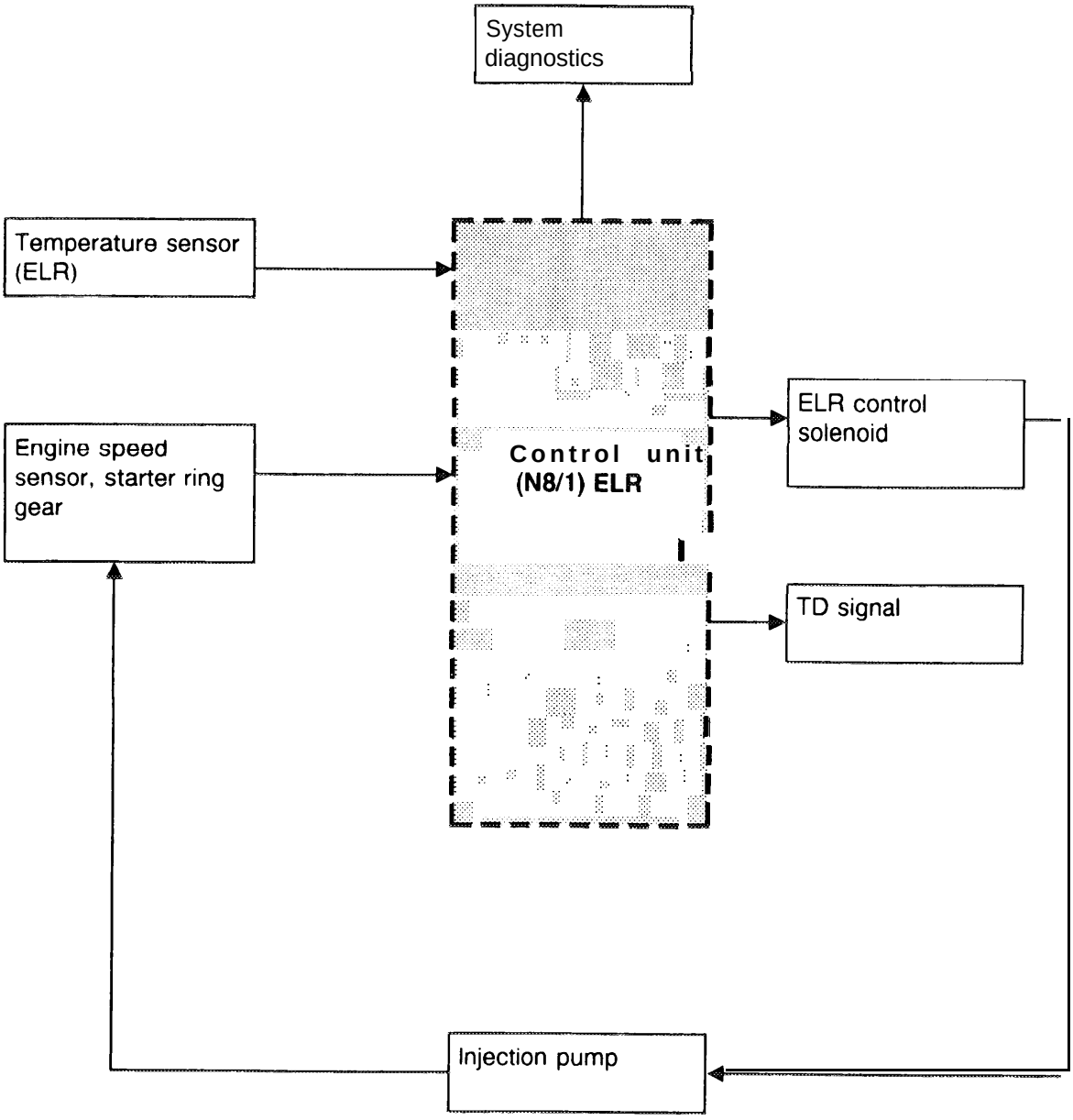
[1]) Only short-circuit faults are detected on control units with the designation "RO1". Control units with "RO2" also detect interrupt.

Location of components



B11/1	Coolant temperature sensor	N8/1	ELR control unit
K1/1	Overvoltage protection	x92	Test connector
L3	Engine speed sensor	Y22	ELR actuator
L3x	Engine speed sensor plug connection		

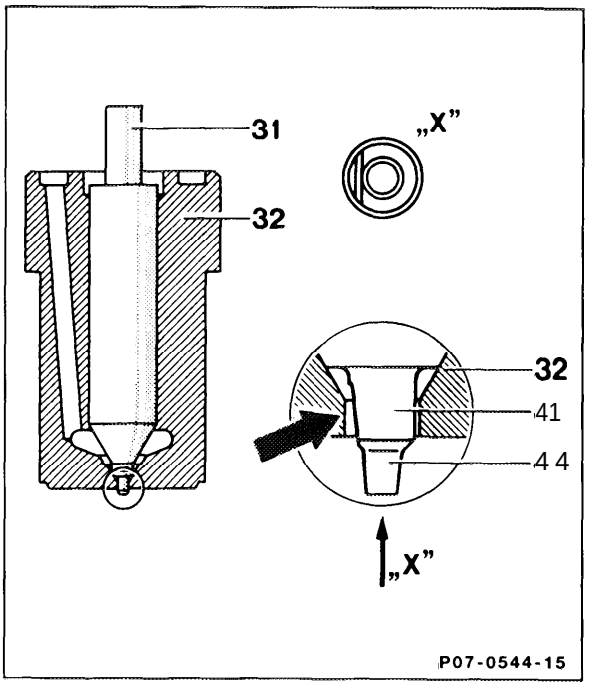
ELR block diagram



O. Facet pintle nozzle

Bosch Designation DN 0 SD 265

The facet pintle nozzle differs from the pintle nozzle in having an oblique face angled at approx. 6° (arrow) on the throttling pintle (41), which improves the throttling effect.

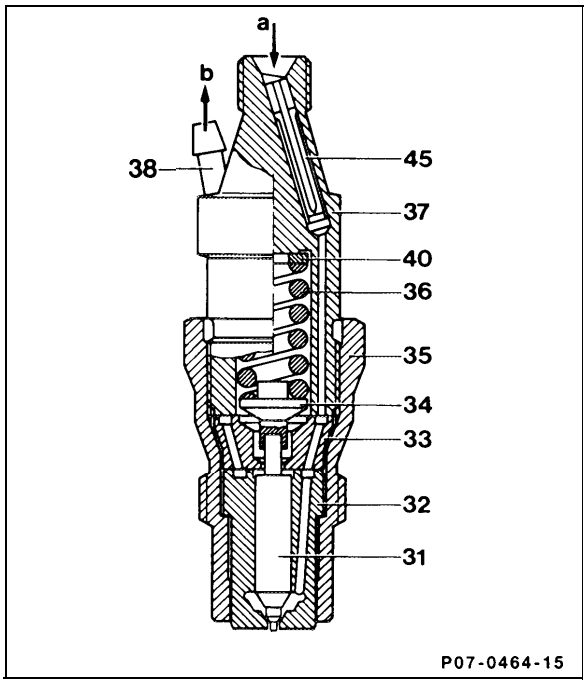


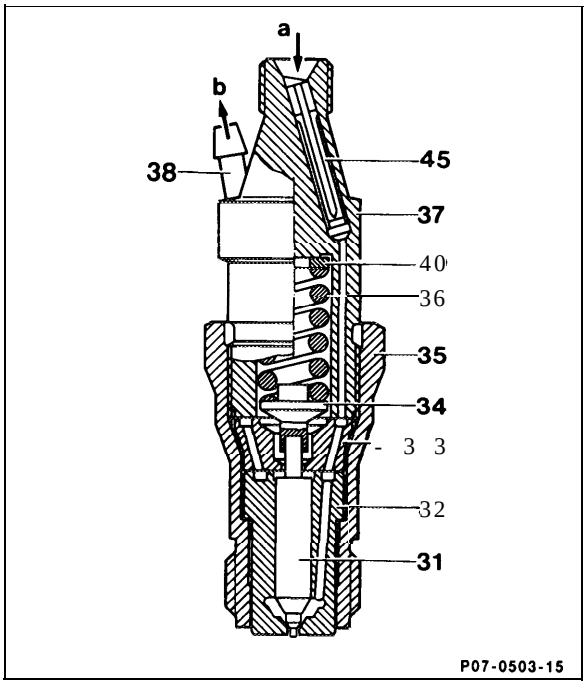
31 Nozzle needle
32 Nozzle body
41 Throttling pintle
44 Spray pintle

P. Nozzle holder

Bosch Designation:
KCA 27 S 55, for oblique injection
KCA 30 S 44, for vertical injection

The thickness of shim (40) determines the pre-load of the compression spring (36) and thus the opening pressure of the injection nozzle. The opening pressure can be set by fitting shims of different thicknesses. The fuel flows to the nozzle seat through the respective inlet orifice (a) in the holder (37), intermediate disk (33) and injection nozzle. During the injection process, the injection pressure raises the nozzle needle, and fuel flows through the annular orifice at the throttling pintle into the pre-chamber. Once the injection pressure drops, the compression spring (36) pushes the nozzle needle (31) back down onto its seat; the Injection process is completed.

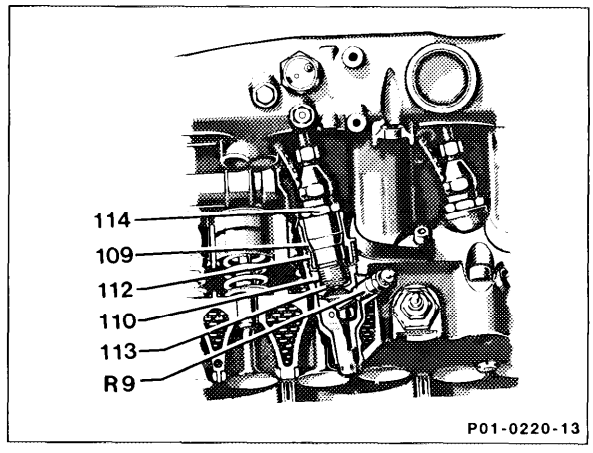




Nozzle holder KCA 27 S 55
(for oblique injection)
31 Nozzle needle
32 Nozzle body
33 Intermediate disk
34 Pressure pin
35 Nozzle tensioning nut
3 6 Compression spring
37 Holder
38 Fuel bypass port
4 0 Shim
45 Inlet orifice
a Fuel inlet
b Leak fuel (return)

Q. Oblique injection

The nozzle holder combination is fastened to the top section of the prechamber tilted at 5° relative to the longitudinal axis of the prechamber. This oblique Injection produces a more intensive mixing of air and fuel.



R9 Glow plug
109 Sealing sleeve
110 Prechamber
112 Threaded ring
113 Sealing shim
114 Nozzle holder

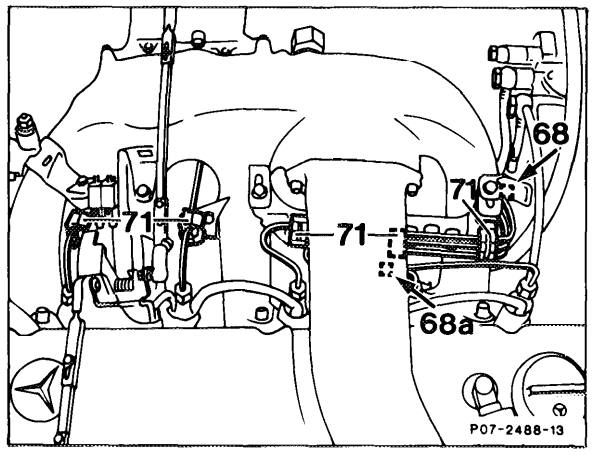
Together with the prechamber modification, the following additional benefits result:

- Improved cold start
- More favorable air/fuel mixing as a result of shorter glow plug (now 23 mm was previously 25 and 27 mm) in combination with recess and the concave in the ball pin.
- Particle reduction and improvement in the emission of hydrocarbons and carbon monoxide.

R. Injection lines

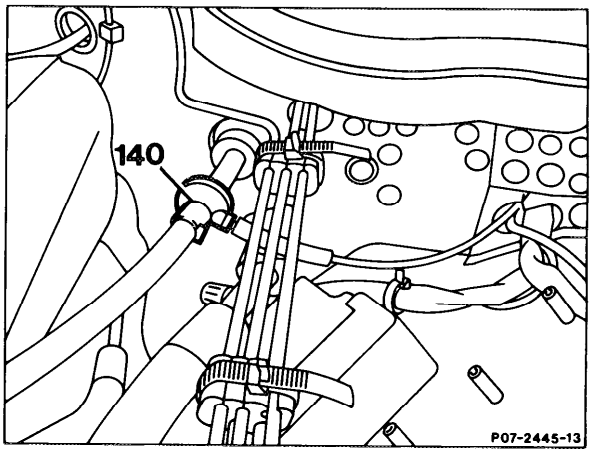
The injection lines are designed so as to allow the injection pump to swivel when the engine is running.

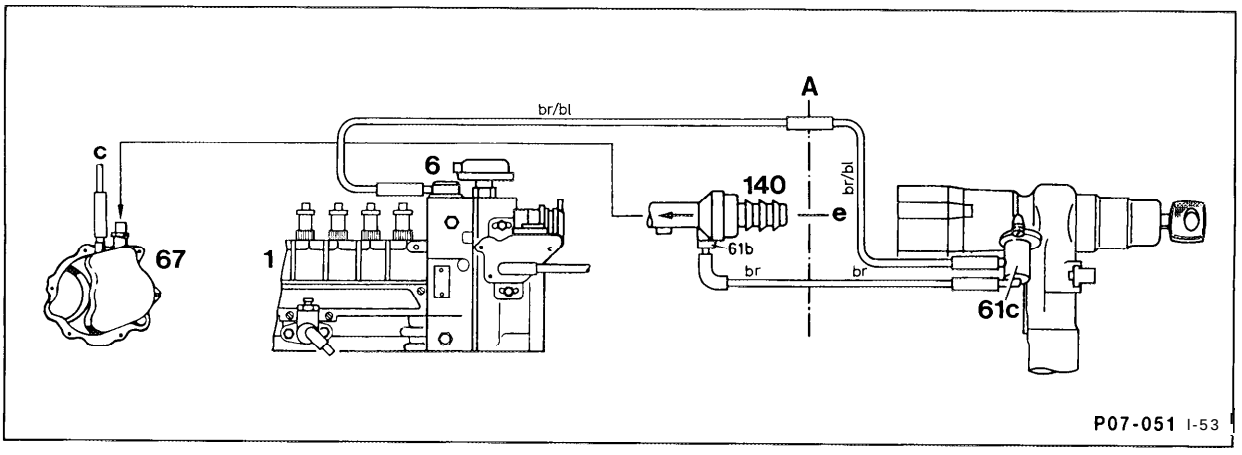
Note
The plastic clips (68 and 68a) must be fitted as close as possible to the radius of the injection lines (arrows). The plastic clips (71) must be locked in place.



S. Vacuum engine stop with car key (glow start switch)

The vacuum for the key-operated engine stop is supplied by the check valve (140) of the main vacuum line.





Vacuum line routing

1	Injection pump	A	Intermediate panel
6	Vacuum unit (stop)	c	Other ancillaries
61c	Valve, glow start switch	e	To brake booster
67	Vacuum pump		
140	Check valve/main vacuum line		

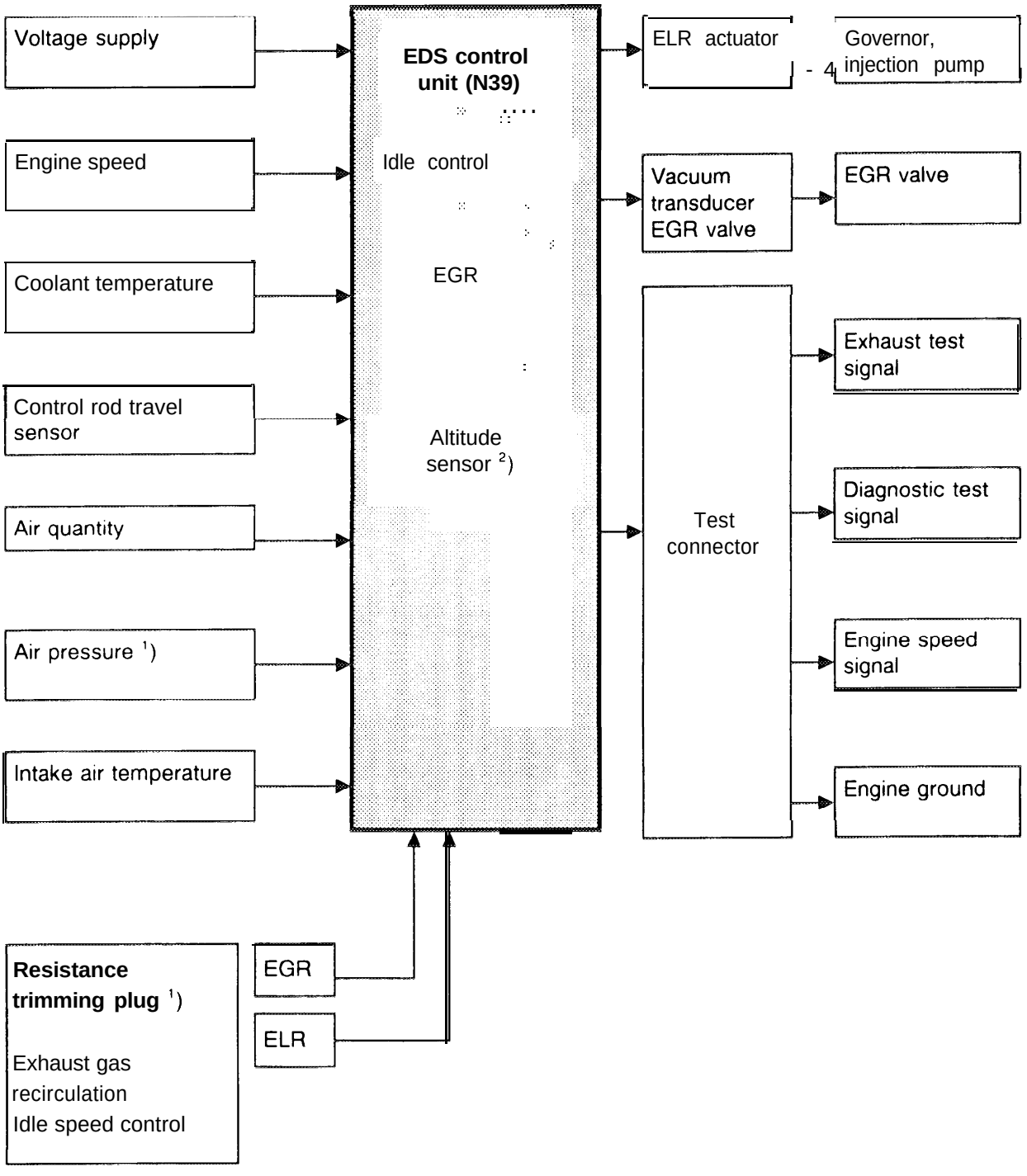
T. Electronic diesel system (EDS)

The electronic control unit processes the following functions:

a) Electronic idle speed control (ELR)
b) Exhaust gas recirculation (EGR)
c) Recirculating air control for trap oxidizer, (California Engine 603.96 Model Year 1986/87 only).
d) Charge pressure control (P2 control) Engine 602.962 from Model Year 1990.
e) System diagnostics

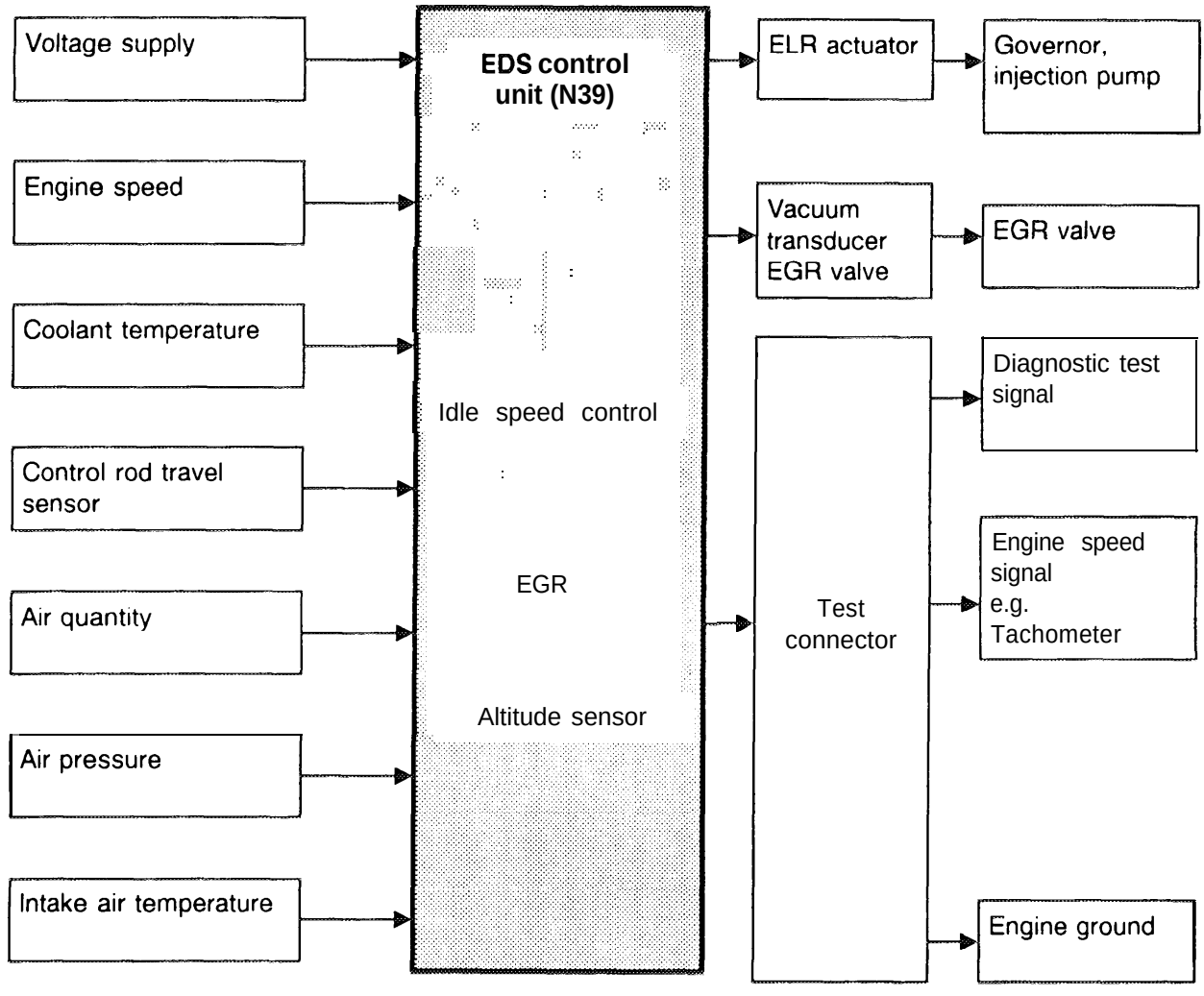
The control unit processes the incoming signals and supplies a current (mA) to the vacuum transducer, as well as to the actuator of the injection pump. The entire system is tested by means of a signal to other outlets, which merge into a test connector.

Influencing variables of Electronic Diesel System (EDS) Engine 602.96 and 603.96

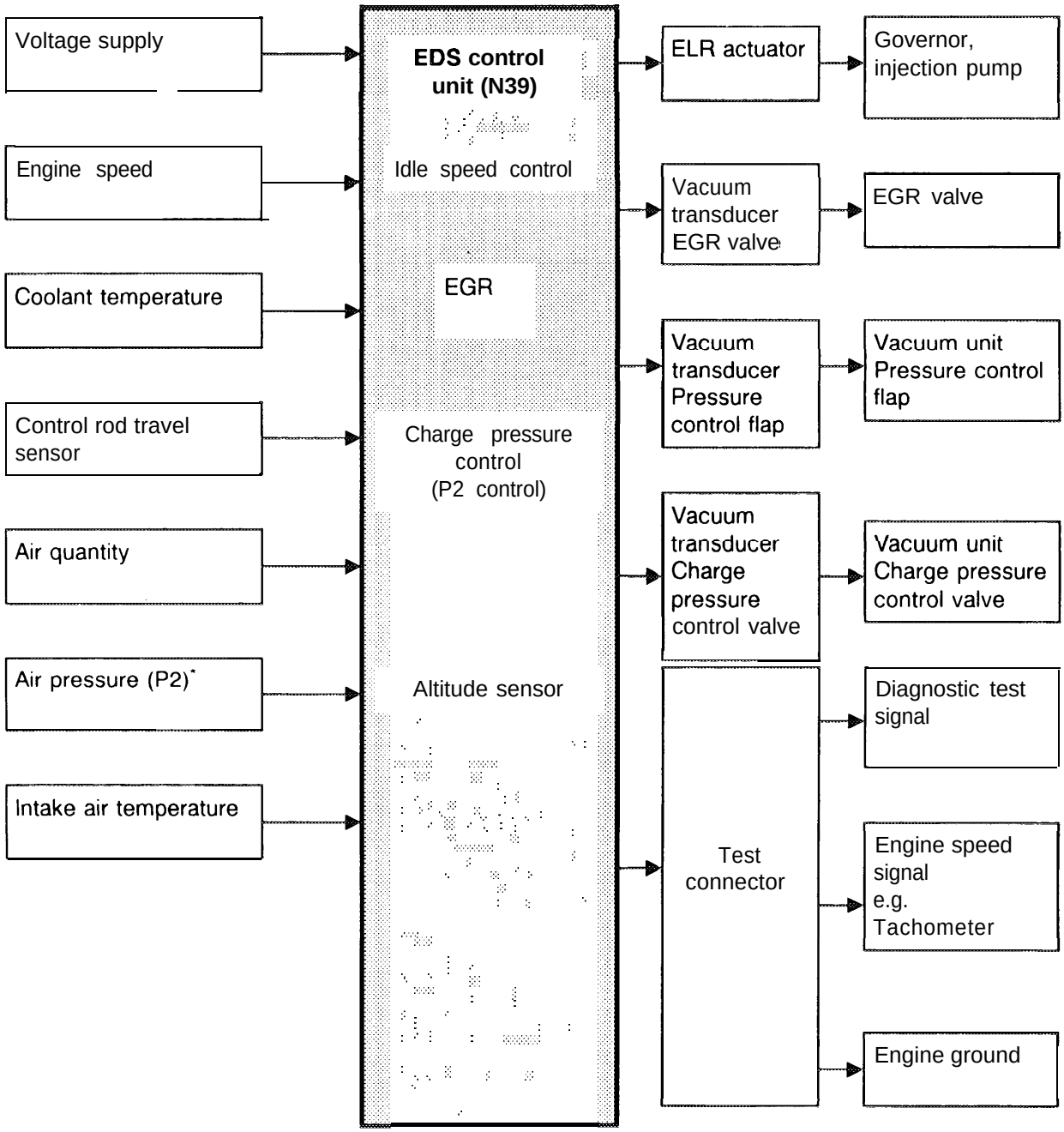


1) Model Year 1986187 only
2) Effective Model Year 1988 Integrated in control unit.

Influencing variables of electronic diesel system (EDS) Engine 603.970 from Model Year 1990



Influencing variables of Electronic Diesel System (EDS) Engine 602.962 from Model Year 1990

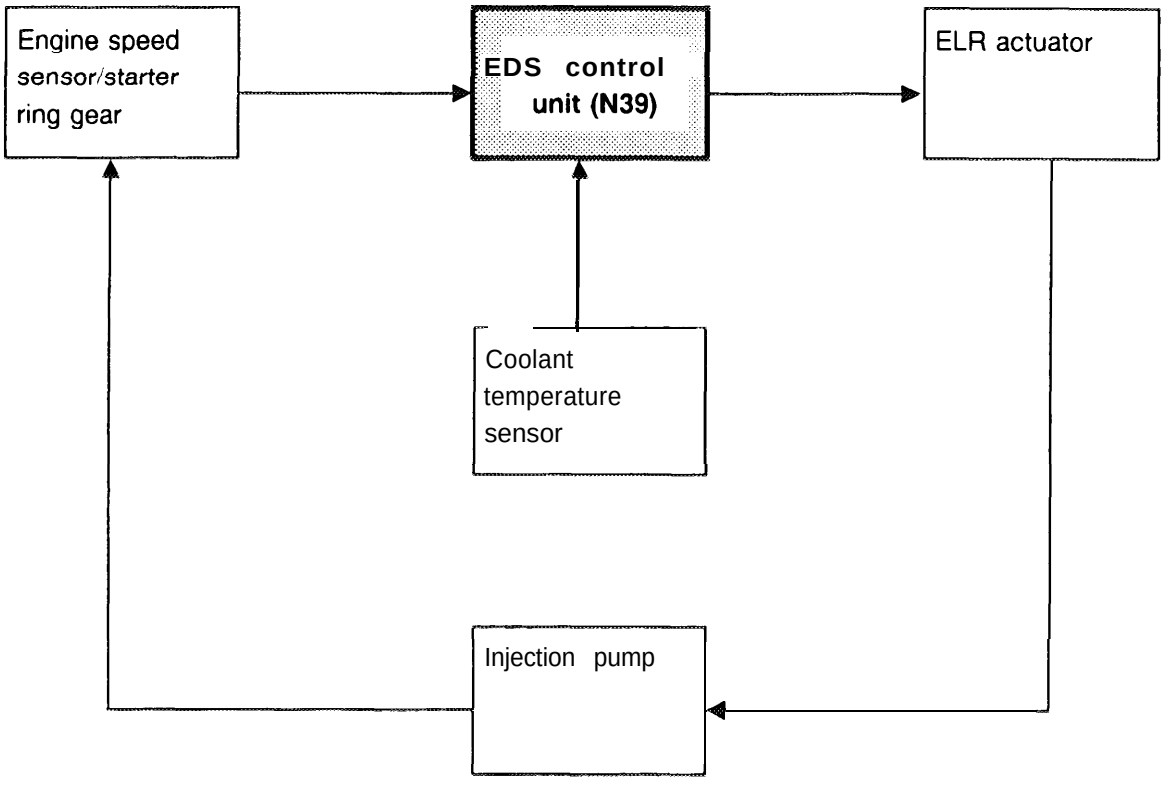


* Pressure in front of inlet valves

a) Electronic idle speed control (ELF?)

A speed sensor detects the engine speed **(144** pulses/revolution) and passes it on to the EDS control unit in the form of an alternating voltage. The EDS control unit processes the speed signal and performs the set value/actual value comparison. This enables idle speed to be maintained at a constant level by the actuator irrespective of engine load. Set idle speed is raised in accordance with a fixed characteristic curve by the temperature sensor at coolant temperatures < 60 °C.

Block diagram of idle speed control (ELR)



b) Exhaust gas recirculation (EGR)

Exhaust gas recirculation is initiated as soon as the following conditions are met:

- Coolant temperature between 60°C and 110°C
- Engine speed between idle and 2800 rpm or 3500 rpm on Engine 602.962 from Model Year 1990
- Control rod travel less than 9 mm
- Battery voltage 1 l-1 4 Volts

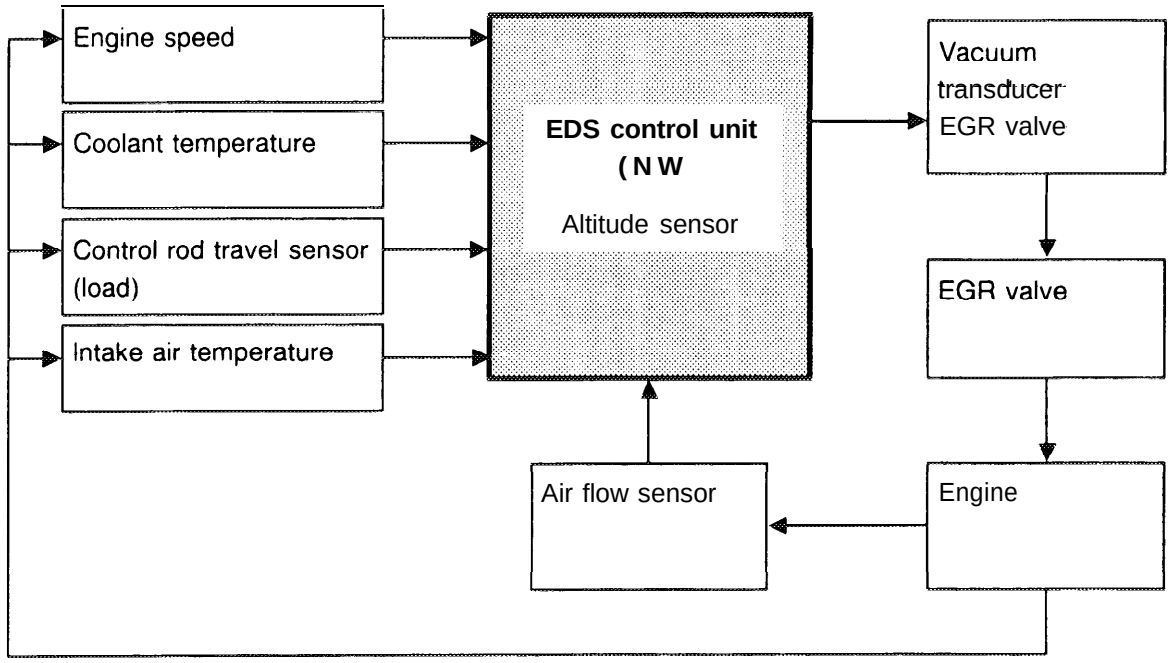
Depending on the input signals of the sensors e.g. control rod travel, engine speed etc., the EDS control unit determines the matching quantity of recirculated exhaust gas for each operating state. The vacuum transducer is energized and supplies the corresponding vacuum to the EGR valve.

The EGR quantity is reduced as engine load and speed increase. This means
Increase in the control current = increase in EGR quantity.
Reduction in control current = reduction in EGR quantity.

Note

Temperature and engine speed are dependent on the control unit version. Refer to test routine for exact data.

Block diagram EGR



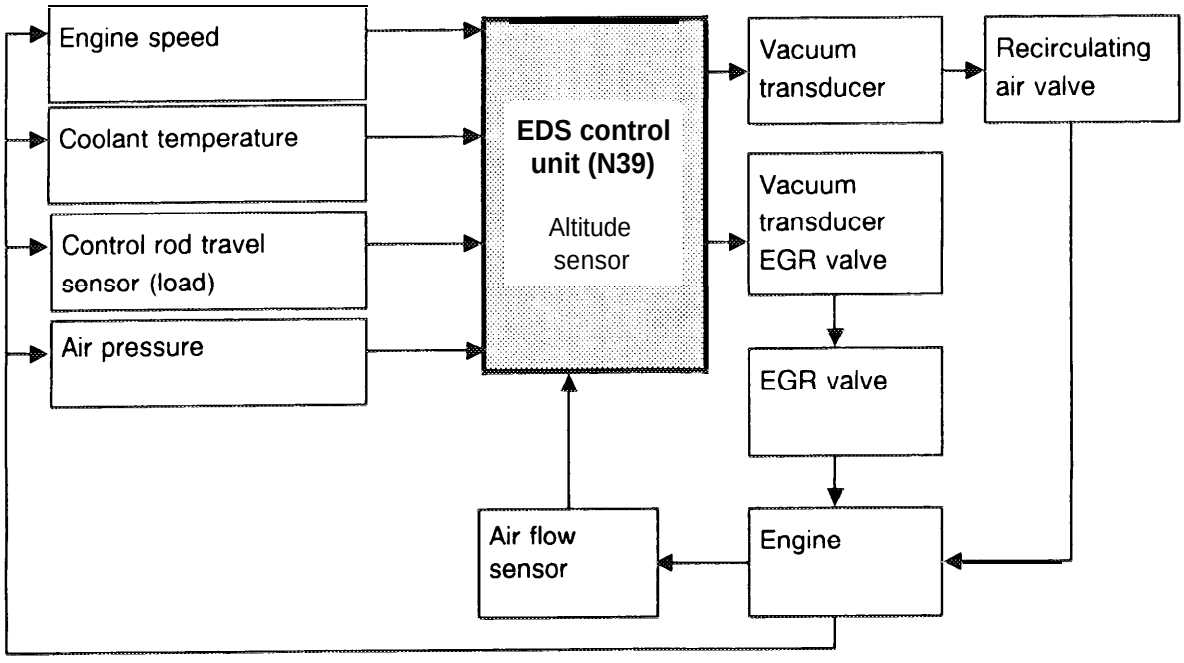
The EGR system with EGR valve, vacuum transducer, air flow sensor and EDS control unit operates as a closed control loop.

c) Recirculating air control for trap oxidizer (California Engine 603.96 Model Year 1986/87 only)

In order to achieve improved combustion conditions for the trap oxidizer, the recirculating air valve is continuously opened or closed according to a performance characteristic map.

Following the closing operation, a residual vacuum of approx. 30 mbar is retained at the recirculating air valve. The recirculating air valve is open between 1000 and 3400 rpm. The control rod travel must be less than 9 mm.

Block diagram recirculating air control



d) Charge pressure control (P2 control)
Engine 602.962 from Model Year 1990

A **"characteristic map" (P2** control) is stored in the **EDS** control unit. The pressure values obtained as a function of injection quantity and engine speed produce an optimum engine operation with respect to **performance, NQ,, HC** and **particle emissions.**

Function

Particle emissions are lowered by reducing the pressure (P2) in front of the intake valves under part load conditions.

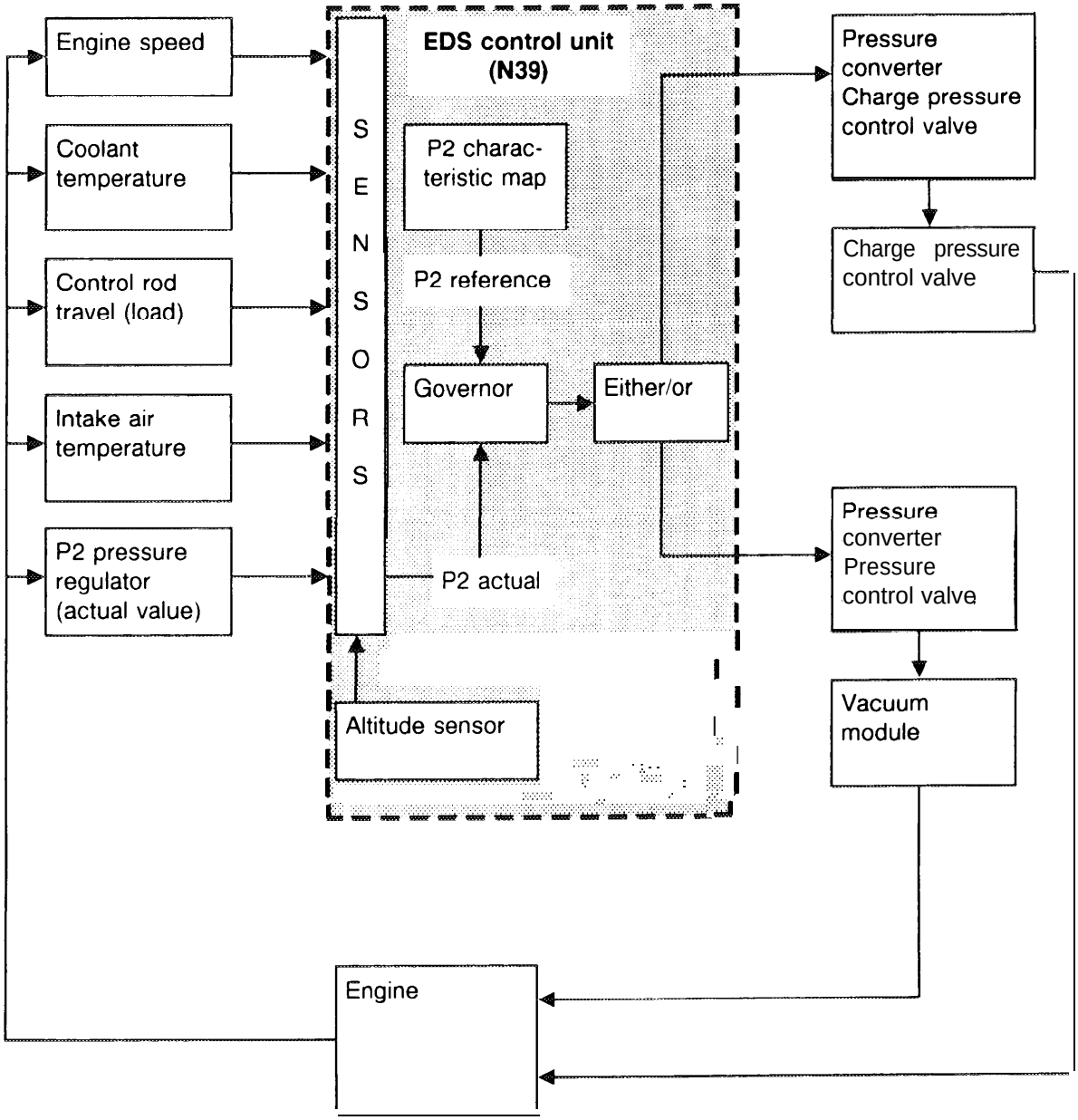
A control circuit exists in the EDS control unit through which a pressure comparison of "P2 **actual" and "P2 reference"** is performed (refer to block diagram).

Any pressure difference is compensated for by the charge pressure control valve or by the pressure control flap.
These pressure actuators are operated by the vacuum transducers by means of an electronically adjustable vacuum.

Charge pressure control is dependent on:

- Coolant temperature
- intake air temperature
- Intake air pressure
- Engine speed
- Position of control rod (control rod travel)

Block diagram charge pressure control (P2 control), Engine 602.962 **Model Year 1990**



e) System diagnostics

The “electronic diesel system” can be checked for component faults respectively and stored by means of the self-test routine integrated in the EDS control unit.
Temporary faults, which last longer than 4 seconds, are also stored.
E.g. sensor faults with the exception of speed sensors are memorized, as well as short-circuits in the actuators or their lines.
The pulse display can be tapped via the test connector (Xl 1/4), socket 4 and the individual faults evaluated with the aid of a pulse counter. Depending on the readout, the defective component or its leads can be determined.

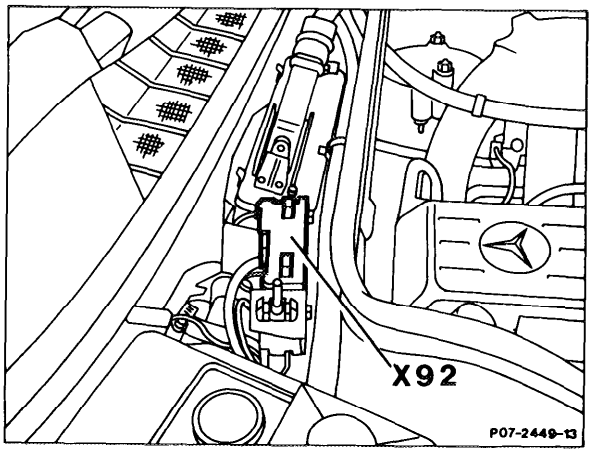
Model Year 1986187
EDS control unit **with** fault detection.
Only permanently occurring faults are detected.

f) Location and function of components

Model Year 1986/87
Test connector (X92) is used for diagnostics.
The diagnostic test signal can be taken from the test connector.

Models 124 and 201 in component compartment right

Modull3	Format 1 ,0 **(77 × 58** mm)
Bild-Motiv	
Foto/Zg-Nr.	
A bgabe	
Korrektur	
Freigabe	
Bild-Nr.	**P07-2467- 13**

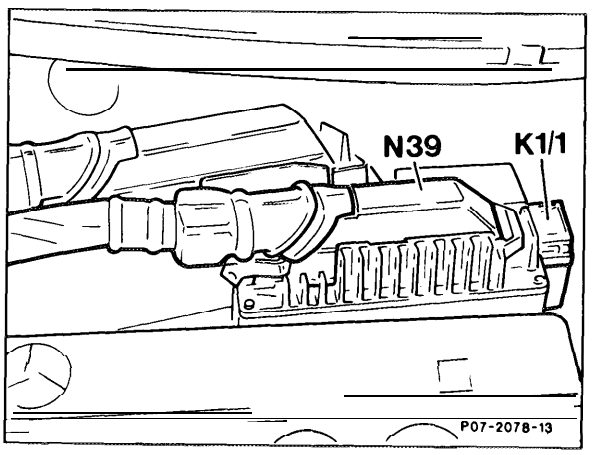


Model 126

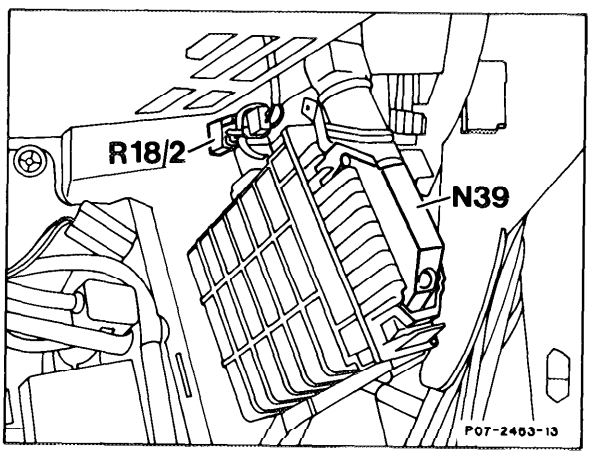
Function of components

Control unit (N39)

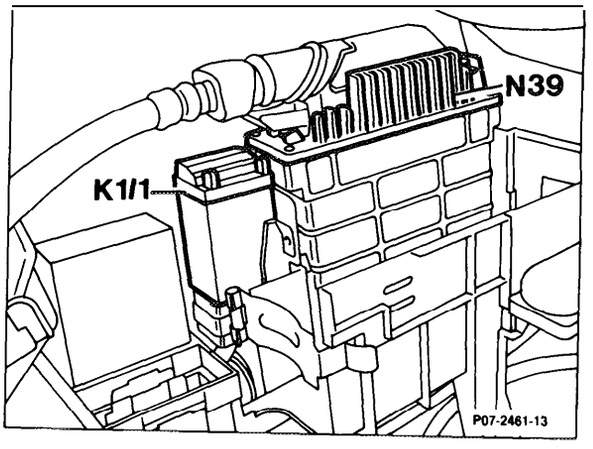
The control unit processes the incoming signals and supplies a current (mA) to the pressure converter, EGR switchover valves, as well as to the actuator of the injection pump. The entire system can be tested by means of a signal passed through four other outlets merging into a test connector.



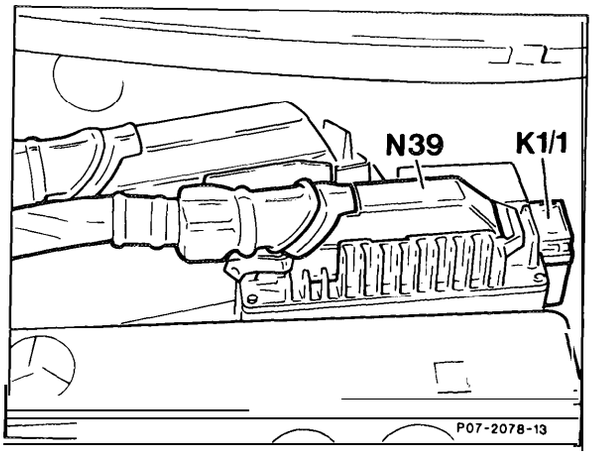
Model 124 behind battery in component compartment



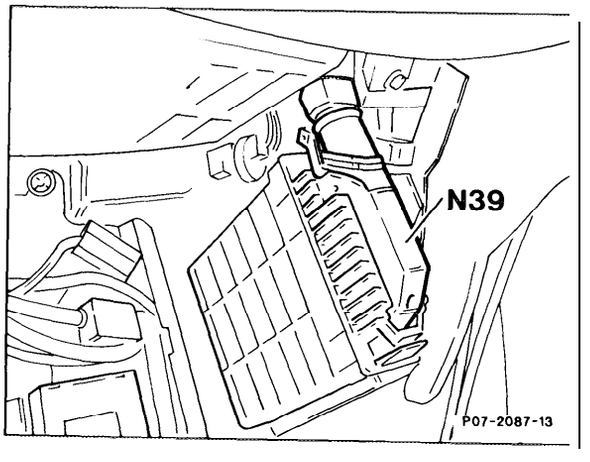
Model 126 in right foot well behind side panelling



Model 201 behind the battery in components compartment



Model 124.128
(Engine 602.962)



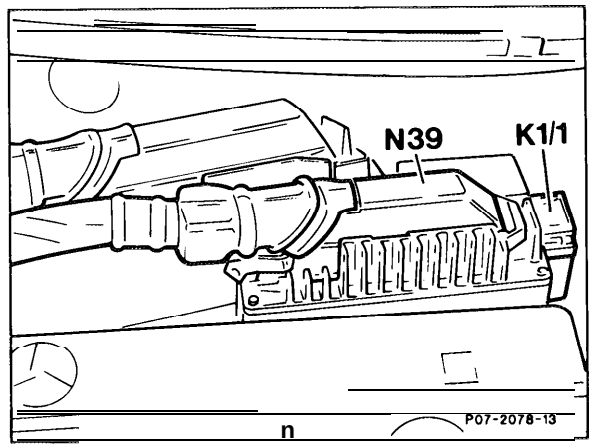
Model 126.13
(Engine 603.970)
Installed on the right in the passenger compartment

Altitude sensor (integrated in control unit) from Model Year 1990

The quantity of recirculated exhaust gas is influenced by the atmospheric pressure sensor as a function of altitude or air pressure. The altitude sensor supplies a voltage signal to the control unit which drops as air pressure drops (increasing altitude). The control unit matches the quantity of exhaust gas recirculated to the respective air pressure by reducing the pressure converter current.

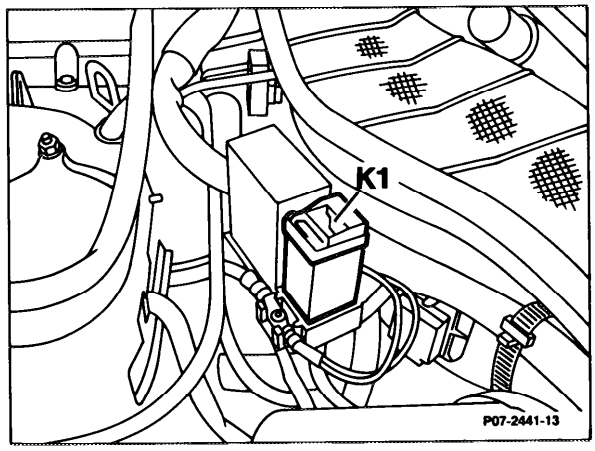
Over-voltage protection (K1 or K1/1)

The power for the electronic control units is supplied through the over-voltage protection relay.



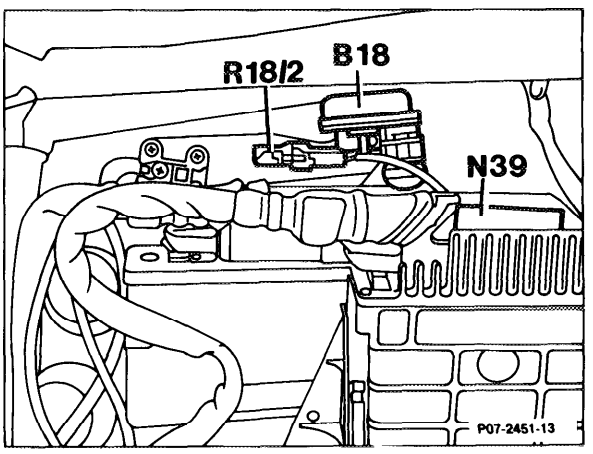
Models 124, 201 behind the battery in the component compartment

The battery voltage is supplied constantly to terminal 30. A10A fuse is fitted between terminal 30 and 30a. The fault memory is constantly energized through terminal 30a. When the ignition is switched on, the relays are actuated through terminal 15 by an electronic unit. The EDS control unit is thus energized through terminal 87E and other ancillaries through terminal 87. The over-voltage protection is achieved by means of a 22 volt Zener diode. Voltage peaks in excess of 22 volts occurring ahead of the over-voltage protection are switched directly to ground by the Zener diode. An overload is prevented by a fuse. Terminals 87E and 87L are protected separately.

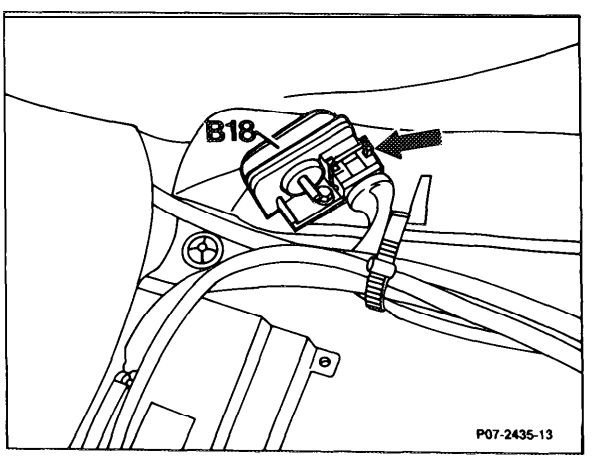


Model 126 in component compartment next to ABS control unit

Altitude sensor (B18)
Model year 1986/87
The quantity of exhaust gas recirculated is influenced by the altitude correction sensor as a function of altitude or air pressure. The sensor supplies a voltage signal to the control unit which drops as air pressure drops (increase in altitude). The control unit matches the quantity of exhaust gas recirculated to the air pressure by reducing the pressure converter current.

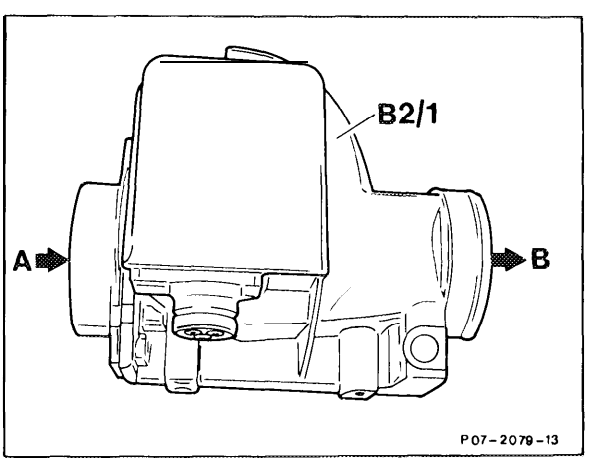


Model 124, 201 in component compartment



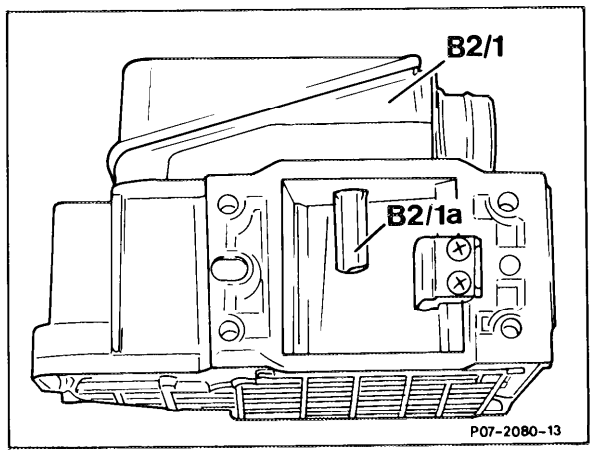
Model 126 in right footwell

Air flow sensor potentiometer (B2/1)
Fitted in the air flow between air filter and exhaust gas turbocharger.



A from air filter
B to exhaust gas turbocharger

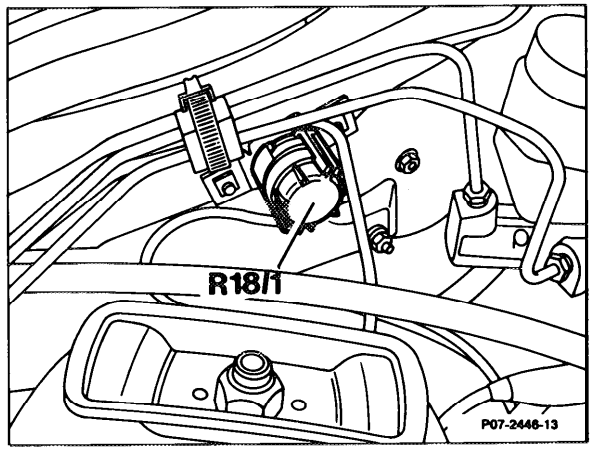
The intake air deflects the air flow sensor flap against the restoring force of a spring into a defined angular position. The position is measured by means of a potentiometer, and converted into a voltage.
The intake air temperature is detected by a temperature sensor (B2/1a) in the air flow sensor.



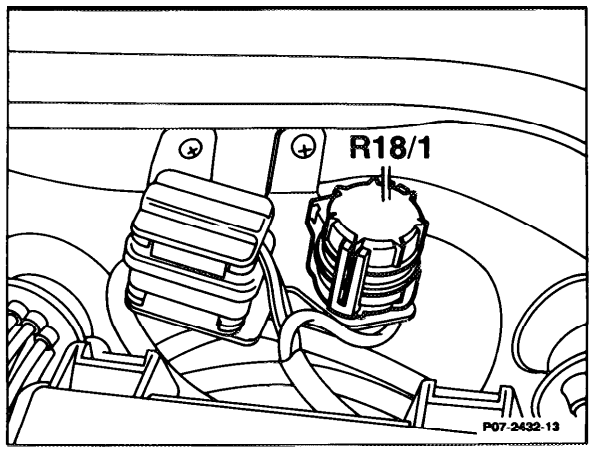
Air flow sensor
Model 201 without round flange

Resistance trimming plug (R18/1) for idle speed

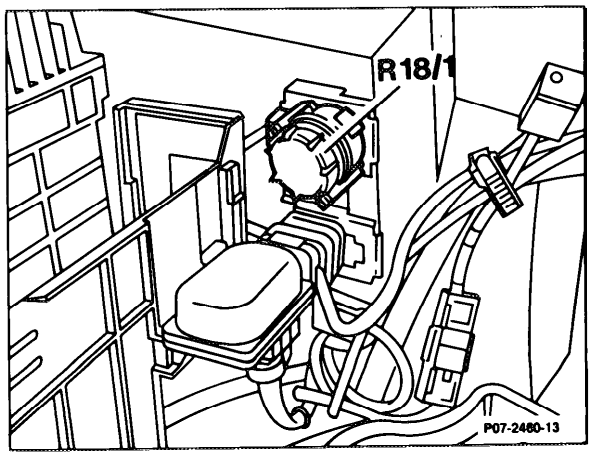
For setting the idle speed.
Specification: 630 ± 20 rpm



Model 124



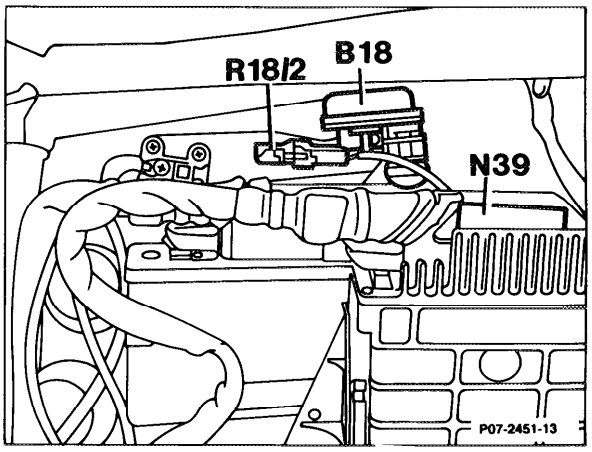
Model 126



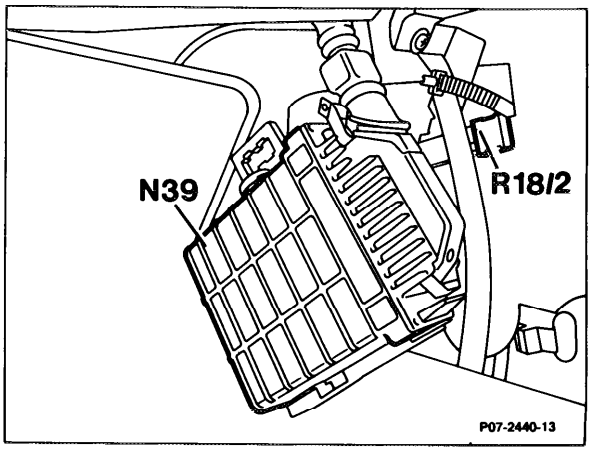
Model 201

Reference resistor (R18/2) for exhaust gas recirculation

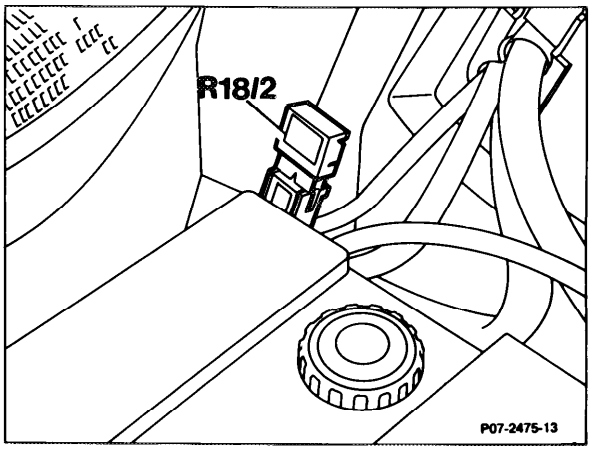
Model 124 in components compartment



Model 126 at right of car Interior next to control unit (N39)



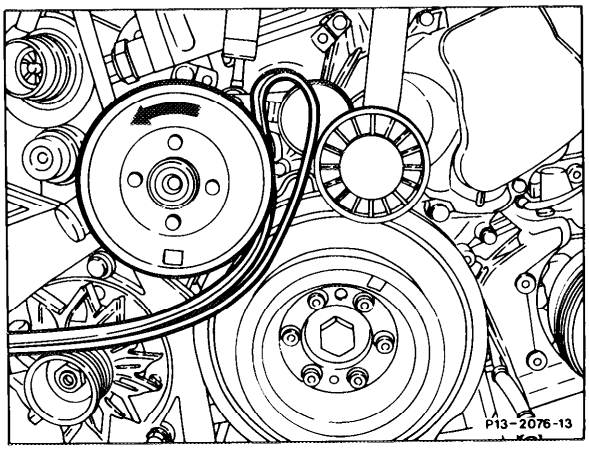
Model 201 in component compartment next to battery

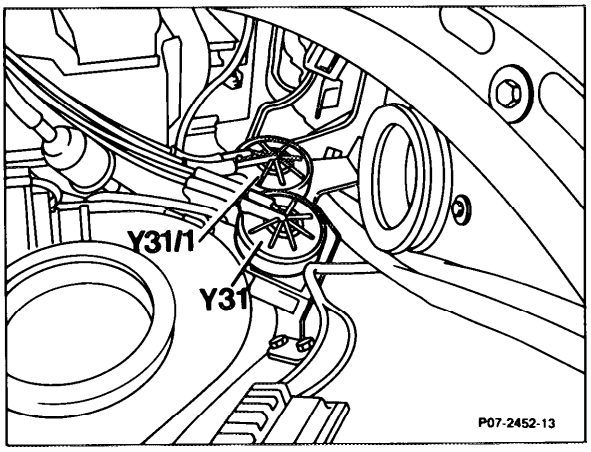


Vacuum transducer (Y31/1, Y31/2 and Y31/3)

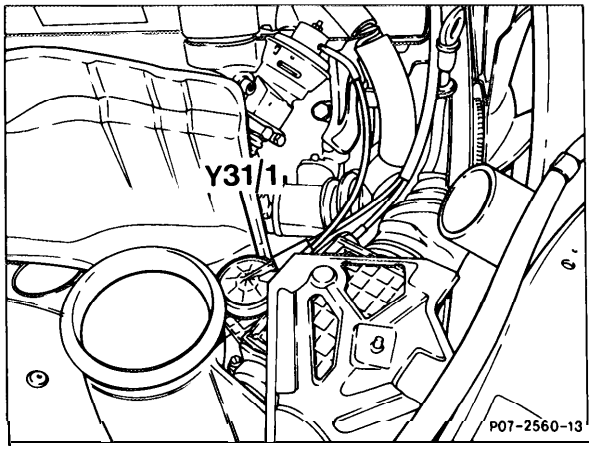
The vacuum transducers are supplied with a control current as an input signal depending on the operating state. The pressure converter then supplies the matching vacuum for the actuators.

Engine 602.962 Model Year 1990
Y31/1 Vacuum transducer - EGR valve
Y31/2 Vacuum transducer - pressure control flap
Y31/3 Vacuum transducer - charge pressure control

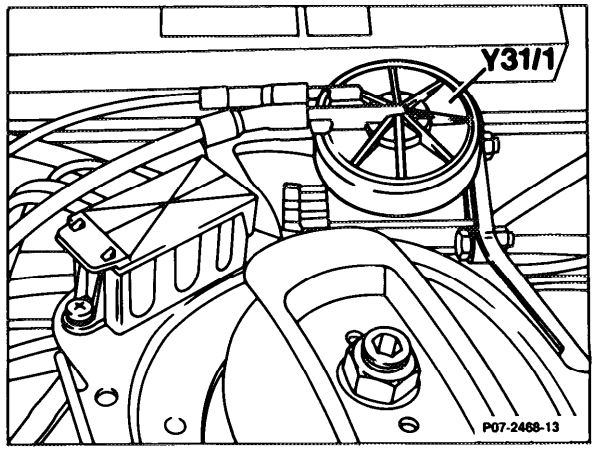




Engine 603.96 in Model 124



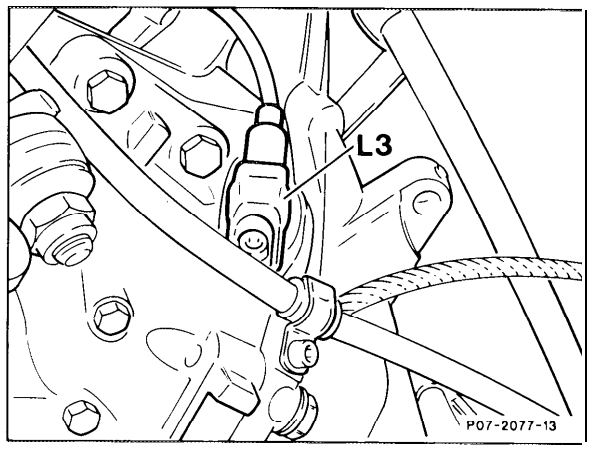
Engine 603.96/97
Y31/1 Vacuum transducer EGR valve in Model 126



Engine 602.96 in Model 201

Engine speed sensor (L3)

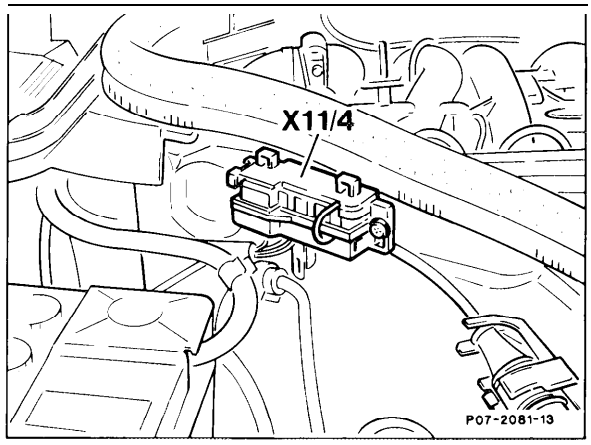
It detects engine speed at the starter ring gear (144 pulses/revolution) and sends it to the control unit in the form of an alternating voltage.



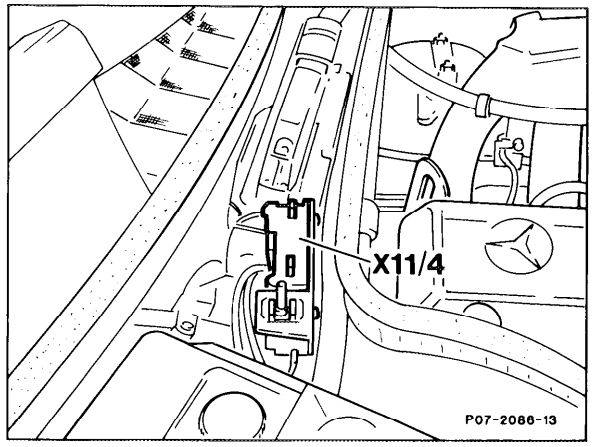
Test connector (XI 1/4)

The pulse display can be tapped by the test connector.

Model 124



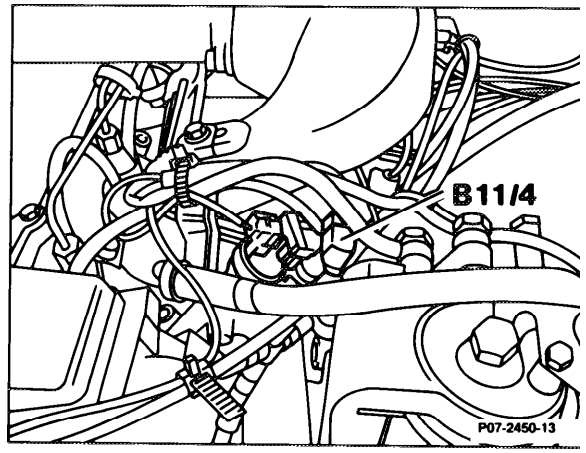
Model 126



Coolant temperature sensor EDS (B11/4)

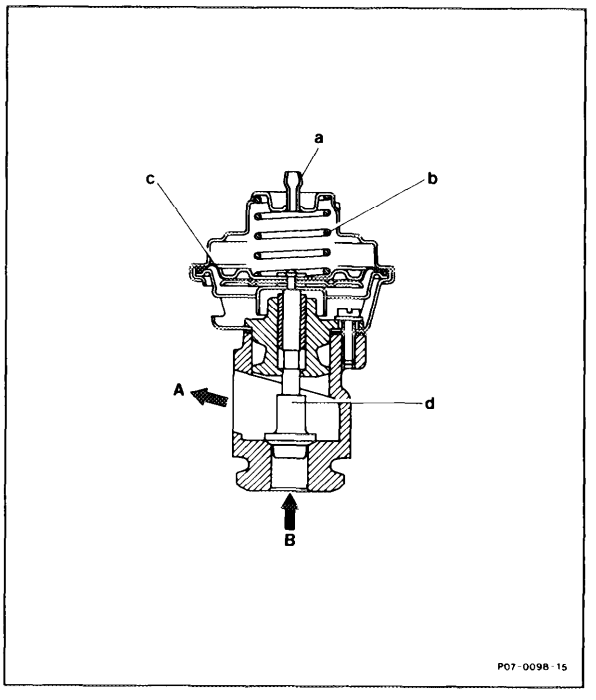
The coolant temperature is detected by the temperature sensor (EDS) (B11/4) and is actuated by the EDS control unit.

The resistance of a coolant temperature sensor EDS varies as a function of coolant temperature.



EGR valve

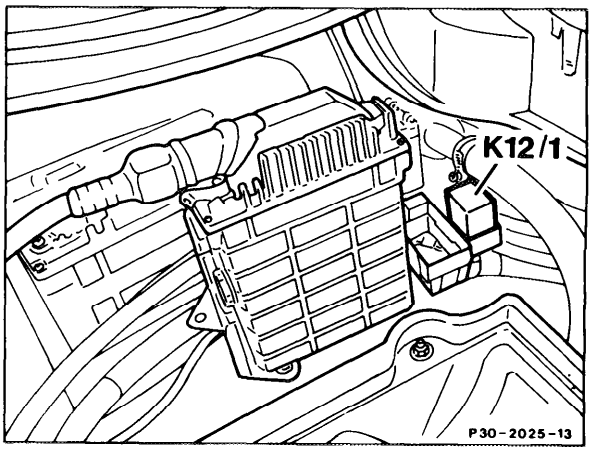
The EGR valve is bolted to the mixing pipe on the side of the cylinder head. It is connected to the exhaust manifold, charge air distribution pipe and a corrugated pipe. The EGR valve is opened by means of a controlled vacuum from the vacuum transducer.



A Exhaust gas to charge air distribution pipe
B Exhaust gas from exhaust manifold
a Vacuum connectron
b Spring
c Diaphragm
d Valve

Cruise control (Tempomat), Model Year 1990

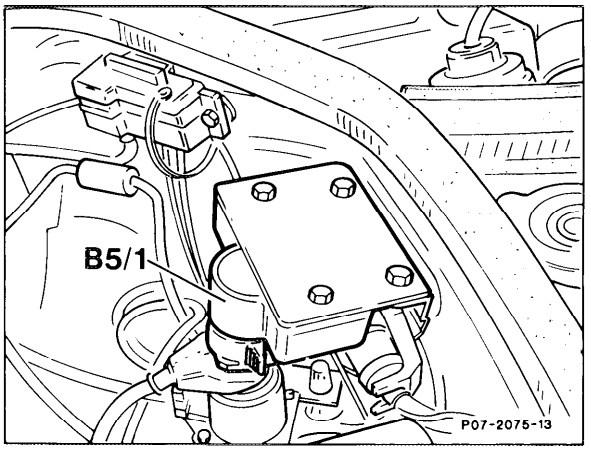
In order not to influence the control of the cruise control in the part load area, the charge pressure is rendered inoperative by the cruise cont./charge pressure relay (K12/1) during cruise control operation.

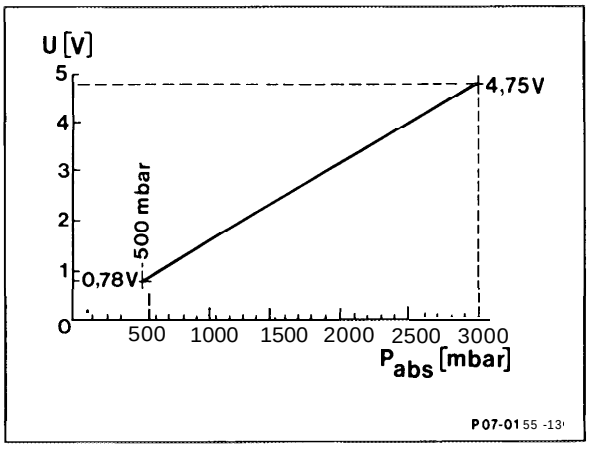


Model 124
K12/1 Cruise control/charge pressure shutoff relay

Model 201
K12/1 Cruise control/charge pressure shutoff relay

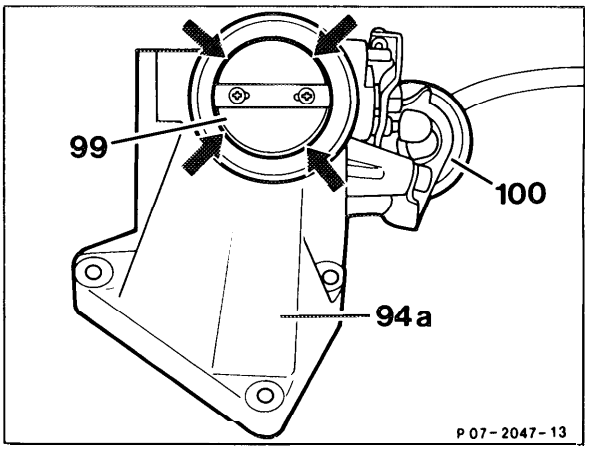
Pressure sensor (B5/1) Engine 602.962
Fitted right behind the bulkhead in the direction of travel. The pressure sensor detects the pressure and converts it into a voltage, which is processed by the EDS control.

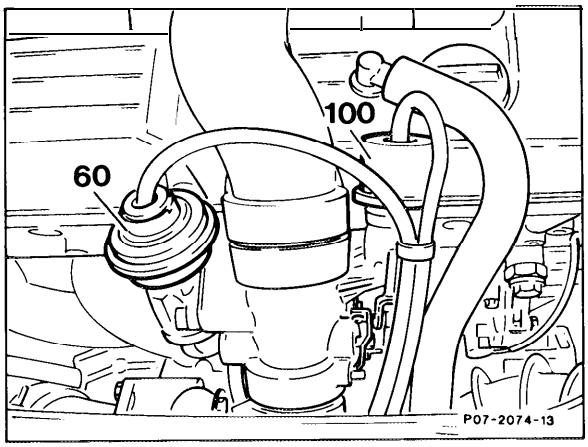




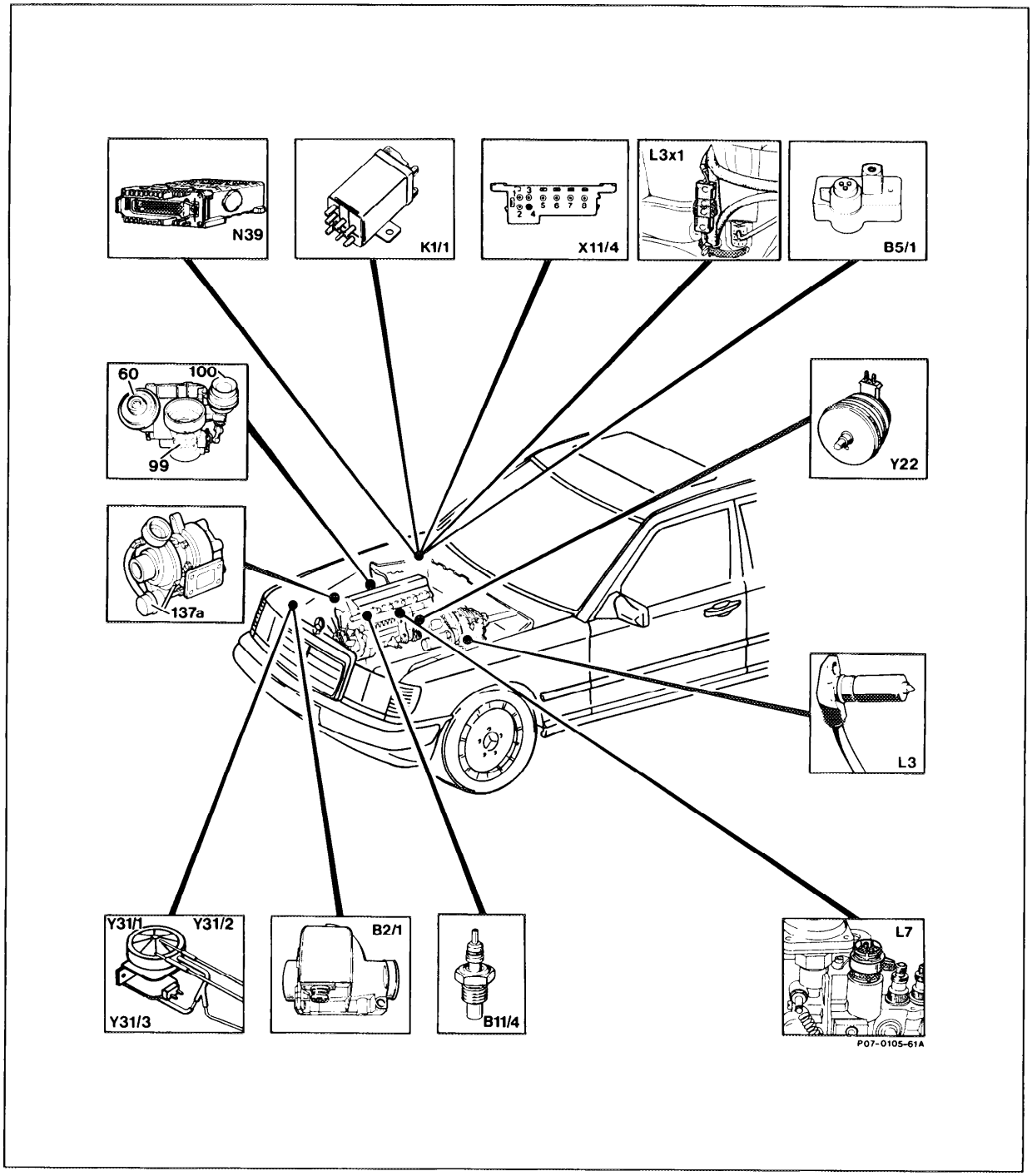
Absolute pressure characteristic (Pabs in mbar) with 5 V voltage supply

Mixture housing (94a) with pressure control flap (99) and vacuum unit (100) (Engine 602.962 only) from Model Year 1990
In order to increase the vacuum in the charge air distribution pipe, a pneumatically operated pressure control flap is fitted to the mixture housing. The pressure control flap closes the fresh air port during engine operation with EGR. A minimum opening (arrows) between the pressure control flap and the mixture housing is maintained. The vacuum unit (100) is actuated by the pressure convertor pressure control flap (refer to function diagram).



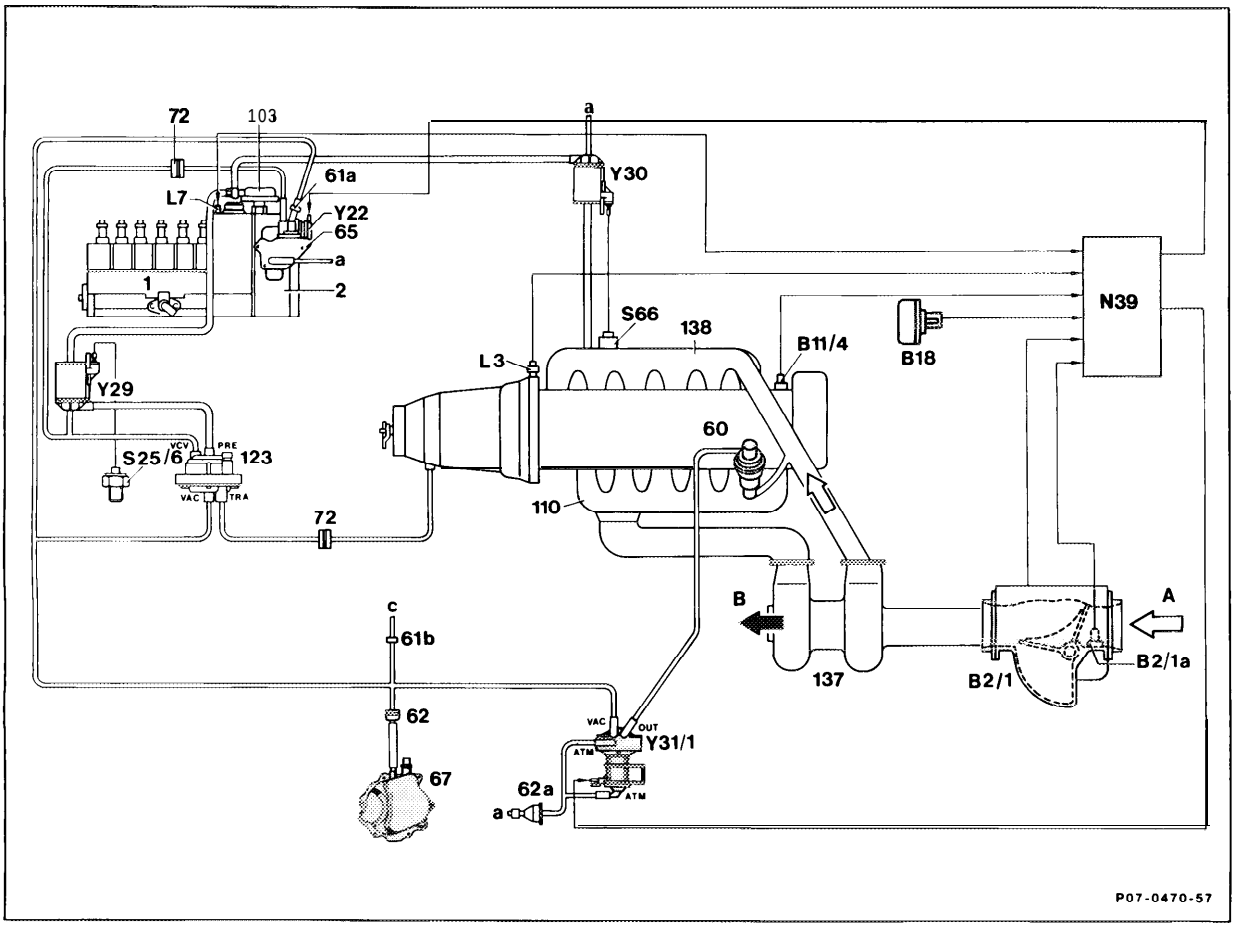


60 EGR valve
100 Vacuum unit



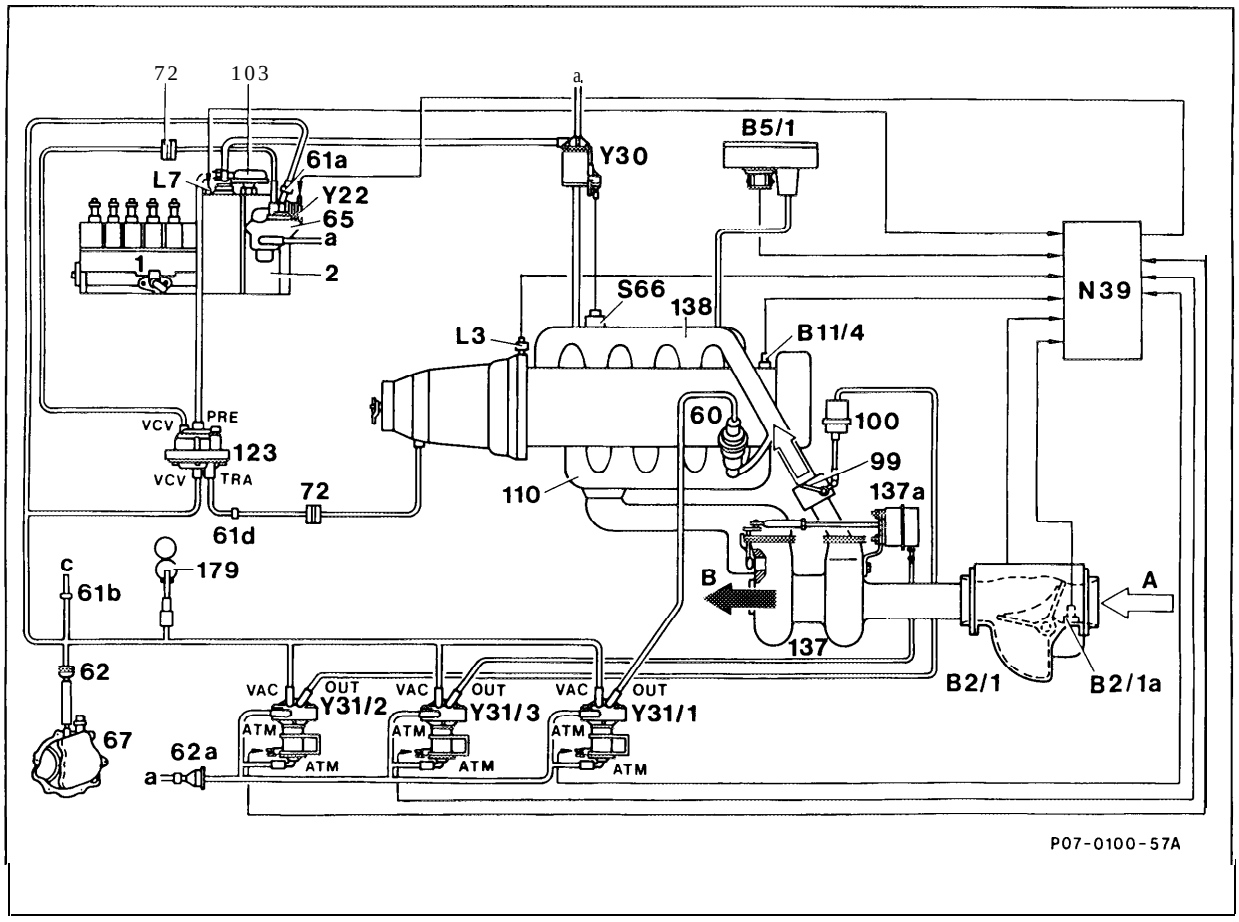
Model Year 1990, Engine 602.962

B2/1	Air flow sensor potentiometer with intake air temperature sensor, EDS
B5/1	Pressure sensor (EDS)
B11/4	Coolant temperature sensor
K1/1	Over-voltage protection relay
L3	Engine speed sensor - starter ring gear
L3x1	Plug connector, engine speed sensor - starter ring gear
L7	Control rod travel sensor
x1114	Test connector
Y22	ELR actuator
Y31/1	EGR vacuum transducer
Y31/2	Pressure convertor - pressure control flap
Y31/3	Pressure convertor - charge pressure control
60	EGR valve
99	Pressure control flap in mixture housing
100	Vacuum unit, pressure control flap
137a	Vacuum unit, charge pressure control **valve**



Engine 603.960 in Model 126, Model Year 1986 Federal
Engine 602.961 in Model 201, Model Year 1987 Federal

1	Injection pump
2	Governor
60	EGR valve
61a	Restriction, blue
61b	Restriction, orange
62	Filter
62a	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
103	ALDA unit
110	Exhaust manifold
123	Vacuum amplifier
137	Exhaust gas turbocharger
138	Charge air distribution pipe
B2/1	Air flow sensor potentiometer
B2/1a	Intake air temperature sensor
B11/4	Coolant temperature sensor
B18	Altitude sensor
L3	Engine speed sensor, starter ring gear
L7	Control rod travel sensor
N39	EDS control unit
S25/6	Temperature switch 50 °C
S66	Switch, engine overload protection
Y22	Actuator
Y29	Switch-over valve, vacuum amplifier
Y30	Switch-over valve, engine overload protection
Y31/1	Vacuum transducer, exhaust gas recirculating valve
a	Fresh air flow to car interior
A	Intake air
B	Exhaust gas
	Pressure and vacuum connections at vacuum transducer or vacuum amplifier
PRE	Charge pressure from ALDA unit
TRA	To vacuum unit of automatic transmission
VAC	Vacuum from vacuum pump
v c v	To vacuum control valve
ATM	Fresh arr flow to car interior
OUT	Exhaust gas recirculation to exhaust gas recirculating valve or recirculating air valve



Engine 602.962, Model Year 1990

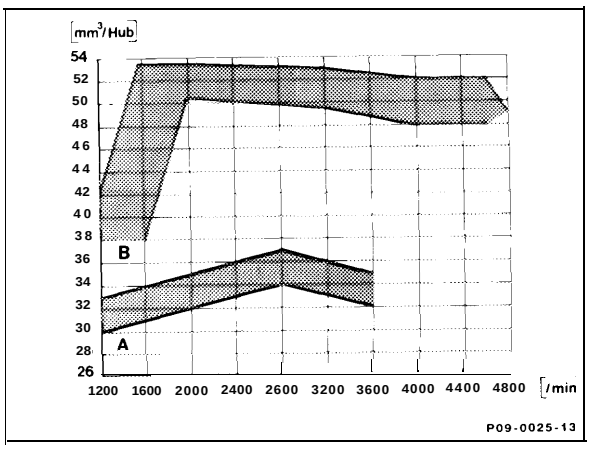
1	Injection pump
2	Governor
60	Exhaust gas recirculating valve
61a	Restriction
61b	Restriction
61d	Connector (without restriction)
62	Filter
62a	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
99	Pressure control flap in mixture housing
100	Vacuum unit, pressure control flap
103	ALDA unit
110	Exhaust manifold
123	Vacuum amplifier
137	Exhaust gas turbocharger
137a	Vacuum unit, charge pressure control valve
138	Charge air distribution pipe
179	Vacuum reservoir
B2/1	Air flow sensor potentiometer with intake air temperature sensor, EDS
B2/1a	Intake air temperature sensor
B5/1	EDS pressure sensor
B11/4	EDS coolant temperature sensor
L3	Engine speed sensor, starter ring gear
L7	Control rod travel sensor
N39	EDS control unit
S66	Switch, engine overload protection
Y22	ELR actuator
Y30	Switch-over valve, engine overload protection
Y31/1	Vacuum transducer, exhaust gas recrrculatrng valve
Y31/2	Vacuum transducer, pressure control flap
Y31/3	Vacuum transducer, charge pressure control
a	Fresh air flow to car interior
c	Other ancillaries
A	Intake air
B	Exhaust air

Pressure and vacuum connections at vacuum transducer or vacuum amplifier

PRE	Charge pressure from ALDA unit
TRA	To vacuum unit of automatic transmission
VAC	Vacuum from vacuum pump
v c v	To vacuum control valve
ATM	Fresh air flow to car interior
OUT	Output from vacuum transducer Y31/1 to EGR valve
OUT	Output from vacuum transducer Y31/2 to vacuum unit of pressure control flap
OUT	Output from vacuum transducer Y31/3 to vacuum unit of charge pressure control valve

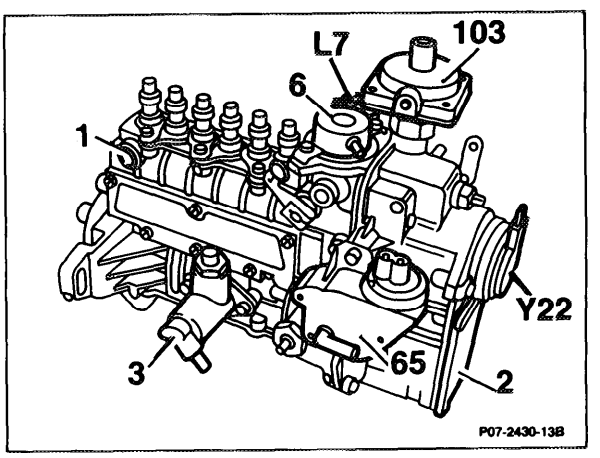
V. Engine overload protection

A pressure switch is fitted in the charge air pipe for overload protection of mechanical parts in the engine. If the charge pressure rises above 1 .1± 0.15 bar gauge pressure, air is admitted to the ALDA unit through the switchover valve and the quantity of fuel is limited to that of a naturally aspirated engine.

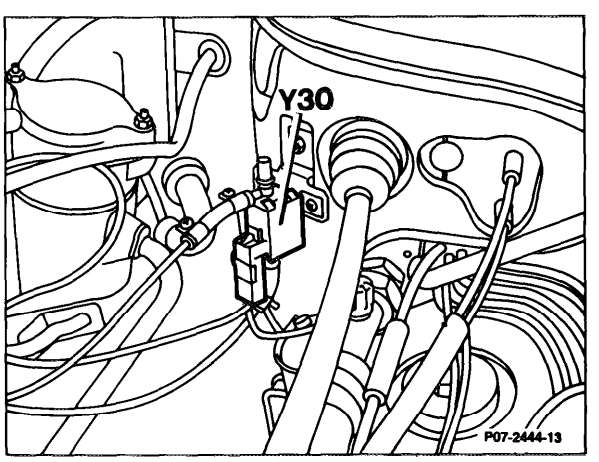


A Full load quantity without charge pressure (P = 1050 mbar)
B Full load quantity with charge pressure

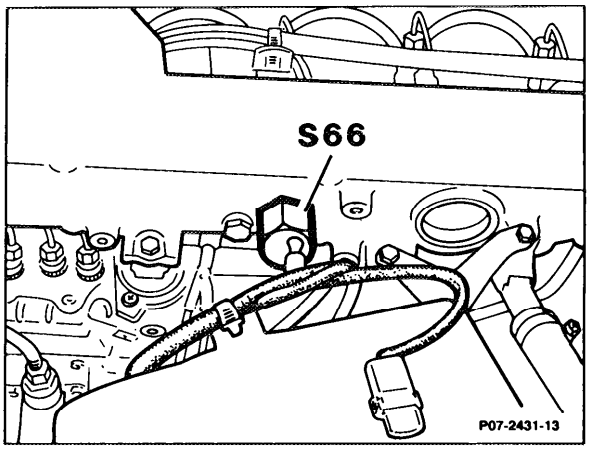
Location of components



	Injection pump
2	Governor
3	Fuel pump
6	Stop unit
103	ALDA unit
Y22	Actuator



Y30 Switchover valve, engine overload protectton

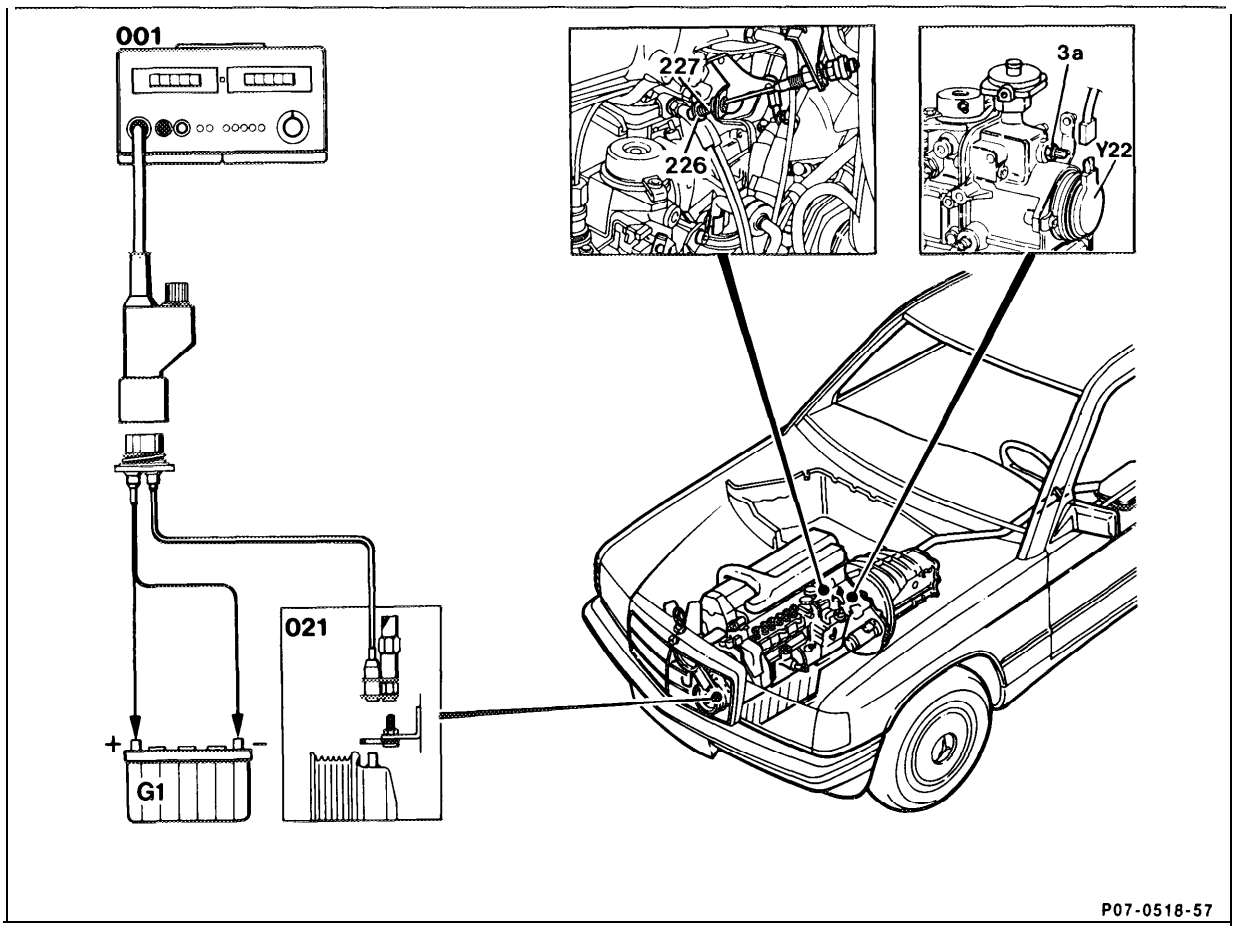


S66 Switch, engine overload protection

W. Handling electronic control units after accident repair

It is necessary to change electronic control units after an accident if at least one of the following conditions is met:

1. The housing is recognizably deformed or damaged.
2. The supporting surface or console is deformed; the outside of the unit exhibits no damage.
3. The plug connector is damaged or corroded by moisture.
4. The functional check or the self-test of the equipment indicates faults.
   When electrical components, e.g. ELR control unit, have been removed for repair work and then used again, these are to be checked in accordance with the existing documents after assembly.



Tester (001) and pulse generator (021)	connect and disconnect.
Accelerator control	examine for ease of operation.
Idle stop on Bowden cable	check, the spring plate (226) must be resting against the compression spring (227) free of tension.
Engine	raise to coolant temperature of approx. 80°C.
2-pin connector on actuator (Y22)	detach, fit on again.
Idle speed	check, adjust. Loosen locking nut (3a) for this step.
Engine running	check. Turn on all ancillary components for this step.

Test and adjustment data

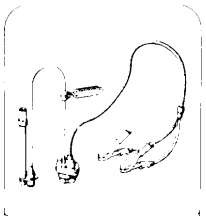
Engine	Electronic idle speed control		Position of resistance trimming plug
	Idle speed rpm **with control**	Idle speed rpm Plug on actuator detached **without control**	
602.96	680 ± 20	620 ± 40	4
603.96/97	630 ± 20	570 ± 40	4

Adjusting idle speed by means of resistance trimming plug

If problems arise regarding idle speed, it is possible to vary idle speed. The positions of the resistance trimming plug are listed in the table opposite.

Position of resistance trimming plug	Engine 602	Engine 603
1	610 ± 20	570 ± 20
2	630 ± 20	590 ± 20
3	650 ± 20	610 ± 20
4 ---	680 ± 20	630 ± 20
5	700 ± 20	650 ± 20
6	720 ± 20	670 ± 20
7	740 ± 20	700 ± 20

Special tool



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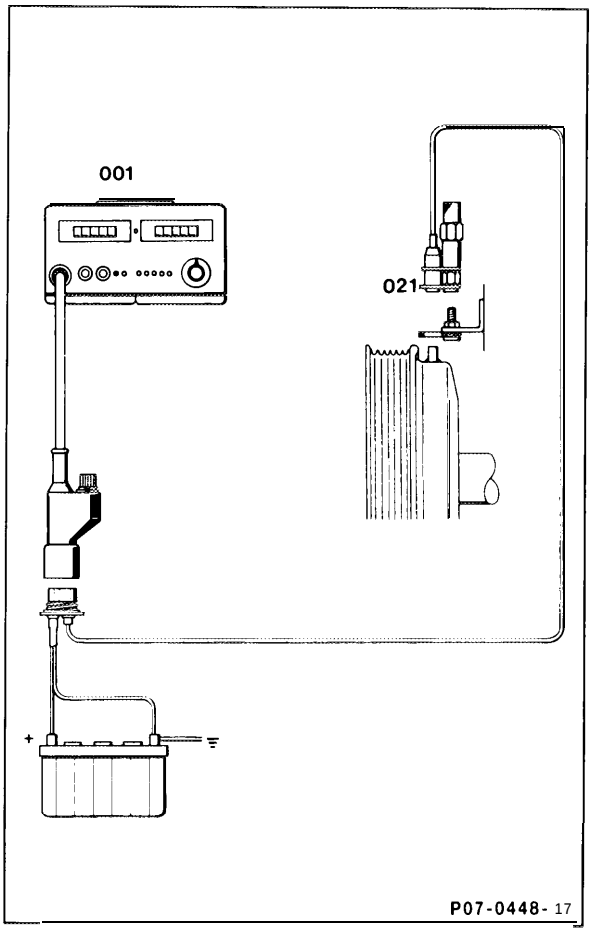
Commercial tools

Multimeter	e.g.	Sun, DMM-5
Digital tester	e.g.	Bosch, MOT 002.01 Sun, DIT 9000

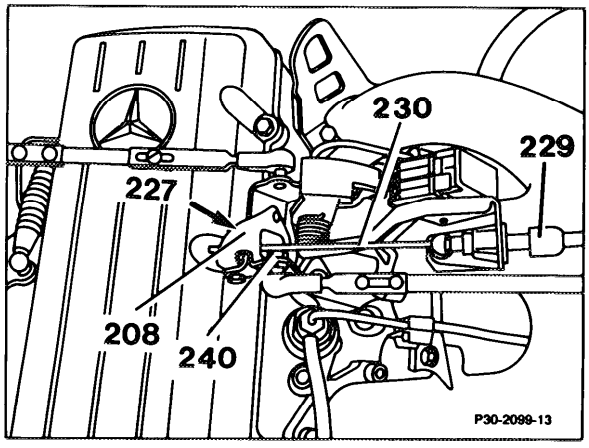
Setting

1 Connect the digital tester (001) and the pulse generator (021).

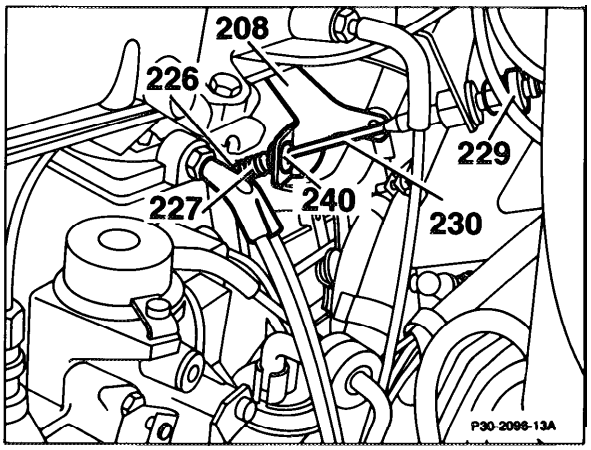
2 Examine accelerator control for ease of movement and condition.



Checking idle stop:
For this step, the spring plate (226) of the Bowden cable (230) must be resting against the compression spring (227), free of tension.



Engine 602.96

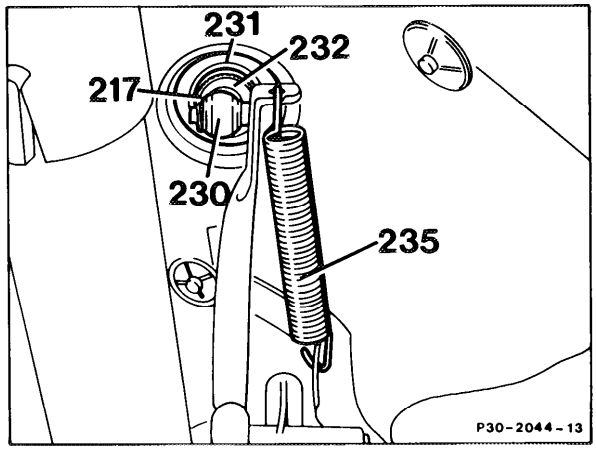


Engine 603.96

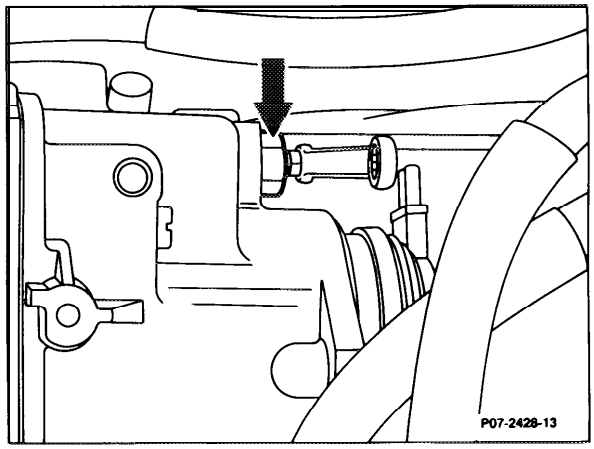
Set Bowden cable (230) with the adjusting nut (232) from the car interior, if necessary.

3 Raise engine to coolant temperature of approx 80 ° **C.**

4 Detach 2-pin connector at actuator.



5 Set idle speed. Loosen locking nut (arrow) for this step.

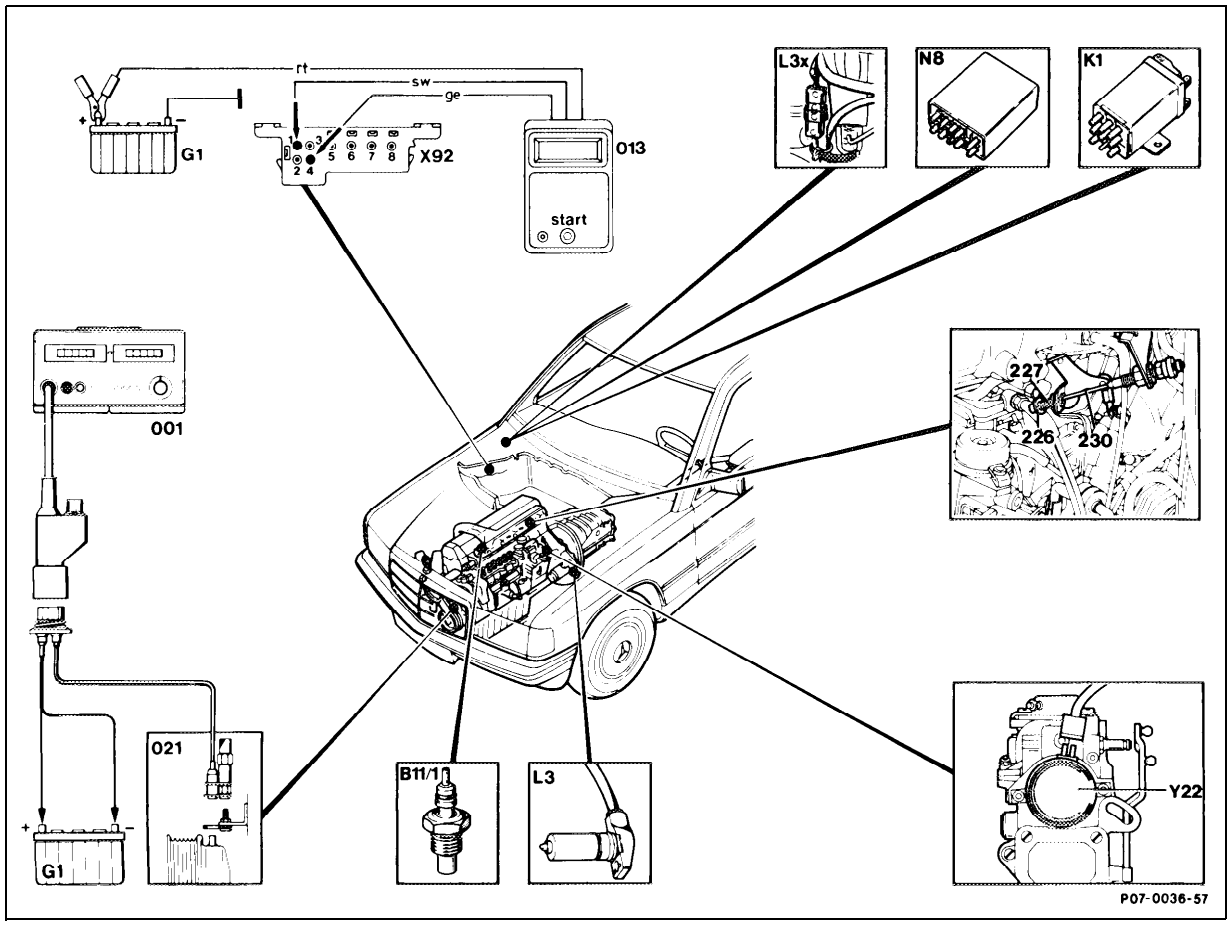


Specifications:

Engine	Idle speed in rpm **with control**	Idle speed in rpm **without control** Plug on actuator detached
602.96	680 ± 20	620 ± 40
603.96197	630 ± 20	570 ± 40

6 Turn on all ancilliary components and check for smooth engine running.

07.1-105 Testing electronic Idle speed control with test connector (X92 and XI 1/4) - Turbodiesel



Digital tester (001) and pulse generator (021)	connect.
Pulse counter (013)	connect to battery (G1) and to test connector (X92).
Accelerator control	check for ease of movement.
idle stop at Bowden cable (230)	check, the spring plate (226) must be resting against the compression spring (227) free of tension.
Fuse of over-voltage protection	check.
Engine	raise to coolant temperature of approx. 80°C.
Engine	run at idle speed.
Start button of pulse counter (013)	operate for 2 to 4 seconds
Display	read and note.
Start button	press again, no new display appears if no further fault in system.

Number of pulses indicates whether and which component is faulty, or whether components in the control circuit are defective.

Assignment (X92)

Jack 1 ground
Jack 2 TD signal

Jack 4 pulse output, EDS control unit (N39)

Pulse readout	Component/faulty circuit
1	all functions "in order"
2	engine speed signal "fault"
3	coolant temperature "fault"
6	ELR control loop "fault"

Only short-circuit faults are detected with control units designation "R01". Control units with designation "R02" also detect interrupts. Production breakdate: control unit with "R02", May 1988.

Pulse readout "2"

Engine speed sensor (L3) to connector (L3x) . . . test, resistance 0.4–2.5 kΩ
engine idle voltage > 4 V ~.

Pulse readout "3"

Coolant temperature sensor (B1 1 /1) . . . . . test, specified value + 20 °C 2.2-2.8 kΩ

Pulse readout "6"

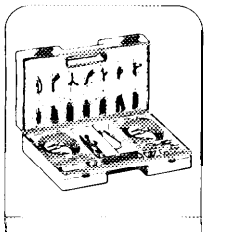
2-pin connector of ELW actuator (Y22) detach
(for at least 3 s) and fit on again. . . . . Engine speed increases briefly.

Test idle speed, adjust if necessary.

Test and adiustment values

Engine	Idle speed in rpm **with control**	Idle speed in rpm **without control** Plug on actuator detached
602.96	680 ± 20	620 ± 40
603.96197	630 ± 20	570 ± 40

Special tools



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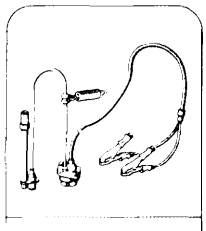

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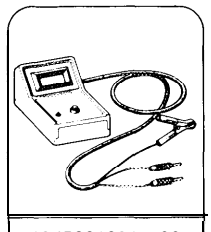

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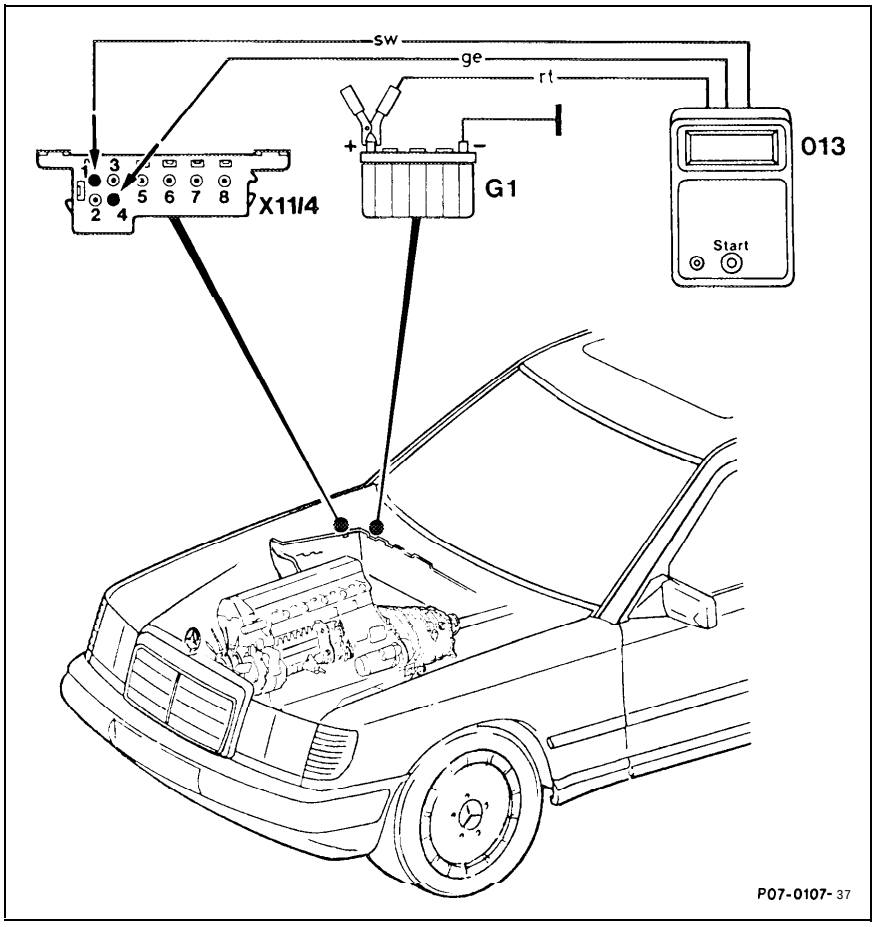
Commercial tools

Multimeter	e.g.	Sun, DMM-5
Digital tester	e.g.	Bosch, MOT 002.02 Sun, DIT 9000

Connection diagram
Connect digital tester and pulse generator.

Connect pulse counter (013) to battery (G1) and test connector (Xl 1/4).



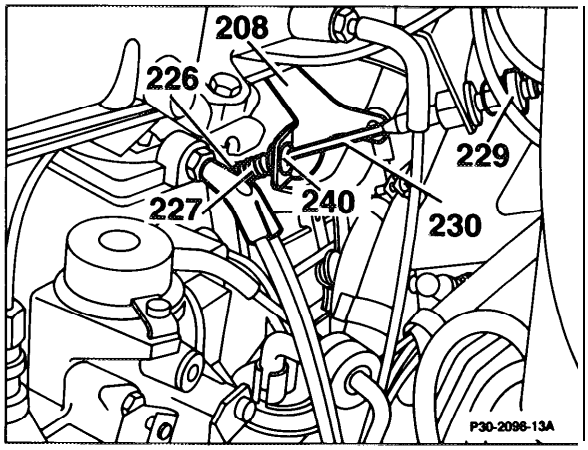
Note

The U-batt LED in display panel must light up; if not:

a) Test fuse of pulse counter
b) Test jack 1 of test connector (Xl 1/4) to battery positive (approx. 12 V)
c) Test jack 4 of test connector (Xl 1/4) to battery positive (approx. 12 V).

Check accelerator control for ease of movement.
Check idle stop at Bowden cable (230).

The spring plate (226) of the Bowden cable (230) must be resting against the compression spring (227) free of tension in the idle position.



Test fuse in the over-voltage protection.

Raise engine to coolant temperature of approx. 80°C.
Run engine at idle speed.

Operate start button of pulse counter (013) for between 2 and 4 seconds.
Check readout on the display of the pulse counter (013) and note.
Again press start button for between 2 and 4 seconds. If there is no other fault in the system, no new readout appears.
Rectify noted faults according to test routine or perform test of components.

Note regarding pulse readout
Numbers from 1 to 6 appear on the display panel of the pulse counter.
The number 1 means that no fault has been detected in the electronic system. All the other numbers are assigned to a certain fault circuit.

Testing components

Testing over-voltage protection (K1/1)

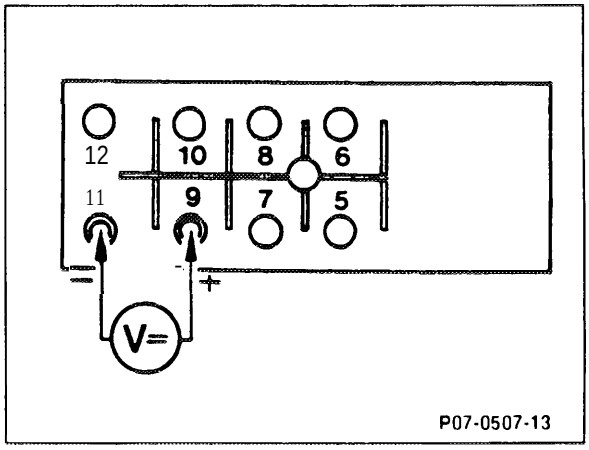
Turn on ignition, detach control unit (N8) and test voltage between the jacks 9 and 11.

Readout: approx. 12 V.

Yes	No

Test fuse at over-voltage protection, actuation according to wiring diagram.

End of test



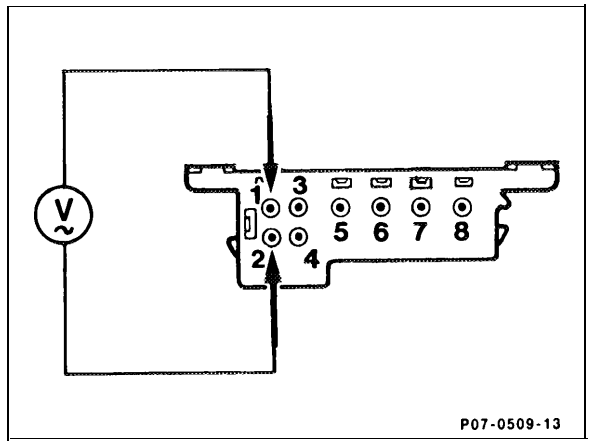
Pulse readout "2"

Testing engine speed signal

Connect multimeter to the terminal 1 and 2 of the test connector (X92 and Xl 1/4). Press button V-. Run engine at idle.

Specification: > 2.8 V~

Yes	No

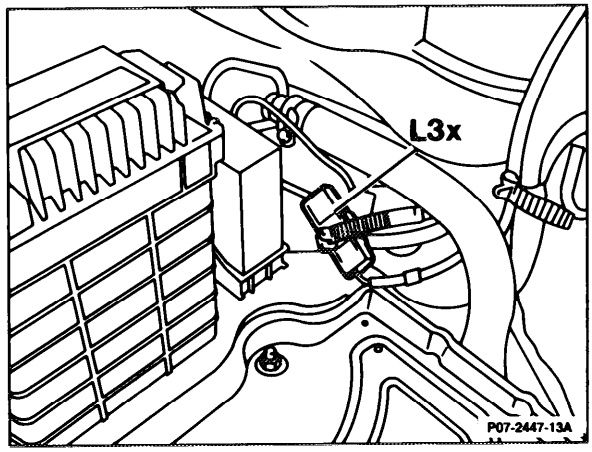


End of test

Engine off. Detach plug connection (L3x). Connect multimeter to engine speed sensor plug connection (L3x) and press button "Ω". Test resistance.

Specification: 0.4–2.5 kΩ

Yes	No



Replace engine speed sensor on starter ring gear (L3).

End of test

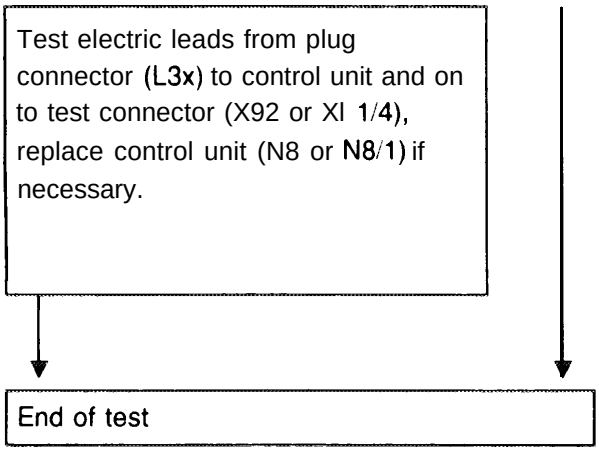
Multimeter connected as above, press button "V~". Run engine at idle.

Readout: > 4 V~

Voltage increases as engine speed rises.

Yes	No

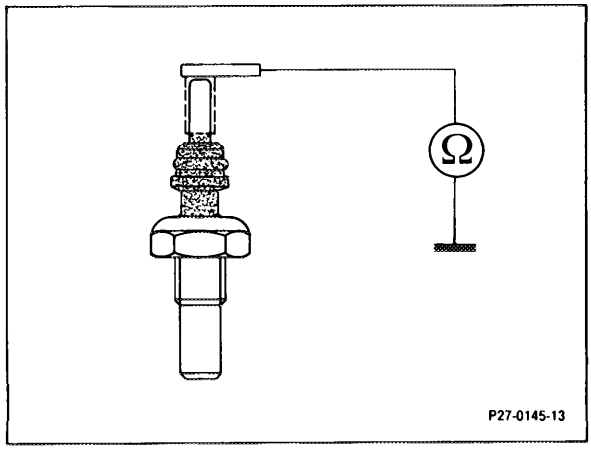
Examine engine speed sensor on starter ring gear (L3) for dirt deposits and metal chips, clean if necessary.


Test electric leads from plug connector (L3x) to control unit and on to test connector (X92 or Xl 1/4), replace control unit (N8 or N8/1) if necessary.
End of test

Pulse read out "3"

Testing coolant temperature sensor (B11/1)
Engine off. Detach plug on temperature sensor and test resistance to ground. Refer to diagram for specified values. Measure resistance at two temperature measuring points.

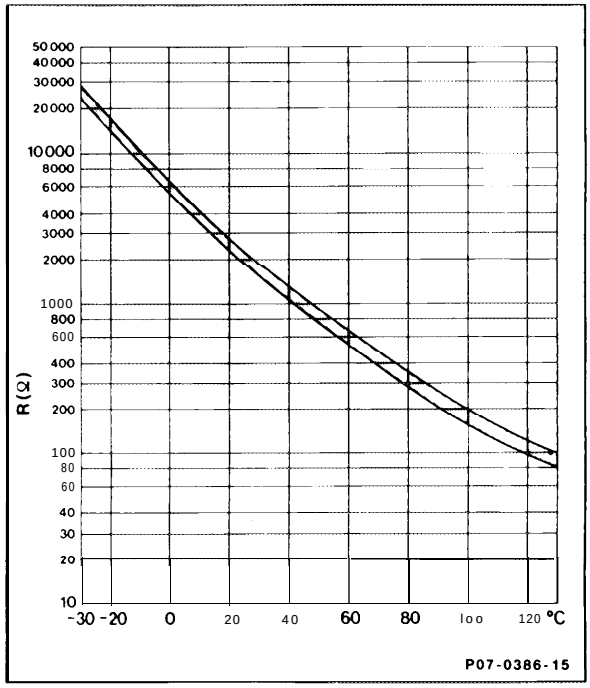
Example:
+ 20 °C = 2.2-2.8 kΩ
+ 80 °C = 290-370 Ω



Yes	No

Replace coolant temperature sensor (B11/1).

End of test

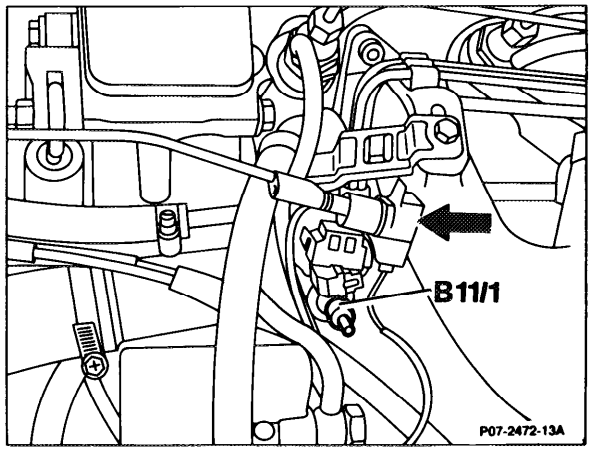


Test voltage at I-pin connector (arrow).
"Ignition" on.

Readout: approx. 5 Volts

Yes	No

Rectify cable interrupt.
Replace control unit (N8).

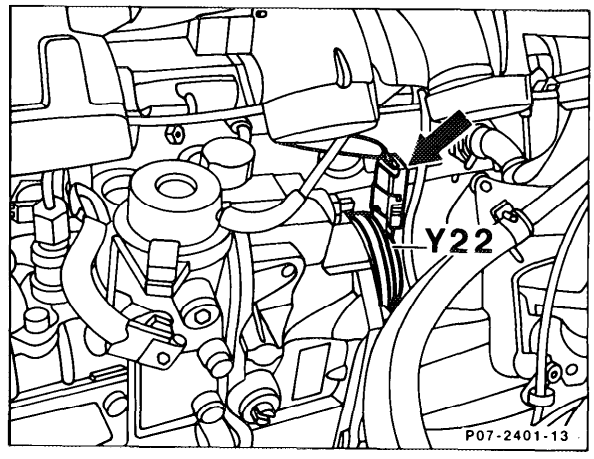


End of test

Pulse readout "6"

Engine at idle. Detach 2-pin connector (arrow) at ELR actuator (Y22) for at least 3 seconds and refit.
Engine speed increases briefly.

Yes	No

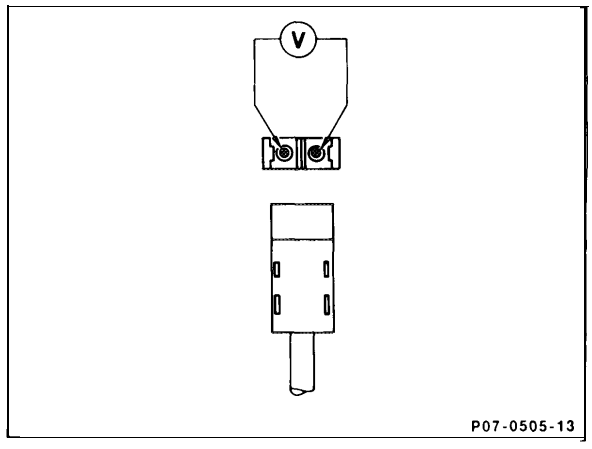


Briefly apply battery voltage (approx. 12 V) to ELR actuator (Y22).

Caution!
The ELR actuator is damaged if battery voltage is applied for longer than 3 sec.

Idle speed increases.

Yes	No



Replace ELR actuator (Y22).

End of test

Engine at idle. Detach 2-pin connector (arrow) from ELR actuator (Y22). Connect multimeter and press button "V = ".

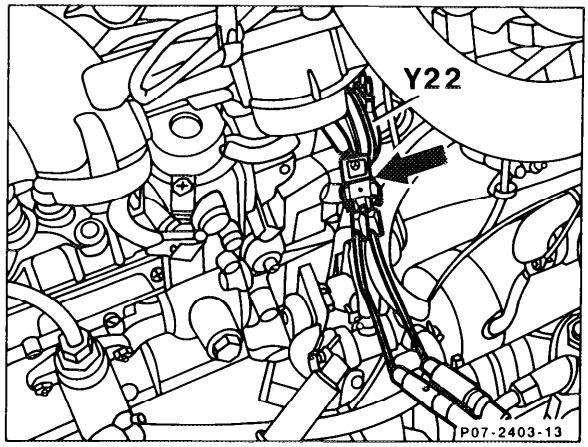
Readout: approx. 12 V

Yes	No

Check cables according to wiring diagram. Test fuse of over-voltage protection relay (K1/1).

If the cables are in order, replace control unit (N8 or N8/1).

End of test



Engine at idle. Detach 2-pin connector (arrow) at the ELW actuators (Y22).

Test idle speed:
Specification:

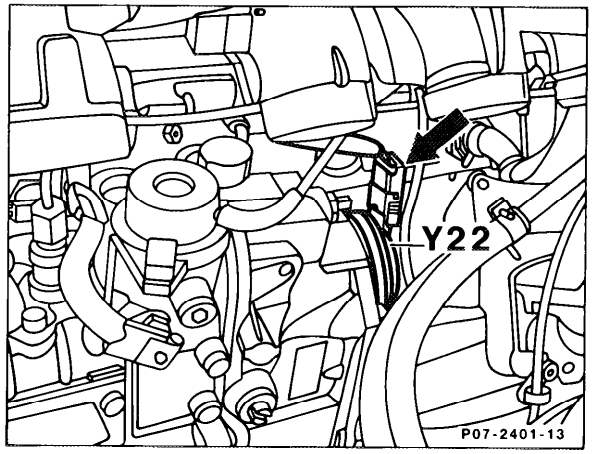
M602	690 ± 40 rpm	manual transmission
	620 ± 40 rpm	automatic transmission
M603	570 ± 40 rpm	

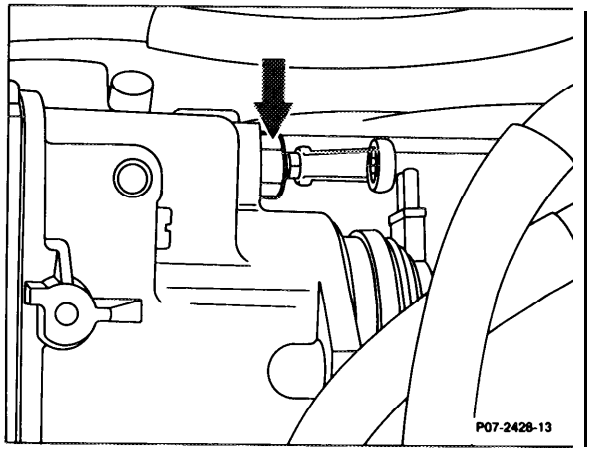
Yes	No

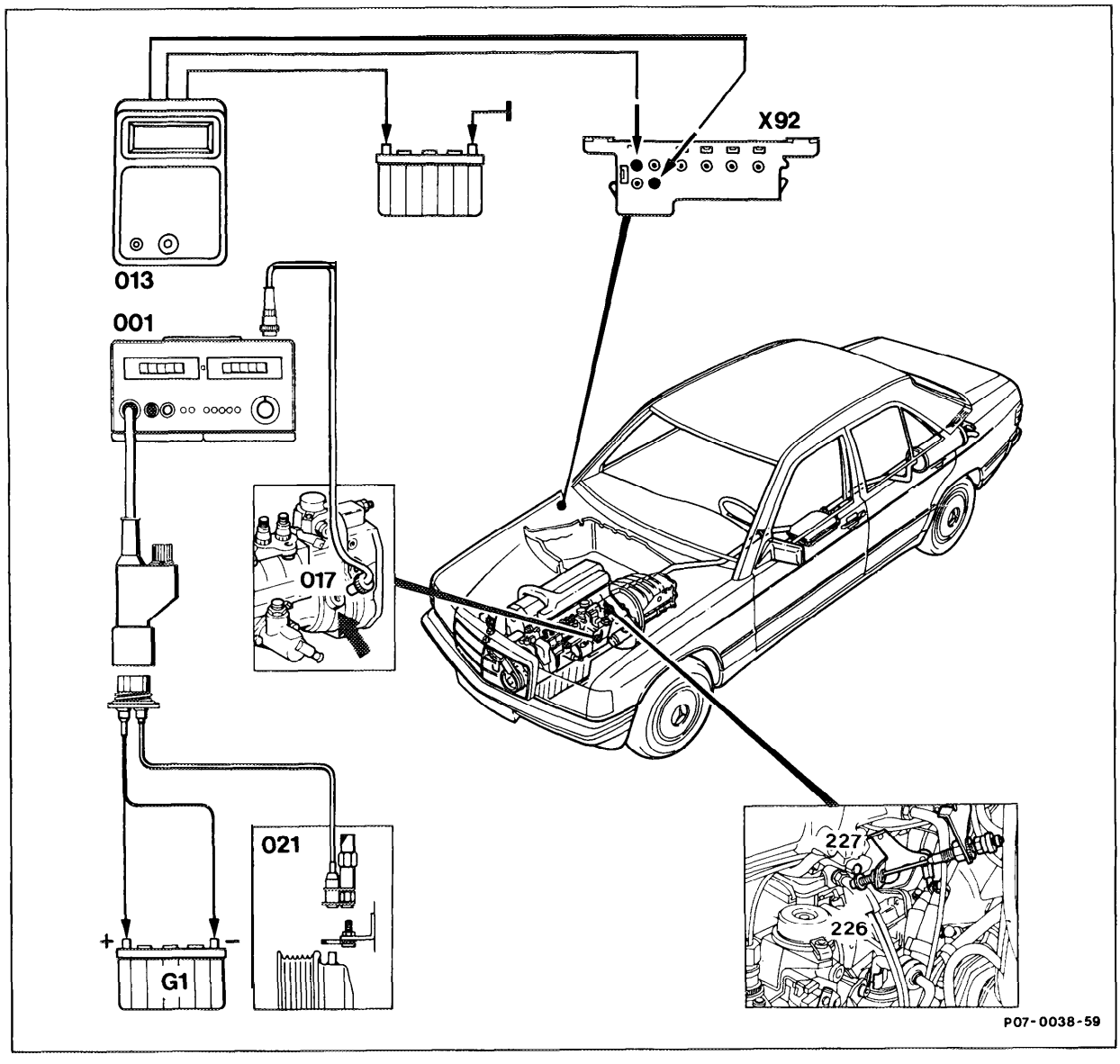
Loosen locking nut and adjust idle speed (arrow).

To the left = higher
To the right = lower

End of test







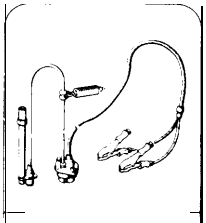
Test sheet	Complete, enter measured values.
Coolant level	check, correct.
Engine oil level	check; pay attention to oil level (visual inspection).
Oil level in automatic transmission	check, correct.
Air filter	remove and install.
Tester (001, 013, 017)	connect.
Pulse generator (021)	connect.

Accelerator control linkage	check ease of movement, condition. Lubricate bearing points, relay levers, ball sockets.
Full throttle stop	check from accelerator pedal; adjust Bowden cable if necessary.
Idle stop	check. Min. specified value 11.5 Volts.
Engine	raise to coolant temperature of approx. 80°C.
Air conditioning or automatic climate control	turn off.
Idle speed	check, adjust if necessary. Detach plug from actuator.
Start of delivery	check. RI specified value 15° ATDC
Max. speed at no-load	check. Specified value: 5150 ± 150 rpm
Timing device	check. Specified value: at 5100 rpm approx. + 3° to + 5° using governor pulse method (RIV).
Electronic diesel system (EDS)	check, with pulse counter (013) (07.1-190).

Test and adjustment data

Engine	Idle speed in rpm with control	Idle speed in rpm without control Plug at actuator disconnected	Start of delivery with digital tester RI specification	Maximum speed at no-load or end of cutoff in rpm	Timing device at no-load or end of cutoff RIV method in degrees
602.96	680 ± 20	620 ± 40	14 ± 0.5" ATDC	5150 ± 150	+ 3° to + 5°
603.96/97	630 ± 20	570 ± 40	15 ± 1° ATDC		

Special tools



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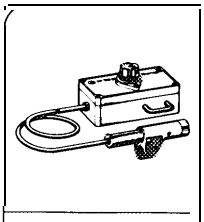

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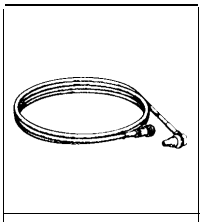

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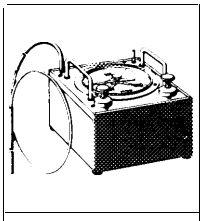


201 589 13 21 00
00 42 80

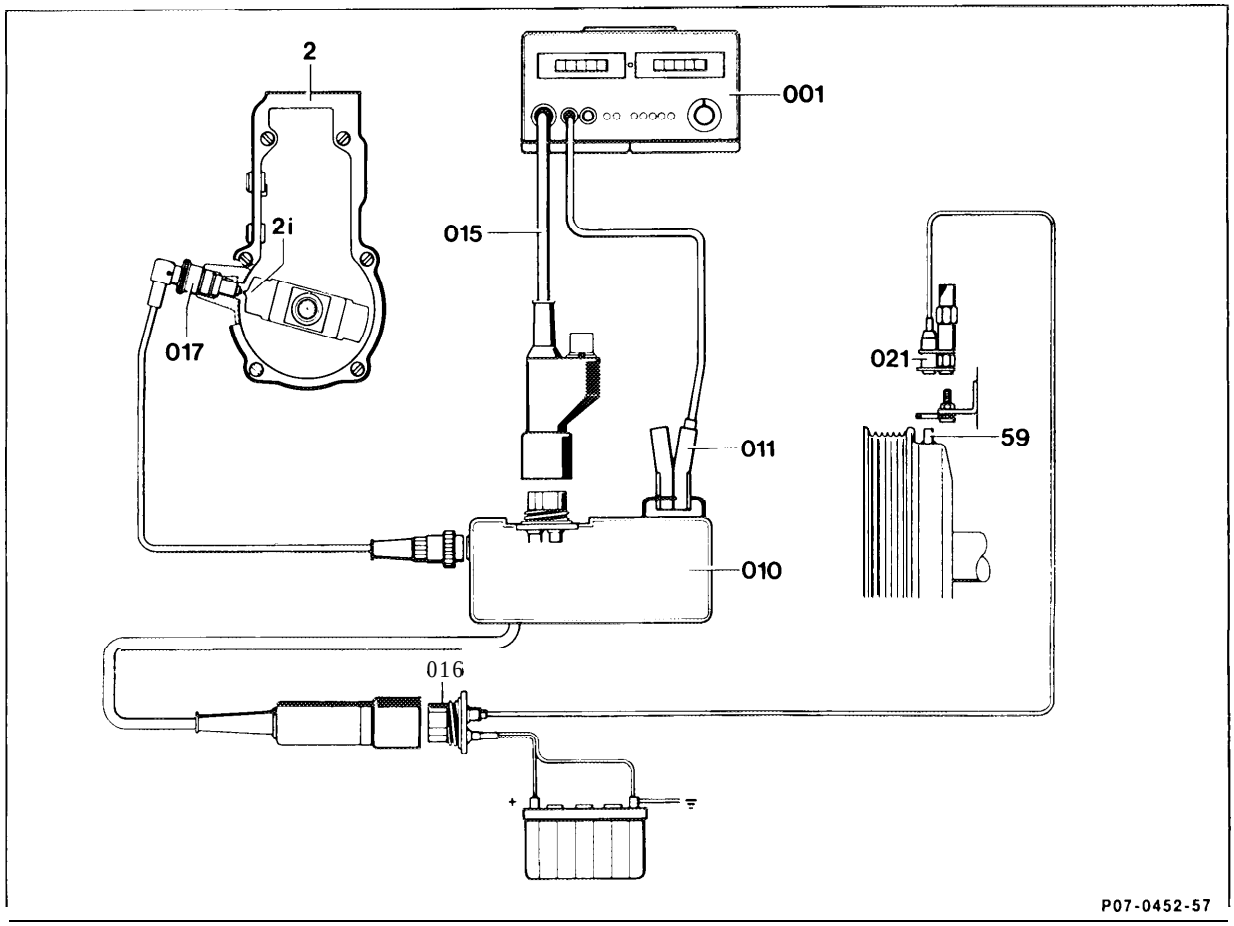
Commercial testers

Used without adapter

Digital testers	e.g. Bosch, ETD 019.02 or MOT 350/500/501 Sun, DIT 9100 AVL, Diesel-Tester 873

Used with adapter

Digital testers	e.g. Bosch, MOT 001.03
Lambda tester (with EDS only)	e.g. Bosch, KDJE-P 600 Hermann, L 115



Connection diagram for existing testers with adapter

001	Digital tester	017	RI generator
010	Adapter	021	TDC pulse generator
011	Trigger clamp	2	Governor
015	Test cable with connector	2i	RI generator pin
016	Diagnostic socket	59	TDC generator pin

Testing, tuning

1 Complete test sheet. Enter test values.

2 Check coolant level, correct.

3 Check engine oil level, paying attention to condition of oil. Visual inspection.

4 Check oil level and automatic transmission.

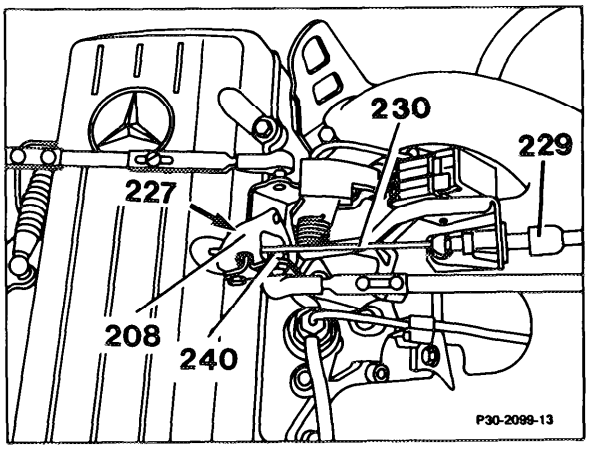
5 Connect tester (013, 001, 017) according to connection diagram.

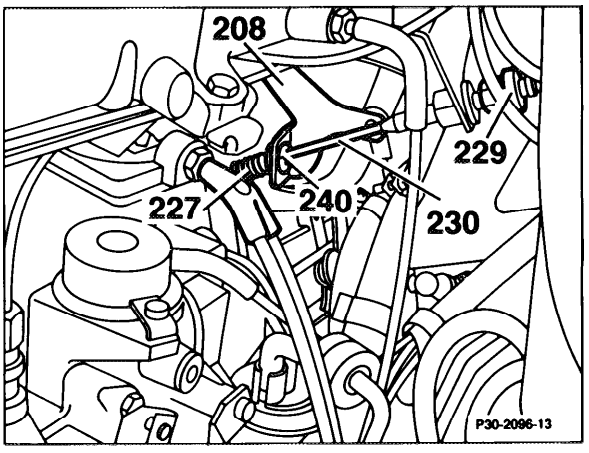
6 Connect pulse generator (021).

7 Remove and install air filter element.

8 Check accelerator control for ease of movement and condition. Lubricate bearing points, relay levers, ball sockets.

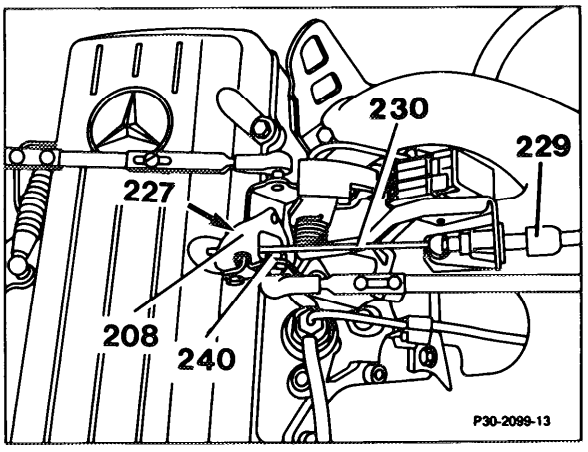
9 Check full throttle stop from accelerator pedal; adjust at adjusting screw (229) if necessary.



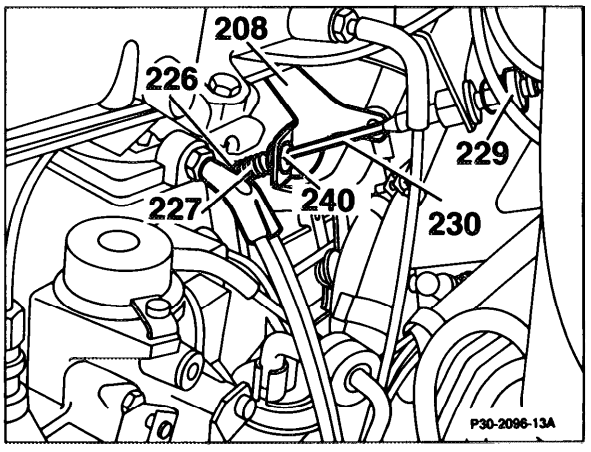


Engrne 603.96

10 Check idle stop.
The spring plate (226) of the Bowden cable (230) must be contacting the compression spring (227).

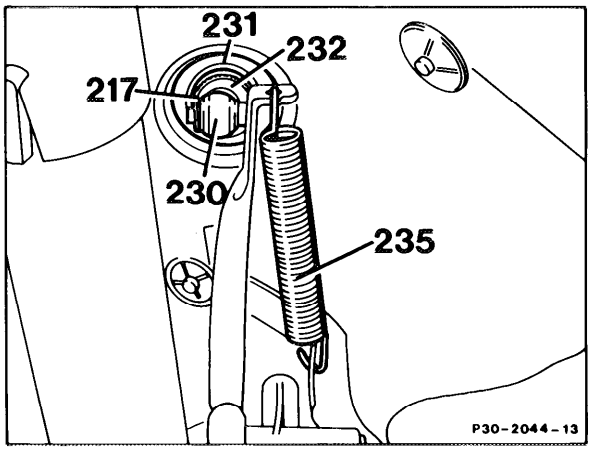


Engine 602.96



Engine 603.96

Set Bowden cable (230) with adjusting nut (232) from the car interior, if necessary.

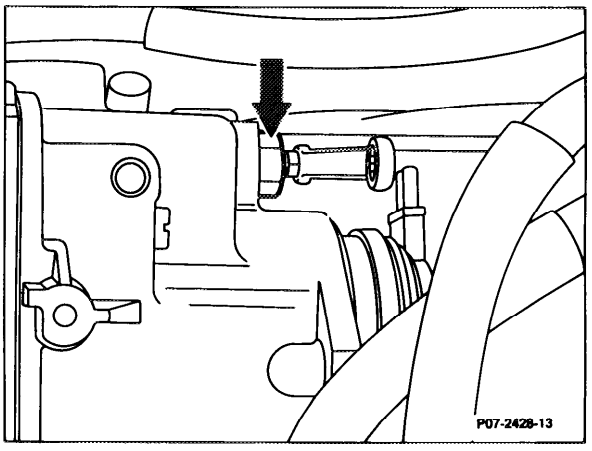


11 Test voltage at the battery.
Specification: at least 11.5 V.

12 Raise engine to coolant temperature of approx. 80° C.

13 Turn off air-conditioning or automatic climate control.

14 Test idle speed.
Detach to 2-pin connector on actuator. Set idle speed. Loosen locking nut (arrow) for this step.



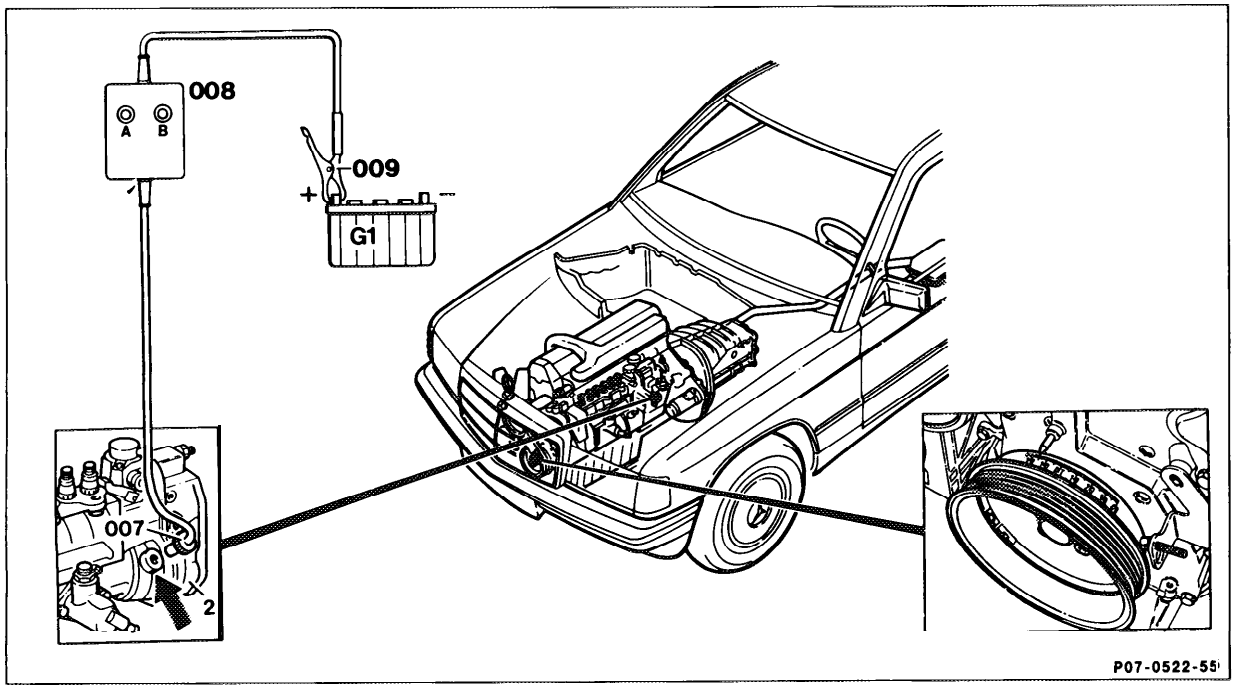
Engine	Idle speed in rpm **with control**	Idle speed in rpm **without control** Plug on actuator disconnected
602.96	680 ± 20	620 ± 40
603.96197	630 ± 20	**570 ± 40**

Read off start of delivery
RI specification 15 ± 1 ° ATDC.

15 Test “maximum speed” at no-load.
Specification: 5150 rpm ± 150

16 Test timing device at no-load.
Specification: at approx. 5100 rpm
+ 3 to + 5° using RIV method.

17 Test electronic diesel system.
(07.1-190).



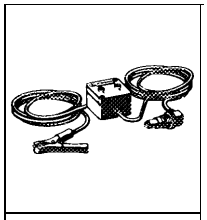
Screw plug (arrow) on governor housing (2)	unscrew, tightening torque 30 - 35 Nm.
Position sensor (007)	install.
Battery terminal (009)	connect to B +.
Crankshaft, crank by hand until	lamps “A” and "B" on indicating instrument (008) light up simultaneously; take reading on scale. Adjust the start of delivery if necessary (07.14 16) RI value (indirect start of delivery).

Test and adjustment data

Engine	Start of delivery (governor pulse) test value, ° ATDC
602.96	15 ± 1
603.96	15 ± 1
602.962 From 09/89	14 ± 0.5 [1])
603.970 From 09/89	14 ± 0.5 [1])

[1]) Adjust once 15,000 mi; adjustment value 14.5° ATDC

Special tools



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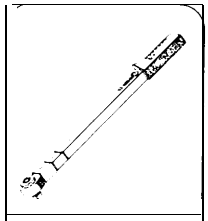
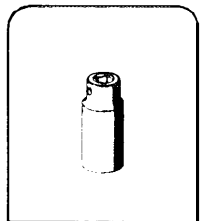
07



001 589 66 21 00
00

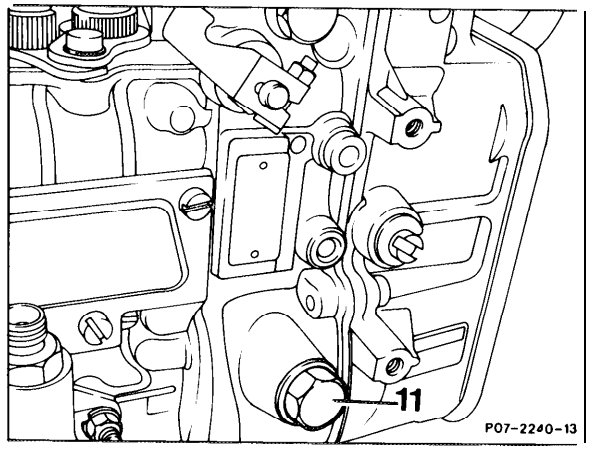


001 589 65 09 00

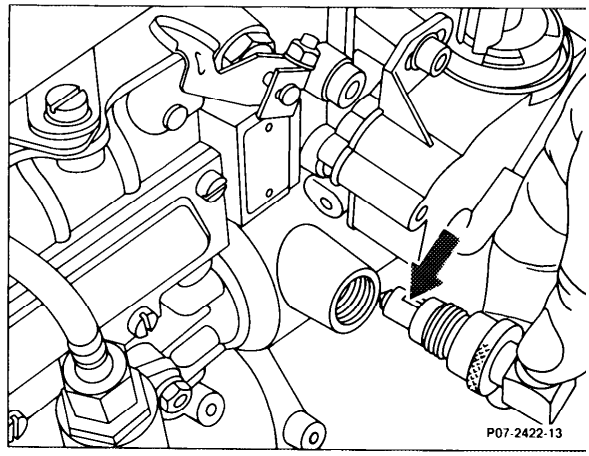
Test

1 Remove plug (11).

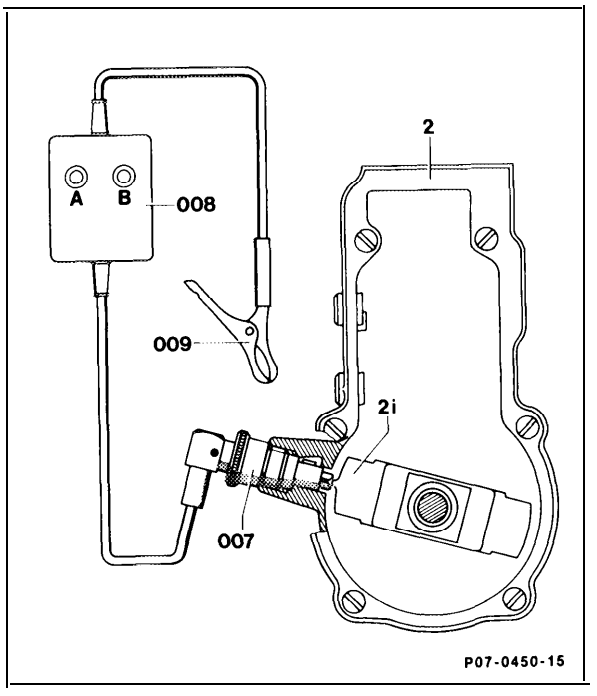
Caution!
Collect leaking oil.



2 Install position sensor into governor housing, ensuring that the guide pin of the position sensor (arrow) is facing upwards. Tighten union nut by hand.



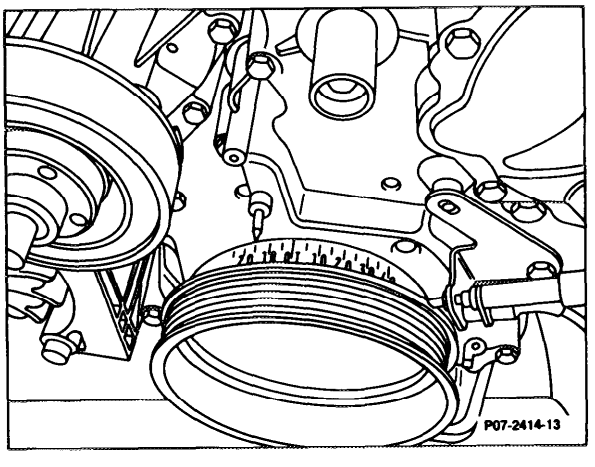
3 Connect position sensor as shown in connection diagram.



007 Position sensor
008 Indicating instrument
009 Battery terminal (battery positive)
2 Governor
2i Flyweight (RI generator pin)

4 Use special tool to turn crankshaft by hand (in direction of rotation only) until lamp "B" lights up. Turn on carefully until **both** lamps "A + B" light up. In this position take reading of RI value (indirect start of delivery) on the scale.

If only lamp "A" lights up, repeat the test.



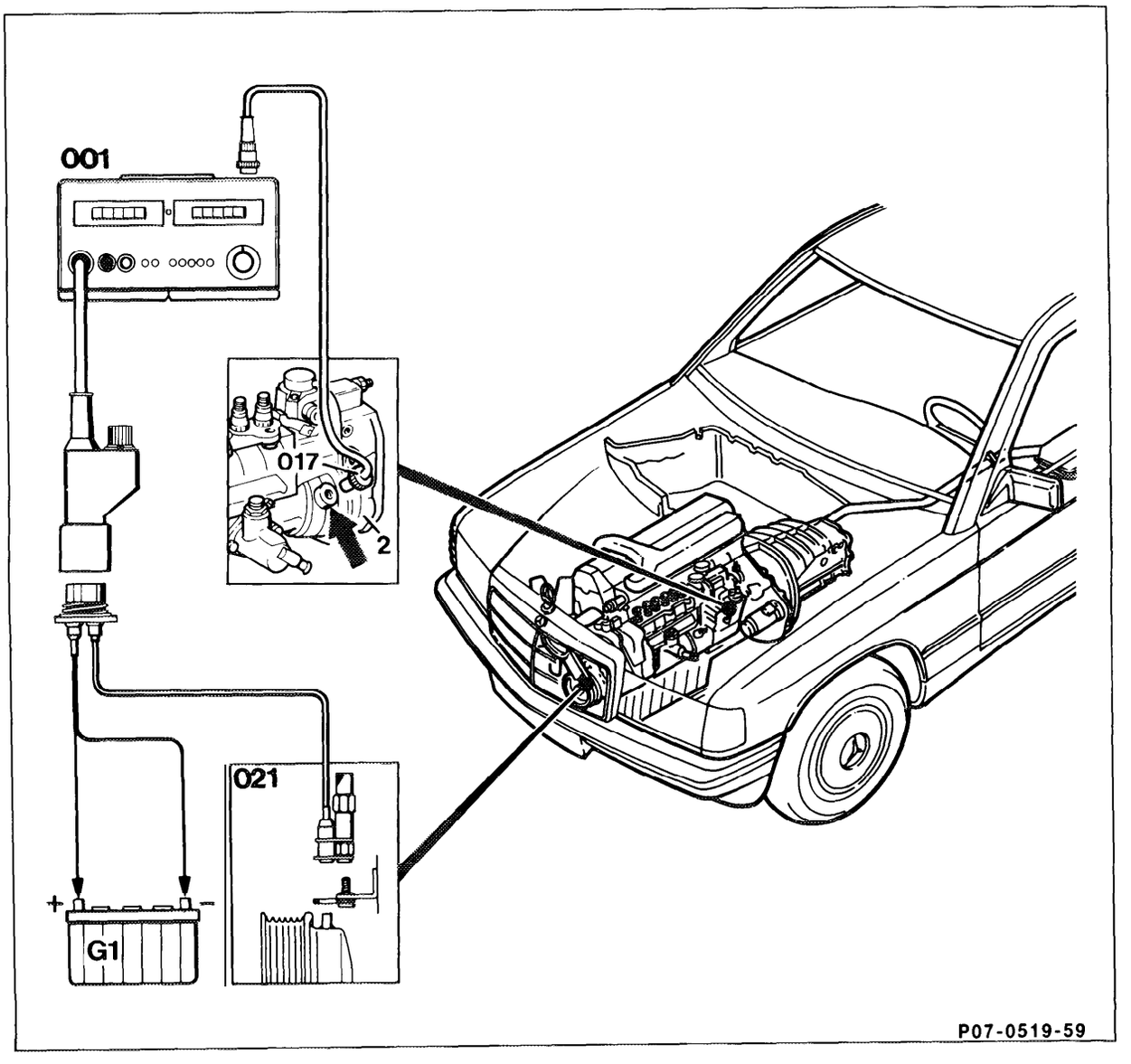
5 Remove position sensor.

6 Install plug.
Tightening torque 30-35 Nm.

7 Perform leak tightness inspection with engine running.

8 Check oil level, correct if necessary.

07.1-l 12 Testing start of delivery - digital tester (RIV method) - Turbodiesel



Screw plug (arrow) on governor housing (2)	unscrew, tightening torque 30 - 35 Nm.
Tester (001, 017, 021)	connect.
Engine, run at idle	read off RI value, adjust start of delivery if necessary (07.14 16 or 07.1-l 17).

Test and adjustment values

Engine	Start of delivery (governor pulse) test value, °ATDC
602.96	15 ± 1
603.96	15 ± 1
602.962 From 09/89	14 ± 0.5 [1])
603.970 From 09/89	14 ± 0.5 [1])

[1]) Adjustment once at 15,000 mi; adjustment value 14.5° ATDC

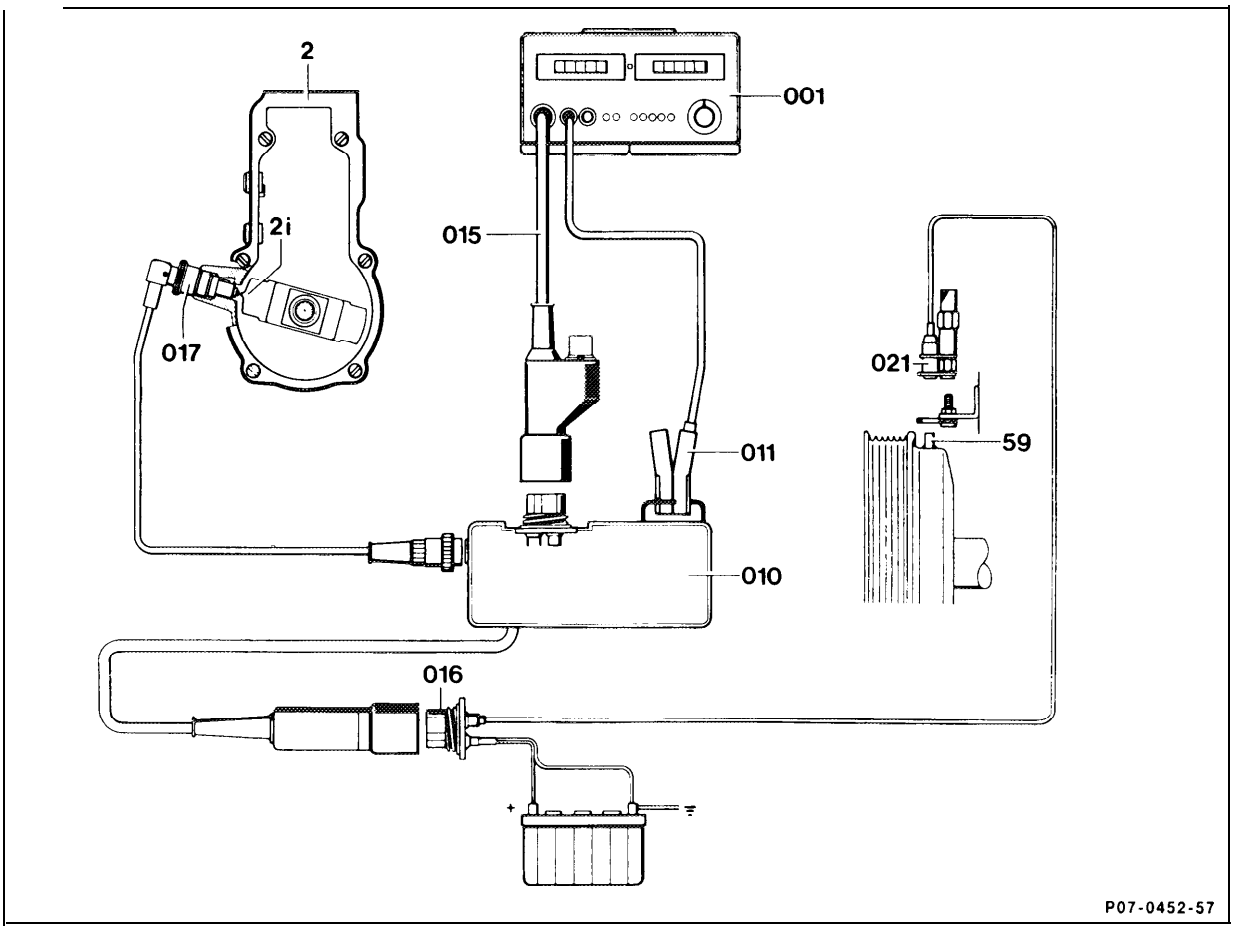
Conventional tools

Used without adapter

Digital testers	e.g. Bosch, ETD 019.002 Sun, DIT 9100 AVL, Diesel-Tester 873

Used with adapter

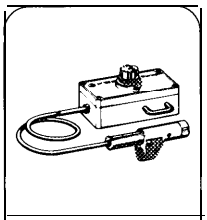
Digital testers	e.g. Bosch, MOT 001.03



Connection diagram for existing testers with adapter

001	Digital tester	017	RI generator
010	Adapter	021	TDC pulse generator
011	Trigger clamp	2	Governor
015	Test cable with connector	2i	RI generator pin
016	Diagnostic socket	59	TDC generator pin

Special tools



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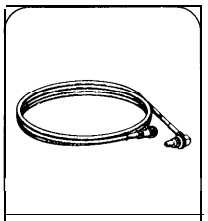

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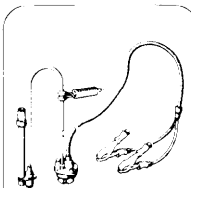
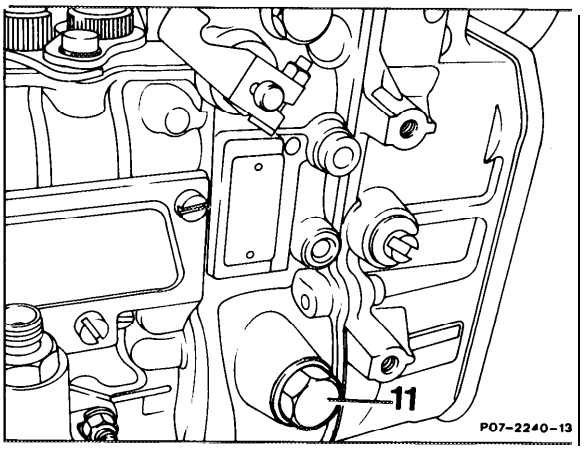
07 J



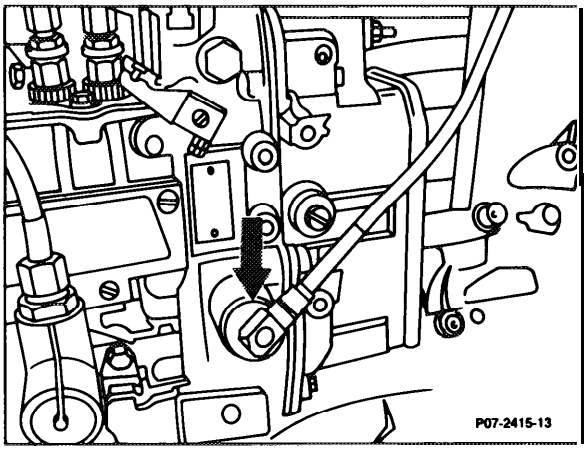
603 589 00 21 00

07

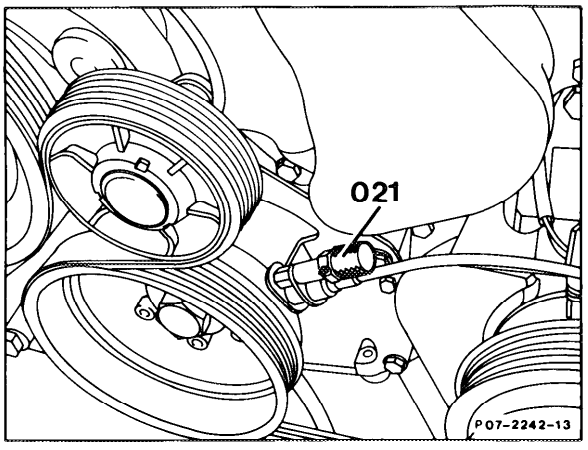
1 Unscrew plug (11) on the governor housing.



2 Thread in RI generator (017, arrow) at governor (injection pump).



3 Screw in TDC pulse generator (021) at bracket (engine).



4 Connect the digital tester as shown in the connection diagram.

5 With engine at idle, take reading of RI value (indirect start of delivery) at the digital tester at idle speed and compare with specification.

6 Turn off engine.

7 Disconnect digital tester.

8 Screw in plug at governor. Tightening torque 30-35 Nm.

9 Perform leakage test with engine running.

10 Check engine oil level, correct if necessary.

1 Fill up vehicle tank in the presence of the customer with the vehicle on level ground.

2 Drive approx. 100 km (62 mi.), of this approx. 40 km (25 mi.) highway and approx. 60 km (37 mi.) back roads and city traffic.

3 After driving fill up again and calculate fuel consumption.

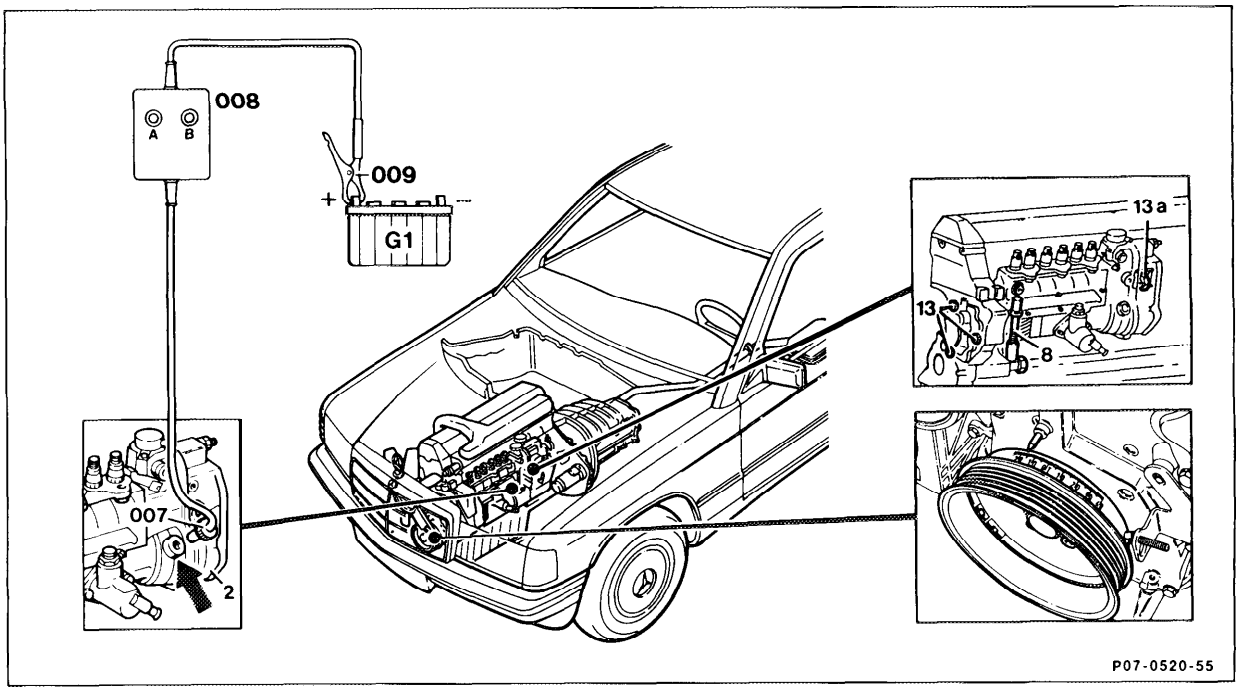
Example 1:
Fuel consumption in liters/l00 km

$$= \frac{\text{Fuel quantity consumed in liters}}{\text{Kilometers driven}} \times 100$$

Example 2:
Fuel consumption in miles/gallon

$$\frac{\text{Miles driven}}{\text{Fuel quantity consumed in gallons}}$$

07.1-I 16 Setting start of delivery (position sensor RIV method) following test - Turbodiesel



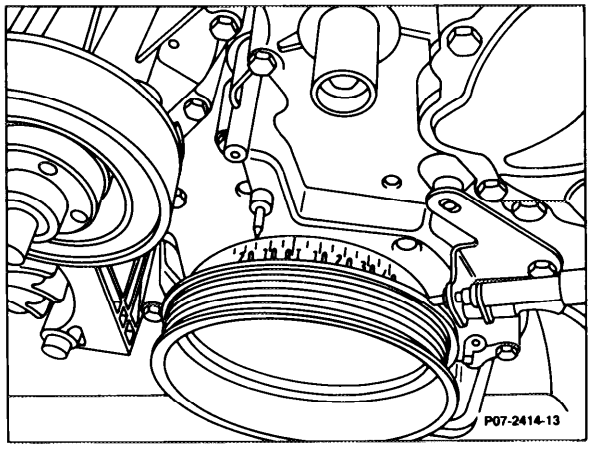
Crankshaft	crank in direction of rotation to 15° ATDC of No. 1 cylinder.
Fastening bolts (13 and 13a) on injection pump flange and on supporting bracket	loosen, tightening torque 20 - 25 Nm.
Indicating instrument (008) and terminal (009)	connect.
Injection pump	swivel by turning adjusting screw at start of delivery adjusting device (8) Both lamps "A" and "B" in indicating instrument (008) must light up. **Direction of rotation of adjusting device (8) or screw** to right = start of delivery retarded to left = start of delivery advanced RI specification 15° ATDC.
Position sensor (007)	remove.
Screw plug (arrow)	screw in.
Accelerator control linkage	check, adjust if necessary (30 - 300).
Leakage test	perform with engine running.

Engine oil level	check, correct.
Leakage check	perform with engine running.
Engine oil level	check, correct.

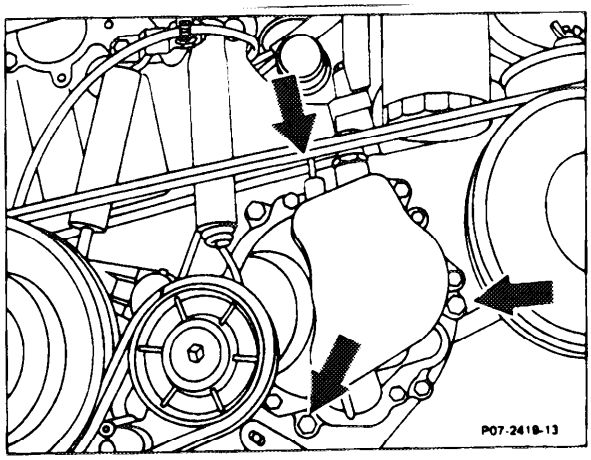
Note
Check start of delivery before performing setting work (07.1411).

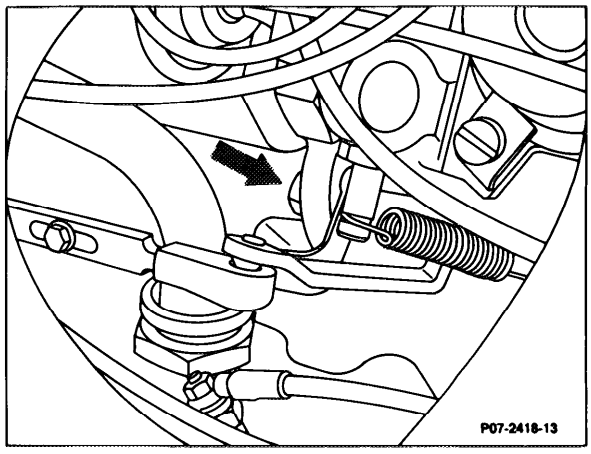
Setting

1 Turn crankshaft in direction of rotation to 15° ATDC of No. 1 cylinder.



2 Loosen fastening bolts (arrows) on the injection pump flange and on supporting bracket.

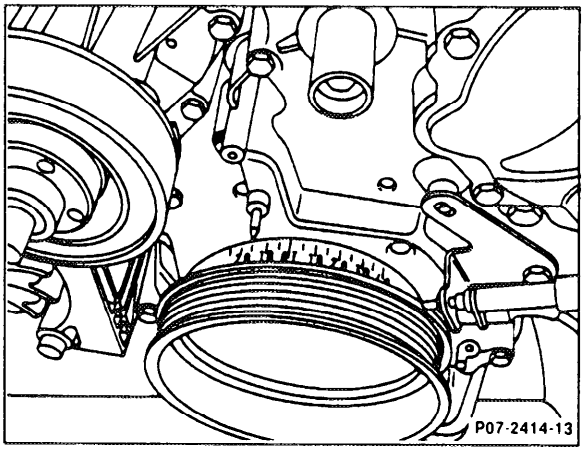




Bolt on supporting bracket (arrow)

3 Connect indicating instrument (008) and terminal (009) to battery positive.

4 Swivel injection pump by turning the adjusting screw on the start of delivery adjusting device until both lamps light up.



Direction of rotation of adjusting screw

to right = start of delivery retarded
to left = start of delivery advanced

RIV specification: 15° ± 1 ° ATDC

Note
If the adjustment facility is not adequate, the injection pump must be moved over. Remove, install injection pump (07.1-200).

5 Tighten fastening bolts on injection pump flange and on supporting bracket. Tightening torque 20-25 Nm.

6 Remove position sensor.

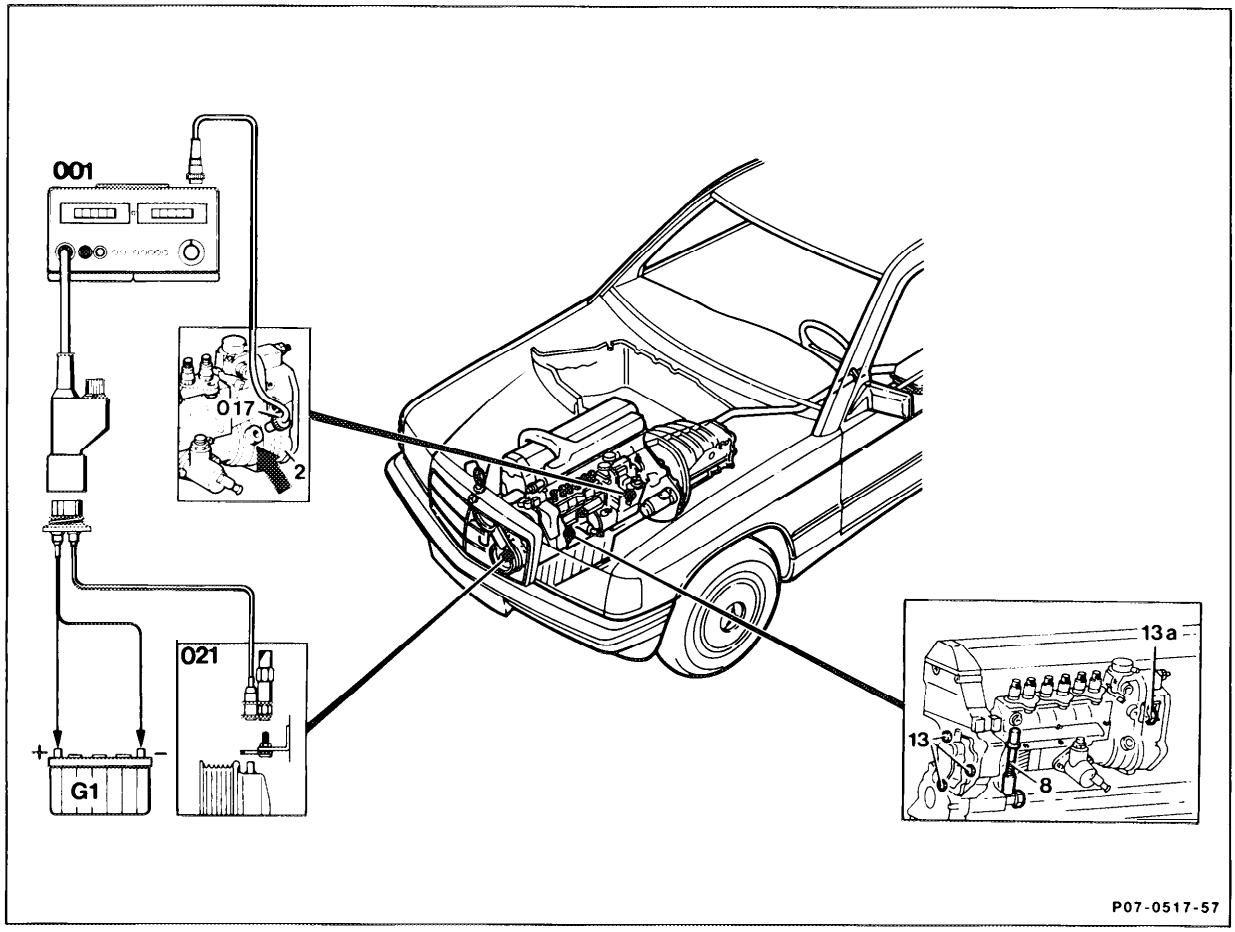
7 Screw in plug. Tightening torque 30-35 Nm.

8 Check accelerator control linkage, adjust if necessary (30-300).

9 Perform leakage test with engine running.

10 Check engine oil level, correct if necessary.

07.1-117 Setting start of delivery with digital tester (RIV Method) following testing - Turbodiesel



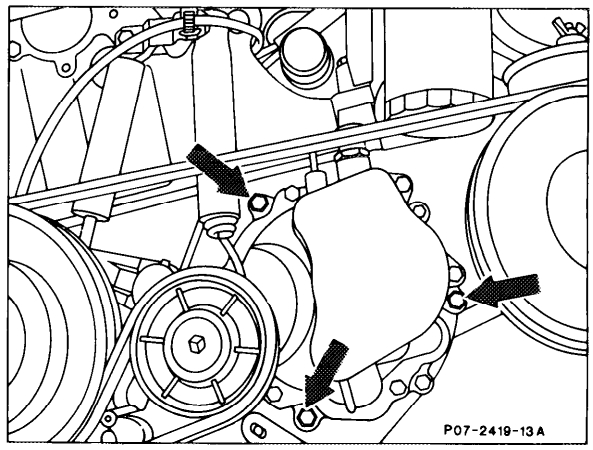
Fastening bolts (13 and 13a) on injection pump flange and on supporting bracket	loosen.
Engine	run at idle speed.
RI value (indirect start of delivery)	set by turning adjusting device (8).
	Direction of rotation of adjusting device (8) or screw
	to right = start of delivery retarded
	to left = start of delivery advanced
	RI specification 15° ± 1 ° ATDC
Engine	turn off.
Fastening bolts (13 and 13a) on injection pump flange and on supporting bracket	tighten, tightening torque 20-25 Nm.

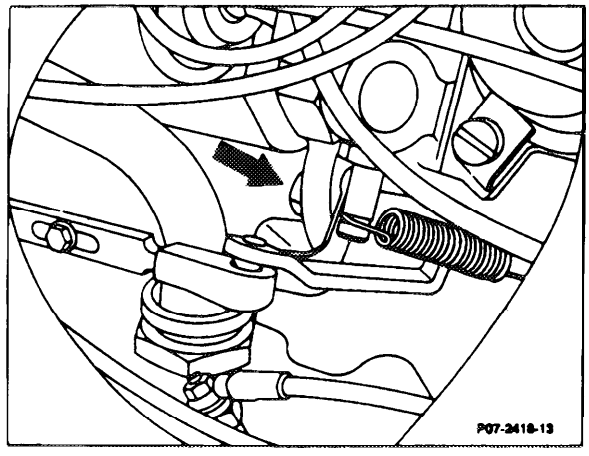
Tester (001)	disconnect.
Screw plug (arrow) on governor	screw in, tightening torque 30-35 Nm.
Accelerator control linkage	check, adjust if necessary (30-300).
Leakage check	perform with engine running.
Engine oil level	check.

Note
Check start of delivery before performing setting work (07.1-l 12).

Setting

1 Loosen fastening bolts (arrows) on the injection pump flange and on supporting bracket.





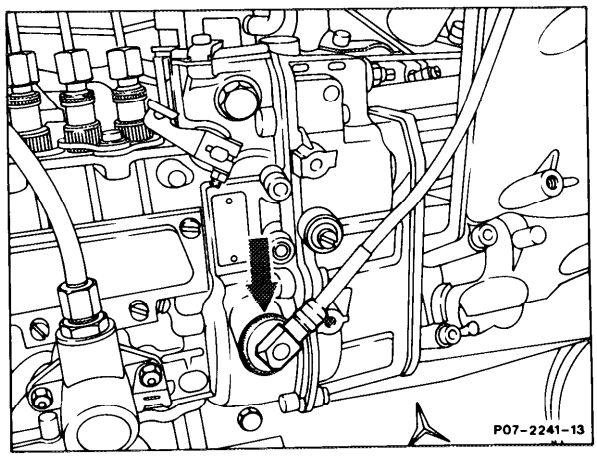
Bolt on supporting bracket(arrow)

2 Run engine at idle.

3 Set RIV value (indirect start of delivery) by turning the adjusting screw on the start of delivery adjusting device.

Direction of rotation of adjustlng screw
to right = start of delivery retarded
to left = start of delivery advanced

RIV specification: 15° ± 1 ° ATDC



Note
If the adjustment facility is not adequate, the injection pump must be moved over. Remove, install injection pump (07.1-200).

4 Turn off engine.

5 Disconnect tester.

6 Screw in plug on governor, tightening torque 30-35 Nm.

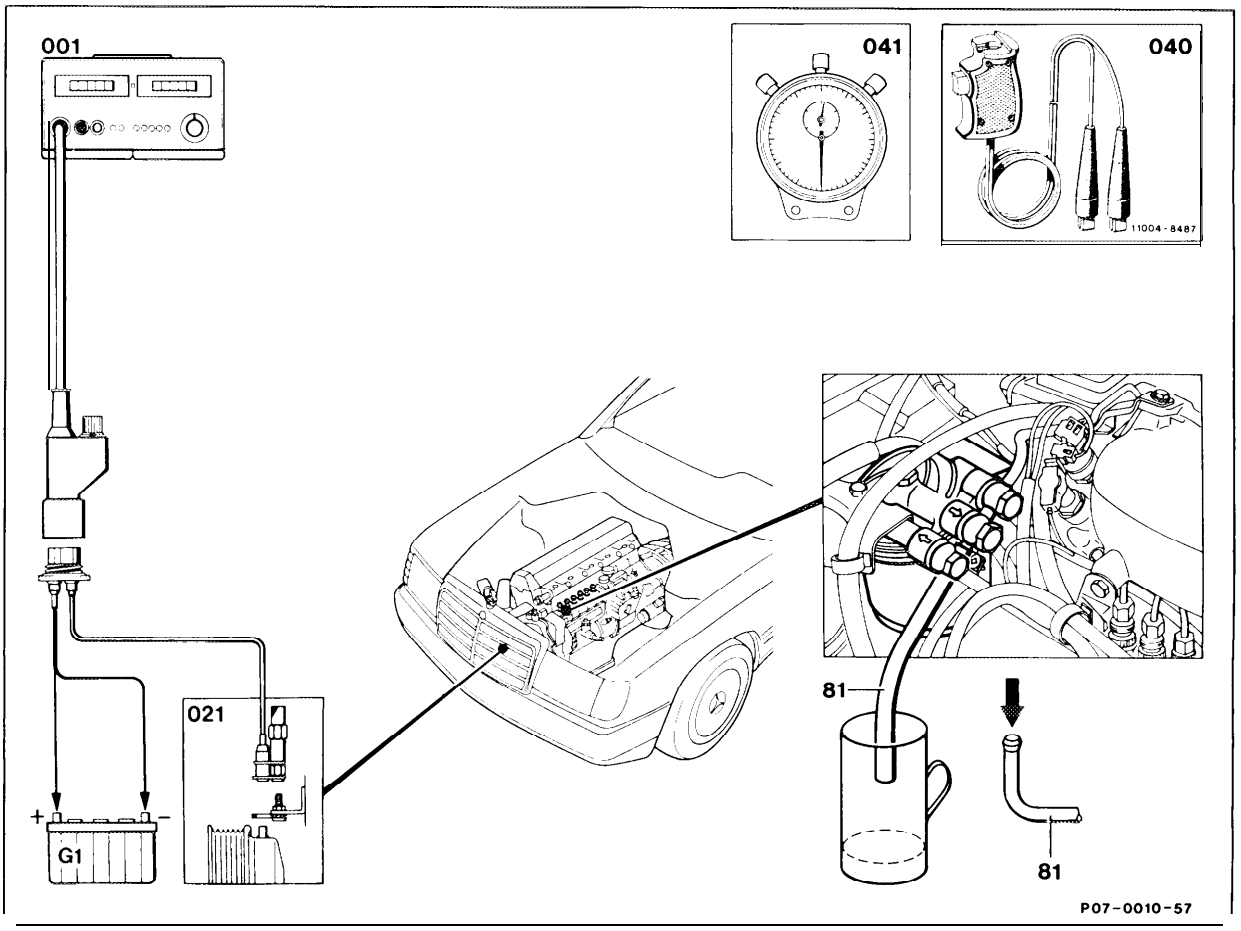
7 Tighten fastening bolts on injection pump flange and on supporting bracket. Tightening torque 20-25 Nm.

8 Check accelerator control linkage, adjust if necessary (30-300).

9 Perform leakage test with engine running.

10 Check engine oil level, correct if necessary.

07.1–145 Testing fuel pump - Turbodiesel



Testers (001, 021) . . . . . connect.

Return line (81) . . . . . disconnect and hold in measuring vessel (approx. 1 l).

Note

The return line to the fuel tank must be sealed.

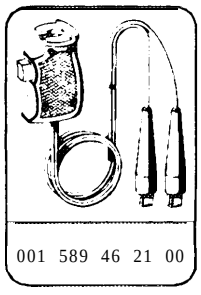
Glow start switch . . . . . move into position “0”, the injection pump is in the zero delivery position.

Contact handle (040)	connect to terminal 30 and terminal 50 and start engine for 30 seconds. Use stop watch (041). Specification: delivery at least 150 cm^3/30 seconds at 150 rpm. Replace fuel filter and/or delivery pump if necessary.
Fuel pressure	test (07.1-l 46).

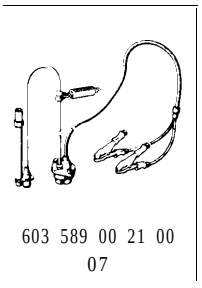
Test data

Engine	602, 603
Delivery at least 150 rpm	At least 150 cm^3/30 s
Test condition	Glow start switch in position "0"

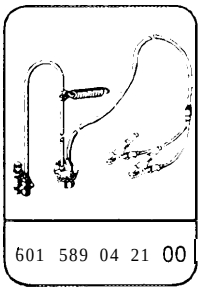
Special tools



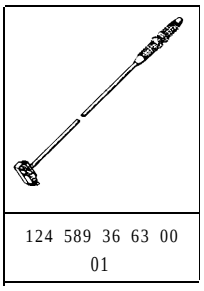
001 589 46 21 00



603 589 00 21 00
07



601 589 04 21 00



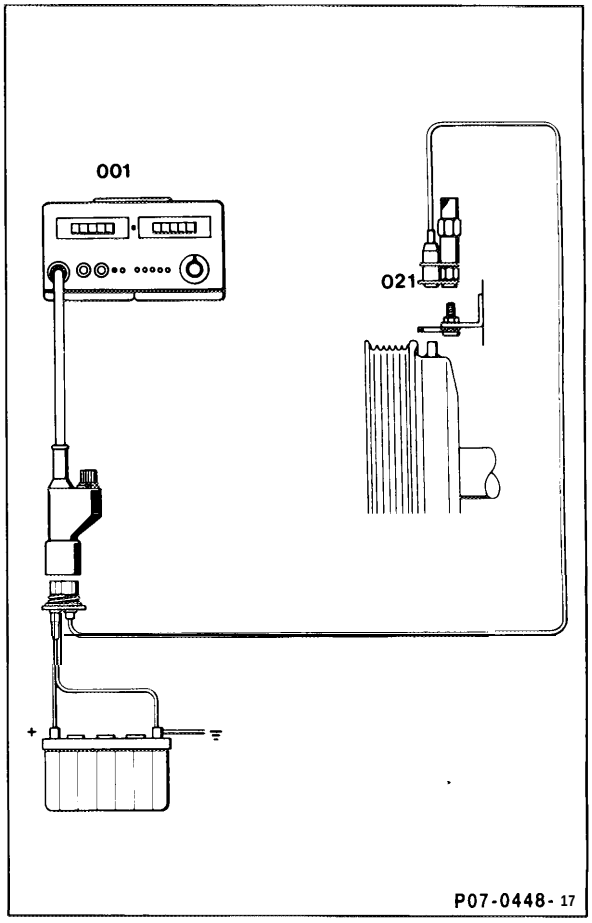
124 589 36 63 00
01

Commercial tools

Digital tester	e.g. Bosch, MOT 001.03
Graduated glass or beaker (at least 1 litre)	
Stop watch	

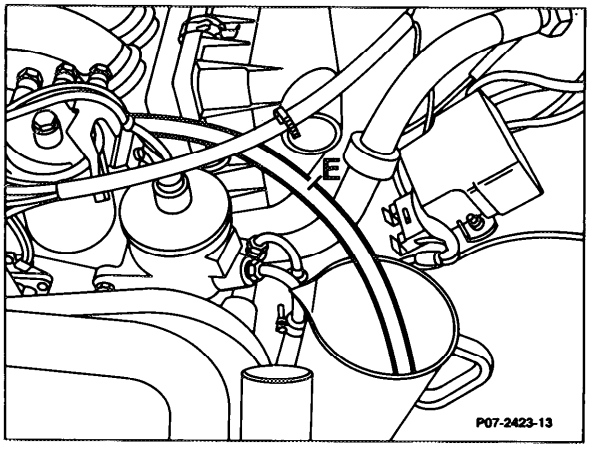
Testing

1 Connect digital tester (001) as shown in connection diagram.



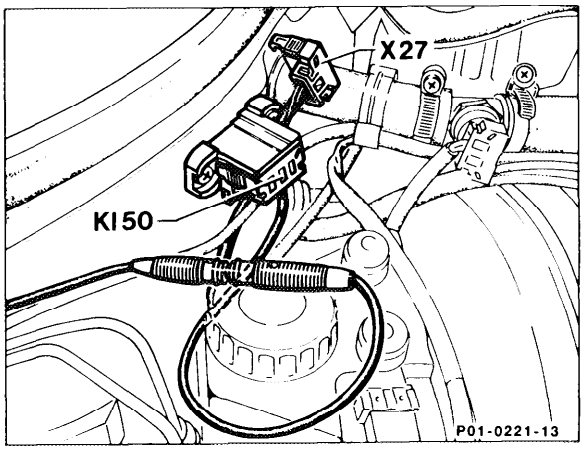
001 Digital tester
021 TDC pulse generator

2 Disconnect return line (E) and hold in measuring vessel.

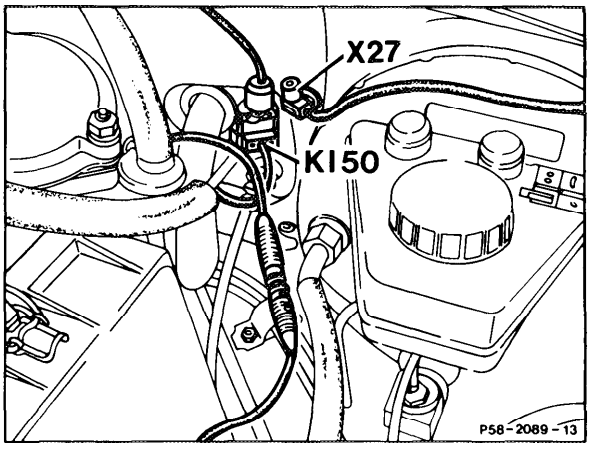


3 Turn glow start switch into position "0", the injection pump is in the "zero" delivery position.

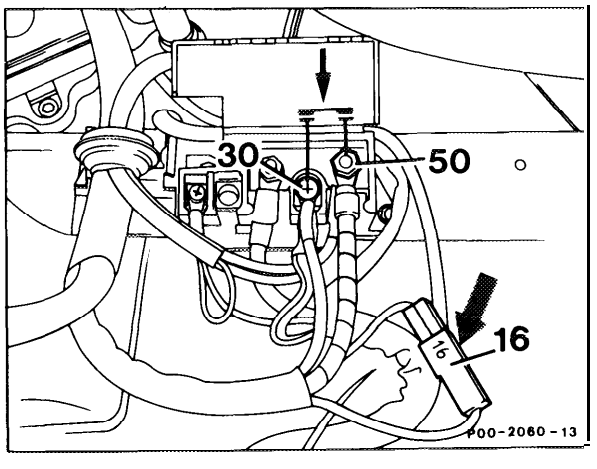
4 Detach connector (X27) and plug adaptor cable to terminal 50.



Model 124



Model 201



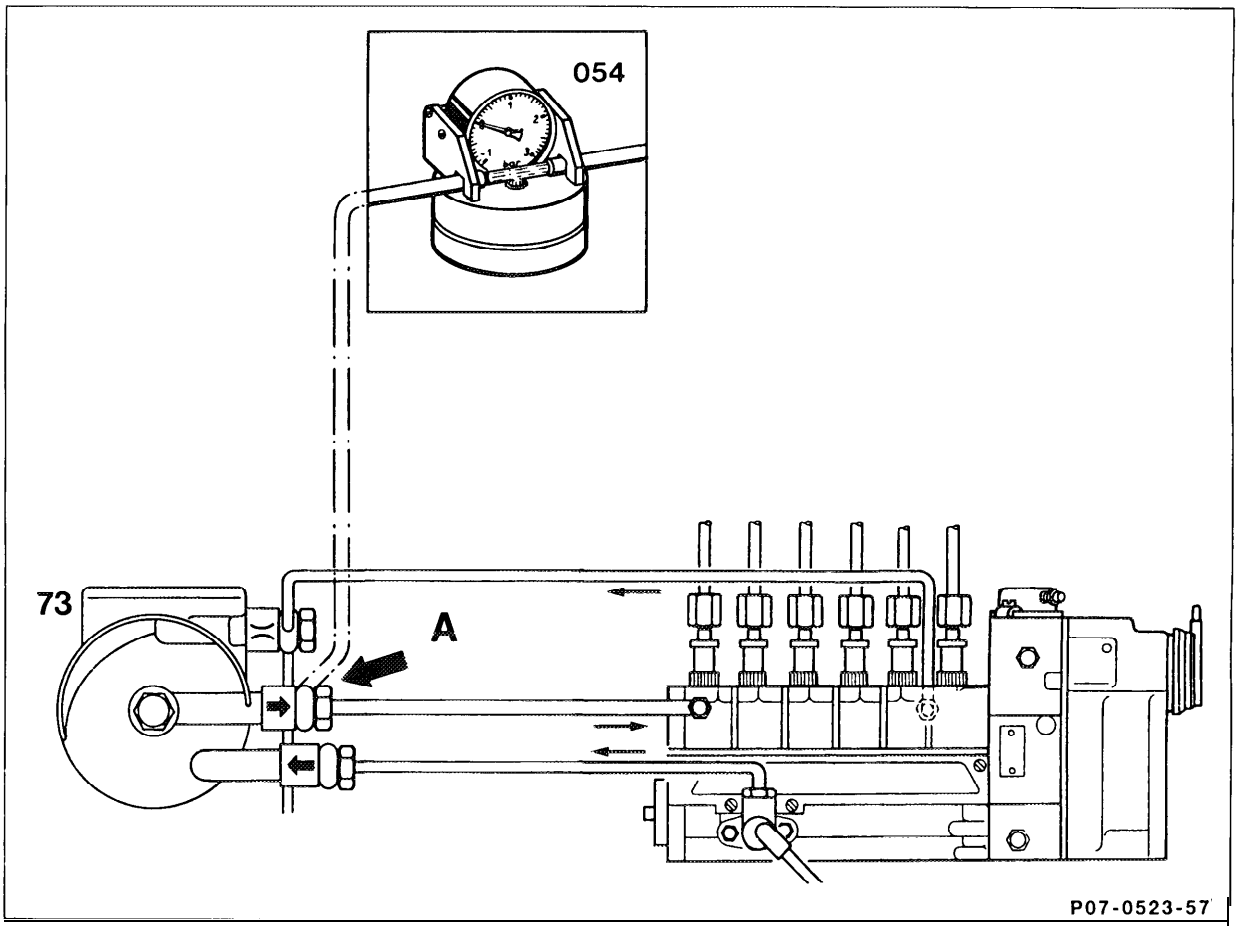
Model 126

5 Connect contact handle to adaptor cable or terminal 50 (term. 50) and to terminal 30 (term. 30) and start engine for 30 seconds.
(Starting voltage at least 10 V)

Delivery: at least 150 cm^3/30 seconds.

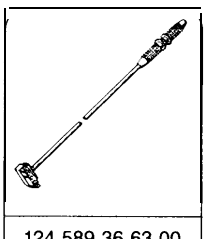
If the specified value is not reached, test fuel pressure (07.1- 146).

07.1–146 Testing fuel pressure (after testing fuel delivery) - Turbodiesel



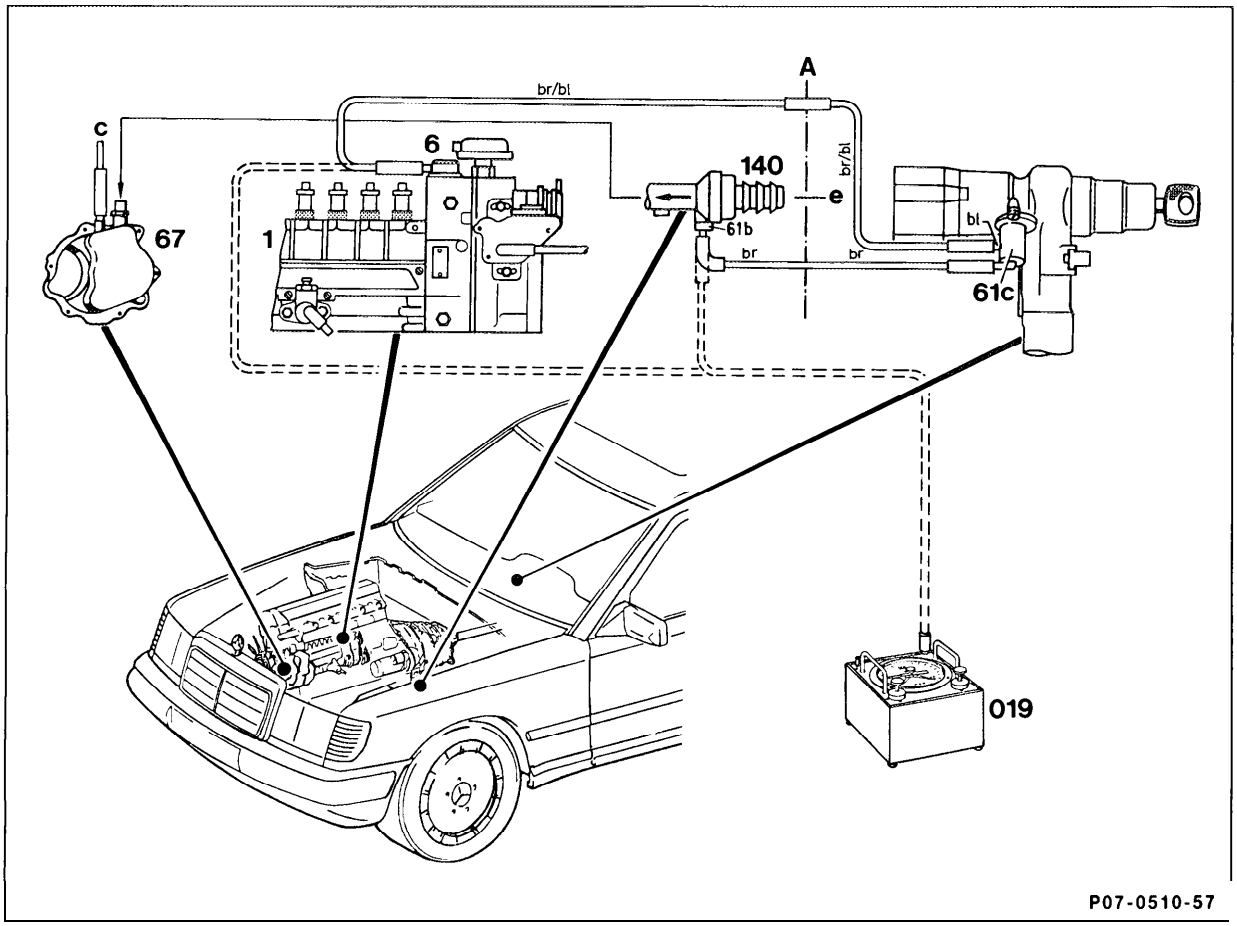
Fuel line “A” on filter top section (73)	remove, reinstall.
Tester (054)	disconnect, connect.
Run engine	specified values at idle speed > 0.3 bar at full-load > 0.5 bar. If the specified values are not reached, replace fuel filter.

617 589 04 21 00



124 589 36 63 00
01

07.1450 Testing vacuum engine stop for leaks - Turbodiesel



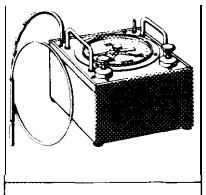
1	Injection pump	A	Intermediate panel
67	Vacuum pump	c	Other ancillaries
140	Check valve/main vacuum line	e	To brake booster

Key in steering lock ..... turn to position “2”.

Tester (019) 201 589 13 21 00 ..... connect to “brown” suction line and pressurize with 400 + 50 mbar vacuum (maximum permissible vacuum drop 6 mbar/min.).

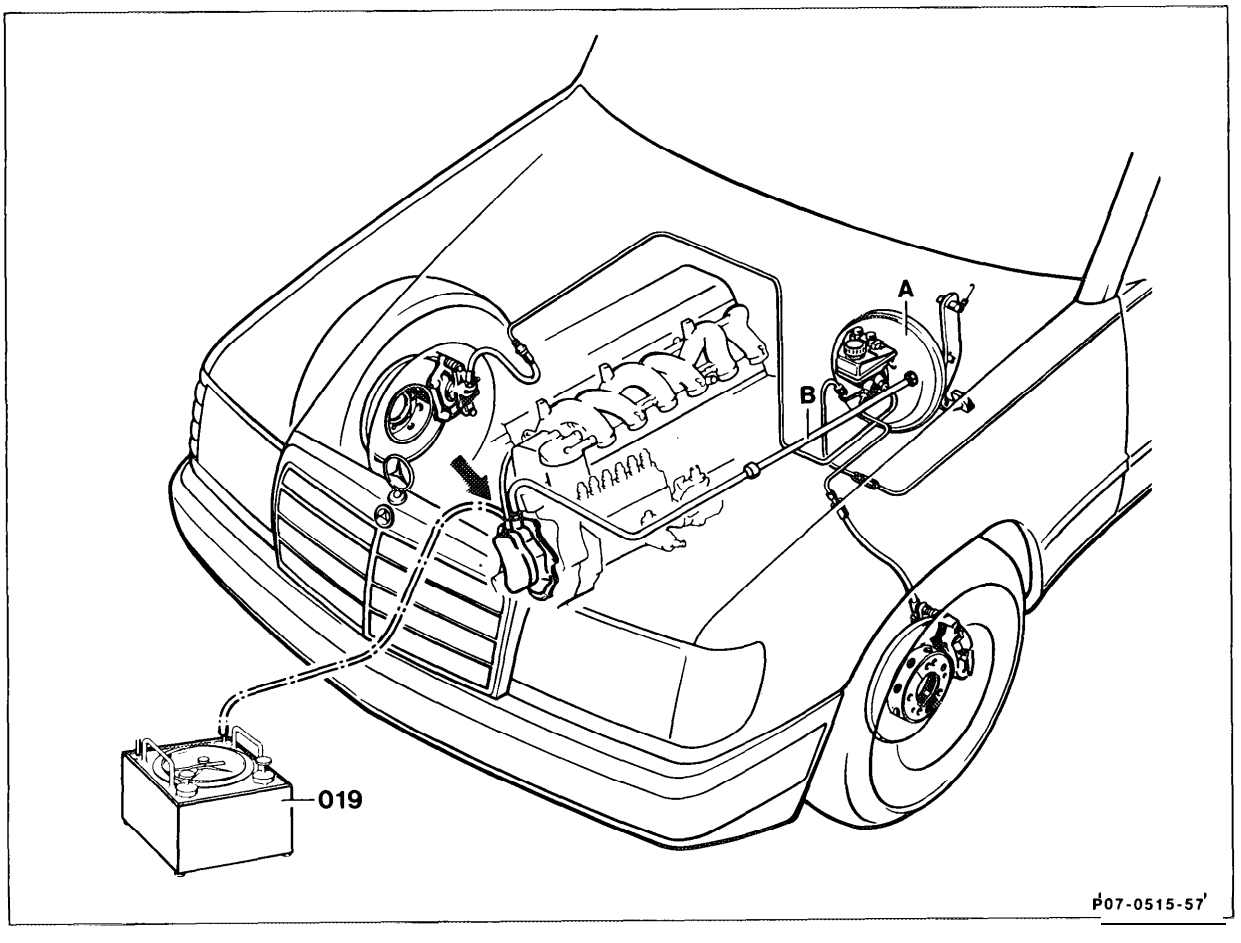
Tester (019) 201 589 13 21 00 . . . . . connect to vacuum unit (6) and pressurize with 300 + 50 mbar vacuum (maximum permissible vacuum drop 5 mbar/min.). If there is too much vacuum loss, determine cause and rectify.

Special tool



201 589 13 21 00
00 42 80

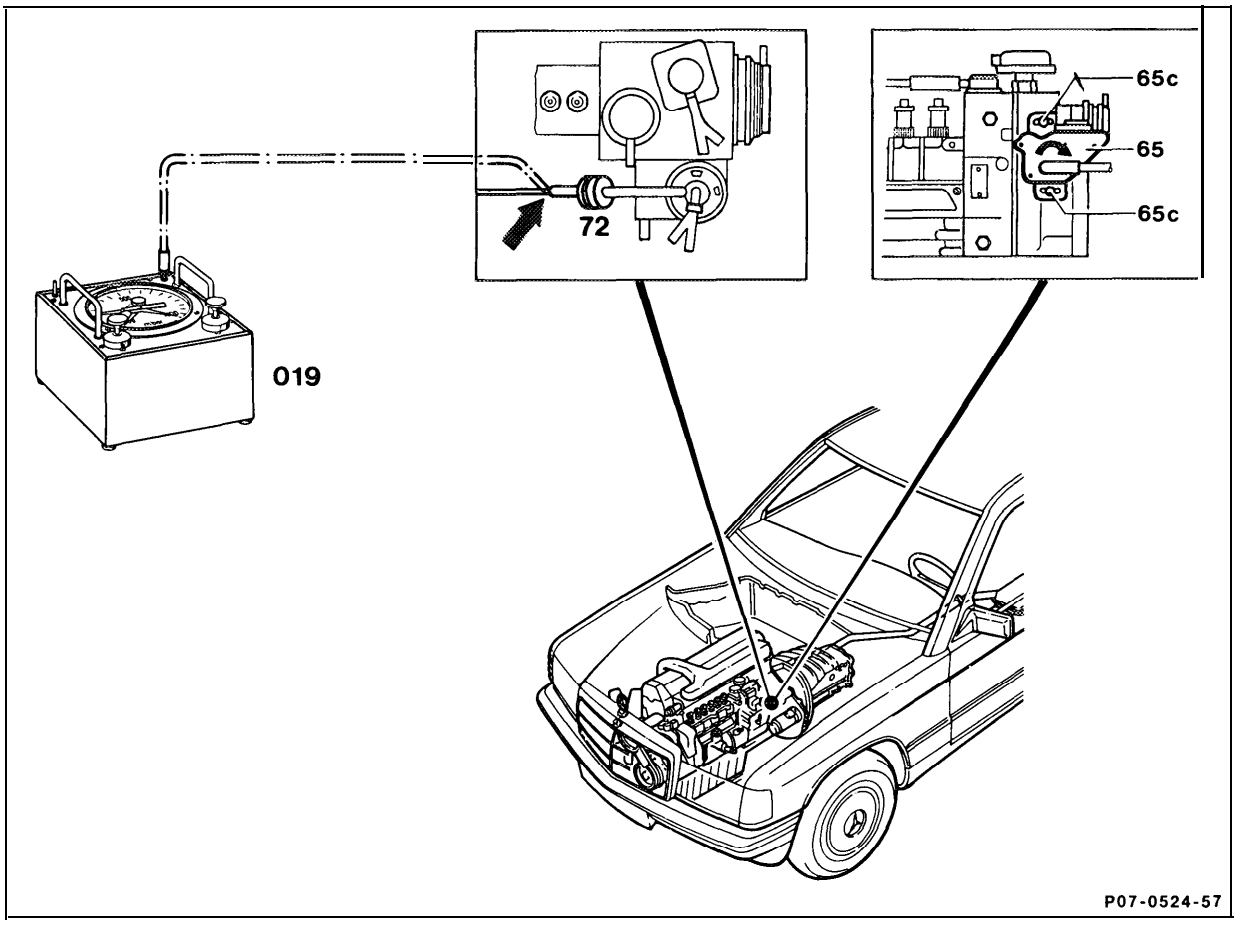
07.1-160 Testing vacuum pump - Turbodiesel



Main vacuum line (B)	disconnect at brake booster (A).
Vacuum line at ancillaries connection	detach, and use 0.8 mm gauge to check that restriction orifice is clear.
Vacuum tester (019) 201 589 13 21 00	connect to ancillaries connection and test vacuum at idle speed.

Specification: 700 mbar after 30 s.

If specified vacuum reading is not reached replace vacuum pump.



Note

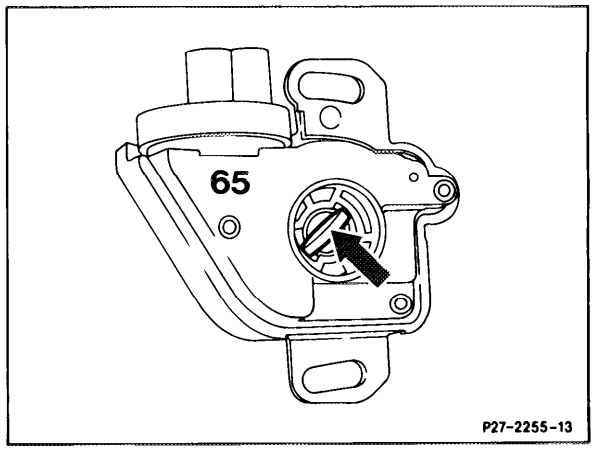
Test conditions:
fun engine up to normal operating temperature
(approx. 80°C coolant temperature).
Accelerator control correctly set (30-300).

Vacuum tester (019) ..... connect to damper (72) of vacuum line and take reading of vacuum at idle speed.
Specification: Engine 602, 420 ± 25 mbar
Engine 603, 385 ± 25 mbar

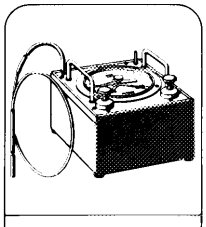
With engine off, move accelerator control to full-load stop.
Specification: 0 mbar, it may be necessary to set vacuum control valve. Test vacuum lines, test vacuum pump, replace vacuum control valve.

Fastening bolts (65c) ..... loosen, run at full throttle until control lever of injection pump is resting against full-load stop. Turn vacuum control valve (65) in direction of arrow until resistance is felt. Tighten vacuum control valve in this position.

A seal (arrow) is installed in the vacuum control valve to prevent dust and dirt getting into the valve.



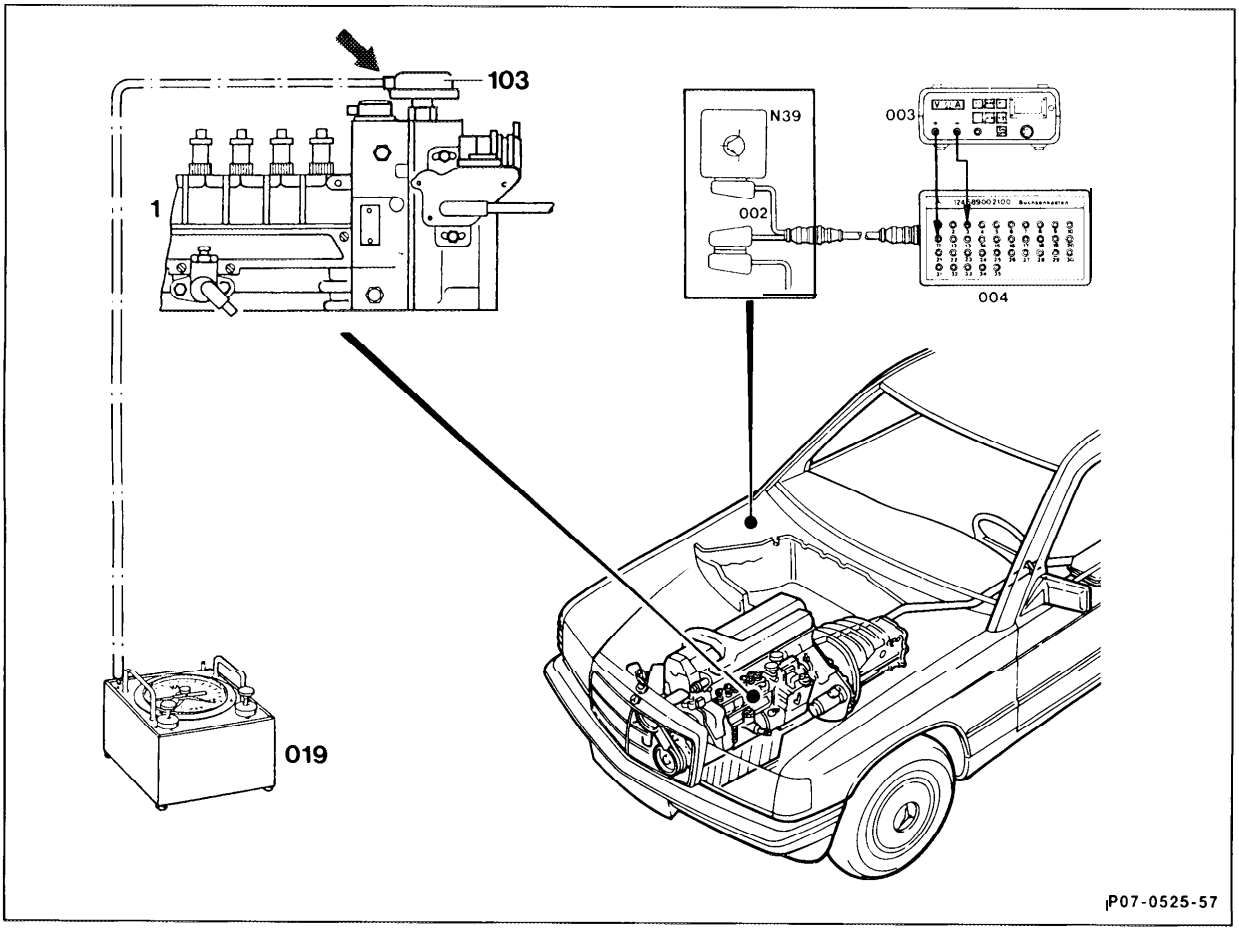
Special tool


201 589 13 21 00
00 42 80

07.1-180 Testing control rod travel sensor- Turbodiesel (Model Year 1986/87 only)

Problem:
Poor performance and/or high fuel consumption.

Test conditions:
Engine coolant temperature > 80°C.
Air-conditioning system off.



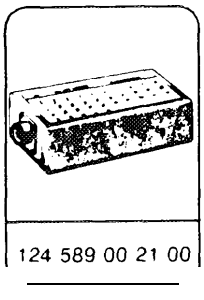
Contact box (004)	connect into circuit at EDS control unit (N39) as shown in connection diagram.
Multimeter (003)	connect to jacks 3 and 11. Press button "V=".

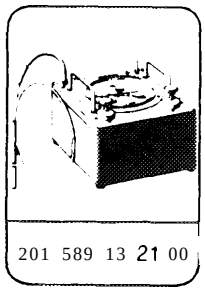
Pressure, vacuum tester (019)	connect to ALDA unit (103) and pressurize with 1000 mbar gauge pressure. White pressure line detached.
Parking brake	apply. **Start** engine, depress service brake. Engage drive position "D", apply full throttle and take reading of voltage at 1500-2200 rpm and note. Specification: 3.27 ± 0.08 V, at ≤ 1600 m above MSL. Pay attention to note 07.1-I 90.
Pressure, vacuum tester	disconnect and admit air to ALDA unit (103). Pressure line must not be connected. Stall engine as above. Take reading and note, compare with table.

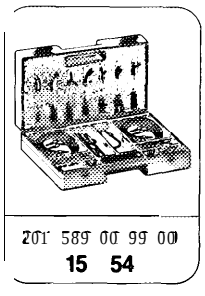
Note

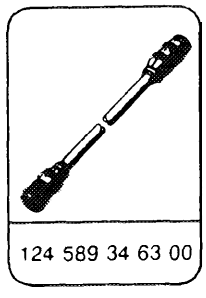
A measurement or hard brake application must not last longer than 5 seconds. A pause of at least 2 minutes should occur between two hard brake applications.

Special tools









Commercial tester

Multimeter	e.g. Sun, DMM-5

Compare voltage reading or corrected voltage of control rod travel sensor with table.

Control rod travel sensor voltage

Engine speed	Pressure at ALDA	Height above MSL	Position of control lever at governor	Spec. voltage at control rod travel sensor evaluation circuit
rpm	mbar	m		U_a corr. volts
1500–2200	1000 (gauge pressure)	≤ 1600	at full-load stop	3.27 ± 0.08
1500–2200	Atmospheric pressure without tester, pressure line at ALDA disconnected	0	at full-load stop	2.45 ± 0.10
		100		2.43 ± 0.10
		200		2.42 ± 0.10
		300		2.40 ± 0.10
		400		2.39 ± 0.10
		500		2.37 ± 0.10
		600		2.35 ± 0.10
		700		2.34 ± 0.10
		800		2.32 ± 0.10
		900		2.31 ± 0.10
		1000		2.29 ± 0.12
		1100		2.28 ± 0.12
		1200		2.26 ± 0.12
		1300		2.25 ± 0.12
		1400		2.23 ± 0.12
		1500		2.22 ± 0.12
		1600		2.20 ± 0.12

Measure reference voltage at jacks 23 (red) and 3 (black). If the reference voltage (U_{ref}) is beyond 5 ± 0.1 V, the two control rod travel sensor outlet voltages ($U_{a,actual}$) measured previously, must be recalculated as follows:

$$U_{a,\,corr} = \frac{U_{a,\,actual} \times 5\ V}{U_{ref}}$$

If the control rod travel sensor voltages do not agree with the figures stated in the table above, the injection pump must be reset on an injection pump test stand.

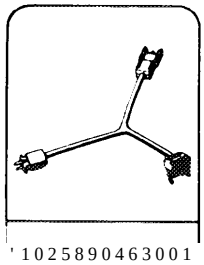
07.1-190 Testing electronic diesel system (EDS) - Turbodiesel

A. Engine 602.96 in Model 201 Federal Model Year 1987
B. Engine 603.96 in Models 124 and 126 Federal and California Model Year 1986/87
C. Engines 602.962 and 603.970, Model Year 1990

Test conditions

- Coolant temperature approx. 80°C
- Air-conditioning: **OFF**
- Shift selector lever position P
- Fuse in over-voltage protection relay in order
- Battery voltage report 12 volt at over-voltage protection between jacks 1 and 5

Special tools



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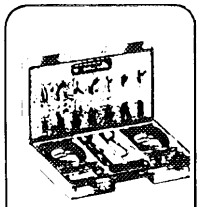
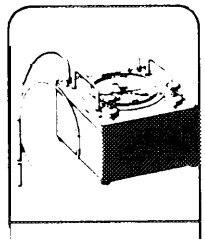


201 589 00 99 00



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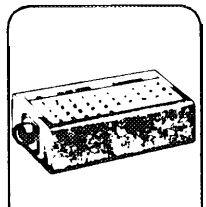
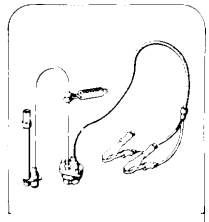


124 589 00 21 00



603 589 00 21 00
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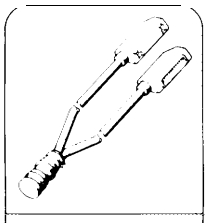
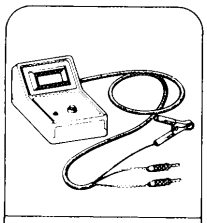
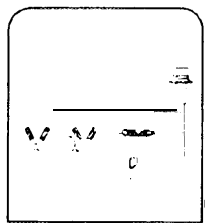


124 589 33 63 00
07 28 54



124 589 19 21 00
07 83



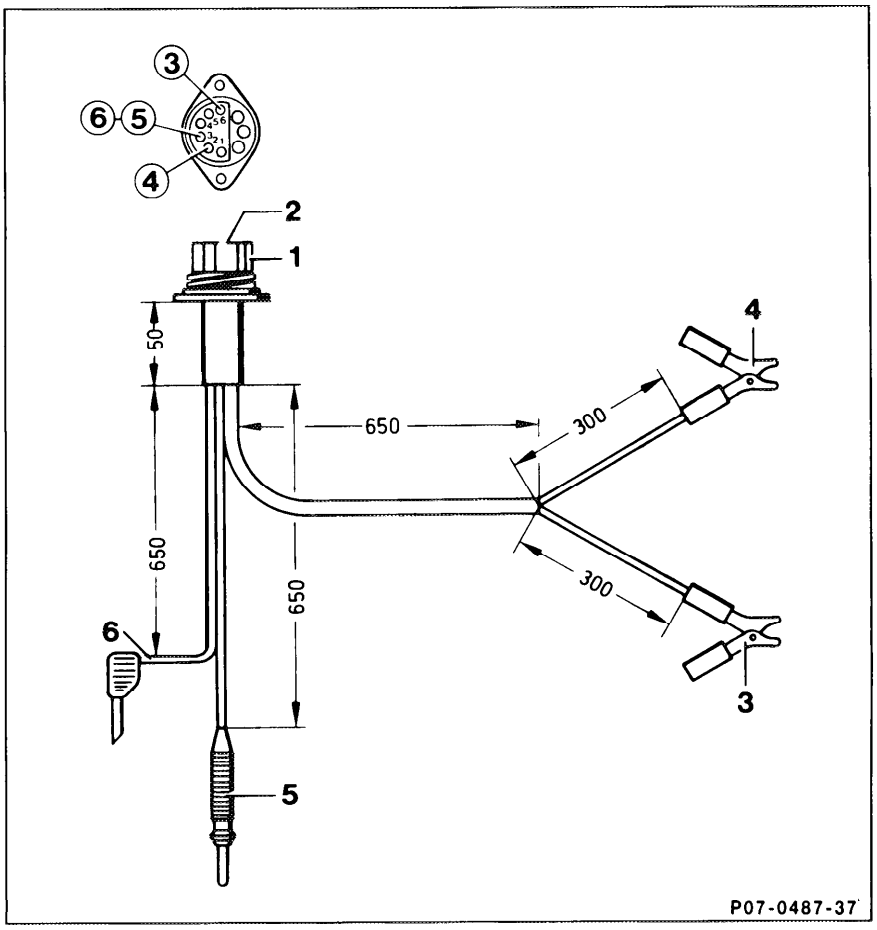
903 589 01 63 00

Commercial tools

Multimeter	e.g.	Sun, DMM-5
Digital testers	e.g.	Sun, EMT-I 01 9/Master 3 Sun, DIT 9000 All-Test, 361 O-MB Bosch, MOT 002.01
Y distributor		117078 01 45
Lambda control tester	e.g.	Bosch KDJE-P600 Hermann L 115

Test cable shop-made

Test cable (XI 1)



Pin assignment of test socket
Posltion 3 to jack 6
Posltion 4 to jack 2
Position 5 to jack 3
Posltion 6 to jack 3

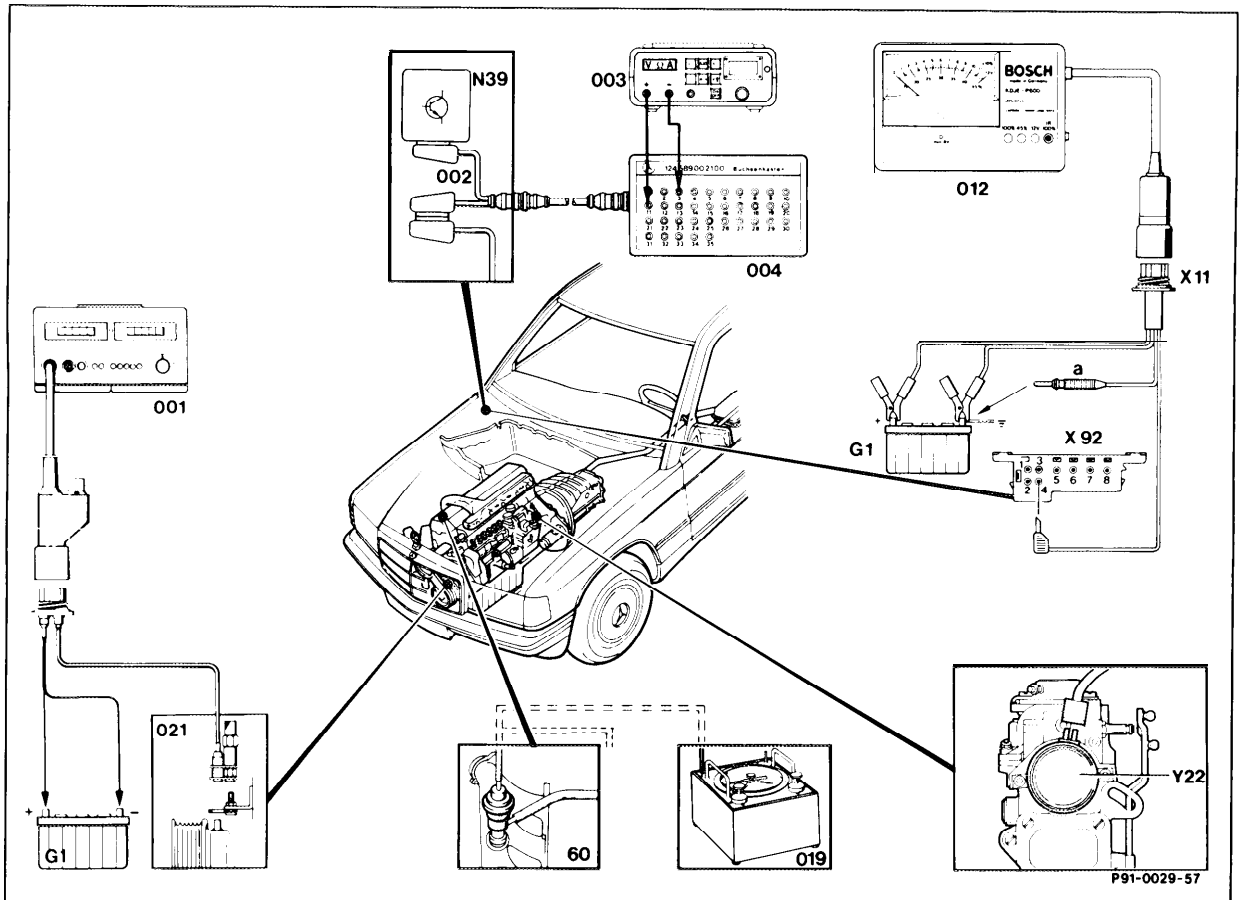
Scope of parts

Position	Designation	Part no.	Quantity/dimension
1	Test socket	123 545 00 26	1
2	Jacks	001 545 28 26	3
–	Cable	Commercial	Length as per drawing
3	Terminal, red	Commercial	1
4	Terminal, black	Commercial	1
5	Connector	Commercial	Ø 4.8 mm
6	Connector	Commercial	Ø 4 mm

A. Engine 602.96 in Model 201 Federal Model Year 1987

a) Testing
b) Testing components
c) Testing electronic idle speed control

a) Testing



Digital tester (001) and pulse counter (021)	connect, disconnect.
Lambda control tester (012)	connect to battery (G1) and test connector (X92). Connect, disconnect, press 100% IR switch.

Contact box (004)	connect, disconnect with test cable (002) to EDS control unit (N39).
Vacuum tester (019)	connect, disconnect with Y distributor at EGR valve.
Digital tester (003)	connect, disconnect to contact box (004).
Fuse at over-voltage protection (K1/1)	test.
Selector lever	move into position “P”.
Air-conditioning/automatic climate control	off.
Engine	bring to operating temperature (coolant temperature to 80° C).

Note

When performing the test work, the air intake hose between the air flow sensor and exhaust gas turbocharger must be fitted, otherwise no signal will pass from the air flow sensor to the EDS control unit (N39).

Connector "a"	hold approx. 1 second to battery ground 100% readout.
Connector "a"	remove. 0% readout, no fault in system. Readout fluctuates, fault in system (refer to troubleshooting table).

Note

One pulse = 0% – 100% – 0%.

The number of pulses indicates which electrical component is faulty.

Repeat test until there are no further pulses displayed.

Trouble-shooting table

Fault readout	Component or circuit not operating
1	Engine speed sensor (L3)
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1) electrical faults
4	Altitude sensor (B18)
5 [1])	Exhaust control circuit, electrical and mechanical faults a. Exhaust gas recirculation valve EGR (60) b. Vacuum transducer (Y31/1) c. Air flow sensor (B2/1)
8	Coolant temperature sensor (B1 1/4)
9	Intake air temperature sensor in air flow sensor (B2/1a)
10	Reference resistor (R18/2) exhaust gas recirculation (EGR)
11	Resistance trimming plug (R18/1) idle speed control (ELR)

[1]) Hold engine speed above 1200 rpm for at least 5 seconds, otherwise no readout.

Double connector of ELR solenoid Y22	Disconnect and fit on again (at least 3 seconds). Engine speed increases briefly.
Engine	Run engine at approx. 1200 rpm and approx. 250 mbar. Briefly apply full throttle. Vacuum drops to 0 mbar.
Engine	off.
EGR valve	Pressurize EGR valve with approx. 300 mbar vacuum. EGR valve audibly closes.

b) ‘Testing components

Fault readout”1”

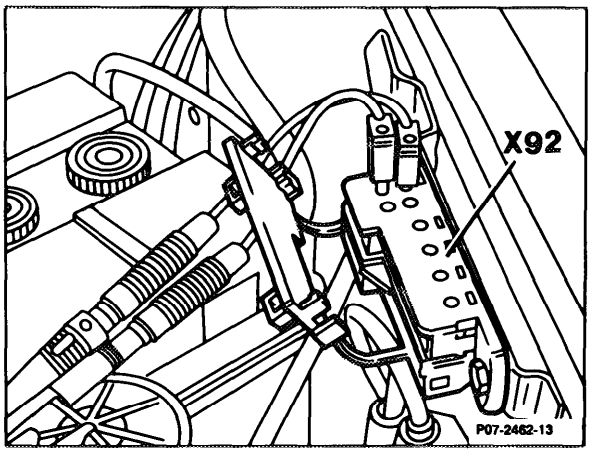
Testing engine speed signal

Connect multimeter to test connector (X92), jacks 1 and 2. Press button "V~". Engine at idle.

Readout: > 2.8 V-

Yes	No

End of test



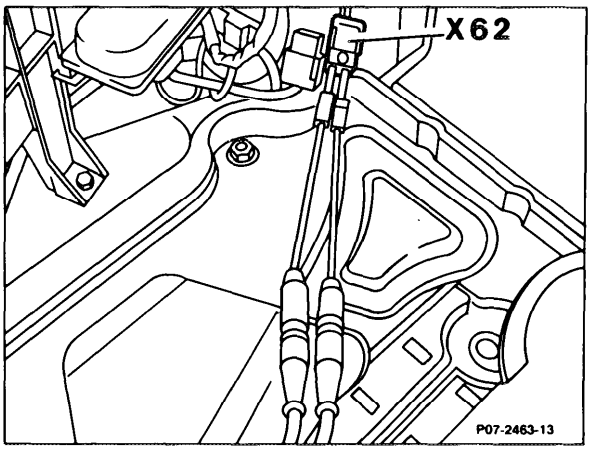
Engine off. Separate plug connection (X62). Press button "Ω" and test resistance with multimeter.

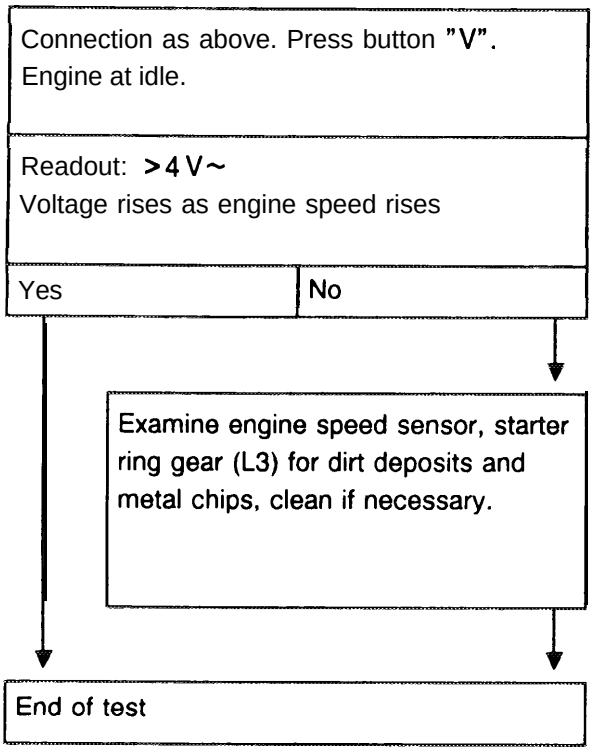
Readout: 0.4–2.5 kΩ

Yes	No

Replace engine speed sensor (L3)

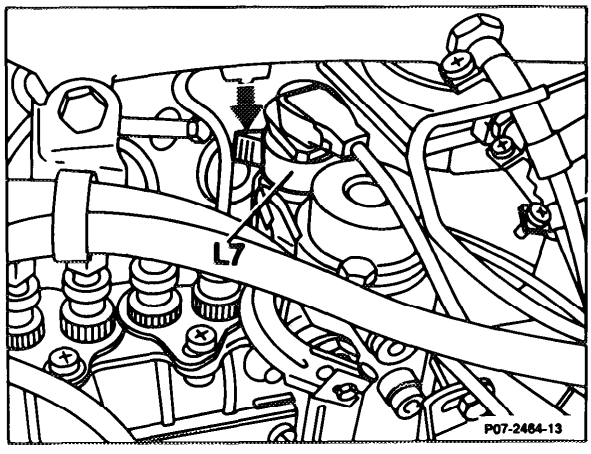
End of test




Connection as above. Press button "V".
Engine at idle.
Readout: >4 V~
Voltage rises as engine speed rises
Yes
No
Examine engine speed sensor, starter ring gear (L3) for dirt deposits and metal chips, clean if necessary.
End of test

Fault readout"2"

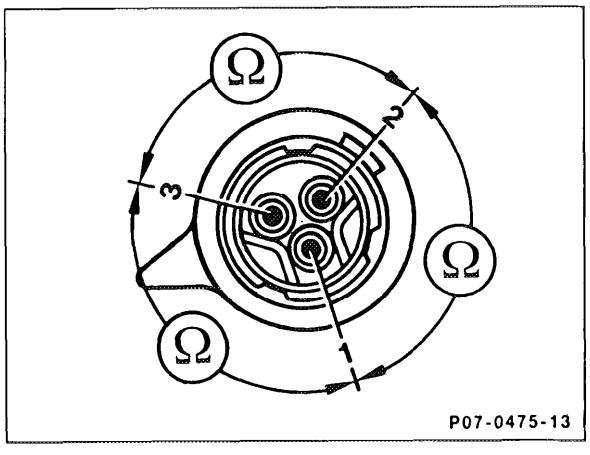
Testing control rod travel sensor (L7)
Engine off. Turn anti-twist lock (arrow) counter-clockwise and detach connector on the injection pump. Press multimeter button "Ω". Test resistance according to drawing.



Readout:
Terminals 1 and 2 = approx. 25 ± 2 Ω
Terminals 1 and 2 = approx. 25 ± 2 Ω
Terminals 2 and 3 = approx. 50 ± 2 Ω

Yes	No

Replace injection pump.

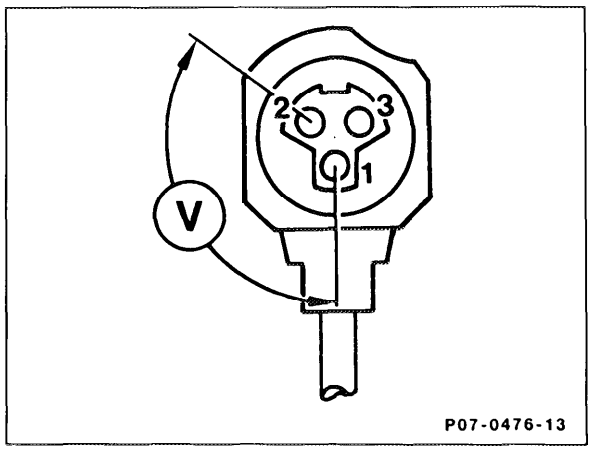


Engine off. Ignition on
Press multimeter button "V = ". Measure voltage between the jacks l-2.

Readout approx. 10 volts

Yes	No

Rectify interrupt according to wiring diagram.
Replace control unit (N39).

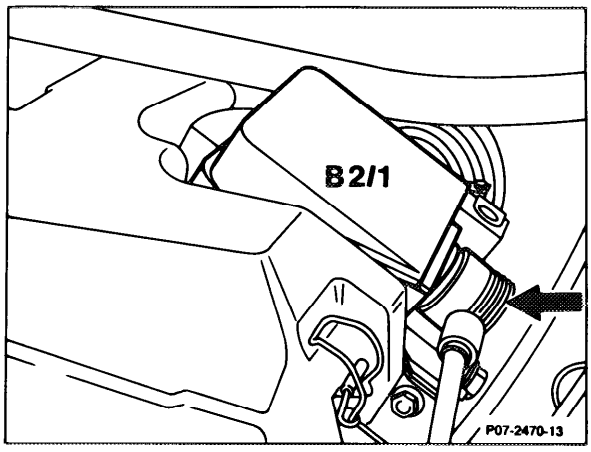


End of test

Fault readout opening "3"

Testing airflow sensor potentiometer (B2/1)

Engine off. Detach connector (arrow) from airflow sensor. Multimeter button Ω. Measure resistance between jacks 1 and 3 on airflow sensor.



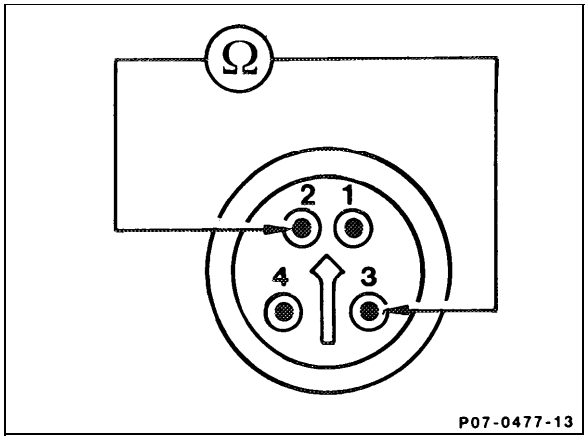
Readout:

airflow sensor plate in idle position = approx. 50-200 Ω

airflow sensor plate fully deflected = approx. 560-l 100 Ω

Yes	No

Examine airflow sensor plate for ease of movement and fouling. Replace airflow sensor if necessary.



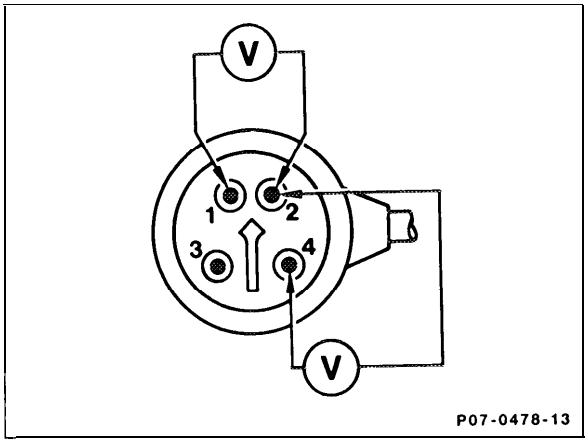
Engine off, ignition: **ON**. Press multimeter button "V = ". Measure voltage between jacks 1 and 2 or 2 and 4, resp.

Readout: approx. 5 volts

Yes	No

Rectify interrupt according to wiring diagram

Replace control unit (N39).



End of test

Note

If airflow sensor removed, also perform "Testing air temperature sensor (B2/1a)" (Fault readout 9).

Fault readout "4"

Testing altitude sensor (B18)

Engine off. Ignition key in position "2". Press multimeter button "V = ". Measure voltage between jacks 1 - 2.

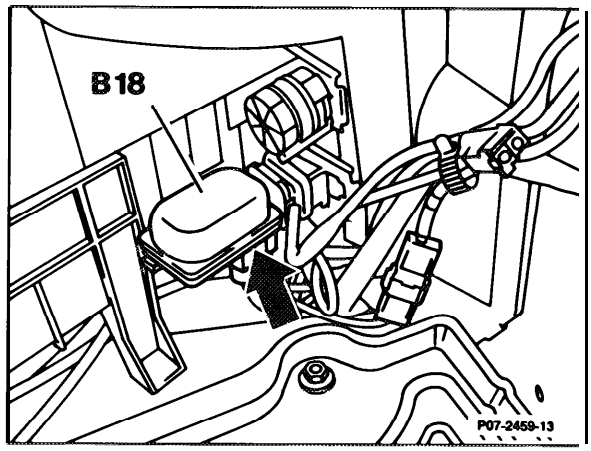
Readout: approx. 5 volts

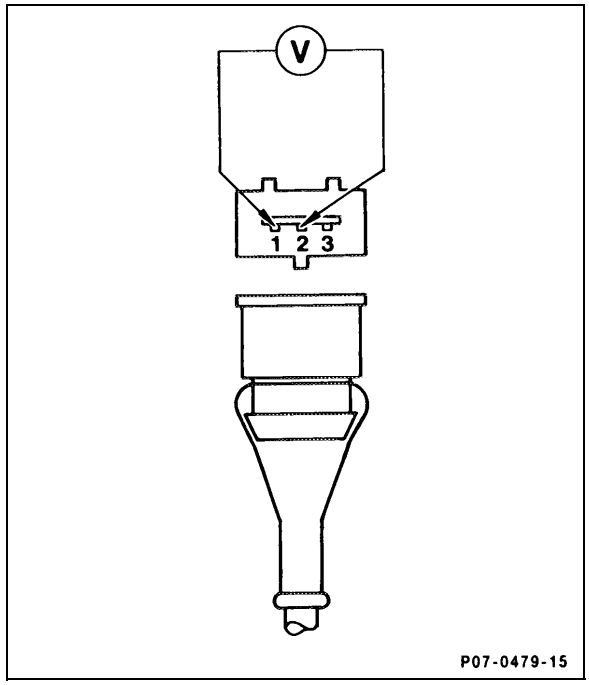
Yes	No

Rectify interrupt according to wiring diagram.
Replace control unit (N39) if necessary.

Replace altitude sensor.

End of test





Fault readout "5"

Testing exhaust control circuit

a) Test EGR valve (60) when engine not funning

Pressurize EGR **valve** approx. 300 mbar vacuum. Detach vacuum line.

EGR valve closes audibly and is felt to close.

Yes	No

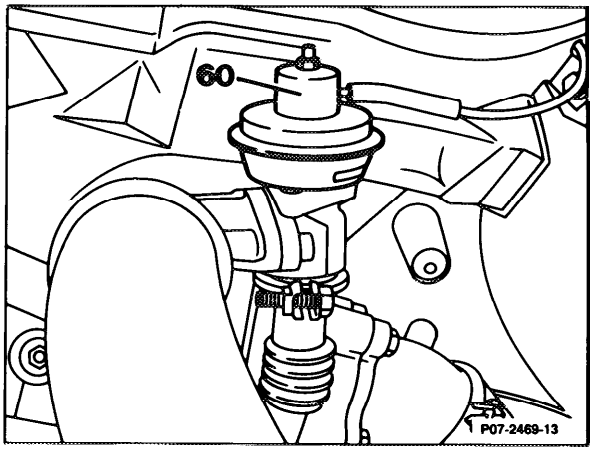
Remove EGR valve and pressurize vacuum tester with approx. 520 mbar.

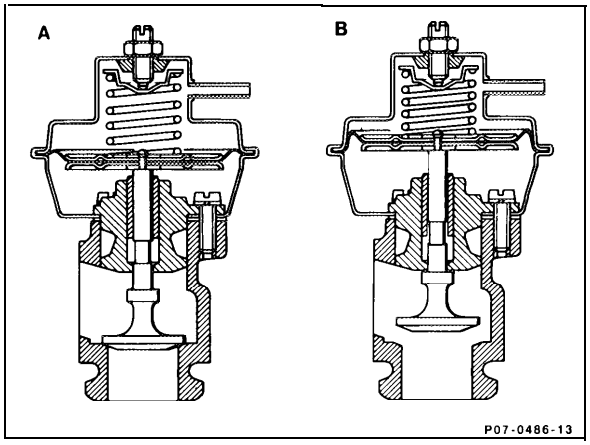
EGR valve rises approx. 5 mm off its seat (end stop).

Detach vacuum line. EGR valve must be heard to close.

If one of these test steps is not successful, replace EGR valve.

End of test 1





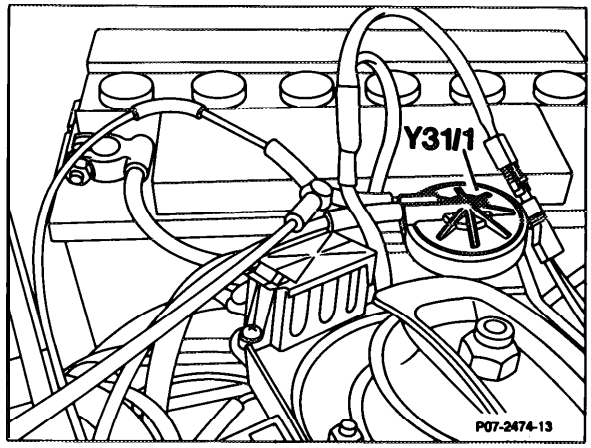
A closed
B open

b) Testing vacuum transducer (Y31/1)

Connect vacuum tester with Y distributor to vacuum transducer (Y31/1). Connect multimeter with test cable to transducer (Y31/1). Press button “A”. Increase engine speed until approx. 250 mbar is reached.

Note

Ensure that connector of vacuum transducer (Y31/1) is correctly connected.



Refer to diagram for specified values.
Example: 250 mbar = 400-500 mA

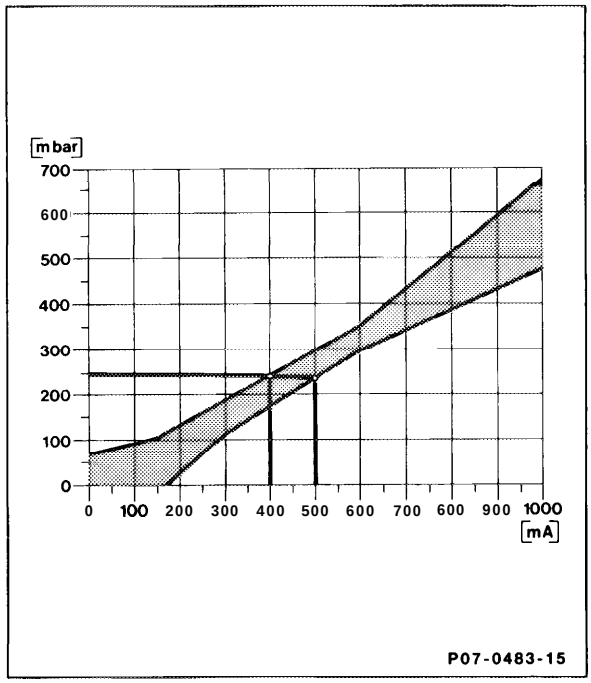
Current at vacuum transducer

0 mA too low too high

Check that vacuum vent (black) and filter are clear.

Check that supply line (blue) is clear. Check whether there is an interruption in vacuum line (white/purple/brown) between transducer and EGR valve. If vacuum line and vacuum are in order, replace vacuum transducer (Y31/1).

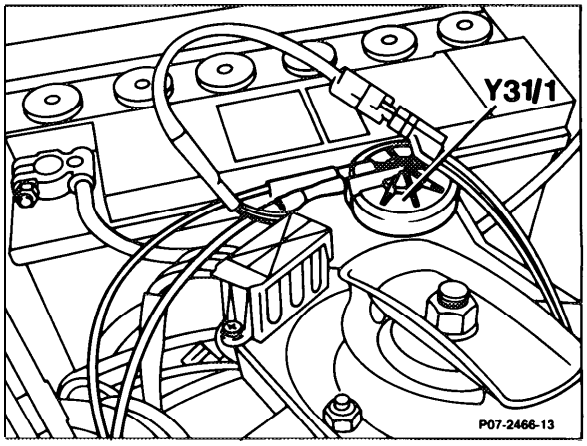
End of test



Engine off. Glow start switch in position “2”. Detach double connector on EGR vacuum transducer (Y31/1), and measure voltage with multimeter button "V = ".

Readout: approx. 12 volts

Yes	No

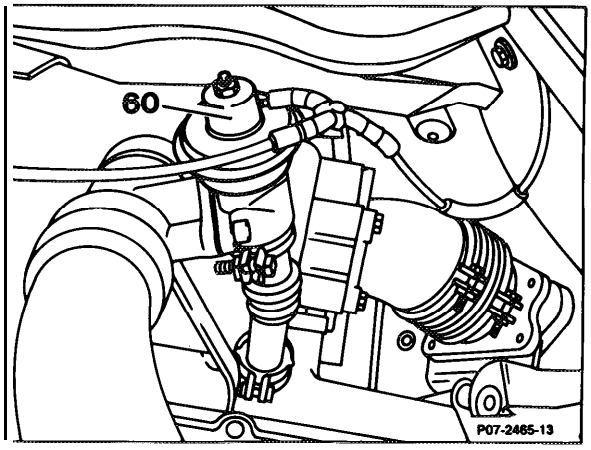


Rectify interrupt according to wiring diagram. Replace control unit (N39), if necessary.

End of test

Connect vacuum tester with Y distributor to EGR valve (60). Take reading of vacuum at 850 rpm. Accelerate briefly, vacuum drops.

Yes	No



Replace vacuum transducer (Y31/1). Check mechanical operation of air flow sensor (B2/1) (refer to section "c"). If these components are in proper order, replace control unit (N39).

End of test

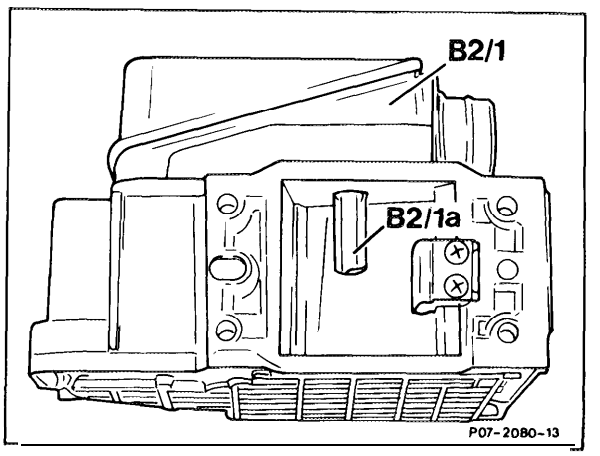
c) Check mechanical operation of air flow sensor (B2/1).

Check ease of operation of air flow sensor flap. Air flow sensor flap must not stick.

Yes	No

Replace air flow sensor (B2/1).

End of test



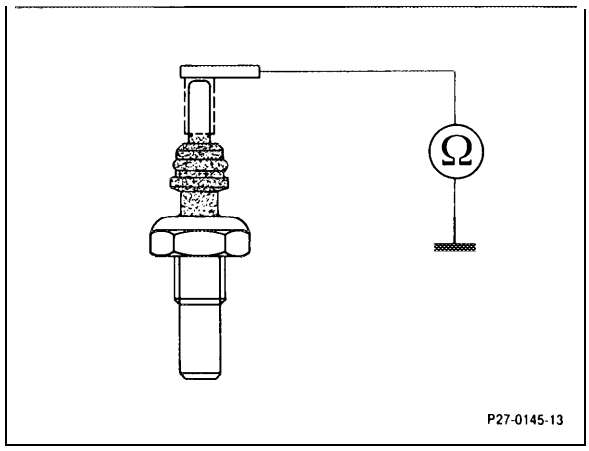
Fault readout "8"

Testing coolant temperature sensor (B11/4)

Engine off. Detach connector at coolant temperature sensor. Test resistance to ground with multimeter position "Ω".

Refer to diagram of "coolant temperature sensor and intake air" for specified value.

Yes	**No**

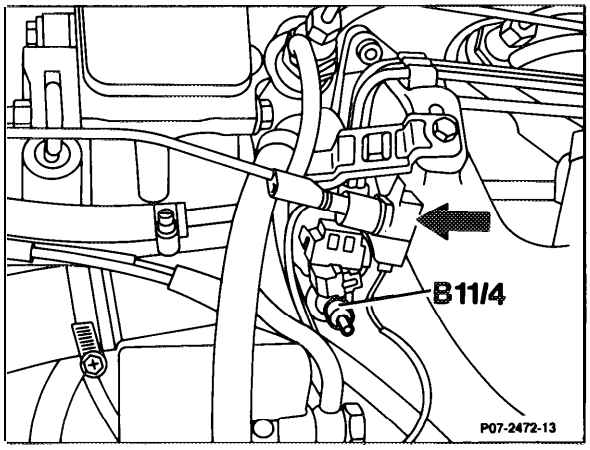


Replace temperature sensor (B11/4)

Test voltage at I-pin connector (arrow) with multimeter in position "volts".
Ignition: ON.

Readout: approx. 5 volts

Yes	No



Rectify interrupt according to the wiring diagram. Replace control unit (N39).

End of test

Fault readout "9"

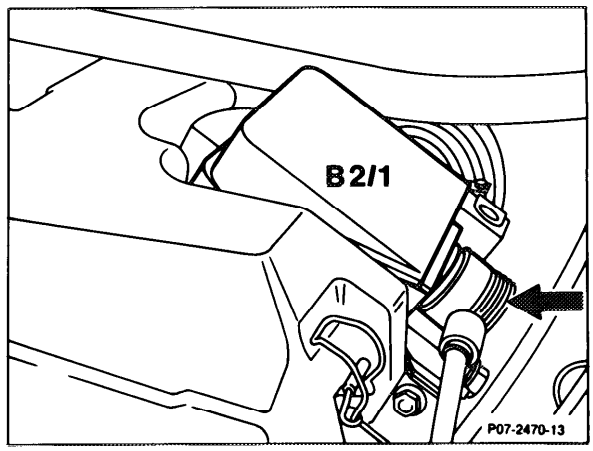
Testing air temperature sensor (B2/1a)
Engine off. Detach connector (arrow) from air flow sensor. Multimeter button "Ω". Test resistance according to table.

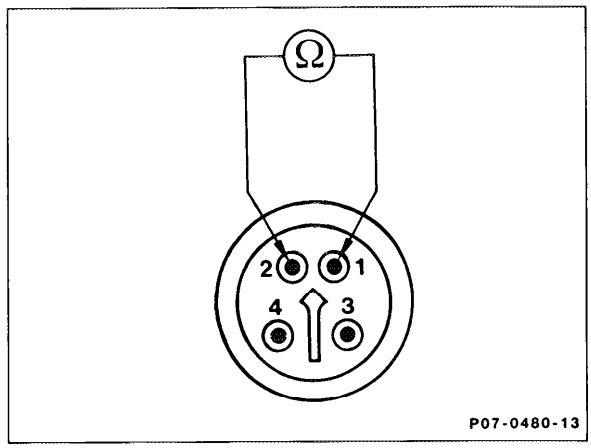
Refer to diagram for specified value.

Yes | No

Replace air flow sensor.

End of test





Coolant temperature sensor and intake air

Temperature in °C	Resistance ± 10%	Voltage in V ± 100%
20	2.5 kΩ	3.85
30	1.7 kΩ	3.47
40	1.18 kΩ	3.05
50	833 Ω	2.63
60	600 Ω	2.22
70	440 Ω	1.85
80	327 Ω	1.5
90	243 Ω	1.22
100	185 Ω	0.99

Fault readout "10"

Testing reference resistor (R18/2)
Detach resistance trimming plug. Turn off engine. Ignition: ON. Press multimeter button "V = ". Check voltage.

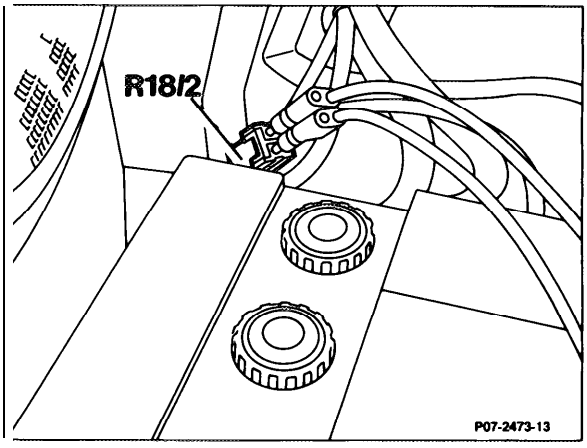
Readout: approx. 5 volts

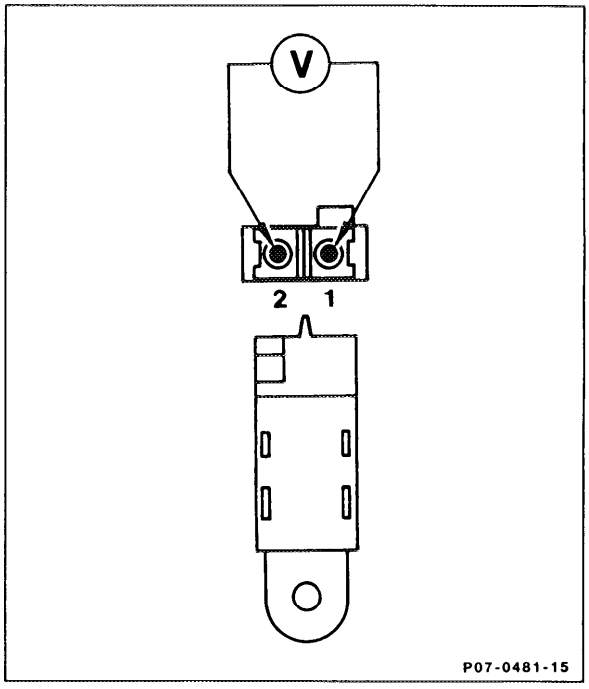
Yes	No

Rectify interrupt according to wiring diagram.

Replace resistance trimming plug (R18/2).

End of test





Mote
When replacing the resistance trimming plug (R18/2), fit only plug with an identical part no.

Fault readout "11"

Testing ELR resistance trimming plug (R18/1)

Detach resistance trimming plug. Engine off. Ignition: ON. Press multimeter button "V =". Check voltage.

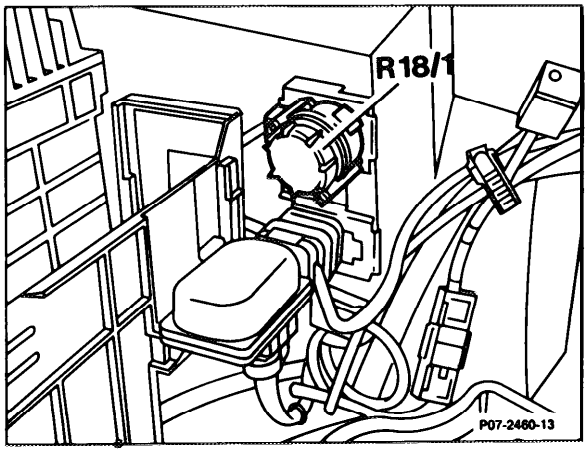
Readout: approx. 5 volts

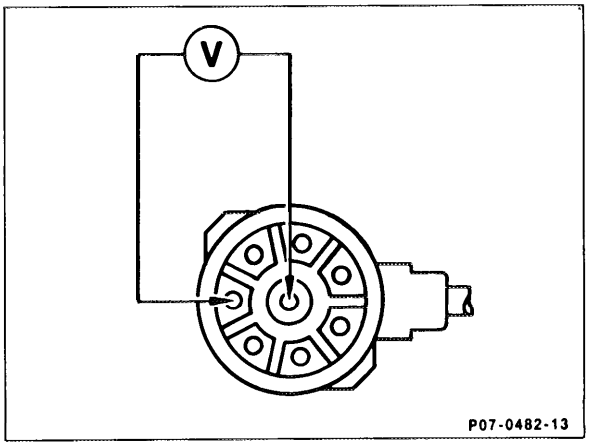
Yes	No

Rectify interrupt according to wiring diagram. Replace control unit (N39).

Replace ELR resistance trimming plug.

End of test





Note

The resistance trimming plug ELR (R18/1) is installed in position "4".

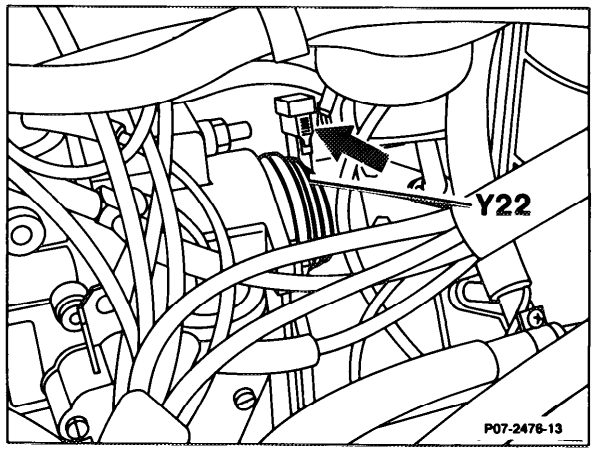
c) Testing electronic idle speed control

Testing idle speed control

Engine at idle. Detach double connector (arrow) at actuator (Y22) for at least 3 sec. and refit.

When connecting, idle speed. increases briefly.

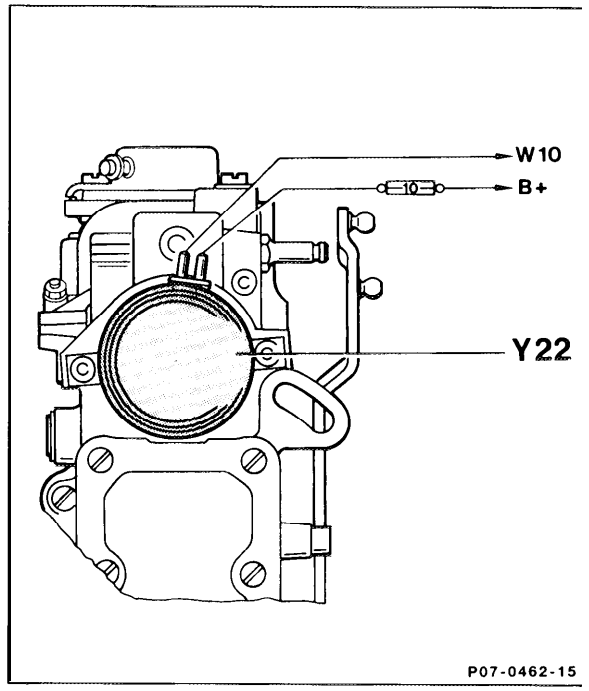
Yes	No



Briefly (max 3 sec.) apply battery voltage (approx. 12V) to actuator (Y22).

Note
Actuator (Y22) is damaged if battery voltage is applied for longer than 3 sec.
Engine speed increases.

Yes	No

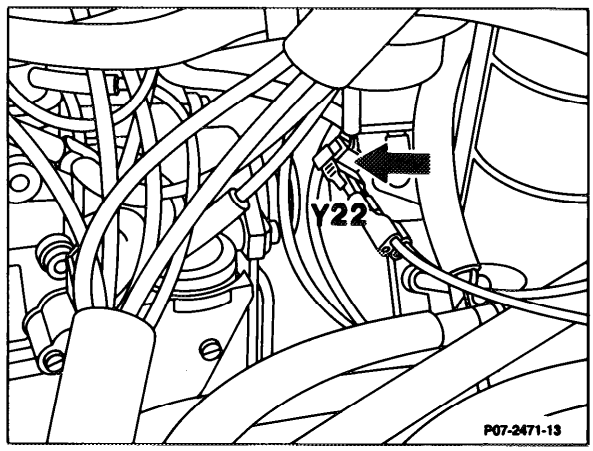


Replace actuator.

Engine at idle. Detach double connector (arrow) at actuator (Y22) and measure voltage with multimeter button "V".
Measure voltage.

Display approx. 12 volts

Yes	No



Test resistance trimming plug ELR (R18/1).
Rectify interrupt according to wiring diagram.
Replace EDS control unit (N39), if necessary.

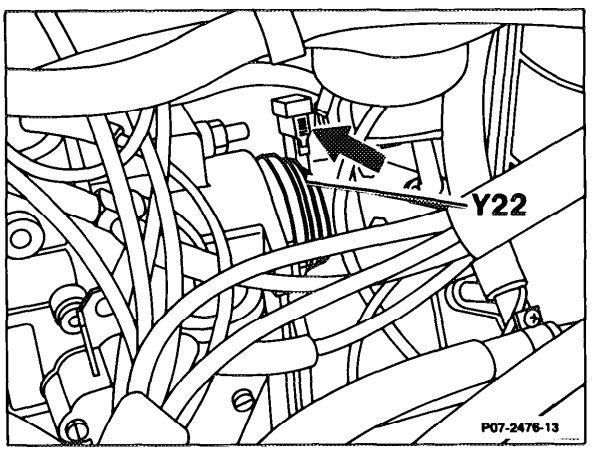
Engine at idle. Detach double connector at actuator (Y22). Test idle speed.

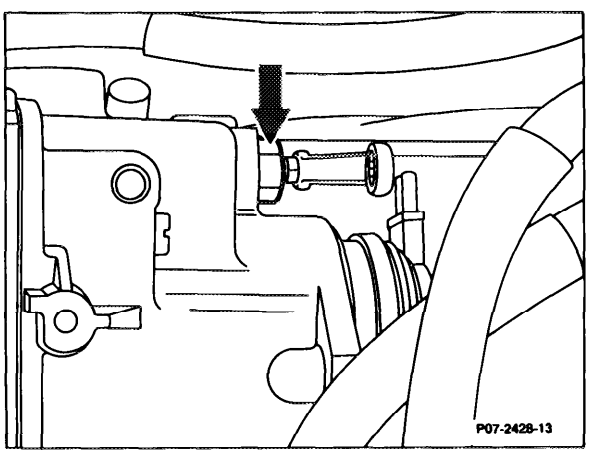
Specification: 620 ± 40 rpm

Yes	No

Set idle speed. Loosen locking nut (arrow) for this step.

End of test

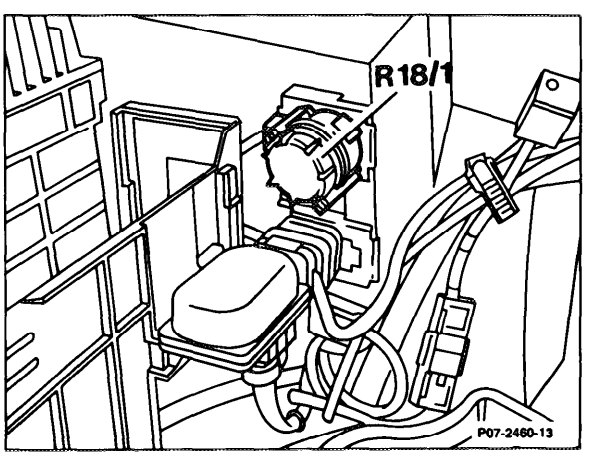




Setting idle speed by means of resistance trimming plug (R18/1)

If problems occur regarding idle, idle speed can be altered.

The positions of the resistance trimming plug are listed in the table below.

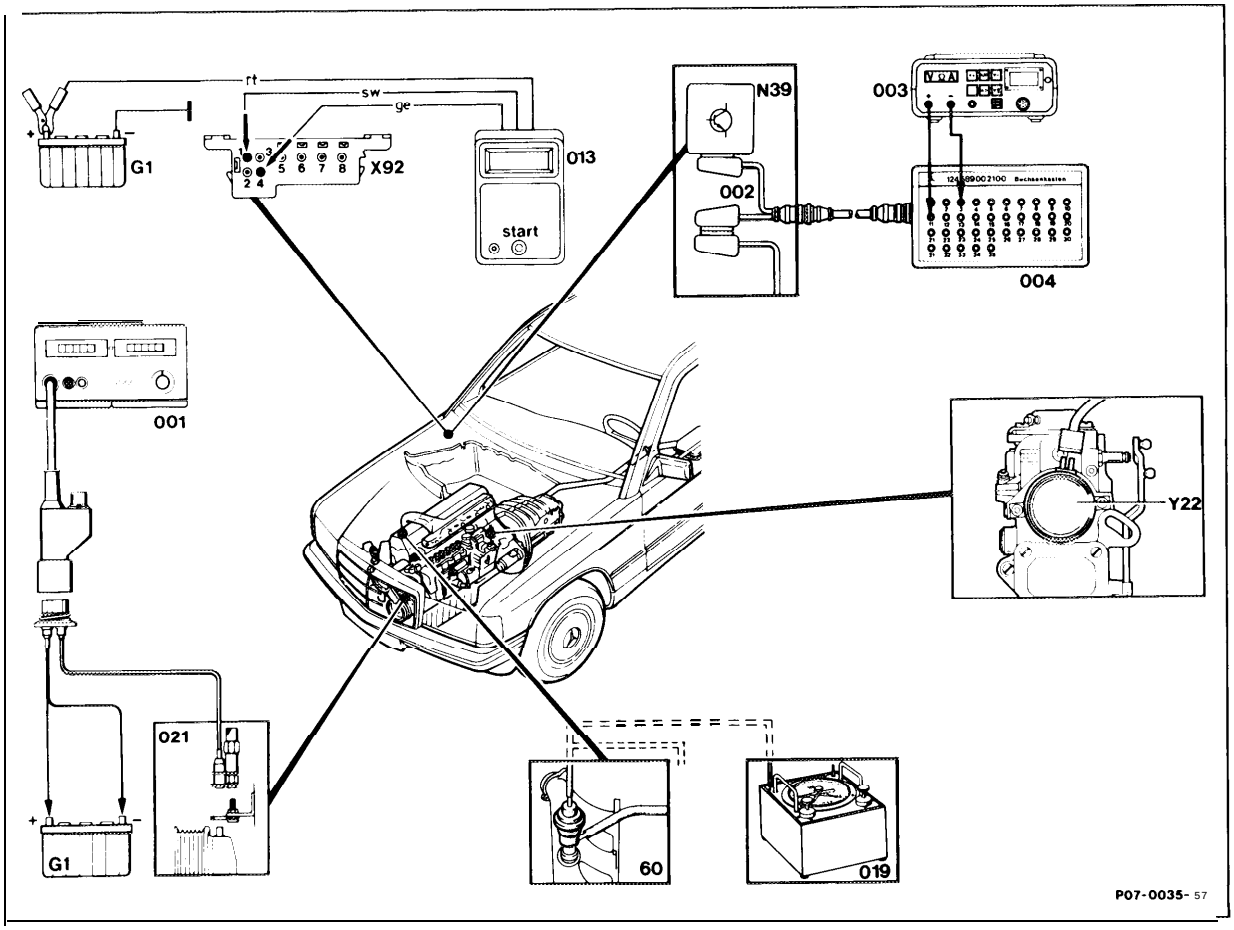


Position of resistance trimming plug	Idle speed in rpm
1	610 ± 20
2	630 ± 20
3	650 ± 20
4	680 ± 20
5	700 ± 10
6	720 ± 20
7	740 ± 20

C. Engines 602.962 and 603.970 Model Year 1990

a) Testing
b) Testing with pulse counter
c) Trouble-shooting schedule
d) Test program with contact box
(Engine 602.962)
e) ELR, EGR function test, P2 control
f) Test program with contact box
(Engine 603.970)
g) ELR and EGW function test (Engine 603.970)

a) Testing



Digital tester (001) and pulse counter (021)	disconnect, connect.
Pulse counter (013)	connect, disconnect to battery (G1) and with adaptor to test connector (X92 or Xl 1/4).
Contact box (004)	connect, disconnect with test cable (002) to EDS control unit (N39).
Digital multimeter (003)	connect, disconnect at contact box (004).
Vacuum tester (019)	connect, disconnect with Y distributor at EGR valve.
Fuse at over-voltage protection (K1/1)	test.
Selector lever	move into position "P".
Air-conditioning/automatic climate control	switch off.
Engine	bring to operating temperature (coolant temperature approx. 80°C).
Start button of pulse counter (013)	operate for 2-4 seconds.
Display	read off and note.
Start button	press again. If no new display appears, there is no further fault in the system.

Engine 602.962

The number of pulses indicate whether and which component is faulty and whether components in the control circuit are faulty.

Pulse readout	Component/controlloop
1 [3])	All functions "in order"
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1)
4	EDS control unit (N39) atmospheric pressure sensor
5 [2])	Vacuum transducer (Y31/1) or fault in exhaust control loop
6	EDS control unit (N39) internal power supply
7	Engine speed sensor (L3)
8	Coolant temperature sensor (B1 1/4)
9	Intake air temperature sensor (B2/1a)
10	Not assigned
11 [1])	ELR actuator or vacuum transducer (Y31/1)
12	Not assigned
13	EDS control unit (N39) defective (internal memory)
14	Pressure sensor (B5/1), EDS defective
15	Vacuum transducer, charge pressure control (Y31/2) pressure transducer pressure control flap (Y31/3) or faults in charge pressure control loop

1) Readout only in the case of short-circuit.
2) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
3) In the event of complaints perform functional test on ELR, EGR, P2 control.

Engine 603.970

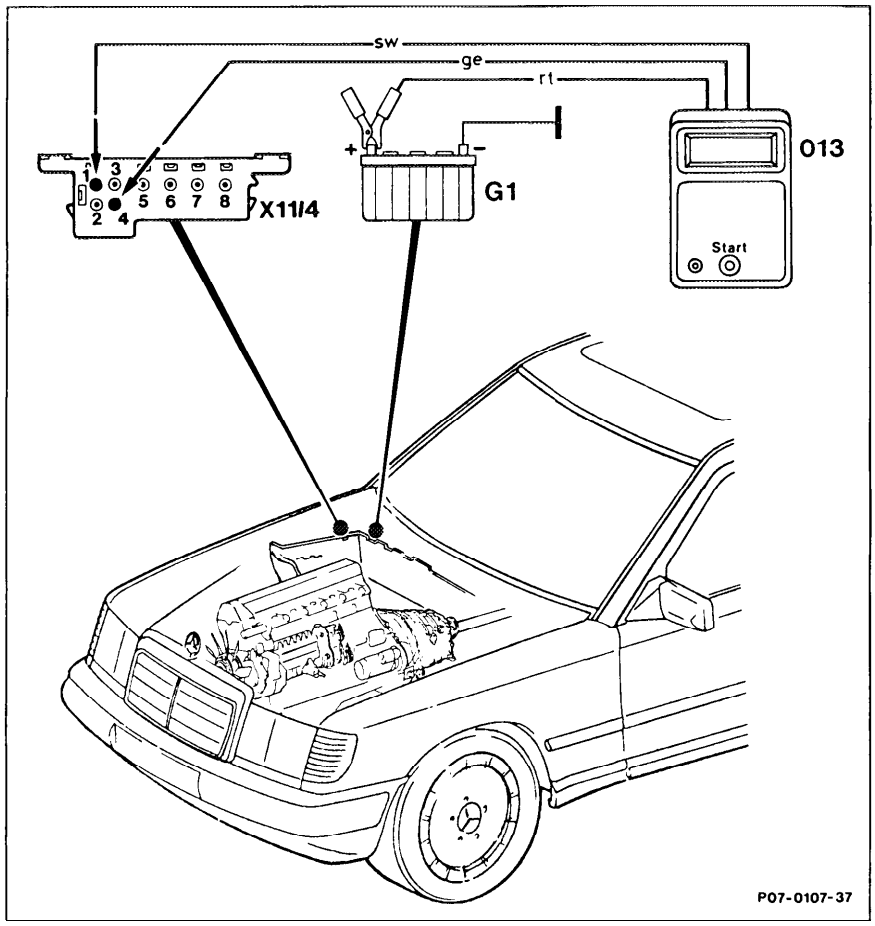
The number of pulses indicates whether and which component is faulty and whether components in the control circuit are faulty.

Pulse readout	Component/control loop
1 [3])	All functions “in order”
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1)
4	EDS control unit (N39) altitude sensor
5 [2])	Vacuum transducer (Y31 /1) or fault in exhaust control loop
6	EDS control unit (N39) Internal power supply
7	Engine speed sensor (L3)
8	Coolant temperature sensor (B11/4)
9	Intake air temperature sensor (B2/1a)
10	Power supply
11 [1])	ELR actuator or vacuum transducer (Y31/1)
12	Not assigned
13	EDS control unit (N39) defective

[1]) Readout only in case of short-circuit.
[2]) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
[3]) In the event of complaints, perform ELR and EGR function tests.

b) Testing with pulse counter

Connection diagram



013 Pulse counter
G1 Battery
X1 1/4 Test connector for diagnostics

A Model 124
B Model 126

Assignment (X1 1/4)
1 Ground
2 TD signal
3 Pulse output
Exhaust test signal (only for production tuning)
4 Pulse readout, control unit (EDS)

Notes regarding pulse readout

If a problem occurs but no fault is indicated on the pulse readout, perform the function test, section "7.4".

The number 1 indicates no fault detected in the electronic system. All other numbers are assigned to a particular fault group.

The numbers from 1 to 11 appear on the display panel of the pulse counter.

If the LED U-Batt appears after connecting, pulse counter and power supply for pulse counter are in order.

Testing

1 Connect pulse counter as shown in the connection diagram.

Note

LED U-Batt in display panel must light up; if not:

a) test fuse of pulse counter.

b) test jack 1 of test connector (Xl 1/4) to battery positive (1 l-l 4 V).

c) test jack 4 of test connector (Xl 1/4) to jack 1 (6-12 V).

2 Engine at idle.

3 Operate start button for between 2 and 4 seconds.

4 Take readout of pulse output and note.

Display "1" = no fault

Greater than "1" = fault in system

5 Again press start button for between 2 and 4 seconds. If no further fault exists in system, the previous readout appears once again.

6 Repeat until the first fault is diplayed again.

7 Rectify noted faults (pulse readout) according to trouble-shooting schedule.

8 Perform component test.

Erasing fault memory

After a fault has been rectified, the pulse display must be erased as follows:

9 Operate start button and readout the rectified fault, then press start button for 6-8 seconds.

Note

Each display pulse must be erased **individually.**

The fault is eliminated and erased when the fault code no longer appears on the fault display.

Display of a number larger than 1, further faults in system.

c) Trouble-shooting schedule

Engine 602.962

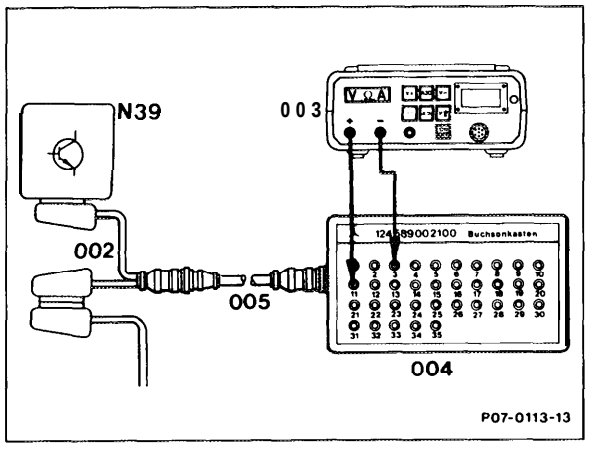
The number of pulses indicates whether and which component is faulty and whether components in the control circuit are faulty.

Pulse readout	Component/control loop
1 [3])	All functions “in order”
2	Control rod travel sensor (L7)
3	Air flow sensor potentiometer (B2/1)
4	EDS control unit (N39) atmospheric pressure sensor
5 [2])	Vacuum transducer (Y31/1) or faults in exhaust control loop
6	EDS control unit (N39) internal power supply
7	Engine speed sensor (L3)
8	Engine coolant sensor (B11/4)
9	Intake air temperature sensor (B2/1a)
10	Not assigned
11 [1])	ELR actuator or vacuum transducer (Y31/1)
12	Not assigned
13	EDS control unit (N39) defective (internal memory)
14	Pressure sensor (B5/1), EDS defective
15	Vacuum transducer, charge pressure control (Y31/2). Vacuum transducer, pressure control flap (Y31/3) or fault in charge pressure control circuit

1) Readout only in the case of short-circuit.
2) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
3) In the event of complaints perform functional test on ELR, EGR, P2 control.

d) Test program with contact box (Engine 602.962)

Connection diagram contact box



002 25-pin test cable 124 589 33 63 00
003 Multimeter
004 35-pin contact box 124 589 00 21 00
005 Test cable 124 589 34 63 00
N39 EDS control unit

Symbols for test instruments:

Contact box
Multimeter
Jack
Pin
Voltage measurement (volt, direct voltage)
Resistance measurement (ohm)

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
1	1.0	–	–	–	
2	2.0 Control rod travel sensor (L7)	N39 4 – 5 4 – 6 4 – 3 4 – 1	Ignition: OFF EDS control unit disconnected	50 ± 4 Ω 25 ± 2 Ω ∞ Ω ∞ Ω	Replace control rod travel sensor or injection pump Cables

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[2]	2.1 Control rod travel sensor (L7)	L7 2 — Ω — 3	Ignition: **OFF** Connector on control rod travel sensor (L7) disconnected	50 ± 4 Ω	Replace control rod travel sensor or injection pump
		L7 2 — Ω — 1		25 ± 2 Ω	Replace control rod travel sensor or injection pump
	2.2 Cables	N39 4 — Ω — L7 3	Ignition: **OFF** Connector on control rod travel sensor (L7) disconnected	< 1 Ω	Cable interrupt
		N39 5 — Ω — L7 2		< 1 Ω	Cable interrupt
		N39 6 — Ω — L7 1	Ignition: **OFF**	< 1 Ω	Cable interrupt
3	3.0 Air flow sensor potentiometer (B2/1)	N39 3 — V — 2 4	Ignition: **ON** EDS control unit (N39) connected	5 ± 0.5 v	EDS control unit (N39)
		3 — V — 10		< 0.5 v	Cables Test value in order although fault was stored. Cause: Air flow sensor plate jammed briefly during starting; replace air flow sensor if necessary.
		N39 3 — V — 10	Engine at idle	1.7 ± 0.2 v [1])	EDS control unit (N39)

[1]) Voltage rises as speed increases.

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[3]	3.1 Air flow sensor potentiometer (B2/1)	N39 3 – Ω + 2 4	Ignition: OFF EDS control unit (N39) disconnected	500-1200 Ω	Air flow sensor potentiometer (B2/1)
		N39 3 – Ω + 1 0	Air flow sensor in off position	50-200 Ω	Air flow sensor potentiometer (B2/1)
		N39 3 – Ω + 1 0	Air flow sensor plate fully deflected	560-1100 Ω	Air flow sensor potentiometer (B2/1)
	3.2 Cables	N39 1 0 – Ω + B2/1 3	Connector on air flow sensor potentiometer (B2/1) disconnected	< 1 Ω	Cable interrupt
		N39 2 4 – Ω + B2/1 4		< 1 Ω	Cable interrupt
4	4.0	–	–	–	Replace EDS control unit (N39) (atmospheric pressure sensor)
5 [2])	5.0 Vacuum transducer (Y31/1) EGR valve	N39 18 – V + 1 Vacuum at EGR valve	Engine 900 rpm ± 50 approx. 300 mbar [4])	> 3 V [4])	Supply line black/white leaking. Air admission line (black) blocked. Air admission filter (62a) dirty. Supply line black/white or vacuum line black (rubber) blocked or leaking. Vacuum transducer (Y31/1). Cables, EDS control unit, air flow sensor potentiometer, EGR valve

[2]) Readout only at 900 rpm for at least 5 seconds, fault is not stored.

[4]) Apply full throttle bnefly, vacuum and voltage drops. The test values are reference values.

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[5] [2]	5.1 Cables	N39 18 — Ω — Y31/1 1	Ignition: OFF Connector on vacuum transducer (Y31/1) detached	< 1 Ω	Cable interrupt
		N39 1 — Ω — Y31/1 E-2		< 1 Ω	Cable interrupt
6	6.0	–		-	Internal power supply. Replace EDS control unit
7	7.0 Engine speed sensor (L3)	N39 13 — V — 20	Engine at idle EDS control unit disconnected	> 3 V [1]	Engine speed sensor, distance, dirt, cables
	7.1 TD signal	N39 3 — V — 25	Engine at idle EDS control unit connected	> 3.5 V [6]	Cable (N39) to (XI 1/4) Short circuit or EDS control unit
	7.2 Engine speed sensor (L3)	N39 3 — Ω — 20	Ignition: OFF EDS control unit disconnected	Beru [5] 527 Ω ± 10 % VDO [5] 1900 Ω ± 10%	Engine speed sensor (L3) Cables
		L3x 1 - * - 2	Plug connector (L3x) detached	Beru [5] 527 Ω ± 10% VDO [5] 1900 Ω ± 10%	Engine speed sensor (L3) (M27)

1) Voltage rises as speed increases.
2) Readout only at 900 rpm for at least 5 seconds, fault is not stored.
5) Measured at 20°C ambient temperature (for each 10°C change in ambient temperature the reststance changes by 4%).
6) Voltage drops by approx. 0.5 V and stabilises.

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[7]	7.3 Cables	N39 2 0 — Ω — L3x 2		< 1 Ω	Cable interrupt
		N39 3 — Ω — L3x 1		< 1 Ω	Cable interrupt
a	a.0 Coolant temperature sensor (B1 1/4)	N39 3 — V — 9	Ignition: ON EDS control unit connected	[3]	Coolant temperature sensor, cables, EDS control unit
	8.1 Coolant temperature sensor (B11/4)	N39 14 — Ω — 9	Ignition: OFF EDS control unit connected	[3]	Coolant temperature sensor
		⊥ — Ω — B11/4	Plug connector (B11/4) detached	[3]	Coolant temperature sensor
	a.2 Cable	N39 9 — Ω — B11/4	Ignition: OFF EDS control unit disconnected	< 1 Ω	Cable interrupt
	9.0 Intake air temperature sensor (B2/1a)	N39 3 — V — 2 2	Ignition: ON EDS control unit connected	[3]	Temperature sensor, intake air, air flow sensor, cables, EDS control unit

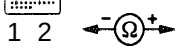
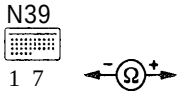
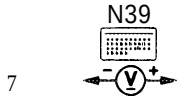
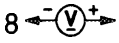
[3] Refer to table of coolant temperature sensor and intake air.

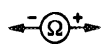
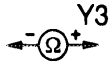
On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[9]	9.1 Intake air temperature sensor (B2/1a)	N39 3 — Ω — 22	Ignition: OFF EDS control unit disconnected	[3]	Cable to intake air temperature sensor Temperature sensor
		B2/1 1 - * — 2	Connector on air flow sensor (B2/1) disconnected	[3]	Intake air temperature sensor
	9.2 Cables	N39 2 2 — Ω — B2/1 — 1	ignition: **OFF** EDS control unit disconnected Connector on air flow sensor potentiometer (B2/1) detached	< 1 Ω	Cable interrupt
		N39 3 — Ω — B2/1 — 2		< 1 Ω	Cable interrupt
10	10.0 Power supply	N39 1 4 — V — 1	Engine approx. 1500 rpm	11–14 V	Alternator regulator Lima Voltage > 18 V
11 [1]	11.0 ELR actuator (Y22)	N39 3 — V — 2	EDS control unit connected	11–14 V	Actuator (Y22) Cables
		N39 2 — V — 1	Ignition: **ON** Engine at idle	2.5 ± [2] 0.5 v	EDS control unit (N39)
			* * *		

1) Readout only in the case of short-circuit.
2) Reference value, voltage drops as speed increases.
3) Refer to table of coolant temperature sensor and intake air.

On/off ratio readout:	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[11] [1])	11.1	N39 1 — Ω + 2	Ignition: OFF EDS control unit disconnected	4 ± 1 Ω	Actuator (Y22) Cables
	11.2 Cables	N39 1 — Ω + Y22 2	Ignition: OFF Detach connector at actuator (Y22)	< 1 Ω	Cable interrupt
		N39 2 — Ω + Y22 1		< 1 Ω	Cable interrupt
13					Internal memory Replace EDS control unit (N39)
14	14.0 Pressure sensor (B5/1)	N39 3 — V + 12	Ignition: ON EDS control unit connected	> 5 v	Pressure sensor Pressure lines Electrical cables
	14.1 Pressure sensor (B5/1)	N39 3 — V + 17	Engine at idle	> 1.5 v 0 mbar	Pressure sensor Pressure lines Electrical cables
		Pressure tester with Y distributor on pressure sensor	Apply full throttle briefly	Voltage rises, pressure rises > 500 nbar	
	14.2 Pressure sensor (B5/1)	N39 3 — Ω + 12	gnition: OFF EDS control unit detached	1.4 ± I.2 kΩ	
	14.3 Cables	N39 3 — Ω + B5/1 3		< 1 Ω	Cable interrupt

[1]) Readout only in the case of short-circuit.

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specification	Possible cause/remedy
[14]	14.4 Cables	N39 1 2  B5/1 2	Ignition: OFF EDS control unit disconnected	< 1 Ω	Cable interrupt
	14.5 Cables	N39 1 7  B5/1 1	Ignition: OFF EDS control unit disconnected	< 1 Ω	Cable interrupt
15	15.0 Vacuum transducer (Y31/2)	N39 7  1	Engine at idle EDS control unit connected	Approx. 0.4 v < 100 mbar	Vacuum transducer (Y31/2) Vacuum lines EDS control unit
	Vacuum unit, pressure control flap	Vacuum tester with Y distributor on vacuum transducer (Y31/2) Output (OUT)	Increase speed slowly to approx. 2000 rpm	Vacuum increases Voltage rises	
	15.1 Cables	N39 7 Y31/2 1	Ignition: OFF EDS control unit disconnected Connector on (Y31/2) detached	< 1 Ω	Cable interrupt
	15.2 Cables	N39 1 Y31/2 2	Connector on (Y31/2) detached	< 1 Ω	Cable interrupt
	15.3 Vacuum transducer (Y31/3)	N39 8  1	Engine at idle EDS control unit connected	Approx. 4 v < 300 mbar	Vacuum transducer (Y31/3) Vacuum lines EDS control unit
	Vacuum unit, charge pressure control valve	Vacuum tester with Y distributor on vacuum transducer (Y31/3) Output (OUT)	Increase speed slowly to approx. 2000 rpm	Voltage drops Vacuum drops	Vacuum transducer (Y31/3) Vacuum lines EDS control unit

On/off ratio readout	Test step/ test scope	Test connection	Operation/ requirement	Specifi-cation	Possible cause/remedy
[15]	15.4 Cables	N39 1  Y31/3 2	Ignition: **OFF** **EDS** control unit disconnected	< 1 Ω	Cable interrupt
		N39 a  Y31/3 1		< 1 Ω	Cable interrupt

Coolant temperature sensor and intake air

Temperature in °C	Resistance (± 10%)	Voltage in V (± 10%)
20	2.5 kΩ	3.85
30	1.7 kΩ	3.47
40	1.18 kΩ	3.05
50	833 Ω	2.63
60	600 Ω	2.22
70	440 Ω	1.85
80	327 Ω	1.5
90	243 Ω	1.22
100	la5 Ω	0.99

e) ELR, EGR function test, P2 control

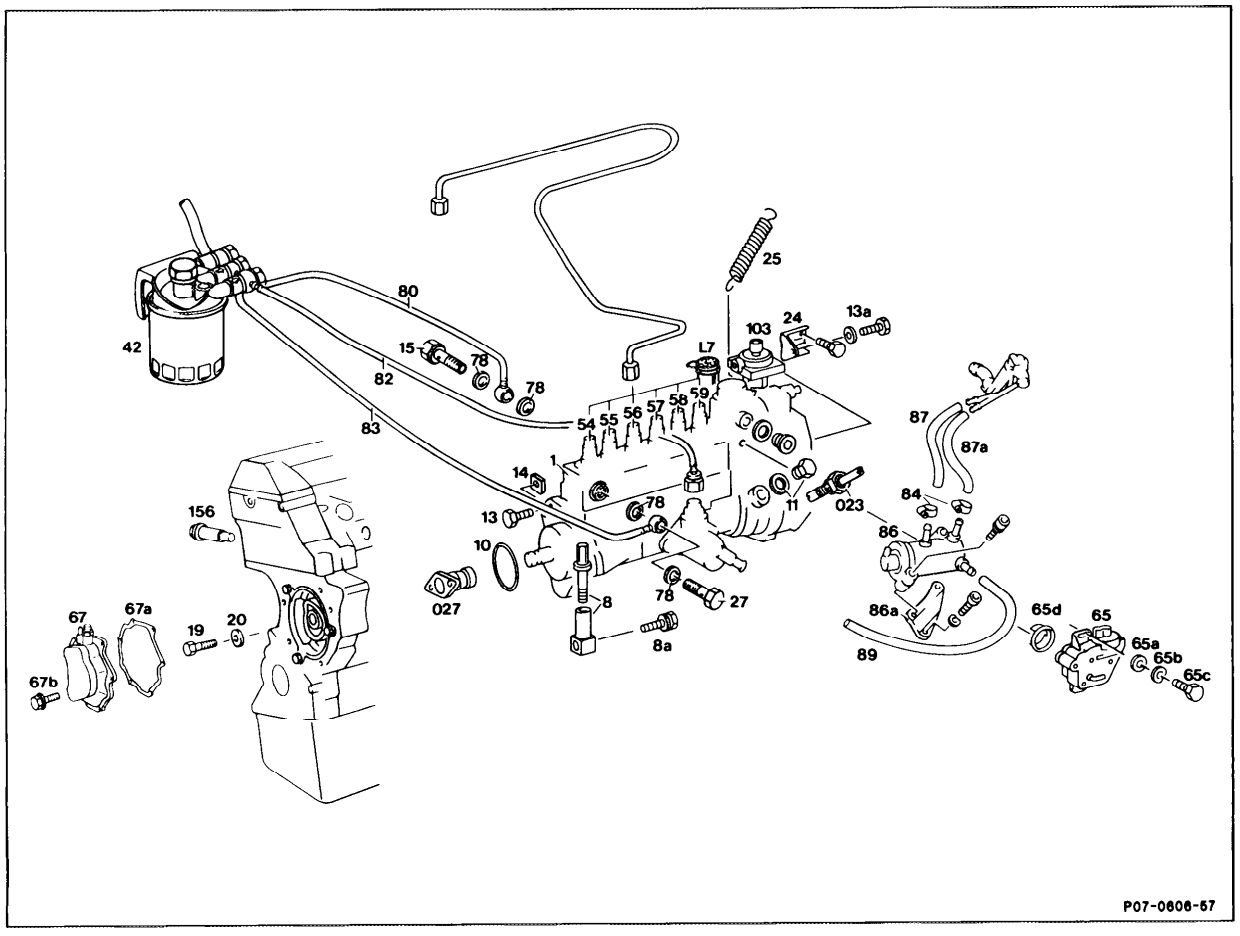
Note
This test is to be performed when in the event of complaint concerning the pulse readout, no fault is displayed.

Engine 602.962 with P2 control

Test step/ test scope	Test connection/ test instrument	Operation/ requirement	Specification	Possible cause/ remedy
1.0 Idle speed control	Revolution counter with TDC generator	Engine at idle Coolant temperature approx. 80°C	680 rpm ± 20	Actuator, injection pump, engine speed sensor, EDS control unit (N39), refer to test steps 7 and 11
		Plug detached from actuator	610 rpm ± 20	Set speed at injection pump. Injection pump
2.0 Exhaust control circuit	Connect vacuum tester with Y distributor to EGR valve	Engine running at 900 rpm ± 50 and approx 300 mbar. Briefly apply full throttle	Vacuum drops	Perform mechanical test on vacuum transducer (Y31 /1) and air flow sensor (B2/1). EDS control unit (N39) EGR valve
3.0 EGR valve	Connect vacuum tester directly to EGR valve.	Engine off Pressurize EGR valve with 300 mbar and disconnect again.	EGR valve audibly closes	Replace EGR valve.

Test step/ test scope	Test connection/ test equipment	Operation/ requirement	Specifi- cation	Possible cause/remedy
4.0 Charge pressure control	Connect vacuum tester (020) with Y distributor to output (OUT) from vacuum transducer (Y31/3)	Engine at idle	> 300 mbar	Vacuum supply Vacuum line Vacuum transducer (Y31/3) EDS control unit (N39)
Vacuum unit Charge pressure control valve		Slowly increase speed to approx 2000 rpm	Vacuum reduces	
4.1 Vacuum unit Pressure control flap (100)	Connect vacuum tester (020) with Y distributor to vacuum unit pressure control flap (100)	Engine at idle	< 100 mbar	Vacuum supply Vacuum line
		Slowly increase speed to approx. 2000 rpm	Vacuum increases	Vacuum transducer (Y31/2) Pressure line on pressure sensor (B5/1) EDS control unit

07.1-200 Removal and installation of injection pump - Turbodiesel

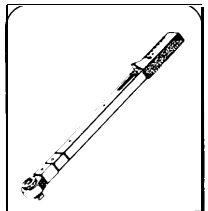


Bottom section of noise encapsulation	. . . . .	remove, fit (94-0050).
Belt tensioning device	. . . . .	remove, install (13-340).
Fan cowl and fan	. . . . .	remove, install (20-335).
Vacuum pump (67)	. . . . .	remove, install (43-610). Replace gasket (67).
Assembly sleeve (067)	. . . . .	install, remove, so that engine can be turned over easily. Special tool 601 589 05 14 00 (engines effective 09/89).
Radiator	. . . . .	remove, install (20-470). Model 201.128 only.
Actuator of cruise control	. . . . .	Remove, install (54-541), Engine 603 only.

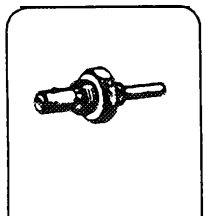
Central fastening bolt (19) with washer (20)	Unscrew, screw in, tightening torque 40-50 Nm.
	Caution! Left-hand thread
Crankshaft	in direction of rotation turn to 15° ATDC of no. 1 cylinder.
Chain tensioner (156)	remove, install (05–310). Special tool 001 589 65 09 00.
Injection lines (54-59) at injection pump	disconnect, connect. Tightening torque 10–20 Nm. Special tool 000 589 77 03 00.
Fuel lines (80, 82, 83)	disconnect, connect, replace seals.
	Caution! Do not mix up hollow bolt (27) and overflow orifice (15).
Fuel thermostat (86) and fuel line (89)	disconnect, connect.
Pressure lines at ALDA unit (103) and vacuum lines	disconnect, connect.
Electric cables	disconnect, connect at control rod travel sensor (L7) and at actuator (Y22).
Accelerator control linkage	detach, attach. Check setting (30-300).
Injection pump (1)	Remove bolt (13 and 13a), tightening torque 20-25 Nm. Withdraw injection pump to the rear; **hold timing device tight** when performing this step.
O-ring (10)	replace.
Start of delivery adjusting device(8)	remove, install; remove bolt (8a) for this step.
Spring (25)	detach, reattach.

Screw plug (11)	remove and turn removed injection pump with serrated wrench (027) until lug is visible in the governor housing hole. In this position, push in locking bolt (023) until it is felt to engage.
	Caution! Remove locking bolt (023) after installing injection pump and refit screw plug (11).
Start of delivery	check (07.1-I 12), set if necessary.
Vacuum control valve (65)	remove, install, set (07.1-I 70).

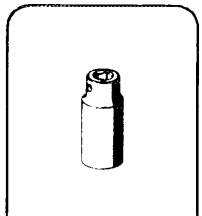
Special tools



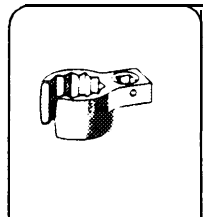
001 589 66 21 00 00



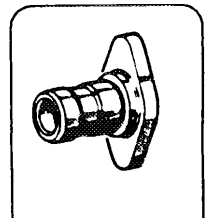
601 589 05 21 00



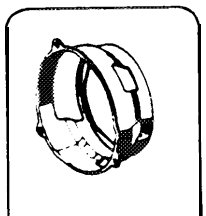
001 589 65 09 00



000 589 77 03 00



601 589000800



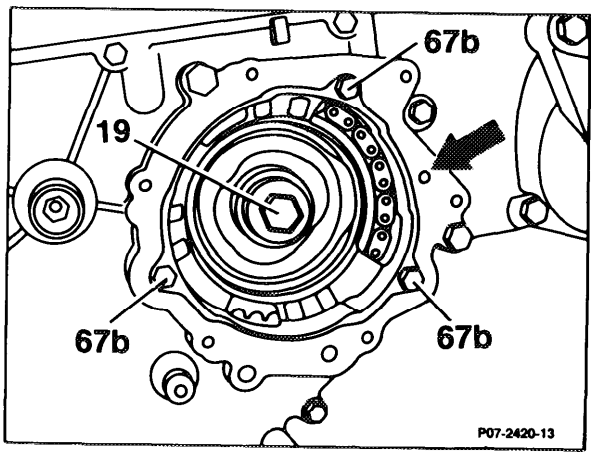
601 589 05 14 00

Removal and installation

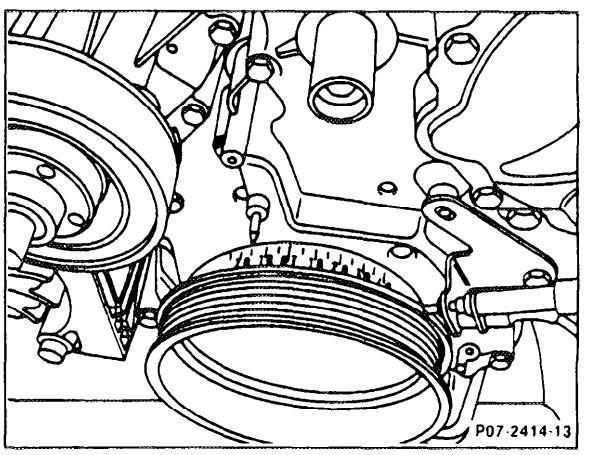
1 Loosen central fastening bolt (19), unbolt while holding crankshaft tight.

Caution!
Left-hand thread

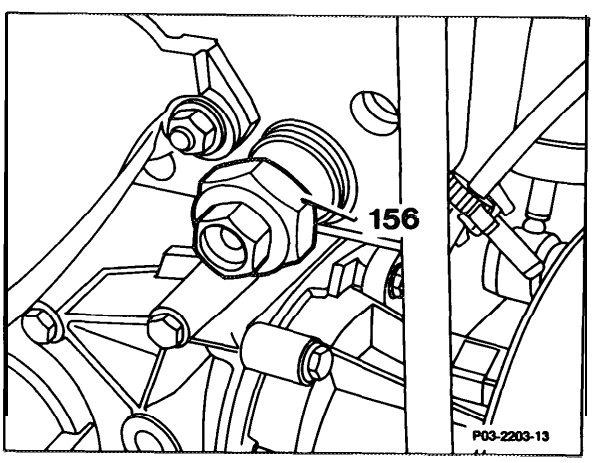
Mount assembly basket using bolts (67b), so that the engine can be cranked easily (on engines effective 09189).



2 Turn crankshaft in direction of rotation to 15° ATDC of no.1 cylinder.

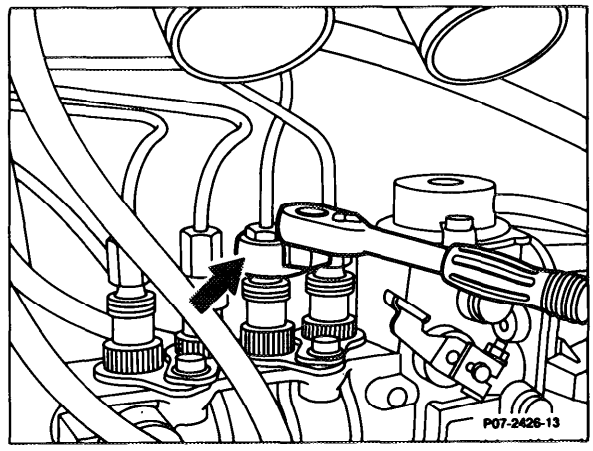


3 Remove chain tensioner (05310).



156 Wrench socket
Special tool 001 589 65 09 00

4 Detach injection and fuel lines at the injection pump.



Arrow **Box wrench socket Special tool 000 589 77 03 00 with 1/4" ratchet**

5 Disconnect vacuum lines at vacuum unit for stop unit and vacuum control valve. Detach 2-pin connector at actuator (Y22) of electronic idle speed control.

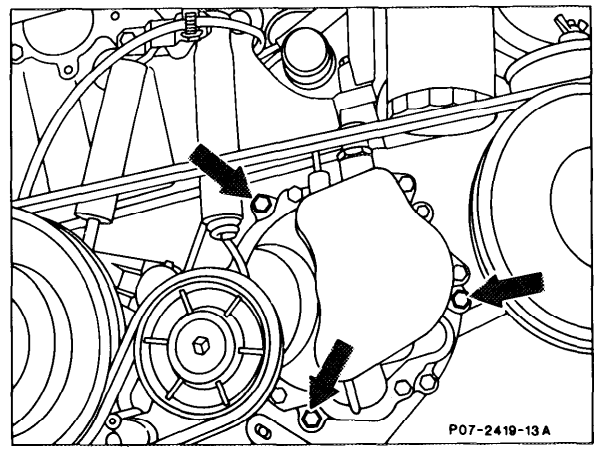
6 Disconnect electric cables at control rod travel sensor (L7) and at actuator (Y22).

7 Disconnect pressure line at ALDA unit.

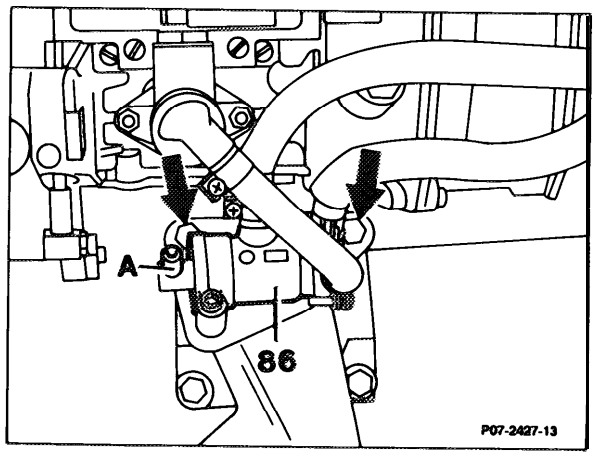
8 Detach accelerator control linkage at control lever and spring.

9 Remove vacuum control valve.

10 Remove injection pump; remove fastening bolts (arrows) and bolt on mounting bracket for this step. Withdraw injection pump to the rear, holding timing device in place.



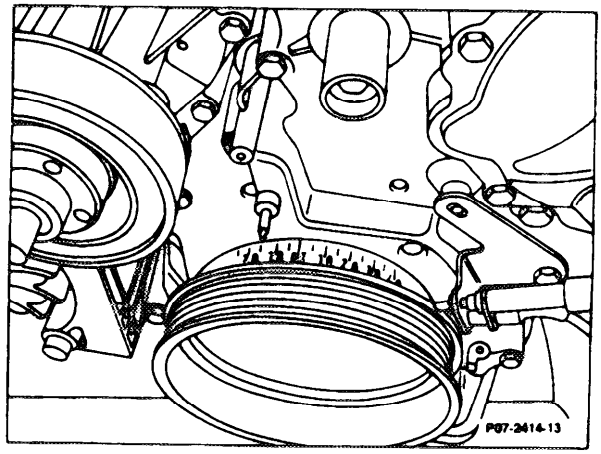
11 Remove fuel thermostat (86) complete; remove bolts (arrows) for this step.



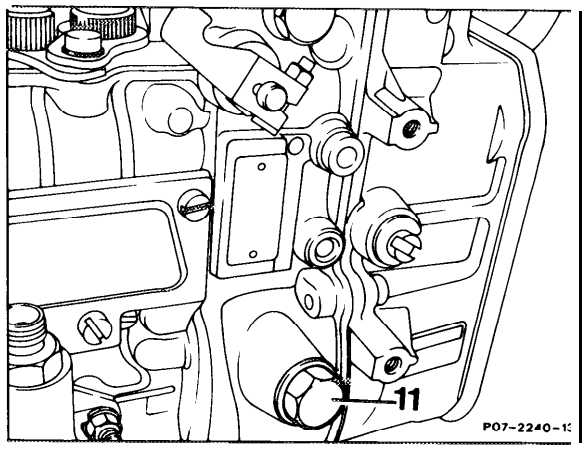
A Inlet from fuel tank

12 Check whether the engine is positioned at 15° ATDC of no. 1 cylinder; adjust if necessary.

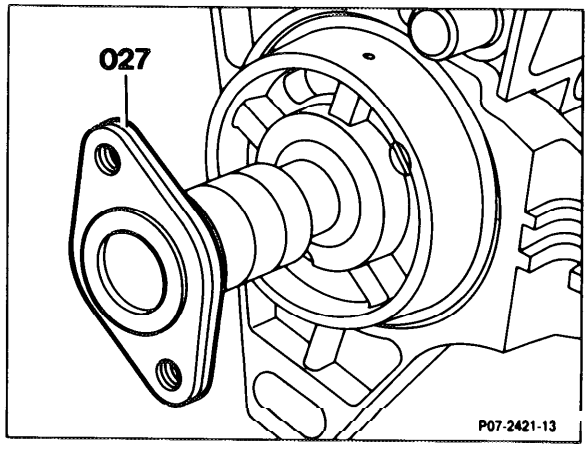
Caution!
Engine must only be cranked in direction of rotation!



13 Unscrew plug (11).

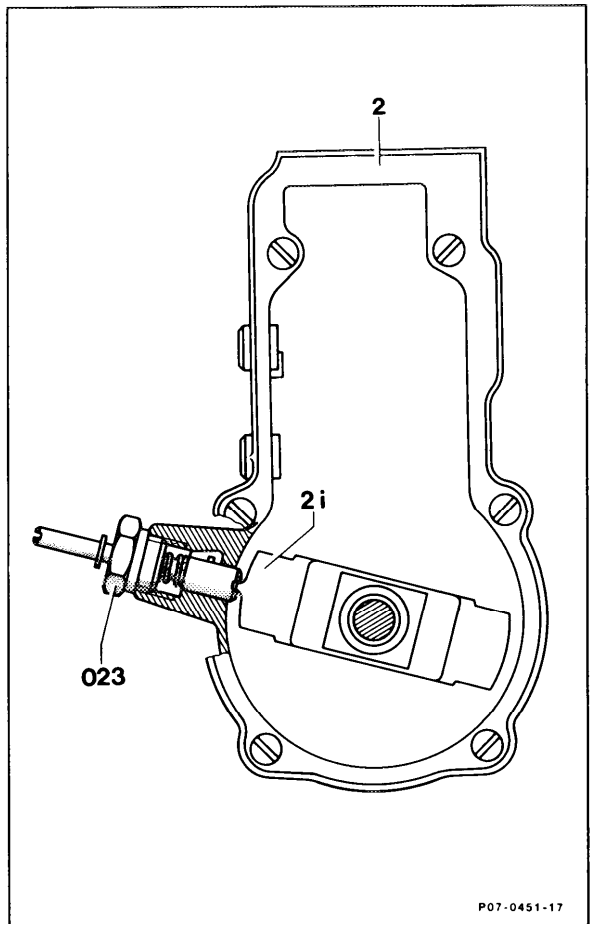


14 Use serrated wrench (027) to turn injection pump on the injection pump crankshaft until the lug of the governor is visible at the hole, i.e. push in locking bolt (023) in this position until it is felt to engage, and tighten by hand.



027 Serrated wrench
Special tool **601 589 00 08 00**

Caution!
Remove locking bolt (023) after installing injection pump, otherwise the injection pump will be damaged when starting the engine.



023 Locking bolt
Special tool 601 589 05 21 00

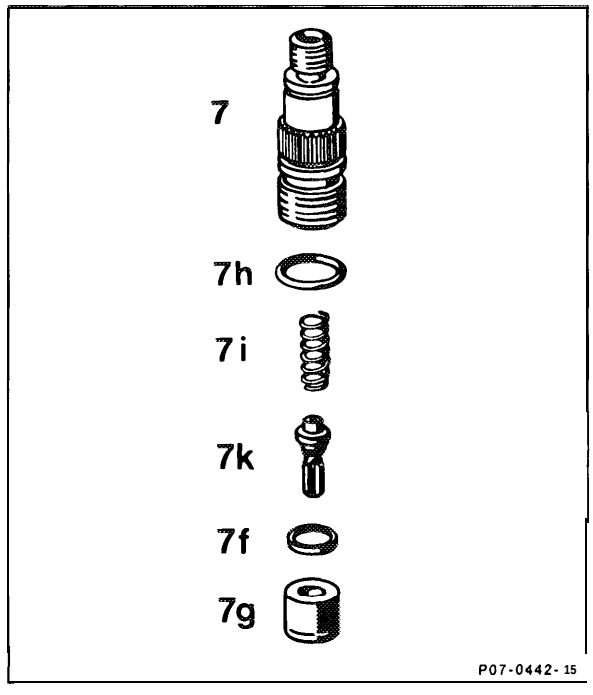
15 Install remaining parts on engine.

Note
When starting engine, the injection system is automatically bled.

16 Check start of delivery (07. l-l 12); set start injection if necessary (07. l-l 17).

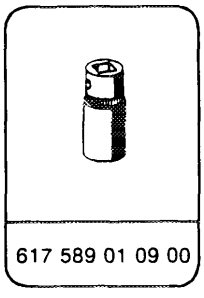
17 install vacuum control valve and set (07. l-l 70).

07.1–210 Replacing delivery valve seal - Turbodiesel



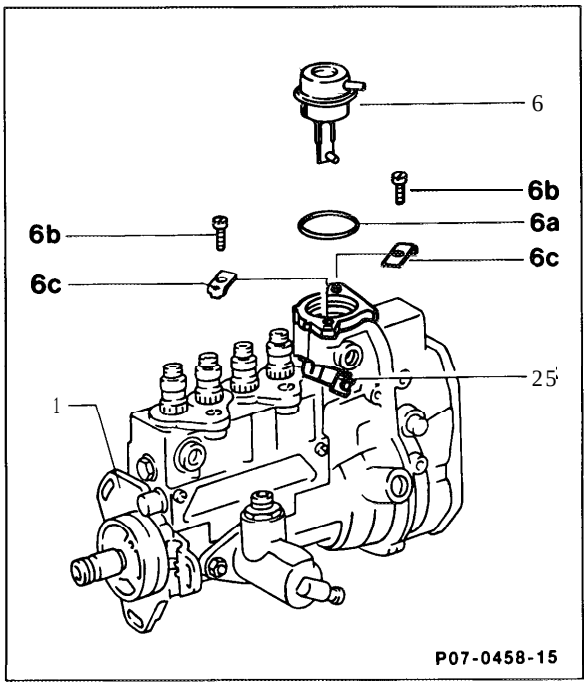
Delivery valve holder (7)	tightening torque 35 Nm, Special tool 617 589 01 09 00.
Compression spring (7i) copper seal (7f)	replace
Delivery valve (7k)	rinse in fuel before installing.
Delivery valve carrier (7g)	Make note of installed position.
O-ring (7h)	oil before assembling.

Special tool



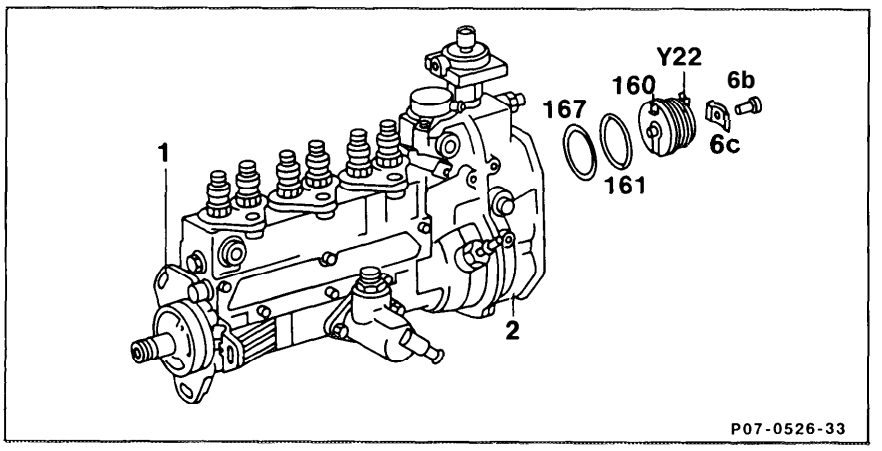
07.1-220 Replacing vacuum unit - Turbodiesel

Preceding work:
Charge air pipe removed (14-180).

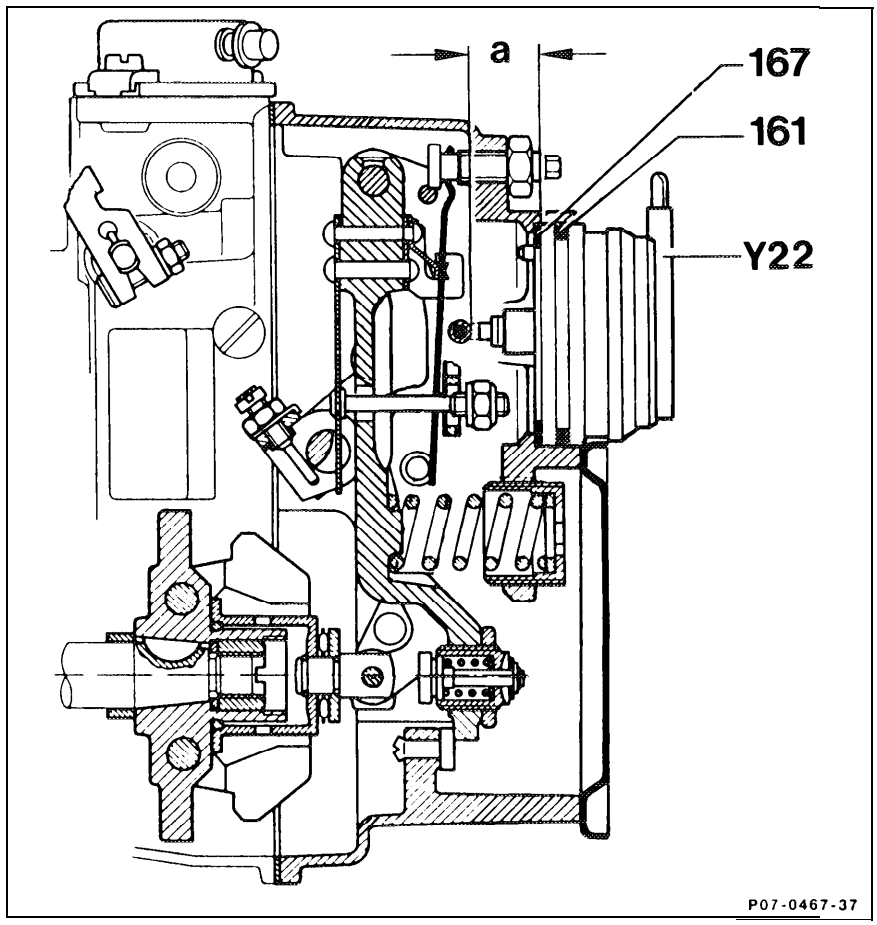


Screw (6b)	remove, install (use TORX-T30).
Bracket (6c)	remove, install.
Stop unit (6)	raise slightly when removing, tilt back towards engine and withdraw.
O-ring (6a)	remove, install.
Emergency stop lever (25)	press when installing and engage connecting rod of vacuum unit into the rocker of the emergency stop lever.

07.1–225 Replacing actuator of electronic idle speed control (EL R) - Turbodiesel

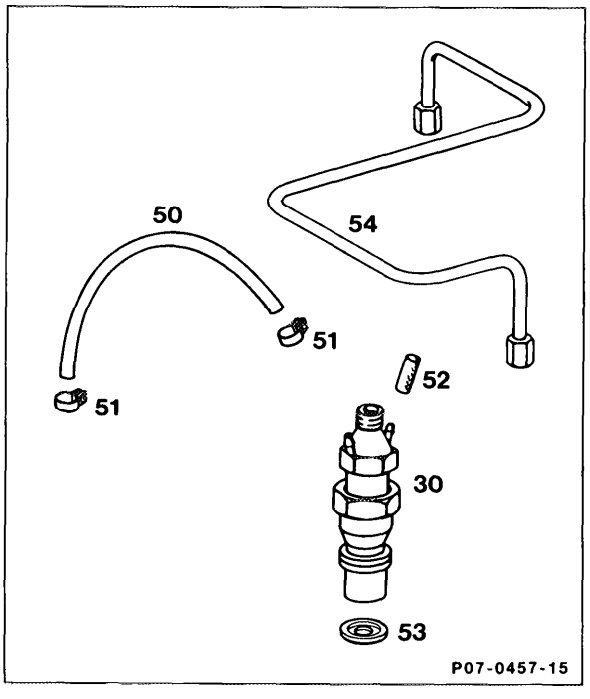


Screw (6b)	remove, install, (use TORX T30).
Bracket (6c)	remove, install.
Actuator (Y22) with intermediate plate (160)	remove, install, electrical connection must be facing upwards.
O-ring (161)	replace.
Shim (167)	for setting size “a”.



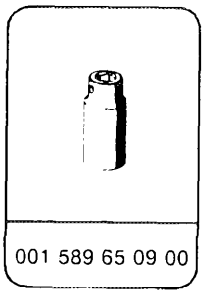
Size "a" 14.6-15.7 mm

07.1430 Removal and Installation of injectors - Turbodiesel



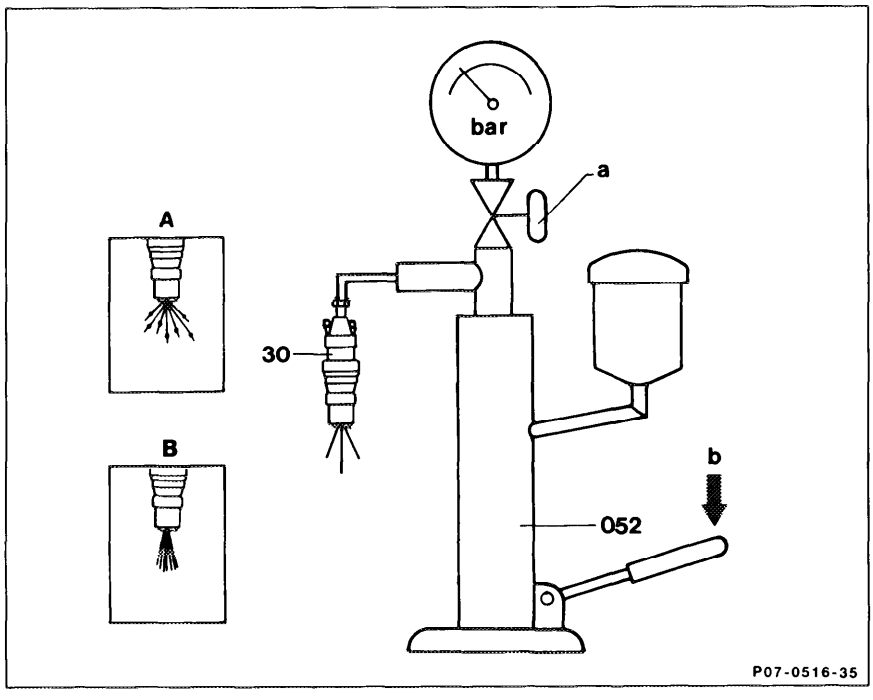
Bypass oil hose (50), plug (52)	remove, refit.
Injection line (54)	remove, install, tightening torque 10–20 Nm as reference value.
Injection nozzle (30)	remove, install, tightening torque 70-80 Nm, Special tool 001 589 65 09 00.
Nozzle seal (53)	replace.

Special tool



07.1–231 Testing injectors - Turbodiesel

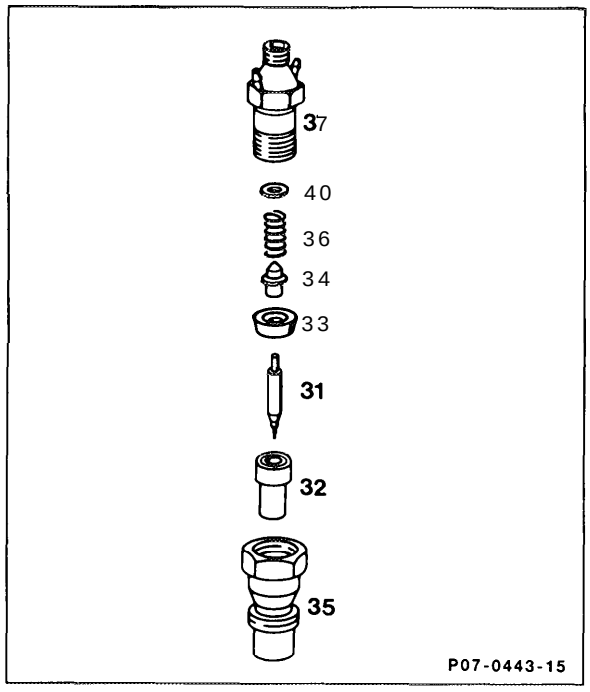
Preceding work:
Removal and installation of injectors (07-230)



Injection nozzle (30)	pump 5 times vigorously on tester (052) 000 589 00 68 00; close valve “a” for the step.
Chatter	test; slowly operate hand lever "b" approx. 1 stroke per second for this step.
Jet	test. With short, rapid strokes, approx. 2 strokes per second, the jet must be closed and be properly formed. A – Stringy jet “poor” B – Closed jet “good”
Ejection pressure or opening pressure	test. Open valve “a” for this step and operate hand lever "b" slowly (at least 1 stroke per second). Specification: 135-145 bar for new nozzles min. 120 bar for used nozzles,

07.1–232 Reconditioning injectors (after testing) - Turbodiesel

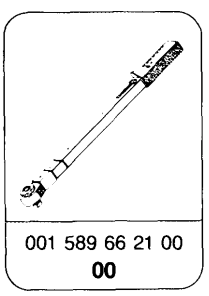
Preceding work:
Removal and installation of injectors **(07.1-230)**
Testing Injectors **(07.1-231)**



Injection nozzles	disassemble(1).
Nozzle needle (31)	remove, install, visual and sliding inspection; clean center and longitudinal bore of hole pintle nozzles; install in the same nozzle body.
Nozzle body (32)	remove combustion residues.
Intermediate disc (33)	dress on surface plate.
Pressure pin (34)	remove, install, point must be facing toward top section.
Nozzle tensioning nut (35)	unscrew, reinstall, tightening torque 70-80 Nm.
Compression spring (36)	remove, insert.
Holder (37)	to strip down and assemble the injection nozzles, clamp in protective jaws of vice.

Steel washer (40) . . . . . set for ejection pressure.
Specification:
135-145 bar for new or newly set nozzle, at least 120 bar for used nozzle. Ejection pressure higher or lower depending on thickness of washer.
0.05 mm results in approx. 3 bar pressure difference.

Special tools


001 589 66 21 00
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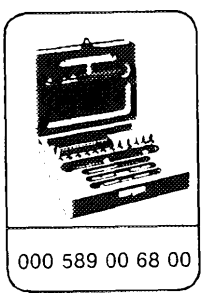
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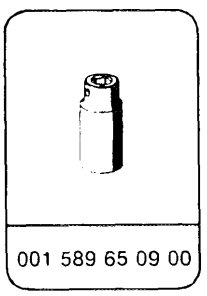
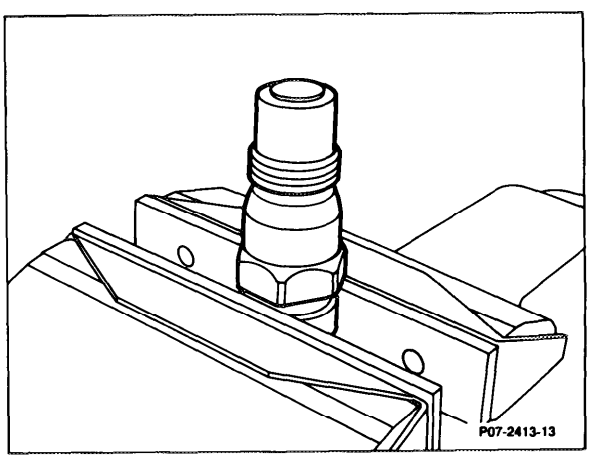
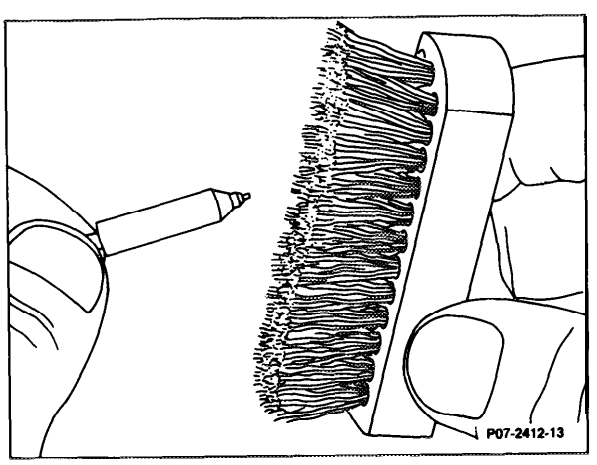

001 589 65 09 00

Reconditioning

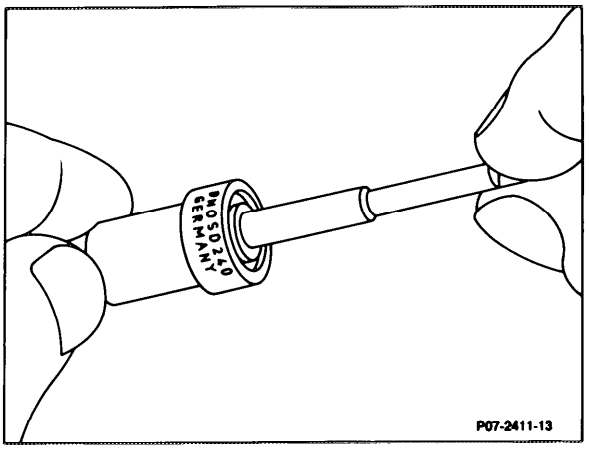
1 Disassemble injection nozzle by clamping body in vice with protective jaws so that the leak oil line connections are not damaged.



2 Clean nozzle needle and nozzle body with a brass wire brush.



Remove combustion residues on seat of nozzle needle with a scraper.

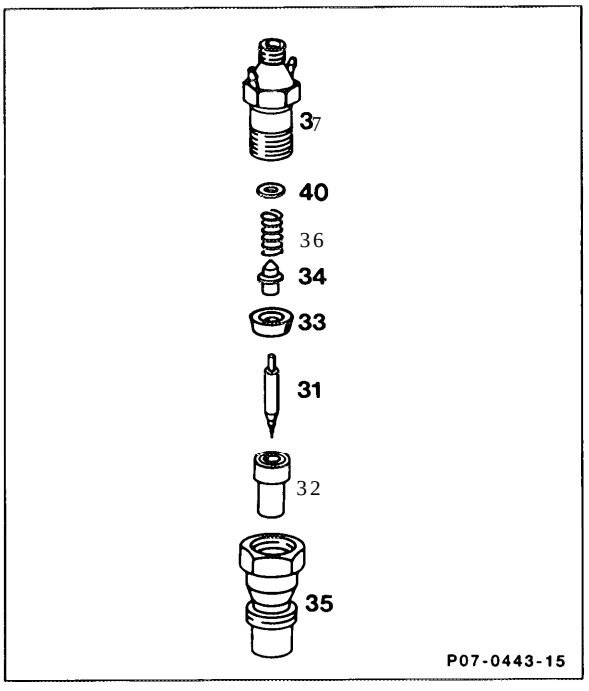


3 Visual and sliding inspection.
Dip nozzle in filtered diesel fuel. With the nozzle body held upright, the nozzle pintle must slide towards the nozzle seat by its own weight.

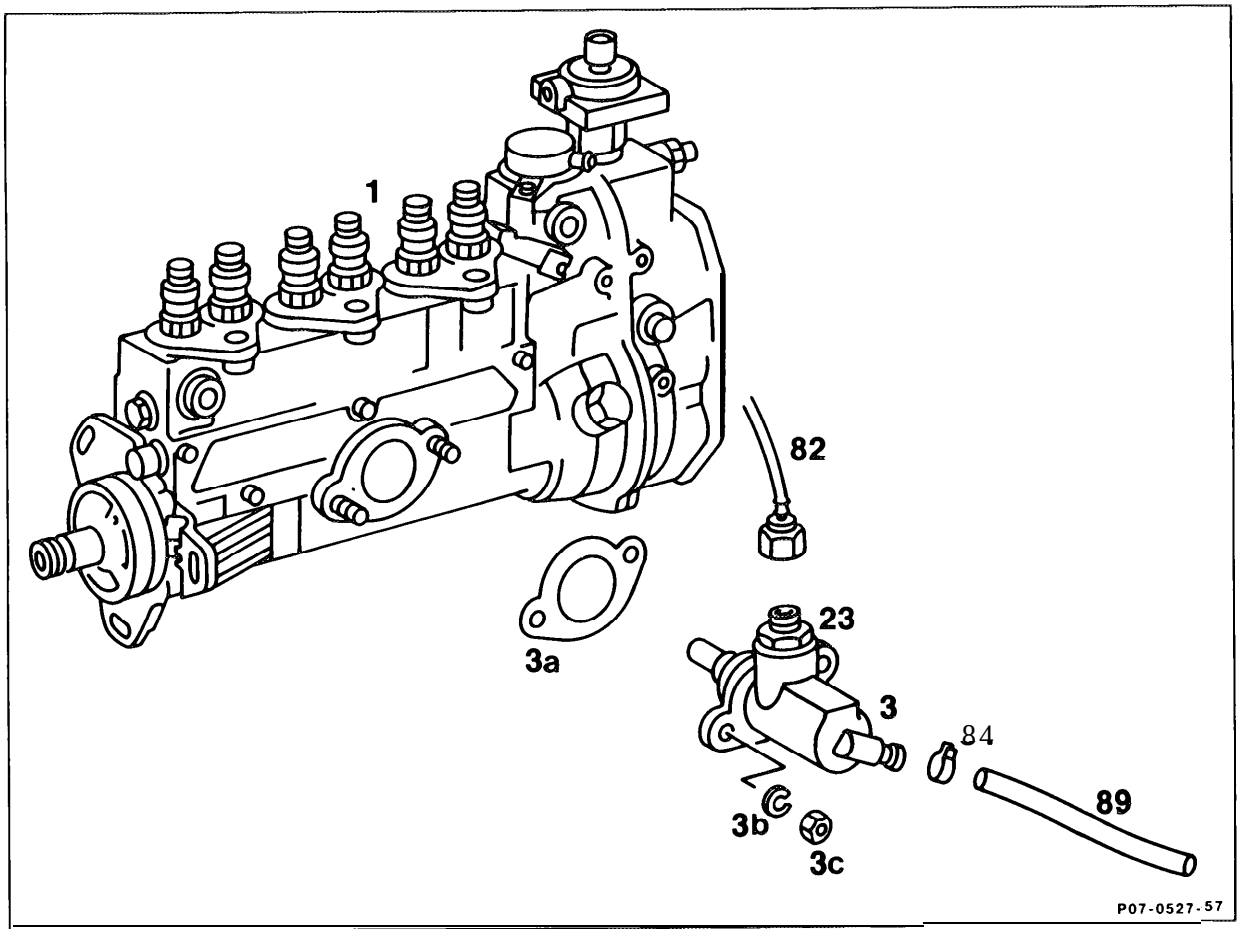
4 Dress intermediate disc (33) on a surface plate.

5 Assemble nozzle holder with injection nozzle. Ejection pressure is set with the steel washer (40). Ejection pressure is higher or lower depending on thickness of the washer; 0.05 mm results in approx. 3 bar pressure difference.

6 Test injection nozzles (07.1-231). Set if necessary.



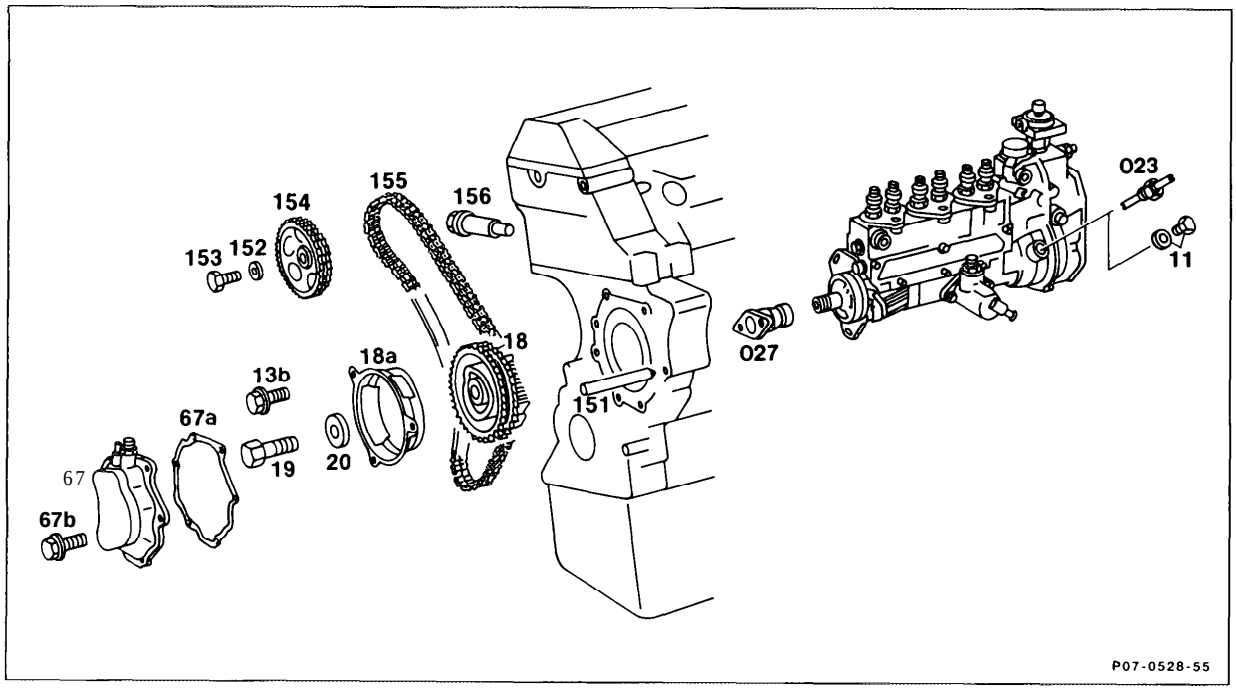
07.1–235 Removal and installation of fuel pump - Turbodiesel



Clip (84)	open, close.
Suction line (89)	detach, fit on.
Fuel filter inlet (82)	disconnect and connect.
Nuts (3c)	remove, install.
Washers (3b)	remove, install.
Fuel pump (3)	remove, install, collect engine oil flowing out during removal.
Gasket (3a)	replace.
Inlet connector (23)	remove, install when replacing the fuel pump.

07.1–240 Removal and Installation of Injection timing device - Turbodiesel

Vacuum pump removed (43-610)



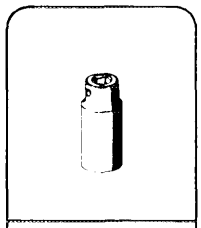
Cylinder head cover	remove, install.
Engine or crankshaft	position on 15° ATDC.
Camshaft gear (154) and timing device (18)	fix in position to timing chain with hose strap.
Chain tensioner (156)	remove, install (05-310). Tightening torque 80 Nm.
Bolt (153) for camshaft gear	unbolt, reinstall. Tightening torque 45 Nm. Note washer (152).
Camshaft gear (154)	remove, install.
Central fastening bolt (19)	unbolt, reinstall, tightening torque 40-50 Nm.

Caution!
Left-hand thread

Check washer (20), replace if necessary.

Locking pin (151)	withdraw with threaded pin (116 589 01 34 00) and impact puller (116 589 20 33 00).
Mounting basket (18a)	remove, install.
Timing chain (155)	press to the outside with metal strips (approx. 0.5 x 70 x 120) and withdraw timing device (18) with universal pliers.
Timing device (18)	remove, install.
Screw plug with seal (11)	remove from injection pump (1).
Injection pump	turn with serrated wrench (027) and lock in position with locking bolt (023).
	Caution! Remove locking bolt.
Engine or crankshaft	crank 1 revolution by hand and check TDC setting on crankshaft and camshaft.
Start of delivery	check (07.1-l 12), set if necessary (07.1-l 17).

Special tools



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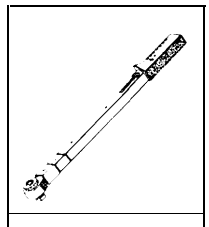

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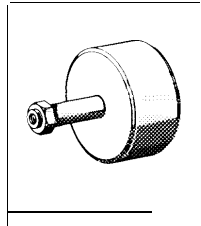

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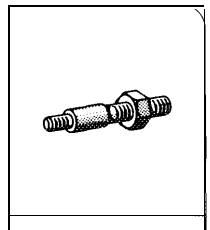

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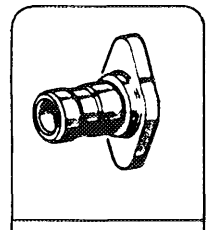
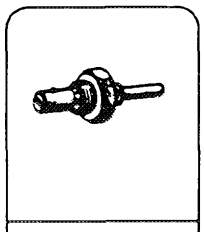


601 589 00 08 OC

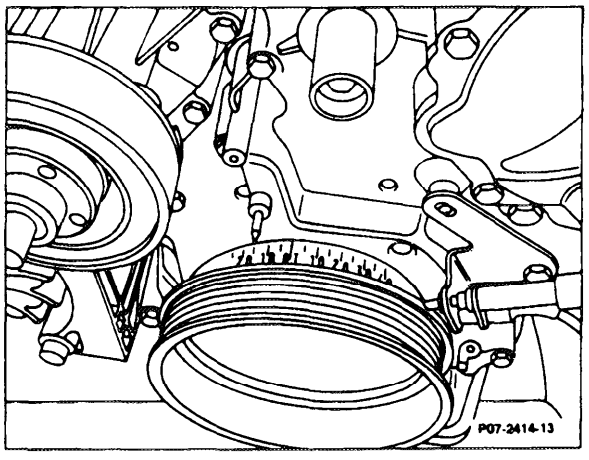


601 589 05 21 00

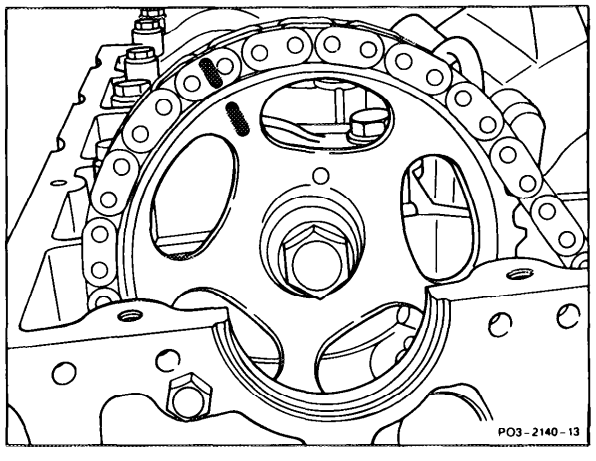
Removal and Installation

1 Remove cylinder head cover.

2 Turn engine to 15° ATDC of no.1 cylinder.

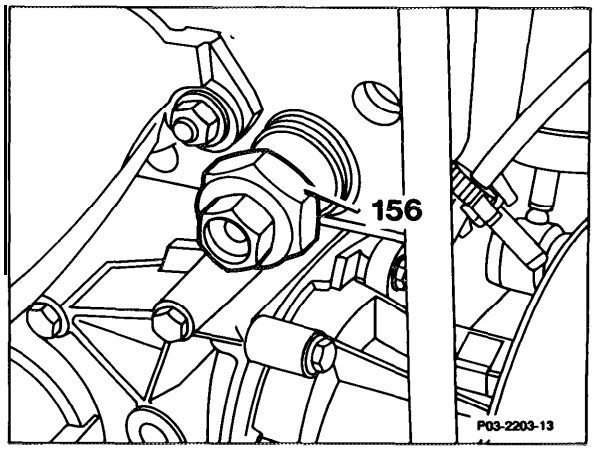


3 Fix camshaft gear and timing device in place with cable strap.

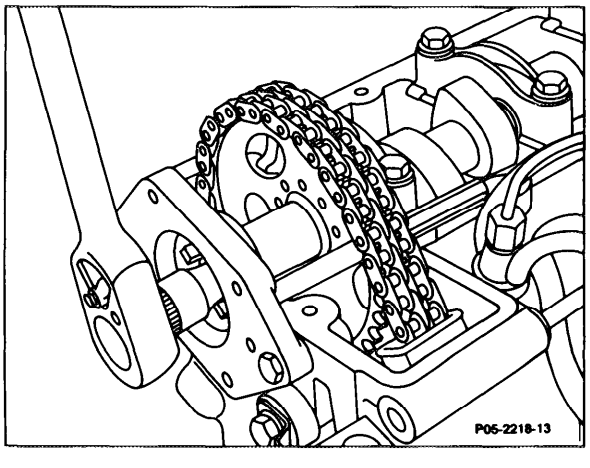


Camshaft gear

4 Remove chain tensioner (156) to relieve the load on the timing chain (05-310).



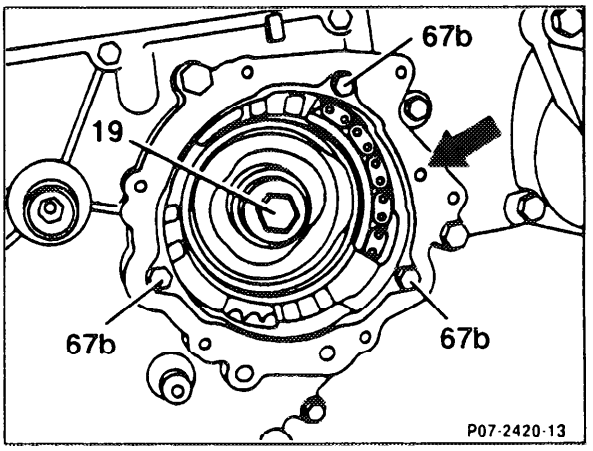
5 Remove bolt for camshaft gear on camshaft; hold crankshaft in place when performing this step.
Tightening torque 45 Nm.
Remove camshaft timing gear.



6 Remove central fastening bolt (19); hold crankshaft in place when performing this step.

Caution!
Left-hand thread

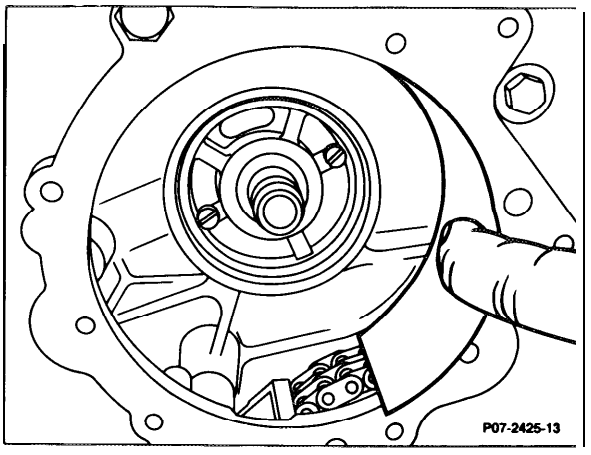
7 Withdraw locking pin (arrow) and remove mounting basket.



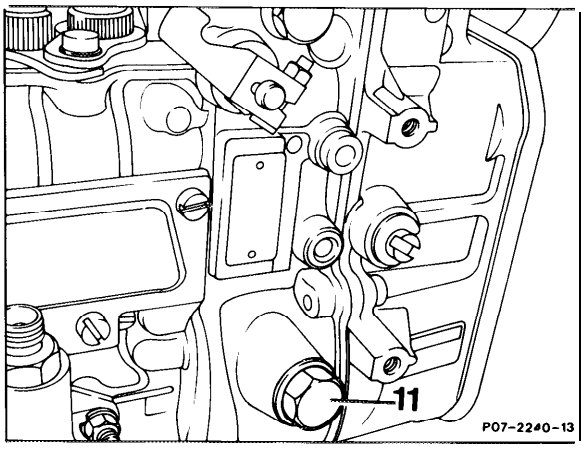
Impact extractor	Special tool 116 589 20 33 00
M6 threaded pin	Special tool 116 589 01 34 00

8 Press timing chain out of the way with metal strips and use universal pliers to withdraw timing device.

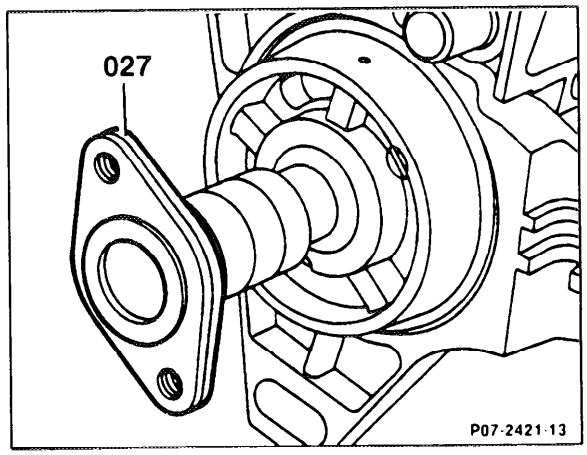
Shop-made metal strips
Thickness approx. 0.5 mm
Length approx. 140 mm
Width approx. 070 mm



9 Unscrew plug (11).



10 Use serrated wrench (027) to turn injection pump on injection pump camshaft until the lug of the governor is visible in the hole. In this position, push in locking bolt (023) until it is felt to engage and tighten union nut by hand.



027 Serrated wrench
Special tool601 589 00 08 00

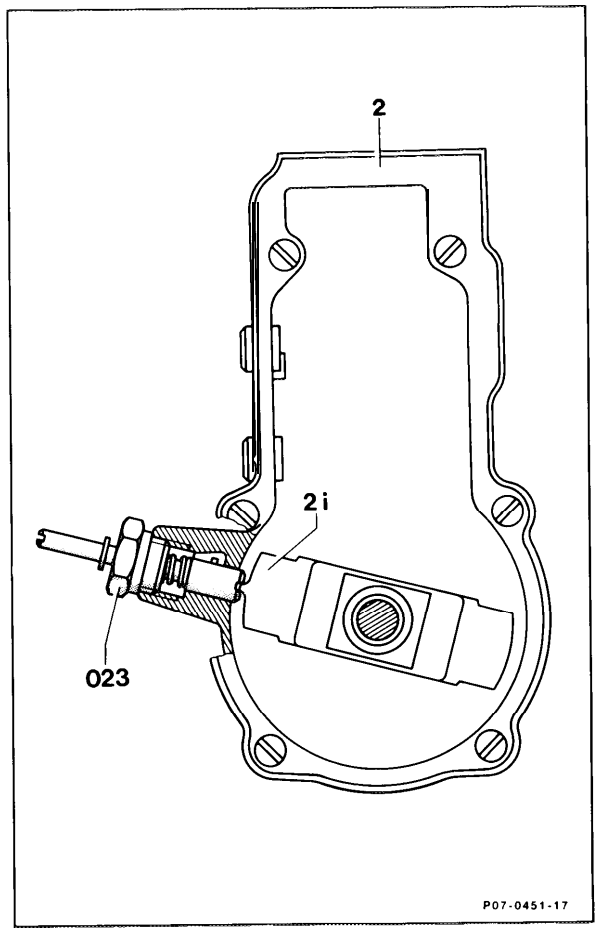
11 Install timing device. Tighten central fastening bolt to 40–50 Nm.

Caution!
Left-hand thread

12 Remove locking bolt (023) otherwise the injection pump will be damaged when engine is started.

13 Assemble engine.

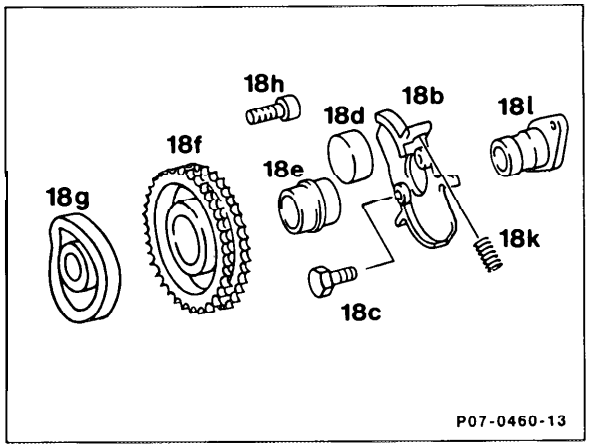
14 Test start of delivery with digital tester (07.1-I 12), set if necessary (07.1-I 17).



023 Locking bolt
Special tool601 589 05 21 00

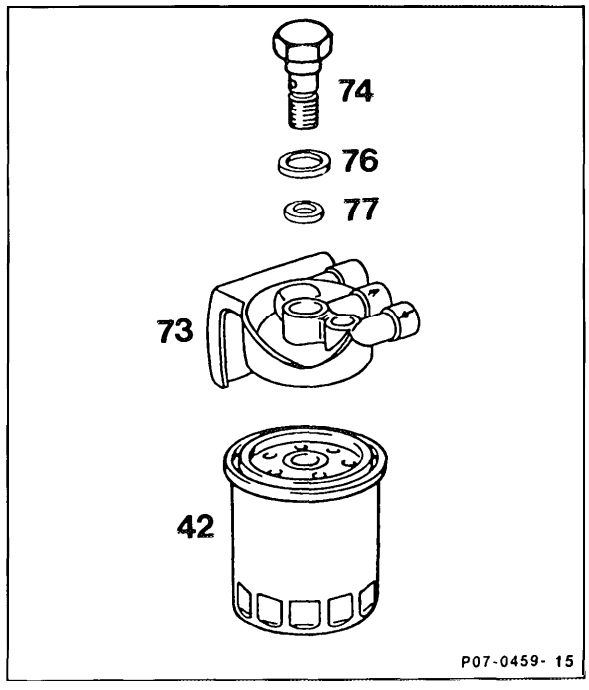
07.1–241 Reconditioning injection timing device - Turbodiesel

Preceding work:
Removal and installation of timing device (07.1-240)



Bolt (18h) ..a.....	M6 x 16, remove and install. Tightening torque 15 Nm.
Drive hub (181)	remove, install.
Bolt (18c)	M8 x 16, remove and install. Tightening torque 25 Nm.
Cam (18g)	examine for signs of wear.
Sprocket wheel (18f)	examine for signs of wear.
Bush (18e)	remove, install, examine for signs of wear.
Segment flange (18e)	examine for signs of wear.
Compression spring (18k)	remove, install.
Flyweight (18d)	M8 x 16, remove, install, examine for signs of wear.

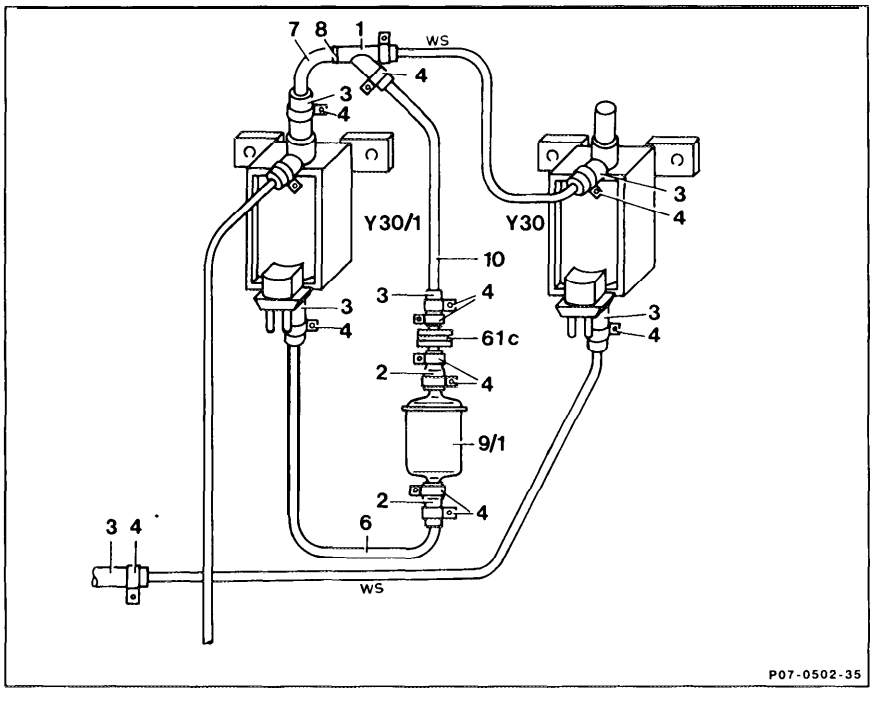
07.1–245 Replacing fuel filter - Turbodiesel



Bolt (74)	remove, install.
O-ring (76)	replace.
O-ring (77)	replace.
Filter (42)	withdraw downwards, replace.
Fuel filter top section (73)	check that restriction orifice 0.8 mm (on return line) is clear.
Leakage	check (with engine running).

Note
When the engine is started, the fuel system is bled automatically as a result of the high output of the fuel pump and the restriction orifices in the top section of the filter as well as at the injection pump.

07.1–250 Retrofitting damper with restriction orifice - Turbodiesel



Engine 603.96

A damper with restriction orifice can be retrofitted to prevent cruise control surging on hills at engine speeds between 2000 and 3000 rpm.

Parts listing

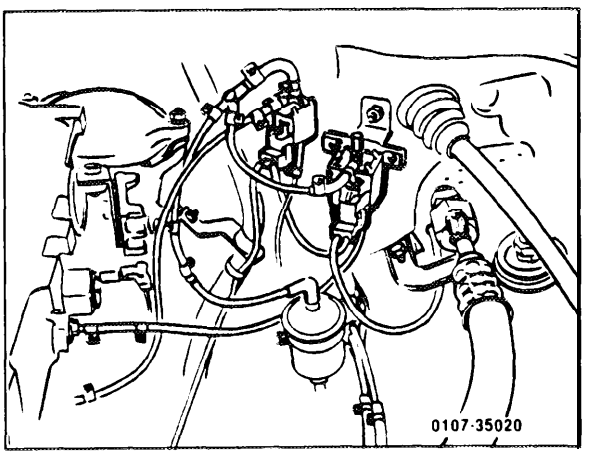
Figure Item	Quantity	Designation	Part No.
1	1	Y distributor	601 078 02 45
2	2	Reducer	117 078 03 81
3	4	Rubber hose approx. 40 mm long	117 997 09 82
4	12	Hose clip 0.8 mm	916 002 008 100
61c	1	Restriction 0.3 mm (red)	000 078 03 56
6	1	Tecalan tube (white) approx. 400 mm long	000 158 1435
Y30/1	1	3/2 solenoid switch-over valve	001 540 86 97
7	1	Bend	117 078 05 81
8	1	Connector	116 276 09 29 *
	2	Bushes	003 545 26 26
	2	Hose clips 11 mm	916 033 01.1 100
9	1	2-pin connector, switch-over valve	011 545 71 28
9/1	1 *	Accumulator	000 078 19 68
	1	Hose strap	002 997 09 90
10	1	Tecalan tube approx. 600 mm long white	000 158 14 35
	1	Cable 0.75 approx. 200 mm long	commercial
	1	Cable 0.75 approx. 900 mm long	commercial
	1	Cable 0.75 approx. 900 mm long	commercial

Scope of **work**

1 Install solenoid switchover valve (Y30/1).

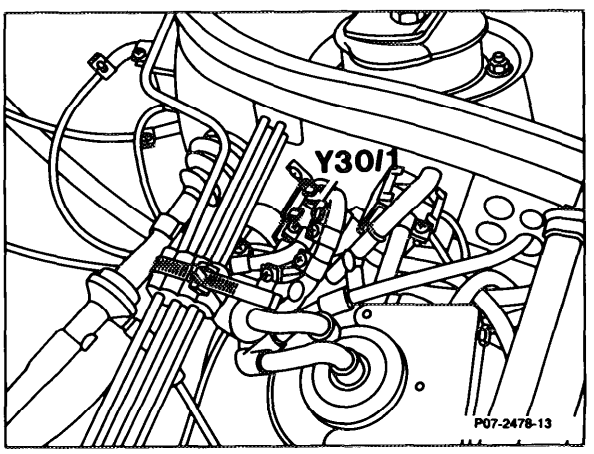
a) Model 126

Install solenoid switchover valve (Y30/1) on the intermediate panel next to the switch-over valve (Y29).

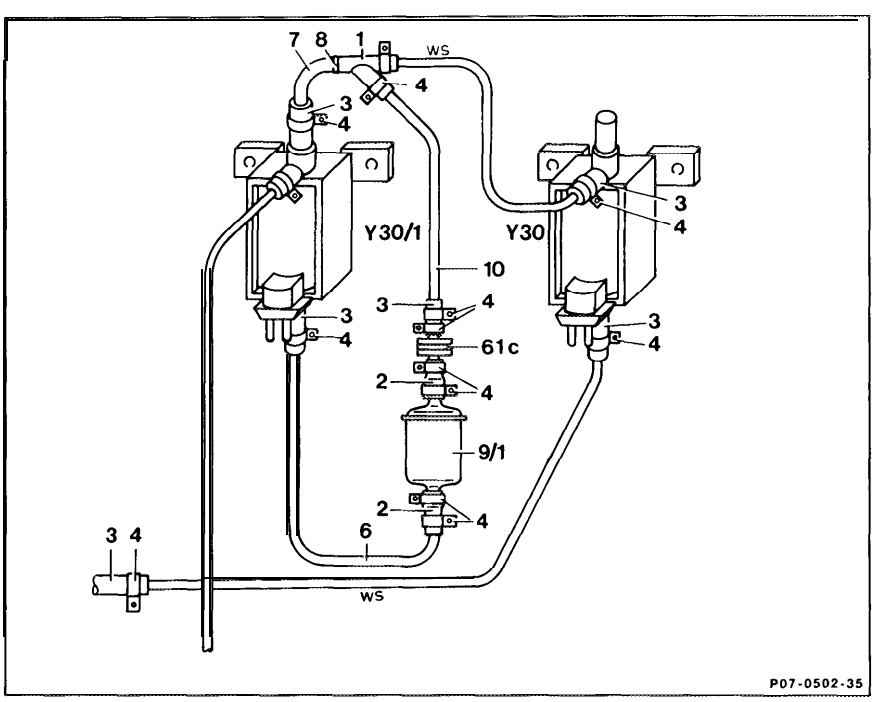


b) Model 124

On Model 124, the switchover valve (Y29) must be moved to the right.



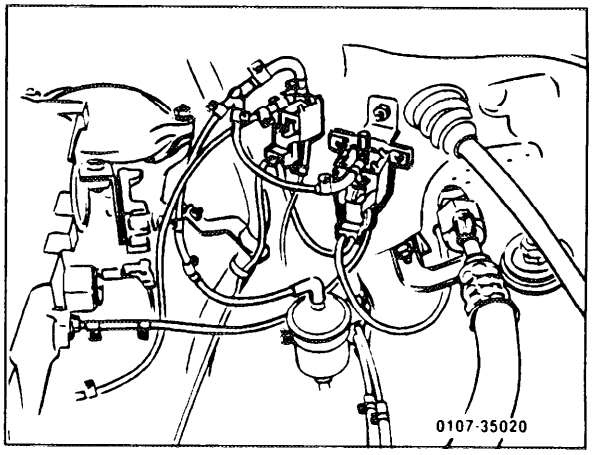
2 Fit out delivery lines as shown in the illustration opposite.



3 install delivery lines with accumulator (9/1).

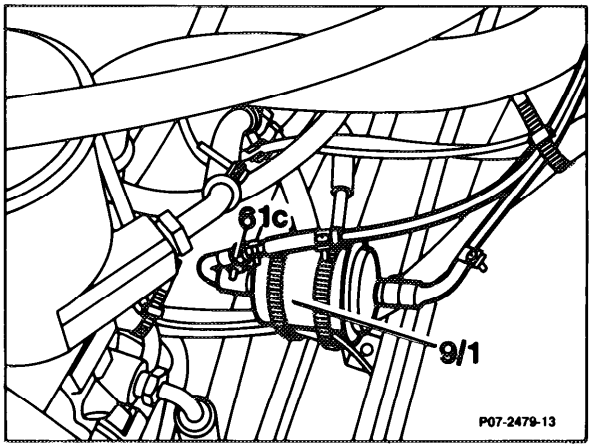
a) Model 126

Attach delivery lines with accumulator (9/1) on Model 126 to fuel line bracket with hose strap.

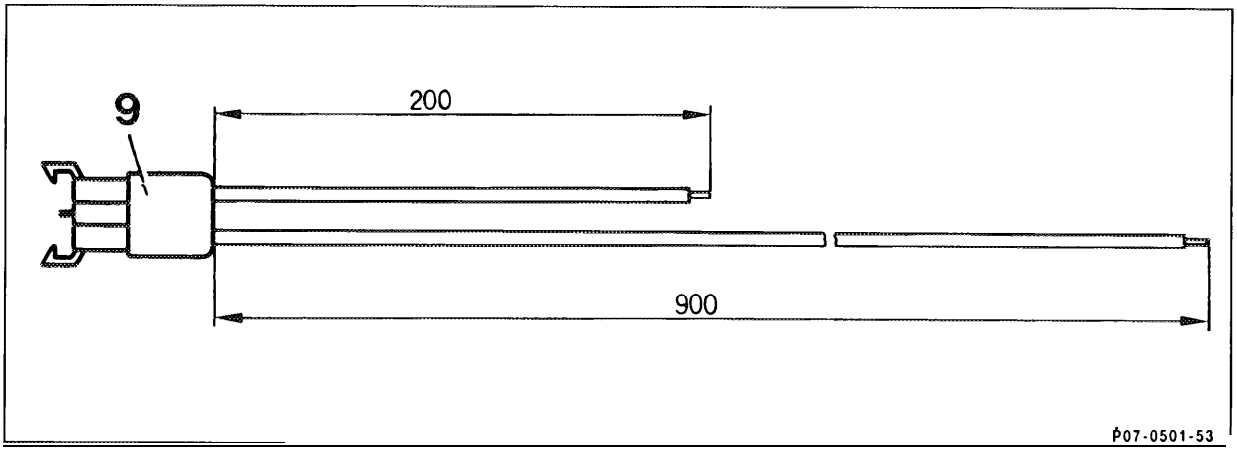


b) Model 124

Attach accumulator (9/1) to bracket of preglow cable harness with hose strap.

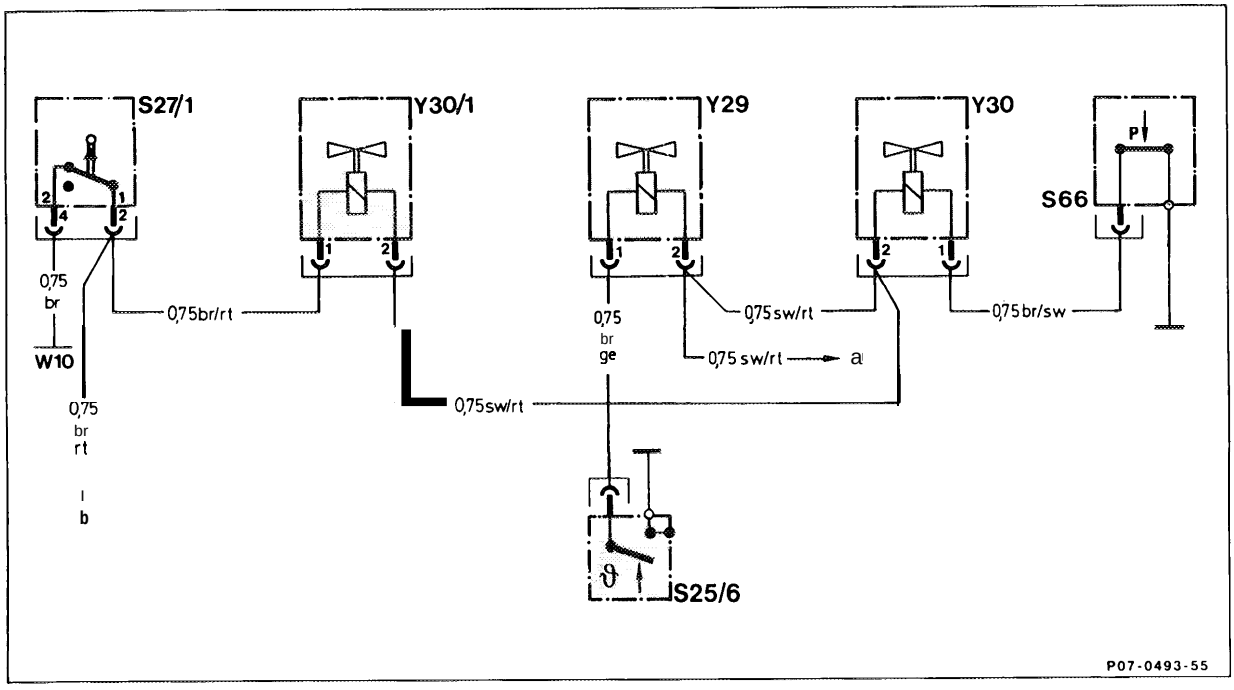


4 Make electric cable harness as shown in the drawing below.



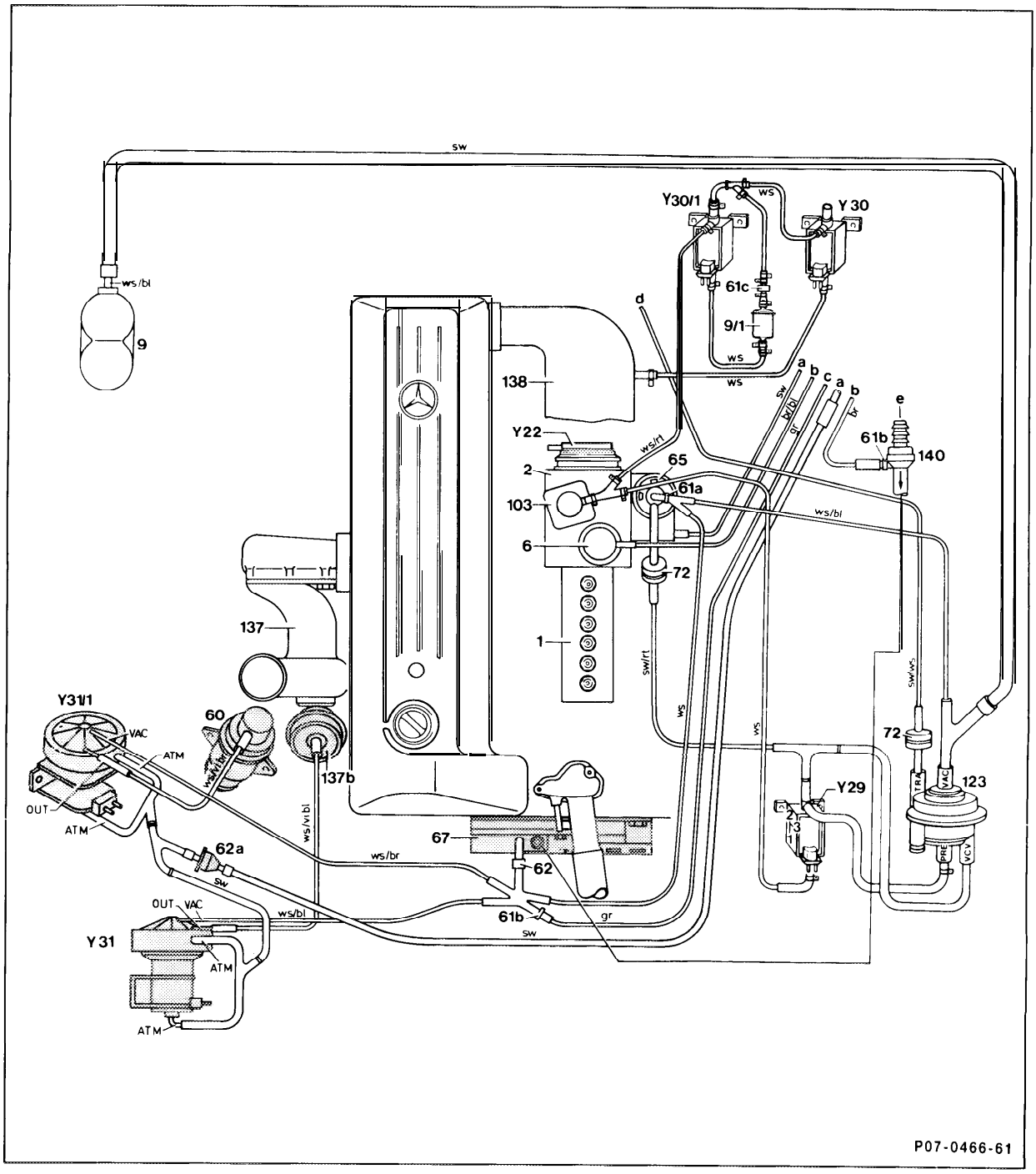
Solder on electric cables as shown in wiring diagram: short cable to contact 2 brown/red of switchover valve (Y30). Long cable to contact 1 brown/red of microswitch (S27/1).

Plug 2-pin connector onto switchover valve.



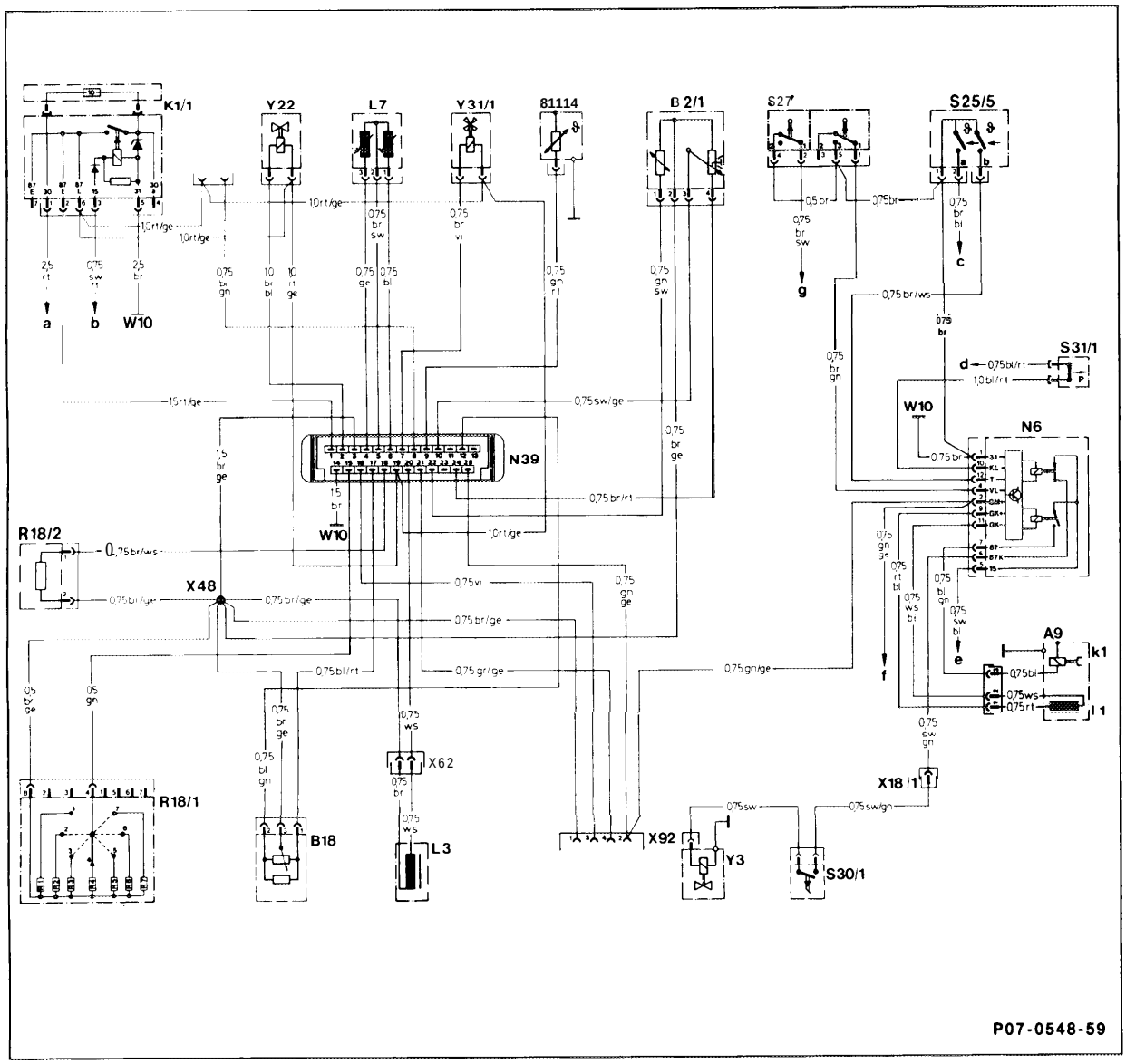
Wiring diagram

Y30	Solenoid switch-over valve, engine overload protection	Y29	Vacuum amplifier switchover valve, (diesel with automatic transmission).
Y30/1	Solenoid switchover valve	a	to control unit (N6) contact 5
S25/6	50°C temperature switch	b	to control unit (N6) contact 4
S27/1	Microswitch		
S66	Switch, engine overload protection (1.2 bar)		


sw
ws/bl
9
Y30/1
ws
Y 30
61c
9/1
ws
d
138
a
b
c
a
b
e
Y22
ws/rt
61b
140
2
65
61a
103
ws/bl
6
72
1
137
sw/rt
ws
ws
sw/ws
72
Y31/1
60
VAC
ATM
137b
OUT
ATM
ws/vi/bl
Y29
123
67
62a
ws/br
62
sw
OUT
VAC
ws/bl
61b
gr
sw
Y 31
ATM
ATM
P07-0466-61

Vacuum line routing (California Engine 603.96, Models 124 and 126)

1	Injection pump
2	Governor
6	Vacuum unit
60	Exhaust gas recirculation valve
61a	Restriction blue
61b	Restriction orange
61c	Restriction
61d	Restriction
62	Filter
62a	Filter
62c	Air admission filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
103	ALDA unit
123	Vacuum amplifier
137	Exhaust gas turbocharger
137b	Recirculation air valve
136	Charge air distribution pipe
140	Check valve, brake booster
Y22	ELR actuator
Y29	Switch-over valve, vacuum amplifier for automatic transmission
Y30	Swttchover valve, engine overload protection
Y31	Vacuum transducer, air recirculation valve
Y31/1	Vacuum transducer (EGR)
a	Fresh arr flow to car interior
b	Key operated engine stop
c	Other ancillaries
d	Vacuum unit, automatic transmission
e	Brake booster
	Pressure and vacuum connections at vacuum transducer or vacuum amplifier
PRE	Charge pressure from ALDA unit
TRA	To vacuum unit, automatic transmission
VAC	Vacuum from vacuum pump
v c v	To vacuum control valve
ATM	Fresh air supply to car interior
ARF	Exhaust gas recirculation to exhaust gas recirculation valve or air recirculation valve

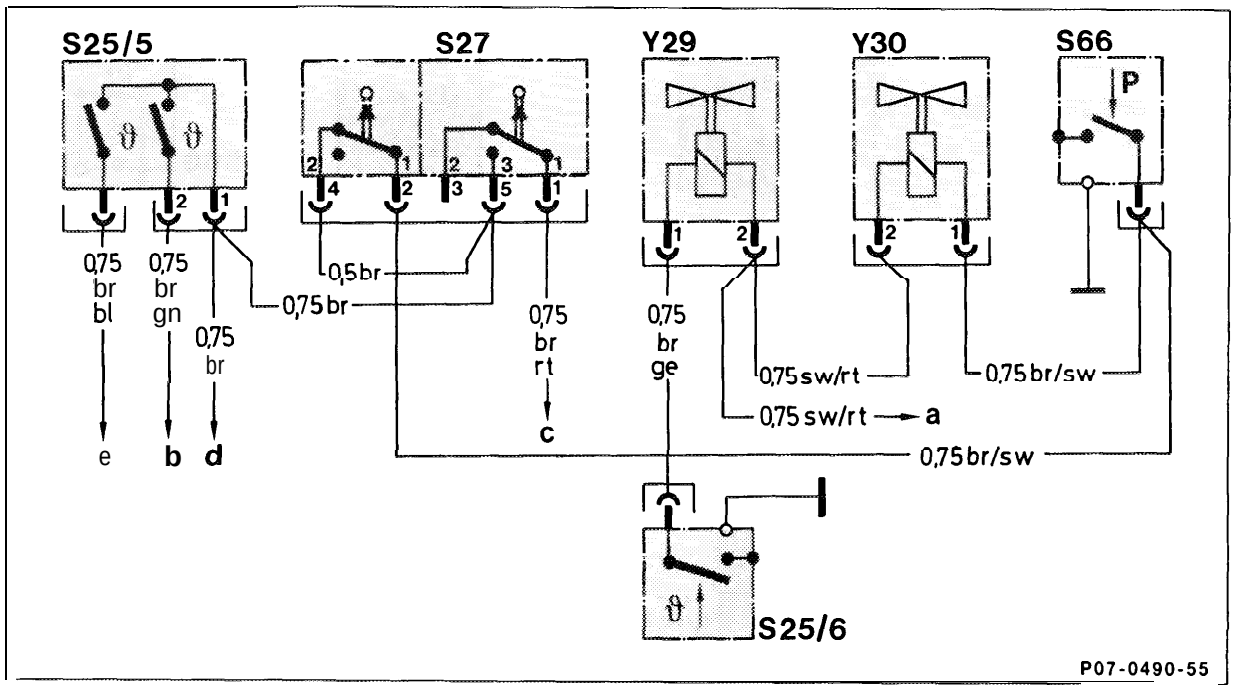

K1/1
Y22
L7
Y31/1
81114
B 2/1
S27
S25/5
S31/1
N6
N39
W10
R18/2
X48
R18/1
B18
L3
X62
X92
Y3
S30/1
A9
X18/1
a
b
c
d
e
f
g
k1
l1
P07-0548-59

Wiring diagram electronic diesel system Engine 602.961 Federal Model 201 Model Year 1987

A9	Refrigerant compressor
A9k1	Electromagnetic clutch
A9/1	RPM sensor
B2/1	Air flow sensor potentiometer
B11/4	Coolant temperature sensor, idle speed control
B18	Altitude sensor
K1/1	Relay, overvoltage protection
L3	Engine speed sensor, starter ring gear
L7	Control rod travel sensor
N6	Control unit, compressor shutoff
N39	Control unit (EDS)
R18/1	Resistance trimming plug (ELR)
R18/2	Reference resistor (EGR)
S25/5	Temperature switch 105/1 15°C
S27	A/C compressor/charge pressure cut-out microswitch
S30/1	Kickdown switch
S31	Pressure switch, refrigerant compressor
W10	Battery ground
X18/1	Plug connection, tail lamp wiring harness/compressor wiring harness
X48	Sleeve terminal (solder connector)
X62	Plug connection, speed sensor, starter ring gear
X92	Test connection for diagnostics (8-pin)
Y3	Kickdown valve automatic transmission
Y22	Actuator (ELR)
Y31/1	Vacuum transducer, exhaust gas recirculation
a	To terminal block X35, terminal 30/61 (battery)
b	To electrical centre connector U contact 5
c	To relay, double auxiliary fan (K8/1) contact 5
d	To electrical centre connector W contact 4
e	To relay, double auxiliary fan (K8/1) contact 4
	To tachometer (Al p7)
g	To switch, engine overload protection (S66)

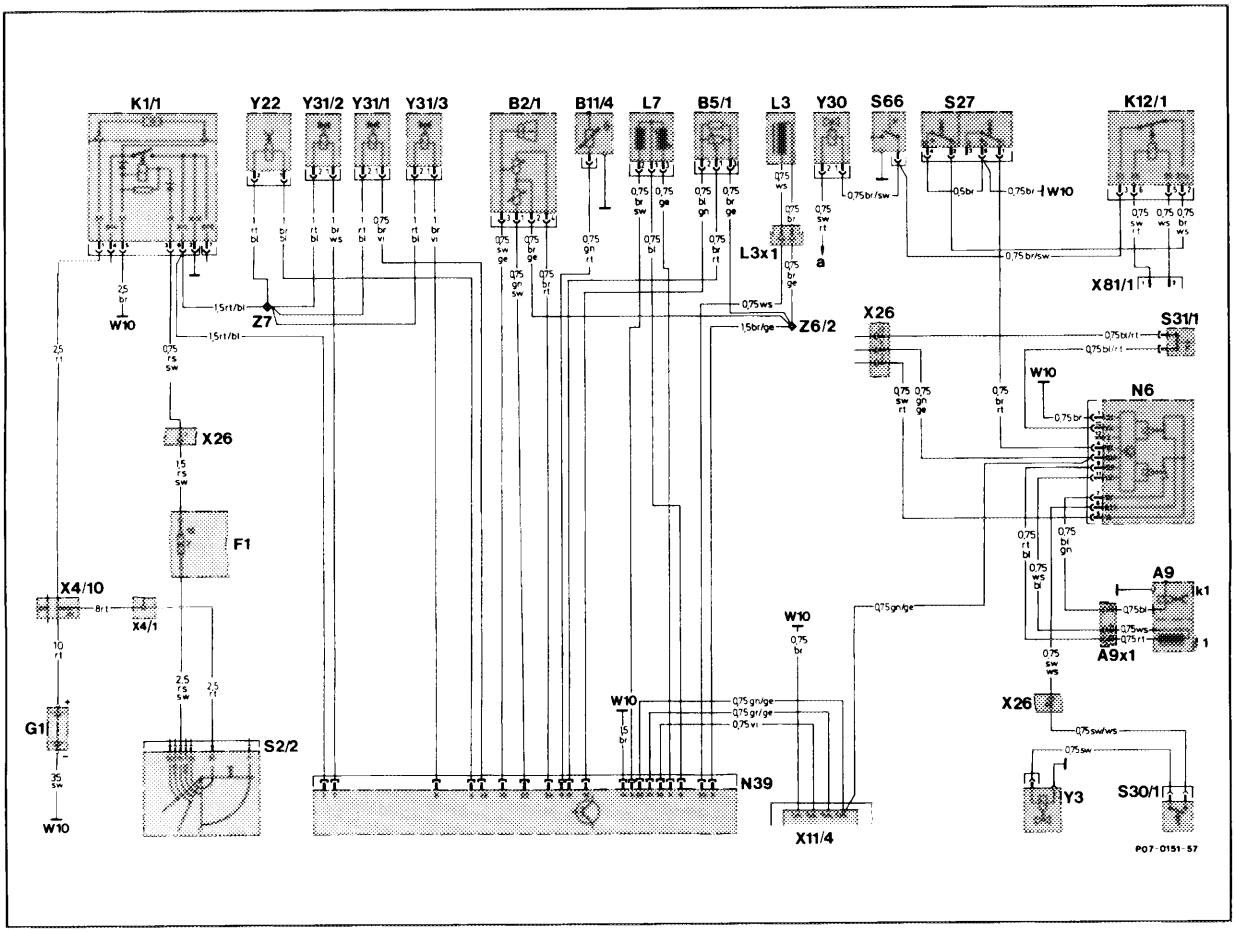
Note

Ground points not shown go to engine ground or battery ground.



Wiring diagram engine overload protection Engine 602.961 Federal Model 201.128 effective Model Year 1987

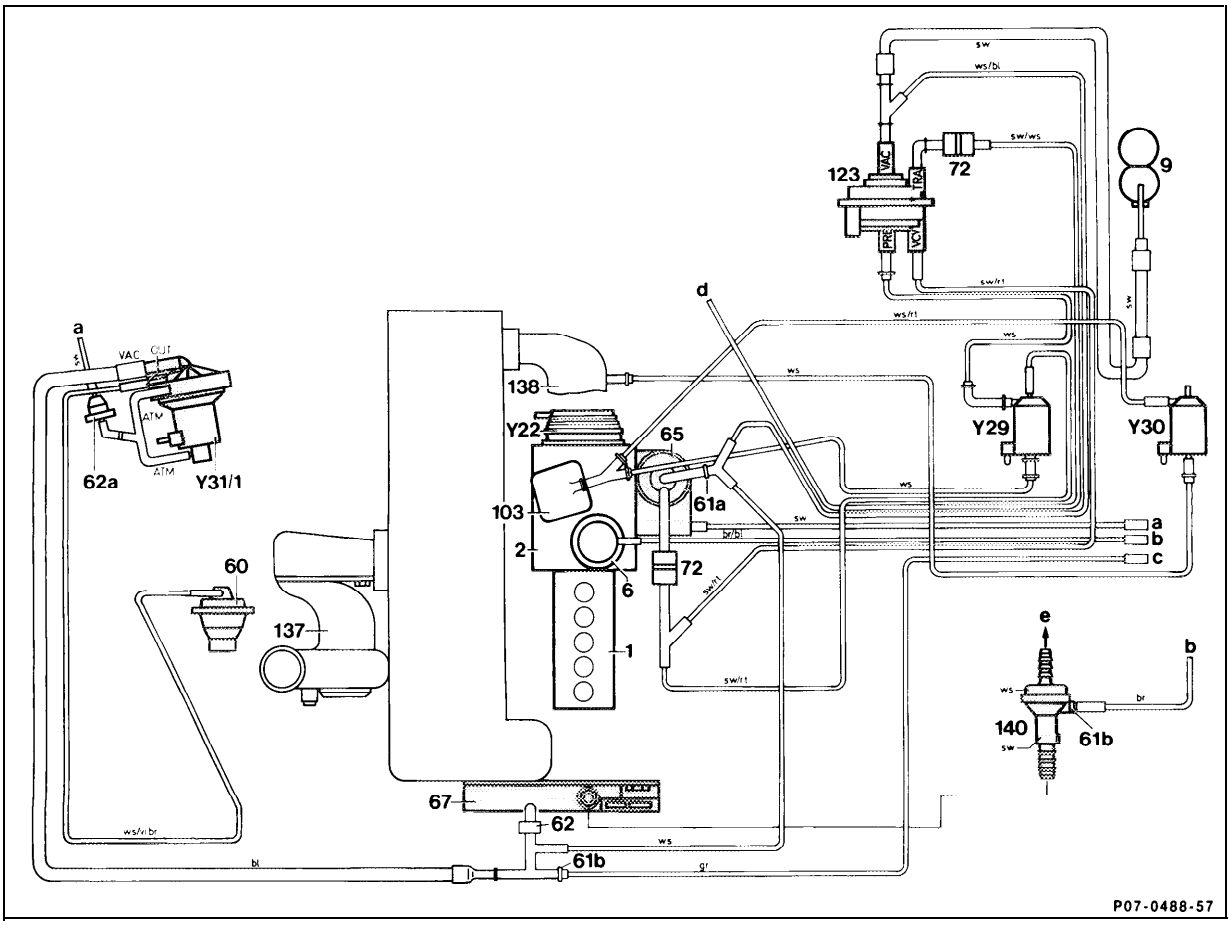
S25/5	Temperature switch 105/115°C	a	To relay K9 auxiliary fan contact 4
S25/6	Temperature switch 50°C	b	To relay K9 auxiliary fan contact 5
S27	A/C compressor/charge pressure cut-out microswitch	c	To control unit N6 compressor cutoff contact 4
S66	Switch, engine overload protection	d	W 10 battery ground
Y29	Switchover valve, vacuum amplifier	e	To control unit N6 compressor cutoff contact 12
Y30	Switchover valve, engine overload protection		



Wiring diagram electronic diesel control Engine 602.962, Model Year 1990 and 1991

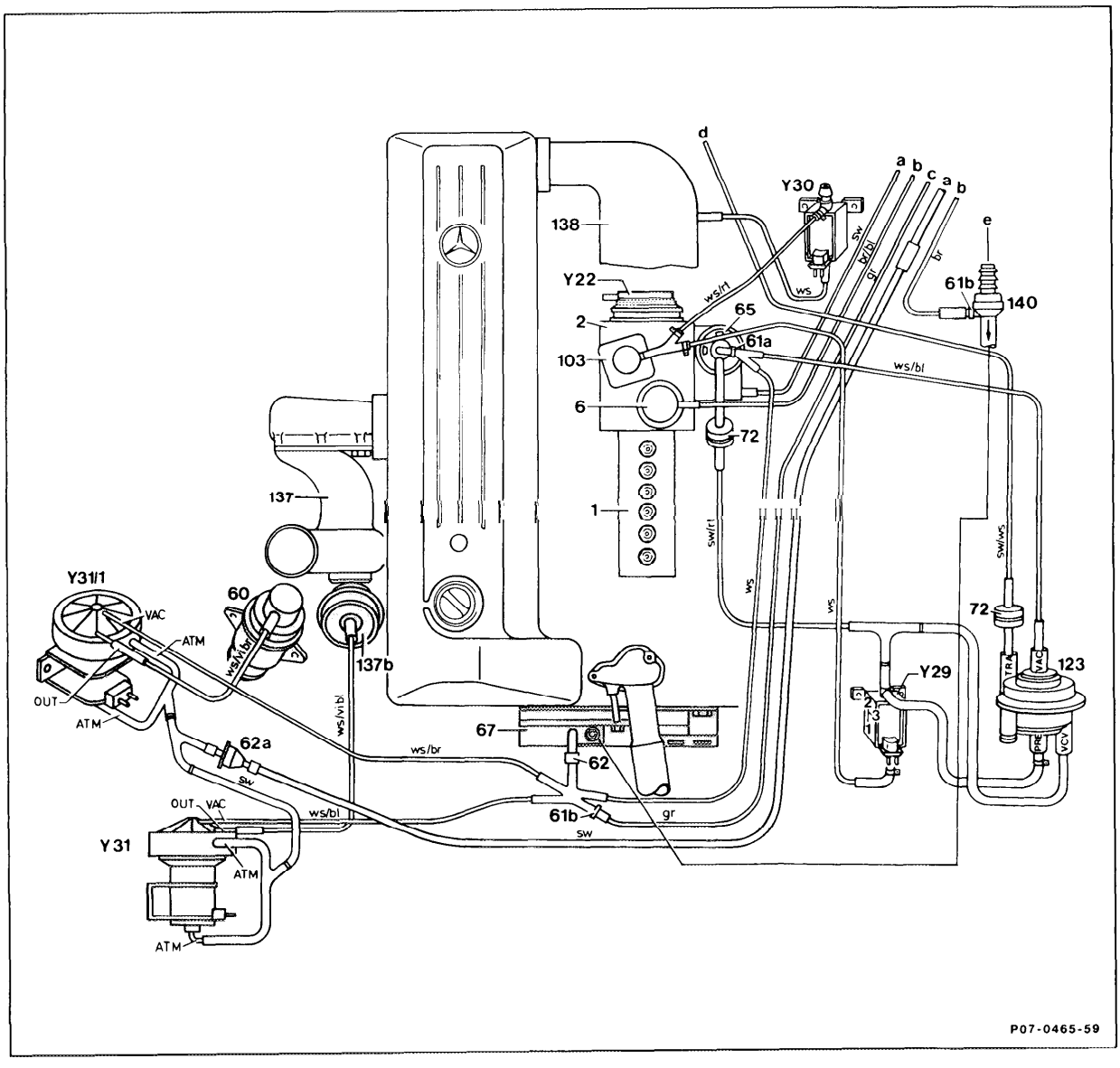
A9	Refrigerant compressor
A9k1	Electromagnetic clutch
A9l1	Engine speed sensor
A9x1	Plug connection, refrigerant compressor
B2/1	Air flow sensor potentiometer with intake air temperature sensor (EDS)
B5/1	Pressure sensor (EDS)
B11/4	Coolant temperature sensor (EDS)
F1	Fuse and relay box
G1	Battery
K1/1	Relay over-voltage protection 87E/87L (7-pin)
K12/1	Relay, Tempomat/charge pressure cutoff
L3	Engine speed sensor, starter ring gear
L3x1	Plug connection, engine speed sensor, starter ring gear
L7	Control rod travel sensor
N6	Control unit, refrigerant compressor cutoff
N39	Control unit (EDS)
S2/2	Glow start switch
S27	A/C compressor/charge pressure cut-out microswitch
S30/1	Kick-down switch
S31/1	Pressure switch, refrigerant compressor, OFF 2.0/30/ON 2.6/22
S66	Switch, engine overload protection
W10	Battery ground
X4/1	Cable connector, terminal 30/interior, 2-pin
X4/10	Cable connector, terminal 30/terminal 61 battery
X11/4	Test connection for diagnostics, 8-pin (pulse readout)
X26	Plug connection, interior/engine
X81/1	Plug connection, engine cable harness/Tempomat/1-pin
Y3	Kick-down valve, automatic transmission
Y22	Actuator (ELR)
Y30	Switchover valve, engine overload protection
Y31/1	Vacuum transducer (EGR)
Y31/2	Vacuum transducer, pressure control flap
Y31/3	Vacuum transducer, charge pressure control
Z6/2	Sleeve connector (solder connection on clutch housing)
Z7	Sleeve connector, terminal 87 (solder connection in cable harness)
a	K9 relay, additional contact 4, terminal 15

07.1-500 Vacuum Circuit Diagrams- Turbodiesel



Vacuum Line Routing Electronic Diesel System Engine 602.961 Federal Model 201
Model Year 1987

1	Injection pump
2	Governor
6	Vacuum unit stop
9	Vacuum reservoir
60	Exhaust gas recirculation valve
61a	Restriction
61b	Restriction
62	Filter
62a	Filter
65	Vacuum control valve
67	Vacuum pump
72	Damper
103	ALDA unit
123	Vacuum amplifier
137	Exhaust gas turbocharger
138	Charge air distribution pipe
140	Non-return valve - brake booster
Y22	ELR actuator
Y29	Vacuum amplifier switch-over valve, automatic transmission
Y30	Switch-over valve, engine overload protection
Y31/1	Vacuum transducer, exhaust gas recirculation valve
a	Ventilation to passenger compartment
b	Key shut-off
c	Other ancillaries
d	Vacuum unit, automatic transmission
e	Brake booster
	Pressure and vacuum connections to vacuum transducer or vacuum amplifier
PRE	Charge pressure from ALDA unit
TRA	To vacuum unit, automatic transmission
VAC	Vacuum from vacuum pump
v c v	To vacuum control valve
ATM	Ventilation to passenger compartment
OUT	Exhaust gas recirculation to exhaust gas recirculation valve
sw	black
bl	blue
br	brown
gr	grey
v l	violet
rt	red
w s	white


d
a
b
c
a
b
e
Y30
138
Y22
2
103
6
1
137
65
61a
61b
140
72
ws/bl
sw/rt
sw/ws
ws
sw
br
gr
bl/sw
Y31/1
VAC
ATM
OUT
ATM
60
ws/vi/bl
137b
62a
sw
ws/vi/bl
ws/br
67
62
61b
sw
ws/bl
OUT
VAC
Y31
ATM
ATM
Y29
123
TRK
VAC
PRI
VCV
P07-0465-59

Job No.

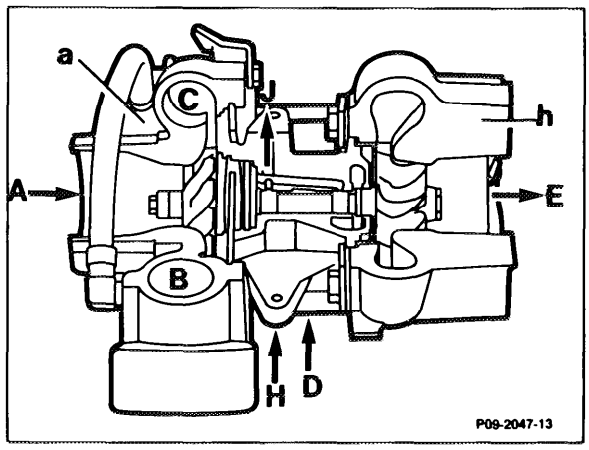
Function of turbocharger . . . . . 09 – 050
Testing turbocharger boost pressure . . . . . 09 – 100
Removal and installation of turbocharger . . . . . 09 – 150
Function of engine overload protection - Turbodiesel . . . . . 09 – 200
Testing engine overload protection - Turbodiesel . . . . . 09 – 250
Removal and installation of air cleaner . . . . . 09 – 400
Removal and installation of air cleaner - Turbodiesel . . . . . 09 – 400

Turbocharger survey

Engine	Designation	Boost pressure at full load, 4000 rpm, gear lever position 3
602.96	Garrett TB **025** 1990 or T **025** KKK K14 [2])	0.85-0.95 bar (13.75 - 14.25 psi)
603.96	Garrett TB 03 [1]) [3]) or T 03 [1]) [3]) KKK K24 [1]) [3])	0.85-0.95 bar (13.75 - 14.25 psi)

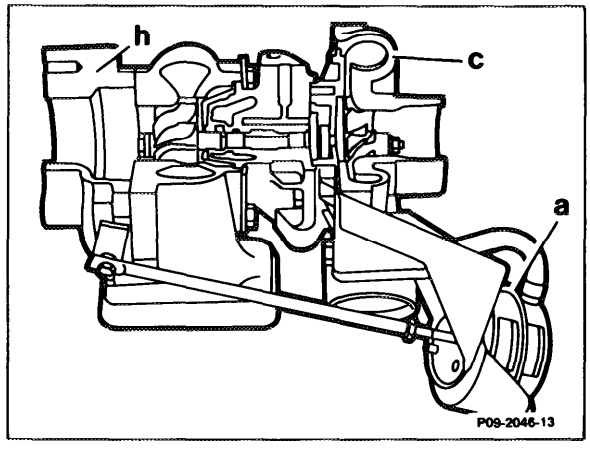
[1]) Optional
[2]) Production breakpoint at a later point in time
KKK = Kuhnle, Kopp und Kausch.
[3]) For California with air recirculation valve.

Engine 602.961, Garrett TB 025



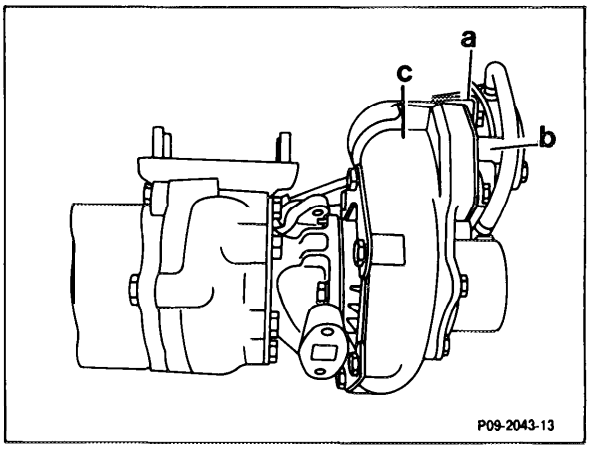
a	Boost pressure control
h	Turbine housing valve
A	Fresh air inlet
B	Compressed air
C	Bypass passage
D	Exhaust inlet
E	Exhaust outlet
H	Oil feed
J	Oil discharge

Engine 603.96, Garrett TB 03



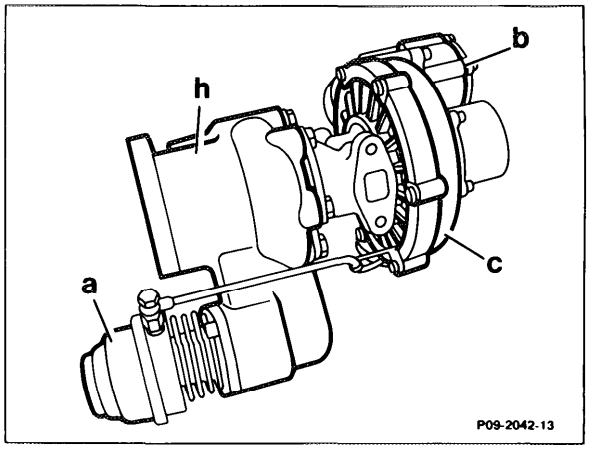
a	Boost pressure control valve
C	Compressor housing
h	Turbine housing

Garrett TB 03 with air recirculation valve



a Boost pressure control valve
b Air recirculation valve
c Compressor housing

KKK-K24 with air recirculation valve



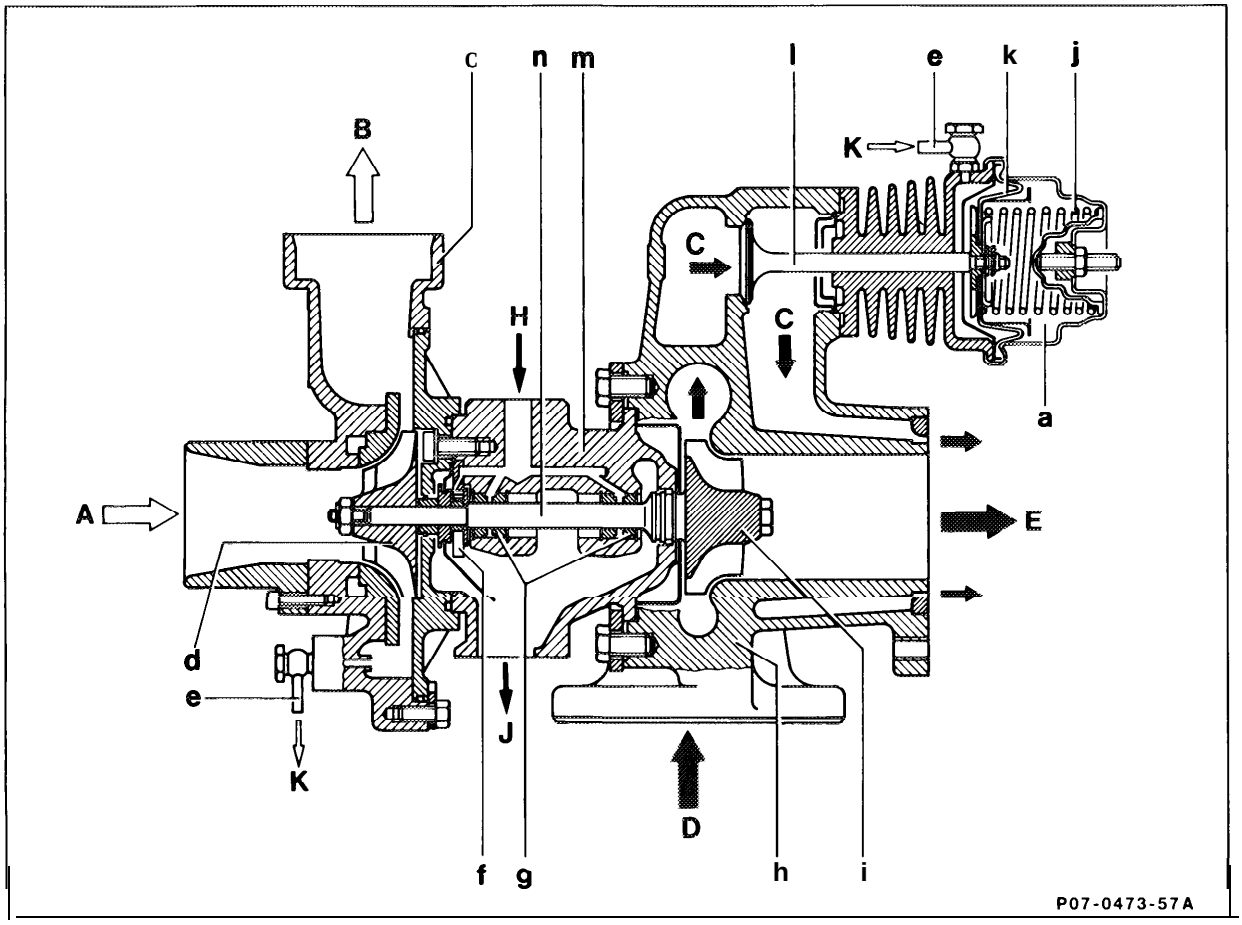
a Boost pressure control valve
b Air recirculation valve
c Compressor housing
h Turbine housing

General

The exhaust gas turbocharger (EGT) is a flow machine. The energy of the engine exhaust gas is used for driving a turbine, which in turn drives a compressor through a shaft. The EGT is installed between the exhaust manifold and the exhaust pipe. It is connected to the engine oil circuit for lubrication and cooling.

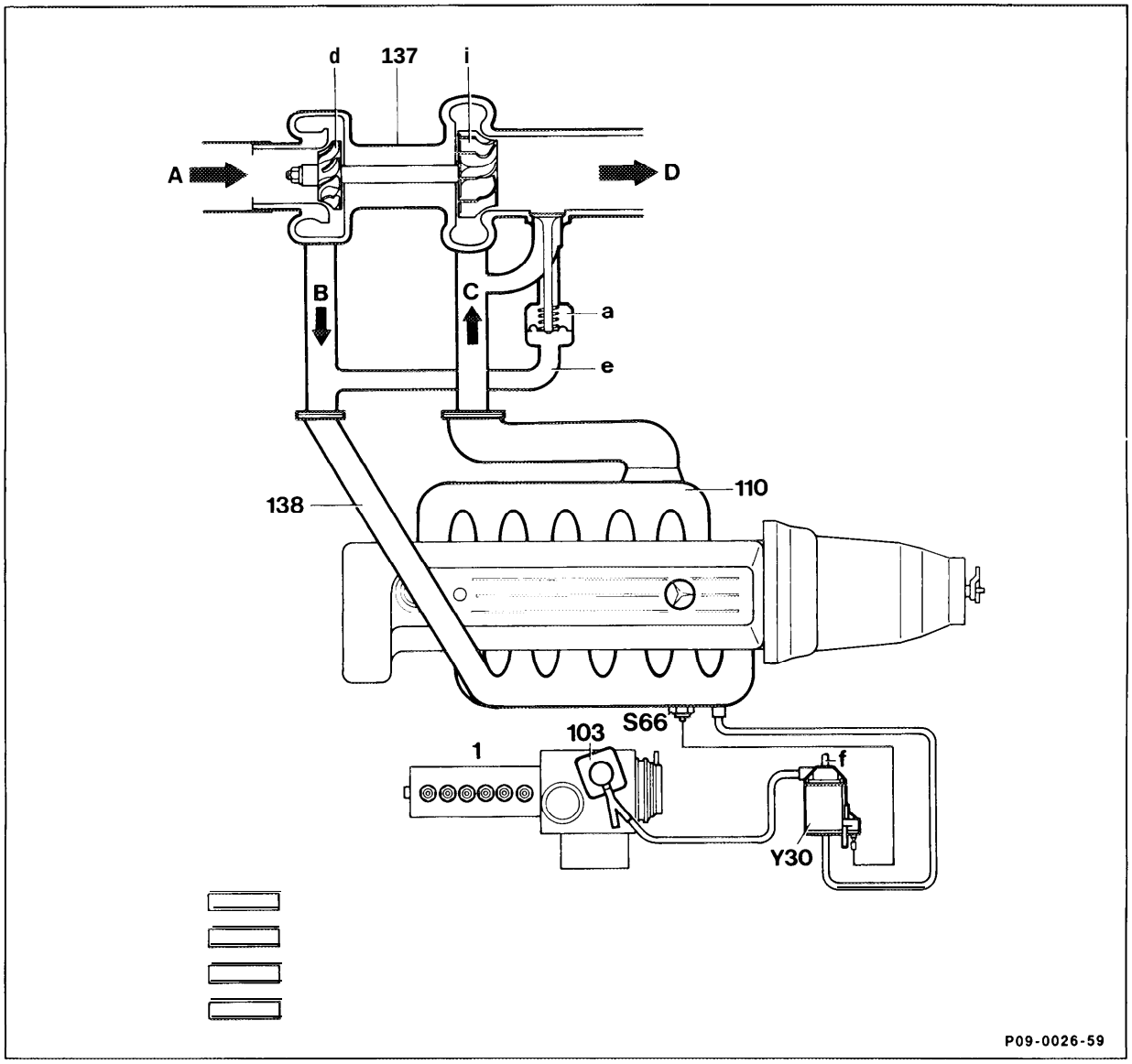
A boost pressure control valve, fitted to the turbine housing or separately, ensures that a boost pressure of 0.95 bar is not exceeded. if a problem develops in the boost pressure control valve, engine failure is prevented by means of an engine overload protection system.

The exhaust gases of the engine are passed through the exhaust manifold into the turbine housing (h) and flow onto the turbine wheel (i). The flow energy of the exhaust gases starts the turbine wheel (i) rotating. This causes the compressor wheel (d) which is connected through the shaft (n) to the turbine wheel (i) to be driven at the same speed. The maximum rotation speed is approx. 135,000 rpm. The fresh air drawn in by the compressor wheel (d) is compressed and sent to the engine.



Functional diagram turbocharger KKK K24 (Engine 603.96)

a	Boost pressure control valve	m	Charge housing
c	Compressor housing	n	Shaft
d	Compressor wheel	A	Fresh arr inlet
e	Control line	B	Compressed air (to engine)
f	Axial bearing	C	Bypass passage/boost pressure control valve
g	Bearing bushing	D	Exhaust inlet
h	Turbine housing	E	Exhaust outlet
i	Turbine wheel	H	Oil feed
J	Spring	J	Oil discharge
k	Diaphragm	K	Control pressure
l	Valve		



Function diagram

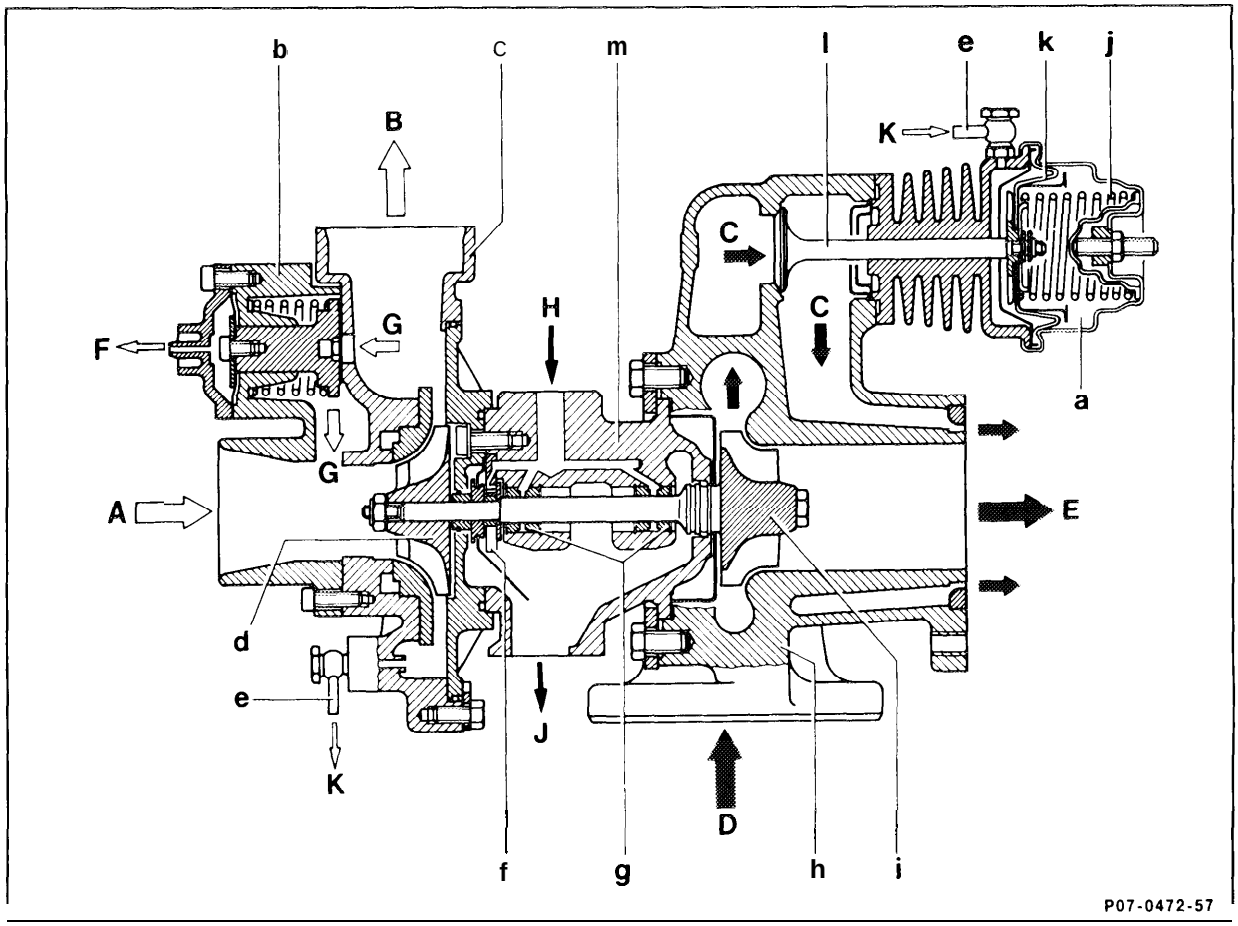
1	Injection pump	a	Boost pressure control valve
103	ALDA unit	d	Compressor wheel
110	Exhaust manifold	e	Control line
137	Turbocharger	f	Air admission
138	Charge air pipe	i	Turbine wheel
S66	Pressure switch, engine overload protection	A	Compressor inlet (fresh air)
Y30	Switch-over valve, engine overload protection	B	Compressor outlet (compressed arr)
		C	Exhaust gases to turbine wheel
		D	Exhaust outlet

Air Recirculation Valve

(refer also to EDS Operation No. 07.1-010)

In order to create more favorable combustion conditions for the trap oxidizer, the air recirculation valve is continuously opened or closed in accordance with the performance characteristic map.

After the closing operation, a residual vacuum of approx. 30 mbar is retained at the air circulation valve.



Function diagram turbocharger KKK with air recirculation valve California

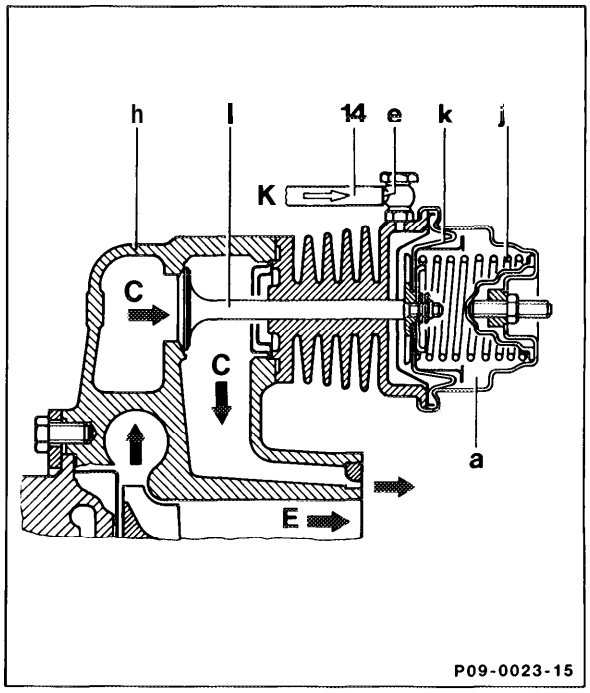
Model year 1986187

a	Control valve, exhaust gas control flap
b	Air recirculation valve
c	Compressor housing
d	Compressor wheel
e	Connector hose
	Axial bearing
g	Bearing bush
h	Turbine housing
	Turbine wheel
	Compressron spring
k	Diaphragm
	Boost pressure control valve
m	Intermediate housing

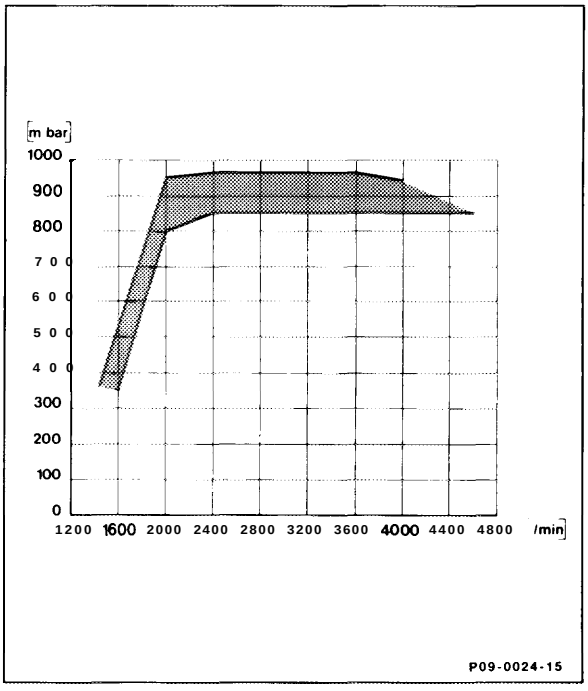
A	Compressor inlet (fresh air)
B	Compressor outlet (compressor air)
C	Bypass passage, boost pressure control valve
D	Exhaust gas to turbine wheel
E	Exhaust gas outlet
F	Vacuum connection to vacuum transducer
G	Recirculated air
H	Lubrication oil inlet
	Lubrication oil outlet
K	Boost pressure (control valve exhaust gas control flap)

Boost pressure Control Valve (KKK)

To prevent the boost pressure from rising above a certain level, a boost pressure control valve (a) is attached to the turbine housing (h). The boost pressure is taken from the compressor housing and passed through the connecting hose (14) to the boost pressure control valve. When maximum boost pressure is reached, the boost pressure control valve begins to open and allows the exhaust gas to flow along the bypass passage (c). Part of the exhaust gas flows directly into the exhaust system, resulting in a constant boost pressure level.



14 Connecting hose
a Boost pressure control valve
e Control line
h Turbine housing
j Spring
k Diaphragm
l Valve
C Bypass passage
E Exhaust gas outlet



Boost pressure diagram - full load

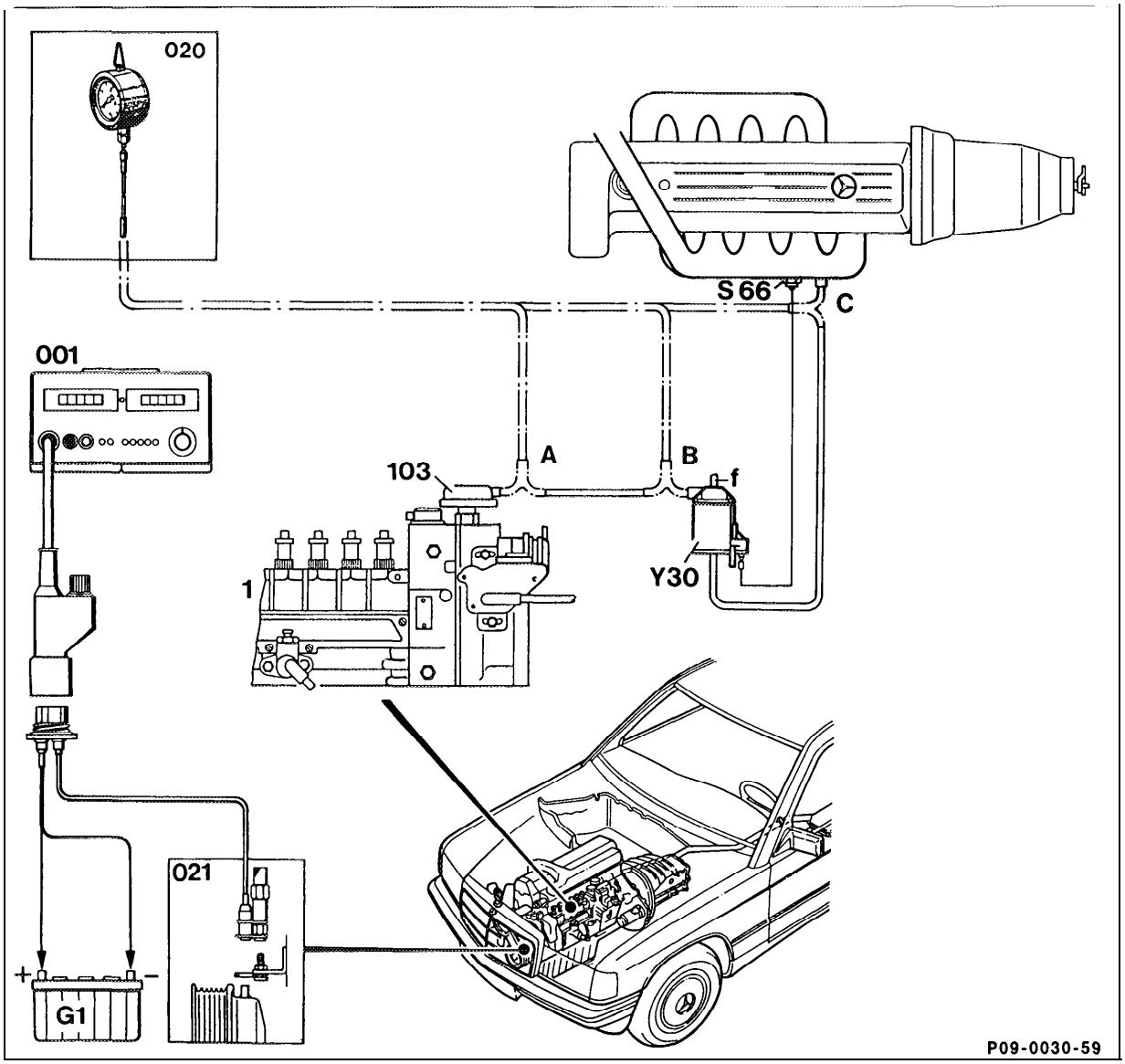
Idle and Lower Part Load

No boost pressure occurs during idling and in the lower part load range; therefore, the engine operates as a naturally aspirated engine.

Upper Part Load and Full Load

As the engine load and speed increase, e.g. with an increase in the exhaust gas flow, the turbine wheel (i) is accelerated producing a boost pressure up to a certain value via the compressor wheel (d). The compressed charge air is passed through the charge air pipe to the individual cylinders. The boost pressure allows an increased quantity of fuel to flow through the ALDA unit at the injection pump.

Although boost pressure exists in the deceleration mode, fuel injection is stopped as a result of the control rod position (deceleration fuel cutoff).



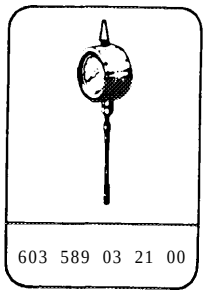
Tester	(001)	connect, disconnect.
Pulse generator	(021)	connect, disconnect.
Tester (020) with Y distributor	.....	connect to measuring point “A” and test boost pressure.
Tester (020) with Y distributor	.....	connect to measuring point "B" and test boost pressure.

Tester (020) with Y distributor	connect to measuring point "C" and test boost pressure. Specification: 0.85-0.95 bar gauge pressure at 4000 rpm full load in drive position "3". **Note** This test can be conducted on the dynamometer or on the road. If the specified boost pressure is not reached, perform the following checks: Connecting line from boost pressure control valve to compressor housing. Switchover valve of engine overload protection (09-250). White vacuum line and rubber connections. If all components are in working order, replace turbocharger.

Test data

Boost pressure at full load in drive position "3" at n = 4000 rpm	0.85-0.95 bar gauge pressure

Special tool

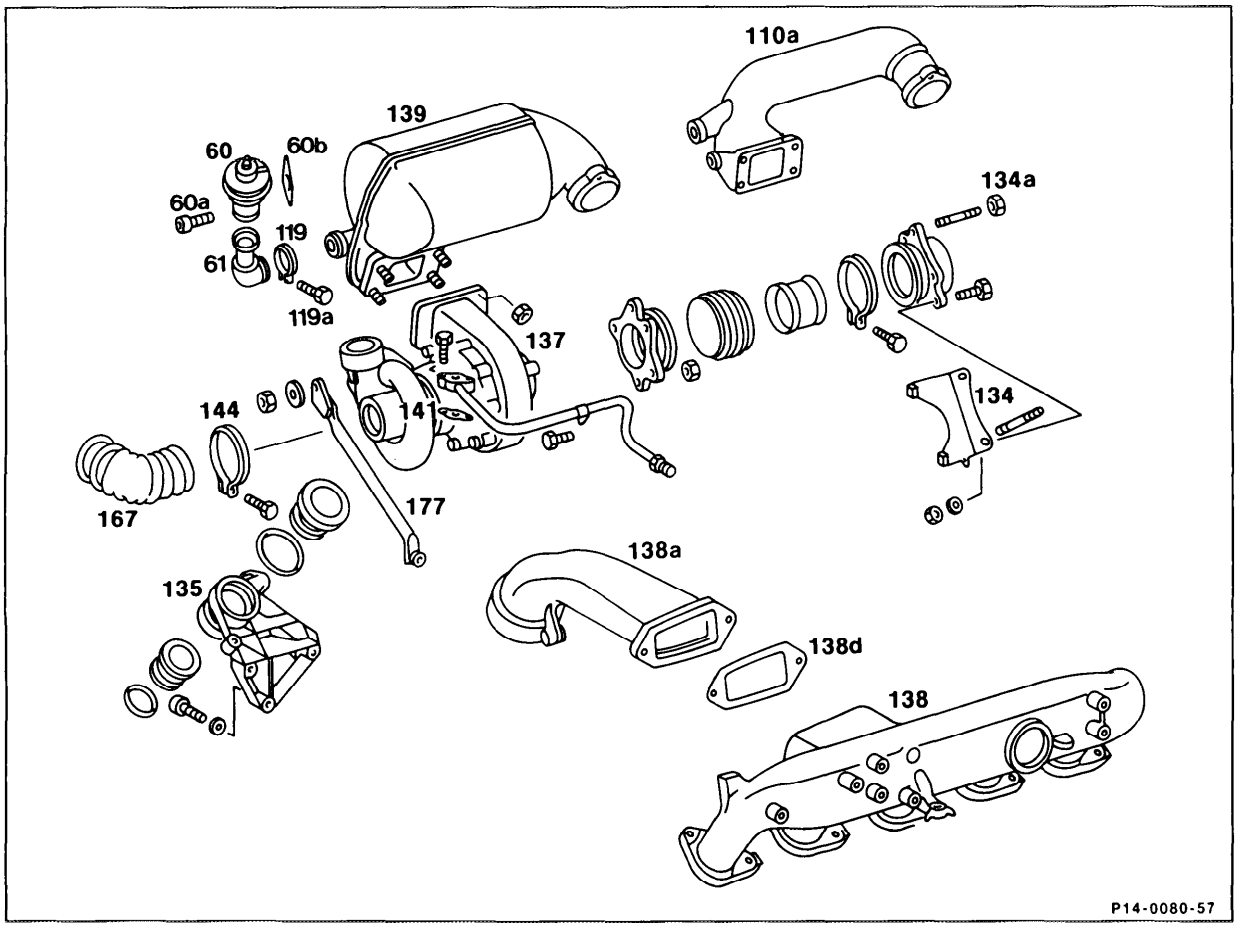


603 589 03 21 00

Commercial tester

Digital tester (or tachometer installed in car)	e.g. Bosch, MOT 002.01 Sun, DIT 9000 Sun, FMT-101 9/Master 3, Sun, MCM-2110, All-Test 361 O-MB

09–150 Removal and Installation of turbocharger



Vehicle	drive onto the platform or inspection pit.
Bottom section of noise encapsulation	detach, attach.
Air cleaner	remove, install (09-400).
Hose clip (144)	loosen and detach, attach intake hose (167).
Partition wall (A) between trap oxidizer and air cleaner	remove, install (9 bolts) of which 6 are accessible from above, 3 accessible from below (Figure 4).
Vacuum lines red/violet/brown on EGR valve (60) and red/violet/blue on air recirculation valve	detach, attach.
Clip (119) on corrugated pipe (61)	loosen, tighten. Tightening torque 45 Nm.

Corrugated pipe (61)	remove, install.
Exhaust gas recirculation valve (60)	remove, install. Tightening torque 25 Nm.
Trap oxidizer (139) on exhaust manifold	unbolt, bolt on. Tightening torque 45 Nm.
Supporting bracket	unbolt, bolt on and remove at the same time with trap oxidizer.
Charge air connecting line (138 a)	remove, install. Replace gasket (138 d).
Engine breather	detach, attach.
Mixing pipe (135) with exhaust gas recirculation valve (60)	remove, install.
Oil feed line (141) of turbocharger (137)	unbolt, bolt on. Replace seal.
Mounting bracket (134)	unscrew, screw on.
Nuts (134 a) (from top and bottom)	loosen, unscrew.
Mounting bracket (177)	remove, install.
Turbocharger (137)	remove, install.

Note
The specified tightening torques are reference values.

Removal, installation

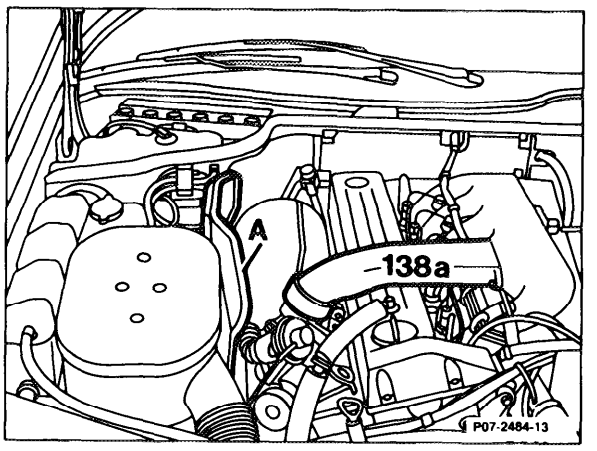
Note
For the conversion, the car must be driven onto an inspection pit or platform.

1 Completely remove noise encapsulation from below.

2 Remove air cleaner entirely.

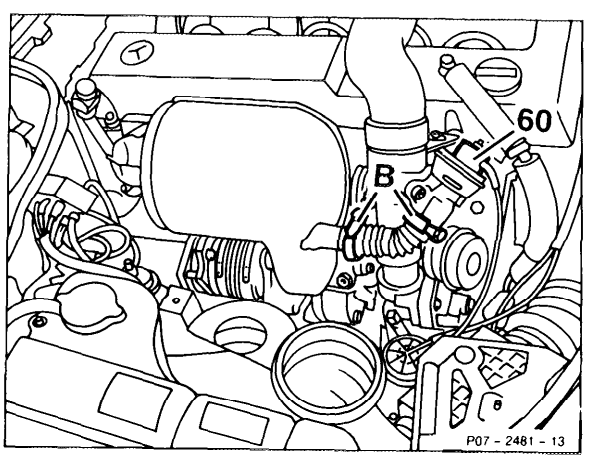
3 Loosen hose clip (144) from air flow sensor and detach intake hose (167).

4 Remove partition wall “A” (9 bolts), of which 6 (WAF10) are accessible from above, 2 (WAF8) and 1(WAF10) accessible from below.



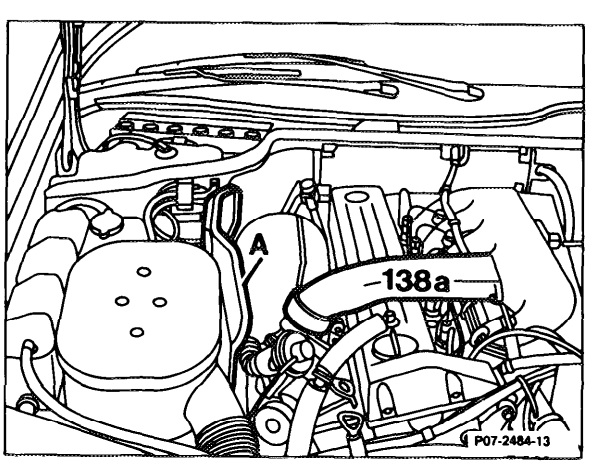
5 Detach vacuum lines red/violet/brown on EGR valve and red/violet/blue on air recirculation valve.

6 Loosen clips "B" on corrugated pipe, and remove corrugated pipe.



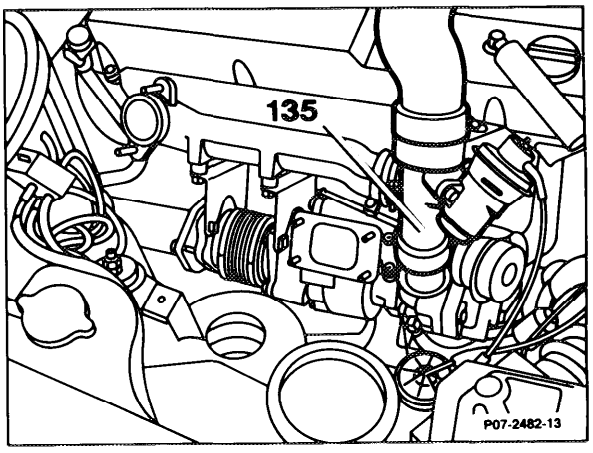
7 Unbolt trap oxidizer from exhaust manifold, remove trap oxidizer and supporting bracket at the same time.

8 Remove charge air connecting line (138 a).



9 Detach engine breather hose.

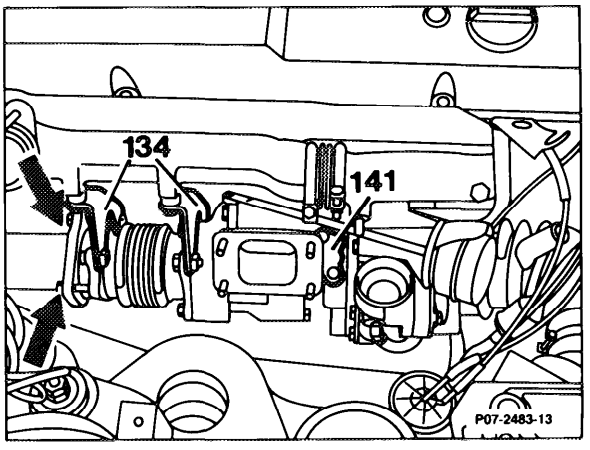
10 Detach mixing pipe (135) with exhaust gas recirculation valve from cylinder head.



11 Unbolt oil feed line (141) from turbocharger (replace seal).

12 Loosen both mounting brackets (134) on the exhaust manifold and turbocharger.

13 Loosen bolts of exhaust pipe - accessible from above (arrows).



14 Loosen bottom bolt of exhaust flange.

15 Unbolt mounting (177) from alternator flange to turbine housing on both components.

16 Remove turbocharger.

17 Install corrugated pipe with flange onto new turbocharger.

18 Clean sealing surfaces mechanically.

20 Install new trap oxidizer, insert supporting bracket at the same time and install. Tightening torque 45 Nm.

21 Install EGR valve together with corrugated pipe.

22 Install partition panel.

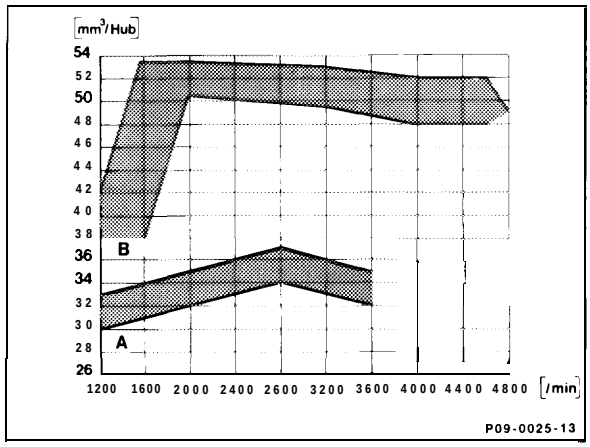
23 Connect vacuum line red/violet/brown to EGR valve and vacuum line red/violet/blue to air recirculation valve.

24 Connect intake hose to air flow sensor and tighten hose clip.

25 Install air cleaner complete.

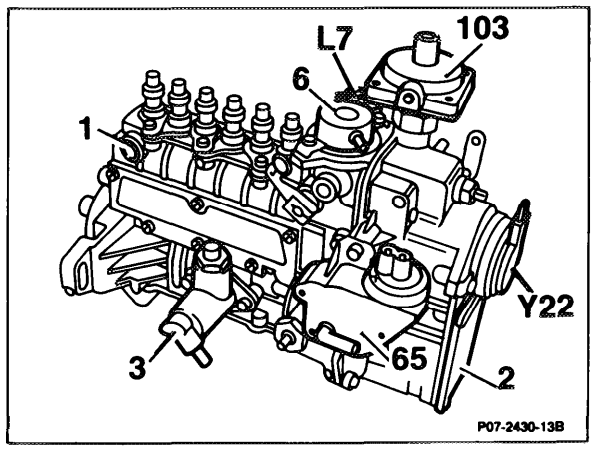
26 Completely reinstall bottom section of noise encapsulation .

A pressure switch is installed in the charge air pipe as an overload protection for the mechanical parts of the engine. In the event that the boost pressure rises above 1 .1± 0.15 bar gauge pressure, air is admitted to the ALDA unit through the switchover valve and the fuel quantity is limited to that of a naturally aspirated engine.

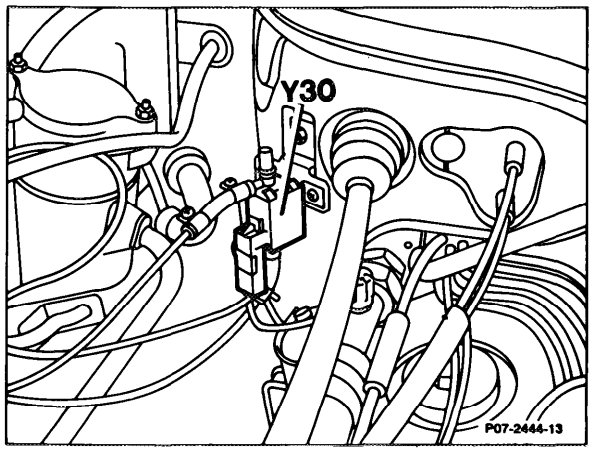


A Naturally aspirated engine quantity (P = 1050 mbar)
B Full load quantity with turbocharging

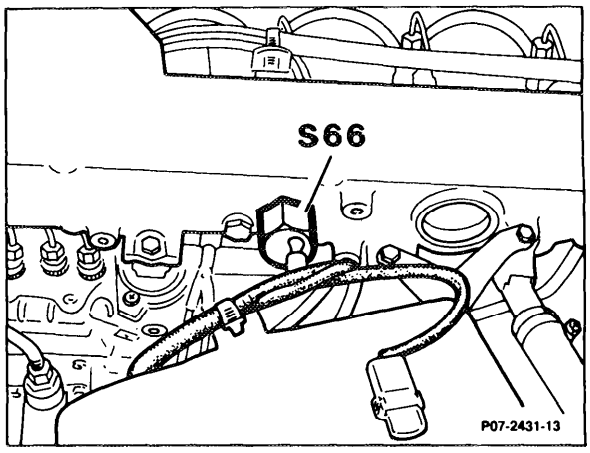
Location of Components



1 Injection pump
2 Governor
3 Fuel pump
6 Stop unit
65 Vacuum control valve
103 ALDA unit
Y22 Actuator



Y30 Switch-over valve, engine overload protection

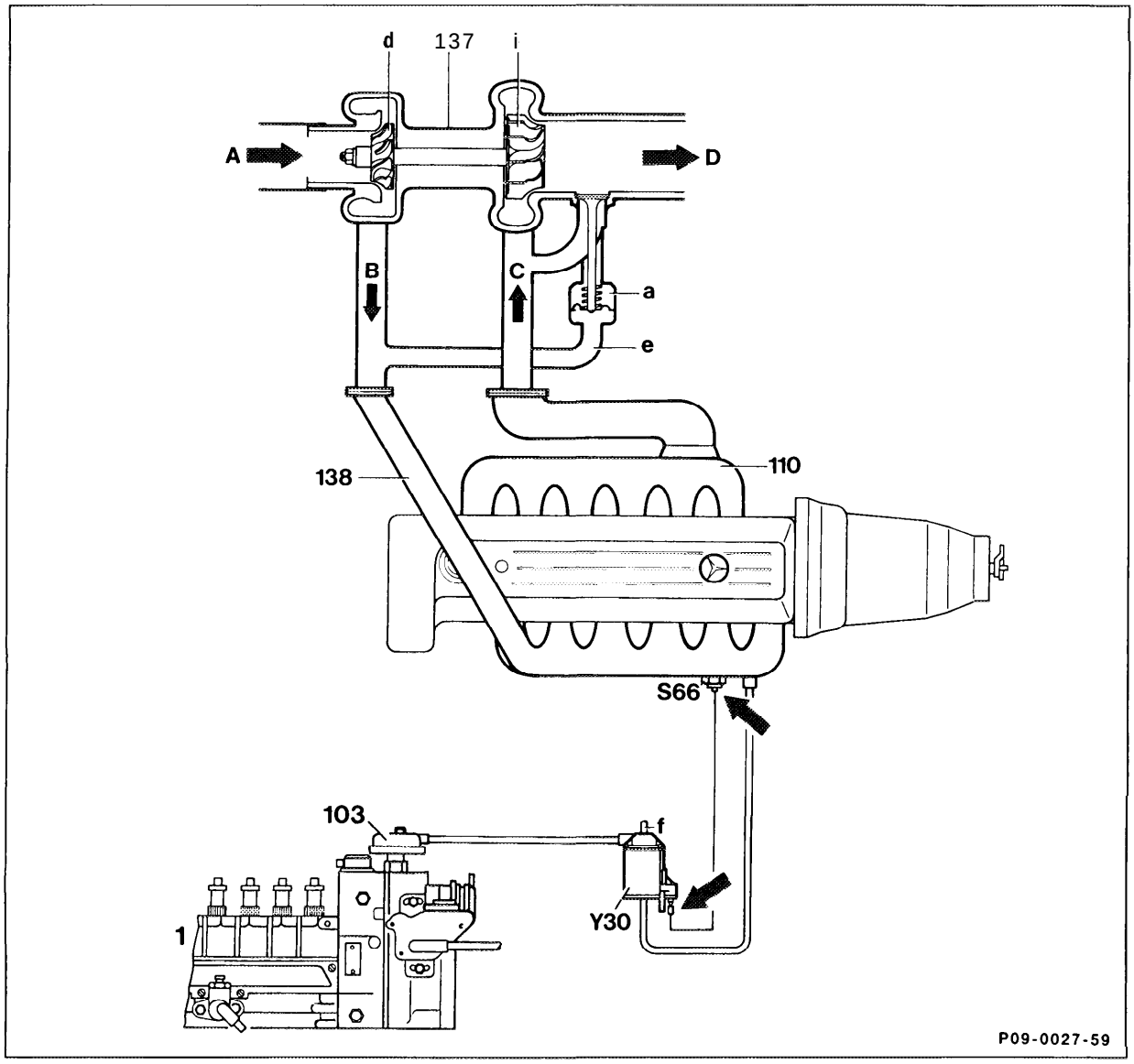


S66 Switch, engine overload protection

Pressure, vacuum diagrams (refer to 07.1-500).

Wiring diagrams (refer to 07.1-400).

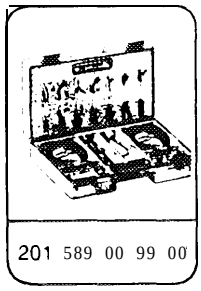
09–250 Testing engine overload protection - Turbodiesel



1	Injection pump	a	Boost pressure control valve
103	ALDA unit	d	Compressor wheel
110	Exhaust manifold	e	Control line
137	Turbocharger	f	Air admission
138	Charge air pipe	i	Turbine wheel
S66	Pressure switch, engine overload protection	A	Compressor inlet (fresh air)
Y30	Switch-over valve, engine overload protection	B	Compressor outlet (precompressed air)
		C	Exhaust gases to turbine wheel
		D	Exhaust outlet

2-pin connector on switchover valve (Y30)	detach and briefly energize with voltage. The switchover valve must audibly actuate; replace if necessary.
l-pin connector on pressure switch (S66)	detach and test for continuity with ohmmeter. The pressure switch (S66) is open in the off position.
Engine overload protection switch (S66)	remove. Connect pressure switch to cable of nozzle tester KDJE-P 400. Connect ohmmeter to pin of pressure switch and to housing. Build up pressure of 1 .1 ± 0.15 bar at nozzle tester; the pressure switch must not have any continuity. Replace pressure switch if necessary.

Special tools

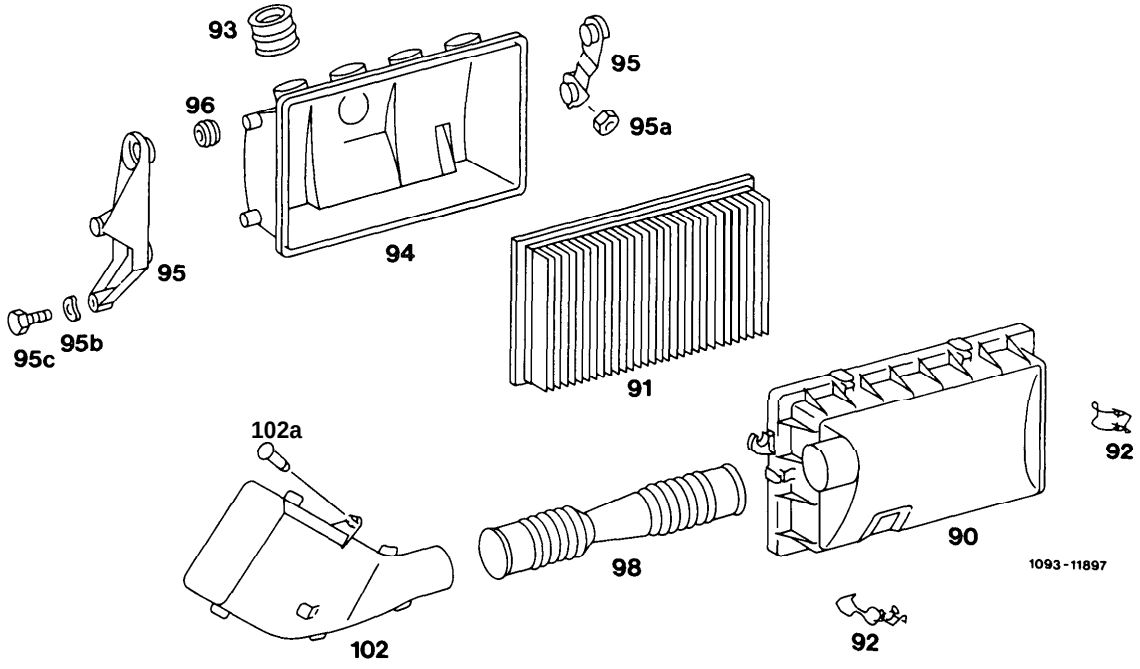


Commercial tester

Digital multimeter	e.g.Sun, DMM 5
Valve tester	e.g. Bosch, KDJE-P 400 (Bosch Order Designation)
Optionally O-6 bar pressure gauge	e.g. Bosch No. 1687 231 000
Optionally nozzle tester EFEP 60H	e.g.Bosch No. 0684 200 700

09-400 Removal and installation of air cleaner

A. Standard version and Federal as of 1984



Suction line (98)	installation position.
Closing catch, 6 off (92)	open, close.
Air cleaner cover (90)	remove, reinstall.
Air cleaner filter element (91)	remove, reinstall.
Nut (95a)	remove, reinstall.
Washer (95b)	remove, reinstall.
Bolt (95c)	remove, reinstall.
Bracket, 2 off (95)	remove, reinstall.
Air guide housing (94)	remove, reinstall.
Sealing boot (93)	remove, reinstall, ensure proper seating.
Rubber, 4 off (96)	replace according to condition.
Intake scoop (102)	remove, reinstall.
Pin (102a)	replace according to condition.

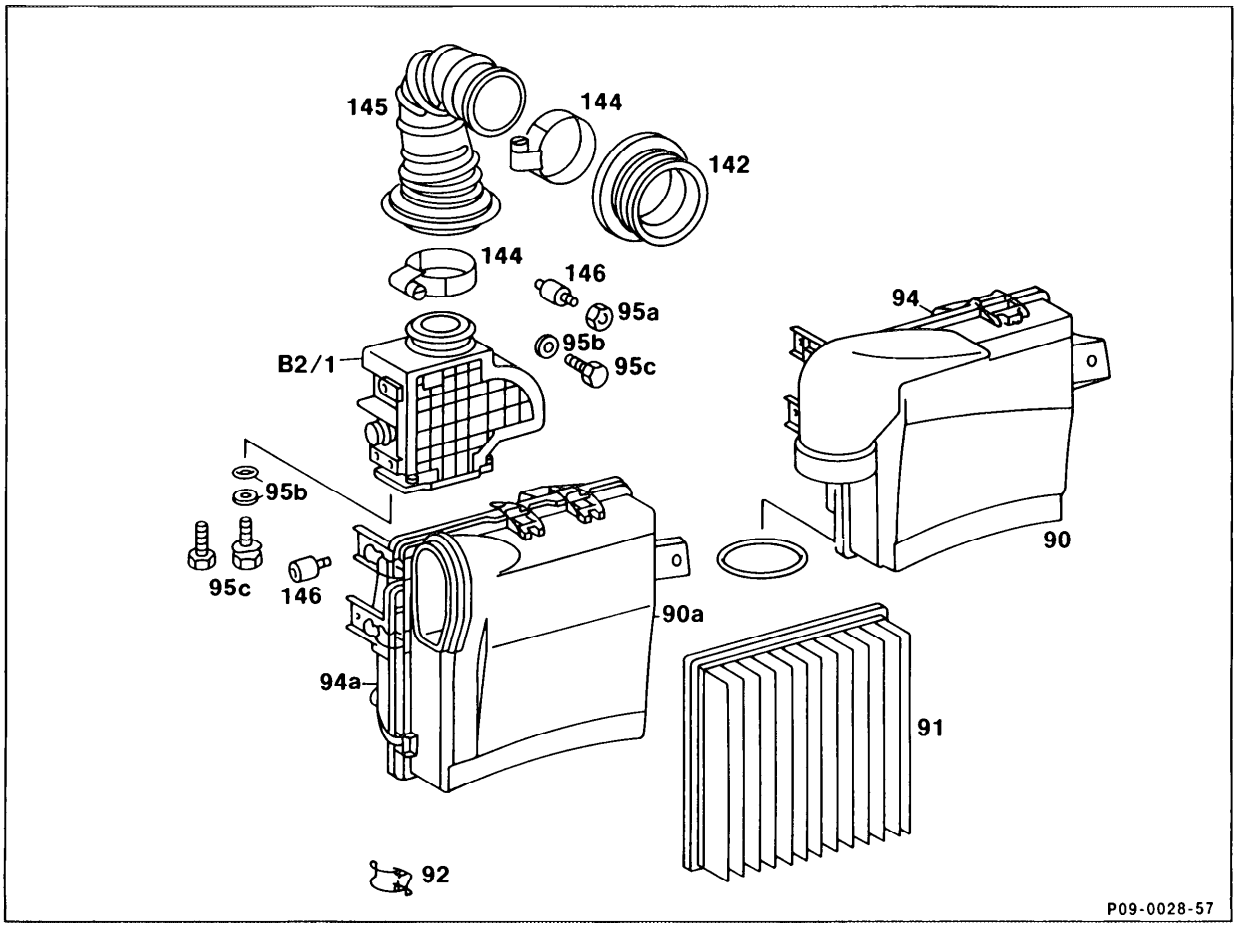
Engine 602.91

Air cleaner cover (90) and filter element (91) of revised material.

Production breakpoint: December 1989

Model	Engine	Engine end no. Manual transmission	Engine end no. Automatic transmission
201.126	602.911	086698	016956

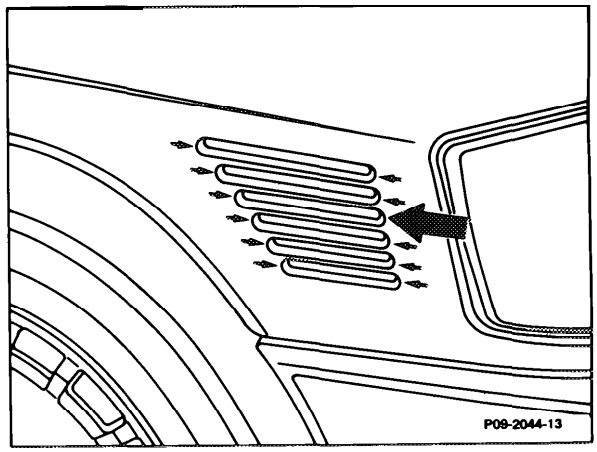
B. Model 201



Air cleaner element (91)	remove, install. Ensure correct position during installation.
Air cleaner cover (90)	remove, install.
Air guide housing (94)	remove, install.
Air guide housing (94 a)	remove, install.
Cup seal (142)	remove, install.
Hose strap (144)	slacken, tighten, remove, install.
Intake pipe air line (145)	remove, install.
Stopper (146)	renew according to condition.
Nut (95 a)	bolt on, unbolt.
Air flow sensor (B2/1)	remove, install.
Wire clip (92)	unclip, clip in place.
Air cleaner cover (90 a)	remove, install.
Washer (95 b)	remove, install.
Bolt (95 c)	remove, install.

Repair Instruction

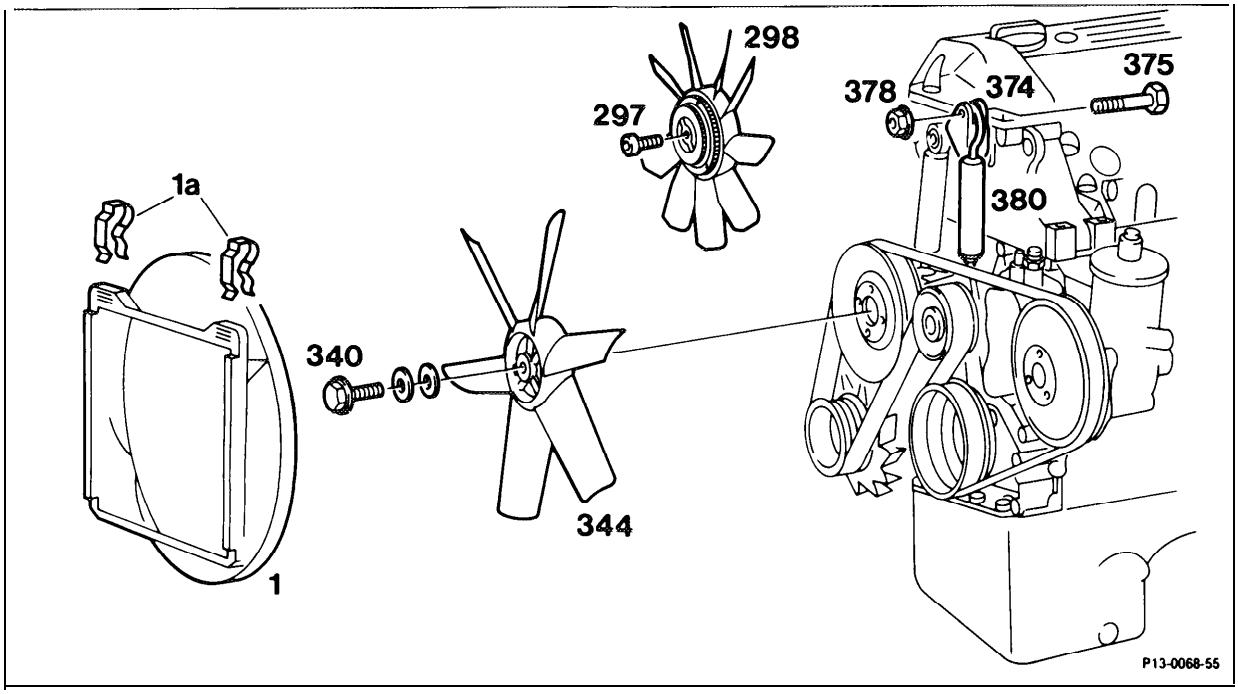
When the engine is running, the fender cover (right) must be removed, otherwise the fresh air intake (arrow) is blocked.



Job No.

Removal and installation of poly V-belt ..... 13 - 342
Checking condition of poly V-belt and tensioner ..... 13 - 343
Removal, installation and dismantling of poly V-belt tensioner ..... 13 - 345

13-342 Removal and installation of poly V-belt



Fan shroud (1)	On engine 602 in model 201 remove, install with one-piece radiator fan shroud (20-420, Number 2). On engine 602 in model 201 with divided fan shroud, remove, install fan shroud (Number 3). Detach fan shroud on engines 602 and 603 in model 124, place above fan.
Viscofan coupling (298)	unbolt, reinstall, remove together with fan shroud, bolt (297), 45 Nm. Special tools 103 589 01 09 00 and 603 589 00 40 00.
Tension lever (374) and tension spring (380)	release, by removing nut (378), take out bolt (375) and remove poly V-belt, Install and tension (Numbers 6 - 11).

Caution!
Check poly V-belt section and tenstoner for damage and contamination, replace if required.
Do not use belt wax or similar lubricant.
Check seating of poly V-belt.

Poly V-belt dimensions

Engine	Poly V-belt layout Length of poly V-belt in mm		
	A[1])	B	C
602	-	**2030**	2100
603	-	2080	2145 (2120)[2])

[1]) Up to 09/85
[2]) Engine 603970

Note
Engine 602
Poly V-belt of different material and revised design.

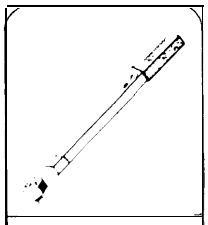
Engines 602.91 and 602.961
Poly V-belt (B drive) provided by additional manufacturer (Gates).

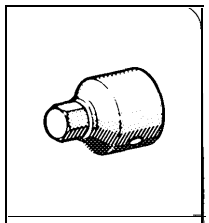
Production breakpoint: 04-08/88

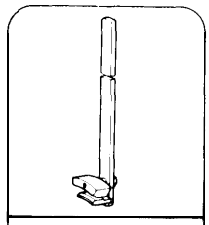
Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
201.126	602.911	062585-067051	013074-013739	*	*
201.128	602.961	-	002420-003680	*	*

* not recorded

Special tools


001 589 72 21 00 00

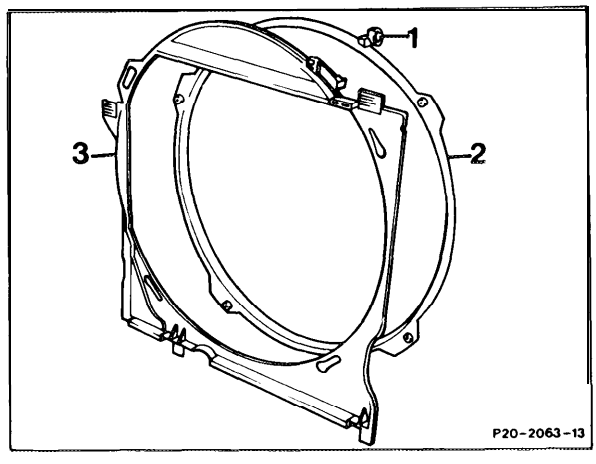

103 589 01 09 00 20


603 589 00 40 00 **20**

Removal

1 Remove radiator with one-piece fan shroud **on engine 602.911 in model 201 (20-420).**

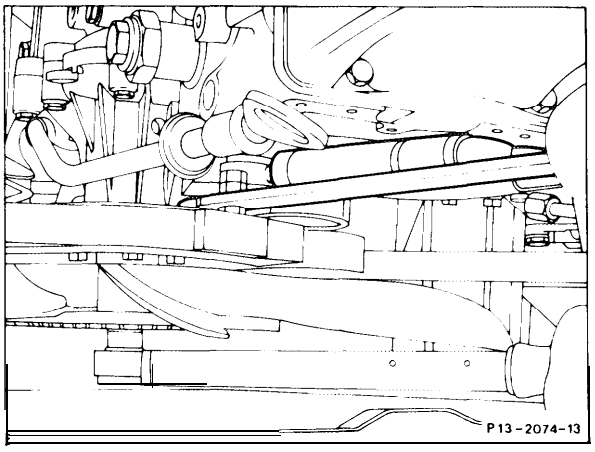
2 **On engine 602 in model 201** with divided fan shroud, open and remove, by taking out locking pin (1) and turning ring (2) to the left. Place ring on the fan, pull out housing (3) and remove ring.



3 **On engines 602 and 603 in model 124**
Detach fan shroud and lay on the fan. Unscrew Viscofan coupling with fan and remove with fan shroud.

Use screw driver bit 103 589 01 09 00 and steady 603 589 00 40 00 in order to detach and tighten up the hexagon socket bolt for the Viscofan coupling.

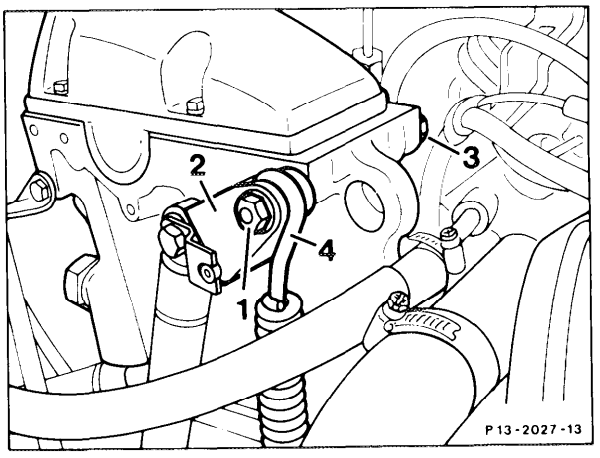
4 **On the engine 603.96 (TURBO)** the Visco-fan coupling cannot be removed without removing the radiator.



5 Detach tensioner, by unscrewing nut (378). Put a lever (12 - 13 mm dia., approx. 300 mm long) or rim wrench from vehicle tool kit in the hole in the spring tension lever (374). Press lever slightly to the left, until bolt (375) can be slid back in the direction of the manifold.

Release tension spring (380), by swinging lever to the right.

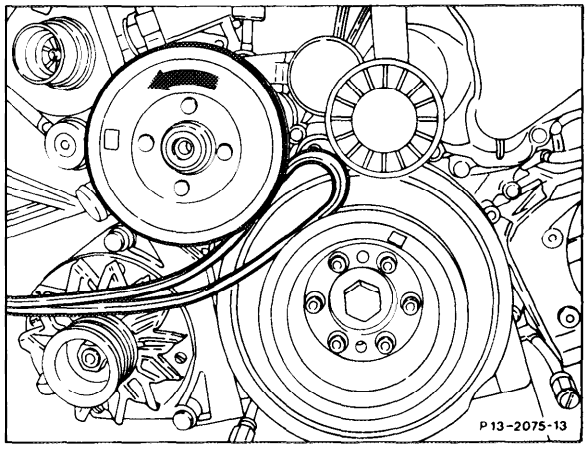
Remove poly V-belt, by pressing back the idler pulley.
Check poly V-belt section and tensioner for damage and contamination, replace if required (e.g. worn bearing points on tensioner, dents in pulley etc.).



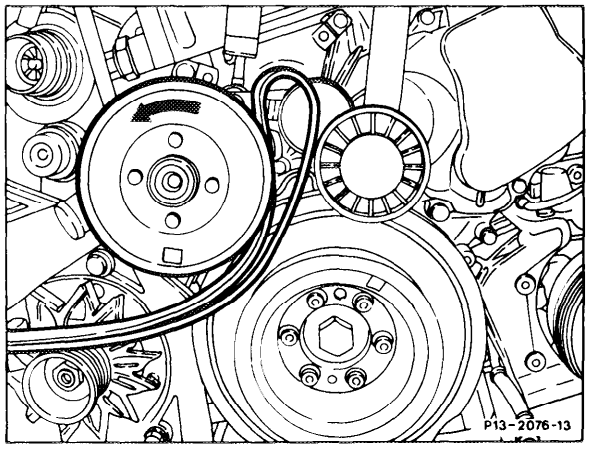
Putting on poly V-belt

Caution!
Do not use any belt wax or similar products.

6 Raise idler pulley slightly. Turn poly V-belt on the back, form a small loop and slide between coolant pump pulley and crankshaft pulley.

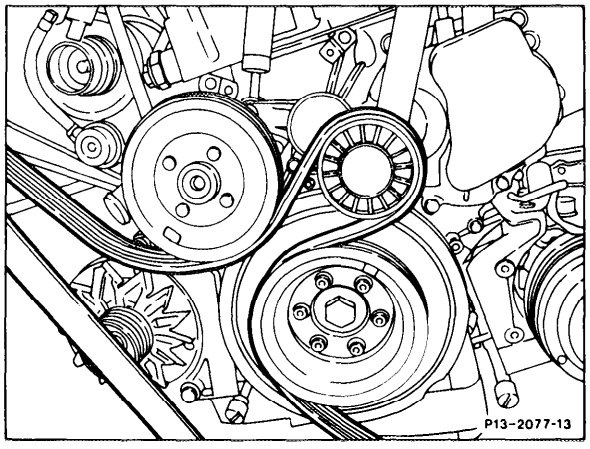


7 Press poly V-belt with the left hand firmly onto coolant pump pulley and turn this to the left (arrow) until poly V-belt rides up onto idler pulley.



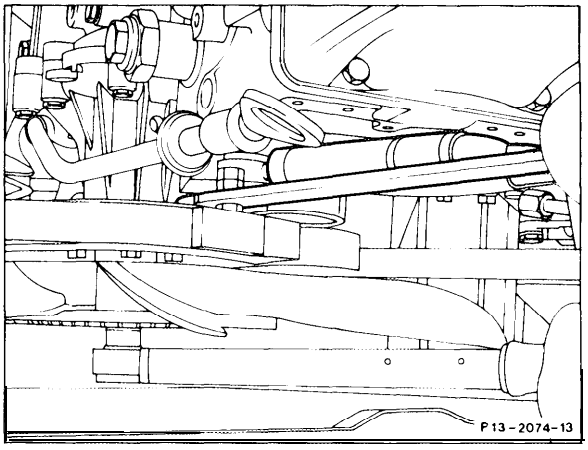
8 Put poly V-belt on idler pulley and crankshaft pulley. Then rotate the free part of poly V-belt and place onto the refrigeration compressor, power steering pump, coolant pump and alternator pulley.

9 Tension poly V-belt and install tensioner.



11 Check seating of poly V-belt on the pulleys.

12 **On engine** 602 **in model** 124 install fan or Viscofan coupling with fan and fan shroud.



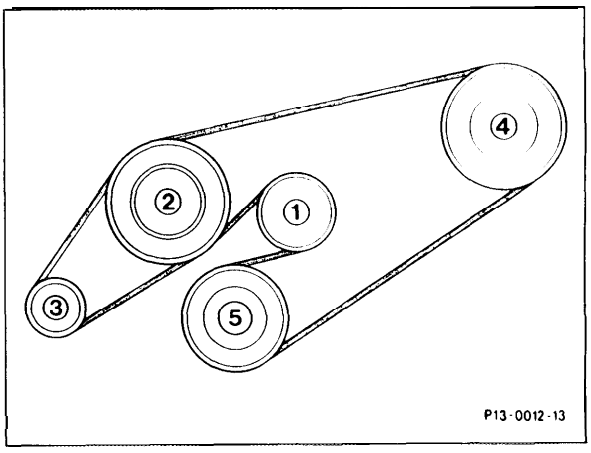
Tightening torque of Viscofan coupling fixing bolt 45 Nm.
Use steady 603 589 00 40 00 for tightening up.

13 On engine 602.911 in model 201 Install radiator (20-420) without divided fan shroud.

B Pulley layout on vehicles with power steering

Length of belt
Engine 602: 2030 mm
Engine 603: 2080 mm

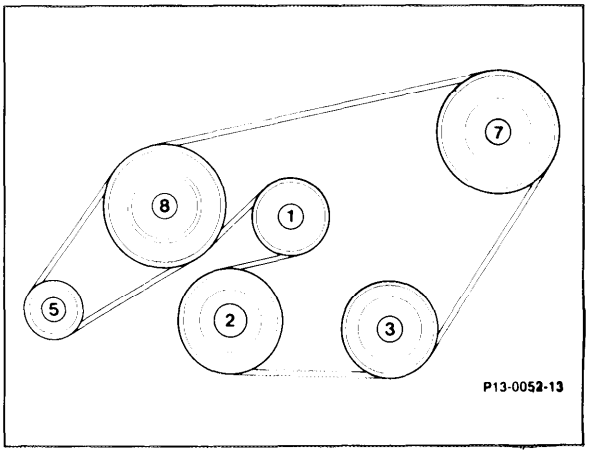
1 Idler pulley
2 Crankshaft
5 Alternator
7 Power steering pump
8 Coolant pump



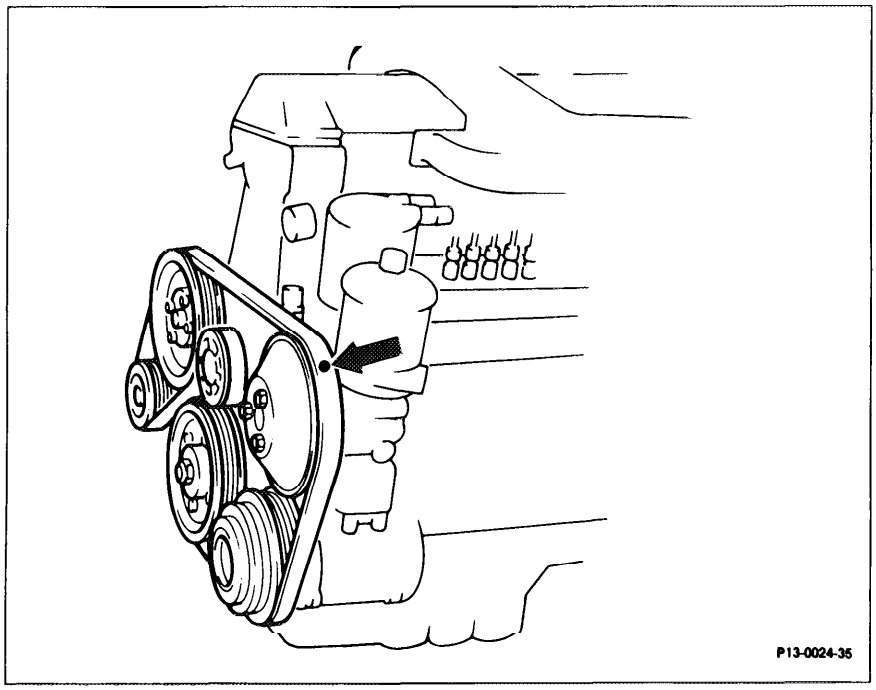
C Pulley layout on vehicles with power steering and refrigeration compressor

Length of belt
Engine 602: 2100 mm
Engine 603: 2145 mm
Engine 603.970: 2120 mm

1 Idler pulley
2 Crankshaft
3 Refrigeration compressor
5 Alternator
7 Power steering pump
8 Coolant pump



13-343 Checking condition of poly V-belt and tensioner



Compression pressure plotter	connect 001 589 76 21 00 with adapter 124 589 366 300 to positive terminal of battery and terminal 50 (Numbers 1 - 3).
Poly V-belt	mark at a clearly visible point with chalk (arrow). Turn engine in Increments.
Tensioner	check condition.

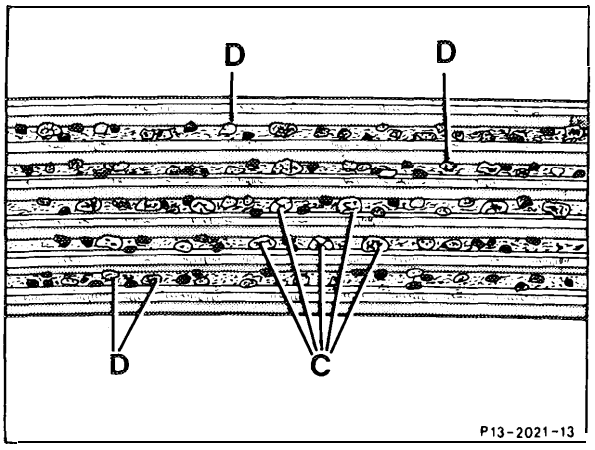
Caution!
Note different design.

A. Poly V-belts

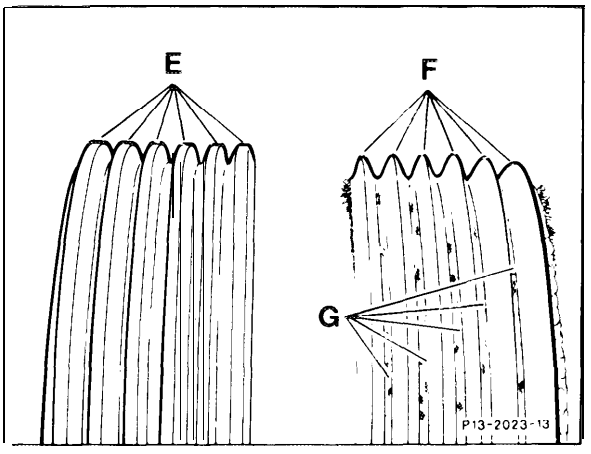
The poly V-belt is to be replaced if one of the following damaged patterns is determined during testing.

Damage pattern

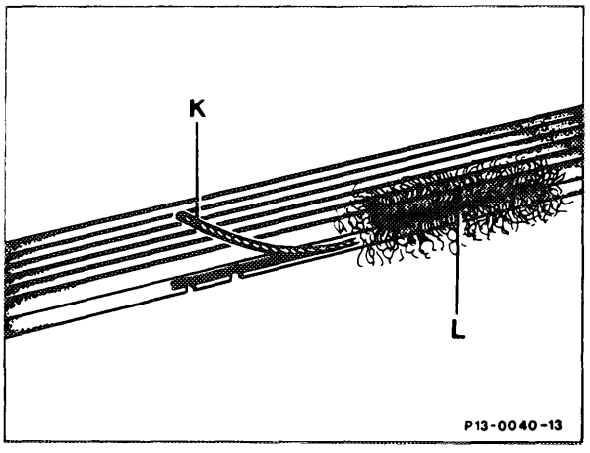
C Lumps of rubber in base of ribs.
D Deposits of dirt or stones.



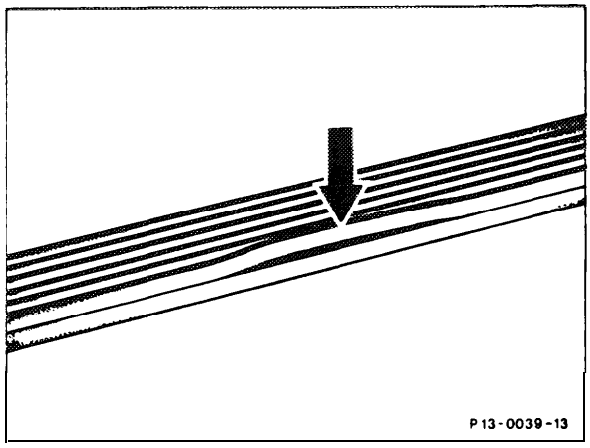
Flank wear
F Ribs are pointed.
E New poly V-belt - ribs are trapezoidal.
G Strand visible in base of ribs (lighter points).



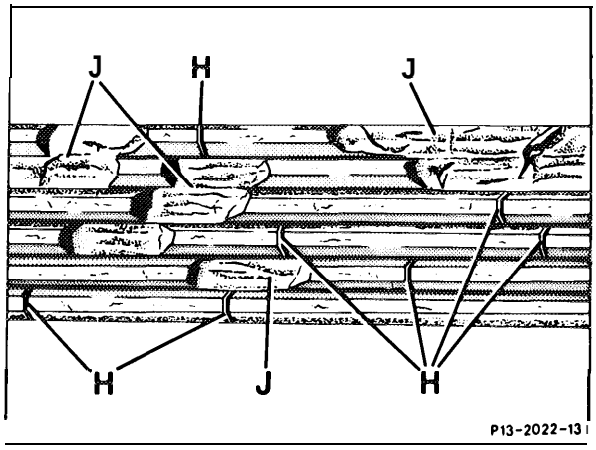
K Strand torn out sideways.
L Outer strands frayed.



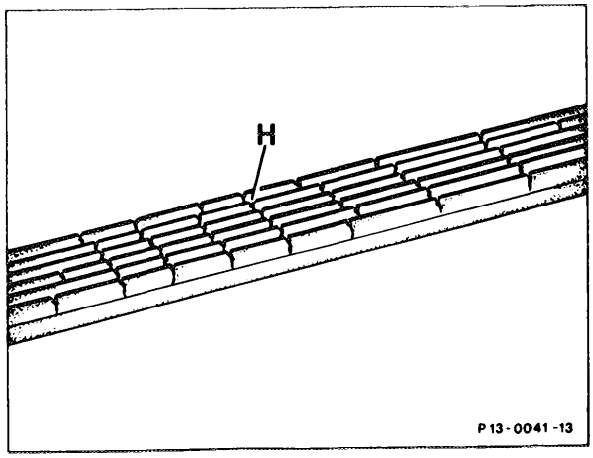
Rib detached from base of belt (arrow).



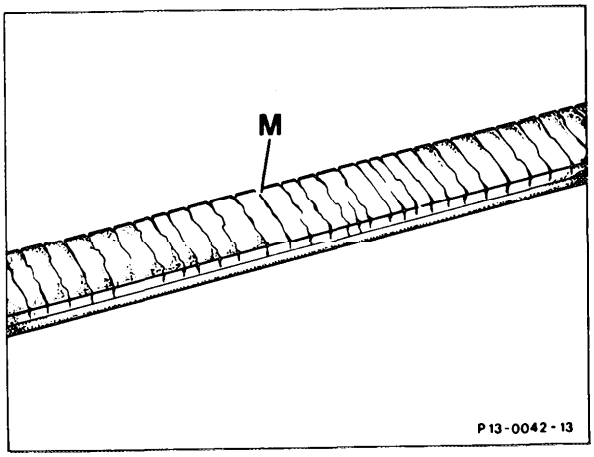
H Transverse cracks in ribs and or
J Rib fractures



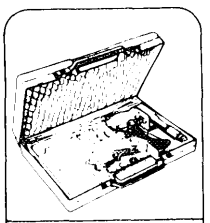
H Transverse cracks in several ribs.



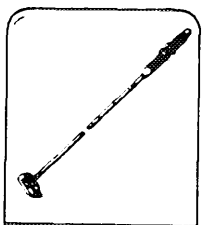
M Transverse cracks on the back.



Special tools



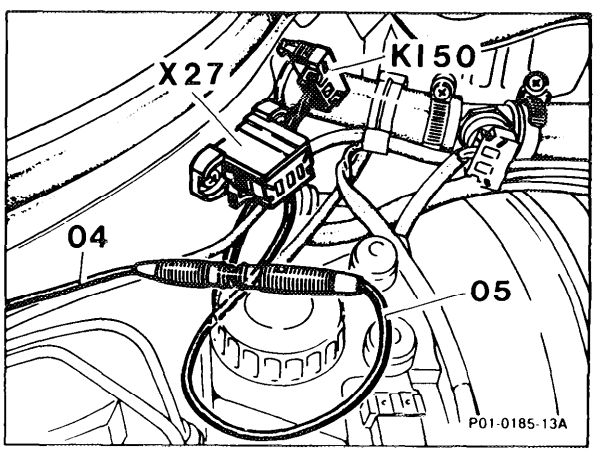
001 589 78 21 00
01



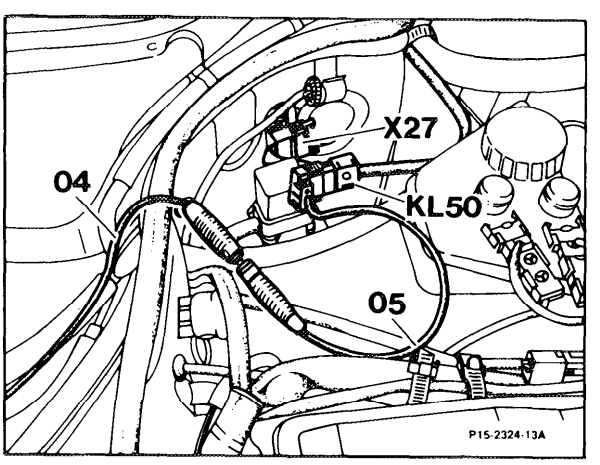
124 589 36 63 00

Model 124 and 126

1 Connect compression pressure plotter 001 589 78 21 00, by separating plug connection (X 27) at the left unit compartment wall and connect connector lead (04) of the compression pressure plotter to the plug (terminal 50) with adapter lead 124 589 36 63 00 (05).



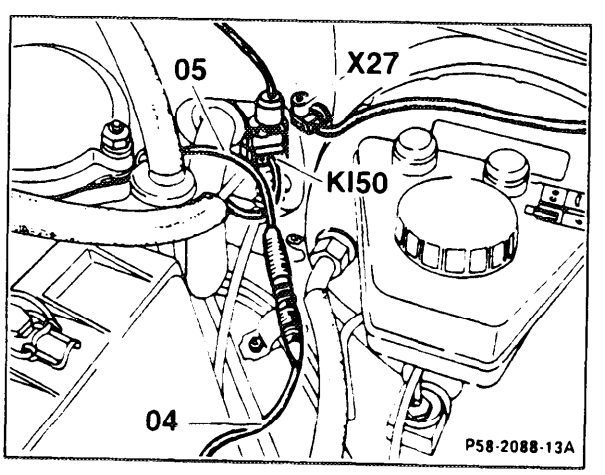
Model 124



Model 126

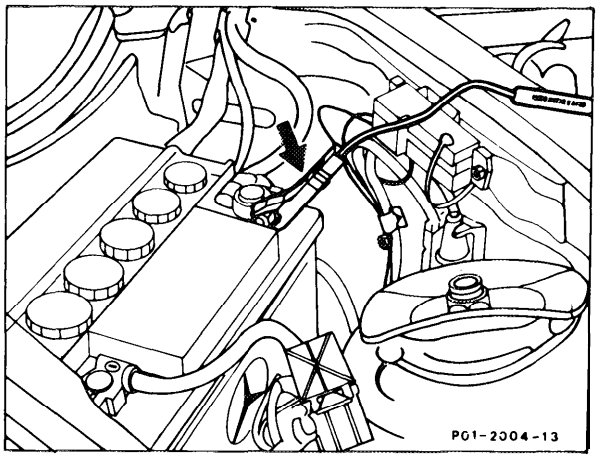
Model 201

2 Connect compression pressure plotter 001 589 78 21 00, by separating plug connector (X 27) at left front wall and connect the connector lead (04) of compression pressure plotter to the plug (terminal 50) with adapter lead 124 589 36 63 00.



Model 201

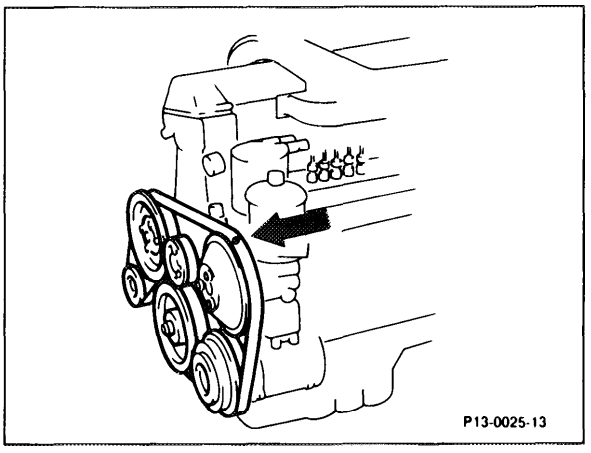
3 Connect up second connector lead of the compression plotter to positive terminal (terminal 30) of the battery.



4 Mark poly V-belt with chalk at a clearly visible point (arrow).

5 Turn engine in increments and check poly V-belt for damage.

Complete process when marking is visible again (one complete belt revolution).



B. Tensioner

The following parts are to be checked on the tension lever bearing (1 st design up to 10 85):

6 Check bearing pin (30) of tension lever (360) for firm seating.

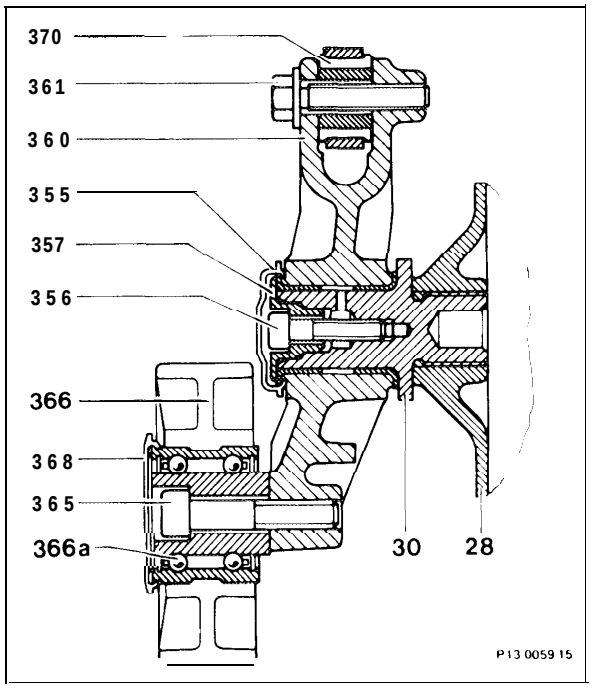
Note

The collar of bearing pin (30) must contact the timing case cover (28). The idler pulley must not have any alignment problems.

7 Check tensioner with bearing bush.

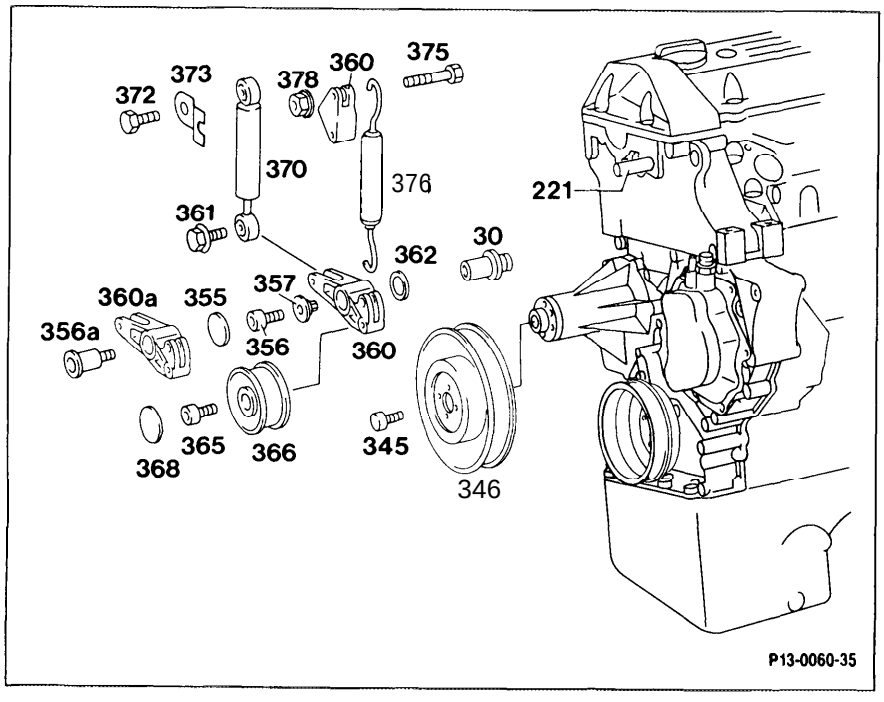
Note

The idler pulley must not exhibit any alignment faults. The bearing bushes are worn when there is a detectable play between the bearing pin (30) and tension lever (360).



13-345 Removal, installation and dismantling of poly V-belt tensioner

Preceding work:
Fan and fan shroud removed (20-312 or 20-335).
Radiator removed (only Model 201, 126, 20-420).
Poly V-belt removed (13-340).



Sealing cap (368)	.....	press off, press on.
Idler pulley (366)	.....	remove, install, 25 Nm.
Pulley (346)	.....	remove, Install. Hexagon socket bolt, 10 Nm Internal Torx bolt, 14 Nm.
Damper (370)	.....	unbolt, install, 25 Nm. Check for function.
Tension spring (376)	.....	remove, assemble.

Tensioner - 1st design:

Sealing cap (355)	remove, install.
Tensioner (360)	remove, install. 10 Nm. Check for condition and wear.
Bearing pin (30)	remove, Install, 100 Nm. Clean thread and coat with Omnifit 100 M orange 002 989 23 71.

Tensioner - 2nd design:

Bearing pin (30)	deleted. Use dowel screw fitting bolt (356), 100 Nm. Clean thread and coat with Omnrfit 100 M orange 002 989 23 71.

Note
Only the 2nd design is now available as a replacement part. Complete with bearing and close-tolerance bolt.

Adhesives

Omnifit 100 M orange	002 989 23 71

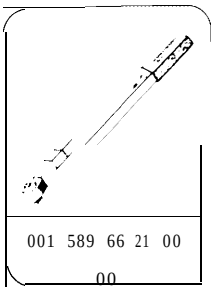
Tightening torques	(Nm)
Hexagon socket bolt on idler pulley	25
Hexagon socket bolt on coolant pump pulley	10
Internal Torx bolt on coolant pump pulley	14
Hexagon bolts on damper	25
Internal hexagon bolt on tensioning lever	10
Bearing pin for tension lever bearing	100
Dowel screw for tension lever bearing	100

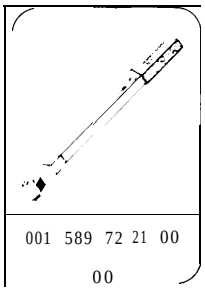
Poly V-belt dimensions

Engine	Poly V-belt layout Poly V-belt length in mm		
	A [1])	B	C
602	–	2030	2100
603	–	2080	2145 (2120) [2])

[1]) Uo to 09 85
[2]) Engine 603 970

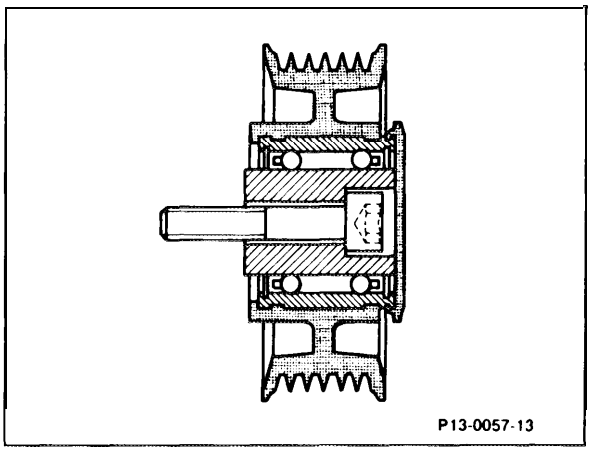
Special tools





Note

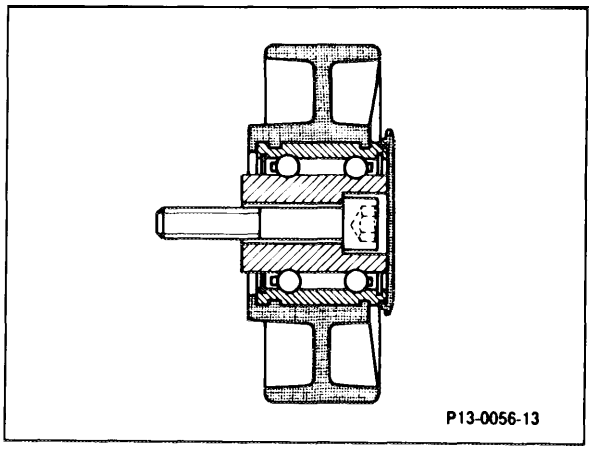
Idler pulleys on vehicles without power steering have grooves for the ribs of the poly V-belt in the running surface.

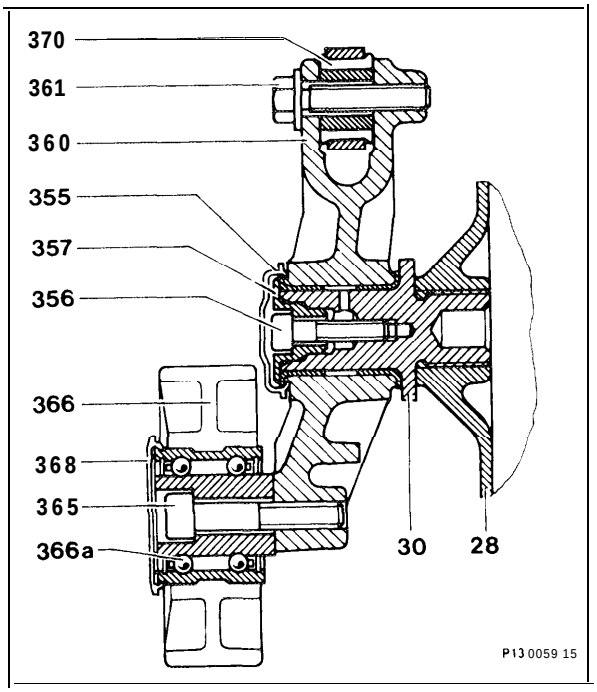


Idler pulleys have flat running surfaces.

Color marking of tension spring:

Vehicles with power steering pump, blue.





Tension lever (2nd design)
28 Timing case cover
30a Dowel screw
360 Tension lever
362 Angular contact ball bearing
363 Washer
368 Sealing cap

Production breakpoint: **09/85**

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.133 124.193	603.962	-	000016	from start of production	
126.125	603.961	-	000114	from start of production	
201.126	602.911	005966	001372	253369	156861

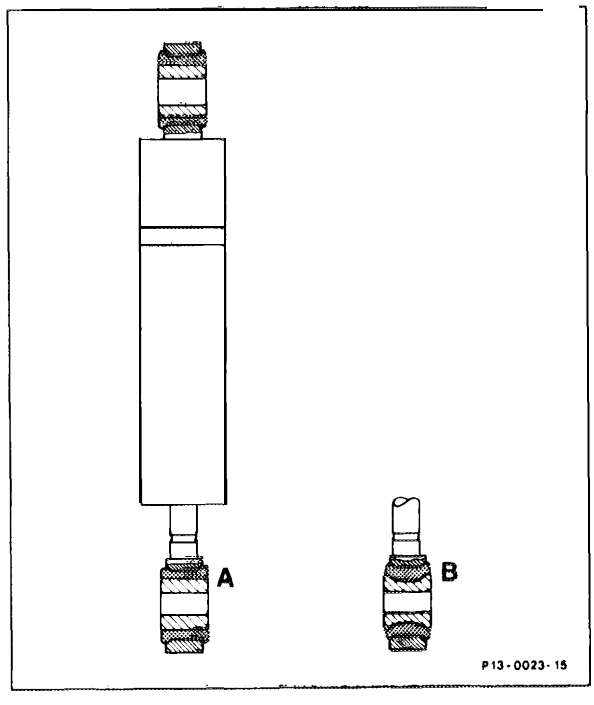
* not recorded

Engine 602
Single-acting damper for belt tensioner,
previously double-acting.

Production breakpoint: 05/86

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
201.126	602.911	020242	005061	306516	237404

Between 07 89 and 09 89 and from 06 90 the dampers for the tensioner have vulcanized lower rubber bearings.



A Pressed-on rubber bearing
B Vulcanized rubber bearing

Production breakpoint: 06/90

Model	Engine	Engine end No.		Vehicle identification end No.	
		Manual transmission	Automatic transmission	A	F
124.128	602.962	004646	005752	*	*
124.133 124.193	603.960	–	027696	*	*
126.135	603.970	–	000878	*	*
201.126	602.911	092299	017772	*	*
201.128	602.961	002615	008097	*	*

* not recorded

Since 03 90 fixing bolts for the power steering pump have been hot galvanized, previously phosphated, for Improved surface protection.

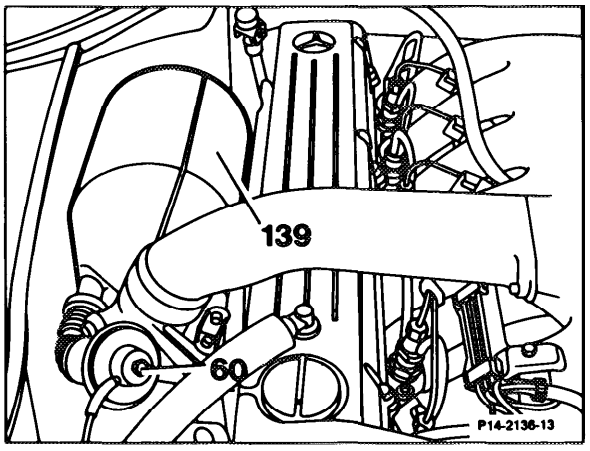
Job No.

Function of trap oxidizer - Turbodiesel . . . . . 14 – 050
Removal and Installation of trap oxidizer - Turbodiesel . . . . . 14 – 100
Testing exhaust backpressure - Turbodiesel . . . . . 14 – 150
Removal and installation of intake manifold . . . . . 14 – 180
Removal and installation of charge air pipe - Turbodiesel . . . . . 14 – 180
Removal and installation of vacuum unit pressure control flap 1990 - Turbodiesel . . . . . 14 – 200
Removal and installation of exhaust manifold . . . . . 14 – 350
Removal and installation of exhaust manifold - Turbodiesel . . . . . 14 – 350

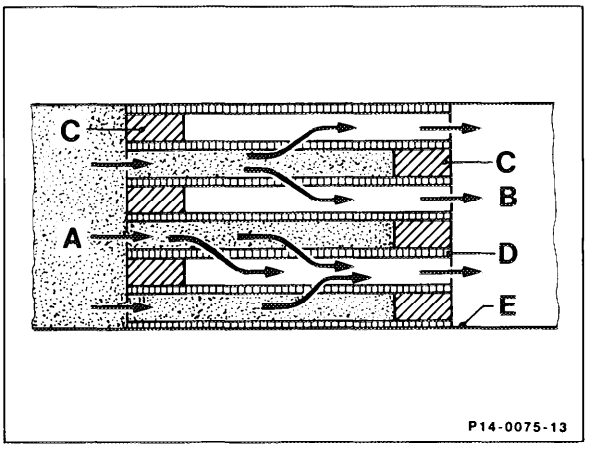
14–050 Function of trap oxidizer - Turbodiesel

The trap oxidizer is a self-regenerating filter installed between the exhaust manifold and turbocharger. It consists of a ceramic monolith surrounded by a metal plate and coated with silver alloy. This enables the oxidizing process to occur even at low exhaust temperatures.

The passages of the filter are closed alternately, forcing the exhaust gases to flow through the porous cell walls. The solid particles trapped as a result are oxidized at various engine operating phases at a high exhaust temperatures as a result of the residual oxygen which is always present in the diesel exhaust.



60 EGR valve
139 Trap oxidizer



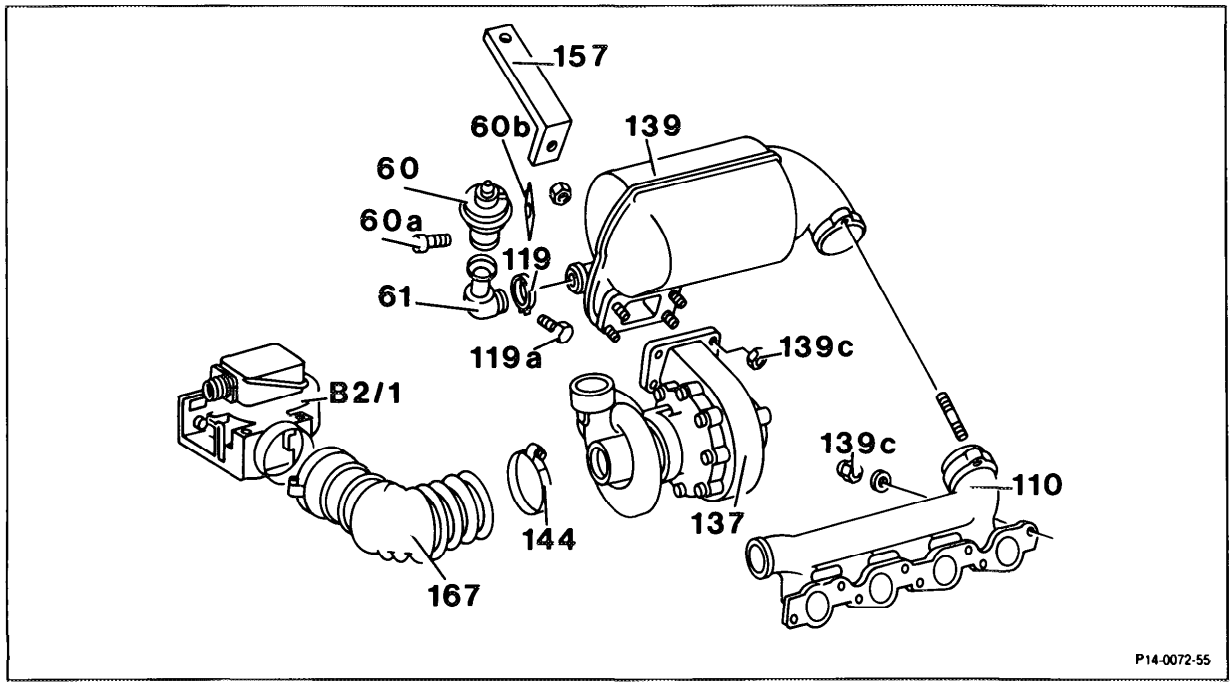
A Exhaust with soot
B Cleaned exhaust
C Ceramic monolith
D Porous cell walls
E Metal casing

Regeneration is dependent on:

- Temperature
- Oxygen content
- Load condition of engine
- Velocity of exhaust gases
- Duration

This oxidizing process begins at > 360 °C. If the exhaust temperatures are > 580 °C for prolonged periods, the trap oxidizer is completely regenerated.

The final product produced as a result of the oxidation of the soot in the filter is almost exclusively carbon dioxide (CO_2).

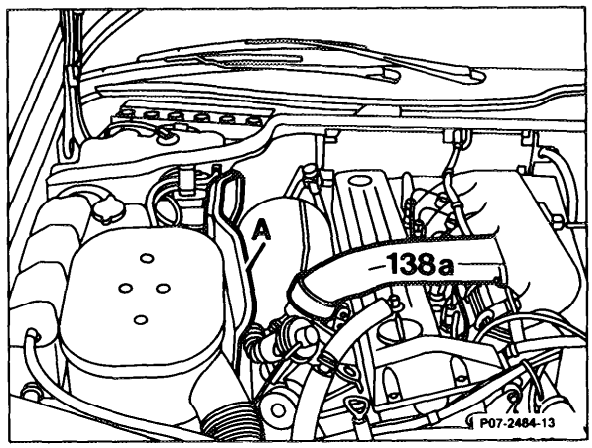


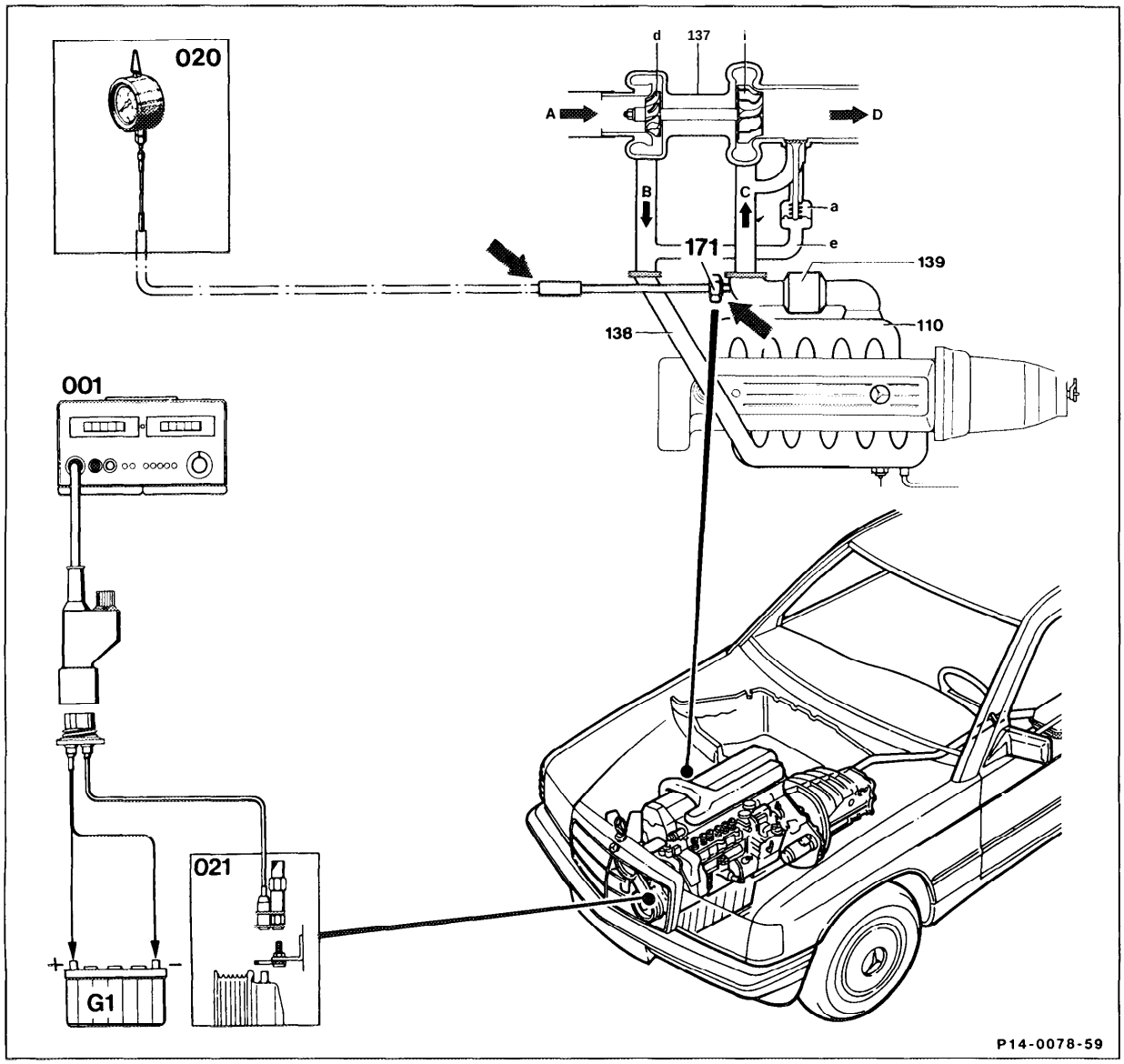
Vehicle	drive onto inspection platform or pit.
Bottom section of noise encapsulation	attach, detach (Model 124 only).
Air cleaner	remove, install (09-400).
Hose clip (144)	loosen at air flow sensor (B2/1) and detach intake hose (167), fit on.
Partition wall between trap oxidizer and air cleaner	remove, install (9 bolts) of which 6 are accessible from above, 3 accessible from below (refer to instruction).
Vacuum line red/violet/brown on EGR valve (60) and red/violet/blue on air recirculation valve	detach, fit on.
Clip (119) on corrugated pipe (61)	loosen, tighten.
EGR valve (60)	remove, install.
Trap oxidizer (139) on exhaust manifold (110)	unbolt, bolt on.
Supporting bracket	unbolt, bolt on and remove at the same time as trap oxidizer.

Bracket (157)	remove, install.
Sealing surfaces	clean.
Gasket (60 b)	replace.
Screw (60 a) 2 off	install, tightening torque 25 Nm.
Bolt for clip (119 a) Nut (139 c, 6 off M10)	install, tightening torque 45 Nm.

Note

Remove, install partition wall (A) (9 bolts), of which 6 are accessible from above and 3 are accessible from below.





110	Exhaust manifold
137	turbocharger
138	Charge air pipe
a	boost pressure control valve
d	Compressor wheel
e	Control line
ı	Turbine wheel

A	Compressor inlet (fresh air)
B	Compressor outlet (precompressed air)
C	Exhaust gases to turbine wheel
D	Exhaust outlet

Digital tester (001) and TDC pulse generator (021)	connect, disconnect.
Screw plug (171)	remove, install.
Tester (020) with connection pipe	connect to exhaust manifold.
Engine	raise to operating temperature (coolant temperature 60-80° C)
Selector lever	move to position "P".
Engine	run up to 4000 rpm. Take test reading. **Specification: < 2.0 bar** Actual value > 2.5 bar. Perform regeneration of trap oxidizer as follows: with selector lever in position "2", run car on dynamometer or on road for a total of 2 minutes at full load. Test exhaust backpressure at 4000 rpm in position "P". **Specification: > 1.5 bar.** Repeat regeneration (max. once) if specified value is not reached, replace trap oxidizer and perform brief EDS test.

Note

If the the problem recurs after a short time, determine whether there are any special driving conditions (e.g. frequent short journeys, particularly in colder climatic conditions or prolonged idling).

Check the following before replacing the trap oxidizer:

1 EDS brief test (07.1-l 90)

2 Full throttle stop on injection pump (30-300)

3 Air cleaner element

4 boost pressure (09- 100)

5 Delivery of fuel pump (07-l 451146)

6 Fuel filter and pre-filter (07-245)

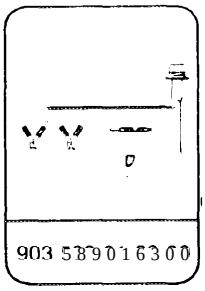
7 Start of delivery (07. l-l 17)

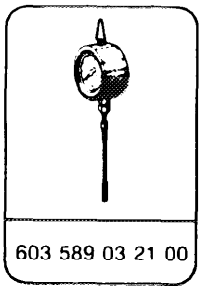
Note
Under normal driving conditions the test reading of the exhaust backpressure is approx. 2.0 bar.

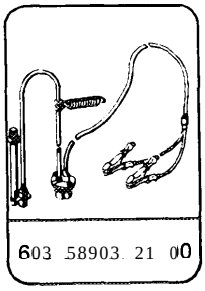
Test data

Selector lever in position "P"	Coolant temperature 60-80° C	At 4000 rpm approx. 2.0 bar

Special tools



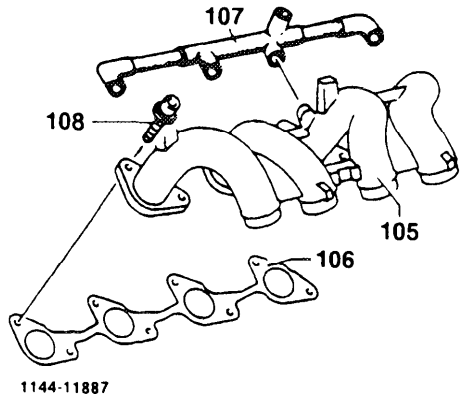




Commercial tester

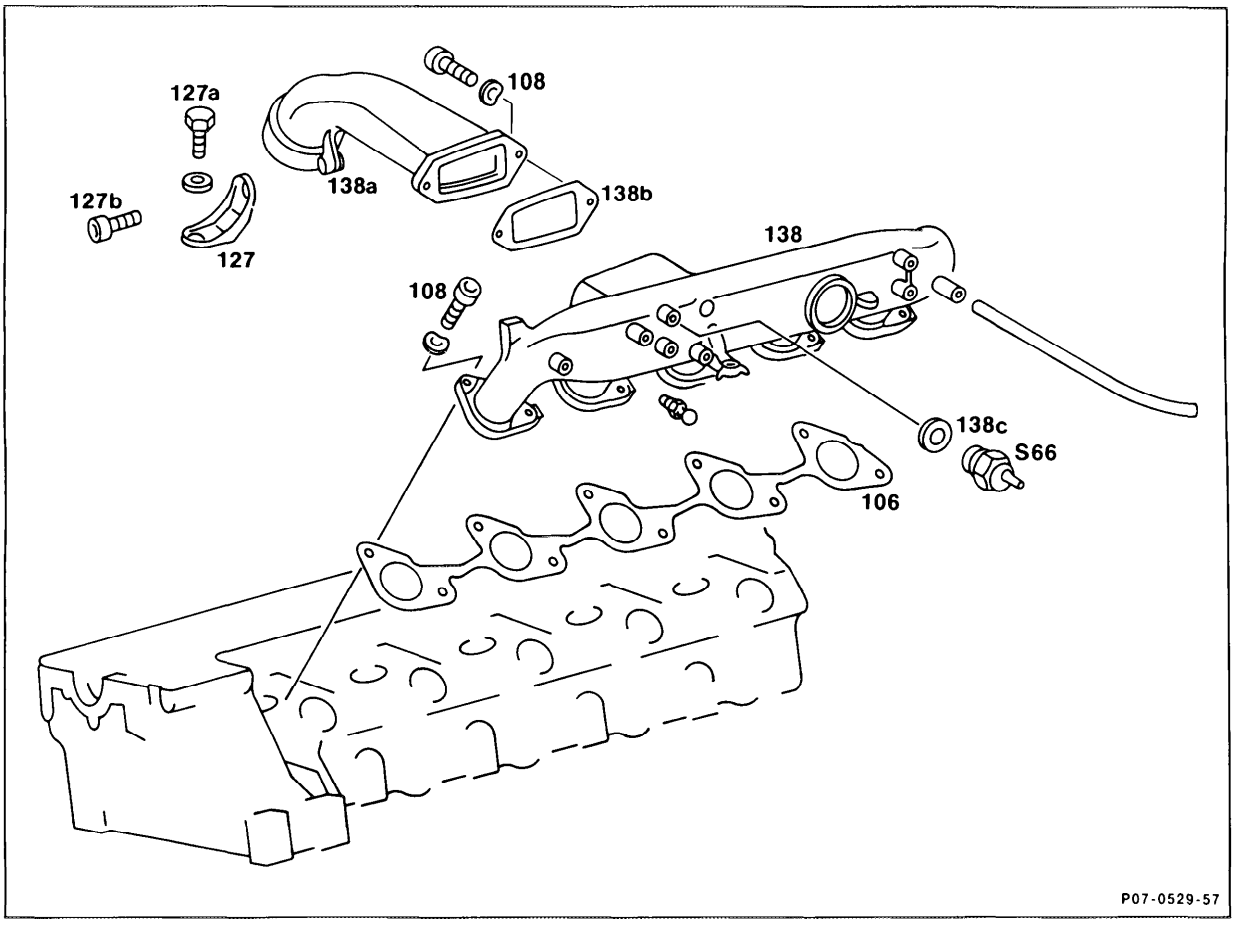
Digital tester	e.g.	Sun, EMT-1019 Master 3, Sun, MCM-2110. All-Test 361 O-MB

14-180 Removal and installation of intake manifold



Engine ventilation (107)	remove, reinstall.
Combination bolt M8 (108)	8, 10 or 12 off M 8 remove, reinstall, 25 Nm.
Intake manifold (105)	remove, reinstall.
Gasket (106)	replace.

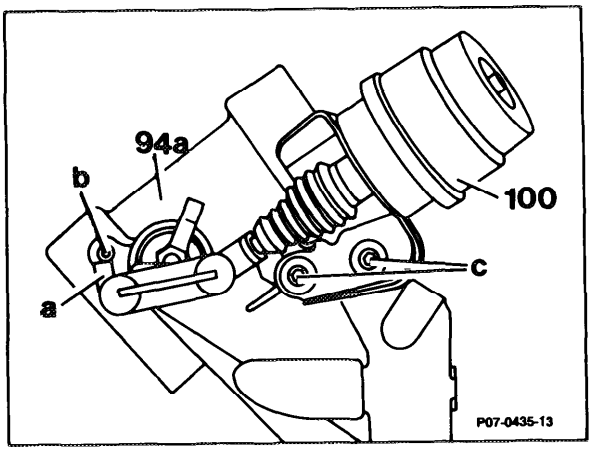
14–180 Removal and installation of charge air pipe - Turbodiesel



Pressure line (transparent) on charge air pipe . . .	disconnect, connect, loosen hose clamp.
Connector on pressure switch (S66)	disconnect, connect.
Pressure switch (S66)	remove, install, replace seal (138 c).
Bracket (127)	remove, install.
Screw-and-washer assemblies (108)	10 or 12 off, remove, install, torque 25 Nm.
Charge air connecting line (138a)	remove, put on, replace seal (138 b).
Charge air pipe (138)	remove, attach, replace gasket (106).

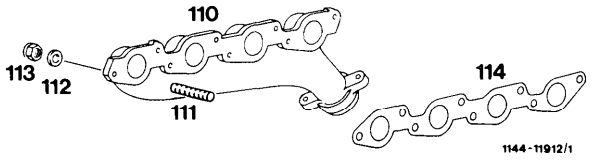
14–200 Removal and Installation of vacuum unit pressure control flap 1990 - Turbodiesel

Engine 602.962



Vacuum unit (100)	remove, install.
Bolts (c)	tighten slightly.
Vacuum unit (100)	pressurize with 385 ± 5 mbar vacuum and slide into the elongated holes until the lever (a) contacts the stop (b). Tighten bolts (c) in this position. Bleed vacuum unit and repeat test, correcting the setting if required.

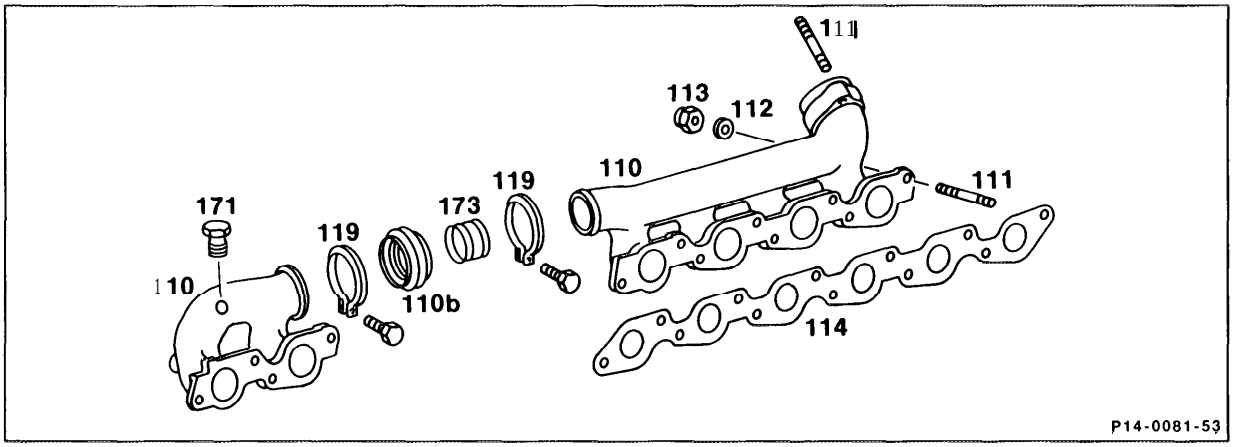
C. National version with exhaust gas recirculation



Clamp (119)	replace.
Nut (113)	8, 10 or 12 off Cu M 8, replace, 25 Nm.
Washer (112)	8, 10 or 12 off to item 113.
Exhaust manifold (110)	remove, reinstall.
Threaded studs in cylinder head (111)	8, 10 or 12 off, if damaged, replace, 12 Nm.
Gasket (114)	replace.
Flexible pipe (61)	remove, reinstall.
Exhaust gas recirculation valve (60)	remove, reinstall.
Exhaust gas recirculation line (120)	remove, reinstall.

14–350 Removal and installation of exhaust manifold - Turbodiesel

Preliminary operation
Turbocharger removed (09-I 50)



Clip (119, 2 off)	loosen.
Nut (113, 12 off)	replace, 25 Nm.
Washer (112, 12 off)	remove, install.
Metal hose (110 b)	remove, install.
Pipe (173)	remove, install.
Screw plug (171)	remove, install.
Exhaust manifold (110)	2-piece, remove, install.
Gasket (114)	replace.
Stay pin in cylinder head (111, 12 off)	check, replace if required.

Job No.

Function of preglow system . . . . . 15 – 705
Function of preglow system - Turbodiesel . . . . . 15 – 705
Checking preglow system without afterglow function . . . . . 15 – 710
Testing preglow system without afterglow function - Turbodiesel . . . . . 15 – 710
Checking preglow system with afterglow function . . . . . 15 – 711
Testing preglow system with afterglow function - Turbodiesel . . . . . 15 – 711
Removal and installation of glow plugs . . . . . 15 – 715
Removal and installation of glow plugs - Turbodiesel . . . . . 15 – 715

A. General

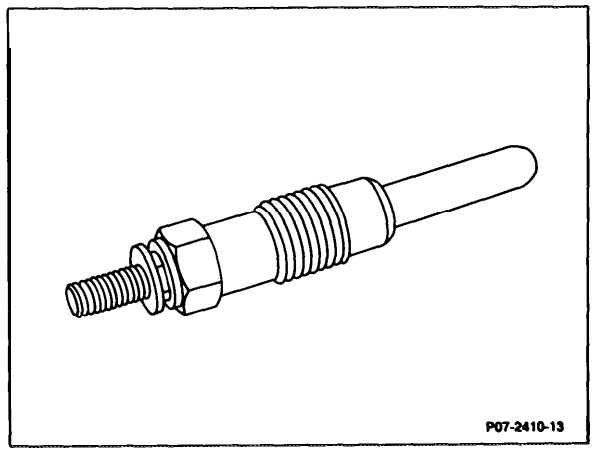
Combustion in the diesel engine occurs through the injection of self-igniting diesel fuel into highly compressed and therefore, hot combustion air.

If the engine is cold, the self-ignition temperature is not reached by compression alone. A preglow system is therefore required to increase the temperature of the compressed air and to allow the engine to start by directly igniting fuel particles on the glow plugs.

The duration of preglow depends on the ambient temperature.

Construction of the quick-start pencil-type glow plugs

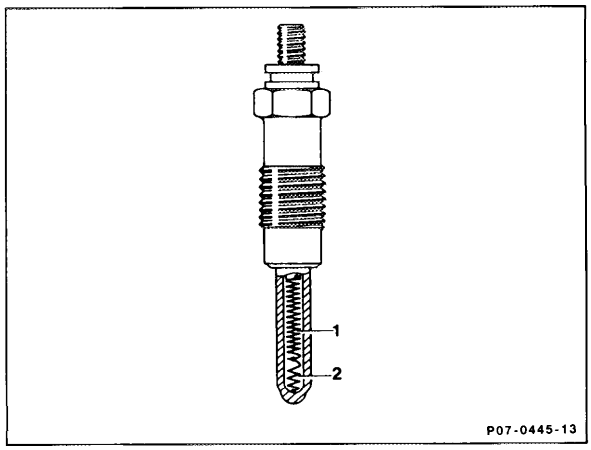
The main components of the pencil-type glow plugs are a housing with screw-in thread M 12 x 1.25 and a heater pin pressed into the housing.



The single-pole connection pin is secured to the housing by means of a permenant connection consisting of a brass round nut.

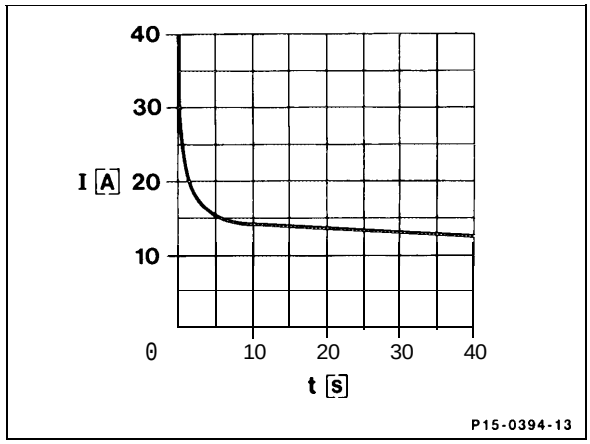
The pencil-type glow plugs are designed for a voltage of 11.5 V and are connected in parallel.

The heating element consists of a series-connected heater and control coil.



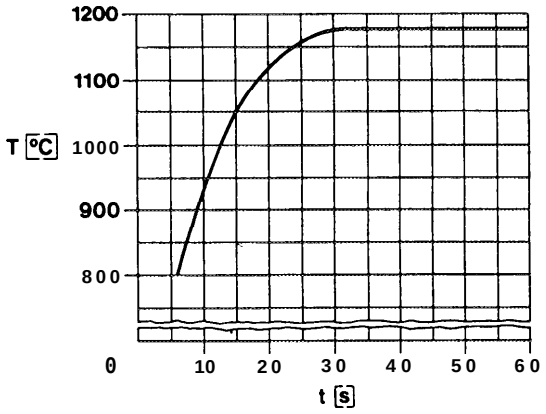
1 Control coil
2 Heater coil

When the glow system is turned on, a current of approx. 30 A is supplied to each glow plug. The heater coil heats up the glow plug very rapidly. The control coil resistance increases with rising temperature, limiting the current to approx. 8-16 A. The glow plug is thus protected against overload.



Current curve of the quick-start pencil type glow plug

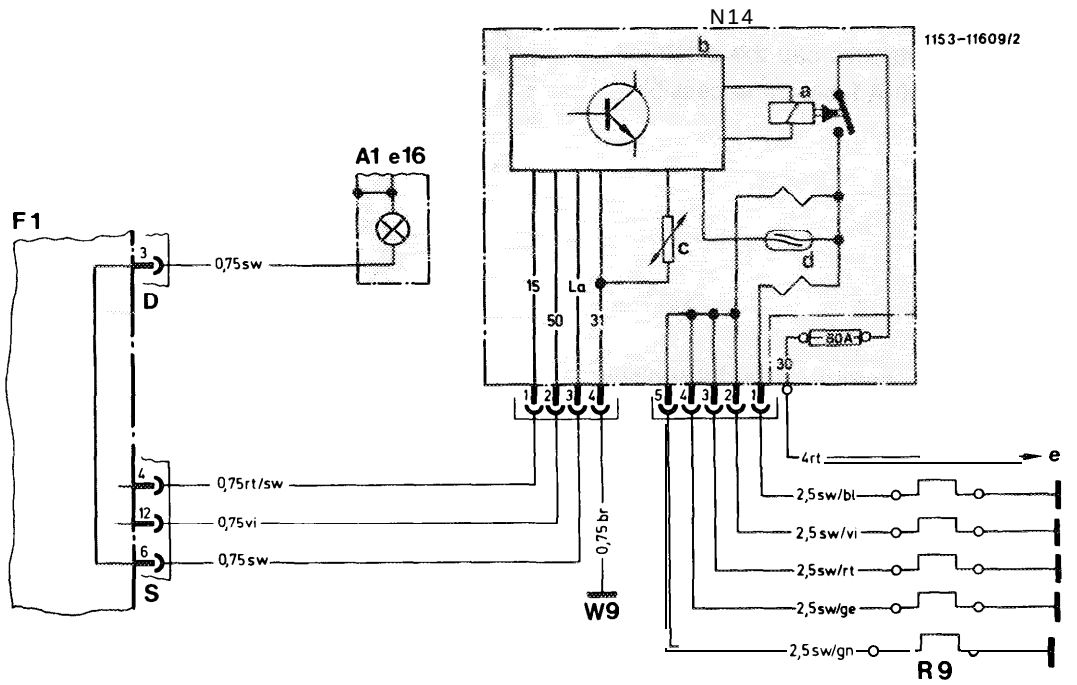
After a glow period of 9 seconds, a heating element temperature of 900°C is reached, the maximum temperature of 1180 °C being reached after 30 seconds.



Temperature curve of quick-start pencil-type glow plug

P15-0395-15

B. Quick-start preglow system

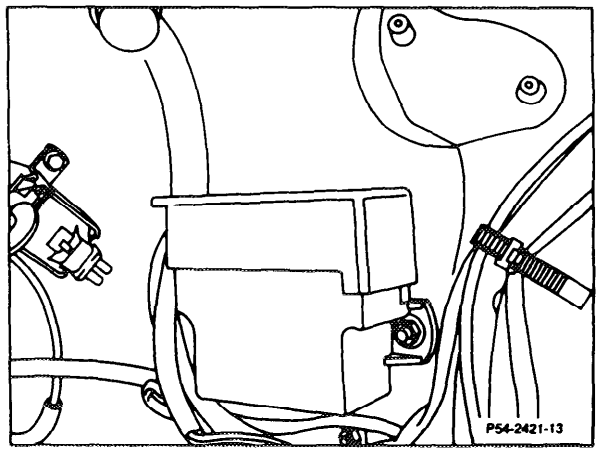


Wiring diagram model 201 .126

Ale16	Preglow indicator in Instrument cluster
N14	Preglow time-delay relay
	a Power relay
	b Electronic unit
	c Temperature sensor (NTC resistor)
	d Reed relay
F1	Central electrics
R9	Glow plugs
W9	Ground, front left (near headlamp unit)
e	X35 Terminal block terminal 30/terminal 61 (battery)

Preglow time relay
The preglow time-delay relay is installed in the engine compartment on the left wheel arch.

After removing the protective cap the electrical connections and the 80-A fuse are accessible.



Model 201

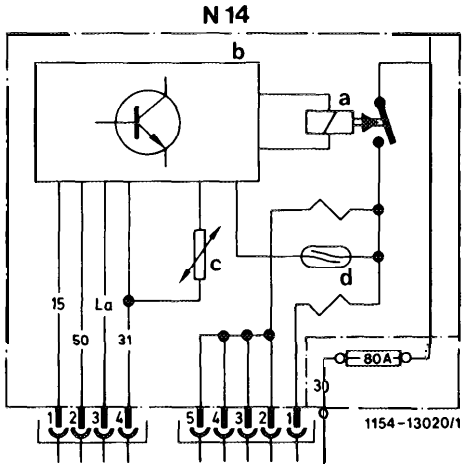
An NTC resistor in the preglow time-delay relay registers the relay ambient temperature.

Functions of the preglow time-delay relay
The preglow time-delay relay has the following functions:

- Activating the glow current
- Indicating readiness to start
- Safety cutout
- Identifying faults

Note
With unfavorable tolerances of the pencil-type glow plugs or the Reed relay (d) it is permissible that the fault indication responds only if two pencil-type glow plugs R9 are defective.

The fault indication (monitoring of pencil-type glow plugs) is effected by comparing the current of the 1st pencil-type glow plug with the current of the 2nd to 5th pencil-type glow plugs connected in parallel.



The currents of the two lines to the pencil-type glow plugs 1 and 2-5 are directed via two counterwound Reed relay windings with different numbers of windings.

With identical current flow in both windings the magnetic fields cancel each other and the Reed contact does not respond.

If the equilibrium of the magnetic fields is disturbed by the failure of one or several pencil-type glow plugs, the Reed contact closes and the electronics unit (b) is activated.

The preglow indicator lamp switches off immediately and, consequently, no longer lights up at the start of the preglow process.

Glow current control

When actuating the key in position “2” (preglow, driving) the preglow time-delay relay (voltage) on terminal **15** is switched on. The power relay (a) closes the power circuit from terminal 30 (plus) via the fuse to the pencil-type glow plugs.

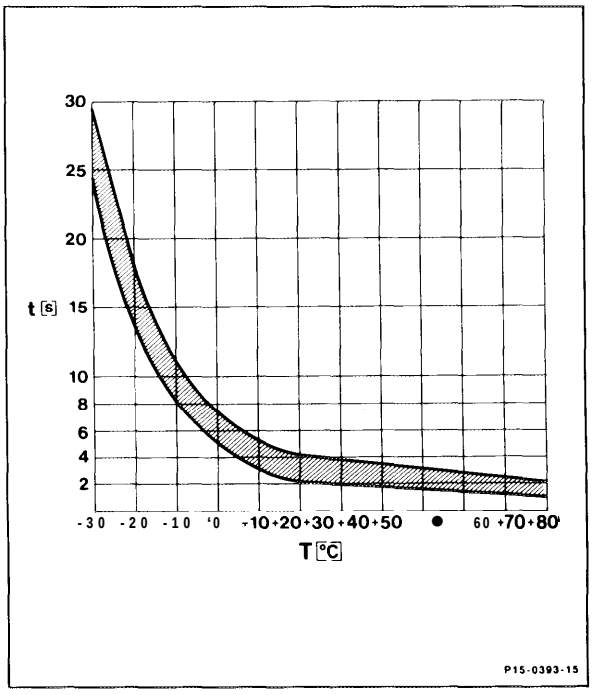
If the key is turned to position “3” (start), the power relay (a) remains retracted, activated by terminal 50. The glowing process is continued until the key is returned to position "2".

Ready-for-starting indication

A temperature sensor installed in the preglow time-delay relay determines the glow period.

The preglow indicator lamp in the instrument cluster lights up when the glow system is turned on.

If the required glow time, dependent on the ambient temperature of the preglow time-delay relay, has been reached, the preglow indicator lamp goes out, indicating readiness to start.

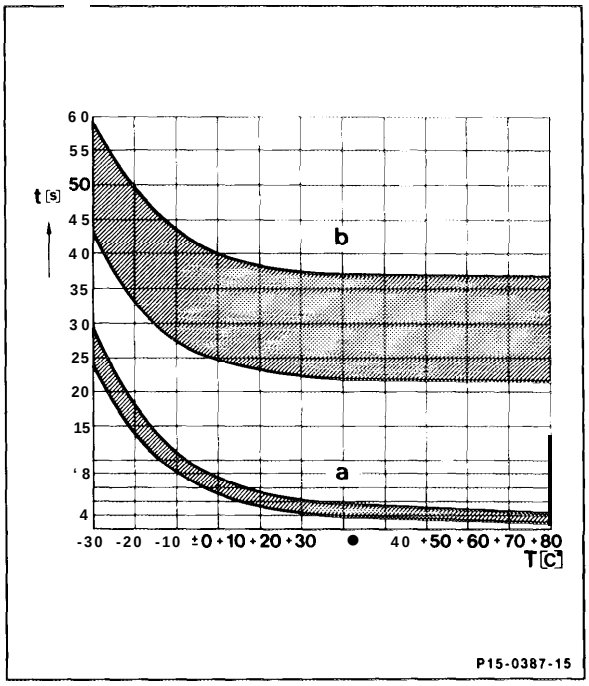


Preglow time

Safety cut-out

If the engine does not start within 20-25 seconds after the readiness for starting has been indicated, the glow current is interrupted by the safety cut-out. If the engine is started thereafter, the glow system is again switched on for the duration of the starting process.

The safety cut-out is no longer fixed. It is determined from the time up to readiness for starting (the preglow indicator lamp goes out) plus 20-35 seconds.



a Preglow time
b Safety cut-out

Fault display

A fault in the preglow system is indicated by failure of the preglow indicator lamp to light up when actuating the key in position “2”.

The following faults are registered:

Interruption of the line to the connection terminal 30.
80-A fuse defective.
Power relay in the preglow time-delay relay defective.
Interruption of one or several lines to the pencil-type glow plugs.
Interruption of one or several pencil-type glow plugs.

C. Preglow system with afterglow

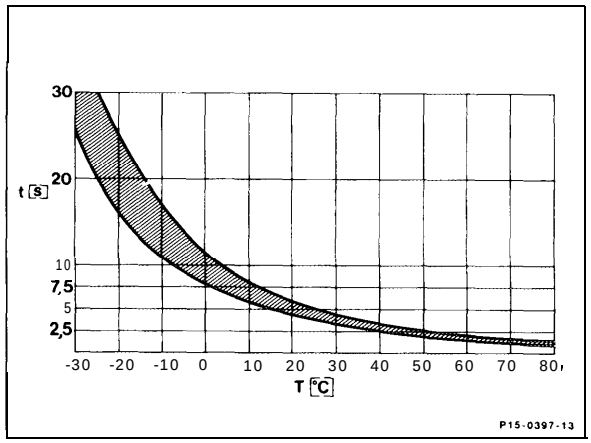
The preglow system has been changed from the previous system in the following areas:

- Preglow time-delay relay
- Coolant temperature sensor
- Pencil-type glow plugs

Preglow time-delay relay

Preglow time

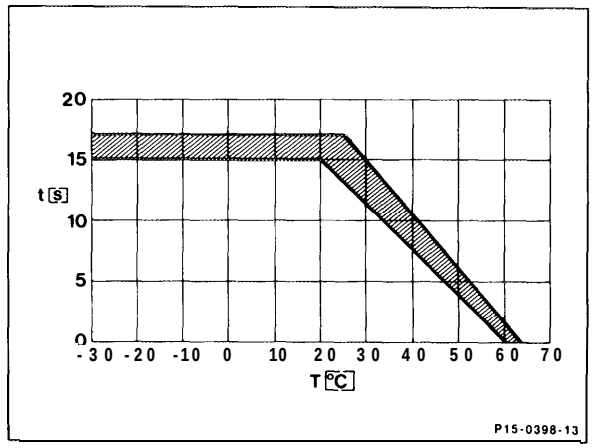
The duration of preglow until the preglow indicator lamp goes out is dependent on coolant temperature (see diagram).



Preglow time t in seconds
Coolant temperature T in °C

Afterglowing time

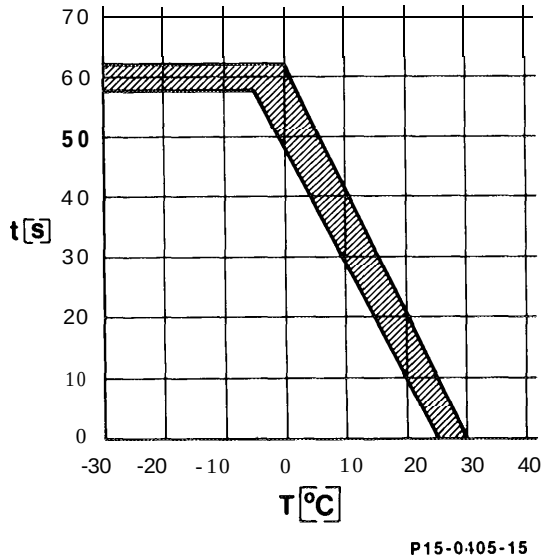
In order to improve the warm-up characteristics of the engine, the glow process is continued with the engine running as a function of the coolant temperature.



Afterglowing time t in seconds
Coolant temperature T in °C

b) Version MJ 89, code 830

Afterglowing time up to a maximum of 60 s (see diagram)



Afterglowing time t in seconds
Coolant temperature T in °C

Production breakpoint: January 1989 (preglow system with afterglowing)

Model	Engine	Engine end no. Manual transmission	Engine end no. Automatic transmission
124.133 124.193	603.960	–	017932
201.126	602.911	073017	014820

Monitoring of glow plugs

The glow plugs are monitored individually by a microprocessor in the preglow time relay.

In addition, the glow plugs are constantly monitored during vehicle operation by a low test current. Failure of one or several glow plugs is indicated if the preglow indicator lamp lights up for approx. 1 minute with the engine running.

Fault indication by preglow indicator lamp

- Lamp fails to light up even during preglow, lights up for approx. 1 minute while driving.
  Fault: One or more glow plugs defective.

- Lamp fails to light up during preglowing and also while driving.
  Fault: Indicator lamp defective, line interruption to the indicator lamp, preglow time relay defective.

- Lamp lights up permanently.
  Fault: Preglow time relay defective (relay sticking).

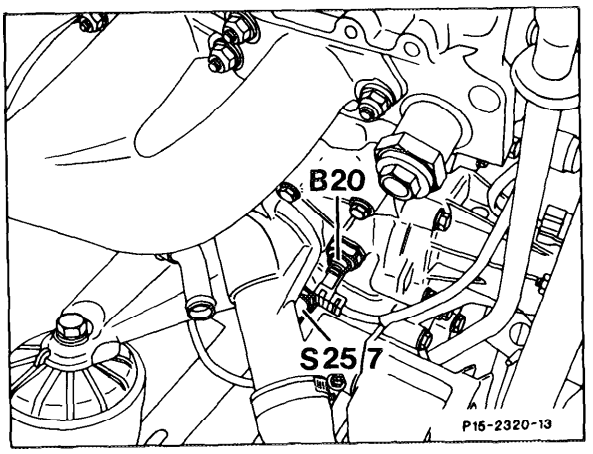
- Lamp fails to light up, engine is hard to start or fails to start altogether.
  Fault: Short circuit on one or more glow plugs, line interruption, preglow time relay defective.

Protection of preglow current circuit

Instead of the 80-A fuse an electronic cut-out has been installed. If a short circuit occurs, the power circuit is interrupted. After the short circuit has been eliminated, the fuse of the relay is restored to the operational state by turning the key in the steering lock back to "0".

Coolant temperature sensor

A coolant temperature sensor (B20) or (B11/8) is installed to control the preglow and afterglow times.

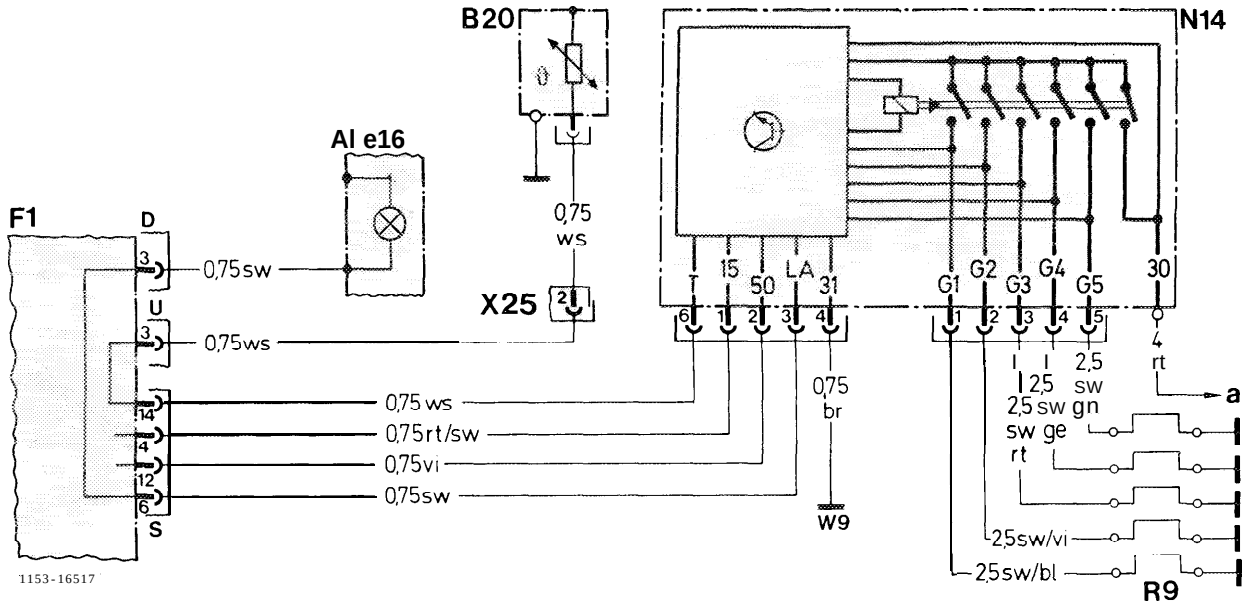


Arrangement engine 602

Pencil-type glow plugs

For afterglowing, pencil-type glow plugs with three different heater tube lengths are installed (see Checking preglow 15-711).

Wiring diagram engine 602.911 model year 1989 code **830**



Ale16	Instrument cluster preglow indicator	R9	Glow plugs
B20	Temperature sensor (preglow)	W9	Ground, front left (near headlamp unit)
F1	Central electrics	x25	Connector preglow cable harness
N14	Preglow time-delay relay	a	X35 Terminal block terminal 30, terminal 61 (battery)

15–705 Function of preglow system - Turbodiesel

General

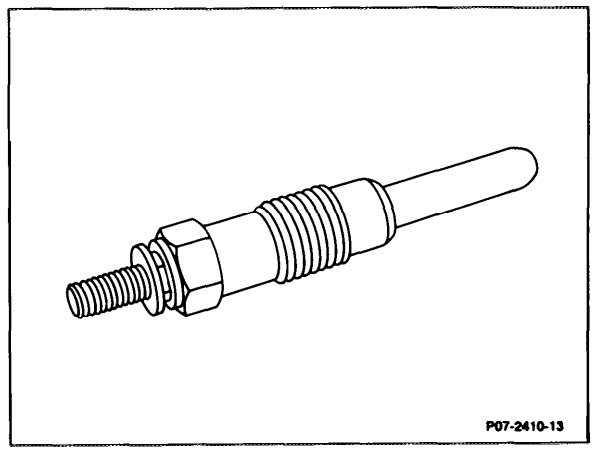
Combustion in the diesel engine occurs through the injection of self-igniting diesel fuel into highly compressed and therefore, hot combustion air.

When the engine is cold, the self-ignition temperature is not reached by compression alone. A preglow system is therefore required to increase the temperature of the compressed air and to allow the engine to start by directly igniting fuel particles on the glow plugs.

The duration of preglow depends on the ambient temperature.

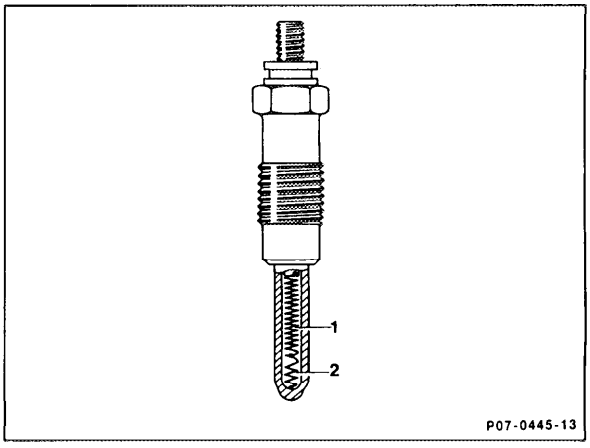
Design of the quick-start pencil-type glow plugs

The pencil-type glow plugs consist essentially of a housing with an Ml 2 x 1.25 internal thread and a heating element press-fitted into the housing.



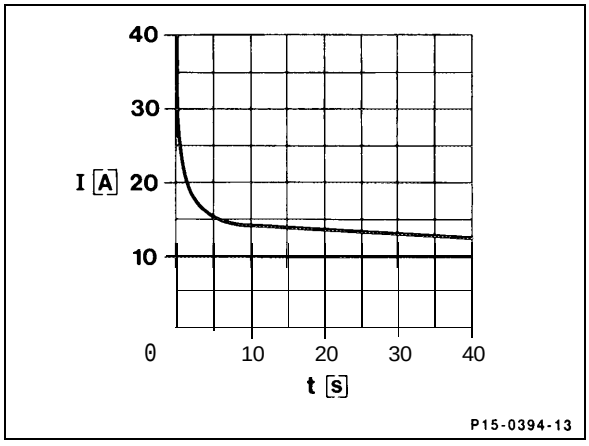
The single-pole connecting pin is screwed into the housing by a non-detachable brass round nut.
The pencil-type glow plugs are designed for a voltage of 11.5 Volts and are connected in parallel.

The heating element consists of a series-connected heating and control coil.



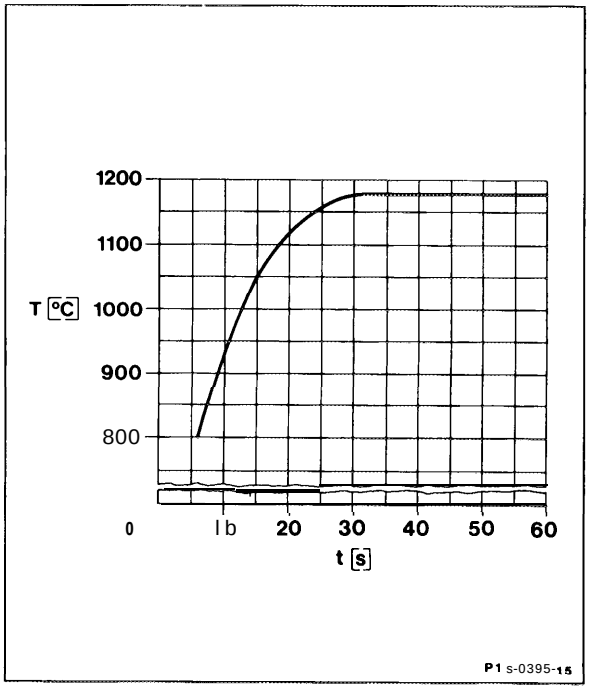
1 Control winding
2 Heating winding

When the glow system is turned on, a current of approx. 30 A is supplied to each glow plug. The heater coil heats the glow plug very rapidly. The control coil resistance increases with rising temperature, limiting the current to approximately 8-15 A. The glow plug is thus protected against overload.

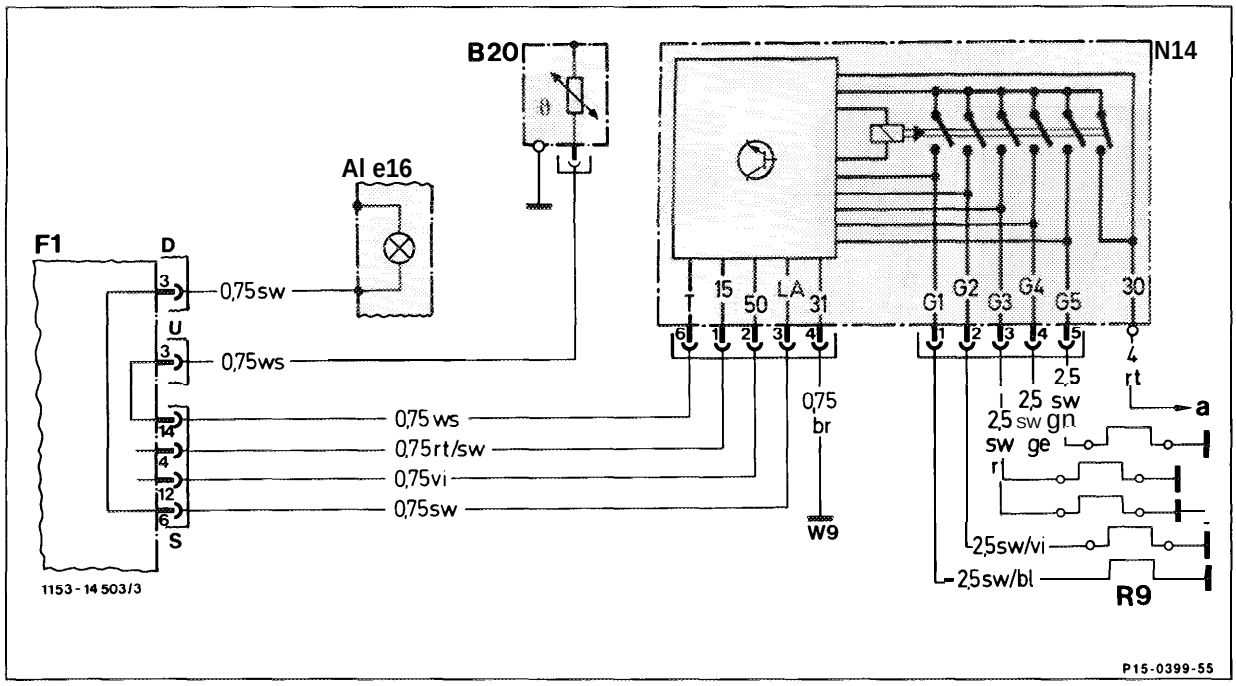


Current curve of quick-start pencil-type glow plug

After a glow period of 9 seconds, a heating element temperature of 900°C is reached, the maximum temperature of 1180°C being reached after 30 seconds.

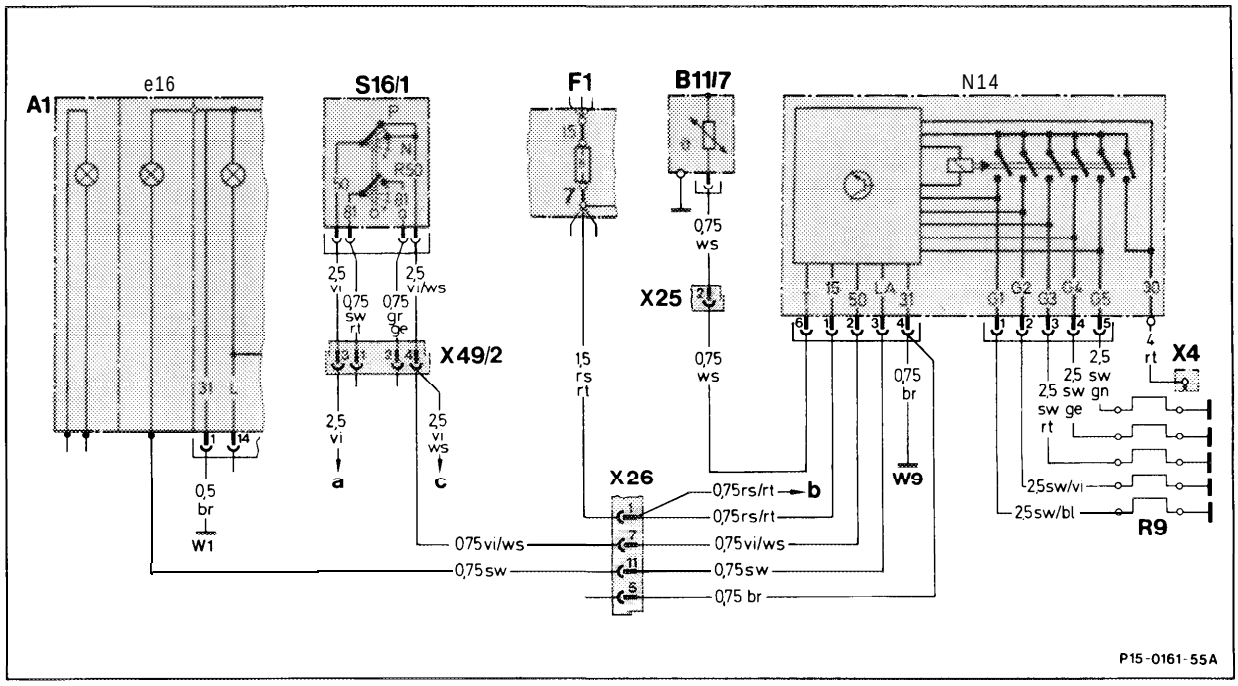


Temperature curve of quick-start pencil-type glow plug



Wiring Diagram Engine 602.961, Model 201.128

Ale16	Instrument cluster, preglow indicator	R9	Glow plugs
B20	Temperature sensor (preglow)	W9	Ground, front left (next to lamp unit)
F1	Electrical centre	a	X35 terminal block, terminal 30
N14	Preglow time relay		



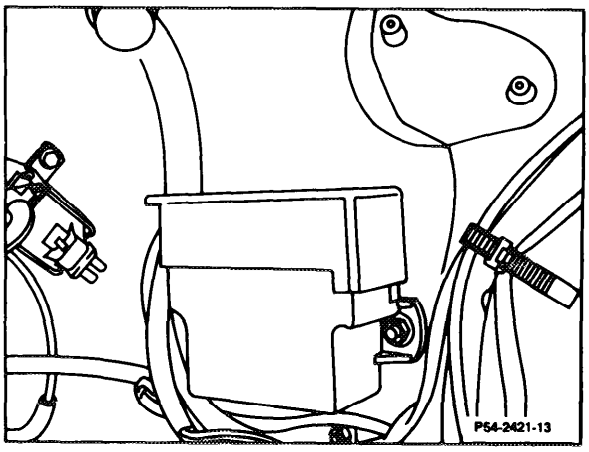
Wiring Diagram Engine 602.962, Model 124.128

A1e16	Instrument cluster, preglow Indicator	x 4	Terminal block, terminal 30 (fuse and relay box)
B11/7	Temperature sensor (preglow)	x25	Plug connector, preglow wiring harness
F1	Fuse and relay box	X26	Plug connector, interior/engine 12-pin
N14	Preglow time relay	x49/2	Plug connector, starter lockout and backup light switch
R9	Glow plugs	a	S2/2 glow start switch terminal 50
S16/1	Starter lockout and backup light switch (with automatic transmission only)	b	K1 Relay, over-voltage protection contact 3 (with air-conditioning system only)
W1	Main ground (behind Instrument cluster)	c	X27 plug connector, starter wiring harness contact 2
W9	Ground, front left (next to lamp unit)		

Preglow time relay

The preglow time relay is housed in the engine compartment on the left wheel arch.

The electrical connections are accessible after removing the protective cap.



Installation of preglow time relay shown on Model 201

Functions of preglow time relay

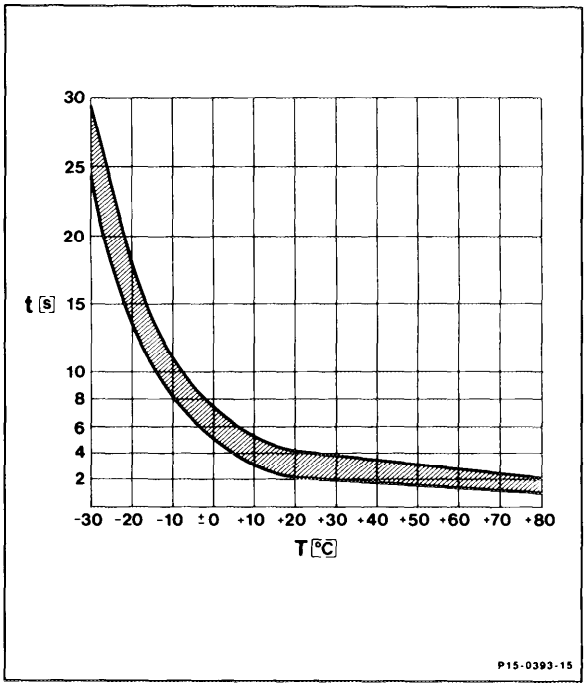
The preglow time relay has the following functions:

- Activating the glow current
- Indicating readiness to start
- Safety cutout
- Identifying faults

Preglow without afterglow Model 124 engine 603.96

T Ambient temperature of preglow time relay in °C

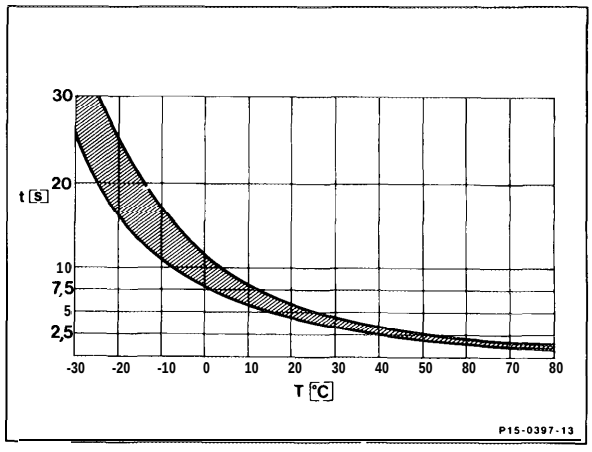
t Preglow time in seconds



Preglow with afterglow

Preglow Time

T Coolant temperature in °C
t Preglow time in seconds

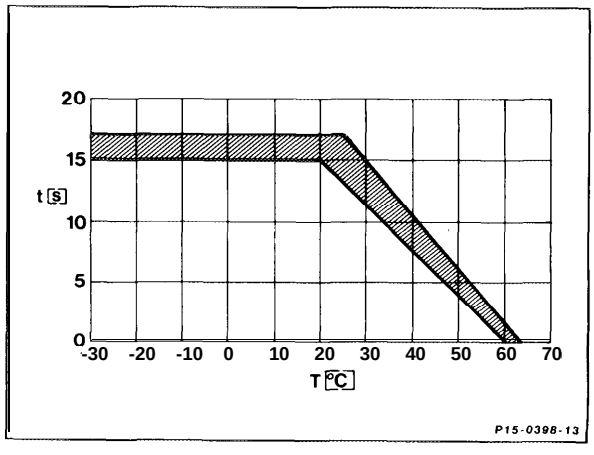


Afterglow Time

To improve warm-up properties, the glow plugs continue to glow when the engine is running dependent on the coolant temperature.

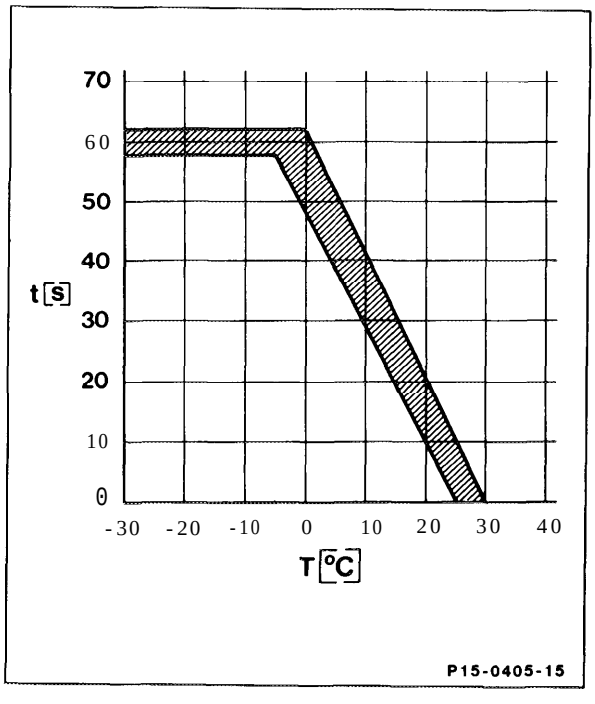
a) Version:
Model 201 Engine 602.961 Model Year 1988

T Coolant temperature in °C
t Afterglow time in seconds
Afterglow time up to max. 175 s (refer to diagram)



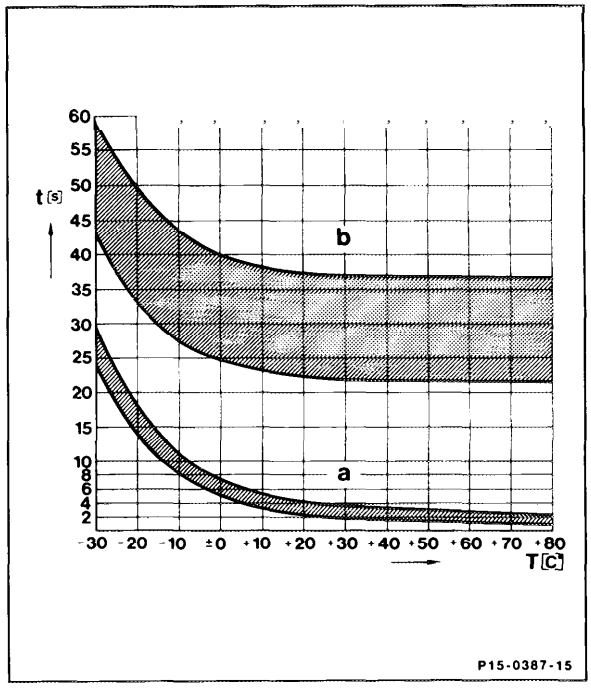
b) Version:
Models 124, 201 Engine 602.9611962,
Model 124 Engine 603.96 from Model Year 1989

T Coolant temperature in °C
t Afterglow time in seconds
Afterglow time up to max. 60 s (refer to diagram)



Safety cutout

If the engine is not started within 20-25 seconds after the readiness to start indication being given, the glow current is interrupted by the safety cutout. If the engine is then started, the glow system is switched on again for the duration of the starting operation.
The duration of safety cutout is not fixed. It is the combination of time up to readiness to start (preglow indicator lamp going out) plus 20-25 seconds.



b Safety cutout

Switching the glow current

When the key is moved into position "2" (preglow, drive), the preglow time relay is switched on (voltage to terminal 15). The preglow time relay closes the circuit from terminal 30 (positive) to the glow plugs (R9).

If the key is turned into position "3" (start), the preglow time relay remains activated and remains retracted through terminal 50. The glow process is continued until the key is turned back to position "2".

Readiness to start indication

a) Model 124 Engine 603.96

When the glow system is switched on, the preglow indicator lamp in the instrument cluster lights up. The glow duration is determined by a temperature sensor installed in the preglow time relay. Once the required glow time has been reached, depending on the ambient temperature of the preglow time relay, the preglow indicator lamp goes out, thus indicating that the engine is ready to start.

Model 201 Engine 602.961,
Model 124 Engine 602.962, Engine 603.96 effective 1989

When the glow system is switched on, the preglow indicator lamp in the instrument cluster lights up. The glow duration is determined by the temperature sensor in the coolant. Once the required glow time has been reached, the preglow time relay switches off the preglow indicator lamp, indicating that the engine is ready to start.

Fault Indication

Model 124 Engine 603.96

A fault in the preglow system is indicated by the preglow indicator lamp failing to light up when the key is moved into position "2".

The following faults are detected:

- Interrupt in the cable to connection terminal 30.
- 80 ampere fuse faulty.
- Fault in power relay of preglow time relay.
- Interrupt in one or more cables to the glow plugs.
- Open circuit in one or more glow plugs.

Fault Indication

Models 124, 201 Engine 602.961, 602.962, 603.96 **Effective 1989**

A fault in the preglow system is indicated by the preglow indicator lamp failing to light up when the key is turned into position "2". In addition, the preglow indicator lights up for approx. 1 minute when the engine is running.

The following faults are detected:

- Interrupt in the cable to connection terminal 30.
- Preglow time relay faulty.
- Open circuit in one or more cables to the glow plugs.
- Open circuit in one or more glow plugs.
- Short-circuit at one or more glow plugs or in the cables.

15-710 Checking preglow system without afterglow function

Commercially available tool

Engines 602/603	
Multimeter	e.g. Sun, DMM 5

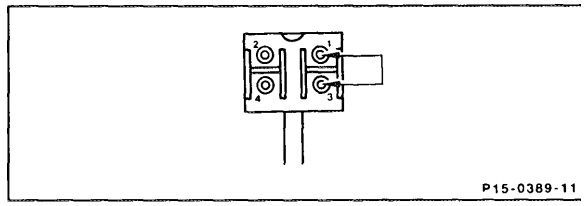
Checking

Electrical wiring diagrams (see 15-705).

1 **Checking glow bulb and wiring**

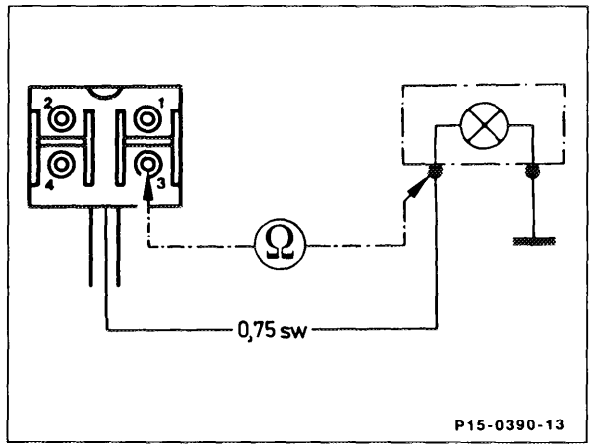
If preglow indicator lamp fails to light up when switching on the preglow system despite opportunity to start.

Pull 4 or 5-pin coupling off preglow time relay, turn key to position "2", bridge jacks 1 and 3 of the coupling.



If the preglow indicator lamp fails to light up, check or replace glow bulb.

If the glow bulb is OK, check the black cable from the coupling jack 3 of the preglow time relay up to the preglow indicator lamp for open circuit. Eliminate open circuit.



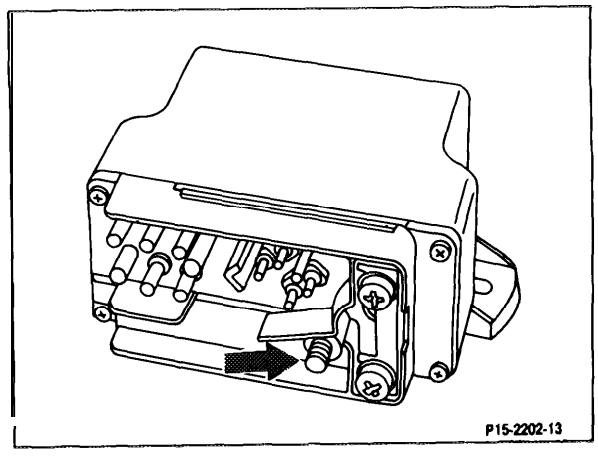
If the preglow indicator lamp lights up, the preglow time relay is defective. Replace preglow time relay.

2 **Checking the main power circuit of the preglow system for open circuit**

Problem:

Preglow Indicator lamp fails to light up, engine cannot be started.

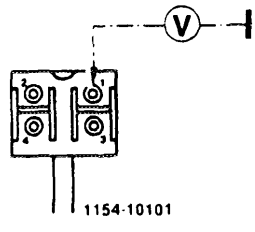
With the multimeter in the volt measuring range, check voltage on terminal 30 of the preglow time relay against ground.



If no voltage is present. check red 4 mm wire from the terminal block X35 terminal 30 to the preglow time relay terminal 30 for open circuit and eliminate open circuit if necessary.

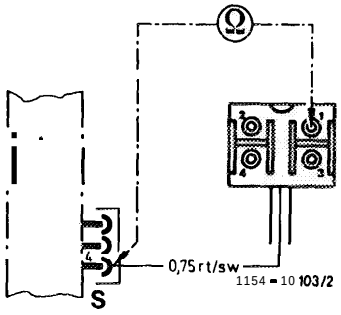
If voltage is present (approx. 12 V), check 80-A fuse for tight seat or an open circuit, replace if required.

If no fault was found so far, check voltage on jack 1 of the 4-pin coupling of the preglow time relay against ground.



If no voltage is present with preglow system switched on (model 201), check red/black wire from the central electrical coupling S jack 4 to the coupling jack 1 of the preglow time relay for an open circuit and eliminate open circuit.

On model 124, check pink/red wire from fuse 7 **(unprotected side)** via connector engine/interior 12-pole X 26 to coupling jack 1 of the preglow time relay for open circuit and eliminate open circuit.

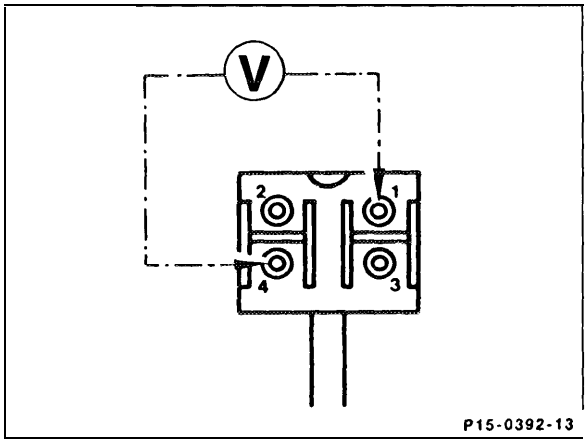


Model 201.1

If voltage is present (approx. 12 V), connect multimeter in volt measuring range to jack 1 (terminal 15) and jack 4 (terminal 31) and measure voltage (set value approx. 12 V).

If no voltage is indicated, check brown wire from jack 4 to ground for open circuit and eliminate open circuit.

If no fault was established to this point, the preglow time relay is defective, replace preglow time relay.



3 Checking pencil-type glow plugs and their lines

Problem:

Preglow indicator lamp fails to light up, engine is hard to start; an open circuit in one or more pencil-type glow plugs or in the lines leading to the pencil-type glow plugs is possible.

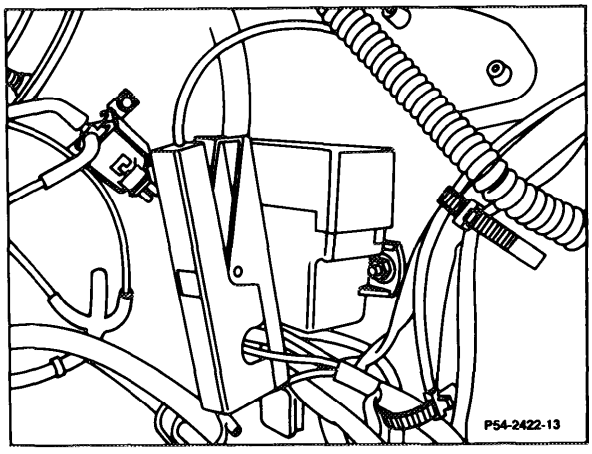
Problem:

Preglow indicator lamp lights up, engine is hard to start after reaching start readiness; an open circuit of a pencil-type glow plug or a line to the pencil-type glow plugs of cylinders no. 2 to 5 is possible or incorrect power may be consumed by the pencil-type glow plugs in cylinders 1 through 6.

Measuring power consumption of the pencil-type glow plugs with the DC current probe.

For this purpose place the current probe over the individual lines on the preglow time relay.

Cylinder 1 = 2.5 black/blue
Cylinder 2 = 2.5 black/purple
Cylinder 3 = 2.5 black/red
Cylinder 4 = 2.5 black/yellow
Cylinder 5 = 2.5 black/green
Cylinder 6 = 2.5 black/white



Turn key in steering lock to position "2", the power consumption of each glow plug should be 8-15 A after 10-20 seconds.

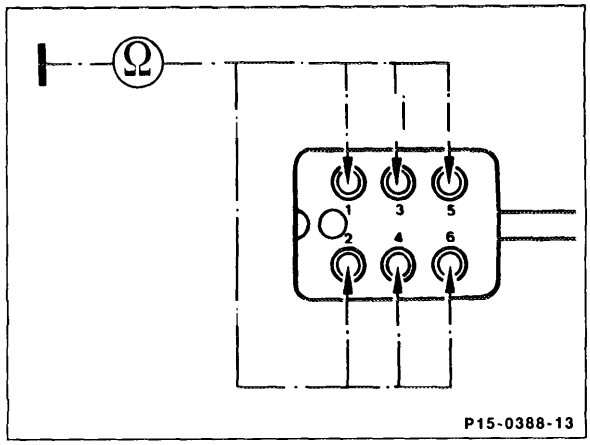
If the value is above 15 A, replace glow plug.

At a value below 8 A, check electric lines or glow plug with multimeter ohm measuring range for open circuit.

In order to test for an open circuit pull 6-pin coupling off preglow time relay.

Using the multimeter ohm measuring range measure the resistance to ground (engine block) of one after the other as follows:

Jack 1 of couplmg	= Pencil-type glow plug cylmder 1
Jack 2 of coupling	= Pencil-type glow plug cylinder 2
Jack 3 of couplmg	= Pencil-type glow plug cylmder 3
Jack 4 of couplmg	= Pencil-type glow plug cylmder 4
Jack 5 of coupling	= Pencil-type glow plug cylinder 5
Jack 6 of couplmg	= Pencil-type glow plug cylmder 6



If infinite resistance is measured, an open circuit in the respective pencil-type glow plug or the feed line or the connection is the problem.

Eliminate open circuit in the feed line or replace glow plug.

Note
It may be possible that the indicator lamp (due to unfavorable tolerances) indicates a fault only upon failure of 2 pencil-type glow plugs in the cylinders 2-5.

In order to ensure that the fault indication in the preglow time relay is accurate, 2 pencil-type glow plugs of the cylinders 2 to 5 have to be disconnected in this case and the preglow process repeated.

15-711 Checking preglow system with afterglow function

Commercially available tool

Engines 602/603	
Multimeter	e.g. Sun, DMM 5

Checking

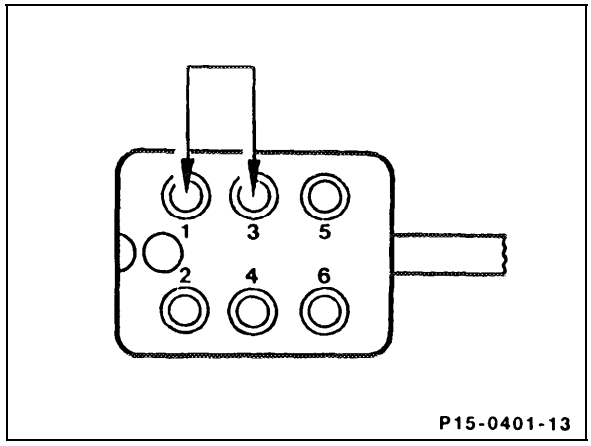
Electrical wiring diagrams (see 15-705).

Checking glow bulb and its wiring

Problem:
Preglow indicator lamp fails to light up when turning on the preglow system despite start readiness.

Pull 6-pin coupling off preglow time relay, turn key to position "2", bridge jacks 1 and 3 of the coupling.

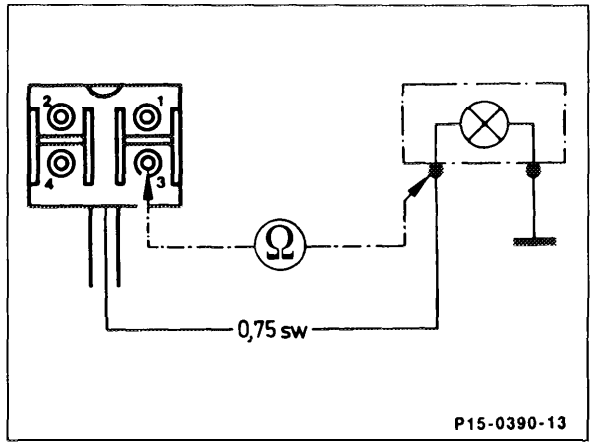
If the preglow indicator lamp fails to light up, check or replace glow bulb.



If the glow bulb is OK, check black wire from coupling jack 3 of the preglow time relay to the preglow indicator lamp for an open circuit. Eliminate open circuit.

If the preglow indicator lamp lights up, the preglow time relay is defective, replace preglow time relay.

Lamp lights up permanently.
Fault: Preglow time relay defective (relay sticking).

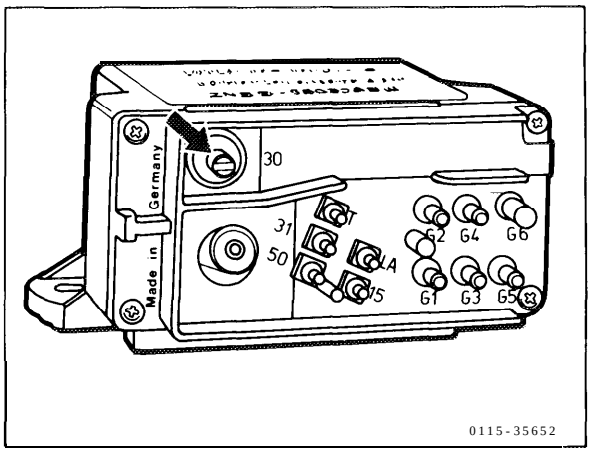


Checking main power circuit of preglow system for open circuit

Problem:

Preglow indicator lamp fails to light up, engine cannot be started.

Using the multimeter volt measuring range, check the voltage on terminal 30 of the preglow time relay against ground (arrow).



If no voltage is present, check 4 mm red wire from the terminal block X35 terminal 30 to the preglow time relay terminal 30 for open circuit and eliminate open circuit.

If no fault was established to this point, measure voltage on jack 1 of the 6-pin coupling of the preglow time relay against ground.

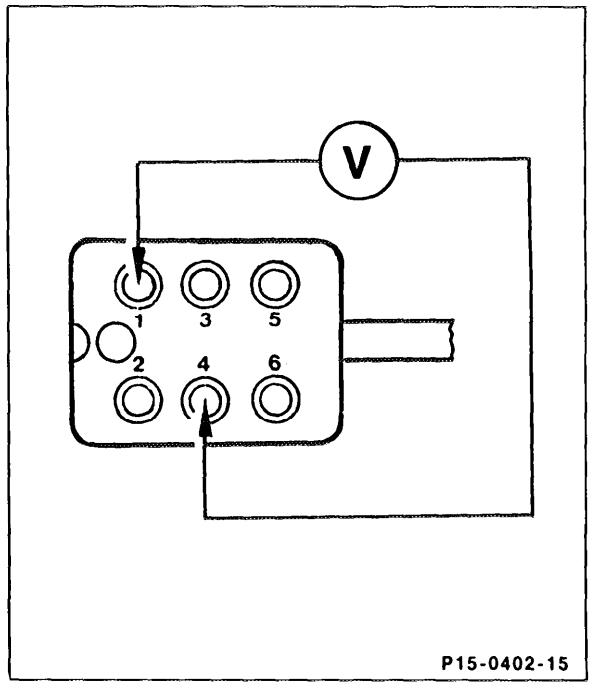
Model 201

If no voltage is present with the preglow system switched on, check red black wire from the central electrical coupling S jack 4 to the coupling jack 1 of the preglow time relay for open circuit and eliminate open circuit.

If voltage is present, connect multimeter volt measuring range to jack 1 (terminal 15) and jack 4 (terminal 31) and measure voltage.

If no voltage is indicated, check brown wire from jack 4 to ground for open circuit and eliminate open circuit.

If no fault was established to this point, the preglow time relay is defective, replace preglow time relay.

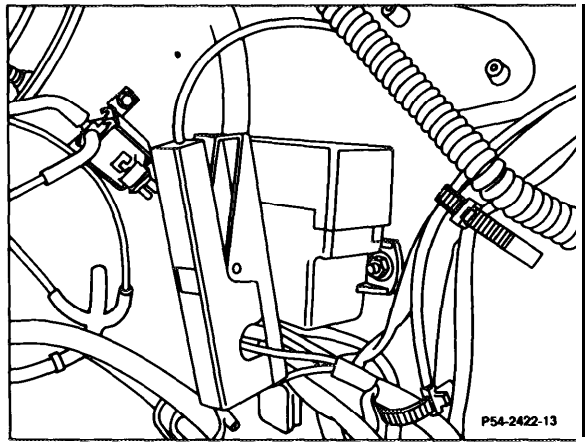


Checking pencil-type glow plugs and their lines

Problem:
Preglow indicator lamp fails to light up when switching on.
Lights up for approx. 1 minute while driving.
Engine is hard to start.
An open circuit of one or more pencil-type glow plugs or their lines to the pencil-type glow plugs is possible.

Measure power consumption of the pencil-type glow plugs using the multimeter ampere measuring range and DC current probe.
For this purpose place current probe over the individual wires on the preglow time relay.

Cylinder 1 = 2.5 black/blue
Cylinder 2 = 2.5 black/purple
Cylinder 3 = 2.5 black/red
Cylinder 4 = 2.5 black/yellow
Cylinder 5 = 2.5 black/green
Cylinder 6 = 2.5 black/white



Turn key in steering lock to position "2", the power consumption for each glow plug should be 14-l 6 A after approx. 8 seconds.

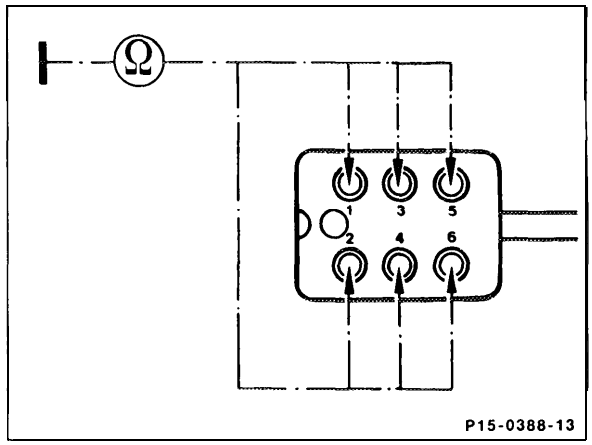
If the value is higher than 16 A, replace glow plug.

With a value below 14 A, check wire and glow plug for open circuit.

In order to check for an open circuit, pull 6-pin coupling off preglow time relay.

With the multimeter ohm measuring range measure the resistance against ground (engine block) one after the other as follows:

Jack 1 of couplmg	= Pencil-type glow plug cylinder 1
Jack 2 of couplmg	= Pencil-type glow plug cylinder 2
Jack 3 of couplmg	= Pencil-type glow plug cylmder 3
Jack 4 of couplmg	= Pencil-type glow plug cylinder 4
Jack 5 of couplmg	= Pencil-type glow plug cylmder 5
Jack 6 of couplmg	= Pencil-type glow plug cylmder 6



If infinite resistance is measured, an open circuit of the respective pencil-type glow plug or the feed line or the connection is the problem.

Eliminate open circuit in the feed line or replace glow plug.

Preglow power circuit protection
An electronic cut-out is installed in the preglow time relay. If a short circuit occurs in the glow plugs or in the electrical lines the power circuit is interrupted.

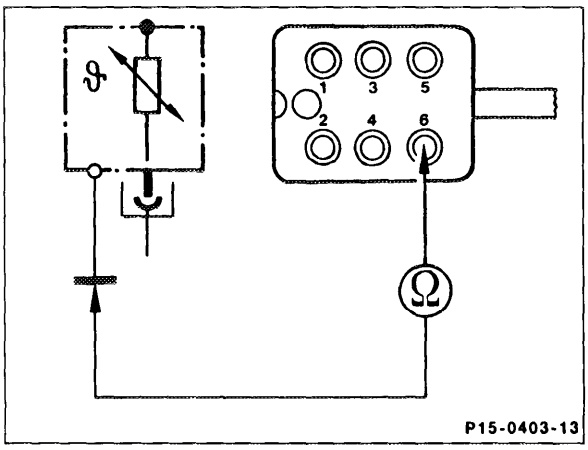
Note
After a short circuit is repaired, the relay is operational again when the key in the steering lock is turned back to position "0".

Checking temperature sensor with line

Preglow time until preglow indicator lamp goes out is excessive or too short. (see table).

Pull plug off preglow time relay and measure resistance against ground using multimeter ohm measuring range.

Set value at + 25 °C 2442 Ω ± 170 Ω
+ 80 °C 291 Ω ± 16 Ω



If set value is not attained:
Replace temperature sensor.

If infinite resistance is indicated:
Eliminate open circuit in electrical wire.

If resistance < 1Ω is indicated:
Eliminate short circuit in electrical line.

15–711 Testing preglow system with afterglow function - Turbodiesel

Models 124, 201 with Engines 602.961, effective Model Year 1989, 602.962, 603.96, effective Model Year 1989

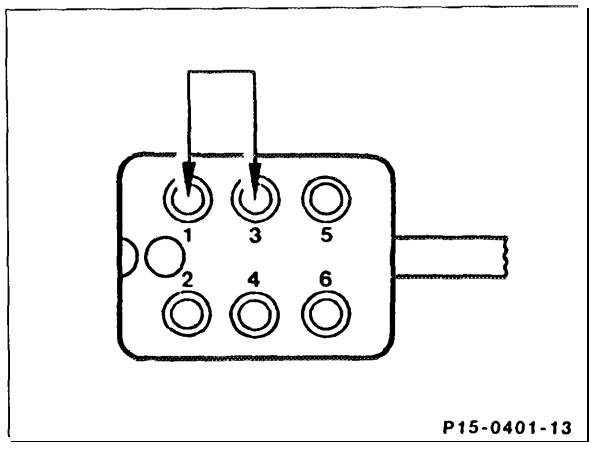
Commercial Tool

Multimeter	e.g. Sun, DMM-5

Testing Bulb and Its Wiring

If the following problem occurs:
Preglow indicator lamp does not light up when the preglow system is switched on, despite being able to start engine.

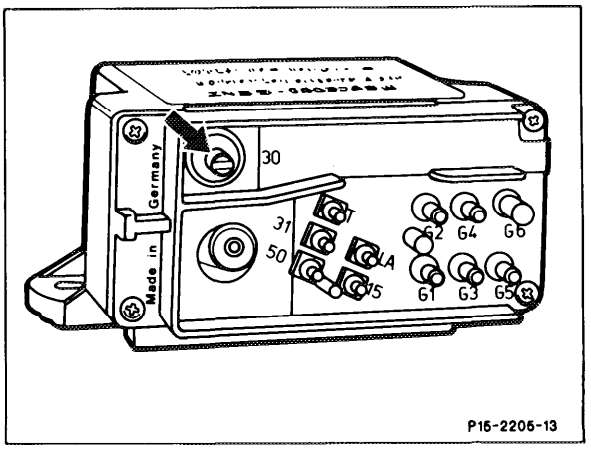
Detach 6-pin connector from preglow time relay, turn key into position "2", bridge contacts 1 and 3 of the connector. If the preglow indicator lamp does not light up, test bulb or replace if necessary.



If the bulb is in order, test black cable from connector contact 3 of the preglow time relay to the preglow indicator lamp for open circuit.
Rectify open circuit.
If the preglow indicator lamp lights up, the preglow time relay is defective. Replace preglow time relay.
Lamp shows a steady light.
Fault: preglow time relay defective (relay sticking).

Testing Main Circuit of Preglow System for Interruption

If the following problem occurs:
Preglow indicator lamp does not light up, engine cannot be started.
With the multimeter set to the Volts range, test the voltage at terminal 30 of the preglow time relay to ground (arrow).



If no voltage is indicated, test 4 mm² red cable from terminal block (X35) terminal 30 to the preglow time relay terminal 30 for open circuit. Rectify open circuit.

If no fault has been detected to this point, test voltage at contact 1 of the 6-pin connector of the preglow time relay to ground.

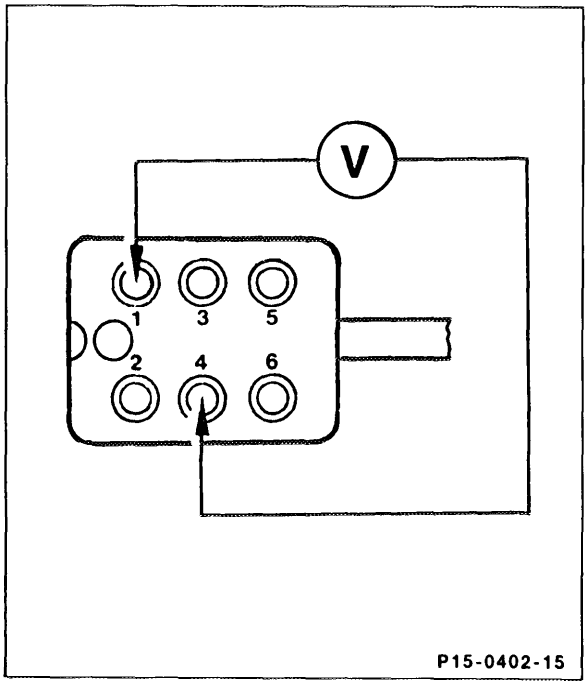
Model 201

If no voltage is indicated when the preglow system is switched on, test red/black cable from the electrical centre connector **S** contact 4 to the connector contact 1 of the preglow time relay for open circuit or rectify open circuit.

Model 124

Test pink/red cable from fuse 7 (unprotected side) through plug connection of engine wiring harness to the connector contact 1 of the preglow time relay for open circuit. Rectify open circuit.

If voltage is indicated, connect multimeter Volts range to contact 1 (terminal 15) and contact 4 (terminal 31) and test voltage. If no voltage is indicated, test brown cable from contact 4 to ground for open circuit. Rectify open circuit. If no fault has been detected to this point, the preglow time relay is defective. Replace preglow time relay.



Testing Glow Plugs and Their Wiring

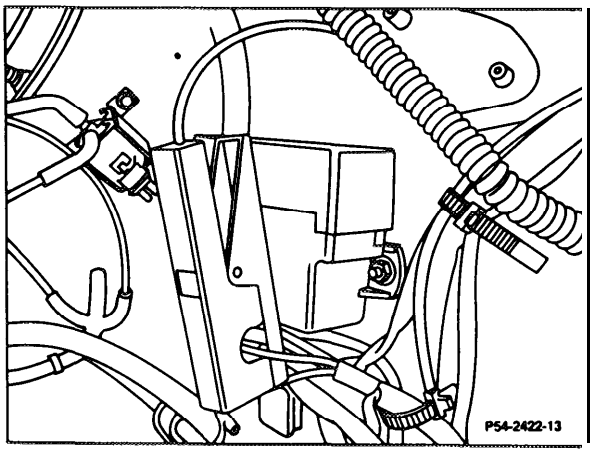
If the following problems occur:

- Preglow indicator lamp does not light up when switching on
- Lights up for approx. 1 min. when driving
- Engine is difficult to start

there may be an open circuit in one or more glow plugs or in the cables to the glow plugs.

Test current consumption of the glow plugs with multimeter set to Amperes range and with D.C. clamp. The clamp is placed over the individual cables at the preglow time relay for the step.

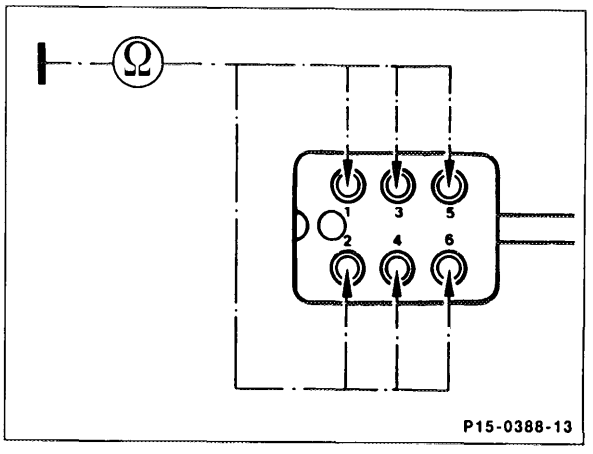
Cylinder 1 = 2.5 black/blue
Cylinder 2 = 2.5 black/violet
Cylinder 3 = 2.5 black/red
Cylinder 4 = 2.5 black/yellow
Cylinder 5 = 2.5 black/green
Cylinder 6 = 2.5 black/white



Turn key in the steering lock to position "2", the current consumption of each glow plug must be 14-16 A after 1 O-12 seconds.
If the reading is higher than 16 A, replace glow plug. If the reading is less than 14 A, test glow plug cable for open circuit.

Detach 6-pin connector from preglow time relay for testing for open circuit. With the multimeter set to Ohms range, measure in turn the resistance to ground (engine block) at

- 1 Connector = glow plug cylinder 1
- 2 Connector = glow plug cylinder 2
- 3 Connector = glow plug cylinder 3
- 4 Connector = glow plug cylinder 4
- 5 Connector = glow plug cylinder 5
- 6 Connector = glow plug cylinder 6



If infinite resistance is measured, there is an open circuit in the respective glow plug or in the lead or the connection. Rectify open circuit in the lead or replace glow plug.

Safeguarding Preglow Circuit

An electronic short-circuit safeguard is installed in the preglow time relay. The circuit is interrupted if a short-circuit develops in the glow plugs or in the cables.

The relay is again operational

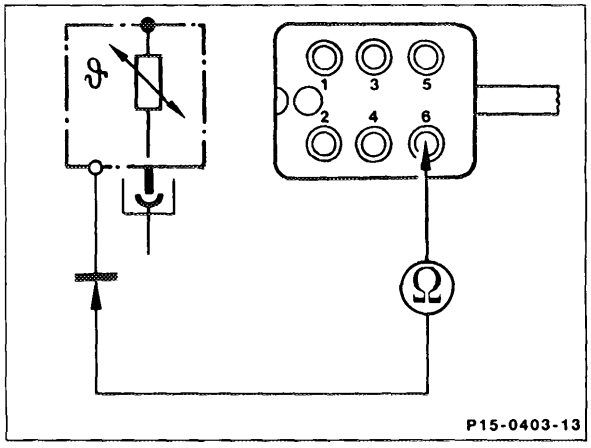
- once the short-circuit has been rectified and
- the key turned back to position "0".

Testing temperature sensor with wiring

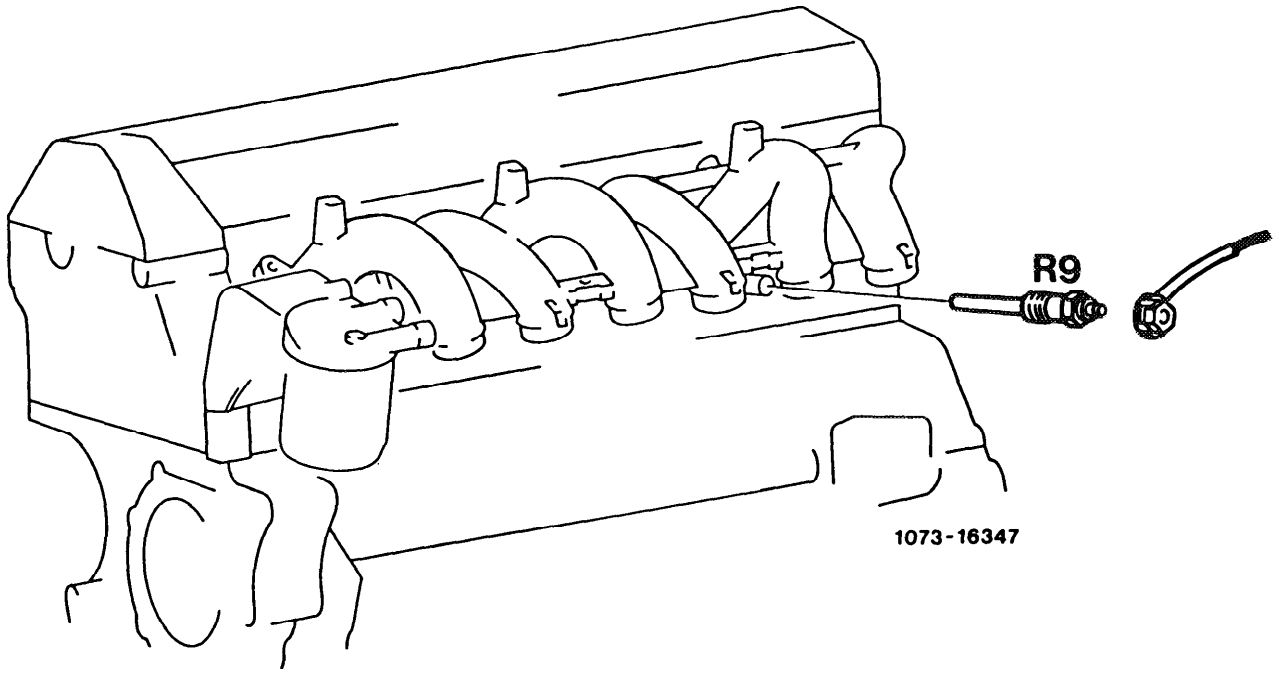
Preglow time until preglow indicator lamp goes out is too short or too long (refer to table). Detach plug on preglow time relay and test F resistance to ground F with multimeter set to Ohms range.

Specification at+25 °C 2442 Ω ± 170 Ω
at+180 °C 291 Ω ± 16 Ω

If specified value is achieved:
Replace temperature sensor. If resistance ∞ Ω is indicated: rectify open circuit in cable. If resistance <1Ω is indicated: rectify short-circuit in cable.



15-715 Removal and installation of glow plugs



Complete air cleaner	remove, reinstall (09-400).
Electrical line on glow plugs	connect, disconnect, tightening torque 4 Nm.
Glow plugs (R9) 4, 5 or 6 off	remove, reinstall, tightening torque 20 + 2 Nm Observe distinguishing features pencil-type glow plugs.

Tightening torques	Nm
Quick-start pencil-type glow plugs	20 + 2
Electrical line on glow plugs	4

Distinguishing features pencil-type glow plugs

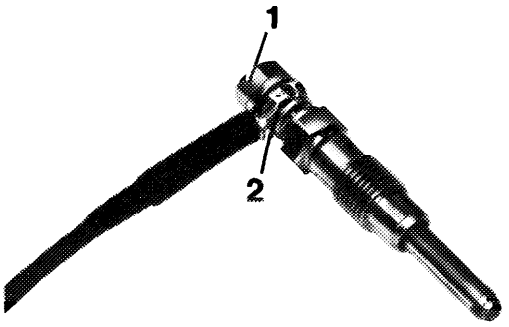
Engine	602	602	602.961	602.911
Injection/preglow system	Vertical injection without afterglow function	Inclined injection precham ber 5°/180° 60 s afterglow function	Inclined injection prechamber 5° 16 s afterglow function	Inclined injection 5° without afterglow function
Beru no.	0100221107	0100221162	0100221153	0100221138
Bosch no.	0250201001	0250201026	–	
Length of glow tube	25	23	27	27
Glowing current after approx. 8 s in ampere	8 - 1 5	14 – 16	14 – 16	14 – 16
Identification	yellow	transparent with circular groove around the hexagon	black	transparent

Removal

1 Remove, reinstall complete air cleaner housing (09-400).

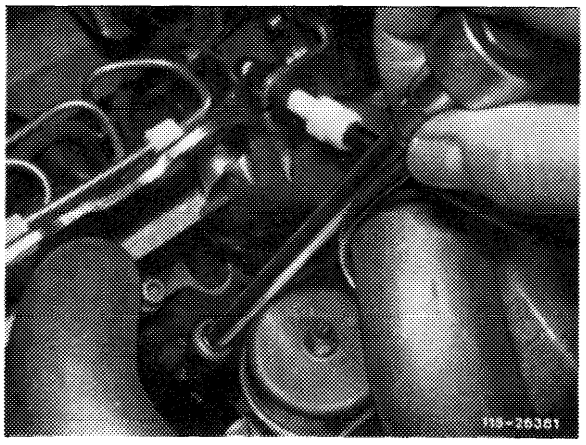
2 Unscrew nuts from glow plugs.

The nuts (1) cannot be lost as they have been inserted in the terminals (2) of the wiring harness.



115-26300

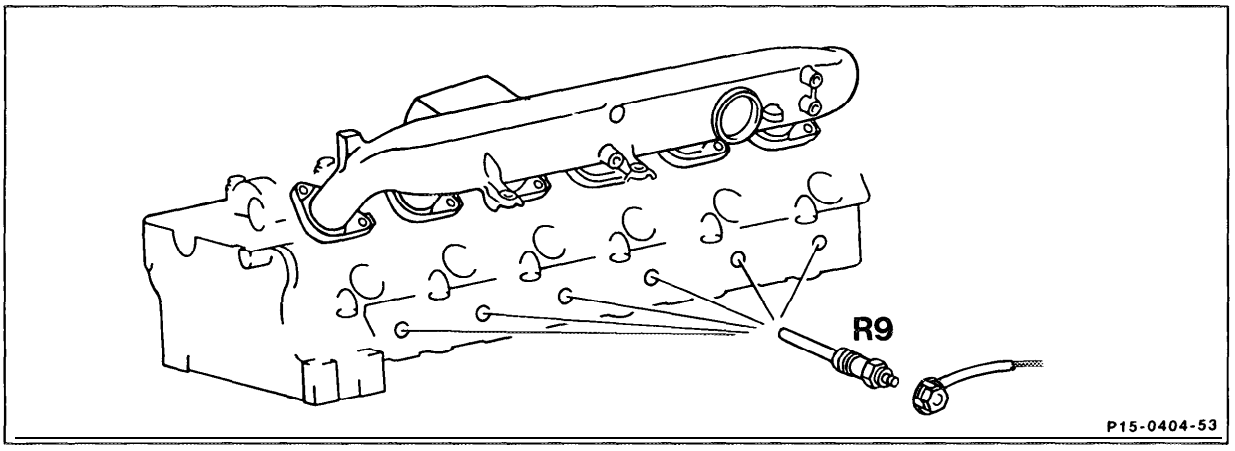
3 Unscrew glow plugs.



Installation

4 Installation occurs in reverse order.

15–715 Removal and Installation of glow plugs - Turbodiesel



Cable to glow plugs	disconnect, connect.
Pencil-type glow plugs (R9)	remove, install.

Tightening torques	Nm
Quick-start pencil-type glow plugs	20 + 2
Cable to glow plugs	4

Commercial tool

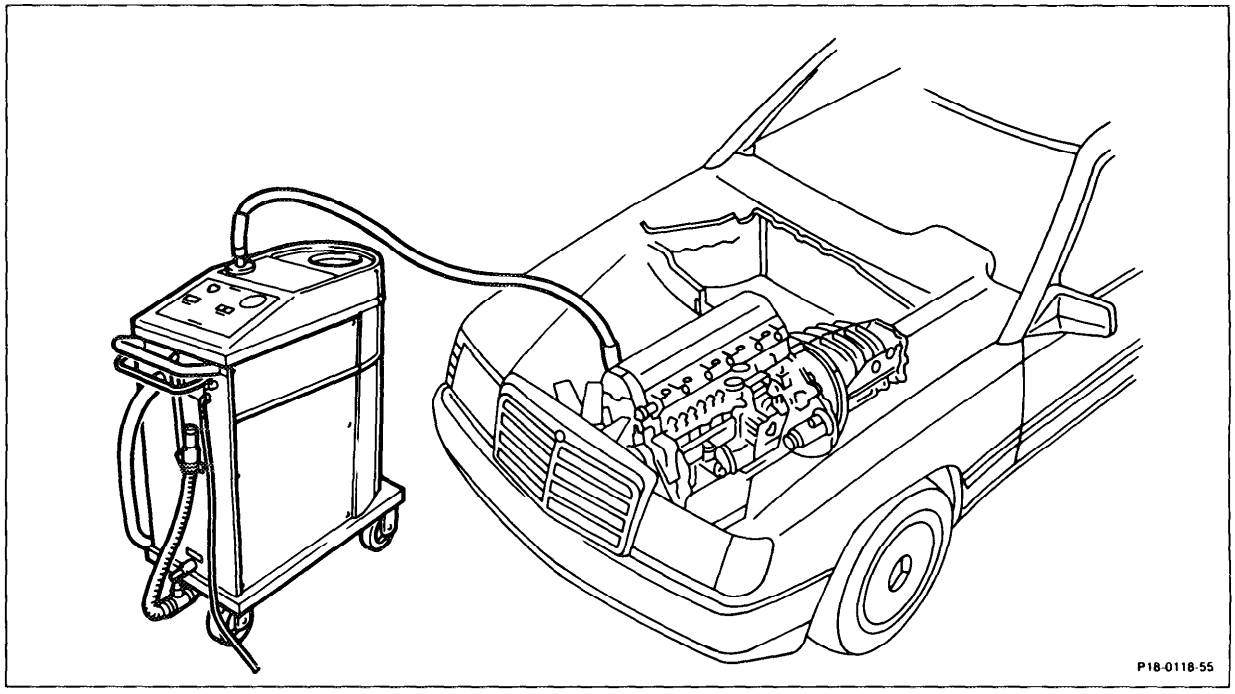
3/8" ratchet with universal joint

Distinguishing Features of Pencil-type Glow Plugs

Engine	603.96	602.96 603.96	602.961 Standard 1987
Injection preglow system	Vertical injection without afterglow	Oblique injection prechamber 5°/180° 60 s afterglow	Oblique injection prechamber 5° 15 s afterglow
Beru No.	010 022 11 07	010 022 11 62	010 022 11 53
Bosch No.	025 020 10 01	025 020 10 26	–
Length of glow tube	25	23	27
Glow current after approx. 8 s in amperes	8–15	14–16	14–16
Identification	yellow	Transparent with annular groove around hexagon	black

Job No.

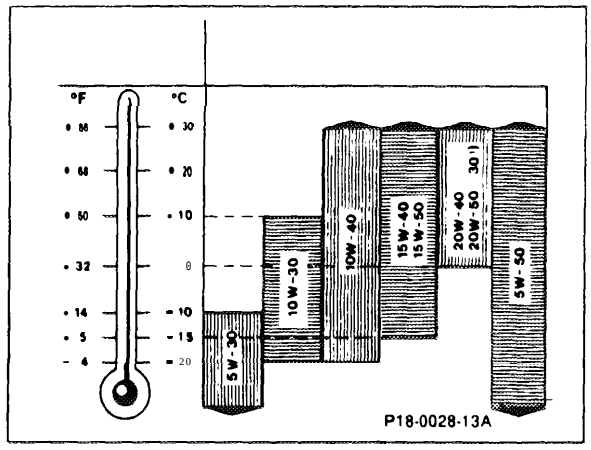
Engine oil and filter change	18 – 002
Oil circuit, oil pressure, overpressure and bypass valve, oil filter	18 – 005
Removal and installation of oil spray nozzles	18 – 040
Removal and installation of oil filter	18 – 110
Modifications to oil filter	18 – 115
Removal and installation of oil pump	18 – 210
Replacement of oil pump chain	18 – 212
Removal and installation of oil pressure relief valve	18 – 215
Testing oil level indicator	18 – 220
Function of oil level indicator	18 – 225
Removal and installation of oil level sensor	18 – 226



Specified viscosity class for engine oil in accordance with SAE at prolonged outside temperatures

Precise use of the SAE class according to outside air temperatures would necessitate frequently changing the engine oil. The temperature limits for the SAE classes should therefore be regarded as guidelines which can be exceeded for short periods.

See **"Service Product Specifications"** for further information on specified viscosity classes and approved engine oils.



1) **SAE 40** may be used at prolonged outside temperatures above + 30 °C.

Oil capacity in liters

Engine	Model	Capacity for oil and filter change	Dipstick marking		
			Colored marking	Colored marking	Numerical marking on handle (color red)
			Round handle	Handle-shaped like bottle opener	
602.91	201	6.5 (6.8 U.S. Qt.)	–	–	60214')
		7.0 [2]) (7.4 U.S. Qt.)	–	green')	–
602.96	124, 201	7.0 (7.4 U.S. Qt.)	–	green[3])	–
603.96	124	7.5 (8.0 U.S. Qt.)	–	black	-
603.96/97	126	7.5 (8.0 U.S. Qt.)	–	–	60316

1st version - rea colored marking
2nd version - black colored marking
3rd version - brown colored marking

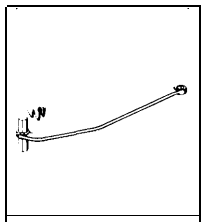
2) On engines with exhaust gas recirculation and side part on oil sump

3) 1st version black

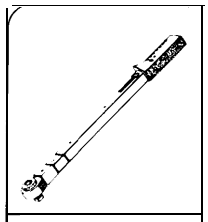
Tightening torques		Nm
Oil filter cover fastening nuts		25
Oil drain plug on oil sump	M 12x1,5x13	30
	M 14x1,5x22	25
Return pipe in oil filter cover')		25

1) Only engine 603 in Model 124

Special tools



117 589 02 07 00
18 26 35



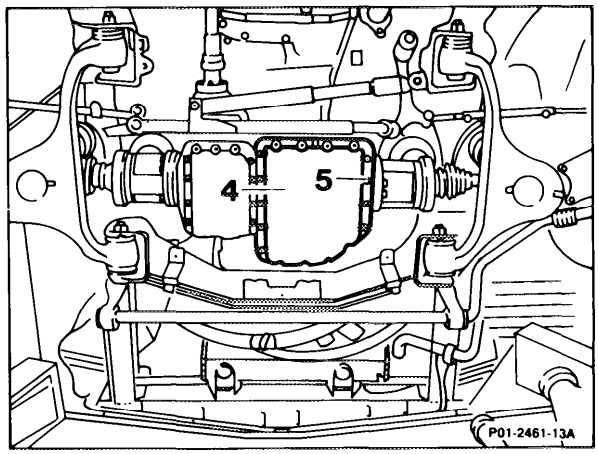
001 589 72 21 00
00

Commercial tool

Engine oil extractor	e.g.	Deutsche Tecalimit Am Metallwerk 11 D-4800 Bielefeld

Note

On models with air-to-oil cooler (turbo engines) the oil does not need to be drained from the air-to-oil cooler.



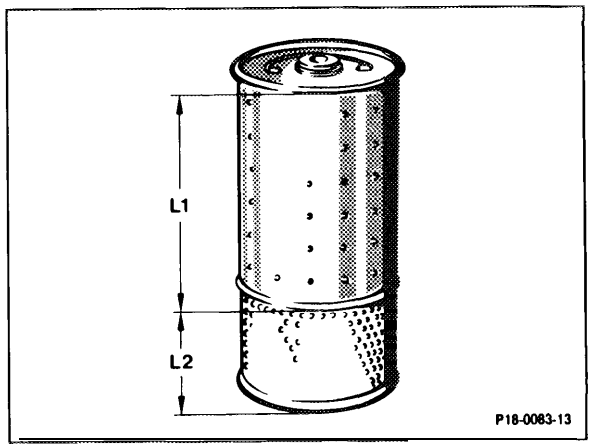
Caution!
The filter element and the rubber seal on the oil filter cover must not be confused with that of engines 615, 616 and 617 as these are different in size.

Engine 602, 603

Size		
	L1	113 mm
	L2	49 mm

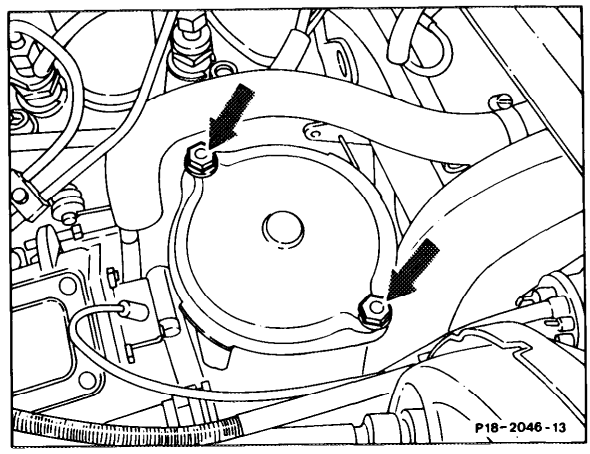
Engine 615, 616, 617

Size		
	L1	131 mm
	L2	55 mm



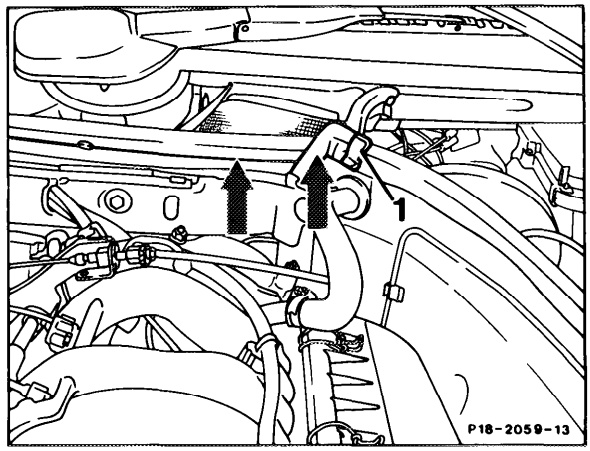
Caution!
Change engine oil only when engine at normal operating temperature.

1 Empty oil filter before extracting or draining the engine oil. This is done by unscrewing the nuts (arrows) and taking off the cover.

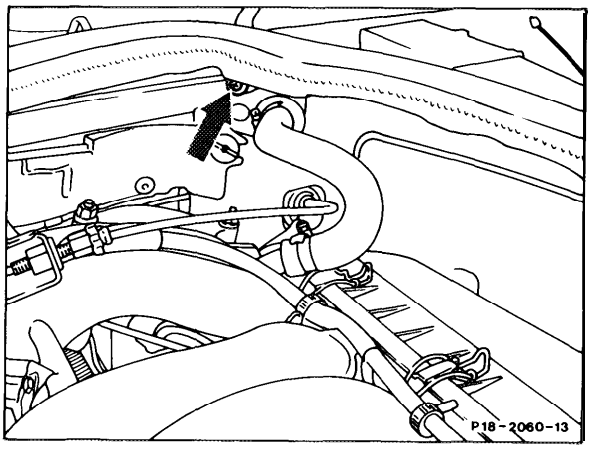


For reasons of space, when performing this step on engine 603 in Model 124 (up to 01/86), detach rubber gasket or sealing strip on the component partition wall in the manner described below, and pull up slightly.

Divided rubber gasket
Pull off retaining clip (1).

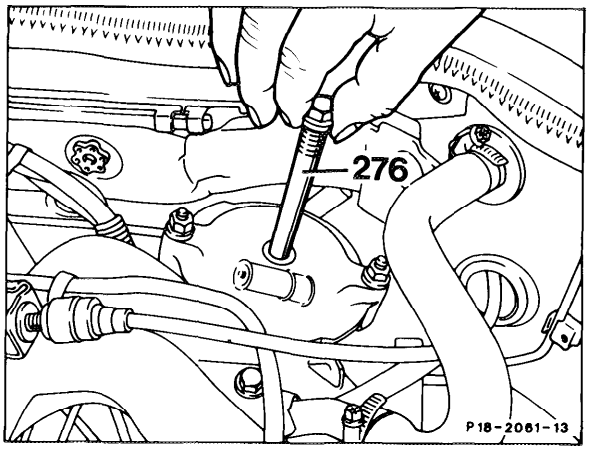


One-piece rubber gasket
Remove screw (arrow).

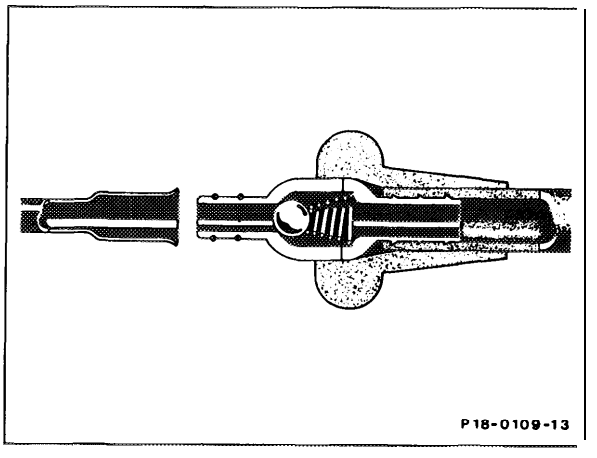


2-part oil filter cover
(effective 02/86, engine **603** in model **124)**

Unscrew return pipe (276) and take off. Unscrew oil filter cover fastening nuts and take off cover.



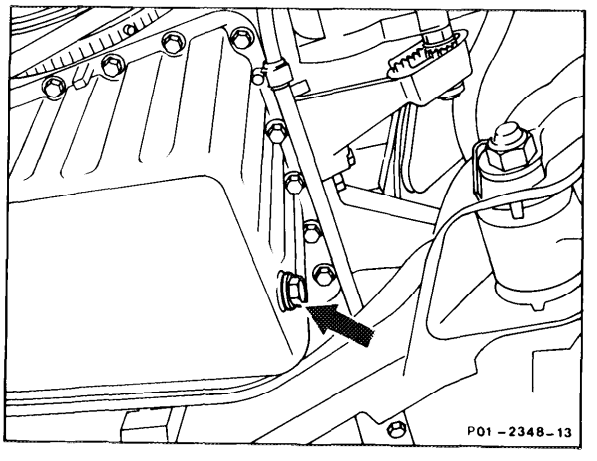
2 Extract engine oil through the dipstick guide tube when the engine is at normal operating temperature.



If no extractor is available:

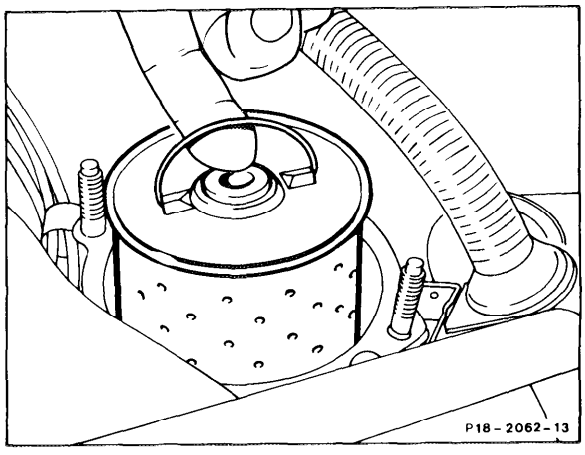
3 Remove engine compartment cover below **(01-006).**

4 Drain engine oil out of sump (arrow).

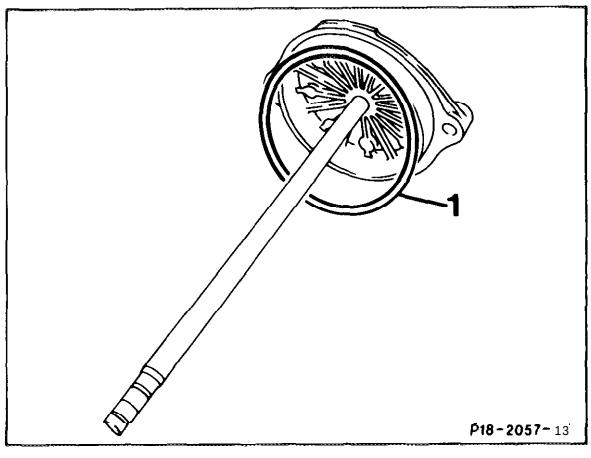


Note
The oil in the air-to-oil cooler does not need to be drained.

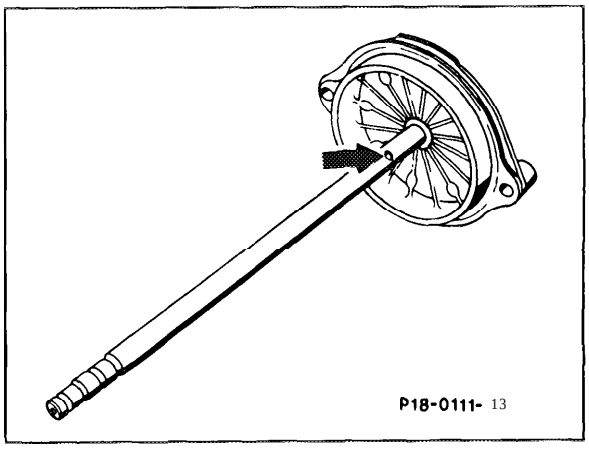
5 Replace filter element.



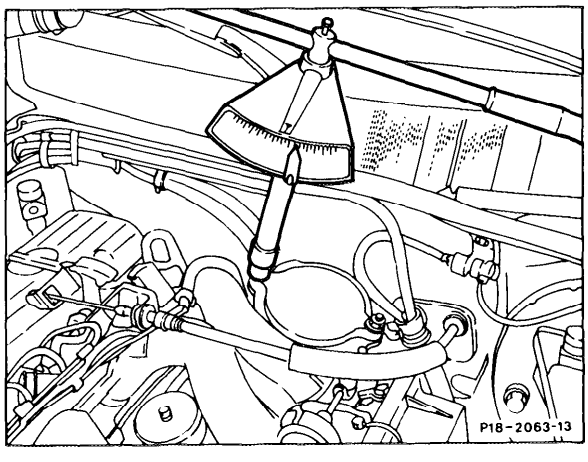
6 Replace rubber seal (1) on the cover.



7 Examine restriction opening on oil pipe for foreign bodies (arrow). If it is blocked, remove foreign bodies by hand. Following this, blow compressed air into restriction opening. Air must be felt to escape at the bottom of the oil pipe. If the restriction opening is not clear or if no air flows out, replace oil filter cover together with oil pipe.



8 Tighten nuts and return pipe to 25 Nm.



9 If the oil has been drained from the sump, replace sealing ring of oil drain plug.

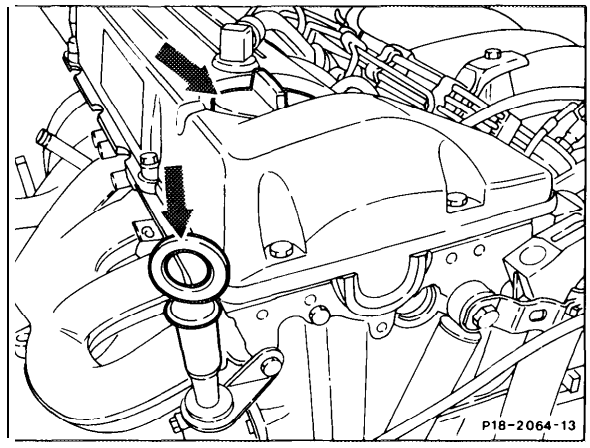
10 Tighten oil drain plug to 30 or 25 Nm, respectively.

11 Add engine oil.

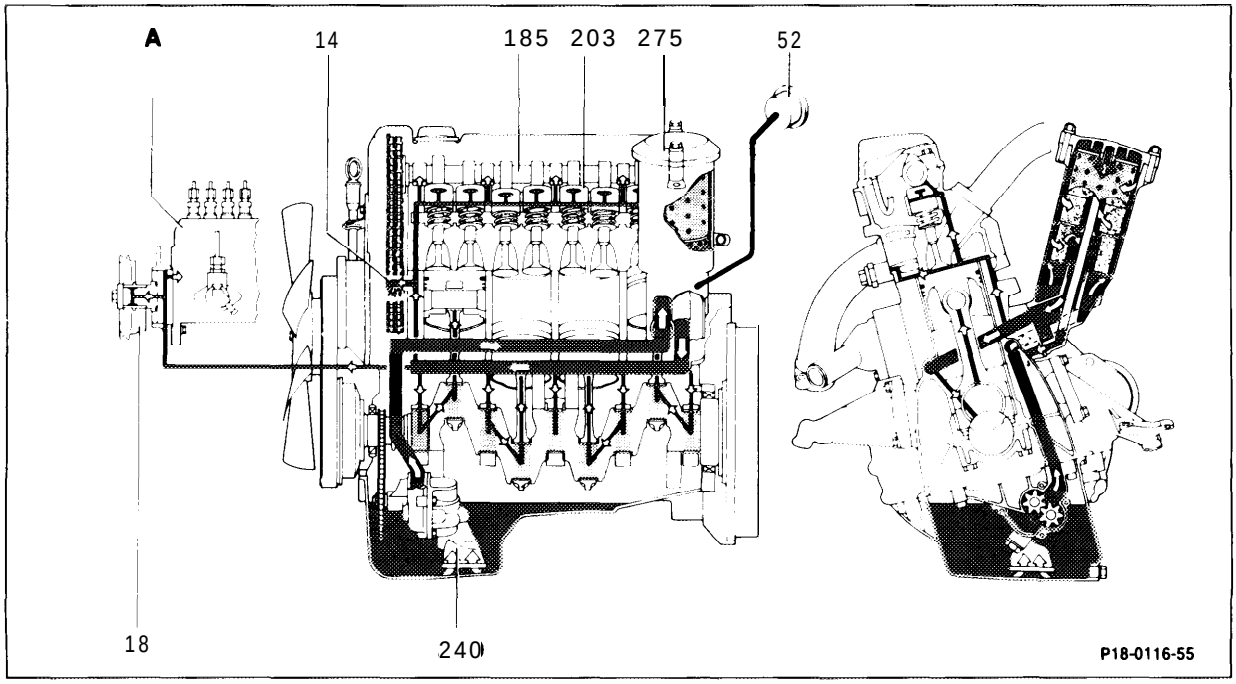
12 Run engine and examine for signs of leaks

13 Check oil level approx. 2 minutes after turning off engine at normal operating temperature.

14 Install engine compartment covering (01-006).

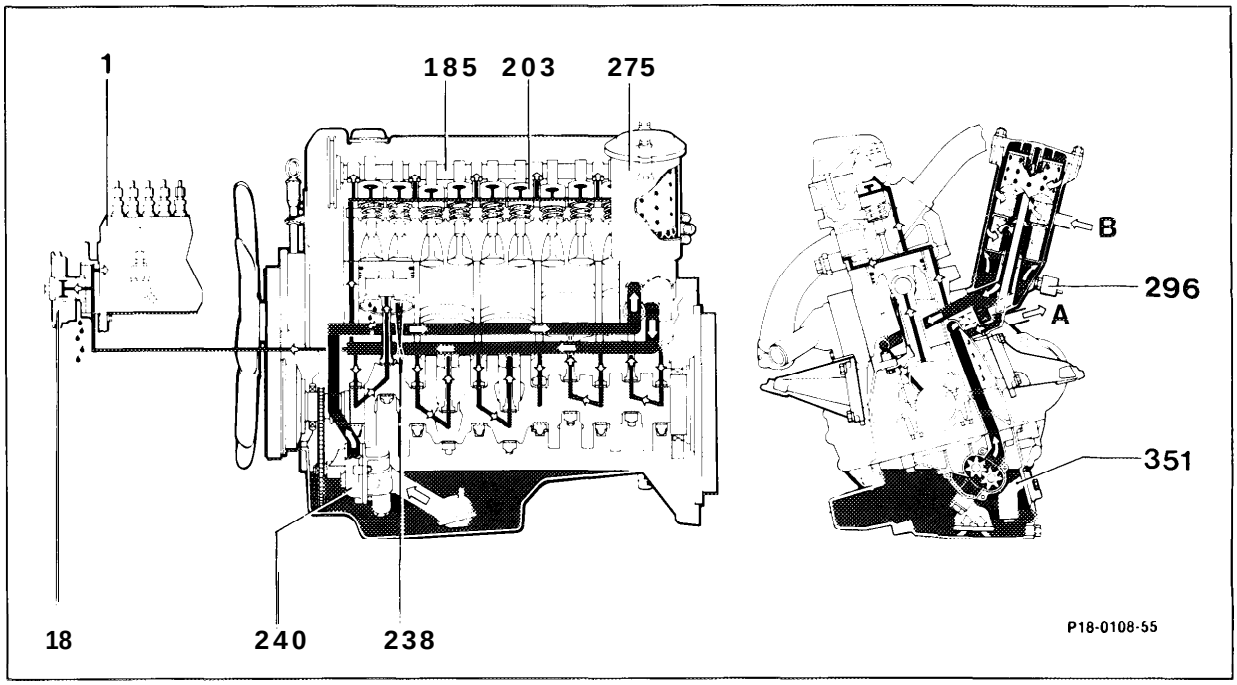


1 8-005 Oil circuit, oil pressure, overpressure and bypass valve, oil filter



Oil circuit diagram engine 602.91

14	Oil spray nozzle	203	Valve tappet
18	Timing device	240	Oil pump
52	Oil pressure gauge	275	Oil filter
185	Camshaft	A	Injection pump

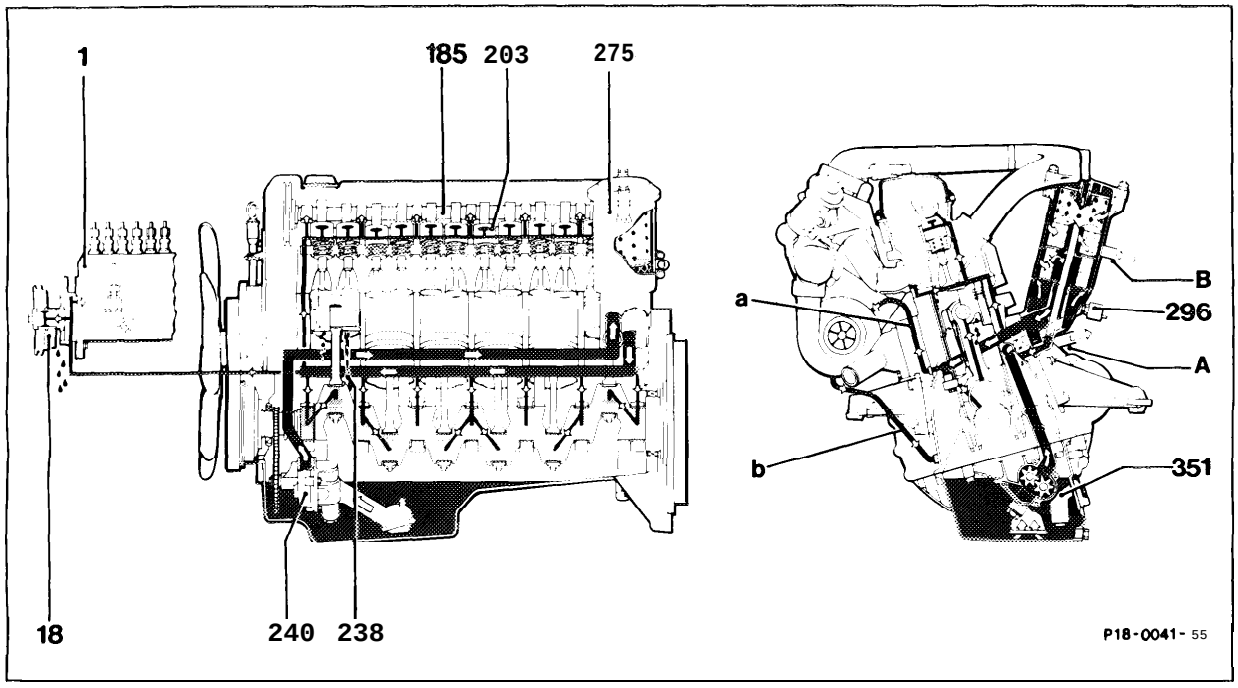


Oil circuit diagram engine 602.91 with exhaust gas recirculation

1	Injection pump	275	Oil filter
18	Timing device	296	Oil pressure switch
185	Camshaft	351	Oil level sensor
203	Valve tappet	A	Unfiltered oil to air-to-oil cooler
238	Oil spray nozzle	B	Unfiltered oil from air-to-oil cooler
240	Oil pump		

Note

Engine 602.91 with exhaust gas recirculation and manual transmission in combination with air conditioning.

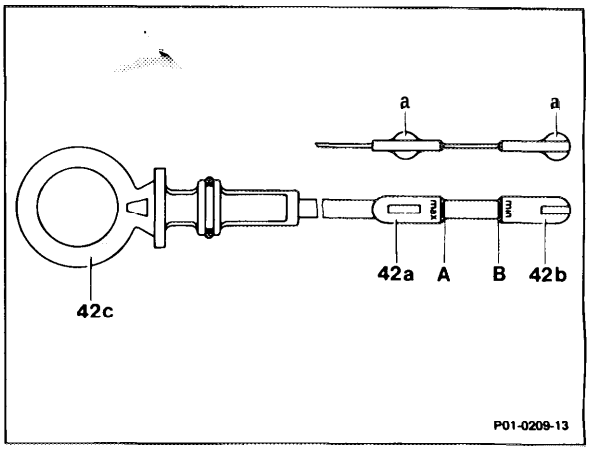


Oil circuit diagram engines 602.96, 603.96197 (Turbo)

1	Injection pump	296	Oil pressure switch
18	Timing device	351	Oil level *sensor*
185	Camshaft	A	Unfiltered oil to air-to-oil cooler
203	Valve tappet	B	Unfiltered oil from air-to-oil cooler
238	Oil spray nozzle	a	To exhaust gas turbocharger
240	Oil pump	b	From exhaust gas turbocharger
275	Oil filter		

Dipstick

Effective 05/84 the Min and Max markings on engine 601 are made of plastic.

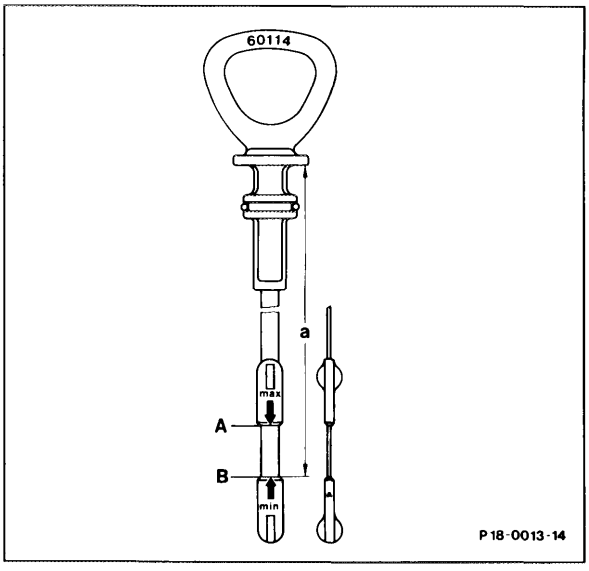


42a Max marking
42b Min marking
42c Round handle
A - B Filling range

Production breakpoint: 05/84

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
201.122	601.921	001552	004036	092057	015430

On engine **602** a dipstick with black handle was fitted to achieve standardization with engine 603.



42a Max marking
42b Min marking
42c Handle shaped like a bottle opener
A – B Filling range

Production breakpoint: 01/86

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
201	602.911	011154	002690	276209	186941

Effective 01/87 a dipstick with green handle (previously black) is fitted to engine 602.96 (Turbo).

Production breakpoint: 01/87

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
201.128	1602.961	–	000405	*	*

* not registered

Engine 602.91 is fitted with a dipstick with a brown handle.

Production breakpoint: 02/87

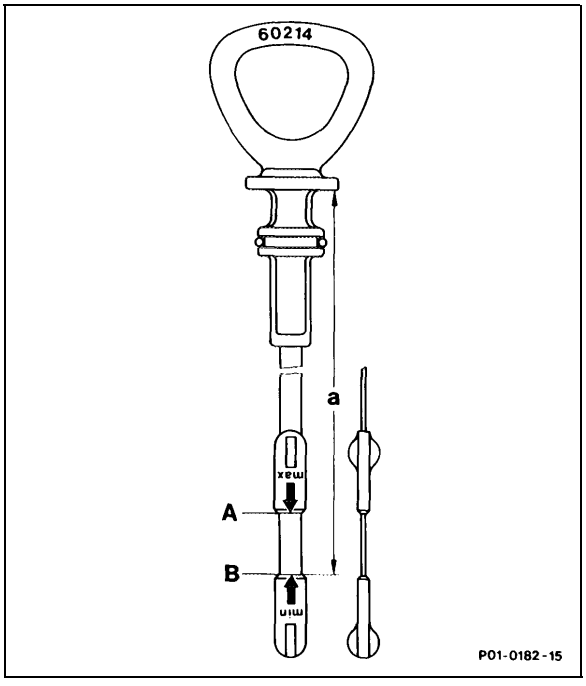
Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	036659	009332	*	*

* not registered

Effective 03/90 the oil level sensor position on engine 602.91 is lowered, which results in a change to the dipstick.

Dipstick marking
Color: red
Marking on handle 60214

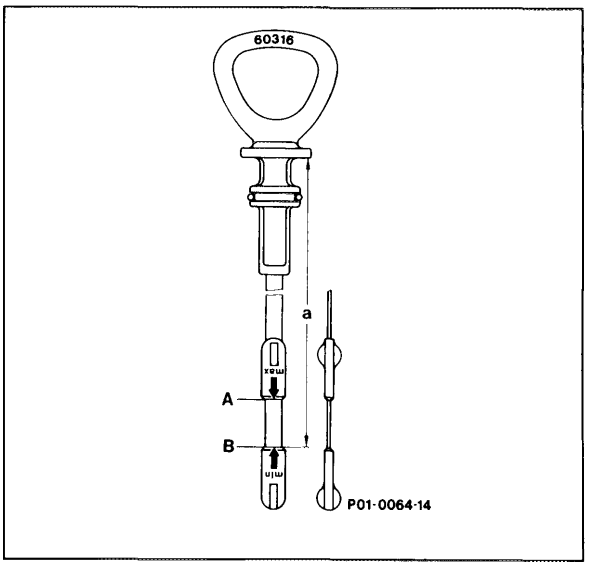
Size: A – B previously 28 mm, now 24 mm
a previously 516 mm, now 516 mm



Production breakpoint:03/90

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
201.122	1602.911	089320	0 17352	558126	723643

On engine 603.970 the dipstick is marked on handle with the number **60316.**



a 512 mm
A – B Filling range

Dipstick marking

Engine	Model	Colored marking Round handle	Colored marking Bottle opener shaped handle	Numerical marking on handle
602.91	201	–	green[2])	60214[1])
602.96	124, 201	–	green[3])	–
603.96	124	–	black	–
603.97	126	–	–	60316

[1]) 1 st version color marking "red"
2nd version color marking "black"
3rd version color marking "brown"
[2]) Only on engines with exhaust gas recirculation and side part on oil sump
[3]) 1 st version color marking "black"

Note

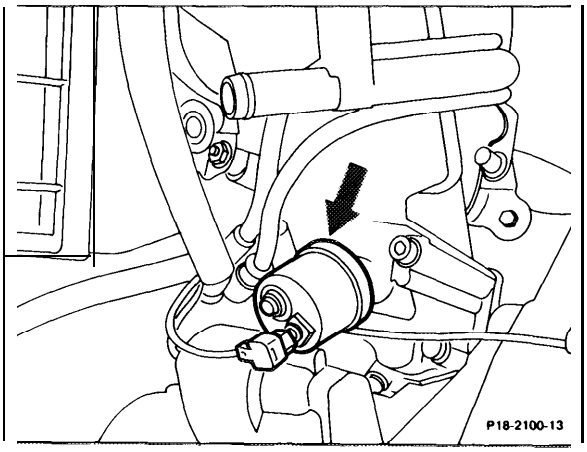
The dipsticks must not be interchanged.

Oil pressure and oil pressure indicator

Specified oil pressure at normal operating temperature

	Idle speed	3000 rpm
Oil pressure	≥ 0.3 bar	≥ 3 bar

Voltage exists at the gauge in the instrument cluster when ignition is switched on. In the pressure sensor on the oil filter housing (arrow) ground is switched to the gauge. Any change in oil pressure results in different electrical resistances in the pressure sensor and thus in a different reading in the gauge.



Resistances of pressure sensor as a function of oil pressure

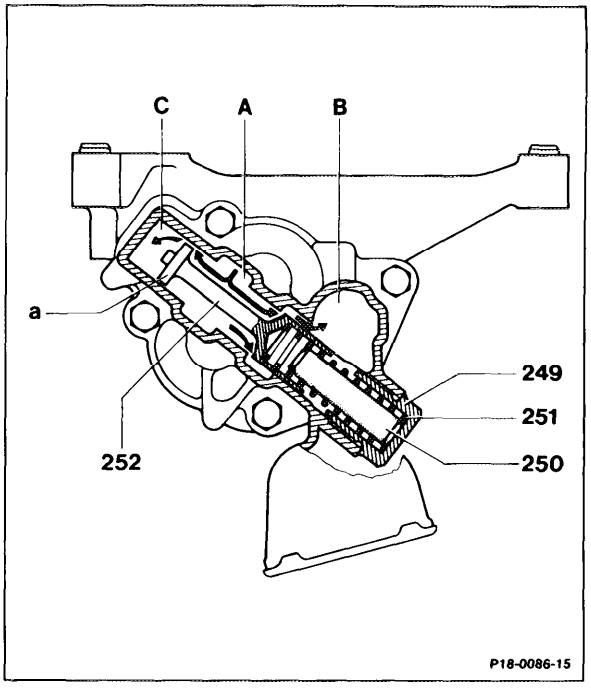
bar gauge pressure	0	1	2	3
Resistance approx. Ω	10	69	129	184

Oil overpressure valve

The oil is drawn through the suction strainer to the suction chamber (B) from the lowest point in the sump. From here, the oil flows through the gears to the pressure chamber (A) and on into the main oil gallery to the filter.

From an oil pressure of 5.8 bar gauge pressure, the piston (252) is pushed against the compression spring (251) and opens the relief bore (arrows) to the suction chamber (8).

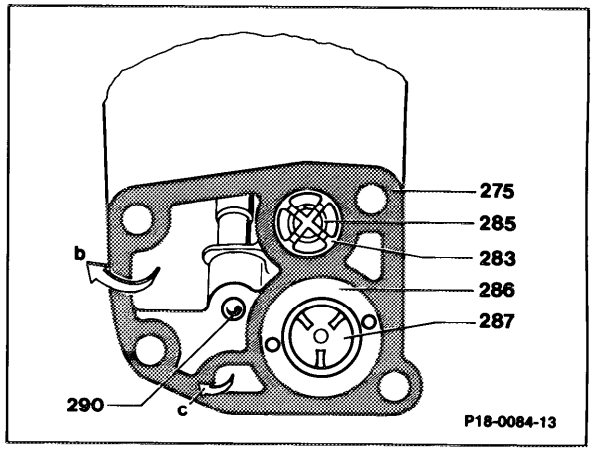
At the same time, the oil flows over two flat faces fitted to the collar (a) into the damping chamber (C). This oil counteracts the piston movements produced by the pulsating oil pressure and results in a damping of the piston.



249 Screw plug
250 Guide pm

Bypass valve

As the filter element becomes increasingly fouled, the lubrication points of the engine are supplied with less and less oil and the pressure in the oil filter rises. Once the filter element is so severely fouled that the oil pressure is 2 bar above the pressure of the oil delivered by the pump, the bypass valve (285) opens. As a result, unfiltered oil flows directly from the sump to the lubrication point, bypassing the filter element.



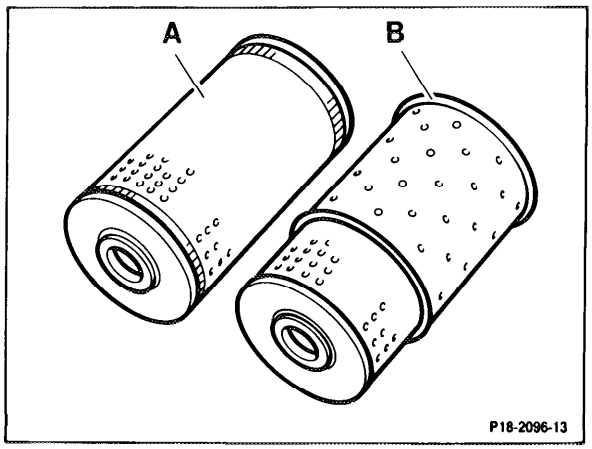
275 Oil filter housing
283 Spnng plate
285 Bypass valve
286 Return check valve seat
287 Return check valve cone
290 8 mm Ø ball
b To the bearing points
c Finely filtered oil to sump

Oil filter element

The full-flow and bypass-flow filter elements are combined in a cartridge.

During the inspection (800 – 1000 miles) the break-in oil filter element (A) should be replaced by the combination oil filter element (B).

The combination oil filter element (B) must be replaced every 7500 miles.



Caution!

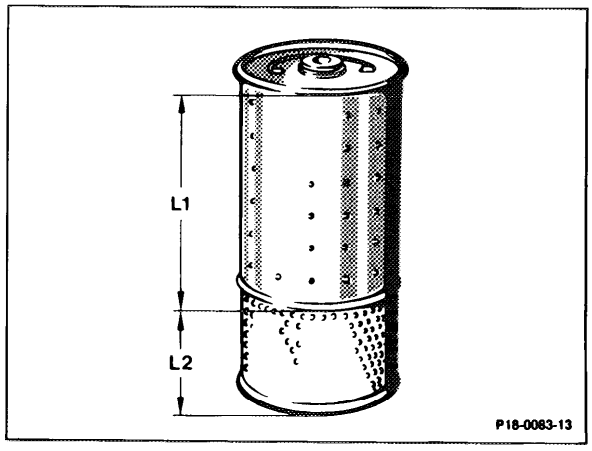
The filter element and the rubber seal on the oil filter cover must not be interchanged with those of engines 615, 616 and 617 as they are different in size.

Engine 602, 603

Size		
	L1	113 mm
	L2	49 mm

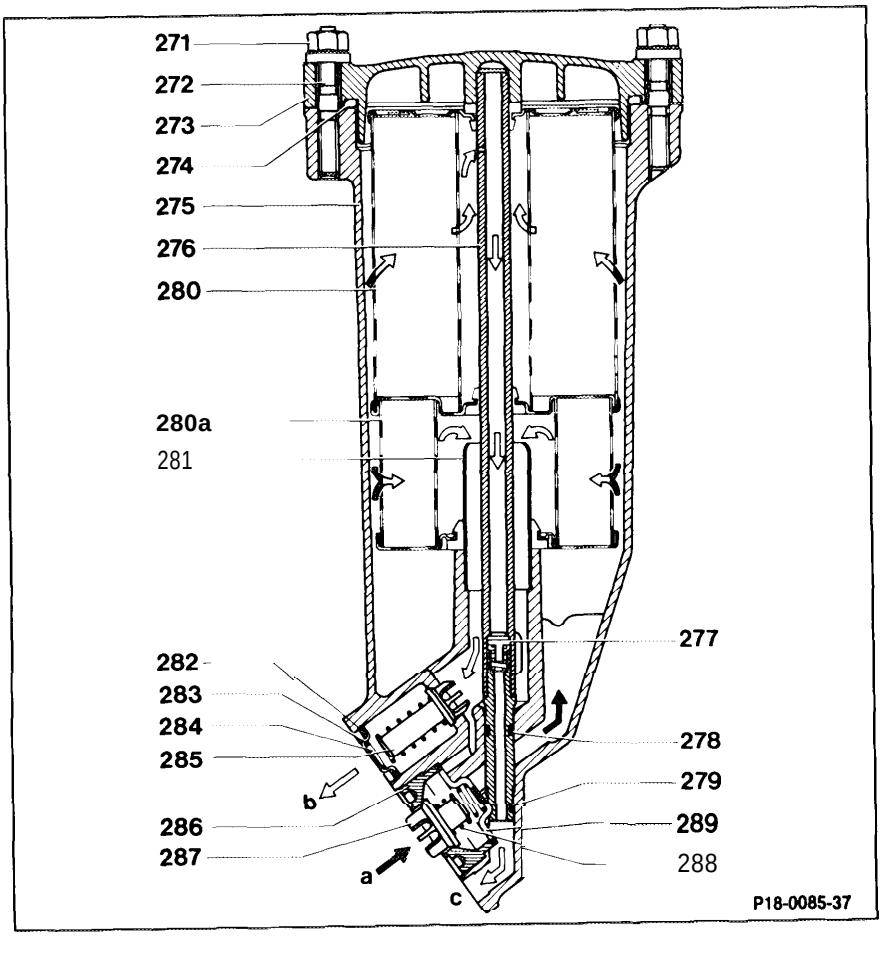
Engine 615, 616, 617

Size		
	L1	131 mm
	L2	55 mm



Oil filter (without air-to-oil cooler connections)

The oil flows from the inlet passage (a) through the return check valve (286, 287) into the oil filter housing and flows direct to the oil filter element (280). It flows through the filter element and then through the riser pipe (281) and the passage (b) to the main oil gallery and on to the main bearings. The finely filtered oil flows through the return pipe (276) and the passage (c) to the oil pan.
A rubber seal is fitted in the oil filter element (280) to separate the full flow and bypass flow.



271	M 8 nut
272	M 8 stud
273	Cover
274	O-ring
275	Oil filter housing
276	Return pipe
277	Check valve
278	O-ring
279	0-rrng
280	Oil filter element
280a	Full-flow filter
281	Riser pipe
282	Locking ring
283	Spring plate
284	Spring
285	Bypass valve cone
286	Return check valve seat
287	Return check valve cone
288	Compression spring
289	Spring plate

Note
When changing the oil filter element, unscrew the cover (273) and raise it slightly. As a result, the return pipe (276) attached to the cover clears an opening which connects the passages (b) and (c) to each other. The oil in the filter flows back along passage (c) into the oil pan.

The return pipe on engines 601, 602 and in engine 603 – 1st version is press-fitted. On engine 603 in model 124 – 2nd version, this return pipe can be unscrewed when changing oil to more easily remove the oil filter cover.

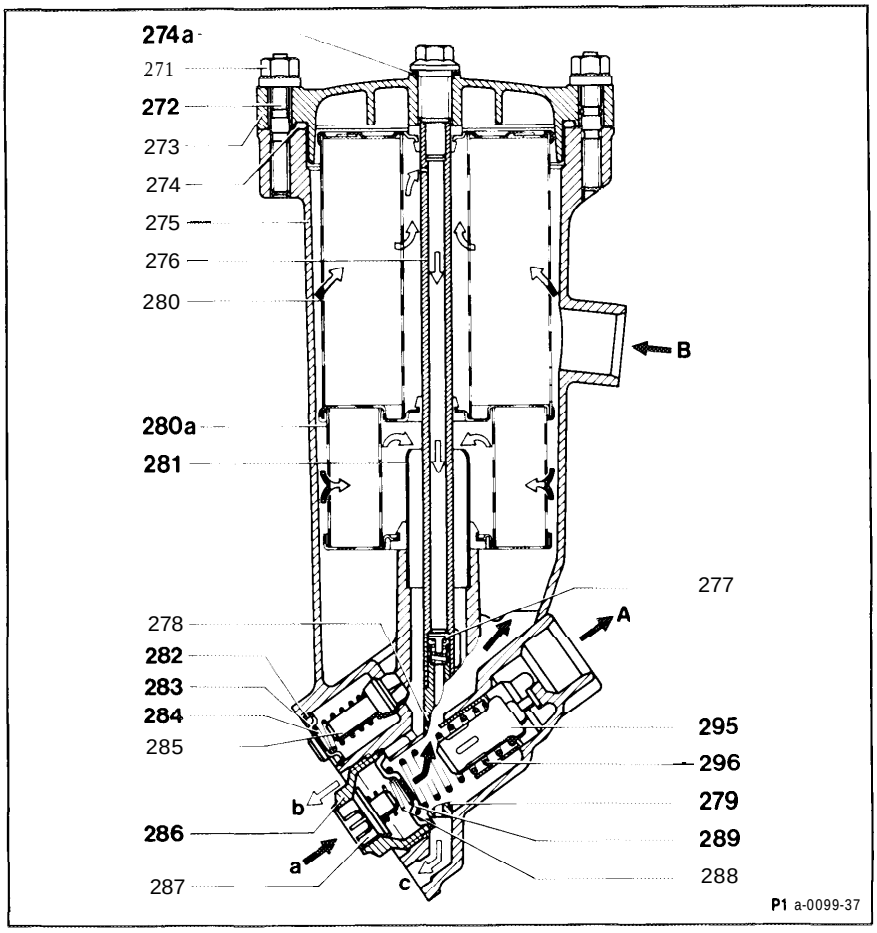
Oil filter (with air-to-oil cooler connections)

A thermostat (295) for controlling the oil circuit through the air-to-oil cooler is fitted in the oil filter.

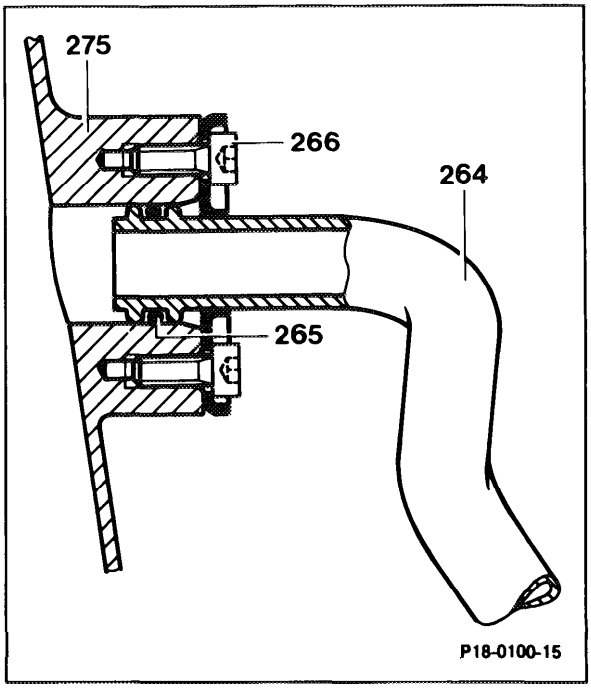
Start of opening approx. 110 °C oil temperature. Fully open at approx. 125 °C oil temperature.

When the thermostat is fully open, only a slight quantity of oil flows directly to the oil filter element.

271 M8 nut
272 M8 stud
273 Cover
274 O-ring
274a Seal (only engine 603 in model 124)
275 Oil filter housing
276 Return pipe
277 Check valve
278 O-ring
279 O-ring
280 Oil filter element
280a Full-flow filter part
281 Riser pipe
282 Locking ring
283 Spring plate
284 Spring
285 Bypass valve cone
286 Return check valve seat
287 Return check valve cone
288 Compressron spring
289 Spring plate
295 Thermostat
296 Spring
A Unfiltered oil to air-to-oil cooler
B Unfiltered oil from air-to-oil cooler
a To oil filter
b To bearing points
c To oil pan



The air-to-oil cooler lines at the oil filter housing are sealed by O-rings (265).



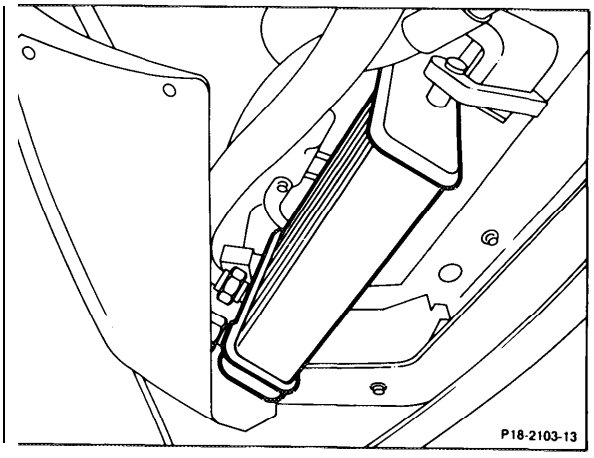
264 Air-to-oil cooler lines
265 O-ring
266 2 screws M 6 x 16
275 Oil filter housing

Air-to-oil cooler (engines 602, 603 with exhaust gas circulation and engines with turbocharger)

The air-to-oil cooler is attached to the left wheelhouse behind the bumper.

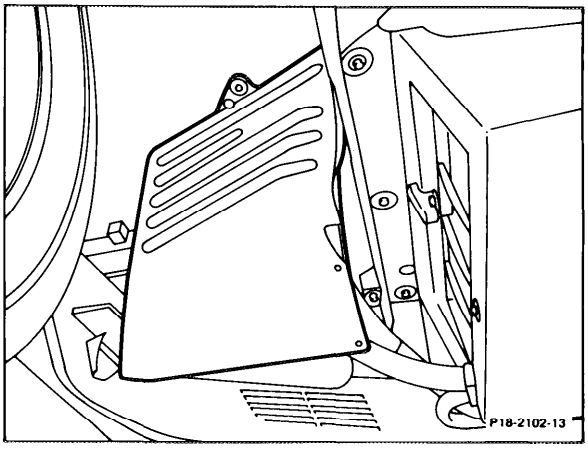
Oil capacity:

Engine 602.91	**0.4** liters
Engines 602.96 1	0.9 liters
Engine 603.96197	0.65 liters



The air-to-oil cooler is shielded by a cover plate.

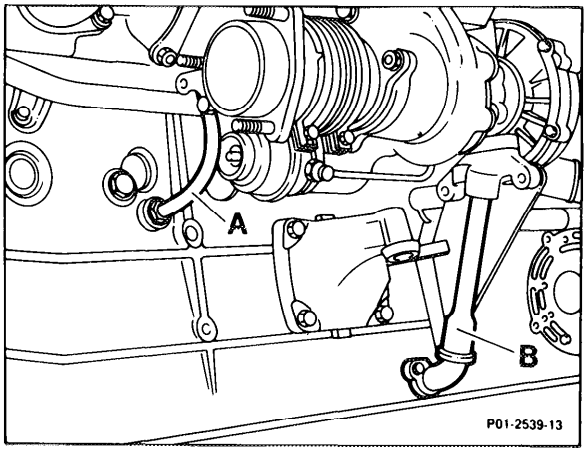
When changing the oil, it is not necessary to drain the oil in the air-to-oil cooler.



Cover for air-to-oil cooler, shown on model 124

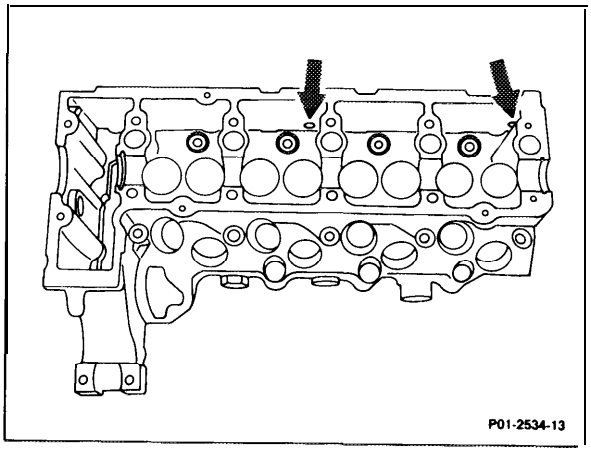
Lubrication of exhaust gas turbocharger

The oil supply of the turbocharger comes from an oil passage in the crankcase and from an oil feed line (A) connected at that point.
The oil return line (B) is likewise located on the right side of the crankcase and is connected directly above the oil pan.

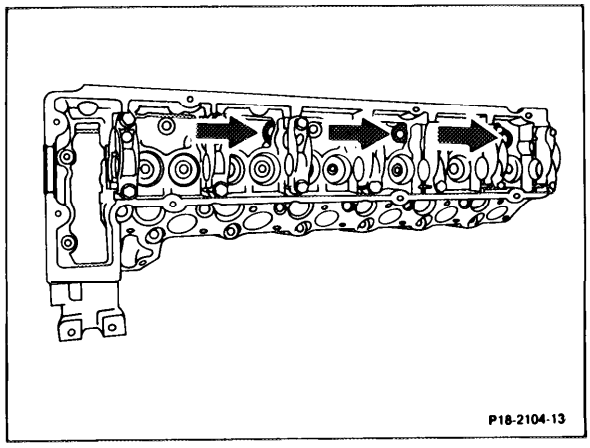


Oil return

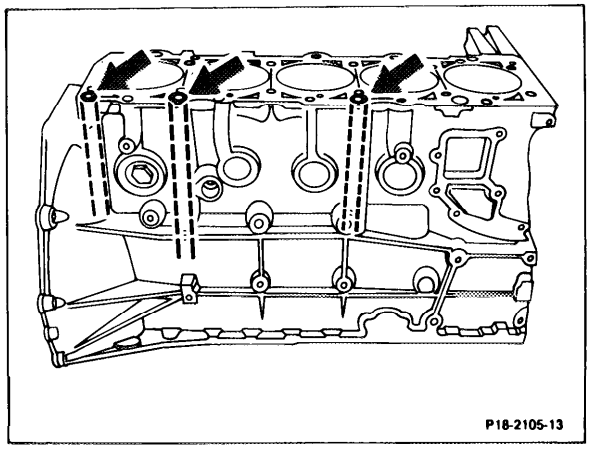
Part of the oil from the cylinder head returns to the oil pan through the timing chain case. Because of the installation position tilted 15" to the right, the cylinder heads and crankcase are fitted with two and three return passages (arrows), respectively, for improving the oil return.



Engine 601
Oil return in cylinder head



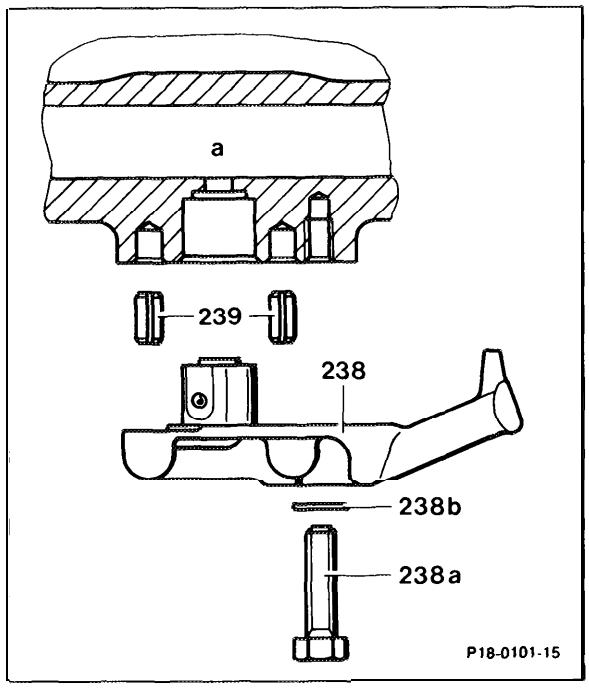
Engines 602 and 603
Oil return in cylinder head



Engines 602 and 603
Oil return in crankcase

18-040 Removal and installation of oil spray nozzles

Preceding work:
Oil pan removed (01-310).



Hex. bolt (238a)	unbolt, bolt in, 10 Nm.
Oil spray nozzle (238)	take off, fit on.

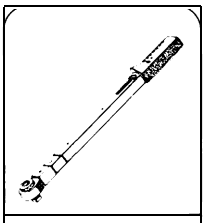
Note

To remove, position crankshaft so that the oil spray nozzle is accessible; do not tilt oil spray nozzle and do not grasp at the nozzle neck. Cover over oil feed bores. Replace oil spray nozzles which have a sharply out-of-round nozzle bore or formation of flash at the nozzle outlet. Blow through oil spray nozzle with compressed air in flow direction of oil. Do not use any hard objects for cleaning. Position oil spray nozzle vertical to the mating surface on the crankcase and press into place.

Caution!
The oil spray nozzles of the naturally aspirated engines (with exhaust gas recirculation and engine 603.970) must not be confused with those of the turbo engines, which have a different spray direction.

Tightening torques	Nm
Hex. bolt of oil spray nozzle	10

Special tool



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Note
Since 1 1/88 die-cast oil spray nozzles have been fitted to the naturally aspirated and turbo engines (previously white heart malleable cast iron).

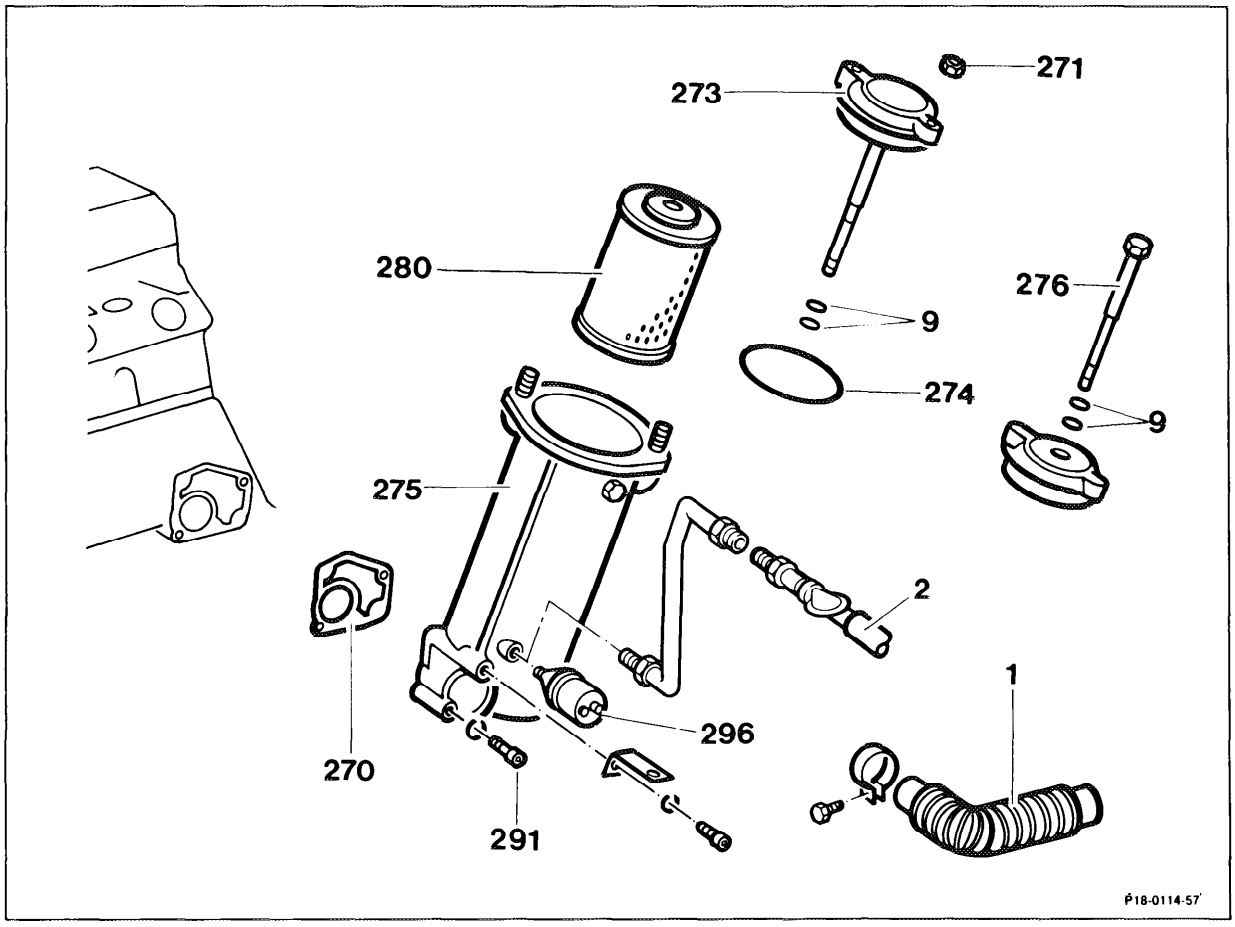
Production breakpoint: 1 1/88

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
124.128	602.962	-	000597	*	*
124.133 124.193	603.960	-	019838	*	*
201.128	602.961	-	004767	*	*

* not registered

18-110 Removal and installation of oil filter

Preceding work:
Naturally aspirated engine: air filter removed (09-400).



Hex. nuts (271)	on oil filter cover (273), unbolt, bolt on, 25 Nm.
Oil filter cover (273)	remove, refit.
Gasket (274) and seals (9)	remove, insert. Replace gasket and seals.

Engine 603

Return pipe (276)	on oil filter cover, unscrew, screw in, 25 Nm. Replace seals (9).
Oil filter element (280)	withdraw, insert.
Bracket or clips	for starter cable, heater return and vacuum line to oil filter housing, detach, attach.

Engine with exhaust gas recirculation

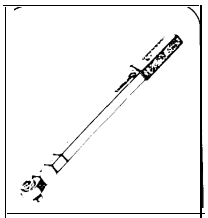
Pipe(l)	between EGR valve and intake manifold or charge air distribution pipe, detach from oil filter housing, attach.
Oil delivery line (2)	unbolt, reinstall.
Electrical connection	detach from oil pressure sensor (296), attach.

With air-to-oil cooler

Connection line	detach from oil filter housing, attach. Replace seal.
Hex. socket screws (291)	on flange of oil filter housing (275), unscrew, screw in, 25 Nm.
Oil filter housing (275)	take off from crankcase together with gasket (270), attach. Replace gasket. **Caution!** Seal bores when cleaning sealing surfaces on crankcase.

Tightening torques	Nm
Oil filter cover hex. nut	25
Return pipe	25

Special tool



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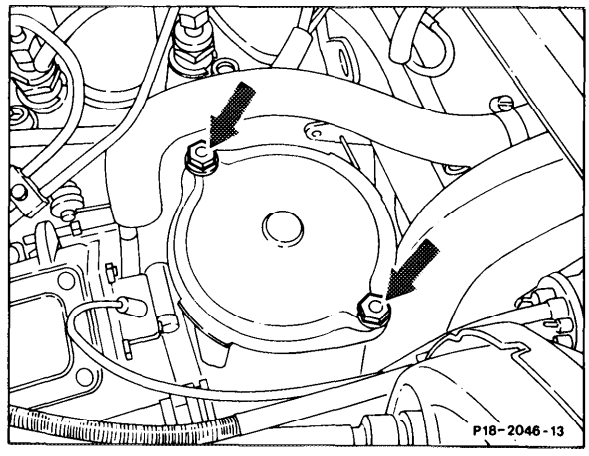
Removal and installation

1 Unscrew hex. nuts (arrows) on oil filter cover.

Installation instruction
Tightening torque 25 Nm.

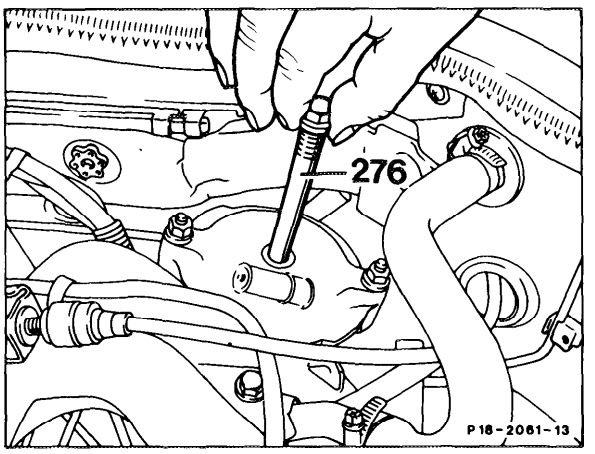
2 Take off oil filter cover together with seal.

Installation instruction
Replace seal of oil filter cover.
Check clear passage of return pipe.



Engine 603

3 Unbolt return pipe (276) and remove, 25 Nm.

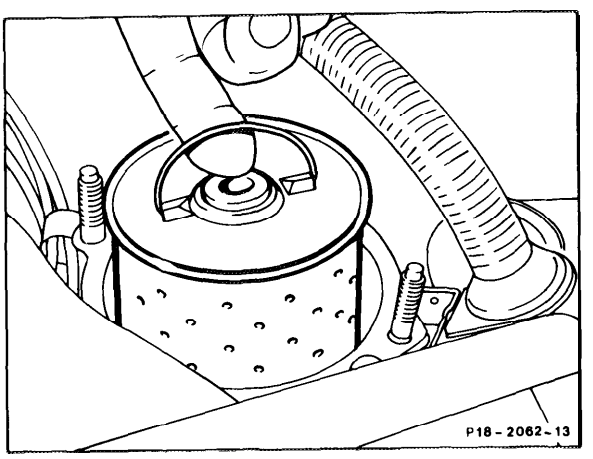


Installation instruction

Replace seals.

Check that the passage of return pipe is clear.

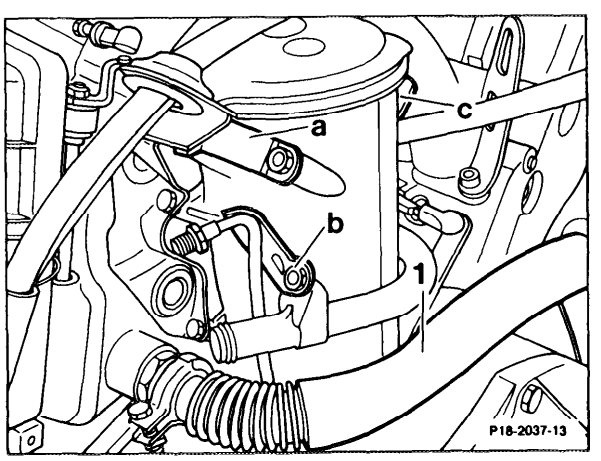
4 Withdraw oil filter element.



Installation instruction

Replace oil filter element.

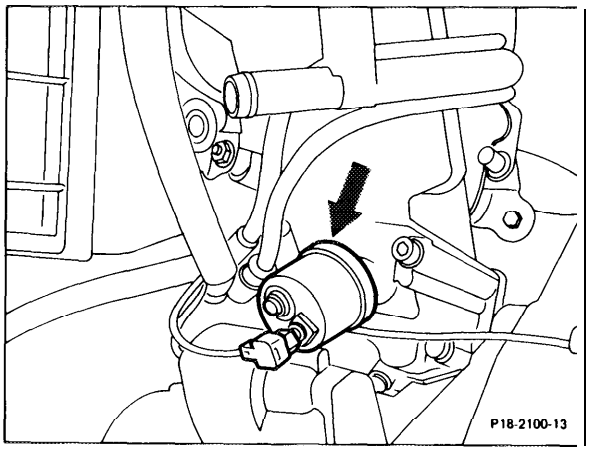
5 Remove brackets (a, b) for starter cable and heater return pipe along with clip (c) for the vacuum line from the oil filter housing.



Engine with exhaust gas recirculation

Remove pipe (1) between EGR valve and intake manifold or charge air distribution pipe from the oil filter housing.

6 Detach electrical connection at oil pressure sensor (arrow).



With air-to-oil cooler

7 Unscrew hex. socket screws (266) and remove connection line (264) from the oil filter housing (275).

Installation instruction

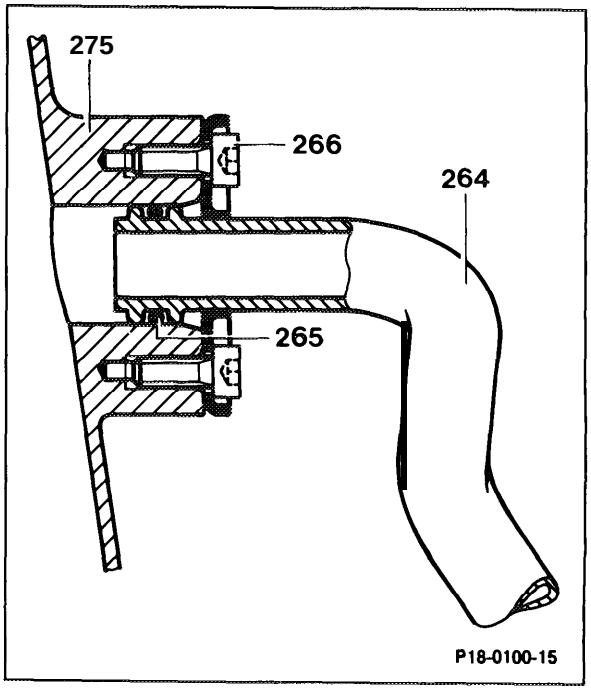
Replace seal (265).

8 Unscrew hex. socket screws at the flange of the oil filter housing.

9 Remove oil filter housing together with gasket from the crankcase and seal connection bore in the crankcase.

Installation instruction

Clean mating surfaces and replace gasket.



18-115 Modifications to oil filter

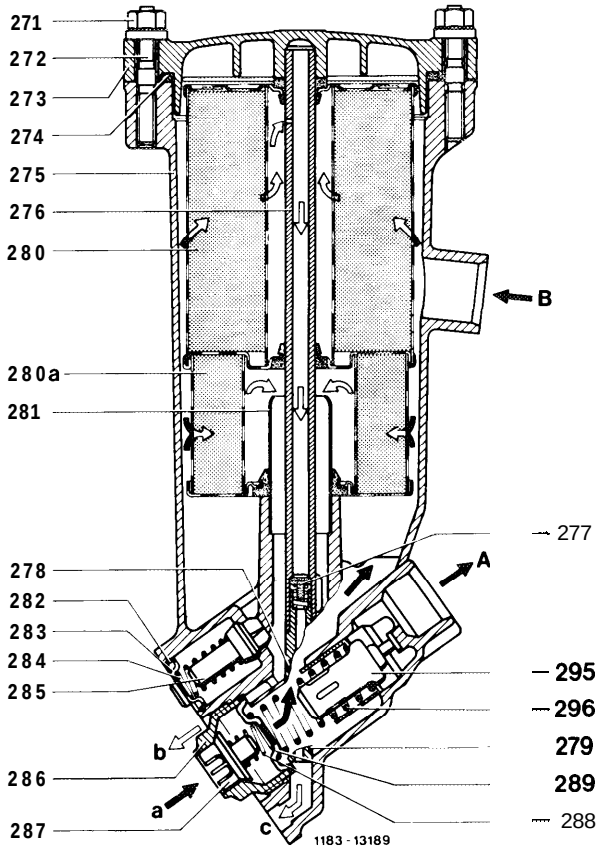
Engine 603.960 in model 124.133/.93, Model Year 1987

The oil filter housing has a thermostat (295) between the engine and the oil cooler for controlling the oil cooling.

Start of opening: approx. 110°C oil temperature.
Fully opened: approx. 125°C oil temperature.

With the thermostat fully opened, a small quantity of oil will continue to flow to the oil filter element.

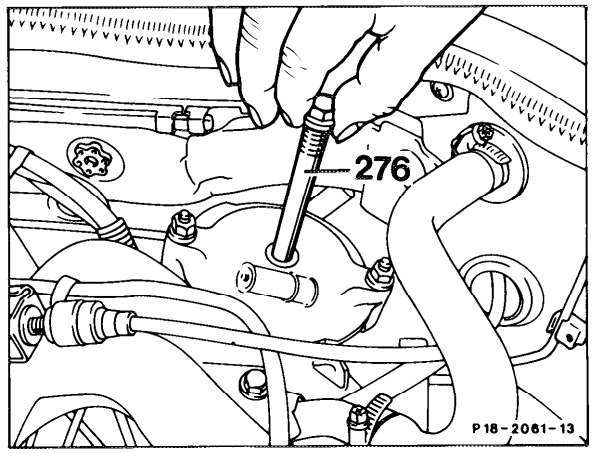
The oil cooler lines on the oil filter are sealed by O-rings (previously screw connections with conical seal).



271	Nut, M 8	286	Valve seat return flow check valve
272	Stud, M 8	287	Valve cone return flow check valve
273	Cover	288	Compression spring
274	O-ring	289	Spnng seat
275	Housing	295	Thermostat
276	Return tube	296	Spring
277	Check valve	a	Supply from oil pump
278	O-ring	b	To bearings
279	O-ring	c	Return to oil pan
280	Oil filter element	A	Unfiltered oil to oil cooler
280a	Full flow filter section	B	Unfiltered oil from oil cooler
281	Riser		
282	Retaining ring		
283	Spnng seat		
284	Spnng		
285	Valve cone bypass va		

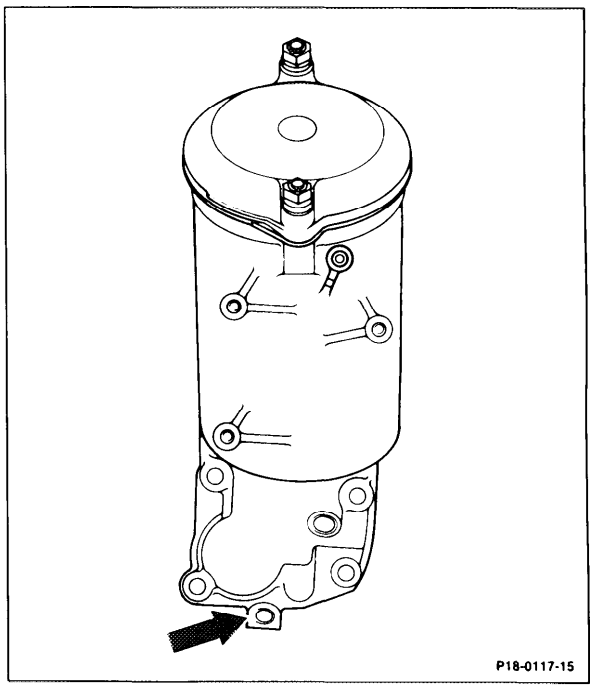
Oil filter cover with removable oil return pipe (only engine 603 in model 124)

The oil filter cover has been modified. The return pipe (276) can be removed. This facilitates the oil change.



Elimination of thread on hole for initial filling

The tapped hole with M 10 x 1 screw plug at the hole for initial filling (arrow) has been modified into a fit hole with ball (8 mm dia.).



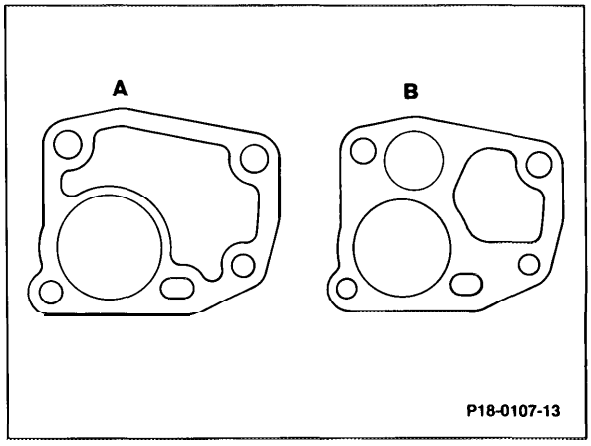
Production breakpoint: 04/86

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	018365	004576	*	*

* not registered

Modification of shape of gasket between oil filter housing and crankcase

The new gasket is pierced only in the area of the supply and return lines. This achieves improved sealing.



A 1 st version
B 2nd version

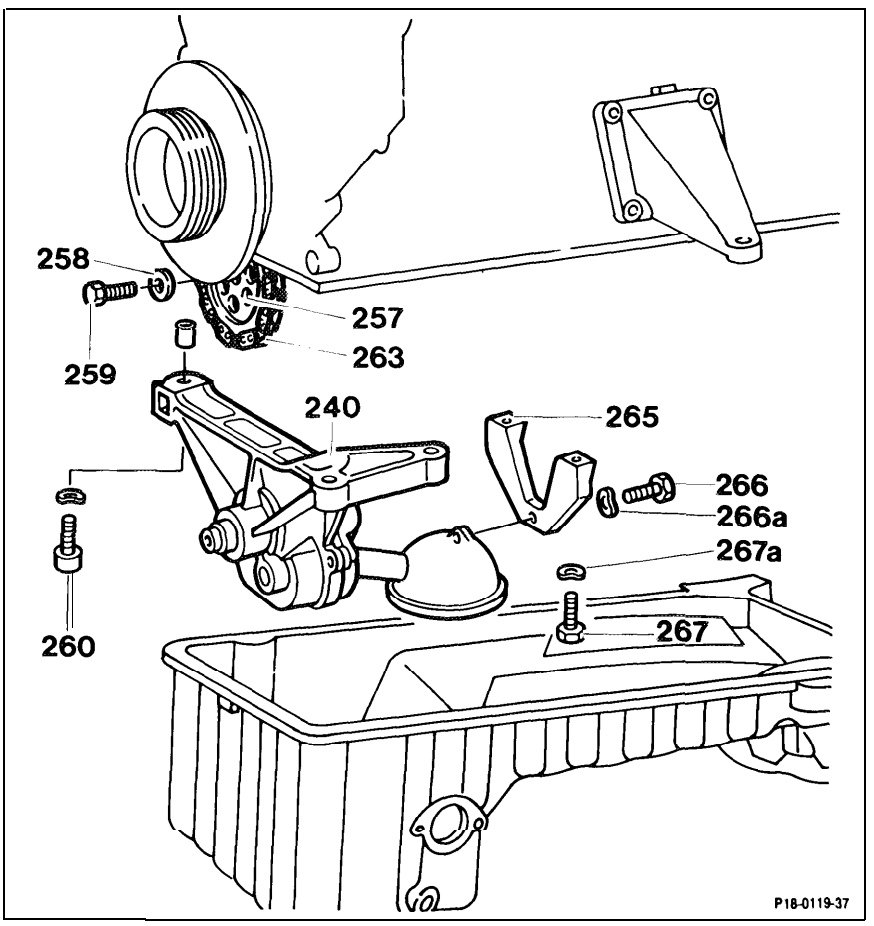
Production breakpoint: 07/87

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	–	013653	*	*
126.125	603.961	–	013409	*	*
201.126	602.911	046779	010562	*	*
201.128	602.961	–	001540	*	*

* not registered

18-210 Removal and installation of oil pump

Preceding work:
Oil sump removed (OI -310A).
Front axle housing removed (01-310B).



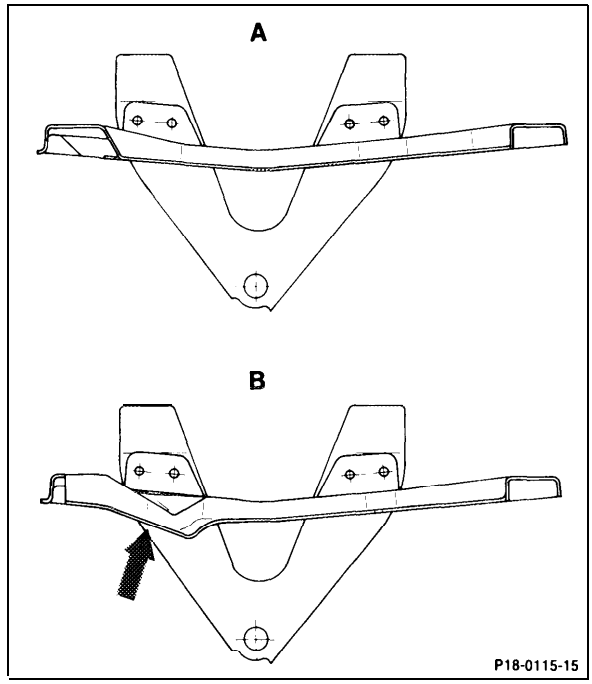
Engines 602 and 603

Support (265)	unbolt from oil pump pickup, screw on, hex. bolt (266, 267), 10 Nm.
Oil pump (240)	detach, attach, hex. socket screws (260), 25 Nm.

Notes

Modification to shape of oil deflector plate

The vibration properties have been improved by modifying the shape of the oil deflector plate (arrow).



A 1st version
B 2nd version

Production breakpoint:04/87

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
201.128	602.961	–	001144	*	*

* not registered

Production modification of oil pump chain

An oil pump chain with open sleeves is fitted to reduce wear.

Production breakpoint: 06/88

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
201.126	602.911	020788	005193		239528

* not registered

Oil pump, engine 603.96

Since 01 90 oil pumps with relief groove for preventing noise have been fitted to these engines.

Production breakpoint: 01/90

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	025426	025426	*	*

* not registered

Oil pump chain

Engines 602 and 603

Since 03/90 oil pump chains made by the manufacturer Daido have been installed.

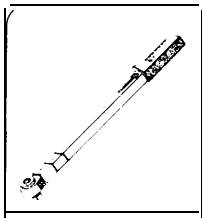
Production breakpoint: 03/90

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
124.128	602.962	002924	004724	*	*
124.133 124.193	603.960	–	026253	*	*
126.135	603.970	–	000070	*	*
201.126	602.911	089224	017337	*	*
201.128	602.961	001751	007791	*	*

* not registered

Tightening torques	Nm
Hex. bolt of sprocket wheel	25
Hex. socket screws of oil pump	25
Hex. bolts of intake manifold bracket (engine 602, 603)	25

Special tools



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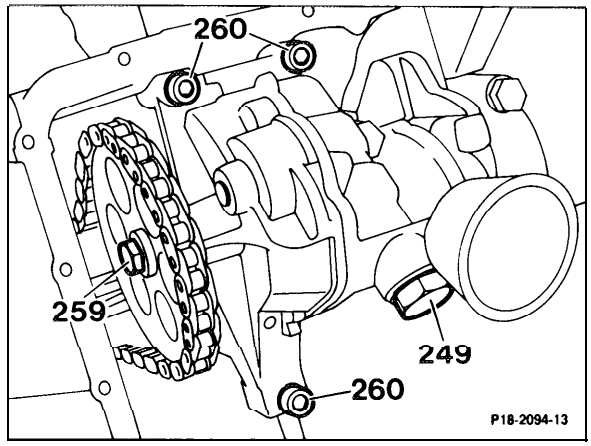
Removal and installation

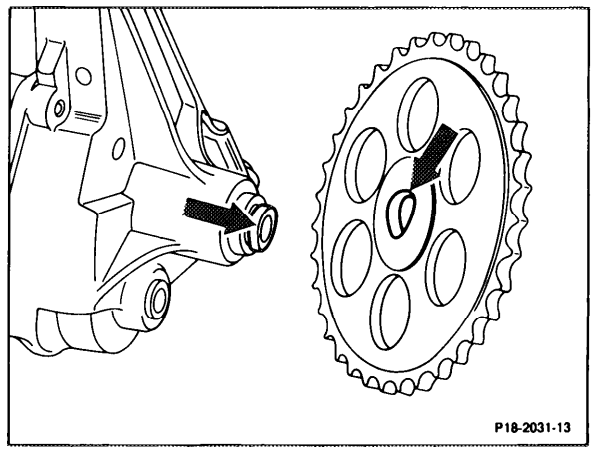
1 Unbolt hex. bolt (259) and remove sprocket wheel from chain.

Installation instruction
Tightening torque 25 Nm.



249 Oil overpressure valve screw plug
260 Hex. socket screws

Installation instruction
Tightening torque 25 Nm. Install sprocket wheel so that the curvature is facing the oil pump (arrows).



Engines 602 and 603

2 Unbolt hex. bolt (266) at the support (265) of the oil pump pickup.

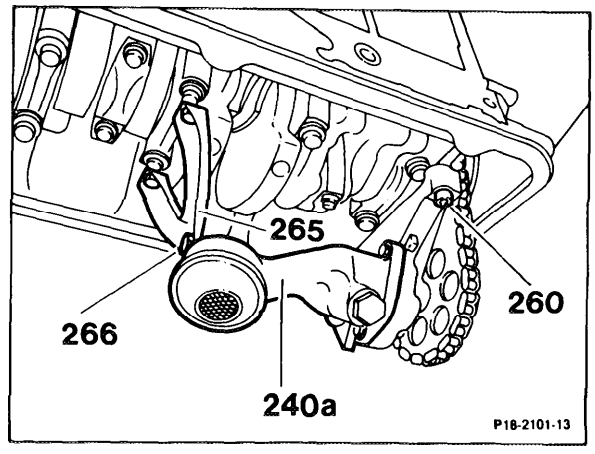
Installation instruction

Tightening torque 25 Nm.

3 Unscrew hex. socket screws (260) of the oil pump (240a) and remove oil pump.

Installation instruction

Tightening torque 25 Nm.

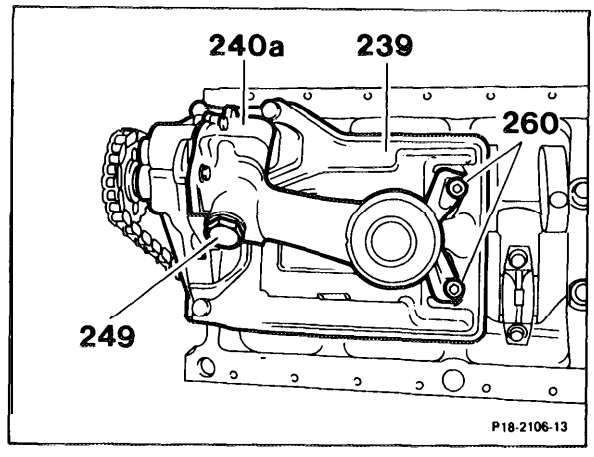


Engine 602.96 and 603.970

4 Unscrew other hex. socket screws (260) and remove oil deflector plate (239).

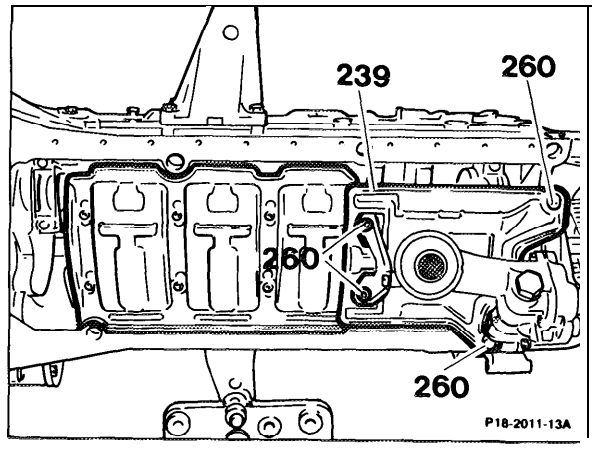
Installation instruction

Tightening torque 25 Nm.



Engine **602.96**
240a Oil pump
249 Oil overpressure valve screw plug

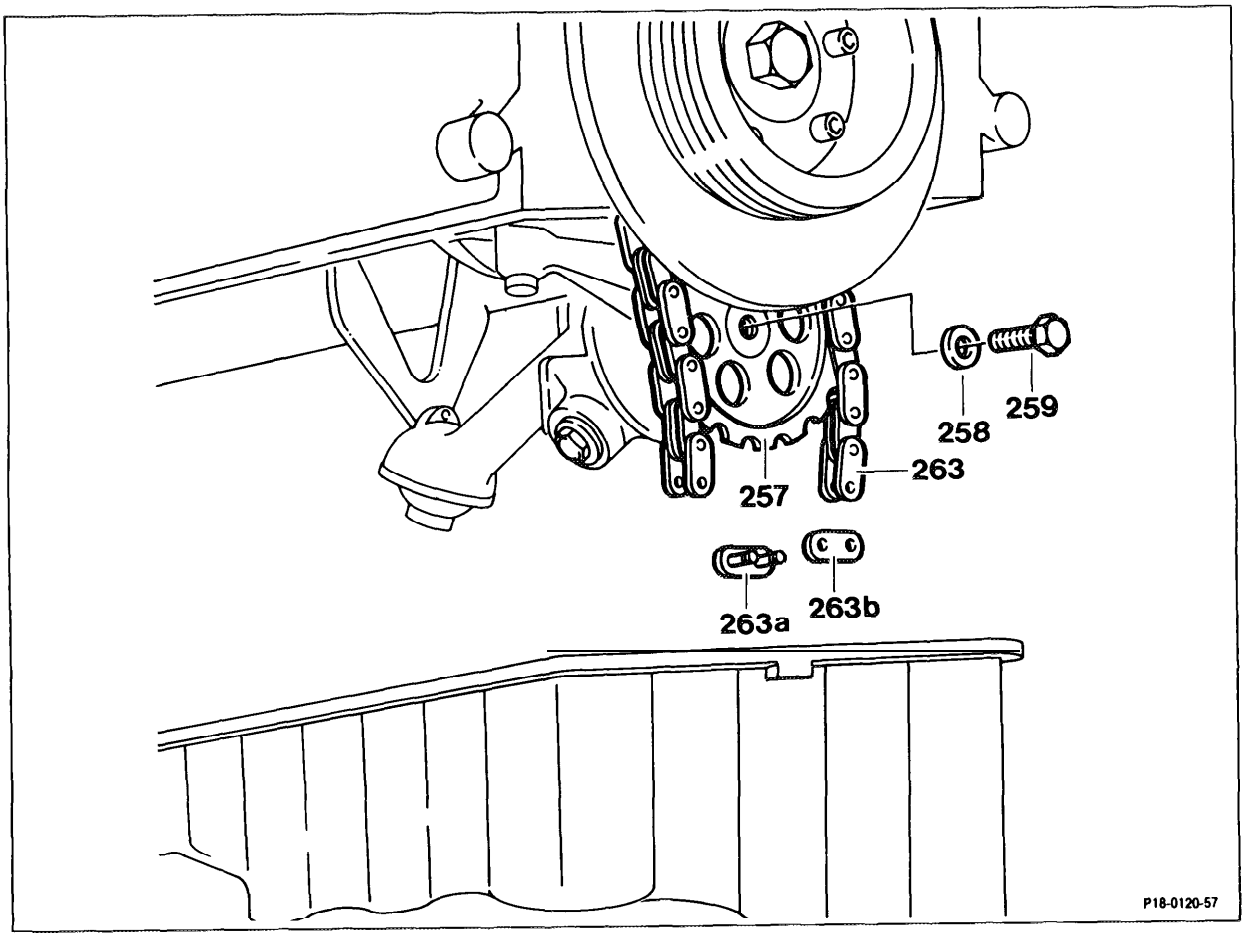
5 Installation is performed in the reverse order.



Engine **603.97**

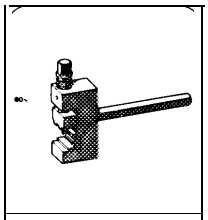
18-212 Replacement of oil pump chain

Preceding work:
Oil sump removed (01-310A).
Front axle housing removed (01-310B).



Bolt (259)	loosen, tighten, 25 Nm (step 1).
Rivet link pin	grind open (step 2).
Oil pump drive gear (257)	replace (steps 3, 4).
New oil pump chain to old oil pump chain	link, fit on (steps 5, 6).
Rivet link (263a)	insert from behind into oil pump chain (step 7).
Plate (263b)	insert into rivet tool, press on (steps 10 - 12).
Oil pump chain rivet link pins	rivet individually, approx. 30 Nm (step 14).

Special tools



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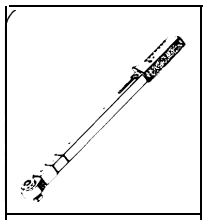

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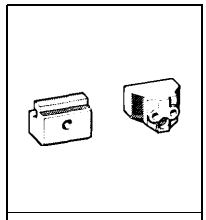

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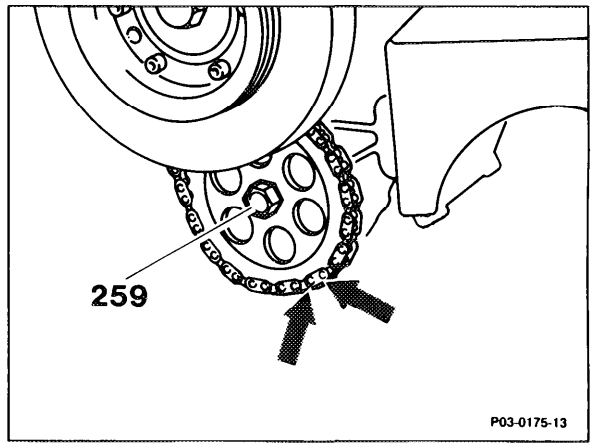
Removal and installation

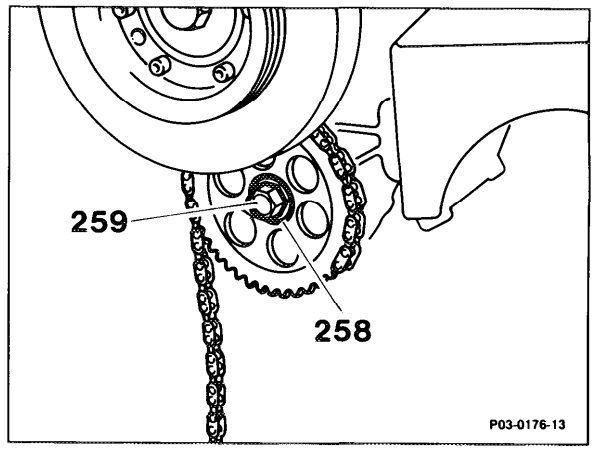
Note
The oil pump drive gear should be replaced together with the oil pump chain.

1 Loosen bolt (259). Tightening torque 25 Nm.

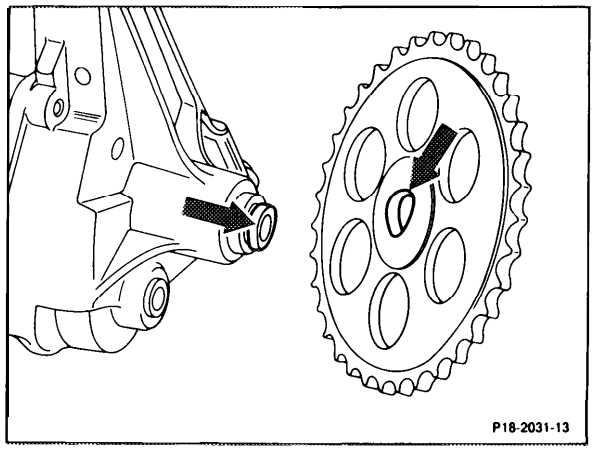
2 Grind open both rivet link pins (arrows) at **a double link** of the oil pump chain. Press out ground open double link.



3 Remove bolt (259) together with washer (258).



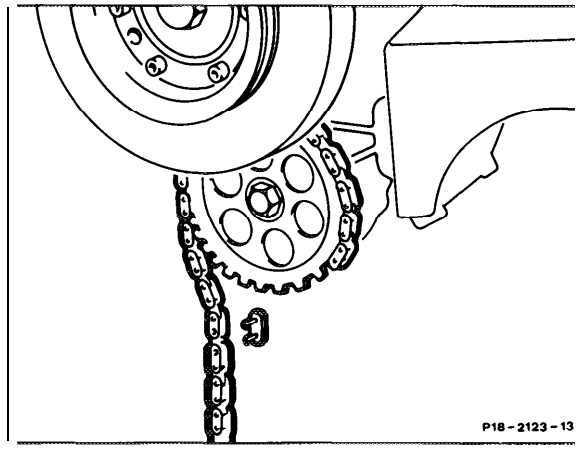
4 Insert new oil pump drive gear with the curved face pointing toward oil pump.



5 Attach new oil pump chain with rivet link to the old oil pump chain.

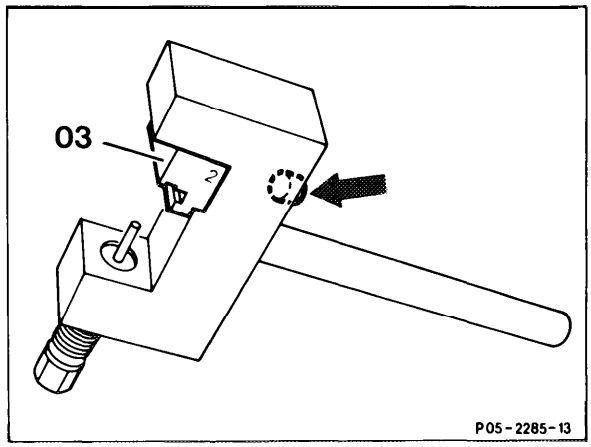
6 Fit on new oil pump chain linked to old oil pump chain by slowly turning the crankshaft in direction of rotation of engine.

7 Detach old oil pump chain. Insert rivet link from behind into the new oil pump chain.

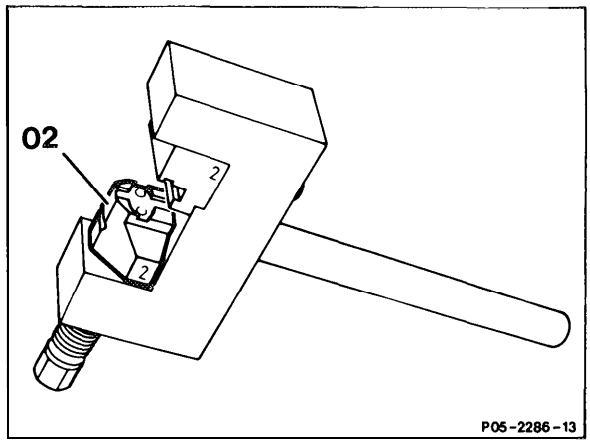


8 Insert thrust piece (03) into the riveting tool as shown in the drawing and tighten with the screw (arrow).

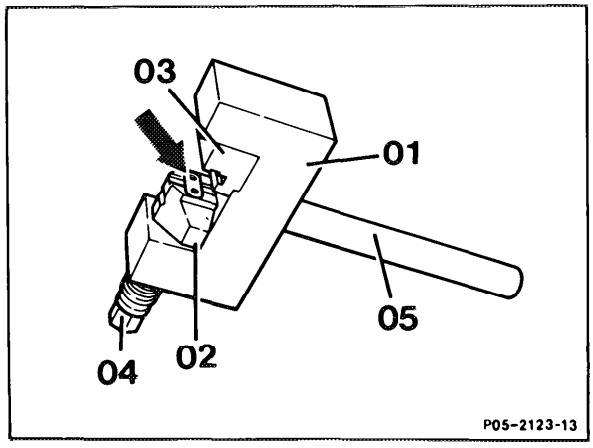
Note
The number 2 is stamped on the side of the thrust piece (03).



9 Insert moving jaw (02) with the figure 2 into the riveting tool as shown in drawing.

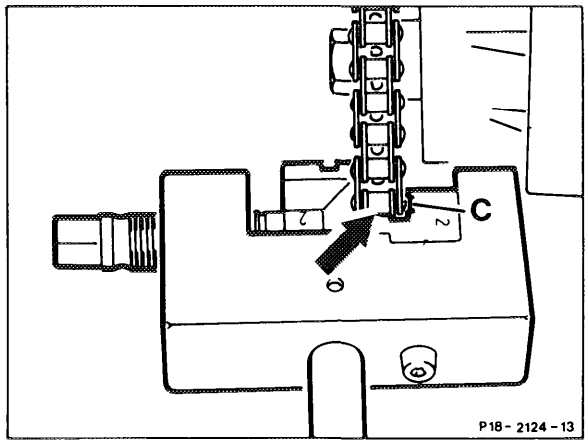


10 Insert plate (arrow) into the moving jaw (02) (magnetic adhesion).



11 Fit web (arrow) onto both rollers at rivet link.

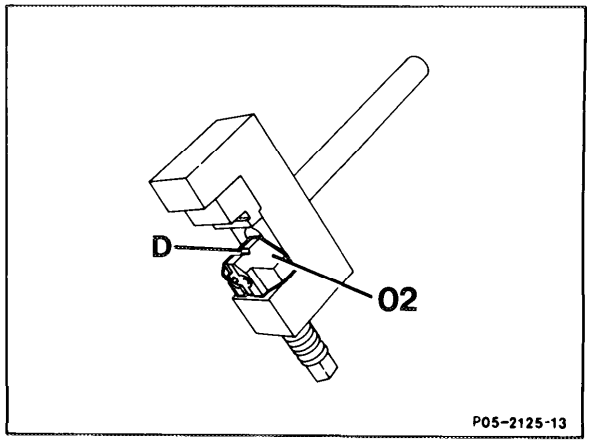
Note
The rivet heads of the rivet link pins must be guided into the groove (C).



12 Screw in spindle (04) until firm resistance is felt.

Note
During installation, ensure that the pins of the rivet link are guided into the holes of the plate.

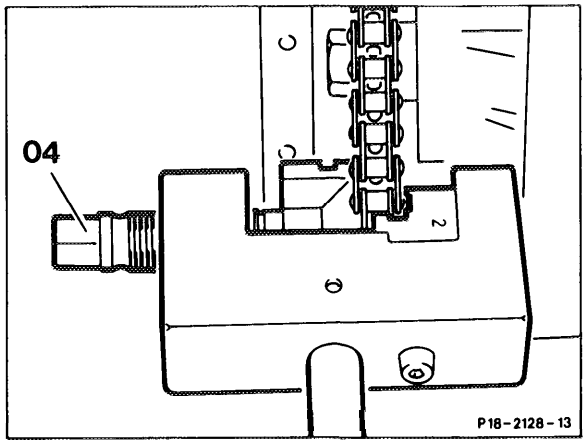
13 Remove riveting tool and switch over the moving jaw (02) to the riveting profile (D).



14 Position riveting tool exactly in center of rivet link pin.
Rivet pins of the rivet link individually by tightening the spindle (04) to approx. 30 Nm.

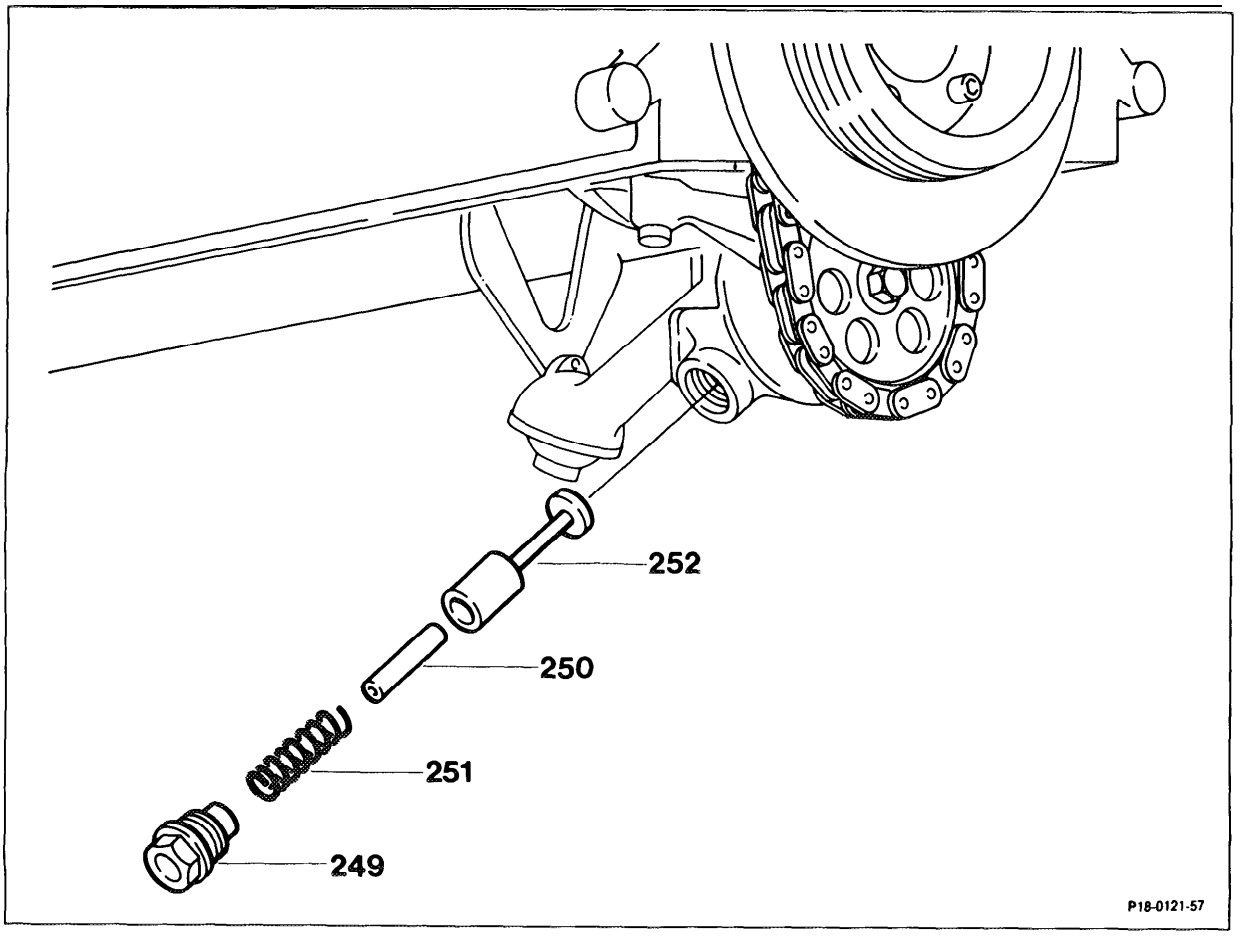
15 Check riveting; re-rivet, if necessary.

16 Install in reverse order.



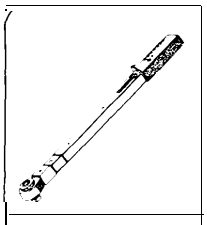
18-215 Removal and installation of oil pressure relief valve

Precedmg work:
Oil pan removed (01-310).



Screw plug (249)	**Caution!** The screw plug is spring-tensioned. Unbolt, install, 50 Nm. Replace seal.
Guide pin (250), compression spring (251) and piston (252)	remove, install.

Special tool



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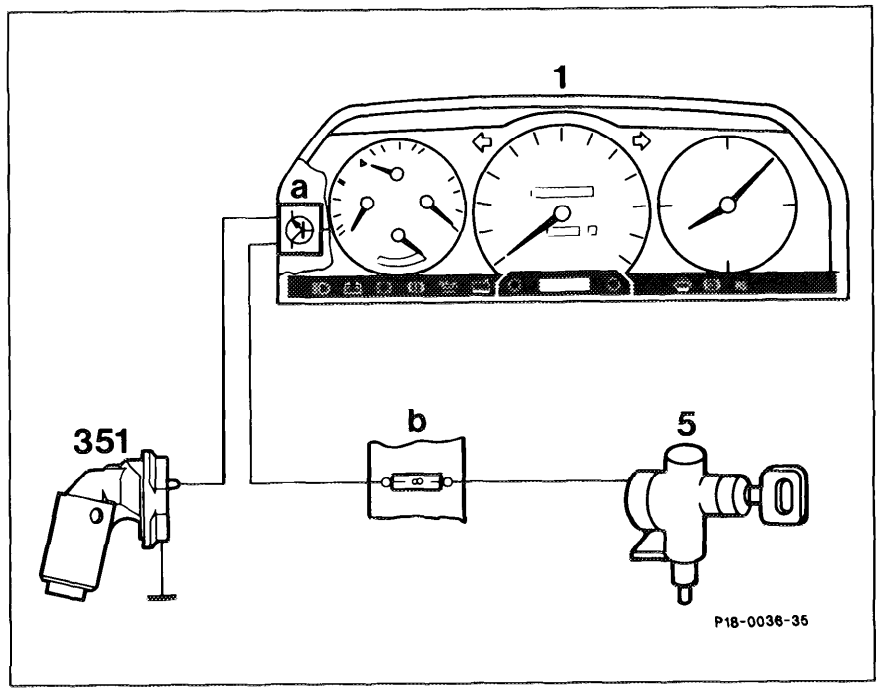
18-220 Testing oil level indicator



1 Instrument cluster
5 Ignition lock
351 Oil level sensor
a Electronics
b Fuse 8 A

Problems

A. Indicator lamp shows a steady light when engine running and oil level correct.

B. Indicator lamp does not light up when key is in position "2".

C. Indicator lamp does not light up when engine running, oil temperature > + 60 °C and oil level below "min".

Test data

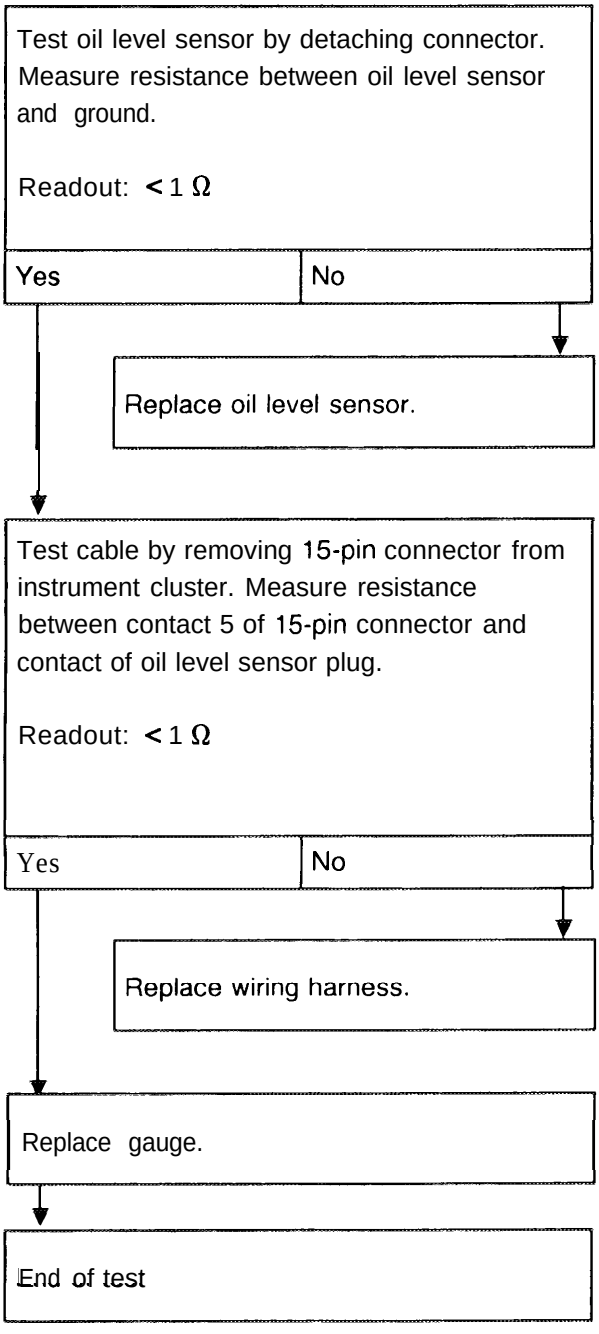
Resistance at max. oil level	< 1 Ω
Resistance at min. oil level	∞ Ω
Battery voltage	approx. 12 V

Commercial tool

Multimeter	e.g. Sun, DMM-5

Testing

A. Indicator lamp shows a steady light when engine running and oil level correct



B. Indicator lamp does not light up when key is in position "2" (check function)

Test operation of bulb.
Result: bulb functions properly.

Yes | No

No → Replace bulb.

Remove instrument cluster. Measure voltage with multimeter at contacts 6 and 9 of the 15-pin connector.

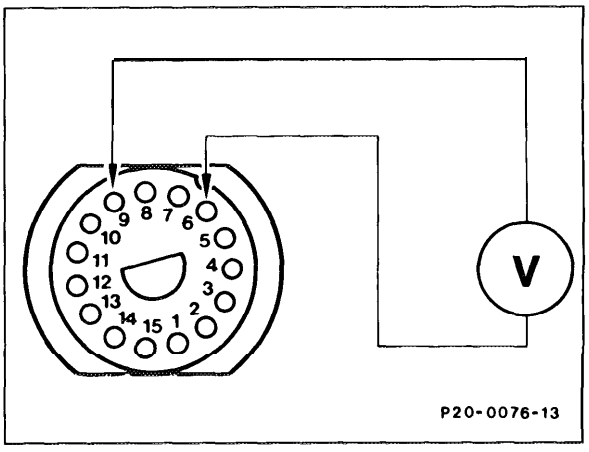
Readout: approx. 12 V

Yes | No

No → Replace wiring harness.

Replace gauge.

End of test



C. Indicator lamp does not light up when engine running, oil temperature > + 60 °C and oil level below "min"

Test operation of bulb.
Result: bulb functioning.

Yes	No

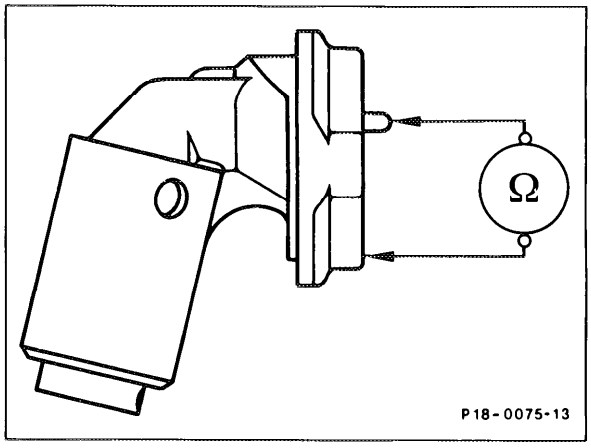
→ No: Replace bulb.

Test oil level sensor by detaching connector.
Test resistance between oil level sensor and ground.

Readout: ∞ Ω

Yes	No

→ No: Replace oil level sensor.

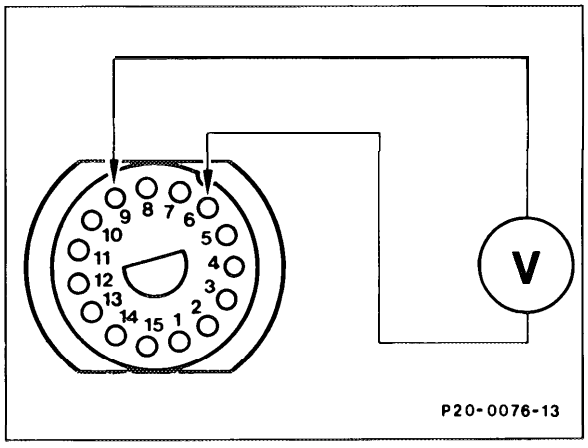


Test cable by detaching 15-pin connector from instrument cluster.
Measure voltage between contacts 6 and 9 of the 15-pin connector.

Readout: approx. 12 V

Yes	No

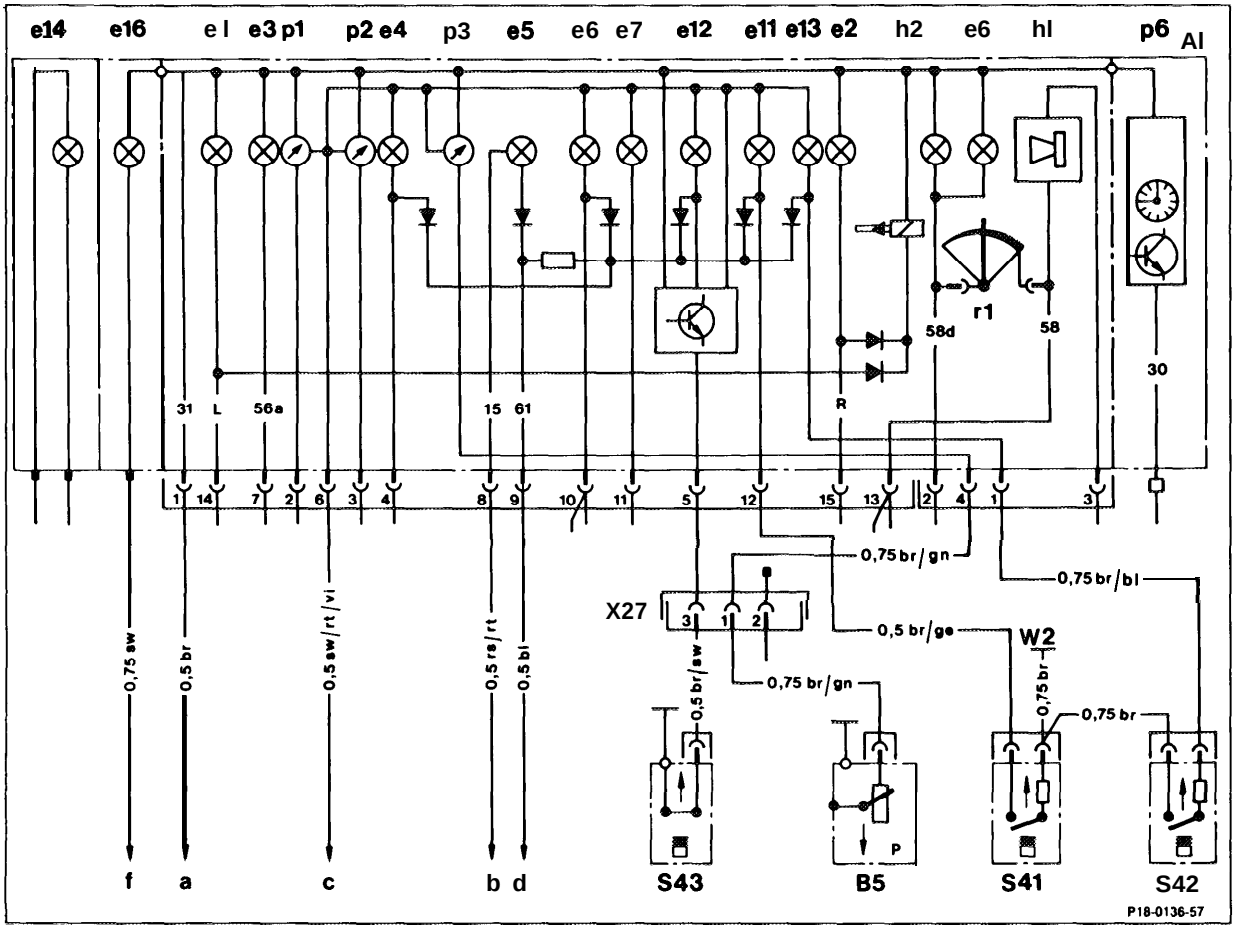
→ No: Replace wiring harness.



Replace gauge.

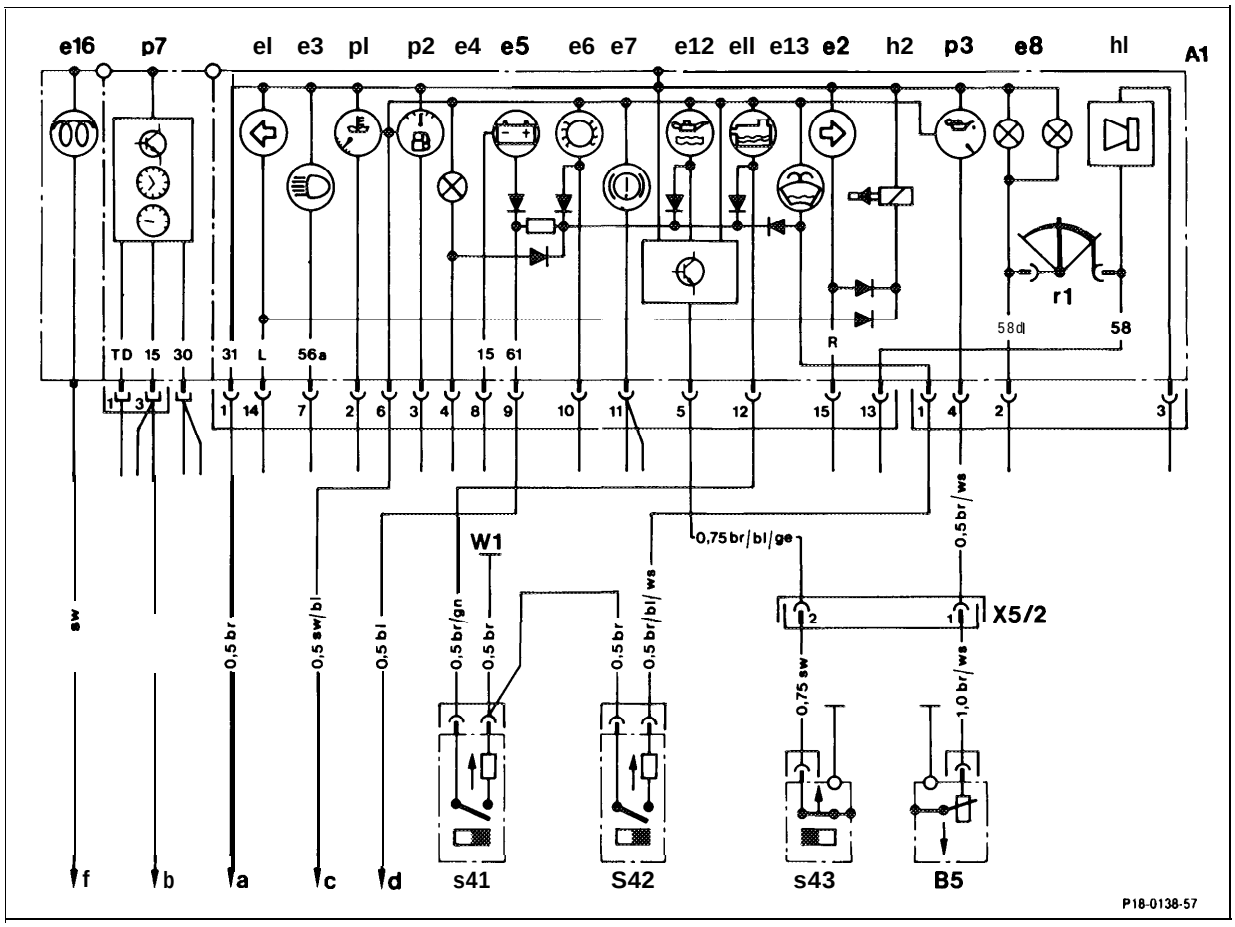
End of test

Model 124



Wiring diagram engine oil level indicator, coolant level indicator, windshield washer level indicator (see Wiring Diagrams Volume 3 and Volume 4 for further information)

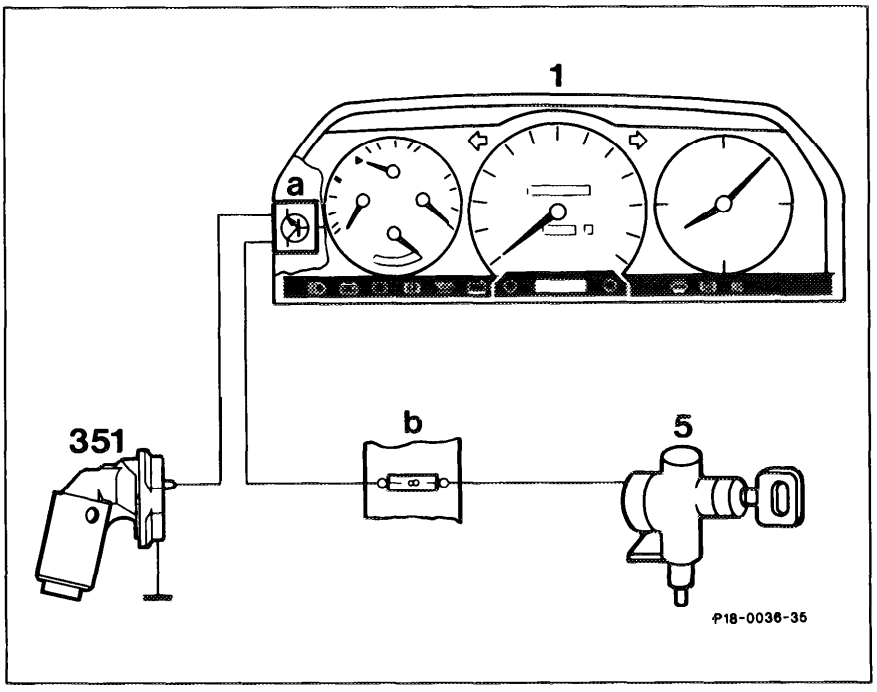
A l	Instrument cluster
e1	Left turn signal Indicator lamp
e2	Right turn signal rndrcator lamp
e3	High beam rndrcator lamp
e4	Fuel reserve warning lamp
e5	Battery charge rndrcator lamp
e6	Brake pad wear rndrcator lamp
e7	Brake fluid and parking brake indicator lamp
e8	Instrument lighting
e11	Coolant level rndrcator lamp
e12	Oil level Indicator lamp
e13	Windshield washer level indicator lamp
e14	Exterror lamp failure rndrcator lamp
e16	Preglow rndrcator lamp
h1	Warning buzzer
p1	Coolant temperature gauge
p2	Fuel gauge
p3	Oil pressure gauge
p6	Electronic clock
B5	Oil pressure gauge sensor
s41	Coolant level rndrcator lamp switch
S42	Windshield washer rndrcator lamp switch
s43	Oil level indicator lamp switch
w 2	Ground, front right (next to lamp unit)
X27	Connector, starter wiring harness
a	Main ground (behind instrument cluster) W1
b	Fuse 7 terminal 15
C	Fuse 5 terminal 15
d	Lamp rndrcator unit
	Preglow time relay terminal La



Wiring diagram engine oil level indicator, coolant level indicator, windshield washer level indicator (see Wiring Diagrams Volume 5 for further information)

A1	Instrument cluster
e1	Left turn signal indicator lamp
e2	Right turn signal indicator lamp
e3	High beam Indicator lamp
e4	Fuel reserve warning lamp
e5	Battery charge indicator lamp
e6	Brake pad wear indicator lamp
e7	Brake fluid and parking brake Indicator lamp
e8	Instrument lighting
e1f	Coolant level indicator lamp
e12	011 level indicator lamp
e13	Windshield washer level indicator lamp
e16	Preglow Indicator lamp
hl	Warning buzzer
h2	Audible turn signal indicator
P1	Coolant temperature gauge
P2	Fuel gauge
P3	Oil pressure gauge
p6	Electronic clock
B5	Oil pressure gauge sensor
s41	Coolant level indicator lamp switch
S42	Windscreen washer indicator lamp switch
s43	Oil level indicator lamp switch
W1	Main ground (behind Instrument cluster)
X5/2	Connector, Interior/starter 4-pole
a	Main ground (behind Instrument cluster) W1
b	Electrical center connector contact 15 terminal 15 unprotected
c	Electrical center connector D contact 2 terminal 15 fuse 8
d	Electrical center connector D contact 8 alternator terminal 61
	Preglow time relay

18-225 Function of oil level indicator



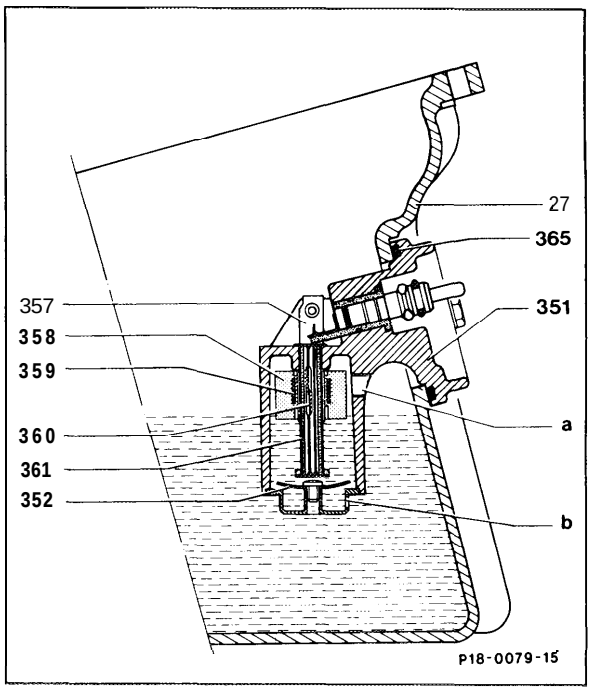
1 Instrument cluster
5 Ignition lock
351 Oil level sensor
a Electronics
b Fuse 8A

General

The electrical oil level indicator monitors the engine oil level in the sump when the engine is running and engine oil temperature is above + 60 °C. When the ignition is switched on, the indicator lamp lights up with a weak light (check function) and goes out as soon as the engine is started.

Oil level sensor

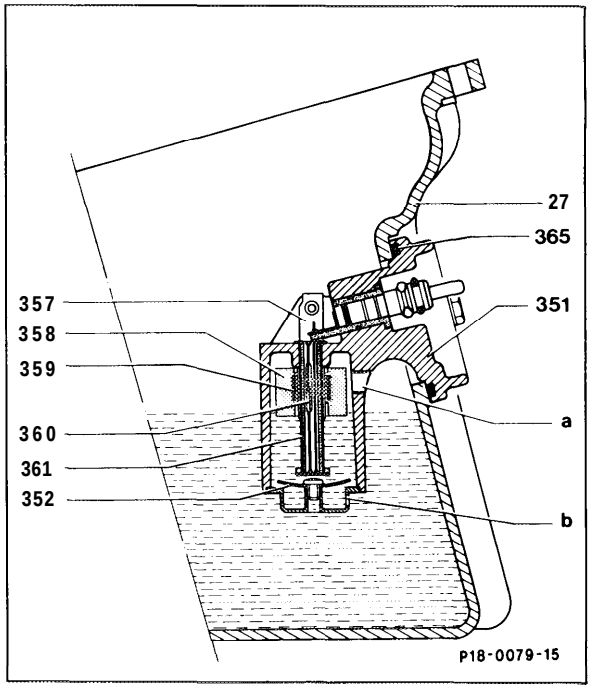
The engine oil level in the oil level sensor (351) is equalized to the oil level in the sump (27) through an outlet bore (b). The float (358) with permanent magnet (359) senses the actual engine oil level. The electronics in the instrument cluster sends a permanent signal to the oil level sensor. If the engine oil level is in the "Min" range of the dipstick, the Reed contact (360) of the float (358) is opened and the permanent signal to the oil level sensor interrupted. The indicator lamp lights up with a bright light (fault signal). The Reed contact (360) is interrupted shortly before the oil level has reached the "Min" marking on the dipstick. If the cable from the oil level sensor to the instrument cluster is interrupted, the permanent signal to the oil level sensor is also interrupted and the indicator lamp shows a bright light (fault signal).



352 Bimetal snap plate
365 O-ring
b Outlet bore **4** mm Ø

Avoiding incorrect readings

As the engine oil is viscous below a temperature of + 60 °C and only flows back to the sump slowly, this could result in incorrect signals of the indicator lamp. In this case, the bimetal snap plate (352) closes the outlet bore (b) and the float (358) only registers the oil level in the oil level sensor (351). This eliminates the possibility of an incorrect signal at low engine oil temperatures. Once the oil temperature climbs above + 60 °C, the bimetal snap plate opens and clears the outlet bore (b). Consequently, the float (358) senses the actual engine oil level in the sump (27). The bimetal snap plate closes at an engine oil temperature of approx. + 30 °C.



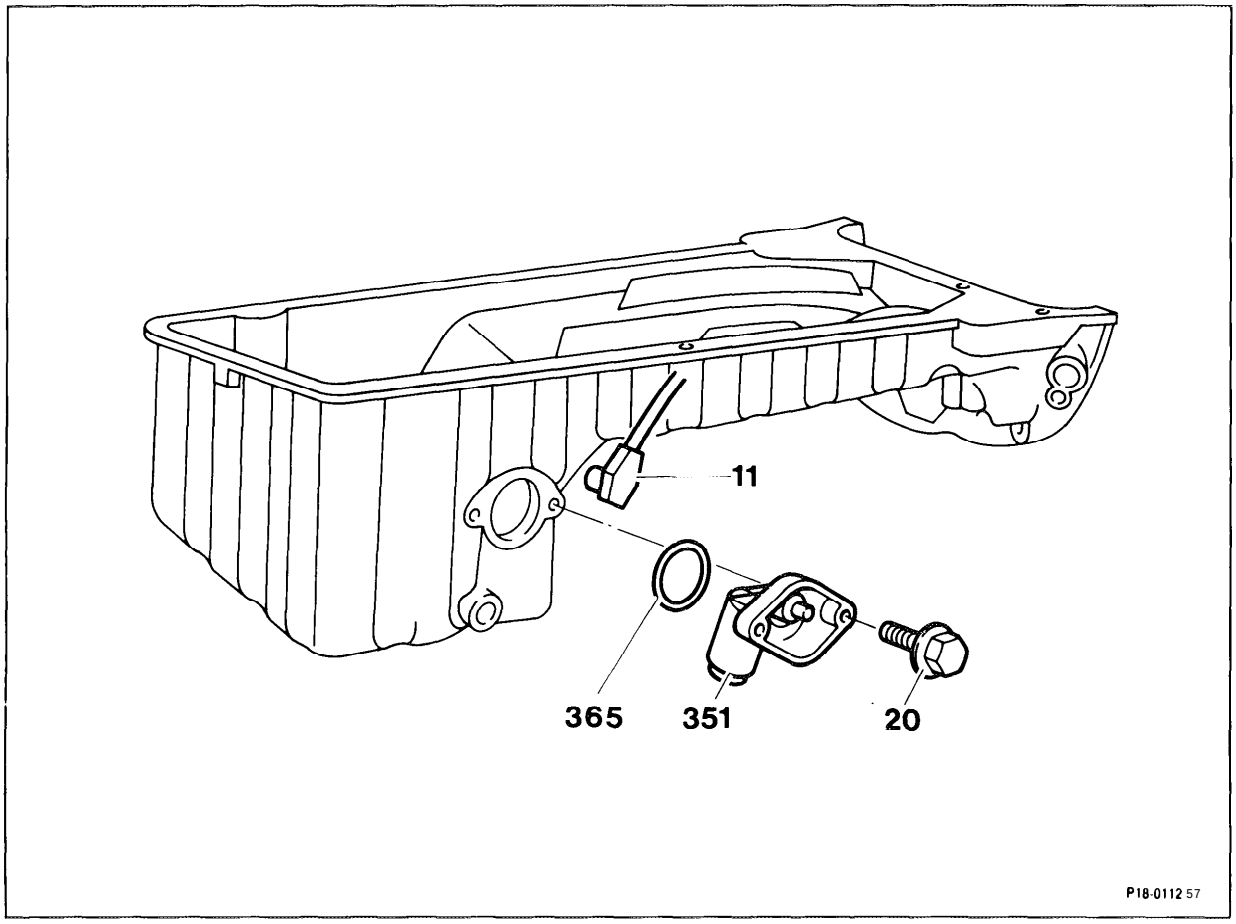
359 Permanent magnet
365 O-ring

If the engine oil is drained during an oil change, the oil also flows out of the oil level sensor. Because the fresh engine oil added is colder than + 60 °C, the bimetal snap plate closes the outlet bore (b) i.e. there is no engine oil in the oil level sensor and the indicator lamp would signal insufficient engine oil although the engine oil level is sufficient. In order to avoid this, the oil level sensor is filled through the vent bore (a). When driving through sharp corners, the engine oil is pushed against the outer walls of the oil pan. Particularly when negotiating left turns, the engine oil level around the oil level sensor drops and the sensor runs dry. The float (358) briefly interrupts the Reed contact (360) and the indicator lamp would show a bright light. The electronics in the instrument cluster prevent the indicator lamp from lighting up until after the Weed contact (360) has been interrupted for 60 s. This avoids any incorrect signal when negotiating sharp corners.

18-226 Removal and installation of oil level sensor

Preceding work:
Engine oil drained.
Engine compartment cladding bottom removed (01-006).

A. Engine 602,603



Plug	(11)	.....	for oil level sensor, disconnect, plug in.
Bolts	(20)	.....	unbolt, bolt in, 10 Nm. Remove and install oil level sensor (351). Replace O-ring (365).

Modifications

A larger diameter O-ring made of Viton is fitted for sealing the oil level sensor at the sump.
Color: green (previously black).
Diameter 3.15 mm (previously 3 mm).

Production breakpoint: 09/86

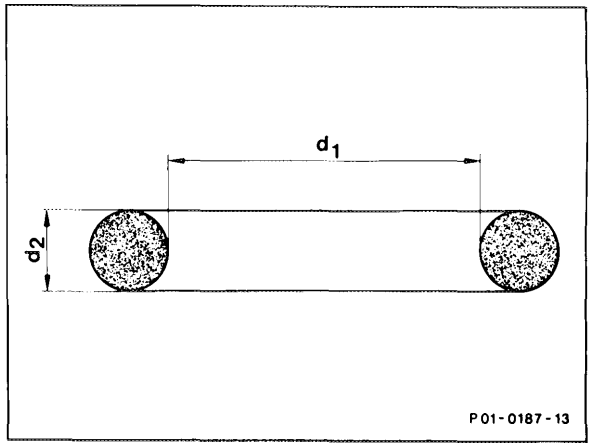
Model	Engine	Engine End No. manual transmission	Engine End No. automatic transmission	Vehicle Ident End No. A	Vehicle Ident End No. F
124.133 124.193	603.960	–	004393	*	*
126.125	603.961	–	005852	*	*
201.126	1602.911	**027261**	**006588**	*	*

* not registered

The seal of the oil level sensor at the sump has been improved by modifications in size of the O-ring.

New O-ring:

Size	Previous version mm	Present version mm
d_1	40,20	37,20
d_2	3,15	3,20



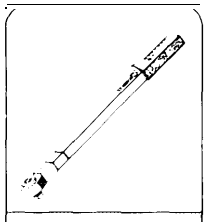
Production breakpoint: 06/87

Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	–	013429	*	*
126.125	603.961	–	013103	*	*
201.126	602.911	045501	010417	*	*
201.128	602.961	–	001553	*	*

* not registered

Tightening torques	Nm
Oil level sensor bolts	10

Special tool



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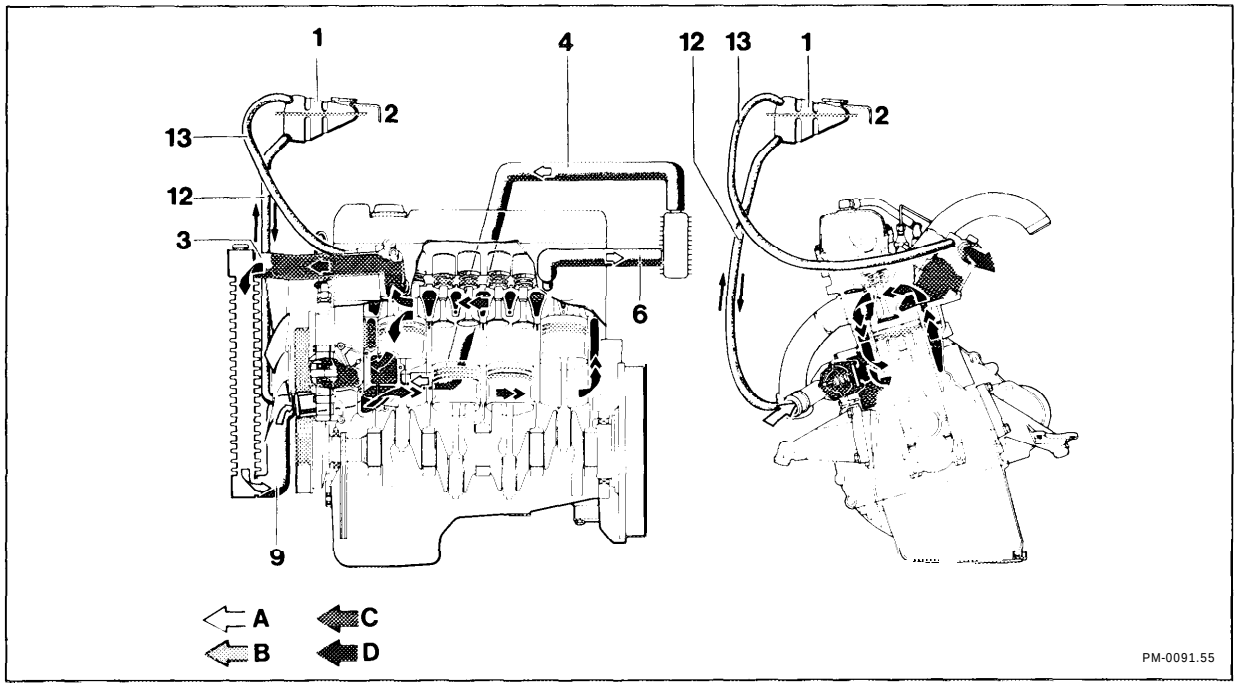
Job No.

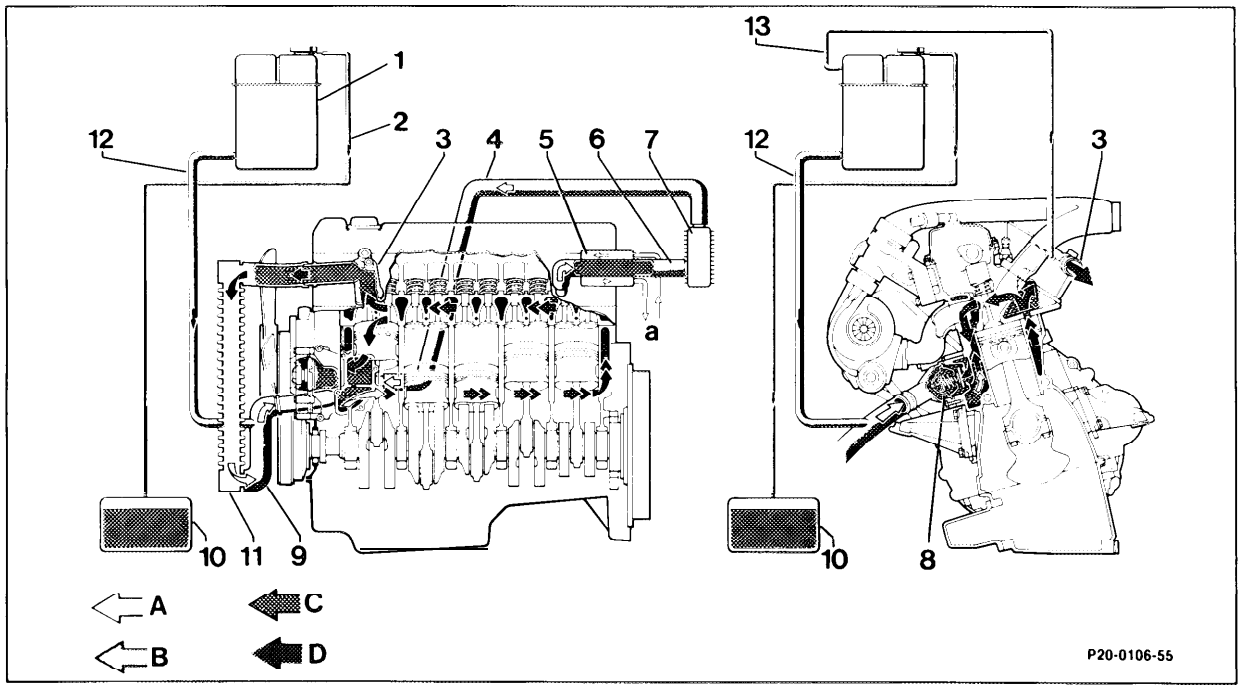
Coolant circuit and engine cooling	20 – 005
Engine coolant replacement - Antifreeze table	20 – 010
Cleaning and flushing cooling and heating system	20 – 015
Removing oil from cooling and heating system	20 – 016
Checking cooling system for leaks	20 – 017
Removal and installation of thermostat	20 – 110
Removal and installation of coolant pump	20 – 210
Notes on coolant pump	20 – 215
Removal and installation of coolant pump housing	20 – 230
Temperature-controlled viscous fan coupling	20 – 310
Removal and installation of viscous fan coupling	20 – 312
Magnetic fan coupling	20 – 330
Removal and installation of magnetic fan coupling	20 – 335
Removal and installation of radiator	20 – 420
Repairing radiator	20 – 425
Testing radiator or expansion tank cap	20 – 430
Testing coolant level indicator	20 – 440
Function of coolant level indicator	20 – 445
Removal and installation of overflow tank	20 – 450

Coolant circuit engine 602.91



1	Expansion tank	9	From radiator to coolant pump via thermostat
2	Overflow line	12	Filling hose
3	From cylinder head to radiator	13	Vent line
4	Return from heating system (heat exchanger)		
6	Feed to heating system (heat exchanger)	A.	Radiator circuit above 100 °C
		B.	Bypass circuit up to 85 °C
		C.	Cool water
		D.	Heating

Coolant circuit engine 602.96, 603.96



1	Expansion tank	9	From radiator to coolant pump via thermostat
2	Overflow line	10	Overflow tank (engine 603.96)
3	From cylinder head to radiator	11	Radiator
4	Return from heating system (heat exchanger)	12	Filling hose
5	Fuel heat exchanger	13	Vent line
6	Feed to heating system (heat exchanger)		
7	Heat exchanger	A.	Radiator circuit above 100 °C
8	Thermostat	B.	Bypass circuit up to 85 °C
		C.	Cooled water
		D.	Heating

Note

Engine 603.96 has an overflow tank (10) in addition to the expansion tank. The overflow tank is installed in the wheelhouse of the right front fender.

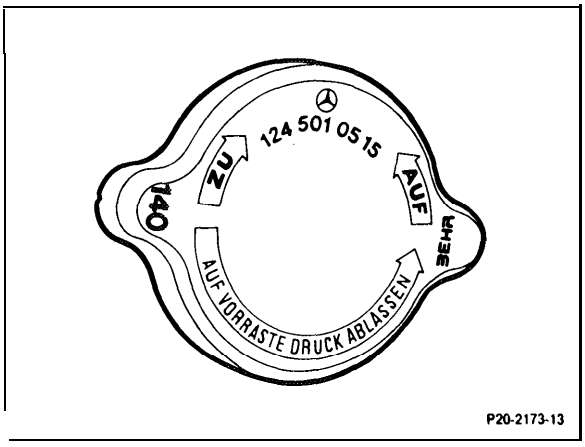
Function of overflow tank

The overflow tank protects the engine from loss of coolant at high outside temperatures. Coolant may flow out along the overflow line after shutting off the engine at high outside temperatures.

The coolant overflow is collected in the overflow tank.

After the engine and the coolant has cooled down, a vacuum is produced in the cooling system which causes the coolant which has flowed into the overflow tank to flow back into the expansion tank.

To enable the vacuum to build up after cooling down, the cap of the expansion tank must provide a tight seal.
The cap (1.4 bar) is fitted with a rubber seal for this purpose.



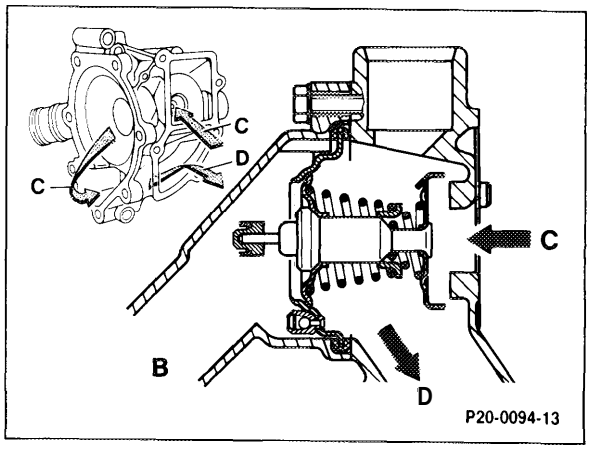
Function of coolant thermostat

Engine	Start of opening °C	Fully open °C
602	85 ± 2	100
602.96, 603.96	80 ± 2	94

Note
The function of the coolant thermostat is outlined in the description below, using, as an example, a naturally aspirated engine.

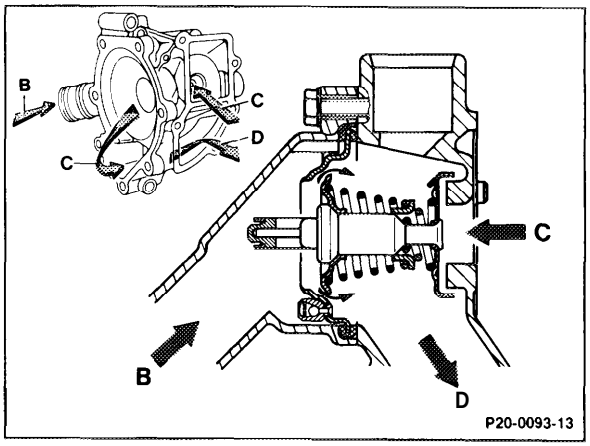
Warm-up period – coolant temperature up to approx. 85 °C
Up to a coolant temperature of approx. 85 °C the main valve is closed and the bypass plate is fully open. The flow (B) from the radiator is thus interrupted. The coolant flows through the bypass passage (C) directly through the coolant pump into the crankcase (D).

C From crankcase (bypass passage)
D To crankcase



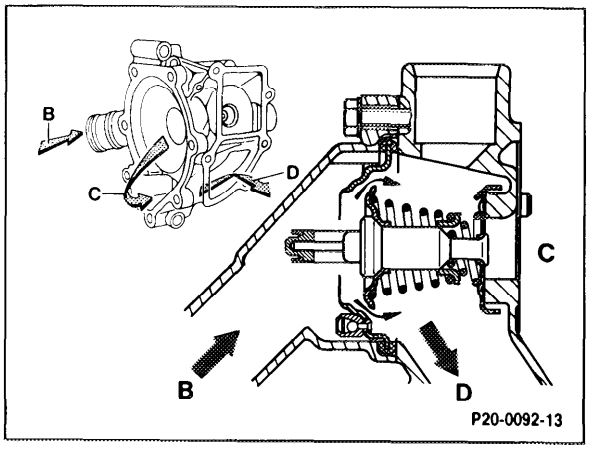
Part-load operation – coolant temperature approx. 85 °C up to maximum 100 °C
At coolant temperatures above approximately 85 – 100 ° C the main valve and bypass plate are mostly open, depending on engine load. The coolant flows from the radiator (B) through the bypass passage (C) through the coolant pump into the crankcase (D).

B From radiator
C From crankcase (bypass passage)
D To crankcase



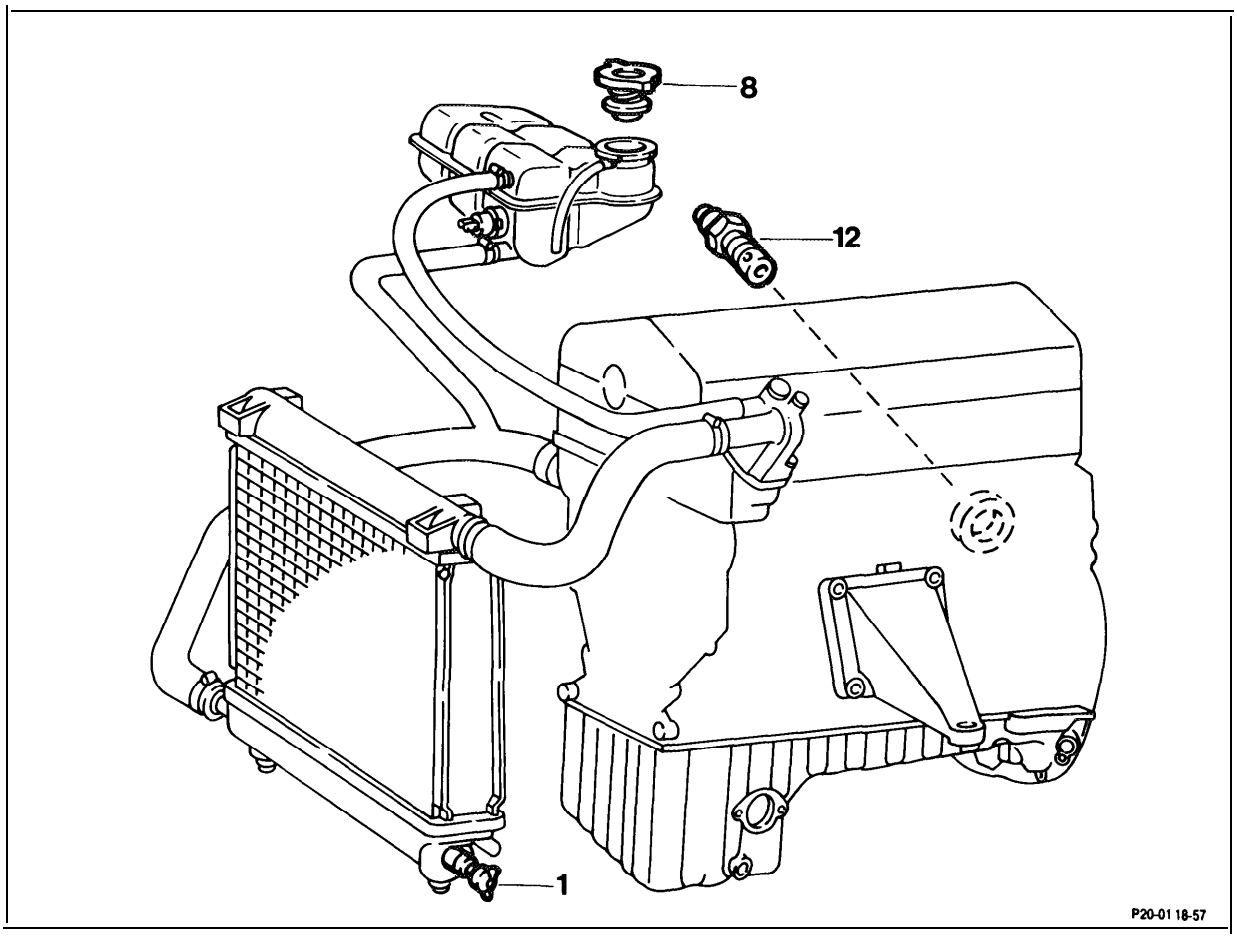
Full-load operation – high outside temperature (coolant at above 100 °C)
At coolant temperatures above approx. 100 °C the main valve is fully open. The bypass passage (C) is sealed off by the bypass plate. The entire quantity of coolant flows through the radiator.

The cooling system is automatically bled through a ball valve in the coolant thermostat when it is filled during engine operation.



20-010 Engine coolant replacement - Antifreeze table

Preceding work:
Engine compartment covering bottom removed (01-006).



Heater switch	set to maximum heating capacity.
Cap(8)	remove, refit.
	⚠ Warning Open cap only when coolant temperature is below 90 °C.
Drain plug (1)	open, close, 1.5 - 2 Nm, drain coolant (step 2).
Drain plug (12) and drain connection	open, close, 30 Nm, drain coolant (steps 3, 4).
Old coolant	flush out.
Coolant	pour in up to marking on expansion tank (10) (step 6).
Engine	run until coolant thermostat opens, approx. 90 - 100 °C (step 7).
Coolant level	check (step 8).
Cooling system	check for leaks (20-017).

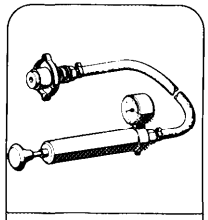
Total capacities of cooling system with heating system and mixing ratio of anti-corrosion/antifreeze agent[1]) and water[2]) in liters

Model	Engine	Total capacity of cooling system with heating system	Mixing ratio anti-corrosion/antifreeze agent/water for antifreeze prot. down to -30 °C	-45 °C
124	602.96	8	3.5/4.5	4.513.5
124, 126	603.96/97	10	4.5/5.5	5.5/4.5
201	602.911, 602.96	8	3.5/4.5	*4.5i3.5*

[1]) See Service Product Specifications sheet 325.1 and 325.2
[2]) See Service Product Specifications sheet 310

Tightening torques	Nm
Radiator drain plug	1.5 - 2
Crankcase drain plug	30
Drain connection (engine 602 and 603 only)	30

Special tools



124 589 15 21 00
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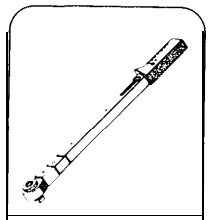

001 589 72 21 00
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Commercial tool

Antifreeze protection tester Prestone-W-Check (Union Carbide)	e.g.	Ph. Gather, 4020 Mettmann

Notes, see VOI Environmental Protection Catalog

Water

Use water which is clean and not too hard. Usually drinking water satisfies these requirements. The content of dissolved substances in the water may result in corrosion.

Anti-corrosion/antifreeze protection

The anti-corrosion/antifreeze agent must perform the following tasks:

- Adequate corrosion and cavitation protection for all components
- Antifreeze protection
- Provides increased boiling point

50% by vol. anti-corrosion/antifreeze agent must be added to the water. This concentration offers antifreeze protection down to approx. -37 °C. A higher concentration is only recommended for very low ambient temperatures.

More than 55% by vol. anti-corrosion/antifreeze agent reduces the antifreeze protection and reduces the heating capacity.

55% by vol. anti-corrosion/antifreeze agent offers antifreeze protection down to approx. -45 ° C. Anti- corrosion/antifreeze agent increases the boiling point, in other words the coolant does not evaporate so rapidly. This avoids coolant being lost at high coolant temperatures.

Use only approved anti-corrosion/antifreeze agents (see Service Product Specifications sheets 325.1 and 325.2).

Operational monitoring of coolant
Check the coolant for resistance to low temperatures at the start of the cold season of the year. Check anti- corrosion/antifreeze agent concentration once a year in areas with high outside temperatures.

When adding coolant (after loss of coolant), it must be assured that there is an anti-corrosion/ antifreeze agent portion of 50% by vol. in the coolant to provide antifreeze protection down to -37 °C.

The anti-corrosion protection in the coolant is reduced over the period of operation. The coolant then has a sharply corrosive effect. The maximum permissible period of use of the specified coolant in car engines is 3 years. Before adding fresh coolant, the used coolant should be first flushed out of the system.

Draining

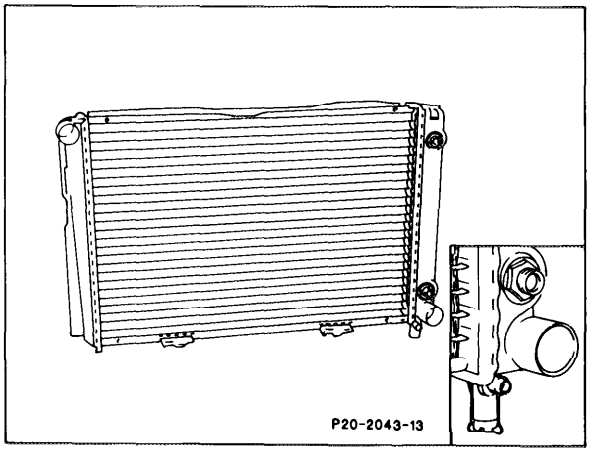
1 Set heating switch to maximum heating capacity.

2 Open cap on expansion tank in stages, allow system pressure to escape and remove cap.
⚠ **Warning**
Open cap only when coolant temperature is below 90 °C.

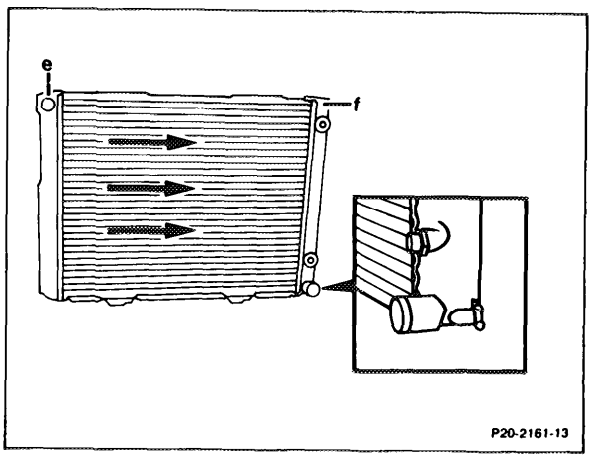
3 Open drain plug on the radiator.

Note
An extension hose can be fitted to the drain connection for collecting coolant.

Installation instruction
Tightening torque 1.5 – 2 Nm.

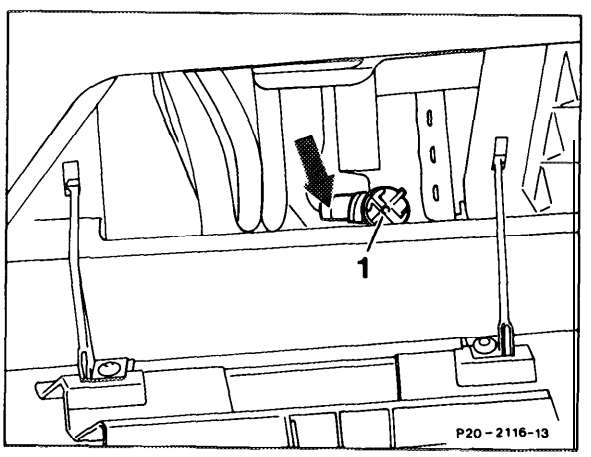


Drain plug on models without air conditioning



Drain plug on models with air conditioning

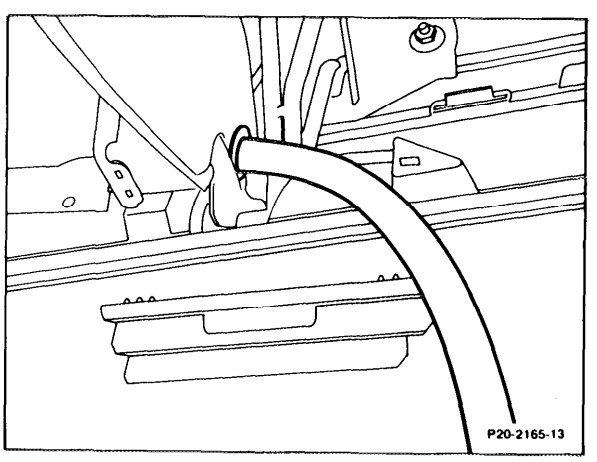
On models with air conditioning, open flap for towing lug at front right of lower bumper molding.



1 Drarn plug on models with air conditioning

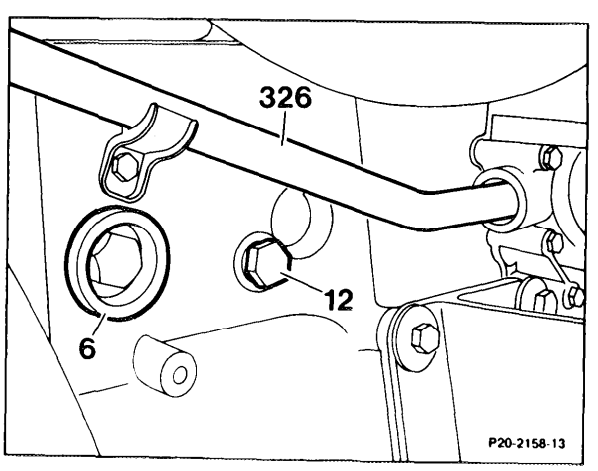
Note

On models with air conditioning, the plug below the right side wheelhouse at the noise encapsulation should be removed. An extension hose can be fitted onto the drain connection of the radiator through this opening.



Extension hose fitted on (with air conditioning)

4 Unscrew drain plug (12) on crankcase.

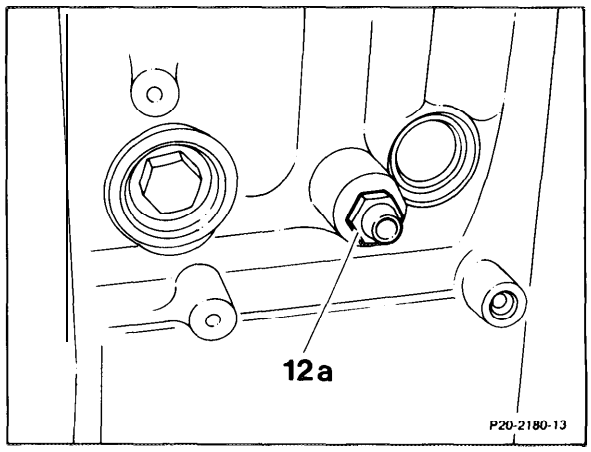


Installation instruction

Tightening torque 30 Nm.

Note
Engines 602 and 603 have a drain connection (12a) in place of the drain plug. A hose can be fitted onto this drain connection for draining.

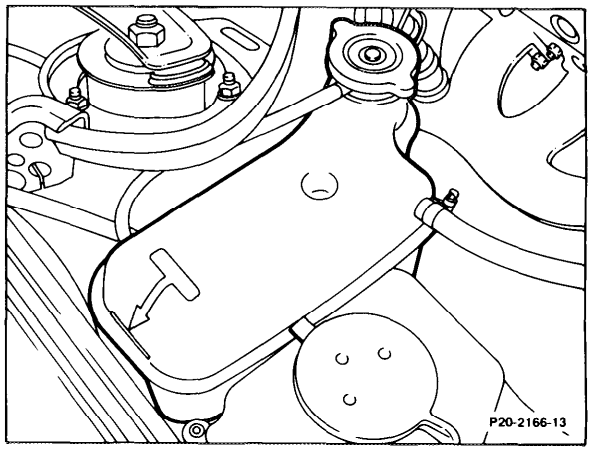
Installation instruction
Tightening torque 30 Nm.



Filling in coolant

5 Flush out old coolant.

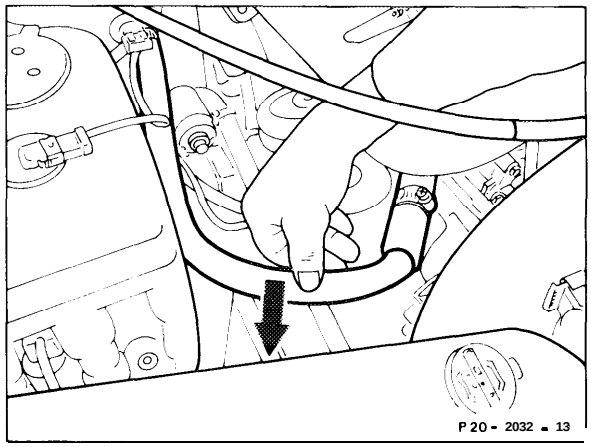
6 Slowly pour in coolant up to the marking (arrow) on the expansion tank.



Marking on expansion tank

Note
The filler hose can be pressed down (arrow) when adding coolant to ensure that it flows more quickly from the expansion tank into the radiator and engine.

7 Run engine until the coolant thermostat opens (coolant temperature approx. 90 – 100 °C).



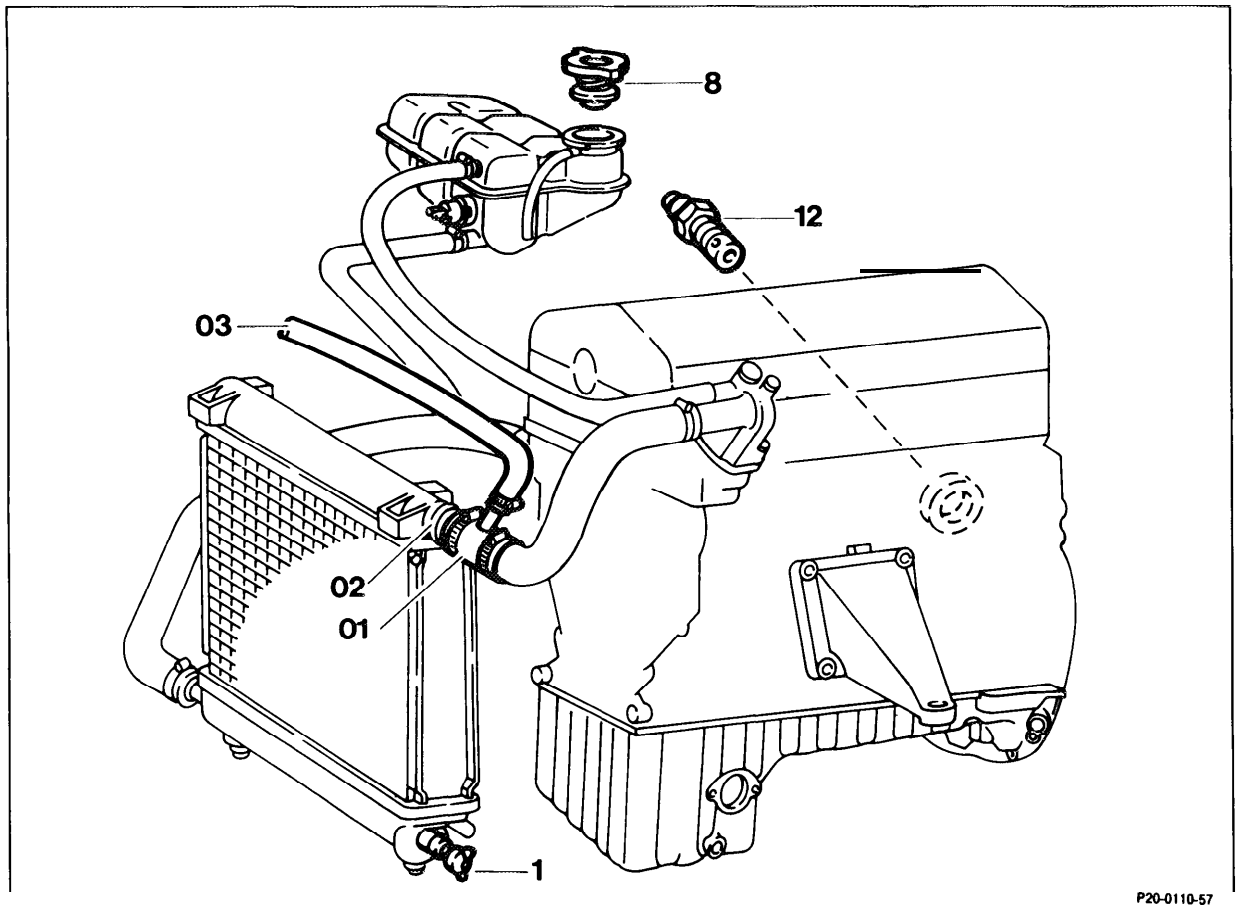
Note
Close filler connection at expansion tank from a coolant temperature of approx. 60 – 70 °C.

8 Check coolant level; top off to specified marking, if necessary.

9 Check cooling system for leaks (20-017).

20-015 Cleaning and flushing cooling and heating system

Preceding work:
Engine compartment covering bottom removed (01-006).
Coolant drained (20-010).

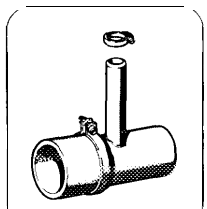


Coolant thermostat	remove and install forcibly-opened thermostat Part No. 000 589 74 63 00 (step 1).
Flushing connection pipe (01)	install and connect tap water hose (03) (steps 2 and 3).
Cooling system	flush (step 4 – 20, 22).
Cooling system expansion tank	remove and install, flush out (step 21).
Cooling system	check for leaks (20-017).

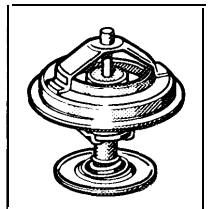
Service products

Anti-corrosion/antifreeze agent	000 989 08 25
Citric acid powder (0.5 kg)	000 989 10 25

Special tools



117 589 20 90 00



000 589 74 63 00
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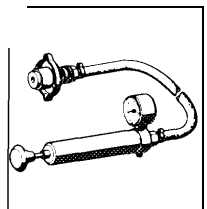

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Notes

High coolant temperatures and low heating capacity may also be caused by deposits of corrosion products in the radiator and in the heat exchanger.

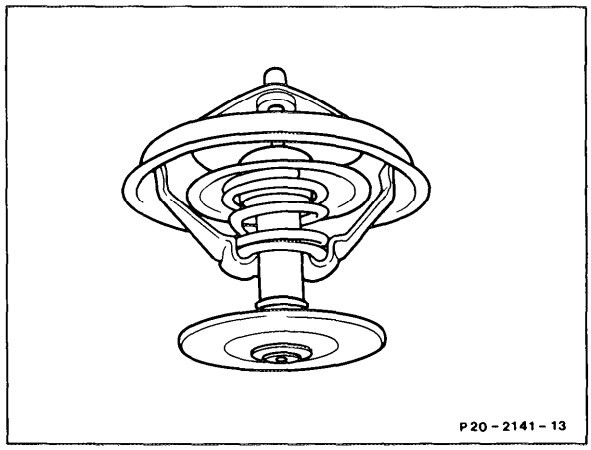
The deposits are recognizable as a jelly-like mass or, when the radiator is empty and dry, from a grey layer on the cooler connection pipes.

In this case, the cooling and heating system can be cleaned with a 10% citric acid solution.

Radiators which have cooling pipes which are fully or partially clogged, must be replaced.

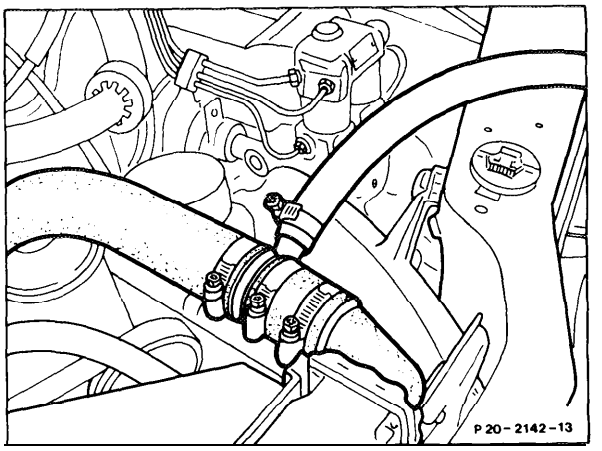
Scope of flushing operation

1 Remove coolant thermostat and install forcibly-opened thermostat 000 589 74 63 00 with sealing ring.



P 20 - 2141 - 13

2 Connect flushing connection pipe Part No. 117 589 00 90 00 with connection hose between radiator and coolant hose.



3 Connect a tap water hose to the flushing connection pipe.

4 Open cap of expansion tank.

5 Set heater to “warm”.

Models with auxiliary heater

6 If automatic heating control is fitted, set the temperature selectors to “Max” or, if automatic climate control is fitted, press the “Defrost” button so that the circulation pump is switched on when the engine is running.

7 Open bleeder valve of the auxiliary heater.

8 Flush cooling and heating system with flowing water for approx. 5 minutes with the engine running (approx. 2500 rpm) so that the remaining coolant is flushed out.

Caution!

During the flushing operation, the cooling system must always be completely filled. Adjust feed quantity accordingly.

9 Allow flushing water in the radiator and crankcase to completely drain out. Screw in drain plugs at radiator and crankcase.

10 Dissolve 15 kg citric acid powder (0.5 kg, Part No. 000 989 16 25) in 5 liters of water in a suitable vessel.

11 Pour cleaning solution into the coolant expansion tank and top off with water as far as the marking on the expansion tank.

12 Close bleeder screw of auxiliary heater.

13 Close cap of expansion tank.

14 Run engine for 15 minutes at approx. 2500 rpm. The solution must flow through the heat exchanger (step 5).

15 Following this, drain cleaning solution.

Caution!
Empty the cleaning solution (citric acid mixture) into a standard workshop oil and water separator.

16 Open the bleeder screw of the auxiliary heater.

17 Flush cooling and heating system for approx. 10 minutes with flowing water with engine running (2500 rpm). The water must flow through the heat exchanger (see steps 5 and 8).

18 Remove flushing connection pipe and connect coolant hose to the radiator.

19 Install normal coolant thermostat with new seal.

20 Screw coolant drain plugs into radiator and crankcase.

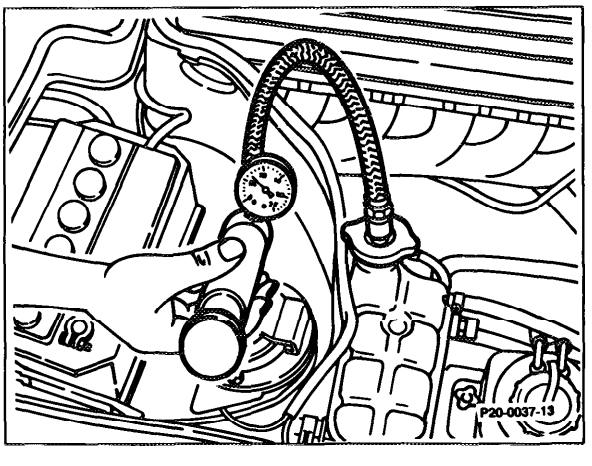
21 Remove coolant expansion tank, flush out once again separately, and install.

Note
The cleaning solution is not completely removed when drained because of pockets or recesses in the coolant expansion tank.

22 If car fitted with auxiliary heater, connect plastic hose to bleeder valve and open valve.

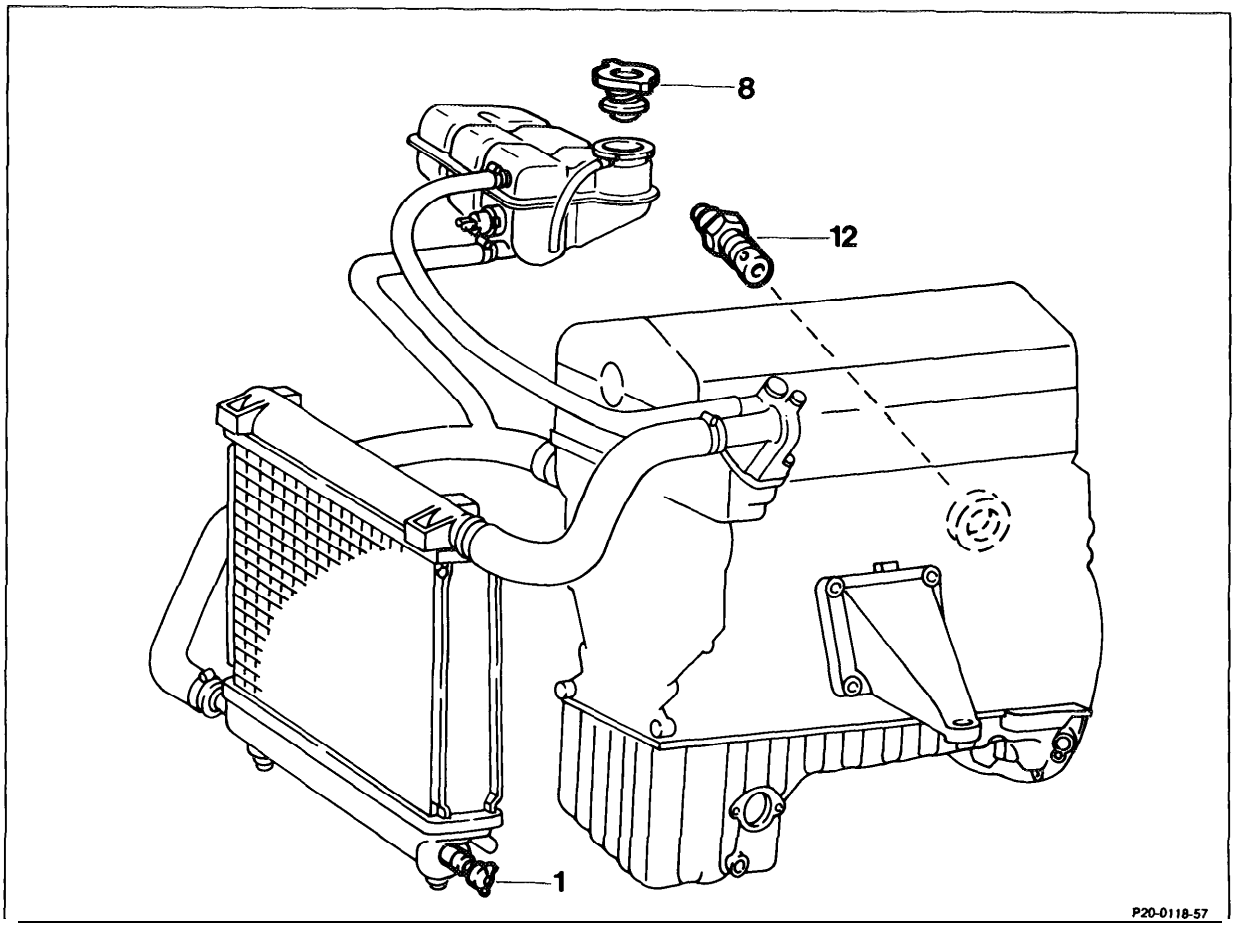
23 Add fresh coolant (20-010).

24 Check cooling system for leaks (20-017).



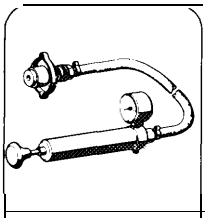
20-016 Removing oil from cooling and heating system

Preceding work:
Coolant drained (20-010).
Coolant thermostat removed (20-l 10).



Heater control	set to “warm” (step 1).
Cooling system	fill with a 5 % flushing solution (step 2).
Engine	warm up to normal operating temperature and run for approx. 5 minutes (step 3).
Flushing solution	drain and fill cooling system twice with fresh water, run engine each time for approx. 5 minutes, completely drain flushing solution (steps 5 and 6).
Cooling system	check for leaks (20-017).

Special tool



124 589 15 21 00
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Note
Oil must be removed from the cooling system if engine oil, automatic transmission fluid on models fitted with automatic transmission, or hydraulic oil entered the cooling system.

Removing oil

1 Set heater control to full capacity.

Caution!
On vehicles with light alloy radiators, strong alkaline cleaners such as P3 Standard (supplier: Henkel) must not be used.

2 Fill the cooling system with a 5 % solution of water and neutral cleaner or with a mild alkaline cleaner such as 3-Croni (supplier: Henkel) or Grisiron 7220 (supplier: Farbwerke Hoechst).

3 Warm up engine to approx. 80 °C by running at moderate rpm and maintain for approx. 5 minutes at this temperature.

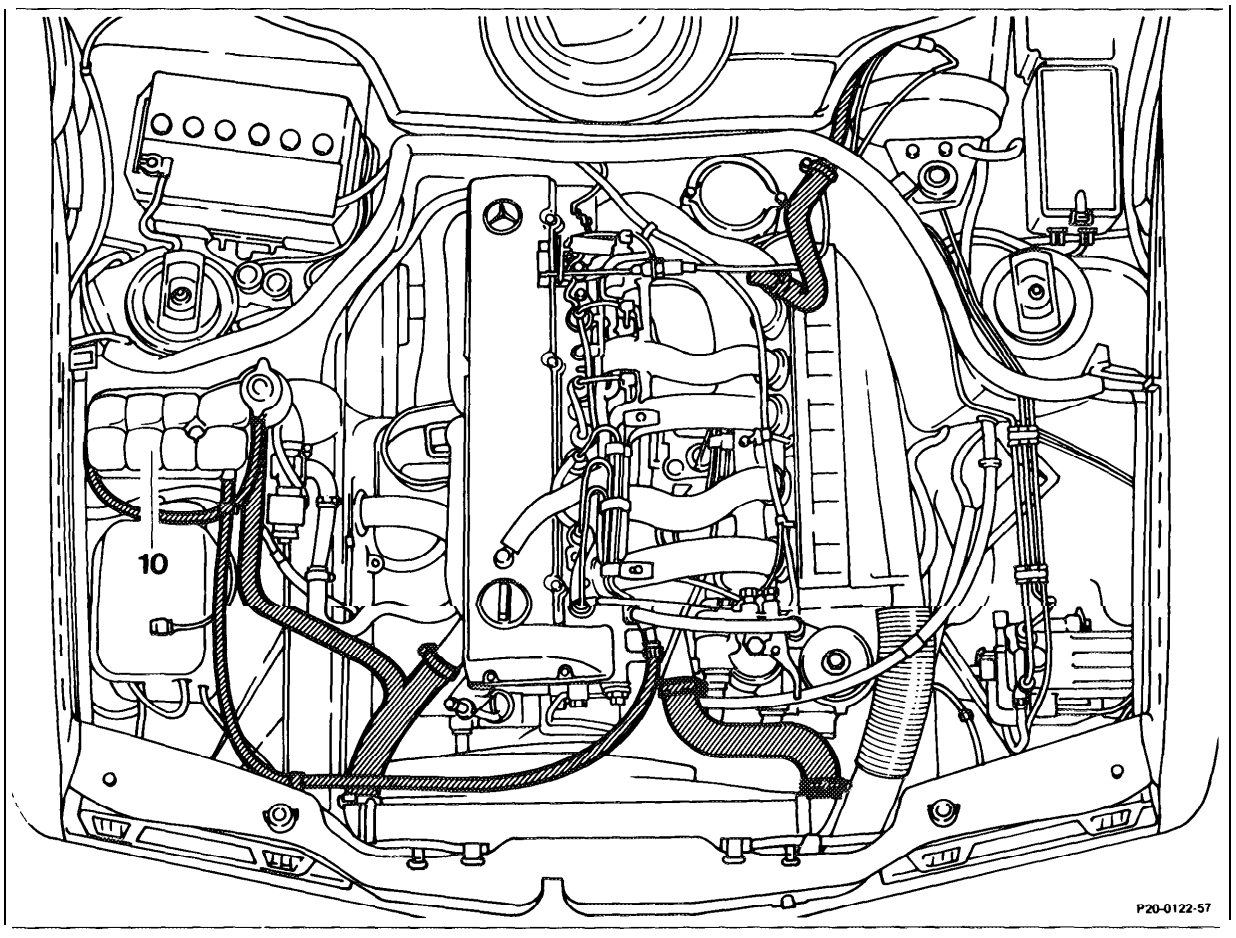
4 Switch off engine and allow cooling system to cool down to approx. 50 °C.

5 Drain solution completely.

6 Immediately following this step, fill cooling system twice with fresh water, warm up engine (approx. 5 minutes) and drain.

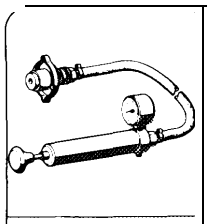
7 Check cooling system for leaks (20-017).

Checking cooling system for leaks



Pressure cap	open in stages, allow system pressure to escape and remove.
	⚠ Warning The pressure cap must only be opened if the coolant temperature is below 90 °C.
Coolant level	must extend up to the mark on the expansion tank (10).
Heater switch	set to maximum heating capacity.
Tester	124 589 15 21 00, attach to expansion tank (10) and pressurize cooling system, approx. 1.4 bar gauge pressure. Check all cooling and heating hoses and their connection points for loss of coolant. Check condition of hose clips, tighten if necessary.

Special tool



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Commercial tool

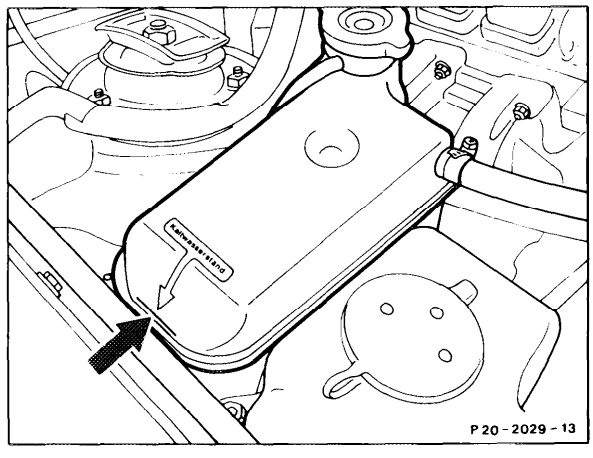
7 mm wrench socket on flexible shaft for hose clips with worm drive	e. g.	Hazet, D-5630 Remscheid Order No. 426-7

Checking for leaks

1 Turn cap to 1st detent and allow system pressure to escape, then turn to 2nd detent and remove cap.

⚠ Warning
The pressure cap must only be opened if the coolant temperature is below 90 °C.

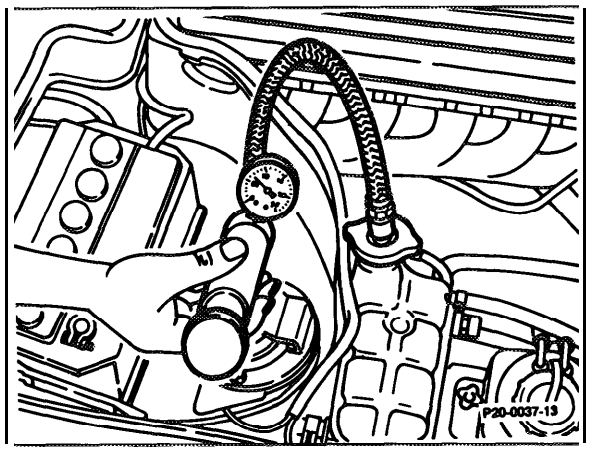
2 The coolant level must extend up to the marking on the expansion tank (arrow).



3 Pressurize cooling system with the tester 124 589 15 21 00 (approx. 1.4 bar).

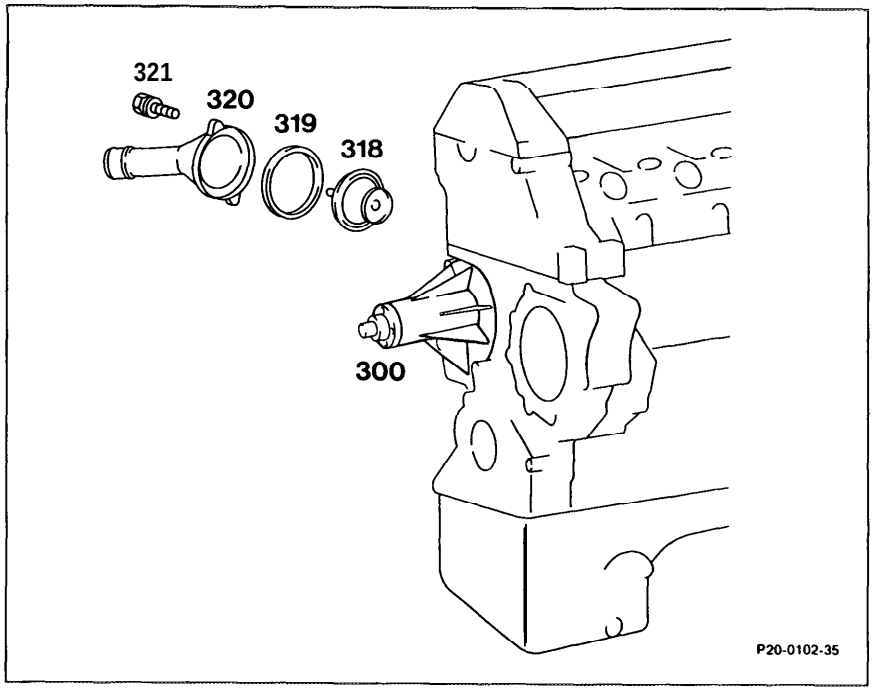
4 Check all cooling and heating water hoses and their connection points for loss of coolant.

Check that hose clips are in proper condition and correctly seated, replace or tighten as necessary.



20-110 Removal and installation of thermostat

Preceding work:
Coolantdrained (20-010).



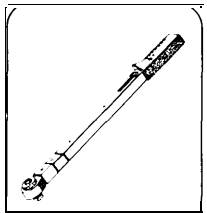
Housing cover (320) ..... unscrew from coolant pump, screw on, bolts (321), 10 Nm. Replace seal (319).

Thermostat (318) ..... check. Make note of installation position; the recess on the thermostat must be aligned with the rib in the thermostat housing cover.

Note

Thermostat and thermostat housing cover are marked with a green dot on turbo engines.

Special tool



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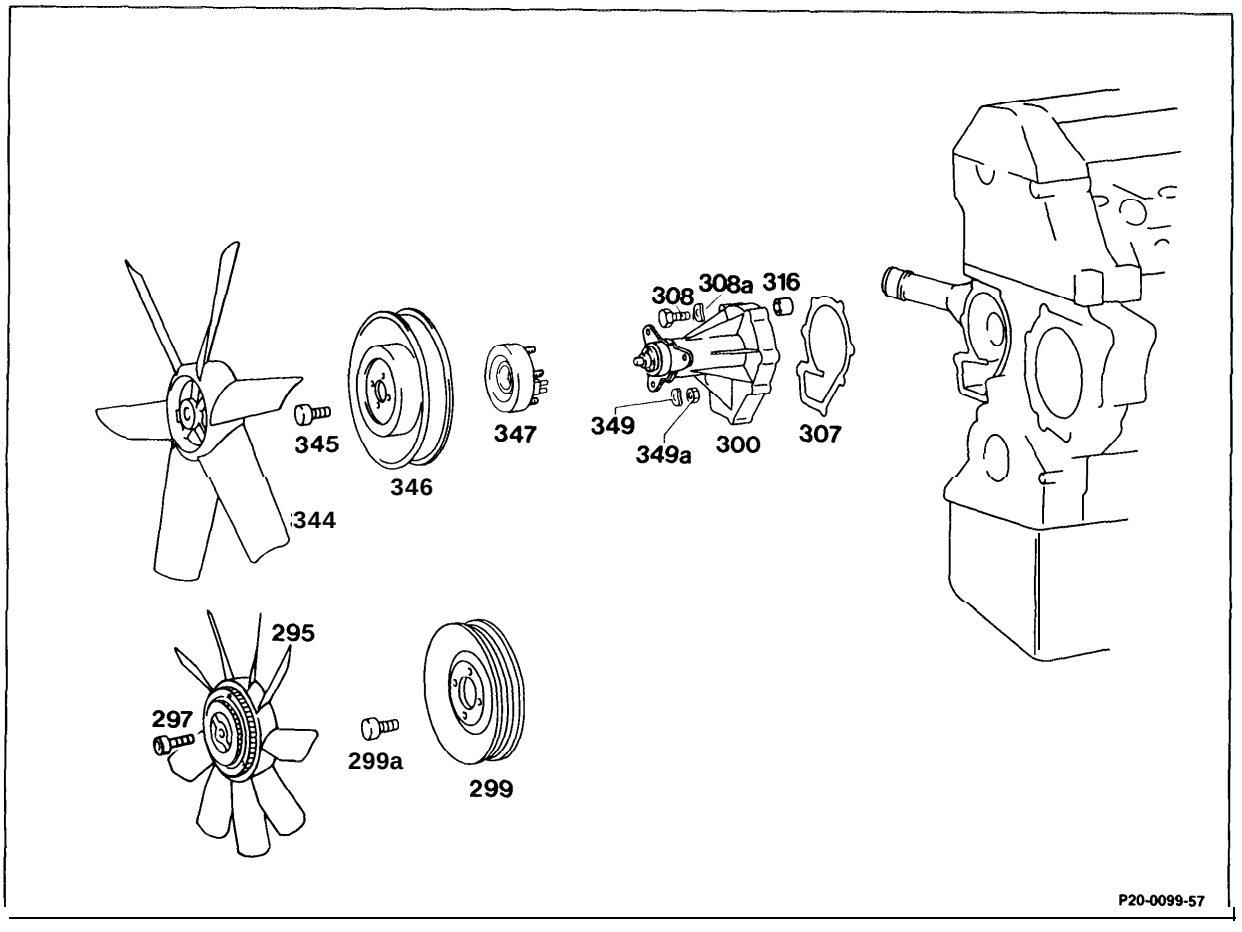
20-210 Removal and installation of coolant pump

Preceding work:
Coolant drained (20-010).
Radiator removed (Model 201 .126 only) (20-420).
Poly V-belt removed (13-342).



Engine 602, 603:

Fan with viscous fan coupling (295)	unbolt, bolt on, hexagon socket bolt (297), 45 Nm. Use screwdriver 103 589 01 09 00, torque wrench 001 589 66 21 00 and counter holder 603 589 00 40 00 (step 2).
Belt pulley (299, 346)	unbolt, bolt on. Hexagon socket bolts (299a), 10 Nm, Torx screws (345), 15 Nm (step 3).

Caution!
The magnet carrier must not be removed.

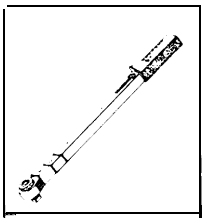
Engine 601:

Magnet body (347) . . . . . Remove cable, unbolt hexagon nut (349a) and remove magnet body (steps 4, 5).

Coolant pump (300) . . . . . unbolt, bolt on, replace hexagon bolts (308), 10 Nm. Replace gasket (307), clean sealing surface.

Tightening torques	Nm
Hexagon bolts of fan	25
Hexagon socket screws of viscous fan coupling	45
Hexagon bolts of coolant pump	10
Hexagon socket screw of belt pulley	10
Torx screw of belt pulley	15

Special tools



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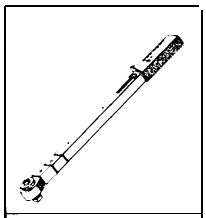
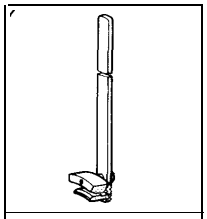
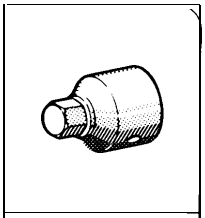


001 589 66 21 00
00



603 589 004000
20

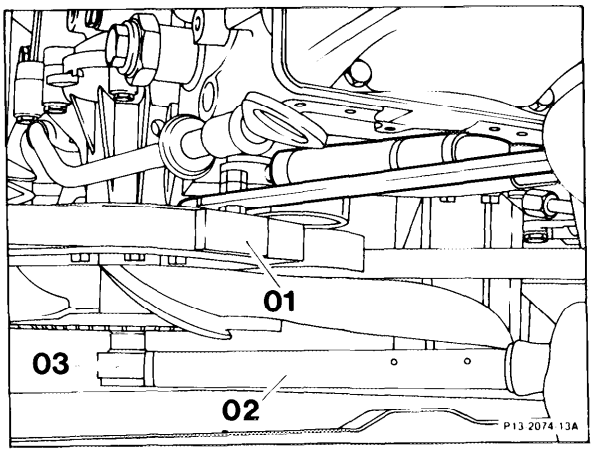


103 589 01 09 00
20

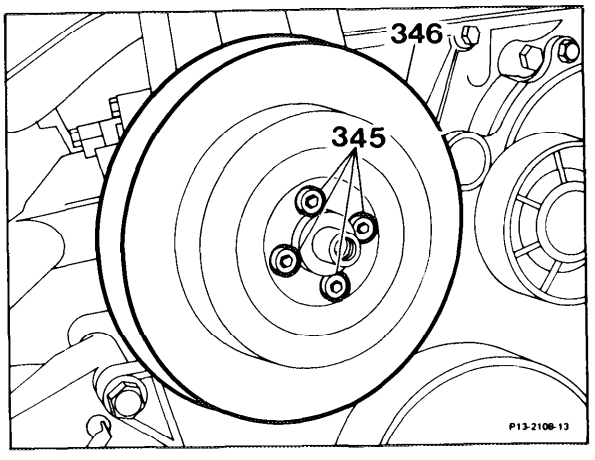
Removal

Engine 602, 603

2 Detach fan cowl, place over the fan.
Unscrew viscous fan coupling, using screwdriver insert 103 589 01 09 00 (03), torque wrench 001 589 72 21 00 (02) and counter holder 603 589 00 40 00 (01).



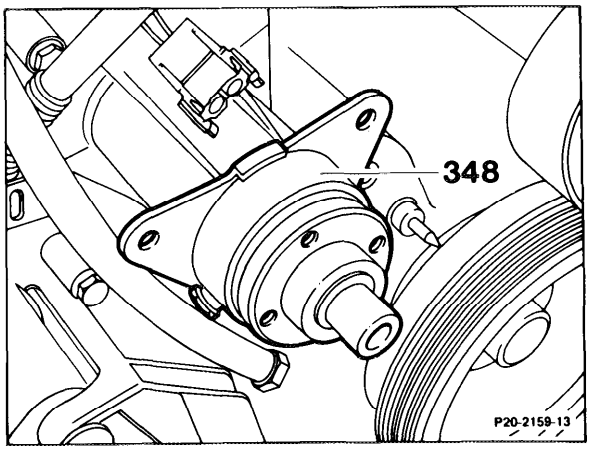
3 Unbolt hexagon socket bolts (345) and remove belt pulley (346).



Note
The magnet carrier (348) is bonded to the coolant pump housing and must not be removed.

6 Unbolt coolant pump.

7 Clean sealing surfaces.



Installation

8 Insert coolant pump with new gasket and tighten hexagon bolts.

Tightening torque 10 Nm.

9 Install magnet body and plug in cable.

10 Install belt pulley.

Tightening torque
Hexagon socket screw 10 Nm,
Hexagon socket torx screw 15 Nm.

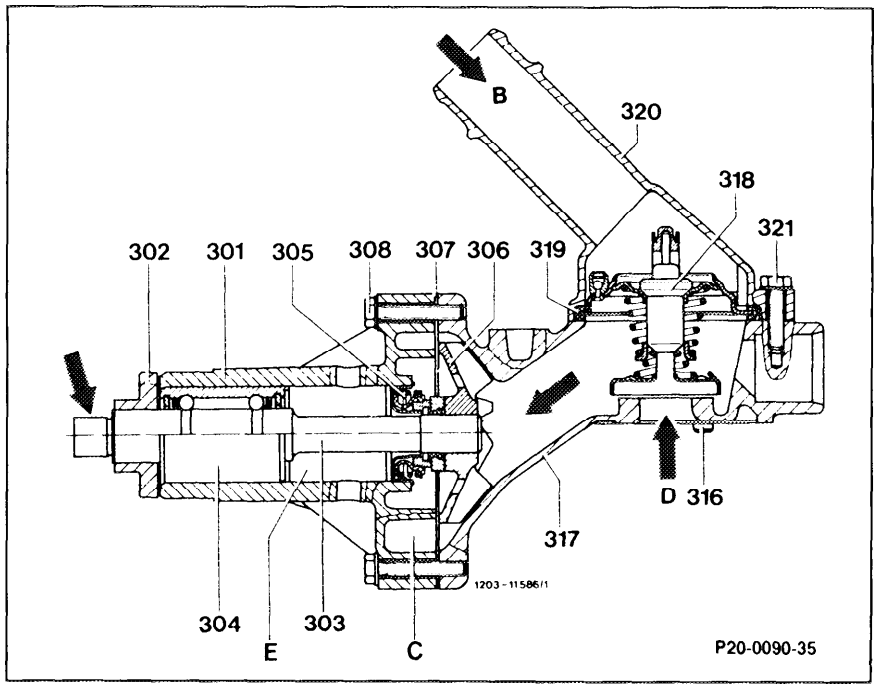
The remaining parts are installed in reverse order.

General

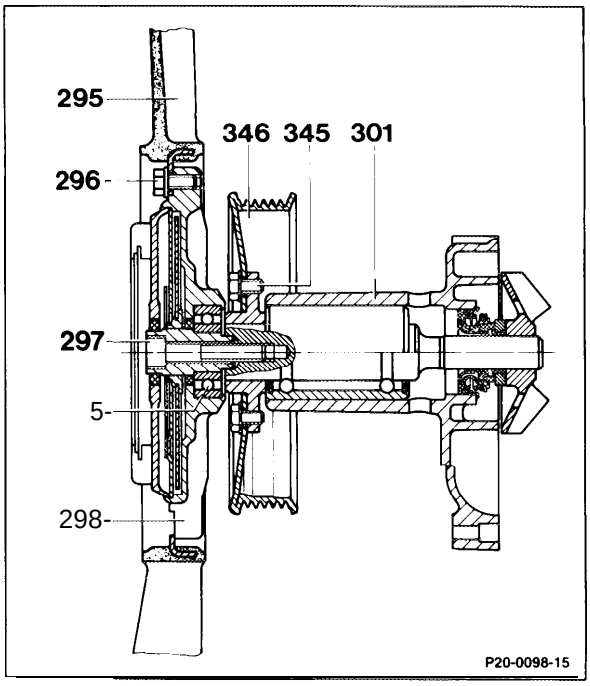
The coolant pump located at the bottom right of the engine is attached to a light alloy housing bolted to the crankcase. The coolant thermostat (318) is also contained in this housing.

A flange (302) is pressed onto the coolant pump shaft (303) for attaching the belt pulley. An expansion space (E) is located between coolant pump bearing (304) and cassette seal (305). The fan is attached at the stub end (arrow).

301 Coolant pump housing
302 Flange
303 Coolant pump shaft
304 Coolant pump bearing
305 Cassette seal
306 Impeller
307 Gasket
308 Hexagon bolt M 6 x 35
316 Fit pin
317 Light alloy housing
318 Coolant thermostat
319 Gasket
320 Inlet connection
B Inlet connection to radiator
C Pump chamber
D Inlet from crankcase
E Expansion space



Engine 602 and 603
Arrangement of viscous fan coupling and coolant pump

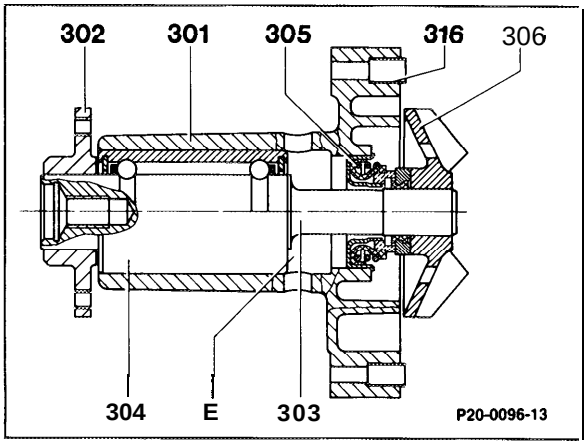


5 Ball bearing
295 Fan
296 3 bolts M 6 × 14
297 Hexagon socket screw M 10 × 40
298 Viscous fan coupling
301 Coolant pump housing
345 4 hexagon bolts M 6 × 12
346 Belt pulley

The coolant pump of engine 602 and 603 is strengthened at the coolant pump housing (301) and at the coolant pump bearing (304) because of the heavier viscous fan coupling.

The diameter of the impeller (306) on all the engines is identical.

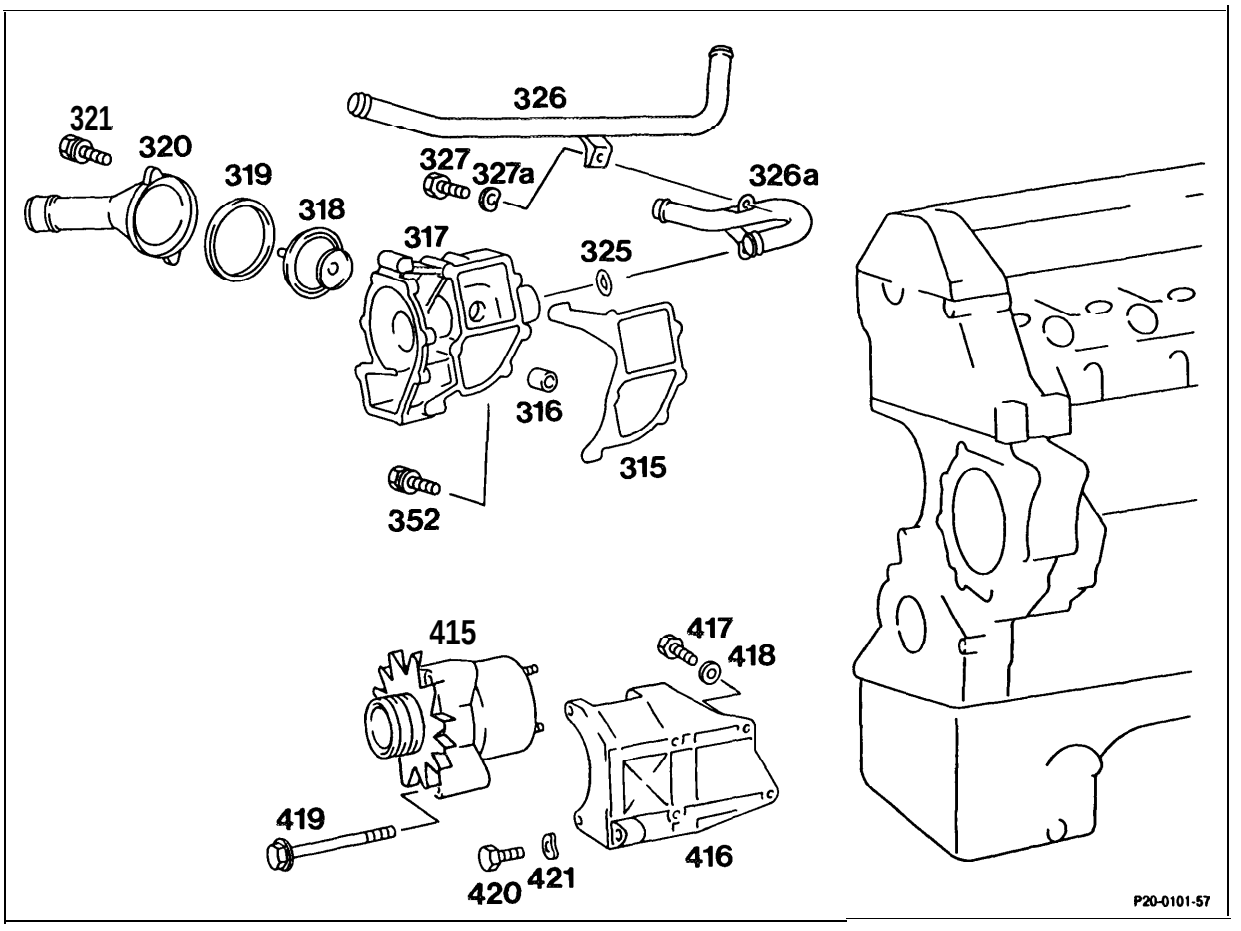
The coolant pump shaft has a tapped hole M 10 × 22 at the front for attaching the viscous fan coupling.



301 Coolant pump housing
302 Flange
303 Coolant pump shaft
304 Coolant pump bearing
305 Cassette seal
306 Impeller
316 Fit sleeve
E Deformation space

20-230 Removal and installation of coolant pump housing

Preceding work:
Coolant pump removed (20-210).
Alternator removed (15510)



Ground cable to battery	disconnect, connect.
Supporting bracket for alternator **(416)**	unbolt, bolt on, hexagon bolts (417, 420), 25 Nm.
Return lines (326,326 a)	unbolt at crankcase, bolt on, withdraw from coolant pump housing (317), insert. Replace O-ring (325).

Caution!
Do not coat O-ring with oil or grease; use only antifreeze.

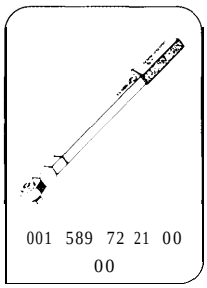
Engines 602.96, 603.96 with automatic transmission:

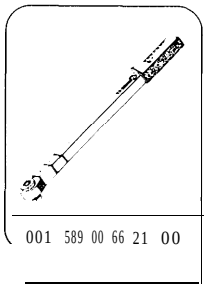
Cable from temperature switch	detach, plug in.
Temperature switch	unscrew, refit.

Coolant pump housing (317)	. . . . .	unbolt, bolt on, hexagon bolts (352), 10 Nm. Clean sealing surface and replace gasket (315).
Cooling system	. . . . .	check for leaks (20-017).

Tightening torques	Nm
Hexagon bolts of coolant pump housing	10
Hexagon bolts of supporting bracket for alternator	25
Hexagon bolts of alternator	45

Special tools

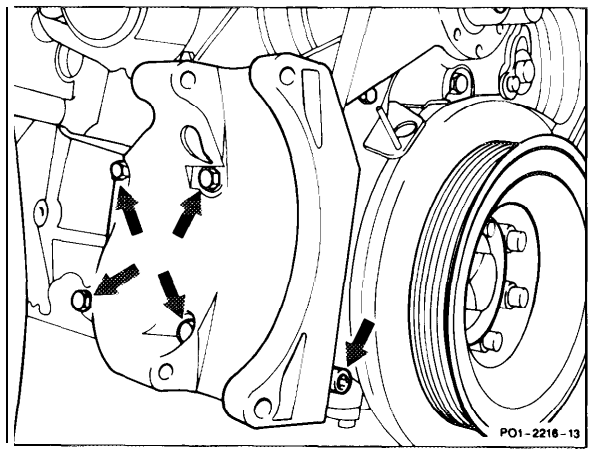




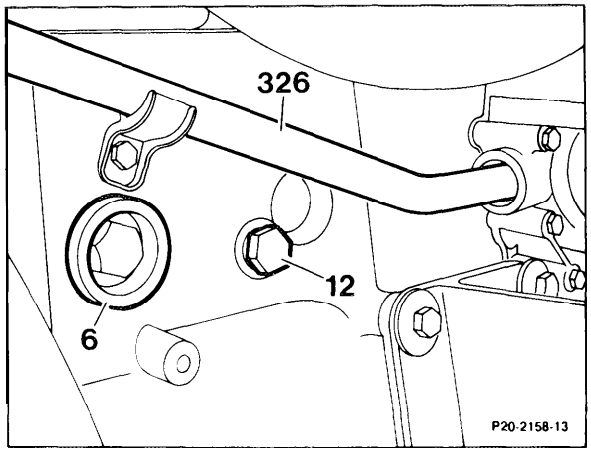
Removal

1 Disconnect ground cable at the battery.

2 Unbolt supporting bracket for alternator (arrows).

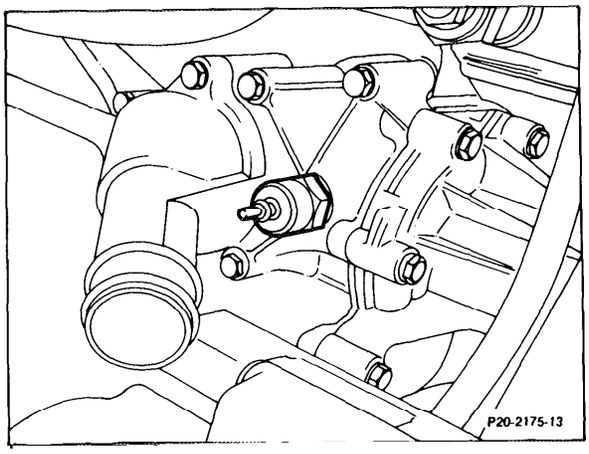


3 Unbolt return line (326) at the crankcase and withdraw from the coolant pump housing.



Engines 602.96 and 603.96 with automatic transmission:

4 Detach cable for temperature switch in coolant pump housing and unscrew temperature switch.



5 Unbolt coolant pump housing.

6 Clean sealing surfaces.

Installation

7 Replace O-ring on return line.

Note
Keep O-ring free of grease. The O-ring can be dipped in coolant to ease installation.

8 Fit coolant pump housing onto the return line and install onto crankcase with a new gasket.

Tightening torque 10 Nm.

9 Bolt return line onto the crankcase.

10 Install supporting bracket for alternator (419) and tighten fastening bolts.

Tightening torque 25 Nm.

11 Connect ground cable to the battery.

12 Check cooling system for leaks (20-017).

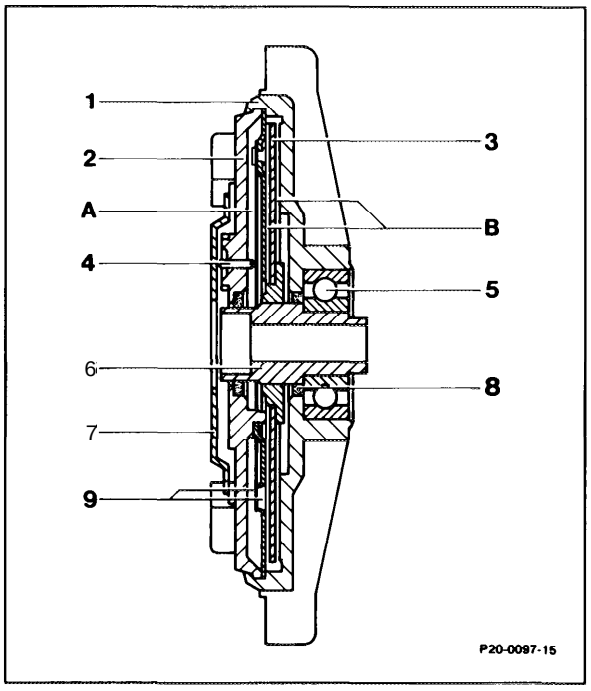
20-310 Temperature-controlled viscous fan coupling

Function

The viscous fan coupling is a maintenance-free hydraulic coupling which operates proportionately to temperature.

When the engine is started (cold start), the fan initially runs at a higher speed until the oil has flowed back from the working chamber (B) into the storage chamber (A). Following this, the fan coupling shuts off. Fan speed in the off state depends on engine speed. Fan speed, in any case, does not exceed 1000 rpm.

This state is maintained until the engine has reached the fan activating temperature.

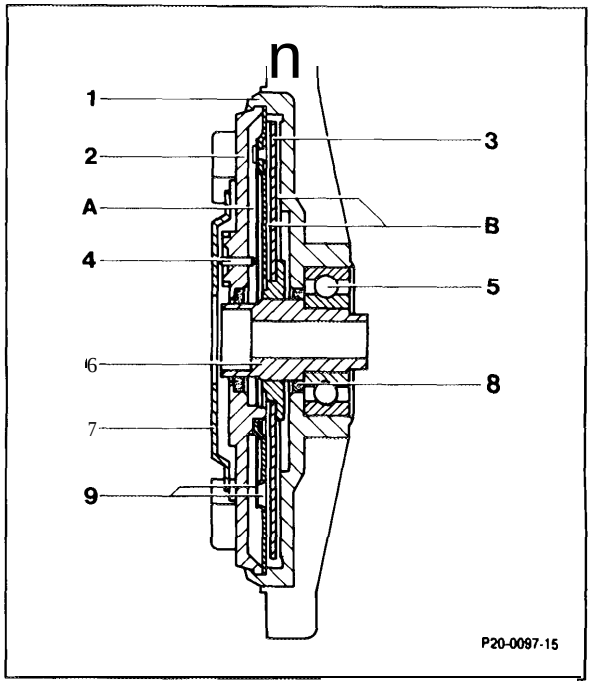


	Coupling body (secondary part)
2	Cover
3	Driving plate (primary part)
4	Switch pin
5	Ball bearing
6	Bearing bush
7	Bimetal strip
8	Seal
9	Valve
A	Storage chamber
B	Working chamber

If the coolant temperature rises due to higher engine loads or high outside temperatures, the air which flows through the radiator and contacts the bimetal strip (7), becomes warmer. The bimetal strip (7) alters its shape as it heats up and opens a valve (9) at approx. 71 °C by means of a pin (4) and thus also the passage for the oil from the storage chamber (A) into the working chamber (B), which causes the fan to activate.

The coolant temperature during this switching operation remains between approx. 90 and 95 °C.

When the coupling is engaged, fan speed increases proportionally with increasing engine speed in the lower rpm range, without exceeding 3300 rpm in the upper range.



1 Coupling body (secondary par-t)
2 Cover
3 Driving plate (primary part)
4 Switch pin
5 Bail bearing
6 Bearing bush
7 Bimetal strip
8 Seal
9 Valve
A Storage chamber
B Working chamber

Checking activation temperature

Run engine at 4000 – 5000 rpm. Once a coolant temperature of approx. 90 – 95 °C has been reached, the speed of the viscous fan coupling must increase, which can be clearly heard.

Repair

It is not possible to repair a defective coupling; it must be replaced.

Transportation and storage

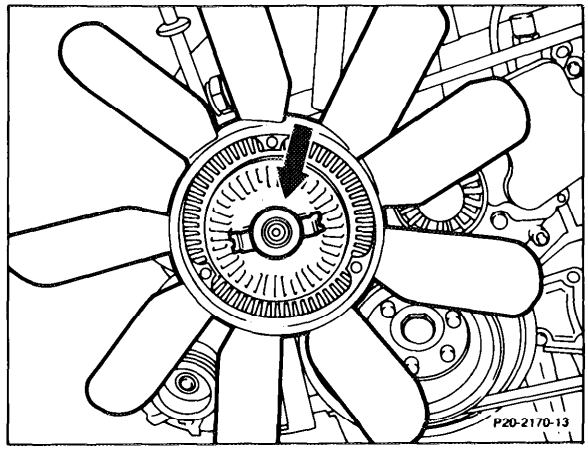
Temperature-controlled viscous fan couplings must be transported upright. For brief periods – e. g. for installation purposes, the coupling may be placed on the flange side, but never on the front side.

Caution!

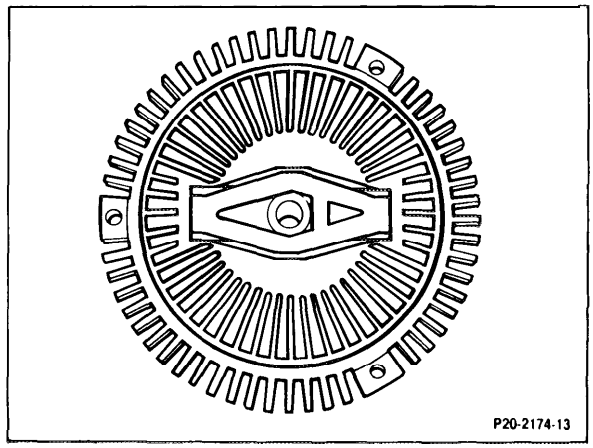
The bimetal strip must not be bent or damaged.

Distinguishing features

Engine 602.911 bimetal spring; color silver grey.
Imprinted Part No. 603 200 00 22 (arrow).

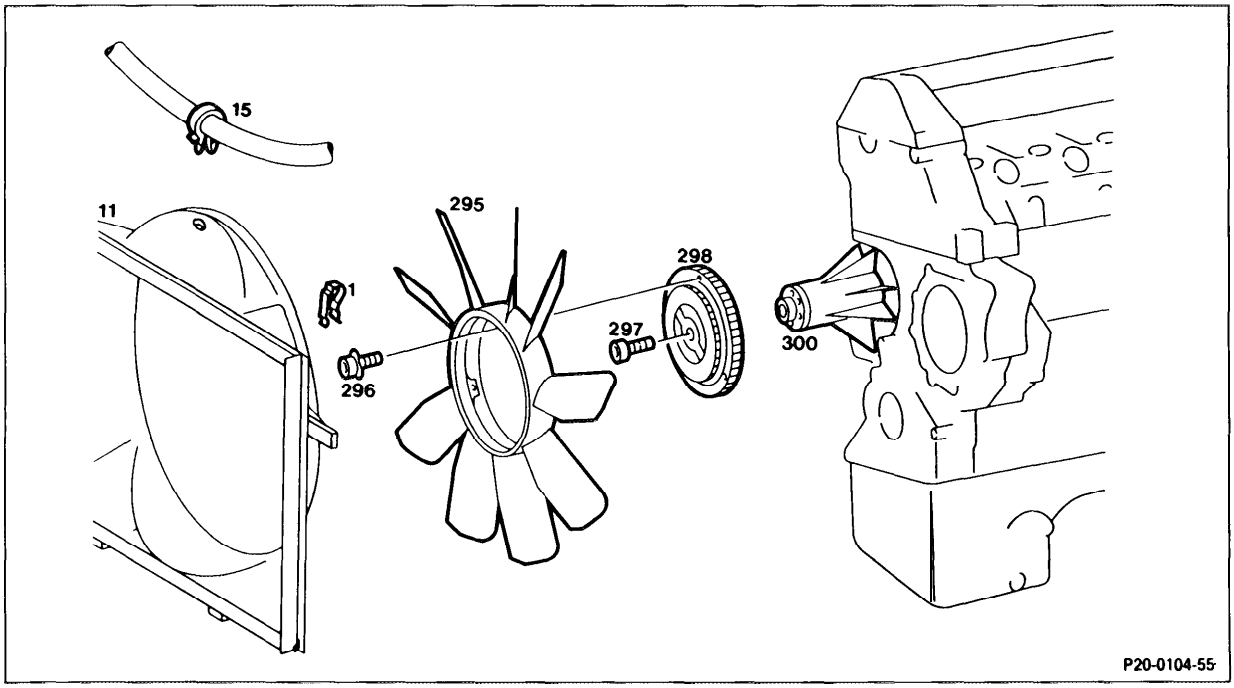


The viscous fan couplings of engine 602.96 and 603.96 have been strengthened to compensate for an enlarged fan.
Bimetal spring; color metal-colored.
Red imprinted Part No. 603 200 04 22.



20-312 Removal and installation of viscous fan coupling

Preceding work:
Radiator removed – only Model 201.126, 124.133, 124.193 (20-210).

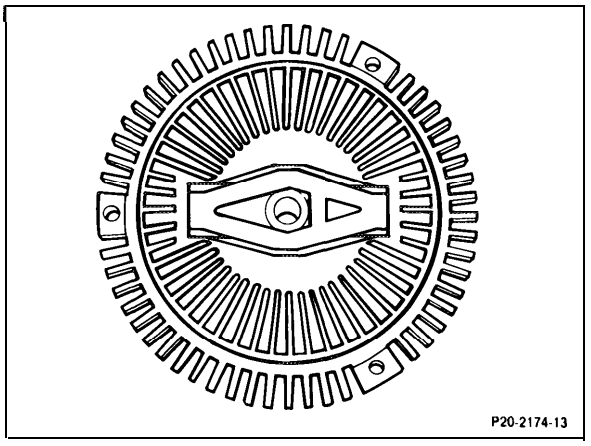


Hose holder (15)	unclip, clip in.
Retaining clip (1)	pull off, fit on.
Fan cowl (11)	place over the fan.
	Caution! Separate split fan cowls and remove.
Hexagon socket screw (297)	unscrew, screw in, 45 Nm, using screwdriver insert 103 589 01 09 00, torque wrench 001 589 72 21 00 and counter-holder 603 589 00 40 00 (step 3).
Fan (295) with viscous fan coupling (289)	remove at coolant pump (300), insert.
Fan (295)	unscrew, screw on, hexagon socket screw (296), 10 Nm.
	Caution! Notice direction of rotation of fan (295). Inscription must be facing direction of travel.

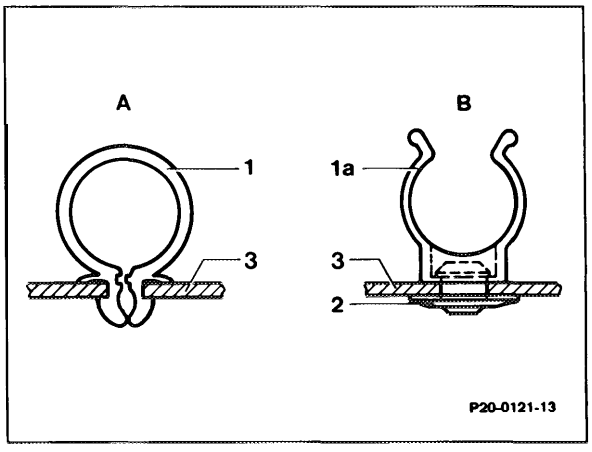
Tightening torques	Nm
Hexagon socket bolts of fan	10
Hexagon socket screw of viscous fan coupling	45

Note

As a distinguishing feature on engines 602 and 603.91 a silver-colored sticker with Part No. 603 200 00 22 and 603 200 04 22, respectively, is attached to the viscous fan coupling. A red inscription appears on the same part for engine 603.96.



The hose holder for attaching the vent hose at the fan cowl has been modified from a single-section version to a two-section version.



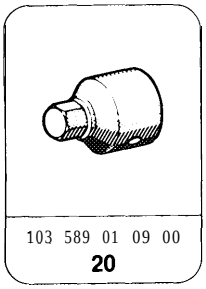
A Previous version
B Present version

Production breakpoint: 10/87 - OY88

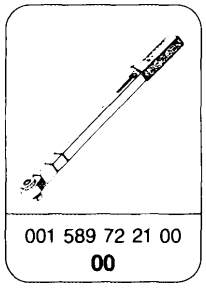
Model	Engine	Engine End No.		Vehicle Ident End No.	
		manual transmission	automatic transmission	A	F
124.133 124.193	603.960	*	*	732131	*
201.126	602.911	*	*	455028	*

* not registered

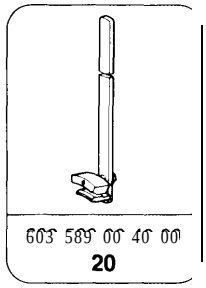
Special tools



103 589 01 09 00
20



001 589 72 21 00
00

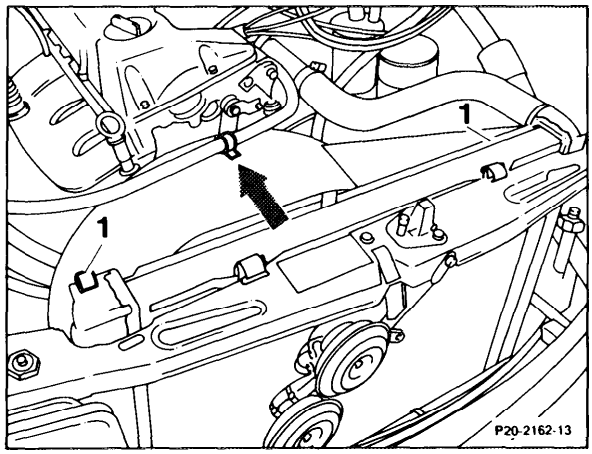


603 589 00 40 00
20

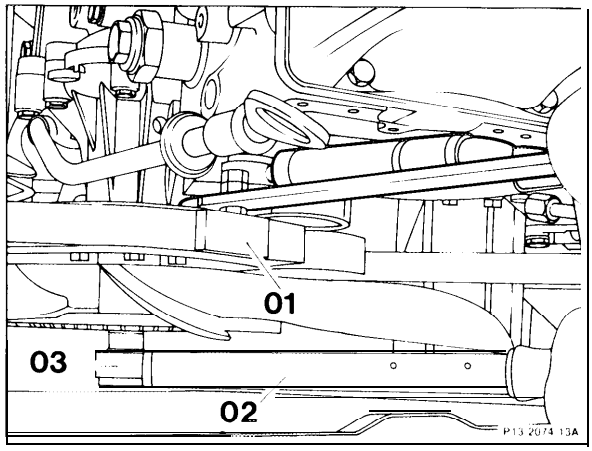
Removal

1 Remove clip together with vent line from fan cowl (arrow).

2 Pull off retaining clips (1) for fan cowl. Place fan cowl over the fan.



3 Unbolt viscous fan coupling with torque wrench 001 589 72 21 00 (02) and screwdriver insert 103 589 01 09 00 (03). Hold the belt pulley with the counter-holder 603 589 00 40 00 (01) when performing this step.



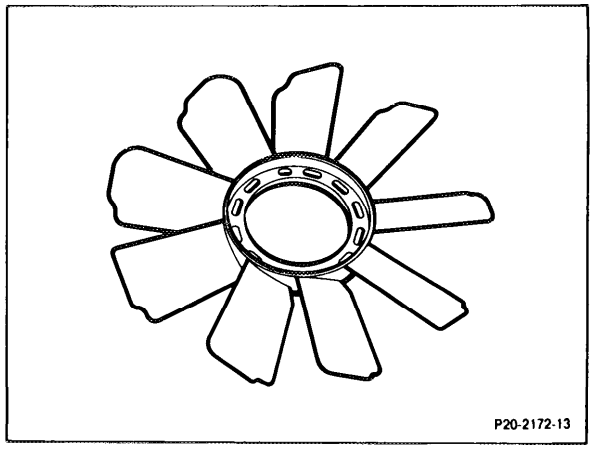
4 Remove viscous fan coupling together with fan and fastening bolt.

5 Unbolt fan from the viscous fan coupling.

Installation

Caution!

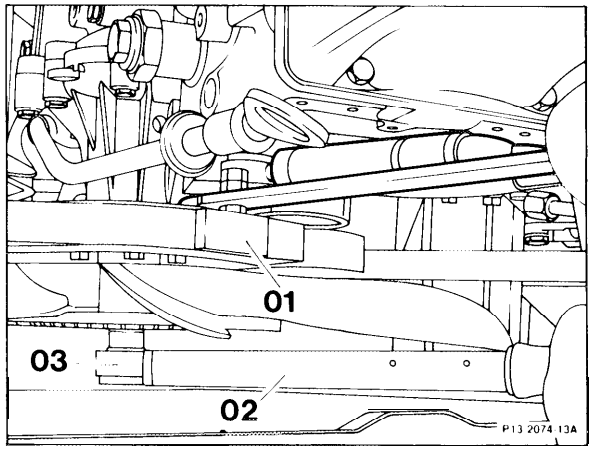
Notice direction of rotation of fan. Marking must be pointing in direction of travel.



6 Bolt fan onto the viscous fan coupling.

Tightening torque 10 Nm.

7 Fit fan with viscous fan coupling and fastening screw onto the coolant pump.



8 Tighten the hexagon socket bolt with screwdriver insert 103 589 01 09 00 (03) and torque wrench 001 589 72 21 00 (02). Hold the belt pulley securely with the counter-holder 603 589 00 40 00 (01) when performing this step.

Tightening torque 45 Nm.

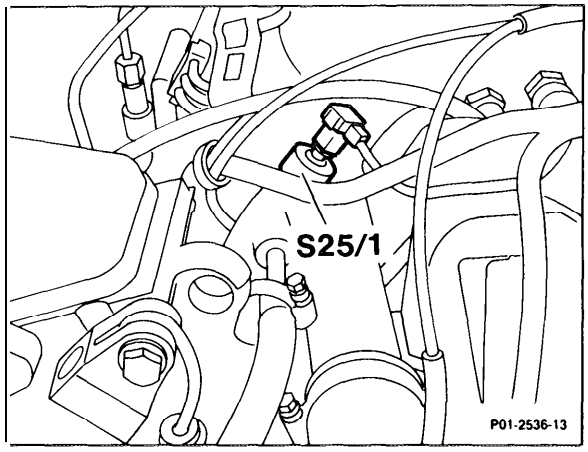
9 Install fan cowl.

10 Attach vent line at fan cowl.

20-330 Magnetic fan coupling

The magnetic fan coupling is activated by a 100 °C temperature switch (S25/1) mounted at the outlet connection.

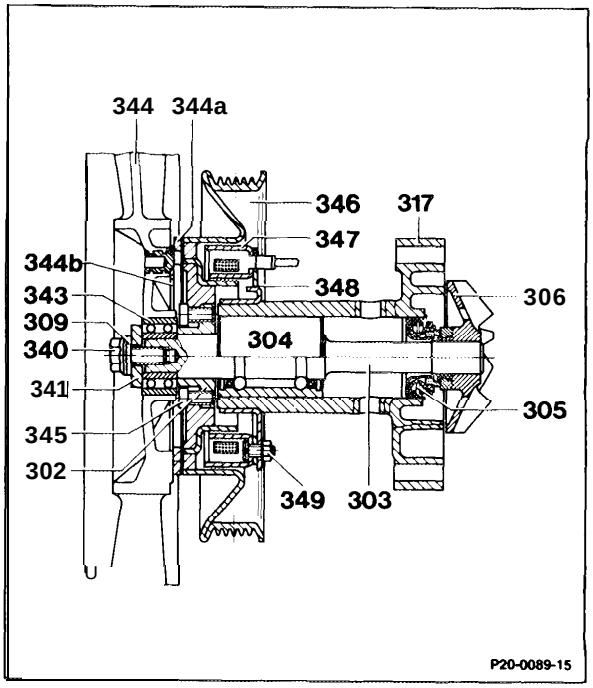
The electromagnetic fan coupling is maintenance-free.



Design of the electromagnetic fan coupling

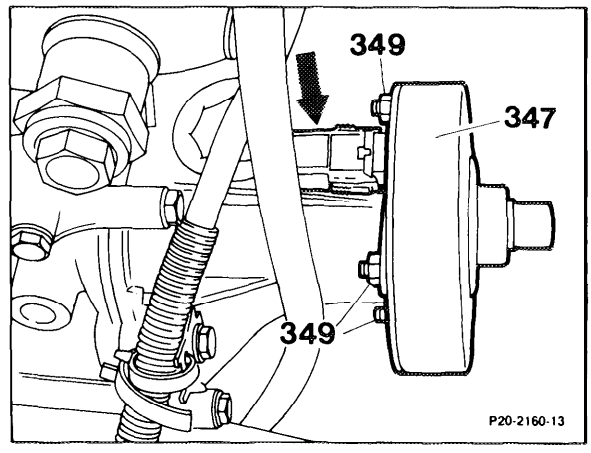
The magnet body **(347)** is attached to the magnet carrier (348) with 3 nuts (349).

The magnet carrier is bonded to the coolant pump housing and does not need to be removed.



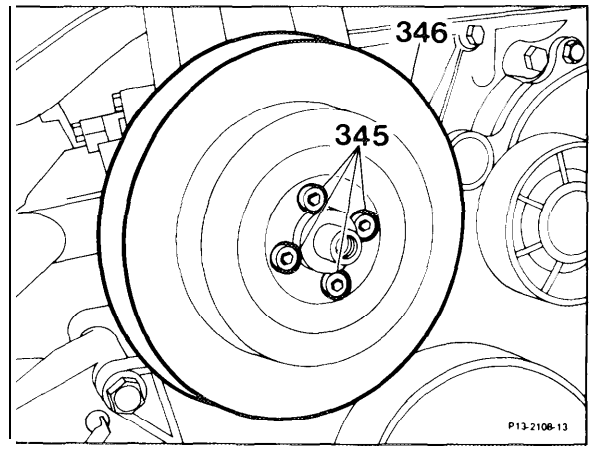
302	Flange
303	Shaft
304	Bearing
305	Cassette seal
306	Impeller
309	Tensioning plate
317	Coolant pump housing
340	Collar bolt
341	Washer
343	Bearing
344	Fan
344a	Armature
344b	Leaf spring
345	Hexagon socket screw M 6 x 12
346	Belt pulley
347	Magnet body
348	Magnet carrier
349	Hexagon nut

The electric cable is connected to the magnet body (347) via a coupling (arrow).



The belt pulley (346) is mounted to the coolant pump shaft in front of the magnet body.

The belt pulley (346) is bolted to the flange of the coolant pump with 4 hexagon socket bolts (345) or torx bolts.



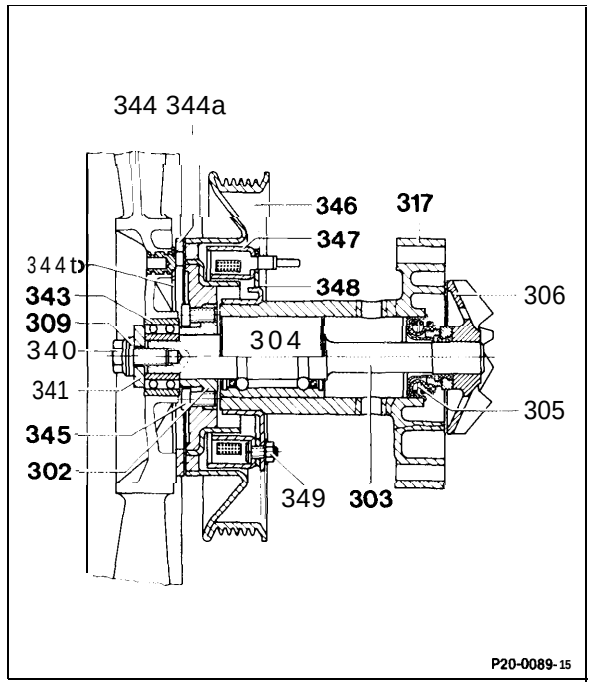
Function

The fan is activated only if the ignition is turned on and the coolant is at a temperature above 98 – 102 °C.

Voltage is applied constantly to the magnet body (347) through fuse No. 10 terminal 15 (1 st version).

Below a coolant temperature of 98 – 102 °C the fan is switched off and only rotates as a result of air flow over the fan when the vehicle is moving.

A negative voltage is applied by the temperature switch in the outlet connection at no less than a coolant temperature of 102 °C.



The armature (344a) is attracted by the magnet body **(347)** and presses against the face of the belt pulley **(346).**

The fan becomes rigidly attached to the belt pulley and rotates at coolant pump speed.

If the coolant temperature drops below 93 – 98 °C, the temperature switch opens and the armature is lifted off the belt pulley (346) by leaf springs (344b).

On vehicles with air conditioning, the fan and electric auxiliary fan are activated through a double contact relay which is activated by the 52 °C temperature switch at the fluid reservoir.

If the air conditioning is off, the **100** °C temperature switch at the outlet connection alone engages or disengages the fan.

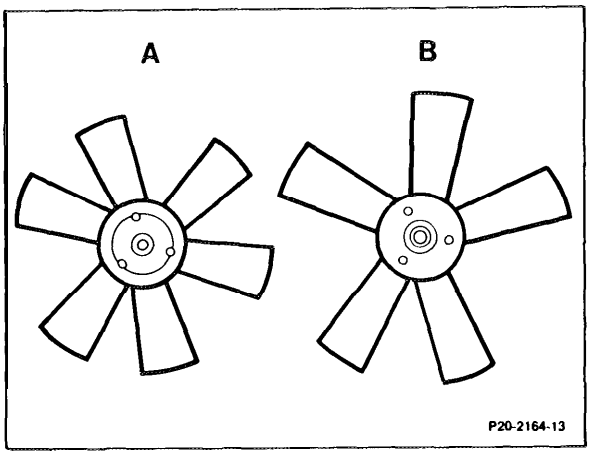
The armature (344a) and the ball bearing (343) are fitted to or to the inside of the fan.

The ball bearing is sealed on both sides with cover plates.

Fan

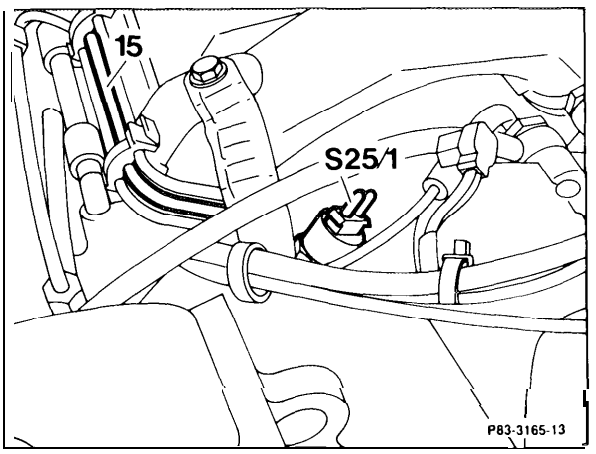
The fan (A) has 6 blades and a diameter of 380 mm.

On vehicles with air conditioning, the fan (B) has 5 blades and a diameter of 430 mm.

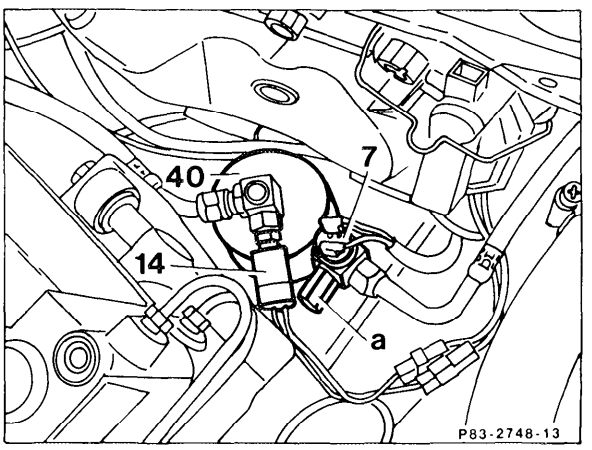


Modification to electromagnetic coupling Model 201

Effective 10 84 a modified electrical center has been installed. As a result, the electromagnetic coupling is operated by a positive voltage through **a** 2-pin temperature switch **(S25** 1) (previously negative voltage).

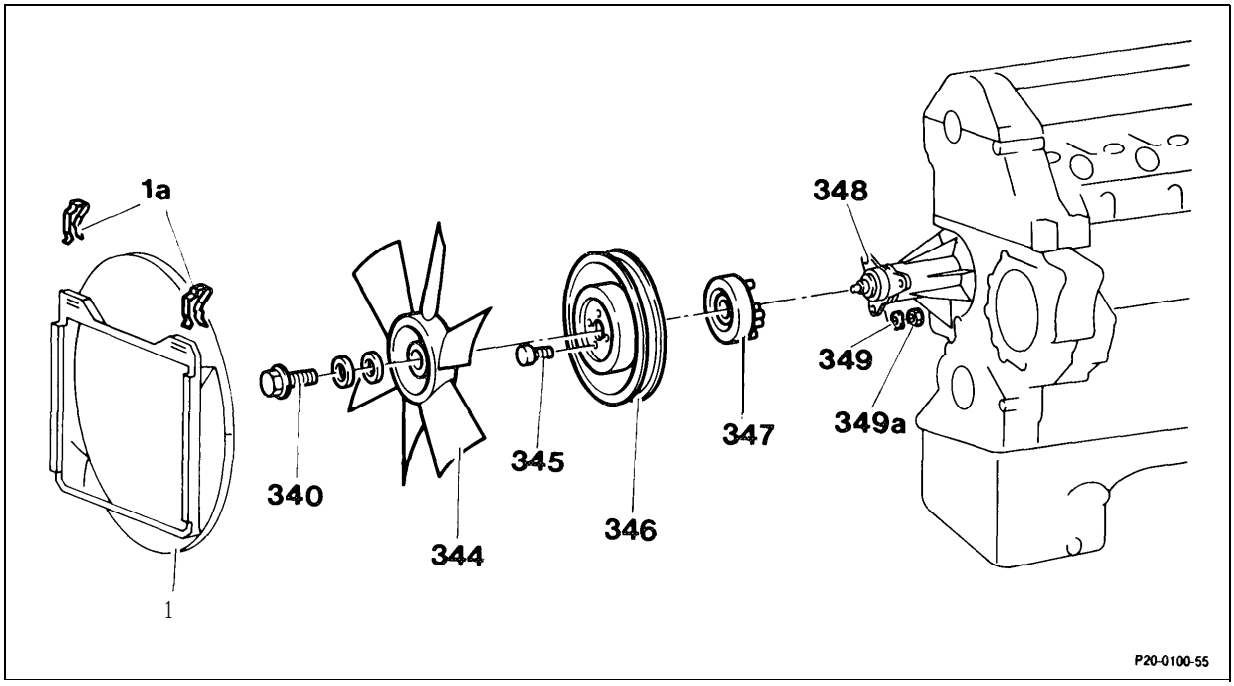


On vehicles with air conditioning positive is connected through a relay also after the pressure switch (14) closes.



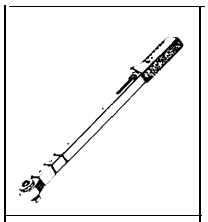
20-335 Removal and installation of magnetic fan coupling

Preceding work:
Poly V-belt removed (13-342).



Retaining clips (1 a)	remove, refit.
Fan cowl (1)	detach, attach, place over fan.
Fan (344)	unbolt, bolt on, 25 Nm.
Belt pulley (346)	unbolt, bolt on, hexagon socket bolt 10 Nm or torx screw 14 Nm.
Magnet body (347)	pull off cable connection, fit on, unbolt nuts (349a), bolt on.
Magnet carrier (348)	do not remove from coolant pump, check for tightness, secure with adhesive 001 989 45 20 10, if necessary.

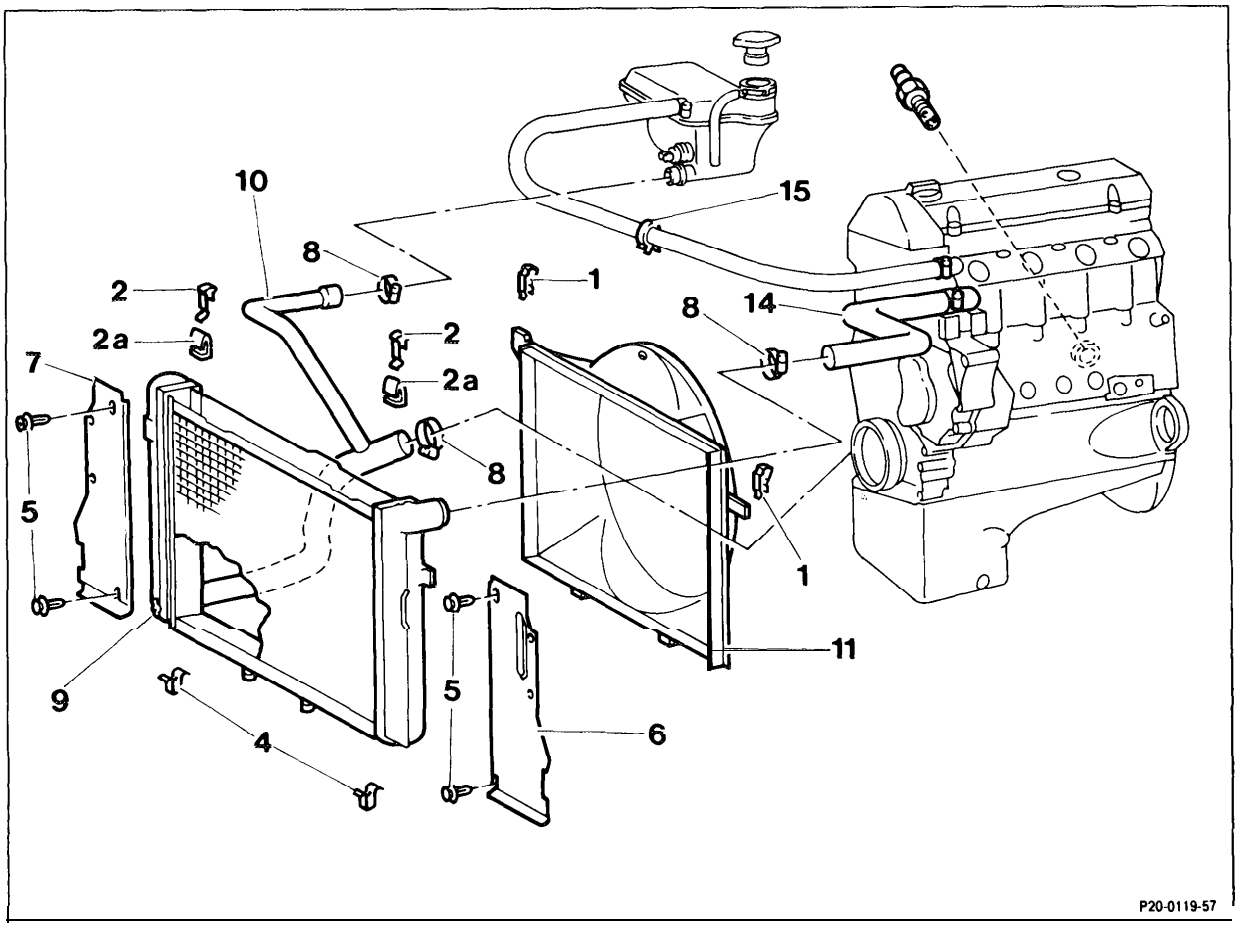
Special tools



001 589 72 21 00 00

20-420 Removal and installation of radiator

Preceding work:
Bottom engine compartment covering removed (01-006).
Coolant drained (20-010).



Vehicles with automatic transmission:

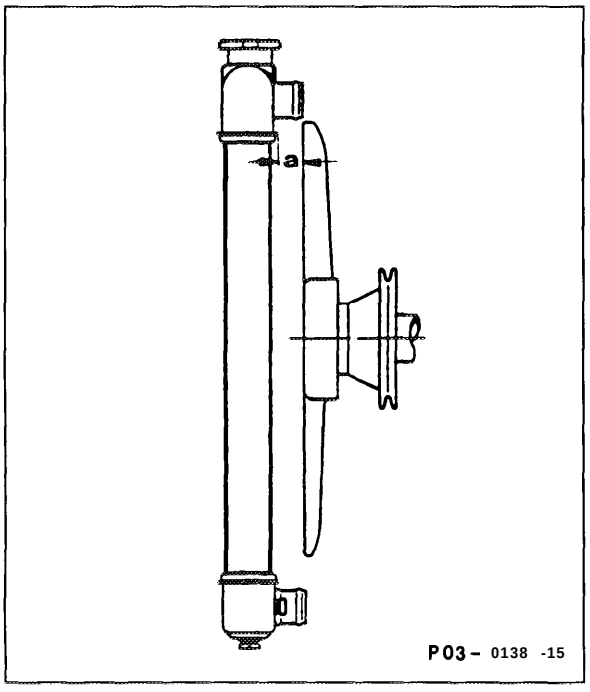
Oil lines at cooler	unbolt, bolt on, clamp with special tool 000 589 40 37 00 (step 1).
Holder (15)	for vent hose, unclip, clip in (step 4).
Flat spring (1)	remove, insert.
Fan cowl (11)	remove, insert. Place fan cowl (11) over the fan.
Coolant hoses (10, 14)	detach, attach, check condition.
Expanding rivets (5)	remove, insert (step 5).
Radiator coverings (6, 7)	remove, install.

Retaining clip (4)	pull off, fit on.
Model 201.128	
Radiator bridge	unbolt, on.
Model 201.128	
Front bumper	remove, attach (88-200).
Evaporator	unbolt from radiator, screw on.
Flat spring (2)	withdraw, insert.
Radiator (9)	lift out, insert.
Cooling system	check for leaks (20-017).

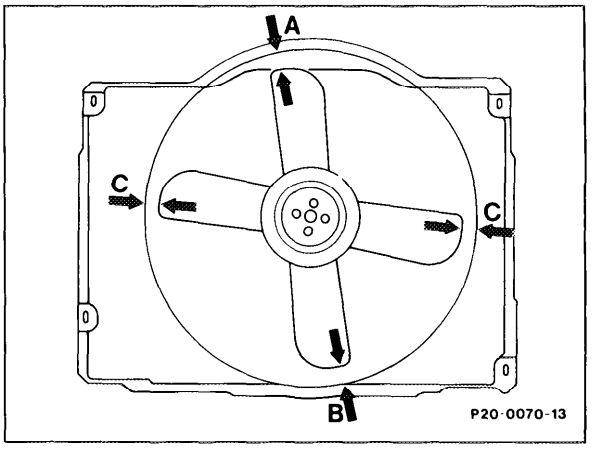
Installation dimensions for radiator, fan and fan cowl

Model	Engine	Distance "a" from fan to radiator, approx. mm	Distance from fan to cowl, approx. mm		
			A	B	C
124.128	602.962	87	22 19.5[1])	28 25.5[1])	20 22.5[1])
124.133	603.960	178			
124.193	603.962	87			
126.125	603.961	87	17.5	23.5	15.5
126.135	603.970	34	22	28	20
201.126	602.911	19	19.5	25.5	22.5
201.128	602.961	178			

[1]) Two-section fan cowl

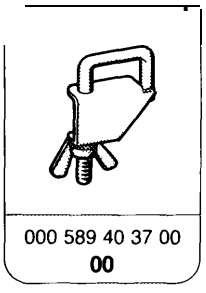


Radiator/fan



Fan/fan cowl

Special tool



000 589 40 37 00
00

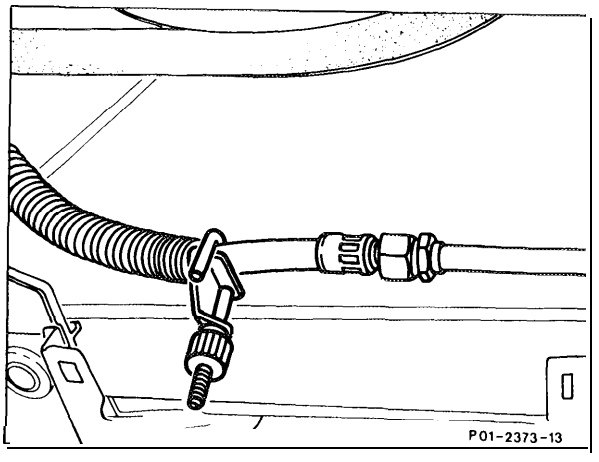
Commercial tool

7 mm wrench socket on flexible shaft for hose clips with worm drive	e. g.	Hazet, D-5630 Remscheid Order No. 426-7

Removal

Vehicles with automatic transmission:

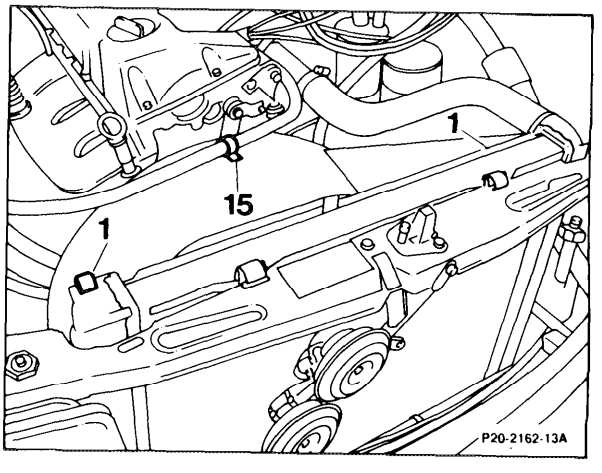
1 Clamp oil lines at automatic transmission with special tool 000 589 40 37 00, moving the spiral spring slightly to the side and unscrewing at the radiator.



2 Seal off coolant hoses at the radiator.

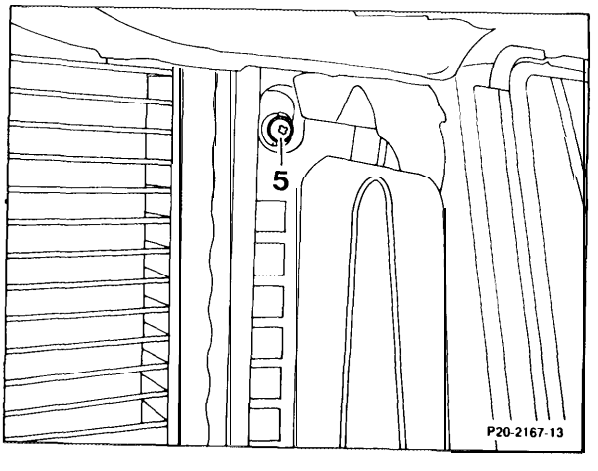
3 Withdraw hose holder (15).

4 Pull out flat springs (1) for fan cowl, raise cowl slightly and place over the fan.

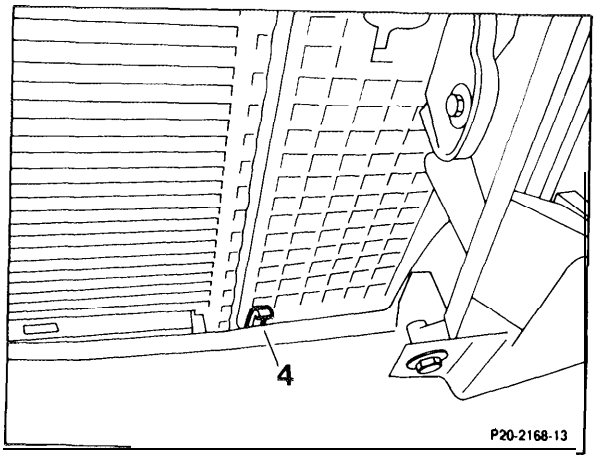


5 Remove the expanding rivet (5) on the right and left side for the side radiator covering.

6 Remove radiator coverings.

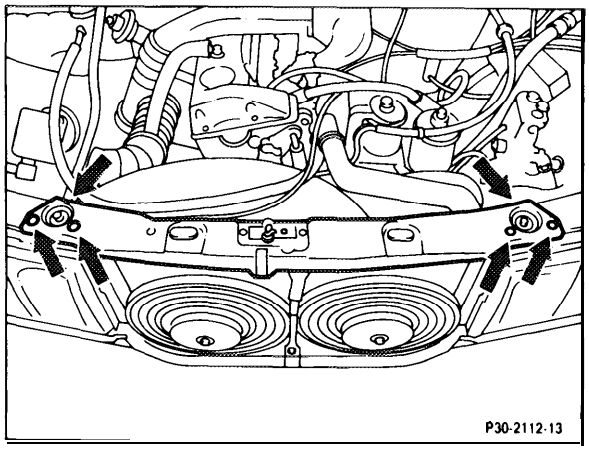


7 Remove the retaining clip (4) at the bottom right and left.



Model 201.128

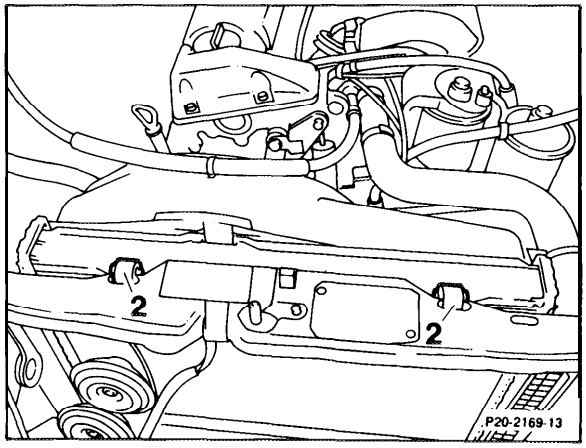
8 Unbolt radiator bridge (arrows).



Note

The front bumper must be removed on vehicles with air conditioning in order to be able to unbolt the evaporator from the radiator (88-200).

9 Withdraw flat springs (2) for radiator and lift out radiator.

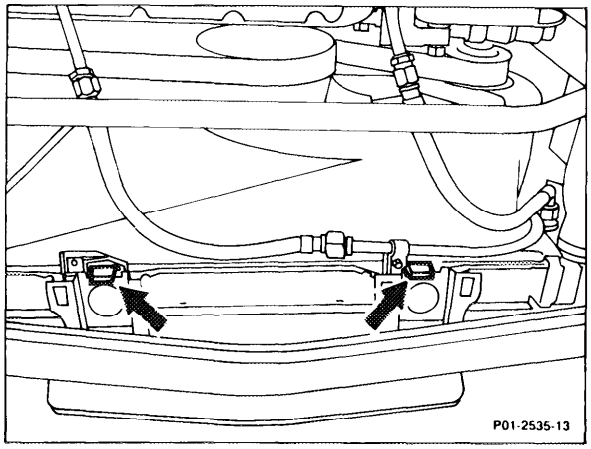


Installation

Installation is performed in the reverse order.

Note

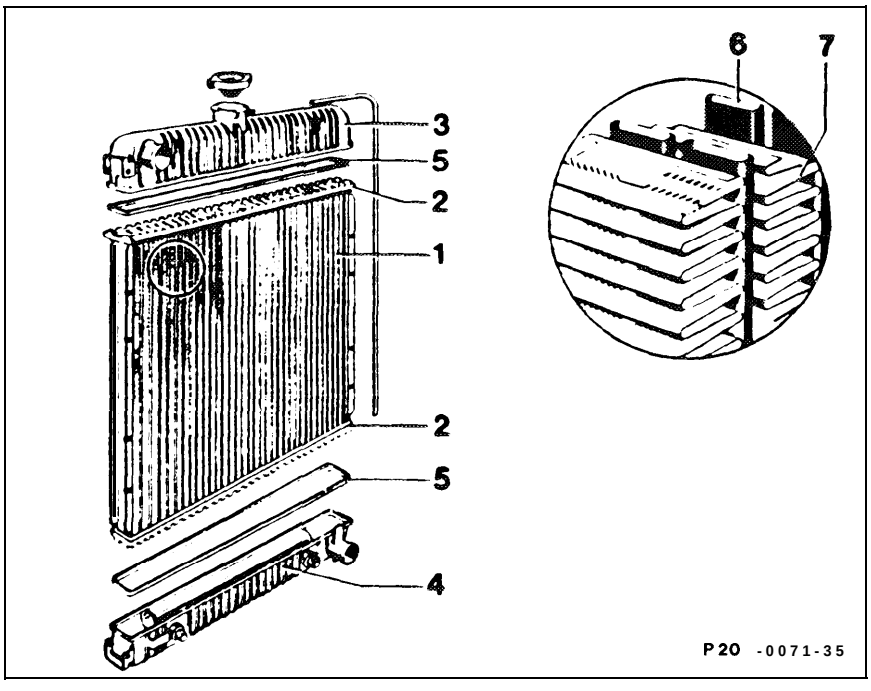
Ensure that the fixing mounts of the radiator are correctly positioned into the rubber grommets of the bottom holders and that the holders of the fan cowl are correctly inserted into the retaining clips on the radiator (arrows).



10 Check cooling system for leaks (20-017).

20-425 Repairing radiator

Preceding work:
Radiator removed (20-420)



Radiator honeycomb (1)	check for signs of damage.
Radiator	clean and seal hose connections and oil cooler line (steps 1 – 4).
Radiator	pressure test with tester 124 589 15 21 00 and 605 589 00 25 00 in water bath, mark leak point, reduce pressure and blow-dry radiator with compressed air (steps 5 – 10).
Top and bottom water tanks (3, 4)	check for leaks.
Gasket (5)	check for leaks.
Radiator	seal leak point with repair kit radiator sealant 123 989 00 20 (steps 11 – 15).

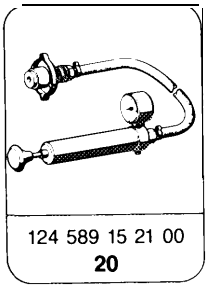
⚠ Warning
Note safety instructions!

Radiator	pressure-test at 1.4 bar gauge pressure in water bath, check for leaks (steps 16 – 17).
Radiator	install (20-420).
Cooling system	check for leaks (20-017).

Sealant

Repair kit radiator sealing	123 989 00 20

Special tools



124 589 15 21 00
20

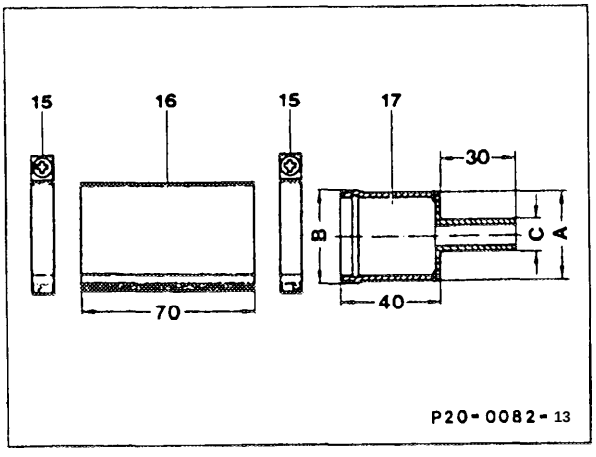
Commercial tool

7 mm wrench insert with flexible shaft for hose clips with worm drive	e. g.	Hazet, D-5630 Remscheid Order No. 426-7

Shop-made tool

Cap for top hose connection:

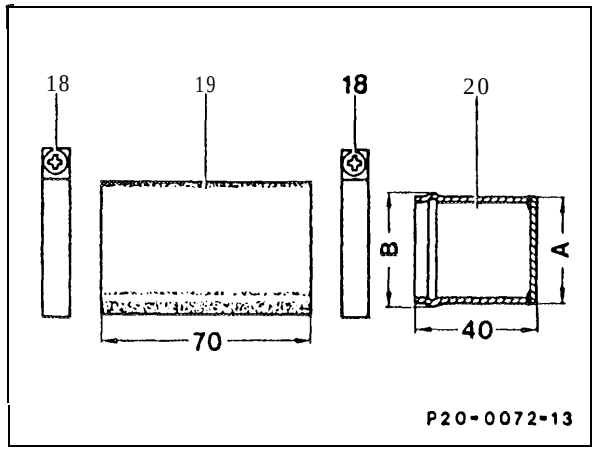
15 2 clips L 3646, Part No. 916026 036000
16 Piece of hose, Part No. 201 501 38 82
17 Reducer made from two tubes
A 35 mm dia.
B 39 mm dia
C 12 mm dia



Shop-made tool

Cap for bottom hose connection:

18 2 clips L 3646, Par-t No. 916026 036000
19 Piece of hose, Part No. 201 501 38 82
20 Cap from a tube
A 35 mm dia.
B 39 mm dia.



Designation	Use
Priming liquid	Preparation of base
Undiluted sealant	For properly sealing accessible points
Diluted sealant	For sealing difficult-to-reach points (e. g. sides of cooling tubes)

Sealant and priming liquid have a storage life of approx. 1 year provided they are always sealed airtight after use.

Priming liquid which has become cloudy should no longer be used.

The following parts or points in the coolant circuit can be sealed with the sealant:

a) Plastic water tanks (3 and 4).
b) Heavy metal water tanks (holes up to 1.5 mm diameter).
c) Light and heavy metal cooling tubes (6).
d) Tube plate (2).
e) Beaded collar (connecting point between radiator honeycomb and water tank).
f) Heat exchanger of heating system.

Fractured or cracked fastening straps or cracks at the connection fittings cannot be repaired.

Brazing or soldering on heavy metal radiators with plastic water tanks may only be performed on the honeycomb (1) at a distance of at least 20 mm from the water tank otherwise the high brazingsoldering temperature will damage the gasket (5) and the water tank (3 and 4). Leaks which are located closer to the water tank should be repaired only with sealant.

The radiator does not have to be removed from the vehicle for sealing. In this case, it is sufficient to drain the coolant and to pressure-test the cooling system with the tester (approx. 1.4 bar gauge pressure) after sealing.

Caution!
Light alloy radiators with plastic water tanks cannot be repaired by brazingsoldering.

Sealant is available in diluted and undiluted form in order to seal leaks of different accessibility at the radiator (e. g. more difficult in the honeycomb than at the water tank).

The various sealant versions and the priming liquid are combined in a repair kit Part No. 123 989 00 20.

⚠ Warning

The priming liquid is easily combustible (note safety instructions, Hazard Class A 1).

Acetic acid is released until the sealant has completely cured. For this reason, avoid contact with skin. Clean affected areas immediately with water and soap. Rinse out eyes with water. Consult a doctor if necessary.

Sealing

1 If the leakage point cannot be properly located with the radiator installed, remove radiator (20-420).

2 Clean radiator.

3 Seal hose connections with the shop-made caps.

4 Seal connections of the transmission oil cooler with plastic caps or plugs from old oil cooler lines. Cut off the oil cooler lines just behind the nipple and solder on.

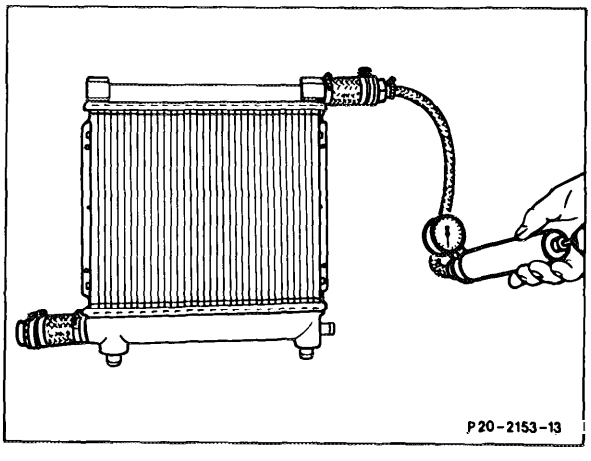
5 Connect testers 124 589 15 21 00, 605 589 00 25 00 to the radiator.

6 Place radiator in a water bath.

7 Pressurize radiator with the tester and check location of rising air bubbles.

8 Mark leakage points.

9 Remove radiator and reduce pressure.



10 Blow-dry radiator with compressed air.

11 Clean leakage point and area around it with a commercial cleaning agent (e. g. tri or white spirit).

It is not necessary to remove any paint. The radiator should then be blown-dry at the affected point with compressed air.

There must not be any dust or grease residues present on the surface.

12 Apply a very thin and even coat of priming liquid with a brush.

Apply the priming liquid at and around the point to be sealed. Pour the quantity of priming liquid required for the repair in a separate vessel to avoid polluting the entire can of priming liquid.

⚠ Warning
Note safety instructions!

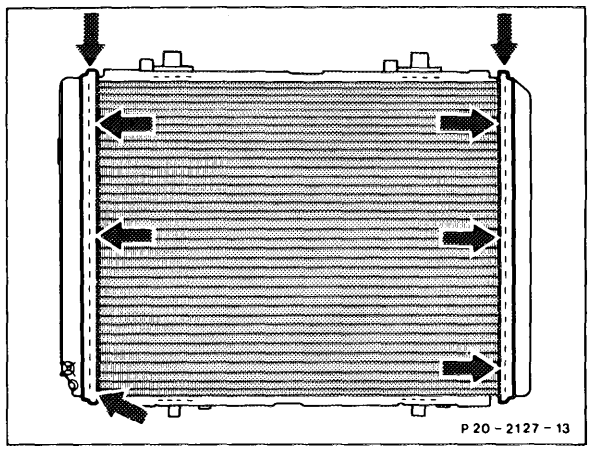
13 Allow priming liquid to dry for approximately 10 minutes at room temperature.

14 Apply diluted or undiluted sealant according to accessibility. Use brush, spatula or the like for spreading the sealant.

Caution!
During application and spreading sealant, ensure that no air is trapped.

Using the same method as for cleaning and priming, apply the sealant not only at the point to be sealed but also around it. If there are several leak points at the beaded collar (arrows) it is recommended to seal the beaded collar completely around its circumference.

Seal leaks in the honeycomb from both sides.



After completing the sealing procedure, close tube immediately. Acetic acid is released until the sealant has completely cured. Avoid contact with skin. Clean affected areas immediately with water and soap. Rinse out eyes with water. Contact a doctor if necessary.

15 Leave radiator upright or face-down for at least 3 hours for the sealant to dry. Depending on the quantity of sealant applied and the size of the point treated, it may take up to 24 hours for the sealant to cure to form a permanent elastic joint at room temperature.

16 Pressure-test radiator for approx. 5 minutes in a water bath at 1.4 bar gauge pressure.

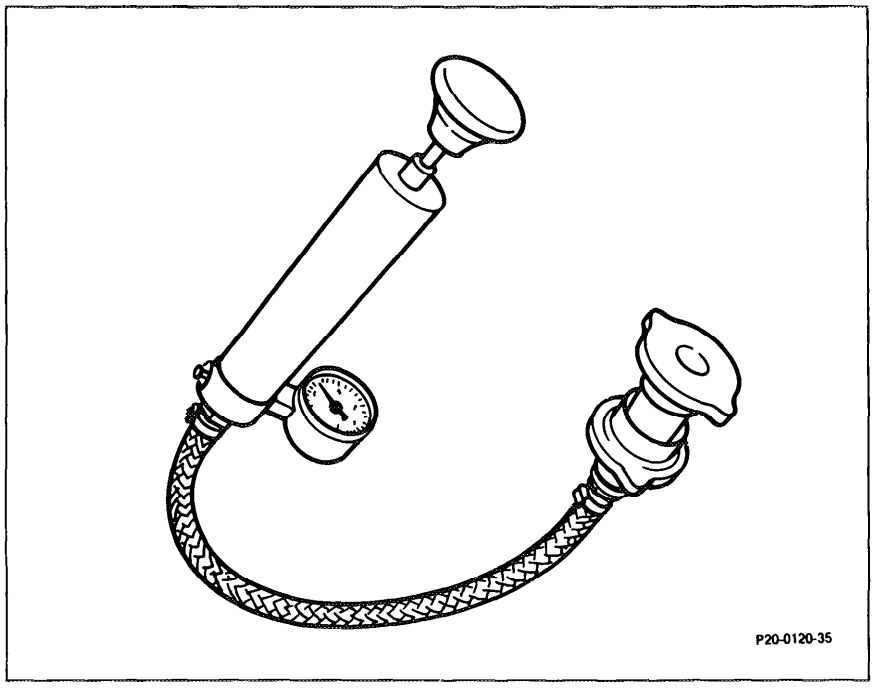
If any leaks remain, repeat sealing operation starting at step 8.

17 Remove testers and plugs.

18 Install radiator (20-420).

19 Check cooling system for leaks (20-017).

20-430 Testing radiator or expansion tank cap



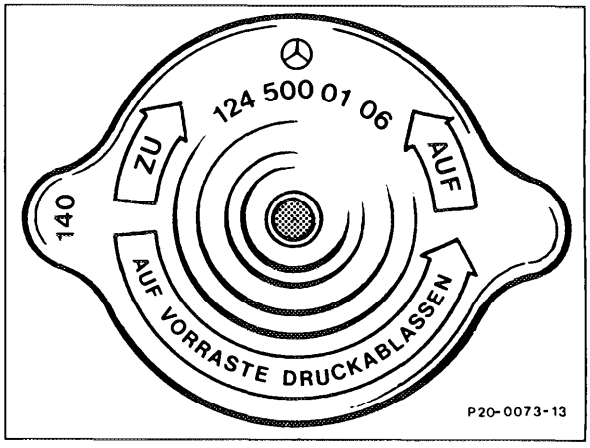
Double connection 000 589 77 63 00	connect to leak tester 124 589 15 21 00.
Cooling system pressure cap	screw onto double connection 000 589 73 63 00.
Opening pressure	test.

Pressure **cap**

Pressure cap code number		120	140
Pressure relief valve opens at bar gauge pressure	new	1.2 ± 0.1	1.4 ± 0.1
	used	1.2 – 0.1	1.4 – 0.1
Vacuum valve opens at bar vacuum		0.1	

Note
If corrosion is present on the expansion tank cap, it must be replaced.

Engines 602.961, 603.960, **603.961**
The opening pressure of the cap has been increased from the previous 1.2 bar to 1.4 bar; with standard antifreeze protection down to -30 °C, the permissible coolant temperature is increased as a result from **125** to 129 °C.

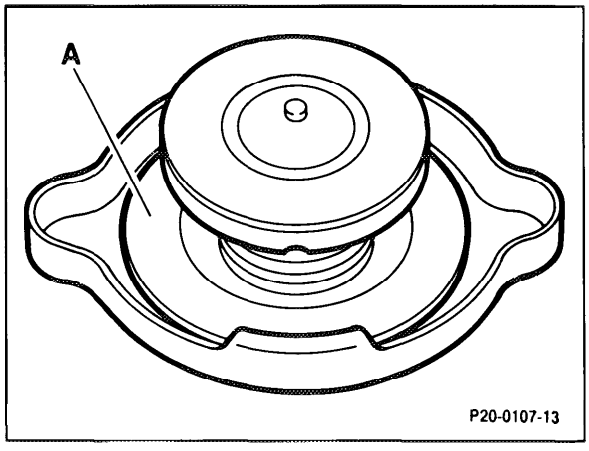


Production breakpoint: 02 - 09/86

Model	Engine	Engine End No. manual transmission	Engine End No. automatic transmission	Vehicle End No. A	Vehicle End No. F
124.133	603.960	*	*	*	*
124.193	603.960	*	*	*	017987
126.125	603.961	*	*	*	*
201.128	602.961	*	*	*	271512

* not registered

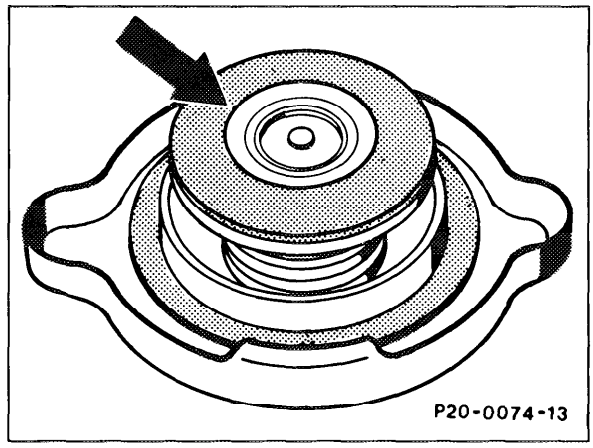
This cap is provided with a rubber seal (A) to prevent any outside air from being drawn in (when vacuum exists in cooling system).



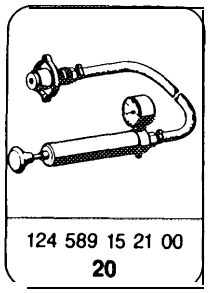
Effective 10/87 and 12/87, respectively, pressure caps with and without guide ring (B) have been fitted to engines 602, 603. Only the pressure cap with guide ring is supplied as a replacement part, however.

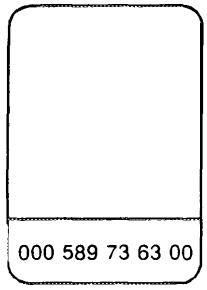
The modified pressure cap can also be fitted to vehicles manufactured previous to production dates with coolant expansion tank.

A Seal
B Guide ring



Special tools


124 589 15 21 00
20

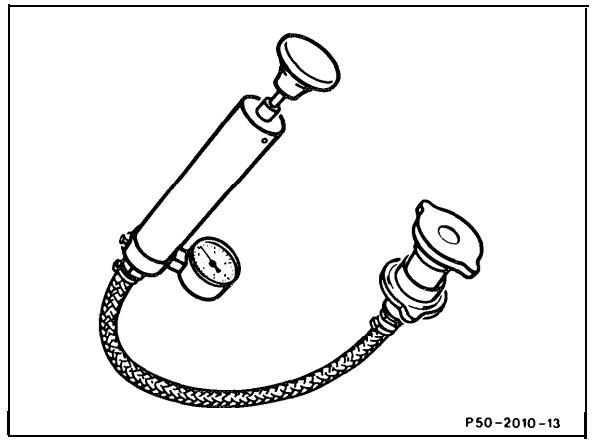

000 589 73 63 00

Testing pressure relieve valve

1 Attach double connection 000 589 73 63 00 to the leak tester 124 589 15 21 00.

2 Fit cooling system pressure cap onto the double connection 000 589 73 63 00.

3 Test the opening pressure by pumping.

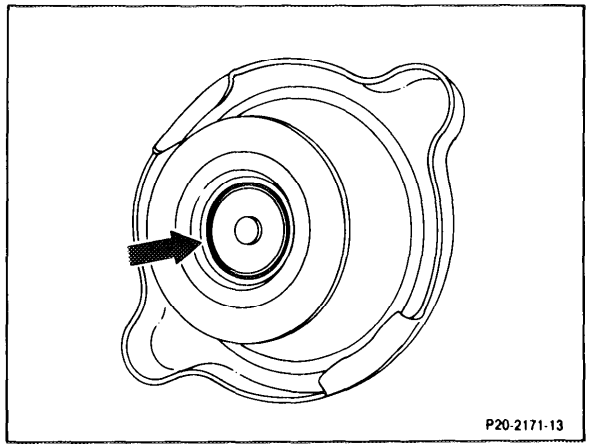


Testing vacuum valve

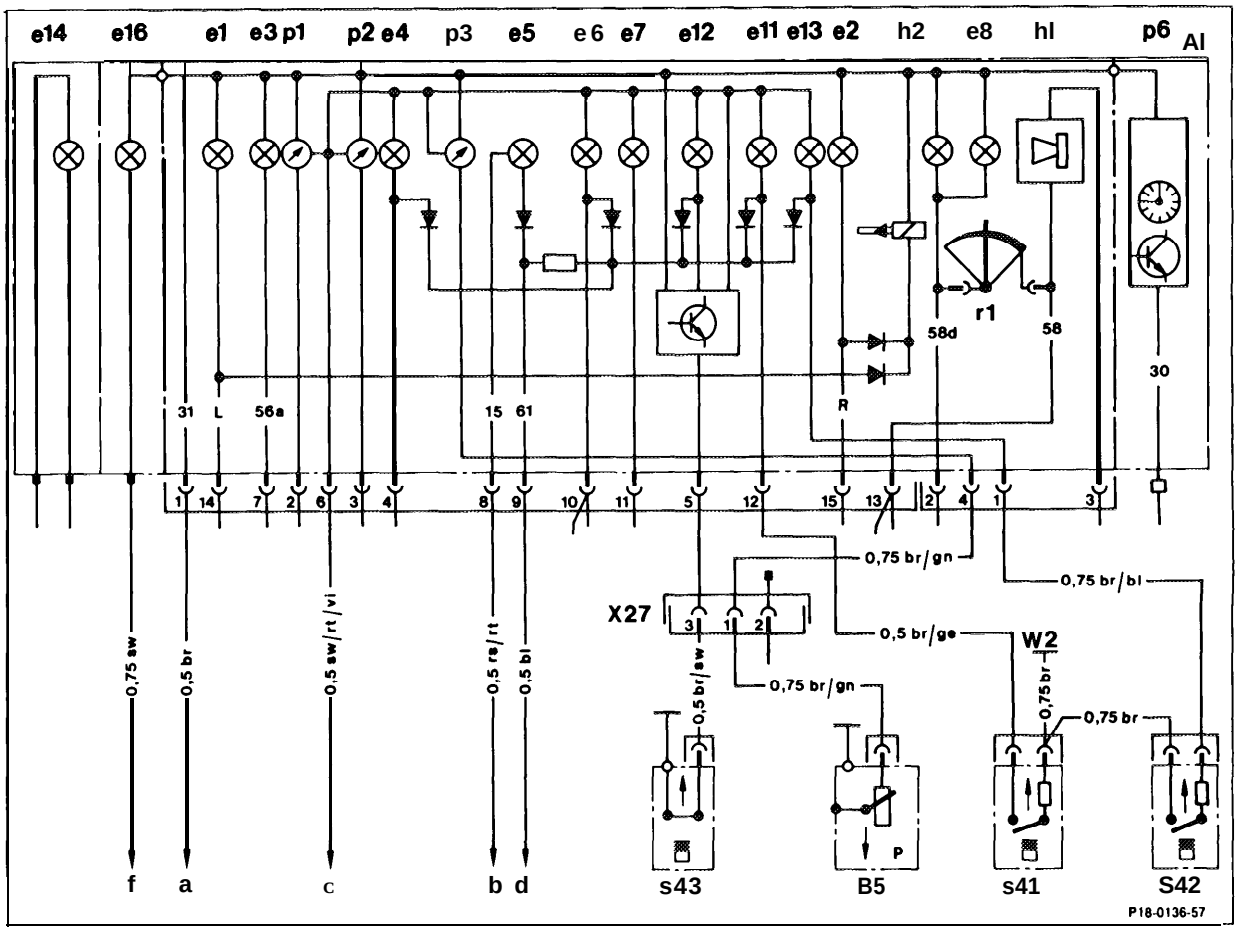
The vacuum valve (arrow) must be contacting the rubber seal. It must be easily raised and must spring back when released.

Note

Always replace expansion tank caps which are corroded (surface rust).

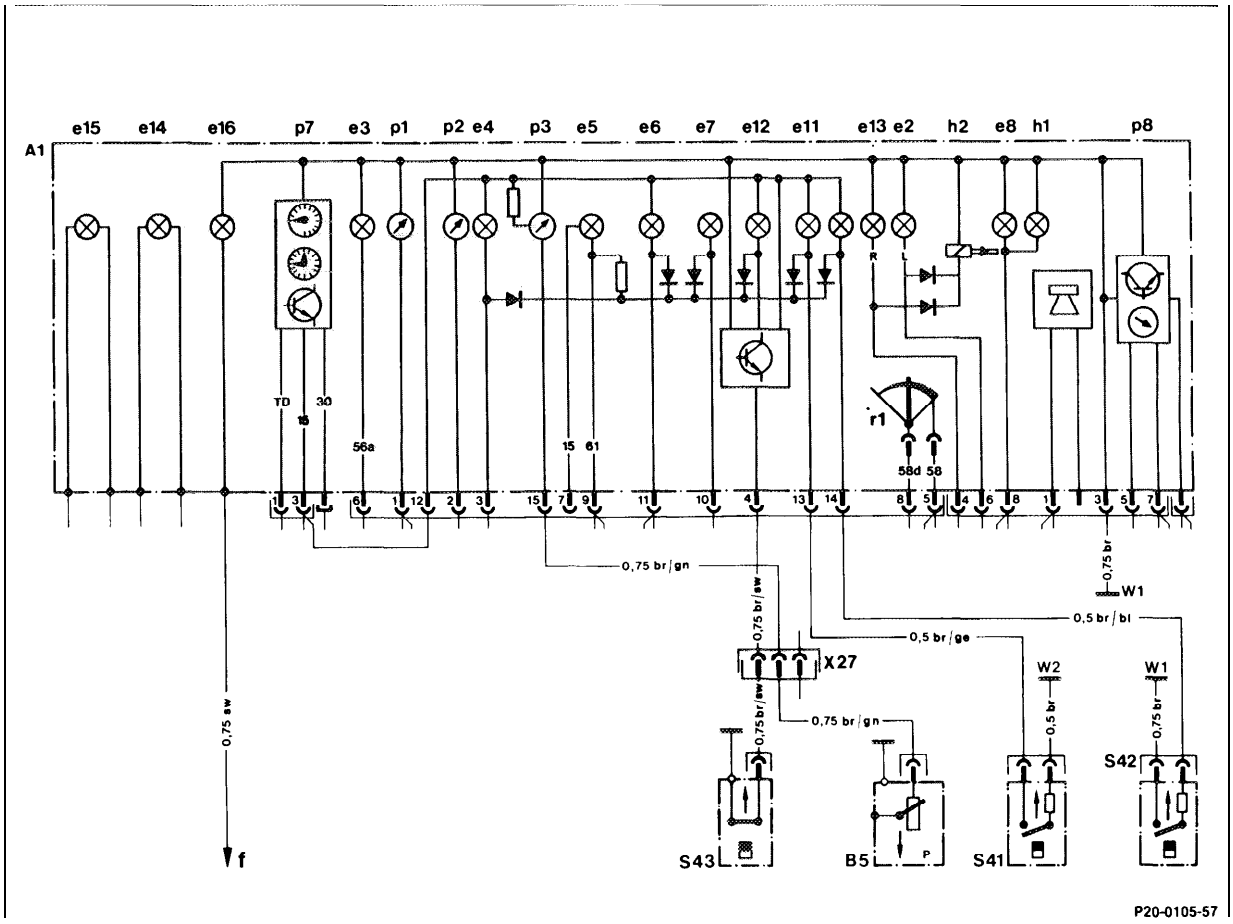


Model 124



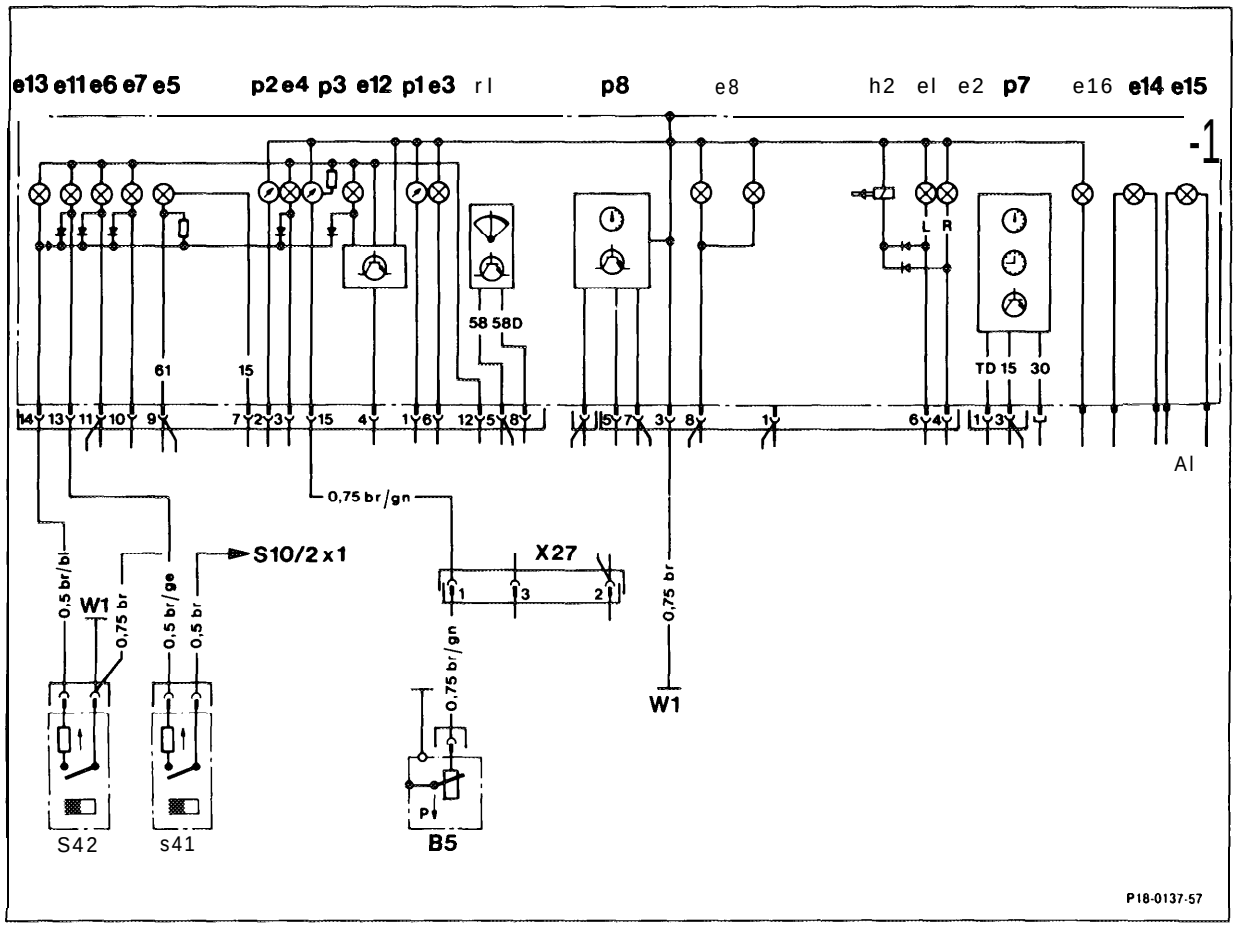
Wiring diagram of engine oil level indicator, coolant level indicator, windshield washer level indicator

Al	Instrument cluster
el	Left turn signal indicator
e2	Right turn signal Indicator
e3	High beam indicator
e4	Fuel reserve warning lamp
e5	Battery charge indicator
e6	Brake pad wear indicator lamp
e7	Brake fluid and parking brake indicator lamp
e8	Instrument lighting
el 1	Coolant level indicator lamp
e12	Oil level indicator lamp
e13	Windshield washer level indicator lamp
e14	Bulb failure indicator lamp
e16	Preglow Indicator lamp
hl	Wamrng buzzer
p1	Coolant temperature indicator
P2	Fuel gauge
p3	Oil pressure gauge
p6	Electronic clock
B5	Oil pressure sensor
s41	Coolant level Indicator lamp switch
S42	Windshield washer level indicator lamp switch
s43	Oil level Indicator lamp switch
w 2	Ground, front right next to lamp unit
X27	Plug connector, starter harness
a	Main ground behind Instrument cluster W1
b	Fuse 7 terminal 15
C	Fuse 5 terminal 15
d	Lamp monitor unit
	Preglow time relay terminal La



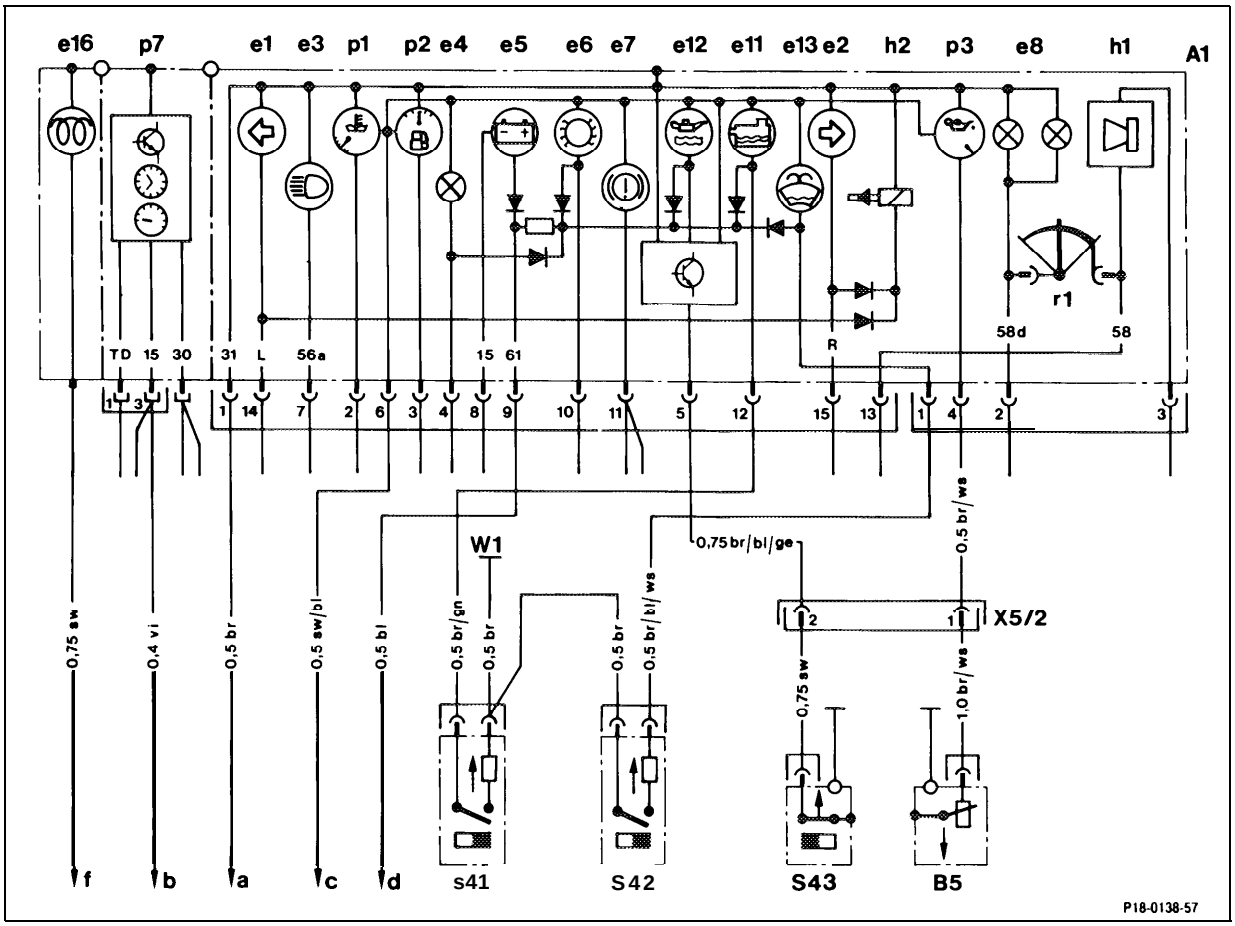
Wiring diagram of engine oil level indicator, coolant level indicator, windshield washer level indicator

A1	Instrument cluster
e1	Left turn signal indicator
e2	Right turn signal indicator
e3	High beam indicator
e4	Fuel reserve warning lamp
e5	Battery charge indicator
e6	Brake pad wear indicator lamp
e7	Brake fluid and parking brake indicator lamp
e8	Instrument lighting
e11	Coolant level indicator lamp
e12	Oil level indicator lamp
e13	Windshield washer level indicator lamp
e14	Bulb failure indicator lamp
e15	Airbag indicator lamp (RS/SRS)
e16	Preglow indicator lamp
h1	Warning buzzer
h2	Audible turn signal indicator
p1	Coolant temperature Indicator
P2	Fuel gauge
P3	Oil pressure gauge
P7	Electronic clocktachometer
B5	Oil pressure sensor
s41	Coolant level indicator lamp switch
S42	Windshield washer level Indicator lamp switch
s43	011 level indicator lamp switch
W1	Main ground behind Instrument cluster
w2	Ground, front right next to lamp unit
X27	Plug connector, starter harness
f	Preglow time relay terminal La



Wiring diagram of engine oil level indicator, coolant level indicator, windshield washer level indicator

A l	Instrument cluster
e l	Left turn signal indicator
e2	Right turn signal indicator
e3	High beam indicator
e4	Fuel reserve warning lamp
e5	Battery charge Indicator
e6	Brake pad wear indicator lamp
e7	Brake fluid and parking brake indicator lamp
e8	Instrument lighting
e l l	Coolant level indicator lamp
e12	Oil level indicator lamp
e13	Windshield washer level indicator lamp
e14	Bulb failure Indicator lamp
e15	Airbag indicator lamp (RS/SRS)
e16	Preglow indicator lamp
h2	Audible turn signal indicator
p1	Coolant temperature indicator
P2	Fuel gauge
P3	Oil pressure gauge
P7	Electronic clock/tachometer
p8	Electronic speedometer
V1	Instrument lighting rheostat
B5	Oil pressure sensor
S10/2x1	Connector, front right brake pad contact sensor
s41	Coolant level indicator lamp switch
S42	Windshield washer level indicator lamp switch
s43	011 level indicator lamp switch
W1	Main ground behind Instrument cluster
X27	Plug connector, starter harness



Wiring diagram of engine oil level indicator, coolant level indicator, windshield washer level indicator (see Wiring Diagrams Volume 5 for further information)

A1	Instrument cluster
e1	Left turn signal indicator
e2	Right turn signal Indicator
e3	High beam Indicator
e4	Fuel reserve warning lamp
e5	Battery charge indicator
e6	Brake pad wear indicator lamp
e7	Brake fluid and parking brake indicator lamp
e8	Instrument lighting
e11	Coolant level Indicator lamp
e12	Oil level Indicator lamp
e13	Windshield washer level indicator lamp
e16	Preglow indicator lamp
h1	Warning buzzer
h2	Audible turn signal indicator
p1	Coolant temperature indicator
p2	Fuel gauge
p3	Oil pressure gauge
p6	Electronic clock
B5	Oil pressure sensor
S41	Coolant level indicator lamp switch
S42	Windshield washer level indicator lamp switch
s43	Oil level indicator lamp switch
W1	Main ground (behind Instrument cluster)
X5/2	Connector, interior/starter 4-pin
a	Main ground behind Instrument cluster W1
b	Electrical centre, connector contact 15 terminal 15 unprotected
c	Electrical centre, connector D contact 2 terminal 15 fuse 8
d	Electrical center, connector D contact 8 alternator terminal 61
f	Preglow time relay

Test data

Resistance at coolant level sensor with "max" coolant level	∞ Ω
Resistance at coolant level sensor with "min" coolant level	approx. 15 Ω
Battery voltage	approx. 12 V

Commercial tool

Multimeter	e. g.	SUN, DMM-5

Complaints

A. **Indicator lamp remains on when engine running and coolant level correct.**

B. **Indicator lamp does not light up when key in position "2".**

C. **Indicator lamp does not light up when engine running and coolant level below "min".**

Testing

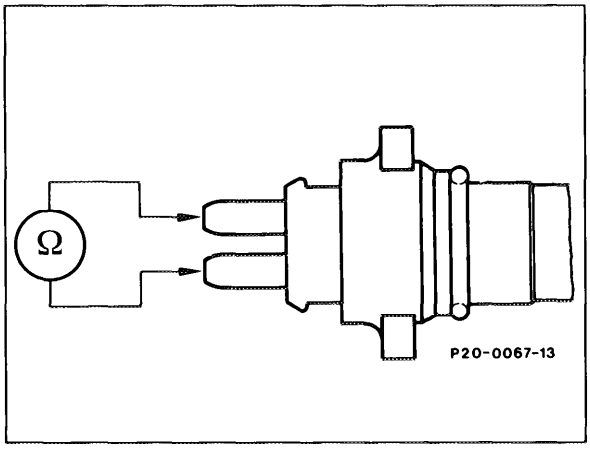
A. Indicator lamp remains on when engine running and coolant level correct.

Test coolant level sensor. Detach connector. Connect both pins to multimeter and test resistance.

Readout: ∞ Ω

Yes	No

No → Replace coolant level sensor.



Check cable. Remove instrument cluster. Test contact 12 of 15-pin connector to ground with multimeter.

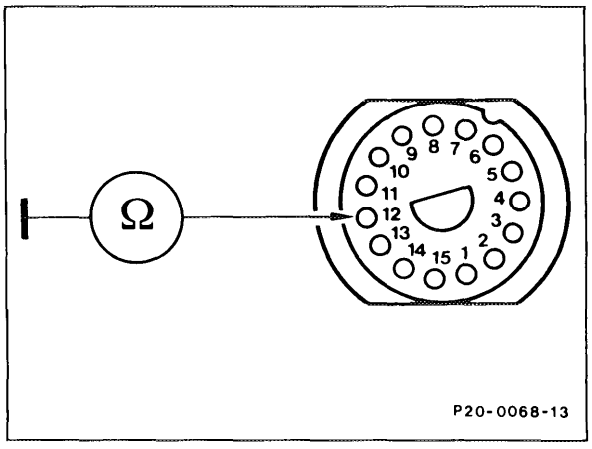
Readout: ∞Ω

Yes	No

Rectify short to ground.

Replace gauge.

End of test



B. Indicator lamp does not light up when key in position "2".

Check operation of bulb.

Yes	No

Replace bulb.

Remove instrument cluster. Measure voltage at contacts 6 and 9 of 15-pin connector with multimeter.

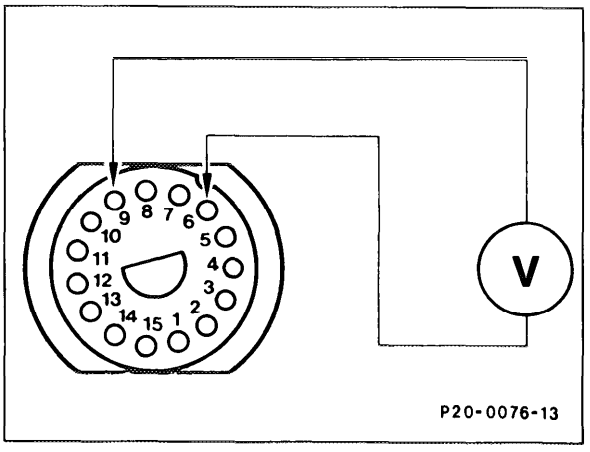
Readout: approx. 12 V

Yes	No

Rectify open circuit according to wiring diagram.

Replace gauge.

End of test



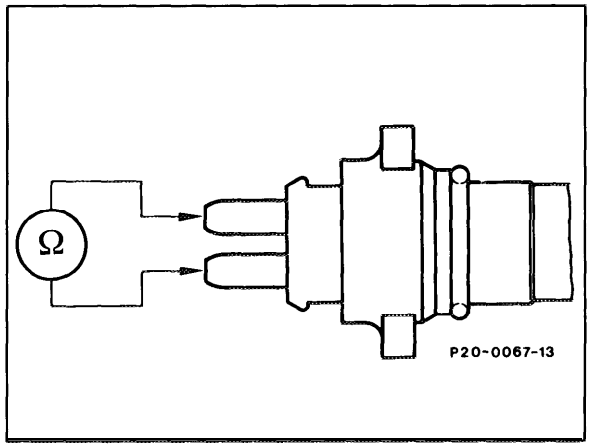
C. Indicator lamp does not light up when engine running and coolant level below "min". Control function section "B" in order.

Check coolant level sensor. Detach connector. Connect both pins to multimeter and test resistance.

Readout: approx. 5 Ω

Yes	No

Replace coolant level sensor.

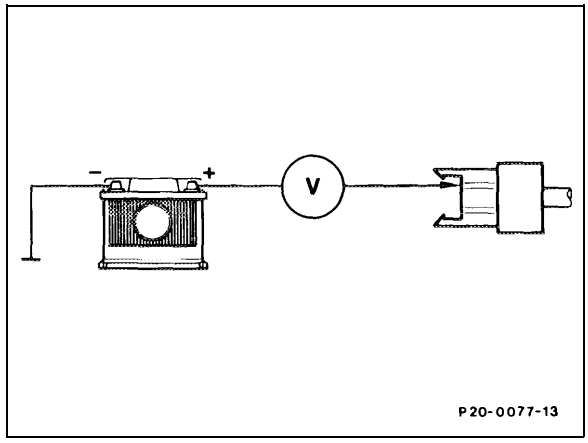


Check cable. Connect multimeter to 2-pin coolant level sensor connector (brown cable) and battery positive.

Readout: approx. 12 V

Yes	No

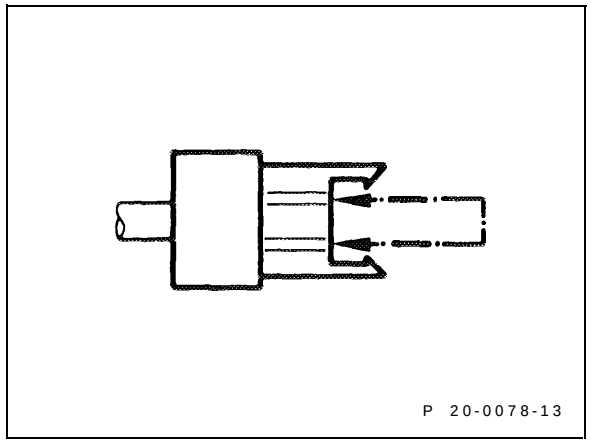
Test ground connection, correct if necessary.



Jumper coolant level sensor connector. With key in position "2", indicator lamp should light up.

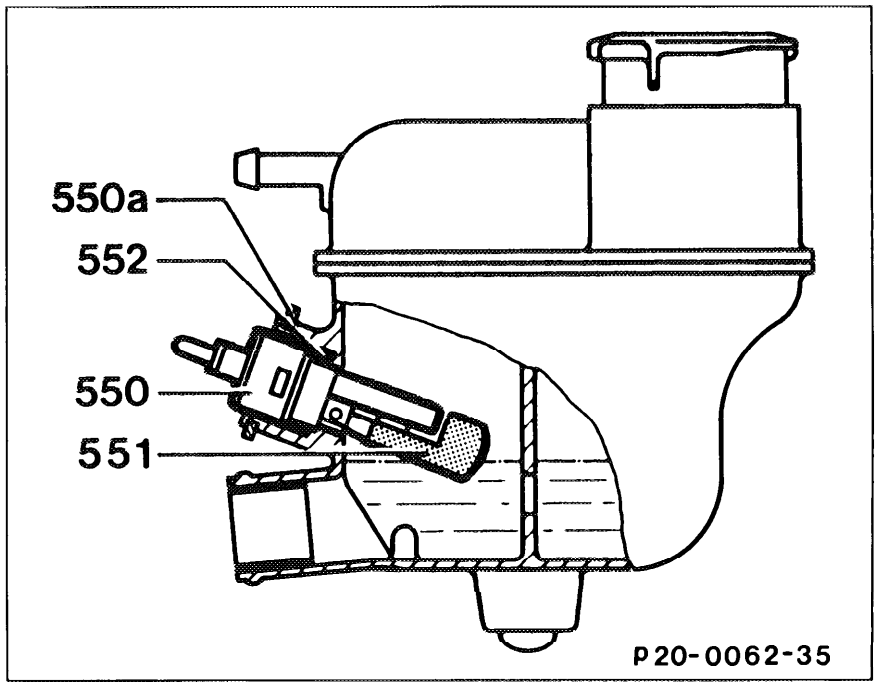
Yes	No

Rectify open circuit according to wiring diagram.



End of test

20-445 Function of coolant level indicator



550 Coolant level sensor
551 Float
552 O-ring

General

The coolant level indicator monitors the coolant level in the expansion tank when the engine is running.

The coolant level indicator lights up when the ignition is switched on (control function) and goes out as soon as the engine is running.

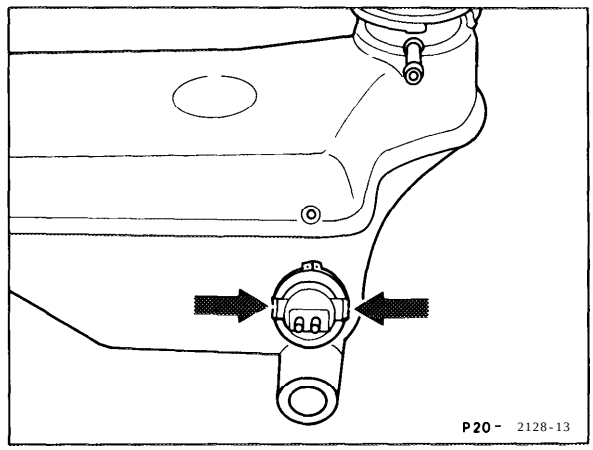
For the control function, the coolant level indicator shows a weak light and a bright light if there is a fault during engine operation.

Components

- Coolant level sensor (550) in expansion tank
- Indicator lamp in instrument cluster.
  Symbol: radiator.

To ensure that the coolant level sensor is correctly installed, it has two lugs of different width which fit into matching slots on the expansion tank (arrows).

The sensor is press-fitted in the expansion tank and sealed with an O-ring. Remove locking ring in order to withdraw the coolant level sensor.



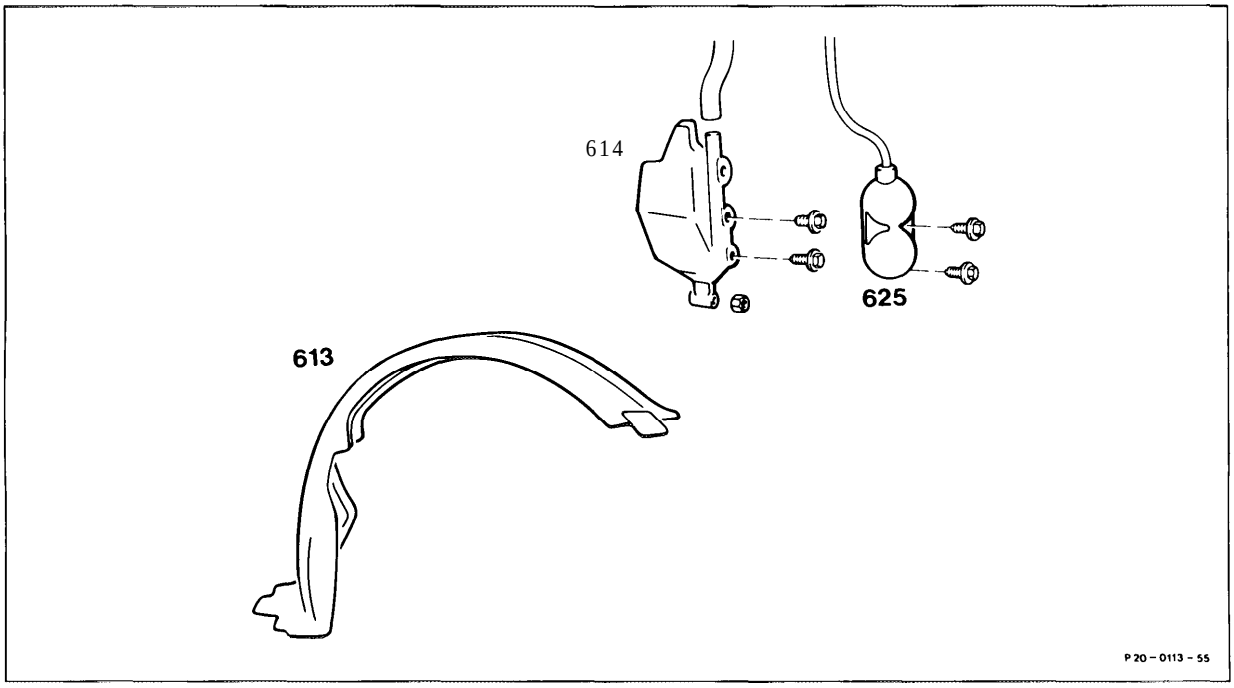
Function

The coolant level in the expansion tank is sensed by a float (551) with permanent magnet attached to the coolant level sensor.

Below a certain coolant level the contact is closed and the indicator lamp lights up.

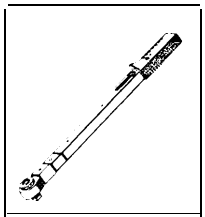
Depending on driving style the indicator lamp lights up briefly and later shows a steady light. If the indicator lamp lights up, top off coolant.

20-450 Removal and installation of overflow tank



Front right wheel	. . . . .	remove, refit. Tightening torque 110 Nm.
Partition panel (613) under front fender	.....	remove, install (step 2).
Vacuum reservoir (625)	. . . . .	remove, install (step 3).
Overflow tank (614)	. . . . .	remove, install (step 4).

Special tool



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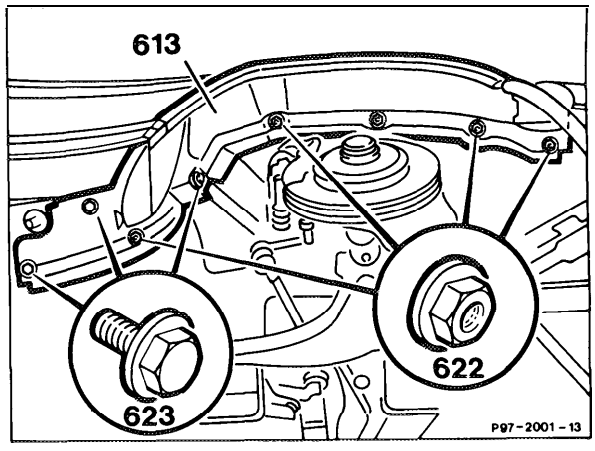
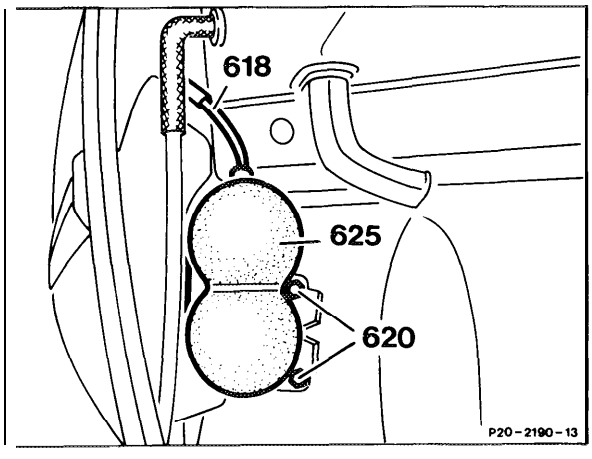
Removal and installation

1 Remove right front wheel.

2 Unscrew bolts (623) and nuts (622), remove partition panel (6 13).

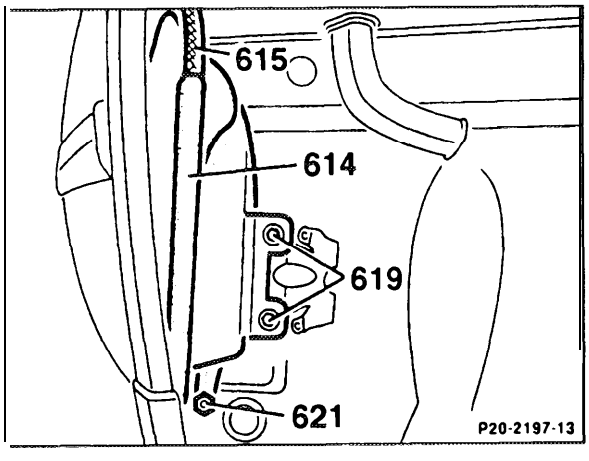


3 Detach vacuum hose (618). Remove bolts (629) and remove vacuum tank (625).



4 Remove bolts (619) and nut (621). Detach hose (615) and remove overflow tank (614).

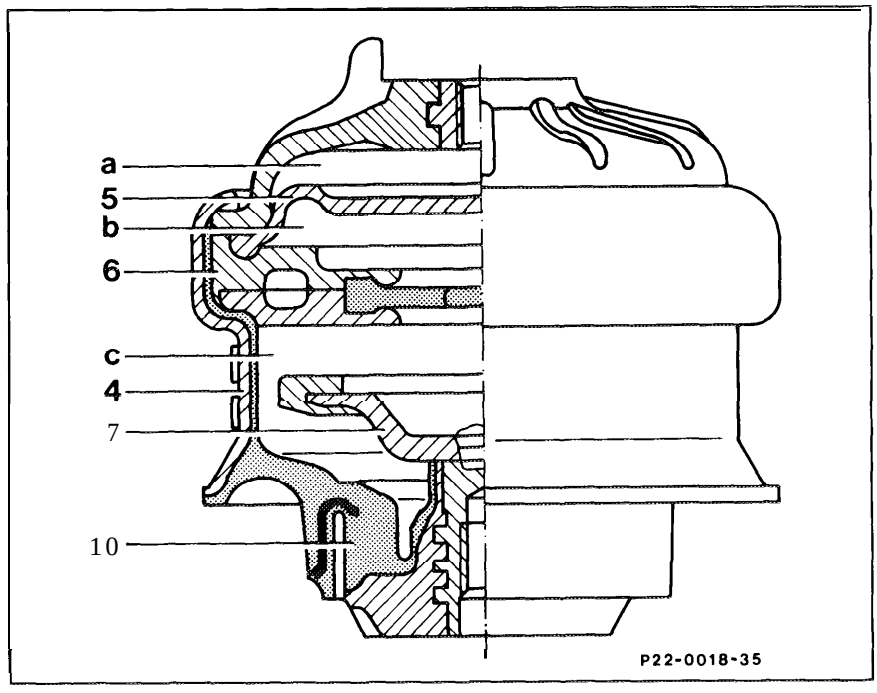
5 Install in the reverse order.



Job No.

Function of hydraulic engine mounts . . . . . 22 – 210
Removal and installation of rear engine mount . . . . . 22 – 212
Removal and installation of front engine stop . . . . . 22 – 215
Adjusting engine stop . . . . . 22 – 220
Removal and installation of engine shock absorber . . . . . 22 – 240

Function of hydraulic engine mounts



4 Engine mount
5 Diaphragm
6 Plastic disc with annular passage
7 Rubber stop plate
10 Rubber mount
a Diaphragm space
b Upper chamber
c Lower chamber

The hydraulic engine mounts are filled with a glycol mixture. The glycol mixture is located in two chambers (b and c). The two chambers are connected to each other by an annular passage in the plastic disc (6). The glycol mixture flows along the annular passage into the respective chamber as the springs compress or rebound. A diaphragm (5) limits the upper chamber (b). Air is admitted to or released from the diaphragm space (a) through two passages. The rubber stop plate (7) in the lower chamber (c) is firmly connected to the bearing foot and limits the spring travel during compression. The engine mount (4) is attached by a hexagon bolt to the engine supporting bracket and by a hexagon socket bolt to the frame cross member.

All parts of the engine mounting are maintenance-free.

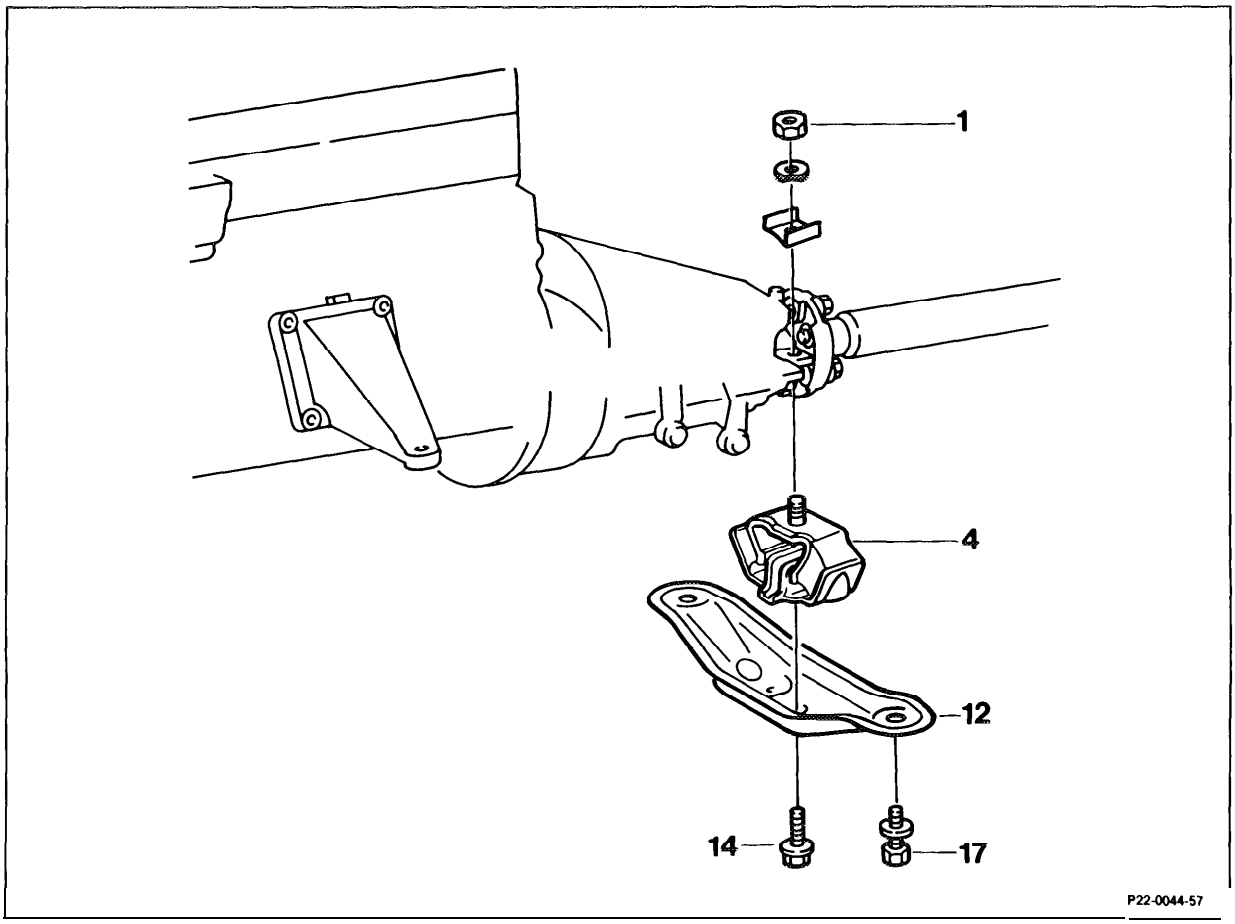
The hydraulic engine mounts have identical load bearing capacity on the left and right but differ depending on the various engine and transmission versions.

They are identified by a colored dot on the housing in order to avoid interchanging them accidentally.

22-212 Removal and installation of rear engine mount

Preceding work:
Bottom engine compartment lining removed (01-006).

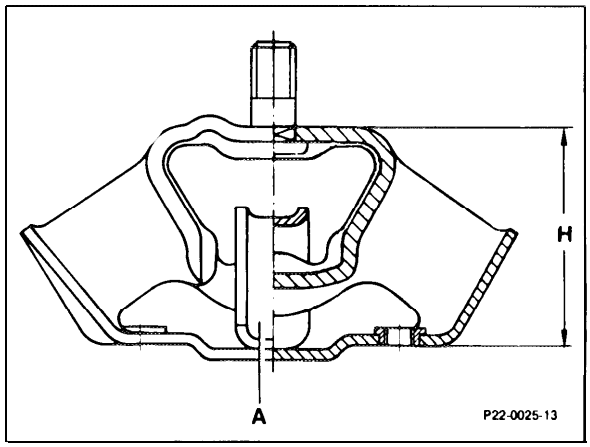
A. Vehicles with hydraulic engine mount



Hexagon nut (1)	unbolt, bolt on, 70 Nm.
Transmission	remove support from below.
Hexagon bolts (17)	unbolt, bolt in, 35 Nm.
Engine supporting bracket (12)	remove together with engine mount (4), attach. Hexagon bolts (14), 25 Nm.

Note

Effective from the introduction of the hydraulic engine mounts, the rear engine mount has been provided with a catch bar (A). In addition, the height (H) of the engine mounts has been altered.

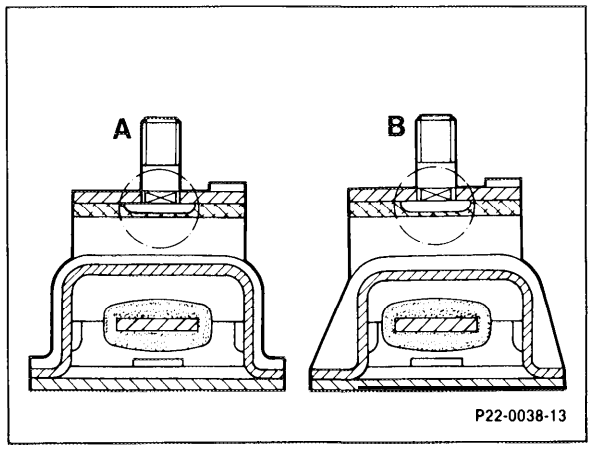


Dimensions

Model	Version	Height (H)
201	4- and 5-speed transmission	64 mm
	automatic transmission	62 mm
124	all	64 mm

Engine mount spring travel to the front limited

As a result of a production modification the spring travel of the engine mount to the front has been restricted.

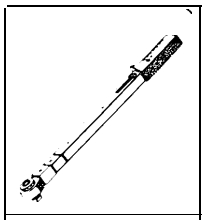


A Previous version
B Modified version

Tightening torques	Nm
Hexagon nut engine mount – transmission	**70**
Hexagon bolt engine mount – engine supporting bracket	25
Hexagon bolts of engine supporting bracket	45

[1]) 603.913 and 603.963 effective 04/88

Special tools



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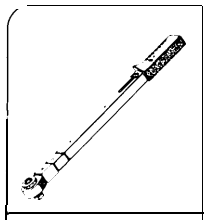

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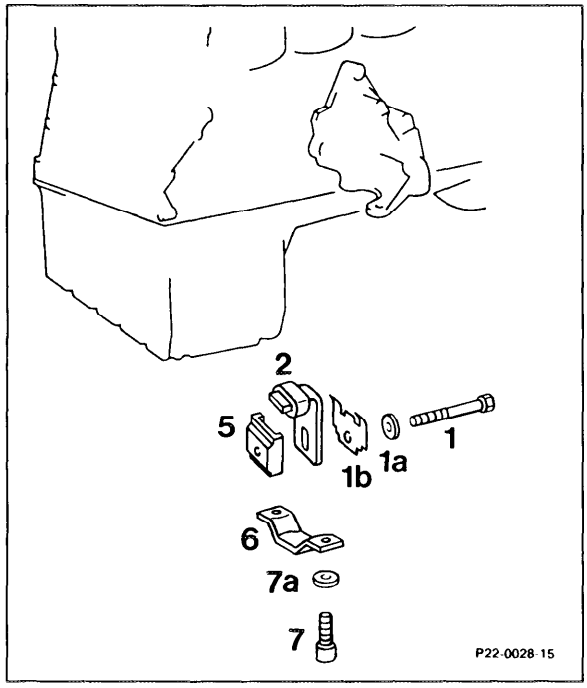
22-215 Removal and installation of front engine stop

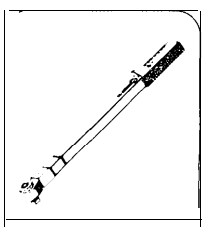
Preceding work:
Bottom engine compartment lining removed (01-006).



Adjusting bolt (1)	. . . . .	unbolt, bolt in, 130 Nm.
		Note
		Adjust engine stop (22-220).
Hexagon socket bolts (7)	. . . . .	unbolt, bolt in, 25 Nm.
Bracket (6) and engine stop (2)	. . . . .	remove, attach.

Tightening torques	Nm
Hexagon socket bolts, engine stop bracket	25
Adjusting bolt	130

Special tools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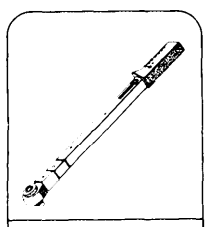
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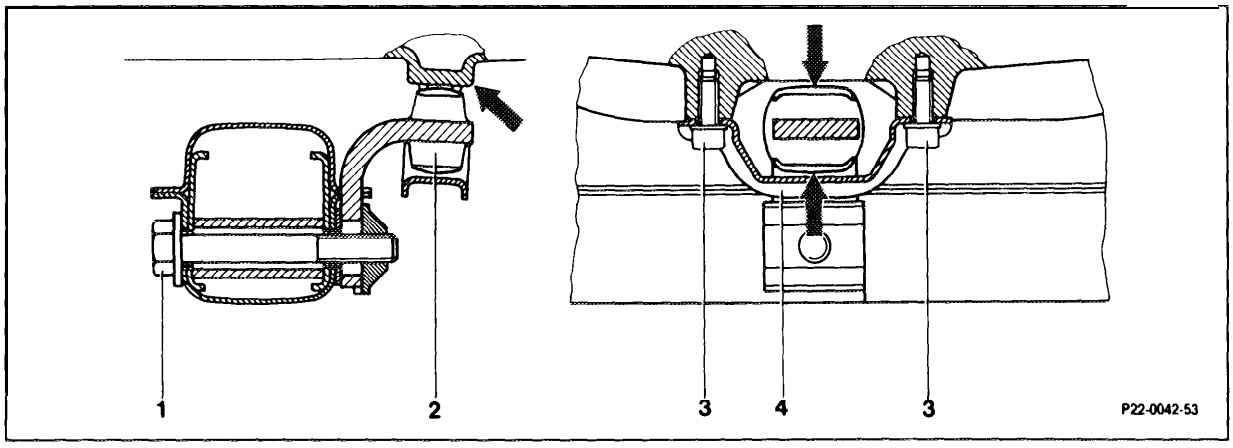
22-220 Adjusting engine stop

Preceding work:
Bottom engine compartment lining removed (01-006).



Note
For this adjustment, the vehicle must be on its wheels and ready to be driven.
The engine stop must not be treated with oil or grease.

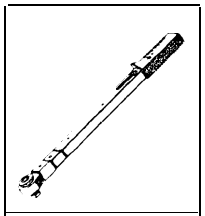
Adjusting bolt (1) . . . . . loosen at front engine stop, tighten, 130 Nm insert gauge 201 589 04 23 00 remove (steps 1, 3 – 7).

Note
Loosen prepared engine stop from frame cross member.

Adjusting bolt (11) . . . . . loosen at rear engine mount, tighten, 30 Nm (steps 2, 5).

Tightening torques	Nm
Adjusting bolt, front engine stop	130
Adjusting bolt, rear engine mount	30

Special tools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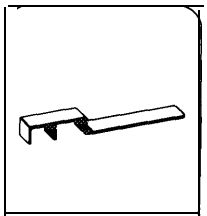
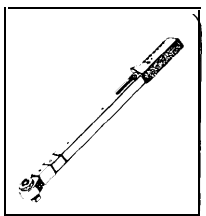

201 589 04 23 00
22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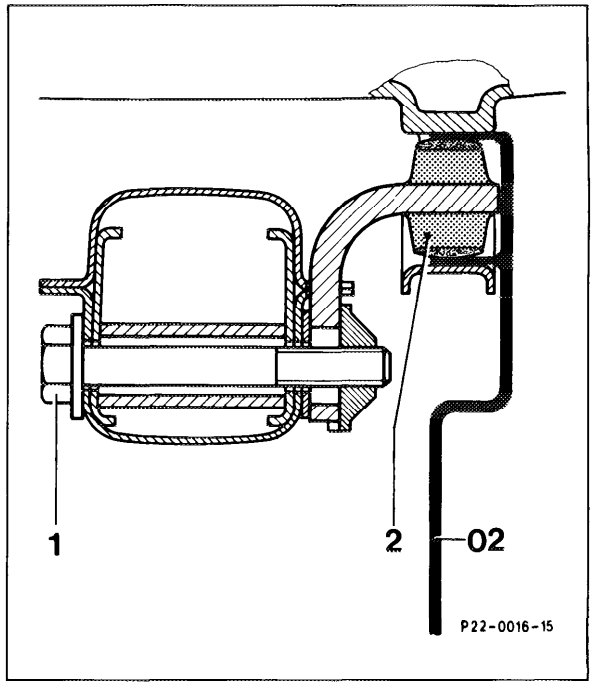
Loosening

Note
To adjust the engine stop, the vehicle must be ready to be driven and on the ground. The engine stop must not be treated with oil or grease.

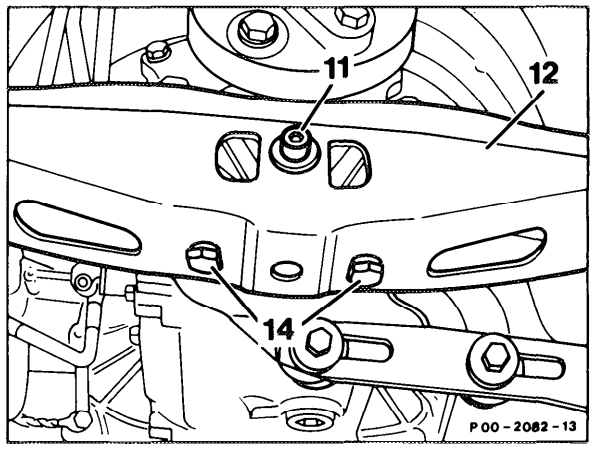
1 Loosen adjusting bolt (1) at engine stop (2) fully.

Note
Loosen the engine stop which may be sticking to the frame cross member due to wax or paint.



04 Gauge 201 589 04 23 00

2 Loosen adjusting bolt **(11)** at rear engine supporting bracket fully.



12 Engme supporting bracket
14 Engme mount hexagon bolts

Adjusting

3 Insert gauge **201 589 04 23 00 (02) at** engine stop.

4 Move engine by shaking slightly from left to right by hand.

5 Tighten adjusting bolt at rear engine mount, 30 Nm.

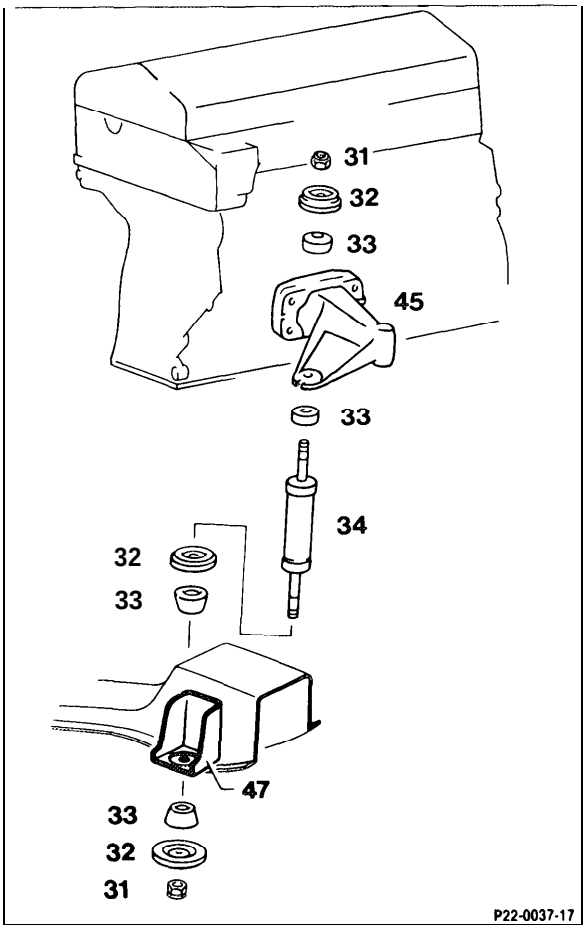
6 Tighten adjusting bolt (1) at engine stop (2), 130 Nm.

7 Remove gauge (02).

22-240 Removal and installation of engine shock absorber

Preceding work:
Bottom engine compartment lining removed (01-006).

Engine 603.96/97 in Model 126



Model 126

Model 126

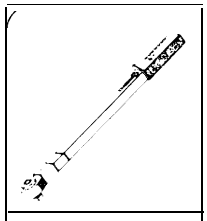
Hexagon nut (31) ..... of left and right shock absorber (34), unscrew at frame cross member and at engine supporting bracket, screw on, 10 Nm.

Shock absorber (34) ..... take off, install.

Note
Check condition of shock absorbers and all attached parts; renew, if necessary.

Tightening torques	Nm
Hexagon nuts, shock absorber mounting	10
Hexagon bolts, shock absorber mount Model 201.128	10

Special tool



001 589 72 21 00
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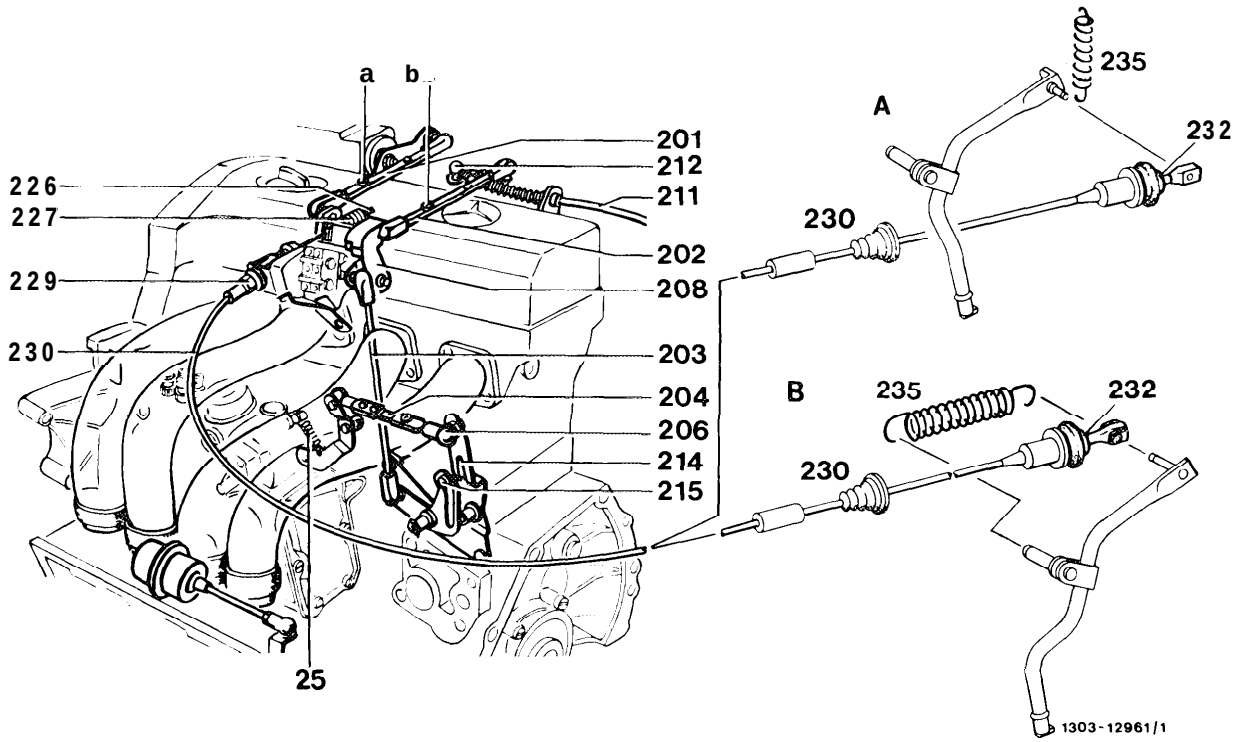
Job No.

Adjustment of accelerator control linkage . . . . . 30 – 300
Adjusting accelertaor control linkage - Turbodiesel . . . . . 30 – 300
Removal and installation of firewall bearing for accelerator lever . . . . . 30 – 315
Removal and installation of firewall bearing for accelerator pedal lever - Turbodiesel . . . . . 30 – 315
Removal, installation and adjustment of Bowden cable . . . . . 30 – 325
Removal, installation and adjustment of Bowden cable - Turbodiesel . . . . . 30 – 325
Adjusting longitudinal accelerator control shaft Model 126 . . . . . 30 – 327
Removal and installation of accelerator pedal . . . . . 30 – 330
Removal and installation of accelerator pedal - Turbodiesel . . . . . 30 – 330
Lubrication of accelerator control linkage and control shafts . . . . . 30 – 335
Lubrication of accelerator control linkage and control shafts - Turbodiesel . . . . . 30 – 335
Retrofitting accelerator control shaft and bearing bracket - Turbodiesel . . . . . 30 – 400

30-300 Adjustment of accelerator control linkage



A Model 201

Accelerator control linkage	Check for bending and ease of movement.
Bowden cable (230)	The spring plate (226) of the Bowden cable must be free of tension when contacting the compression spring (227) in idle position; adjust Bowden cable, if necessary, from inside of car with adjusting nut (232).
Relay lever (214)	Move into idle position, the roller (215) must be resting free of tension against the end stop in the variable-fulcrum lever. Adjust connecting rod (204), if necessary.

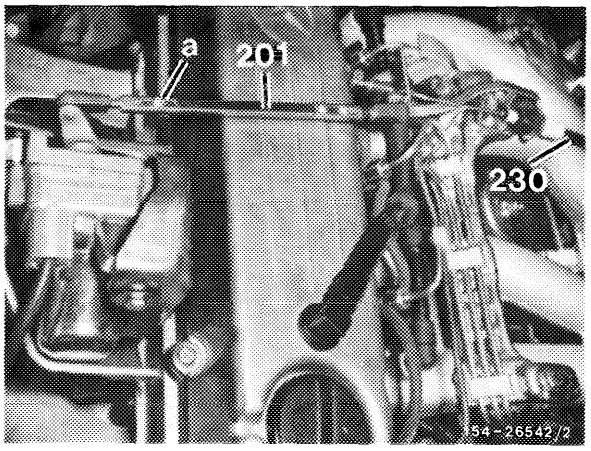
Engine	Length for basic setting
602	219 ± 1

Accelerator control lever (208)	Pull to full load, the injection pump adjusting lever must be contacting the full load stop when this is performed; adjust at variable ball head (206), if necessary.
Tempomat (cruise control)	Adjust: loosen connecting rod (201) at hex bolt "a", move lever of actuator into idle position. Adjust connecting rod (201) such that it is 0.5 mm longer than actual max. distance. Tighten screw "a".
Control cable (211)	Adjust. Detach ball socket (212). Pull control cable (211) forward until a slight resistance is felt. In this position, attach ball socket (212) free of tension, adjust, if necessary, at screw "b" of connecting rod (202).
Full throttle stop	Check, adjust. With engine off, depress accelerator pedal from inside car fully to the stop or to kickdown switch. The adjusting lever of the injection pump must be contacting the full load stop when this is performed; set, if necessary, at adjusting screw (229). The spring plate (226) must be resting free of tension against compression spring (227) in idle position; adjust Bowden cable (230), if necessary, from inside car with adjusting nut (232).

5 Adjusting Tempomat (cruise control)

Loosen hex bolt “a” at the connecting rod (201), and move lever of actuator into idle position.

Adjust connecting rod (201) such that it is 0.5–1.0 mm shorter than the actual maximum distance.
Retighten bolt “a”.

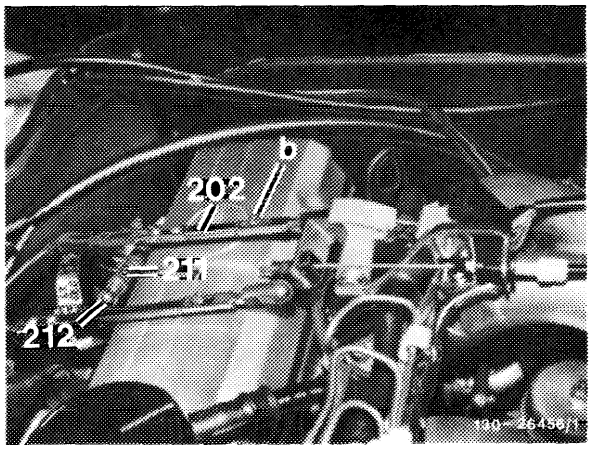


Note

Bolt “a” is not fitted to the round rod. In the case of the round rod, adjust at the ball sockets.

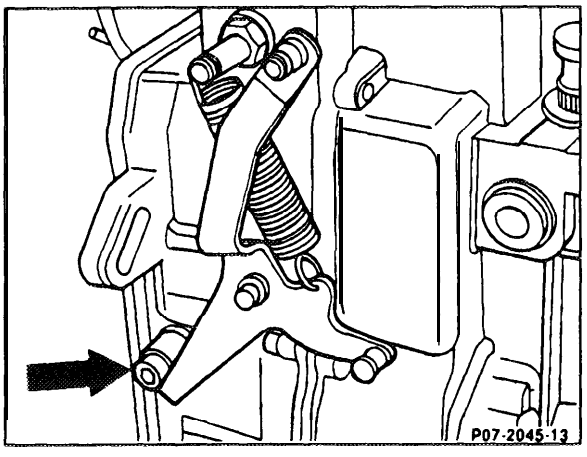
6 Adjusting control cable

Detach ball socket (202). Pull control cable (211) forward until a slight resistance is felt.
In this position, hold ball socket (212) over the ball head and attach free of tension; if necessary, adjust connecting rod (202) with bolt "b".



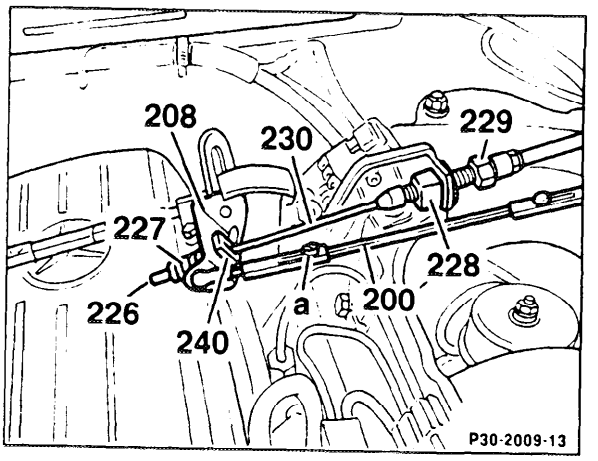
7 Checking, adjusting full throttle stop

With engine switched off, depress accelerator pedal from inside car fully until it is contacting full throttle stop or, if automatic transmission fitted, until it is contacting the stop of the kickdown switch. To do this the adjusting lever must contact the full load stop noticeably (arrow). Check by applying excess pressure to the connecting rod (204).

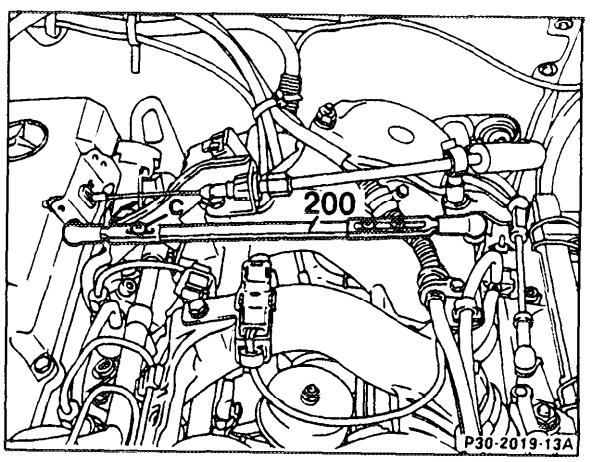


Set adjusting screw (229), if necessary.

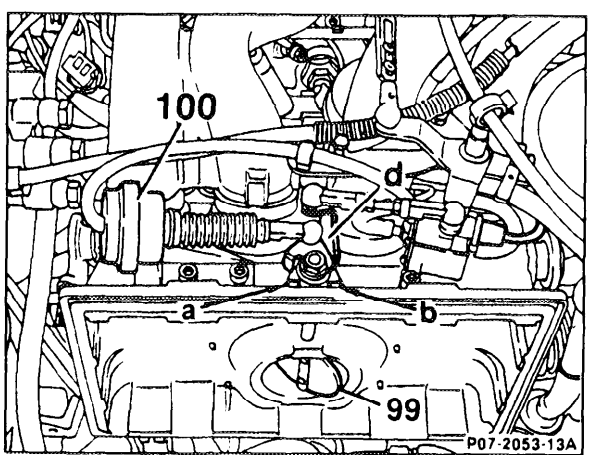
Note
The spring plate (226) of the Bowden cable (230) must be resting free of tension against the compression spring (227).



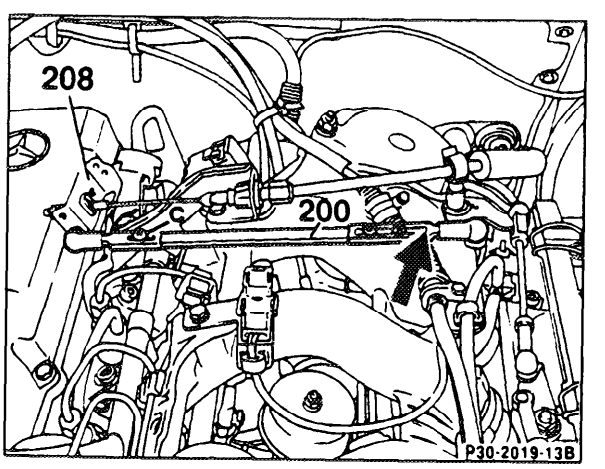
8 **Mechanical actuation**
Adjust pressure control flap
Loosen screw (c) on the connecting rod.



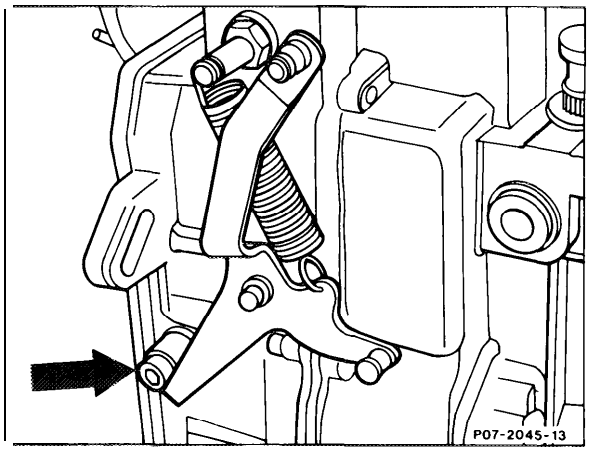
9 Turn reversing lever (d) up to the stop (a). (The piston rod of the vacuum unit is now compressed).



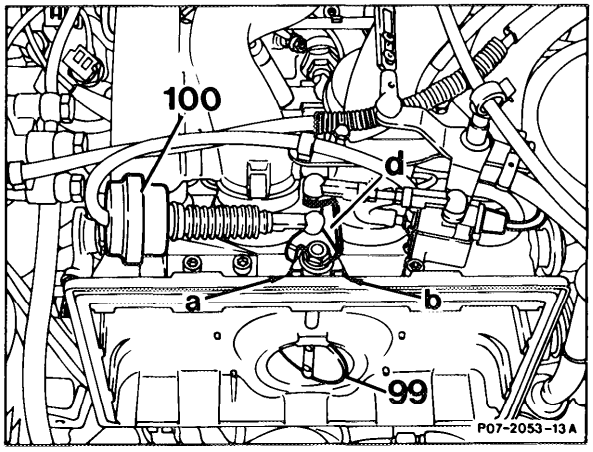
10 At the same time compress connecting rod (200) up to the stop of the rivets (arrow) and retighten screw (c).



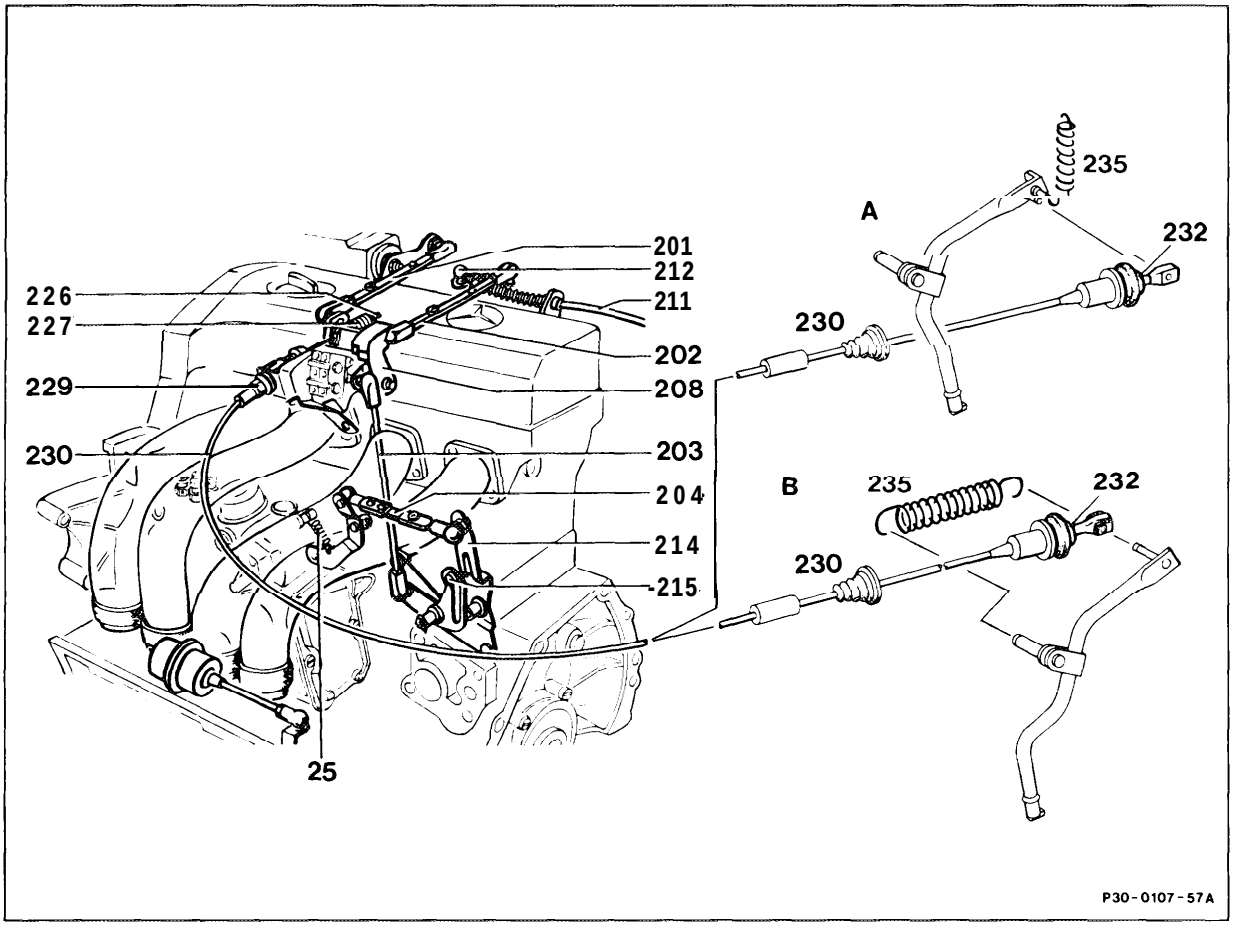
11 Check full throttle stop: depress accelerator pedal from inside car fully to the stop or to kickdown switch. The adjusting lever of injection pump must contact the full load stop detectably when this is done.



The reversing lever (d) must not contact the stop (b) (approx. 0.5mm play). If there is no play present, repeat adjustment from No. 6.



A. Engine 602.96 in Models 124, 201



Accelerator control linkage	examine for bending and ease of movement.
Idle stop	check, adjust. The spring plate (226) of the Bowden cable (230) must resting against the compression spring (227) free of tension in the idle position; adjust Bowden cable, if necessary, with the adjusting nut (232) from the interior of the car.
Return springs (25 and 235)	check.

Relay lever (214)	move into idle position; this must cause the roller (215) to contact the end stop in the variable-fulcrum lever free of tension. Adjust connecting rod (204), if necessary. Length 219 ± 1 mm.
Accelerator control lever (208)	pull to full load; this **must** cause the injection pump control lever to contact the full load stop and the roller (215) to rest approx. lmm before the end stop in the gate. Adjust at adjustable ball head (206) in elongated hole if necessary (Number 5).
Cruise control (Tempomat)	adjust: loosen connecting rod (201) at the hexagon bolt “a”, move lever of actuator into idle position.
Connecting rod (201)	adjust so that it is 0.5 - 1.0 mm longer than the actual max. distance. Tighten bolt "a".
Control push cable (211)	adjust. Detach ball socket (212). Pull control push cable (211) forward until a slight resistance is felt. In this position, attach ball socket free of tension; adjust at the bolt "b" of the connecting rod (202), if necessary.
Full throttle stop	check, adjust. With engine off, depress accelerator pedal fully to the kickdown switch from the car interior. This must cause the control lever of the injection pump to contact the full load stop; adjust at adjusting screw (229), if necessary. The spring plate (226) must be resting against the compression spring (227) free of tension in idle position. Adjust Bowden cable (230), if necessary, with the adjusting nut (232) from interior of car.
Connecting rod (203)	cannot be adjusted.

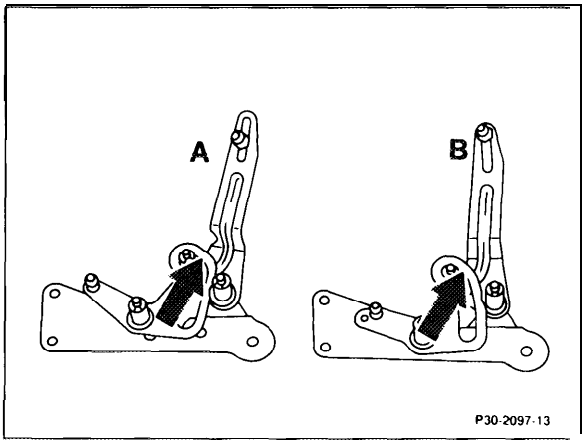
Note

Use anti-corrosion grease
Part No. 000 989 87 51 10 when performing assembly work on the accelerator control.

Lengths of connecting rods in mm		
Item **201** Cruise control connecting rod	255 ± 1	
Item **202** Idle travel rod of automatic transmission	197 ± 1	(pulled out)
Item 204 Injection pump connecting rod	219 ± 1	

Note

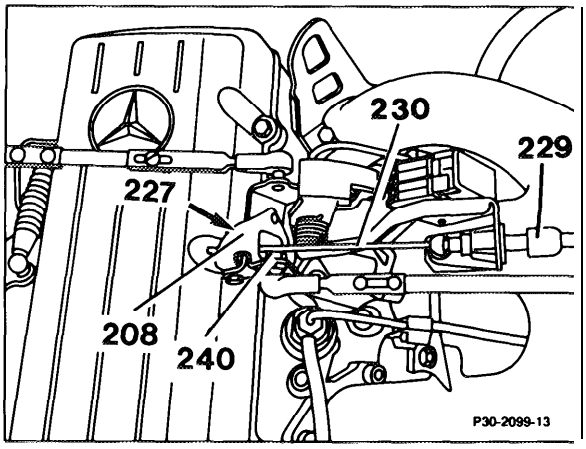
As a result of a modified transmission control, the idle travel at the accelerator pedal is no longer required.



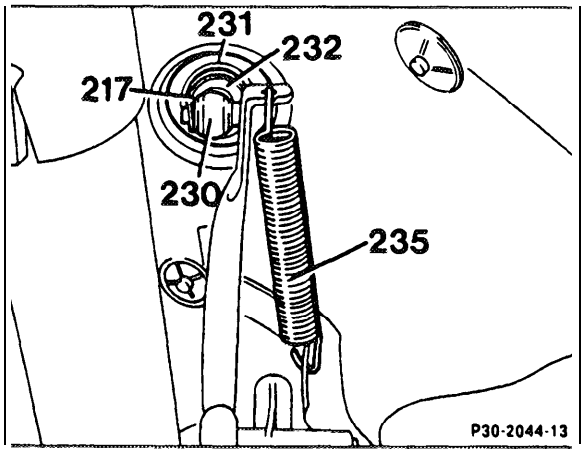
Variable-fulcrum lever "A" with idle travel
Variable-fulcrum lever "B" without idle travel

1 Examine accelerator control linkage for bending and ease of movement.

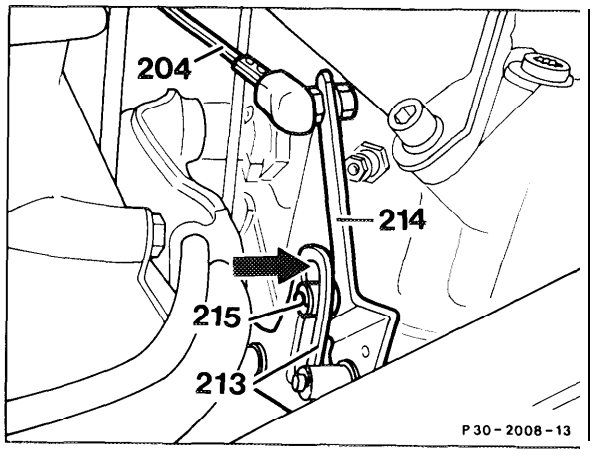
2 Check idle stop, adjust. The spring plate of the Bowden cable (230) must be resting free of tension against the compression spring (227).



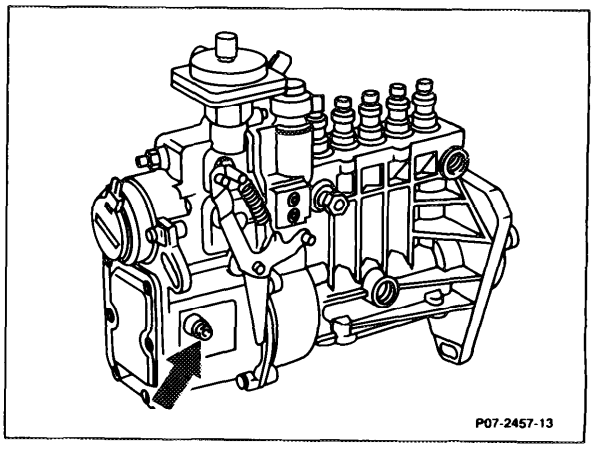
Adjust Bowden cable (230), if necessary, with the adjusting nut (232) from the interior of the car.



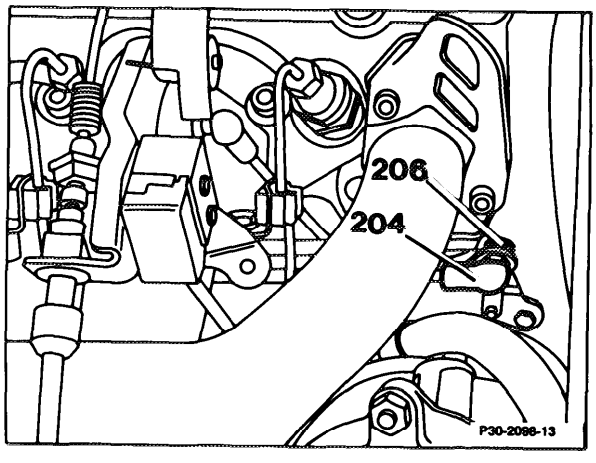
3 Move relay lever (214) into idle position; this must cause the roller (215) to move free of tension against the end stop in the variable-fulcrum lever (arrow). Adjust connecting rod (204), if necessary.



4 Pull accelerator control lever (208) to full load; this must cause the injection pump control lever to move against full load stop (arrow) and the roller (215) to rest approx. 1 mm before the end stop in the gate.

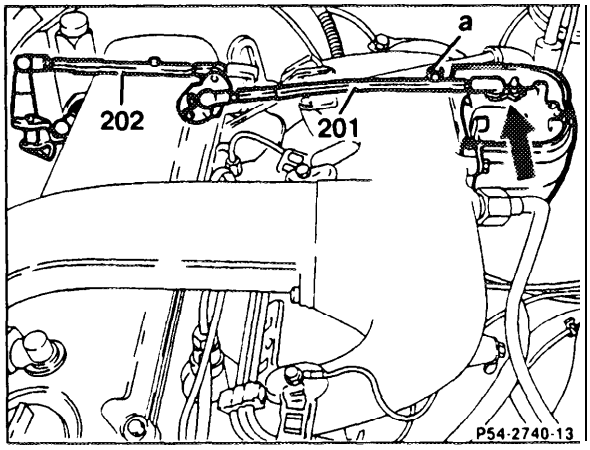


5 Adjust, if necessary, at adjustable ball head (206) in the elongated hole of the relay lever.

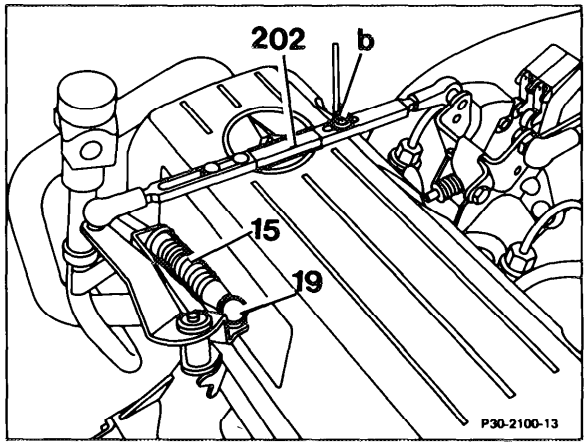


6 Set cruise control. loosen hexagon bolt (a) on the connecting rod (201).

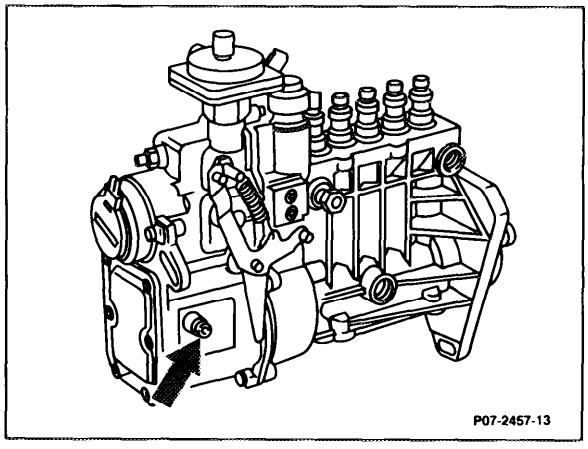
- Move lever of actuator (arrow) into idle position.
- Adjust connecting rod (201) so that it is 0.5 mm longer than the actual max. distance
- Tighten connecting rod (201) in this position.



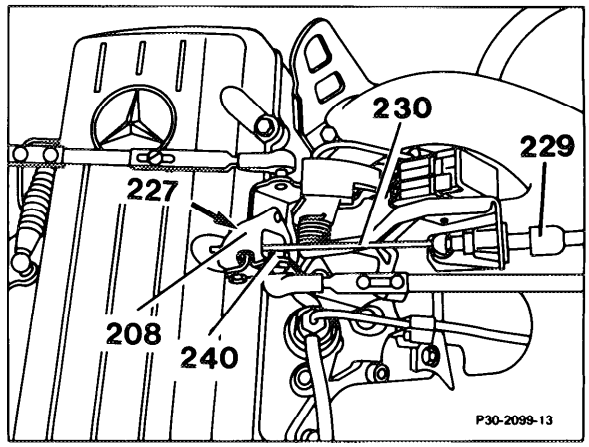
7 Adjust control cable. Press off ball socket (212) for this step. Pull control cable (211) forward until resistance is felt. In this position, attach ball socket free of tension. Adjust at the hexagon bolt (b), if necessary (measure connecting rod (202) pulled out).



8 Check full throttle stop, adjust. With the engine off, depress accelerator pedal fully to the stop on the kickdown switch from the interior of the car. This must cause the control lever to move against the full load stop (arrow) of the injection pump.

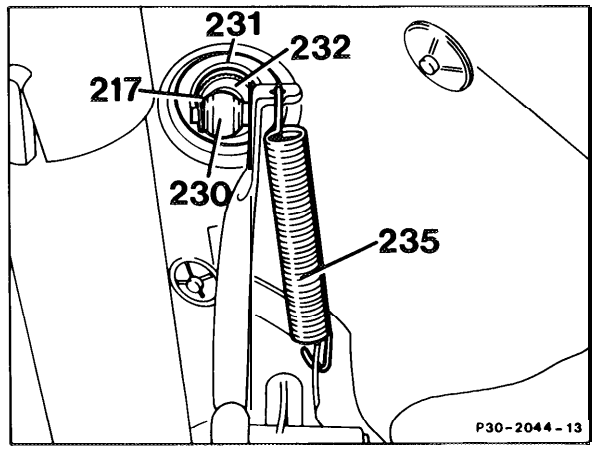


Adjust Bowden cable at adjusting screw (229), if necessary.



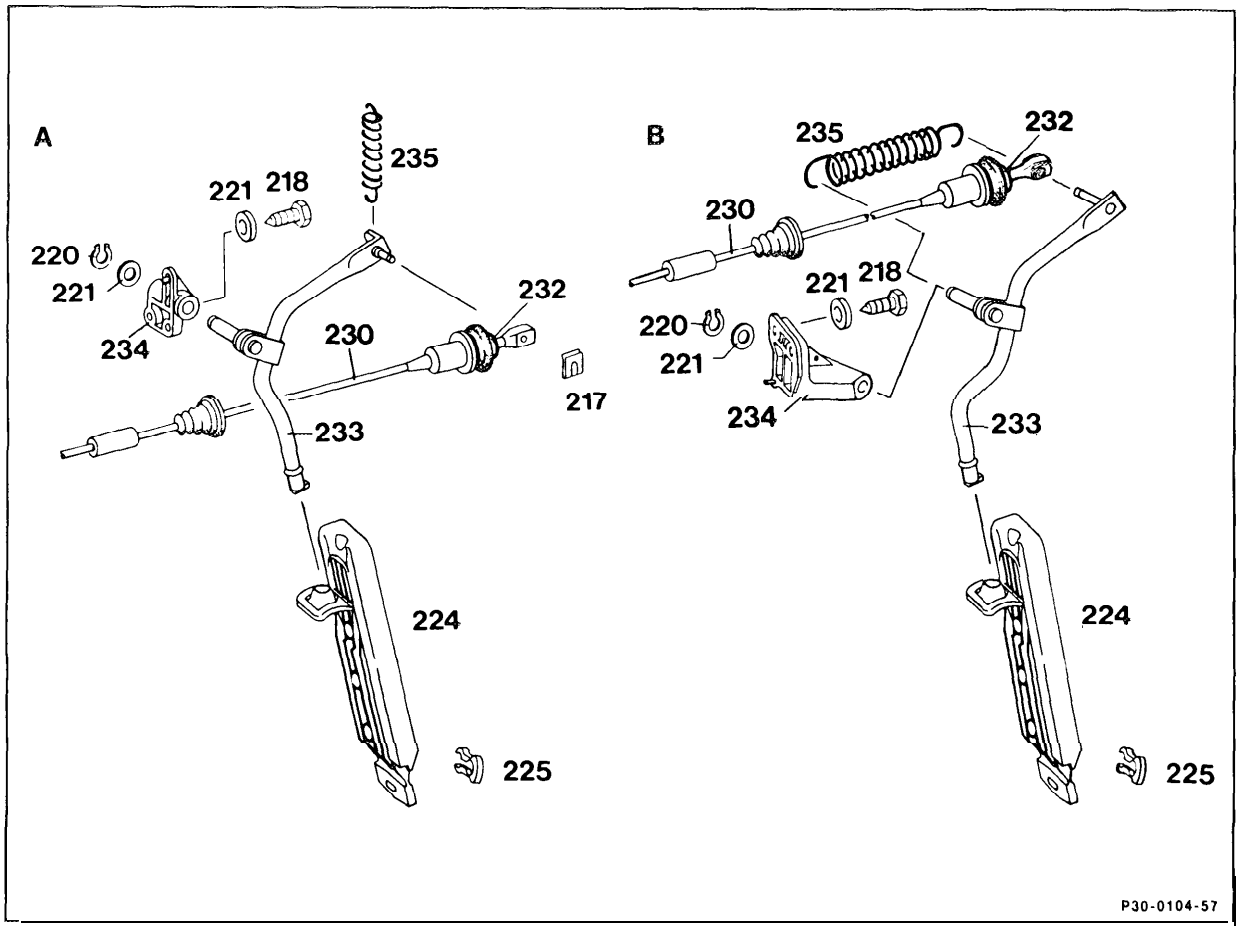
Note

The spring plate of the Bowden cable (230) must be resting free of tension against the compression spring (227) in the idle position. Adjust Bowden cable (230), if necessary, with the adjusting nut (232) from the interior of the car.



30–315 Removal and instaiiation of firewaii bearing for accelerator pedal lever - Turbodiesel

A. Model 124, 201 Turbodiesel



A Model 201
B Model 124

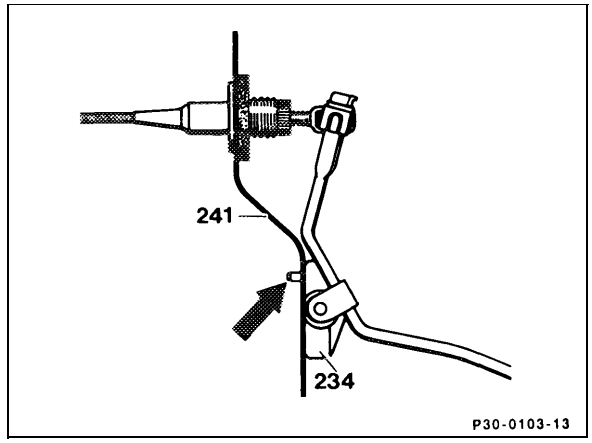
Footwell covering	remove, install.
Accelerator pedal (224)	remove, Install (30-300). Unclip, clip in expanding clip (225) for this step.
Return spring (235)	detach, attach.
Locking element (217)	(Model 201 only) remove, refit.
Bowden cable (230)	detach, attach.

Firewall bearing (234) with accelerator pedal lever (233)	remove, install. Remove, fit bolt (218) and washer (221) for this step. Observe installation note for Model 201.
Locking element (220)	detach from accelerator pedal lever, fit on. Press accelerator pedal lever out of firewall bearing, press in.
Accelerator control	check, adjust if necessary (30-300).

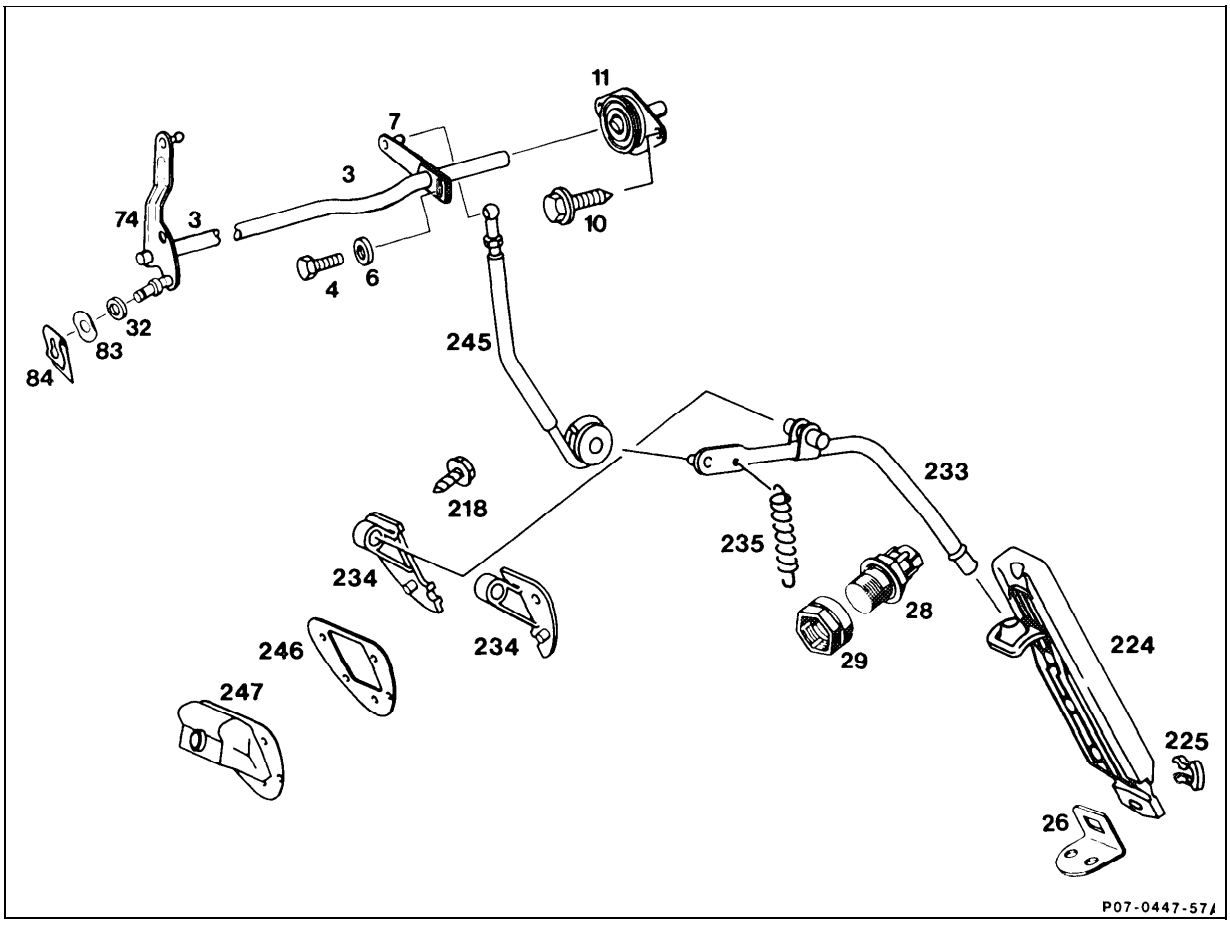
Installation note Model 201

Ensure that the lug (arrow) of the firewall bearing (234) engages in the hole on the firewall (241).

Check accelerator control linkage, adjust if necessary (30-300).



B. Model 126



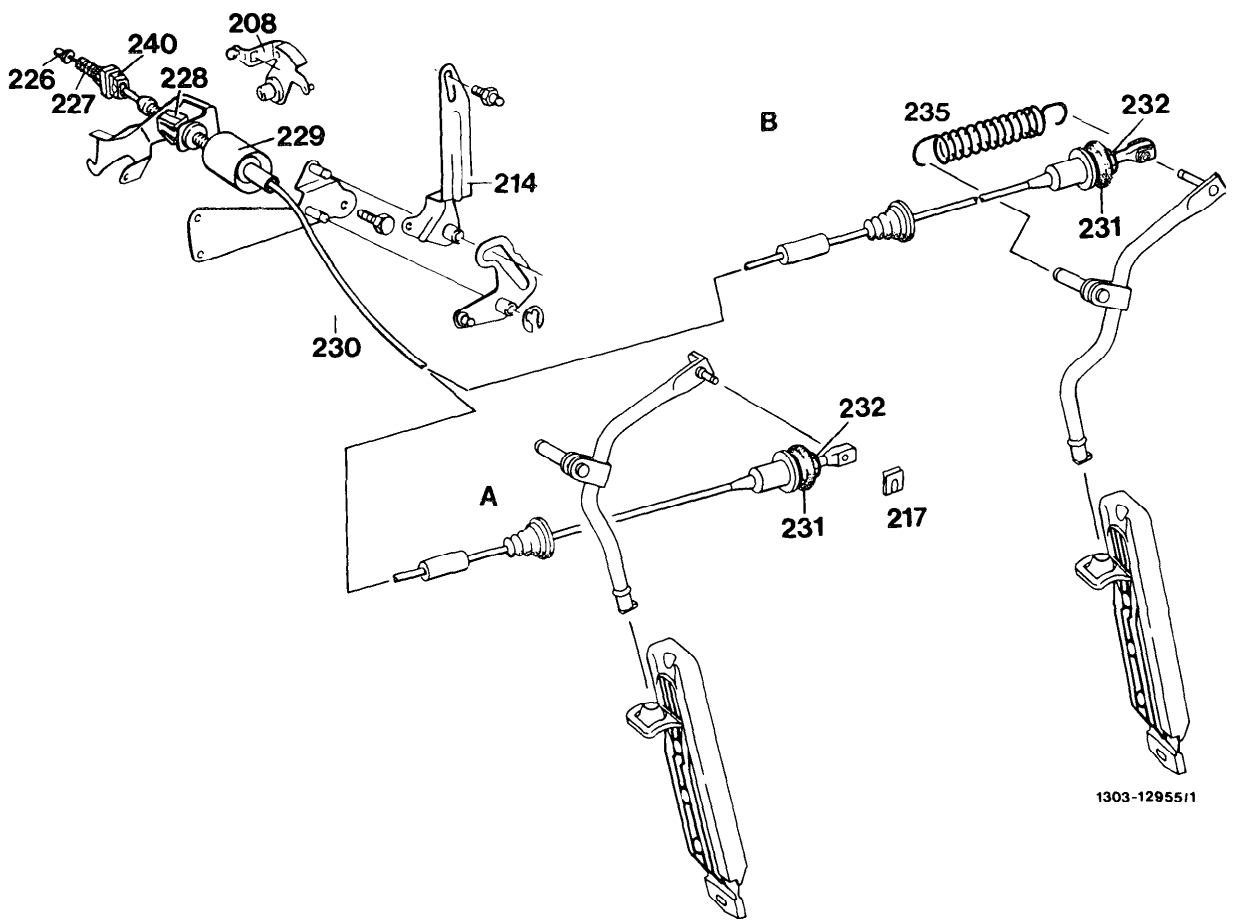
Footwell covering	remove, install.
Accelerator pedal (224)	remove, install (30-300). Unclip, clip in spreader clip (225) for this step.
Return spring (235)	detach, attach.
Firewall bearing (234) with accelerator pedal lever (233)	remove, install. Remove, fit bolt (218) for this step.
Thrust rod (245), intermediate plate (246) and rubber seal (247)	remove, fit.
Accelerator control	check, adjust if necessary (30-300).

Note

The bearing points as well as the ball sockets of the accelerator control linkage should be greased with DB anti-corrosion grease (Part No. 000 989 87 57 10).

The link from the accelerator pedal lever to accelerator pedal is maintenance-free and does not need to be greased.

30-325 Removal, installation and adjustment of Bowden cable



A Model 201
B Model 124

Bowden cable (230)	Detach at accelerator control lever (208), remove, install guide piece (240) at control lever for this purpose.
Plastic clips (228)	Compress and remove, install Bowden cable (230).

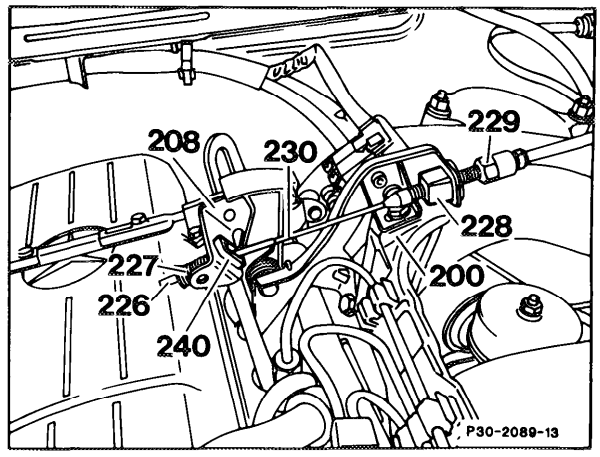
Footwell cover	Remove, install.
Locking plate (217) or spring (235)	Remove, install.
Vacuum lines for key-operated engine stop	Withdraw from, insert into rubber grommet.
Bowden cable (230)	Press out of the way; ensure that the rubber grommet (231) is not pressed out.
Relay lever (214)	
Adjusting screw (229)	Adjust full throttle stop.
Adjusting nut (232)	Adjust idle stop.
Rubber grommet (231)	Ensure that the grommet is correctly located.
Accelerator control	Adjust (30-300).

Removal, installation

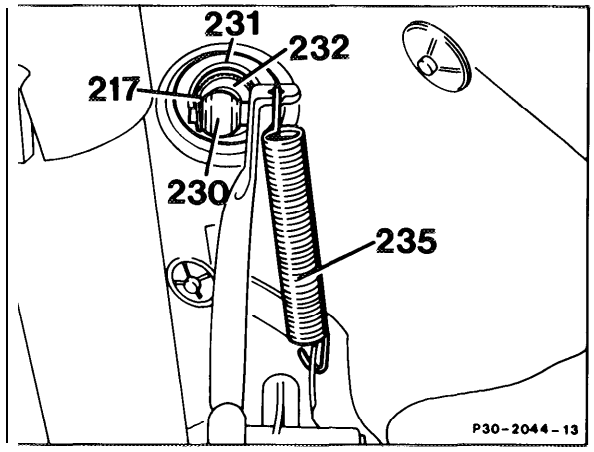
1 Raise accelerator control lever (208), press out guide element (240) and remove together with Bowden cable (230).

2 Compress black plastic clip (228) and remove Bowden cable.

3 Remove footwell cover.



4 Remove locking plate (217) for Bowden cable (230) in interior of car.



Model 201

5 Press Bowden cable (230) out of the way. Ensure that the rubber grommet (231) is not pressed out.

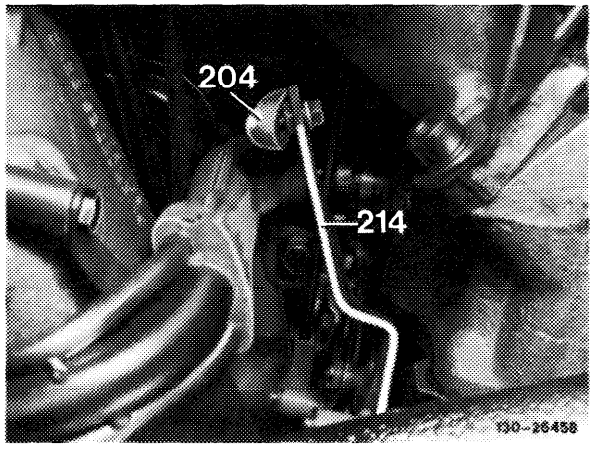
6 Pull vacuum lines for key-operated engine stop out of the rubber grommet of the Bowden cable.

7 Withdraw Bowden cable entirely from outside between firewall and component compartment wall.

8 The parts are reassembled in the reverse order.

Adjusting

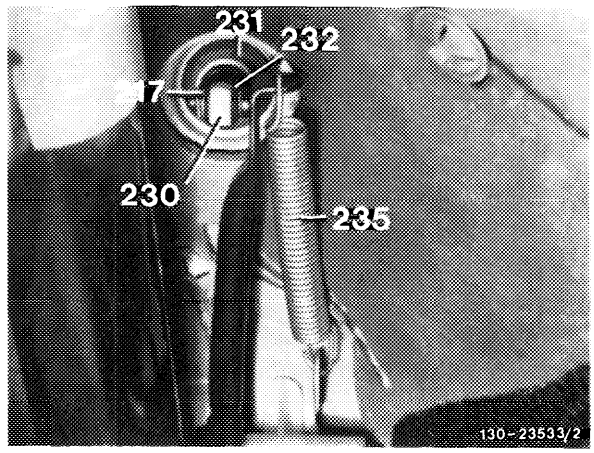
9 Check that the relay lever (214) can be felt contacting the inside idle stop of the injection pump; **adjust accelerator control linkage if necessary (30-300).**



10 With the engine off, depress accelerator pedal from inside of car as far as the full throttle stop or, if equipped with automatic transmission , as far as the stop on the kickdown switch. The adjusting lever must be contacting the full throttle stop of the injection pump when performing this step. If necessary, set adjusting screw (229) at Bowden cable.

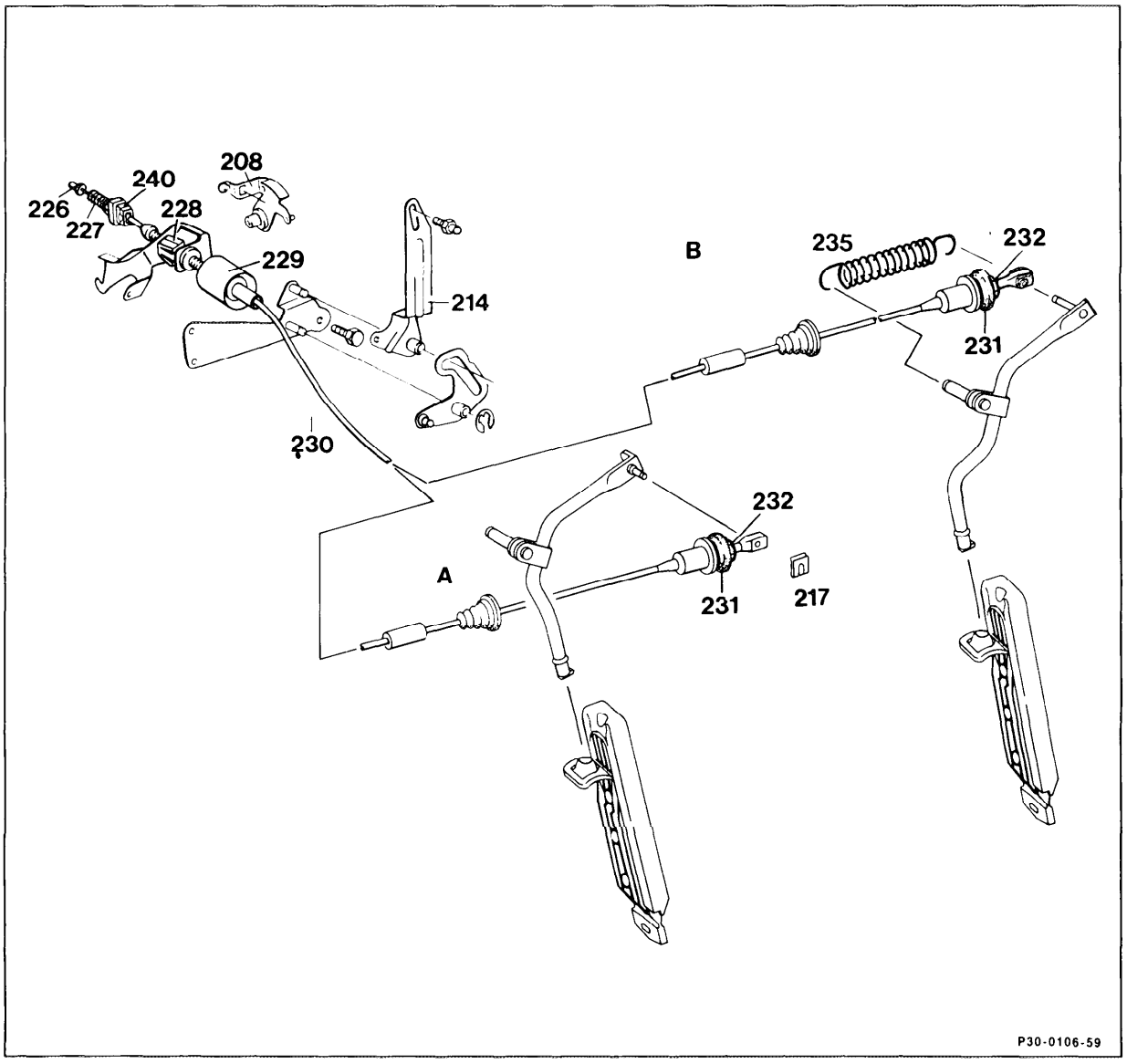
11 Slowly allow accelerator pedal to return to idle position. In this position, the roller in the variable-fulcrum lever must be resting free of tension against the end stop. If necessary, adjust Bowden cable (230) from inside car with the adjusting nut (232).
After adjusting, there must not be any idle travel between spring plate (226) and spring (227).

Model 201



Note
When performing assembly work on accelerator control, use anti-corrosion grease Part No. 000 989 87 51 10.

30–325 Removal, adjustment and Installation of Bowden cable -Turbodiesel



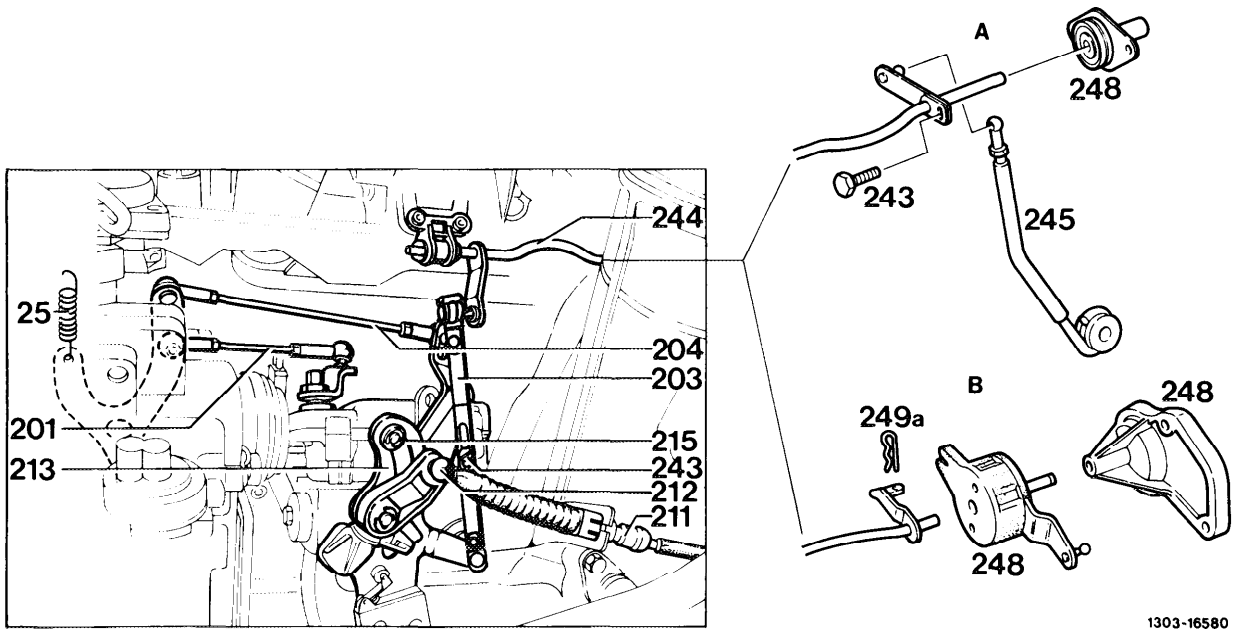
A Model 201
B Model 124

Bowden cable (230)	detach at accelerator control lever (208). Remove, Install guide piece (240) on accelerator control lever for this step.
Plastic clip (228)	compress and remove, install Bowden cable (230).

Footwell covering	remove, install.
Locking element (217)	(Model 201 only) remove, install.
Spring (235)	remove, install.
Vacuum lines for key-operated engine stop	withdraw from rubber grommet, insert.
Bowden cable (230)	press outwards, ensuring that the rubber grommet (231) is not pressed out.
Adjusting screw (229)	adjust full throttle stop.
Adjusting nut (232)	adjust idle stop.
Rubber grommet (231)	ensure correct position.
Accelerator control	adjust (30-300).

Note

Use anti-corrosion grease
Part No. 000 989 87 51 10 when performing assembly work on the accelerator control.



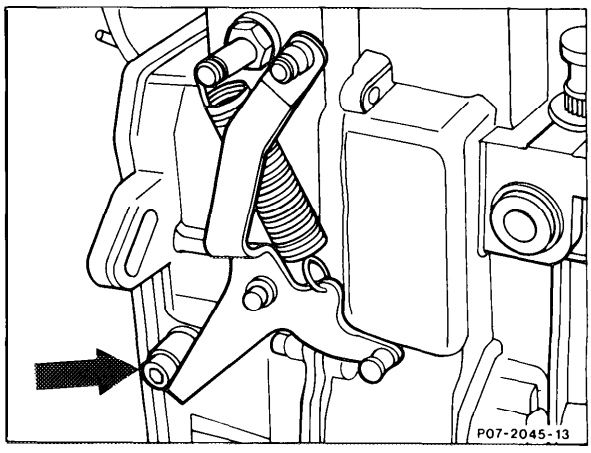
A 1st version Full throttle adjusting screw on accelerator control shaft
B 2nd version Full throttle adjusting screw on connecting rod (203)

Full throttle stop . . . . . check, adjust. With engine off, depress accelerator pedal up to the kickdown switch from interior of car. This must cause the control lever of the injection pump to move against the full throttle stop. Adjust at the adjusting screw (243), if necessary.

Note

1st version - full throttle adjusting screw on accelerator control shaft.
2nd version - full throttle adjusting screw on connecting rod (203).

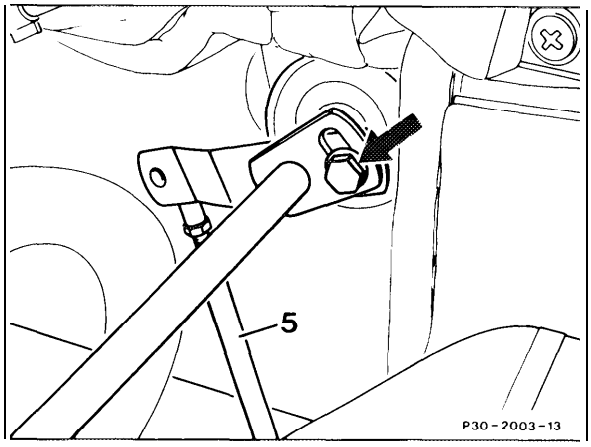
With engine off, depress accelerator pedal as far as the stop on the kickdown switch from the interior of the car. This must cause the accelerator control lever on the injection pump to contact the full throttle stop (arrow).



1 st Version

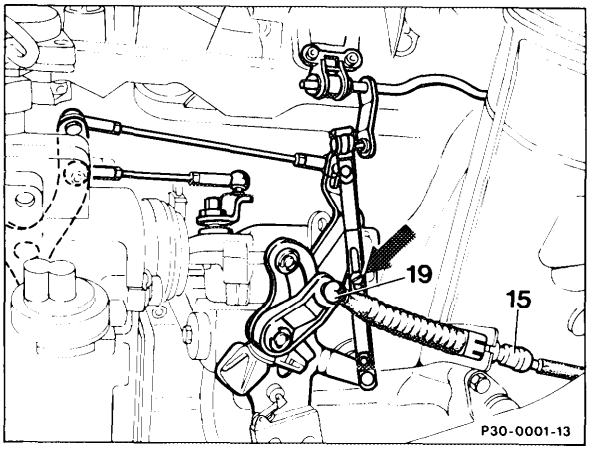
If not, loosen bolt (arrow) and adjust accelerator control linkage so that the accelerator control lever is resting against full throttle stop.

If the full throttle or idle stop is not reached with this adjustment, adjust thrust rod (245) from the longitudinal accelerator control shaft to the accelerator pedal to 222 mm, measured from the center of ball socket to center of damping ring.



2nd Version

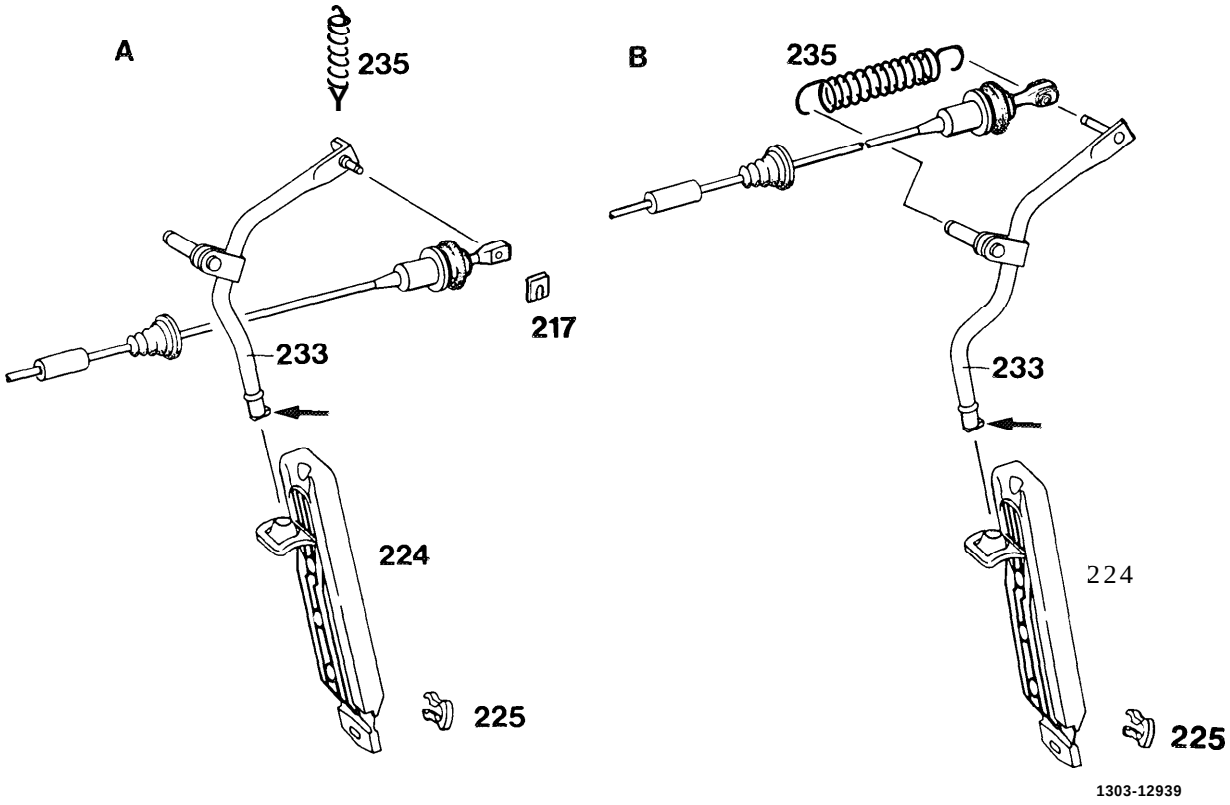
If not, loosen bolt (arrow) and adjust profile rod so that the accelerator control lever is contacting full throttle stop.



Note

It is essential to ensure that the accelerator control operates freely.

30-330 Removal and installation of accelerator pedal



A Model 201

Expanding clip (225)	Compress behind accelerator pedal and remove.
Accelerator pedal (224)	Push down and turn through 180°, then pull down. When doing this, the lug (arrow) on accelerator lever (233) must be aligned with the slot in accelerator pedal.

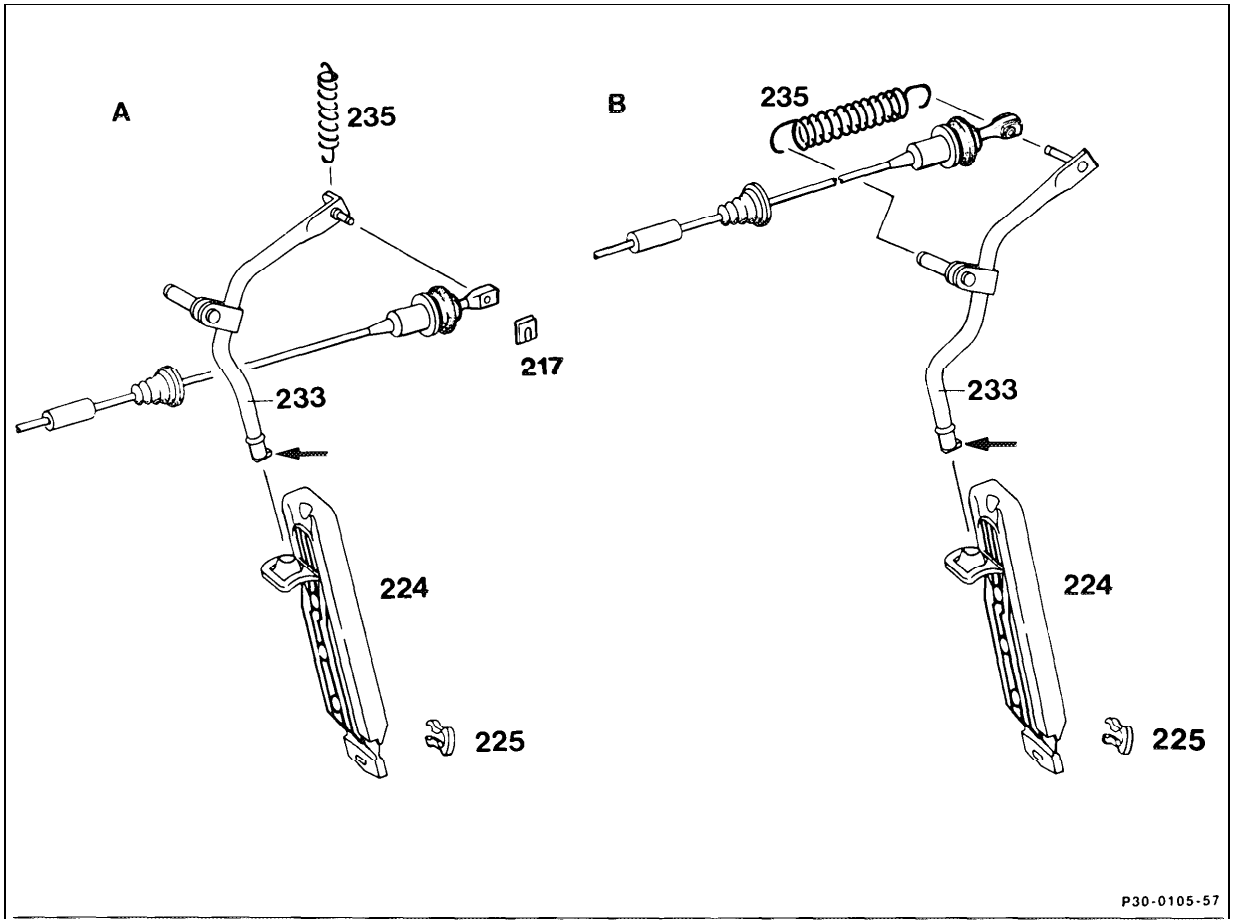
Accelerator lever (233)

Return spring (235)

Note

The connection between accelerator lever and accelerator pedal is maintenance-free and does not require grease.

30–330 Removal and Installation of accelerator pedal - Turbodiesel



A Model 201
B Model 124

Expanding clip (225)	compress behind accelerator pedal and withdraw.
Accelerator pedal (224)	push upwards and turn through 180°, then withdraw downwards. This aligns the lug (arrow) on the accelerator pedal lever (233) with the slot in the accelerator pedal.
Accelerator pedal lever (233)	remove, install.
Return spring (235)	detach, attach.

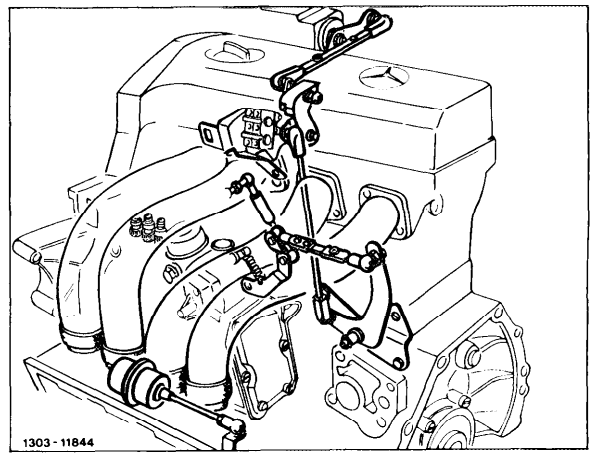
Note

Removal and installation of the accelerator pedal on Model 126 is identical to that for Models 124 and 201. The link from the accelerator lever to the accelerator pedal is maintenance-free and does not need to be greased.

30-335 Lubrication of accelerator control linkage and control shafts

- After each engine wash, lubricate all bearing points of all control shafts, control levers, joints of accelerator control linkage with an oil can.

- The Bowden cable is maintenance-free and does not need to be lubricated.



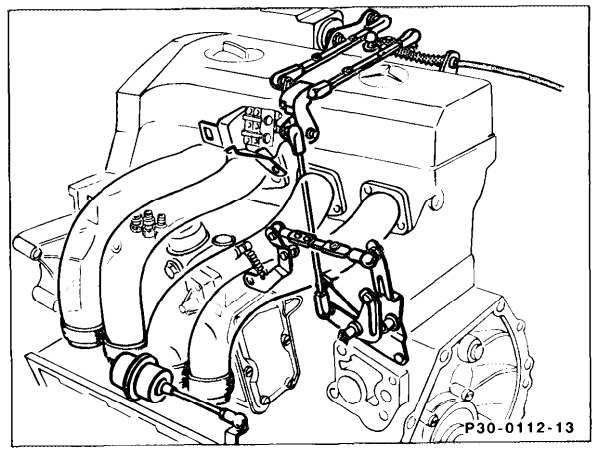
Version with manual transmission

- Only the following hydraulic oils may be used:

  Castrol DB Hydraulic Fluid
  Mobil Aero HFA
  Shell Aero Fluid 4

- When performing assembly work on accelerator control linkage, use anti-corrosion grease 594 M 3 (make: Pfinder) Part No. 000 989 87 51 10.

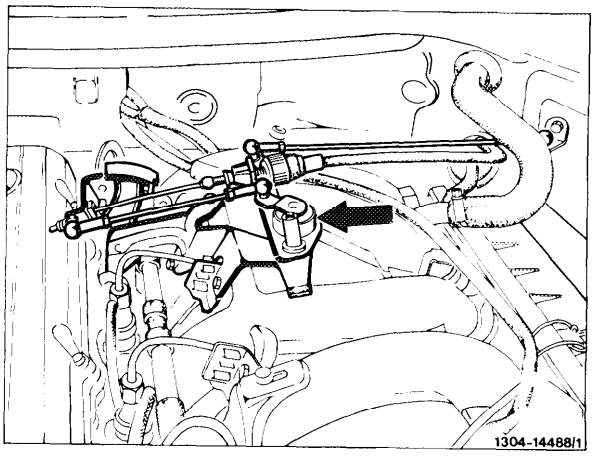
- Examine accelerator control shafts, control levers, relay levers, ball sockets, Bowden cable and accelerator control linkage for ease of movement and wear.



Version with automatic transmission

Note

The friction damper (arrow) must not be lubricated.

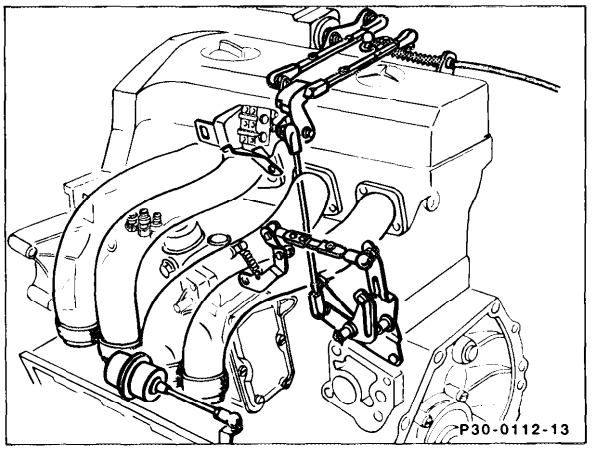


Arrangement on manual transmisison with support and friction damper

30–335 Lubrication of accelerator control Linkage and control shafts - Turbodiesel

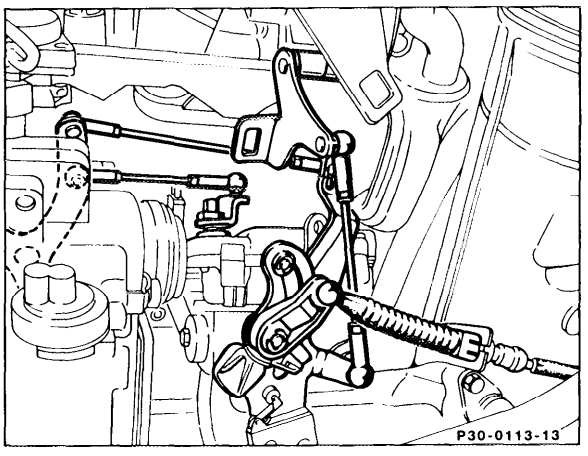
- After each engine wash, lubricate all bearing points of all control shafts, accelerator control levers and joints of the accelerator control linkage with an oil can.
- The Bowden cable is maintenance-free and does not need to be lubricated.
- Only the following hydraulic oils may be used:

Castrol DB Hydraulic Fluid
Mobil Aero HFA
Shell Aero Fluid 4



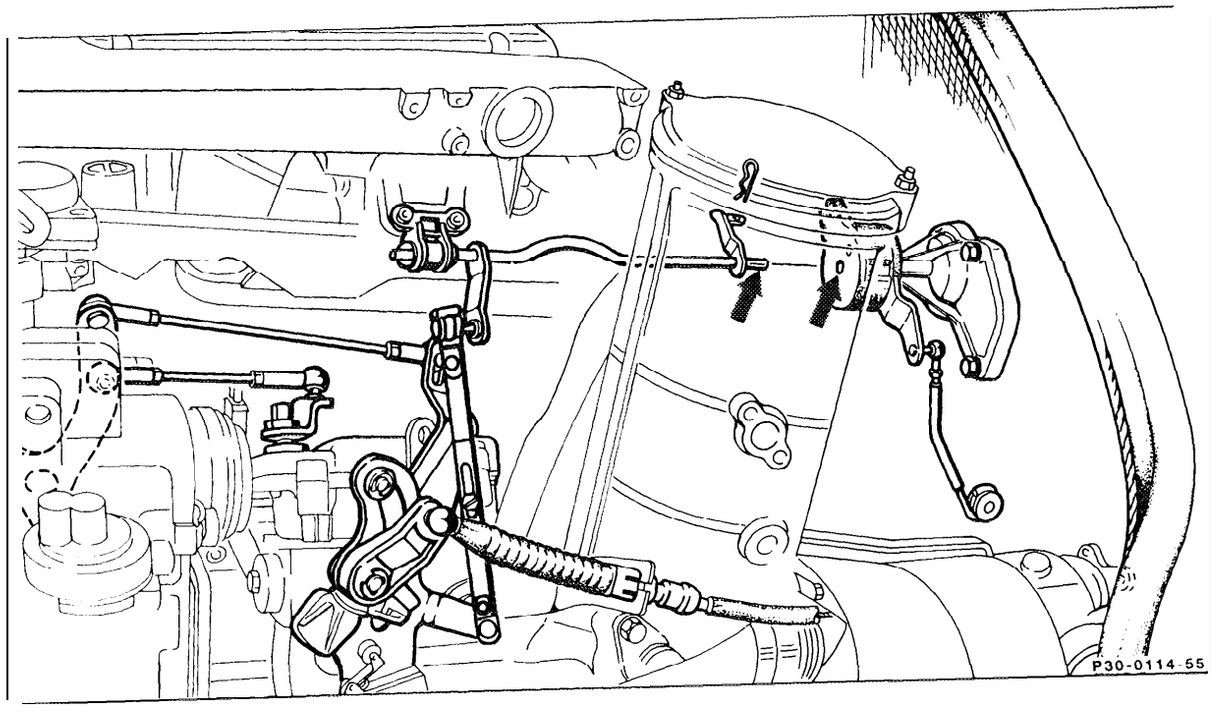
Engine 602.96, Model 201

- Use anti-corrosion grease MB Part No. 000 989 87 57 10 when performing assembly work on the accelerator control linkage.
- Check the accelerator control shafts, control levers, relay levers, ball sockets, Bowden cable and accelerator control linkage for ease of movement and wear.



Engine 603.96, Model 124

The link between accelerator control shaft and lever (arrow) must not be lubricated.

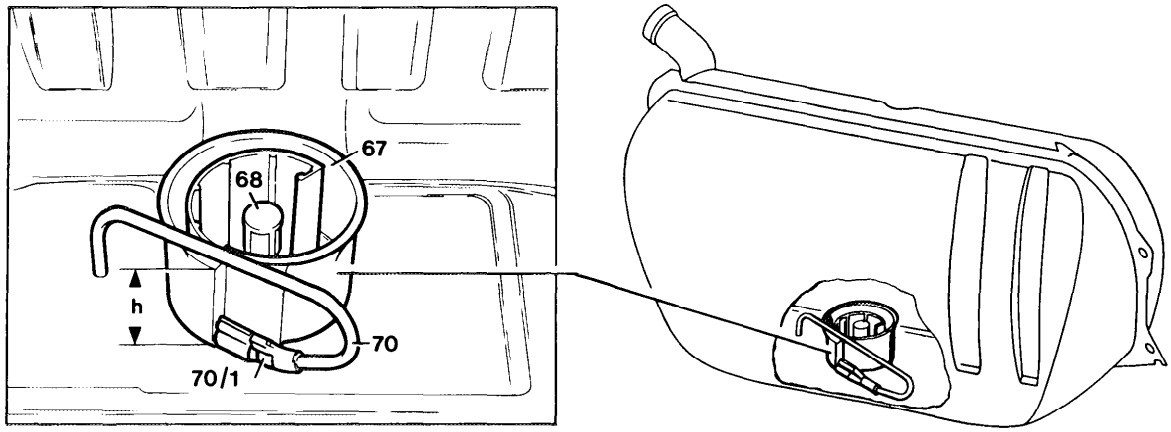


Engine 603.96, Model 126

Job No.

Function of fuel tank with splash pot . . . . . 47 – 010
Function of fuel gauge sending unit . . . . . 47 – 020
Function of fuel gauge sending unit - Turbodiesel . . . . . 47 – 020
Function of fuel tank breather and vent . . . . . 47 – 030
Function of fuel tank ventilation - Turbodiesel . . . . . 47 – 030
Removal and installation of fuel tank . . . . . 47 – 100
Removal and installation of fuel gauge sending unit . . . . . 47 – 120

47-010 Function of fuel tank with splash pot



P47-0071-55

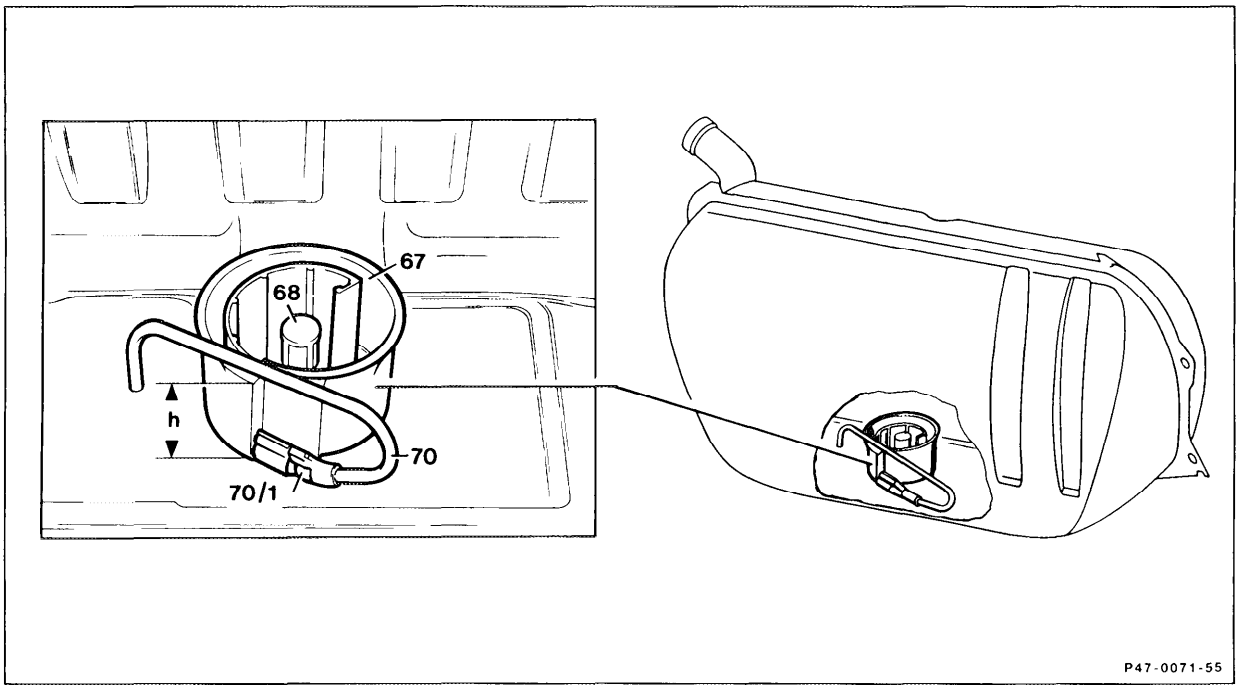
Model 201 with naturally-asprrated engines

67	Splash pot
68	Fuel filter
70	Return line
70/1	Return nozzle

The sheet steel fuel tank is fitted with a splash pot (67). The purpose of this is to ensure that the engine is reliably supplied with fuel when the fuel level in the tank is low and when negotiating a lengthy series of curves.

When the fuel pump is running, the return fuel jet flows at a high speed out of the return nozzle (7011) into the splash pot. In this way it draws fuel around the return nozzle into the splash pot as well.

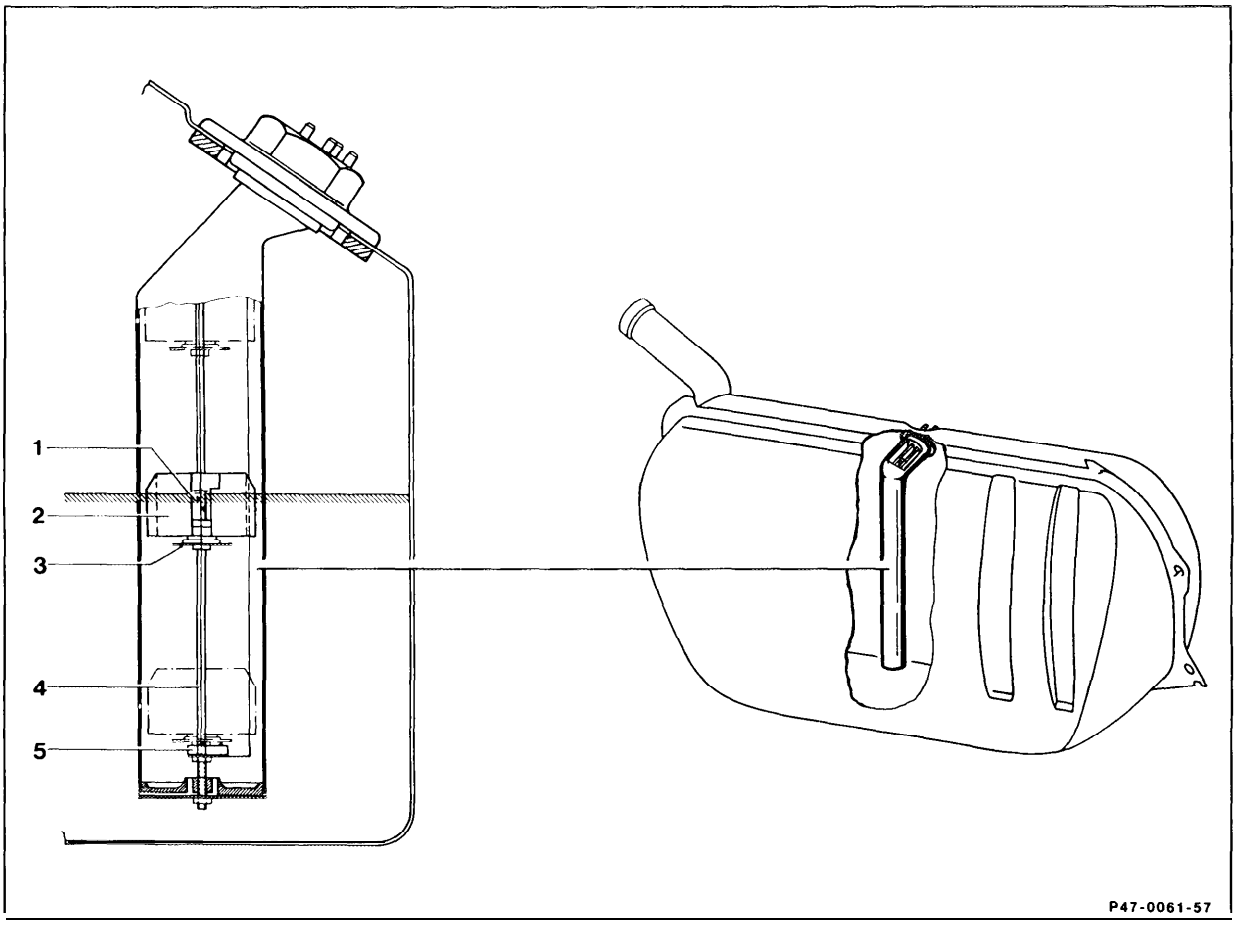
The level of fuel (h) in the splash pot is maintained even if the fuel level in the tank drops below the height (h).



Model 201, 124, 126 with Turbocharged engines

67	Splash pot	70	Return line
68	Fuel filter	7011	Return nozzle

47-020 Function of fuel gauge sending unit



1 Wiper contact
2 Float
3 Contact plate
4 Guide and contact rod
5 Reserve warning contact

As the fuel level drops, the resistance is increased by the wiper contact (1). At the float (2), the voltage drops and the gauge needle in the instrument cluster moves back.
If the fuel level drops to the reserve quantity, the reserve warning contact (5) closes and switches ground to the reserve warning lamp. The reserve warning lamp lights up when the ignition is switched on (check function).
As soon as the engine starts, the lamp goes out provided there is more fuel in the tank than the reserve quantity.

Note
The reserve warning lamp shows a weaker light for the check function, and a stronger light to indicate reserve quantity.

Check fuel gauge (54-269).

Fuel gauge sending unit, Model 201
The installation angle has been modified from approx. 15° (off perpendicular) to approx. 5°. The instrument gauge has been adapted to the new sending unit position (refer to Group 54).

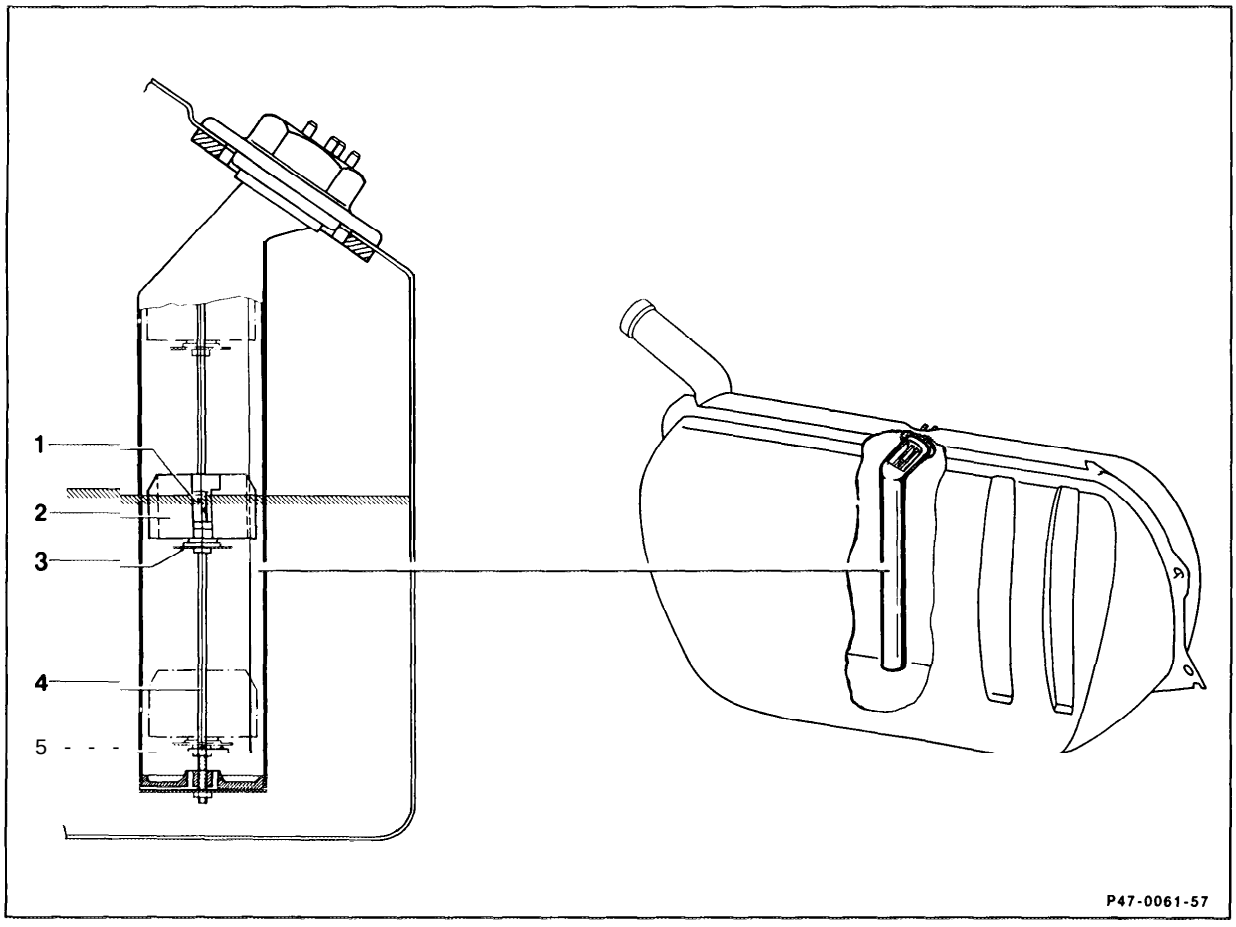
Repair instructions
The modified sending unit (5°) may also be fitted in place of the existing sending unit (15°), but not vice versa.

Standard implementation: July 1987

Vehicle ident No.
A 394 178
F 390 243

Modifications effective 09/88 (Model Care)
The fuel gauge sending unit has been modified at the flange and in its length such that it is valid for all fuel tanks of Model 201 effective 09/88.

47–020 Function of fuel gauge Sending unit - Turbodiesel



1 Wiper contact
2 Float
3 Contact plate
4 Guide and contact rod
5 Reserve fuel warning circuit

If the fuel level drops, the resistance is increased by the wiper contact (1) on the float (2), the voltage drops and the needle on the gauge in the instrument cluster moves back.

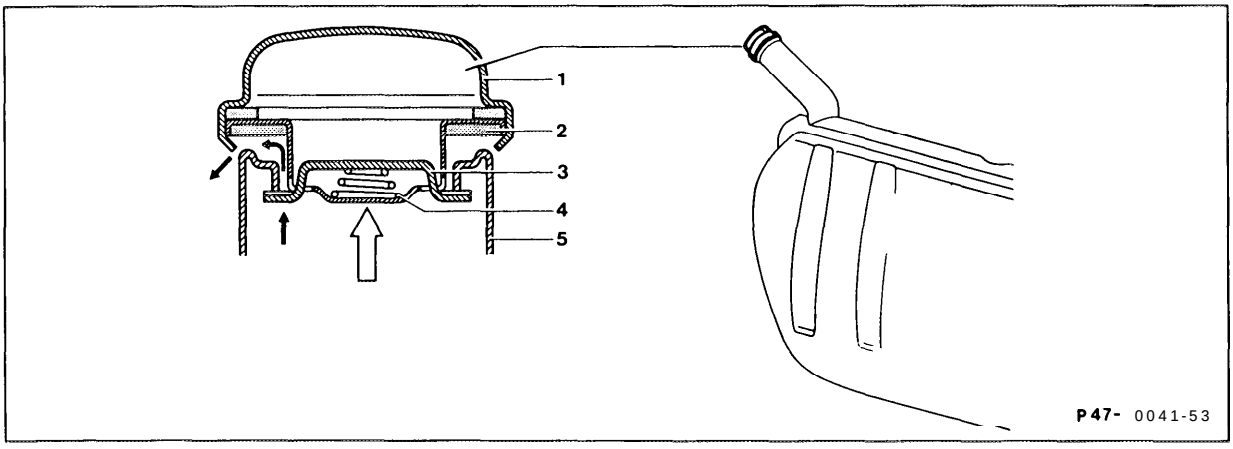
If the fuel level drops to reserve quantity, the reserve warning contact (5) closes and switches ground to the reserve warning lamp. The reserve warning lamp lights up if the ignition is switched on (indicating function). As soon as the engine is running, it goes out provided there is more fuel in the tank than the reserve quantity.

Note
The reserve fuel warning lamp shows a weaker light for the indicating function and a stronger light for the reserve quantity.

Check fuel gauge (54-257).

47-030 Function of fuel tank breather and vent

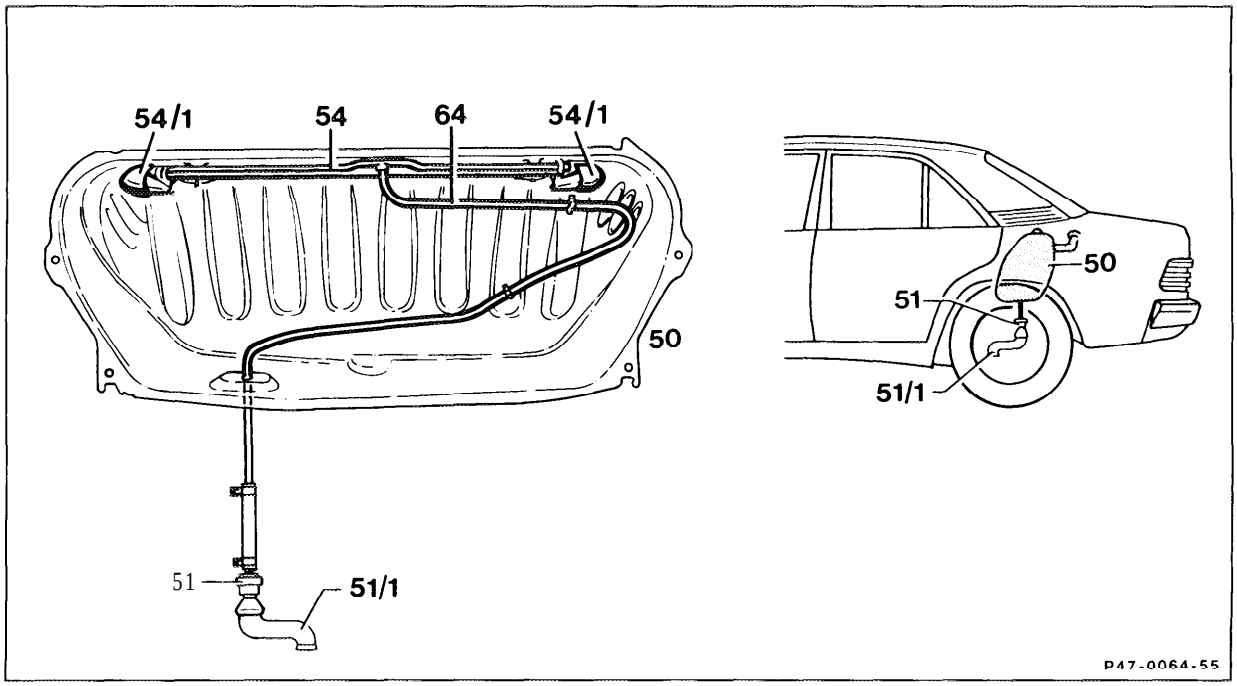
Filler cap



All models

1 Filler cap
2 Sealing ring
3 Locking bar
4 Compression spring
5 Filler neck

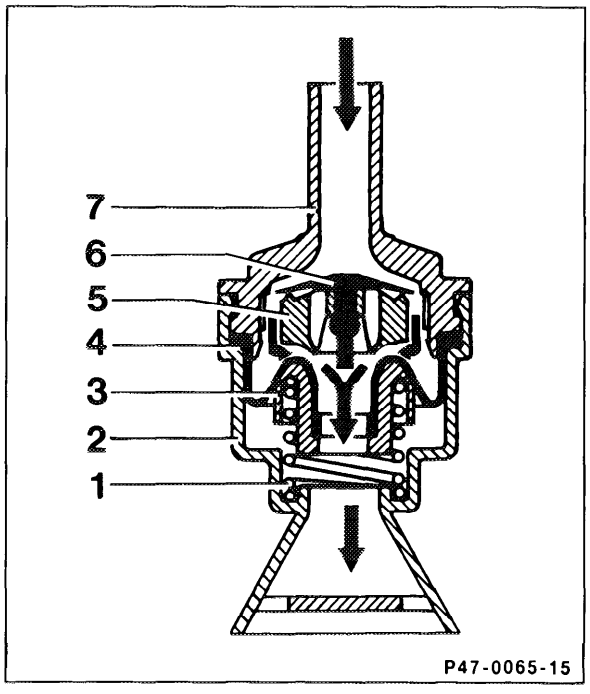
The fuel evaporation gases escape through the filler cap at a pressure of 100-300 mbar gauge. This only **occurs,** if, for example, the passage in the vent line from the fuel tank is not clear. If the system is operating properly, an overpressure of up to 50 mbar may be present in the fuel tank.



50	Fuel tank
51	Vent valve
51/1	Protective rubber boot
54	Central pipe
54/1	Siphon breaker
64	Vent line

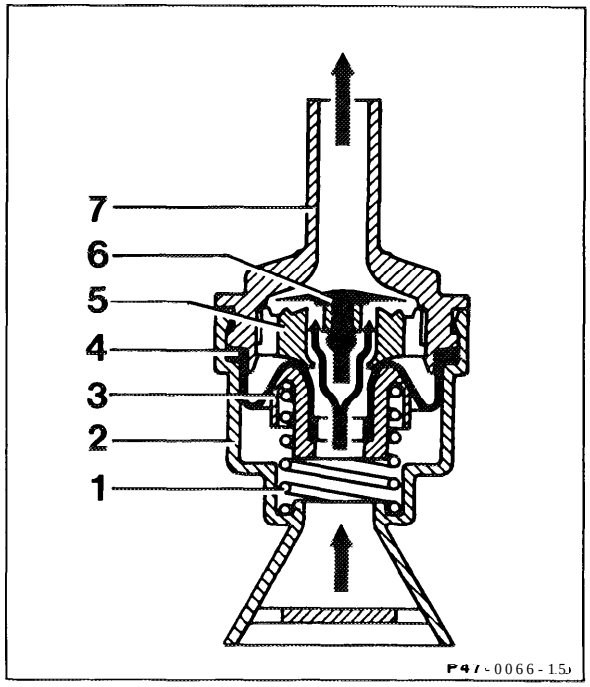
The vent system consists of a central pipe (54) with an siphon breaker (54/1) at each end. The siphon breakers prevent fuel escaping along the vent line. The vent line (64) runs from the central pipe to the vent valve (51).

If an overpressure of 30-50 mbar is reached in the fuel tank, the vent valve (4) opens and the fuel vapors flow to the charcoal canister.



1	Compression spring
2	Valve housing
3	Spring plate
4	Vent valve
5	Valve plate
6	Air admission valve
7	Connection fitting

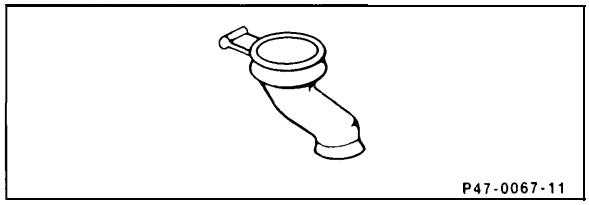
If a vacuum of 1-1 6 mbar is produced in the fuel tank, the air admission valve (6) opens.



The protective rubber boot at the end of the vent valve prevents dirt and splash water entering the vent valve.

Standard implementation:

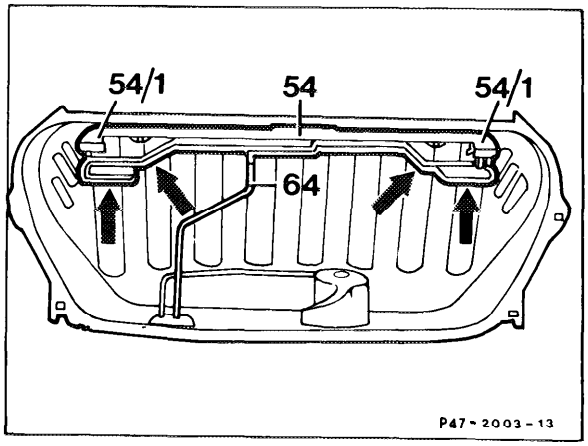
Model	Vehicle ident No.	
	April 1986	May 1986
201	A 296211	F 227064



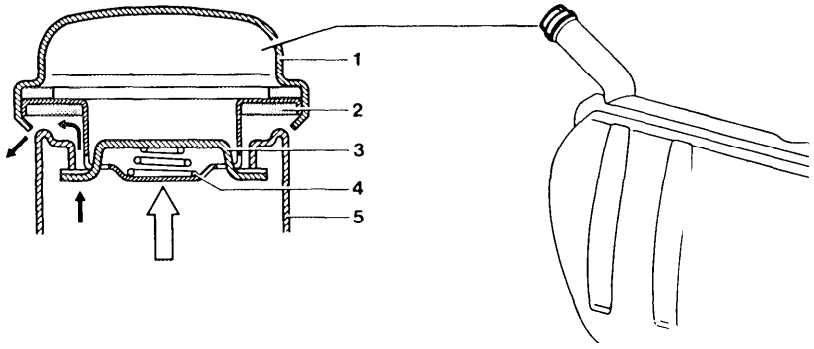
Vent system modified

The vent system has been modified by the addition of lines and siphon breakers (arrows) so that no fuel can escape through the vent system even under extreme conditions (rollover).

Standard implementation: phased-in (approx. 1 0/88)



47–030 Function of fuel tank ventilation - Turbodiesel

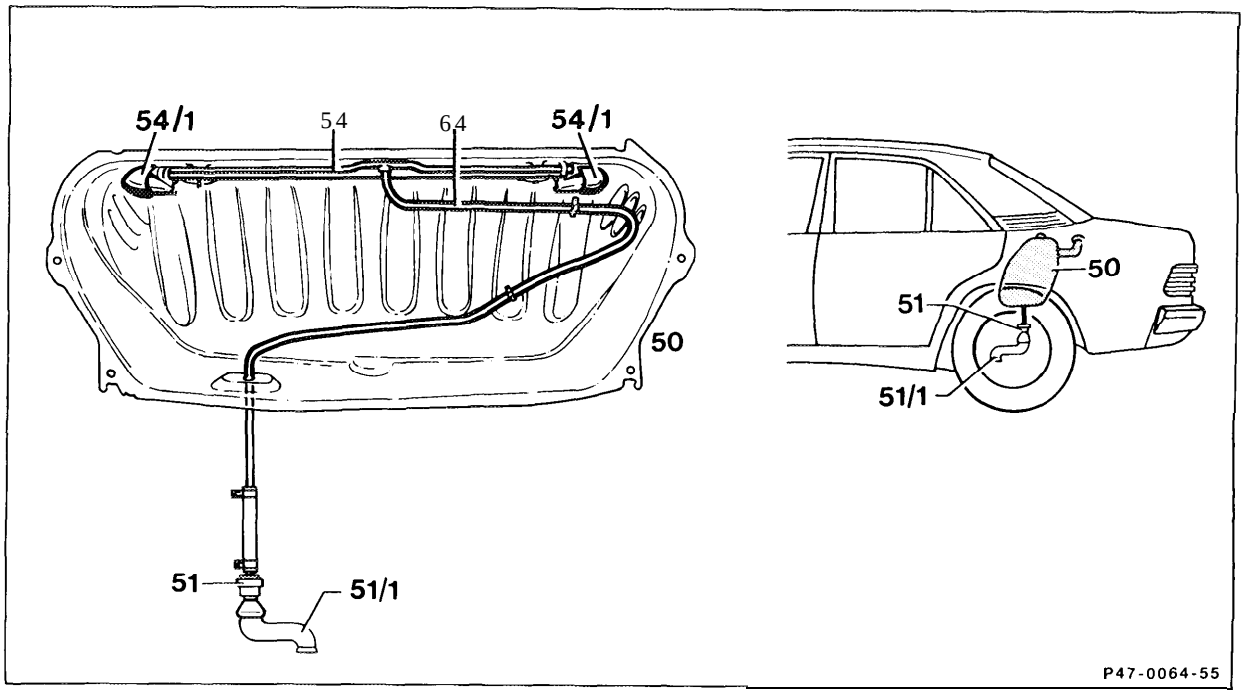


P47-0041-53

All Turbodiesel models

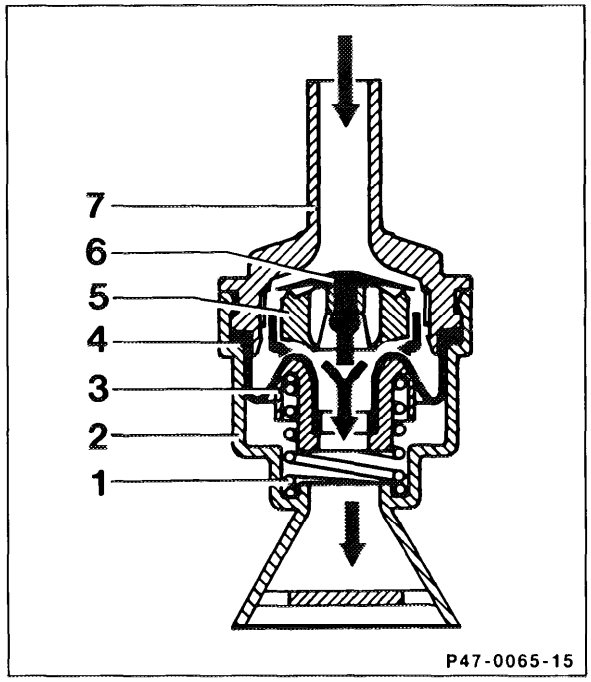
1	Cap		Compression spring
2	Sealing ring		Filler neck
3	Closing bar		

At a gauge pressure of 100-300 mbar, vaporized fuel can escape through the fuel cap. This is only the case if the vent line from the fuel tank is not clear. If the system is operating properly, a gauge pressure of up to 50 mbar may be present in the fuel tank.



The vent system in the fuel tank (50) consists of a central pipe (54) each with a siphon breaker (54 1) at the ends. The siphon breakers prevent fuel escaping through the vent line.
The vent line (64) runs from the central pipe to the vent valve (51). The protective seal (51/1) at the end of the vent valve prevents dirt and splash water from getting into the vent valve.

If a gauge pressure of 30-50 mbar is present in the fuel tank, the vent valve (4) opens and allows the fuel vapors to escape.

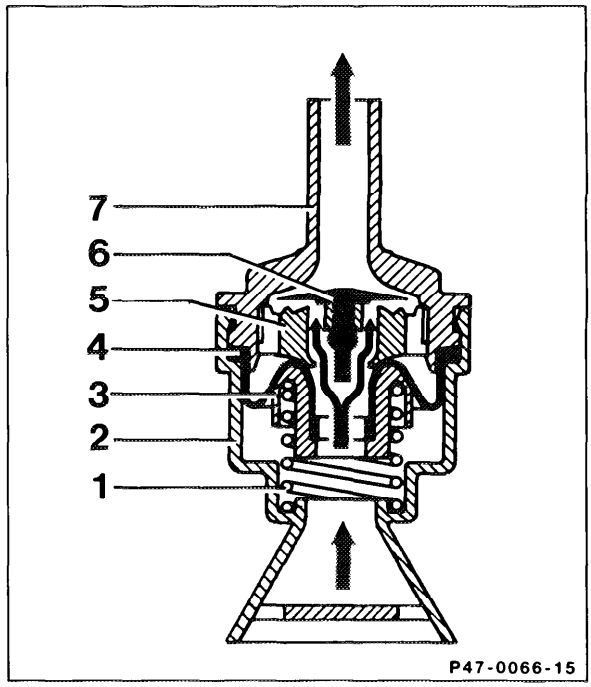


1 Compression ring
2 Valve housing
3 Spring plate
4 Vent valve
5 Valve plate
6 Air admission valve
7 Connection fitting

If a vacuum of 1-16 mbar is produced in the fuel tank, the air admission valve (6) opens.

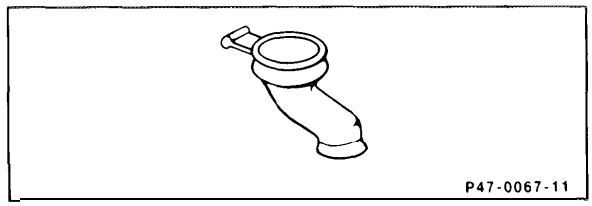
Station wagons

These models are fitted with a modified vent valve with a bright base section. The performance is the same as for other vent valves.



1 Compression spring
2 Valve housing
3 Spring plate
4 Vent valve
5 Valve plate
6 Air admission valve
7 Connection fitting

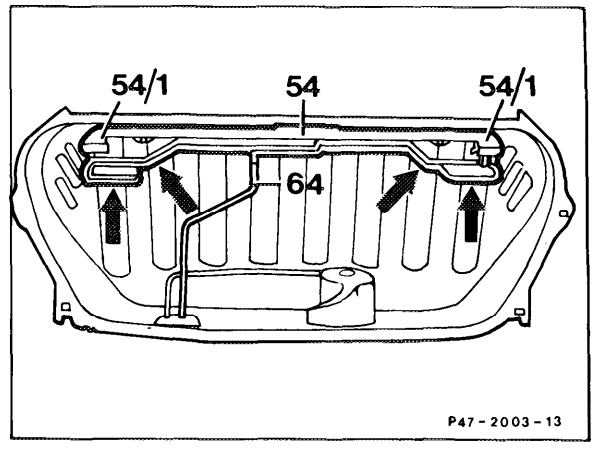
The dirt seal at the end of the vent valve prevents dirt and splash water from getting into the vent valve.



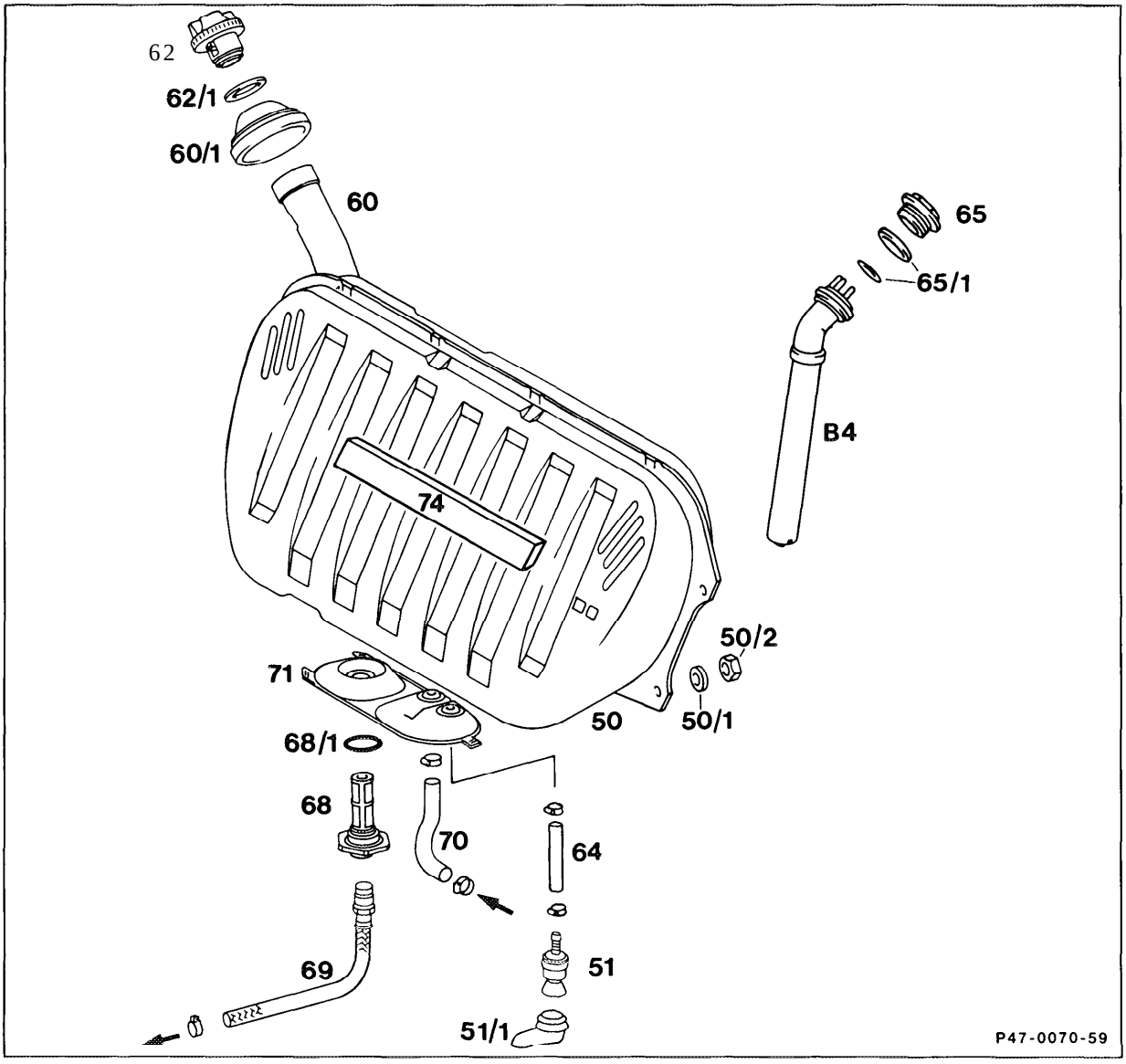
Modified vent system

The vent system has been modified by additional lines and siphon breakers (arrows) with the result that no fuel can escape through the vent system, even under extreme conditions (rollover).

Production breakpoint: phased in (approx. 10/88).



D. Model 201 naturally-aspirated versions



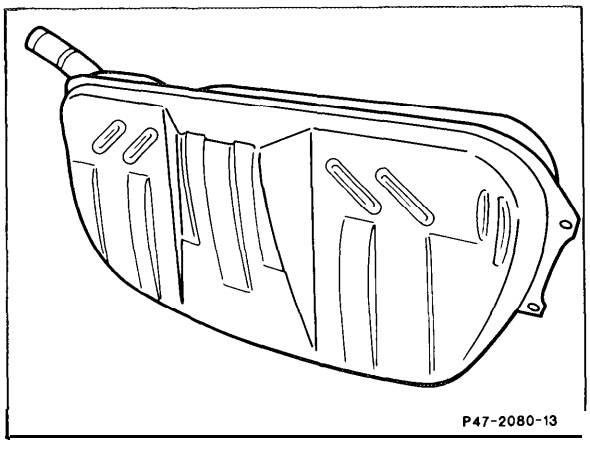
Safety regulations	Observe, risk of accident!
Battery ground cable	Disconnect, connect.
Filler cap (62)	Remove, fit. Check seal (62/1), replace if necessary.
Fuel tank (50)	Drain. Carefully pump out fuel to ensure no fuel remains in the tank. Capacity approx. 55 liters (14.5 US gal.). Stick on 4 sound-absorbing strips (74), if necessary, with MB Universal Adhesive 000 989 92 71 (steel fuel tank only).
Cup seal (60/1)	Remove, Install.
Lining of fuel tank	Detach, attach.

Fuel gauge	Detach, fit on connector at sending unit (64). Check operation. Remove, install sending unit (B4), if necessary, 39 Nm (47-120). Replace seals.
Supply line (69), return line (70), vent valve (51)	Disconnect, connect, 28 Nm. Check for re-use. Collect remaining fuel. Seal connections. Ensure cup seal (71) is correctly seated.
Nut (50/2, 4 off)	21 Nm, use 4 washers (50/1).
Drain hose of tank recess	Before taking out the fuel tank, pull drain hose slightly up the way and lay to behind edge of fuel tank. Refit correctly after installation.
Fuel filter (68)	Remove, install if necessary, 39 Nm, clean. Check for reuse. Replace seal (6811).
Run engine briefly	Check connections and joints for leaks.

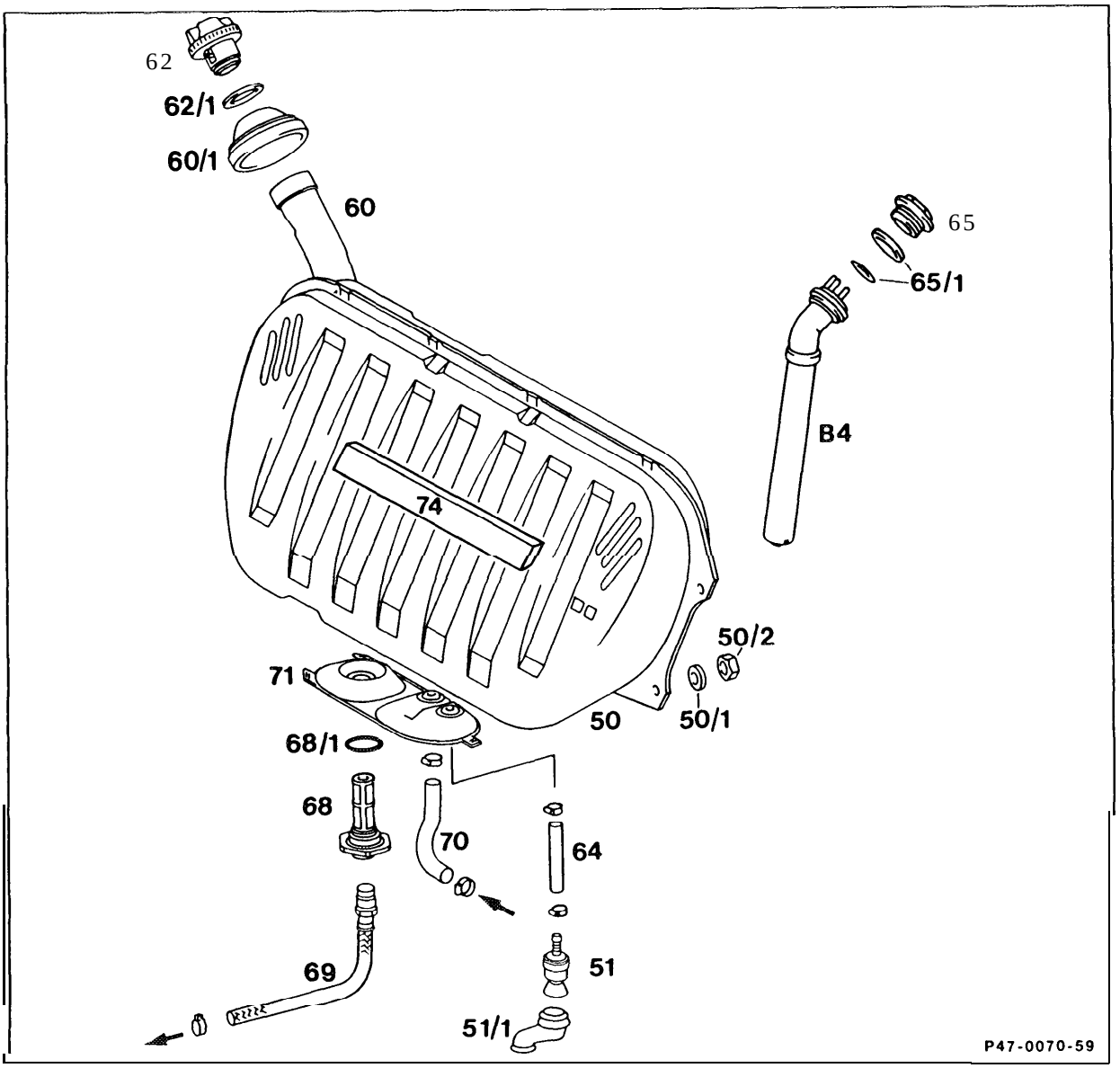
Repair instruction

Fuel tanks effective from 09/88 cannot be installed in cars manufactured prior to this date.

effective 09/88



E. Model 201 **Turbodiesel** versions

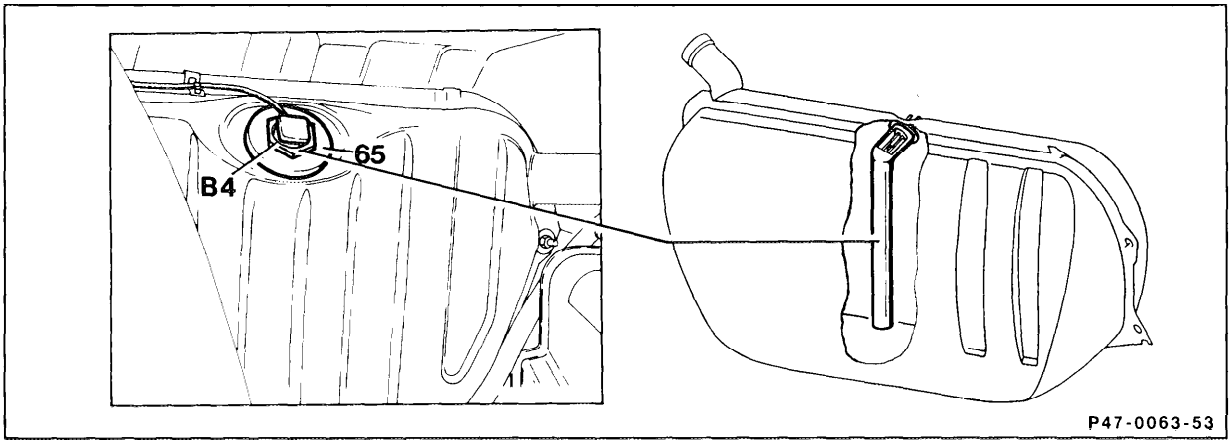


Safety regulations	observe, risk of accident!
Battery ground cable	disconnect, connect.
Cap(62)	remove, install. Check seal (62/1), renew if necessary.
Fuel tank (50)	drain. Carefully pump out fuel to ensure that there is no fuel remaining in the tank. Capacity approx. 55 litres. Stick 4 sound-deadening strips (74) with MB universal adhesive 000 989 92 71, if necessary.

Cup seal (60/1)	remove, install.
Panelling of fuel tank	detach, attach.
Fuel gauge	detach connector on sending unit (B4), fit on, check operation. Remove, install sending unit (B4) 39 Nm, if necessary (47-120). Renew seal rings.
Supply hose (69), return hose (70), vent valve (51)	disconnect, connect, 28 Nm. Check for re-use. Collect remaining fuel, seal connections. Ensure cup seal (71) is correctly fitted.
Nut (50/2, 4 off)	21 Nm. Use 4 shims (50/1).
Drain hose from tank recess	before removing the fuel tank, pull drain hose slightly upwards and lay over edge of fuel tank. Position correctly following installation.
Fuel filter (68)	if necessary, remove, install, clean, 39 Nm. Check for re-use. Replace seal (68/1).
Run engine briefly	Check joints for leaks.

47-120 Removal and installation of fuel gauge sending unit

A. Model 201

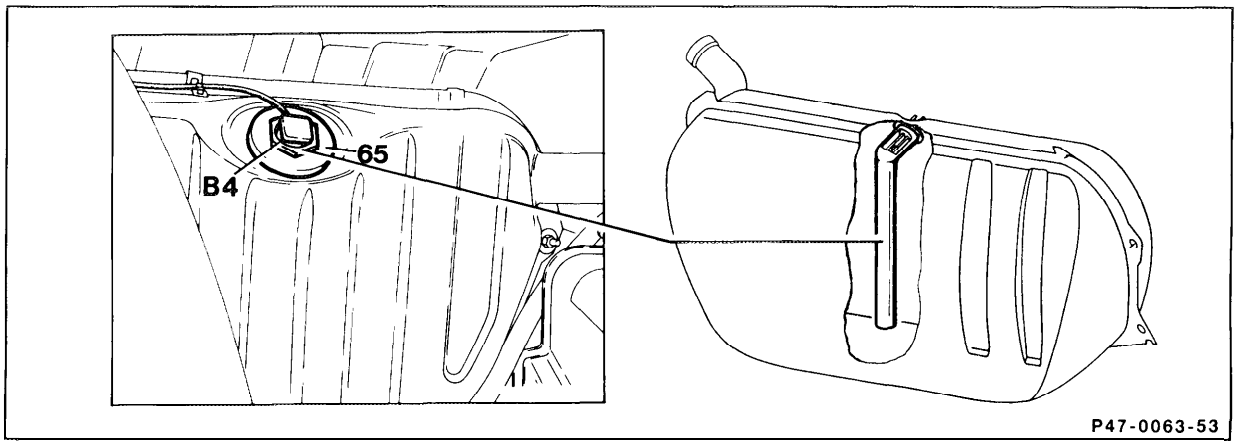


Battery ground cable	Disconnect, connect.
Fuel tank lining	Remove, install, Model 201 only partially.
Connector at sending unit (B4)	Remove, fit.
Sealing flange (65)	Unbolt, bolt on, 39 Nm. If fuel tank full, pump out approx. 8 litres (2 U.S. gal.) beforehand. Replace sealing rings.
Sending unit (B4)	Remove, install, run to drain, if necessay. Remove locking pin below adhesive strip (new part only).

Note

Refer to “Function of fuel gauge sending unit” (47-020) for fuel gauge sending unit Model 201.

B. Models 124, 201 Turbodiesel

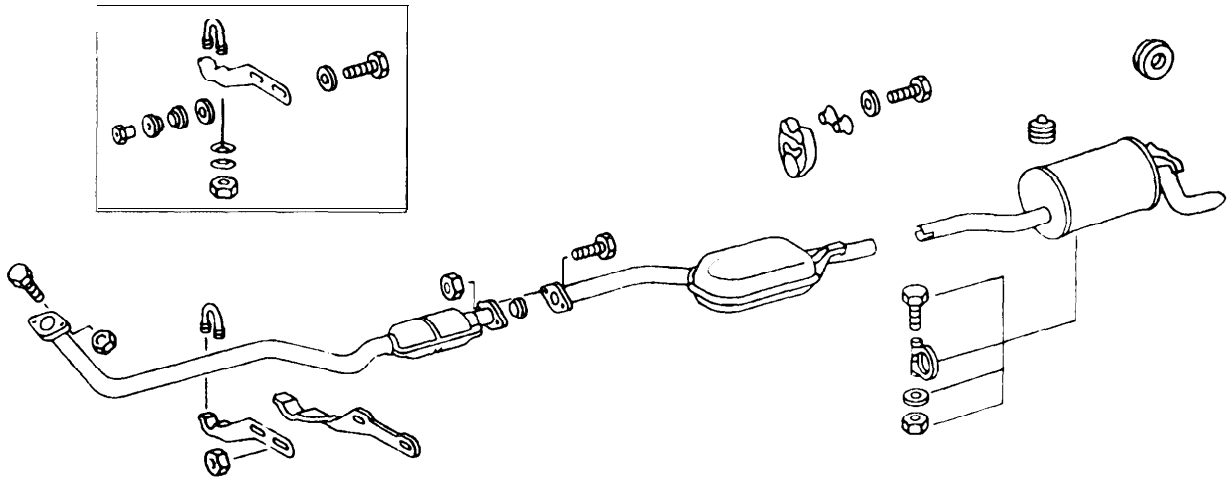


Battery ground cable	disconnect, connect.
Panelling of fuel tank	remove, install. Model 201 only partially.
Connector on sending unit (B4)	detach, fit on.
Sealing flange (65)	unbolt, bolt on, 39 Nm. Initially pump out approx. 8 litres (2 U.S. gal.) if fuel tank full. Replace seals.
Sending unit (B4)	remove, install. Empty by running if necessary. Remove locking pin below adhesive strip (new part only).

Job No.

Removal and installation of exhaust system . . . . . 49 – 100
Removal and installation of exhaust system - Turbodiesel . . . . . 49 – 100

A. Model 201 with Engine 602



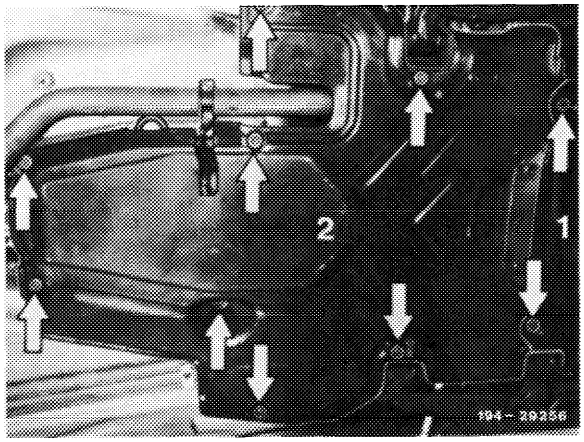
Hexagon bolt (1)	Replace, 20 Nm.
Front exhaust pipe (2) or front exhaust pipe with oxidation catalytic converter (2a)	Check flanges for signs of damage, tighten evenly.
Self-locking hexagon nut (3)	Replace.
Self-locking hexagon nut (4)	Replace, 20 Nm.
Sintered sealing ring (5)	Examine for signs of damage, ensure correctly seated.
Retaining clamp (6)	Examine for re-use.
Center muffler (7)	Examine for signs of damage.
Hexagon bolt (8)	Replace.
Rear muffler (9)	Examine for signs of damage.

Side supporting bracket (10)	Loosen, fix.
Hexagon bolt (11)	20 Nm.
Washer (12)	
Rubber pad (13)	Examine for signs of wear.
Large rubber disc (14)	Examine for signs of damage.
Spacer sleeve or small rubber disc (15)	
Self-locking hexagon nut (16)	Replace, 7 Nm.
Cup spring (17)	Replace, ensure correctly installed.
Rubber ring (18)	Examine for signs of damage and wear.
Hexagon bolt (19)	
Washer (20)	
Pipe clip (21)	
Spring lock washer (22)	Replace.
Hexagon nut (23)	20 Nm.
Hexagon bolt (24)	20 Nm.
Hanger plate (25)	Examine for signs of damage and wear.
Tensioning plate (26)	

The description which follows does not cover removal and installation of the exhaust system to the full extent, but deals only with particularly important points which should be noted during removal, installation or partial replacement of the exhaust system, e.g. the rear muffler with push-in joint.

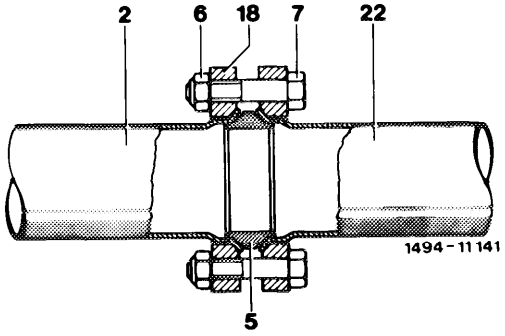
Removal

1 Detach rear section of noise capsule when working on the front exhaust system.



2 Examine hanger parts for possible re-use, replace if necessary.

3 Before installing the exhaust system, ensure that the flange to the exhaust manifold is not twisted; align flange if necessary. Clean combustion residues from tapered connector pieces of pipes and centered sealing rings (2, 5 and 22), if necessary, with emery cloth.

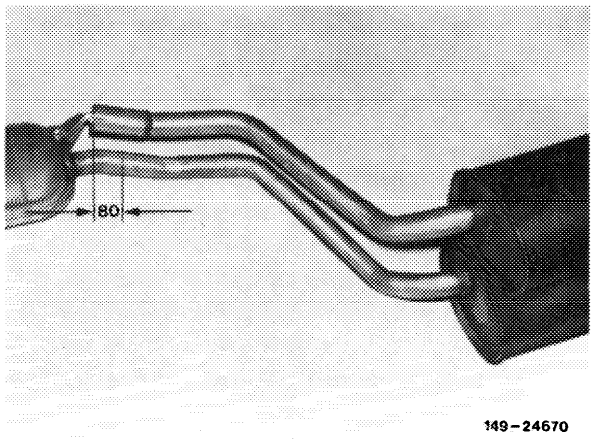


Installation

Replacement of rear muffler.

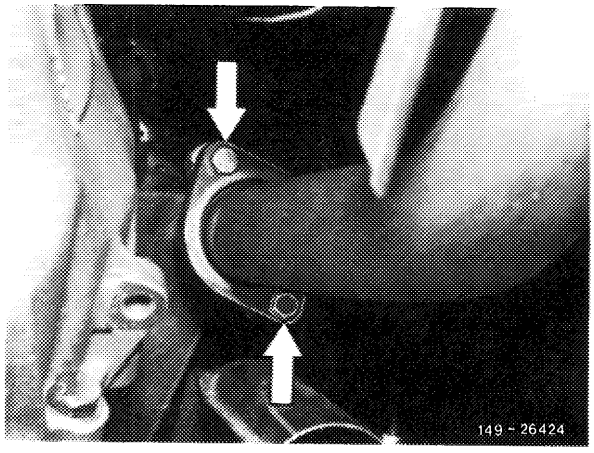
4 Position new rear muffler with plug-in joint precisely over removed system and mark length of pipe of new rear muffler on removed system.

Cut through the pipe 80 mm away from the mark (tolerance minus 10 mm) in the direction of rear muffler to obtain an insertion depth of 70-80 mm.



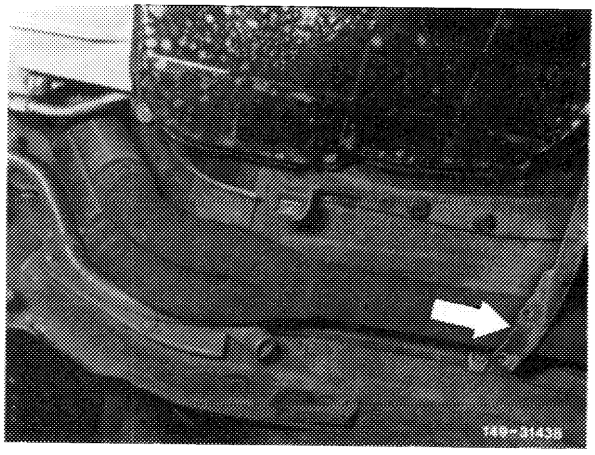
5 Always replace self-locking hexagon nut.

6 Tighten the flanged joint to the manifold evenly. Tightening torque of self-locking hexagon nuts 20 Nm.

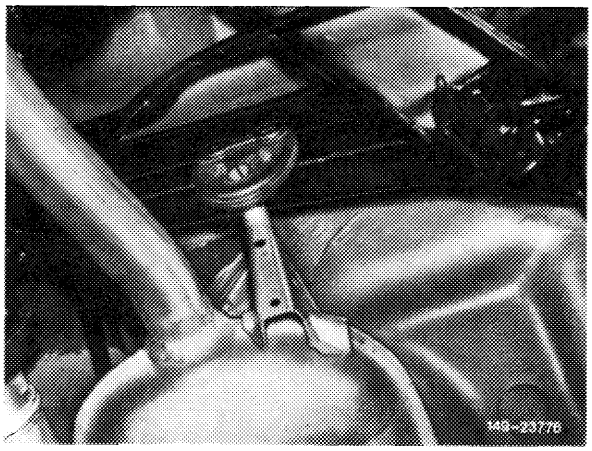


Model 201.1

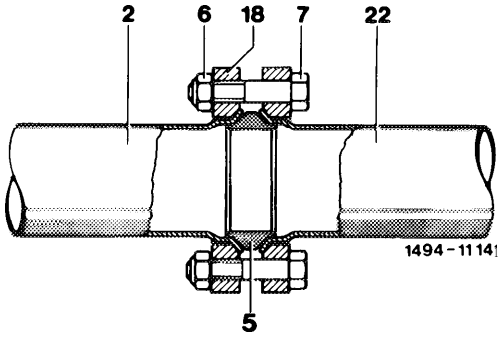
Caution!
When installing the front exhaust system to the manifold, do not allow the spiral hoses to be tensioned by the weight of the system. Use the side mounting brackets on the transmission as a support (arrow).



7 Install rear exhaust system with center and final mufflers, at the same time attaching the exhaust system to the rubber hanger at the rear axle support.

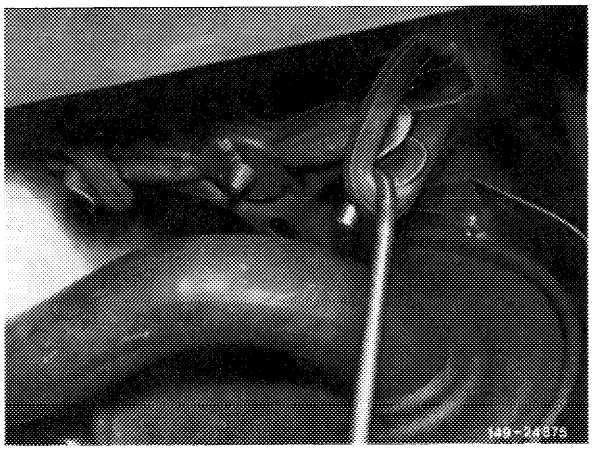


8 Install sintered sealing ring (5) at the flanged joint and ensure it is correctly seated. Tightening torque of self-locking hexagon nuts 20 Nm.

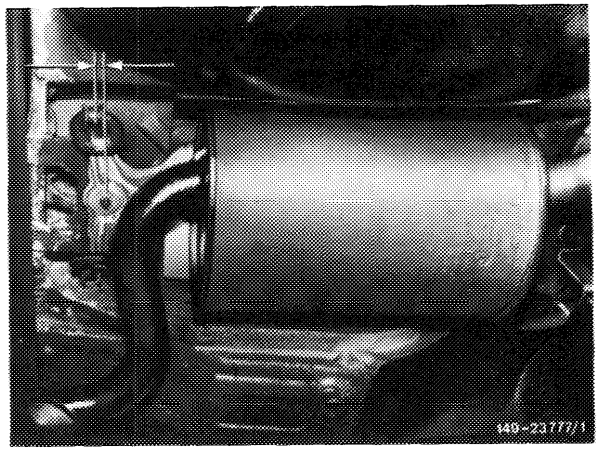


2 Front exhaust pipe
5 Sintered sealing ring
6 Self-locking hexagon nut
7 Hexagon bolt
18 Flange
22 Rear exhaust pipe

9 Use a suitable hook to attach rubber rings to the rear muffler.

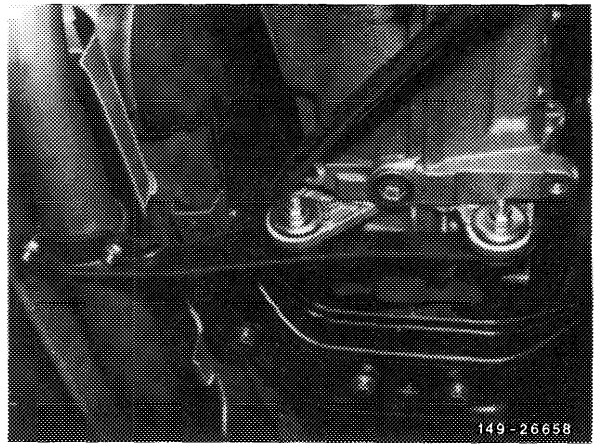


10 Install rear muffler in such a way that the retaining clamps of the rear muffler are positioned approx. 10 mm ahead of the brackets on the frame floor to ensure that the system is correctly installed when the exhaust expands (arrows).



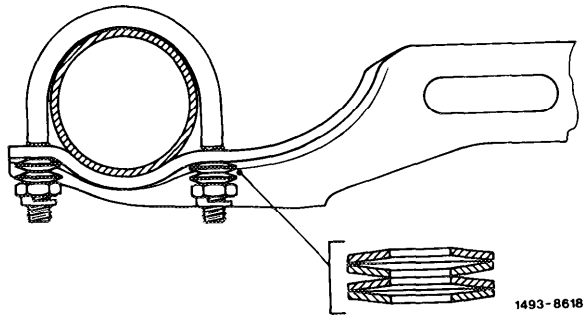
Note
This applies only to replacement mufflers with plug joints between the center and rear mufflers.

11 Install side mounting bracket of exhaust free of tension. Tightening torque of self-locking hexagon nuts at tensioning clamp is 7 Nm, of hexagon bolts of side mounting bracket on transmission 20 Nm.

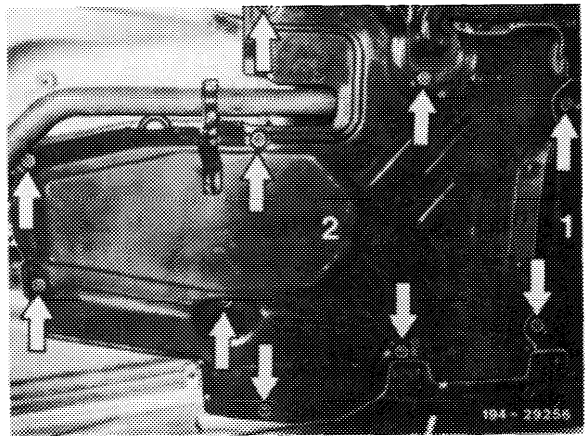


Note
Install 4 cup springs on each side of the retaining clamp in such a way that the convex ends are apart (as shown in illustration).

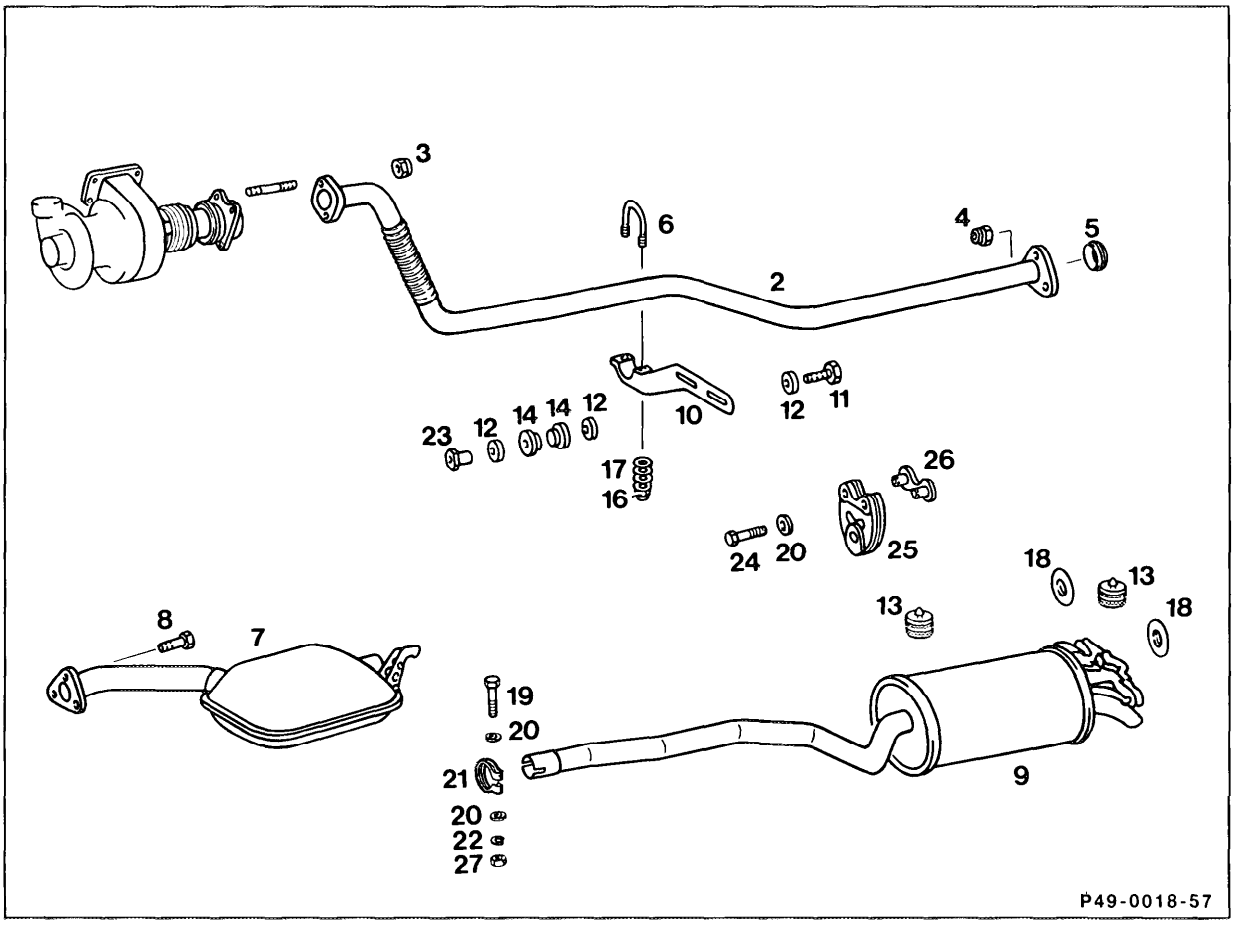
12 Run engine and examine exhaust system for leaks.



13 Install noise capsule.



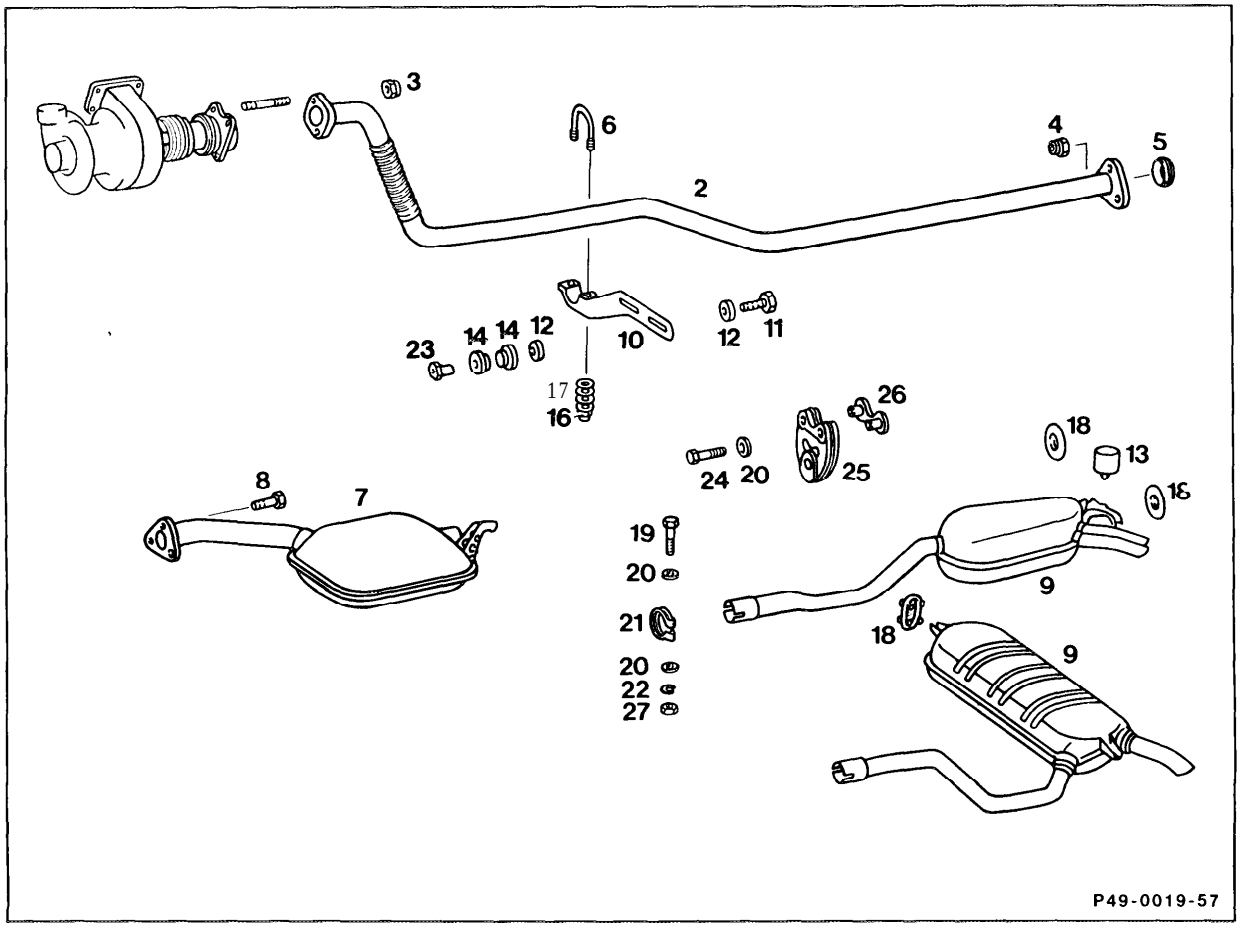
A. Model 201 with Engine 602.96



Rear muffler (9)	remove, install, check for damage, replace if necessary.
Rubber buffer (13)	check for wear, replace if necessary.
Pipe clamp (21)	replace.
Center muffler (7)	remove, install, examine for signs of damage, replace if necessary.
Hexagon bolts (8) and self-locking nuts (4)	replace. Tightening torque 20 Nm.

Sintered seal (5)	examine for signs of damage, Ensure correct seating.
Retaining bar (6) with Belleville spring washers (17) and self-locking nuts (16)	remove, refit. Tightening torque 7 Nm.
	Installation note Check parts and replace if necessary.
	Caution! Note pictorial information for assembling Belleville spring washers.
Front exhaust pipe with flexible hose (2)	remove, install, check flange for damage, tighten evenly and assemble flexible hose free of tension. Replace self-locking nuts (16), tightening torque 20 Nm.

B. Model 124 with Engines 602.96, 603.96



Rear muffler (9)	remove, install, check for damage, replace if necessary. Tightening torque of nut (27) 20 Nm.
Rubber buffer (13)	check for wear, replace if necessary.
Pipe clamp (21)	replace.
Center muffler (7)	remove, install, check for signs of damage, replace if necessary.
Bolts (8) and self-locking nuts (4)	replace. Tightening torque 20 Nm.
Sintered seal (5)	check for damage, ensure correct position.

Retaining bar (6) with Belleville spring washers (17) and self-locking nuts (16)	detach, mount, tightening torque 7 Nm. **Installation note** Test parts and replace if necessary. **Caution!** Note pictorial information on assembly of Belleville spring washers.
Front exhaust pipe with flexible hose (2)	remove, install, check flanges for signs of damage, tighten evenly and install flexible hose free of tension. Replace self-locking nuts (16). Tightening torque 20 Nm.

Mercedes-Benz

Service

Maintenance Manual

Model Year 1981 – 1993

Mercedes-Benz of North America, Inc.

S-2388-CS1

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Order number S-2388-CS1

This manual provides detailed descriptions of maintenance jobs, testing and adjustment data, filling capacities, torque specifications, and special tools.

Each individual maintenance job is identified by a job number located at right or left heading of each page. The job numbers in the Maintenance Manual are identical with those on the Maintenance System Sheets and the Maintenance Booklets, so that the respective texts and data can be quickly located when performing maintenance work.

The first two digits of the 4-digit job number are the group numbers as used in the workshop literature. In this manner, each maintenance job is associated with the appropriate group.

The models and/or engines to which the jobs apply are listed below the job numbers.

Particularly extensive job numbers are subdivided according to models or engines.

Mercedes Benz of North America
Service and Parts Literature

March 1993

Preface

This Maintenance Manual applies to vehicles starting model year 1981 and covers all maintenance jobs for the following models:

Sales Designation	Model	Engine	1981	1982183	1984185	1986	1987	1988	1989	1990	1991	1992	1993
107													
380 SL	107.045	116.960	●										
380 SL	107.045	116.962		●	●								
380SLC	107.025	116.960	●										
560SL	107.048	117.967				●	●	●	●				
123													
240 D	123.123	616.912	●	●									
300 D	123.130	617.912	●										
300 D Turbo	123.133	617.952		●	●								
300CD	123.150	617.912	●										
300 CD Turbo	123.153	617.952		●	●								
300 TD Turbo	123.193	617.952	●	●	●								
280 E	123.033	110.984	●										
280 CE	123.053	110.984	●										
124													
300 D 2.5 Turbo	124.128	602.962								●	●	●	●
300 D Turbo	124.133	603.960				●	●						
300 TD Turbo	124.193	603.960				●	●						
260 E	124.026	103.940					●	●	●				
300 E 2.6	124.026	103.940								●	●	●	
300 E 2.8	124.028	104.942											●
300 E	124.030	103.980				●	●	●	●	●	●	●	
300 E	124.032	104.992											●
300 E 4MATIC	124.230	103.980								●	●	●	●

Sales Designation	Model	Engine	1981	1982/83	1984/85	1986	1987	1988	1989	1990	1991	1992	1993
124 continued													
300 CE	124.050	103.980						●	●				
300 **CE**	124.051	104.980								●	●	●	
300 **CE**	124.052	104.992											●
300 **CE Cabriolet**	124.066	104.992											●
300 **TE**	**124.090**	**103.983**						●	●	●	●	●	
300 **TE**	**124.092**	**104.992**											●
300 TE 4MATIC	**124.290**	**103.983**								●	●	●	●
400 **E**	124.034	119.975										●	●
500 **E**	124.036	119.974										●	●
126													
300 **SD Turbo**	**126.120**	**617.951**	●	●	●								
300 SDL Turbo	126.125	603.961				●	●						
350 SD Turbo	**126.134**	**603.970**									●		
350 SDL Turbo	**126.135**	**603.970**								●	●		
300 **SE**	126.024	103.981						●	●	●	●		
300 **SEL**	**126.025**	**103.981**						●	●	●	●		
380 SE	**126.032**	**116.963**			●								
380 SEL	**126.033**	116.961	●	●									
380 **SEC**	126.043	116.963		●									
420 **SEL**	**126.035**	**116.965**				●	●	●	●	●	●		
500 SEL	126.037	117.963			●								
500 **SEC**	126.044	117.963			●								
560 **SEL**	**126.039**	**117.968**				●	●	●	●	●	●		
560 **SEC**	**126.045**	**117.968**				●	●	●	●	●	●		

Sales Designation	Model	Engine	1981	1982183	1984185	1986	1987	1988	1989	1990	1991	1992	1993
129													
300 SL	129.061	104.981								●	●	●	●
500 SL	129.066	119.960								●	●	●	
500 SL	129.067	119.972											●
600 SL	129.076	119.960											●
140													
300 SD	140.134	603.971										●	●
300 SE	104.032	104.990										●	●
400 SE	140.042	119.971										●	
400SEL	140.043	119.971											●
500 SEL	140.051	119.970										●	●
600 SEL	140.057	120.980										●	●
500SEC	140.070	119.970											●
600 SEC	140.076	120.980											●
201													
190 D 2.2	201.122	601.921			●								
190 D 2.5	201.126	602.911				●	●	●	●				
190 D 2.5 Turbo	201.128	602.961					●						
190 E 2.3	201.024	102.9611 985			●	●							
190 E 2.3	201.028	102.985					●	●			●	●	●
190 E 2.6	201.029	103.942					●	●	●	●	●	●	●
190 E 2.3-16	201.034	102.983				●	●						

We want you to enjoy your MERCEDES-BENZ car for a long time to come. Vehicle safety and operational reliability are two very important factors, and in order to maintain them, a certain amount of maintenance and service work is necessary.
The MERCEDES-BENZ maintenance system includes all the necessary maintenance work which should be carried out at regular intervals if the vehicle is used under normal operating conditions.

Routine Maintenance

- Inspection service
  Up through model year 1991,
  once at 800-l 000 miles/l 300-l 600 km
  As of model year 1992,
  once at 800-3000 miles/l 3005000 km
- Lubrication service
  All Diesel models except 140.134
  every 5,000 miles/8,000 km
  All Gasoline models and model 140.134
  every 7,500 miles/l 2,000 km
- Maintenance service
  every 15,000 miles/24,000 km
- Additional work
  every 30,000 miles/48,000 km

In the case of low **mileage operation** (vehicle is driven infrequently), the maintenance service must be carried out at least once every 2 years.

Engine oil and filter change

Required at specified mileage interval, or at least once a year when using year-round multigrade oil; otherwise twice a year (spring and fall). A detailed list of maintenance jobs is contained in the maintenance booklet following the maintenance vouchers.
Vehicle and engine models are indicated on the vehicle data card.

Severe operating conditions

Starting model year 1992

As a result of technical product enhancements, improved engine management systems, upgraded fuels and lubrication products, true cases of severe operating conditions will rarely exist in non-commercial passenger car applications. For a vehicle to qualify for severe operating conditions the following criteria must be met:

1. More than 50% short distance driving (less than 5 miles per trip) combined with engine operating at a temperature of less than 80°C (176° F), especially at low outside temperatures.

2. More than 50% operation in lower gears combined with high engine load (mountain driving, poor roads, etc.)

If these requirements are met, it is recommended that an additional oil change (without oil filter change) be performed between the scheduled engine oil change intervals, i. e. engine oil change every 2,500 miles or every 3,750 miles , depending upon model (Vehicles occasional/y exposed to severe operating conditions do not require *an additional oil change.)*

Model year 1981 through 1991

In case of severe **operating conditions** or heavy use mainly in city traffic or over short distances, frequent mountain driving, poor roads, dusty and muddy conditions, trailer towing, hard driving, etc., it may be necessary to carry out maintenance work at shorter intervals, i. e.:
Oil and filter change: half the normally recommended interval.
Automatic transmission: Fluid change (without filter change) every 15,000 miles/24,000 km
Inspect tires.
Air cleaner, clean or replace element.

Non-scheduled MB Maintenance Service

Every 15,000 miles/24,000 km, the maintenance service consists of 3 parts:

- General and Lubrication Service
- Engine Maintenance
- Safety Inspection

These parts can be performed individually on request, if particular driving conditions so require, or on a precautionary basis before leaving on a long trip, etc.

Special Maintenance Measures

Brake fluid should be replaced annually, preferably in the spring, on all models except models 129 and 140 which should have a brake fluid change every 2 years.
Engine coolant should be checked for sufficient protection before the start of and during the cold season. Have the coolant (water/antifreeze mixture) replaced no later than after 3 years.

It is necessary to have all regularly scheduled maintenance work performed to maintain your vehicle In good operating condition and to keep your warranty valid. While it is not required that such work be performed by factory-authorized dealers, it Is strongly recommended to have an authorized MERCEDES-BENZ dealer do such work because he is equipped wlth tools, instruments, literature, and trained personnel necessary for correct and systematic completion of these jobs.

Spare parts

It is recommended that only MERCEDES-BENZ parts be used for service and repairs, since they have been made according to the manufacturer's specifications. It is also important to use only fuels and lubricants that meet factory specifications. See a MERCEDES-BENZ dealer for more information.

Routine Checks

In addition to the lubrication and maintenance services, it is recommended that the following items be checked regularly and prior to any long trip:

Engine oil level - during the break-in period not later than after 300 miles/500 km.

Automatic transmission fluid level

Brake (and clutch) fluid level

If brake fluid needs to be added, see a MERCEDES-BENZ dealer to determine the cause, i.e. leaks or worn brake pads.

Battery - add distilled water only.

Windshield washer system - add water mixed with MERCEDES-BENZ windshield detergent, check operation and wiper blades.

Tire pressure - check at least every other week.

Lubrication
Lubricate engine throttle control linkage rods and shafts and check for free movement and for wear every Lubrication Service, at least twice a year, and also after the use of engine cleaning solvent.
Use only Automatic Tranmsission Fluid. Refer to MBNA Factory Approved Service Products list for listing of approved ATF's.

Maintenance Vouchers

The MERCEDES-BEN% dealer will certify in the maintenance booklet that all lubrication and maintenance services have been carried out at the correct intervals.

Stickers that indicate when the next lubrication service or maintenance service is necessary, or when the brake fluid must be changed, are provided in the middle of the maintenance booklet.

Sticker attachment locations:
In driver's door frame:
- Lubrication service and maintenance service

In the engine compartment:
- Brake fluid change

Lubrication service

Maintenance service

On maintenance booklet with window:
If required, enter next date for next scheduled service or brake fluid replacement.
Maintenance work does not include repair jobs.
For information concerning warranty, see Warranty Policy Booklet.

Model 107 up to 07.1985
123
126 up to 08.1985
201 up to 12.1984

- Inspect all components - engine, transmission, shock absorbers, steering, power steering pump, rear axle, checking condition and for leakage. Remove lower engine compartment cover (6190) or noise encapsulation panel (9490).

Note:
Install the lower engine compartment cover or noise encapsulation panel only after all the other maintenance jobs have been completed.

Inspecting condition of lines and hoses

0051

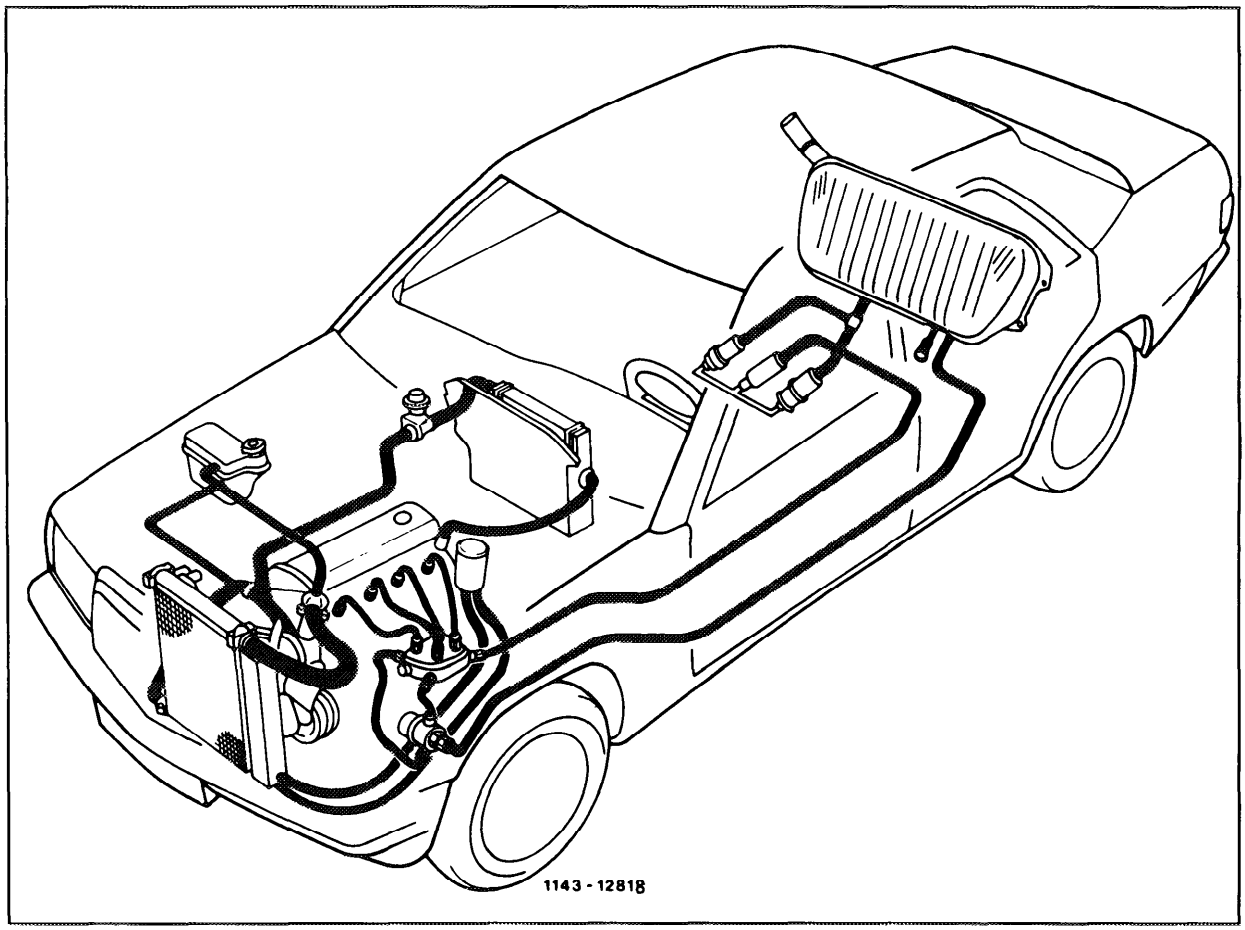
Model 107 through 07.1985
123
126 through 08.1985
201 through 12.1984

- Inspect lines and hoses on engine, automatic transmission, and power steering pump checking condition and for leakage.

Model 107 starting 08.1985
124
126 starting 09.1985
129
201 starting 01.1985
140

Note: To perform this job number, the engine compartment lower panels or the lower noise encapsulation panels must be removed and then reinstalled after completion of all maintenance work (see jobs 6190 or 9490, respectively)

Inspect engine and fuel system, including lines and hoses, for leaks. Check for chafe marks and proper routing.



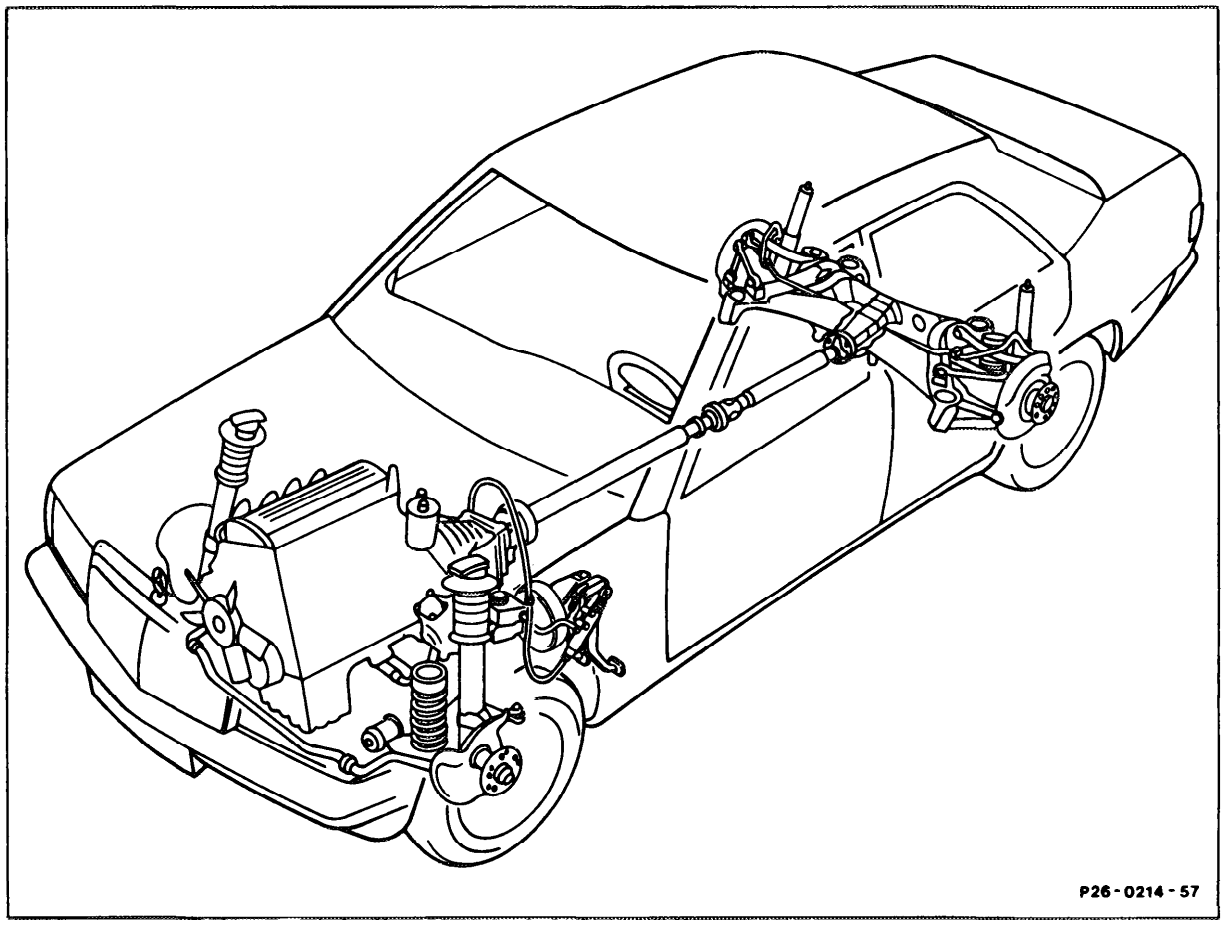
Engine

Crankcase
Coolant pump and housing
Oil pan
Air-oil cooler with hoses
Crankcase seal, front
Timing housing cover
Coolant and heating hoses
Cylinder head cover
Radiator
Oil filter

Fuel system

Fuel tank
Injection pump
Fuel pump
Fuel filters
Prefilter
Fuel cooler starting 1986
Fuel pump assembly
Injection system
Fuel preheating

Check condition of manual transmission. hydraulic clutch system, damper struts, shock absorbers, and rear axle.
If traces of oil are found on lower engine compartment panels, determine source.



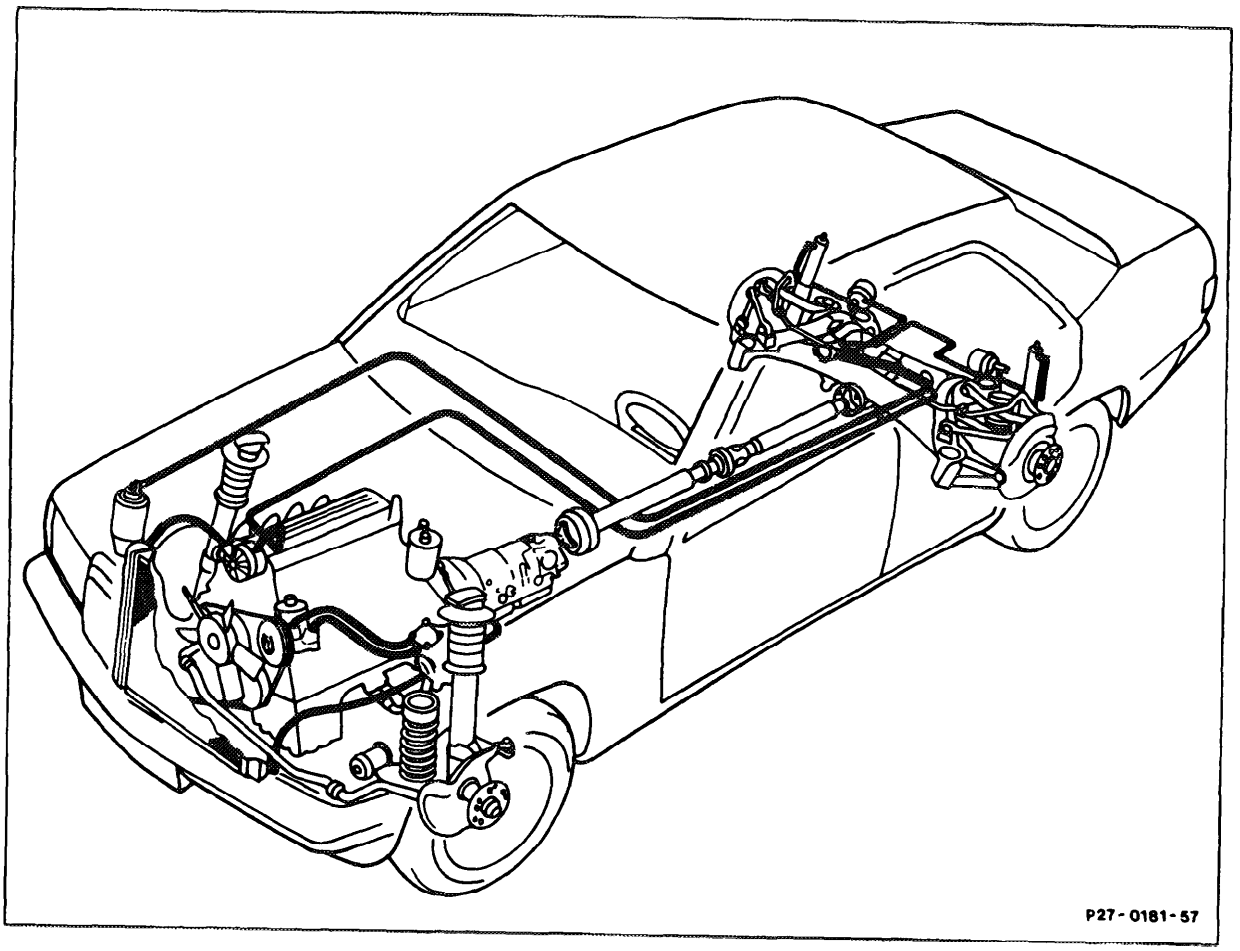
Manual transmission, clutch hydraulic system, and rear axle

Sealing rings
Fill and drain plugs
Housing cover
Clutch line and hose

Damper struts or shock absorbers

Leaks
Mounting

Check condition of automatic transmission, level control and power steering, including lines and hoses. Check for chafe marks and proper routing.



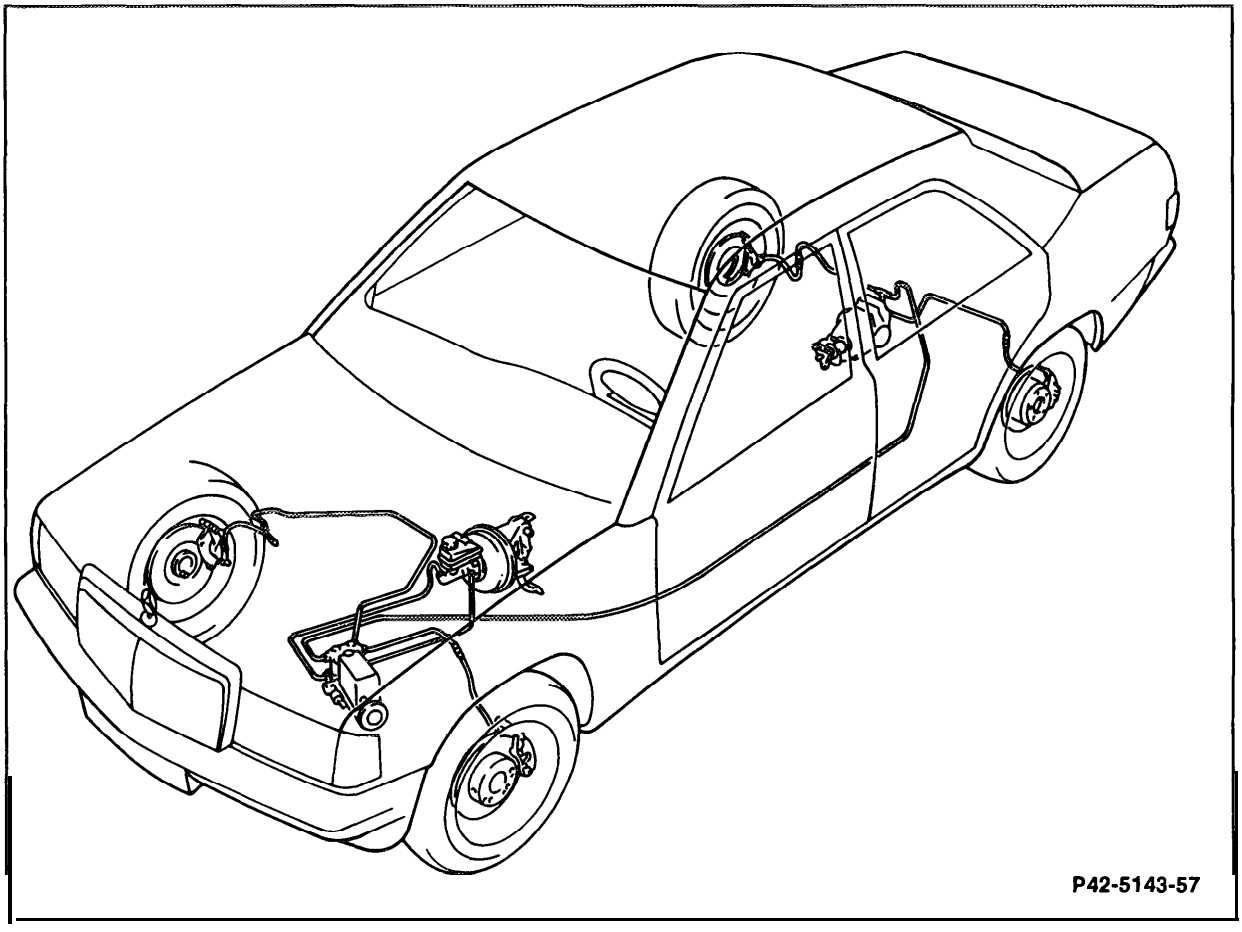
Automatic transmission, power steering

Torque converter
Sealing rings and gasket
Housing plugs
Line connections
Hoses
Oil pan

Level control/ADS

Suspension struts
Line connections
Hoses
Leveling valves
Hydraulic oil reservoir
Hydraulic oil pump
Suspension pressure reservoirs
Distribution valve
Control valve
Damping valve units

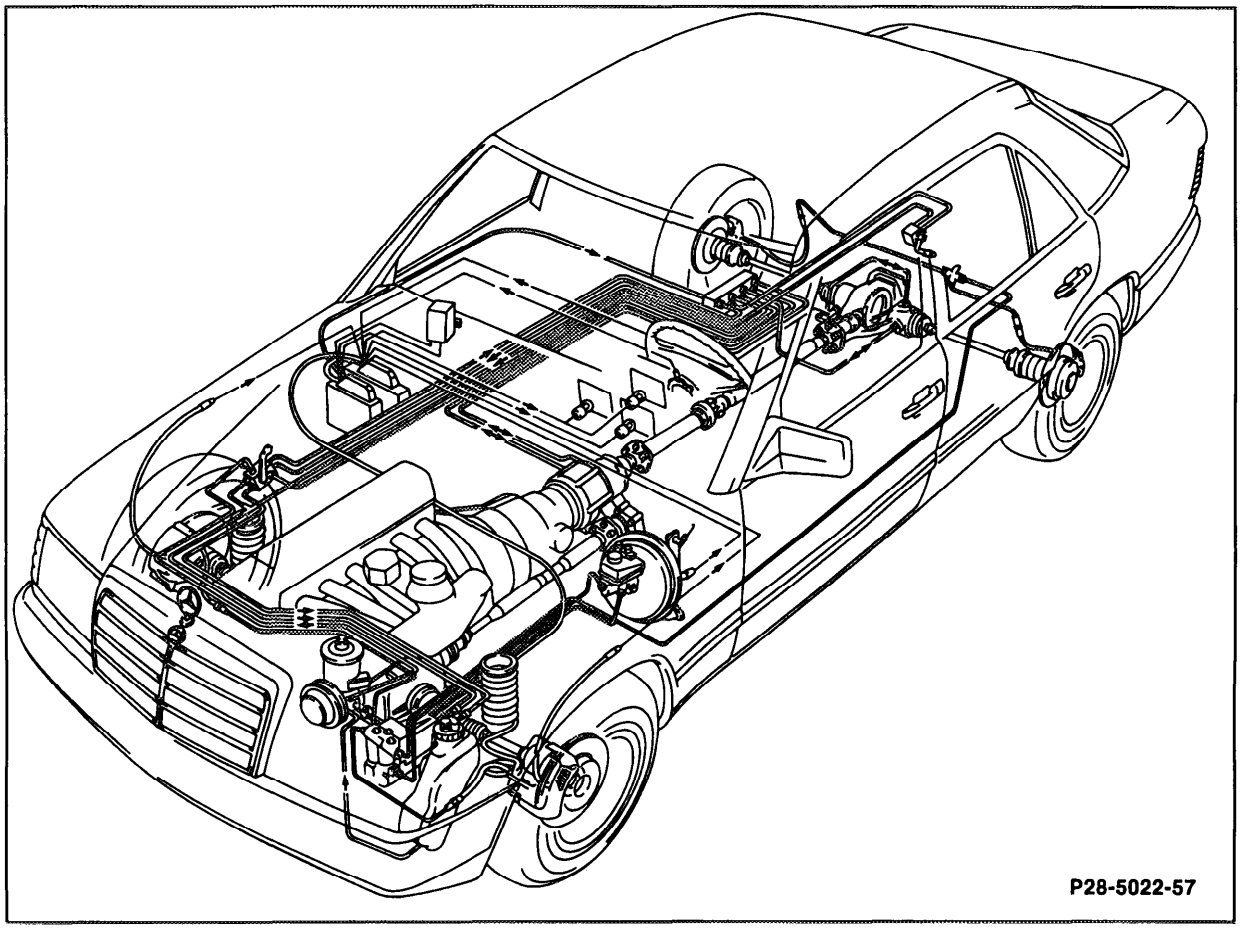
Check condition of brake system including lines and hose . Check for chafe marks and proper routing.



Brake system

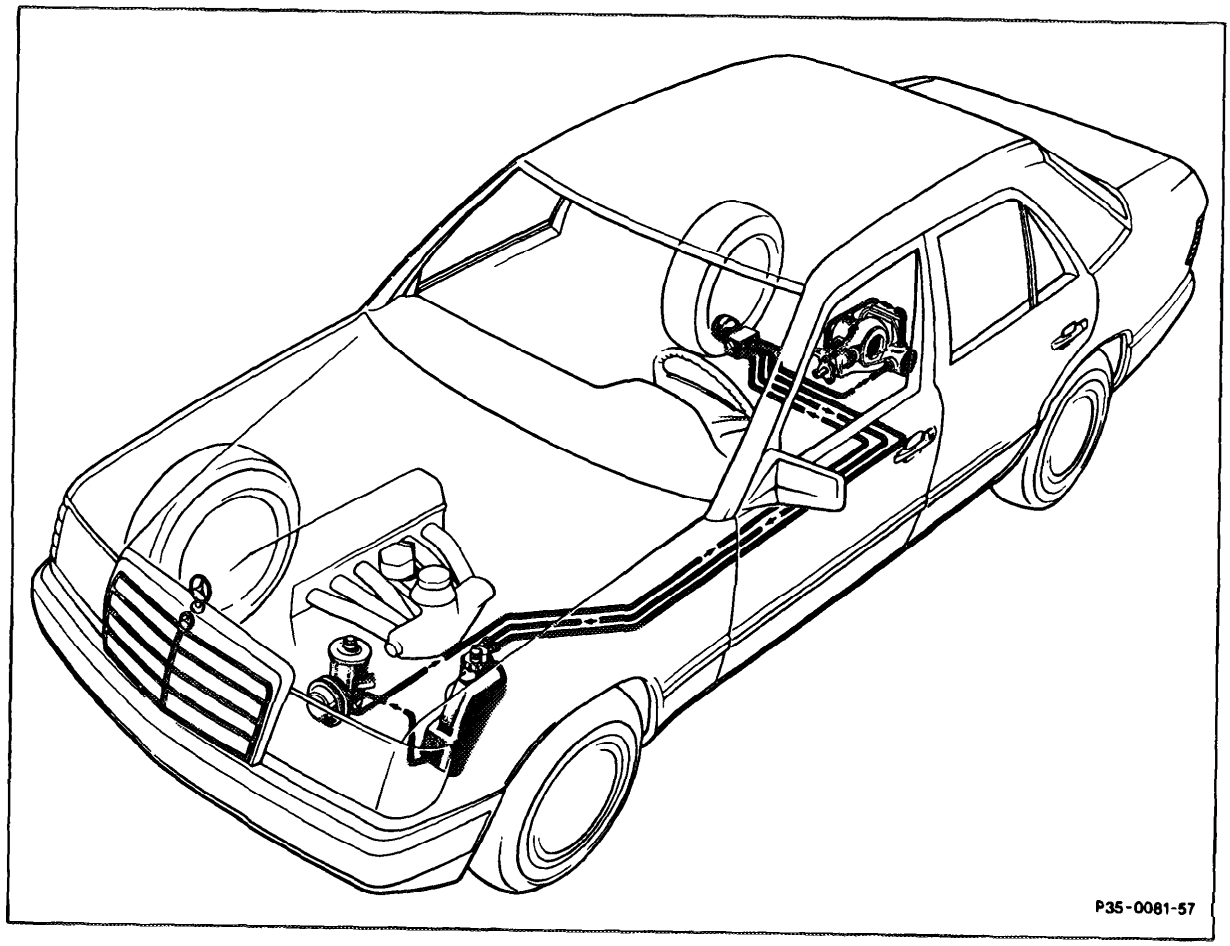
Lines
Hoses
Master cylinder
Fluid reservoir
Brake calipers
ABS hydraulic unit

Check condition of all lines and hoses. Check for chafe marks and proper routing.



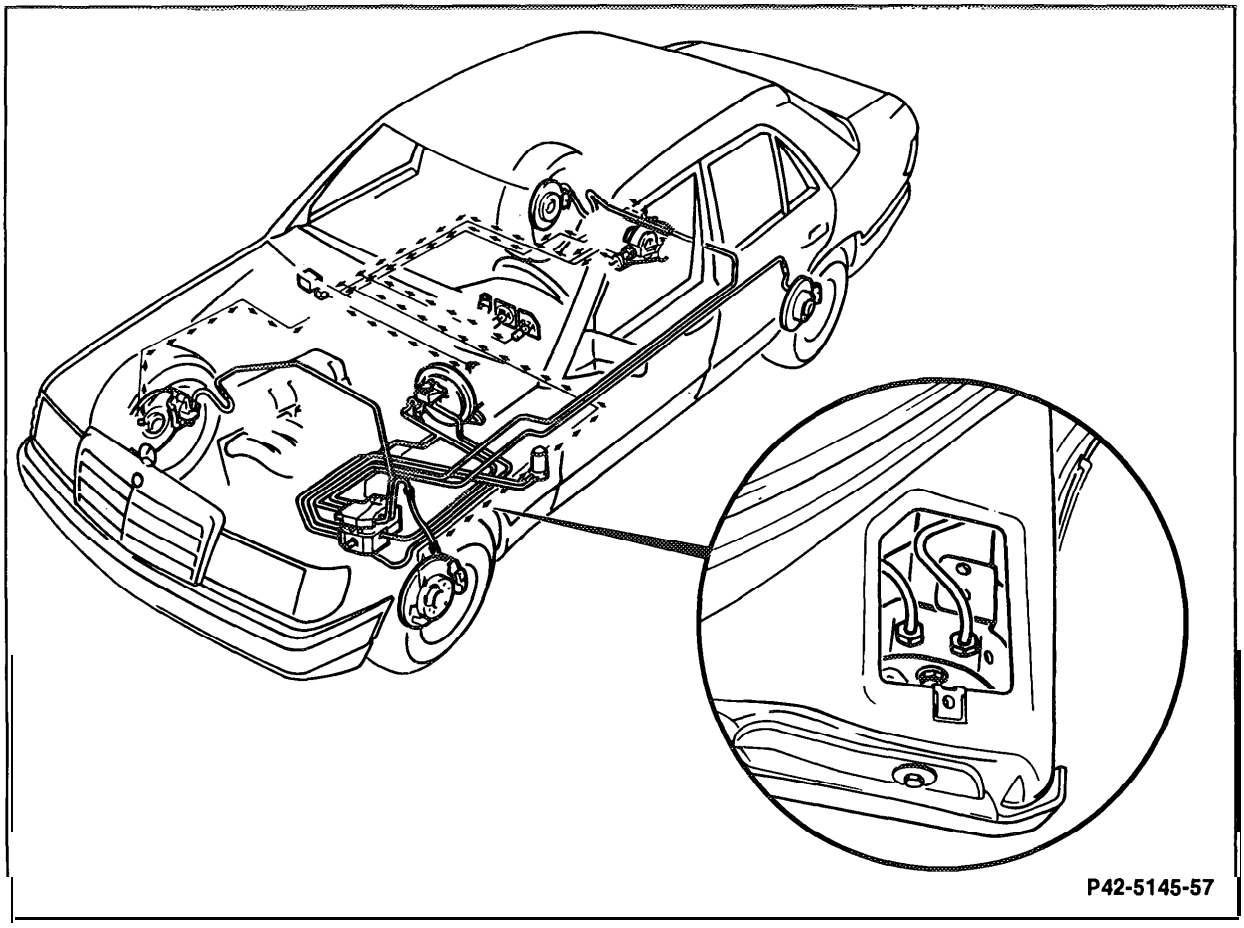
Vehicles with 4MATIC

Check condition of all lines and hoses. Check for chafe marks and proper routing.



Vehicles with ASD

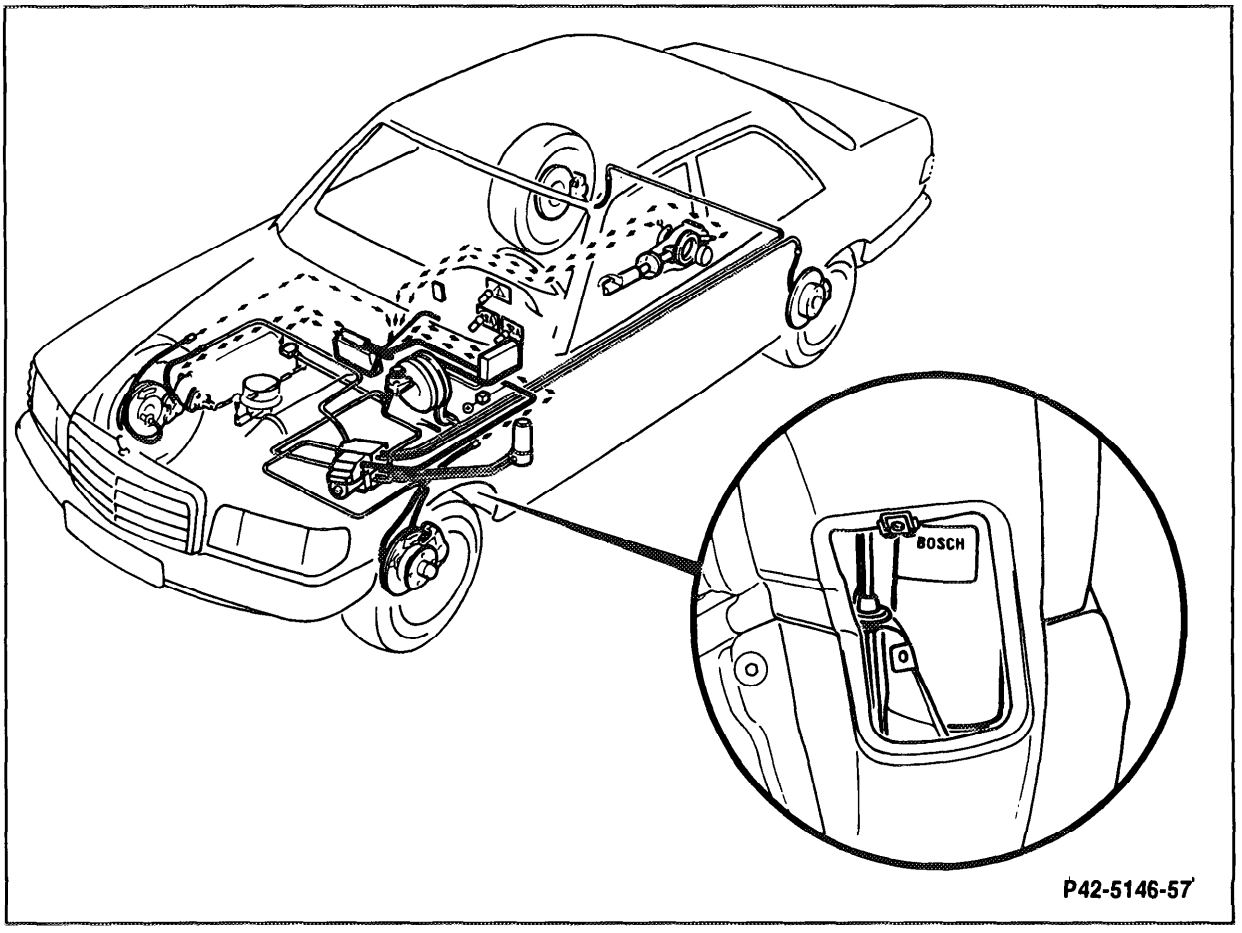
Check condition of all lines and hoses. Check for chafe marks and proper routing.



Vehicles with ASRII
Models 124, 201
Vehicles with ASRIII
Models 124.034/036

- Inspect lines and charging pump. Inspect pressure reservoir through opening in plastic cover under left front fender.

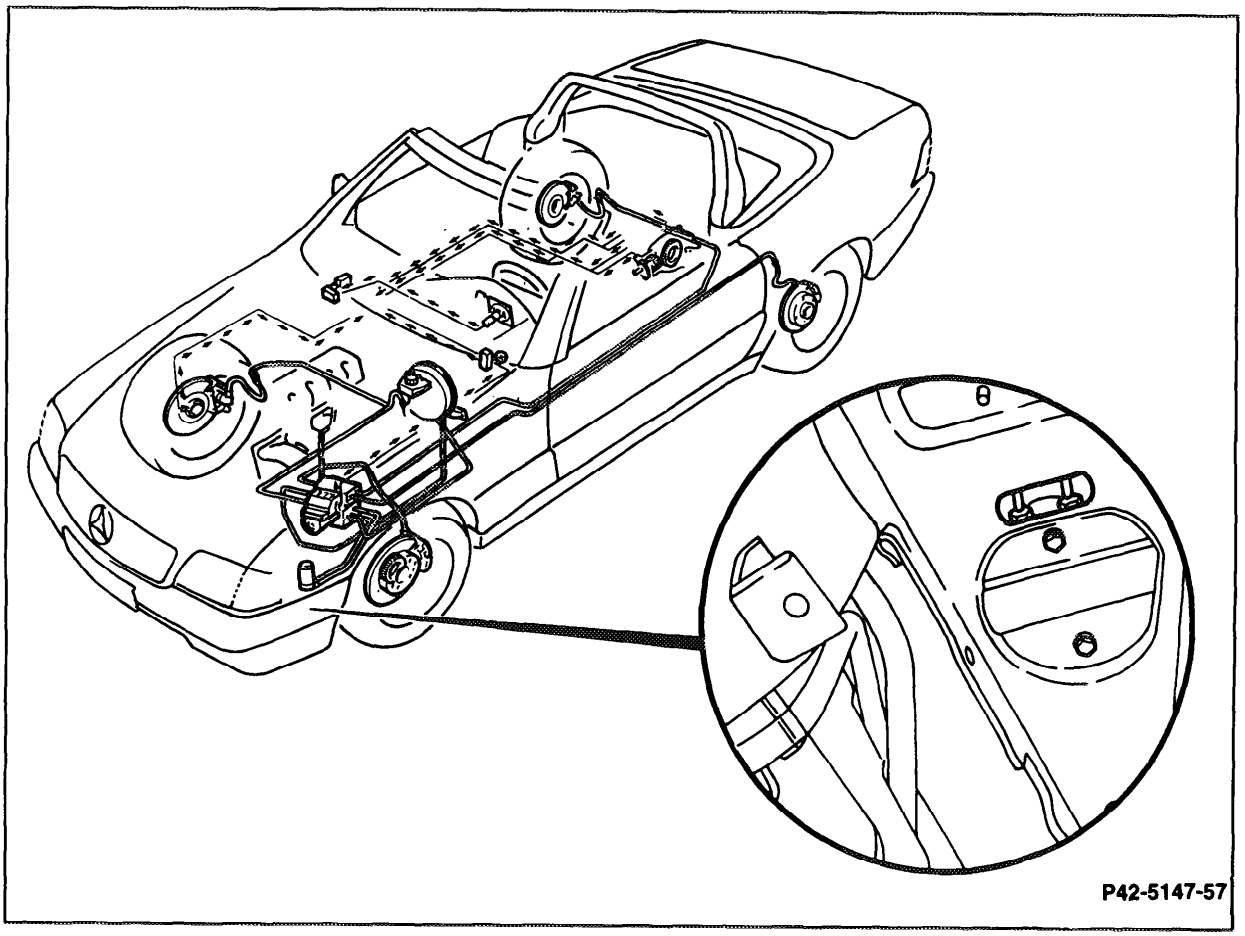
Check condition of all lines and hoses. Check for chafe marks and proper routing.



Vehicles with ASR II
Model 126

- Inspect lines and charging pump. Inspect pressure reservoir through opening in plastic cover under left front fender.

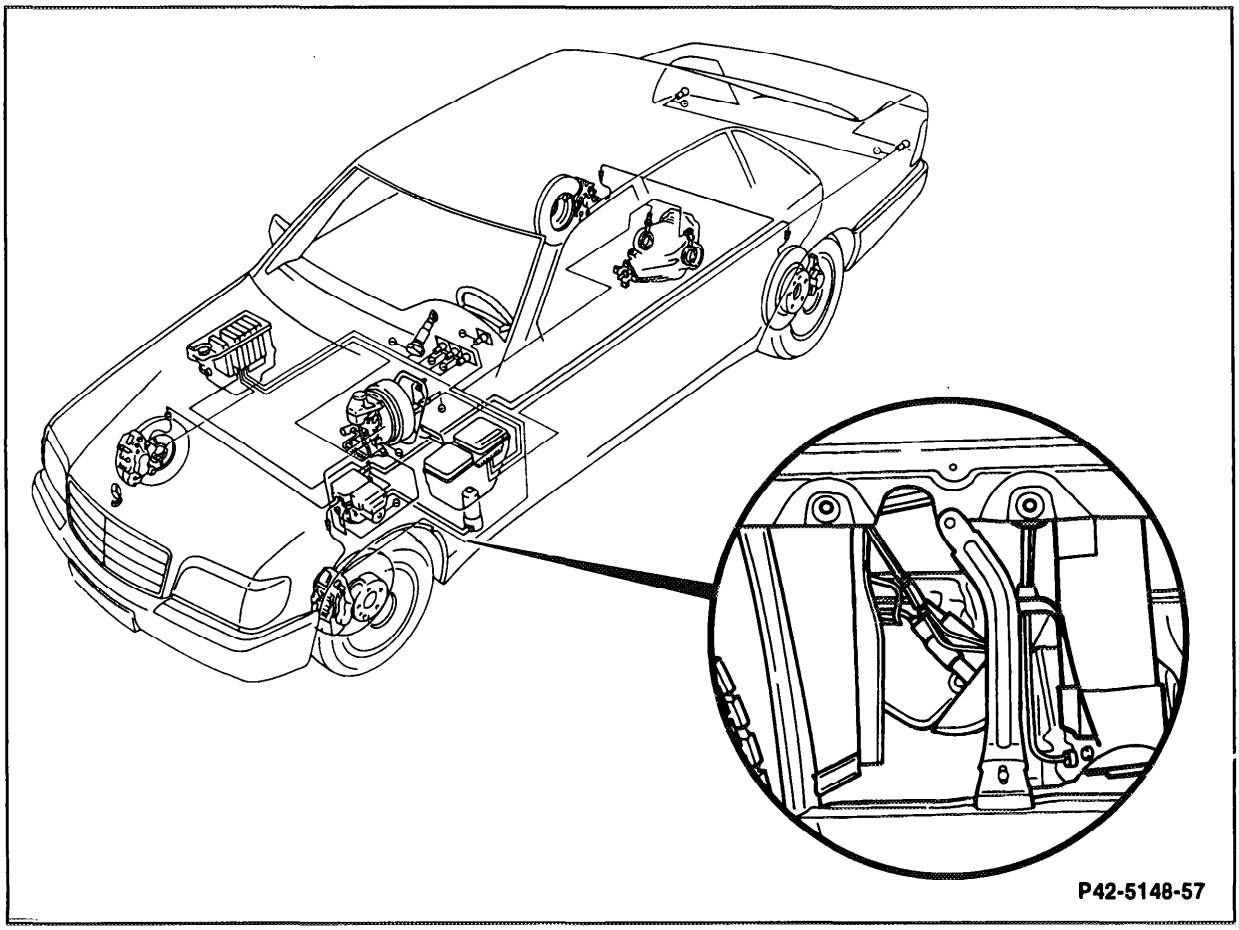
Check condition of all lines and hoses. Check for chafe marks and proper routing.



Vehicles with ASRII
Model 129

- Inspect the pressure reservoir connections from underneath the vehicle through opening in engine compartment left side wall.

Check condition of all lines and hoses. Check for chafe marks and proper routing.



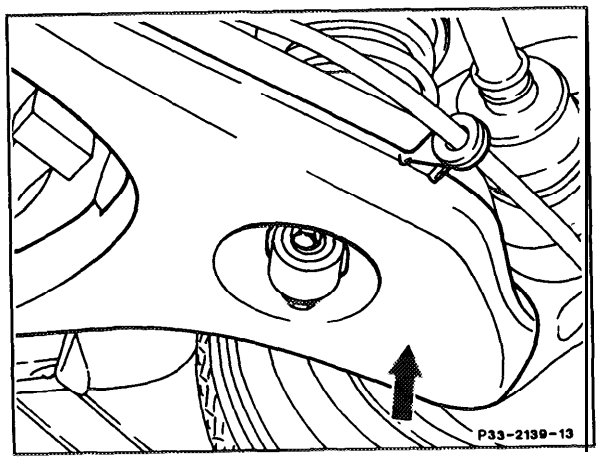
Vehicles with ASRIII
Model 140

- Inspect the pressure reservoir connections by removing left front fender lower side panel.

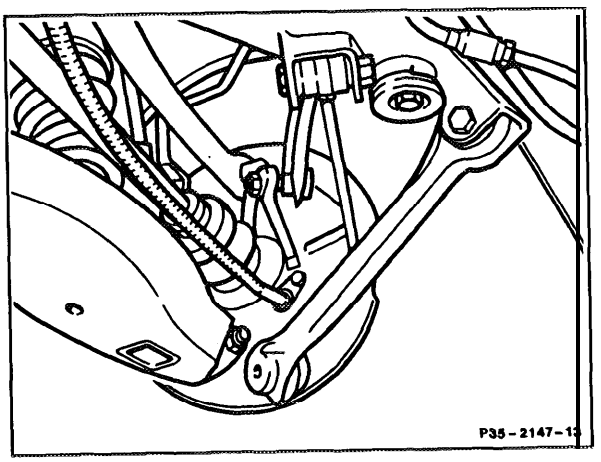
Suspension and body structure inspection

Check the following for damage and corrosion:

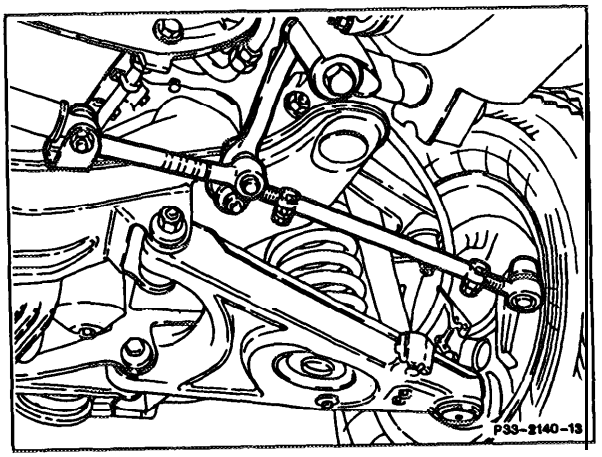
- Rear suspension control arms (semi-trailing arm suspension).



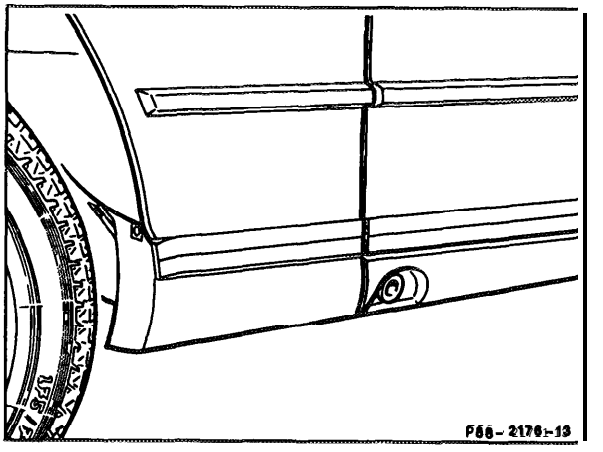
- Rear suspension links (multi-link suspension).



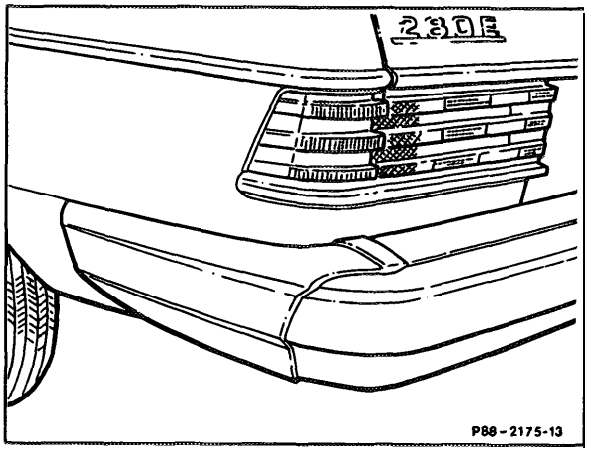
- **A-arms and bushings.**



- Rocker panel.



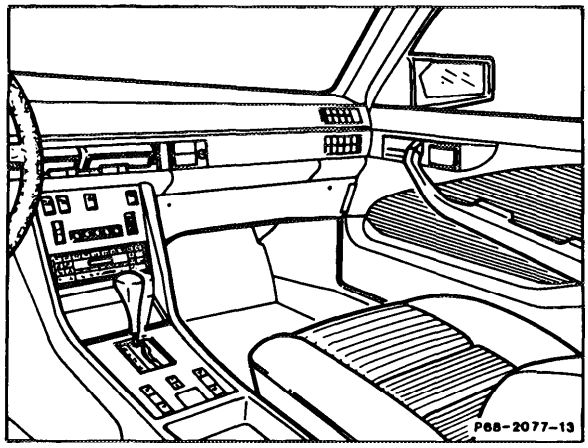
- Bumper and mounting on body.



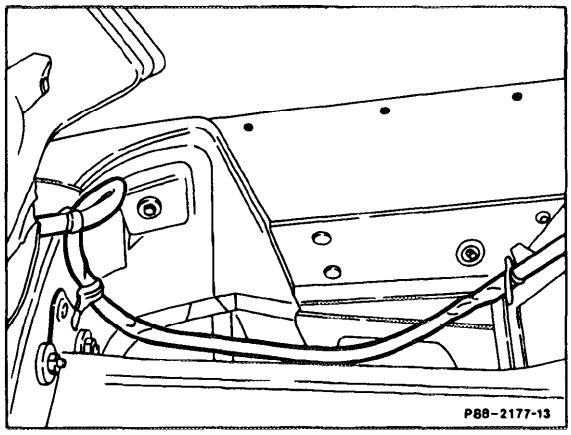
Model 107 through 07.1985
123
128 through 08.1985
201 through 12.1984

Check the following for water entry and corrosion:

- Foot wells front and rear.



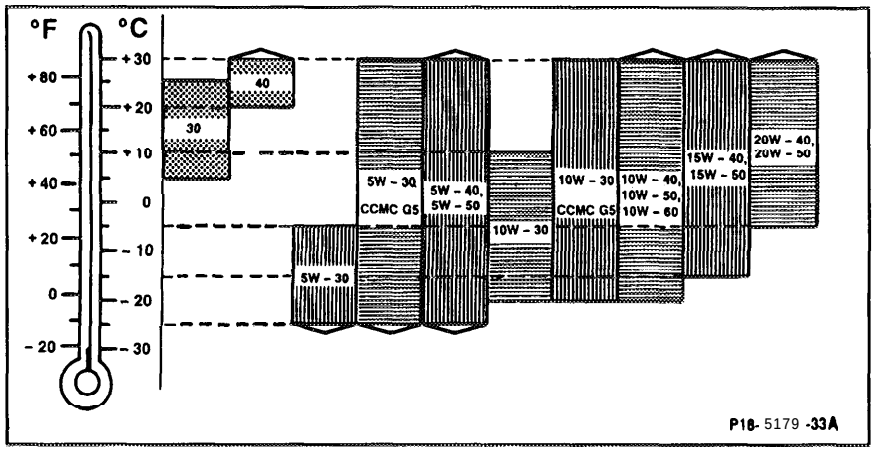
- Lateral trunk recesses.



Engine 102.9611983

Specified SAE viscosity classes during continuous ambient temperatures

Following the SAE grades exactly according to the ambient air temperatures would result in frequent engine oil changes. The temperature ranges for the SAE grades should therefore be regarded as a guideline which may be exceeded for brief periods.



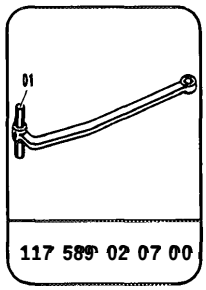
Oil capacity In liters

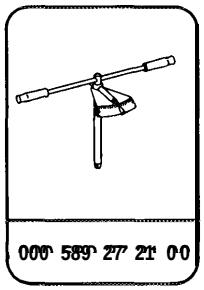
Engine	102.961	102.983
Total capacity during oil and filter change	4.5	5.0
Oil pan	4.3	4.8
Oil dipstick color code	light blue	gray

Torque specifications (Nm)

Oil pan drain plug	30	25
Center bolt, oil filter cover	25	25

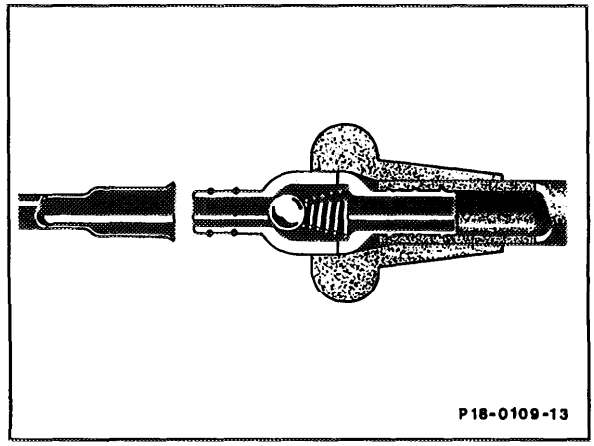
Special tools





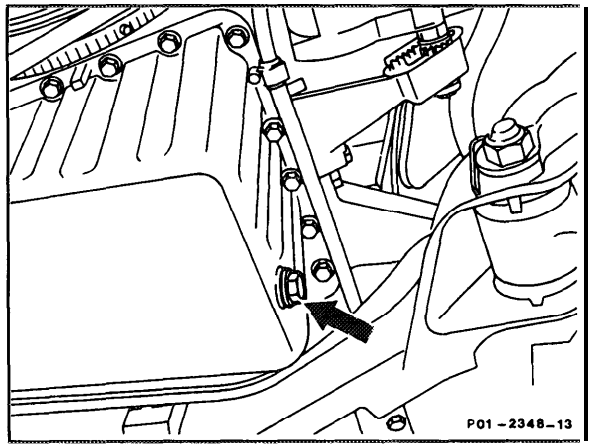
- Before suctioning or draining engine oil, drain oil filter, by unscrewing center bolt and removing together with oil filter cover.

- Suction engine oil via oil dipstick tube with engine at operating temperature.

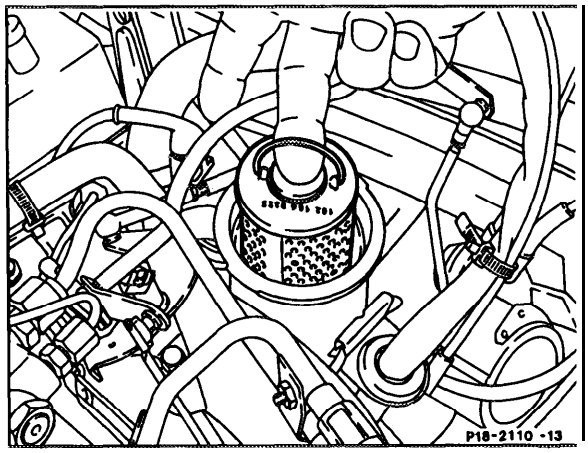


If no suction unit is available:

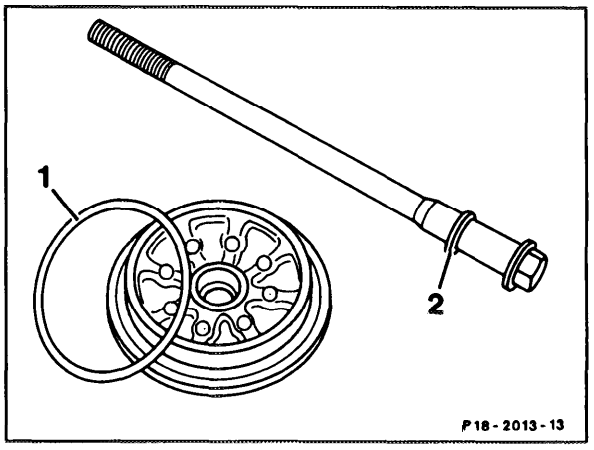
- Drain engine oil from oil pan (arrow).



- Replace filter element.



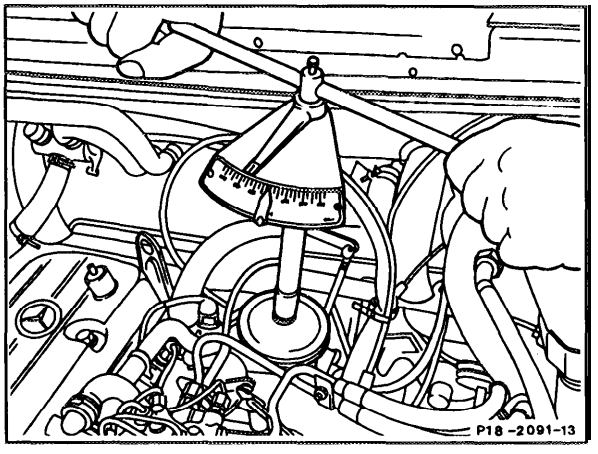
- Replace rubber seal ring (1) on cover.
- Check seal ring (2) on center bolt and replace as appropriate.



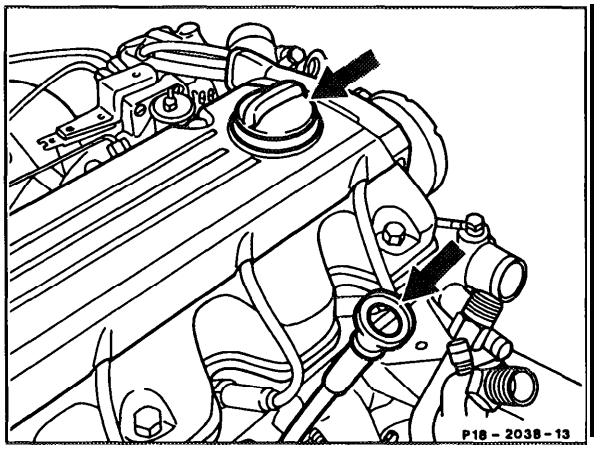
NOTE: There are two oil filter versions which differ in cover and rubber seal ring diameter and in thickness of rubber seal ring.

Use care not to use the incorrect rubber seal ring (1).

- Torque center bolt to 25 Nm with torque wrench.



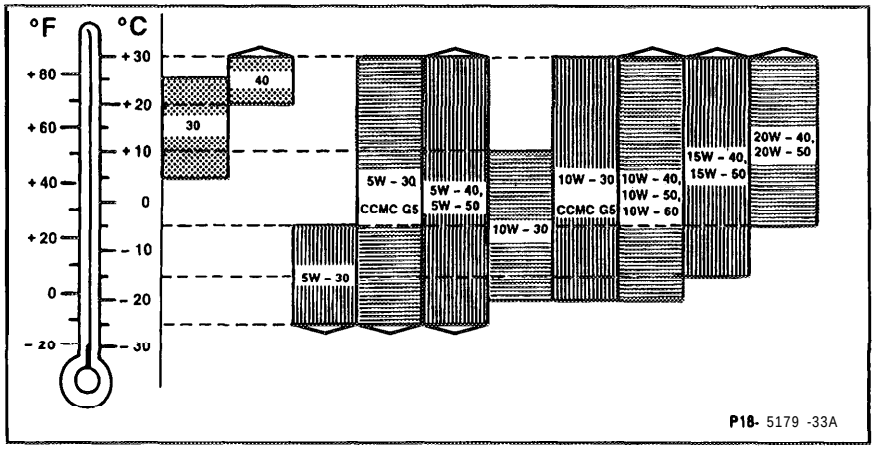
- If oil has been drained from oil pan, replace seal ring on drain plug.
- Tighten oil drain plug to 30 Nm, or for engine 102.983 to 25 Nm.
- Add engine oil.
- Run engine and check for leaks.
- Check oil level approx. 2 min. after stopping engine at operating temperature.



Engine 102.985 103 104

Specified SAE viscosity classes during continuous ambient temperatures

Following the SAE grades exactly according to the ambient air temperatures would result in frequent engine oil changes. The temperature ranges for the SAE grades should therefore be regarded as a guideline which may be exceeded for brief periods.



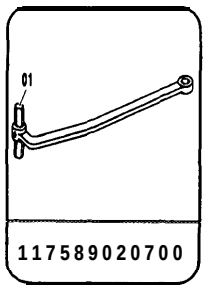
Oil capacity in liters

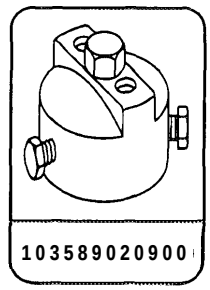
Engine	Model	Total capacity during oil and filter change	Oil dipstick identification	
			Oil dipstick color code	Identification on dipstick handle
102	201	5.0	gray	–
103	124, 126, 201	6.0	red	–
103	124 4MATIC	6.5	red	
104	124, 129	7.5	–	10407
104	140	7.5	I-	60322

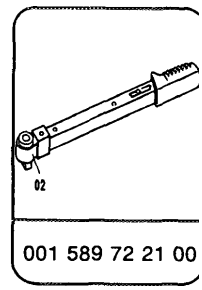
Torque specifications (Nm)

	Engine	Nm
Oil pan drain plug	all	25
Spin on oil filter	102, 103	20
Threaded cover	104	20

Special tools







NOTE: Change engine oil only with engine at operating temperature.

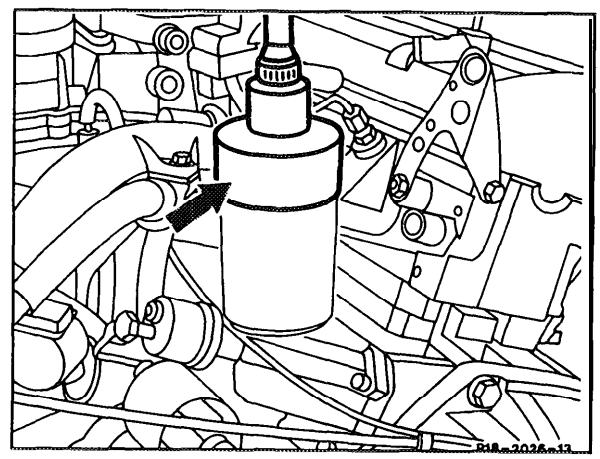
Removing old oil filter

Engine 102 and 103

- Before suctioning or draining engine oil, unscrew spin-on filter with socket wrench insert 74 mm (arrow). Apply a light seating blow against socket wrench insert, so that it is tightly seated on filter.

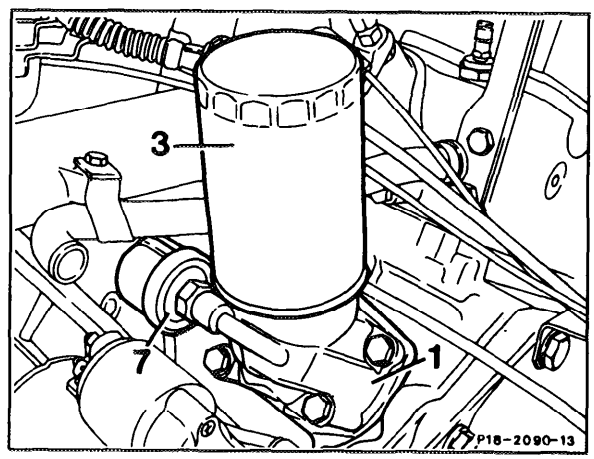
While unscrewing, some oil may run out until the check valves in oil filter cartridge close.

For this reason, hold or place a suitable rag under mounting surface at bottom of oil filter.



Engine 102

Note: If the spin on oil filter cannot be loosened with the socket wrench element, remove the air cleaner and drive in a screwdriver or other suitable tool to provide leverage to remove the oil filter.



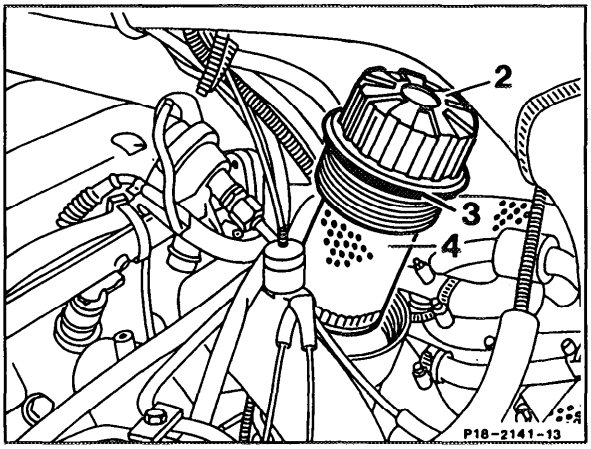
Engine 103

Engine 104

- Prior to suctioning or draining of engine oil, unscrew screw cover (2) with socket wrench element 74 mm.

- Remove threaded cover (2) with oil filter element (4).

On Model 140, remove air filter and replace after installing oil filter cartridge.

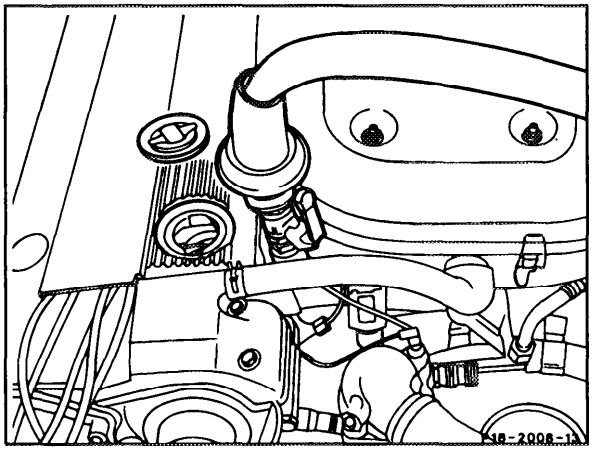


Engine 104

Removing old oil

Engine 102, 103, 104

- Suction engine oil via dipstick tube with engine at operating temperature.

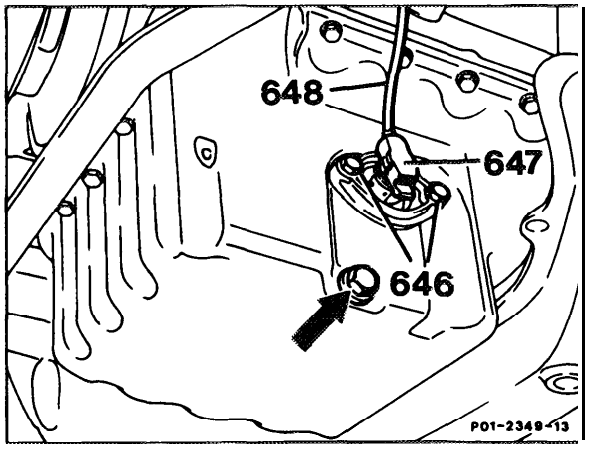


Engine 104

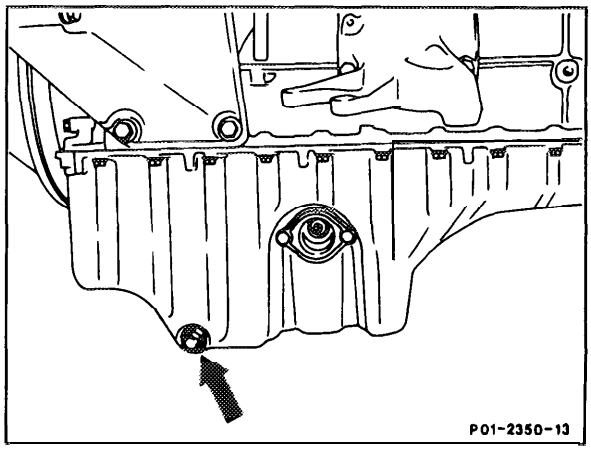
If no suction unit is available:

- Drain engine oil from oil pan (arrow).

First remove engine compartment lower panel and reinstall upon completion of maintenance jobs.



Engine 102

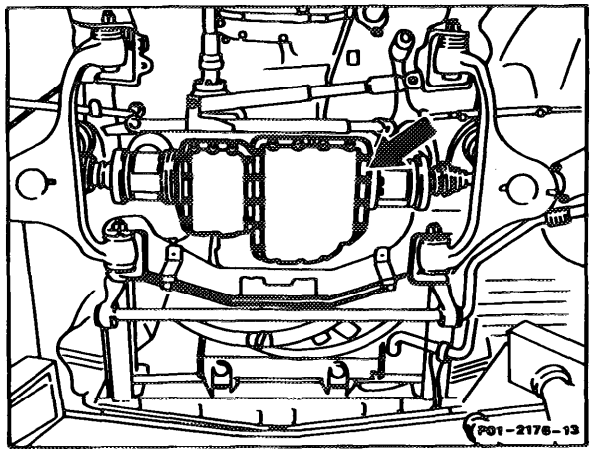


Engine 103,104

- On 4MATIC vehicles open drain plug (5) on large oil pan (4) only.

- If the oil has been drained out of oil pan, replace seal ring on oil drain plug.

- Tighten oil drain plug to 25 Nm.

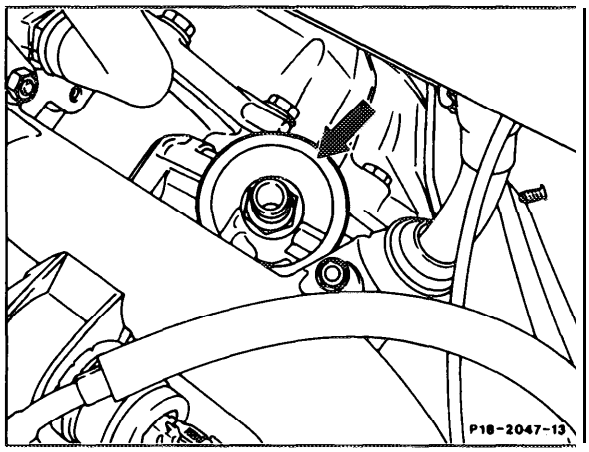


Engine 103 4MATIC

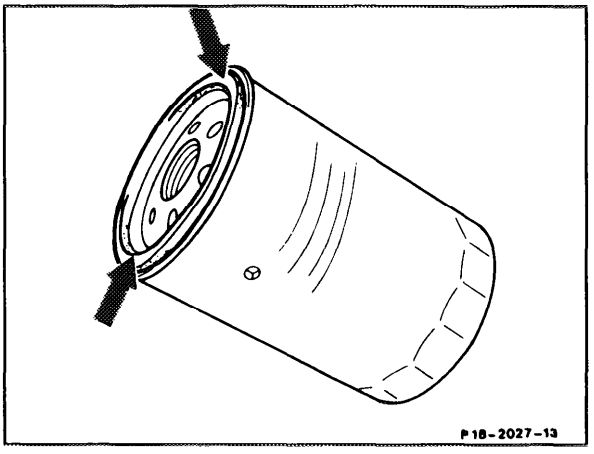
Installing new oil filter

Engine 102 and 103

- Clean mating surface (arrow) on oil filter mounting flange.

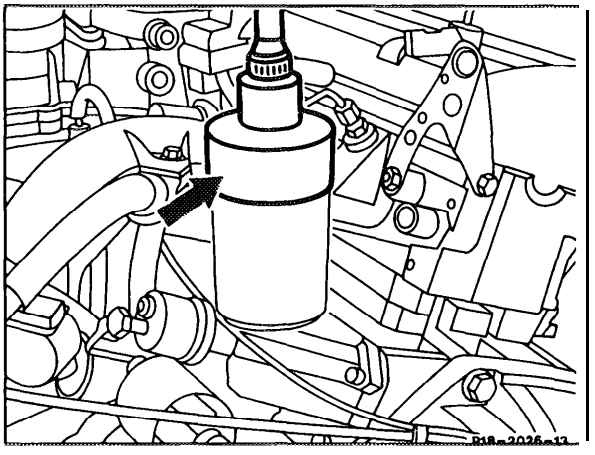


- Slightly lubricate gasket (arrows) on new spin-on filter.



- Screw on filter and tighten by hand.

Then turn filter with 74 mm socket wrench element (arrow) an additional 1/4 turn (90°) (20Nm).

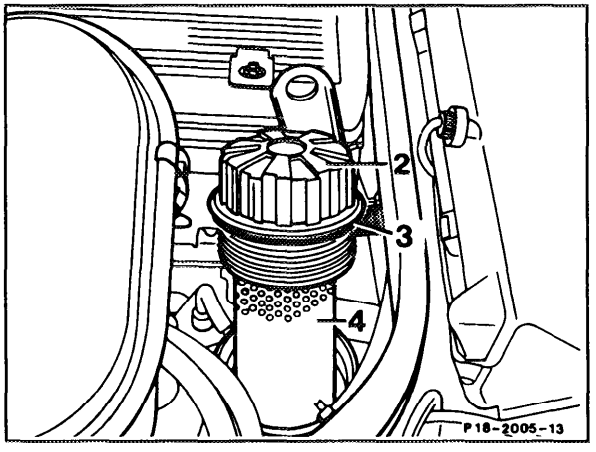


Engine 104

- Replace seal ring (3).

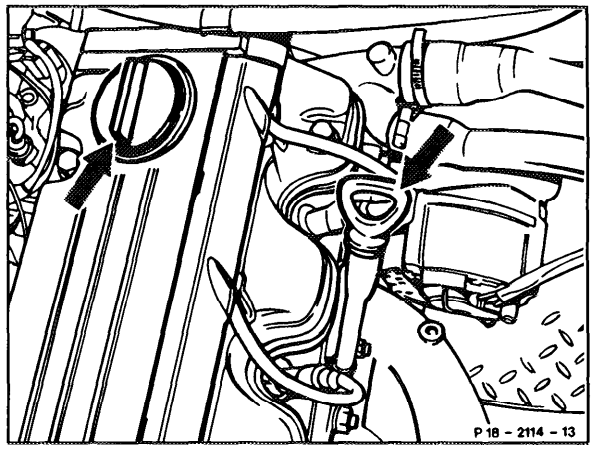
- Insert oil filter element (4) into threaded cover (2).

- Insert threaded cover with oil filter element and tighten to 20 Nm.

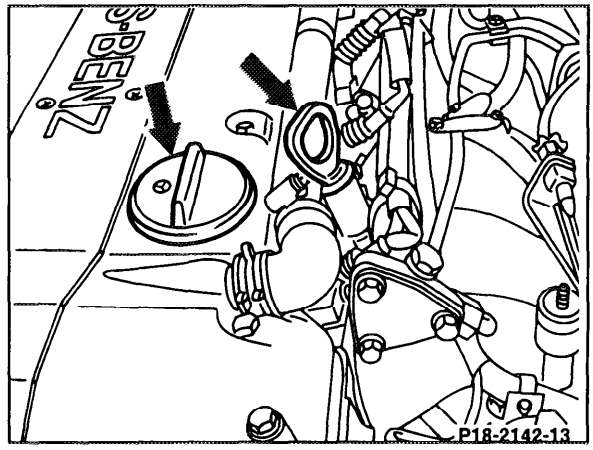


Filling engine oil

- Add engine oil (arrow).
- Run engine and check for leaks.
- Check oil level (arrow) approx. 2 minutes after shutting off engine at operating temperature.



Engine 102

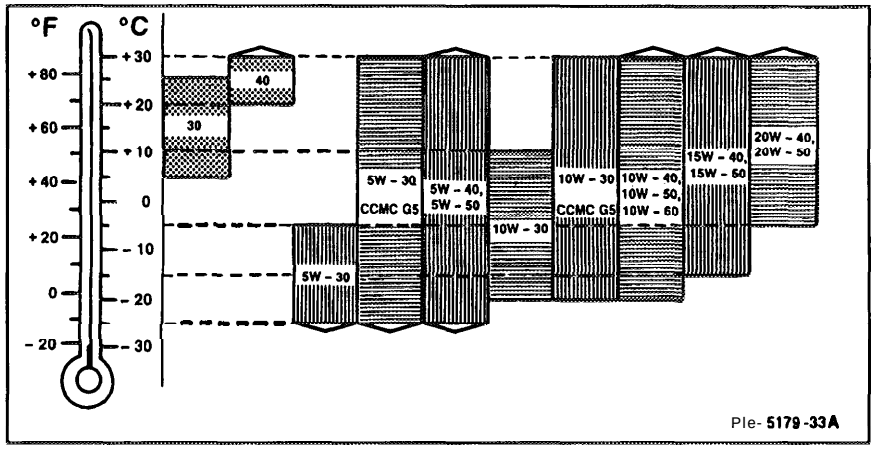


Engine 103 and 104

Engine 110

Specified SAE viscosity classes during continuous ambient temperatures

Following the SAE grades exactly according to the ambient air temperatures would result in frequent engine oil changes. The temperature ranges for the SAE grades should therefore be regarded as a guideline which may be exceeded for brief periods.



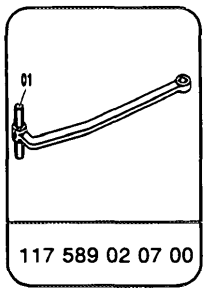
Oil capacity in liters

Oil dipstick color code	pink burgundy	yellow/green
Total capacity during oil and filter change	6.5	6.0
Oil pan	6.0	5.5

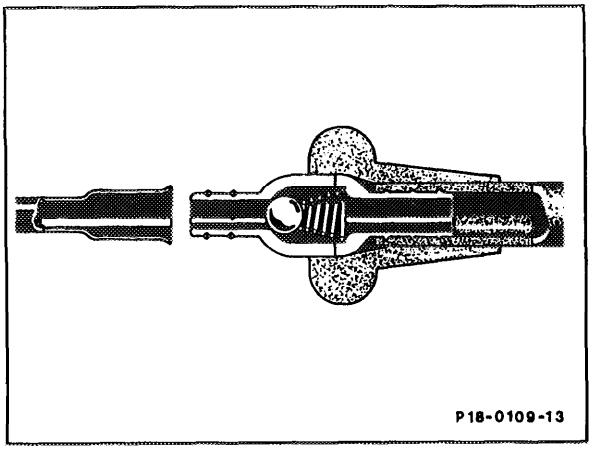
Torque specifications (Nm)

Oil pan drain plug	40
Center bolt, oil filter cover	35

Special tools

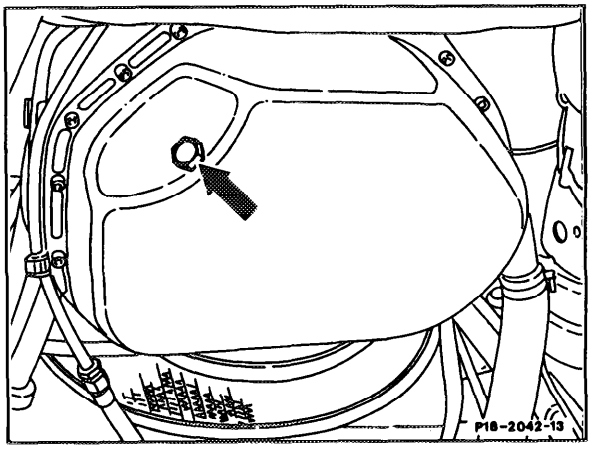


- Suction engine oil via oil dipstick tube with engine at operating temperature.



If no suction unit is available:

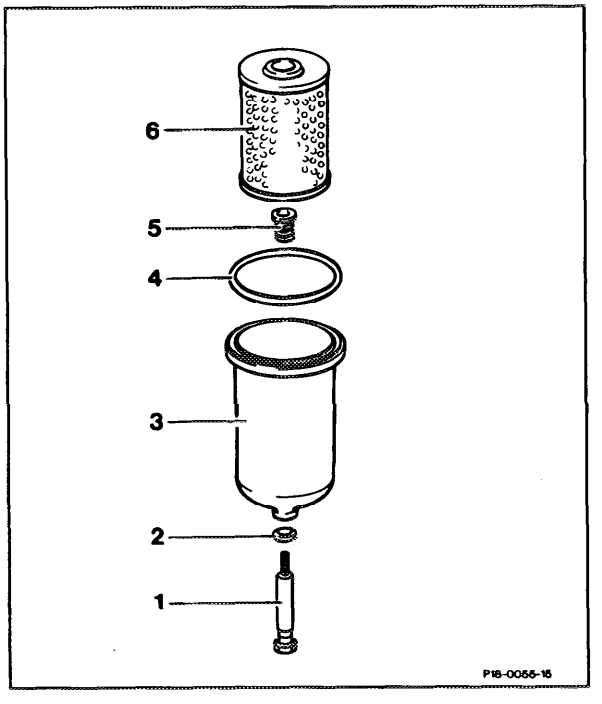
- Drain engine oil from oil pan (arrow).



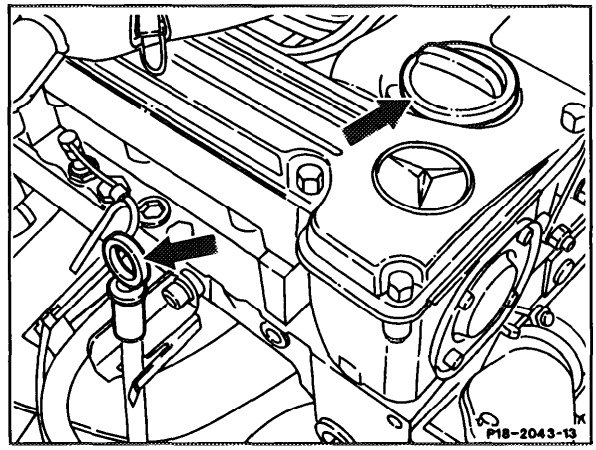
- Unscrew and empty oil filter lower half (3).
- Wash and blow out oil filter lower half.
- Check sealing ring (2) and replace as necessary.

For this purpose, pull compression spring together with spring retainer (5) off fastening screw **(1).** Make sure that the compression spring and retainer is correctly installed during assembly.

- Replace rubber sealing ring (4).
- Install oil filter lower half with a new filter element (6) and torque fastening screw (1) to 35 Nm.



- If oil has been drained from oil pan, replace sealing ring on drain plug.
- Torque oil drain plug to 40 Nm.
- Add engine oil.
- Run engine and check for leaks.
- Check oil level approx. 2 min. after stopping engine at operating temperature.

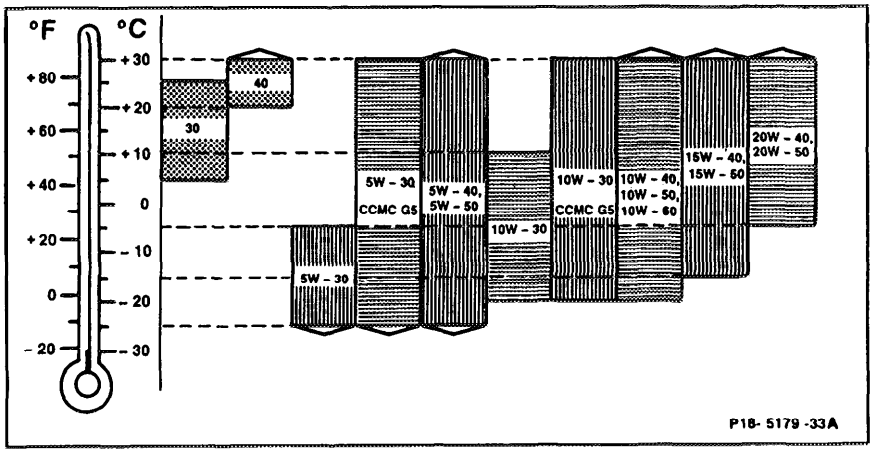


Engine **110**

Engine 116 117 119 120

Specified SAE viscosity classes during continuous ambient temperatures

Following the SAE grades exactly according to the ambient air temperatures would result in frequent engine oil changes. The temperature ranges for the SAE grades should therefore be regarded as a guideline which may be exceeded for brief periods.



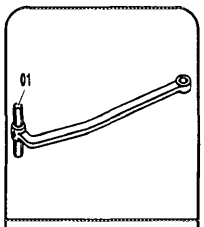
Oil capacity in liters

Engine	Model	Total capacity during oil and filter change	Dipstick identification		
			color code round handle	color code bottle opener shaped handle	identification number (red color)
116, 117	107	8	blue	–	–
116, 117	126	8	light blue gray	gray	–
119	124, 129, 140	8	–	gray	–
120	140	10	–	–	12010

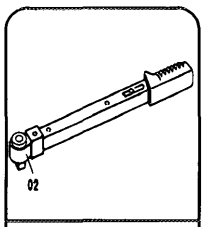
Torque specifications (Nm)

Model	107	126	124, 129, 140
Oil pan drain plug	50	40	40
Center bolt, oil filter cover	-	25	20
Center bolt, oil filter lower housing	25	–	–
Threaded cover (Engine 120)	-	-	20

Special tools



117 589 02 07 00

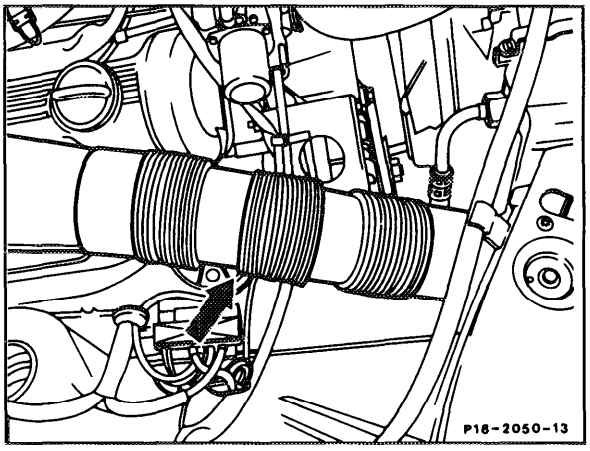


001 589 72 21 00

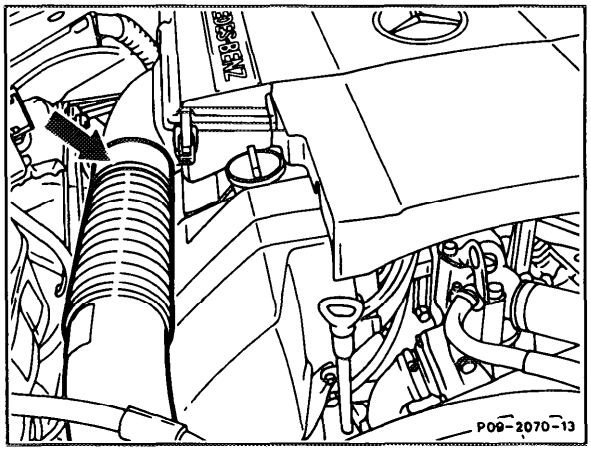
Removing old oil filter

Engine 116, 117 in model 126
Engine 119 in model 124, 129, 140

- Remove flexible air duct (arrow).



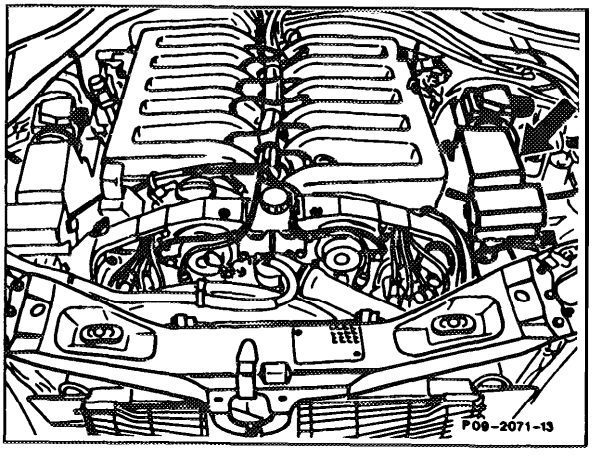
Engine 116, 117



Engine119

Engine 120

- Remove left air filter housing and mass air flow sensor as an assembly (job no. 09-0015).



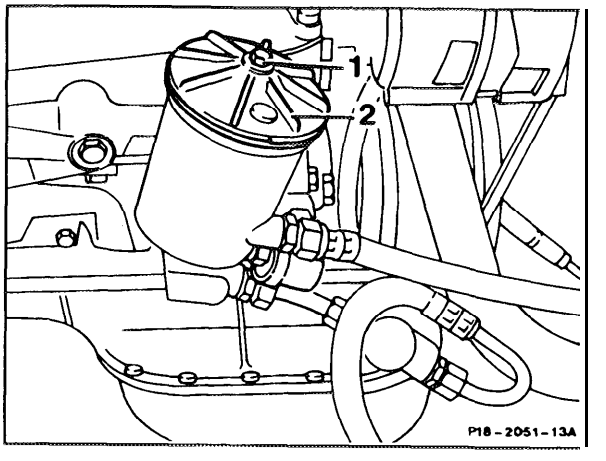
Engine 120

Removing old oil

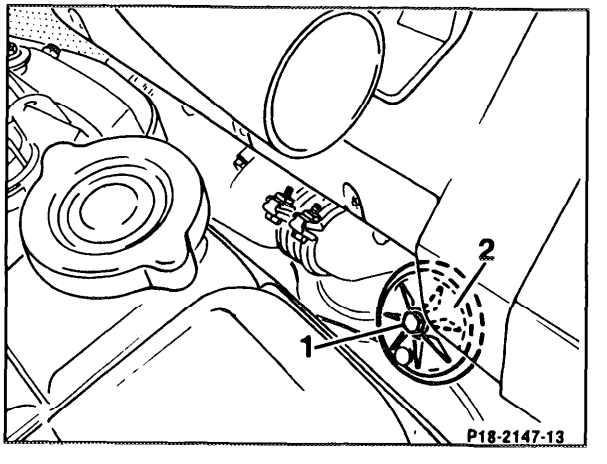
NOPE: Change engine oil only with engine at operating temperature.

Engine 116, 117 **in model 126**
Engine 119 in model 124, 129, 140

- Drain oil filter prior to suctioning or draining engine oil. For this purpose, loosen center screw (1) and remove together with oil filter cover.



Engine 116, 117 in model 126

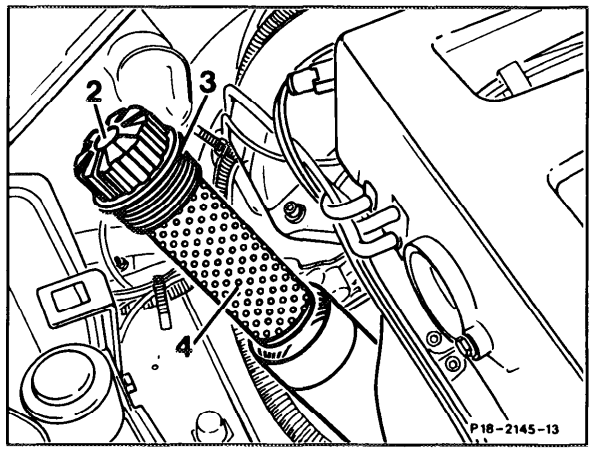


Engine 119

Engine 120 in model 140

- Before suctioning or draining engine oil, remove threaded cover **(2)** using **74** mm insert.

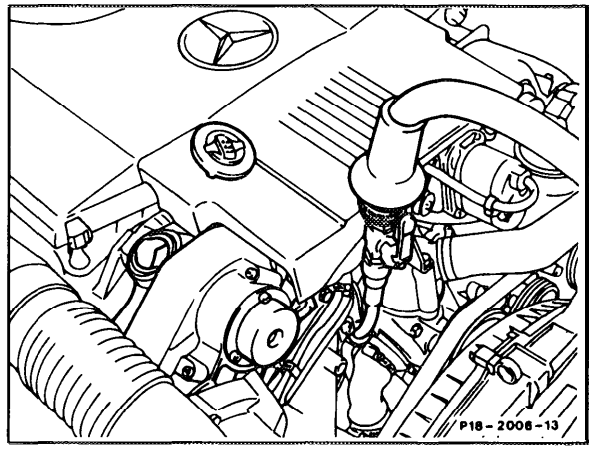
- Remove threaded cover **(2)** and oil filter cartridge (4).



Engine 120

All Engines

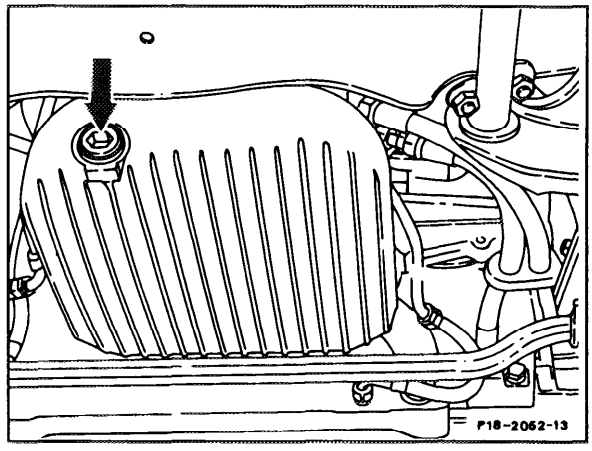
- Suction engine oil via oil dipstick tube with engine at operating temperature.



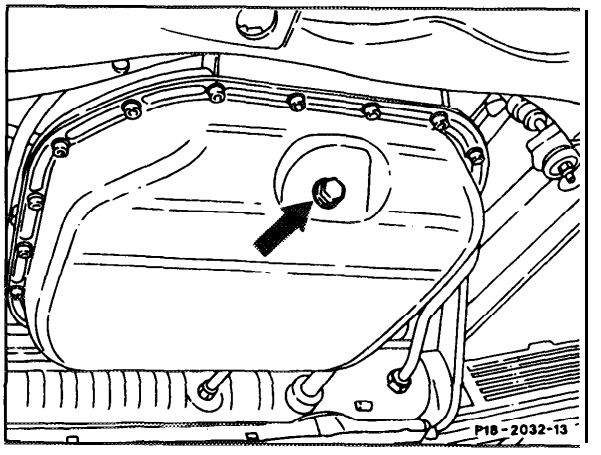
Engine 119 in model129

If no suction unit is available:

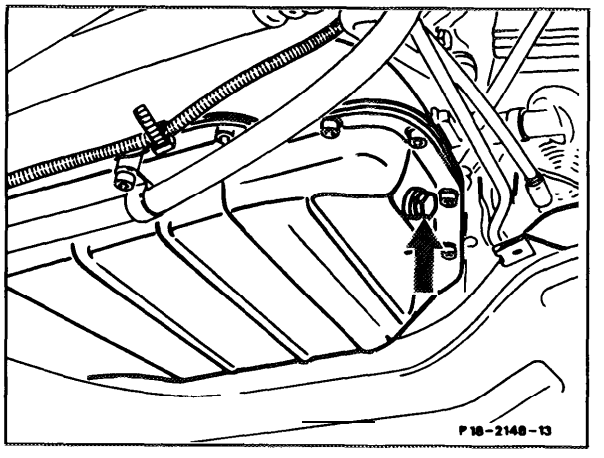
- Drain engine oil from oil pan (arrow).



Model107



Model 126, 129



Model 140

- On model 129 and 140, remove engine compartment lower panel first and reinstall after completing maintenance jobs (refer to job item 6190).

- If the oil has been drained from oil pan, replace seal ring on oil drain plug.

- Tighten oil drain plug. Refer to table for correct torque.

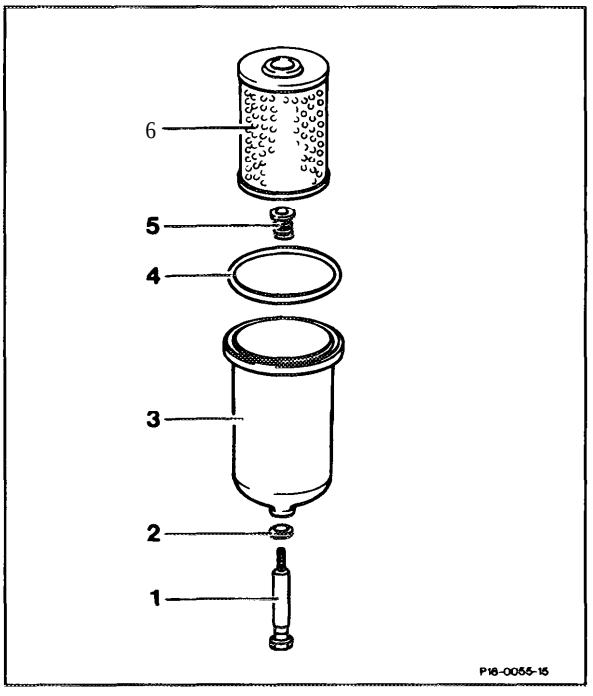
installing new oil filter

Engine 116, 117 in model 107

- Unscrew oil filter housing (3) and drain.
- Wash out oil filter housing and blow out.
- Check seal ring (2) and replace as necessary.

For this purpose, pull compression spring with spring washer (5) from fastening screw (1). Be **sure to properly install compression spring with spring washer during assembly.**

- Replace rubber seal ring (4).
- Install oil filter lower part with a **new** filter element (6) and tighten fastening screw (1) to 25 Nm.



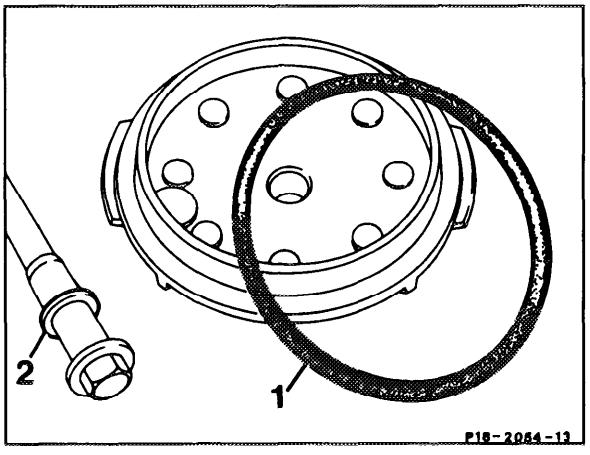
Engine 116, 117 in model 107

Engine 116, 117 in model 126
Engine 119 in model 124, 129, 140

- Replace filter element while making sure that the large rubber seal (24 mm ID) points in downward direction.

Engine 116, 117 in model 126

- Replace rubber seal ring (1) on cover.
- Check seal ring (2) on center screw and replace as necessary.
- Tighten center screw to 25 Nm.

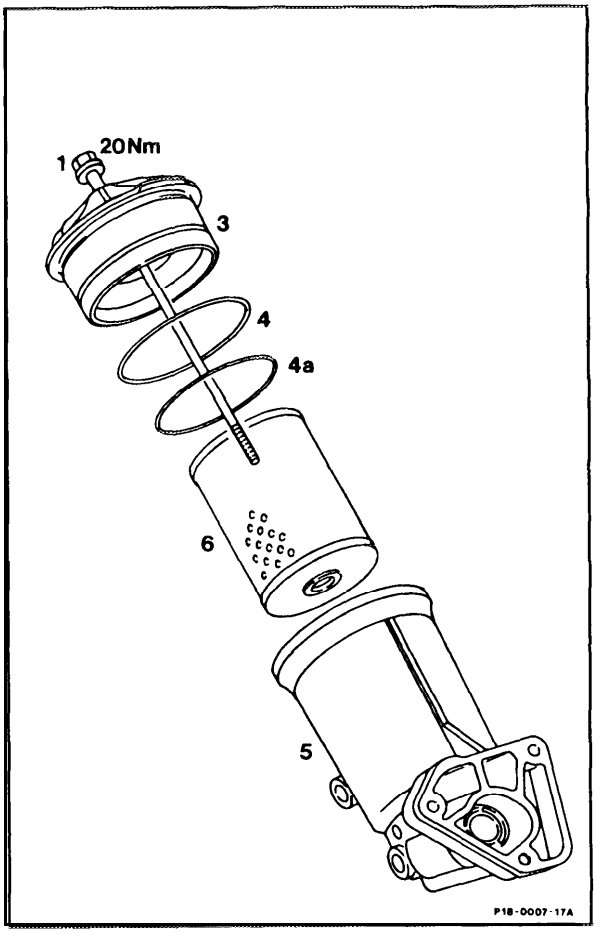


Engine 116, 117 in model 126

Engine 119 in model 124, 129, 140

Replace rubber seal rings (4 and 4a) on cover.

- Tighten center screw to 20 Nm.



Engine **119**

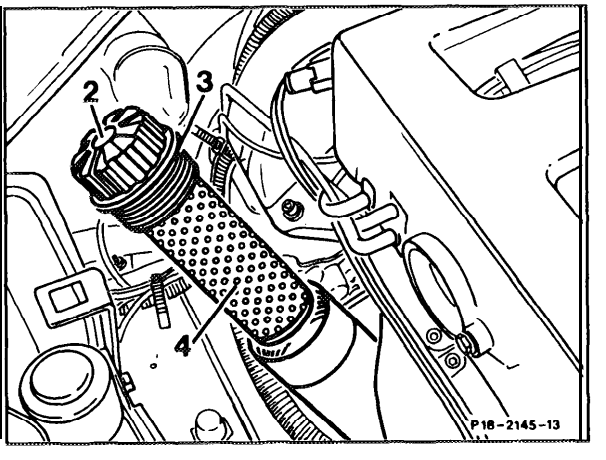
Engine 120 in model 140

- Replace seal **(3).**

- Insert oil filter cartridge (4) **in threaded cover** (2).

- Insert cartridge with cover and tighten.

- Install left air filter housing and mass air flow sensor assembly.



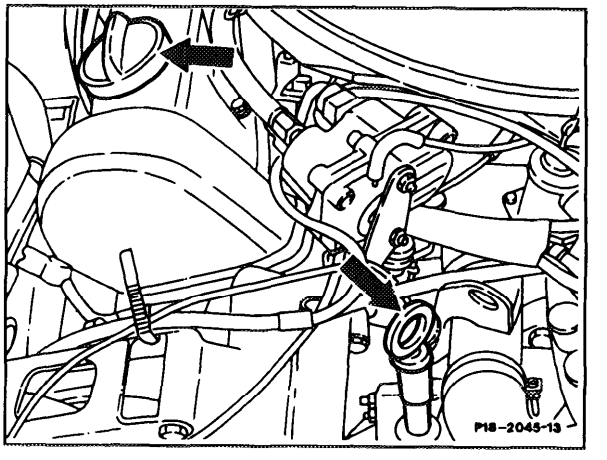
Engine 120

Filling engine oil
All engines

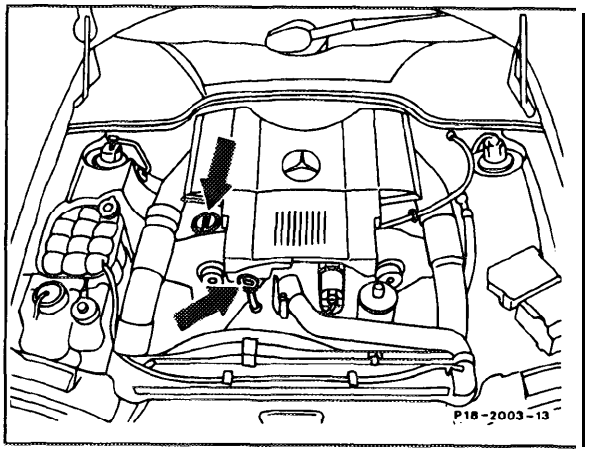
- **Add engine oil (arrow).**

- **Run engine and check for leaks.**

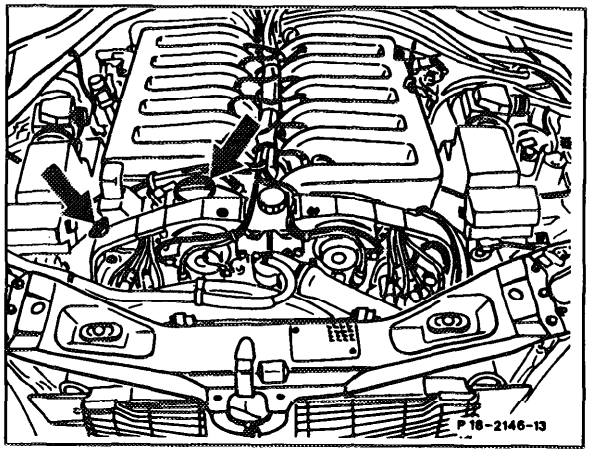
- Check oil level with engine at operating temperature approx. 2 minutes after stopping engine (arrow).



Engine 116, 117 in model 107, 126



Engine 119 in model 129



Engine 120 in model 140

- **Install air duct (engine 116, 117 in model 126, engine 119** in models **124, 129, 140).**

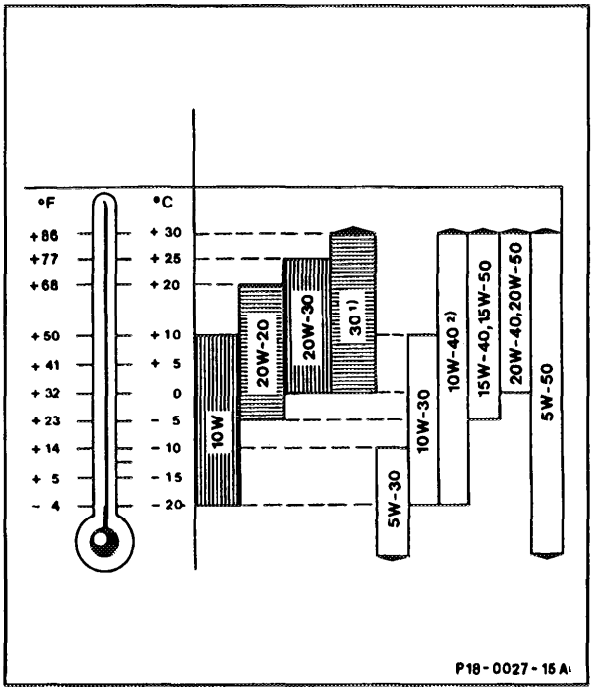
Engine 616 617

Specified SAE viscosity classes during continuous ambient temperatures

Following the SAE grades exactly according to the ambient air temperatures would result in frequent engine oil changes. The temperature ranges for the SAE grades should therefore be regarded as a guideline which may be exceeded for brief periods.

⚠CAUTION!

SAE 10W single grade oils must not be used in engine 617.95.



1) For continuous ambient temperatures above + 30 °C (86 °F), SAE 40 can be used.

2) Except Turbodiesel engine 617.95

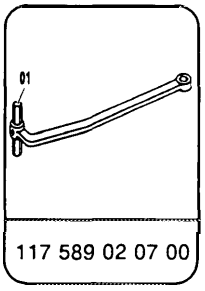
Oil capacity in liters

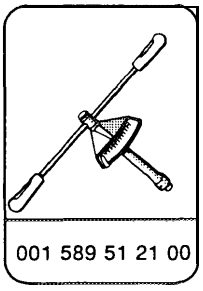
Engine	616, 617.91	617.95	617.95 (04/84)
Oil dipstick color code	red	white	ocher brown
Total capacity during oil and filter change	6.5	7.5	8.0
Oil pan	4.3	4.8	4.8

Torque specifications (Nm)

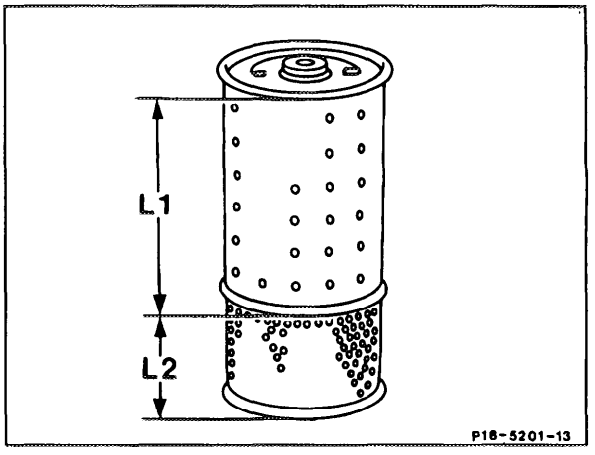
Oil pan drain plug	**40**
Mounting nuts, oil filter cover	25

Special tools



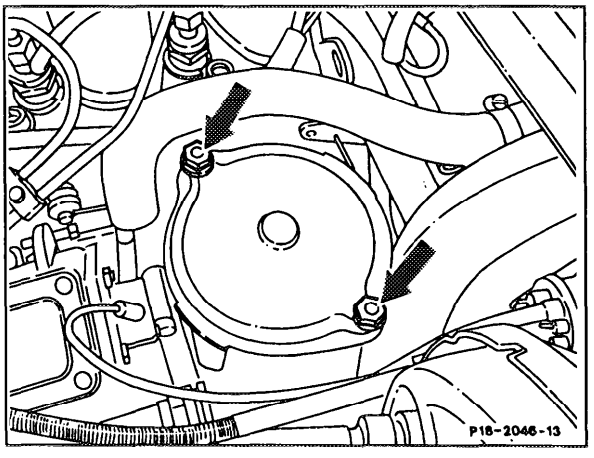


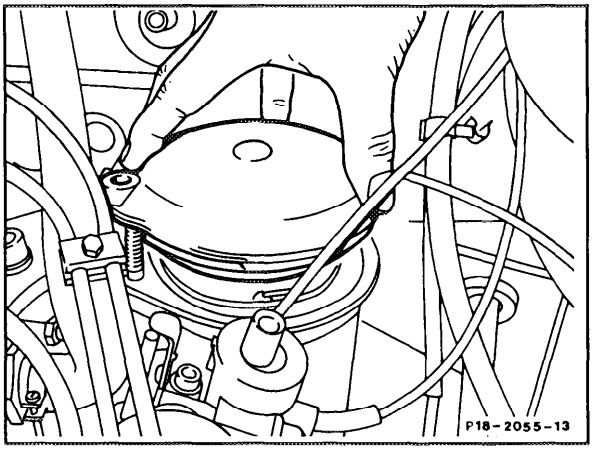
Due to the different sizes, the filter element and the rubber seal ring on the cap should not be exchanged with those on engines 601, 602 and 603.



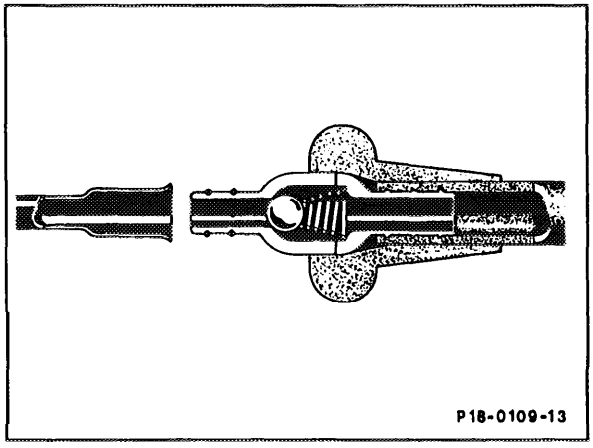
Engine 601,602,603		Engine 616,617	
Dimension	L1 113 mm	Dimension	L1 131 mm
	L2 49 mm		L2 55 mm

Prior to suctioning or draining engine oil, empty oil filter. For this purpose, loosen nuts (arrows) and remove cover.



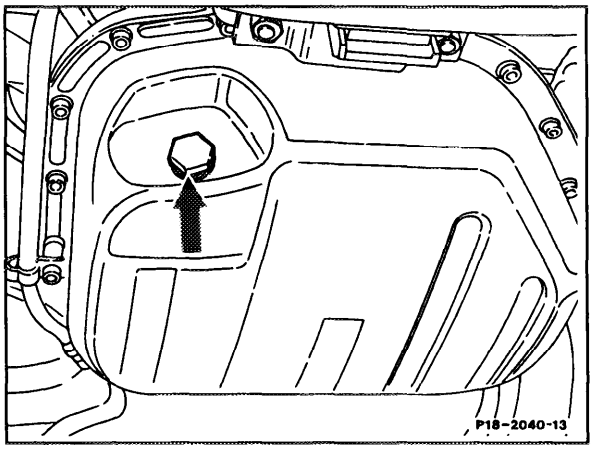


Suction engine oil via oil dipstick tube with engine at operating temperature.

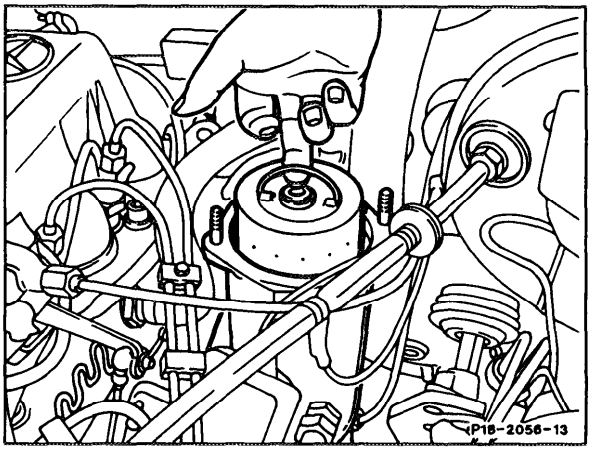


If no suction unit is available:

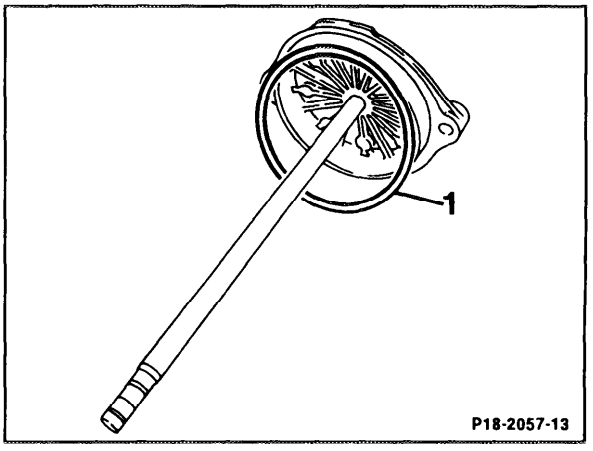
Drain engine oil from oil pan (arrow).



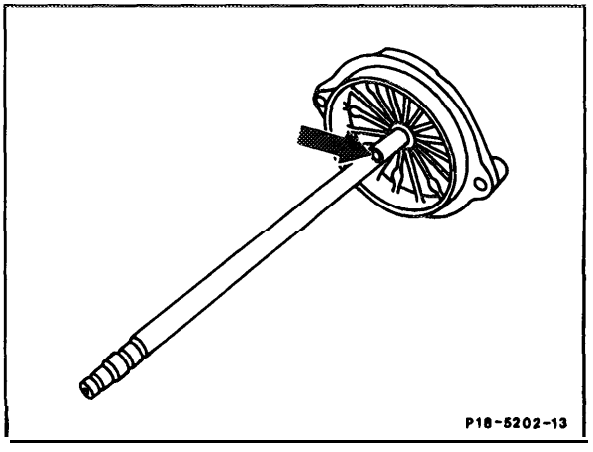
Replace filter element.



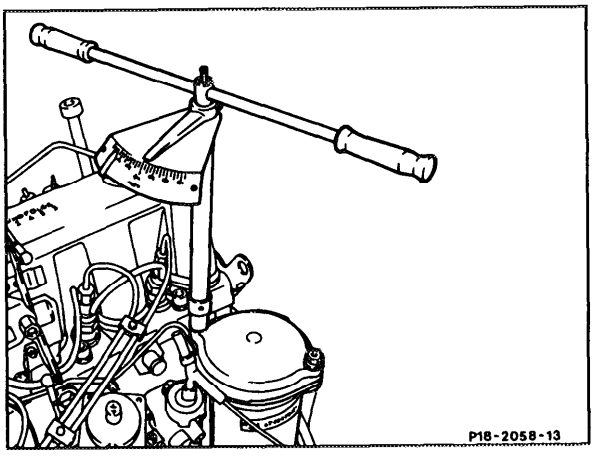
Replace rubber seal ring (1) on cover.



Check the oil port on the oil tube for foreign matter (arrow). If it is blocked, remove the foreign matter by hand. Then blow through the oil port with compressed air; air must noticeably come out of the bottom of the oil tube. If the oil port is not open or if no air comes out, replace oil filter cap and oil tube.



Tighten nuts to 25 Nm with torque wrench.



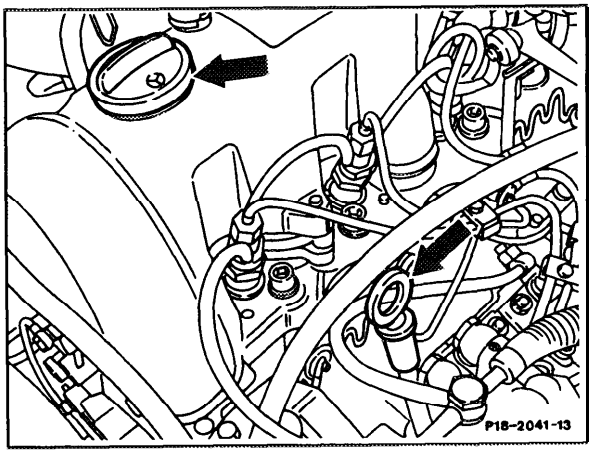
If oil has been drained from oil pan, replace seal ring on drain plug.

Tighten oil drain plug to 40 Nm.

Add engine oil.

Run engine and check for leaks.

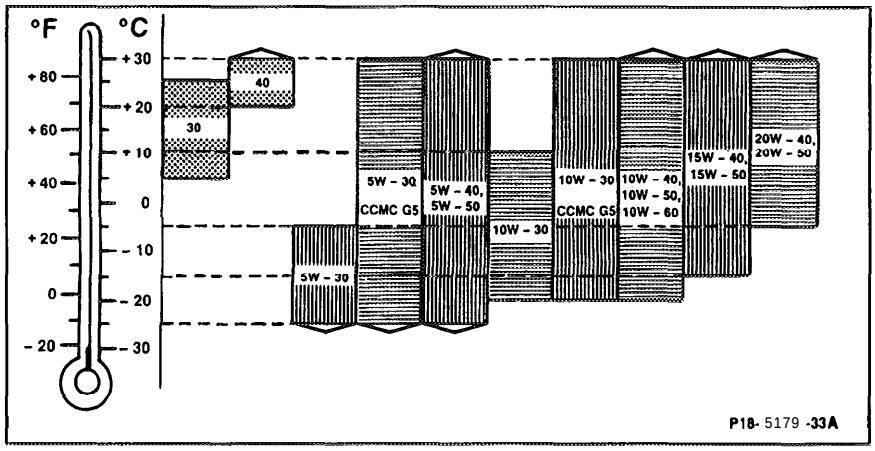
Check oil approx. 2 min. after stopping engine at operating temperature.



Engine 601 602 603

Specified SAE viscosity classes during continuous ambient temperatures

Following the SAE grades exactly according to the ambient air temperatures would result in frequent engine oil changes. The temperature ranges for the SAE grades should therefore be regarded as a guideline which may be exceeded for brief periods.



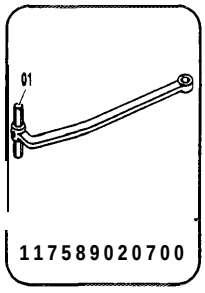
Oil capacity in liters

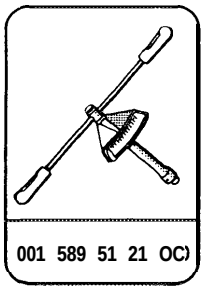
Engine	Model	Total capacity during oil and filter change	Oil dipstick identification		
			round handle	bottle opener shaped handle	Identification no.
601	201	6	black	-	-
602.91	201 (1986-88)	6.5	-	red black brown	60214
602.91	201 (1989)	7	-	green	-
602.96	124, 201	7	-	black green	-
603.96	124, 126	7.5	-	black	-
603.97	126	7.5	-	-	60316

Torque specifications (Nm)

Mounting nuts, oil filter cap	25
Oil pan drain plug 12 x 1.5 x 13	30
Oil pan drain plug 14 x 1.5 x 13	25
Return pipe in oil filter cover	25 (model 124 only)

Special tools

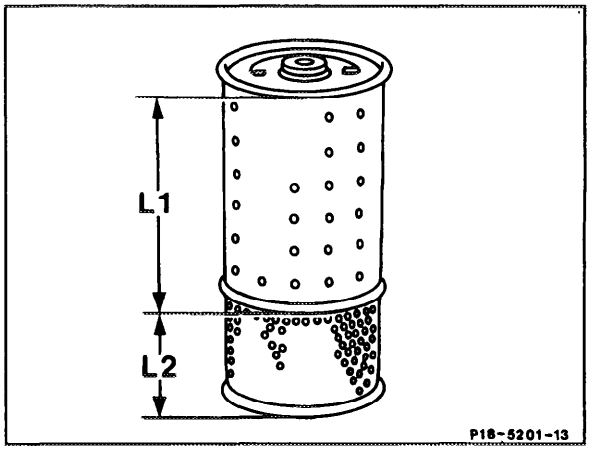




Due to the different sizes, the filter element and the rubber seal ring on the cap should not be exchanged with those on engines 615, 616 and 617.

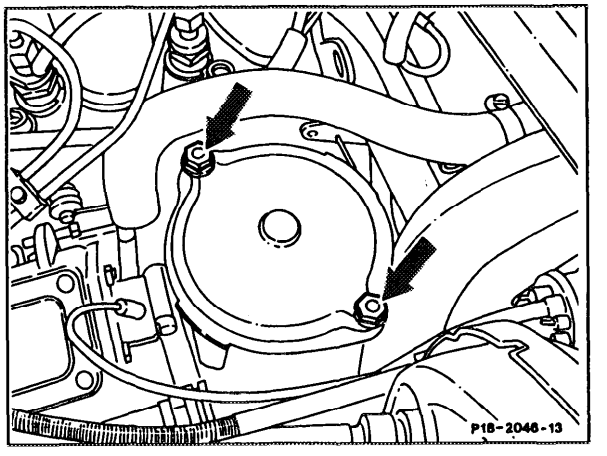
On vehicles with air oil cooler (turbocharged engines) the oil need not be drained from the air oil cooler.

NOTE: Change engine oil only with engine at operating temperature.



Engine 601,602,603		Engine 616,617	
Dimension	L1 113 mm	Dimension	L1 131 mm
	L2 49 mm		L2 55 mm

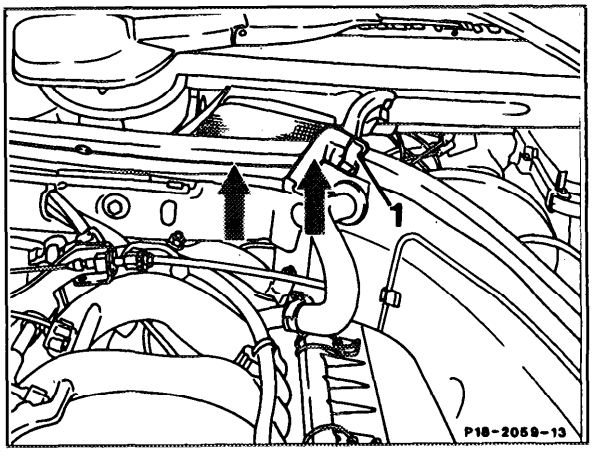
Empty oil filter prior to drawing off or draining engine oil. For this purpose, unscrew nuts (arrows) and remove cover.



For this purpose, for reasons of available space, on engine 603 in model 124 (up to January 1986) loosen rubber gasket or sealing strip on unit partition as follows and pull slightly in upward direction.

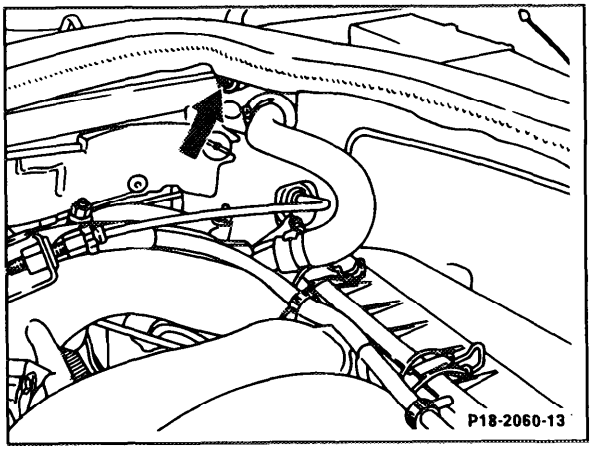
With split rubber gasket

Pull off holding clamp (1).



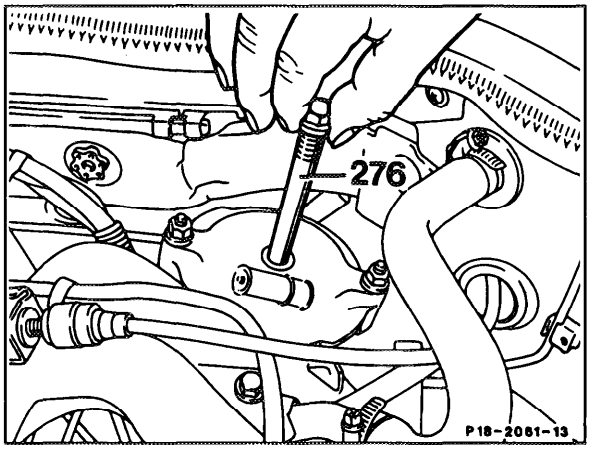
With one-piece rubber gasket

Unscrew screw (arrow).

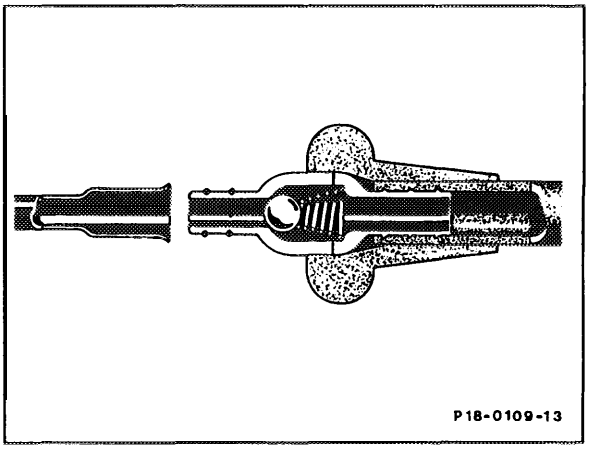


With two-piece oil filter cover
(starting February 1986, engine 603 in model 124)

Unscrew return pipe (276) and remove. Unscrew oil filter cover retaining nuts and remove cover.



Suction engine oil via oil dipstick tube with engine at operating temperature.

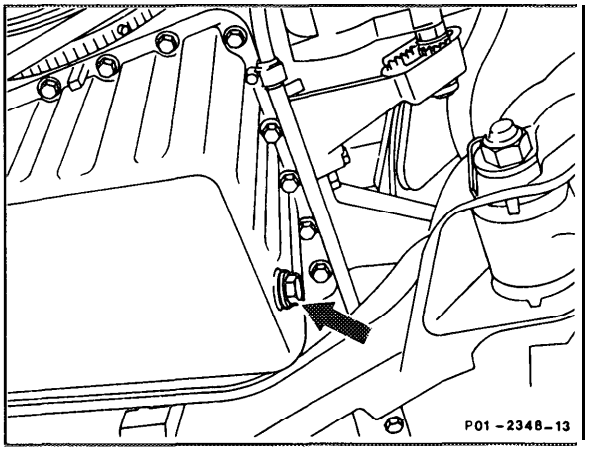


If no suction unit is available:

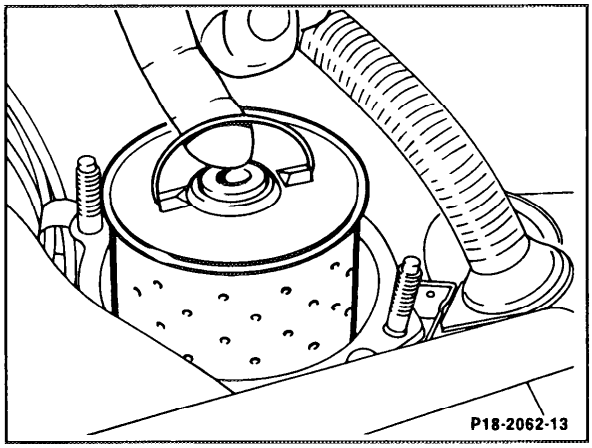
Remove lower noise encapsulation panel and install after finishing all maintenance work.

Drain engine oil from oil pan (arrow).

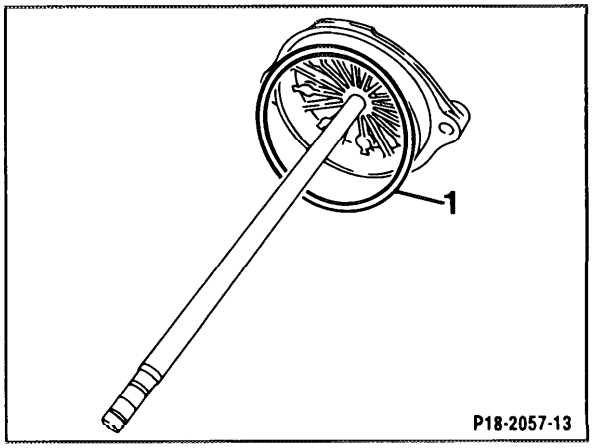
Note: The oil in air-oil cooler need not be drained.



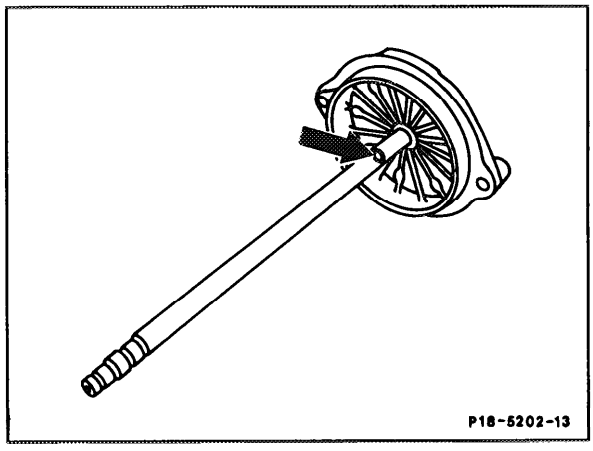
Replace filter element.



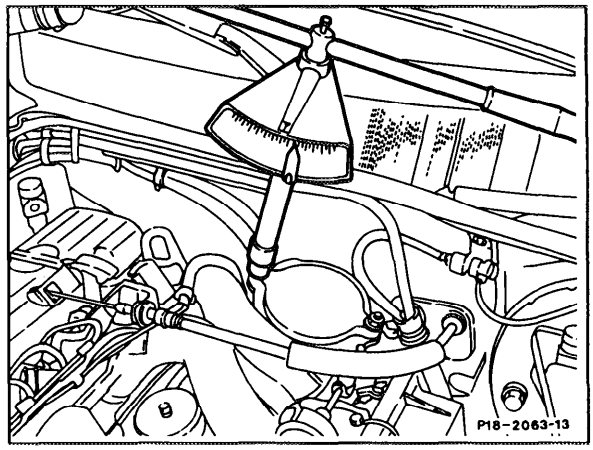
Replace rubber seal ring (1) on cover.



Check the oil port on the oil tube for foreign matter (arrow). If it is blocked, remove the foreign matter by hand. Then blow through the oil port with compressed air; air must noticeably come out of the bottom of oil tube. If the oil port is not open or if no air comes out, replace oil filter cap and oil tube.



Tighten nuts to 25 Nm with a torque wrench.



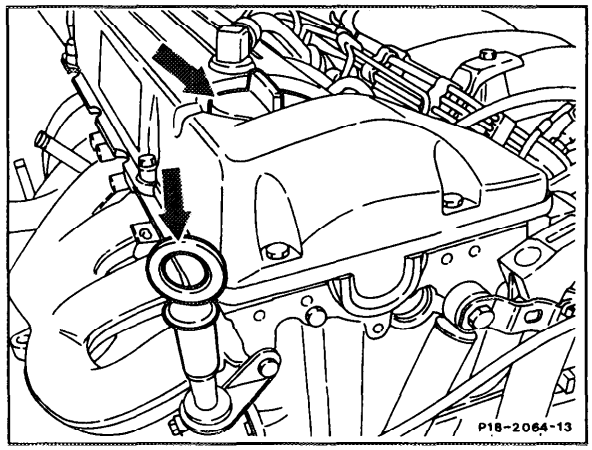
If the oil has been drained from oil pan, replace seal ring on oil drain plug.

Tighten oil drain plug to 30 or 25 Nm.

Add engine oil.

Run engine and check for leaks.

Check oil level approx. w minutes after stopping engine at operating temperature.



Engine 110

Adjusting specifications in mm

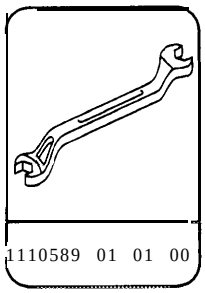
	Cold engine (approx. 20°C)	Warm engine (60°C ± 15°C)
Intake	0.10 [1]	0.15 [1]
Exhaust	0.25	0.30

[1] 0.05 mm more during extended ambient temperatures below -20°C.

Torque specifications (Nm)

Cylinder head cover cap nuts and bolts	5
Valve adjusting screws	20-40

Special tools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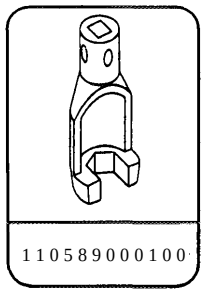
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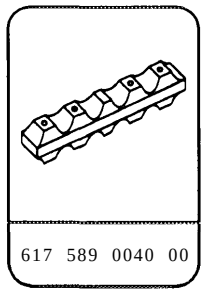
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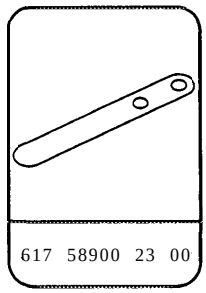
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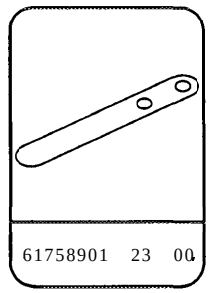
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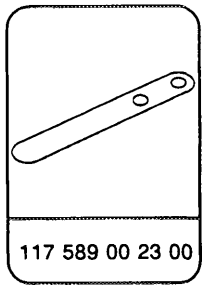
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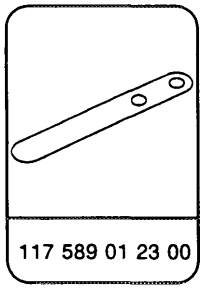
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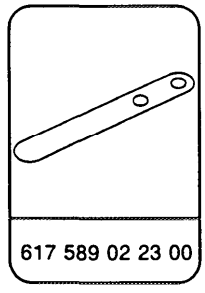
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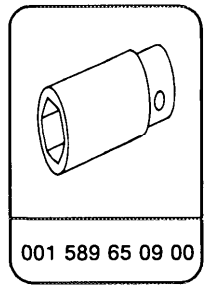
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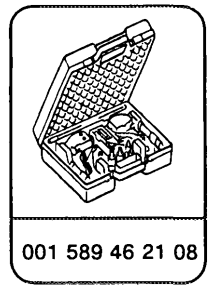
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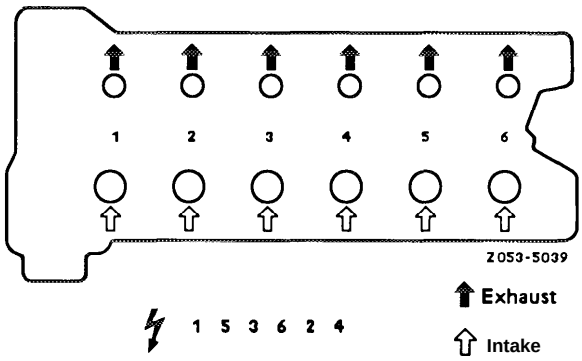
NOTE:

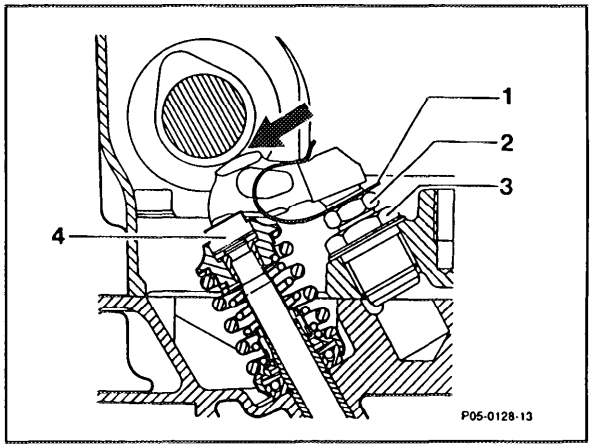
Check or adjust valve clearance with engine cold or warm.

Note layout of intake and exhaust valves.



Checking

- Remove rubber gaskets.
- Measure valve clearance between slide surface of rocker arm and cam base circle of camshaft (arrow).

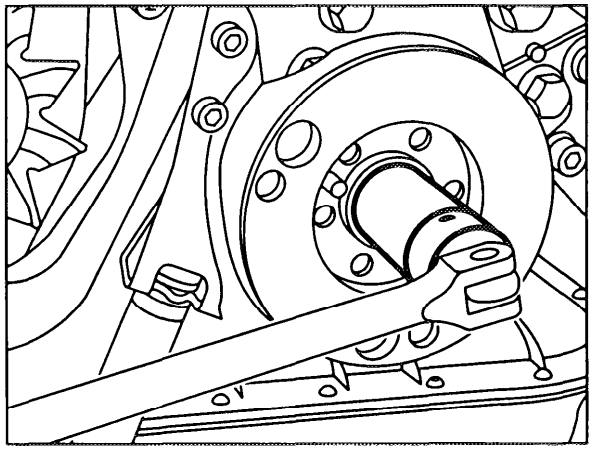


Rotating engine:

(a) With socket wrench on crankshaft balancer hex bolt.

⚠**CAUTION!**
Do not use **camshaft sprocket** mounting bolt to turn engine.

Do not rotate crankshaft **in reverse.**



(b) With starter:

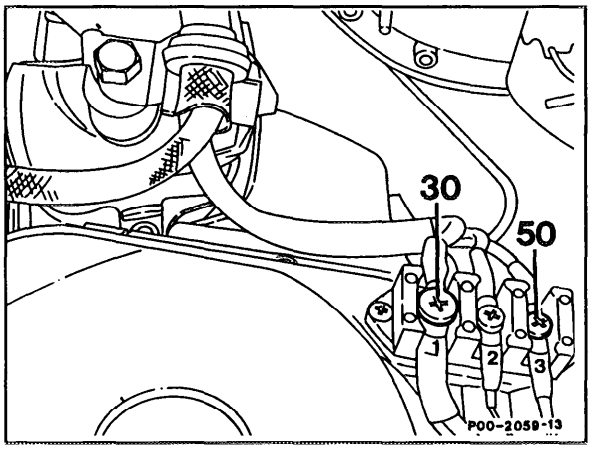
Switch off ignition and connect terminals as indicated.

Model 123

On cable connector to engine harness, disconnect cable terminal 16 (cable color red/purple), so that the ignition coil and the fuel pump are not activated.

Connect terminal 30 and terminal 50 on cable connector.

Instead of terminal 30, connection can also be made to battery **+**.



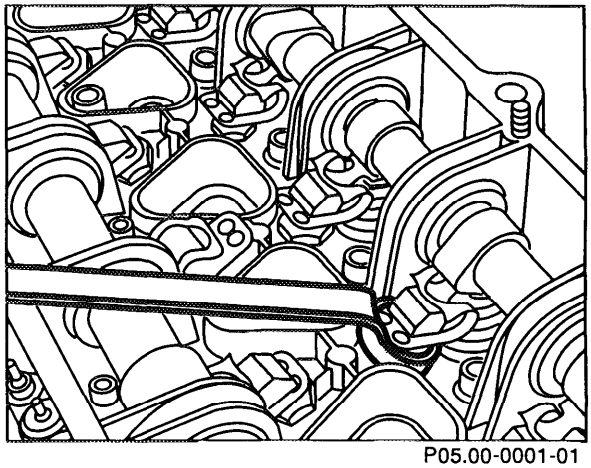
Adjusting

Adjust valve clearance by turning valve adjusting screw (2) with valve adjusting wrench.

The valve clearance is correctly adjusted if slip gauge requires tight pull.

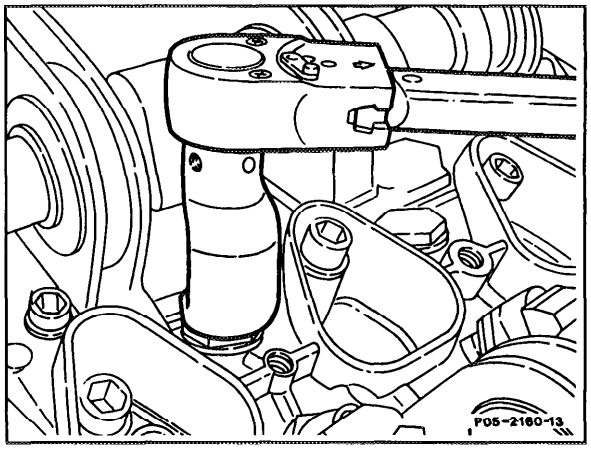
NOTE: If adjustment is inadequate, replace plunger (4). Plungers are available in various sizes (refer to spare part documentation).

At end of adjusting jobs, check tension springs (1) for perfect seat.


P05.00-0001-01

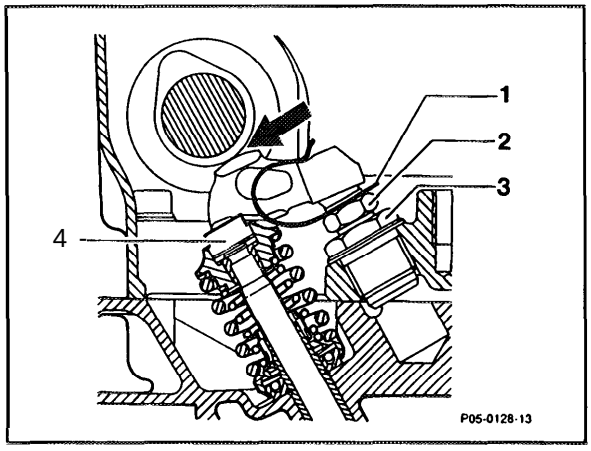
1 Valve adjusting wrench 100 589 01 01 00

NOTE: A torque check is required on loose valve adjusting screws. For this purpose, remove tensioning springs by means of a screwdriver and measure torque with valve adjusting wrench, part no. 110 589 00 01 00 and a torque wrench (e.g. part no. 000 589 27 21 00).



1 Valve adjusting wrench 110 589 00 01 00

If the torque of the valve adjusting screw is below 20 Nm, replace valve adjusting screw (2) or valve adjusting screw (2) together with threaded bushing (3).



Engine 616 617

Adjusting specifications In mm

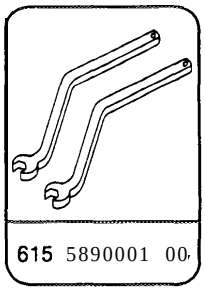
Engine	Cold engine (approx. 20° C)	Warm engine (60°C ± 15°C)
616, 617	**Intake** 0.10 1)	0.15 1)
616, 617.91	**Exhaust 0.30**	**0.35**
617.95	**Exhaust** 0.35	0.40

1) 0.05 mm more during extended ambient temperatures below -20°C.

Torque specifications (Nm)

Cylinder head cover cap nuts	15

Special tools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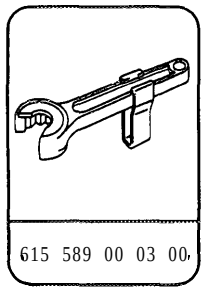
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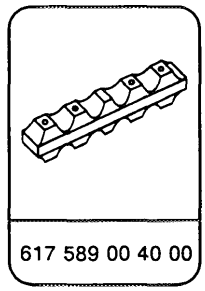
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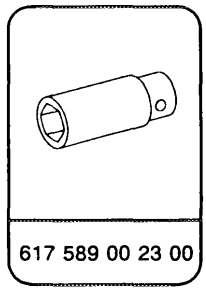
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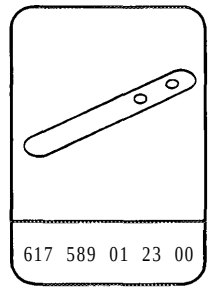
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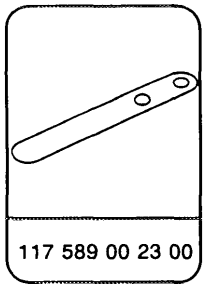
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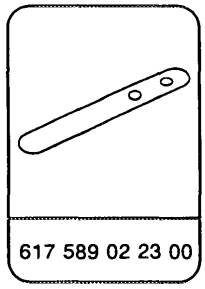
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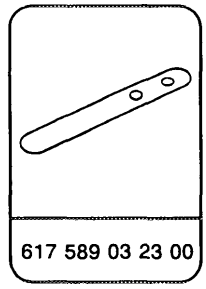
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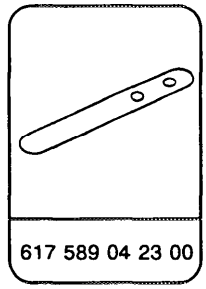
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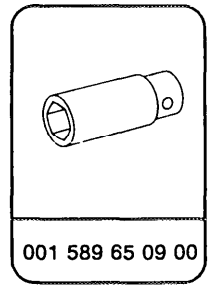
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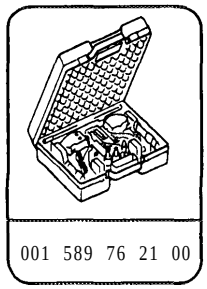
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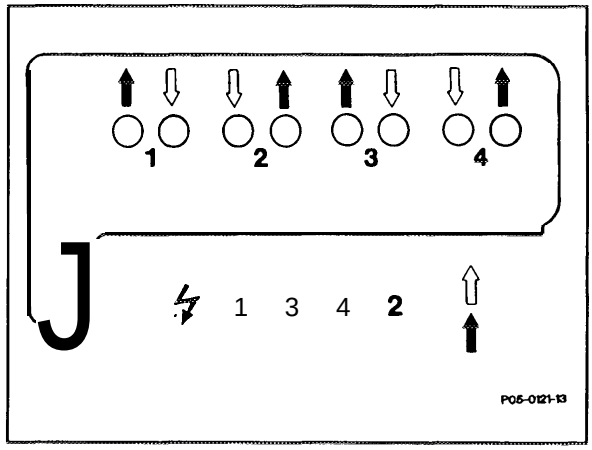
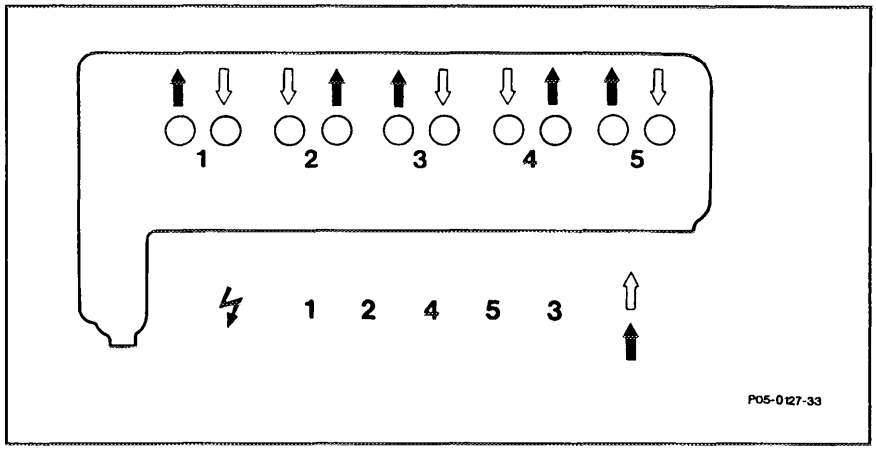
NOTE:

Check or adjust valve clearance with engine cold or warm.

Note layout of intake and exhaust valves.



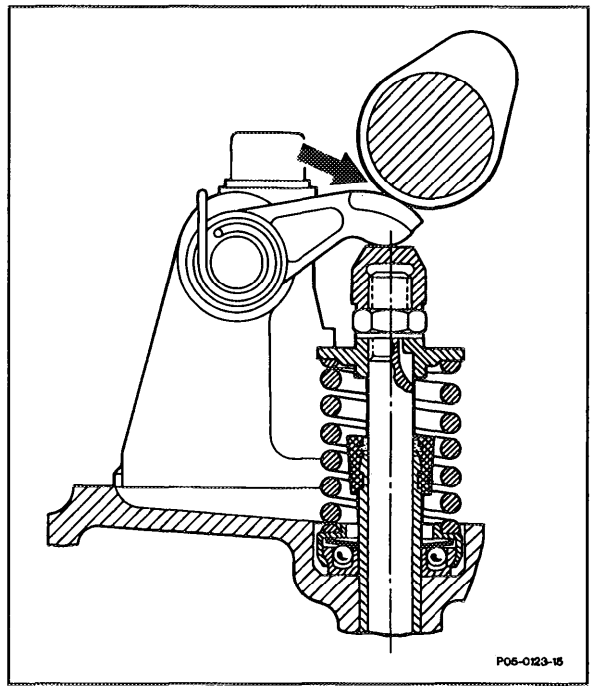


Adjusting

- Measuring valve clearance between sliding surface of rocker arm and cam base circle of camshaft (arrow), by positioning camshaft so that **tip of cam is vertical** relative to rocker arm.

Valve clearance is correctly adjusted if feeler gauge can be pulled through with some resistance.

- Position start and stop cable to “Stop“ or turn starter key to “0“.

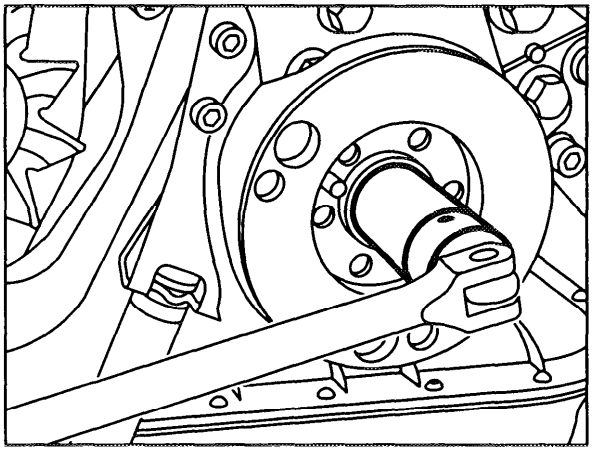


The engine can be cranked as follows:

a) With socket wrench on crankshaft balancer hex bolt.

⚠**CAUTION: Do not** use **camshaft sprocket** mounting bolt to turn engine.

Do not rotate crankshaft **in reverse.**

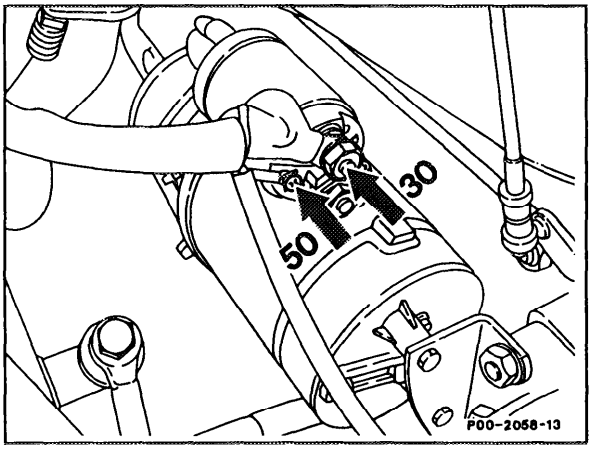


b) With starter

Model 123 with engine 616 and 617.912

Connect remote starter switch to terminal 30 and 50 at starter.

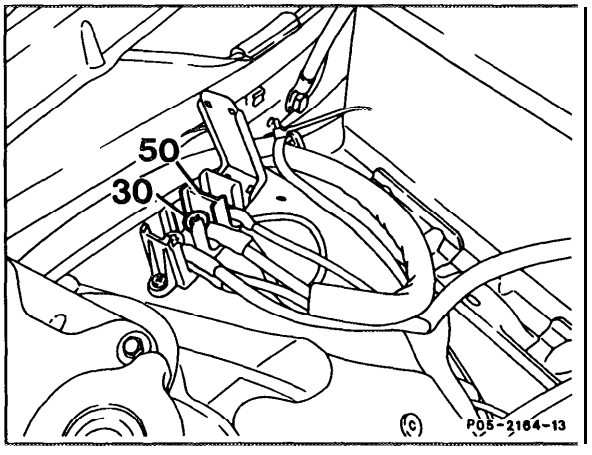
Remote starter switch may also be connected to battery + instead of terminal 30.



Model 123 with engine 617.952 (turbodiesel)

Connect contact handle to terminal 30 and 50 at cable connector.

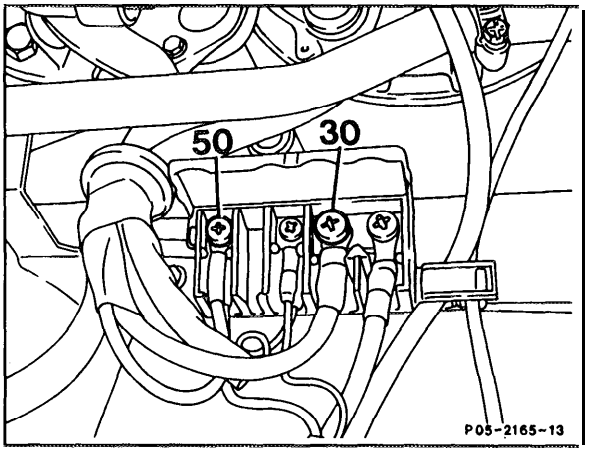
The cable connector is fitted in the right hand wheel housing.



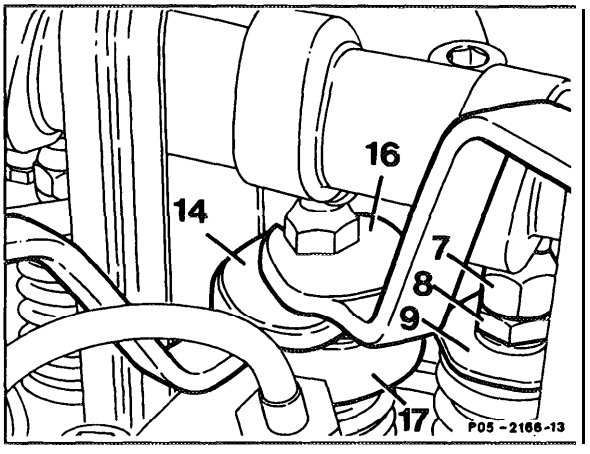
Model 126 with engine 617.951 (turbodiesel)

Connect contact handle to terminal 30 and 50 at cable connector.

The cable connector is fitted to the right hand side member.



- Place retaining wrench (17) to hexagon of valve spring plate.
- Loosen hex nut (7), by holding locknut (8) at valve with valve adjusting wrench (14).
- Set valve clearance by turning cap nut.
- After adjusting, secure cap nut with locknut.



Also check that cap and locknuts of valves which were not adjusted are tight.

- Re-check valve clearance.

Engine 102.983
Adjust valve clearance on separate order only

Adjustlng specifications In mm

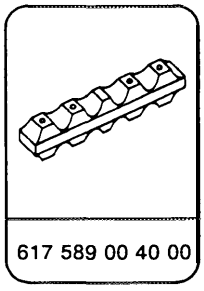
	Cold engine (up to 50°C coolant temperature)	Warm engine (60-80°C)
Intake	0.1 o-0.20	0.15-0.25
Exhaust	0.25-0.35	0.30-0.40

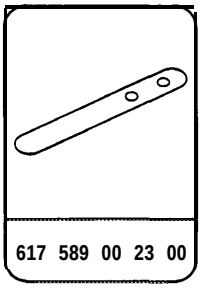
1) 0.05 mm more during extended ambient temperatures below -20°C.

Torque specifications (Nm)

Cylinder head cover cap nuts	9
Screws, ignition cable cover	20-40

Special tools


617 589 00 40 00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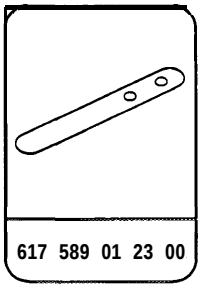
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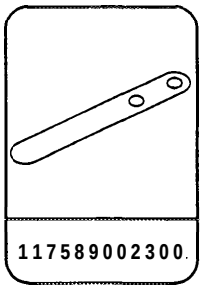
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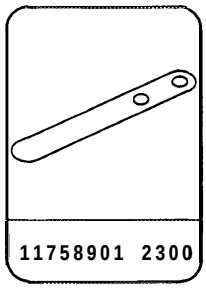
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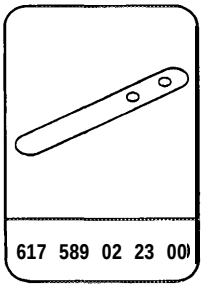
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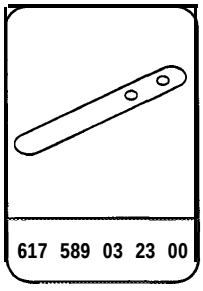
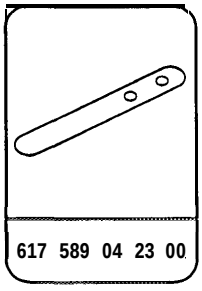

617 589 03 23 00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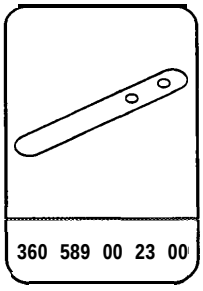
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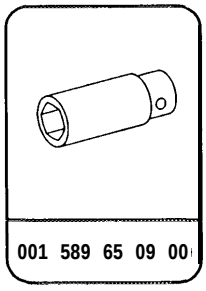
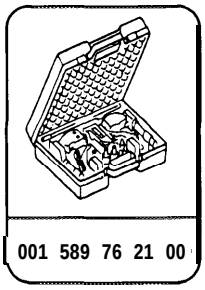
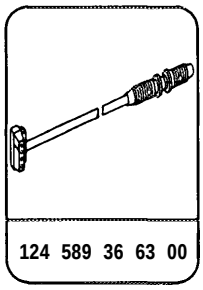
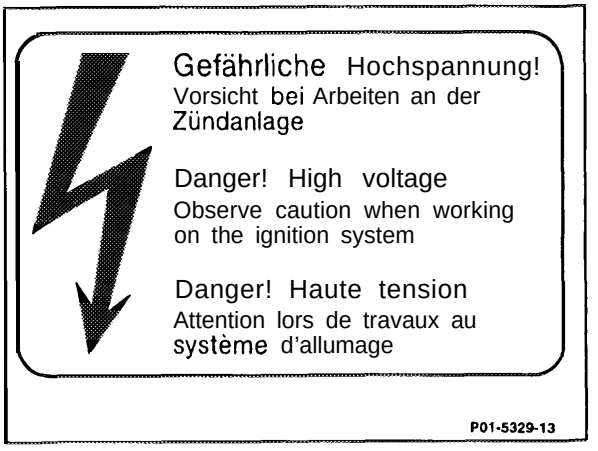

001 589 65 09 00


001 589 76 21 00


124 589 36 63 00

⚠ WARNING!
Because of the high ignition voltage, it is dangerous to touch ignition components (ignition coil, ignition cables, spark plug connector, module push connectors) when

- the engine is running,
- the engine is being started,
- the key in in position 2 while the engine is being turned manually.

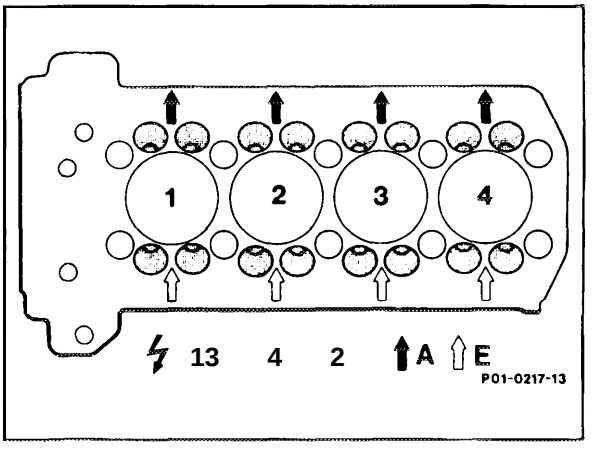


NOTE:

Check valve clearance with engine cold or warm.

Note layout of intake and exhaust valves.

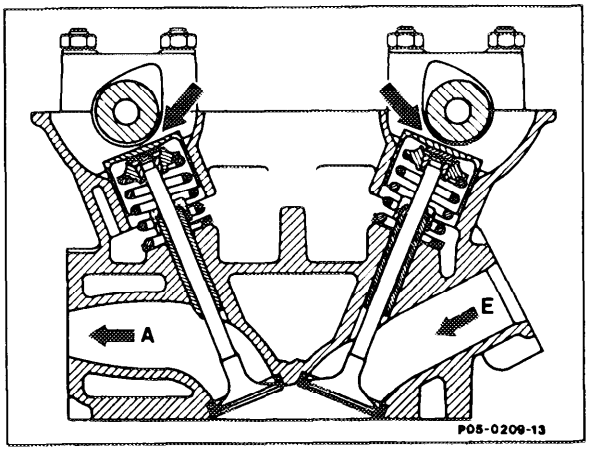
E = Intake
A = Exhaust



Measure valve clearance between bucket tappet and cam base circle (arrows).

Turn the camshaft in such a way that the cam points up (base circle on bucket tappet).

Valve clearance is set correctly if the feeler gauge blades, minimum or maximum thickness, can be pulled through with some resistance (e.g., intake with cold engine, feeler gauge blade 0.10 or 0.20 mm).



Turning the engine crankshaft:

a) By hand

Use socket wrench adaptor (27 mm, 1/2" drive) and ratchet, on the vibration damper bolt.

⚠CAUTION!

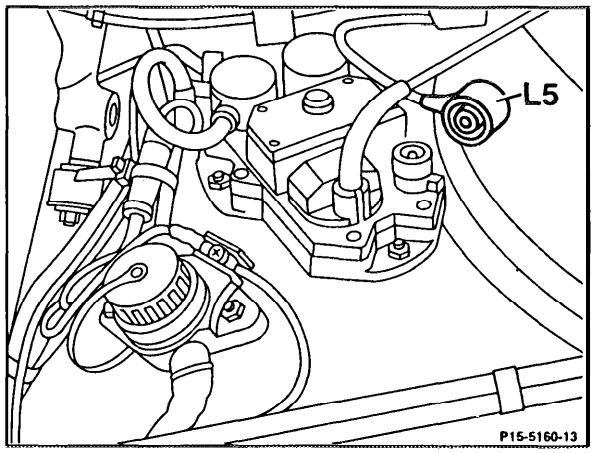
The engine must **not** be turned via the camshaft.

Do **not turn crankshaft backwards.**

After turning off ignition, disconnect crankshaft position sensor (L5, green cable) from ignition control module.

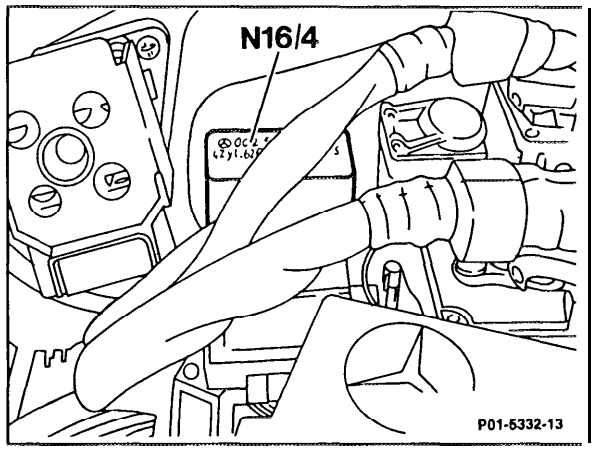
b) With starter:

Disconnect crankshaft position sensor (L5, green cable) from ignition control module.

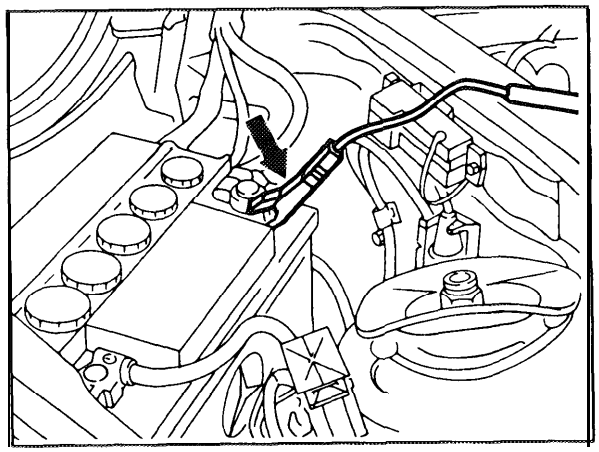


⚠ CAUTION!

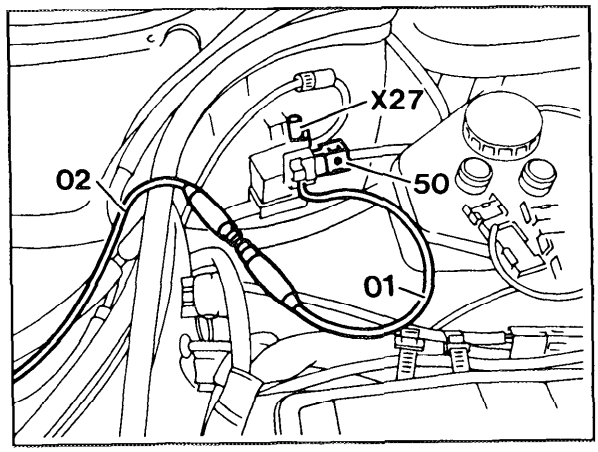
Before turning engine, pull out fuel pump relay module (N16/4), to prevent fuel from being injected.



Connect once clamp of remote starter switch to the battery positive terminal.



Disconnect connector (X27) from plug connector 50. Connect plug from adapter cable (01) 124 589 36 63 00.

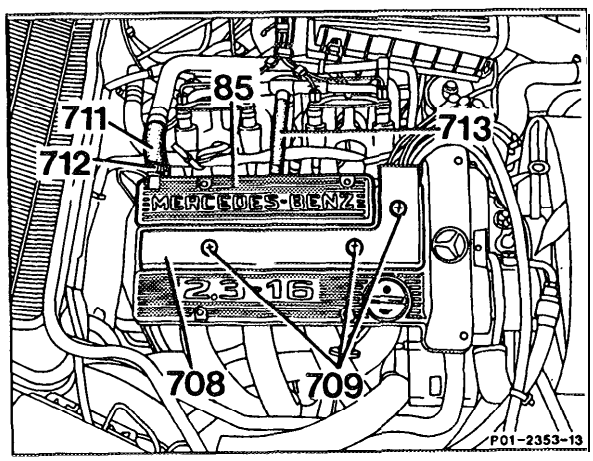


Checking

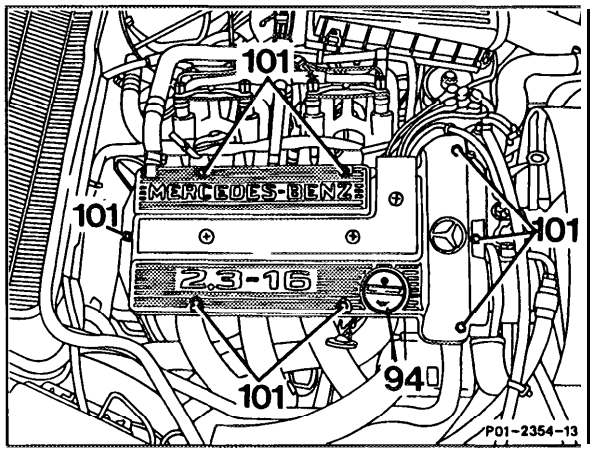
- Remove cylinder head cover.

Remove securing screws (709), remove ignition cable valley cover (708), pull off the spark plug connectors and lay the ignition cable to the side.

Loosen hose clamp (712) and pull off the hoses (711 and 713) on the cylinder head cover (85).



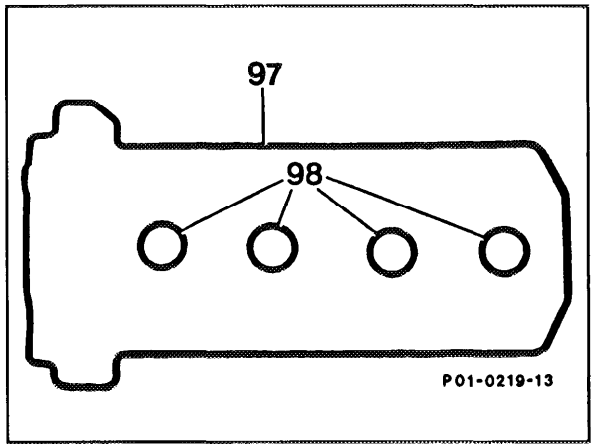
- Remove cap nuts (101) and remove cylinder head cover.



- According to engine temperature and valve (intake or exhaust), try to pull the corresponding feeler gauge blade (minimum and maximum thickness) between the bucket tappet and the cam base circle.

  If the feeler gauge with the minimum thickness cannot be pulled through, or if the feeler gauge blade with the maximum thickness can be pulled through lightly, adjust the valve clearance (on separate order).

- Check cylinder head cover gasket (97) and sealing rings (98) for damage and replace if necessary.

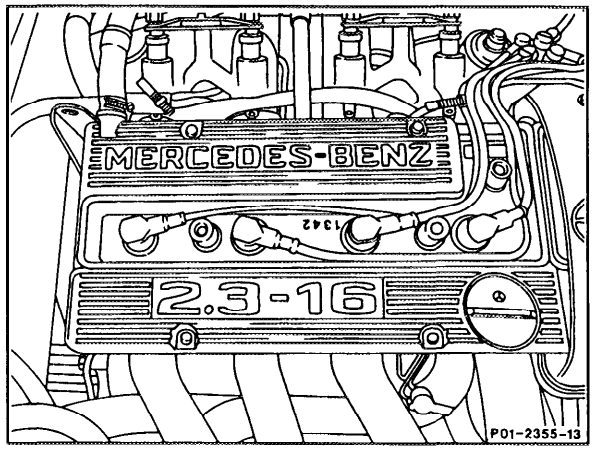


- Replace cylinder head cover in reverse order of its removal. Gradually tighten cap nuts in steps to 9 Nm.

- Route ignition cable according to the symbols and guide ribs in the ignition cable valley.

Note: Check the valleys for foreign matter before the spark plug connectors are reattached.

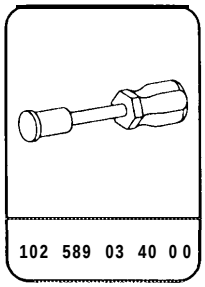
- Check for leaks with engine running.

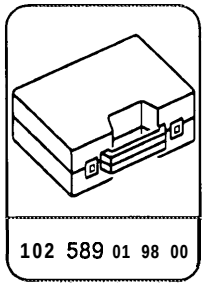


Note the following when adjusting valve clearance

Torque specifications (Nm)	
Nuts, camshaft bearing brackets	21
Bolts, timing gear to camshaft	12

Special tools

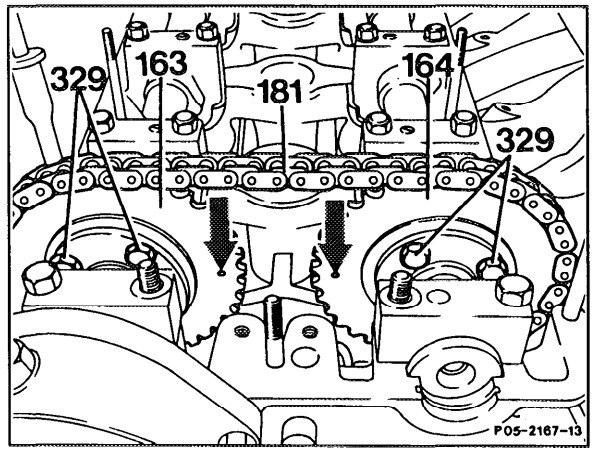




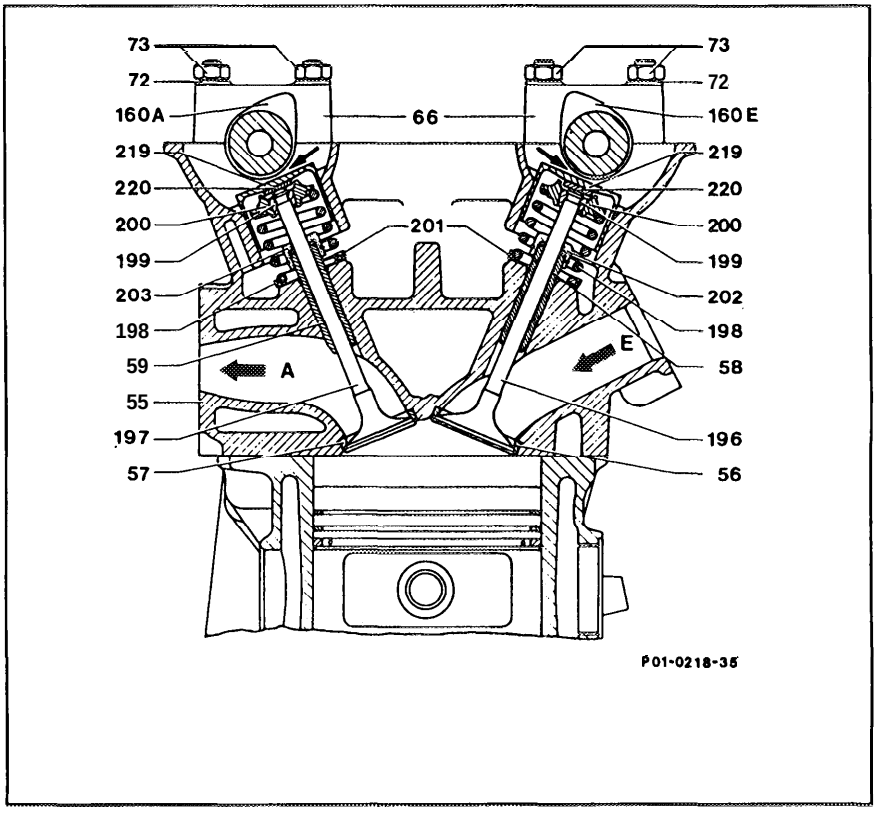
Adjusting

- Remove appropriate camshaft.

Turn the engine to the TDC position of the first cylinder; the holes (2 mm, arrows) in the timing gears must be opposite each other. Mark the camshaft and timing gear for alignment. Remove retaining screws (329, four for each timing gear). Using a plastic mallet, carefully tap the camshaft toward the rear to separate it from the timing gear center collar.



NOTE: If both camshafts are taken out at the same time, mark each for later identification because they are identical.



- Unscrew fastening nuts (73) and take off bearing brackets (66).
- Pull out the corresponding bucket tappet (219) with the magnetic lifter.
- Take out disk (220).
- Position new disk.

Example (intake, engine cold)

Measured value Desired average value	0.25 0.15
Difference [1]) Thickness of removed disk	0.10 2.8
Thickness of disk to be installed	**2.9**

[1]) If valve clearance is excessive, add the difference to the thickness of the removed disk; **if valve clearance is** too small, subtract the difference.

With an intake valve clearance of less than 0.10 mm always put in a 0.10 mm thinner disk.

- Set disks in the valve spring retainer.
- Oil and install bucket tappets.
- Oil and install camshaft.

Before tightening the camshaft on the timing gear, carefully tap the camshaft toward the front on the center collar of the timing gear with a plastic hammer. Observe previously inscribed alignment marks.

NOPE: The camshaft can be secured to the timing gear in only one position.

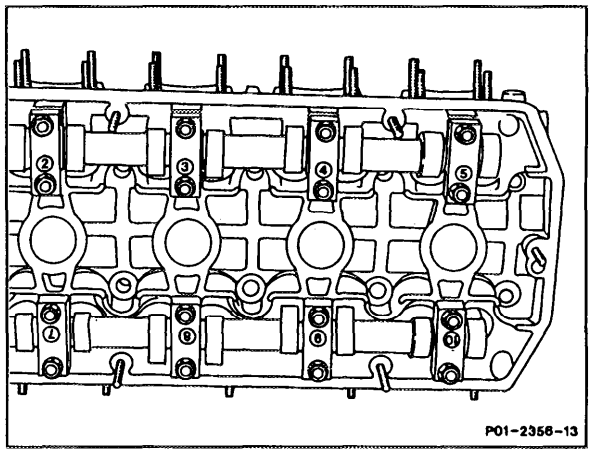
The camshaft bearing brackets are numbered for identification:

Intake camshaft identification numbers 7-10.
Exhaust camshaft identification numbers 2-5.

The stamped identification numbers must be adjacent to the inside stud bolts.

Tighten all nuts equally, in steps.

- Check the valve clearance again (check measurement).

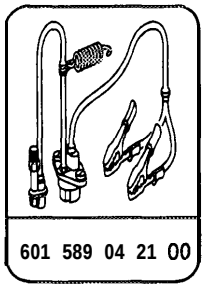


Engine 601
1964

Test values

Idle speed rpm	750 ± 50

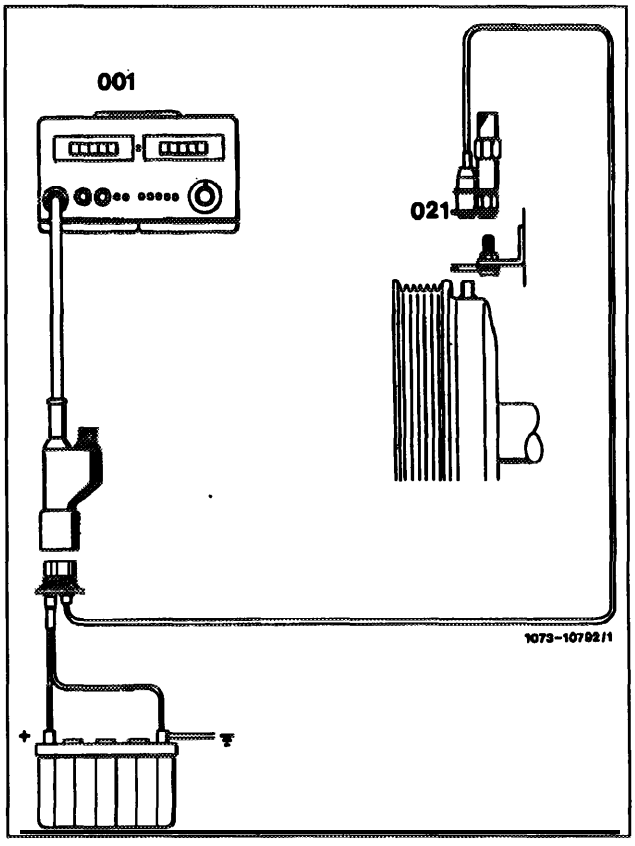
Special tool



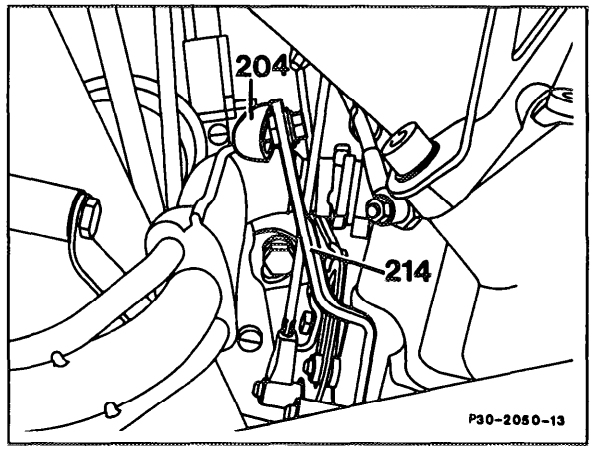
Equipment

Digital tester	Bosch MO-I= 001.03

- Connect digital tester (001) and impulse transmitter (021).

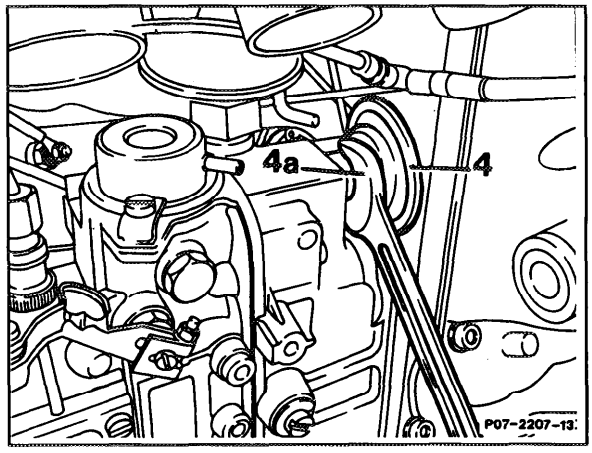


- Disengage connecting rod (204) on guide lever (214).



- Run engine to approx. 80°C coolant temperature.

- Check idle speed 750 ± 50 rpm, adjust by turning vacuum control unit **(4),** if required, loosen counter nut (4a) for this purpose.
- Engage connecting rod (204) free of tension.
- Switch on all additional units and check engine for smooth running.



Checking and adjusting idle speed

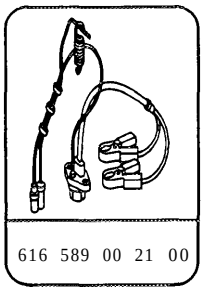
0750.16

Engine 616 617.912
1981

Test values

Engine		Idle speed rpm
616.912	1981	750 ± 50
617.912	1981	750 ± 50

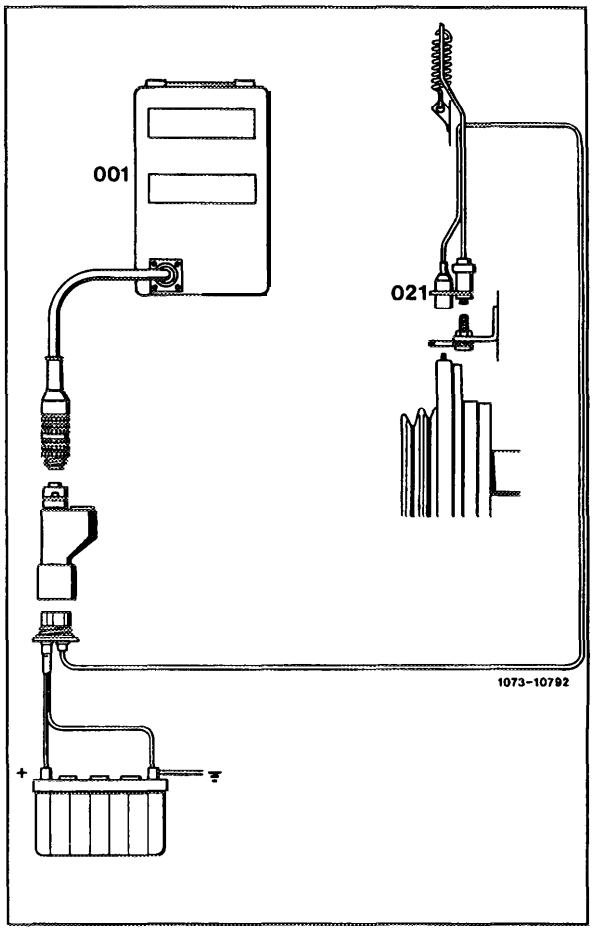
Special tool



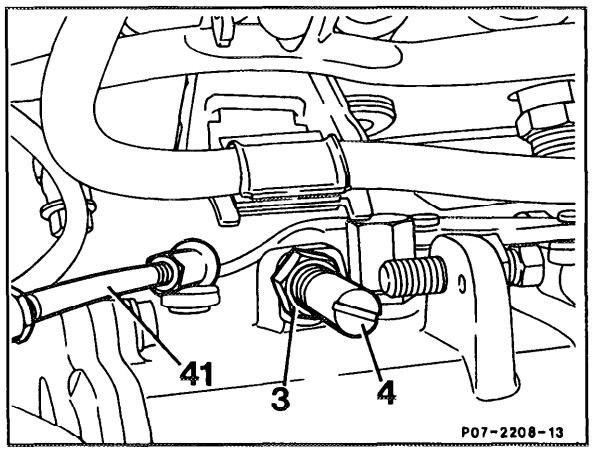
Equipment

Digital tester	Bosch MOT 001.03

- Connect impulse transmitter (021) and digital tester (001).
- Run engine to approx. 80°C coolant temperature.
- Turn button for idle adjuster on instrument panel fully to the right.



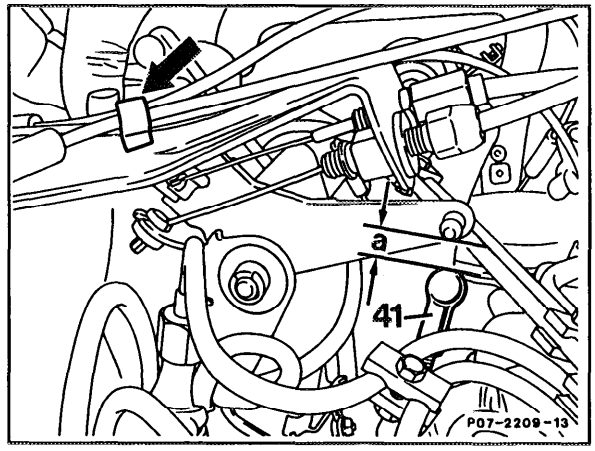
- Disconnect push rod (41) at angle lever.
- Check idle speed. If necessary, loosen lock nut (3) and adjust idle speed to specified speed of **750 ± 50** rpm with idle speed adjusting screw (4).



- Checking adjustment of regulating linkage.

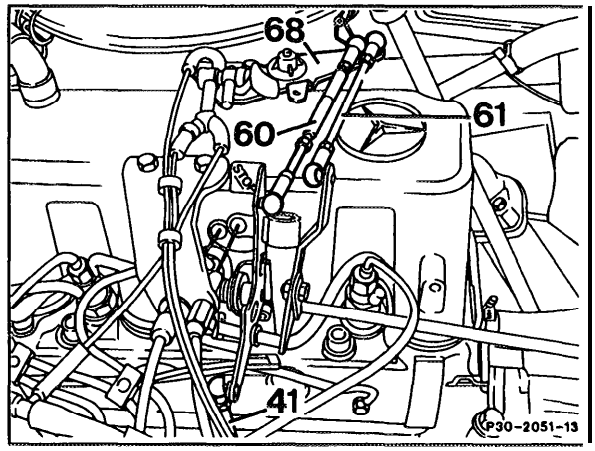
a) Vehicles with manual transmission

Adjust push rod **(41) by pressing shutoff lever** (arrow) against stop. Adjust push rod so that play between lower edge of ball head and upper edge of ball socket is 5-6 mm (distance **"a").** Connect push rod.

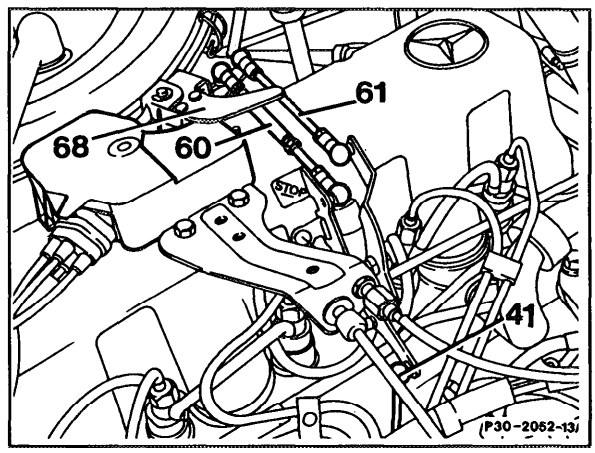


b) Vehicles with automatic transmission

Adjust push rod (41) so that reversing lever (68) just rests on perceptible selector cam leading edge. The regulating lever must also rest against the idle speed stop of the injection pump.



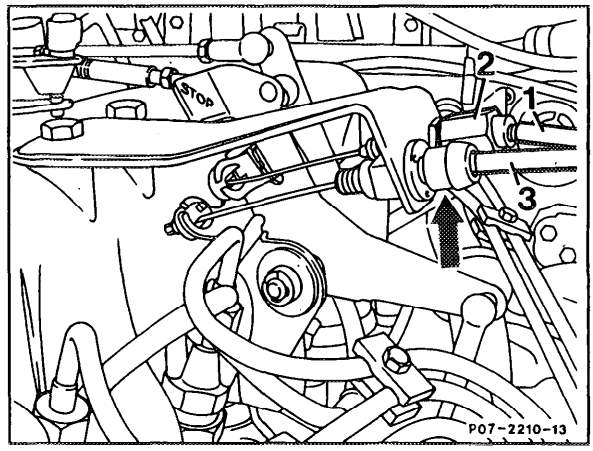
Engine 616



Engine 617.912

- Check Bowden cable for cruise control and adjust as necessary. Press throttle valve lever against the stop; the Bowden cable must rest free of tension against regulating lever. Adjust Bowden cable with adjusting screw if required, Release throttle valve lever (idle setting). In this position the Bowden cable must have play.

- Move selector lever to drive, switch on climate control, turn power steering to full lock. Engine should still run smoothly. Readjust speed if necessary.



⚠ **CAUTION**:
If speed is set higher, the engine will leave the idle speed control range and may accelerate up to maximum engine speed (at no load).

Engine 617.95

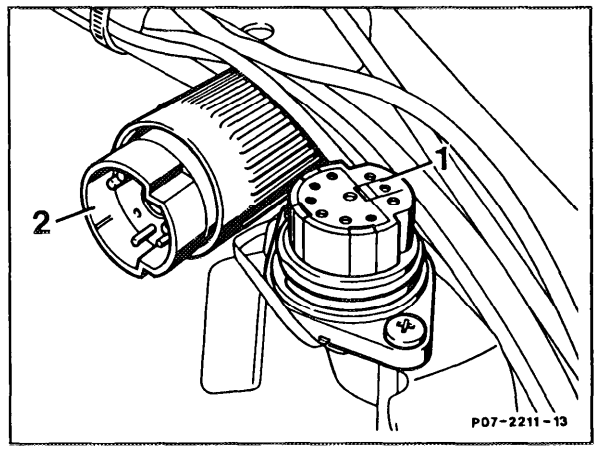
Test values

Idle speed /rpm	700 -800

Equipment

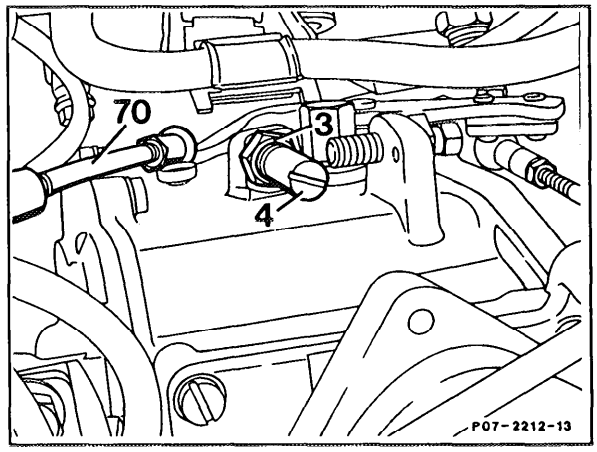
Digital tester	e.g. Bosch, MOT 011.03

- Connect digital tester to diagnosis socket.
- Run engine to approx. 80°C coolant temperature.

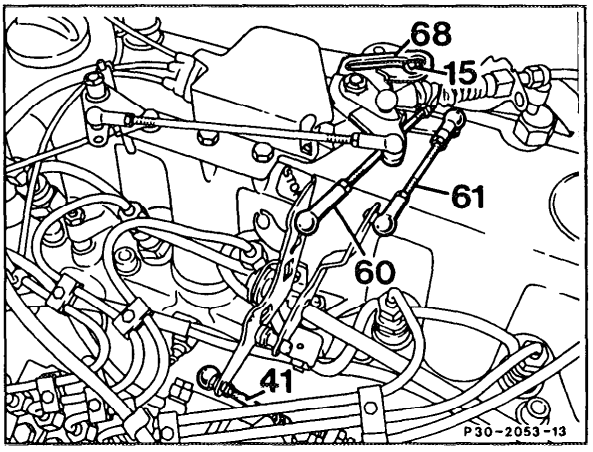


- Detach push rod (70) at angle lever.
- Check idle speed. If necessary, loosen lock nut (3) and adjust idle speed with adjusting screw (4) to a speed of 700-800 rpm.

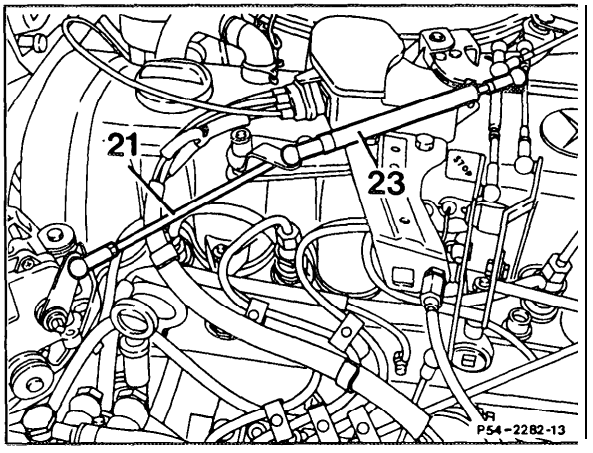
Note: The idle speed can also be adjusted using the tachometer in the vehicle.



- Adjust push rod (60) so that roller (15) in reversing lever (68) rests at final stop free of tension.



- Adjust cruise control. For this purpose, detach pull rod (21) and push lever of actuating element clockwise against idle speed stop.



When connecting pull rod (21), make sure that the lever of the actuating element is pushed away from idle speed stop by approx. 1 mm. Readjust pull rod, if required.

- Move selector lever to drive, switch on automatic climate control. When power steering is turned to full lock, engine must still run smoothly. Readjust speed, if required.

⚠CAUTION:
If speed is set higher, engine will leave idle speed control range and may increase to maximum engine speed (at no load).

Engine 616.912
198211983

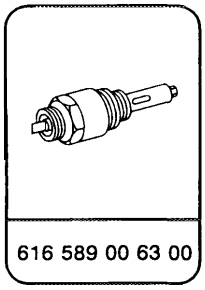
Adjust engines according to data of respective exhaust gas information plate.

Identification: Information plate on cross member in front of radiator.

Test values

Idle speed rpm	750 ± 50

Special tool



Commercial tools

Tachometer

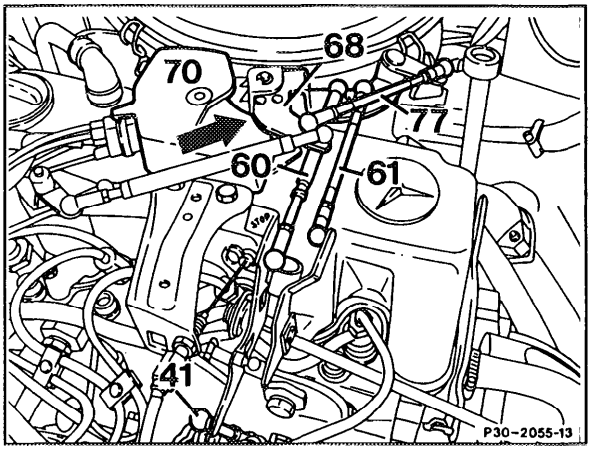
Connect tachometer and adapter.

Run engine until coolant temperature is approx. 80°C.

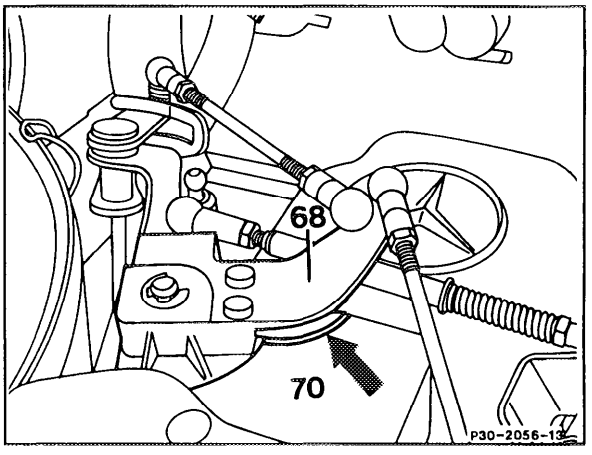
Turn knob for idle speed adjuster on instrument panel completely to the right.

Detach pushrod (41) at angle lever.

Move guide lever (68) into idle speed position. Set edge of lever arm of guide lever (68) to mark (arrow) of cap (70) (seen from above).



Engine 616.912 with automatic transmission

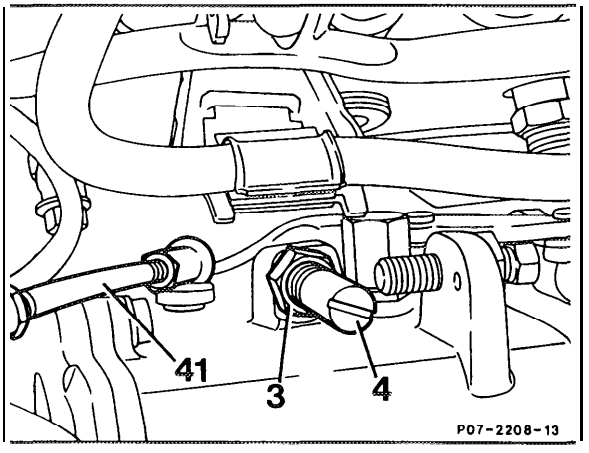


Engine 616.912 with manual transmission

If necessary, check idle speed. Loosen locknut (3) and set idle speed adjusting screw (4) to specified speed 750 ± 50 rpm.

Check adjustment of regulating linkage.

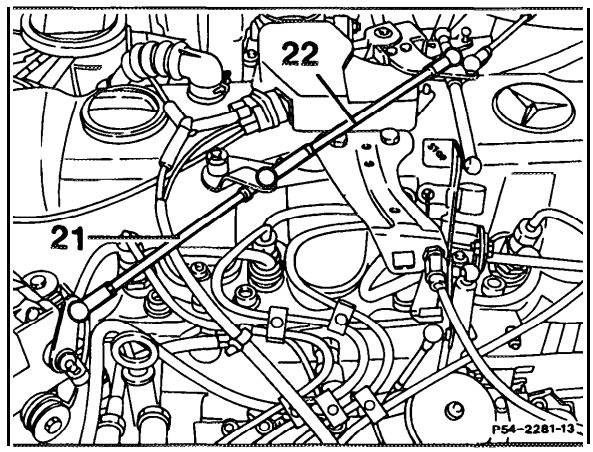
Adjust pushrod (41) and attach free of tension. Regulating lever of injection pump should rest against idle speed stop.



Adjusting cruise control/Tempomat:

a) With manual transmission

Check connecting rod (22) for specified length of 178 mm. Detach connecting rod (21) on actuator, check whether regulation is in idle speed position. Push lever of actuator clockwise to idle speed position. Check whether connecting rod (21) is 1 mm longer than lever of actuator and adjust, if required. Attach connecting rod (21).



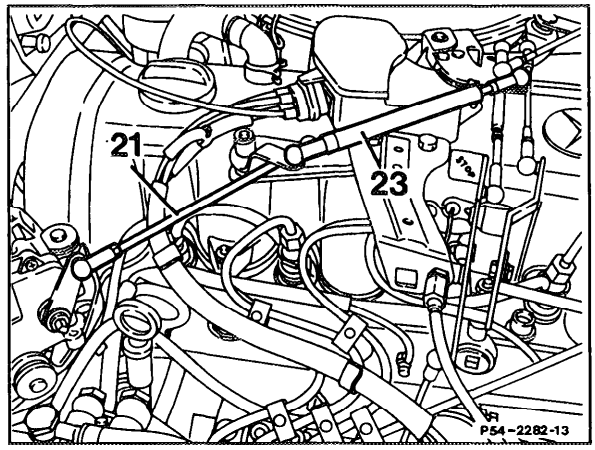
Manual transmission

b) With automatic transmission

Check pull rod (23) for specified length of 178 mm. Detach connecting rod (21) on actuator.

Check whether regulation is in idle speed position. Push lever of actuator clockwise into idle speed position.

Check whether connecting rod (21) is 1 mm longer than lever of actuator and adjust, if required. Attach connecting rod (21).



Automatic transmission

Checking and adjusting idle speed

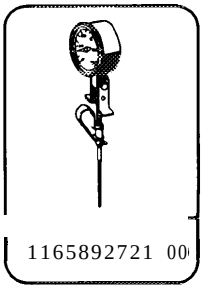
0758

Engine 110
1981

Test values

Idle speed rpm	750 ± 50

Special tools



Commercial tool

Tachometer

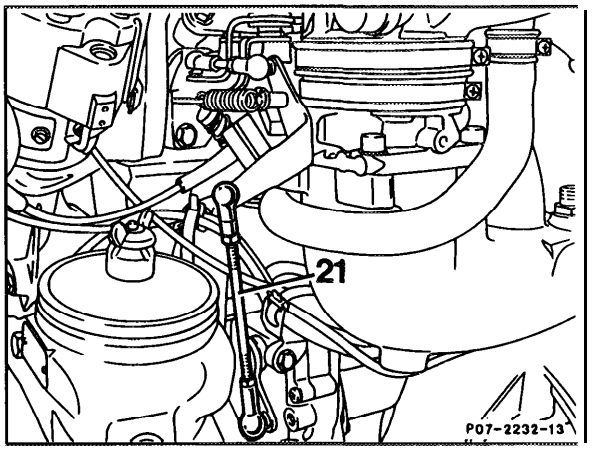
Connect tachometer and oil telethermometer.

Switch off climate control, move selector lever to "P".

Check whether throttle valve lever rests against idle speed stop.

Adjust cruise control (tempomat). Check whether actuating element rests against idle speed stop of cruise control (tempomat). To check, disconnect pull rod (21) and push lever of actuating element clockwise against idle speed stop.

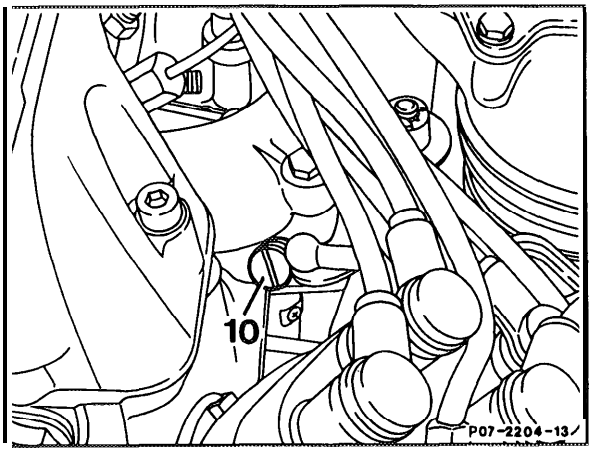
When engaging pull rod (21), make sure that the lever of the actuating element is pushed away from idle speed stop by approx. 1 mm. Readjust pull rod, if required.



Run engine to 75-85°C oil temperature.

Checking and adjusting idle speed

Check idle speed and set to specified speed, if required, by means of idle speed air screw (10).



Engine 616 617

Test values

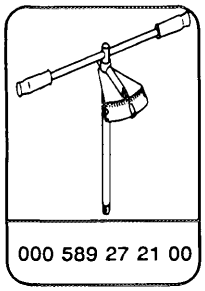
Engine	616,617
Start of delivery BTDC[1)]	24" ± 1°

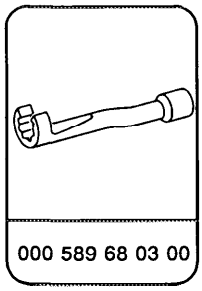
1)Note:Pull regulating lever of injection pump **to full load** stop during measurement and disconnect vacuum hose at vacuum unit.

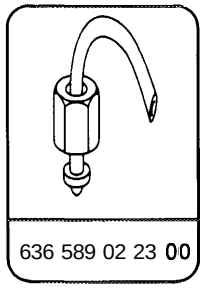
Torque specifications (Nm)

Pipe connection	40

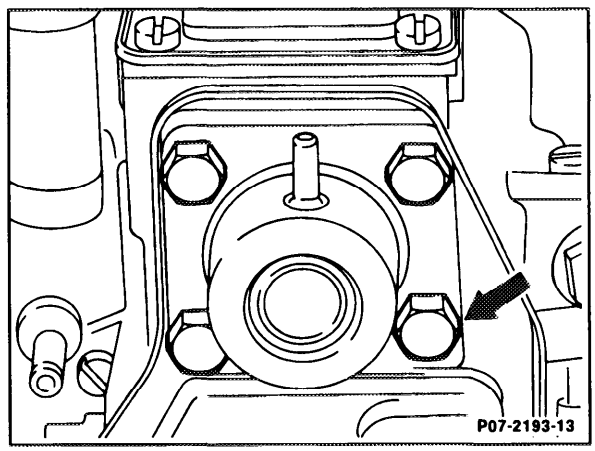
Special tools







Disconnect vacuum hose at vacuum unit.



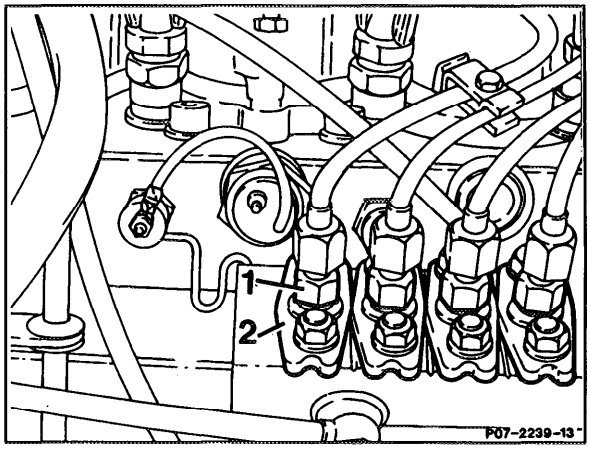
Unscrew pipe connection (1) of first injection pump element, remove compression spring and delivery valve.

Install pipe connection (1) without compression spring and delivery valve.

Attention! Do not slacken barrel-and-valve assembly (2).

Screw on overflow pipe.

Pull regulating lever of injection pump **to full load stop during measurement.**



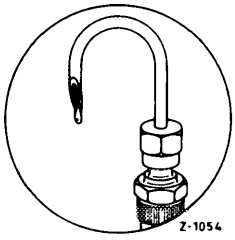
1 Pipe connection 2 Barrel-and-valve assembly

Turn crankshaft in direction of rotation until fuel just stops dripping.

This position represents start of delivery.

If injection timing has to be adjusted, refer to adjustment instructions

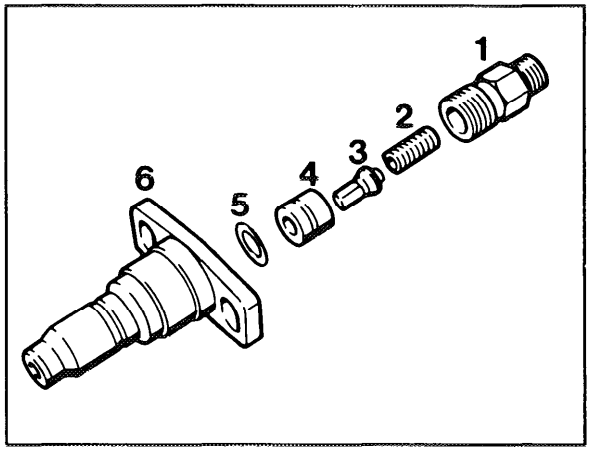
Remove overflow pipe and unscrew pipe connection.



Fit delivery valve, compression spring and pipe connection.

Torque pipe connection in one movement to 40-50 Nm.

Run engine and check for leaks. If a pipe connection leaks, it must be replaced. When fitting a new pipe connection, use **new** copper sealing ring under delivery valve holder.



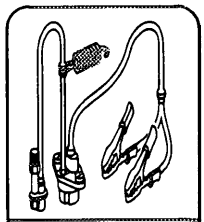
Engine 601 602 603

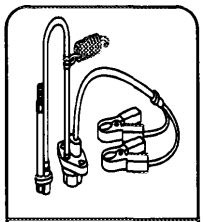
Test values

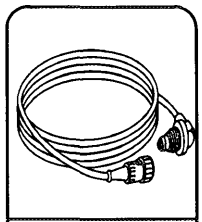
Model year	Indirect injection timing (after TDC)	
	RI (reference impulse) checking value	WI (reference impulse) adjusting value
1984-89	15° ± 1°	15"
starting 1990	14° + 0.5°	14° + 0.5°

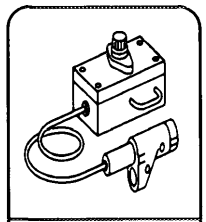
Tightening torques (reference values)	Nm
Closing plug to regulator (measuring point)	30-35
Injection pump flange	20-25

Special tools


601 589 04 21 00


603 589 00 21 00


617 589 10 21 00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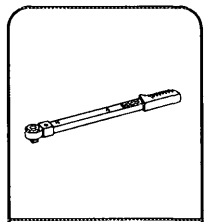

001 589 66 21 00

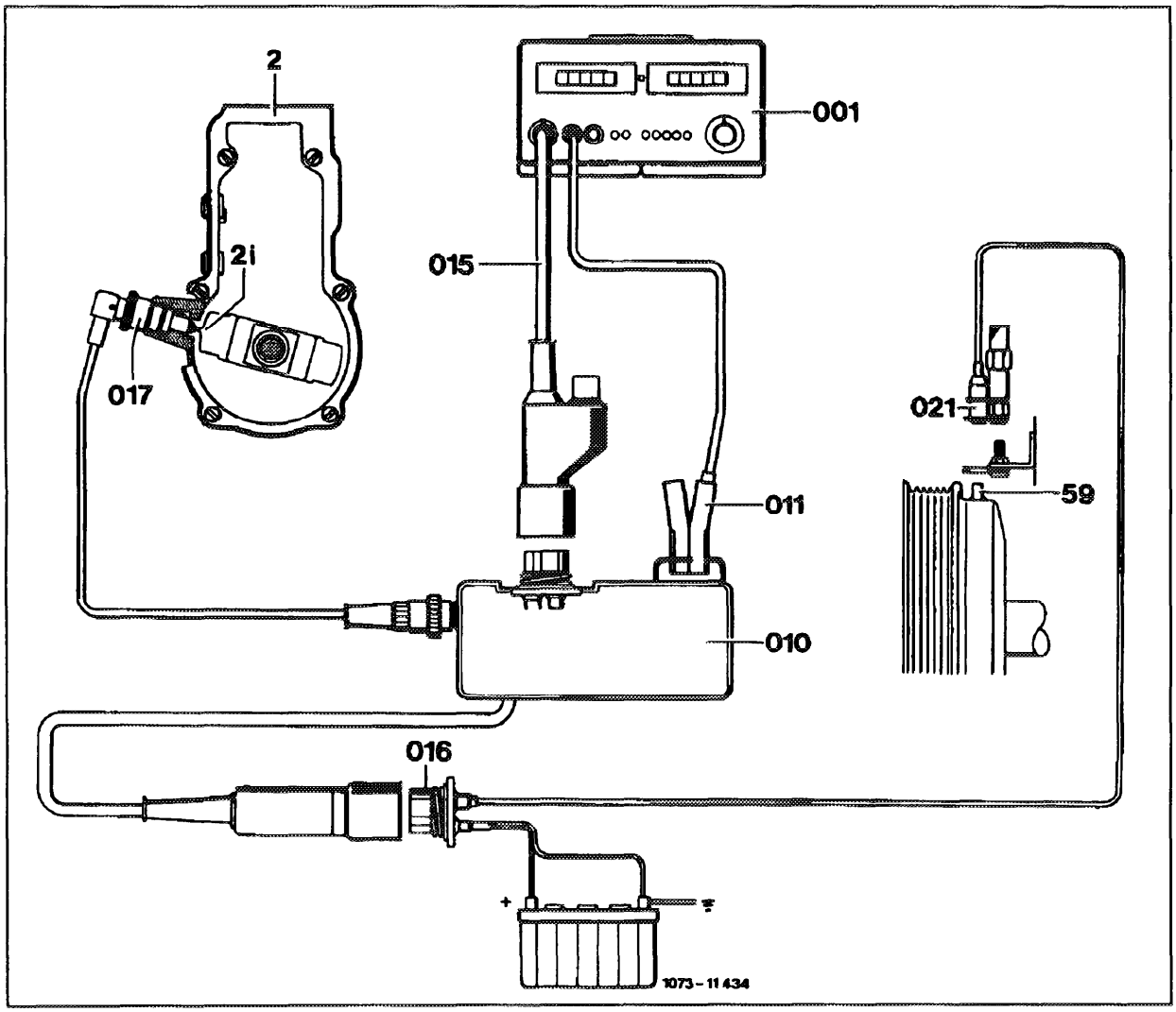
Equipment
For use with adapter

Digital testers	e.g. Bosch, ETD 019.00
	e.g. Hartmann & Braun, EOMT 3

Equipment
For use without adapter

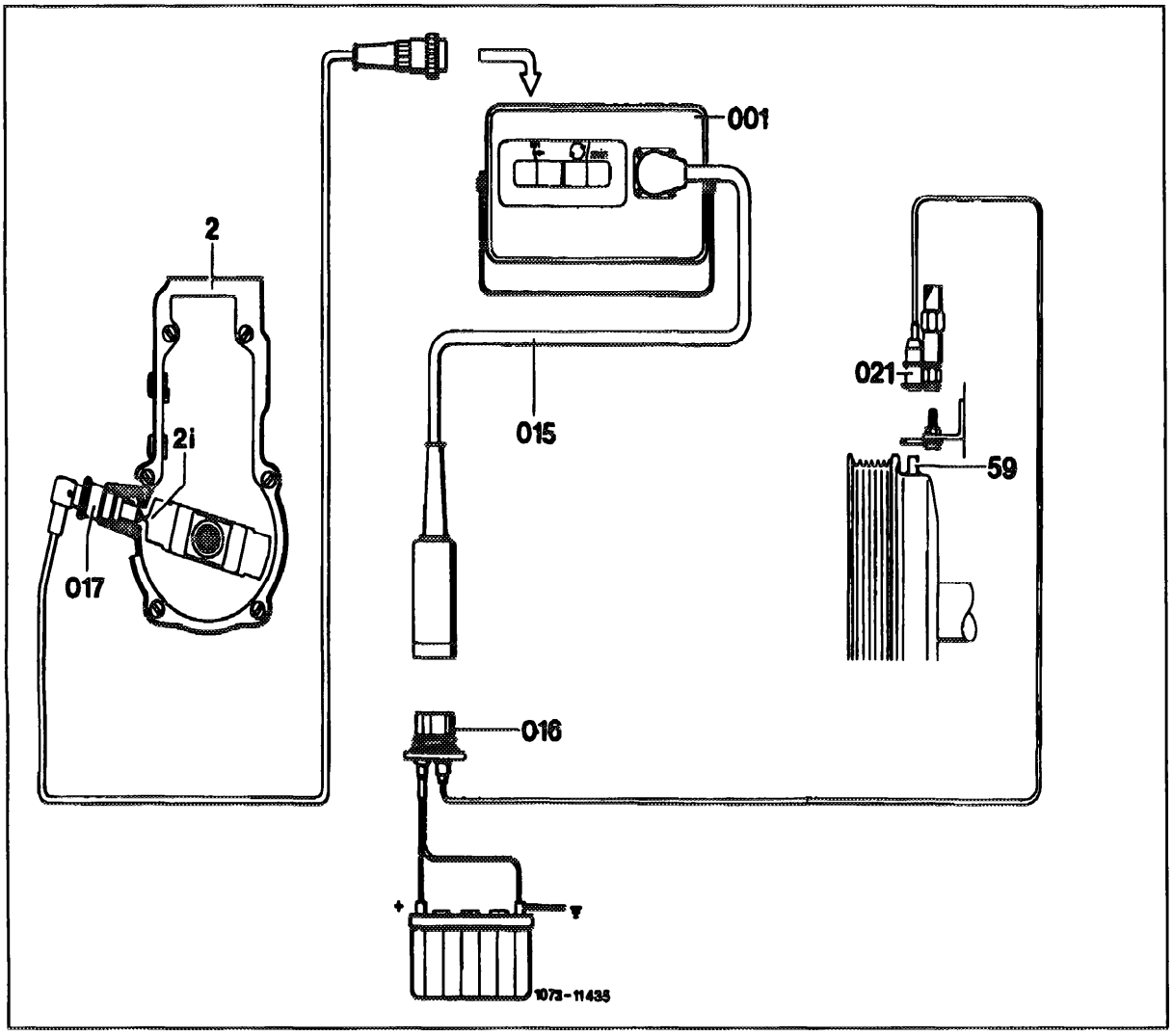
Digital testers (Diesel tester)	e.g. Bosch, ETD 019.00
	e.g. Sun, DIT 9000
	e.g. AVL, Diesel Tester 875

Connection diagram for available testers for use with adapter, e.g. Bosch MOT 001.03, Hartmann & Braun, EOMT 3



)01	Digital tester
010	Adapter
011	Trigger clamp
015	Test cable with connector
016	Diagnostic socket
017	RI-transmitter
021	TDC-impulse transmitter
2	Governor
2i	RI-transmitter pin
59	TDC-transmitter

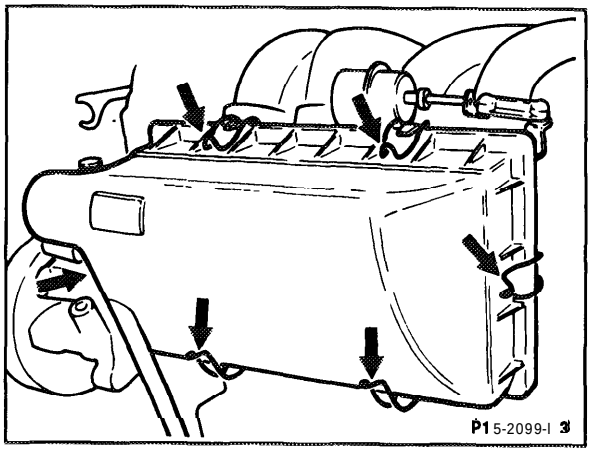
Connection diagram for testers for use without adapter,
e.g. Bosch ETD 019.00, SUN DIT 9000, AVL Diesel-Tester 875



001	Digital tester	2	Governor
015	Test cable with connector	2i	RI-transmitter pin
016	Diagnostic socket	59	TDC-transmitter
017	RI-transmitter		
021	TDC-impulse transmitter		

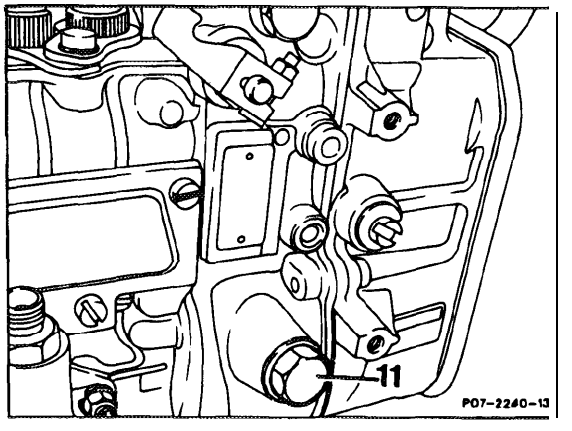
Checking

Remove air cleaner cover (arrows).

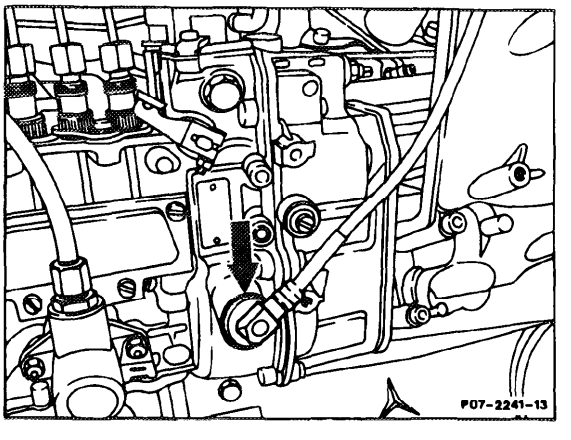


Remove plug (11) on governor.

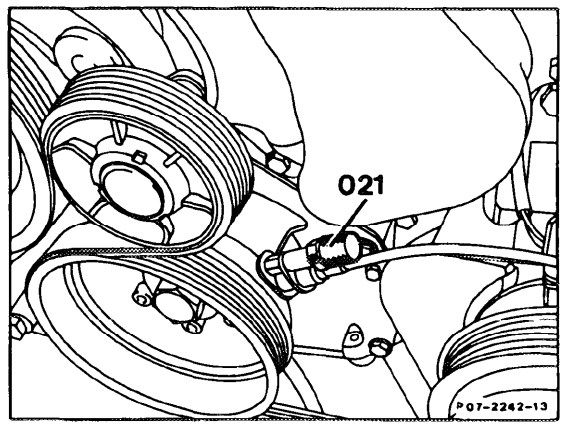
Note: Catch escaping oil.



Connect digital tester according to connection diagram.



017 RI-transmitter on governor (arrow) (injection pump)



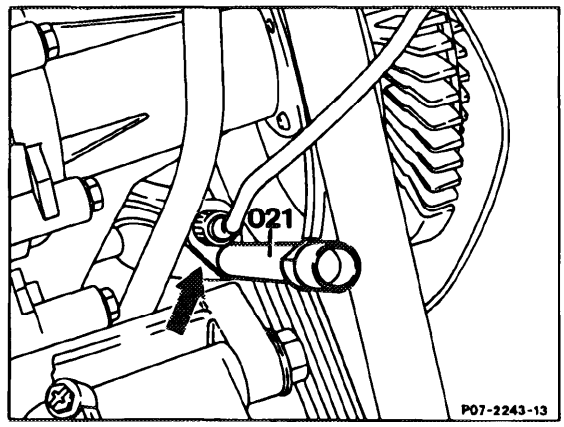
021 TDC-impulse transmitter on holder
Engine 601

Read RI-value (indirect injection timing) at idle speed on digital tester.

RI-nominal value:
15° ATDC on 1984-89 models;
14° + 0.5° ATDC on 1990 and later models.

Perform leak test with engine running.

Check engine oil level and correct, if required.



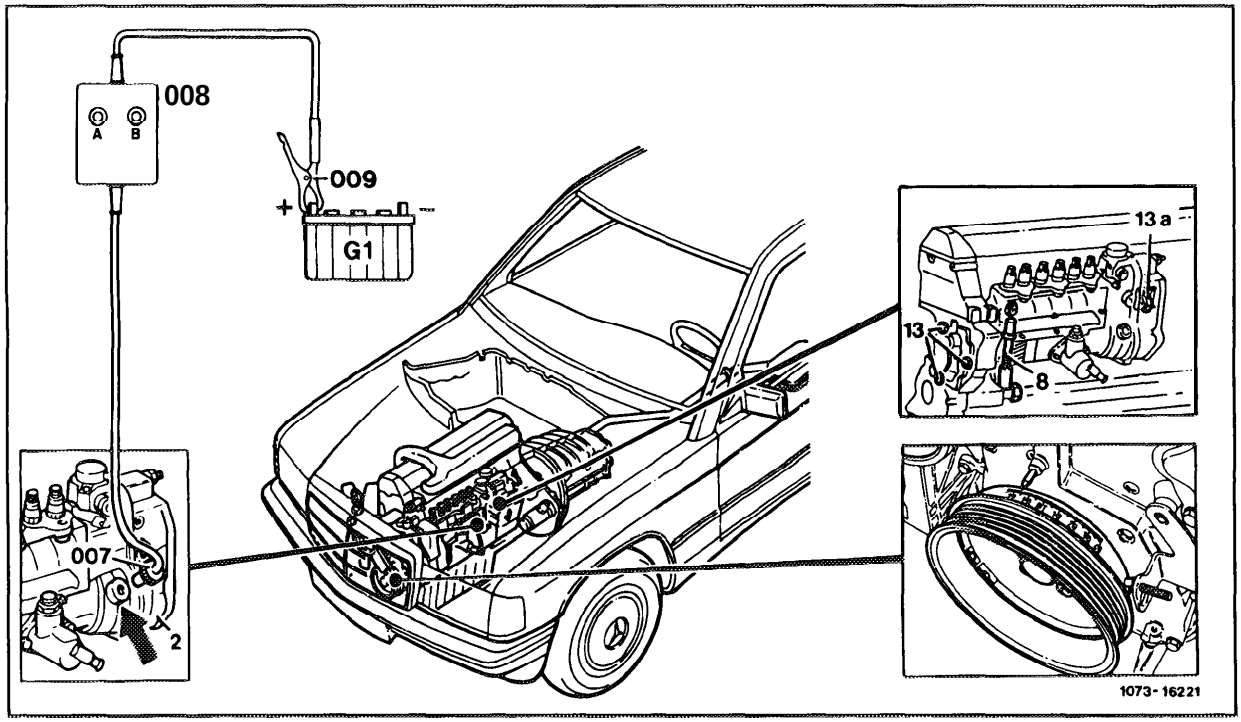
021 TDC-impulse transmitter on holder (arrow)
Engines 602, 603

Engine 601 602 603

Test values

Model year	Indirect injection timing (after TDC)	
	RI (reference impulse) checking value	RI (reference impulse) adjusting value
1984-89	15" ± 1°	15"
starting 1990	14° + 0.5°	14° + 0.5°

Adjusting injection timing (position sensor RIV method) - after checking (0760.2)



Turn crankshaft in direction of rotation to ..... value in chart

Injection pump mounting bolts (13 and 13A) at flange and bracket ..... loosen, 20-25 Nm.

Indicator (008) and clamp (009) ..... connect to B +

Pivot injection pump by turning injection timing adjustment screw (8) ..... both lamps, A and B, must light up in indicator (008)

Adjustment screw direction
Right = Retard injection timing
Left = Advance injection timing

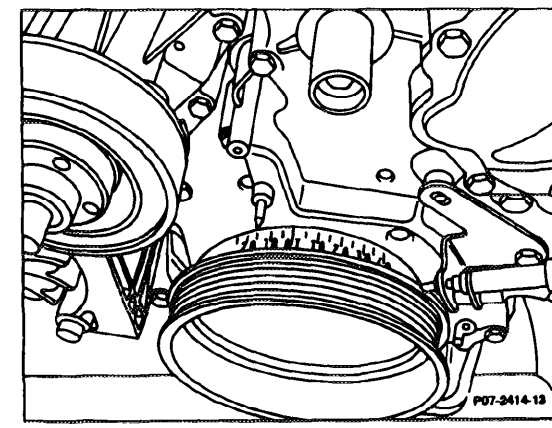
RI (reference impulse) adjusting value: refer to chart

Position sensor (007)	remove
Plug (arrow)	screw in
Regulating linkage	check, adjust if necessary (repair instruction 30-300)
Leak check with running engine	perform
Engine oil level	check, correct if necessary

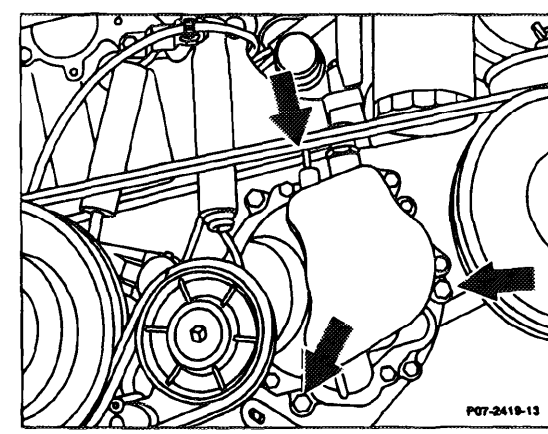
Note:
Check injection timing before adjusting (0760.2)

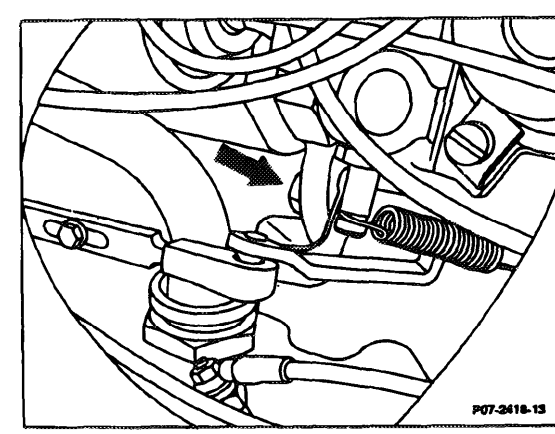
Adjusting

1. Turn crankshaft in direction of rotation to 15" ATDC on 1984-89 models; 14° ATDC on 1990 and later models.



2. Loosen mounting bolts (arrows) at injection pump flange and bracket (arrow).

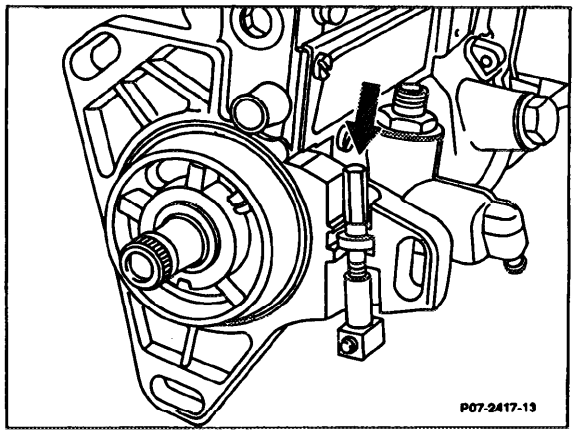




Bracket mounting bolt

3. Connect indicator (008) and clamp (009)to battery positive terminal.

4. Pivot injection pump by turning adjusting screw until both lamps A and B light.



Adjustment screw direction

Right = Retard injection timing
Left = Advance injection timing

RI nominal value:
15° ATDC on 1984-89 models;
14° + 0.5° ATDC on 1990 and later models.

Note:
If the adjustment range is inadequate, the pump must be repositioned. Refer to SMS, Job No. 07.1-200, Injection pump removal and installation.

5. Torque mounting bolts on injection pump flange and bracket to 20-25 Nm.

6. Remove position transmitter.

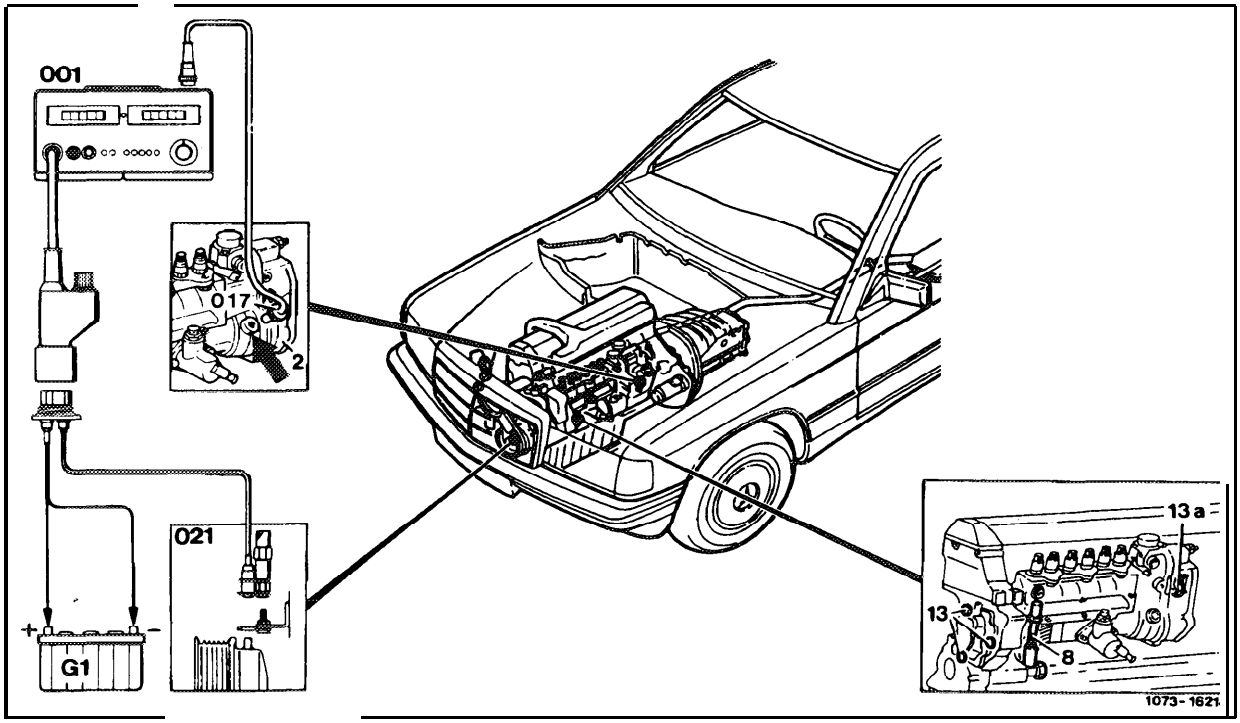
7. Install screw in plug, torque to 30-35 Nm.

8. Check regulating linkage, and adjust if necessary (SMS, Job No. 30-300).

9. Check for leaks with engine running.

10. Check engine oil level, and correct if necessary.

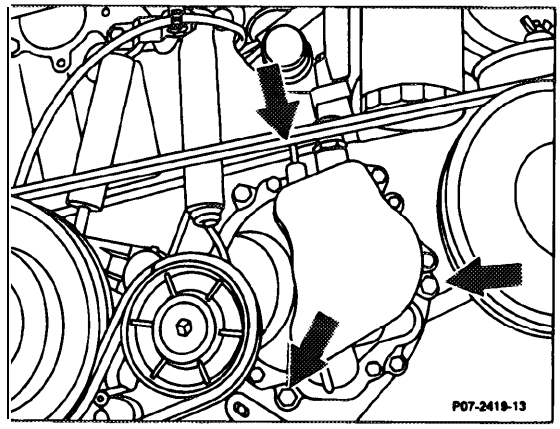
Adjusting injection timing using digital tester (RIV method) - after checking (0760.2)

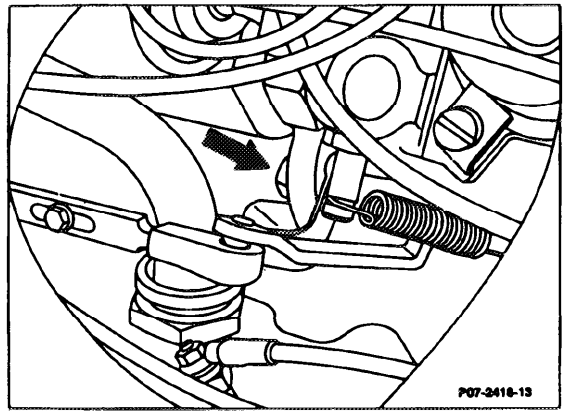


Injection pump mounting bolts (13 and 13A) at flange and bracket	loosen
Engine	run at idle speed
RI value (indirect injection timing)	adjust by turning injection timing adjustment screw (8)
Adjustment screw (8) direction Right = Retard injection timing Left = Advance injection timing	RI (reference impulse) adjusting value: refer to chart
Engine	shut off
Injection pump mounting bolts (13 and 13A) at flange and bracket	torque to 20-25 Nm.
Tester	disconnect
Plug (arrow) on governor	screw in and torque to 30-35 Nm
Regulating linkage	check, adjust if necessary (repair instruction SMS, Job No. 30-300)
Leak check with running engine	perform
Engine oil level	check, correct if necessary

Note:
Check injection timing before adjusting (0760.2)

1. Loosen mounting bolts (arrows) at injection pump flange and bracket (arrow)

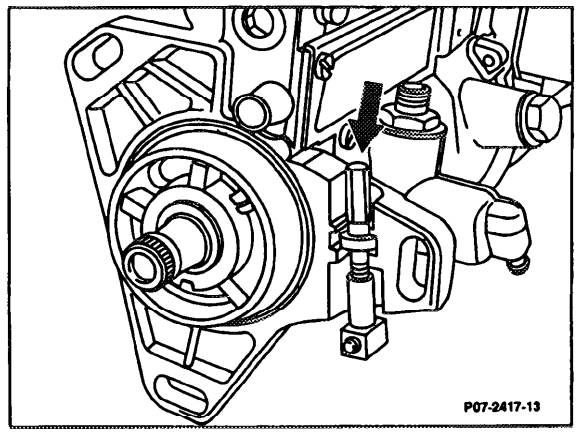




Bracket mounting bolt

2. Run engine at idle speed.

3. Adjust RI value (indirect injection timing) by turning adjusting screw.



WI nominal value:
15° ATDC on 1984-89 models;
14° + 0.5° ATDC on 1990 and later models.

Adjustment screw direction
Right = Retard injection timing
Left = Advance injection timing

Note:
If the adjustment range is inadequate, the pump must be repositioned. Refer to SMS, Job No. 07.1-200, Injection pump removal and installation.

4. Turn engine off.

5. Disconnect tester.

6. Install screw in plug on governor and torque to 30-35 Nm.

7. Torque mounting bolts on injection pump flange and bracket to 20-25 Nm.

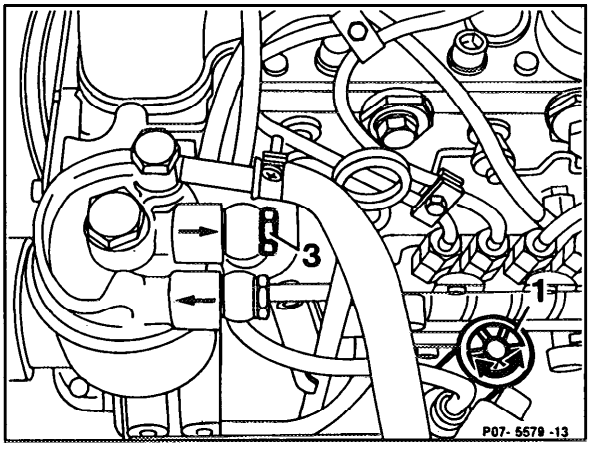
8. Check regulating linkage, and adjust if necessary (SMS, Job No. 30-300).

9. Check for leaks with engine running.

10. Check engine oil level, and correct if necessary.

Diesel engines

Loosen mounting screw (1) and remove housing with filter element in downward direction.



Engine 616, 617

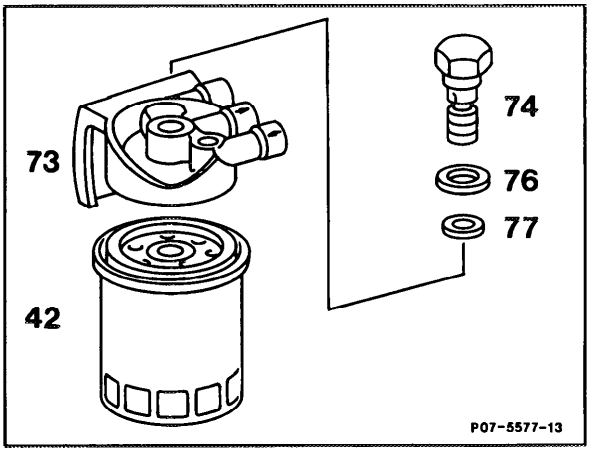
Install new filter element with housing (3) and gasket (4).

Bleeding fuel system

Engines 616, 617

Fuel filter

Loosen hollow bolt (3, upper illustration) and using hand pump, pump manually until fuel flows out free of bubbles. Retighten hollow bolt.



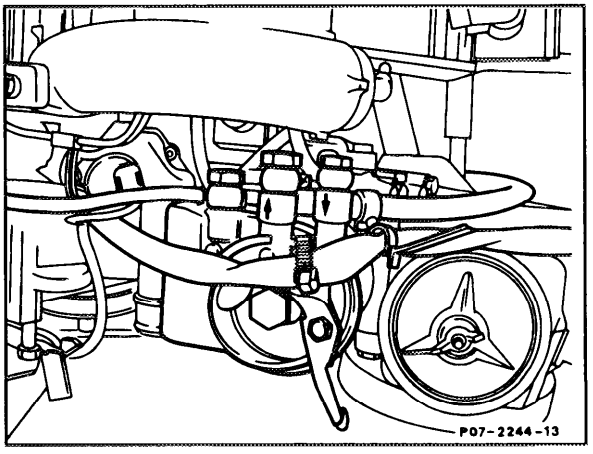
Bleeding injection pump

Pump manually until overflow valve on injection pump opens with an audible buzzing sound.

Engines 601, 602, 603

When starting, injection system will bleed automatically.

Run engine and check for leaks.

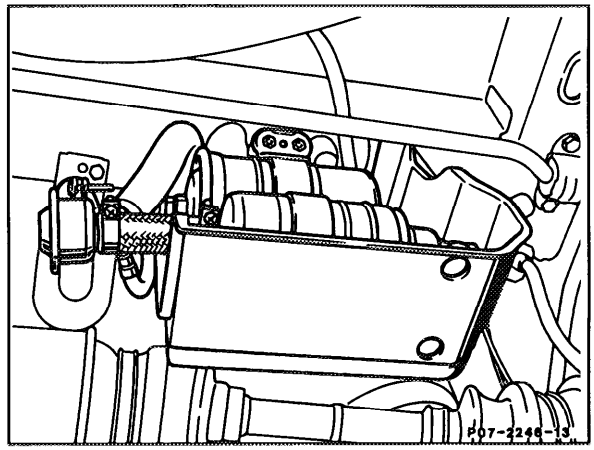


Engine 601, 602, 603

Engine 102 **110 116 117**
with CIS

Remove protective cover.

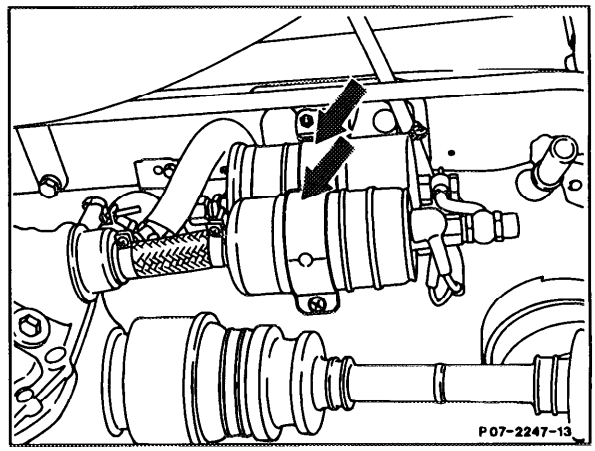
Disconnect fuel lines.



Loosen mounting screws (arrows) and remove filter.

Unscrew fitting from old filter and attach to new filter with new seal ring.

Install new fuel filter in flow direction.with plastic sleeve. Sleeve should project on both sides of the holder since contact corrosion may occur if there is direct contact with the holder. Replace plastic sleeve, if necessary.



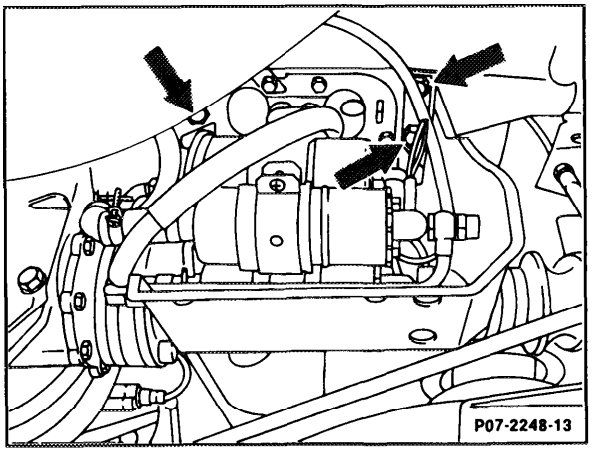
Connect steel line to filter.

Retighten mounting screws.

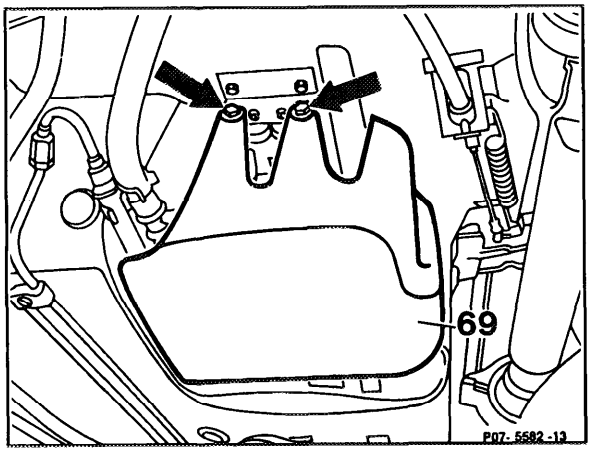
Check for leaks.

Engine102103104116117119 with CIS-E

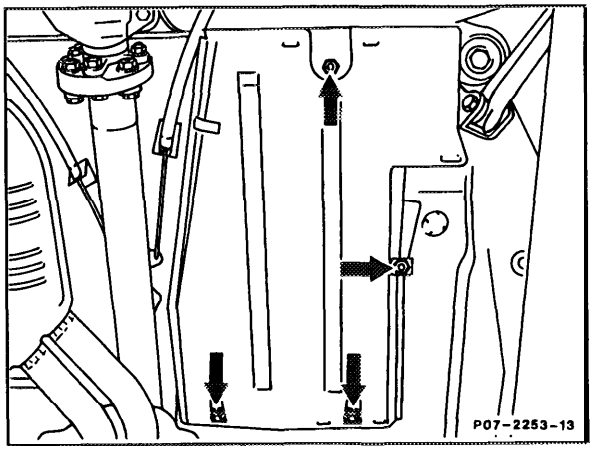
Remove protective cover by removing mounting bolts (arrows). On model 201 (2nd version) pull out expanding rivets.



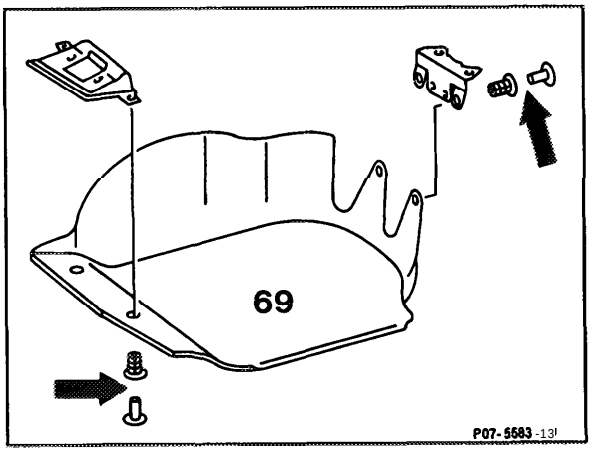
Model 107, 126



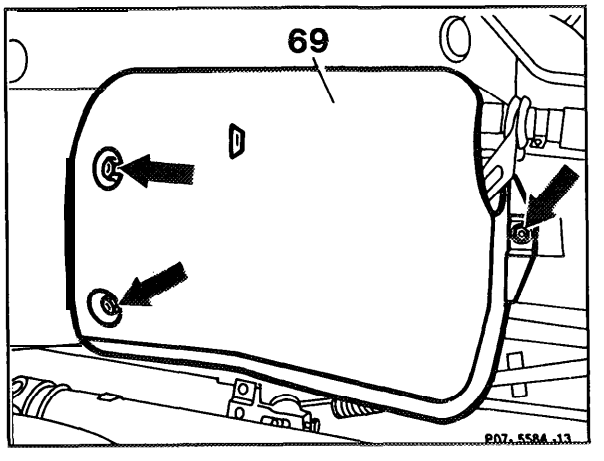
Model 201 1st version



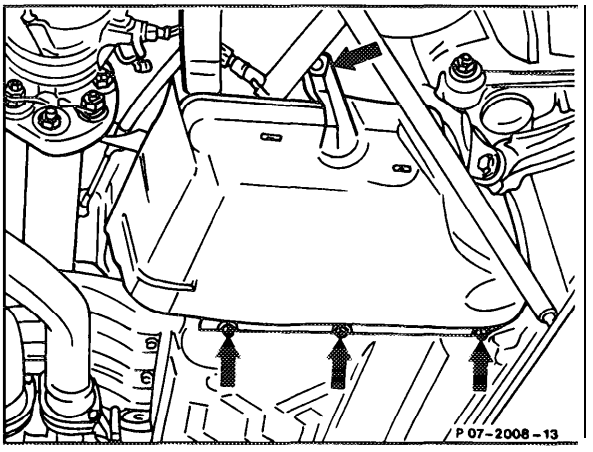
Model 124



Model 201 2nd version



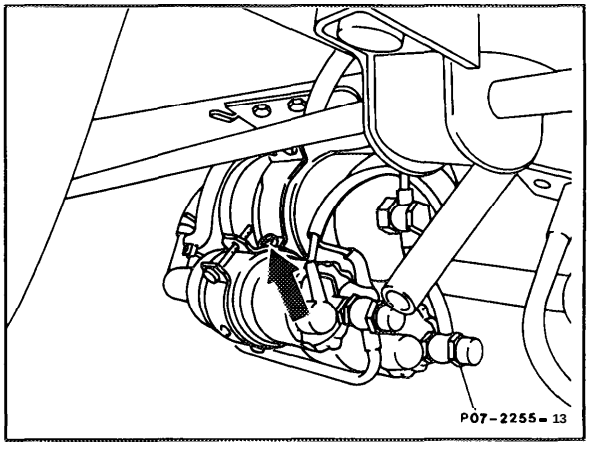
Model 201 (3rd version as of 08.1985)



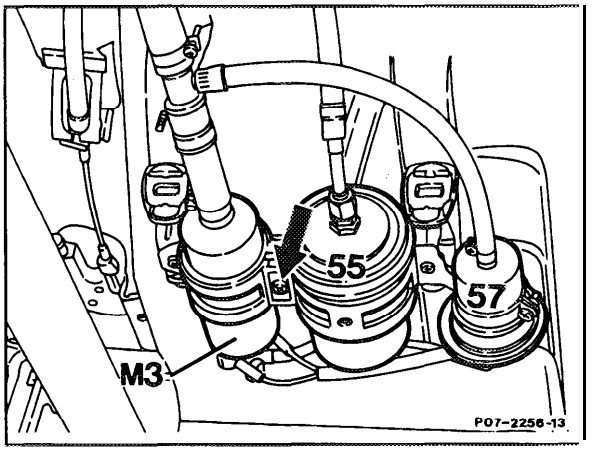
Model 129

Disconnect fuel line and fuel hose.
Loosen mounting screws (arrow) pivot holder down and remove filter.

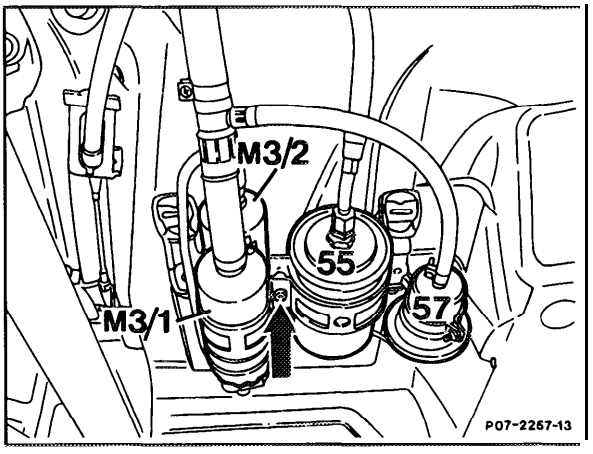
Install new fuel filter and plastic sleeve in flow direction. Sleeve should project on both sides of the holder since contact corrosion may occur if there is direct contact with the holder. Replace plastic sleeve, if necessary.
On model 124, an additional plastic sleeve is required.
Install protective cover.



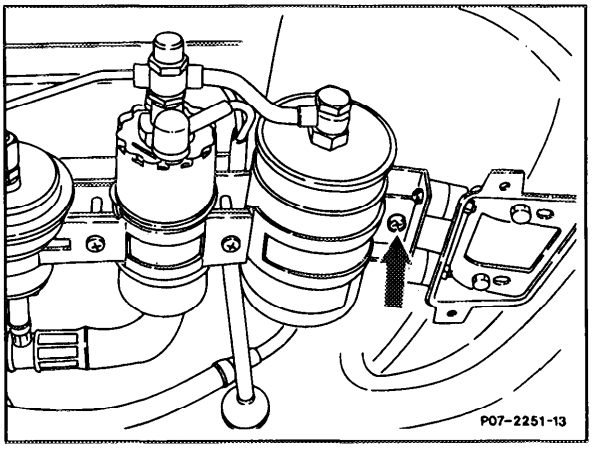
Model 107, 126



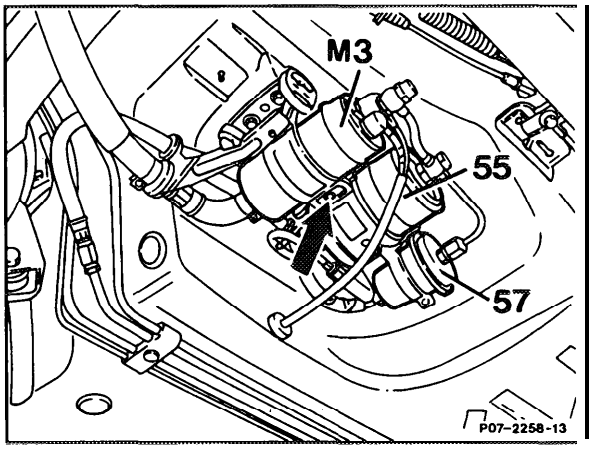
Model 124



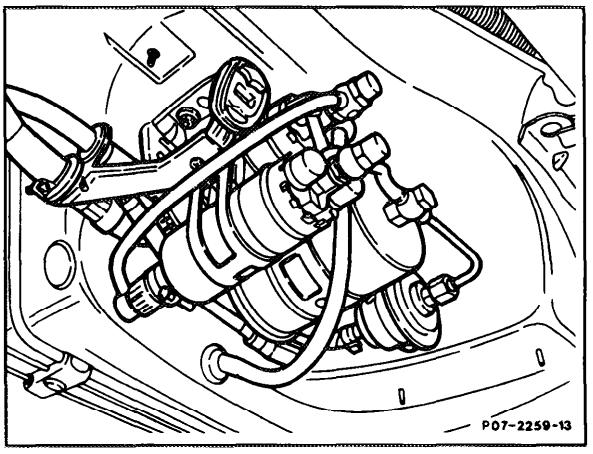
Model 124.026/030/050 as of 11. 1986, and 124.230
Model 129



Model 201 1st version



Model 201 2nd version



Model 201.029/034 starting 10.1986

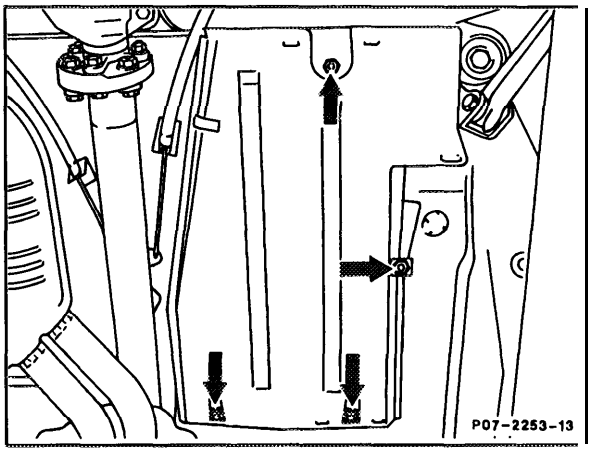
Engine 104 119 120
with LH

- Remove protective cover by removing screws (arrows).

- Disconnect fuel lines and fuel hose from fuel filter (55).

- Loosen clamping screw (arrow) and remove fuel filter towards rear.

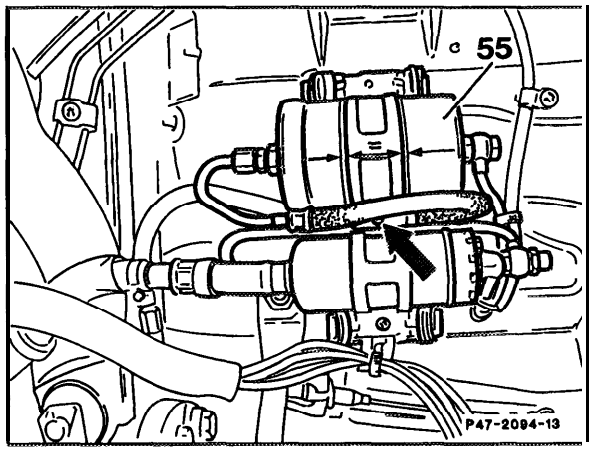
- Install new fuel filter with plastic sleeve so that sleeve extends on both sides of holder since contact corrosion may occur if there is direct contact with the holder.



Model 124

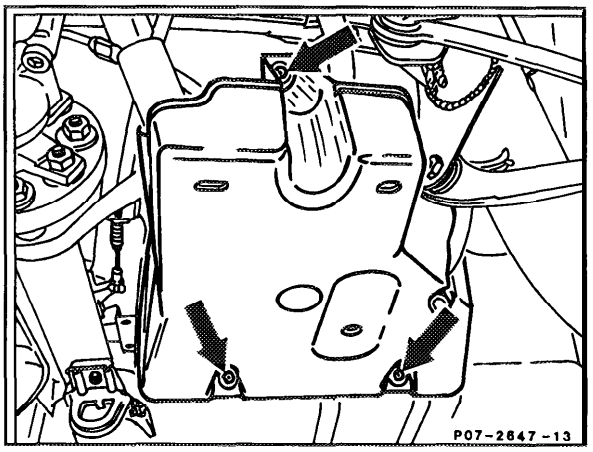
- Run engine briefly to check connections for leakage.

- Reinstall protective cover.

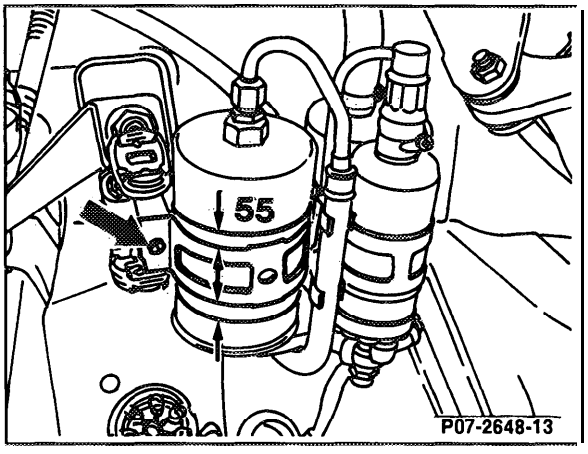


Model 124

Model 140

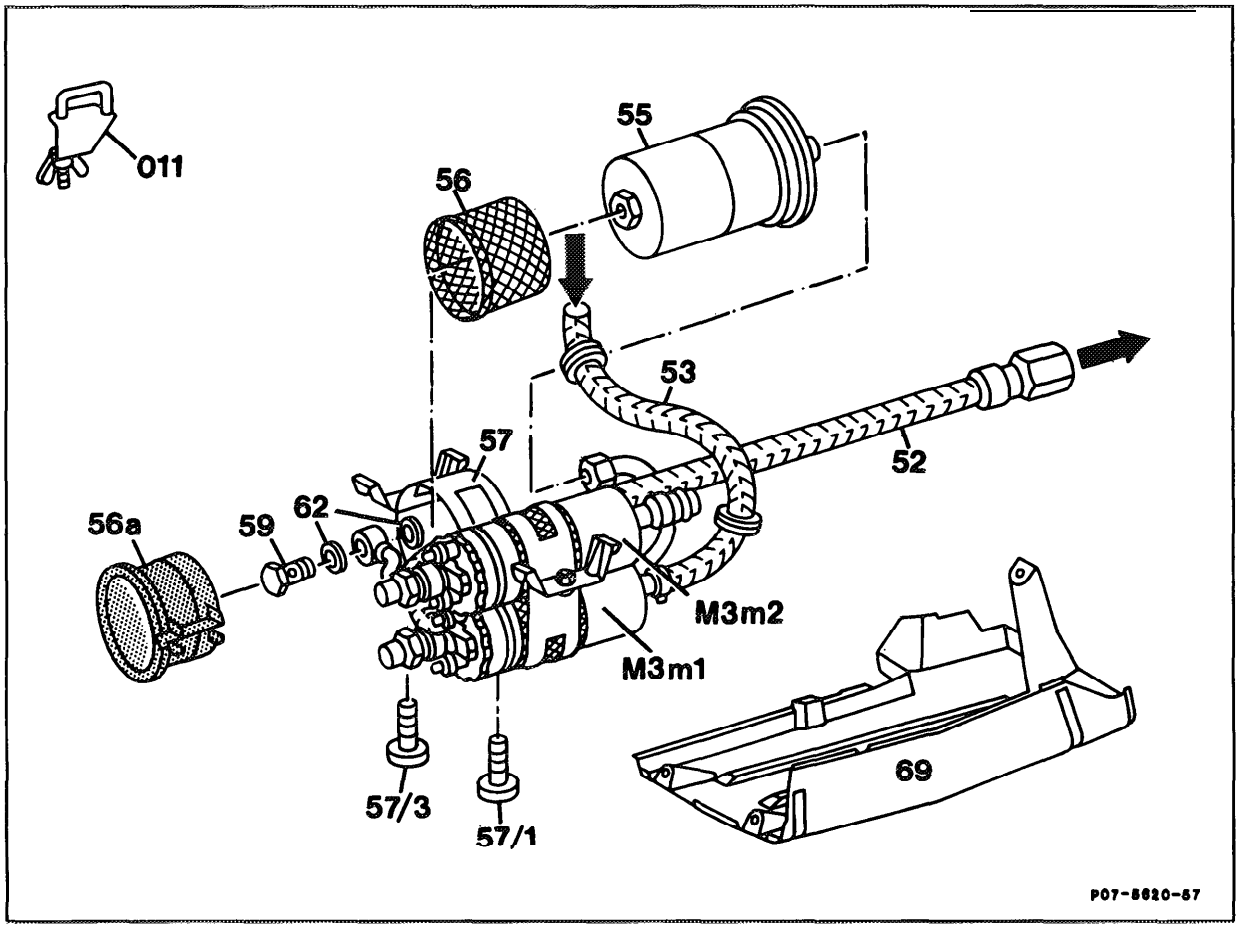


Model 140



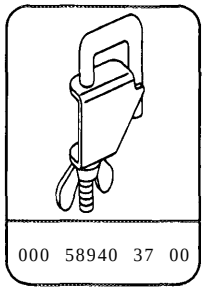
Engine 104
with HFM-SFI

> ⚠ **WARNING!**
> Apply parking brake before performing work with engine running.
> Place automatic transmission selector lever in Park position.



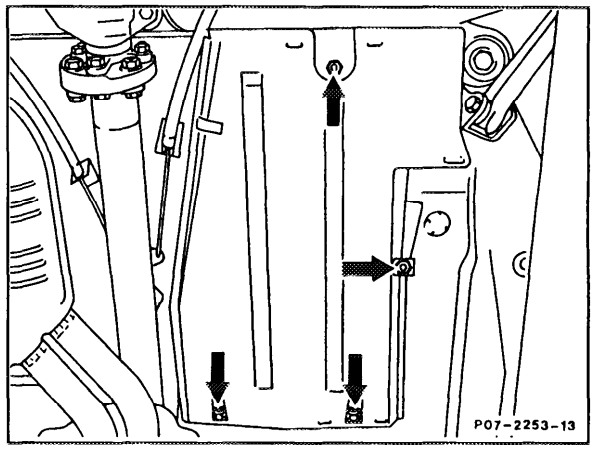
Shown on fuel pump assembly with two fuel pumps.

Special tools



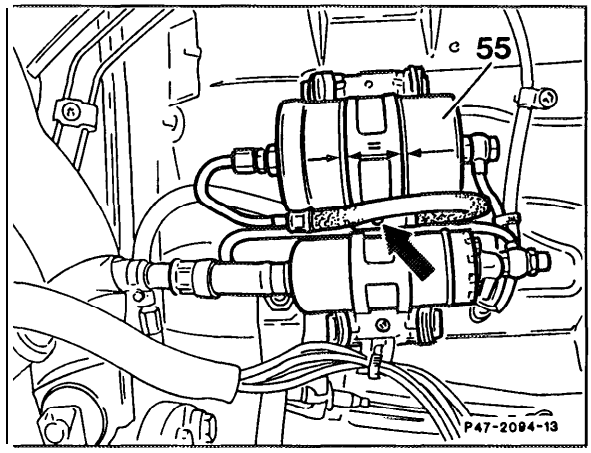
⚠WARNING!
Observe fuel-related safety precautions.

- Release fuel tank pressure by opening filler cap.
- Disconnect battery negative cable and cover battery negative terminal.
- Remove protective cover by removing screws (arrows).
- Disconnect fuel lines and fuel hose from fuel filter (55).



Model 124

- Loosen clamping screw (arrow) and remove fuel filter towards rear.
- Install new fuel filter with plastic sleeve so that sleeve extends on both sides of holder since contact corrosion may occur if there is direct contact with the holder.
- Run engine briefly to check connections for leakage.
- Reinstall protective cover.



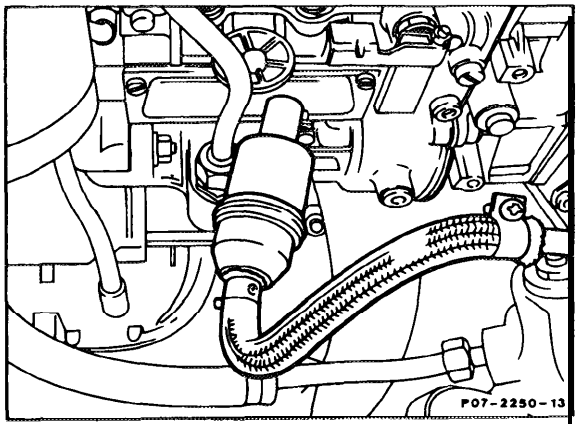
Model 124

Replacing fuel prefilter

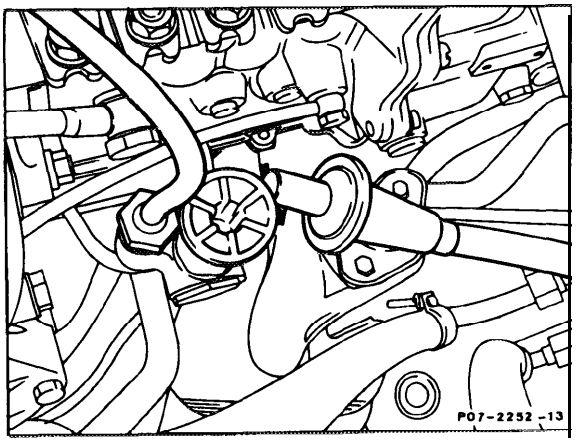
0781

Diesel engines

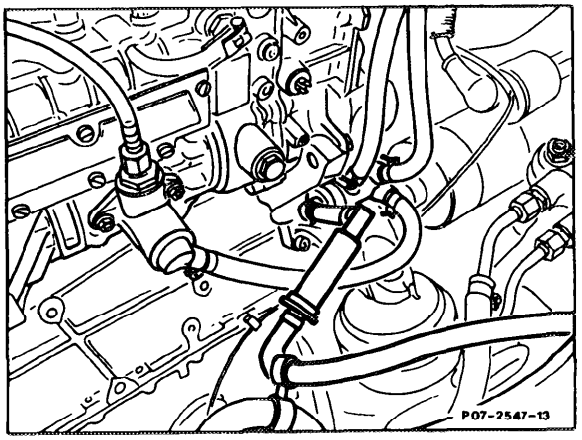
Replace fuel prefilter. Run engine and check for leaks.



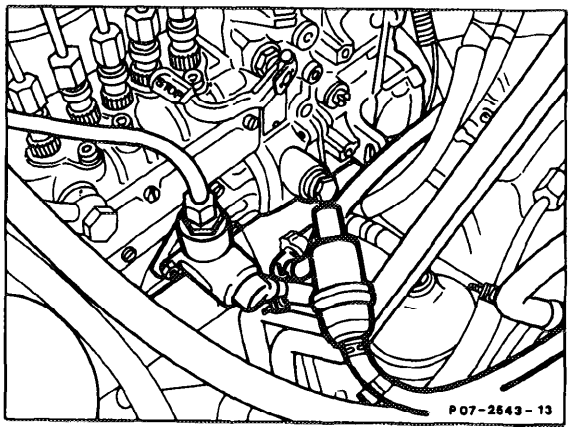
Engine 616, 617



Engine 616, 617



Engine 601.91, 602.91



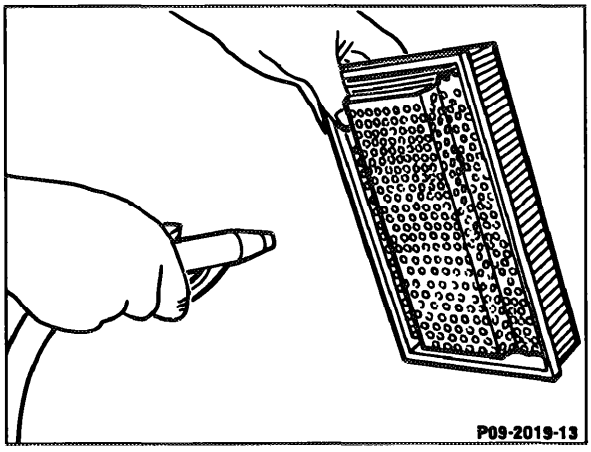
Engine 602.96, 603.96, 603.97

Cleaning metal-reinforced air filter element

Diesel engines

Note: Under severe operating conditions, such as poor road conditions resulting in substantial dust deposits in the air cleaner, the air filter element is to be cleaned at every maintenance service. **This applies only to filter elements reinforced with perforated metal.** Filters without the perforated metal reinforcement should be **replaced, not cleaned.**

Cleaning



Using no more than 5 bar pressure, blow compressed air through the element from the reinforced side, holding the nozzle about 20 cm away from the perforated metal.

Caution! Never blow directly into the folds of the filter since this can tear the element resulting in unfiltered air entering the engine. Do not wash, beat out, or oil the filter element.

Clean the air filter housing and cover.

Check whether filter element sealing compound is damaged and replace element, if necessary.

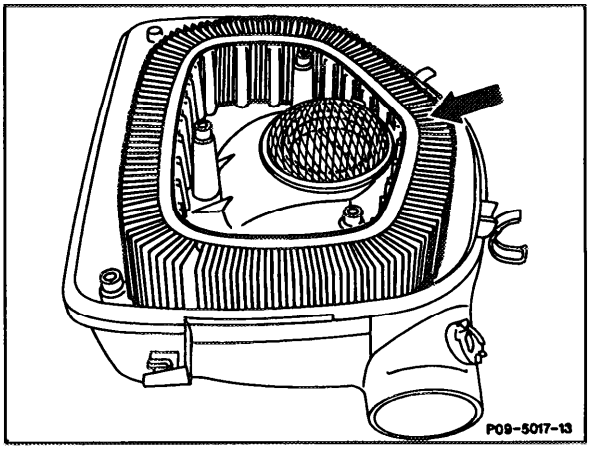
Check whether air filter cover seal is damaged and replace, if required.

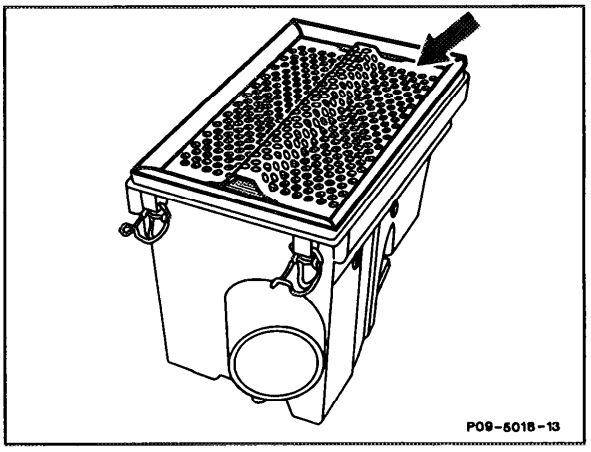
Carefully install air filter element and note that the rubber seals are installed correctly.

All engines
except engines 116 117 with secondary air injection pump

All engines except engine 120

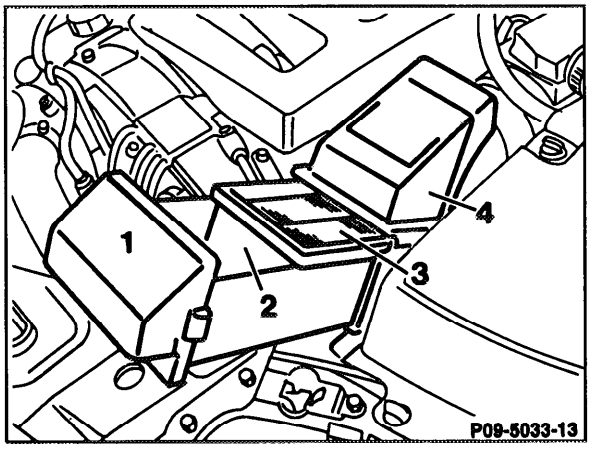
- Remove air filter element.
- Clean out air cleaner housing and cover.
- Inspect air cleaner cover seal and replace if damaged.
- Carefully insert new air filter element and note correct location of rubber seals.





Engine 120

- Pull out slide (1). Remove air cleaner (2).and remove air filter element (3).
- Clean air cleaner housing (2).
- Press filter element into air cleaner (2).
- Push air cleaner in until it contacts stop.
- Push slide (1) in.



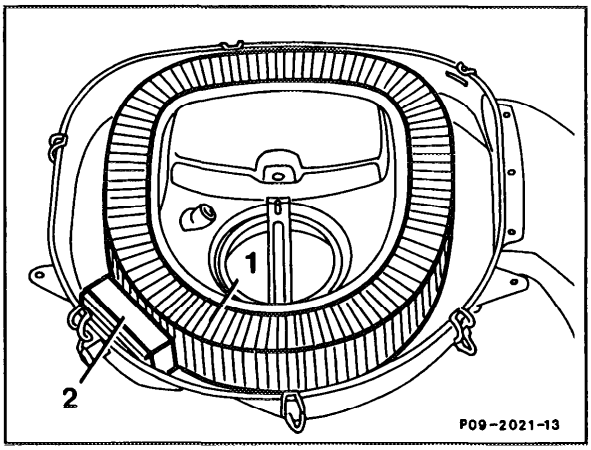
Engine 116 117 **with air pump**

Remove air filter element (1) and (2)..

Clean out air filter housing and air filter cover.

Inspect filter cover seal and replace if damaged.

Carefully insert new air filter element and note correct location of rubber seals.

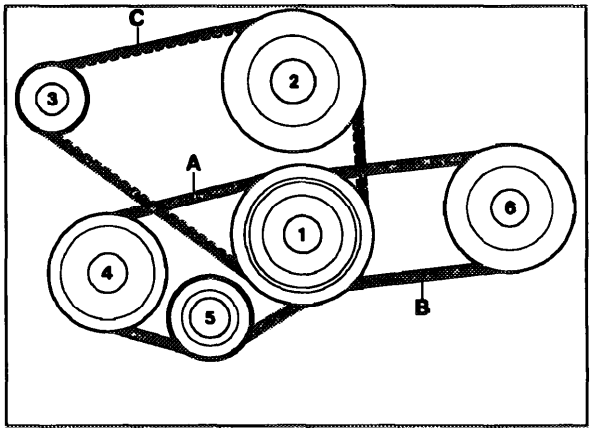


1 Engine filter element
2 Air pump filter element

Checking condition and tension of V-belts

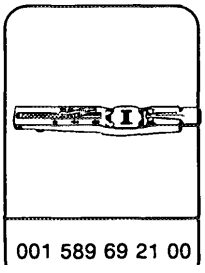
Engine 102
with multiple belt drive

V-belt	Location	Tension (KG) New V-belt	Tension (KG) Used V-belt
A	Air conditioning compressor	50	40-45
B	Power steering pump	50	40-45
C	Generator--coolant pump	30	20-25



1 Crankshaft
2 Coolant pump
3 Generator
4 A/C compressor
5 Tensioning pulley
6 Power steering pump
Belt A A/C compressor
Belt B Power steering pump
Belt C Coolant pump - generator

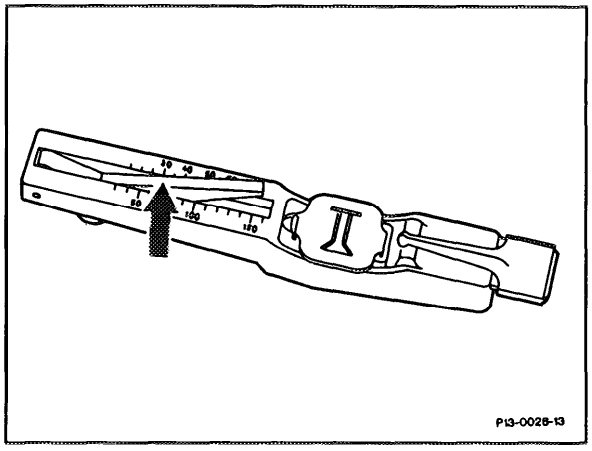
Special tools



Note

Refer to operating instructions for use of measuring instrument.

The specified tensioning values refer to the KG scales on the instrument (arrow).



Checking condition of V-belt

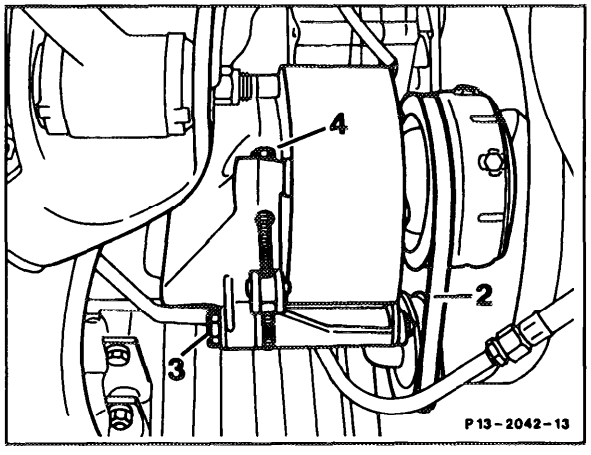
- Replace cracked or worn V-belts.

Tensioning

- Before tensioning, remove lower engine compartment panel.

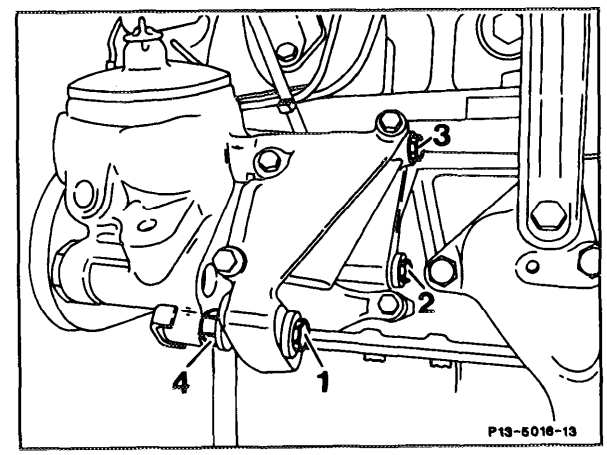
V-belt A Air conditioning compressor

- Loosen bolt (3).
- Tension V-belt with adjusting screw (4).
- Tighten bolt (3).



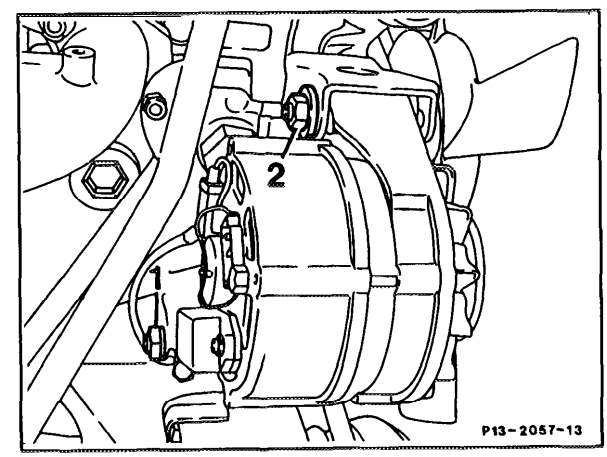
V-belt B Power steering pump

- Loosen bolts (1, 2, and 3).
- Tension V-belt with adjustment gear (4).
- Tighten bolts (1, 2, and 3).

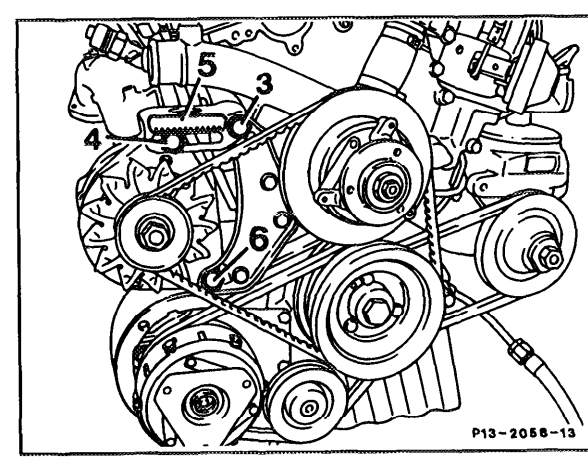


V-belt C Generator--Coolant pump

- Loosen nuts (1 and 2) as well as bolt (3).



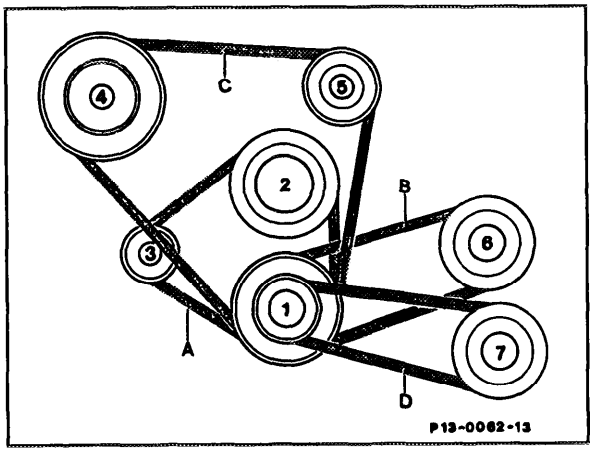
- Tension V-belt with adjusting screw (4).
- Tighten nuts (1 and 2), as well bolt (3).
- Install lower engine compartment panel.



Checking condition and tension of V-belts

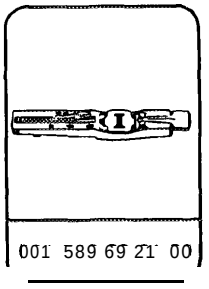
Engine 110

V-belt	Location	Tension (KG) New V-belt	Tension (KG) Used V-belt
A	Generator--coolant pump	30	20-25
B	Power steering pump	50	40-45
C	Air conditioning compressor	50	40-45
D	Secondary air injection pump	30	20-25



1 Crankshaft
2 Coolant pump
3 Generator
4 A/C compressor
5 Tensioning pulley
6 Power steering pump
7 Secondary air injection pump

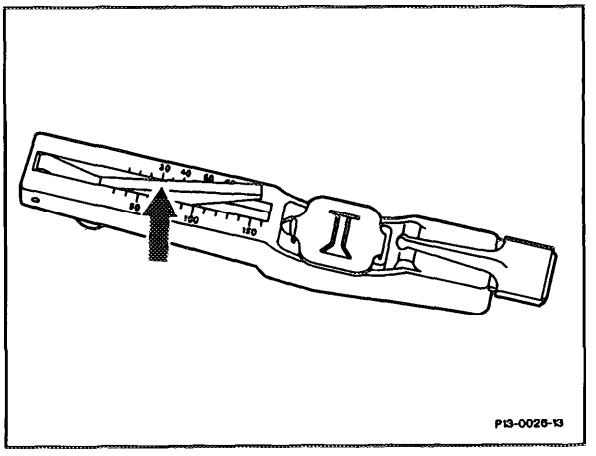
Special tools



Note

Refer to operating instructions for use of measuring instrument.

The specified tensioning values refer to the KG scales on the instrument (arrow).



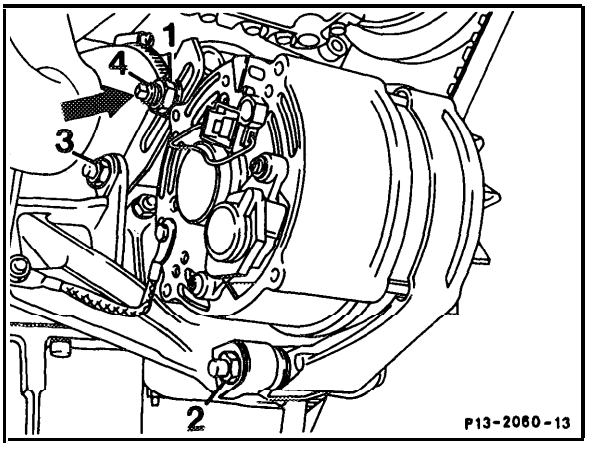
Checking condition of V-belt

- Replace cracked or worn V-belts.

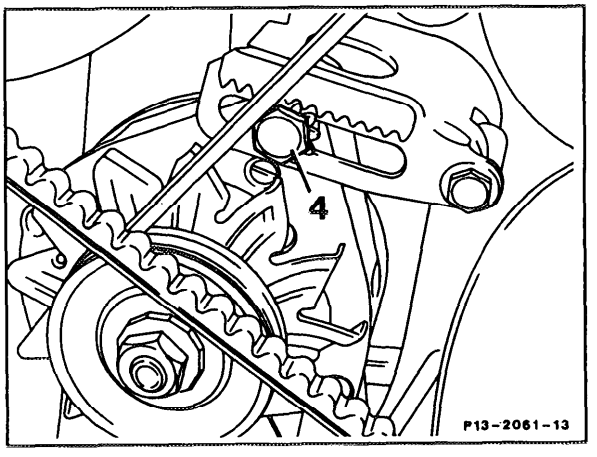
Tensioning

V-belt A Generator--coolant pump

- Loosen nuts (1, **2** and 3).



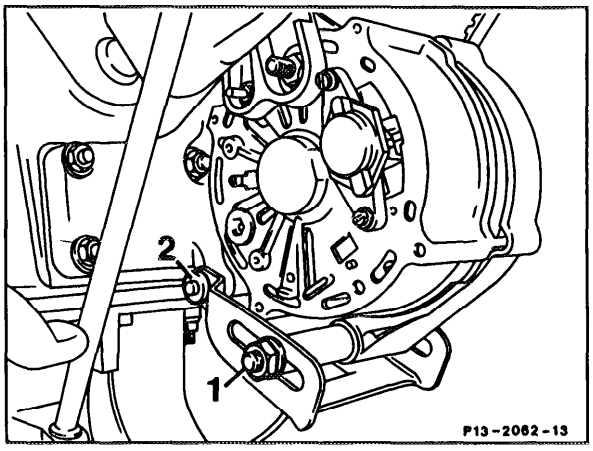
- Tension V-belt at hexagon or on engines with air conditioning compressor at 6 mm square of adjustment bolt (4).
- Tighten nuts (1, 2 and 3).



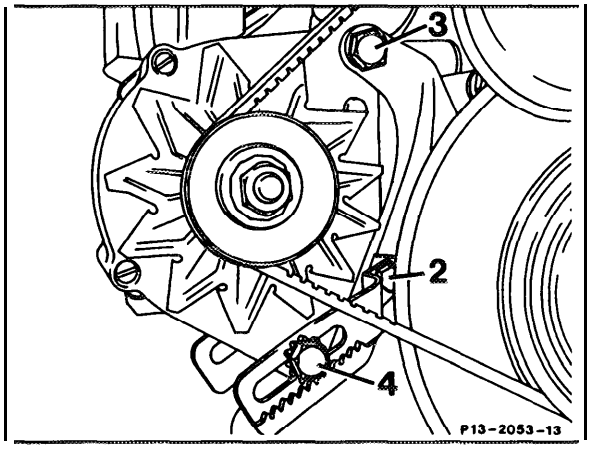
V-belt A Generator 80 A--coolant pump

- Loosen nut (1).

Note:
Bolt (2) is installed from the rear of the generator on vehicles built starting July 1984.

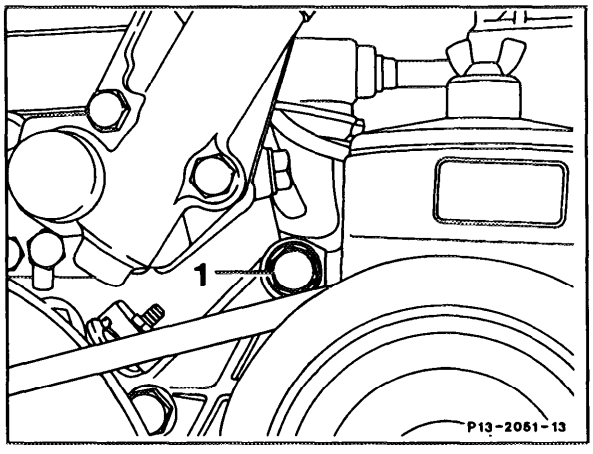


- On vehicle built up to July 1984, loosen bolt (2) from underneath the engine.
- On vehicle built starting July 1984, loosen bolt (2) from back of generator.
- Loosen bolt (3).
- Tension V-belt on hex of adjusting screw (4).
- 'Tighten nut (1) and bolt (3).
- Tighten bolt (2).

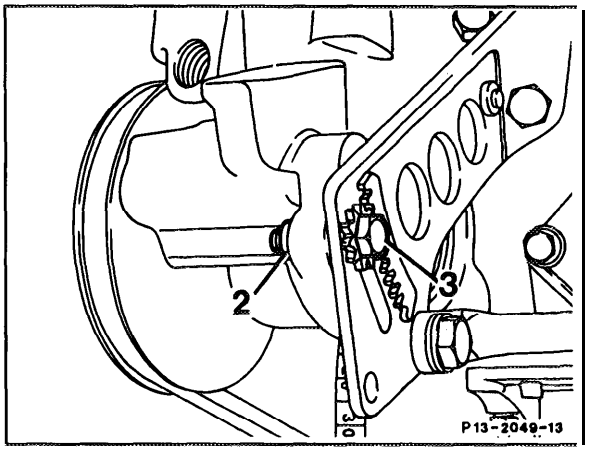


V-belt B Power steering pump

- Loosen bolt (1) on face of power steering pump.

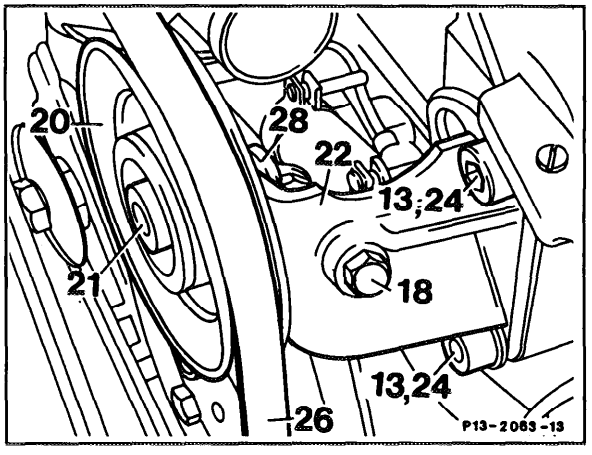


- Loosen nut (2).
- Adjust V-belt with adjustment bolt (3).
- Tighten nut (2) and bolt (1).



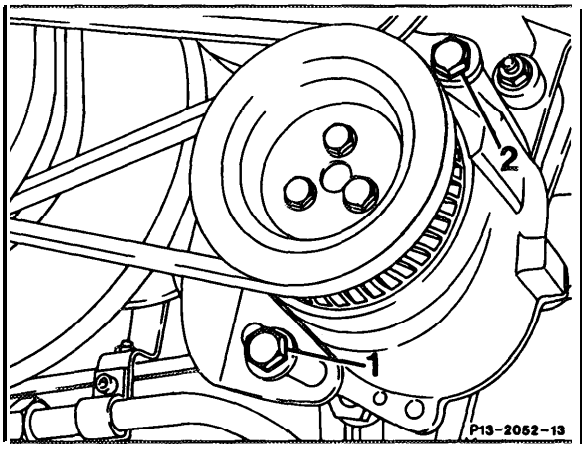
V-belt C Air conditioning compressor

- Loosen necked down bolt (21).
- Adjust V-belt with adjusting bolt (18).
- Tighten necked down bolt (21) to 25 Nm.



V-belt D Secondary air injection pump

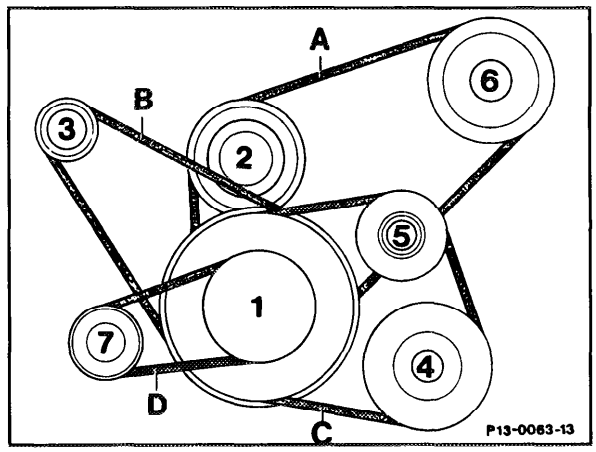
- Loosen mounting bolts (1 and 2).
- Adjust V-belt by swiveling secondary air injection pump outward.
- Tighten fastening bolts (1 and 2).



Engine 116 117

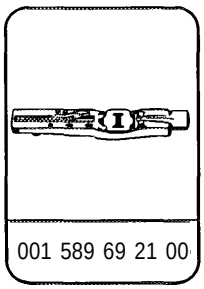
V-belt	Location	Tension (KG) New V-belt	Tension (KG) Used V-belt
A	Coolant pump - power steering pump[1)]	30	20-25
B	Generator	35	30-35
C	Air conditioning compressor	50	40-45
D	Secondary air injection pump	30	20-25

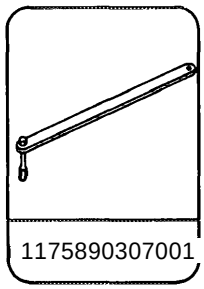
1) Double V-belt



1 Crankshaft
2 Coolant pump
3 Generator
4 A/C compressor
5 Tensioning pulley
6 Power steering pump
7 Secondary air injection pump

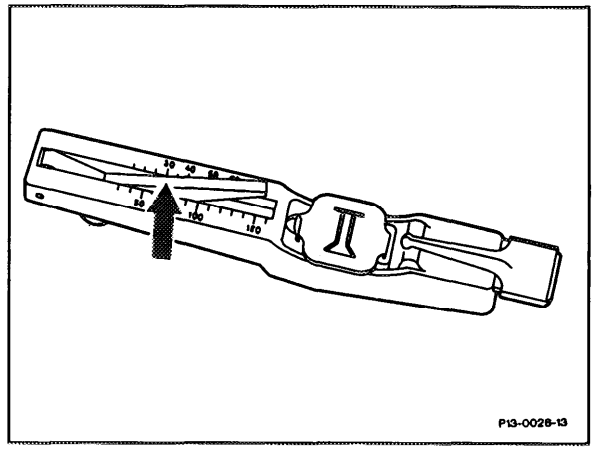
Special tools





Note
Refer to operating instructions for handling of measuring instrument.

'The specified tensioning values refer to KG scale of measuring instrument (arrow).



Checking condition of V-belts

Replace cracked, scorched or worn V-belts.

Note: If one of the two V-belts of the double belt drive has to be replaced due to wear, both V-belts must always be replaced.

Only belts from one manufacturer may be installed together.

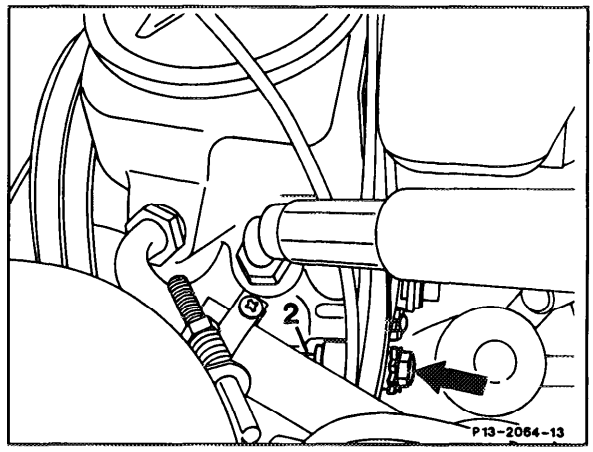
V-belts are supplied only in sets as spare parts.

Adjusting

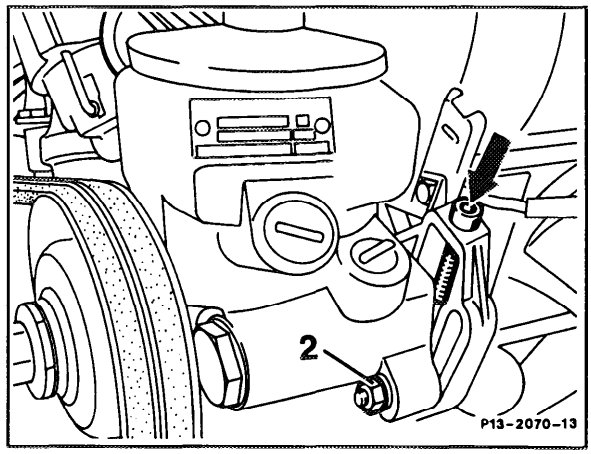
V-belt A Coolant pump- Power steering pump

Loosen nuts (1,2 and 3 [fulcrum]).

Adjust V-belt with adjustment screw (arrow).

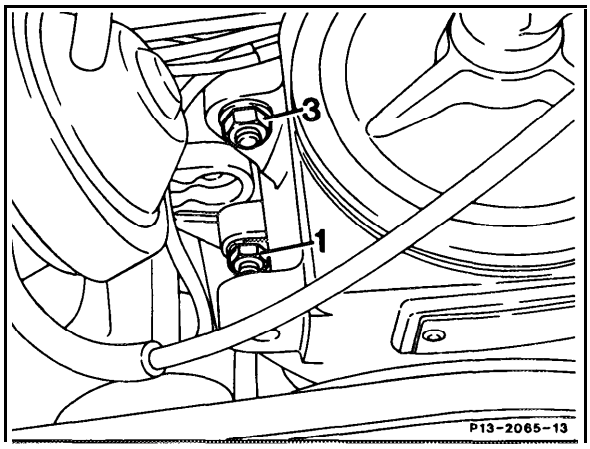


Power steering pump carrier (1 st version)



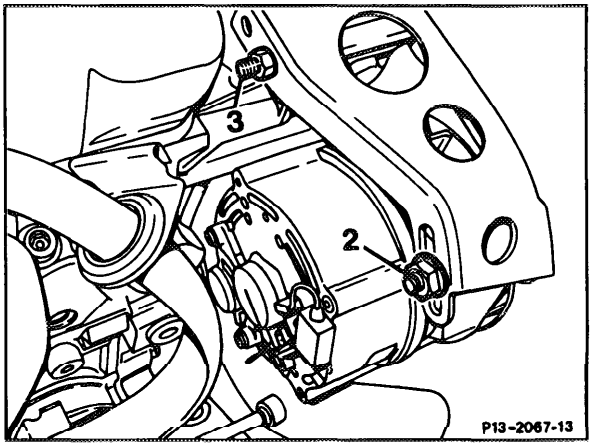
Power steering pump carrier (2nd version)

- Tighten nuts (1, 2 and 3).

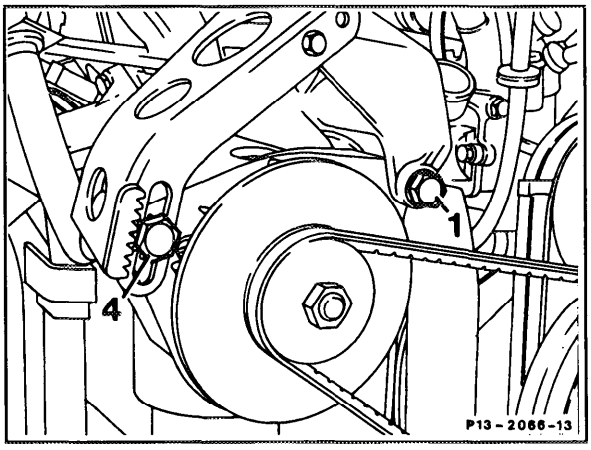


V-belt B Generator

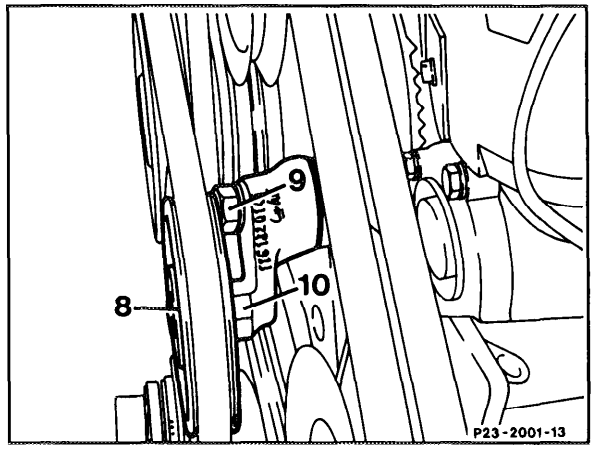
- Loosen fastening bolt (1) and nuts (2 and 3).



- Adjust V-belt with adjustment bolt (4).
- Tighten fastening bolt (1) and nuts (2 and 3).



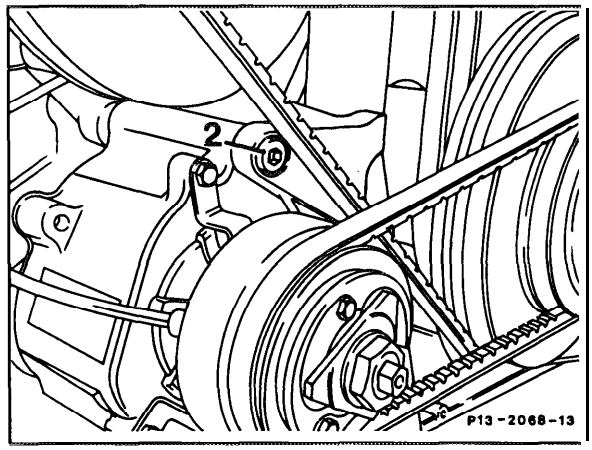
V-belt C Air conditioning compressor



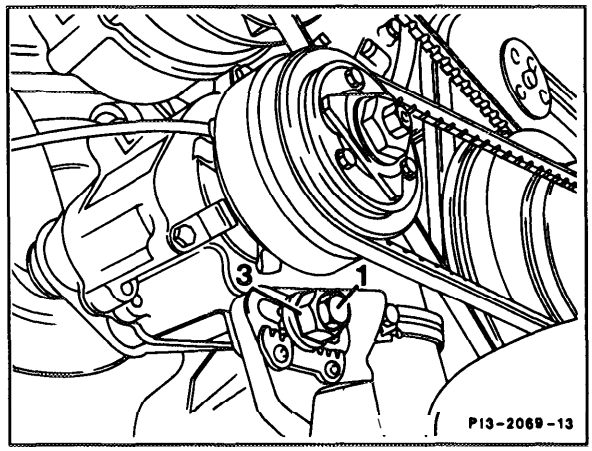
- Loosen fastening bolt (9).
- Adjust the V-belt by turning the tensioning pulley **(8). To** do this place a right angle open end wrench **(22** mm) on the flat surface (10).
- Tighten fastening bolt (9).

Note: As of November 1985 the mounting screw (9) is designed as a hex. socket screw. Use special tool **117 589** 03 07 00.

V-belt D Secondary air injection pump



- Loosen fastening bolts (1 and 2).

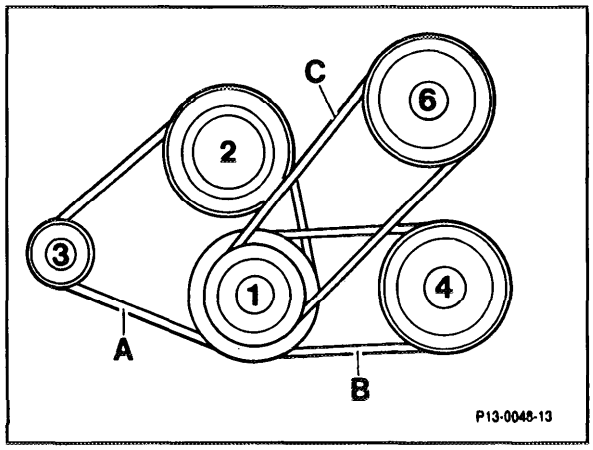


- Adjust V-belt with adjustment wheel (3).
- Tighten fastening bolts (1 and 2).

Engine 616 617

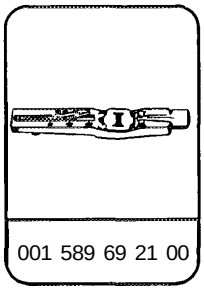
Engine		616, 617.91	617.95	616, 617.91	617.95
V-belt	Location	Tension (KG) New V-belt	Tension (KG) New V-belt	Tension (KG) Used V-belt	Tension (KG) Used V-belt
A	Generator - coolant pump	50	30[1)]	40-45	20-25[1)]
B	Air conditioning compressor	50	50	40-45	40-45
C	Power steering pump	50	50	40-45	40-45

1) Double V-belt



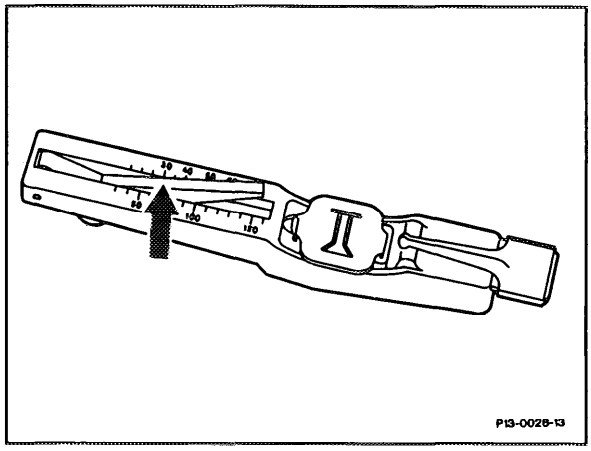
1 Crankshaft
2 Coolant pump
3 Generator
4 A/C compressor
6 Power steering pump

Special tools



Note:
Refer to operating instructions for handling of measuring instrument.

The special tension data refer to KG scale of the measuring instrument (arrow).



Checking condition of V-belt

Replace cracked, scorched or worn V-belts.

Note: If one of the two V-belts of the double belt drive (engine 617.95) has to be replaced due to wear, both V-belts must be replaced.

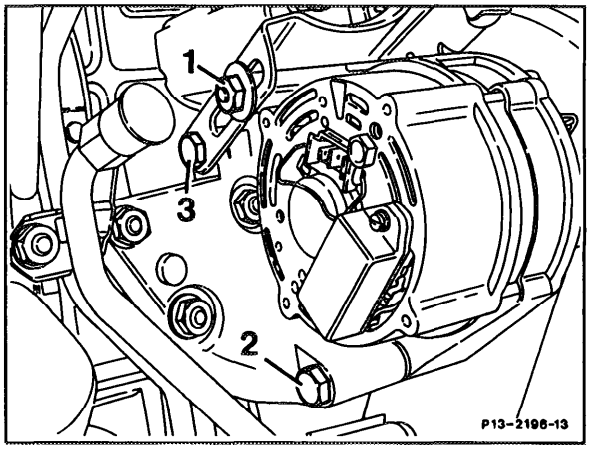
Only belts from one manufacturer may be installed together.

V-belts are supplied only in sets as spare parts.

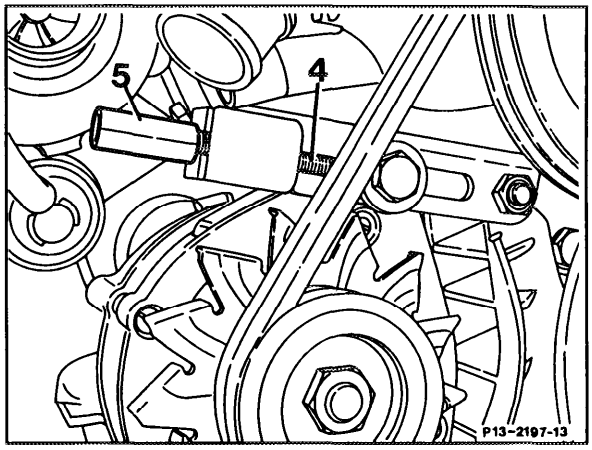
Adjusting

V-belt A Generator - Coolant pump

- Loosen nut (1) and bolts (2 and 3).

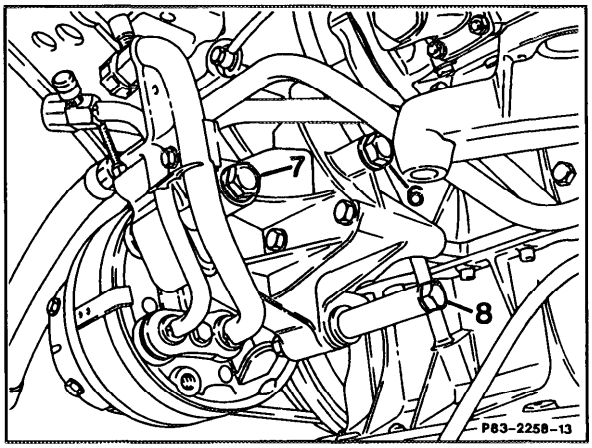


- Adjust V-belt with nut (5).
- Tighten nut (1) and bolts (2 and 3).
- Then keep turning nut (5) for approx. 1/4 to 1/2 turn (until tight).

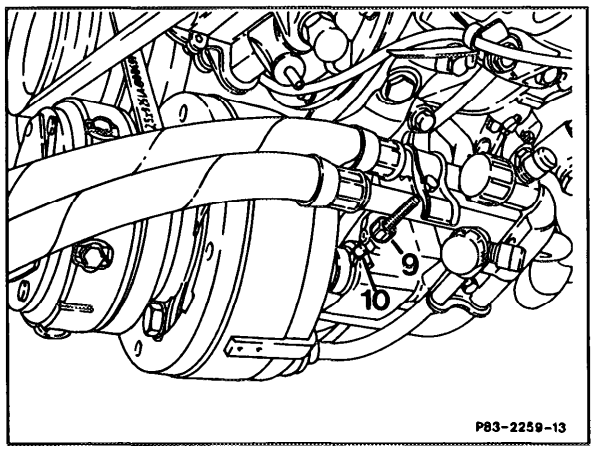


V-belt B Air conditioning compressor

- Loosen bolts (6, 7 and 8).

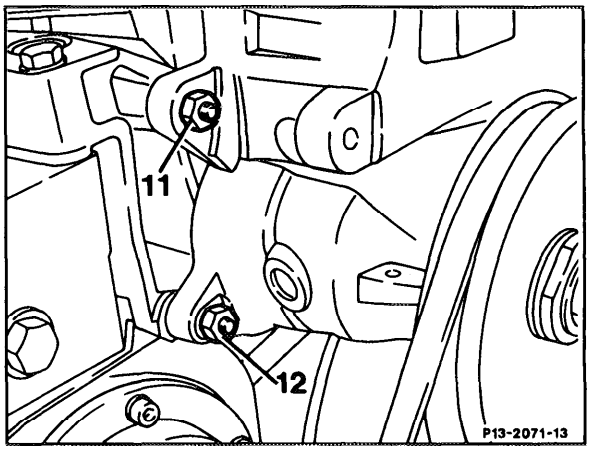


- Adjust V-belt with nut (9) of tensioning bolt (10).
- Tighten bolts (6, 7 and 8).

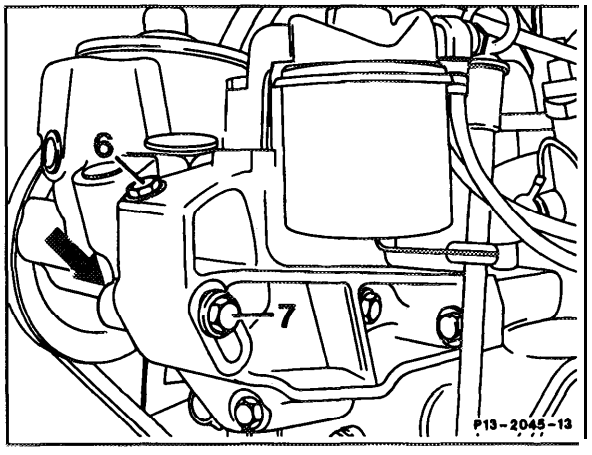


V-belt C Bower steerlng pump

- Loosen nuts (11, 12 and 13).



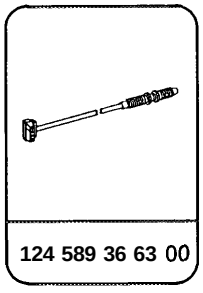
- Adjust V-belt with clamping bolt (14).
- Tighten nuts (11, 12 and 13).



Engines 102103104119120601 602603

Special tools

001 589 76 21 00


124 589 36 63 00

Note: Turn crankshaft using starter and compression test recorder on all models except 140. Use ignition switch on model 140.

⚠

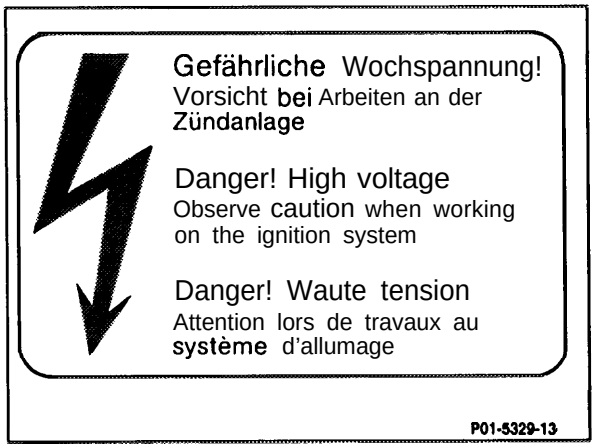
IMPORTANT NOTE!
Model 124.034/036, 129, 140
Certain connectors must be disconnected when turning the crankshaft. This results in the setting of Diagnostic Trouble Codes which must then be erased from the following control modules:

- LH-SFI control module.
- Ignition control module.
- Diagnostic module, if equipped.

(Refer to Diagnostic Manual, Engines, Vol. 2, 3).

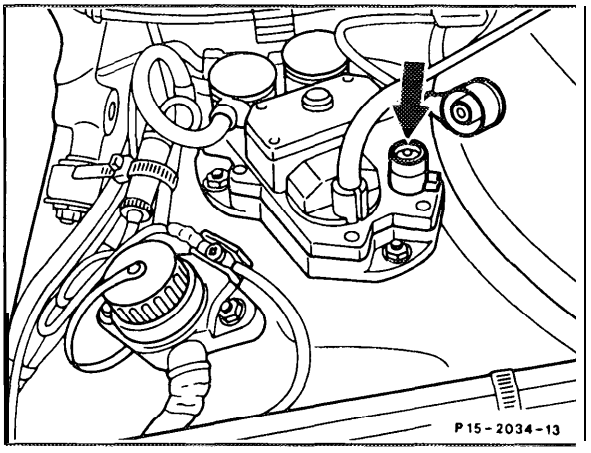
A! WARNING!
Because of the high ignition voltage on gasoline engines, it is dangerous to touch ignition components (ignition coil, ignition cables, spark plug connector, module push connectors) when

- the engine is running,
- the engine is being started,
- the key is in position 2 while the engine is being turned manually.

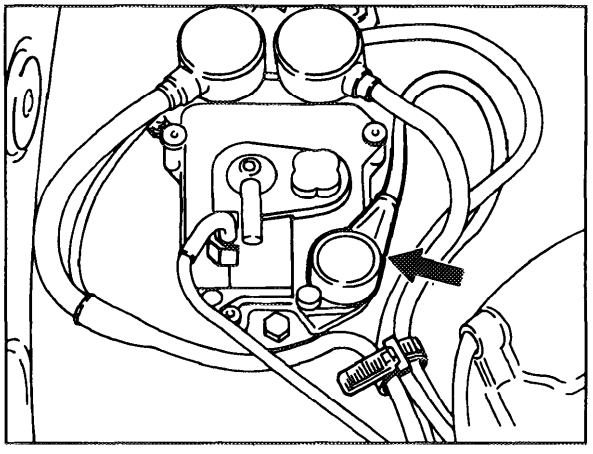


Disabling ignition

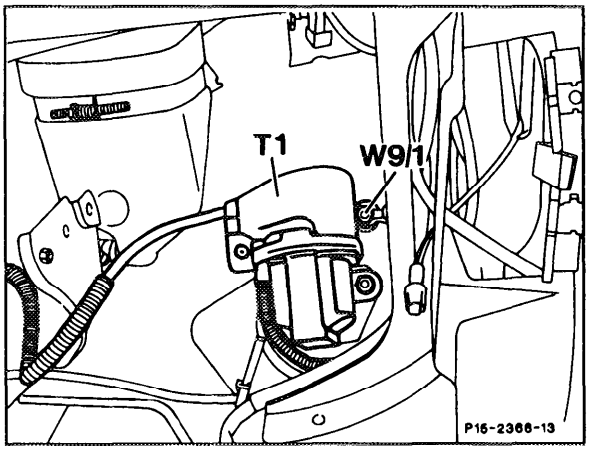
- Switch off ignition on gasoline engines. Pull off plug from crankshaft position sensor (green or black cable) on control module (arrow).



Model 201 with TSZ ignition control module



Models 124, 126, 129 and 201
with EZL ignition control module

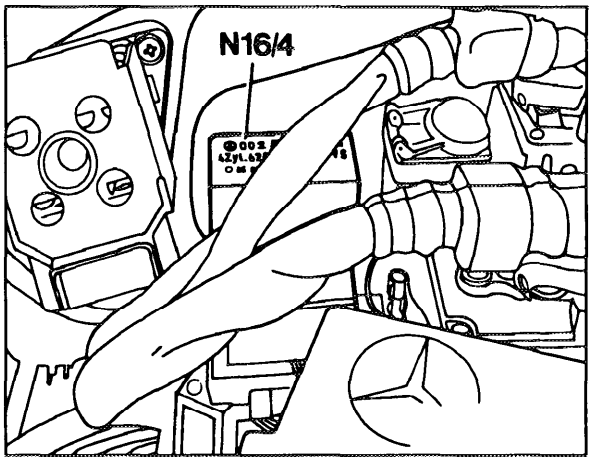


Disconnect connector on model 140

Disabling fuel supply and connecting remote starter switch

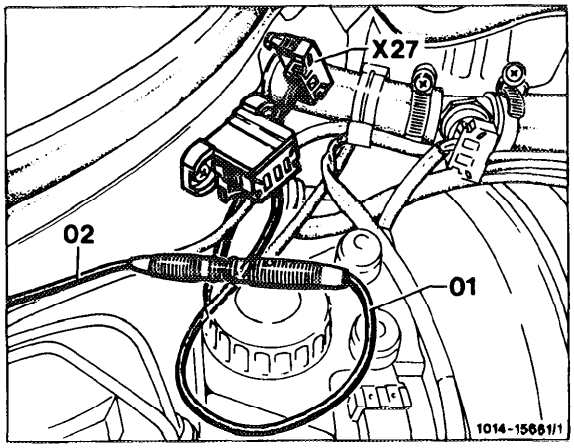
Model 124, 126, 201 except model 124 starting model year 1990 and model 201.029 starting model year 1990

- Before turning the engine, the fuel pump relay module (N16/4) should be pulled out, so that no fuel is injected into the engine.

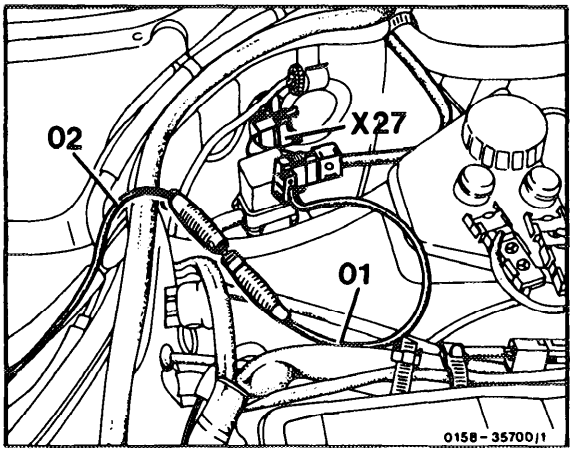


Shown on model 201

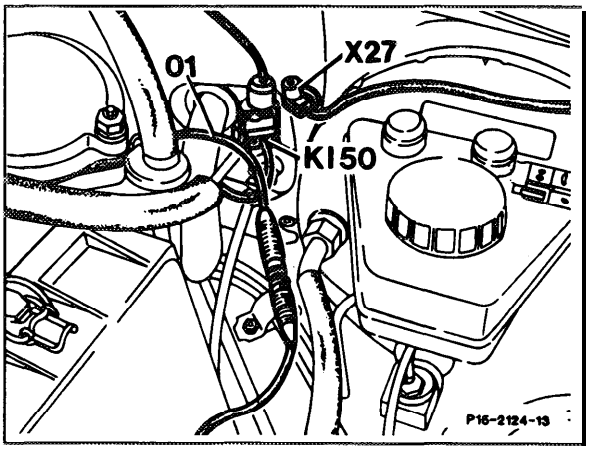
- Connect compression test recorder to battery positive (circuit 30) and to the plug (circuit 50) of the connector (X27). Insert adapter cable 124 589 36 63 00 (01) in the cable (02) of the compression test recorder.



Model 124, left side component compartment wall



Model 126, left side of fire wall

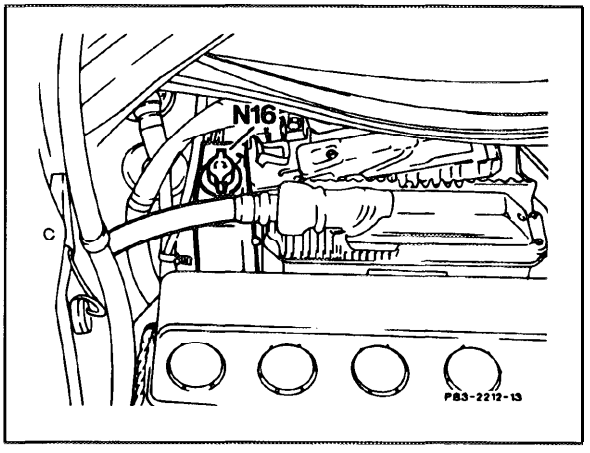


Model 201, left side component compartment wall

Model 124 with Engine 103, 104 starting model year 1990,
Model 201.029 starting model year 1990

- Remove component compartment cover.

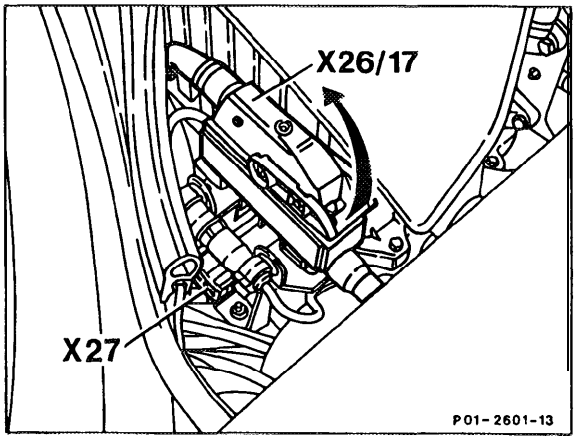
- To interrupt fuel supply, remove engine systems control module (MAS) (N16) by turning locking knob from position 1 to position 0. Pull unit up.



Shown on model 124

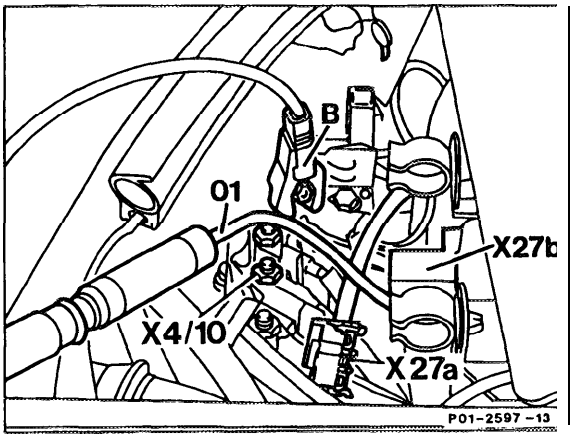
Model 124 with engine 119

- In order to interrupt the fuel supply, disconnect engine plug connection (X26/17) of engine wiring harness on right side of vehicle.



- Remove component compartment cover.

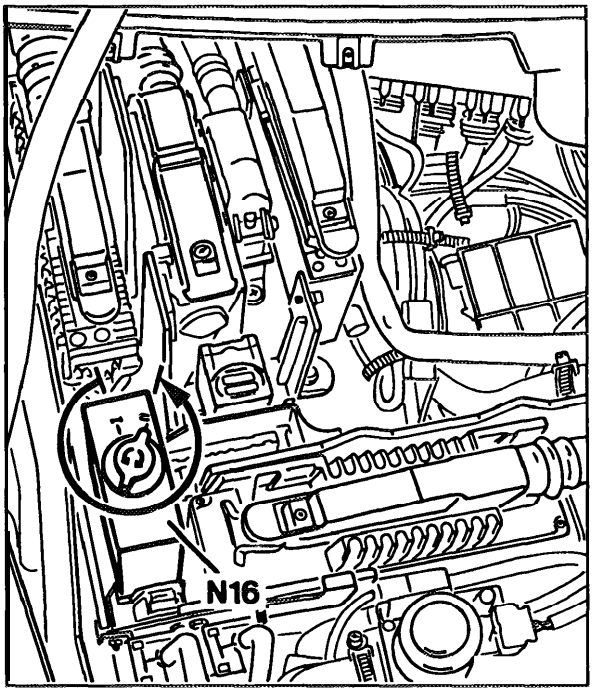
Connect remote starter switch to starter harness connector **(X27)** (circuit 50) and to terminal block **(X4/10)** (circuit **30)** position B located behind Module box.



Model 129

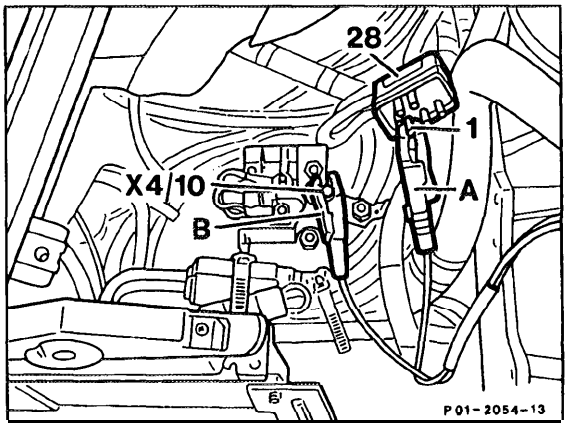
- Remove component compartment cover

- To interrupt fuel supply, remove engine systems control module (MAS) (N16) by turning locking knob from position 1 to position 0. Pull unit up.



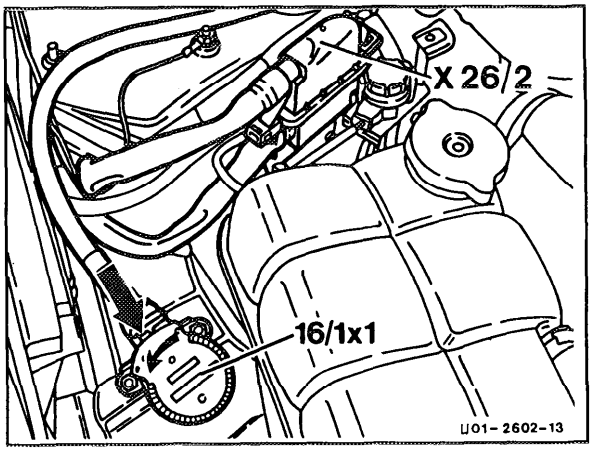
Model 129

- Disconnect plug (28) from starter harness connector (X27). Connect remote compression tester clamp (A) to plug (28) pin 1 (circuit 50) and clamp (B) to terminal block (X4/10) (Circuit 30).



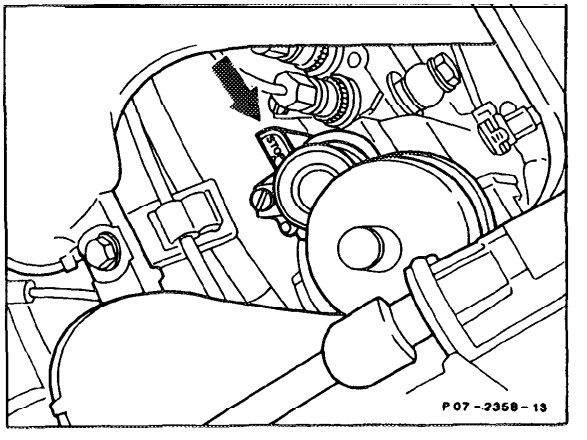
Model 140

- **To** interrupt the fuel supply disconnect engine plug connector (X26/2) on right side of vehicle.



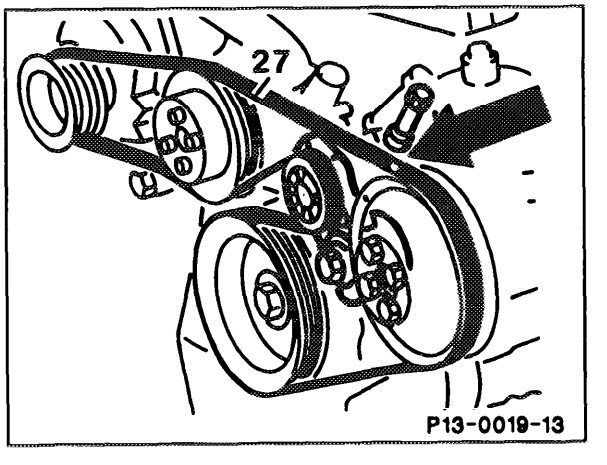
Note for Diesel engines

- While cranking, press shut off lever (arrow) to prevent the engine from starting.



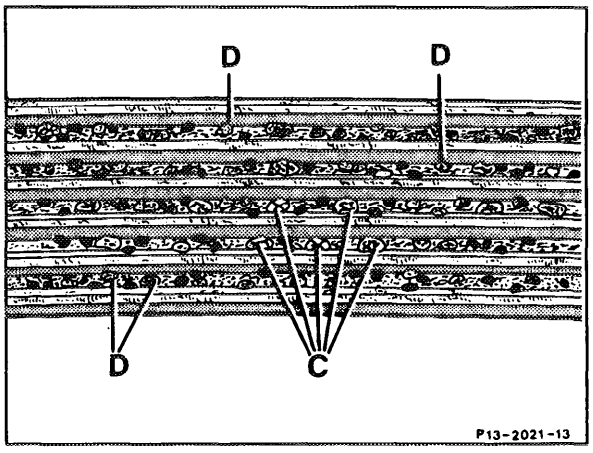
Checking poly-V-belt

- Mark poly-V-belt clearly using chalk.
- Crank engine in steps while checking the poly-V-belt for damage.
- End the process when the mark is visible again (one full turn of the belt).
- The poly-V-belt must be replaced according to SMS Job No. 13-342 (on separate order) if the damage patterns on the following pages are evident:

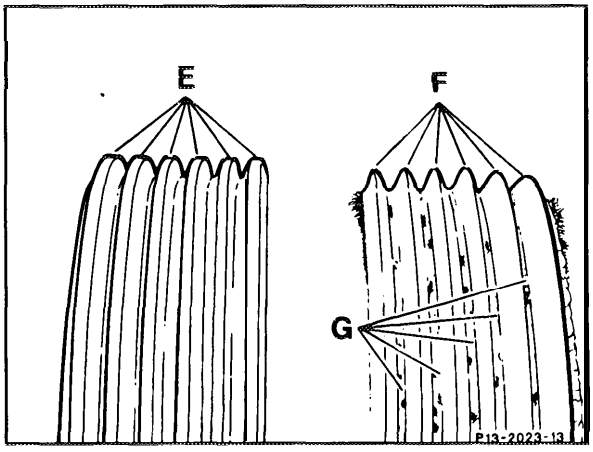


Damage patterns

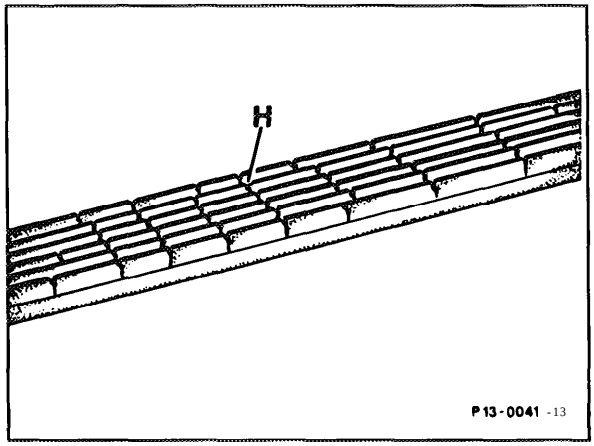
- Rubber lumps in rib base (C).
- Dirt or stone deposits (D).



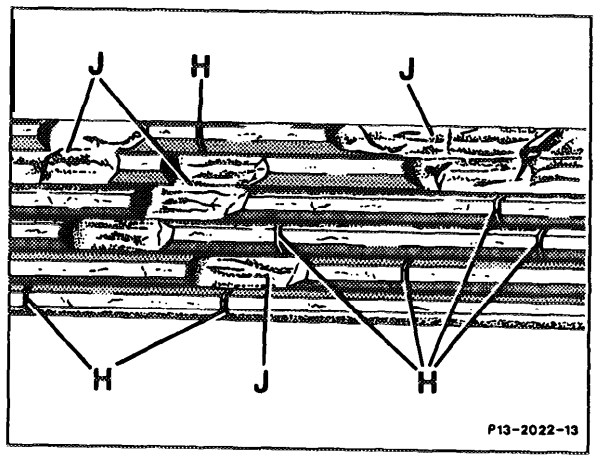
- Flank wear (F, ribs are pointed - trapezoidal when new, E).
- Strand showing through rib base (G, brighter spots).



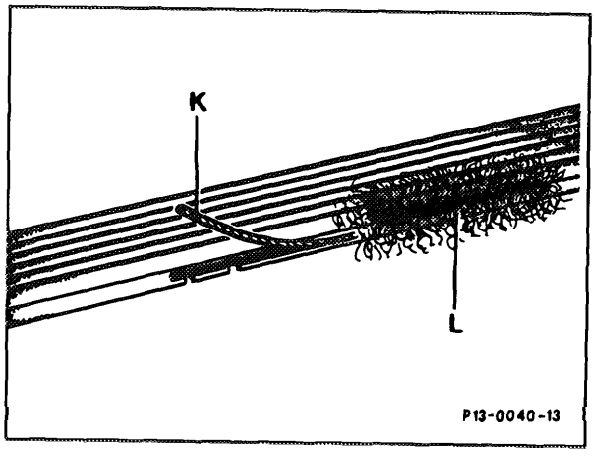
- Transverse cracks (H) in several ribs.



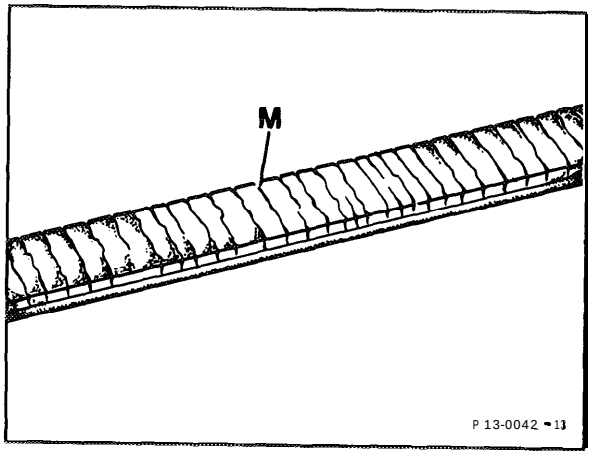
- Transverse cracks in ribs (H) and/or rib chunking (J).



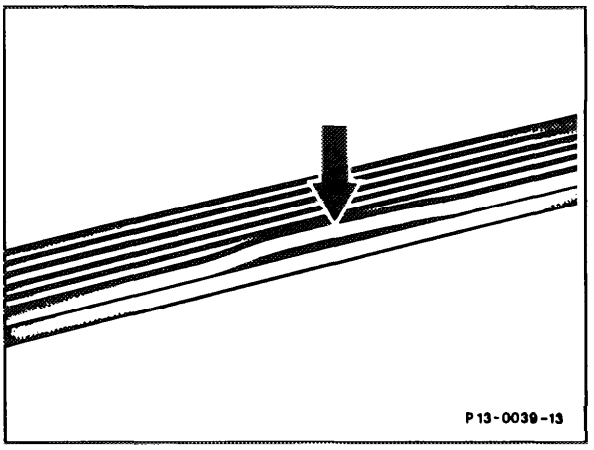
- Strand (K) pulled out laterally or outer strands frayed (L).



- Transverse cracks (M) on back.



- Rib separated from belt (arrow).



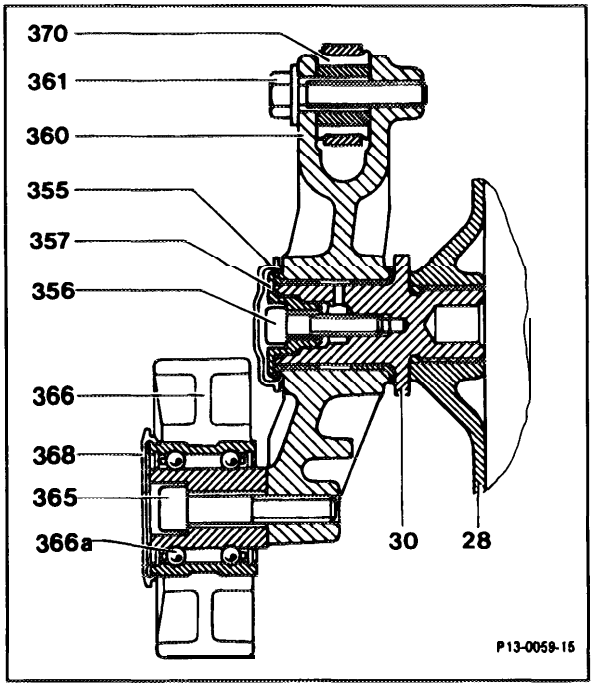
- On diesel engines, with 1st version tensioning lever bearing, check the following parts:

Check pivot shaft (30) of tensioning lever (360) for tight seat (visual inspection)

- When the pivot shaft is loose, the shaft collar no longer rests against the timing housing cover (28). This is also recognized by misalignment of tensioning pulley.

Check tensioning lever bearing for wear (visual inspection)

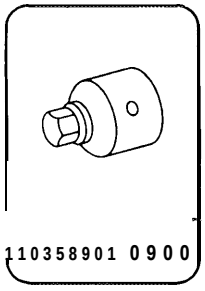
- Tensioning lever bearing bushings are worn out, resulting in considerable play between pivot shaft (30) and tensioning lever (360). Recognized by tilted position of tensioning pulley.

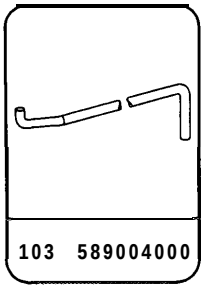


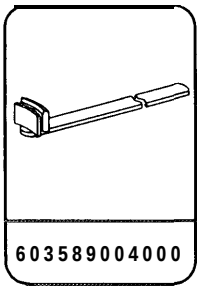
Replacing poly-V-belt

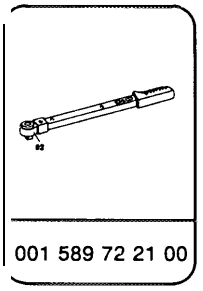
Torque specifications (Nm)		Engine	
Viscofan clutch on coolant pump or bearing body		103, 104, 602, 603	45
Tensioning device mounting bolt (M 12)	19 mm	102,103	75
	17 mm	102	80
Fan to viscofan clutch		103,104	10

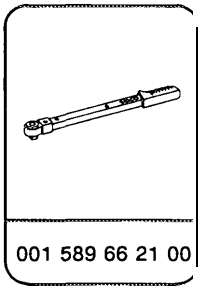
Special tools

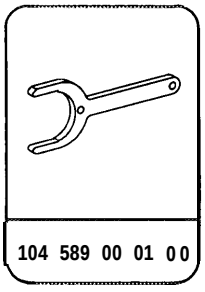










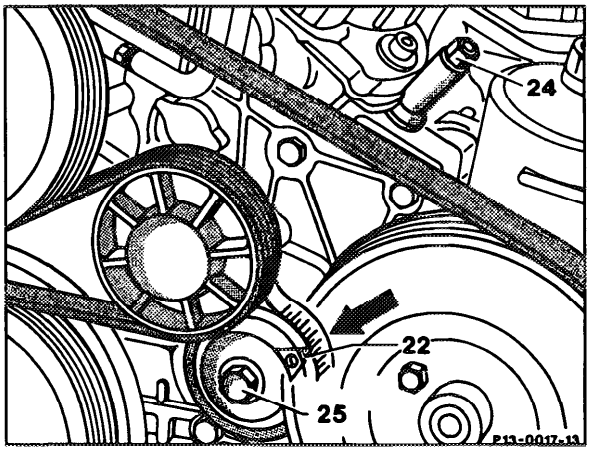


Engine 102

- Loosen screw (25) by 1/4-1/2 turn.

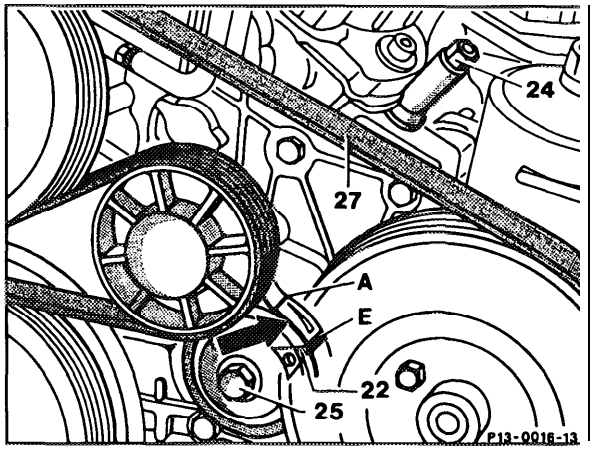
- Loosen tensioning device with tensioning nut (24) (turn counterclockwise) until poly-V-belt (27) can be removed.

- Check the pulley profiles and the tensioning device for damage and dirt and replace if required (e.g. worn out tensioning device bearing bushing, dents in the pulleys, etc.).



- On vehicles produced up to the middle of October 1986, slide adjusting pointer (22) to the left until the tip of the pointer is above the first dividing line of the adjusting scale (arrow).

- On vehicles produced as of the middle of October 1986, slide adjusting pointer to the left until the tip of the pointer is above the thin line (A) of the adjusting scale.



Installing poly-V-belt:

- Start in numerical sequence of belt routing diagrams at tensioning pulley (1) (for illustrations, refer to following pages).

Note:
Do not use belt wax or similar products.

- Check the seating of the poly-V-belt on the belt pulleys.

- On vehicles produced up to the middle of October 1986, turn the tensioning nut (24) to the right until the tip of the adjusting pointer (22) is positioned between the 8th and 9th index mark.

- On vehicles produced as of the middle of October 1986, keep turning tensioning nut to the right until the tip of the adjusting pointer is centered above the thick line (E) of the adjusting scale.

- Tighten bolt (25) as follows:

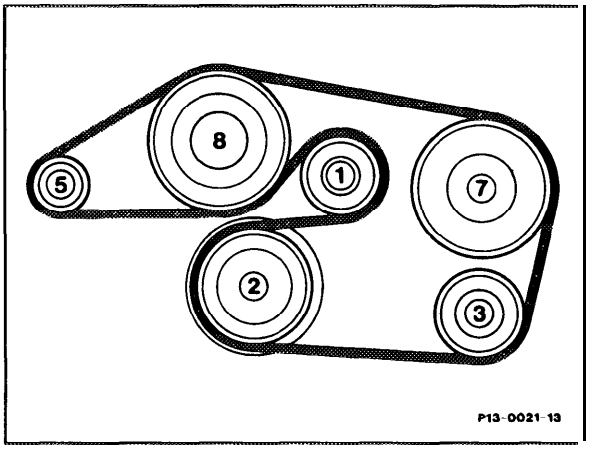
Width between flats 19 mm	**75** Nm
Width between flats 17 mm (shouldered bolt)	80 Nm

Engine 102

Belt routing diagram on vehicles with power steering and A/C compressor

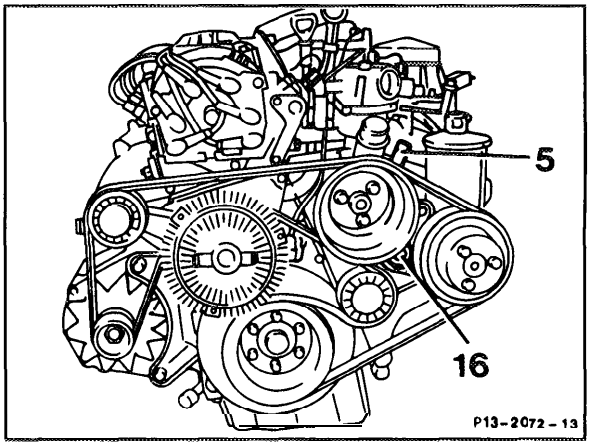
Belt length: 1980 mm

1 Tensioning pulley
2 Crankshaft
3 A/C compressor
5 Generator
7 Power steering pump
8 Coolant pump

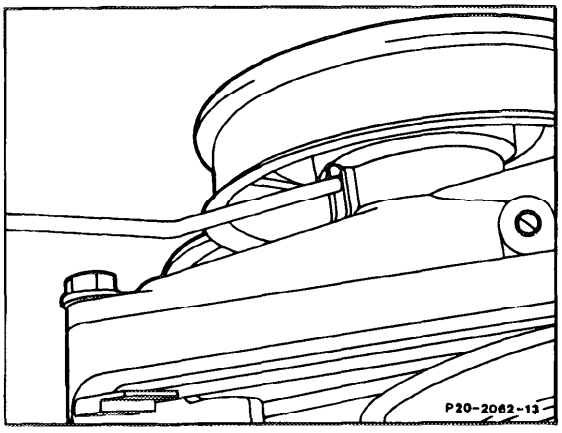


Engine 103

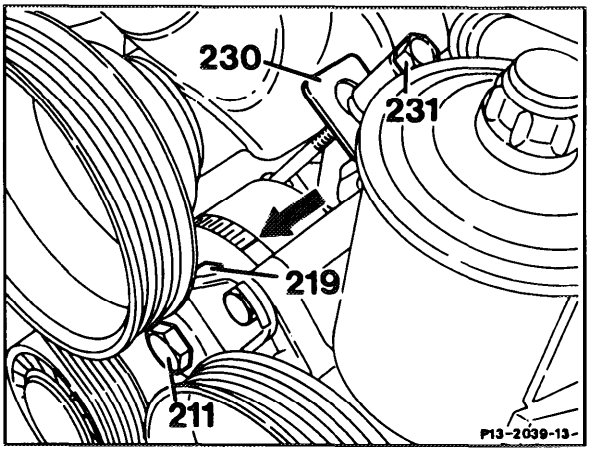
- Loosen fan cover and place on fan.
- On Model 201: remove radiator.
- On all models unscrew viscofan clutch with fan. Remove fan cover.
- For loosening and tightening of hex. socket screw, use special tool 103 589 01 09 00 and torque wrench 001 589 72 21 00.



- Lock pulley by simultaneously engaging counterhold 103 589 00 40 00 in bearing bracket notch and in hub bore.
- Loosen screw (16) by about 1/4 to 1/2 turn.
- Release tensioning device with tensioning nut (5) (turning counterclockwise) until belt can be removed.
- Check pulley profiles and tensioning device for damage and contamination, replace if required (e.g. worn out bearing points of tensioning device, dents in pulleys etc.).



- Turn adjusting pointer (219) to the right (seen from the front) and set adjacent to the 1st index mark (arrow), on vehicles as of 02,1988, set on the cast mark on the right (seen from the front).

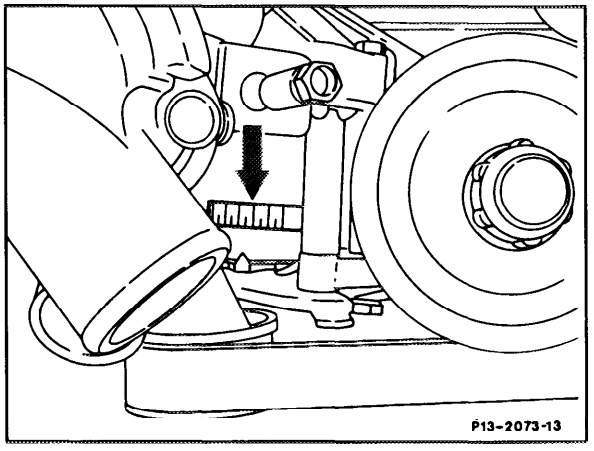


Installing poly-V-belt:

- Start in numbering sequence of belt routing diagrams, start with tensioning pulley (1).

- Do not use belt wax or similar products.

- Turn clamping nut (231) to the right until the adjusting pointer is positioned over the 7th index mark (arrow), on vehicles as of 2/88 over the left mark accordingly (seen from the front).



- Tighten bolt (211) to 75 Nm (reference value).

Note: Starting November 1986 the generator is installed with a lower collar screw 13 mm. When this collar screw is removed, the poly-V-belt can be loosened by swiveling the generator and can be tensioned to its original condition without loosening bolt (211).

- Check if belt is correctly seated on pulleys.

- Insert and install viscofan clutch with fan cover.

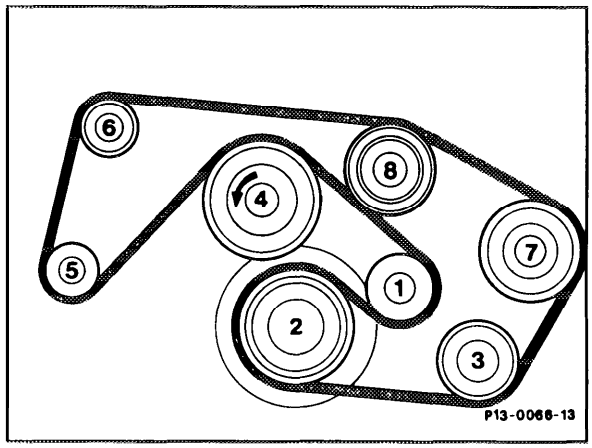
- When tightening hex. socket screw (tightening torque 45 Nm) apply counterhold to pulley.

- To do this, insert counterhold at back of hub and engage simultaneously into holding groove of bearing bracket.

Then remove counterhold.

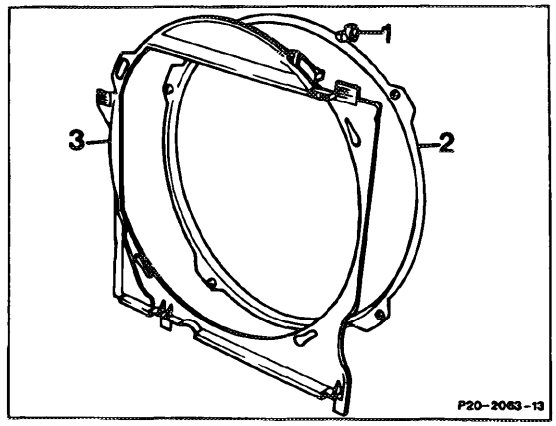
Engine 103

Belt routing diagram on vehicles with air conditioning compressor
Belt length: 2255 mm

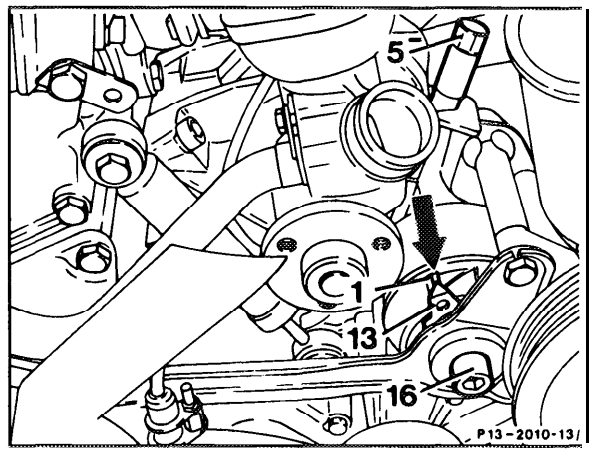


1 Tensioning pulley
2 Crankshaft
3 Compressor
4 Fan
5 Generator
6 Deflector pulley
7 Power steering pump
8 Coolant pump

Engine 104



- Pull out locking pin (1) on fan cover.
- Turn ring (2) to the left and remove.



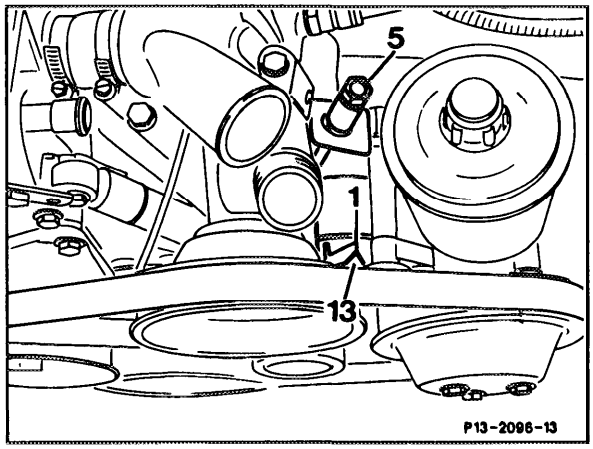
- Loosen screw (16) for approx. 1/4 to 1/2 turn.
- Loosen tensioning unit with tensioning nut (5) **(turn counterclockwise)** until the belt can be removed.
- Check pulley profiles and tensioning device for damage and contamination and replace, if required (e.g. worn out bearing points of tensioning device, dents in pulley etc.).

Install poly-V-belt:

- Starting in numerical sequence of belt routing diagrams at tensioning pulley (1).

Note: Do not use belt wax or similar products.

- Set pointer (13) of tensioning unit to mark 2.
- Turn tensioning nut (5) downwards until adjusting pointer (13) is in alignment with mark 1 (arrow).
- Check seat of belt on pulleys.
- Tighten screw (16) to 75 Nm.
- Install ring of fan cover in reverse sequence.

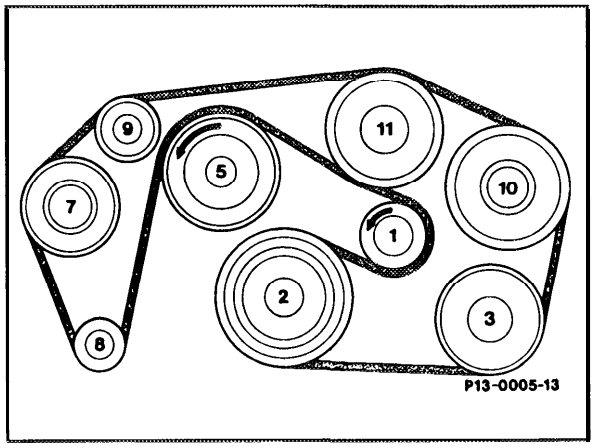


Engine 104 models 124, 129 up to 01/91

Belt routing diagram vehicles with air pump and with air conditioning compressor,

Belt length: 2445 mm; 6 ribs

1 Tensioning pulley
2 Crankshaft
3 Air conditioning compressor
5 Fan
7 Air pump
8 Generator
9 Guide pulley, upper
10 Power steering pump
11 Coolant pump

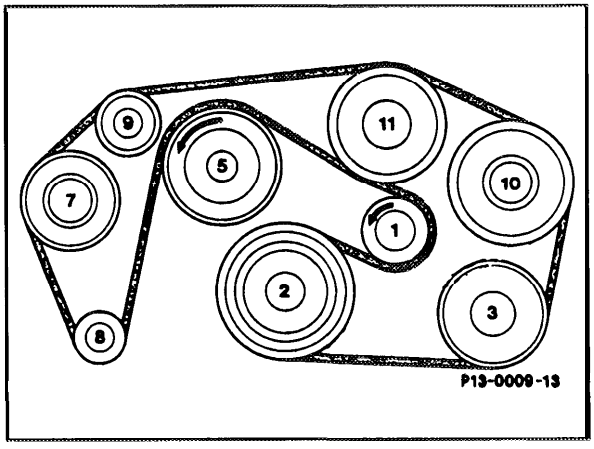


Engine 104 models 124, 129 starting 01/91, model 140

Belt routing diagram vehicles with air pump and with air conditioning compressor,

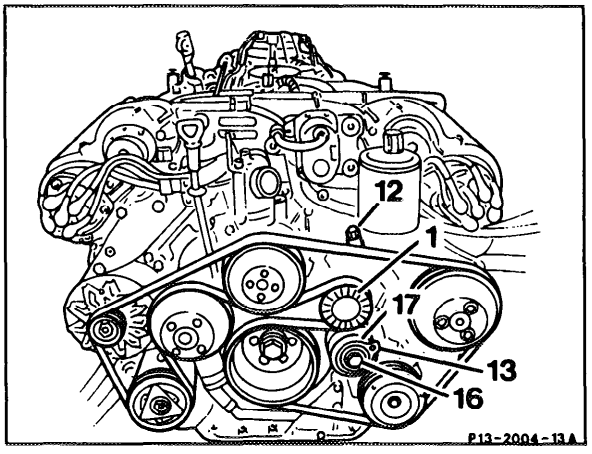
Belt length: 2440 mm
models 124, 129, 6 ribs; model 140 8 ribs

1 Tensioning pulley
2 Crankshaft
3 Air conditioning compressor
5 Fan
7 Air pump
8 Generator
9 Guide pulley, upper
10 Power steering pump
11 Coolant pump



Engine 119

- Pull locking pin from fan cover.
- Turn ring to the left and remove.
- Loosen screw (16) approx. 1/4 to 1/2 turn.
- Loosen tensioning device with tensioning nut (12) **(turning counterclockwise)** until the belt can be removed.



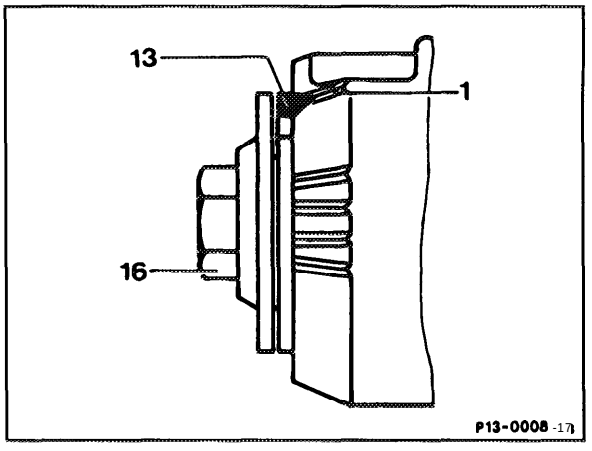
- Check pulley profiles and tensioning device for damage and contamination and replace, if required (e.g. worn out bearing points of tensioning device, dents in pulleys etc.).

Installing poly-V-belt:

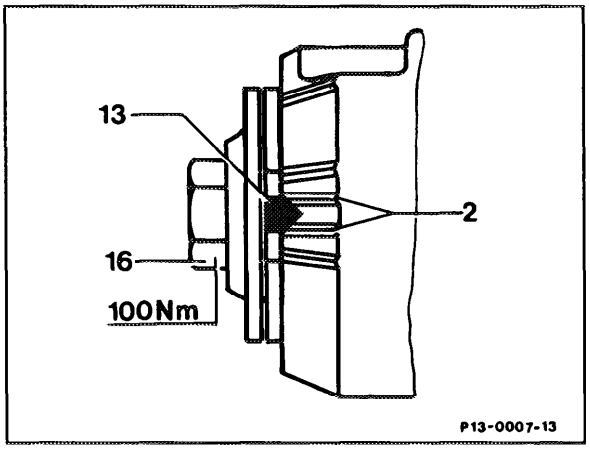
- In numerical sequence of belt routing diagrams, start with tensioning pulley (1).

Note:
Do not use belt wax or similar products.

- Set pointer (13) of tensioning device to mark 1.



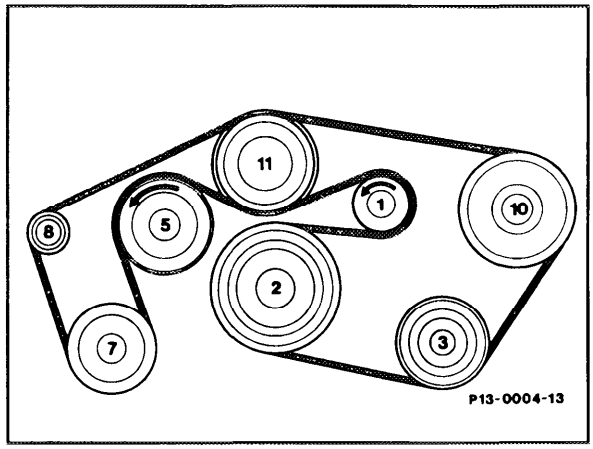
- Turn tensioning nut (12) clockwise until pointer (13) is in position 2.
- Check that belt is seated correctly on pulleys.
- Torque screw (16) to 100 Nm.
- Install fan cover in reverse order.



Engine 119 model 129

Belt routing diagram
Belt length: 2523 mm; 6 ribs

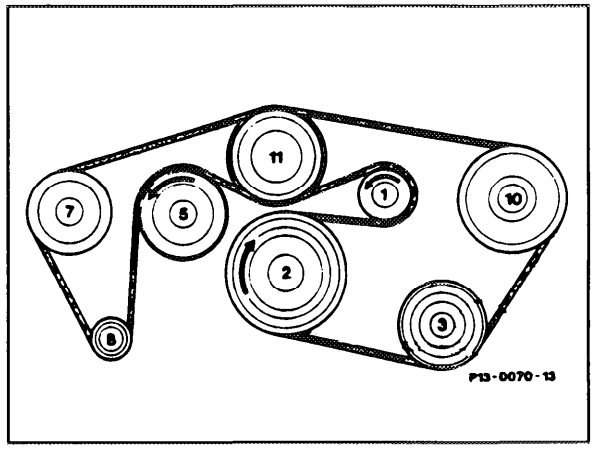
1. Tensioning pulley
2. Crankshaft
3. A/C compressor
5. Fan
7. Air pump
8. Generator
10. Power steering pump
11. Coolant pump



Engine 119.970 model 140.051
119.971 model 140.042
119.974 model 124.036
119.975 model 124.034

Belt routing diagram
Belt length: 2460 mm; 8 ribs

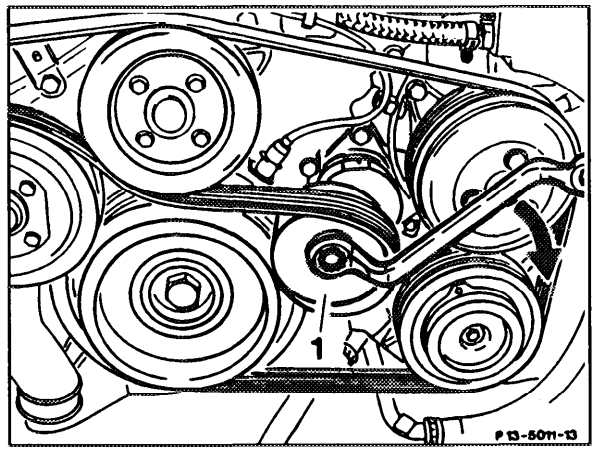
1. Tensioning pulley
2. Crankshaft
3. A/C compressor
5. Fan
7. Air pump
8. Generator
10. Power steering pump
11. Coolant pump



Engine 120

- Remove cooling fan (job no. 20-3129)

- Using 15 mm wrench, swing tensioning roller (1) aside in direction of arrow up to stop and no further so that belt can be removed. Check pulley profiles and tensioning device for damage and contamination and replace, if required (e.g. worn out bearing points of tensioning device, dents in pulleys etc.)



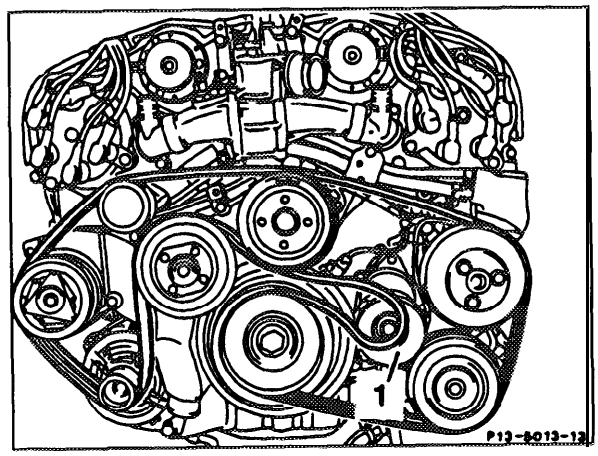
Installing poly-V-belt:

- In numerical sequence of belt routing diagrams, start with tensioning pulley (1).

Note:

Do not use belt wax or similar products.

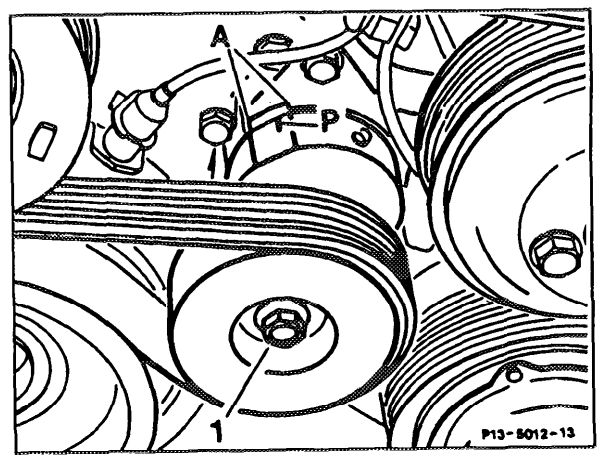
- Pretension tensioning pulley (1) and install belt over pulley (1). Check that belt is seated correctly.



Note:

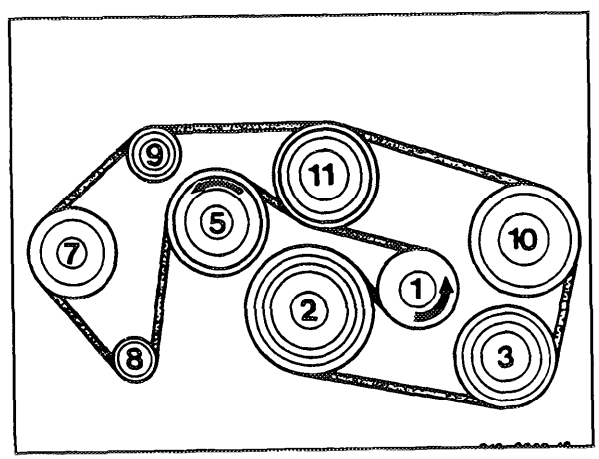
When the belt length and tension are correct the positioning mark (P) will be within range (A).

- Reverse procedure to install.

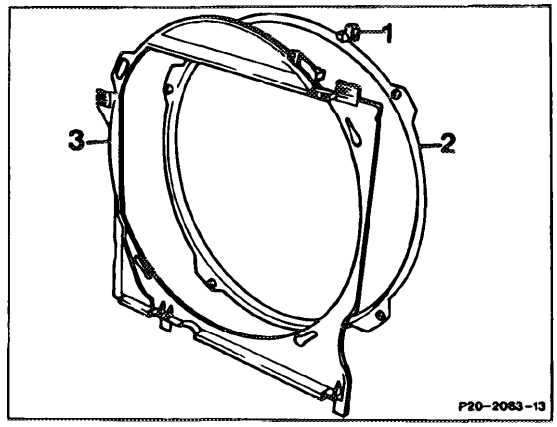


Engine 120.980 Model 140.056/57
Belt routing diagram
Belt length 2585 mm 8 ribs

1. Tensioning pulley
2. Crankshaft
3. A/C compressor
5. Fan
7. Air pump
8. Generator
9. Guide pulley, upper
10. Power steering pump
11. Coolant pump



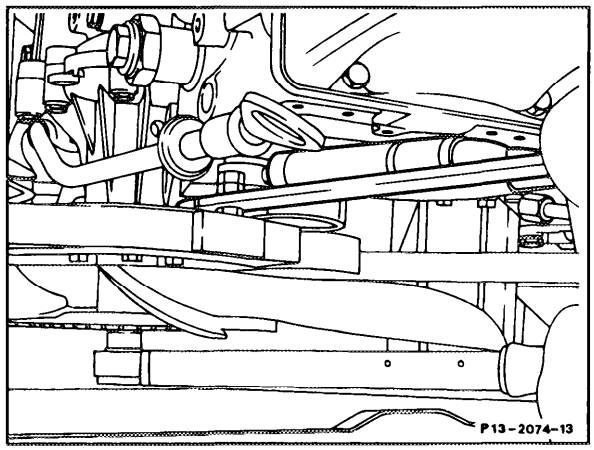
Engine 601, 602 and 603



On engine 601, loosen fan cover and place on fan. Unscrew fan and remove with fan cover.

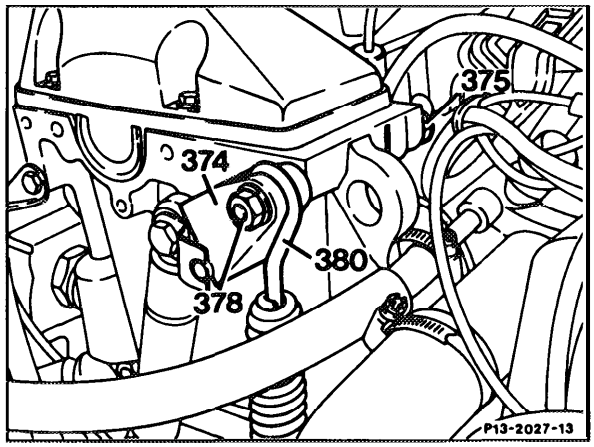
On engine 602.911 in model 201 with one piece fan cover, remove radiator.

On engine 602 in model 201 with two piece fan shroud, pull locking pin (1) and turn ring (2) to the left. to open shroud and remove. Place ring on fan. Pull out shroud body (3) and remove ring.



On engine 602 **in model 124,** loosen fan cover and place on fan. Unscrew viscofan clutch with fan and remove with fan cover.
To loosen and tighten hex. socket screw of viscofan clutch, use screwdriver insert 103 589 01 09 00 and counterhold 603 589 00 40 00.

On engine 603.96 (TURBO), the viscofan clutch cannot be removed without removing the radiator.



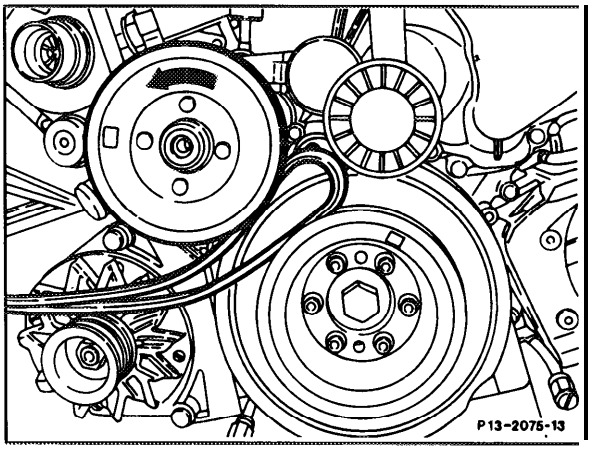
- Loosen tensioning device (vehicle tool or conventional tool):

- Unscrew nut (378).
- Insert a lever (12 -13 mm dia., approx. 300 mm long) or wheel nut wrench from vehicle tool set into hole on spring tensioning lever (374). Push lever slightly to the left until screw (375) can be pushed back in direction of intake manifold.
- Loosen draw spring (380) by swiveling lever to the right.
- Push back tensioning pulley and remove poly-V-belt.
- Check belt pulley profiles and tensioning device for damage (such as worn out pivot points of tensioning device, dents in pulleys, etc.) and contamination and replace, if necessary.

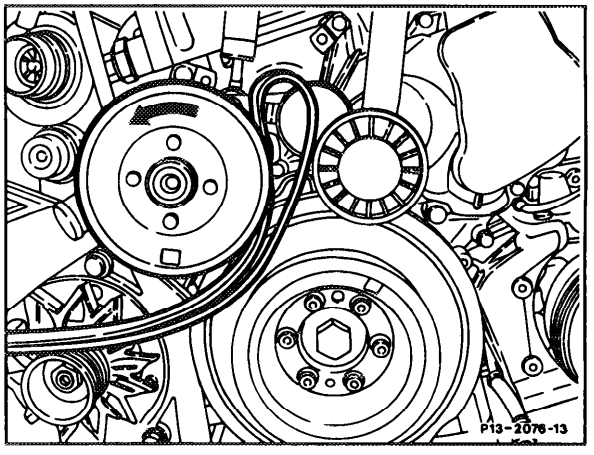
Installing poly-V-belt:

- Do not use belt wax or similar products.

- Slightly pull up tensioning pulley. Make a loop in the poly-V-belt with the V-grooves facing outwards, and slip between coolant pump pulley and crankshaft pulley.

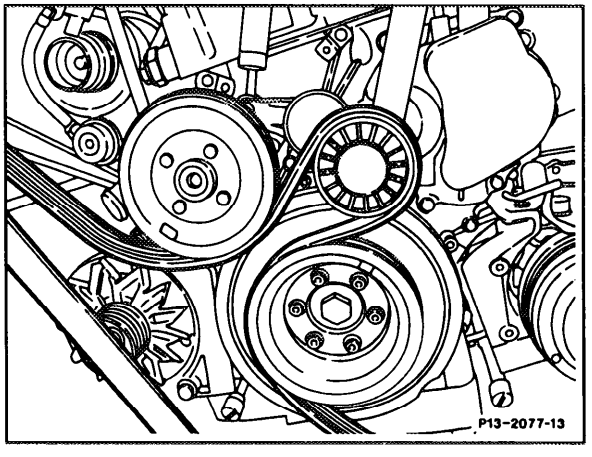


- Push poly-V-belt firmly against coolant pump pulley and turn pulley counterclockwise (arrow) until the poly-V-belt is adjacent to tensioning pulley.



- Position poly-V-belt on tensioning pulley and on crankshaft pulley. Then turn free portion of poly-V-belt around and position on air conditioning compressor, power steering pump, coolant pump and generator pulleys.

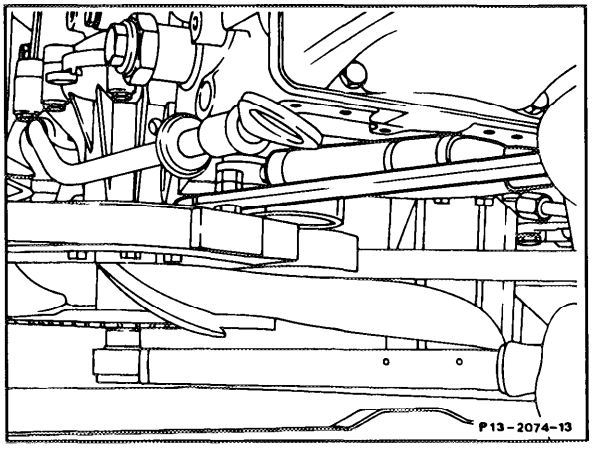
- Tension poly-V-belt and screw on tensioning device.



Inspecting poly-V-belt

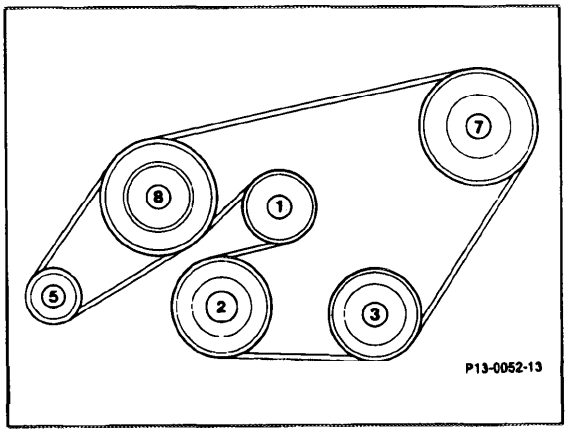
- Check seat of poly-V-belt on belt pulleys.

- On engines 601, 602, 603.91 in model 124, install fan or viscofan clutch with fan and fan cover.
- On engine 601, torque fan mounting screw to 28 Nm.
- Torque viscofan clutch mounting screw to 45 Nm. When tightening use counter hold 603 589 00 40 00.
- On engine 602.911 in model 201 without two piece fan shroud, install radiator.



Belt routing diagram for vehicles with power steering and automatic climate control
Belt lengths:
Engine 601: 2120 mm
Engine 602: 2100 mm
Engine 603.96: 2145 mm
Engine 603.970: 2120 mm

1. Tensioning pulley
2. Crankshaft
3. A/C compressor
5. Generator
7. Power steering pump
8. Coolant pump

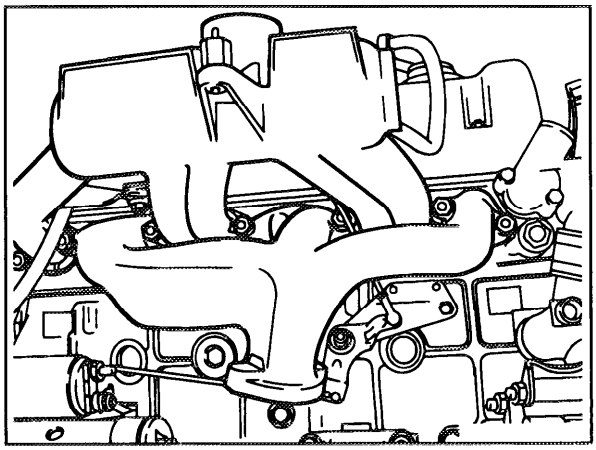


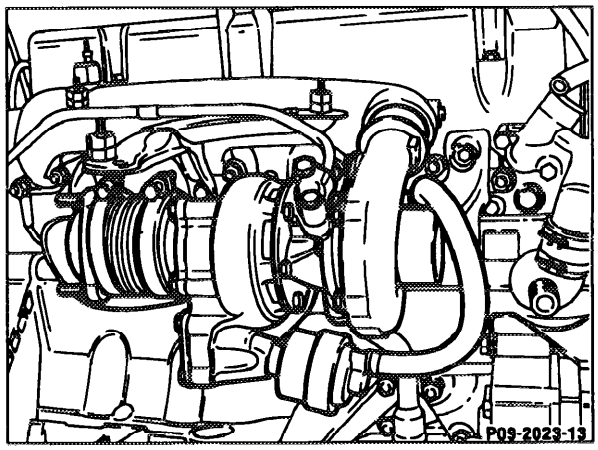
Checking intake/exhaust manifold seating

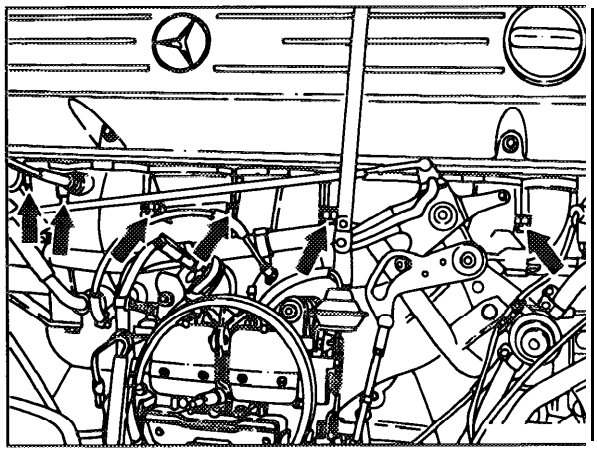
Engine 616 617

Check that all fasteners on intake manifold, boost air pipe, and exhaust manifold are tightened securely, and retighten, if necessary.

On vehicles with turbocharger, remove air filter for access.



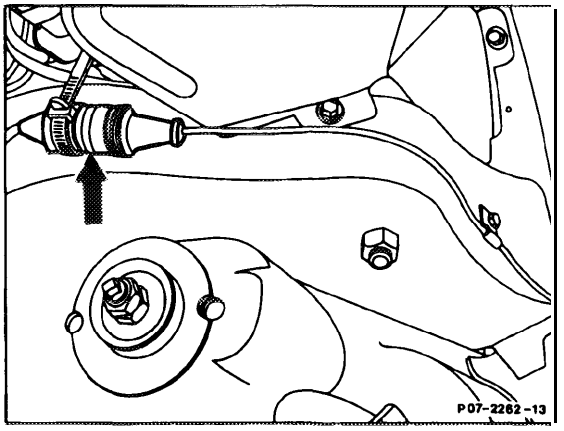




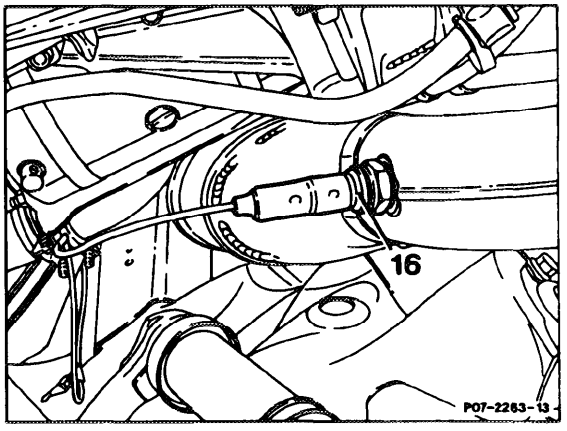
Engine 102 103 110 116 117 119

Model 123

- Disconnect oxygen sensor connector (arrow).
- Loosen oxygen sensor wire retaining clips.

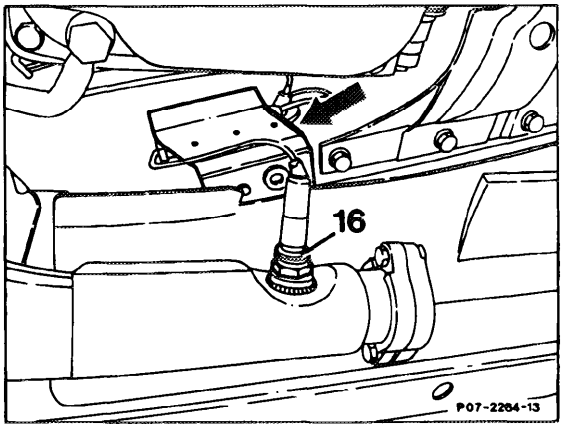


- Unscrew oxygen sensor (16).
- Apply lubricating paste Part no. 000 989 88 51 to threads of new oxygen sensor.
- Install oxygen sensor and torque to approx. 50-60 Nm.
- Remove oxygen sensor warning lamp bulb.

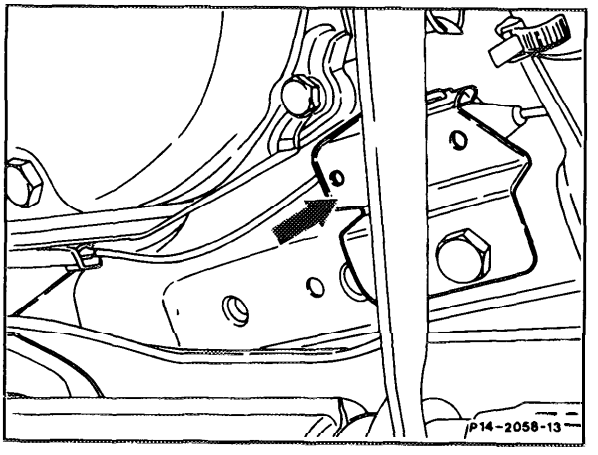


Model 107, 126

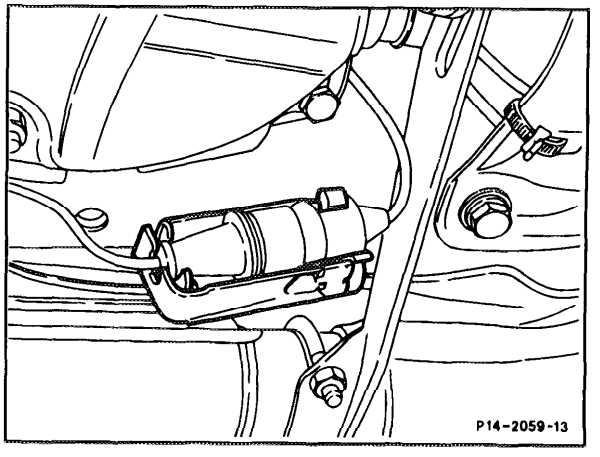
- On model 107, push connector upward out of bracket (arrow) and disconnect.



- On model 126, remove bracket (arrow) and push coupling upward, then disconnect. Remove oxygen sensor wire from retaining bracket.
- Unscrew oxygen sensor.



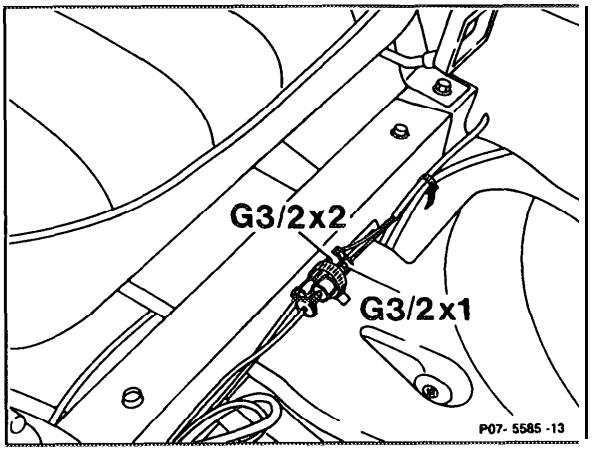
- Apply lubricating paste, part no. 000 989 88 51, to threads of new oxygen sensor.
- Install oxygen sensor and torque to approx. 50-60 Nm.
- Install bracket on model 126, and press wire into retaining strip.
- On 1981-85 models only, remove oxygen sensor warning lamp bulb.



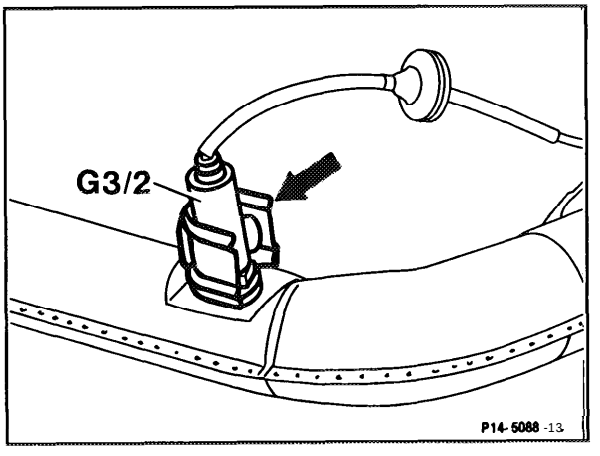
Replacing oxygen sensor

Model 124, 201

- Separate oxygen sensor connector (arrow) and sensor heater connector on right side of vehicle interior.
- Push wire and grommet out through floor pan from inside.



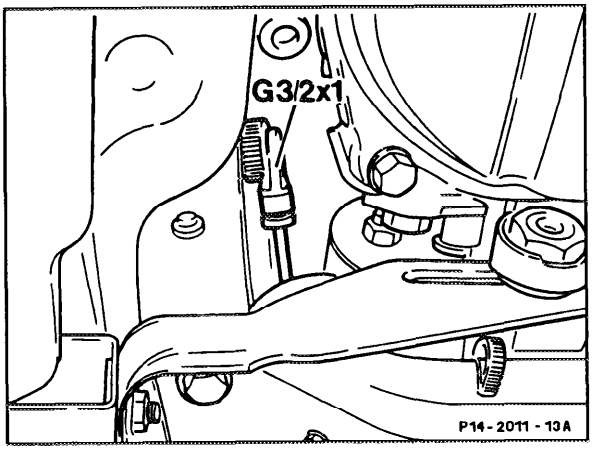
- Remove shield (arrow).
- Unscrew oxygen sensor.
- Apply lubricating paste, part no. 000 989 88 51, to threads of new oxygen sensor.
- Install oxygen sensor and torque to approx. 50-60 Nm.



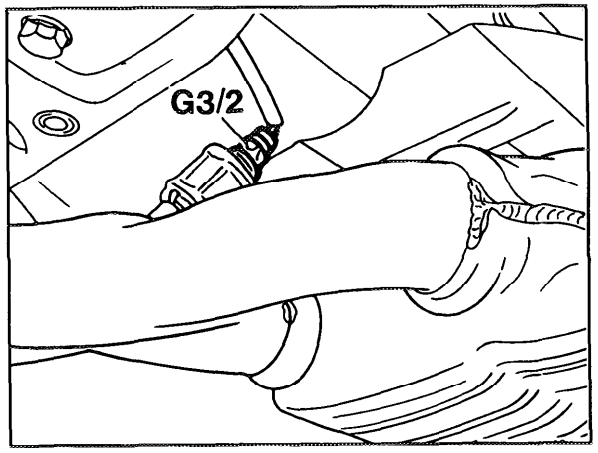
On 1984-86 model 201 only (except 201.034), remove oxygen sensor warning lamp bulb.

Model 129

- The oxygen sensor connector (G3/2x1) is secured to the right side of the transmission tunnel.
- Turn connector nut counterclockwise and separate connector.

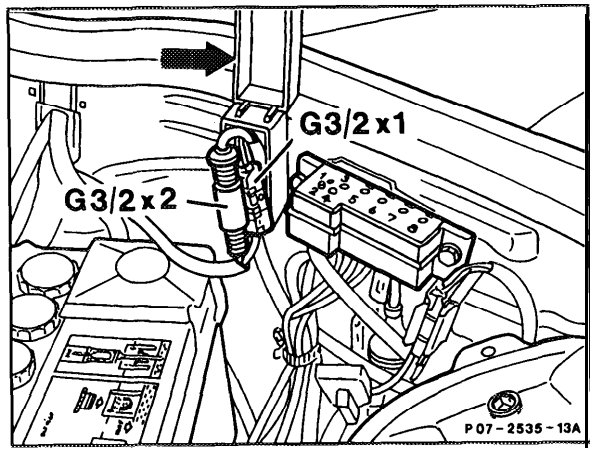


- Unscrew oxygen sensor.
- Apply lubricating paste, part no. 000 989 88 51, to threads of new oxygen sensor.
- Install oxygen sensor and torque to approx. 50-60 Nm.

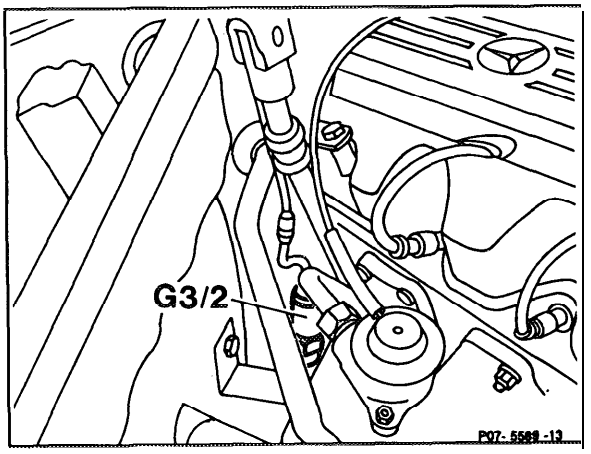


Model 201 with engine 102 California starting model year 1992

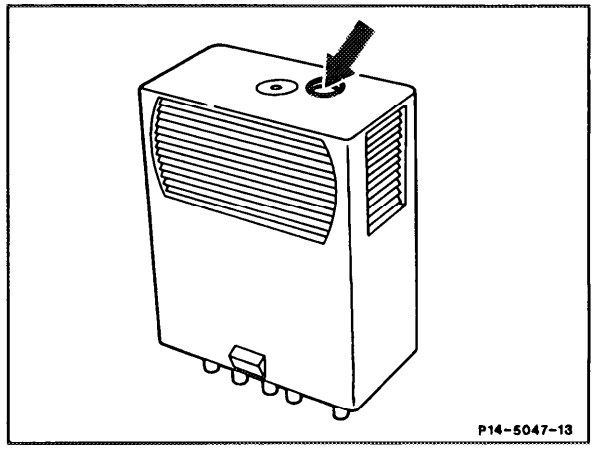
- Disconnect oxygen sensor heater coil connector (G3/2x1) and oxygen sensor signal connector (G3/2x2).



- Unscrew oxygen sensor.
- Apply lubricating paste, part no. 000 989 88 51, to threads of new oxygen sensor.
- Install oxygen sensor and torque to approx. 50-60 Nm.



Maintenance note:
The oxygen sensor must be replaced when the warning lamp illuminates for the first time at 60,000 ± 250 miles. After replacing the sensor, the warning lamp may be switched off via the button (arrow) on the oxygen sensor replacement indicator control module (N44/1). The button must be pressed for longer than 2 seconds to turn off the lamp. In ignition/starter position "2", the lamp remains lit even after resetting the control module. The lamp will only go out after the engine is started (circuit 61 recognition). The previously recorded mileage remains stored. The warning lamp will illuminate for a second time at 120,000 miles.



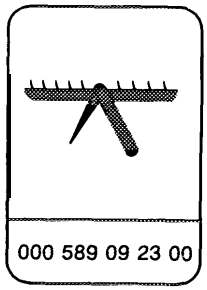
Note:

After the 120,000 mile indication, the on-off ratio should be checked, and the oxygen sensor only replaced if necessary.

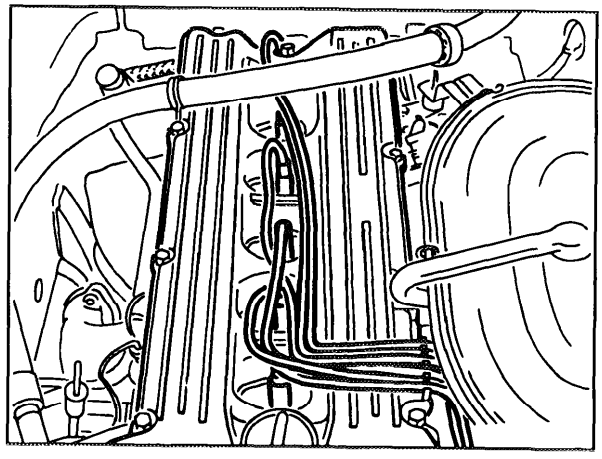
If the oxygen sensor is replaced outside of the interval limit, the oxygen sensor replacement indicator control module (N44/1) must be replaced.
Starting model year 1993, the control module can be reset as often as needed.

All gasoline engines

Special tools



On engine 110 (illustration), blow out spark plug wells in cylinder head before removing spark plugs.



Remove spark plugs and check for deposits on electrodes. If deposits are present, replace spark plugs.

If no deposits are present, regap spark plugs to specification.

Install spark plugs and torque to 25-30 Nm.

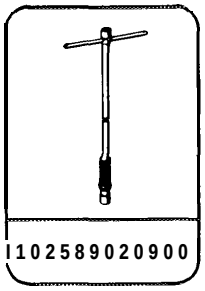
Replacing sparkplugs

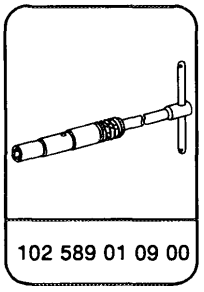
1580

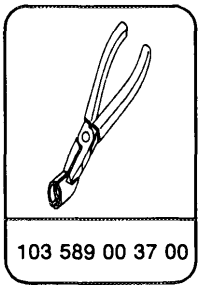
Gasoline engines

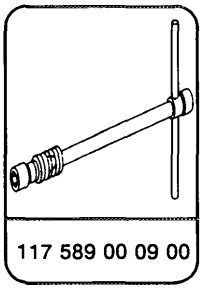
Torque specifications	Nm
Spark plugs with taper seat	1 O-20
Spark plugs with gasket	25-30

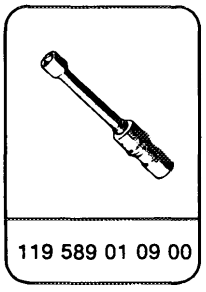
Special tools











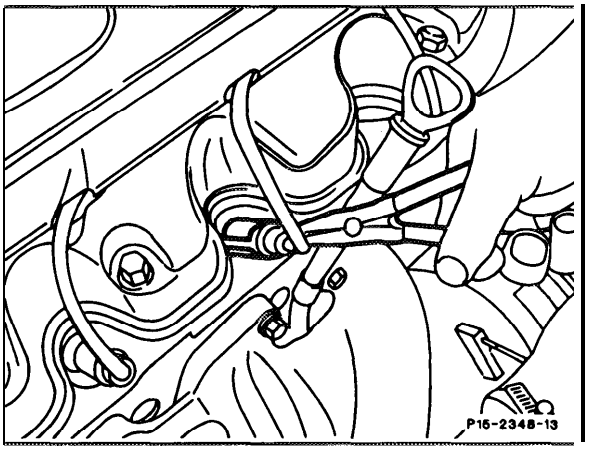
Engines 102.983, 104, **119**

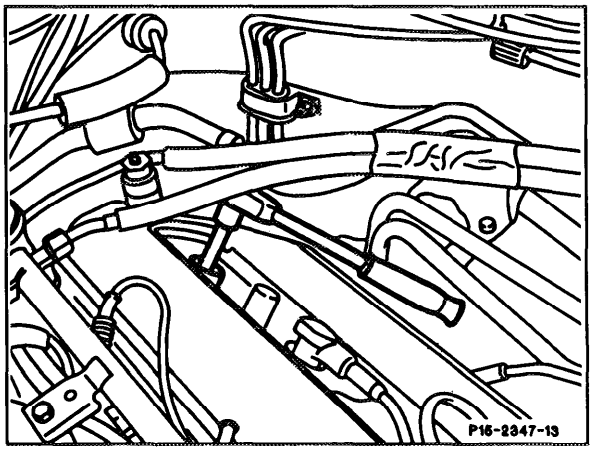
- Remove spark plug valley cover.

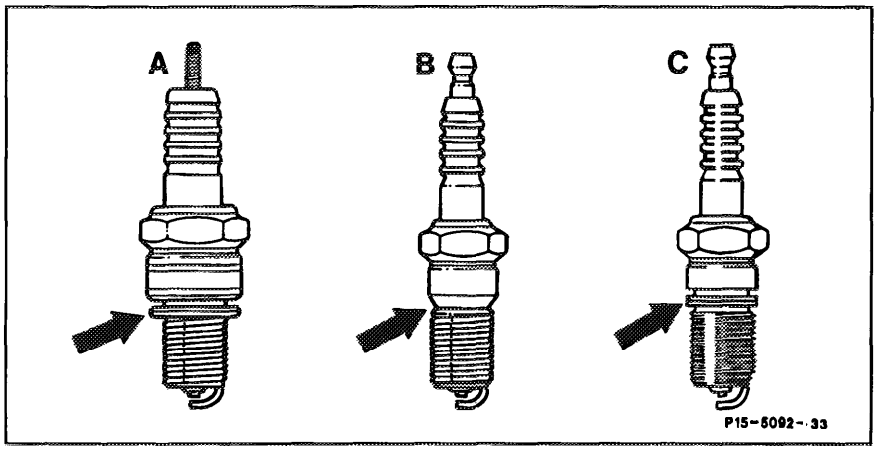
All **engines**

- Twist spark plug connector slightly and pull off using special tool 103 589 00 37 00.

- Blow out recesses with compressed air.







A flat seat (A)
B tapered seat (B)
C flat seat (C)

CFI fuel injection

Motor	Spark plug seal	Spark plug wrench
102,103	Tapered seat (B)	102 589 01 09 00
104,119	Flat seat (C)	120589 02 0900')
116,117	Flat seat (A)	1175890009 00

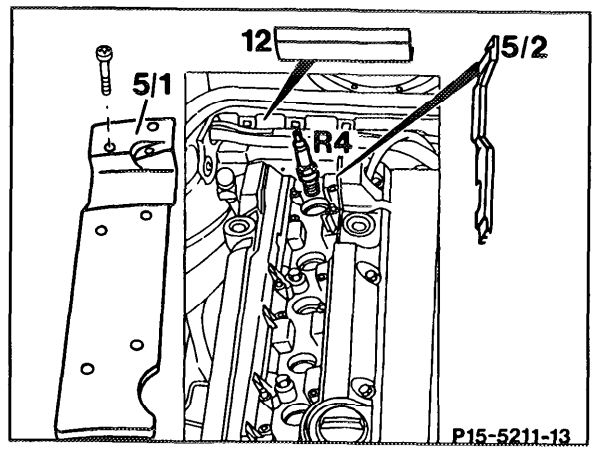
1) Insert commercially available torque wrench

LH-SFI fuel injection

Motor	Spark plug seal	Cylinder	Spark plug wrench
104	Flat seat (C)	all	119 589 01 09 00
119	Flat seat (C)	1–3 and 5–7	120 589 02 09 00 1)
		4 and 8	119589 01 09 00
120	Flat seat (C)	1–5 and 7–12	120 589 02 09 00')
		6	119 589 01 09 00

1) Insert commercially available torque wrench

Spark plug cover, removal and installation

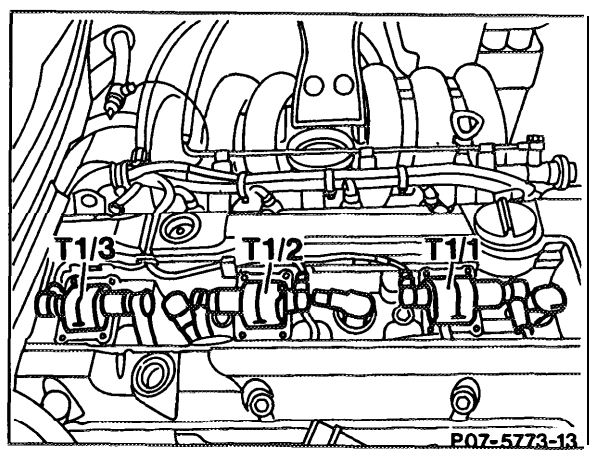


Engine 104 HFM-SFI

Remove air cleaner crossover duct, wiring cover, ignition cable cover (5/1), and guide rail (5/2).

Installation is in the reverse order of removal.

ignition coils, removal and installation

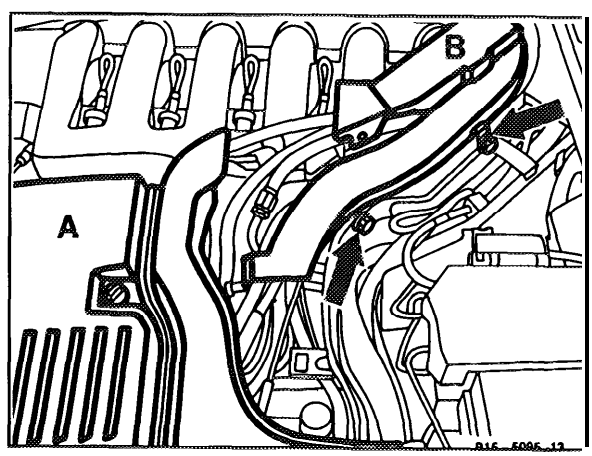


Engine 104 HFM-SFI

Remove ignition coils and cables with associated wiring.

Installation is in the reverse order of removal.

Partial removal of wiring conduit



Engine 120

Pull weatherstripping off partially. Remove covers for ignition control module (A) and for wiring harness (B).
Remove screws for wiring conduit.
Disengage wiring conduit and push forwards.

Checking coolant level/antifreeze protection

2010

All models

⚠WARNING!
Open expansion tank/radiator cap **only** at coolant temperatures **below 90°C.**

Specified coolant mixture:

(Antifreeze protection to approx. **-37° C)**
50% water
50% antifreeze and anti-corrosion protection.
Do not use additives.

Check concentration of antifreeze/anti-corrosion protection. Top up only on separate order.

The corrosion protection/antifreeze protection should not drop below 40% by volume (corresponding to antifreeze protection to approx. **-25°C),** since with too low a proportion, corrosion protection becomes inadequate.
Use only approved antifreeze. Refer to Factory Approved Service Products list.

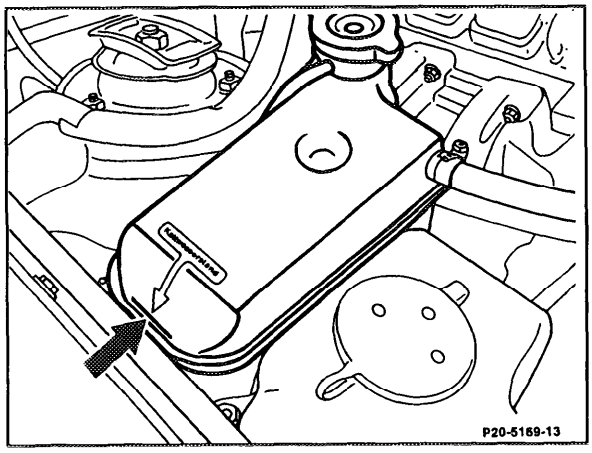
- With coolant loss not caused by normal use determine the cause and repair on separate order.

- Opening: Turn cap only to first detent to release excess pressure.

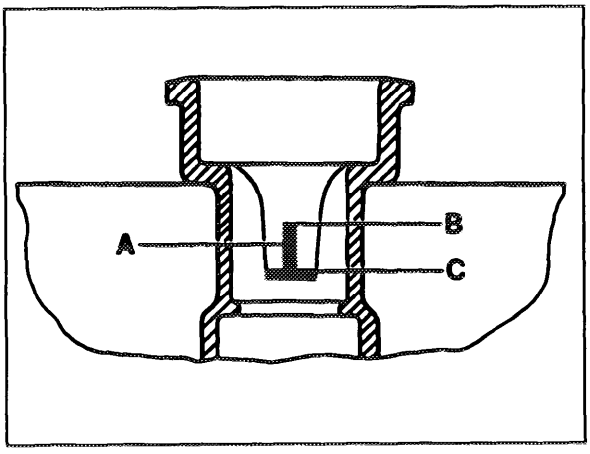
- Turn cap to second detent and remove cap from expansion tank /radiator.

Coolant level should be as follows:

- With cold coolant, up to mark on tank (arrow).
- With warm coolant approx. 1 cm above mark.



- On vehicles without separate expansion tank, up to marks as illustrated.



Vehicles without coolant reservoir
A Filling mark
B Coolant warm
C Coolant cold

Checking coolant level

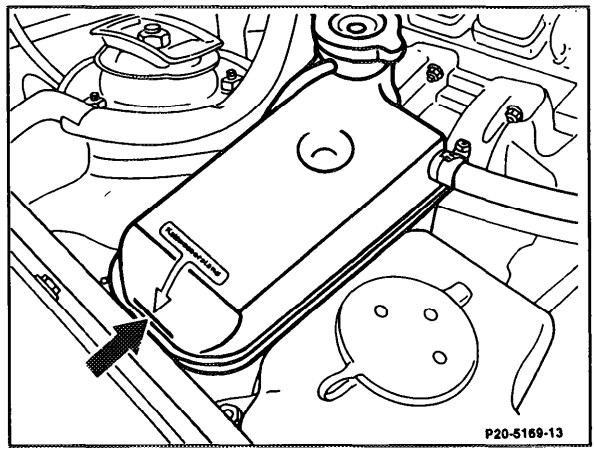
2011

Model 107 starting 08.1985
124
126 starting 09.1985
129
140
201 starting 01.1985

⚠ **Warning!**

Open the expansion tank/radiator cap **only** at coolant temperatures **below 90°C.**

- Opening: Turn cap only to first detent to release pressure.
- Turn cap to second detent and remove cap from expansion tank/radiator.



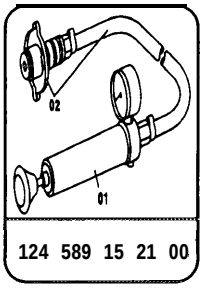
Coolant level should be as follows:

- Up to mark printed on tank (arrow).
- With warm coolant approx. 1 cm above this mark.

- If coolant loss is excessive, determine the cause and repair on separate order.

Model 107 up through 07.1985
123
126 up through 08.1985
201 up through 12.1984

Special tools



124 589 15 21 00

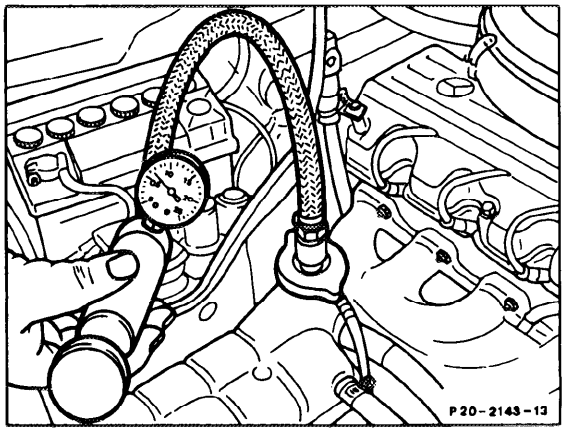
Commercial tools

7 mm hex. socket wrench on flexible drive for worm drive hose clamps.	obtain locally

Warning! Perform leak test on **cold engine only!**

Check hoses for porosity, hardening, swelling, cracks or chafing marks and correct routing. Replace defective hoses.

- Apply pressure of 1 .O to 1.3 bar gauge to cooling system.
- Check all hoses and connections for leakage.
- Retighten hose clamps, if required.
- Replace corroded hose clamps.
- Replace a corroded radiator/expansion tank cap.



All **models**

On separate order

Total capacity of cooling system and ratio of antifreeze to water in liters

Model	Engine	Total capacity of cooling system incl. heater	Antifreeze protection to -37°C (50 Vol. -%)	Antifreeze protection to -45°C (55 Vol. -%)
107	116.96	12.5	6.25	7
	117.96	13.5	6.75	7.5
123	110, 616	10	5	5.5
	617.91	11	5.5	6
	617.95	12.5	6.25	7
124	103, 104, 602.96	9.5	4.75	5.25
	119	15.5	7.75	8.5
	603.96	10	5	5.5
126	103	8	4	4.4
	116.96	12.5	6.25	7.5
	117.96	13.5	6.75	7.5
	603.96/97	10	5	5.5
	617.95	12	6	6.5
129	104	11.5	5.75	6.3
	119	15	7.5	8.25
	120	15.5	7.75	8.5

Model	Engine	Total capacity of cooling system incl. heater	Antifreeze protection to -37°C (50 Vol. -%)	Antifreeze protection to -45°C (55 Vol. -%)
140	104	14.5	7.25	a
	119.970/971	16.5	a.25	9
	120	18.5	7.75	10.25
	603.96	10	5	5.5
201	102.961/985 601.921	a.5	4.25	4.75
	103.942	9.5	4.75	5.25
	1 02.983 602.91 1/961	a	4	4.5

Torque specifications (Nm)

Radiator drain plug, model 107 (w/o light alloy radiator)	6-10
Radiator drain plug, model 107 (w/ light alloy radiator), model 123, 124, 126, 129, 201	1.5-2 [1])

[1]) This torque can be achieved using a washer or coin.

Coolant

Coolant composition

50% by volume of water
50% by volume of corrosion protection/antifreeze agent.

Water

Use clean water that is not too hard. Usually, though not always, tap water meets these requirements. The dissolved substances in the water can contribute to corrosion. If in doubt, have the water analyzed.

Corrosion protection/antifreeze

Corrosion protection/antifreeze must provide the following:

- Adequate corrosion and cavitation protection for all components
- Antifreeze protection
- Higher boiling point.

Approx. 50% by volume of antifreeze must be added to the water. This concentration provides antifreeze protection down to approx. -37°C.

A higher concentration is only practical with even lower ambient temperatures.

Exceeding 55% by volume of corrosion protection/antifreeze agent reduces the antifreeze protection as well as the heat dissipating ability of the coolant.

55% by volume of corrosion protection/antifreeze agent proves antifreeze protection down to approx. -45°C.

Corrosion protection/antifreeze increases the boiling point, i.e. the coolant does not vaporize as rapidly. At high coolant temperatures, coolant boil over is avoided.

Use only approved corrosion protection/antifreeze.

Checking coolant in service

Before the start of the cold season, check the coolant for antifreeze protection.

In countries with high ambient temperatures, check corrosion protection/antifreeze concentration in coolant once a year.

When refilling (after coolant loss), ensure that the coolant contains 50% by volume of corrosion protection/antifreeze (protection down to -37°C).

The corrosion protection in the coolant diminishes during operation. The coolant then has a corrosive effect.

Thee coolant should be used for a maximum of 3 **years.**

Before adding in new coolant, flush the old coolant from the cooling system.

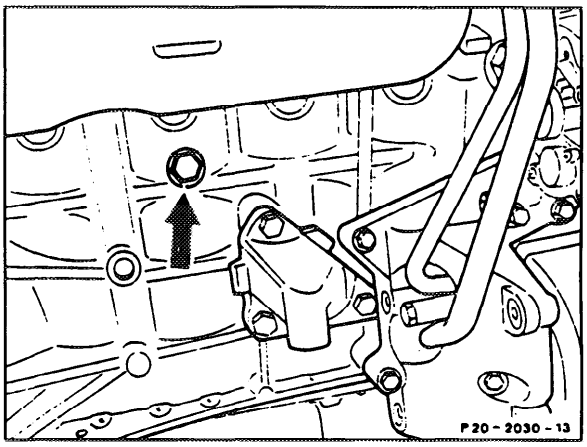
For draining and filling of coolant, see repair instruction 20-010.

Disposal of coolant

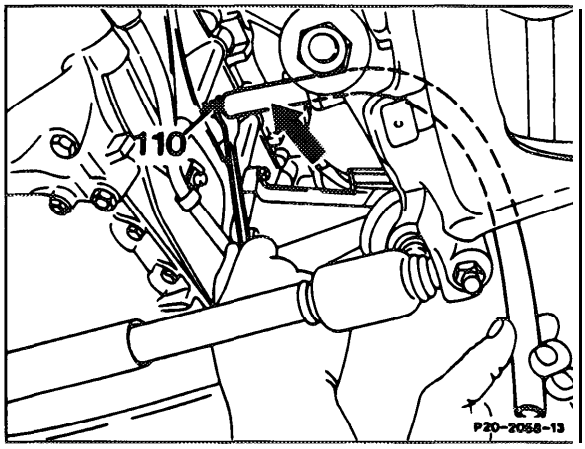
Old coolant must be disposed of according to local laws and waste water or environmental regulations.

Enaine block coolant drain locations

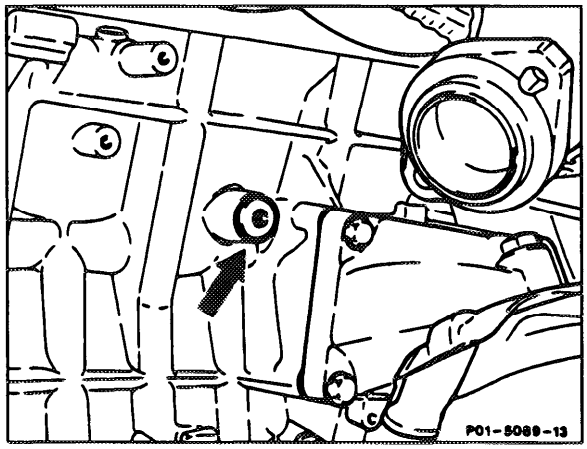
Engine 110	Right side of engine block to rear of engine mount bracket.
Engine 116, 117, 119	Right plug is forward of RH engine mount; left plug is forward of LH engine mount.
Engine 616, 617	Right side of engine block to rear of engine mount bracket, forward of starter.



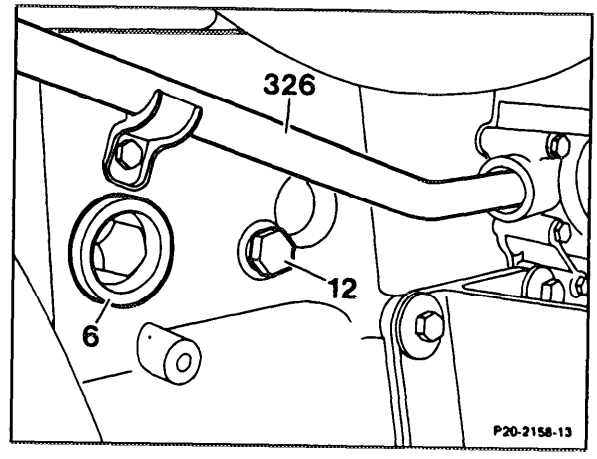
Engine block coolant drain, engine 102



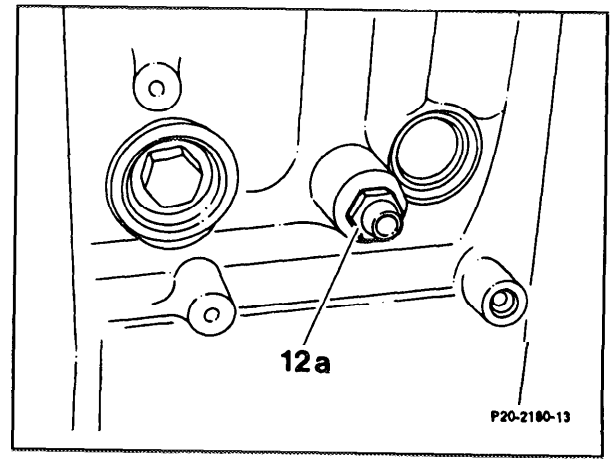
Engine block coolant drain (110) with drain hose attached, engine 103, 104



Engine block coolant drain, engine 120



Engine block coolant drain **(12),** engine 601

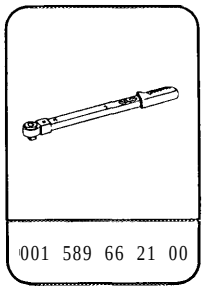


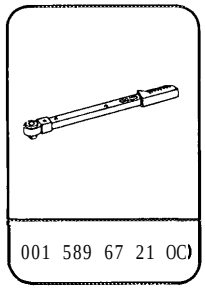
Engine block coolant drain **(12a),** engine 602, 603

Engine 616 617

Torque specifications	Nm
Nuts (4) and bolts (6) of front engine stop	30
Adjusting bolt (2) of front engine stop	130
Nut (1) at rear of engine stop (ref. value)	70
Bolts (14) on rear engine mount	20
Adjusting bolt (11) on rear engine mount	30

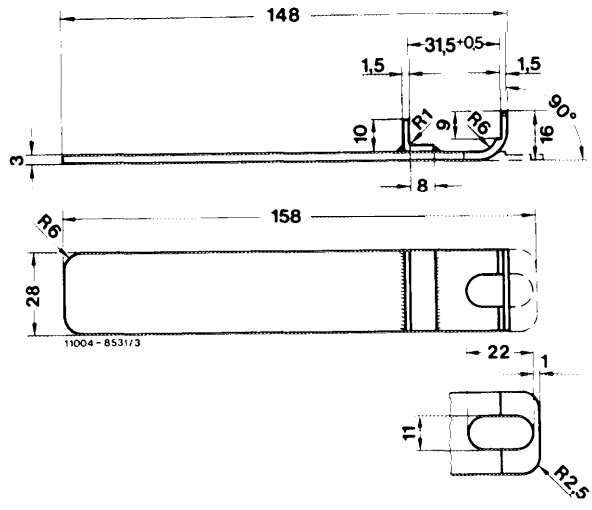
Special tools





Locally fabricated tools

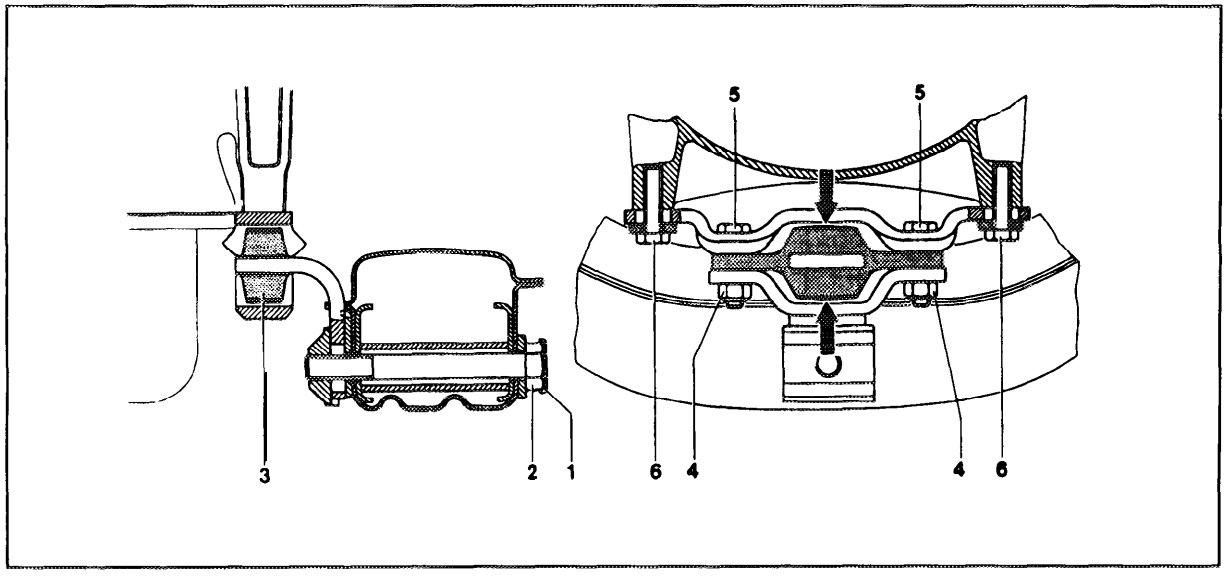
Gauge for adjusting front engine stop



Note: The vehicle weight must rest on the wheels.

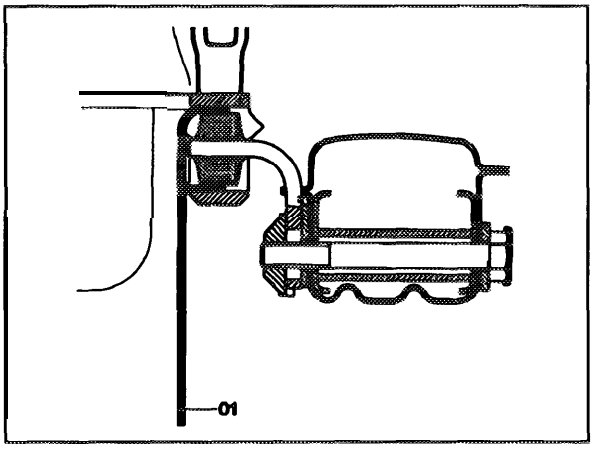
Torque or retorque all bolts and nuts to the specified torque with torque wrench except nut (1) on rear engine mount.

On engine 617.91 loosening and retightening of bolts on front engine stop is not required.



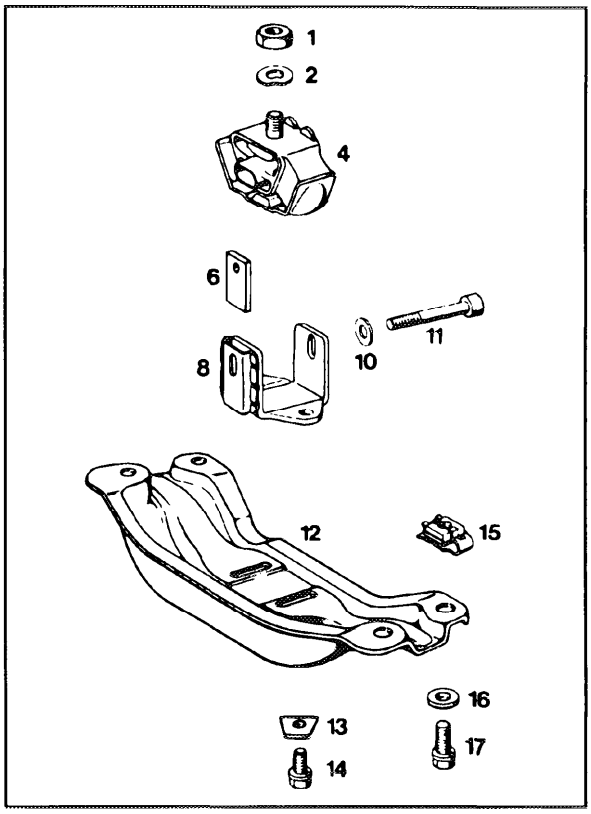
Front engine stop

- Turn steering wheel to full lock either right or left.
- Tighten bolts (6) and nuts) at front engine stop. When tightening nuts (4) hold bolts (5) in position.
- Tighten nut (1) and bolts (14) on rear engine mount.
- Lift lock (1) on front engine stop and move aside. Completely loosen adjusting bolt (2). Make sure that engine stop is not stuck to frame crossmember due to wax or paint.



- Completely loosen adjusting bolt (11) on rear engine mount.
- Place fabricated gauge (01) on front engine stop.
- Shake engine from side to side by hand.
- Tighten adjusting bolt (11) on rear engine mount.

- Tighten adjusting bolt (2) on front engine stop and secure with lock (1).
- Remove fabricated gauge.



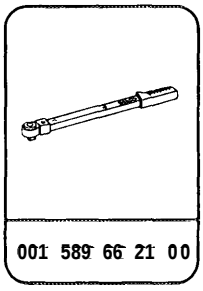
Rear engine mount with engine stop
Version: **4 & 5** cylinder models with automatic transmission

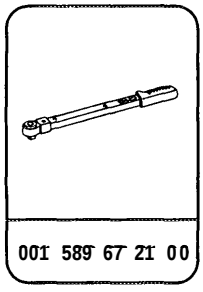
Adjust engine stop

Engine 616 617.91

Torque specifications	Nm
Adjusting bolt (2) on front engine stop	**130**
Adjusting bolt (11) on rear engine mount	30

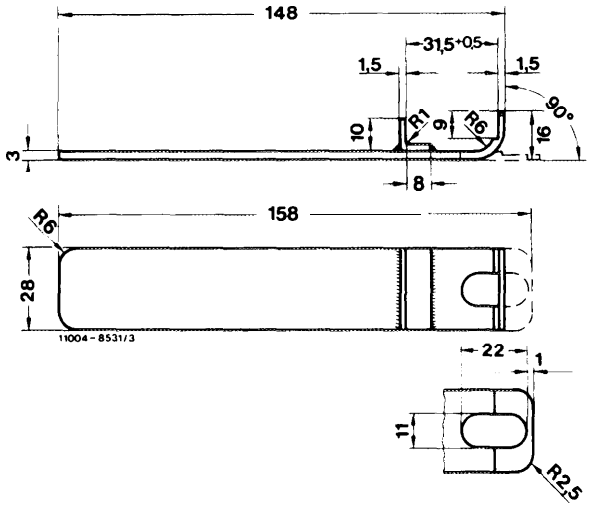
Special tools

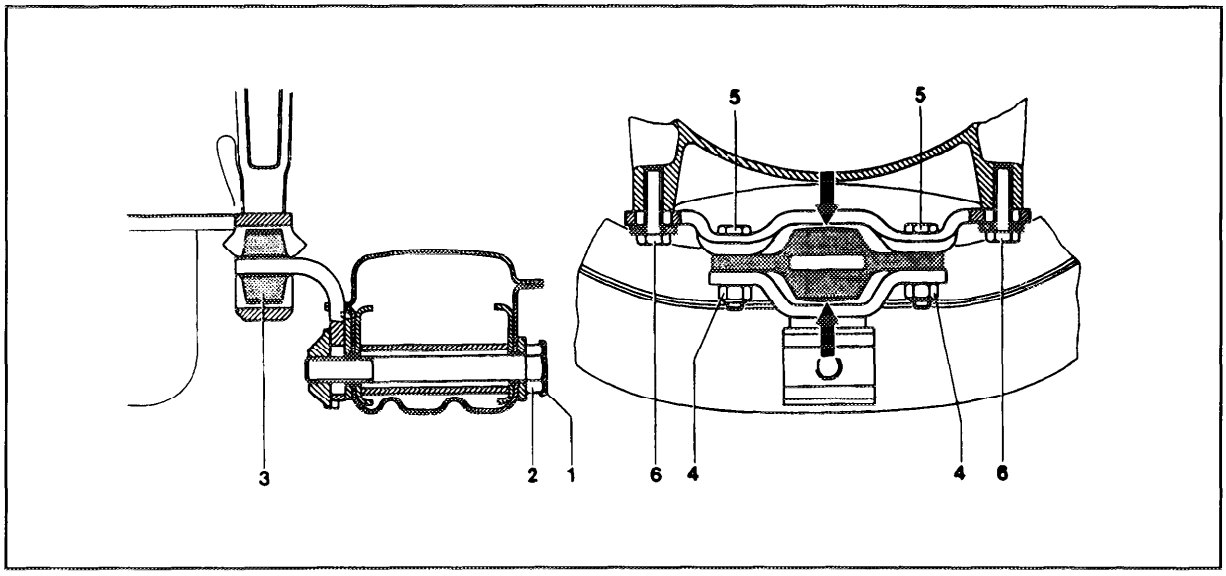




Locally fabricated tools

Gauge for adjusting front engine stop





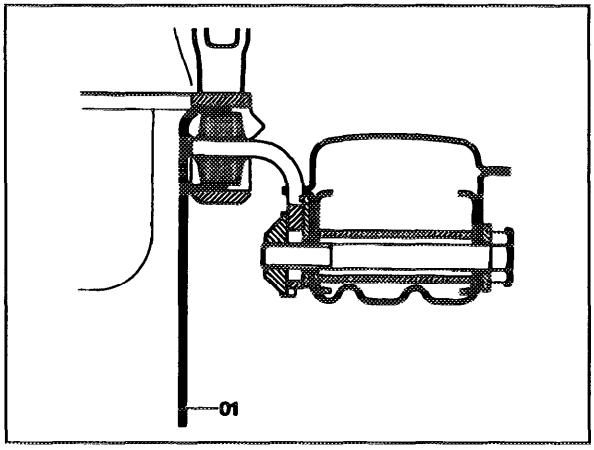
Front engine stop

Note: The vehicle weight must rest on the suspension.

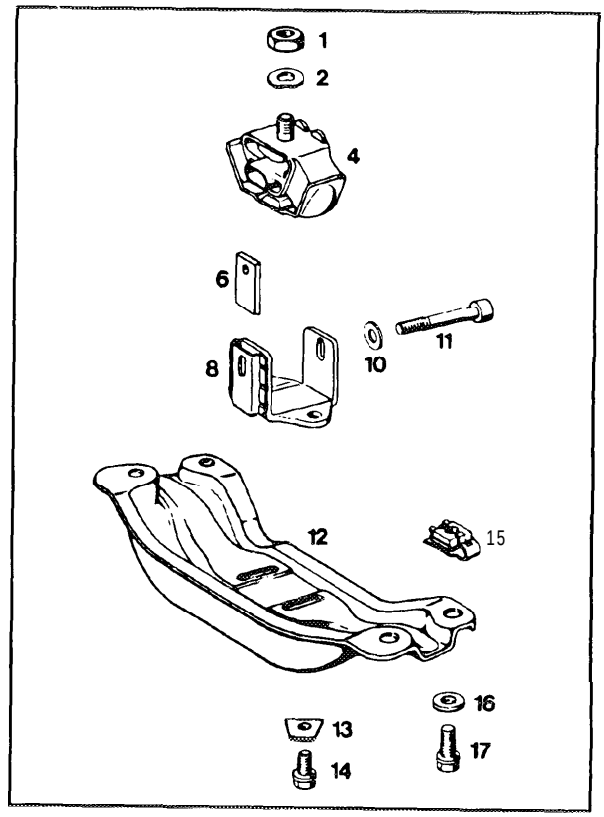
On engine 617.91 loosening and retightening of bolts on front engine stop is not required.

- Turn steering wheel to full lock, either right or left.
- Lift lock (1) on front engine stop and move aside. Completely loosen adjusting bolt (2). Make sure that engine stop is not stuck to frame crossmember due to wax or paint.

- Completely loosen adjusting bolt (11) on rear engine mount.
- Place fabricated gauge (01) on front engine stop.
- Shake engine from side to side by hand.



- Tighten adjusting bolt (11) on rear engine mount.
- Tighten adjusting bolt (2) on front engine stop and secure with lock (1).
- Remove fabricated gauge.

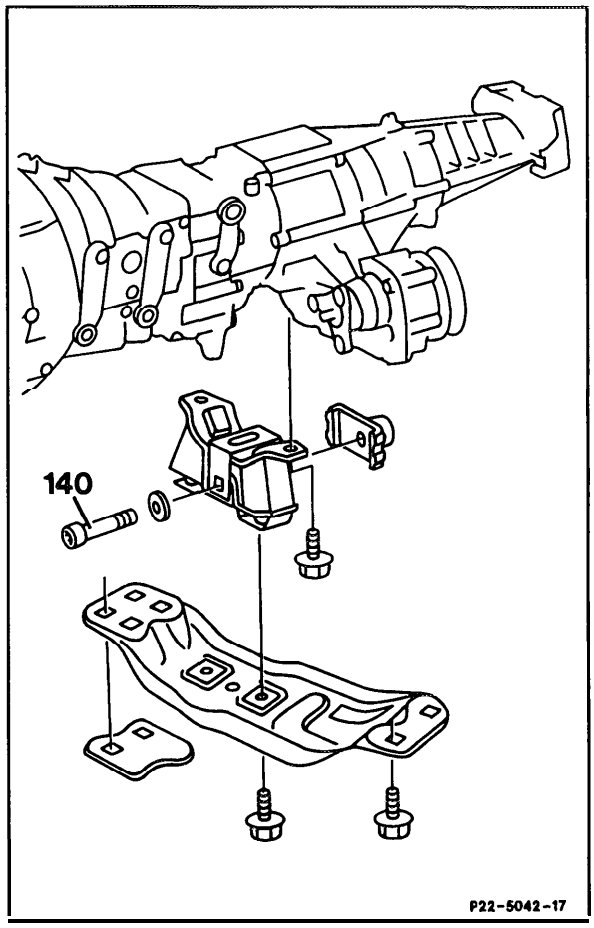


Rear engine mount with engine stop
Version: 4&5 cylinder models with automatic transmission

Engine 103 in model 124 with 4MATIC

Torque specifications (Nm)

Adjusting screw (140) on rear mount (reference value)	45



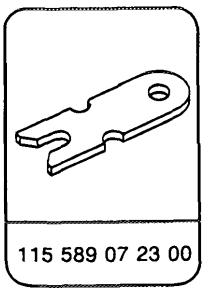
- Completely loosen adjusting bolt (140) on rear engine mount.
- Start engine and depress gas pedal several times to rock engine to adjust engine stop.
- Tighten adjusting bolt (140) on rear engine mount to 45 Nm.

Checking clutch disk for wear

2551

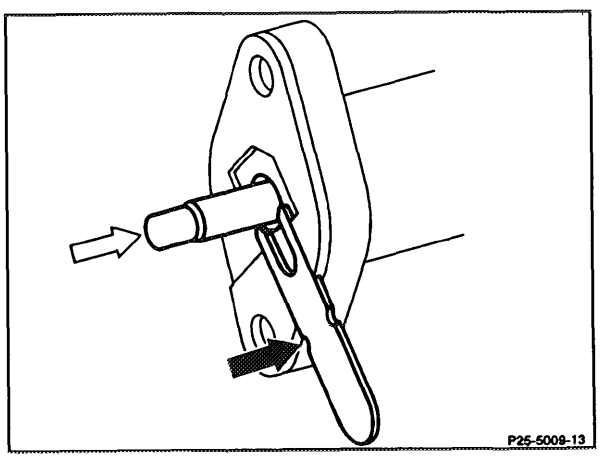
Models 123 124 129 201

Special tools



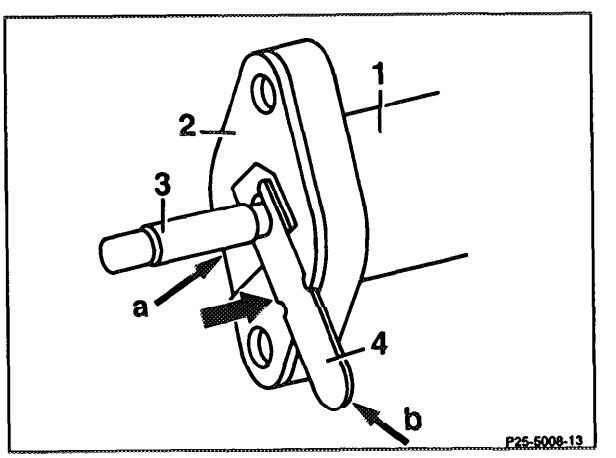
Insert slip gauge as far as possible between clutch housing and slave cylinder and note position of notches (arrow) in gauge.

If notches are not visible:
Clutch disk wear is acceptable.



If notches are visible:
Wear limit of disk **has been reached.**

Replace clutch disk.



1 Slave cylinder
2 Shim between slave cylinder and clutch housing
3 Actuating rod
4 Slip gauge

Model 123 124 129 201

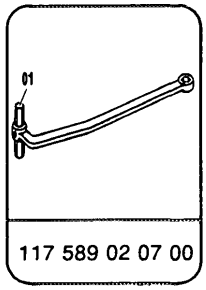
Oil grades

approved oil	Refer to MBNA Factory Approved Service Products list

Capacities in liters

Transmission type		Capacity
4-speed transmission	716.0	1.6
	716.21	1.3
5-speed transmission	717.40	1.6
	717.41	1.5
	717.43	1.5
	717.45	1.7

Special tools



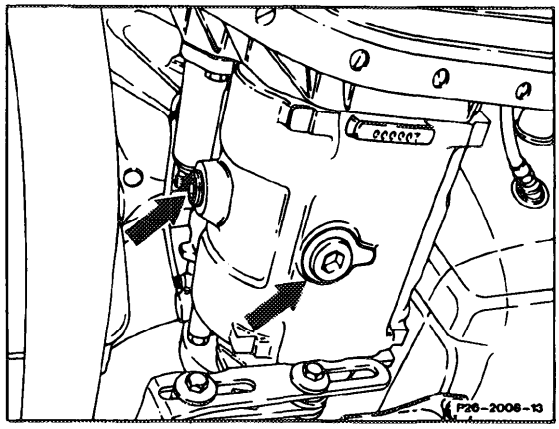
Commercial tools

14 mm hex. driver insert, 1/2" square drive	obtain locally

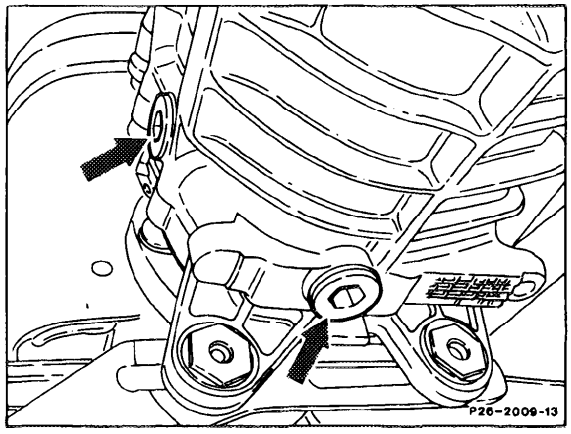
Note: When performing this job number, the engine compartment lower panel or the noise encapsulation panel must be removed, and replaced after completing all maintenance work (refer to job number 6190 or 9400).

Warning! To help prevent risk of injury when opening filler plug on model 201, wear leather gloves; place an extension on wrench; or open filler plug by striking wrench.

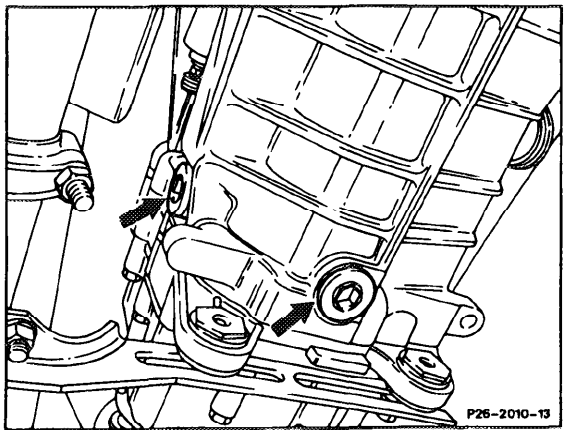
- Drain oil only with transmission at operating temperature; remove both oil filler plug and drain plug. Clean drain plug with magnet.
- Install oil drain plug and torque to max. 60 Nm.
- Fill oil up to over flow (upper arrow). Install oil filler plug and torque to max. 60 Nm.
- Check transmission for leaks at operating temperature.



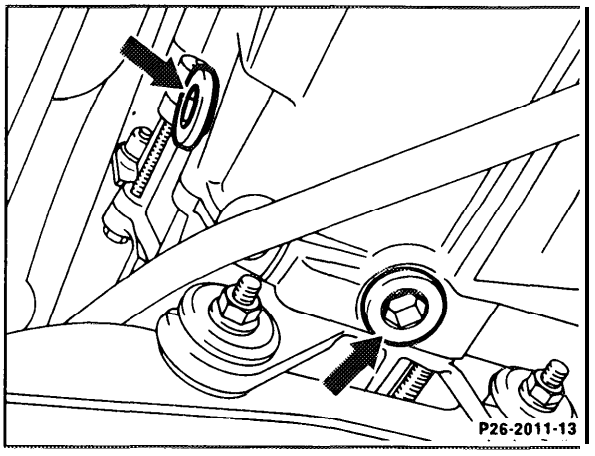
Transmission 716.0



Transmission 716.21



Transmission **717.40**

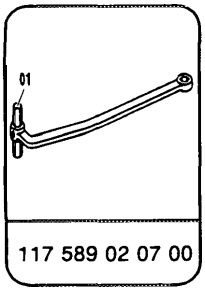


Transmission **717.41, 717.43, 717.45**

Oil grades

ATF approved oil	Refer to MBNA Factory Approved Service Products list

Special tools



Commercial tools

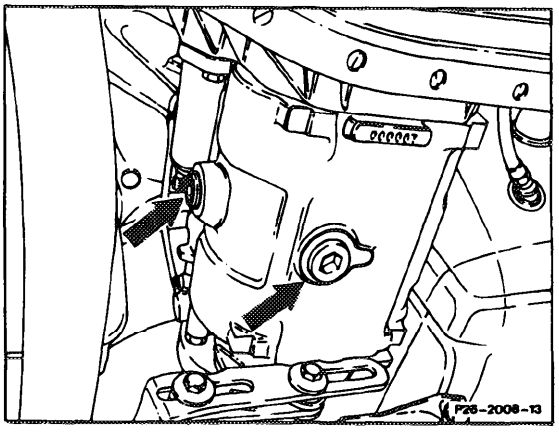
14 mm hex. driver insert, 1/2" square drive	obtain locally

Note: When performing this job number, the engine compartment lower panel or the noise encapsulation panel must be removed, and replaced after completing all maintenance work (refer to job number 6190 or 9400).

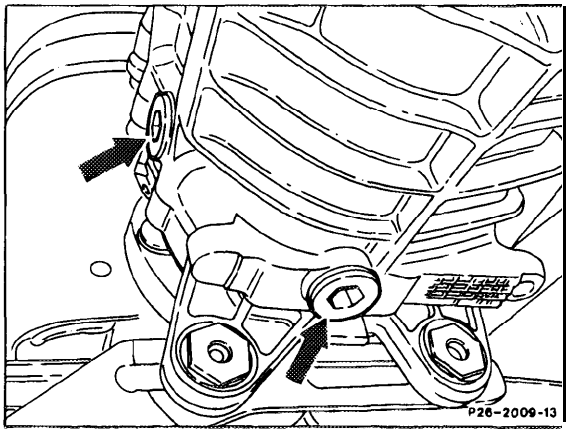
Warningf To help prevent risk of injury when opening filler plug on model 201, wear leather gloves; place an extension on wrench; or open filler plug by striking wrench.

- Remove oil filler plug (upper arrow in figure).
- If a minimal amount of oil runs out or if the oil level is at lower edge of opening, oil level is correct.
  If not, add oil.

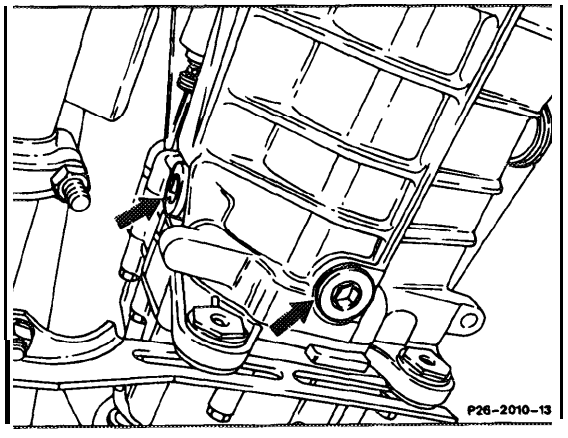
- Install oil filler plug and torque to max. 60 Nm.
- If oil loss is excessive, determine cause and repair on separate order.



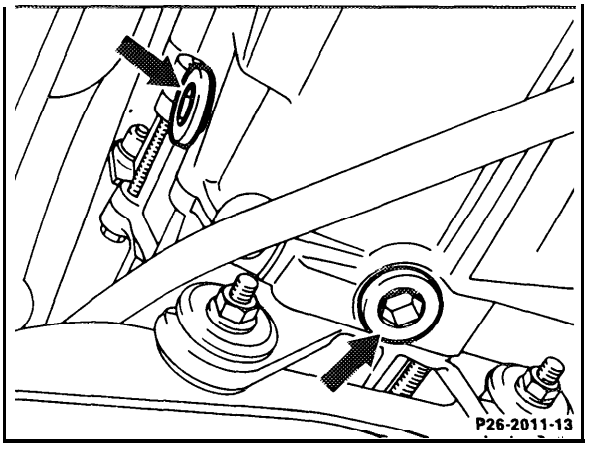
Transmission 716.0



Transmission 716.21



Transmission 717.40



Transmission **717.41,** 717.43, 717.45

All models

Oil grades

AI-F	Refer to MBNA Factory Approved Service Products list

Capacities in liters

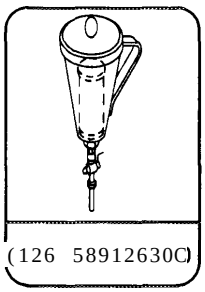
Models with		Transmission	Full capacity	Oil change
4- and 5-cylinder engines		722.1	6.1	4.8
		722.3	7.3	6.2
	(exc. 102.98, 602.96)	722.4	6.6	5.5
	(102.98, 602.96)		7.1	6.0
6-cylinder engines		722.1	6.6	5.3
		722.3	7.3	6.2
		722.4	7.1	6.0
		722.5	7.3	6.2
8-cylinder engines	3.8, 1981-82	722.3	7.3	6.2
	3.8, 1983-85		8.6	7.7
	4.2, 5.0, 5.6	722.0	8.9	7.9
		722.3	8.6	7.7
12-cylinder engines		722.3	8.6	7.7

Torque specifications

		Nm
Drain plug, torque converter		14
Drain plug, oil pan (transmission 722.3, 722.4, 722.5)		14
Bolts, oil pan	Transmission 722.0, 722.1	7
Bolts, oil pan	Transmission 722.3, 722.4, 722.5	8
Bolts, front axle crossmember (model 126)		45

Note: On vehicles operating under severe conditions (e.g. taxi operation, primarily city operation, trailer operation, or operation in mountainous regions), perform additional oil change (without filter change) in between normal interval.

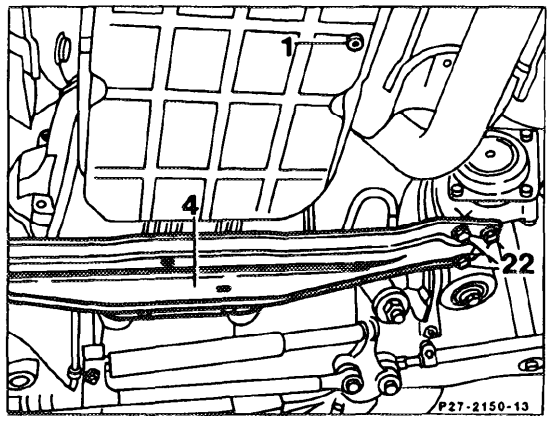
Special tools



Note: When performing this job number, the engine compartment lower panel or the noise encapsulation panel must be removed, and replaced after completing all maintenance work (refer to job number 6190 or 9400).

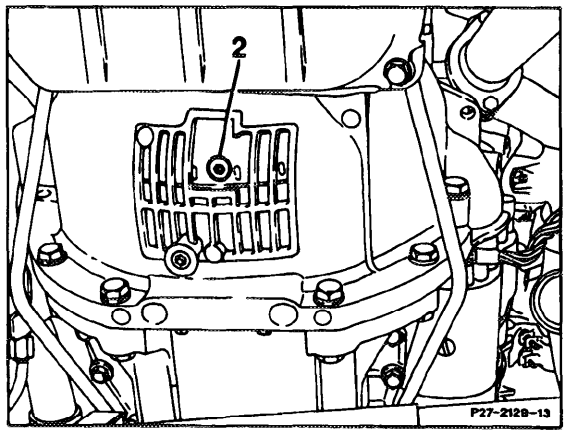
Caution! Perform fluid change with engine stopped and selector lever in P position.

On model 126, remove front axle crossmember (4), to gain access to torque converter drain plug.
Bolts (22) are self-locking (micro-encapsulated) and should be replaced.

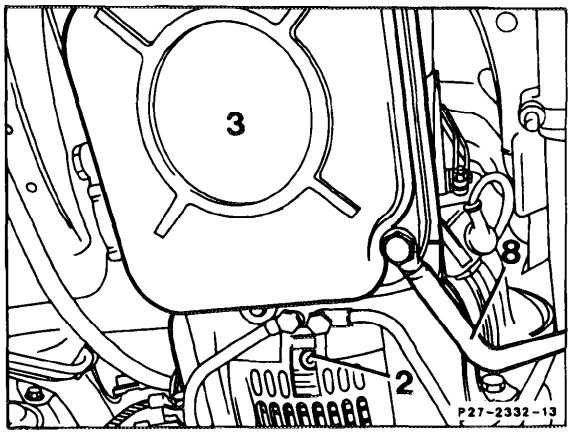


- Remove oil pan drain plug (1) on transmission 722.3, 722.4, and 722.5 and drain fluid.

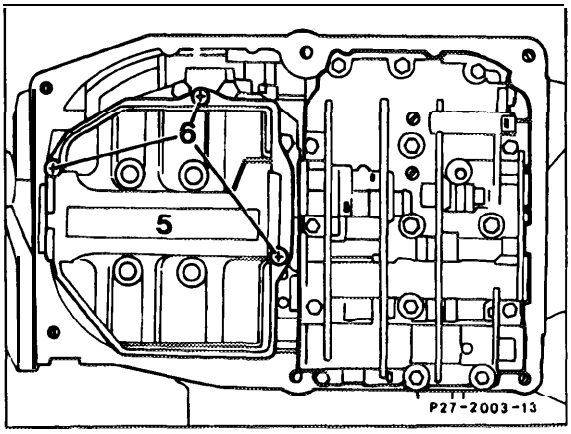
- Turn crankshaft until drain plug (2) of torque converter is accessible through opening in vent grille. Remove drain plug and allow fluid to drain.



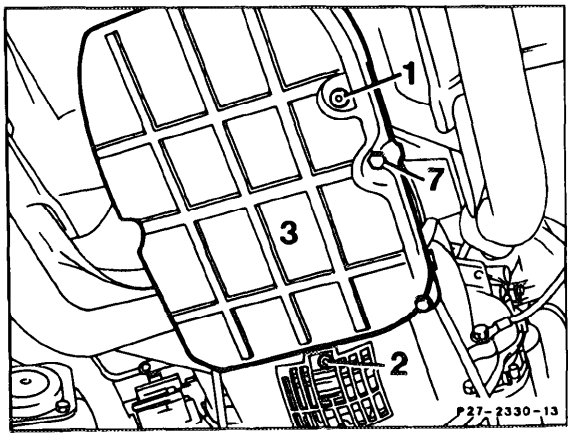
- Disconnect filler pipe (8) (transmission 722.0 and 722.1) and drain fluid.
- Remove pan (3).



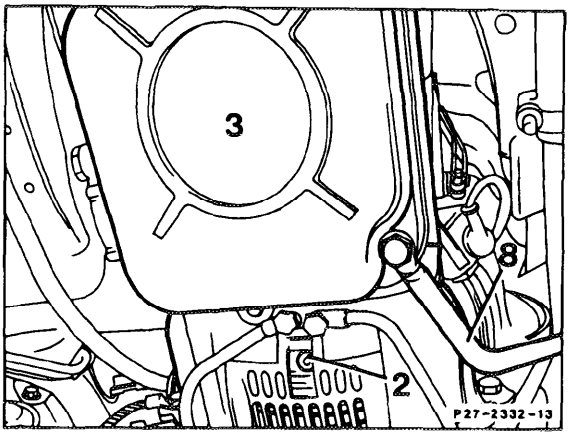
- Replace filter (5).



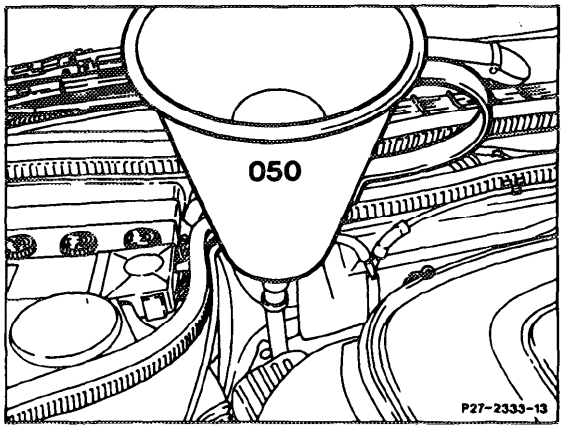
- Clean pan (3) and install, torque bolts (7) on transmission 722.0, 722.1, to 7 Nm and transmission 722.3, 722.4, 722.5 to 8 Nm.
- Install pan drain plug (1) and torque converter drain plug (2) and torque to 14 Nm.
- Model 126: Install front axle crossmember, torque bolts to 45 Nm.



- Install oil filler pipe (8) (transmission 722.0, 722.1).



- Actuate parking brake.
- Insert funnel (050) into dipstick opening and, with engine stopped, fill in approx. 4 liters of fluid. Start engine and run in selector lever position P at idle. Gradually add remaining fluid. Move selector lever through positions R-N-D-N-R, pausing in each position for several seconds, then return to position P.



- Correct fluid level (refer to job no. 2710).

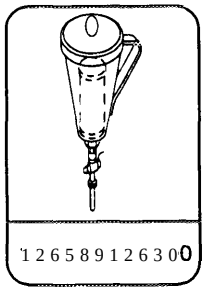
Automatic transmission, checking, correcting fluid level 2710

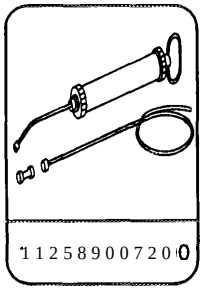
All **models**

Oil arades

Al-F	Refer to **MBNA** Factory Approved Service Products list

Special tools



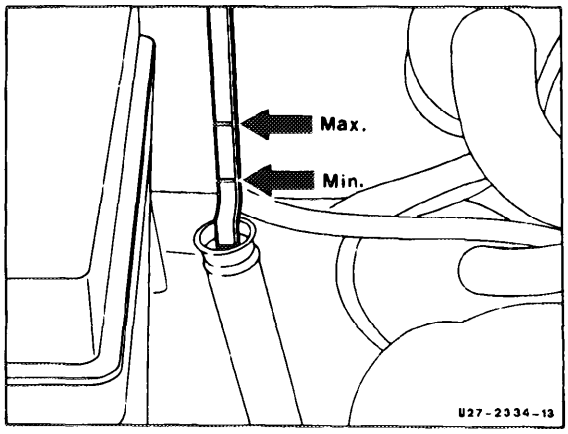


Note: Too low or too high a fluid level will affect the operation of the transmission. The fluid level should be checked regularly with the dipstick from the engine compartment. When checking fluid level, vehicle should be parked on level surface.

The fluid level varies with fluid temperature. The min. and max. marks on the dipstick are based on a **fluid temperature of 80°C** (transmission at normal operating temperature).

However, at a fluid temperature of 20-30°C the max. oil level will read below the min. mark as follows:

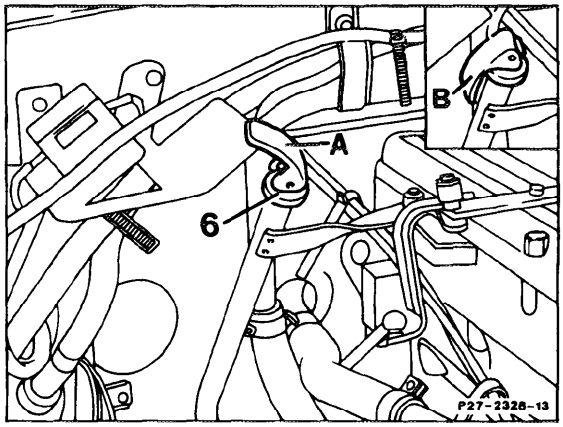
Transmission	**722.0**	**30** mm
	722.1	**30** mm
	722.3	**10 mm**
	722.4	**12 mm**
	722.5	**10 mm**



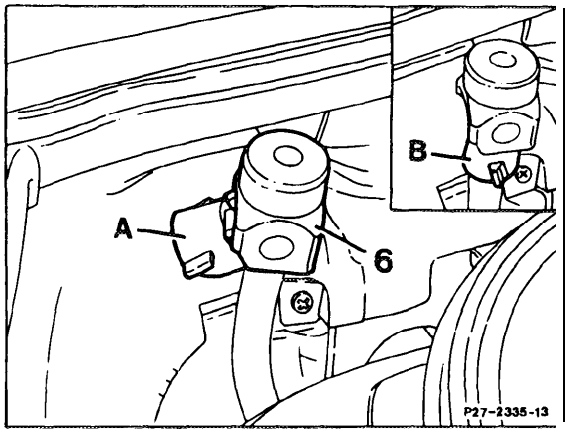
Check

- **Apply parking brake.**
- **Place selector lever in position P.**
- **Run engine for** 1 to **2 minutes.**

- Open latch (position A), pull out dipstick (6), wipe with lint free rag (leather is best).
- Insert dipstick fully with latch open, and read fluid level.
- After measuring or correcting fluid level, close latch (position B).

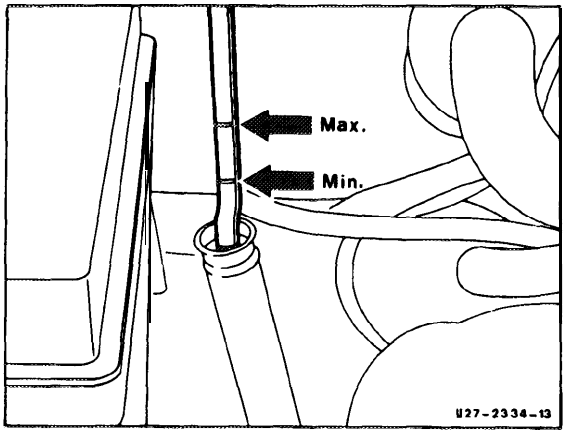


Dipstick latch, transmission 722.0, 722.1



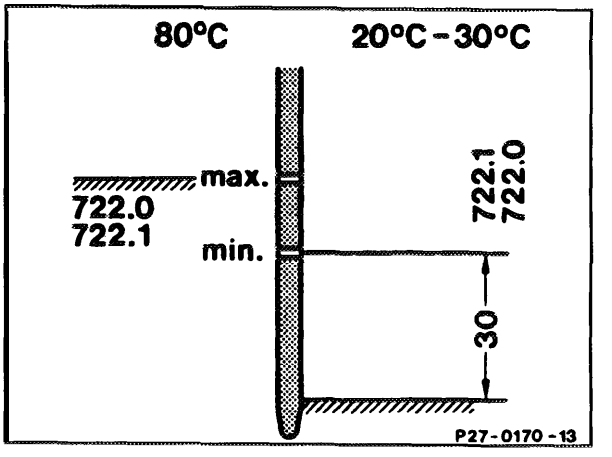
Dipstick latch, transmission 722.3, 722.4, 722.5

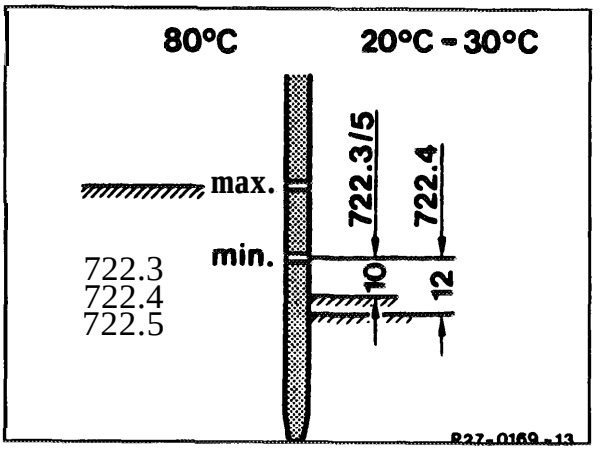
- With the transmission at operating temperature, the oil level should be at the max. mark.



- At a transmission fluid temperature of approx. 20-30°C, the fluid level should be below min. mark, depending on type of transmission (as shown).

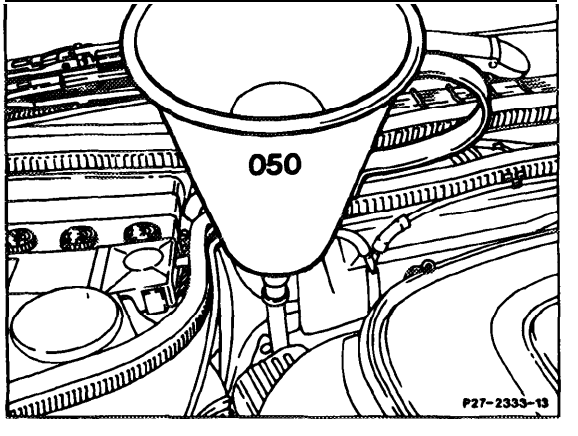
If fluid loss is excessive, determine cause and repair on separate order.





Correcting fluid level

Add necessary amount of fluid through funnel (050) into dipstick tube with engine running.

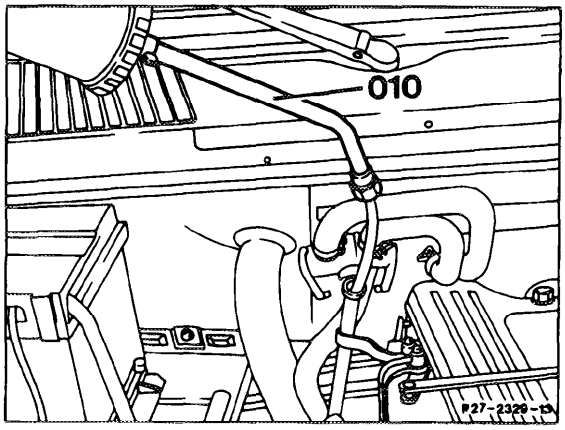


Note: The distance between min. and max. mark on dipstick is approx. 0.3 liter of transmission fluid.

After filling fluid to specified level, apply parking brake. Move selector lever through positions R-N-D-N-R, pausing for a few seconds in each position, and return to P position, to ensure that the operating pistons of the servo members are filled with fluid. Recheck fluid level and correct, if necessary.

If fluid level **is too low,** the pump will draw in air, (which can be heard), causing **foaming** and leading to an **incorrect** fluid level reading. Stop engine and wait until fluid is no longer foaming (approx. 2 minutes). Add fluid and check level.

Be sure to drain or draw off excessive fluid, to avoid excessive churning of the fluid by the gears. This results in excessive temperature increase causing the foaming fluid to be forced out through the breather. Extended operation in this condition will cause transmission damage. The oil cooler flushing syringe (010) with the attached hose can be use to remove excessive transmission fluid.



Model 124 with 4MATIC

Oil grades

ATF	Refer to MBNA Factory Approved Service Products list

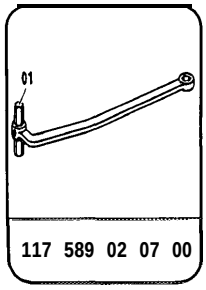
Capacity during fluid change

	Liters
All models	approx. 0.6

Torque specifications

	Nm
Oil filler and drain plug	50

Special tools



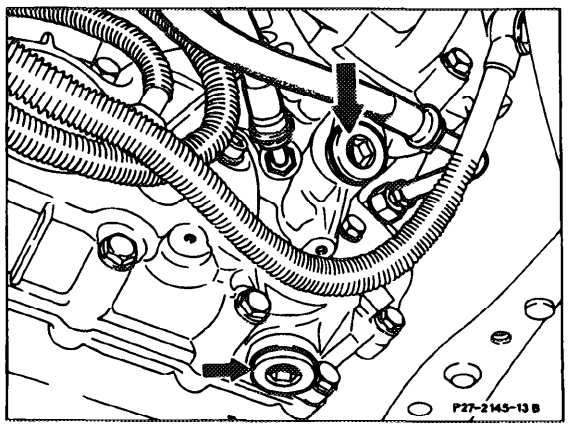
Commercial tools

14 mm hex. driver **insert, 1/2" square drive**	**obtain locally**

Note: When checking fluid level and changing fluid, the vehicle should be level.

Before fluid change, check transfer case for leaks

- Remove shielding plate under transfer case.
- Drain fluid with transfer case at operating temperature.
- Fill specified fluid quantity.
- Check fluid level. Fluid level should be up to filler hole.



Transfer case, checking, correcting fluid level 2810

Model 124 with 4MATIC

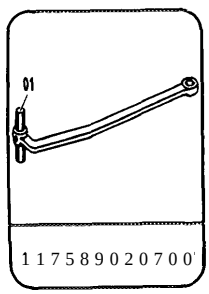
Oil grades

ATF	Refer to MBNA Factory Approved Service Products list

Torque specifications

	Nm
Oil filler and drain plug	50

Special tools



Commercial tools

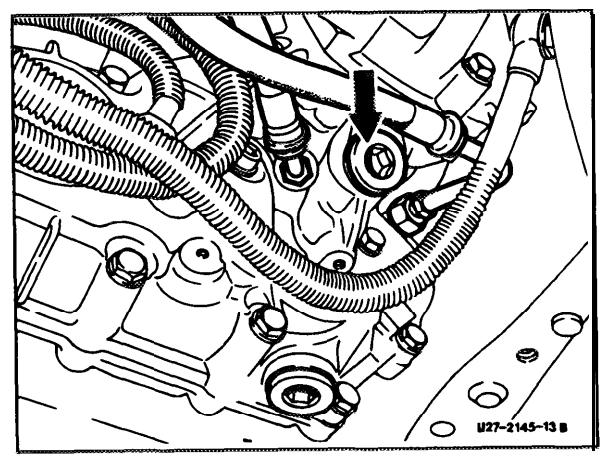
14 mm hex. driver insert, 1/2" square drive	obtain locally

Note: When checking fluid level, the vehicle should be level.

- Remove filler plug.

Note: If more than approx. 50 cc of fluid flows out of filler hole, the multi-disc clutches AV or ZS are leaking. Check oil level in hydraulic oil reservoir in engine compartment.

Repair or replace transfer case.



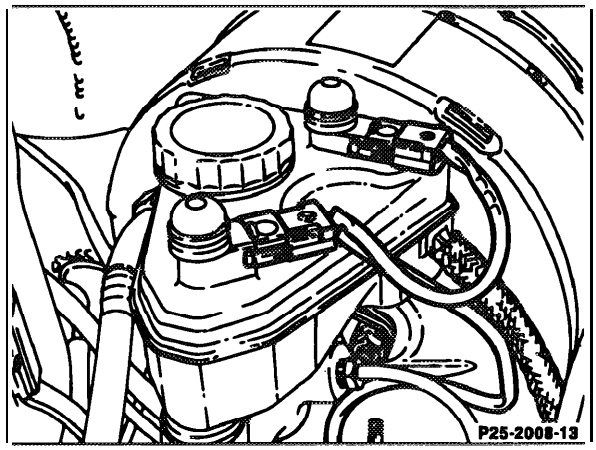
- The fluid level is correct, if a small amount of fluid flows out or if fluid level extends up to lower edge of opening.

If not, add fluid.

- Install filler plug and torque to **50** Nm.

Model 123
201 up through 12.1984

Hydraulic clutch fluid	
Use specified brake fluid only	DOT 4



Check fluid level in reservoir and add fluid up to max. mark, if necessary.
Clean vent opening in reservoir cover (refer to job no. 4210).

Handle brake fluid with care.

Store brake fluid only in containers, which make accidental consumption of fluid impossible **(Fatal dosage 100 cc).**

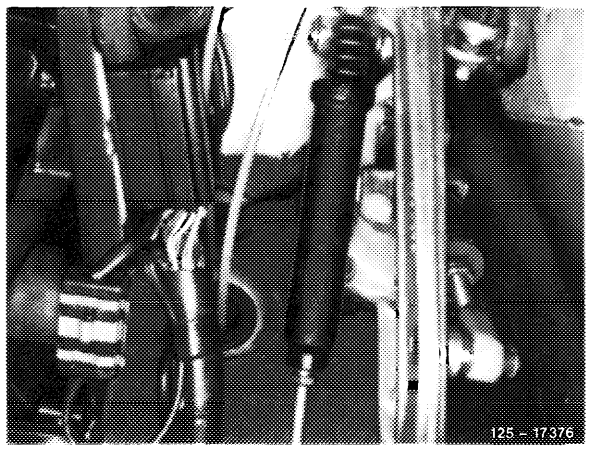
Make sure that brake fluid does not contact painted surfaces of vehicle, since the fluid acts as a paint solvent.

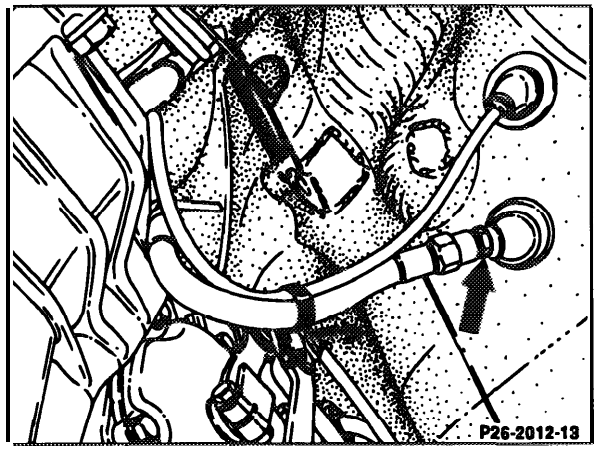
Brake fluid is highly hygroscopic, meaning it will absorb moisture from the air, as a result of which the fluid's boiling point is lowered. Brake fluid should only be stored in well sealed containers.

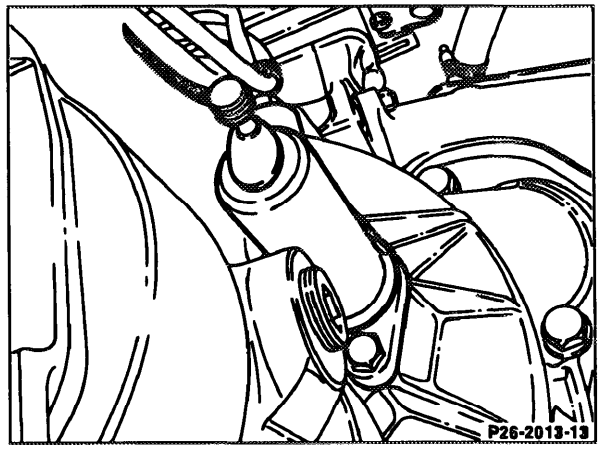
Even minute quantities of mineral oil will result in failure of clutch and brake systems. Special care should be taken with brake fluid that is colorless or dyed yellow, since here the risk of confusion is the greatest. Whenever mineral oil is found in the clutch and brake system, or if the presence of mineral oil is suspected, the entire clutch and brake system should be thoroughly flushed. At the same time, replace the master cylinders and all rubber components, including hoses, in hydraulic system.

Model 123
201 up through 12.1984

- Check master and slave cylinder for leaks (visual inspection).
- Check lines and hoses for leaks, chafe marks, and damage.

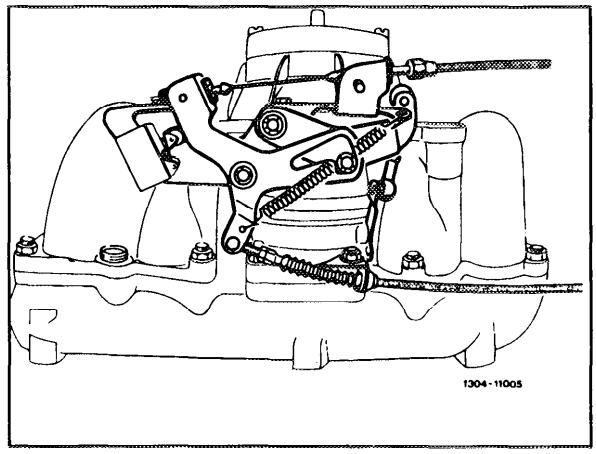






All engines

- Remove air cleaner.
- Lubricate pivots of control shafts, control levers, throttle linkage joints and control cables using only ATF. Refer to MBNA Factory Approved Service Products list.
- Check control shafts, control levers, guide levers, ball sockets, bowden cable, and throttle linkage for smooth operation and possible wear.

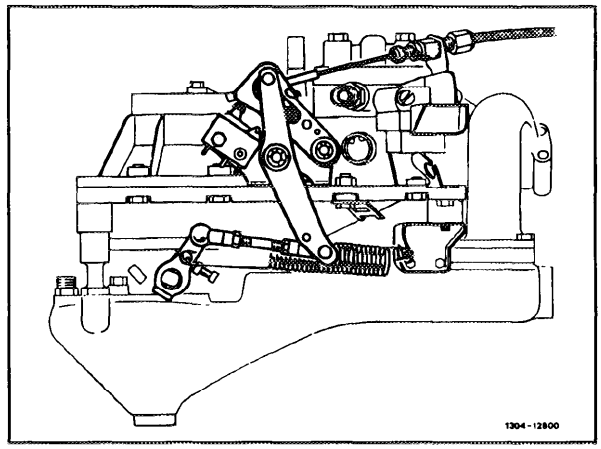


Engine 102.96/98 (except 102.983)

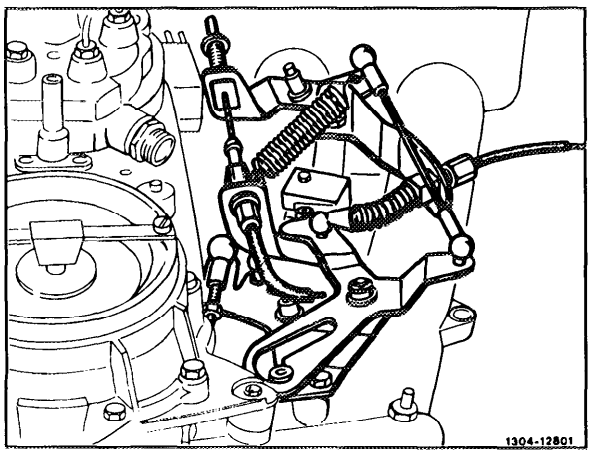
- During assembly jobs use corrosion protection grease, part no. 000 989 87 51 10.

Note: On model 126 with engine 603.961 as of 1986, note 2nd version control linkage.

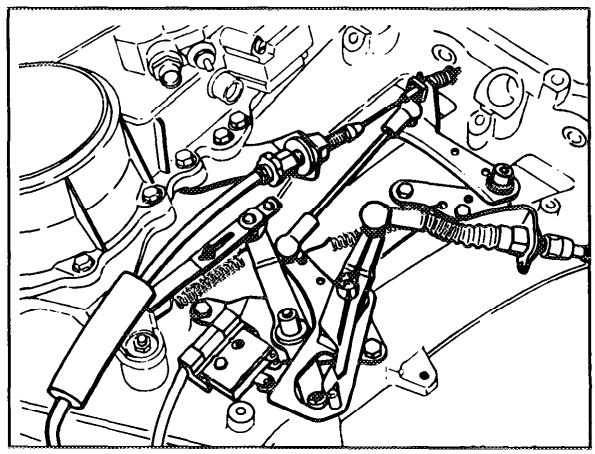
On vehicles with electronic accelerator, the linkage should only be moved when the ignition is off to avoid setting a Diagnostic Trouble Code in the control module memory.



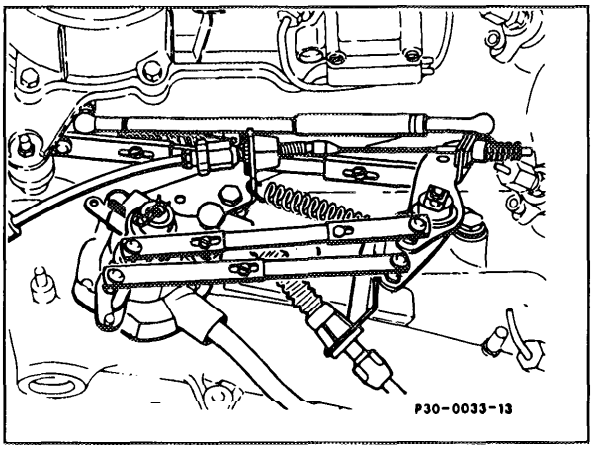
Engine 102.983



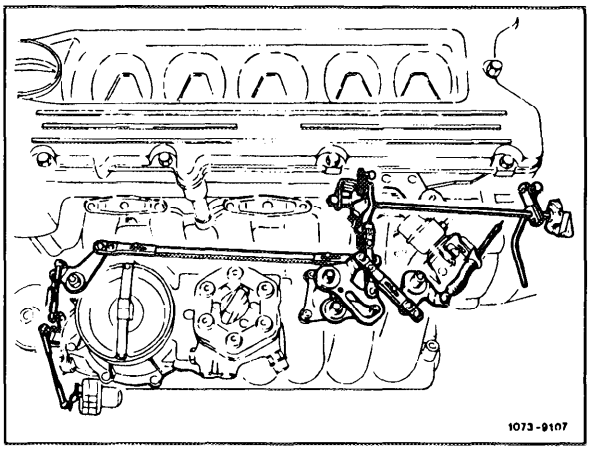
Engine 103



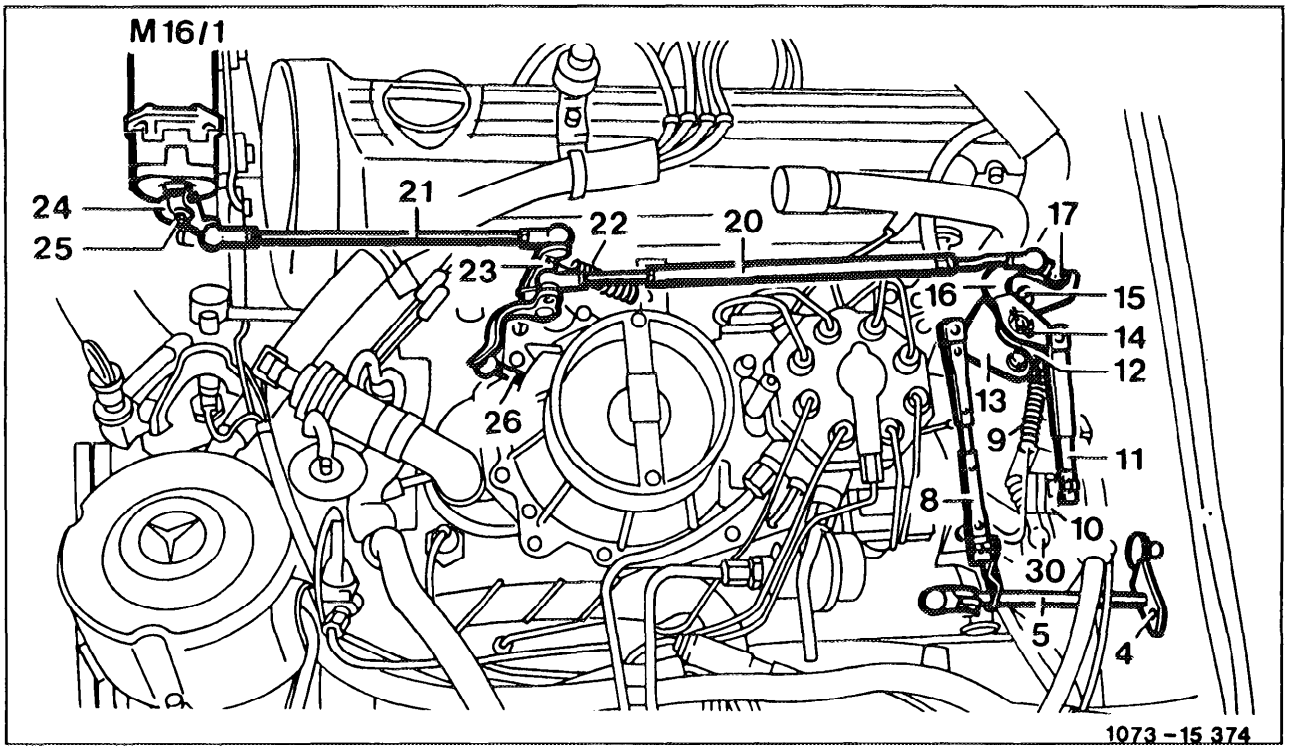
Engine 104 CFI



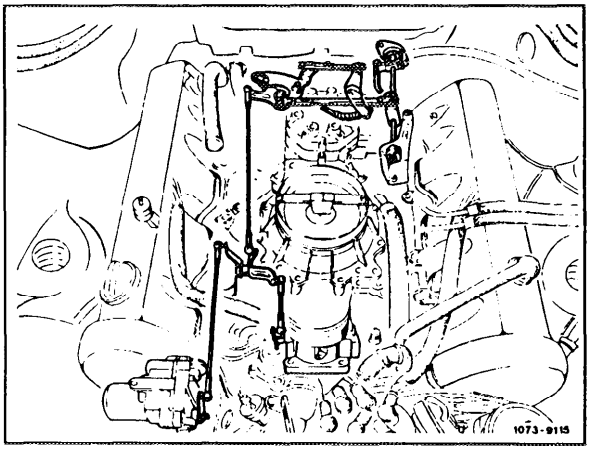
Engine 103, 104 CFI with ASRII



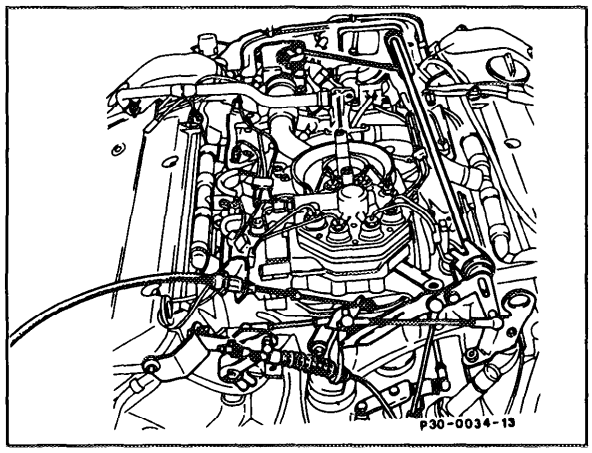
Engine 110



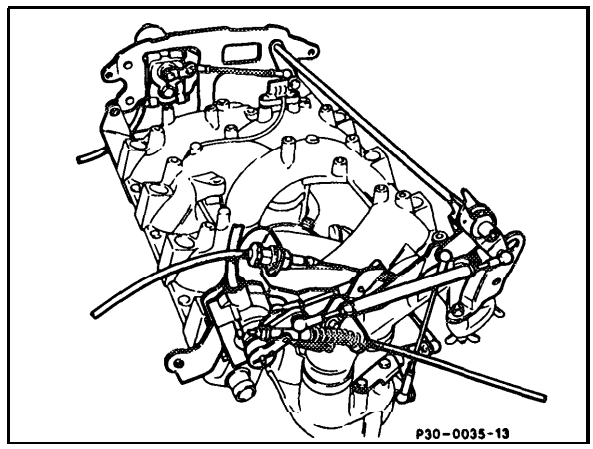
Engine 116, 117 with ASR II



Engine 116, 117

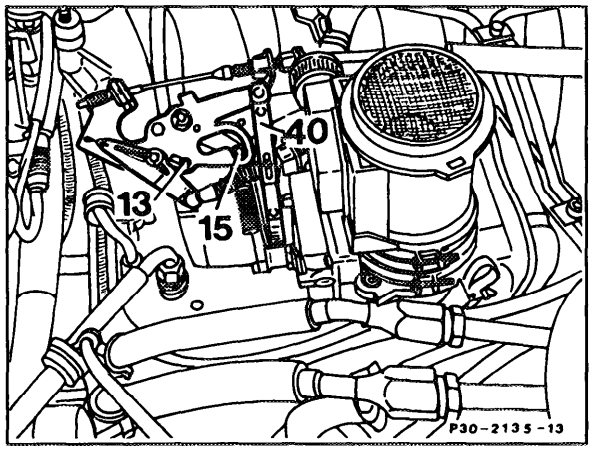


Engine 119 CFI

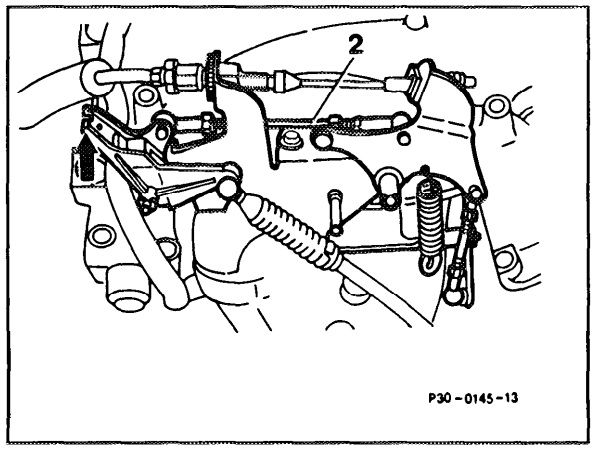


Engine 119 CFI with ASR II

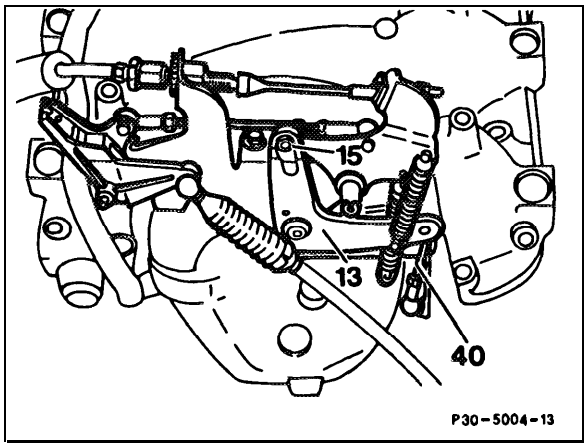
Engines with LH-SFI-injection



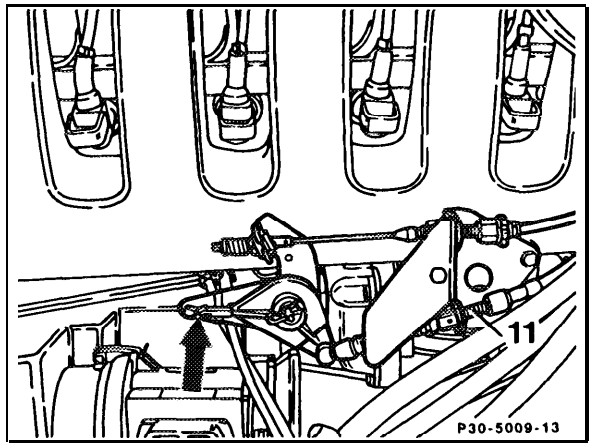
Engine **104** LH-SFI



Engine 119 LH-SFI without slotted lever

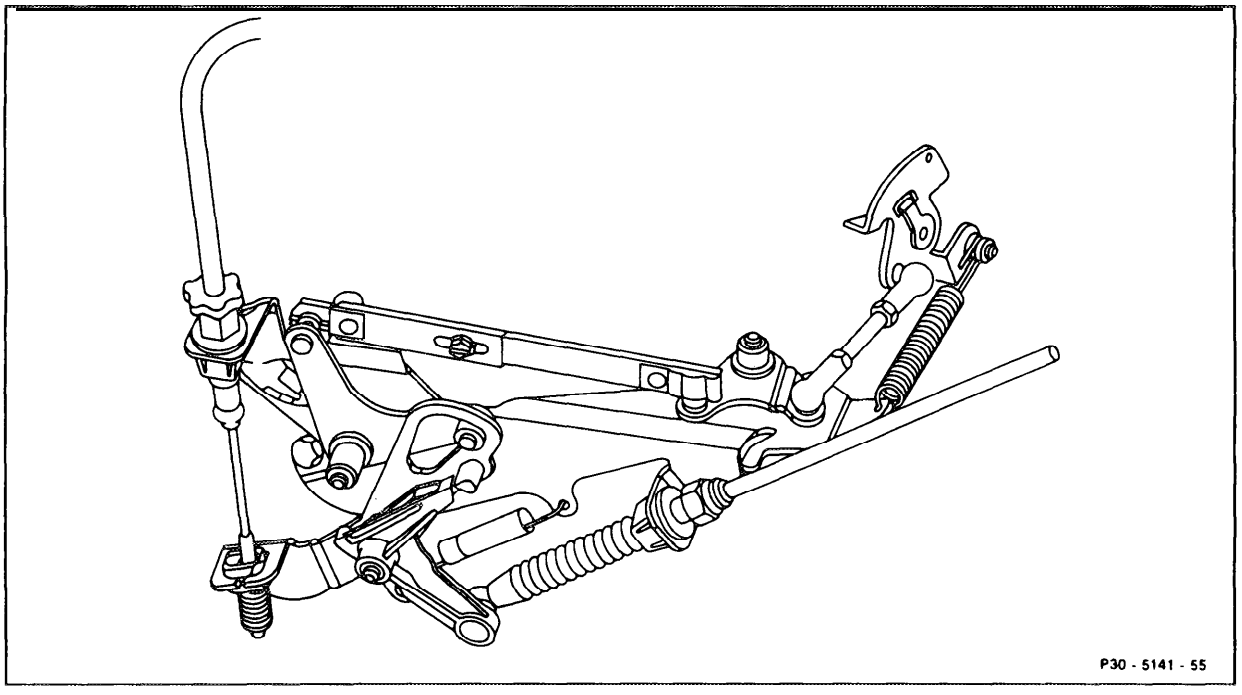


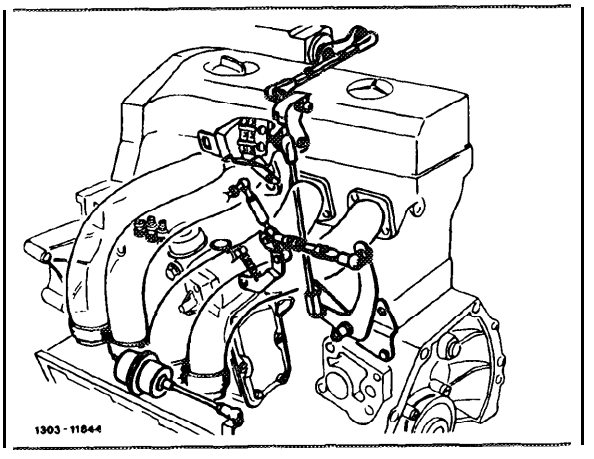
Engine **119** LH-SFI with slotted lever



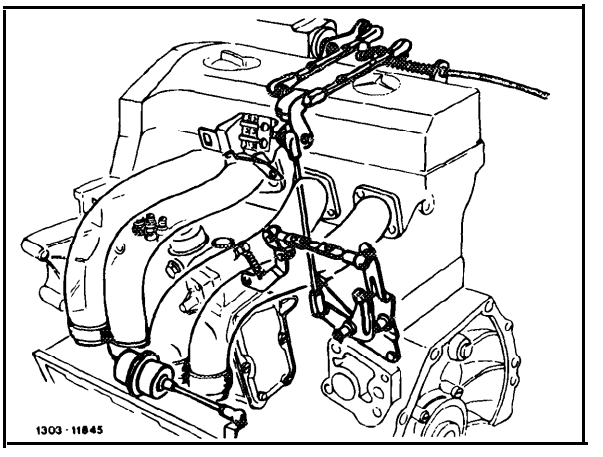
Engine 120

Engine 104 HFM-SFI



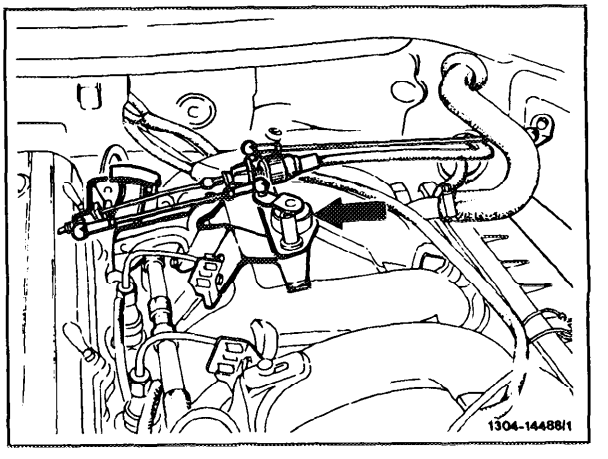


Engines 601, 602 with manual transmission

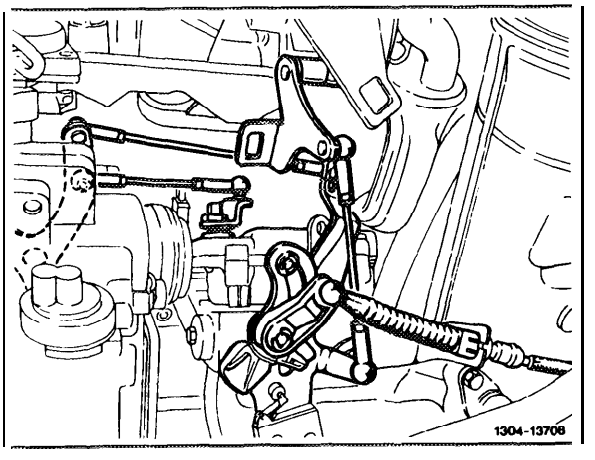


Engines 601, 602 with automatic transmission

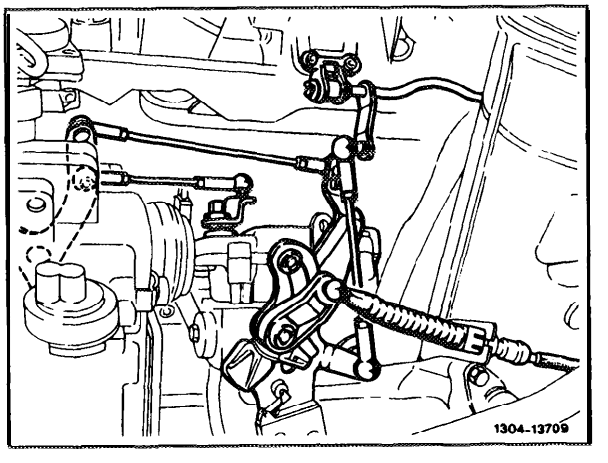
Do not lubricate friction damper (arrow).



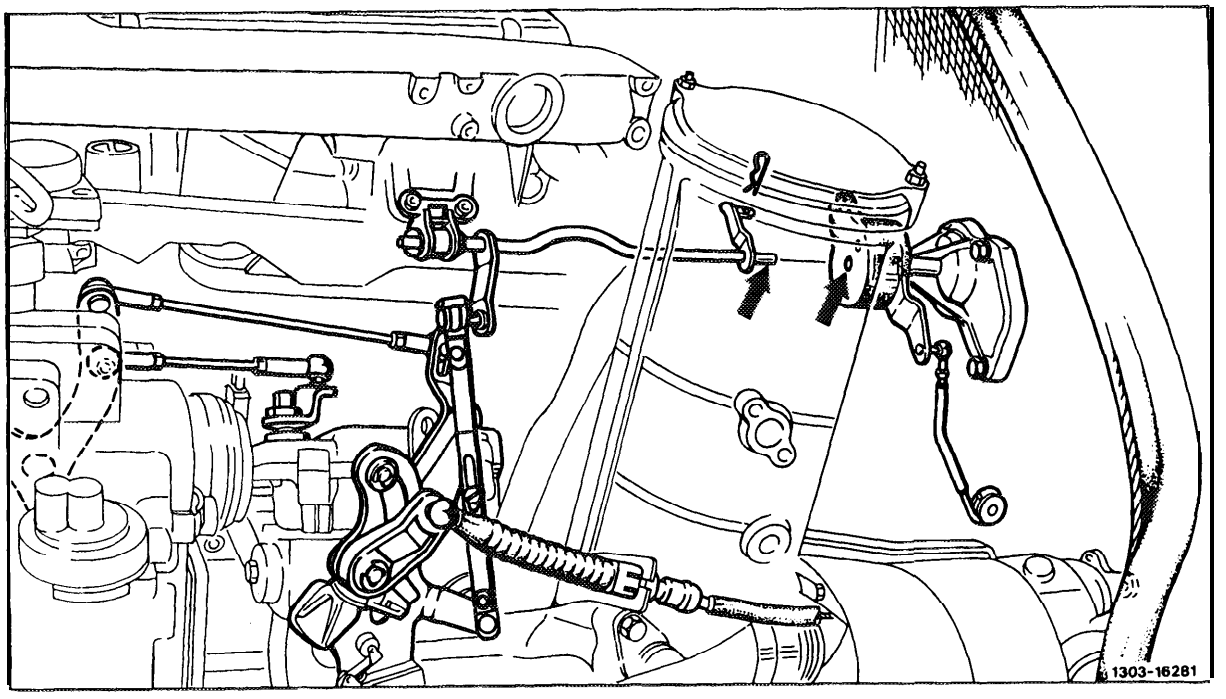
Engines 601, 602 with manual transmission , configuration with support and friction damper.



Model 124 Engine 603.960 1987

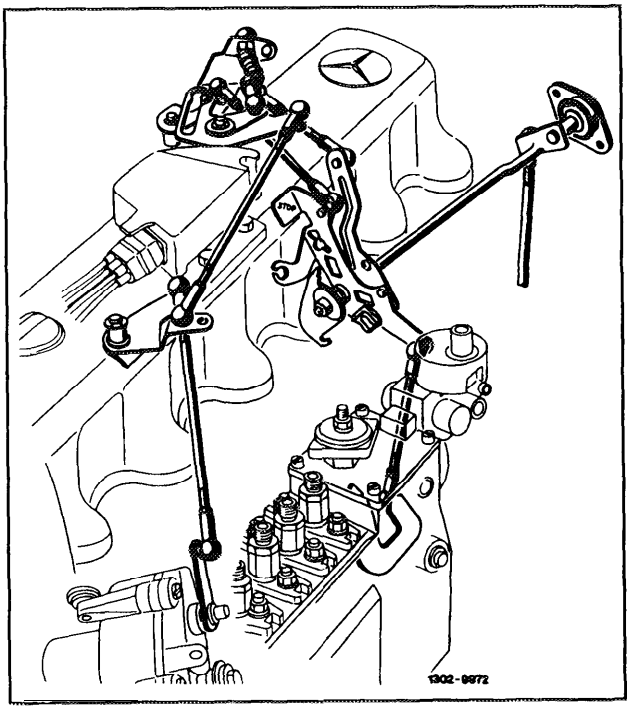


Model 126 Engine 603.961 starting 1 st version

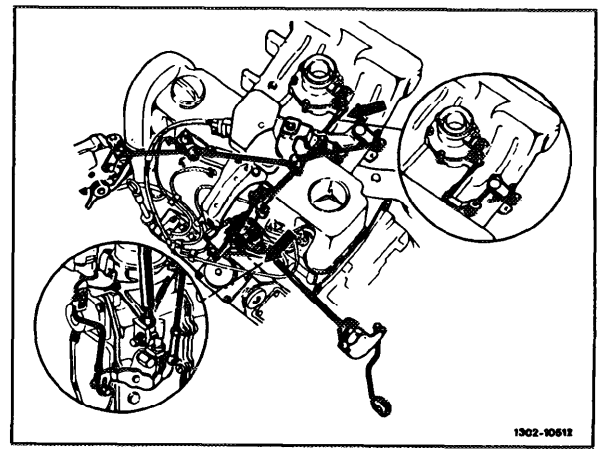


Model 126 Engine 603.961 starting 1986
2nd version, Engine 603.970

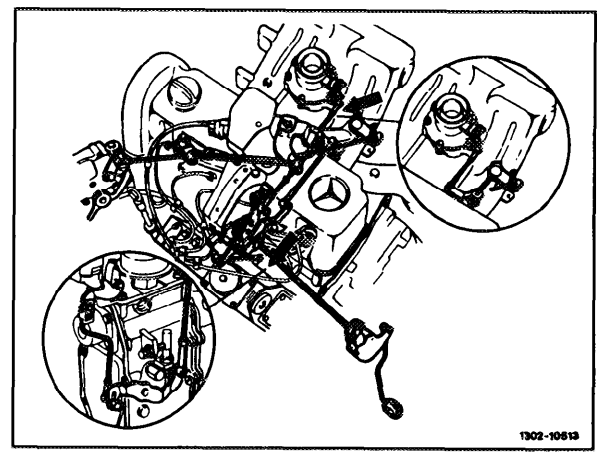
Do not lubricate bearings indicated by arrows



Engine 617



Engine 616.912 starting 1982
with manual transmission



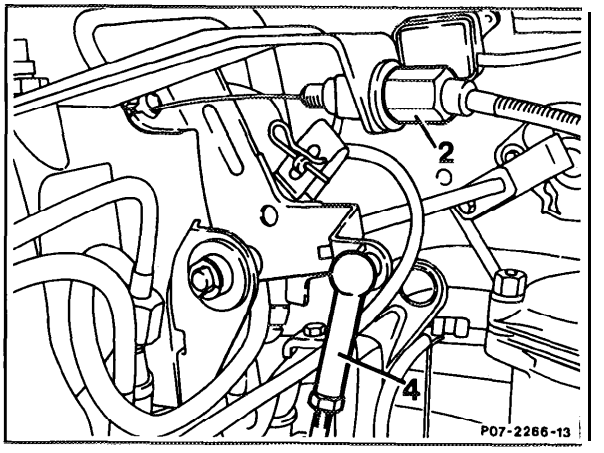
Engine 616.912 starting 1982
with automatic transmission

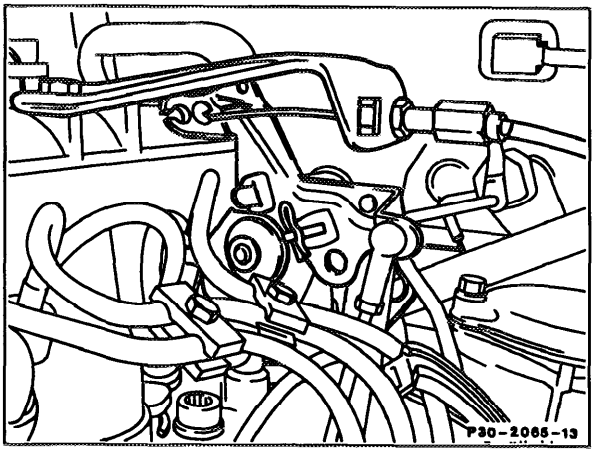
Engine 616 617.912

- Turn idle speed adjuster knob on instrument panel fully to the right and check distance between adjusting ring/nipple and shaped spring, adjust, if necessary. Distance should be approx. 1.0 mm.

- With engine off, depress accelerator and turn idle speed adjuster knob to the left.

- With engine running, idle speed should now be approx. 1100 rpm. Adjust with screw (2) if necessary.

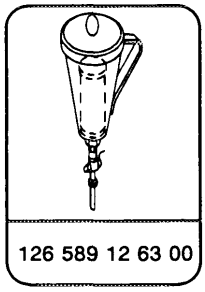




Level control, ADS, ASD, 4MATIC, fluid level 3211

All models

Special tools



Oil

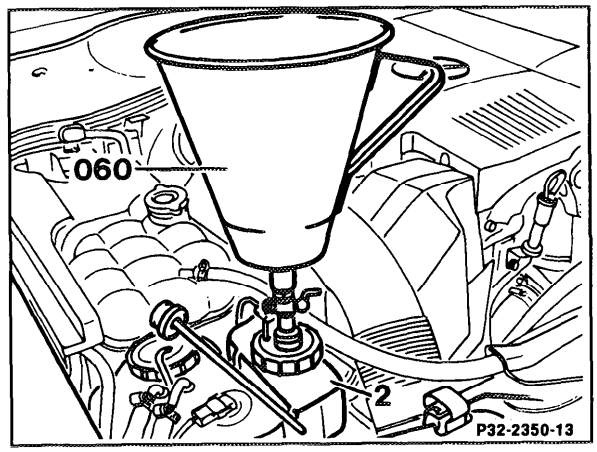
Hydraulic fluid	MB part no. 000 989 91 03/10 Refer to Factory Approved Service Products list

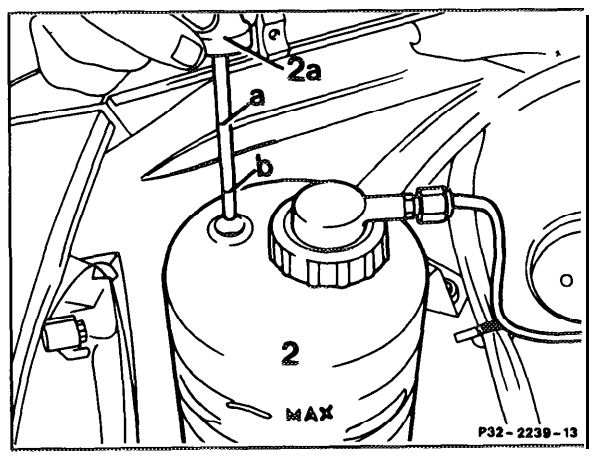
Note: Check fluid level with engine off. Correct if necessary.
With system in operating condition, the oil level should be between the MAX. and MIN. marks.

With vehicle loaded the resulting oil level will be near the MIN. mark (or below on vehicles with small reservoirs.)

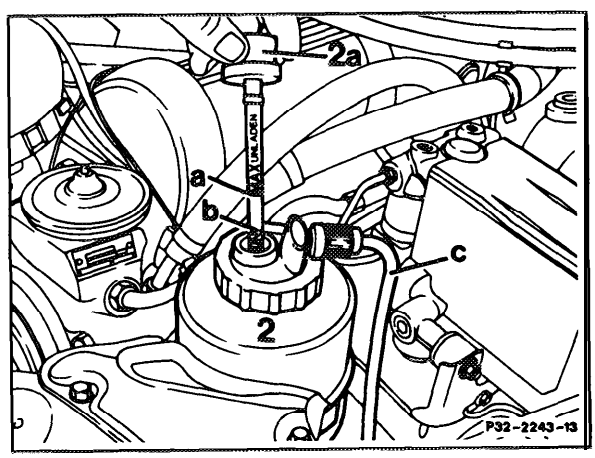
Remove cap with integral dipstick front fluid reservoir. Read fluid level after wiping and reinserting dipstick.

Use filter funnel (060) to add fluid.

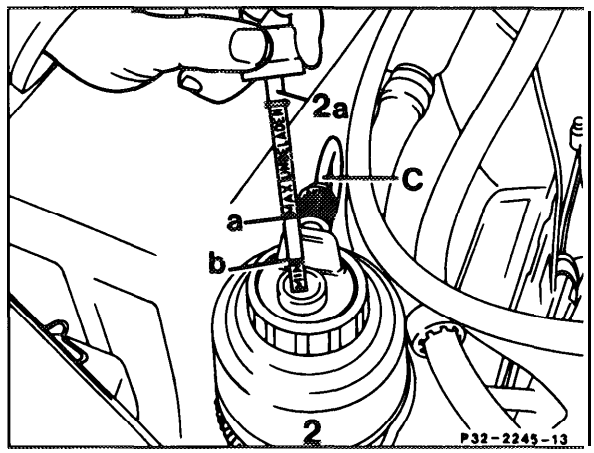




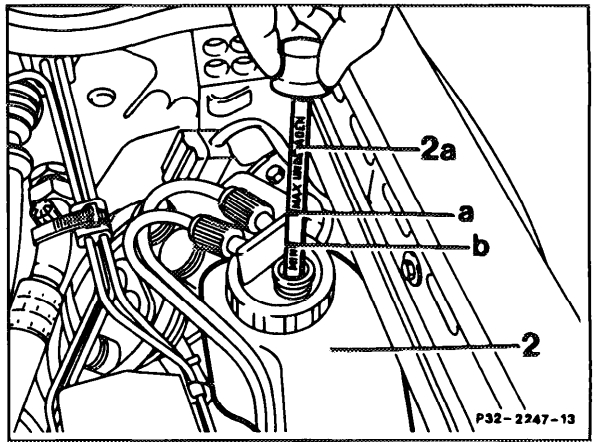
Model 123, 126 (1st version up through 08.1985)
Plastic fluid reservoir
2 Fluid reservoir
2a Cap with integral dipstick.
a Max. mark
b Min. mark
C Return line, level control ▪ reservoir.



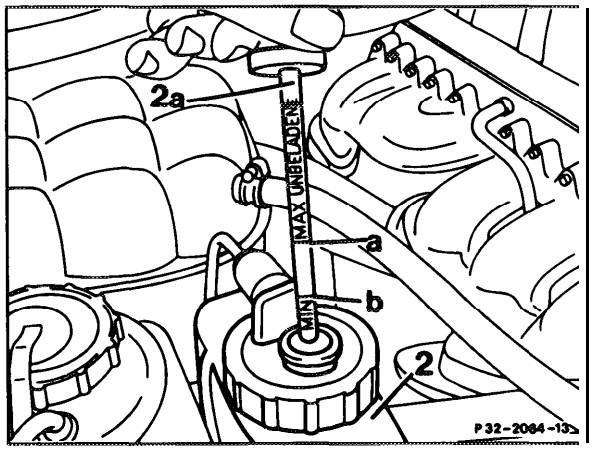
Model 126 (2nd version as of 09.1985)
Plastic fluid reservoir
2 Fluid reservoir
2a Cap with integral dipstick.
a Max. mark
b Min. mark
C Return line, level control ▪ reservoir.



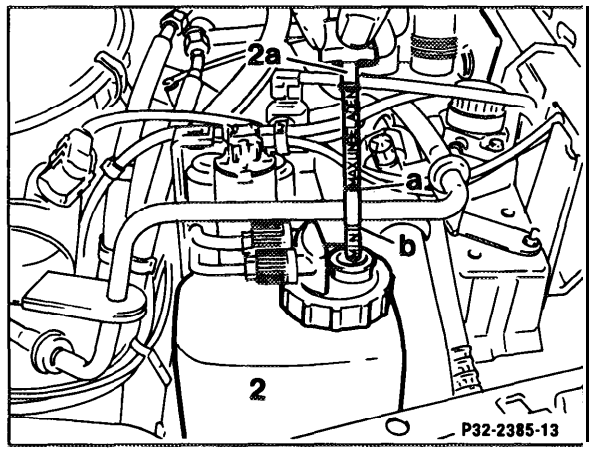
Model 124, 201
Plastic fluid reservoir
2 Fluid reservoir
2a Cap with integral dipstick.
a Max. mark
b Min. mark
C Return line, level control - reservoir.



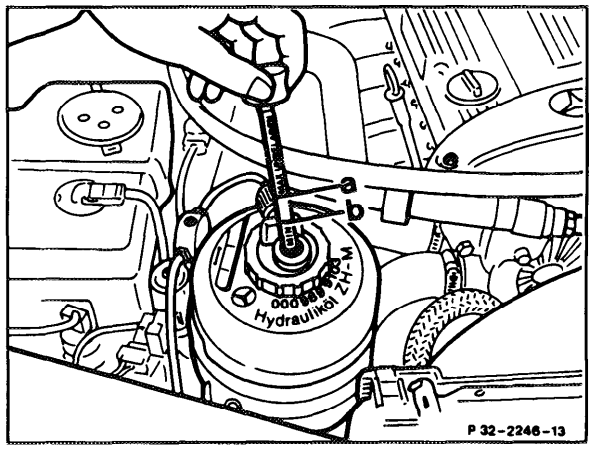
Model 124 with 4MATIC or ASD
2 Fluid reservoir
2a Cap with integral dipstick.
a Max. mark
b Min. mark
El Return line, hydraulic unit (connection T) -fluid reservoir
E2 Without level control:
Return line, hydraulic unit (connection N) -fluid reservoir
With level control:
Return line level control - fluid reservoir



Model 129 with with ADS and/or ASD
2 Fluid reservoir
2a Cap with integral dipstick.
a. Max. mark
b Min. mark



Model 140
2 Fluid reservoir
2a Cap with integral dipstick.
a. Max. mark
b Min. mark

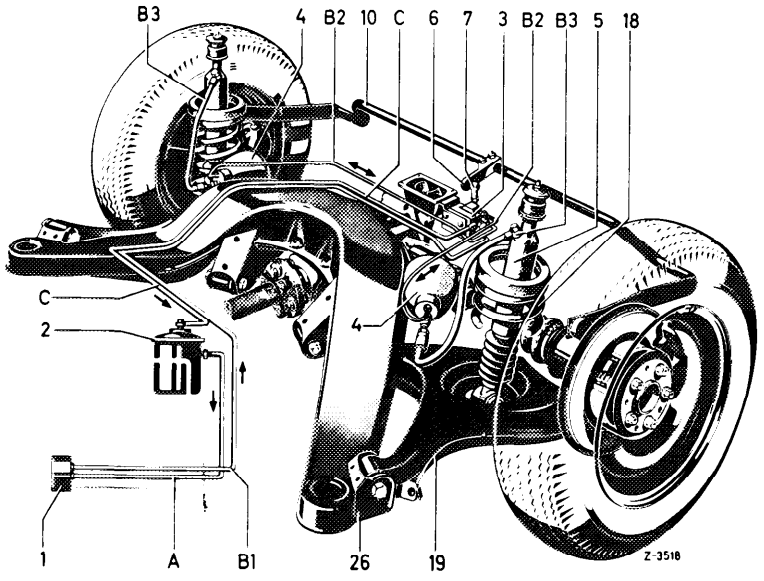


Model 201.034
Light alloy reservoir
2 Fluid reservoir
2a Cap with integral dipstick.
a. Max. mark
b Min. mark

Inspecting self-leveling suspension

3251

Model 123
126 up through 08.1985



Visual inspection

Hydraulic fluid pump
Fluid reservoir
Level controller
Pressure reservoir
Spring struts
Line connections

Check hoses and lines for chafing, dents, cracks, corrosion, and leaks (with engine running).

Note: Po check for leaks that may only occur when the vehicle is loaded, check vehicle with the engine running and with vehicle rear loaded with approx. 150 kg (or 2 persons).

Front axle, checking, correcting oil level

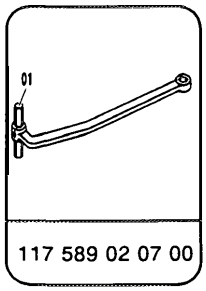
3310

Model 124 with 4MATIC

Oil grades

Hypoid gear oil SAE 90	Refer to Factory Approved Service Products list

Special tools

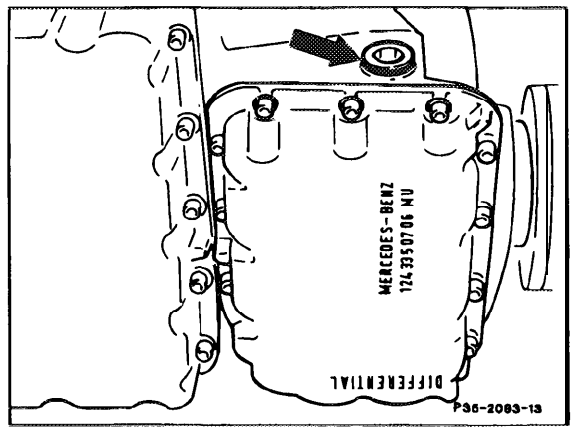


Commercial tools

14 mm hex. driver insert, 1/2" square drive	obtain locally

Note: When checking oil level and changing oil, the vehicle should be in horizontal position.

When performing this job number, remove engine compartment lower panel or lower half of noise encapsulation, and reinstall after completing all maintenance jobs (refer to job number 6190 or 9490).



Remove oil filler plug.
If a minimal amount of oil runs out or if the oil level is at lower edge of opening, oil level is correct.
If not, add oil.
Install filler plug, and torque to 50 Nm.
If oil loss is excessive, determine cause and repair on separate order.

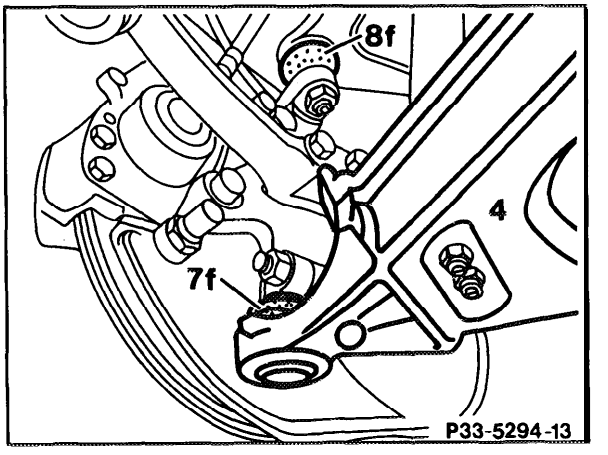
Checking front axle ball joints

3353

All models

Carefully check condition of ball joint rubber boots.

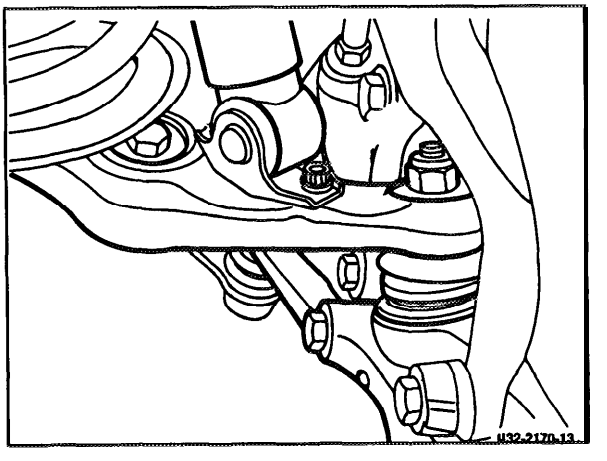
Note: In the event of a leaking rubber boot, replace respective joint or control arm immediately, since any dirt that enters will destroy the joint within a short period. Replacement of a rubber boot is permitted only if it is certain that no dirt has as yet entered the joint.



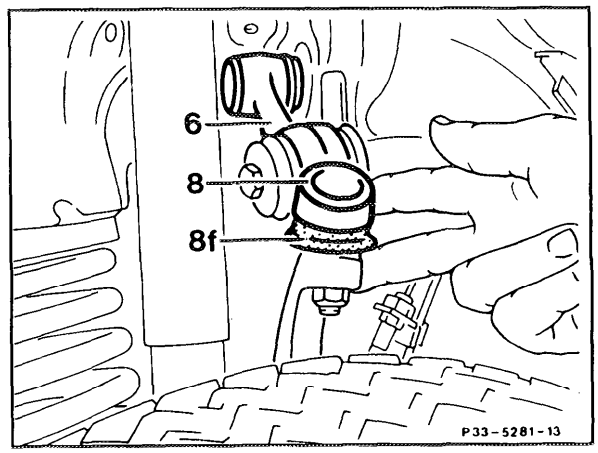
Model 107

7f Supporting ball joint (lower)

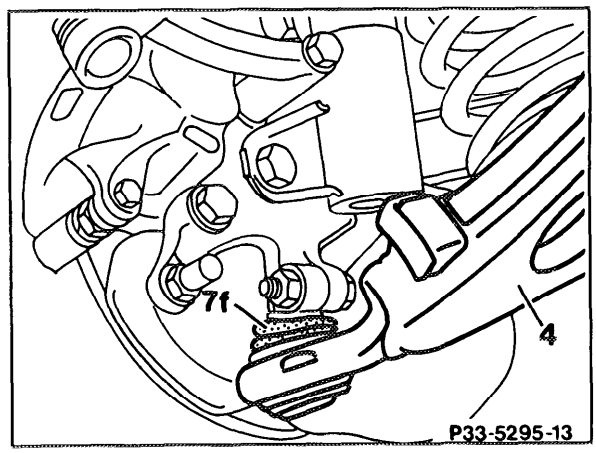
8f Guide ball joint (upper)



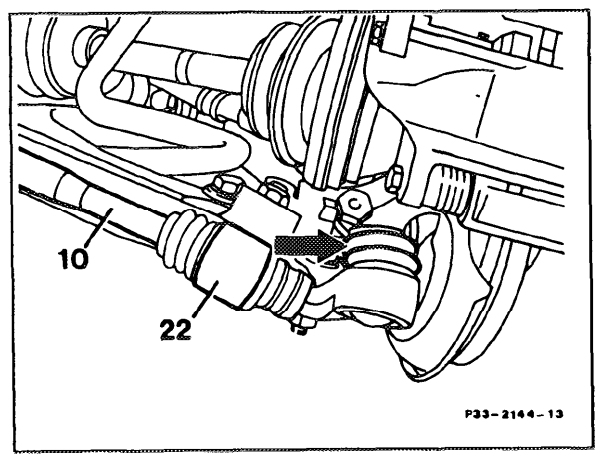
Model 123 and **126** Supporting (lower) ball joint



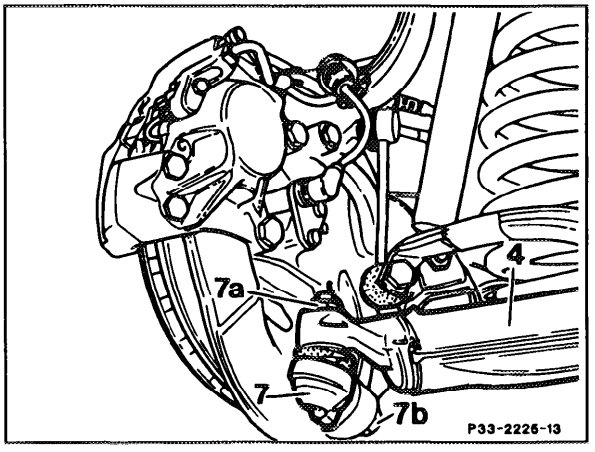
Model 123 and 126 Guide (upper) ball joint



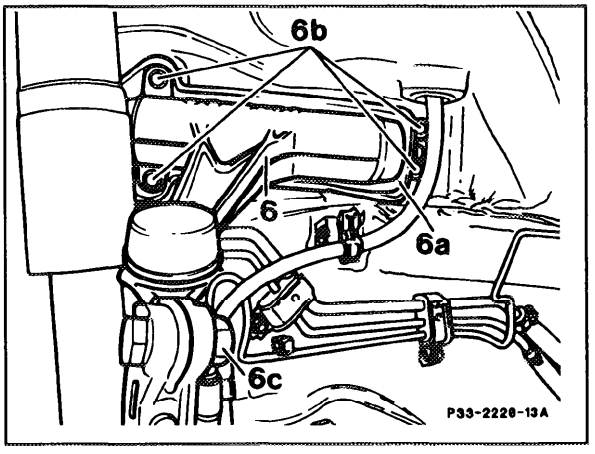
Models 124, 129 and 201 Supporting ball joint



Model 124 4MATIC Supporting ball joint



Model **140** Supporting (lower) ball joint

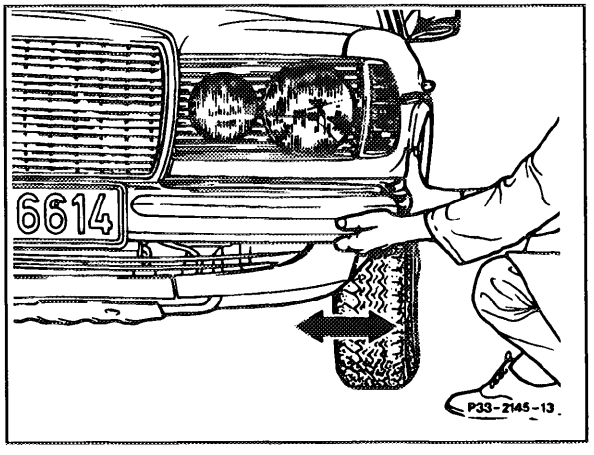


Model **140** Guide (upper) ball joint

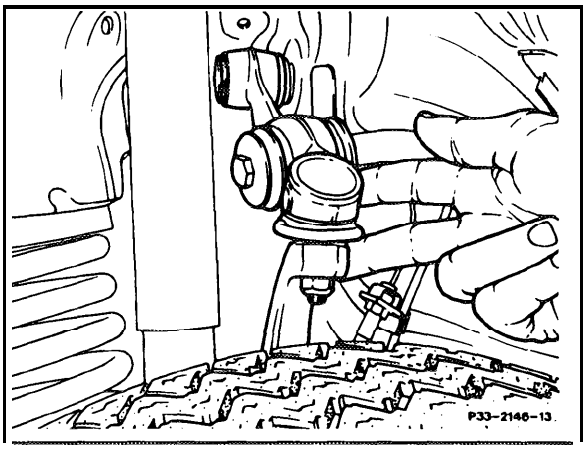
In addition, on models 107, 123, 126 and 140, thoroughly check the guide (upper) ball joint for play.

Models 107, 123, and 126

- Holding the bumper, vigorously shake the vehicle from side to side.

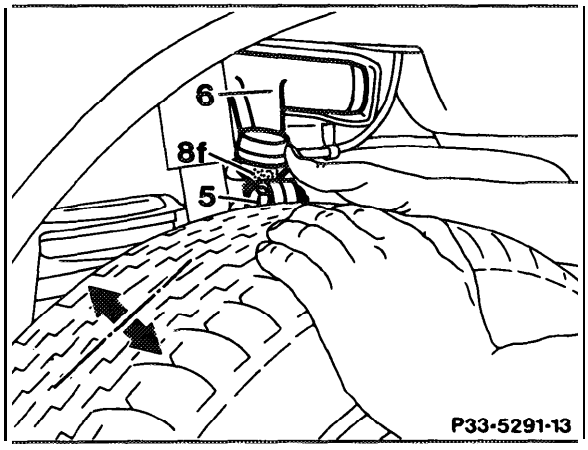


- Have an assistant check for play in ball joint by feeling the ball joint and steering knuckle.
- Repeat procedure on opposite side.
- If ball joint has play, replace upper control arm.



Model 140

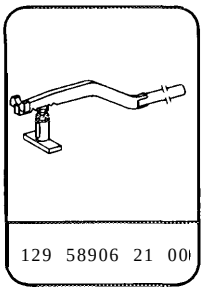
- Raise vehicle to unload ball joints.
- Check play by touching upper ball joint (8f) while vigorously pushing and pulling front wheel in and out (arrows).
- Repeat procedure on opposite side.
- If ball joint has play, replace upper control arm.



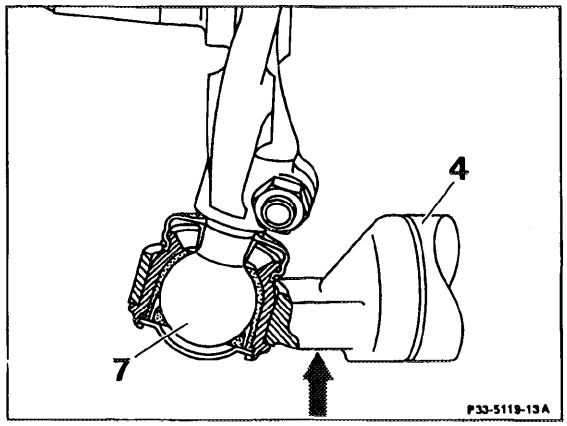
Checking ball joints using special tool

All models except 140

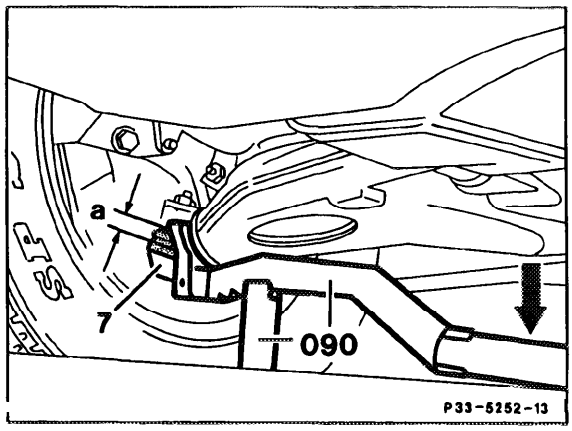
Special tools



- Position special tool (090) 129 589 06 21 00 under ball joint (arrow).



- By lifting/lowering - loading/unloading wheel at the control arm **(4),** an assistant can determine if any play (a) exists between the standing and lifted positions of the wheel.
- If play is found in the control arm, ball joint or control arm (on versions with integral ball joints) must be replaced on separate order.



All models

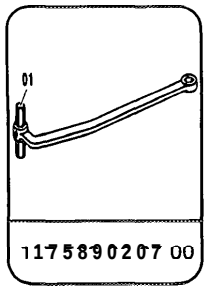
Oil grades

Differential **without** limited slip approved oil grades	Hypoid gear oil SAE 90, 85W/90 Refer to **MBNA** Factory Approved Service Products list
Differential **with** limited slip and vehicles with 4MATIC approved oil grades (note information plate on rear axle housing)	Special hypoid gear oil SAE 90 Refer to **MBNA** Factory Approved Service Products list

Capacities

Model	Liters
107.025/045/048, 124.034/036/051, 126.03/04, 129.061/066, 140.03/04	1.3
123, 126.02, 126.1	1.0
201.024/122/126	0.7
124.026/03/050/09/13/19/2, 201.028/029/03 124 with 4MATIC	1.1
140.05/134	1.4

Special tools

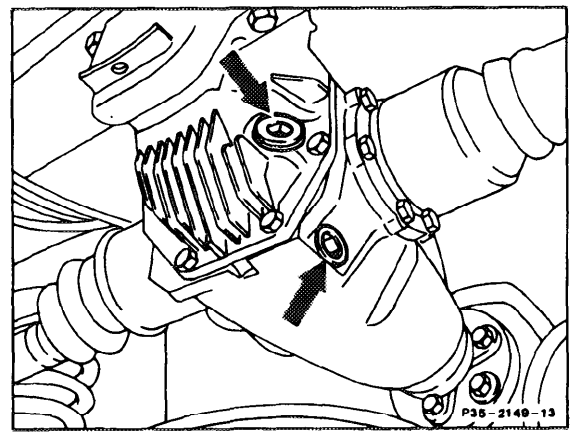


Commercial tools

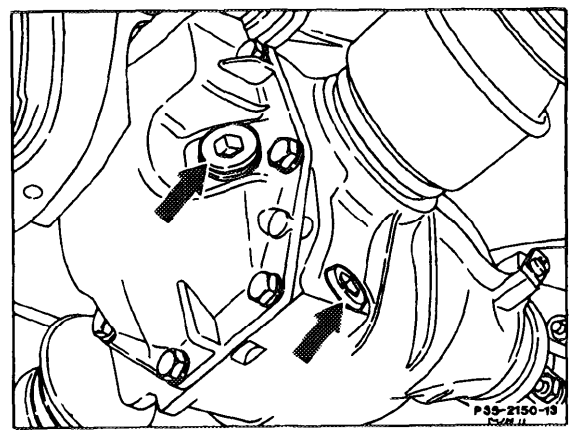
14 mm hex. driver insert, 1/2" square drive	obtain locally

Note: Vehicle should be horizontal when checking oil level and when changing oil.

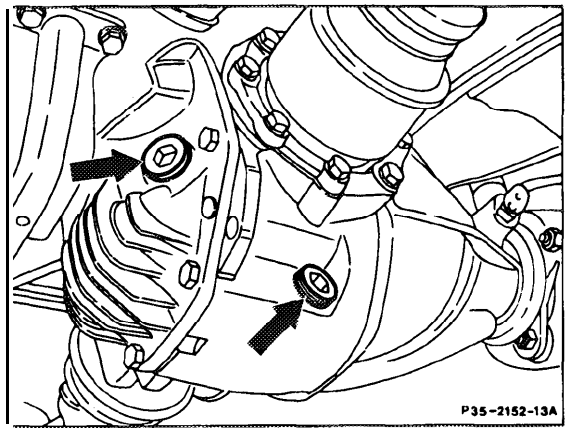
- Prior to oil change, check rear axle for leaks.
- Drain oil only with rear axle at operating temperature.
- Add specified quantity of oil.
- Check oil level. Oil level should be up to filler opening.
- Torque oil filler plug and drain plug to 50 Nm.



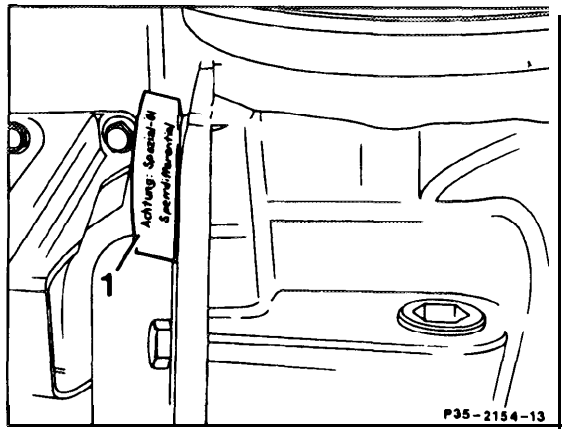
Rear axle centerpiece **with** side bearing covers model 123 (up through 01.1981)



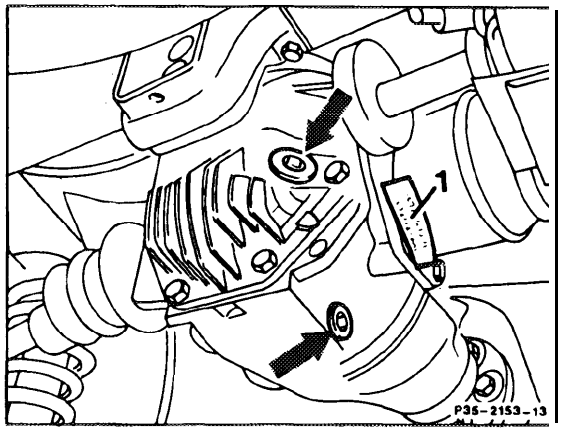
Rear axle centerpiece **without** side bearing covers model 123 (from 02.1981) model 126.02/1 (from start of production)



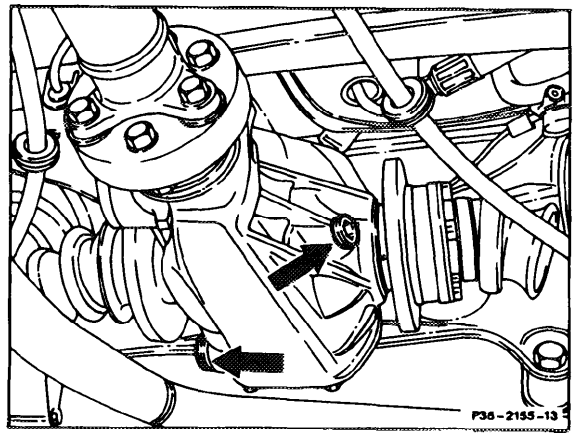
Model **107.025/045/048,126.03/04**
Differential **without** limited slip



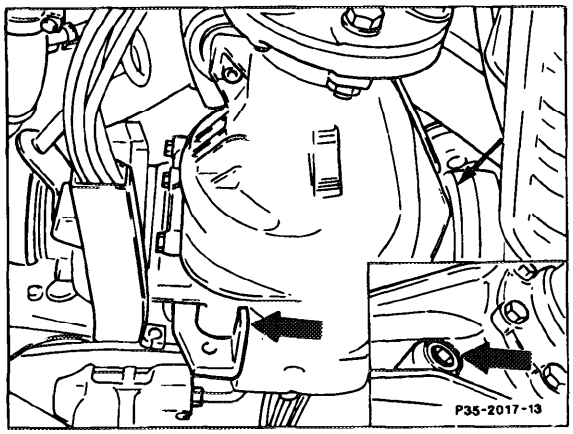
Model 126.04
Differential **with** limited slip
1 Information plate for limited slip differential



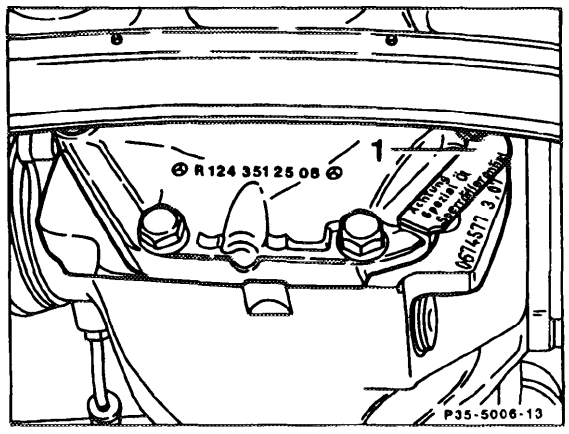
Model **107.025/045/048,** 126.03
Differential **with** limited slip
1 Information plate for limited slip differential



Model 124, 201



Model 129, 140



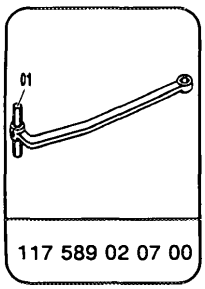
Vehicles with 4MATIC or ASD
1 Information plate for limited slip differential

All **models**

Oil grades

Differential **without** limited slip approved oil grades	l-lypoid gear oil SAE 90, 85W/90 Refer to MBNA Factory Approved Service Products list
Differential **with** limited slip and vehicles with 4MATIC approved oil grades (note information plate on rear axle housing)	Special hypoid gear oil SAE 90 Refer to MBNA Factory Approved Service Products list

Special tools



Commercial tools

Screwdriver insert 14 mm, 1/2 " square	obtain locally

Note: Vehicle should be horizontal when checking oil level.

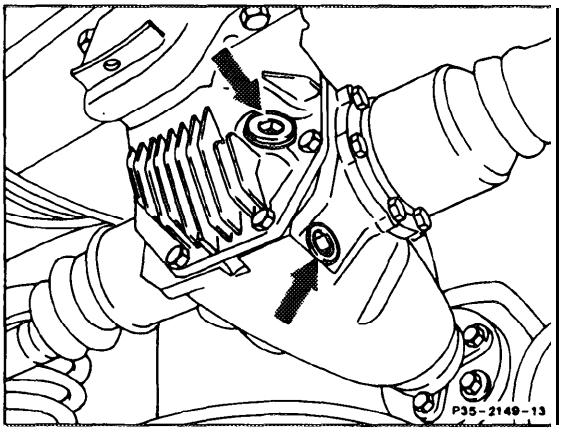
- Remove oil filler plug.

- If a minimal amount of oil runs out or if the oil level is at lower edge of opening, oil level is correct.

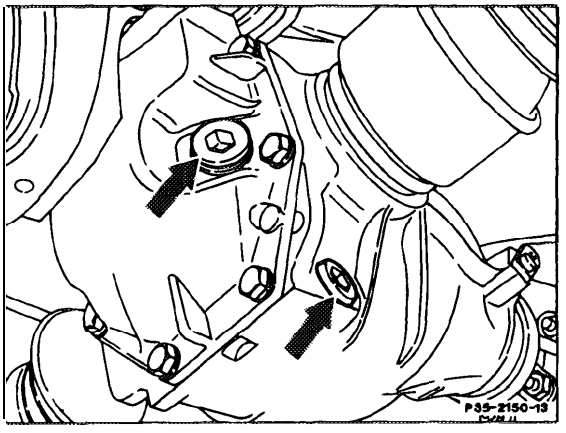
- If not, add oil.

Install filler plug, and torque to 50 Nm.

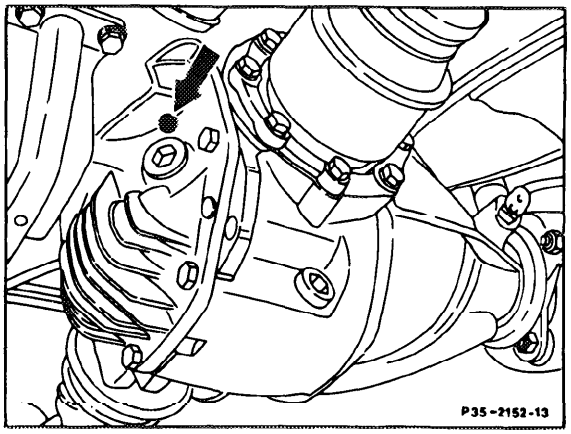
- If oil loss is excessive, determine cause and repair on separate order



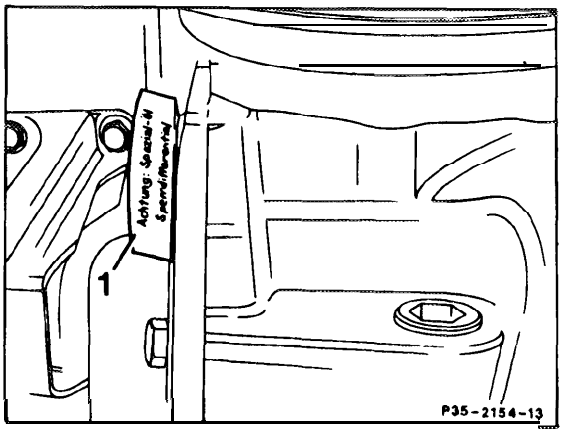
Rear axle centerpiece **with** side bearing covers model 123 (up through 01.1981)



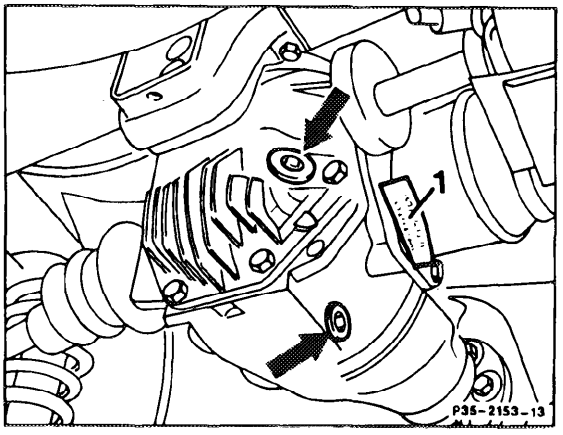
Rear axle centerpiece **without** side bearing covers model 123 (from 02.1981) model 126.02/1 (from start of production)



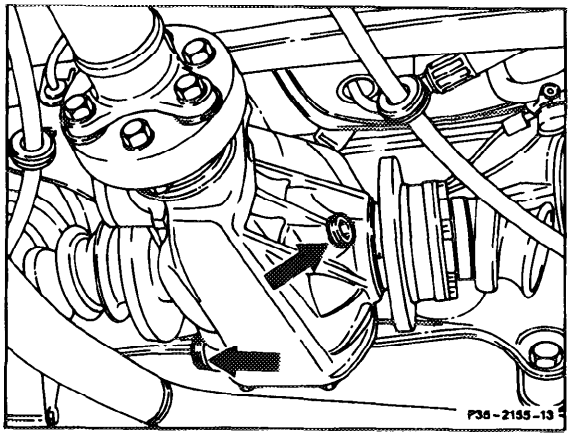
Model 107.025/045/048, 126.03/04
Differential **without** limited slip



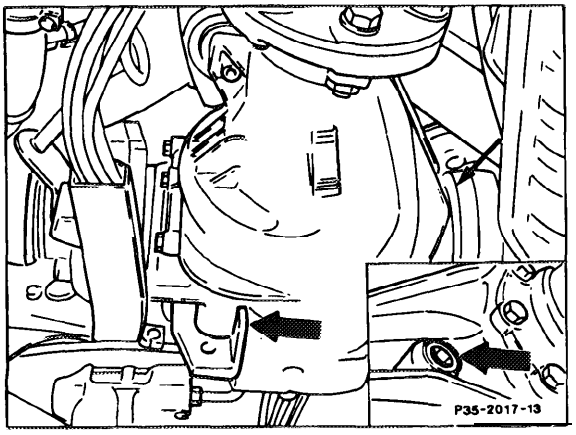
Model 126.04
Differential **with** limited slip
1 Information plate for limited slip differential



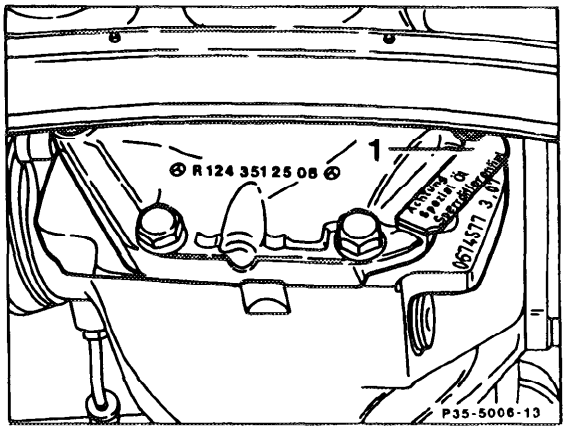
Model 107.025/045/048, 126.03
Differential **with** limited slip
1 Information plate for limited slip differential



Model 124, 201



Model 129, 140



Vehicles with **4MATIC** or ASD
1 Information plate for limited slip differential

Rear axle mount, adjusting limiting stop

3565

Model 123 with engine 616 617

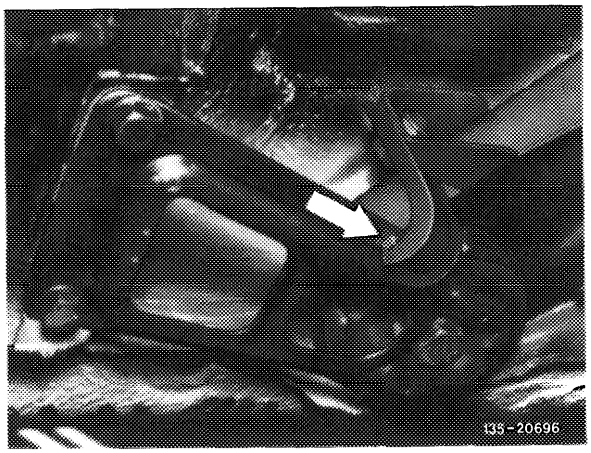
Adjustment specifications

Clearance between deflection limiting rubber stop and front mount supporting plate	2-3 mm

Torque specifications

	Nm
Bolt with self-locking nut for securing limiting stop	40-50

Note: When checking and adjusting the rear axle mount limiting stops, the vehicle's weight must be on the wheels.



Adjusting

Loosen bolt.

Insert adjustment gauge between rubber buffer and supporting plate (arrow).

Note: The gauge should be locally fabricated to the following dimensions:

Length:	60 mm
Height	20 mm.
Width	10 mm.
Thickness	2.5 mm.

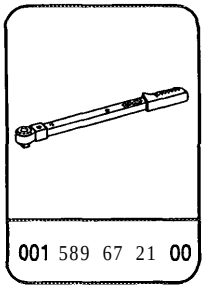
Press limiting stop slightly upward and torque bolt to 40-50 Nm.

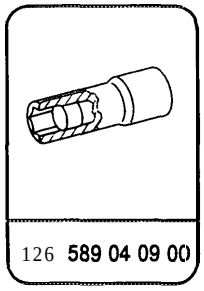
Remove adjustment gauge.

All Models

Torque specifications	Nm
Wheel bolts Ml2 x 1.5 (All models except 140)	110
Wheel bolts Ml 4 x 1.5 (Model 140 only)	150

Special tools



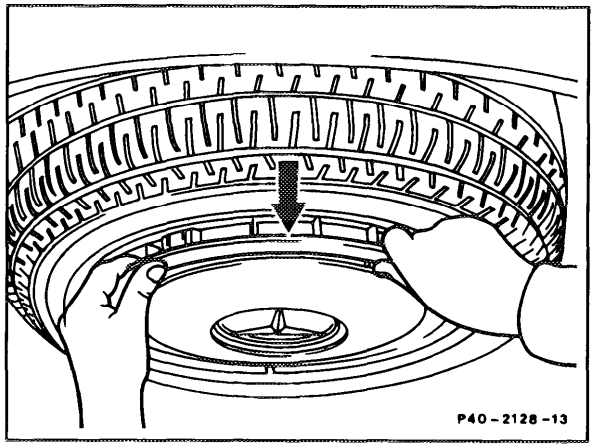


Commercial tools

Electric or pneumatic impact wrench, torque limited to 100 Nm	obtain locally
Hex. socket 17 mm for impact wrench, OD max. 26.5 mm	obtain locally

- Remove metal wheel cover by hand or with combination wrench.

- Grasp edge of plastic wheel cover with both hands and pull off.



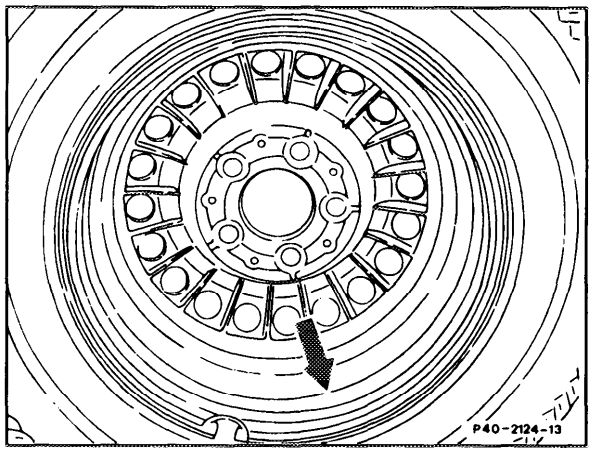
- Loosen wheel bolts and remove.

- When removing last wheel bolt on light alloy wheels, make sure that the wheel does not tilt, since this can damage the paint.

- Check inside of wheel (arrow) for dirt. Clean wheels, if required.

- Check centering opening and bolt hole seats and rim flanges for damage.

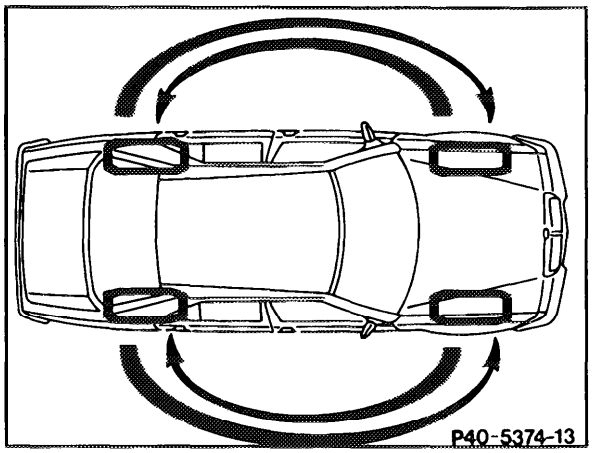
- Check related components (wheel, as well as front wheel hub or brake disk bowl) for corrosion, clean corroded surfaces with wire brush or emery cloth, if necessary.



Rotating wheels

Maximum tire mileage and good handling characteristics require rotating tires before a heavy wear pattern is visible. Tires should be inspected during routine service visits for wear patterns (refer to Job No. 4051), and if necessary, rotated from front to rear while maintaining direction of rotation.

To avoid deterioration of the handling characteristics, rotate the wheels before the tires show a distinct wear pattern.



Rotating the wheels

If the tires show even sawtooth wear, the wheels can also be rotated diagonally, provided the tires do not have a directional tread pattern.

- Depending on driving style, wear pattern and condition of tires, the wheels may require rebalancing.

- After rotating wheels, correct tire inflation pressure (refer to Job No. 4060).

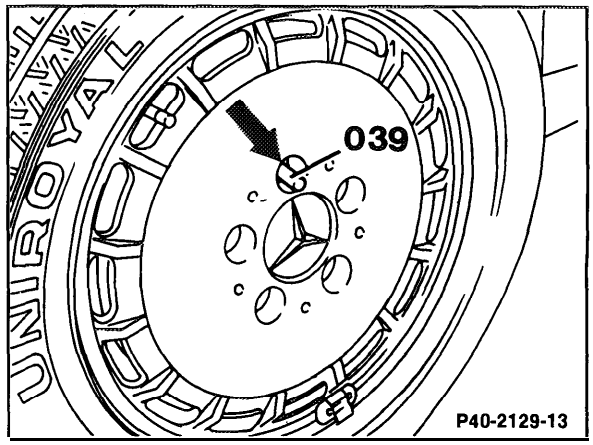
- Make sure that the correct wheel bolts are used for the type of wheel.

- Check that wheel bolts thread in smoothly. Replace bolts that are hard to turn or that are corroded at the spherical collar (e.g. from road salt).

- Inspect threads in front wheel hubs and rear axle flanges and repair, if necessary.

- Use only original equipment Mercedes Benz wheel bolts. Identification: Mercedes star stamped on face of bolt shaft or on head of bolt.

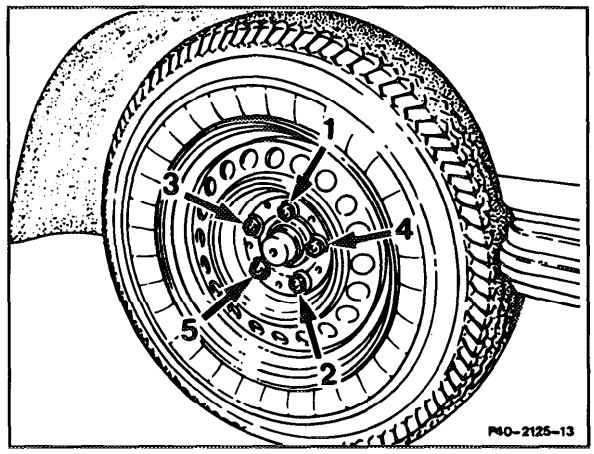
- On light alloy wheels with recessed mounting holes, screw centering bolt (039) into the uppermost hole (arrow) prior to positioning wheel.
The centering bolt is included in the vehicle tool kit or with the spare wheel in a rubber sleeve.



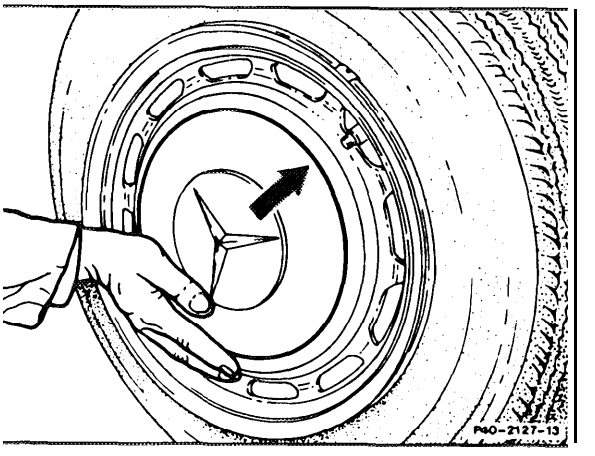
- Install wheels. The wheel bolts can also be tightened with an impact wrench up to 3/4 of the specified torque. Then, final tighten bolts with torque wrench.

- Note torque sequence and specification (refer to job no. 4070).

Note: When using power wrench on light alloy wheels, the OD of the socket should not exceed 26.5 mm, since otherwise the socket will damage the wheel. When screwing in the first wheel bolt on light alloy wheels, make sure that the wheel does not tilt, since the paint can be damaged.



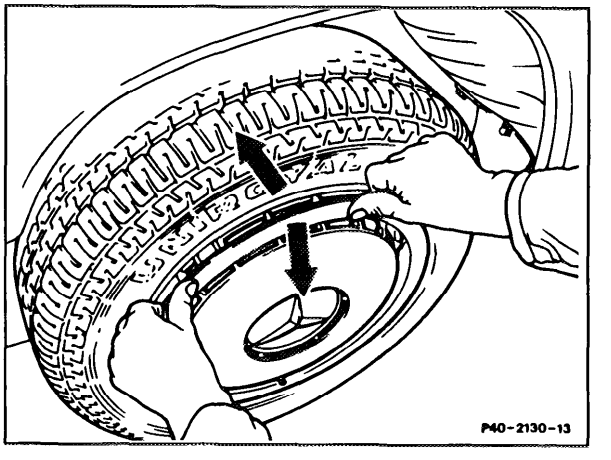
- Insert metal wheel cover on rim in such a manner that the valve is located between two retaining springs. Push on wheel cover first toward valve (arrow) and then push in at side opposite from valve.



- Position wheel so valve is at 6 o'clock position. Position plastic wheel cover with valve recess at bottom, push in downward direction and press on by exerting pressure against upper edge of wheel cover (arrows).

Caution! Use care to correctly insert retaining clips into rim. This is especially important where the retaining clip aligns with a balance weight.

Do not apply pressure to, or strike, the center of plastic wheel cover to avoid damaging cover.



All models

Check tires for cuts and other damage as well as for objects penetrating the inside walls of tread (outside and inside).

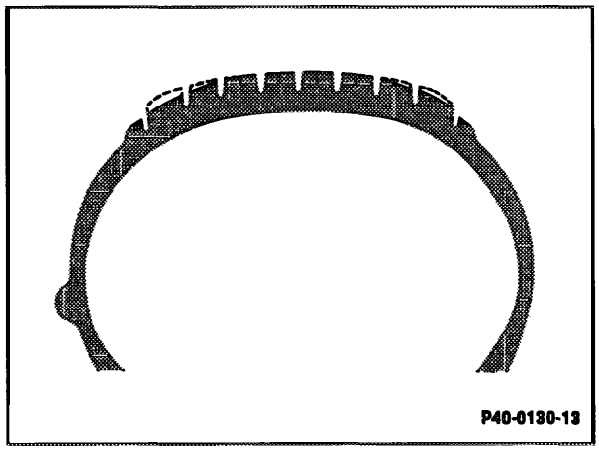
Check tire tread depth and enter in table.

Check wear pattern of tires noting the following points:

Tread depth	Front left	Front right
Outside		
Center		
Inside		
Tread depth	Rear left	Rear right
Outside		
Center		
Inside		

Front axle

It is normal to have somewhat greater wear on both shoulders of the front tires compared to the center tread. This wear pattern is caused by low tire pressure, fast cornering, releasing the accelerator abruptly in fast turns, or by a high proportion of city driving.

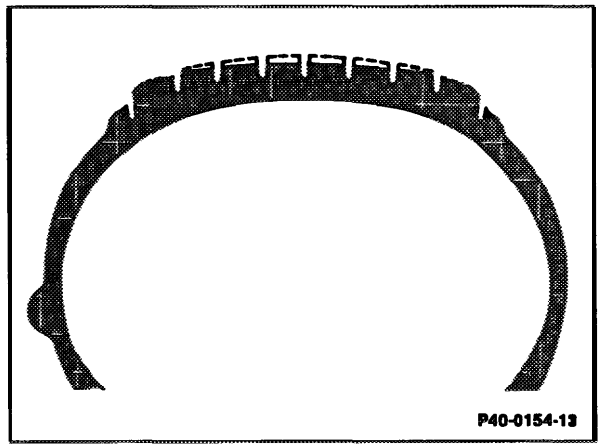


Shoulder wear on front tire

Rear axle

Wear is normally distributed over the entire tread are of the rear wheels, although it is usually somewhat higher at the center of the tread than on the shoulder. Depending on the rear vehicle load (increased negative camber with high load) the wear on the inner side of the tread area can be somewhat higher than on the outer side.

Rotate wheels, if required (refer to job no 4050).



Center tread wear on rear tire

All models

Note: When correcting tire pressure, also check spare tire.

The label on the tank filler flap lists the correct inflation pressures for the respective tires (summer and winter tires) as well as for various operating conditions.

Tire pressures listed for light loads are a minimum and afford optimum driving comfort. 'The higher tire pressure listed for heavy loads is also permissible for lightly loaded vehicles and has a positive effect on driving characteristics. However, the ride will be somewhat firmer.

Tire temperature and therefore tire pressure increase with vehicle speed and load. Tire pressure should normally only be adjusted with cold tires. Correct tire pressure of warm tires only if pressure has dropped below the pressures listed on the label and the operating conditions are taken into consideration. Never reduce tire pressure when warm.

Note: Tire pressure changes by approx. 0.1 bar per 10°C change in air temperature. This should be considered when checking/adjusting tire pressure in workshops, particularly in winter.

Example:

Ambient temperature = approx.	+20°C
Outside temperature = approx.	0°C

Tire pressure to be set to specified pressure + 0.2 bar.

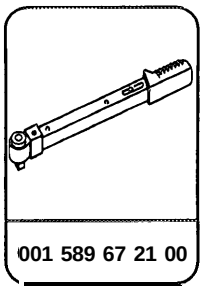
Tightening wheel bolts

4070

All models

Torque specifications	Nm
Wheel bolts Ml 2 x 1.5 (All models except 140)	110
Wheel bolts Ml4 x 1.5 (Model 140 only)	150

Special tools



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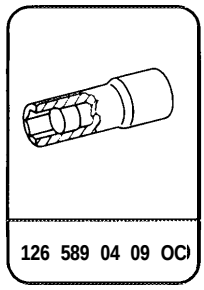
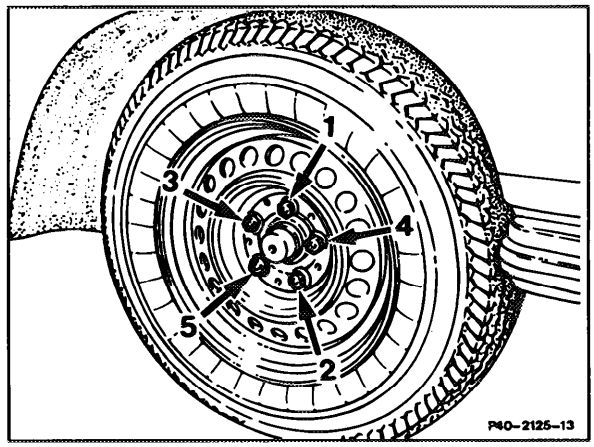


126 589 04 09 OCI

- Remove wheel covers from steel wheels, if so equipped.
- Always tighten wheel bolts with torque wrench.
- **Torque In correct sequence (arrows).**
- Replace wheel covers on steel wheels.



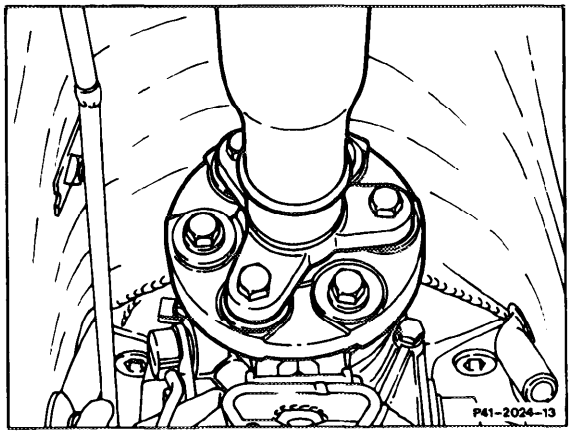
Inspecting drive shaft flexible coupling

All models

Note: When performing this job number, the engine compartment lower panel or the noise encapsulation panel must be removed on models 124.1/3 and 201.1, and replaced after completing all maintenance work (refer to job number 6190 or 9490).

- Check flexible coupling for wear and damage, as well as for distortion (visual inspection).

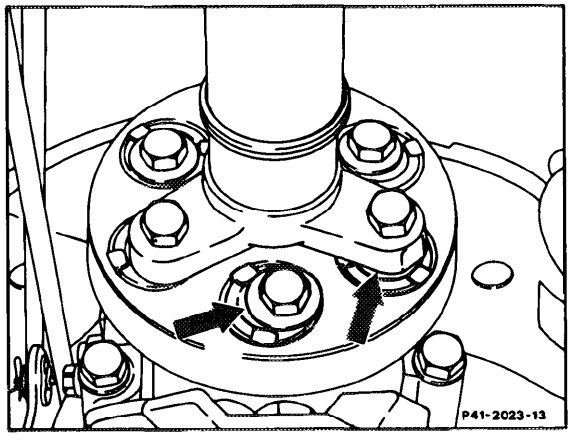
- On those flexible coupling mounted at the transmission end, that are radially soft (soft in thrust) and tangentially soft (soft in thrust and tension), check the lands in the area of the dowel sleeves (arrows) for cracks (visual inspection).



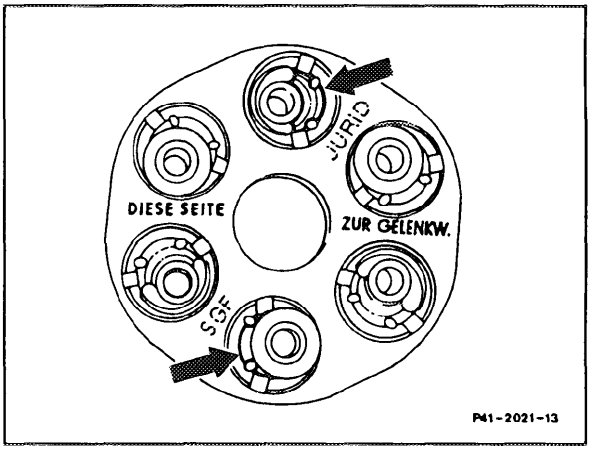
Model 107, 123, 126.03/04
Model 123 1 st version through 09.1980 on vehicles with 6 cylinder engine

- Replace flexible coupling if damaged or worn.

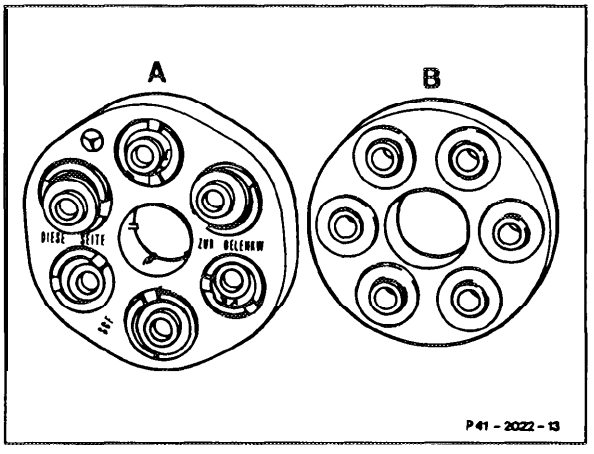
- If distortion is found, loosen and retighten drive shaft. If distortion remains, replace flexible coupling.



Model 126.02 with radially softer flexible coupling (transmission end only)
Model 123 2nd version starting 10.1980 on vehicle with 6 cylinder engine



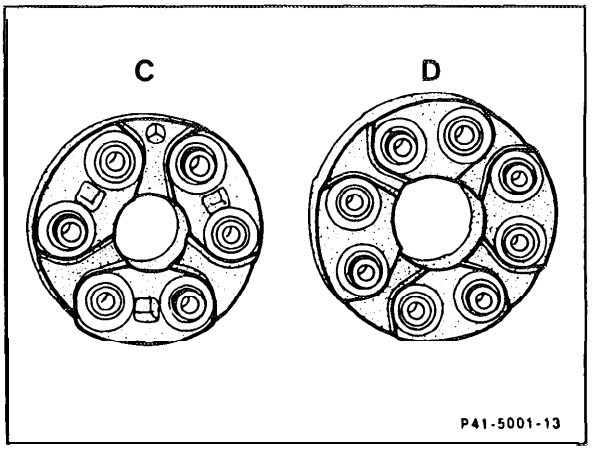
Tangentially softer flexible coupling, front and rear, on model 123 with 5-speed manual transmission
Starting 10.1985 model 126.02 at transmission end only



Models 107, 124, 129, 201

A Model 124, 201.02/1 front flexible coupling (tangentially softer)

B Model 107, 124, 126, 201.02/1 rear flexible coupling and model 129.06, 201.03 front and rear



Models,1 24.036, 129, 140

C Model 129.060 (90mm bolt circle), 129.061, 140.03 (100 mm bolt circle) torsionally rigid

D Model 124.036, 129.066, 140.04/05 (110 mm bolt circle) 4 arm flange and torsionally rigid

Checking brake fluid level

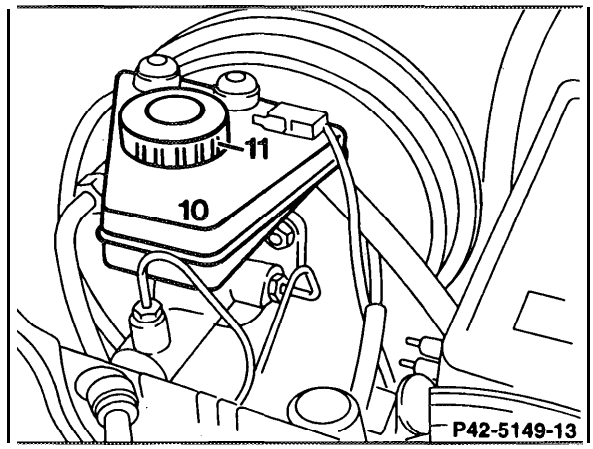
4210

All **models**

Brake fluid

Use specified brake fluid only	Refer to Factory Approved Service Products list

Note: During its service life, the boiling point of brake fluid will decrease as a result of the moisture absorbed from the atmosphere. When the braking system is under extreme stress, this moisture can vaporize. For this reason, the **brake fluid must be changed once a year,** preferably in spring on models 124 and 201 through 03/91 production as well as models 107, 123, 126. On models 124 and 201 starting 04/91 production, and models 129 and 140 the **brake fluid must be changed once every two years.**



10 Fluid reservoir
11 Cap

Checking fluid level

The brake fluid level should be between the MAX and MIN marks on the reservoir.
When brake fluid level is extremely low, determine cause (leaks, worn brake pads).

Correcting fluid level

Note: If brake pads are about to be replaced, correct the fluid level following installation of pads.

Remove cover from reservoir and add in new brake fluid up to "MAX. " mark on fluid reservoir.

Remove cap. Check that vent hole is cap is not clogged.

Handle brake fluid with care.

a) Store brake fluid only in containers, which make accidental consumption of fluid impossible. **(Fatal dosage 100 cc.)**

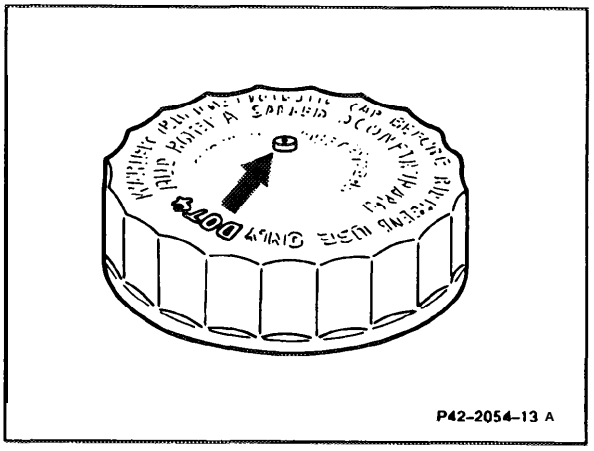
b) Even minute quantities of mineral oil will result in failure of clutch and brake systems Special care should be taken with brake fluid that is colorless or dyed yellow, since here the risk of mix up is the greatest. Whenever mineral oil is found in the brake system, or if the presence of mineral oil is suspected, proceed as follows:

1. Replace master cylinder and brake fluid reservoir.
2. Flush entire brake system with new brake fluid.
3. Any components containing rubber parts that came into contact with mineral oil, such as brake calipers, brake hoses, ABS or ASR hydraulic unit, ASR pressure reservoir must be replaced.
4. Bleed brake system.

c) Make sure that brake fluid does not contact painted surfaces of vehicle, since the fluid acts as a paint solvent.

d) Brake fluid is highly hygroscopic, meaning it will absorb moisture from the air, as a result of which the fluid's boiling point is reduced. Brake fluid should only be stored in well sealed containers.

e) Brake fluid that has been bled out of the system can not be reused, since it may contain foreign matter or water which could re-enter the brake system in this manner.



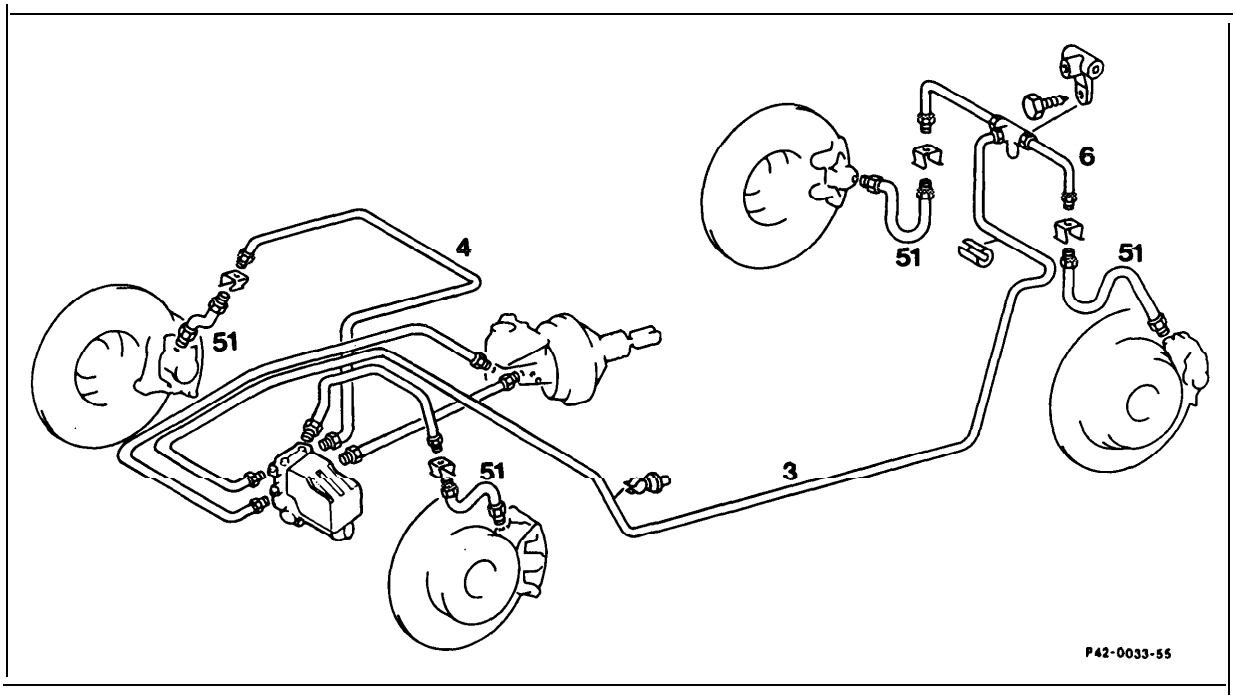
a Vent opening

Inspecting brake lines for damage

4250

Model **107 up through 07.1985**
123
126 up through 08.1985
201 up through 12.1984

Check all brake lines and hoses for damage from external causes, such as road debris.



Model 107 starting 08. 1985
124
126 starting 09. 1985
129
140
201

Front brake pad specifications in mm

Model	107 [1]) 124.034 [2])/ 0361051 126 129	124 (except 124.034/036/ 051 201.034	124.032/ 034 [3])/ 052/066/ 092	140.03 2 piston caliper	140.04/05 4 piston caliper	201.01 201.02 201.1
Thickness of brake pad (pad and backing plate)	17.5	19.3	16	18.5	19.3	17.9
Wear limit at maintenance service (pad and backing plate)	12	14	11	13	13	13
Allowable wear of lining to a thickness of	2	2	2	2	2	2

1) The backing plate is modified to fit the 4 piston fixed caliper starting 09/85. As a result, pads from models 123 and 126 can no longer be installed.
2) through 09/92.
3) starting 10/92.

Rear brake pad specifications in mm

Model	107 124 [1]) 126 129.06 201.03	124.036 129.07 140	201.01 201.02
Thickness of brake pad (pad and backing plate)	15.5	16	13.5
Wear limit at maintenance service (pad and backing plate)	11	13	10
Allowable wear of lining to a thickness of	2	2	2

1) Installed on model 124.036 through 11/92.
2) starting 12/92.

Front brake disk specifications in mm

Model	Brake pad thickness	Wear limit	Limit at maintenance service
107 124.026 124.028 124.030 124.050 124.051 124.090 124.128 124.2 201.028 201.029 201.034 201.128	22	19.4	20
124.034 124.036 126 129.06 140.03 140.1	28	25.4	26
124.032 124.034 124.052 124.066 124.092	25	22.4	23
124.036 140	30	27.4	28
129.07	30	28	28.5
201.024 201.122 201.126	11	9	29.5

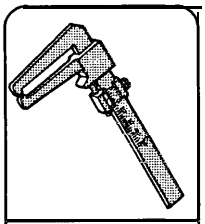
1) Installed on model 124.036 through 1 1/92.
2) starting 12/92.

Rear brake disk specifications in mm

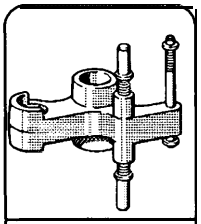
Model	Brake disk thickness	Wear limit	Limit at maintenance service
107 126	10	8.3	8.6
124.030 124.032 124.05 124.06 124.090 124.1 124.2 129.06 201	9	7.3	7.6
124.092	20	17.4	18
124.034 124.036	24	21.4	22
129.07 140.04 140.05	22	19.4	20
140.03 140.1	12	9.8	10.5

Checking brake pad/disk thickness

Special tools



124589051900



201 589 00 19 OC)

Checking brake pads

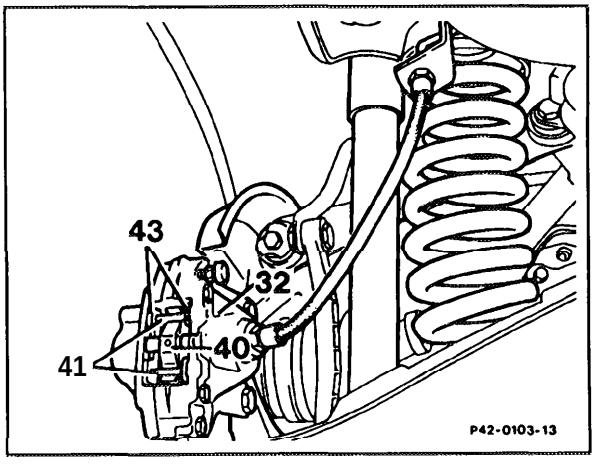
- Check pad thickness on front and rear axle (pads installed). If necessary, replace pads on separate order.

Note:

To make sure that the wear limit is not exceeded before the next maintenance job, refer to the recommended limits in the chart at beginning of the chapter.

⚠IMPORTANT NOTE!

On vehicles that are driven fewer than 6,000 miles per year, remove, clean, and reinstall brake pads on separate order. In addition, check that dust boots and pistons move freely.

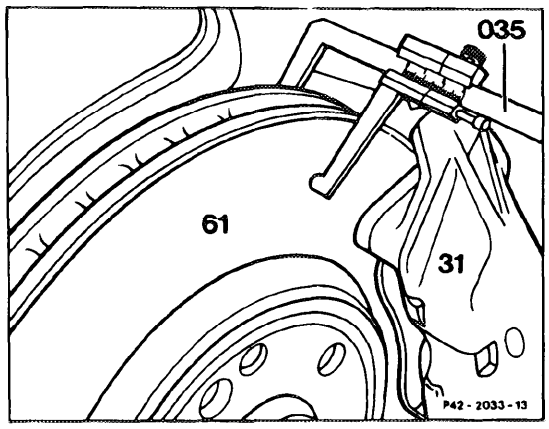


Checking brake disks

- Check brake disks for score marks and cracks. Cracks in a circumferential direction up to 0.5 mm in depth are permitted.

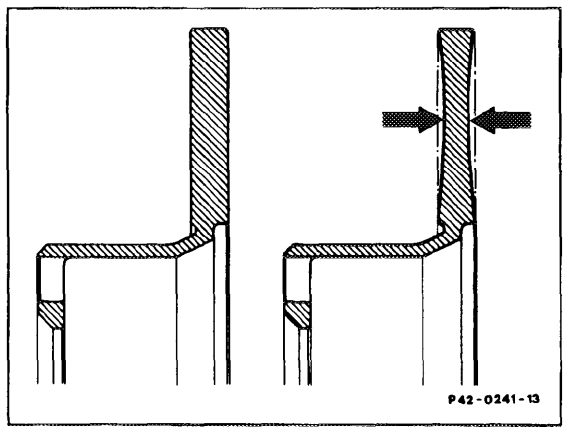
Note: Brake disks which are badly discolored - gray or blue discoloration should be cleaned with cleaning pads (at extra cost).

- Measure thickness of brake disk using special tool (035).



Note: Wear limits for brake disks must be strictly observed.
To ensure that brake disk does not exceed wear limit before next maintenance service, observe wear limits in chart at beginning of chapter.

Ventilated brake disks with hairline cracks up to 25 mm in length, which may show up under high loads, need not be replaced. Replace disks with open cracks and score marks deeper than 0.5 mm immediately.



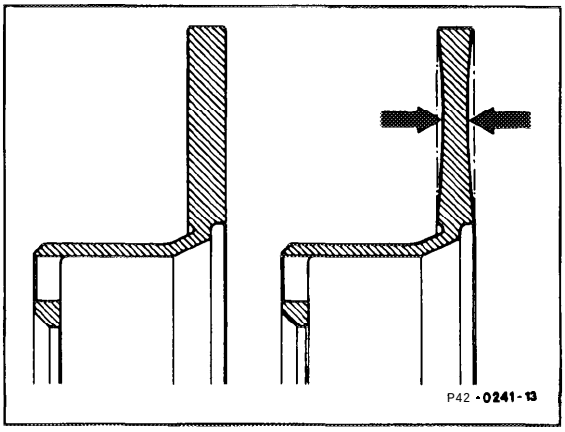
Checking brake pad/disk thickness

Note: If measuring the front brake pads shows that they must be replaced, perform the following additional jobs on separate order:

a) Check all brake disks for wear.
Wear limit:

Ventilated front brake disks	19.4 mm
Solid front brake discs	9 or 10 mm
Rear brake disks	7.3 mm

Note: To make sure that the wear limit is not exceeded before the next maintenance job, the smallest dimension on the ventilated front disk, should be greater than 20.0 mm, on the solid front disk greater than 9.5 mm or 10.5 mm, and on the rear brake disk greater than 7.6.



b) Check brake pads or rear wheel brake for wear. Brake pads must be replaced when the distance between the eye of the lining back plate and the cross spring is approx. 3 mm.

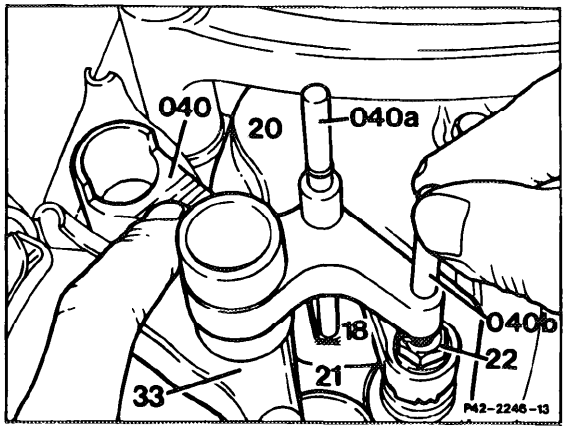
c) Check dust caps and that pistons move freely in brake calipers.

Measuring procedure

Model 201 through 12/84

Position measuring device on hex. head bolts of spring strut and brake caliper mounting of steering knuckle. Supporting surfaces must be clean.

Press measuring device against steering knuckle.



Slip long pin against backing plate of inner pad and short pin against head of caliper to brake carrier mounting bolt.

Remove measuring device and read brake pad wear on measuring pins. If less than 6 measuring rings can be seen, more than approx. 6 mm of the total pad thickness of 12 mm on models 201.02, 201.1, and of 13 mm on model and 201.03 are worn out. In this case it is recommended that the brake pads be replaced, provided the customer does not want to use up the remaining pad thickness until the wear indicator lights up.

Note: The short pin measures outer pad wear, the long pin measure inner pad wear.

Model 107 through 07. 1985
123
126 through 08. 1985

Brake pad specifications

Model		107 123 126.02/03 126.1	126.04
Front caliper type		Fixed caliper	Floating caliper
Thickness of brake pad (pad and backing plate)	front rear	17.5 15.5	10.5 15.5
Thickness of pad backing plate	front rear	4.5 5.0	5.5 5.0
Permissible wear[1]) of brake pad down to thickness of	front rear	2.0 2.0	3.5 2.0

[1]) Replace brake pad during maintenance service if the distance between eye of pad backing plate and cross spring/pad retaining spring on fixed caliper equals approx. 3 mm.

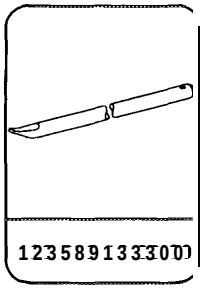
Brake disk specifications

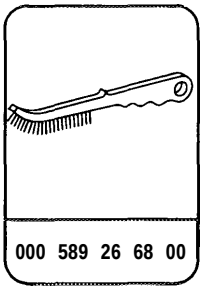
Model		107 126	123
Thickness of brake disk	front rear	22 10	12.6 10
Wear limit	front rear	19.4 8.3	10.6 0.3
Limit at maintenance service	front rear	20 8.6	11.1 8.6

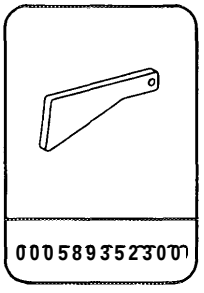
Lubricant

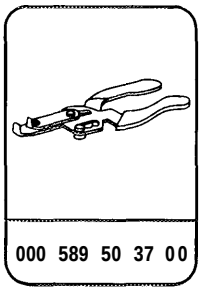
MB brake pad paste	000 989 10 51

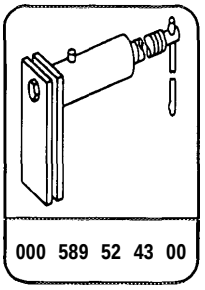
Special tools

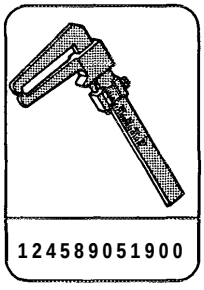








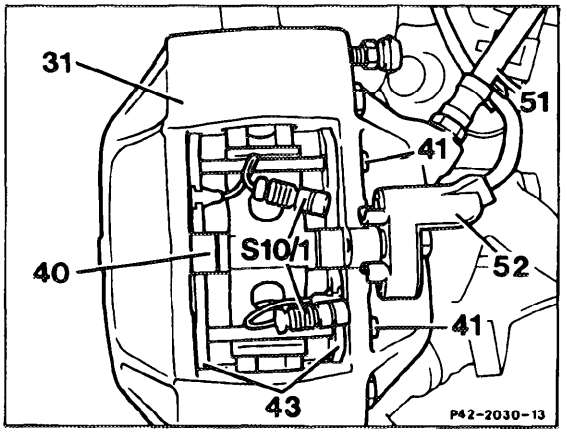




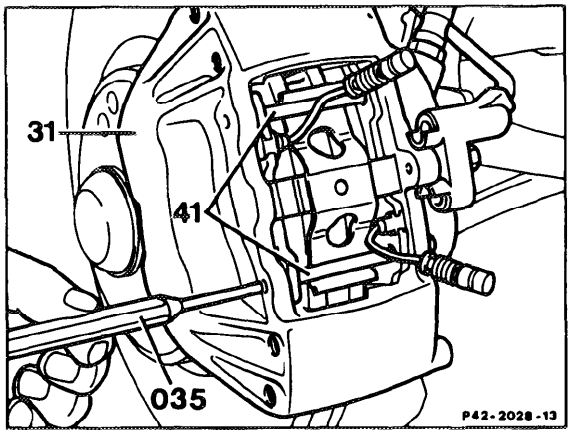
Brake pad replacement

A. Fixed caliper

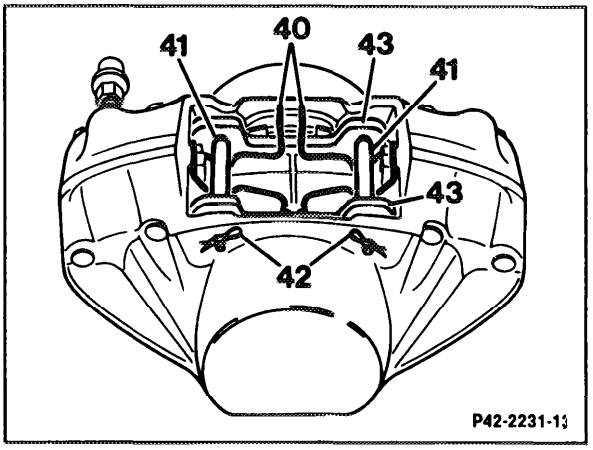
- On fixed caliper with brake pad wear indicator, pull sensor wire (S10/1) out of plug connection (52) on fixed caliper.



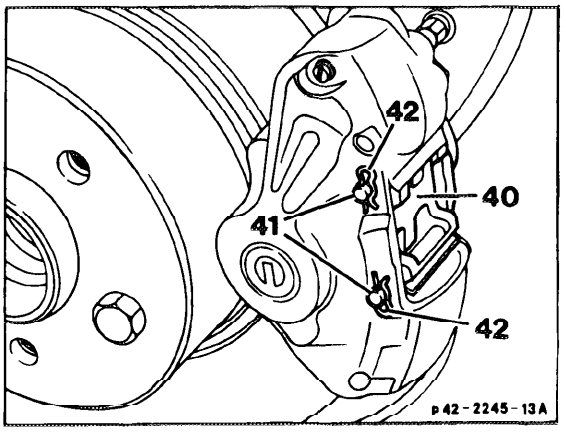
- On Yeves (ATE) fixed caliper, knock retaining pins (41) out of fixed caliper by means of punch (035) and remove cross spring/pad retaining spring.



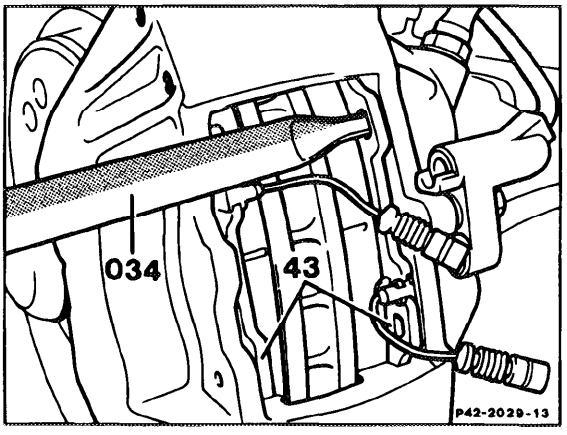
- On Bendix (BX) fixed caliper, remove securing clips **(42),** retaining pins (41) and springs (40).



- On Girling caliper, remove securing clips (42) on rear axle, remove retaining pins (41) and plate (40).

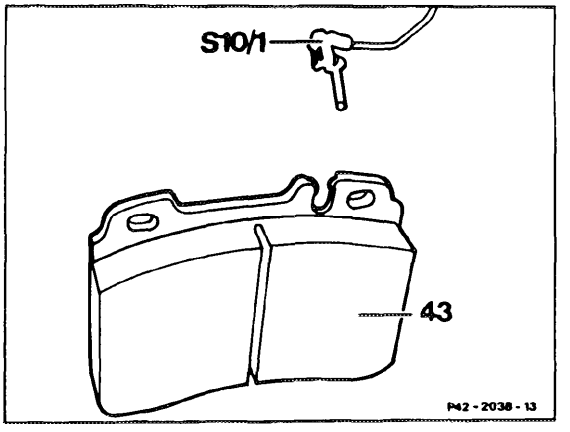


- Remove brake pads (43) from fixed caliper using removing tool (034).



- Pull clip sensors (Sl O/l) out of pad or backing plate.

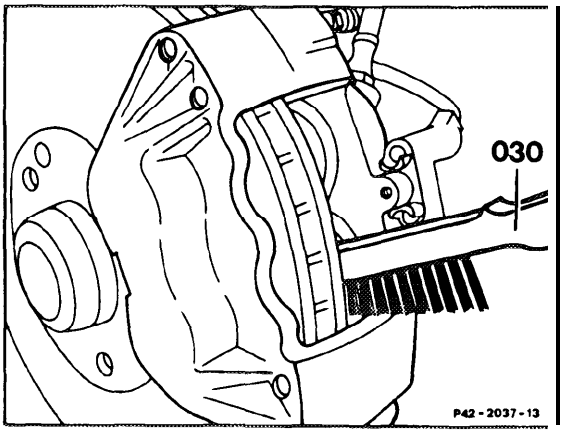
On vehicles with ASR, remove sensors from rear pads in addition.



⚠CAUTION!
Replace clip sensors in which the insulating layer of the contact pin has been worn through or where part of the sensor including the wiring insulation is damaged.

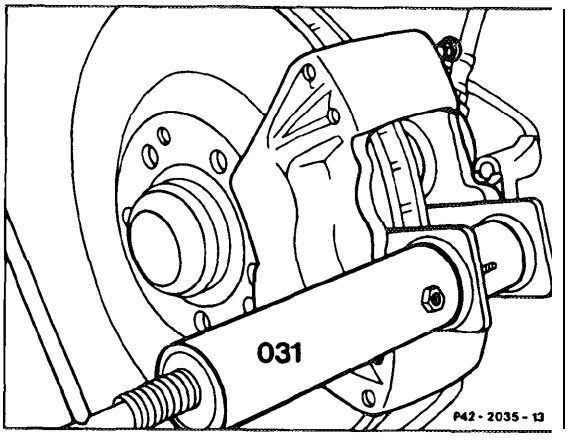
- Clean brake pad guide in fixed caliper using of brake caliper brush (030)

- Visual inspection of dust boots for cracks and piston leaks. If a dust boot is damaged, remove fixed caliper and recondition.

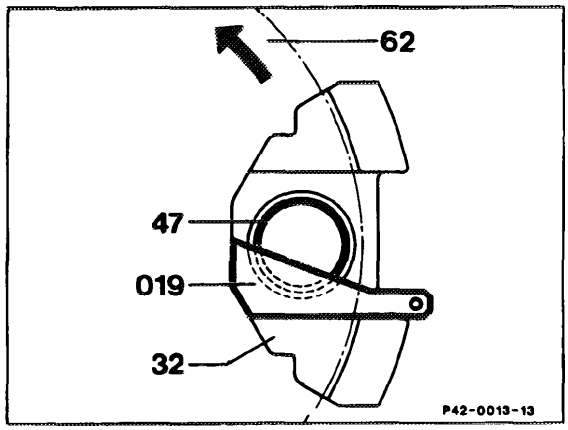


- Push piston back using resetting tool (031), while checking that piston moves freely.

⚠CAUTION!
Use **only** piston resetting tool 000 589 52 43 00. Using other tools may result in damage to the pistons or the dust boots.

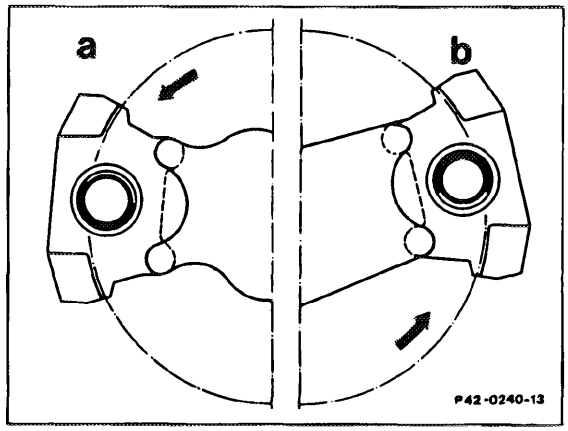


- On rear axle fixed calipers, check the position of the piston (47) in the caliper using the special tool (019).

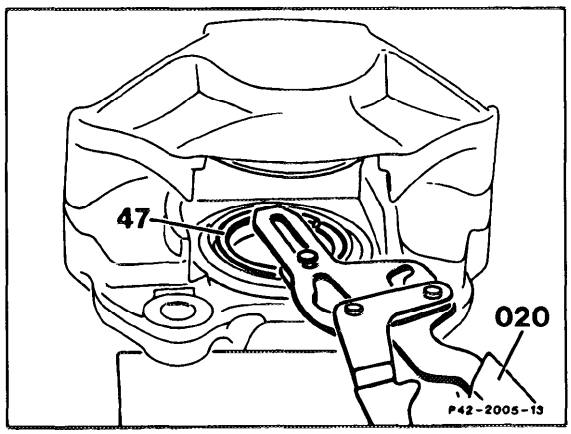


Note:
The raised portion of the piston must be positioned at the top on calipers located behind the axle center line (b) on semi-trailing arms suspensions.

However, the raised portion of the piston must be positioned at the bottom on calipers located in front of the axle center line (a) on semi-trailing arms suspensions with torque compensation.



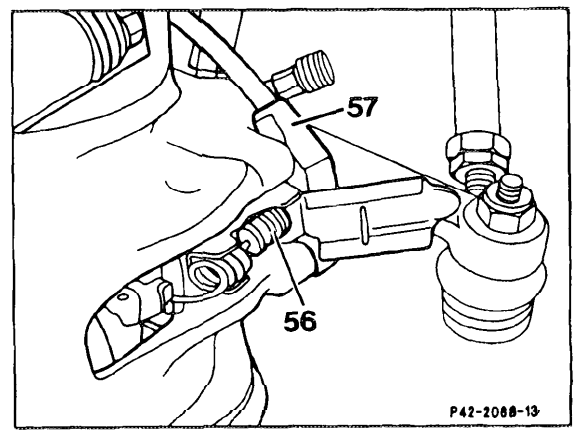
- If necessary, turn piston (47) using special tool (020).
- Clean rain groove in brake pad, measure lining thickness.



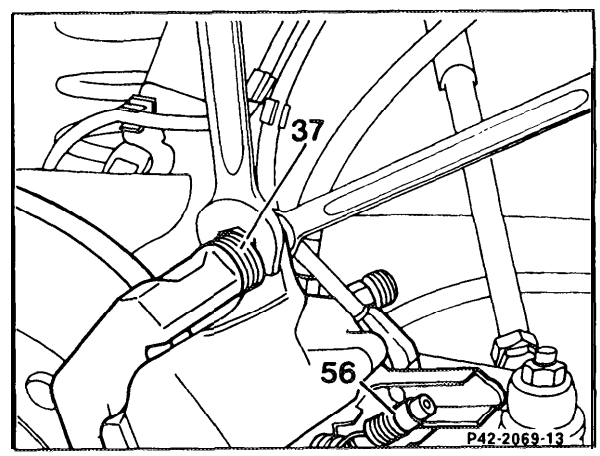
B. Floating caliper (Model 126.04 up through 08/85 only)

- Lift the two holding lugs located laterally on cover of plug connector using a screwdriver and open cover. Do not use force.

- Remove cable of clip sensor (56) from plug connection (57) on floating caliper. Do not pull on cable.



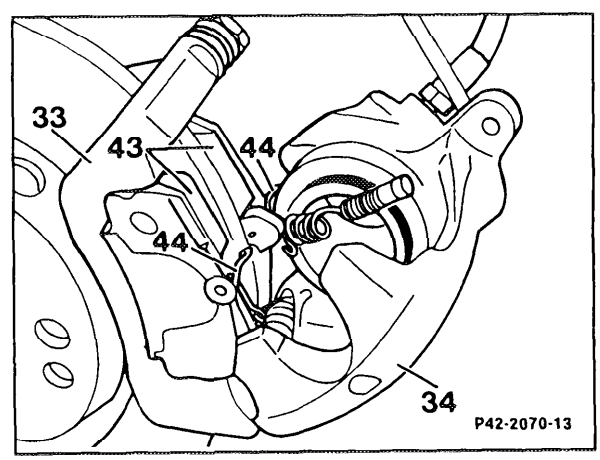
- Unscrew upper hex. bolt while applying counterhold at slide bolt (37).



- Swing caliper (34) down and attach to stabilizer bar with suitable hook. Remove both brake pads (43) from brake carrier (33).

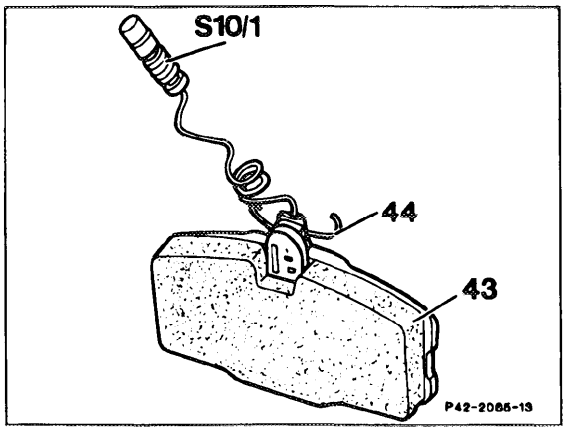
⚠CAUTION!

When the caliper housing is swung open, make sure that the guide bolts do not get bent. Never use the caliper housing to change the steering angle.



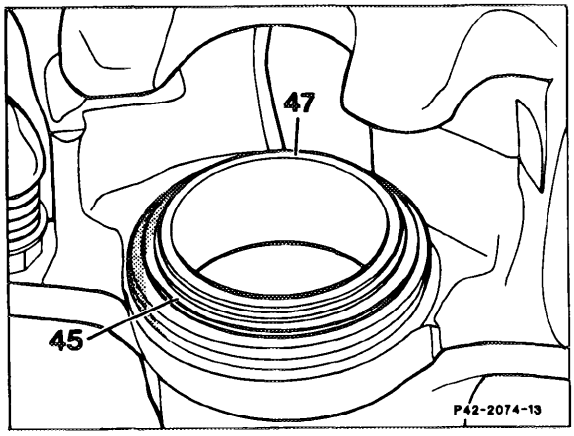
- Pull clip sensor (S10/1) out of pad backing plate.

Note: On floating calipers only the inner brake pad has a wear indicator.



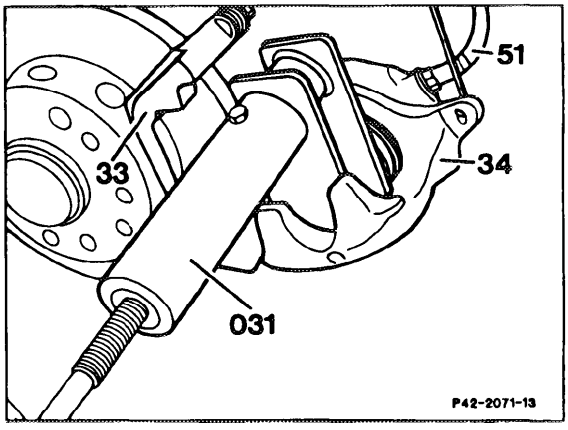
⚠CAUTION!
Replace clip sensors on which the insulation layer of the contact plate is worn through or where part of the sensor including the wiring insulation is damaged.

- Clean brake pad supporting surface of brake carrier.
- Check dust boot (45) for cracks and piston for leakage. If dust boot is damaged, remove and repair caliper, since the entrance of dirt will quickly lead to caliper leakage.



- Push piston back using resetting tool (031).

⚠CAUTION!
Use **only** piston resetting tool 000 589 52 43 00. Using other tools may result in damage to the pistons or the dust boots.

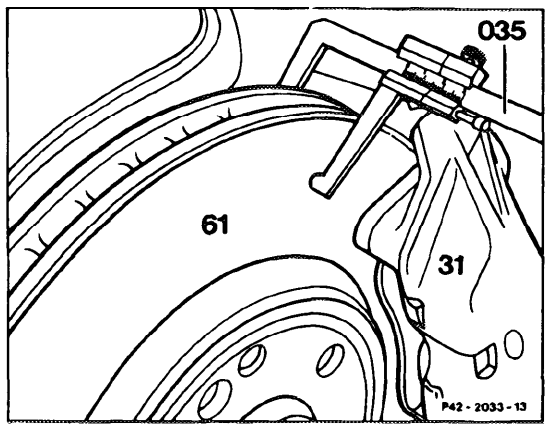


Checking brake disks

- Check brake disks for score marks and cracks. Cracks in a circumferential direction up to 0.5 mm in depth are permitted.

Note:
Brake disks which are badly discolored - grey or blue discoloration should be cleaned with cleaning pads (at extra cost).

Measure thickness of brake disk using special tool (035).

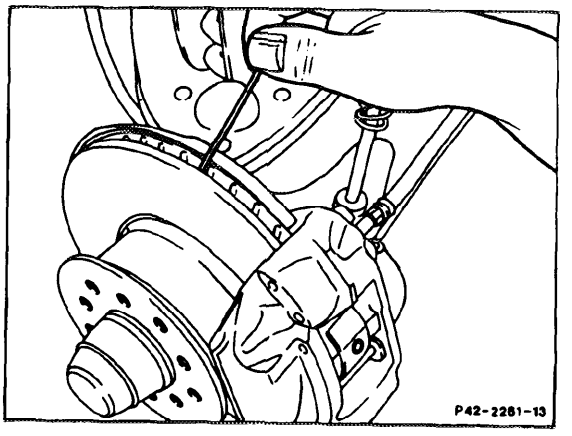


Note:
Wear limits for brake disks must be strictly observed.
To ensure that brake disk does not exceed wear limit before next maintenance service, observe wear limits in chart at beginning of chapter.

Ventilated brake disks with hairline cracks up to 25 mm in length, which may show up under high loads, need not be replaced. Replace disks with open cracks and score marks deeper than 0.5 mm immediately.

- Clean air passages of vented brake disks with a thin wire, taking care not to dislodge any balancing weights. Blow loosened dirt out of passages with compressed air.

Note:
Badly clogged air passages can be cleaned only by removing brake disks and placing them in a washing unit.

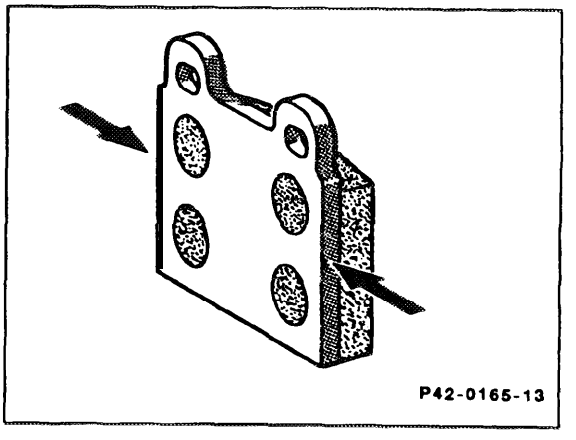


Brake pad installation

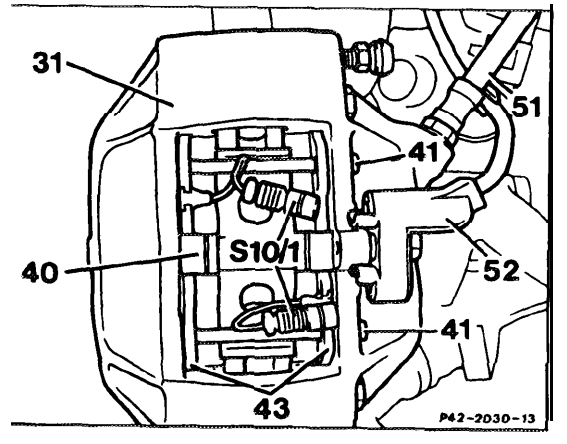
A. Fixed caliper

- On fixed caliper, apply heat resistant long term lubricant to brake pads at spots indicated by arrows. Then install brake pads.

- Install cross spring/pad retaining springs, holding plate for pads, retaining pins, and locking clips, as required.



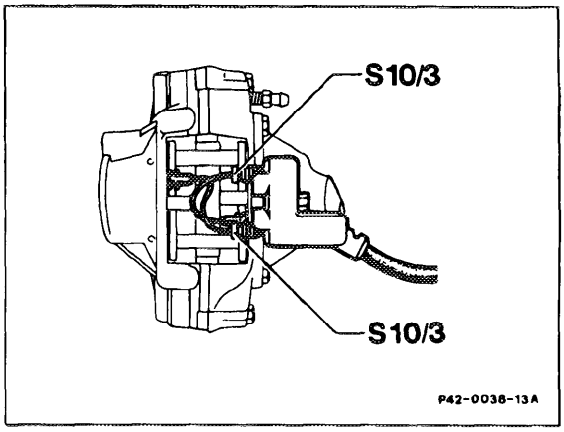
- On fixed caliper with brake pad wear indicator, insert clip sensors (S10/1) into brake pad (43) and into plug connector (52).



Note:
The rear brakes on vehicles equipped with ASR II have wear sensors as on the front brakes.

The same wear sensors (Sl 0/3) are used on the rear wheels as are used on the front wheels.

The wires must be routed as shown in the illustration



- **Apply brakes vigorously several times** until strong resistance is felt. Then check brake fluid level in reservoir and add, as necessary.

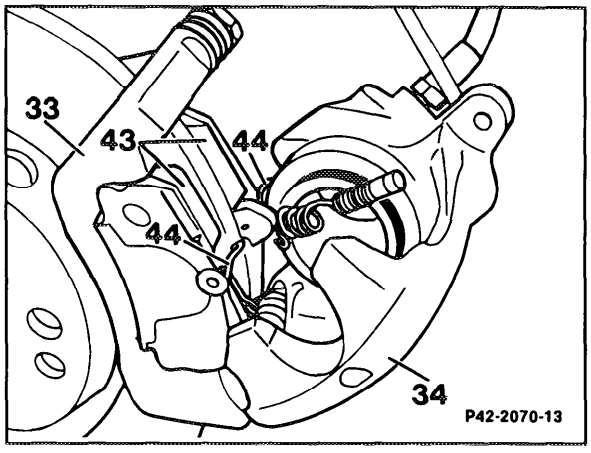
  If new brake pads are installed, they must be broken-in carefully by stopping several times from 80 to 40 km/h with light pedal pressure.

  Allow brakes to cool between each application. l-lard braking should only be done with pads that have been broken-in.

B. Floating caliper (Model 126.04 up through 08/85 only)

- On floating caliper, insert both brake pads (43) into brake carrier (33), making sure that the spring clip (44) is located parallel with upper edge of pad.

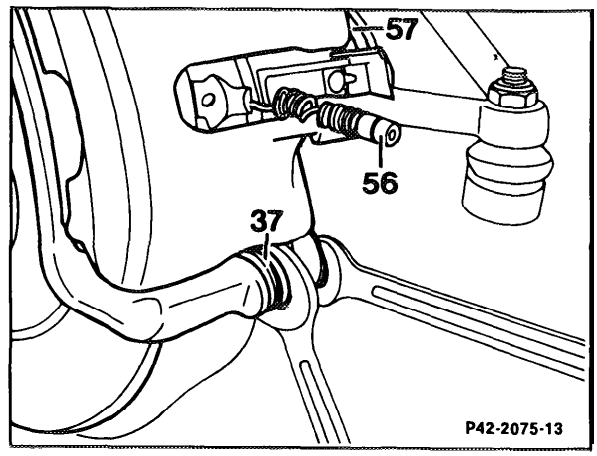
- Plug clip sensor into inner brake pad.



- Secure caliper (34) with new self locking bolt to brake carrier (33) while applying counterhold to slide bolts (37). Torque to 35 Nm.

Note: Do not re-use self locking bolts.

- Coil cable of clip sensor (56) and insert into plug connector (57) on floating caliper. Close cover of plug connector.



- Apply brakes vigorously several times until strong resistance is felt. Then check brake fluid level in reservoir and add, as necessary.

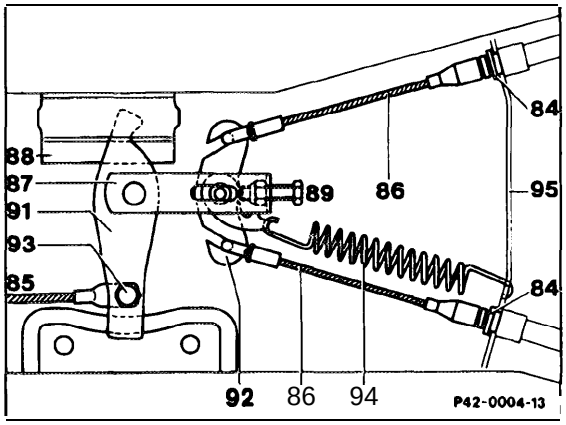
  If new brake pads are installed, they must be broken-in carefully by stopping several times from 80 to 40 km/h with light pedal pressure.

  Allow brakes to cool between each application. l-lard braking should only be done with pads that have been broken-in.

Inspecting parking brake cable

All models

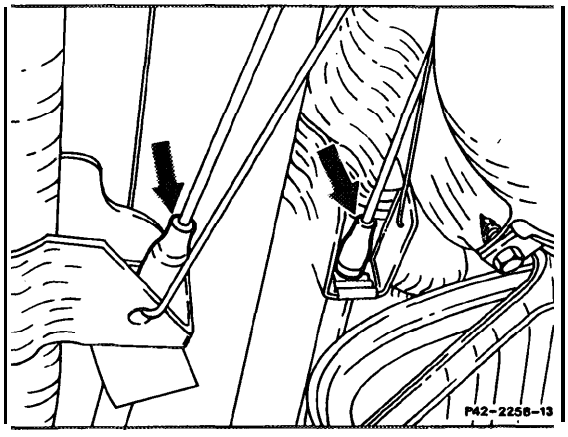
- Apply parking brake several times, while an assistant checks the operation of the rear cables, the intermediate and compensating lever, and the front cable.



85 Front brake cable
86 Rear brake cable
89 Adjustment screw
91 Intermediate lever
92 Compensating lever

Models 124, 129, 201

- Visually check brake cables, paying particular attention to the rubber sleeves (arrows) that seal cable to guide.



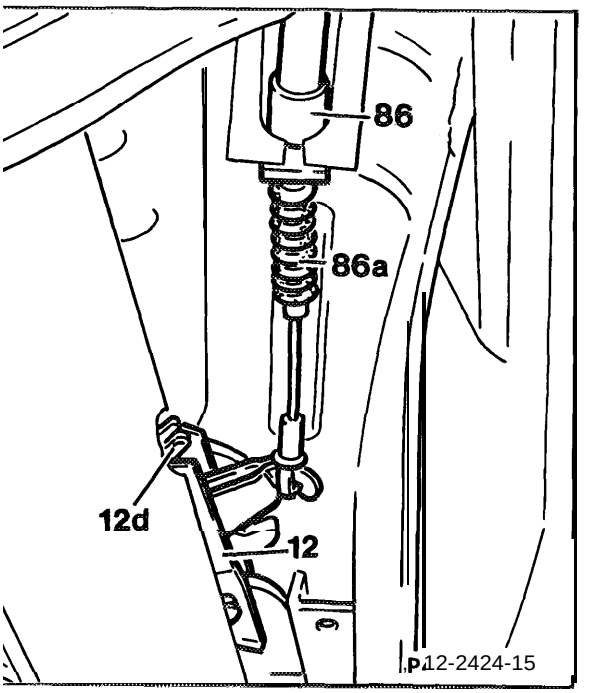
Models 124, 129, 201

Inspecting parking brake cable

12 Automatic cable length compensator

86 Rear brake cable

86a Rubber boots



Model 140

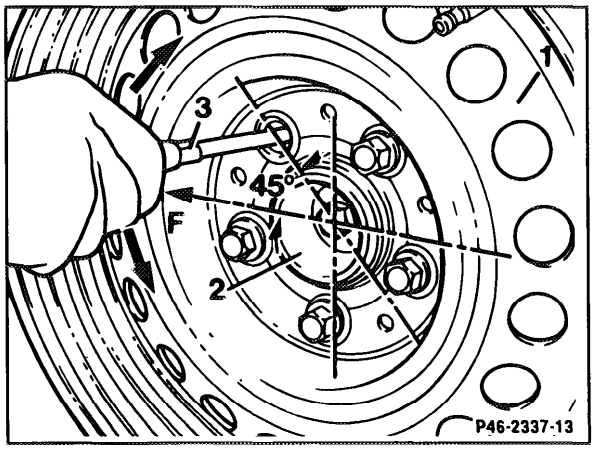
Model 107 up through 0711985
123
126 up through 0811985

Adjusting specifications (except model 140)

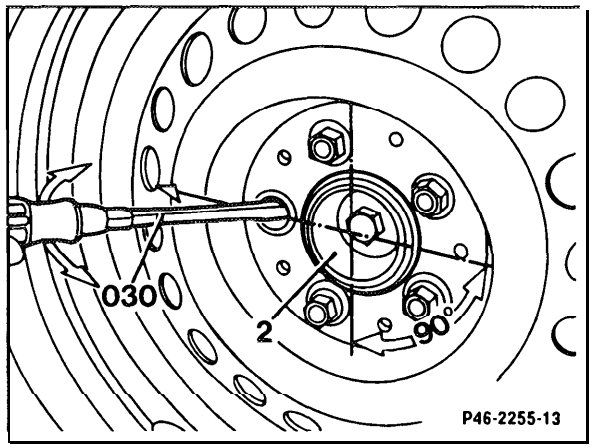
Model	107	123, 126
Parking brake reduction ratio	22	35.6
Number of notches on quadrant	6	12
Force required to pull or push parking brake lever from rest position to first notch	150 – 180 N	120 – 150 N
Number of notches until parking brake becomes effective.	1 - 2	1 - 2

Note: The parking brake should be adjusted if the pedal (on vehicles with **foot operated parking brake)** can be depressed more than 2 notches (model 107) or 4 notches (models 123, 126), without any noticeable braking effect.

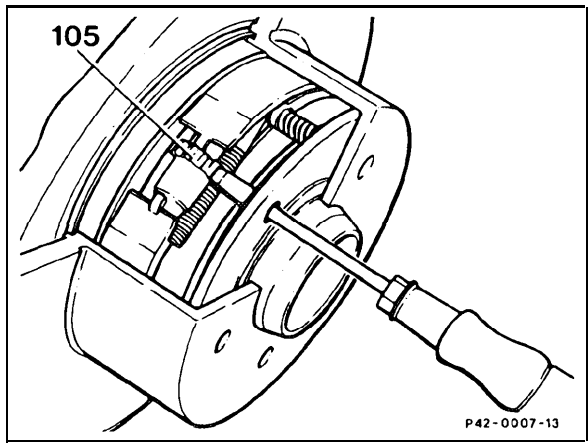
- Remove one wheel boit from both sides on rear axle.
- Jack up rear of vehicle.
- On vehicles with **semi-trailing arm suspension,** turn each rear wheel so that the bolt hole points **45°** up in a forward direction.



- On vehicles with **semi-trailing arm suspension with torque compensation,** turn each rear wheel so that the bolt hole is pointing forward.



- Using screwdriver inserted through bolt hole of wheel, brake disk, and axle flange, turn adjuster until it can no longer be rotated. Then back adjuster off 2-3 teeth **,** until wheel turns freely.



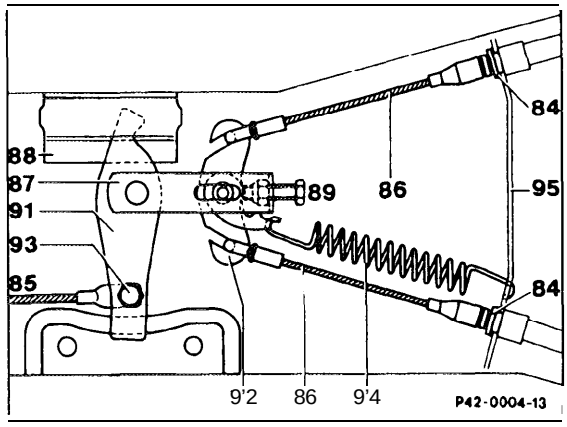
105 Adjuster

Note: To tighten brake shoes, adjust as follows:

Vehicles with **semi-trailing arm suspension:**
Left hand side: from bottom in upward direction.
Right hand side: from top in downward direction.

Vehicles with **semi-trailing arm suspension with torque compensation:**
Left hand side: from bottom in upward direction.
Right hand side: from top in downward direction.

Note:
When adjusting the parkig brake, do not adjust the adjusting screw on the intermediate lever. this is used only to compensate for the length of the cables.



Model 107 starting 08/1985
124
126 starting 09/1985
129
140
201

Adjusting specifications (except model 140)

Model	107	124 129 through 09/89	124 129 starting 10/89	126	201 through 01/87	201 starting 02/87
Parking brake reduction ratio	21.32	28.4	28.4	33.44	25.2	25.2
Number of notches on quadrant	6	11	15	12	8	12
Force required to pull or push parking brake lever from rest position to first notch	150-180 N	150-180 N	150-180 N	120-150 N	90-120 N	90-120 N
Number of notches until parking brake becomes effective.	1	1	1	1	1	1
Number of notches at which parking brake should be adjusted if no adequate braking effect is felt	2	4	5	4	2	3
Number of teeth on adjuster through 03/84	10	-	-	10	8	-
Number of teeth on adjuster starting 04/84	10	15	15	10	15	15

All models except 140

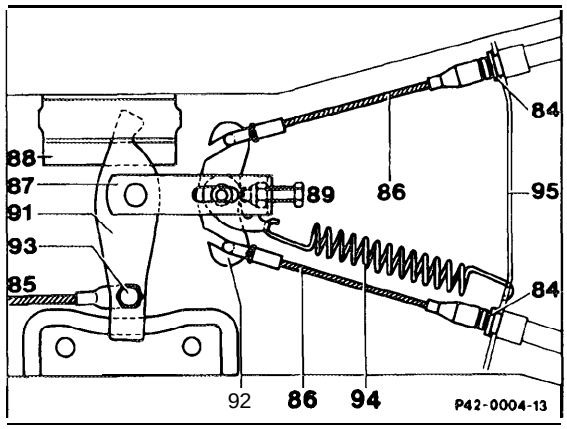
Note: The parking brake should be adjusted if the pedal (on vehicles with **foot operated parking brake)** can be depressed more than 2 notches (model 107) or 4 notches (models 124, 126, 129), without any noticeable braking effect. On vehicles with lever **operated parking brake,** the parking brake should be adjusted if the lever can be pulled more than 2 notches without any noticeable braking effect.

- Loosen adjusting screw (89) completely. The expanding locks should not be preloaded.

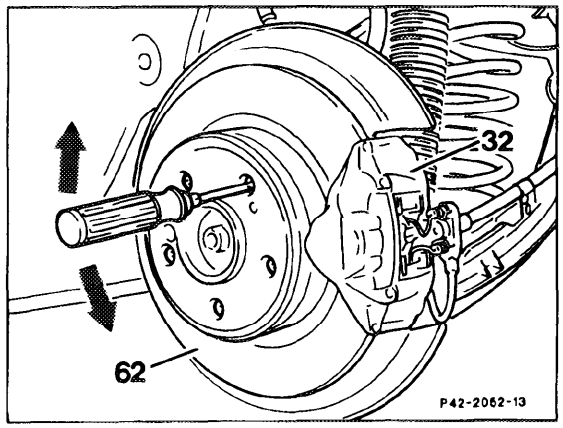
Note:
Light alloy wheels must be removed.

- Remove one wheel bolt from both sides on rear axle.

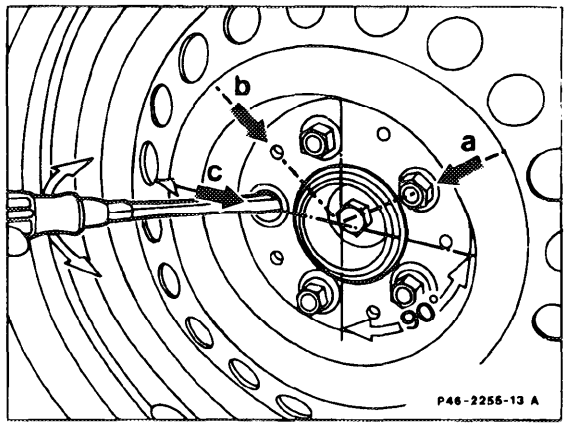
- Jack up rear of vehicle.



- Turn brake disk so the adjuster can be turned by using a screwdriver inserted through a bolt hole.



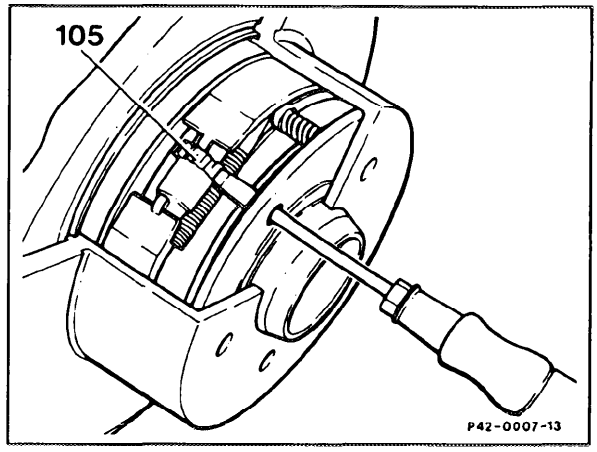
Note:
Location of adjuster shown on left rear wheel; right side is mirror image.



a) Multi-link suspension (Models 124, 129, 201)
b) Semi-trailing arm suspension (Models 107, 126)
c) Semi-trailing arm suspension with torque compensation (Models 107, 126)

- Using screwdriver inserted through bolt hole of wheel, brake disk, and axle flange, turn adjuster until it can no longer be rotated. Then back adjuster off 2-3 teeth on adjuster with 8-10 teeth; 5-6 teeth on 15 tooth adjusters, until wheel turns freely.

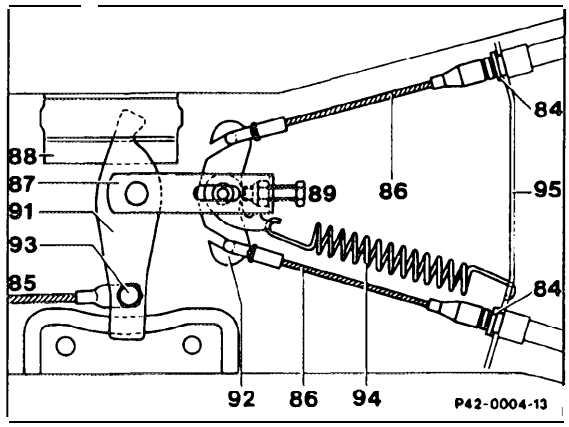
Note: To tighten brake shoes, adjust as follows:
Left hand side: from bottom in upward direction.
Right hand side: from top in downward direction.



105 Adjuster

- Tighten adjusting bolt (89) until brake cables no longer sag.

- Apply parking brake vigorously several times at approx. 400 N.



Pedal operated parking brake:

- Turn adjusting bolt (89) in bracket (87) until pedal is depressed by 1 tooth when the following forces are applied:

Models 107, 124, 129:	150-180 N
Model 126:	120-150 N

Lever operated parking brake:

- Turn adjusting bolt (89) in adjusting bracket **(87)** until lever can be tightened by one tooth at a force of approx. 90-120 N.

Model 140

- Jack up rear of vehicle.

- Remove one wheel bolt from left and right sides. Do not remove wheel.

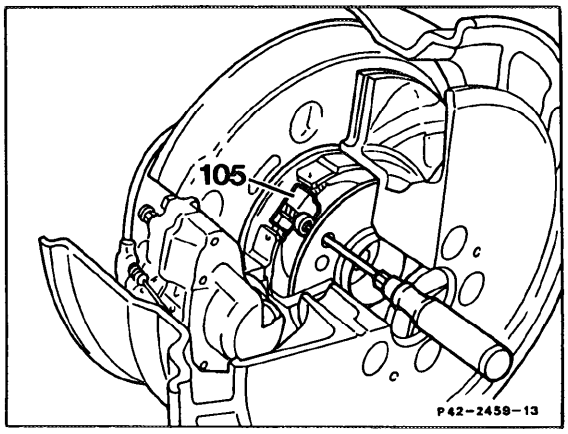
- Turn wheel so that bolt hole is positioned at a 45° angle from the top, towards the rear.

- Using a phillips head screwdriver, turn the adjuster (105) to the right until the rear wheel can not be turned. Then loosen adjuster 5 1/2 turns (mark screwdriver) until wheel turns freely.

- Apply parking brake vigorously several times.

- Release parking brake and check that rear wheels turn freely.

- Install wheel bolt and torque to 150 Nm.



105 Adjuster

Replacing brake fluid

4280

All models

Brake fluid	
Use specified brake fluid only	Refer to Factory Approved Service Products list

Note: During its service life, the boiling point of brake fluid will decrease as a result of the moisture absorbed from the atmosphere. When the braking system is under extreme stress, this moisture can vaporize. For this reason, the **brake fluid must be changed once a year,** preferably in spring on models 124 and 201 through 03/91 production as well as models 107, 123, 126. On models 124 and 201 starting 04/91 production, and models 129 and 140 the **brake fluid must be changed once every two years.**

⚠

When correcting the brake fluid level be sure not to exceed the original level to avoid having the reservoir overflow when the brake pads are replaced.

Wandle brake fluid with care.

a) Store brake fluid only in containers, which make accidental consumption of fluid impossible. **(Fatal dosage 100 cc.)**

b) Even minute quantities of mineral oil will result in failure of clutch and brake systems Special care should be taken with brake fluid that is colorless or dyed yellow, since here the risk of mix up is the greatest.

Whenever mineral oil is found in the brake system, or if the presence of mineral oil is suspected, proceed as follows:

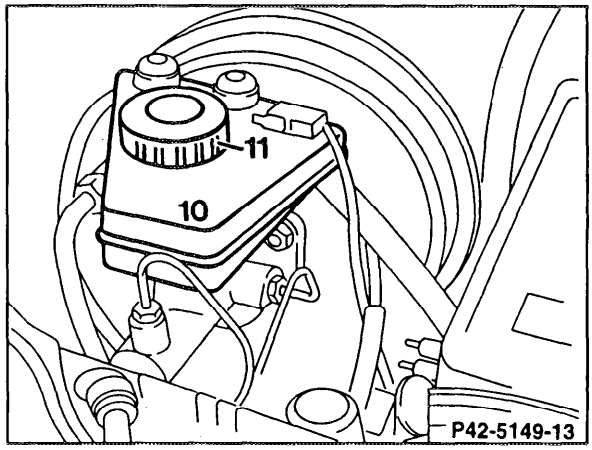
1. Replace master cylinder and brake fluid reservoir.
2. Flush entire brake system with new brake fluid.
3. Any components containing rubber parts that came into contact with mineral oil, such as brake calipers, brake hoses, ABS or ASR hydraulic unit, ASR pressure reservoir must be replaced.
4. Bleed brake system.

c) Make sure that brake fluid does not contact painted surfaces of vehicle, since the fluid acts as a paint solvent.

d) Brake fluid is highly hygroscopic, meaning it will absorb moisture from the air, as a result of which the fluid's boiling point is reduced. Brake fluid should only be stored in well sealed containers.

e) Brake fluid that has been bled out of the system can not be reused, since it may contain foreign matter or water which could re-enter the brake system in this manner.

Vehicles without ASR



- Unscrew cap (11) and drain reservoir down to fluid level of approx. 10 mm.

Note: If reservoir is completely drained, entire brake system must be bled (refer to repair instructions)..

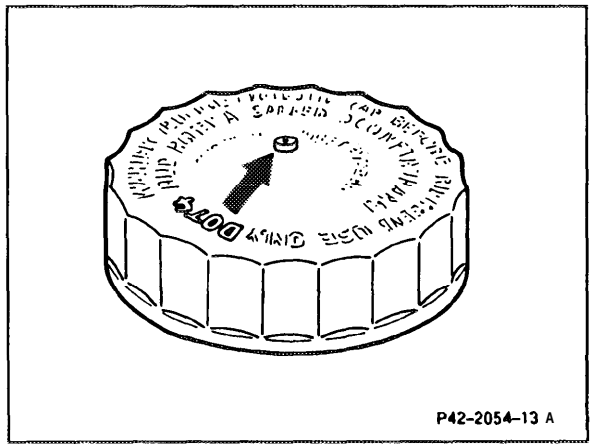
- **Using brake bleeder:**

Connect bleeder unit according to manufacturers instructions. Let approx. **80 cc** brake fluid flow out a each caliper, so that lines and calipers are filled with new brake fluid.

- **Without brake bleeder:**

Fill reservoir up to “MAX” mark with brake fluid. Pump old brake fluid out of each caliper by applying 10 pump strokes each. Add in new brake fluid.

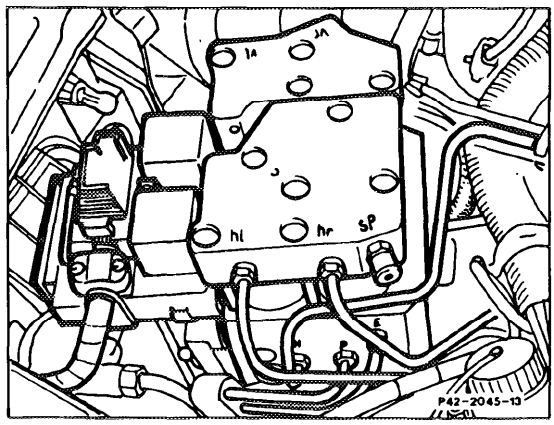
Note: With either method, clear brake fluid without bubbles should come out of the bleeder hose.



- Disconnect bleeder unit and correct fluid level in brake reservoir.

- Screw on cap. Check that vent opening (a) in cap is not blocked.

Vehicles with ASR II and ASR III



- With ignition switched off, empty pressure reservoir at bleeder valve SP
- Remove reservoir cover and empty the reservoir compartments down to a fluid level of approx. 10 mm.

Note:
If the reservoir is completely emptied, the **entire** brake system must be bled (500 cc brake fluid per wheel).

- Connect bleeder unit according to manufacturer's instructions.

Allow approx. 80 cc of brake fluid to flow from each wheel brake to ensure that lines and caliper cylinders are filled with new brake fluid.

- Start engine.
- Keep bleeder valve SP open until clear brake fluid, free of bubbles, flows out.
- Close bleeder valve SP. Allow charging process of pressure reservoir to complete. (Charging pump will run audibly for approx. 30 seconds.)
- Switch engine off.
- Disconnect bleeder unit and correct fluid level in brake fluid reservoir.

All **models**

Parking brake adjusting specifications

Model	107	124 129 through 09/89	124 129 starting 10/89	126	140	201 through 01/87	201 starting 02/87
Number of notches at which parking brake should be adjusted if no adequate braking effect is felt	2	4	5	4	5	2	3

If parking brake does not apply as specified, adjust (refer to SMS Job No. 42-540) on separate order.

Measure effectiveness of the parking brake on dynamometer.

Note: Before measuring effectiveness, break in parking brake. Observe the following:
When actuating the parking brake, the ratchet of the pedal or lever should not be allowed to engage.

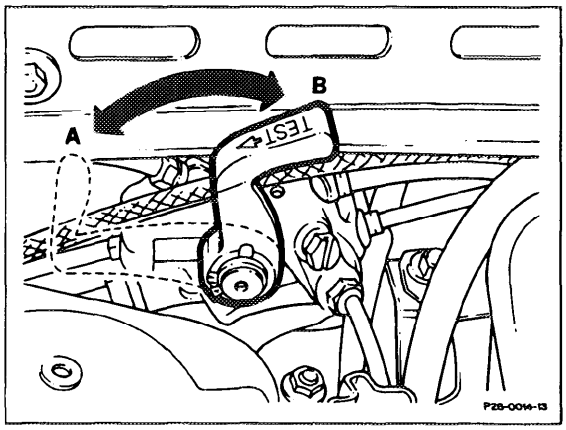
The parking brake can be broken in using the following methods:

- During a test drive on a dry road at a speed of approx. 50 km/h, apply parking brake 2 to 3 times with a force of 100-200 N for pedal operated parking brake and 80-160 N for lever operated parking brake. Brake vehicle to a stop while observing any traffic behind vehicle since stop lamps do not light.

- At a constant speed of approx. 50 km/h on a dynamometer, apply parking brake for 10 seconds at a max. of 100 N for pedal operated parking brake and at 80 N for lever operated parking brake.

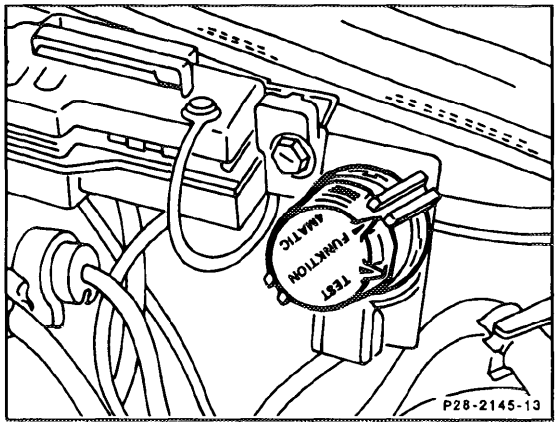
⚠WARNING!
On vehicles with **4MATIC,** the system must be shut off before operating vehicle on dynamometer.

On vehicles with **4MATIC** up through 04/91 production, set service switch located on right side in engine compartment to test position (A) when operating vehicle on dynamometer.



up through 04/91

On vehicles with **4MATIC** starting 05/91 production, the switch (located on the right inner side of the component compartment wall) must be switched from the FUNKTION position to the TEST position. Pull the round cover out, turn and reinsert in the TEST position.
The ignition must be off when setting the switch back to the FUNKTION position, otherwise the 4MATIC warning lamp will not go out.



starting 05/91

- On chassis dynamometer, operate vehicle at a constant speed of 50 km/h (3rd gear). Apply parking brake for 10 seconds at a constant force of 100 N for pedal operated parking brake and 80 N for lever operated parking brake. Do not exceed specified force.

The break in procedure can be repeated after the brakes have been allowed to cool off.

Service brakes
Check free travel of brake pedal. At a force of approx. 200 N, the brake pedal should be halfway through the total travel. Perform test with vacuum assist from running engine.

Checking power steering fluid level

4611

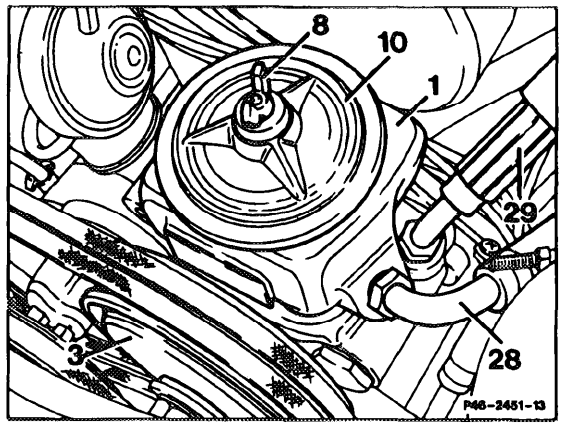
All **models**

Oil grade

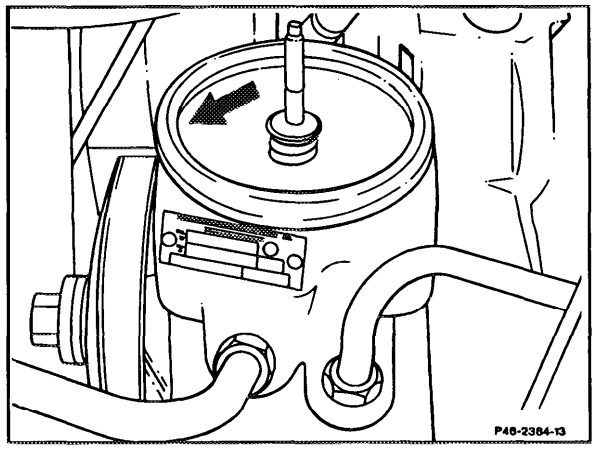
MB steering gear oil p/n 000 989 88 03	Refer to MBNA Factory Approved Service Products list

VT 27, VT 49 and ZL 49

- Unscrew wing nut or knurled nut (8) from reservoir and remove cover (10)



- Warm fluid level (operating temperature, approx. 80°C) up to stamped or cast in mark (approx. 20 mm below reservoir edge).
- Cold fluid level (room temperature 20°C) 6-8 mm below mark.



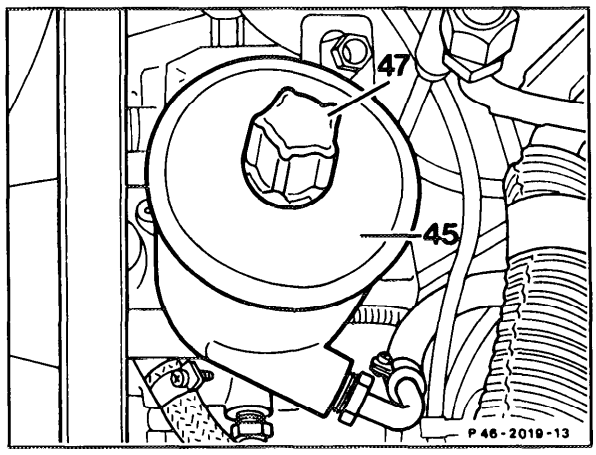
⚠CAUTION!

Do not overfill reservoir. During maintenance work, the oil is often only at room temperature.

- Install cover, making sure that gasket seats properly. Screw on wing nut, or knurled nut.

VT 61, VT 161, VTP 62, VTP 162, ZL 61 and ZL 161

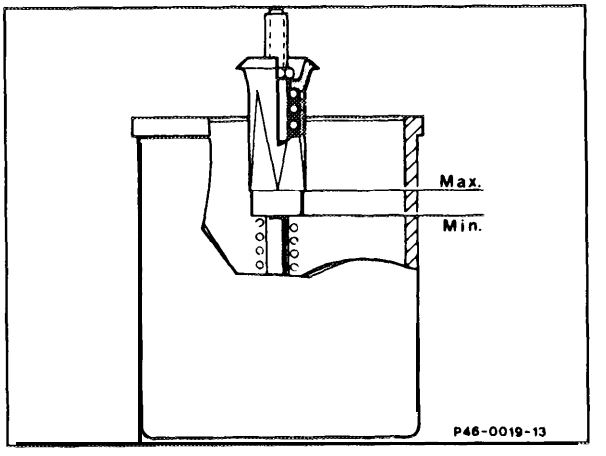
- Unscrew vent cap **(47),** wing nut or knurled nut from reservoir and remove cover (45)



45 Cover
47 Vent cap

Version through 12/90

Warm fluid level (operating temperature, approx. 80°C) 18-26 mm below upper reservoir edge. Cold fluid level (room temperature 20-50°C) between minimum and maximum marks.



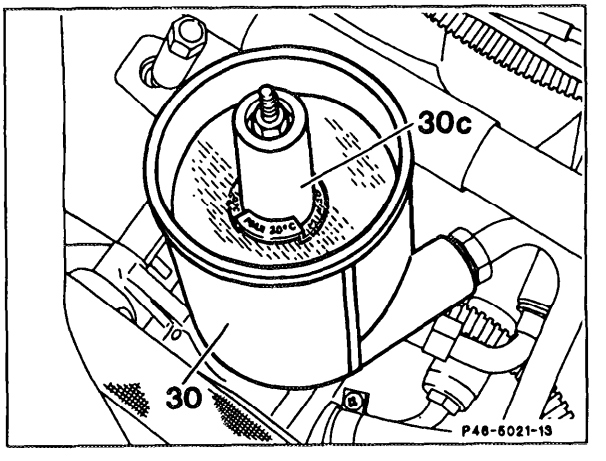
Version starting 1/91

Cold fluid level (room temperature 20°C) between minimum and maximum marks on plastic sleeve (3Oc).

- Add fluid, if necessary.

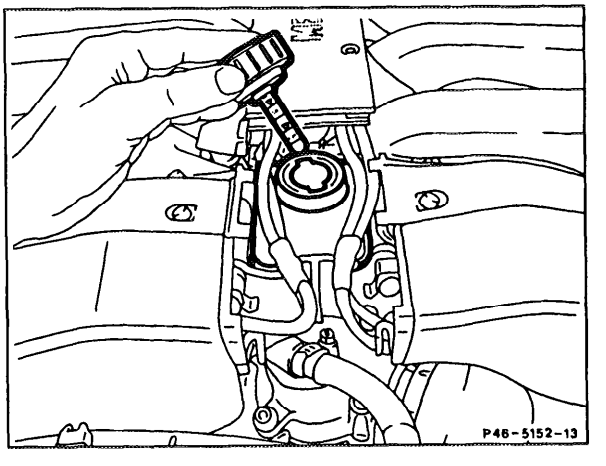
⚠CAUTION!
50 not overfill reservoir.

- Install cover, making sure that gasket seats properly. Screw on vent cap, wing nut, or knurled nut.



Engine 120

- Remove cover between cylinder head covers.
- Remove filler cap. The integral dipstick shows the correct minimum and maximum markings and the respective temperature ranges.



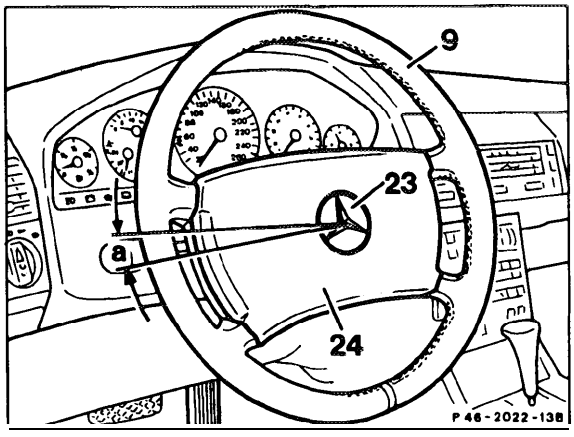
All **models**

Note:
When performing this job number, the engine compartment lower panel or the noise encapsulation panel must be removed, and replaced after completing all maintenance work (refer to Job No. 6190 or 9490).

- In steering center position, maximum allowable play (a) at steering wheel is 25 mm.

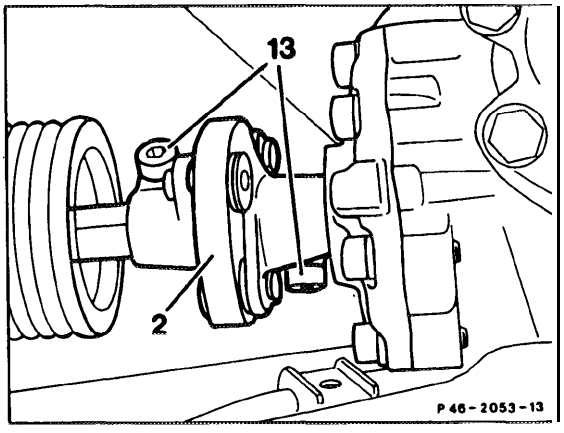
Note:
The steering gear may be adjusted in car if adjusting specifications are carefully observed (on separate order only).

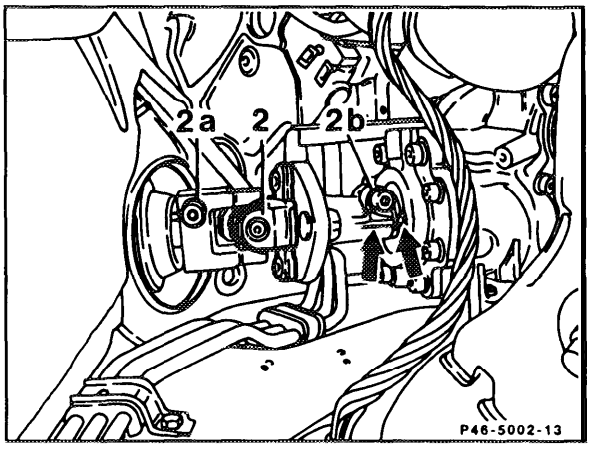
a=max. 25 mm



- On all models starting **04/1984,** check play of steering coupling or of both flexible couplings **(2).**

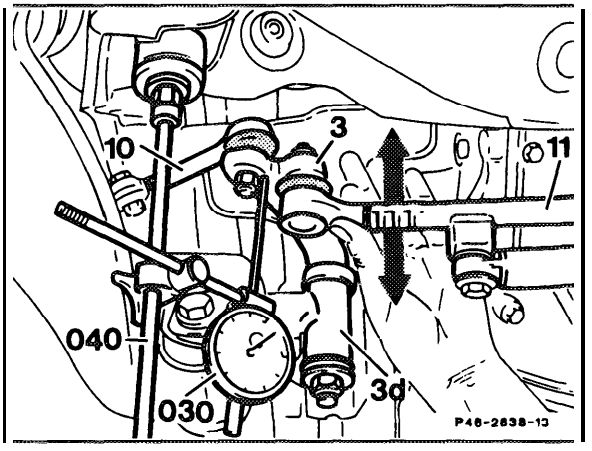
Models 124 (except **124.034/036),** 129, 201
2 Flexible coupling



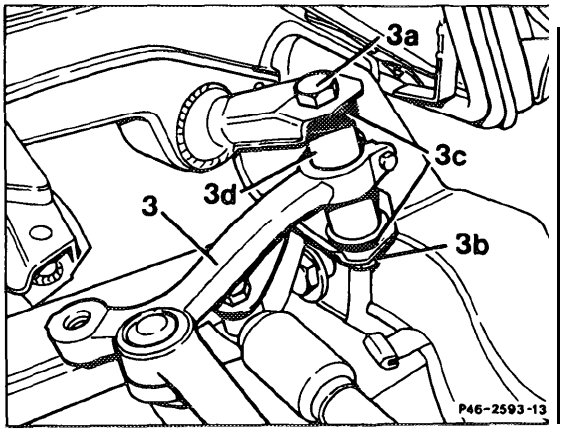


Models 124.034/036, 140

- Check mounting of idler arm (3) in rubber bushings, using dial indicator as necessary (SMS Job No. 46-0110). If play is greater than 0.5 mm, replace rubber bushing (SMS Job No. 46-0520) on separate order.

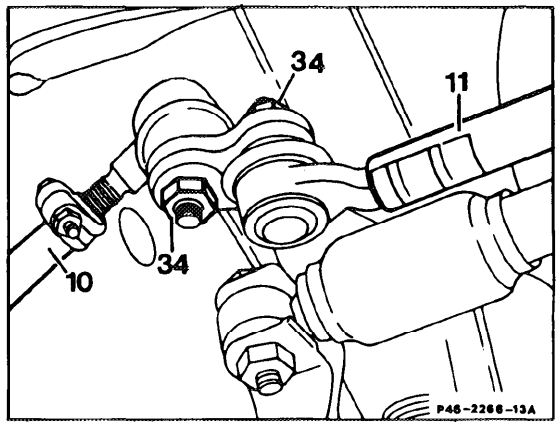


All models except 140

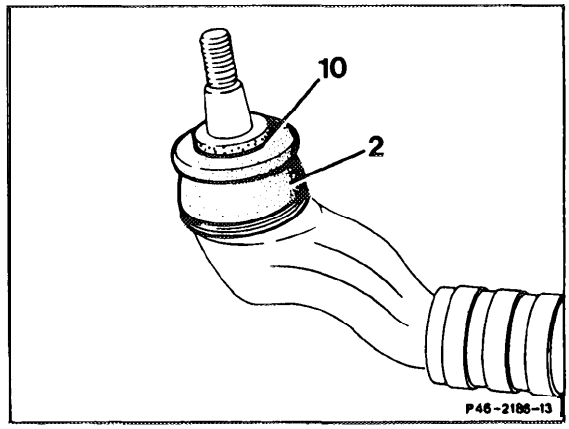


Model 140

- With vehicle resting on wheels, move steering left and right approx. 100 mm while checking the following ball joints:
- Tie rod end (10) ball joints.
- Tie rod (11) ball joints.
- If play is found, replace the appropriate ball joint.
- Check condition of rubber boots.



⚠ CAUTION!
If a damaged rubber or plastic boot is found, replace affected joint immediately, since penetrating dirt will destroy joint in a short time. **Replacement of only the boot is permitted only if no dirt whatsoever has entered the joint.**



2 Rubber boot

Retightening steering bolts

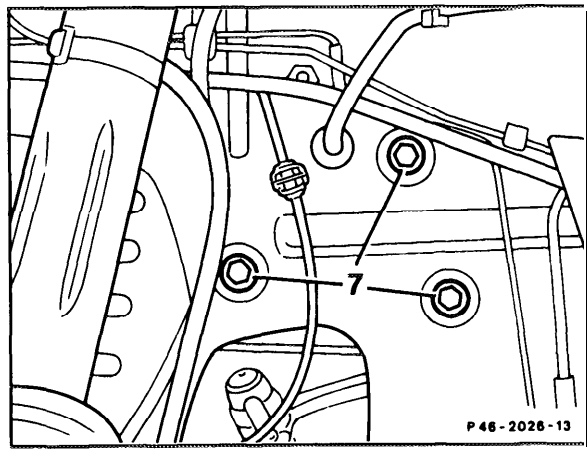
4671

All models except 140

Torque specifications	Nm
Steering gear mounting bolts	**70-80**

Check that steering gear bolts are tight, retighten, if necessary.

Note: Do not loosen bolts to check torque. If the torque required to turn the bolt **further** is less than specified, tighten bolt accordingly.



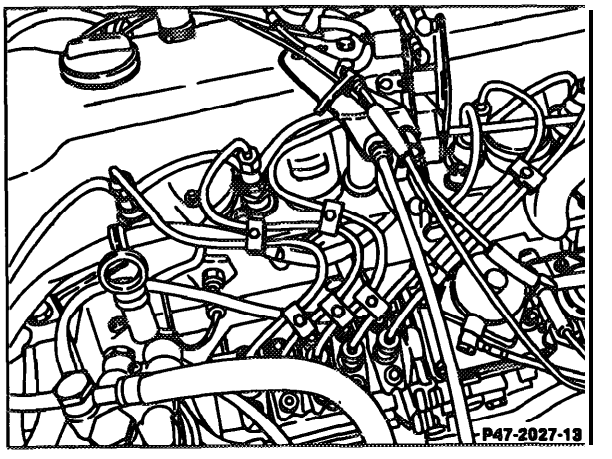
7 Steering gear bolts

Model 107 up through 07.1985
123
126 up through 08.1985
201 up through 12.1984

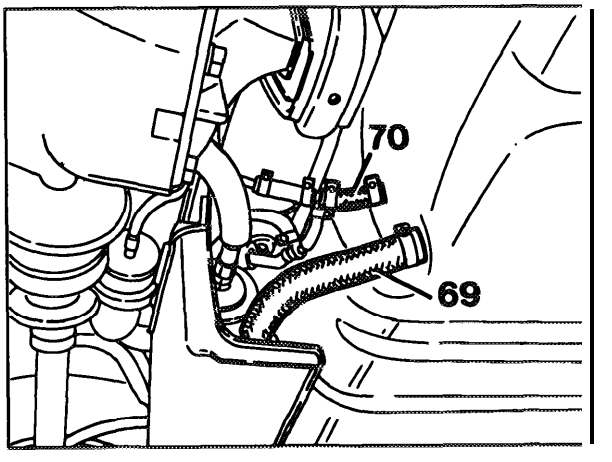
Visual check

Check all fuel system components for leaks.

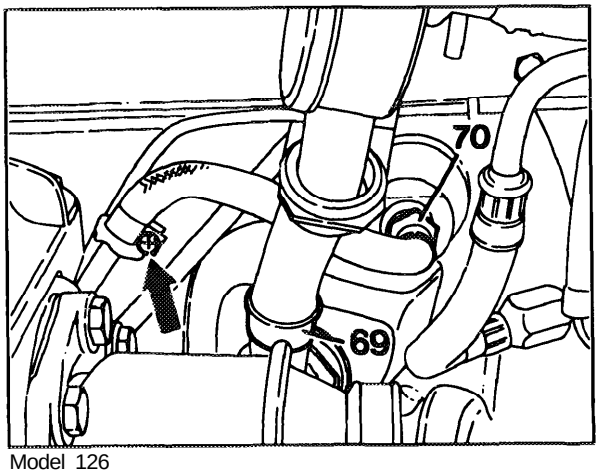
Check condition of fuel lines and hoses and for correct routing.



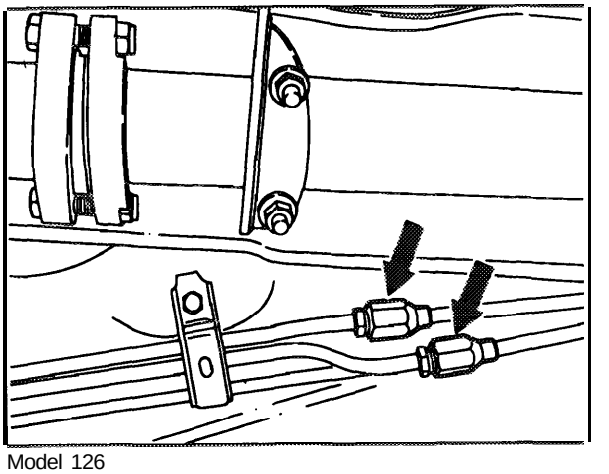
All diesel engines



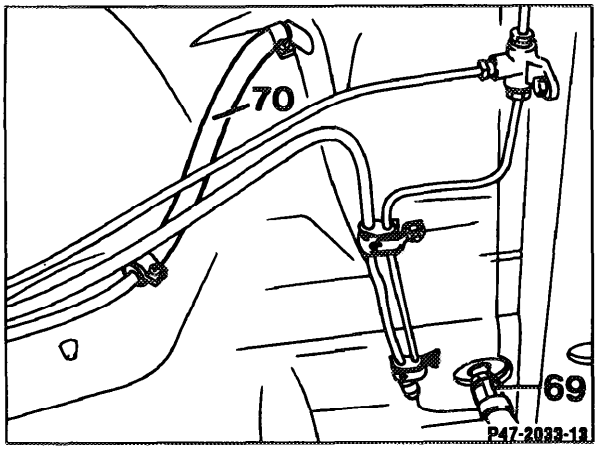
Model 123 station wagon
69 Supply line
70 return line



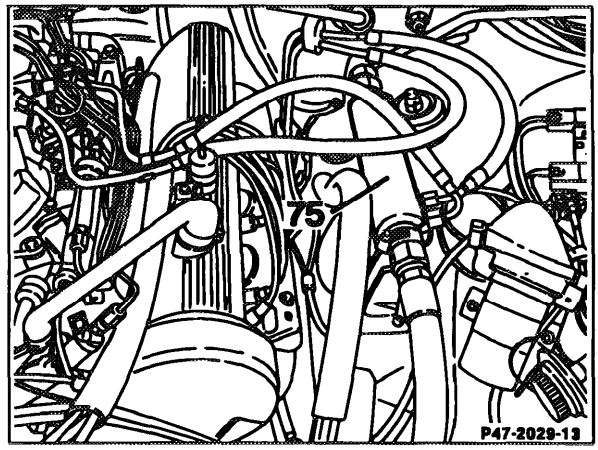
Model 126
69 Supply line
70 Return line



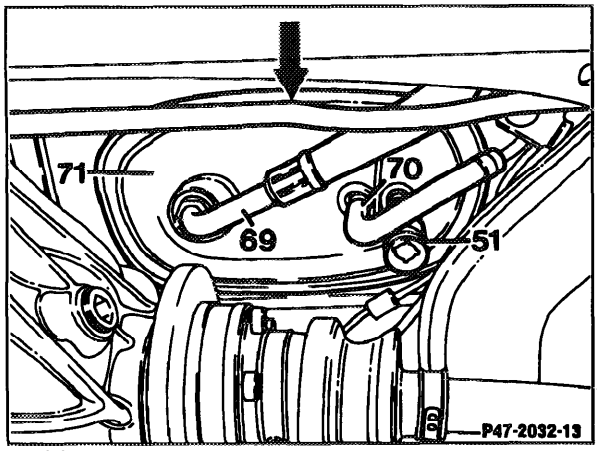
Model 126



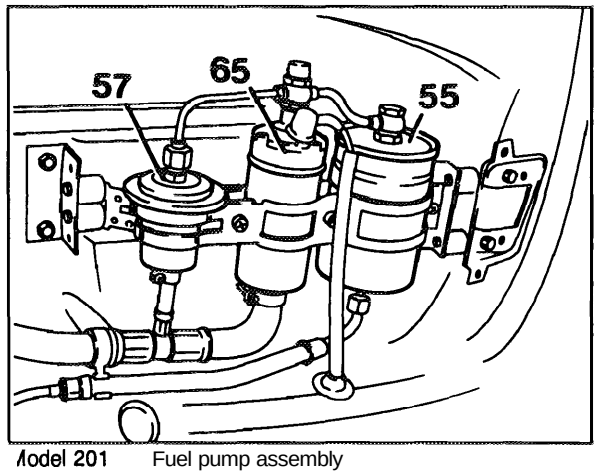
Model 107
69 Supply line
70 Retrun line



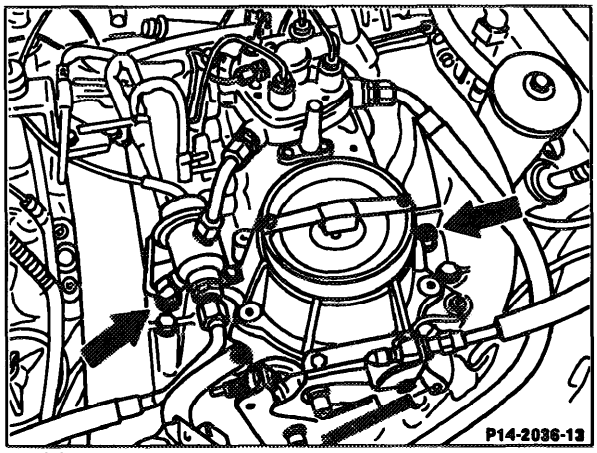
Fuel cooler (75)



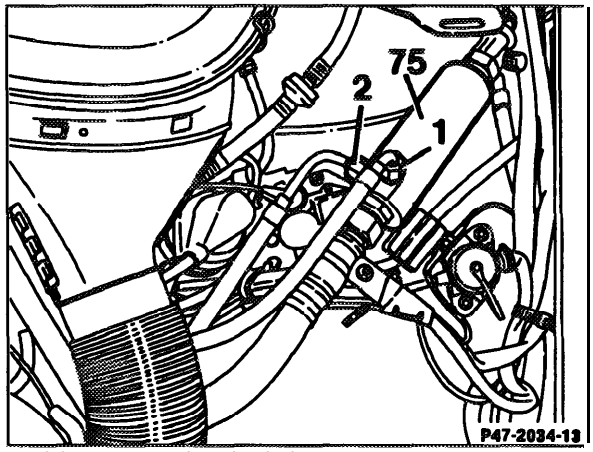
Model 201
51 Vent valve
69 Supply line
70 Retrun line



Model 201 Fuel pump assembly



Model 201



Model 201 Fuel cooler (75)

Retightening exhaust flange

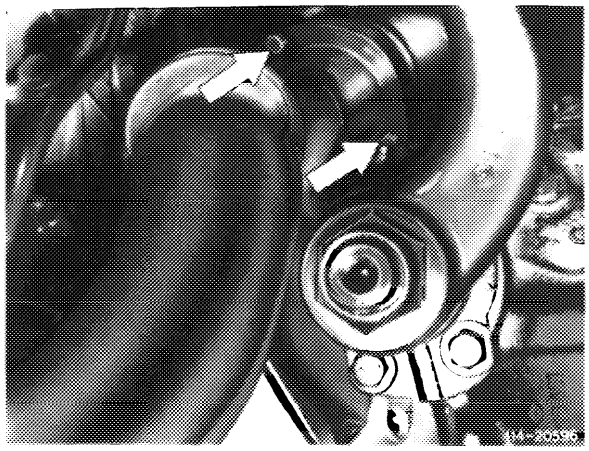
4970

All models

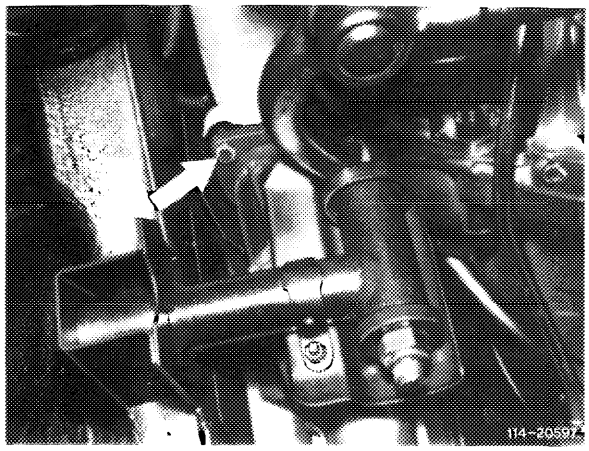
Note: When performing this job number, the engine compartment lower panel or the noise encapsulation panel must be removed, and replaced after completing all maintenance work (refer to job number 6190 or 9400).

Retighten bolts/self-locking nuts of exhaust flange connections. Torque to 20 Nm.

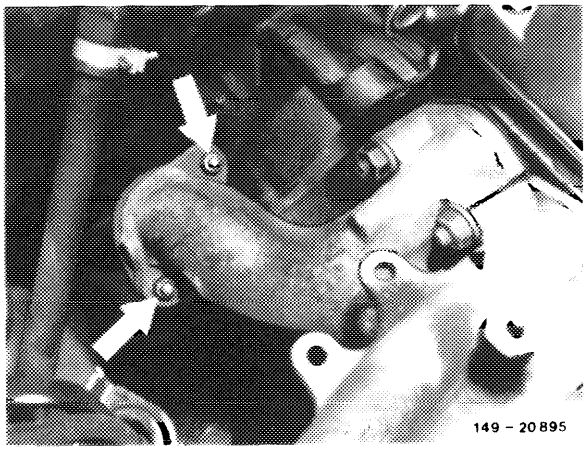
On vehicles with V-engines, retighten exhaust flange connections on left and right sides.



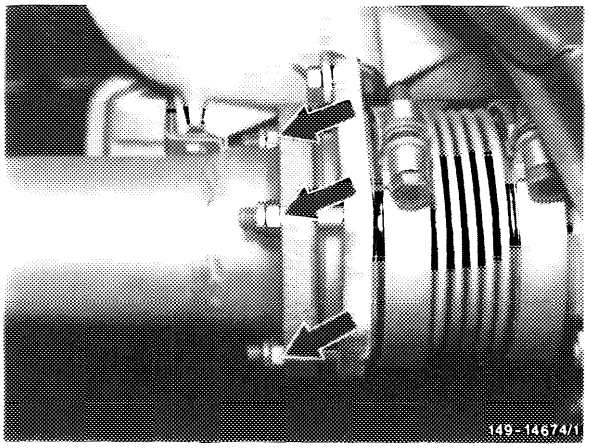
Model 107.025/045 **048 (left** hand side)



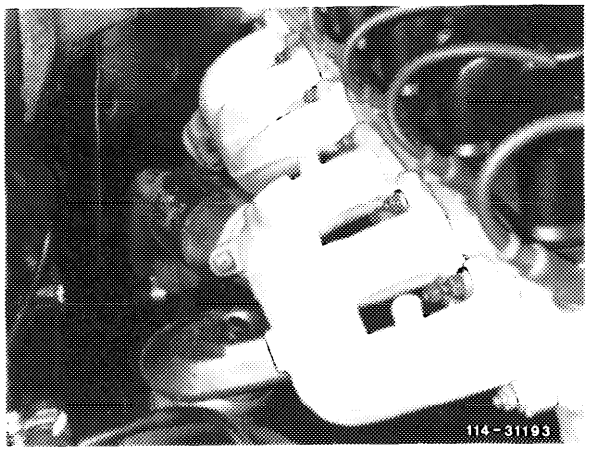
Model 107.025/045/048 (right hand side)



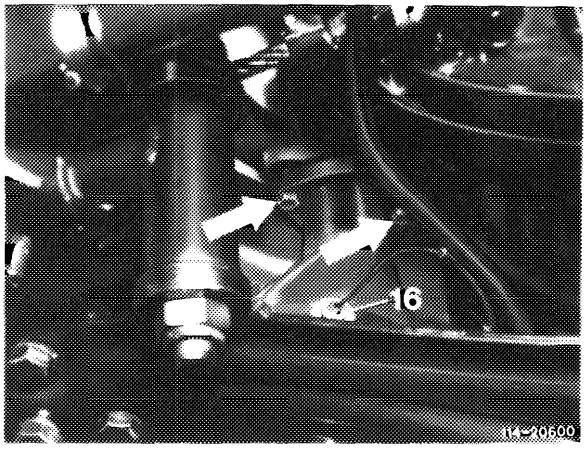
Model 123.123/130/150/190



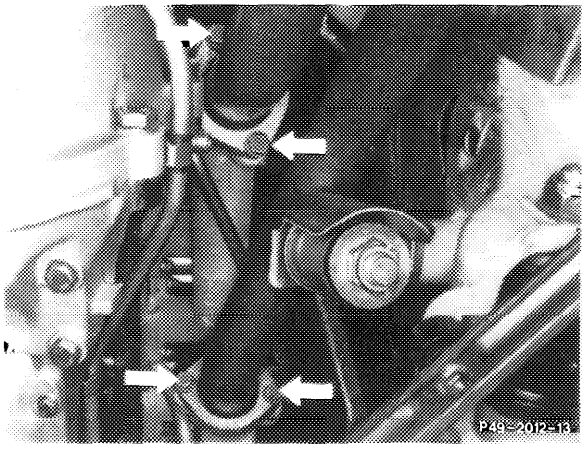
Model 123.133/153/193, 126.1



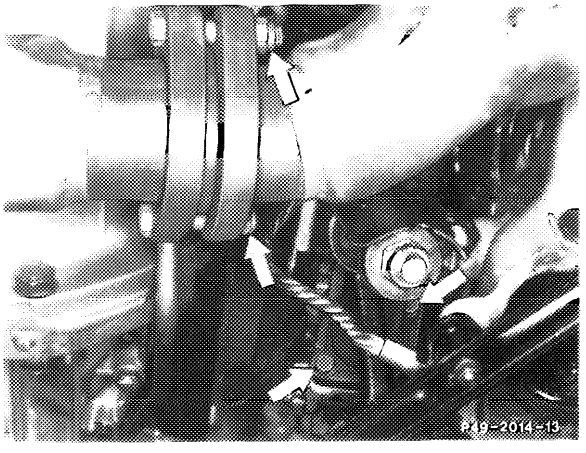
Model 124.026/030/05/090, 126.024/025, 201.029



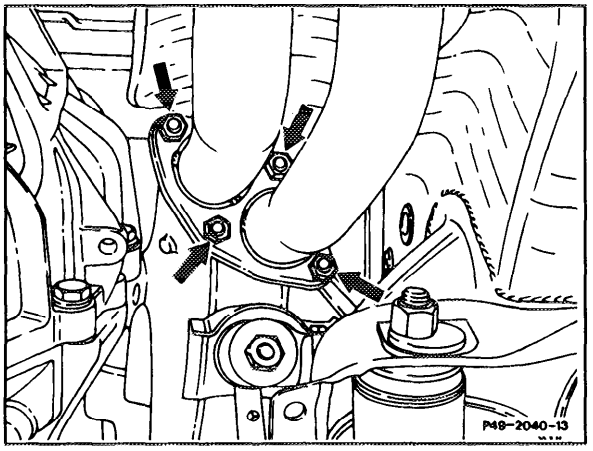
Model 126.03/04



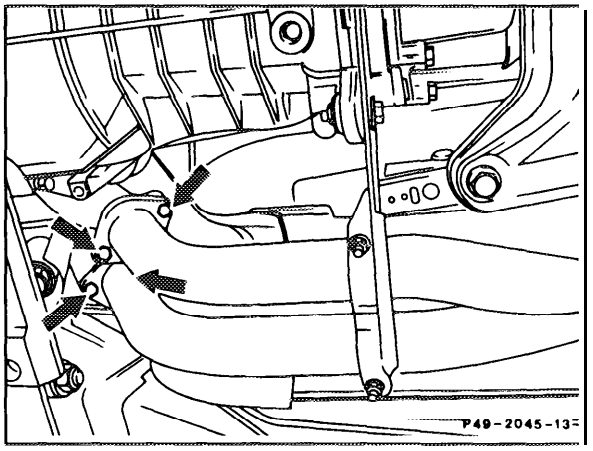
Model 129.061



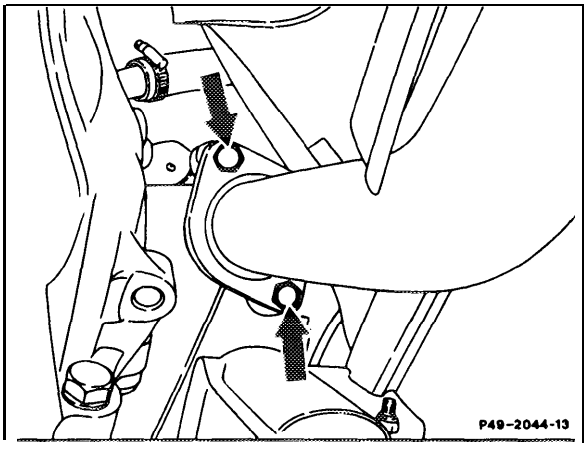
Model 129.066



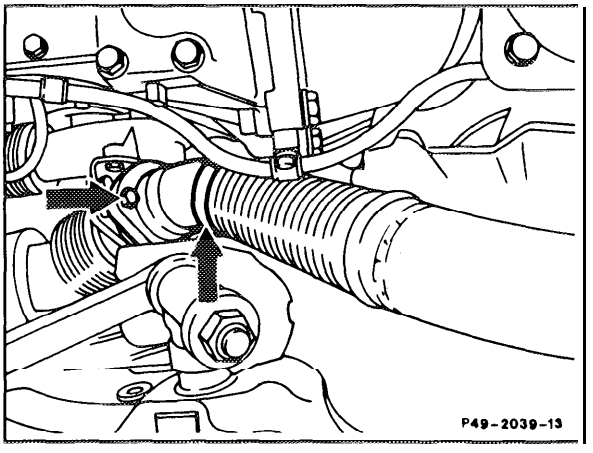
Model **201.02** up through 09.1984
(Non-catalyst model shown for location of bolts.)



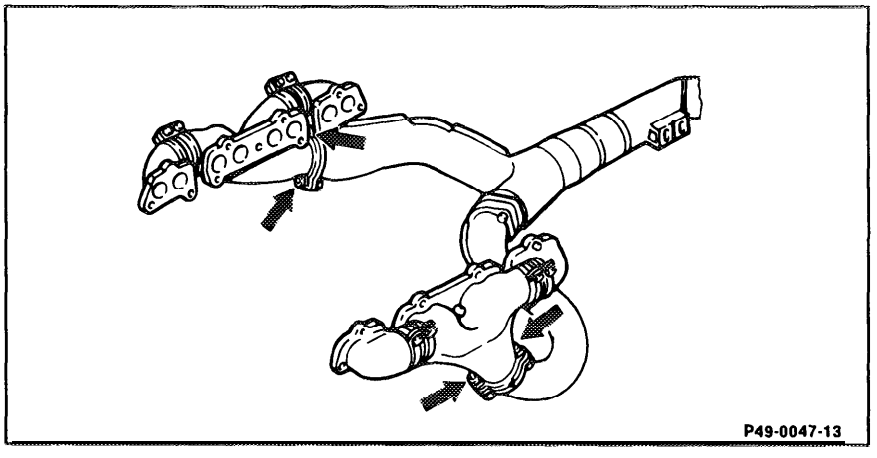
Model 201.02 as of **10.1984** and 201.03
(Non-catalyst model shown for location of bolts.)



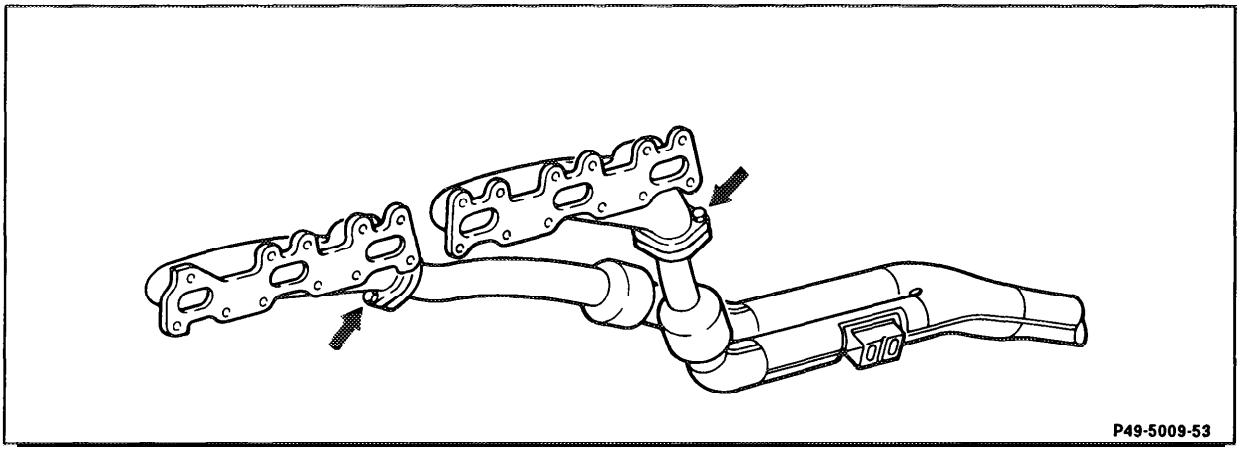
Model 201.122/126



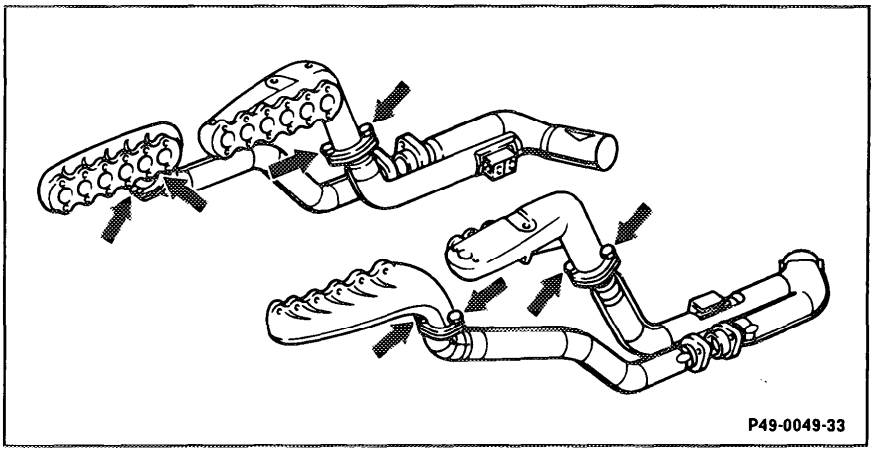
Model 124.133/193, 201.128



Model 124.034/036



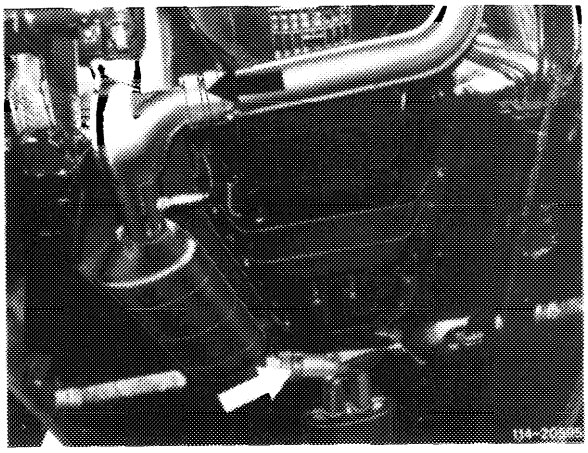
Model 140.03



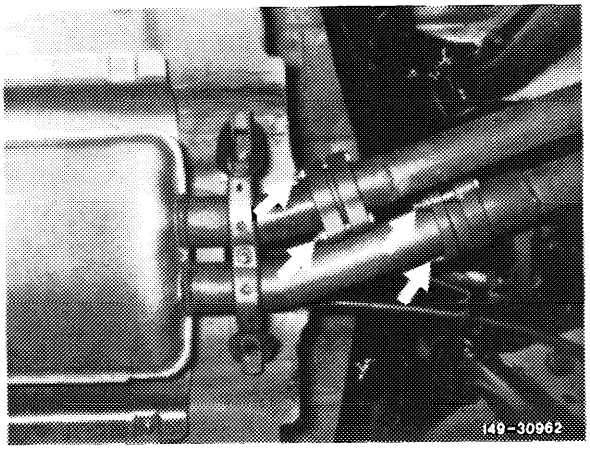
Model 140.057

All models

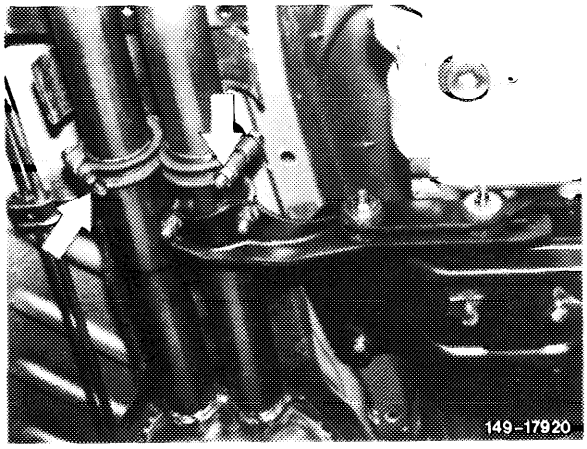
Retighten bolts on slip joints or flanged connections. Torque to 20 Nm.



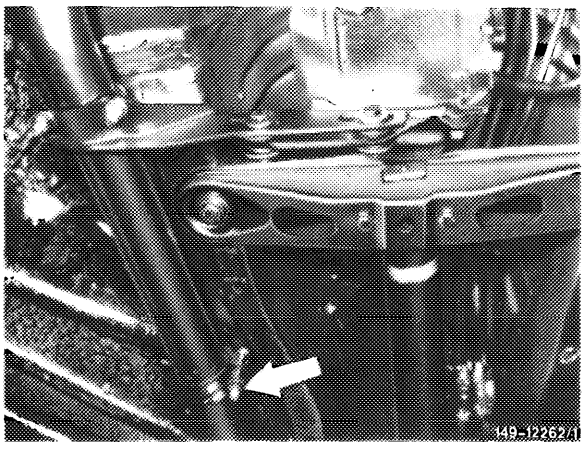
Model **107.025/045; 107.048** similar (no fear flange)



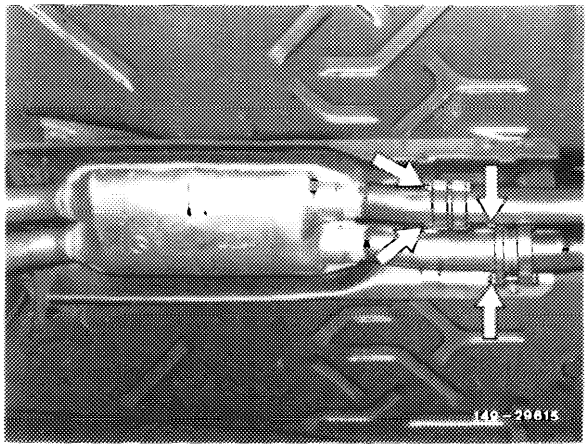
Model **107.048**



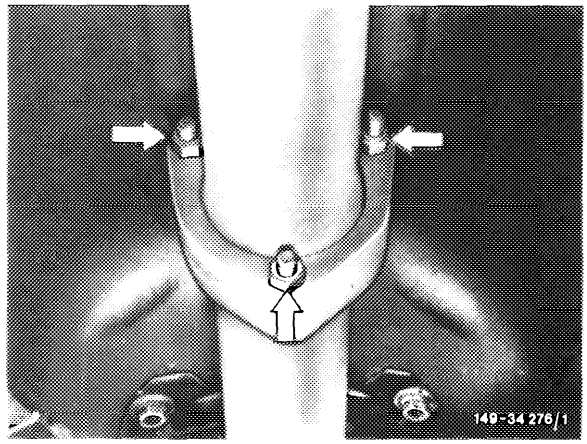
Model **123.03/05**



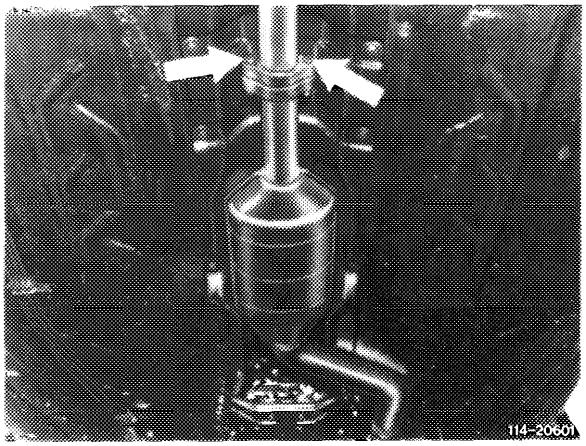
Model **123.123/130/150/190**



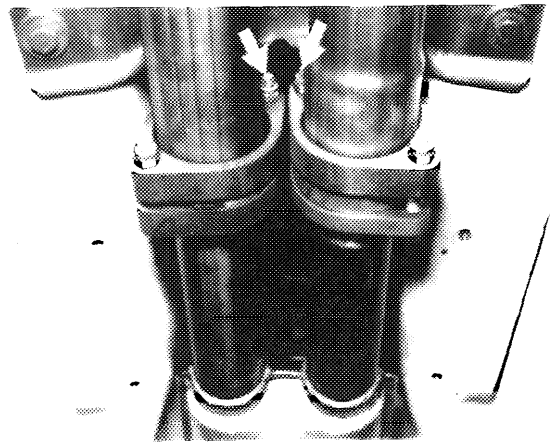
Model **124.026/030/05/09/2,** 126.02, **201.029/034**



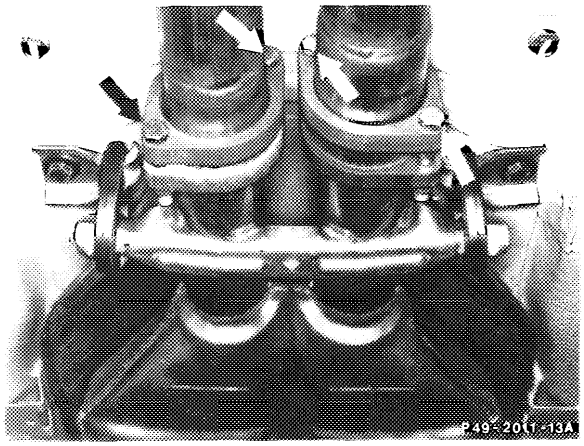
Model **124.133/193,** 126.1, 201.128



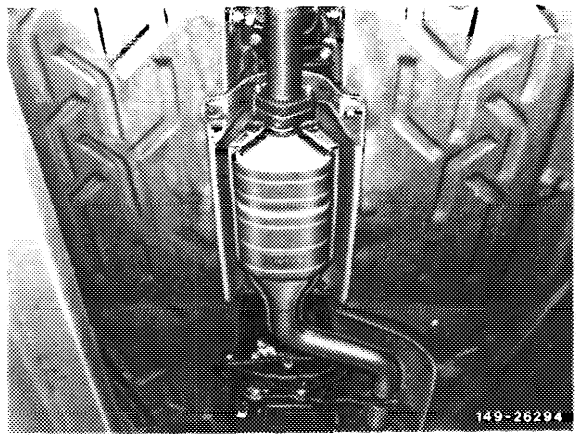
Model **126.03/04** up through 09.1985



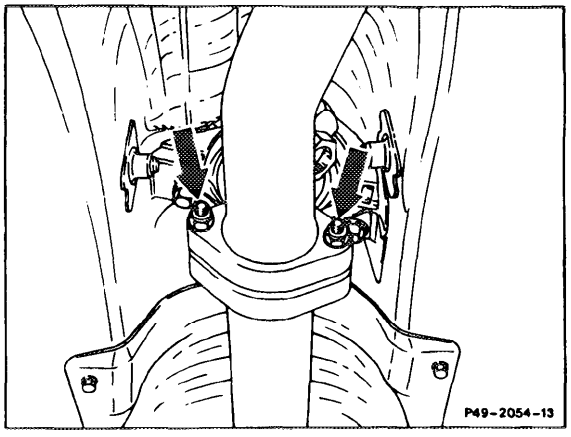
Model **126.03/04** as of 09.1985



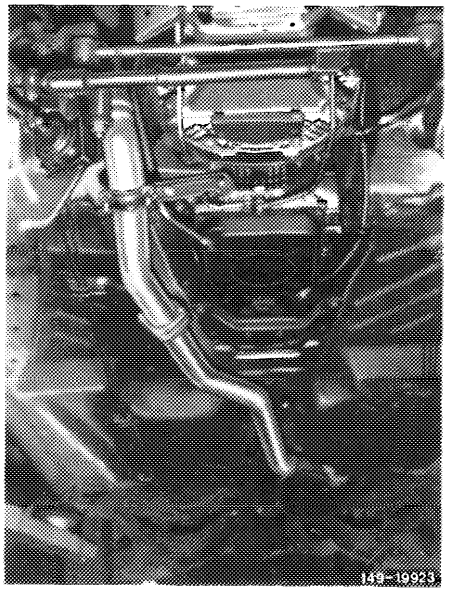
Model 129



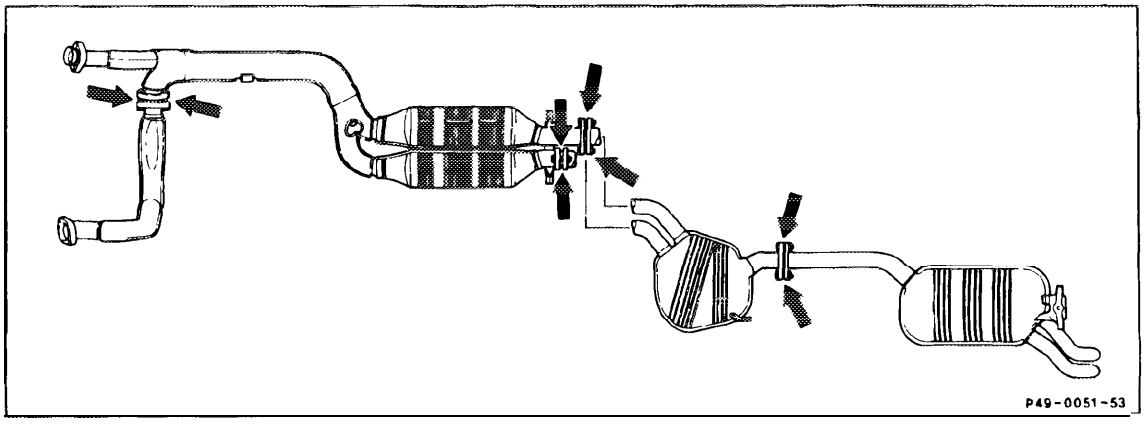
Model **201.024/028**



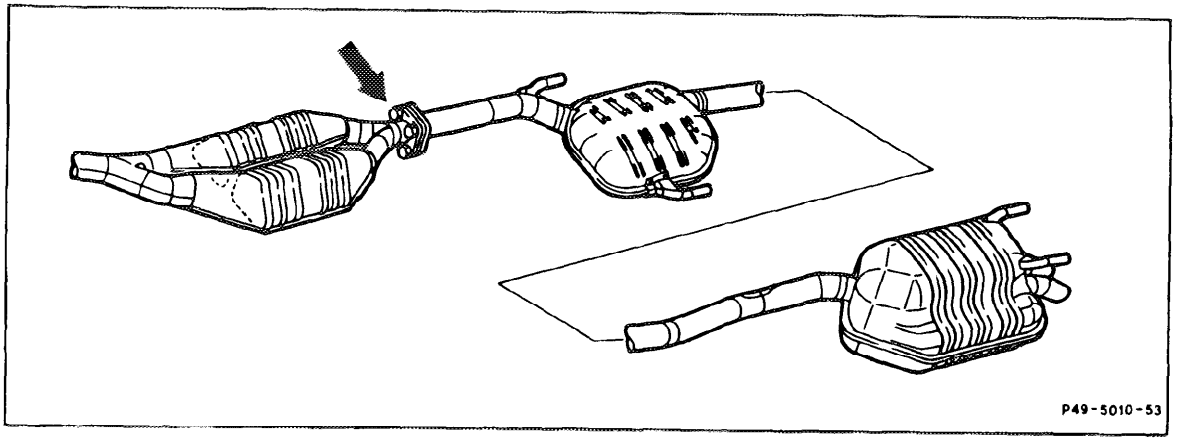
Model 201.122/126



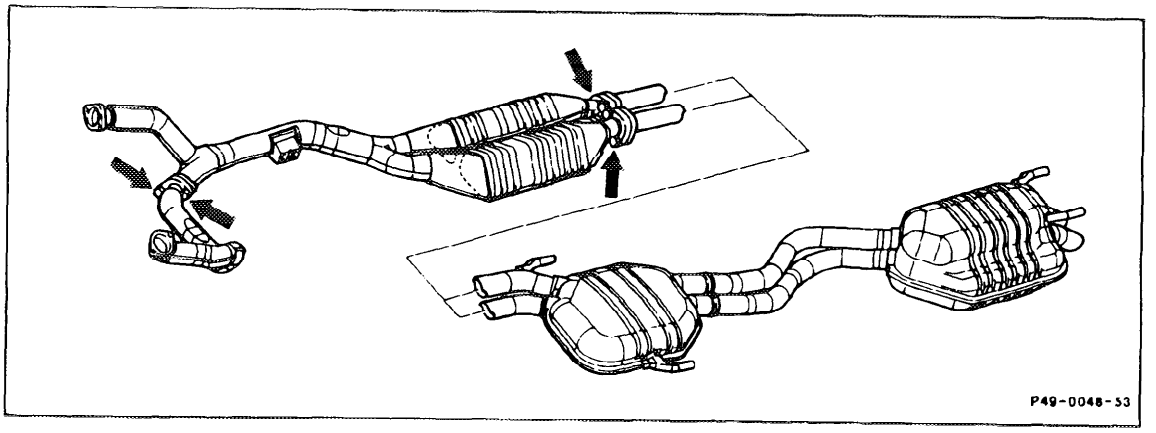
Model 123.133/153/193



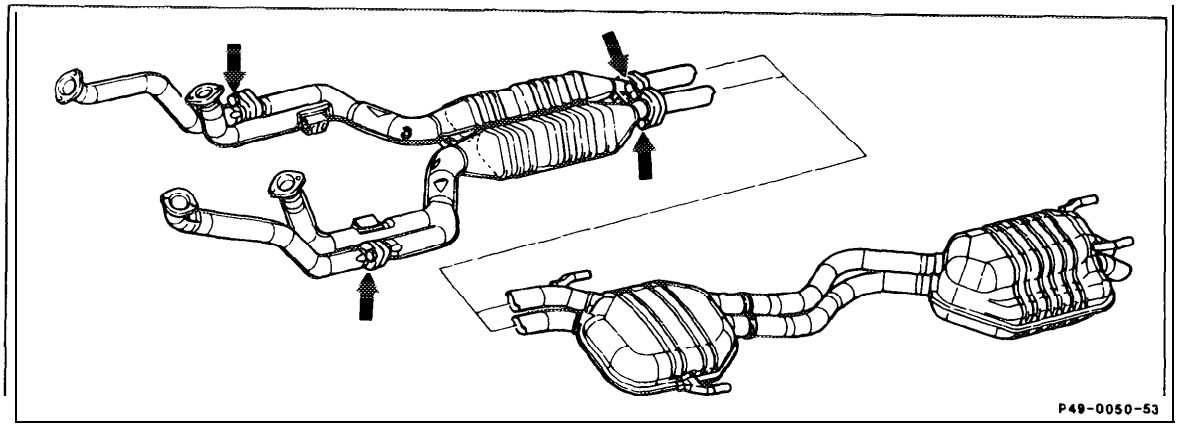
Model 124.034/036



Model **140.03**



Model 140.042/051



Model **140.057**

Checking and correcting battery fluid level

5410

All models except 129

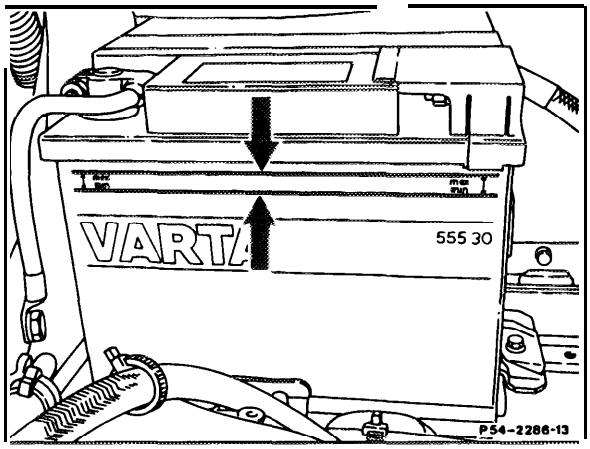
Fluid	distilled water only
Quantity	as required

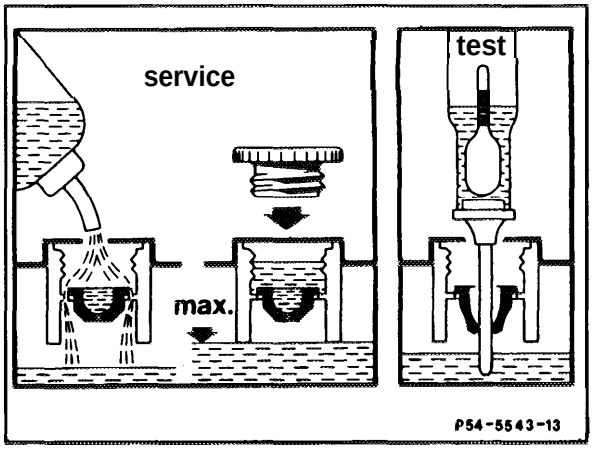
Note:
Check fluid level more often when outside temperatures are high.

Batteries with overfill protection feature

- Check fluid level against markings on case.
- If distilled water must be added or the fluid level is not visible from outside unscrew all caps and add distilled water until the water no longer drains from the overfill protection.

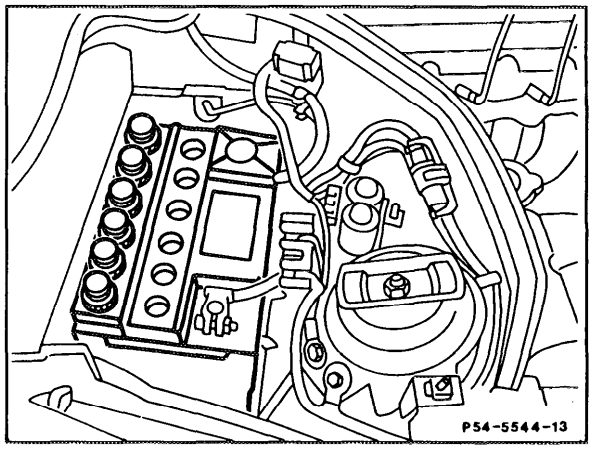
Note:
When adding water do not push through the overfill protection membrane.



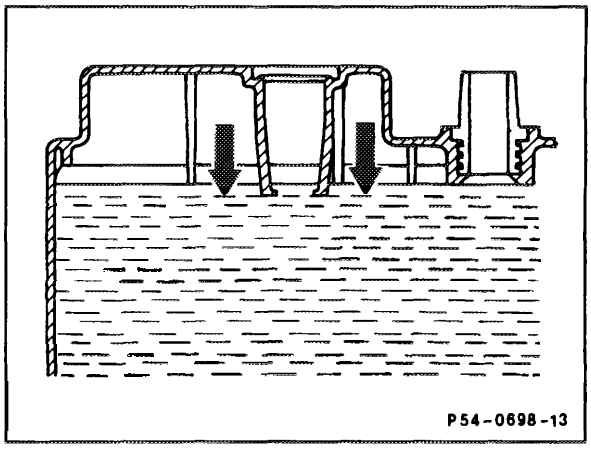


Batteries without overfill protection feature

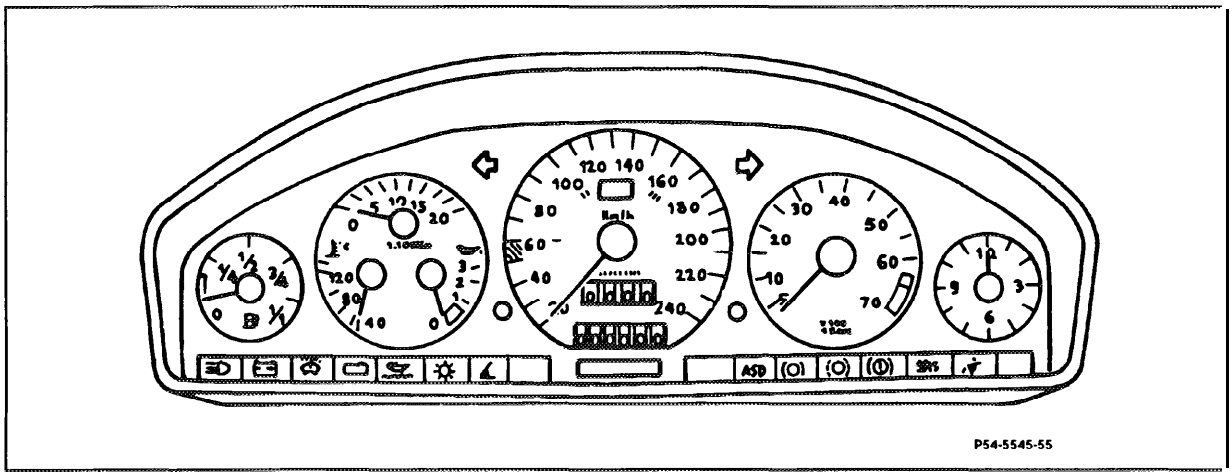
- Unscrew or pull out all caps according to design.



- Check fluid level in filler opening of cells and, if necessary, add fluid up to the inner marking.



All **models**



Functional check - ignition key in position 2.

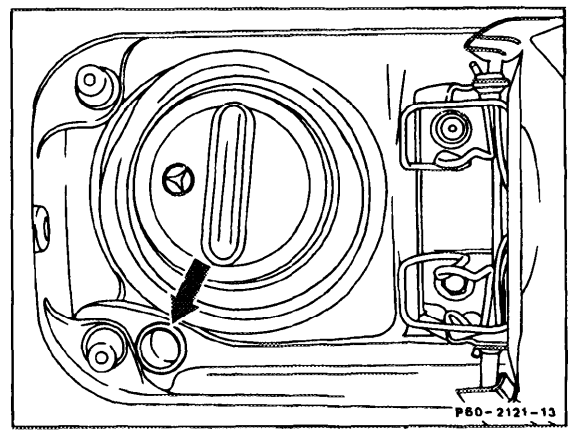
- Check warning lamps:

- Check indicator lamps:

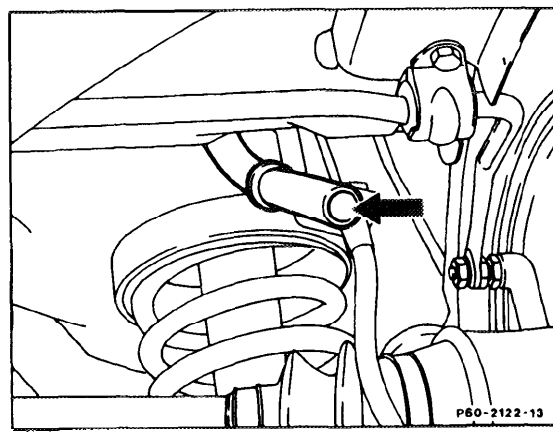
Fuel reserve (starting 09.1982).
charge indicator lamp
Brake pad wear indicator
ABS
Pre-glow
ETR, SRS Airbag - restraint system - should go out after approx. 10 s.
O_2 sensor replacement up thru model year 1985
O_2 sensor failure indicator starting model year 1986 (except 201.024) lights up briefly when switching ignition on.
Turn signal lamp left and right
Headlamp flasher
Parking brake and brake fluid level
Engine oil level indicator
Coolant level indicator
Washer fluid level indicator
Bulb failure warning unit.
Seat belt/backrest lock warning lamp
4MATIC function indicator
4MATIC warning lamp
Roll bar indicator lamp
Oil pressure waning lamp
CHECK ENGINE lamp

All **models**

- Fuel filler well drain

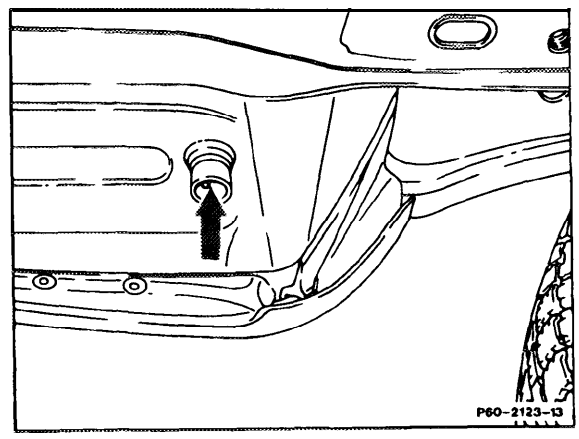


- Fuel filler well, drain outlet



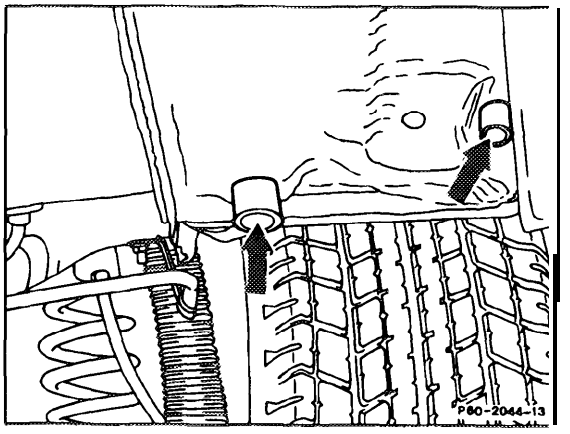
Model 107, 123, 124, 126, 201

- Rear fender



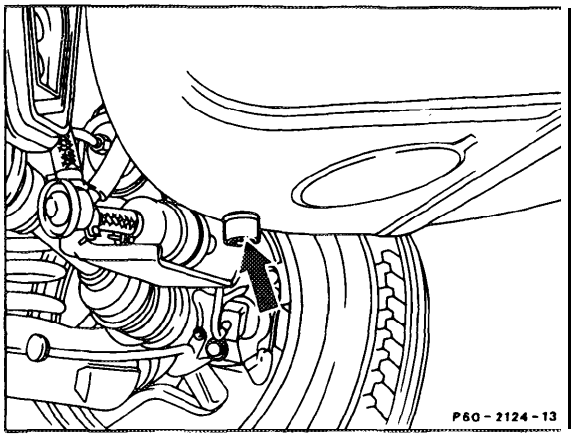
Model 107, 123, 124, 126, 140, 201

- Rear fender
- Fuel filler well, drain outlet

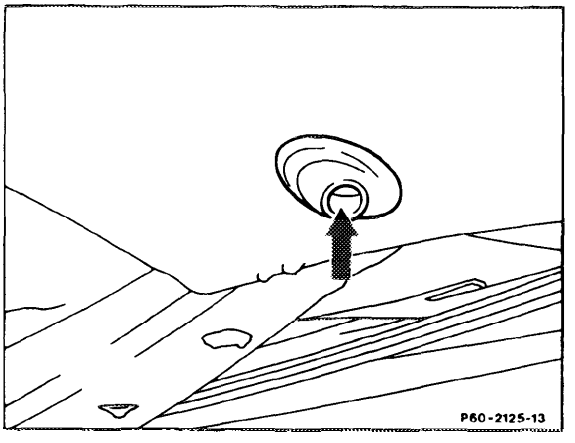


Model 129

- Spare tire well

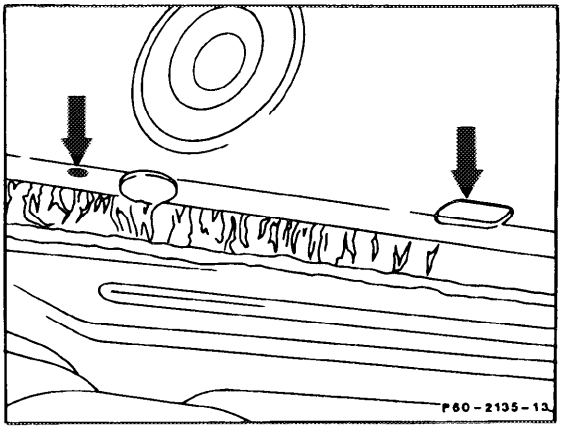


- Side member



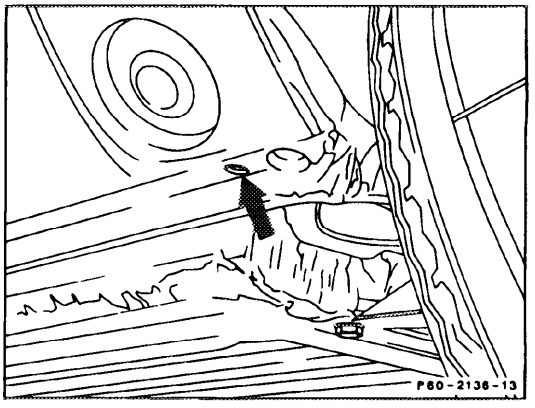
Models 123, 124, 126, 129, 140, 201

- Front of side member



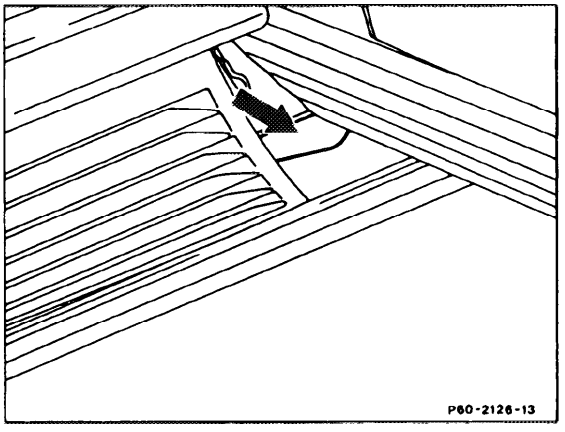
Model 107

- Rear of side member



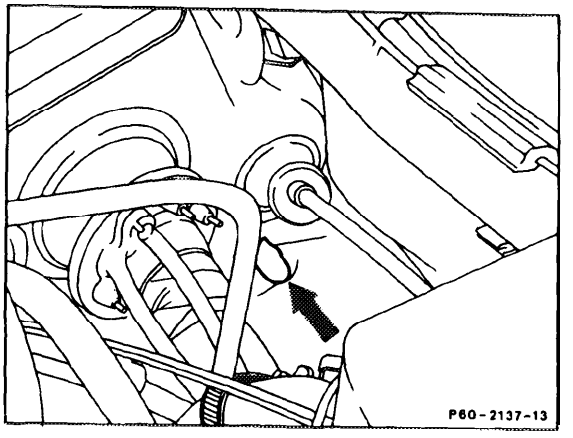
Model 107

- Side member to A-pillar transition joint



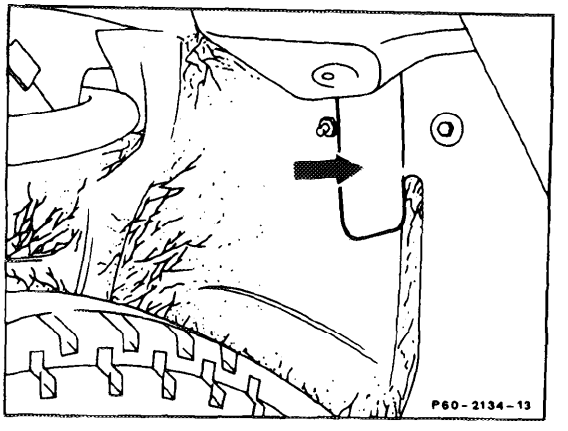
Model 107

- Upper engine compartment



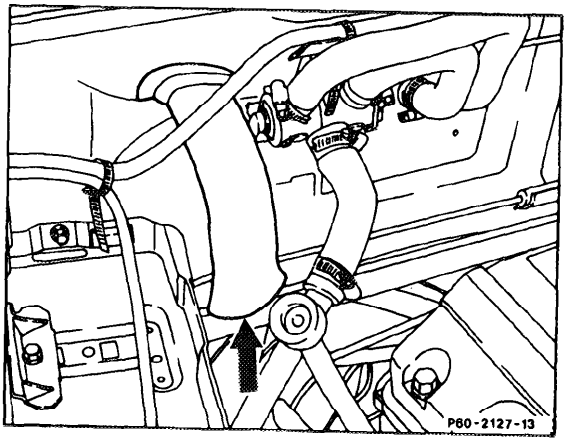
Model 123

- Lower engine compartment



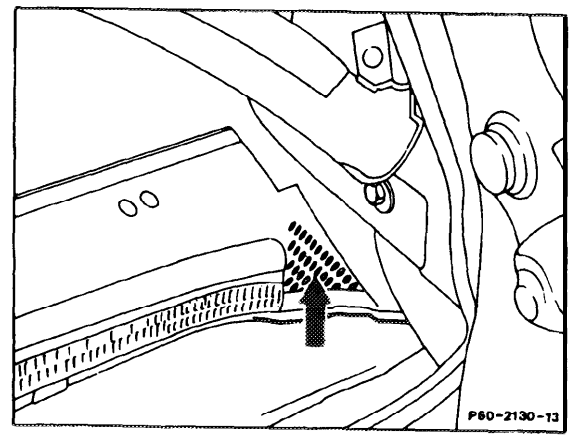
Model 123

- Air plenum (cowl) drain



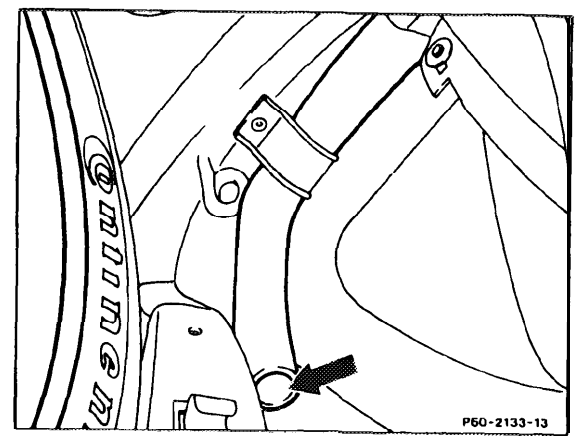
Model 123

- Drain holes in air plenum cover



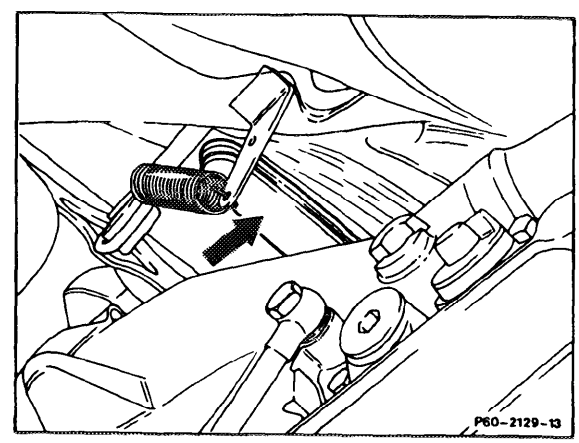
Model 126

- Air plenum (cowl), outer drain hoses



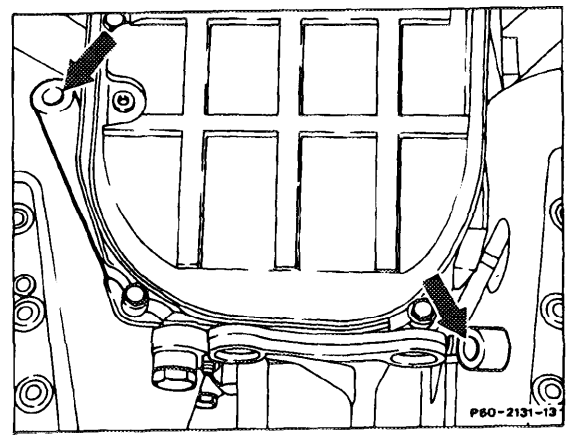
Model 126

- Air plenum (cowl), center drain



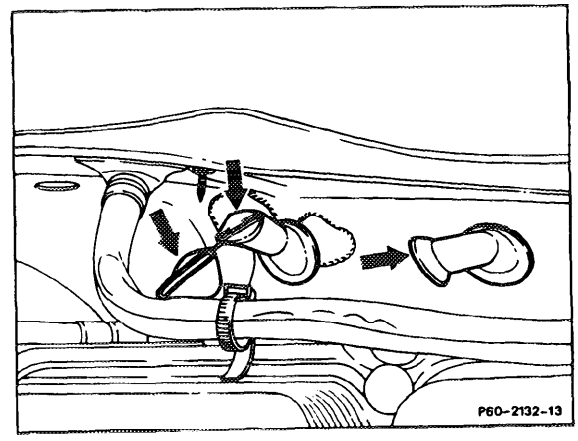
Model 126

- Air conditioning condensation drain



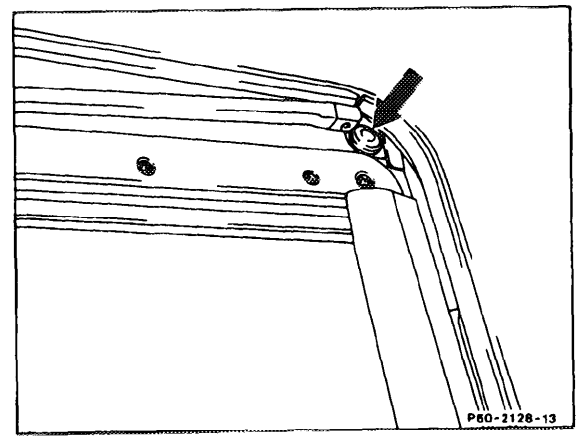
Model 124, 126, 129, 140

- Heating and air conditioning drains (in transmission tunnel)



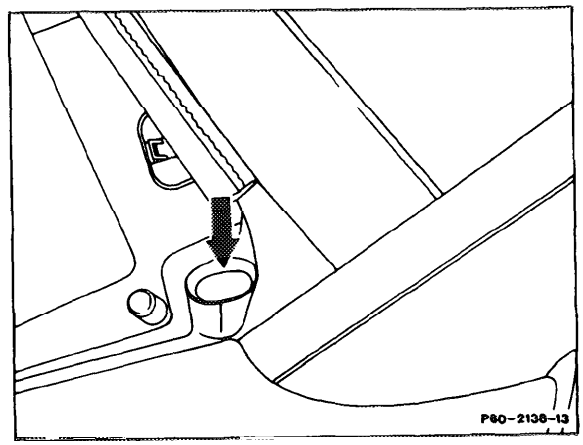
Model 107, 123

- Sunroof front



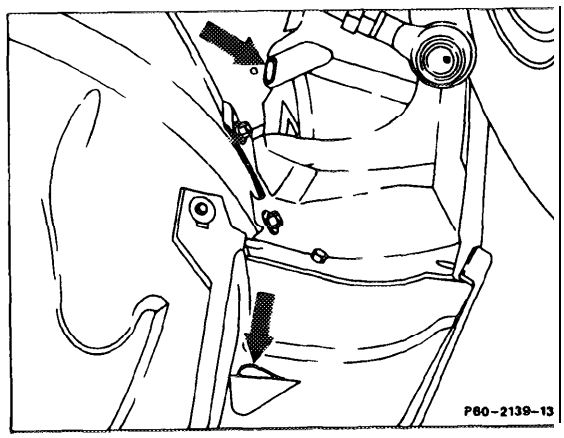
All models

- Upper A-pillar



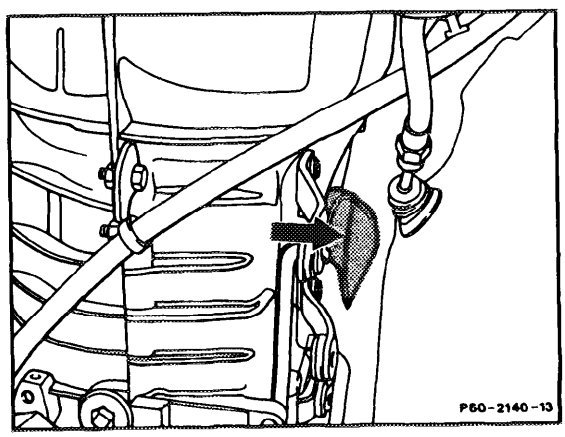
Model 124, 129, 140, 201

- A-pillar drain outlet (top arrow)
- Component compartment (lower arrow)



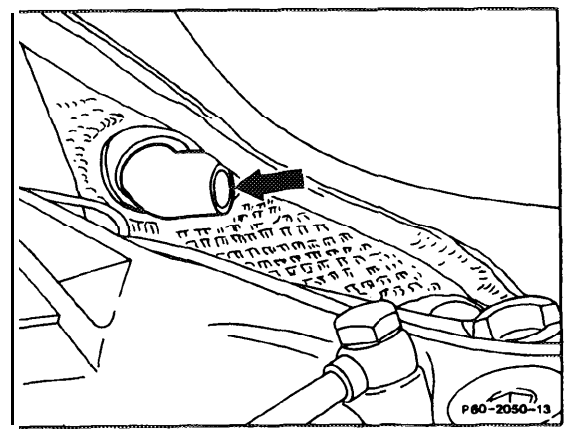
Model **124, 201**

- Air plenum (cowl) drain outlet



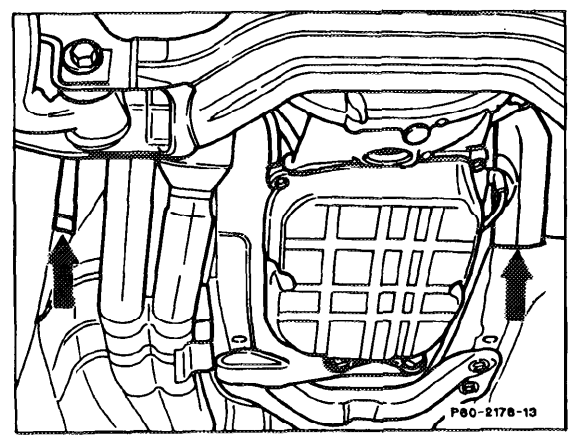
Model **124, 201**

- Air plenum (cowl)



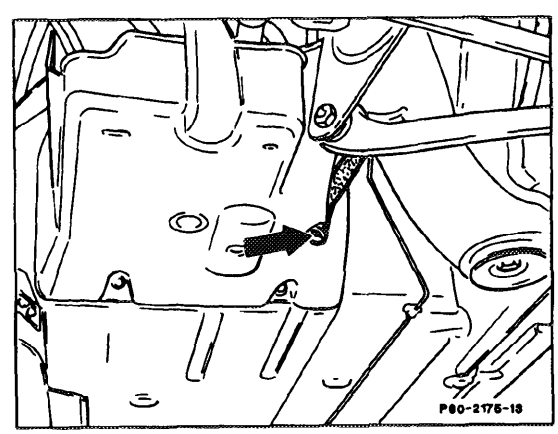
Model 129

- Air plenum (cowl)



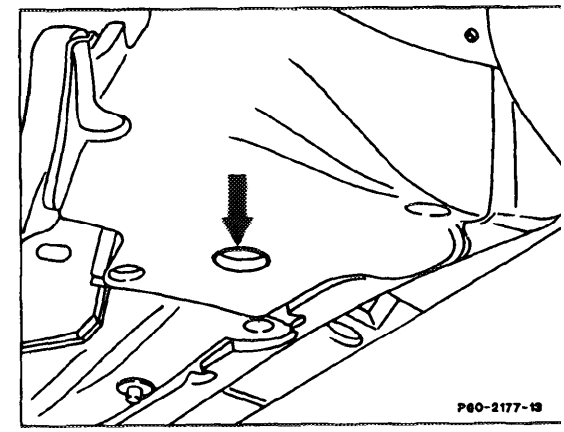
Model 140

- Fuel filler well drain outlet



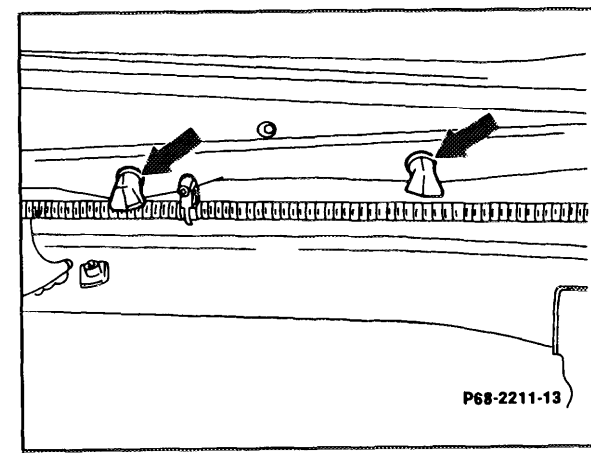
Model 140

- Lower A-pillar



Model 129,140

- Rear air conditioner



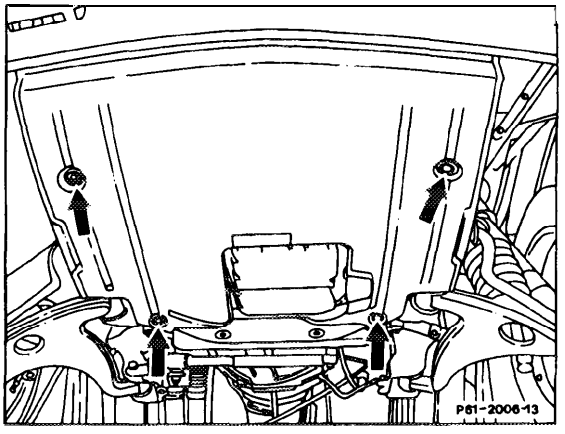
Model 140

Model 124.0/2 129 140 201 .O

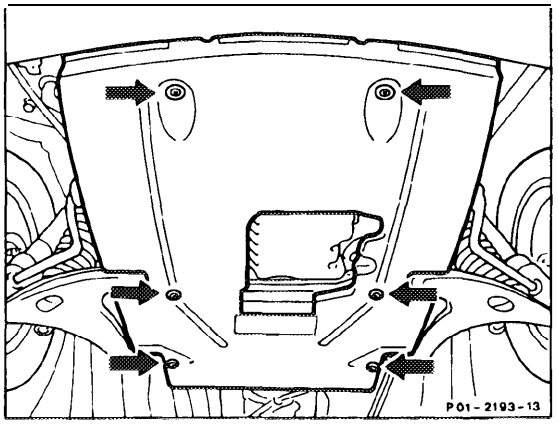
Unscrew small bolts (arrows) and remove engine compartment lower panel.

Install in reverse sequence.

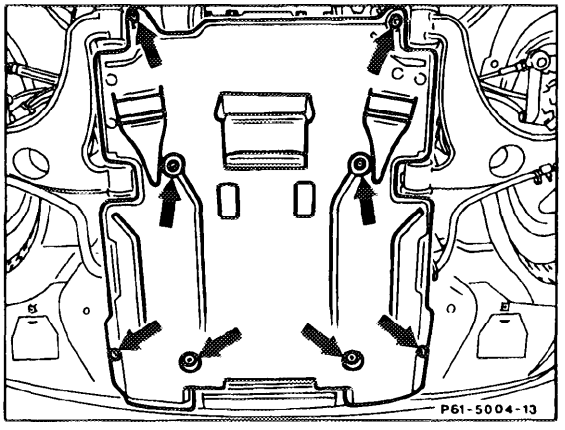
Note: On model 129 and 201.028/029 install engine compartment lower panel so that the edges of the side panels overlap the lower panel.



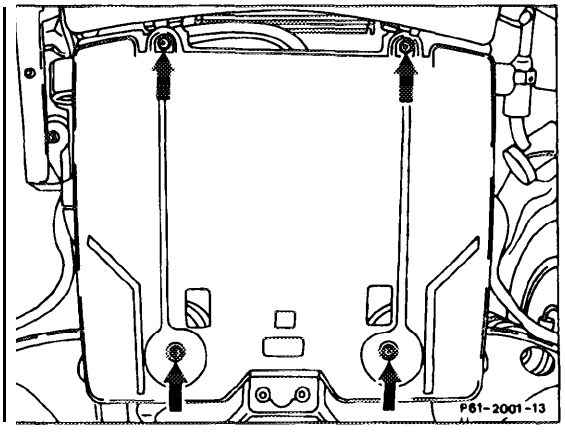
Model **124** Engine compartment lower panel, short version



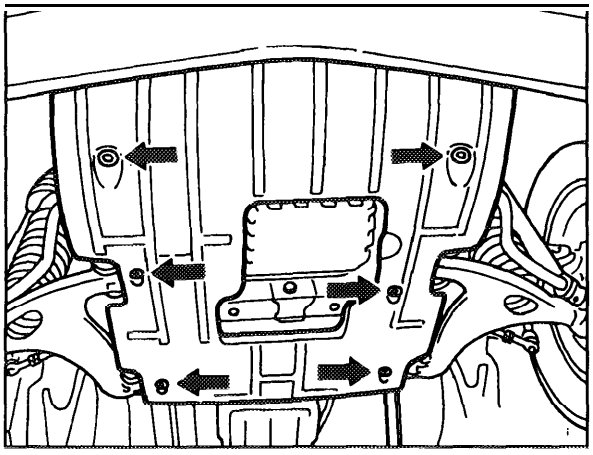
Model 124 Engine compartment lower panel, long version



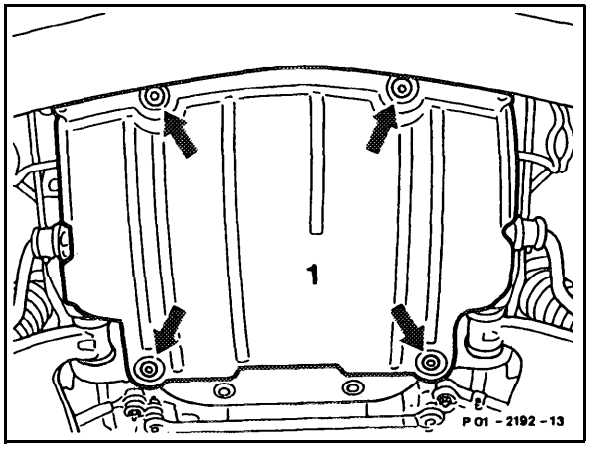
Model 124.036



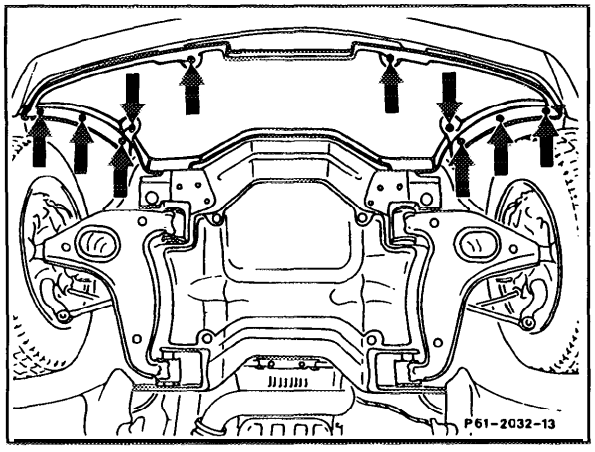
Model 129



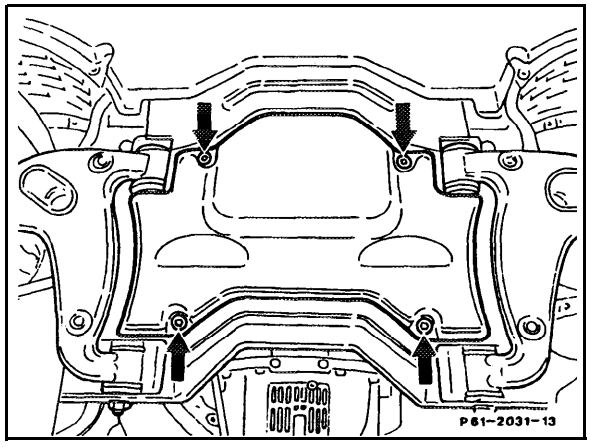
Model 201.024/028/034



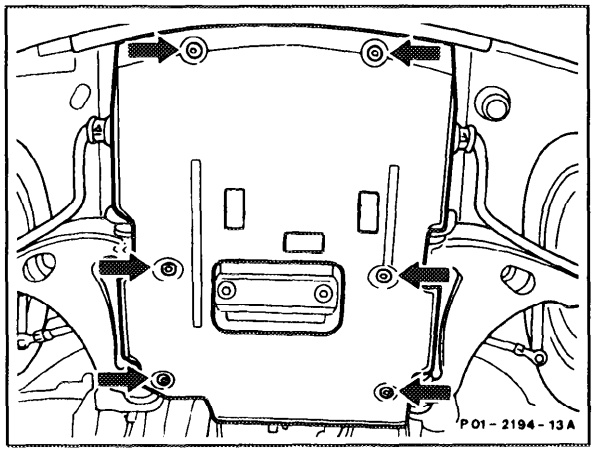
Model 201.028



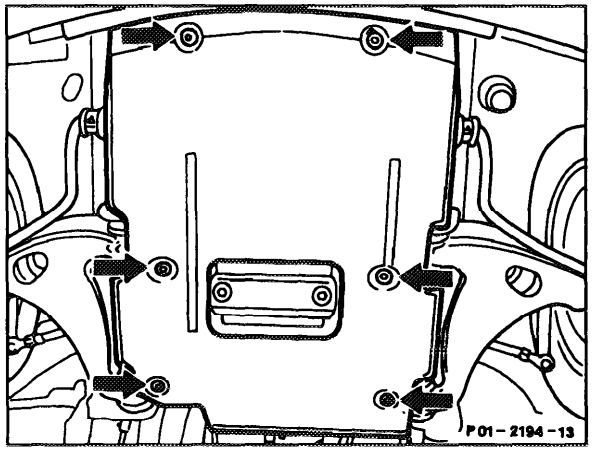
Model 140 front section



Model 140 rear section

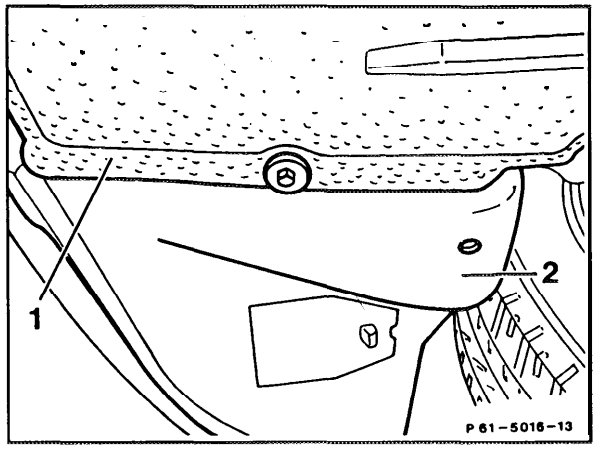


Model 201.029 with cooling openings



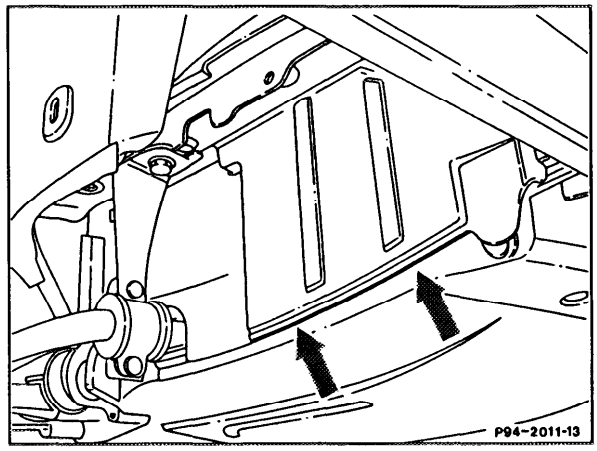
Model 201.029 without cooling openings

Models 124.036, 140
Install lower engine compartment cover (1) so that it overlaps the wheel well covers (2).

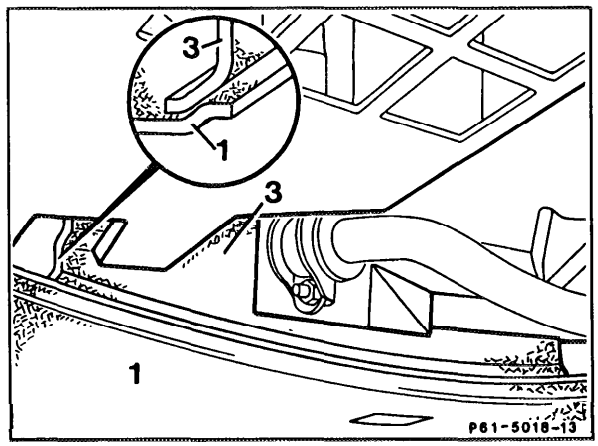


Model 124.036

Models 124 (except 124.036), 201
Install the side panels so that the edges overlap the engine compartment cover.



Model 129
Install lower engine compartment cover (1) so that the side panels (3) are positioned inside the lower engine compartment cover.



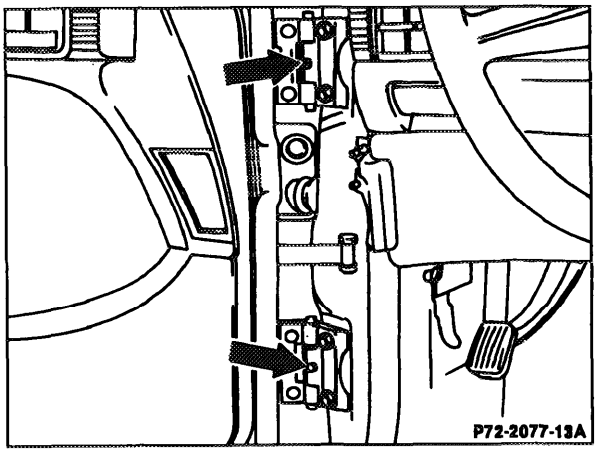
Lubricating door hinges

Model 107 123 126

Grease type	
Lubricating grease	Multipurpose grease

Commercial tools	
Grease gun with pointed tip	obtain locally

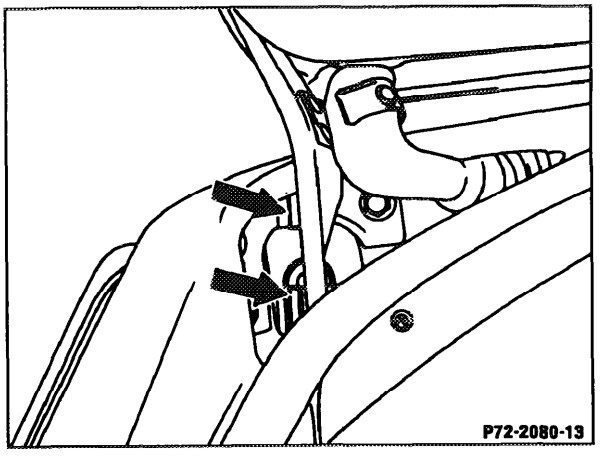
Door hinges (arrows).



Oil can T-models only

Tailgate hinge

Tailgate gas pressure spring pivo (arrows).



Lubricating door locks

7221

Model 107, 123, 126

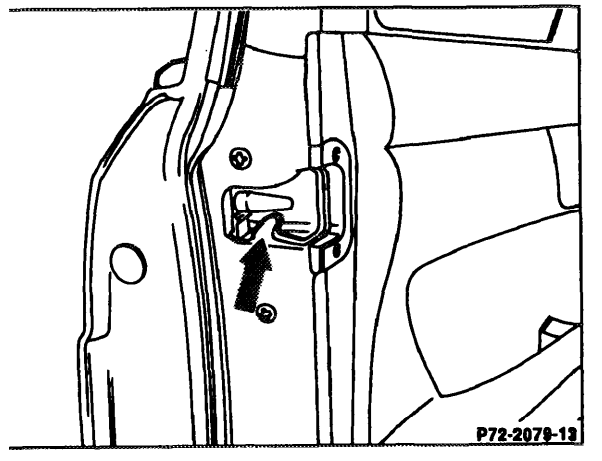
Type of lubricant

Fluid grease (NLGI **Class 00)**	Refer to MBNA Factory Approved Service products list

Door lock: Driver's and rear door.

Striker pin and striker eye

Contact surfaces of latch.



Hydraulic top, checking and correcting fluid level

7710

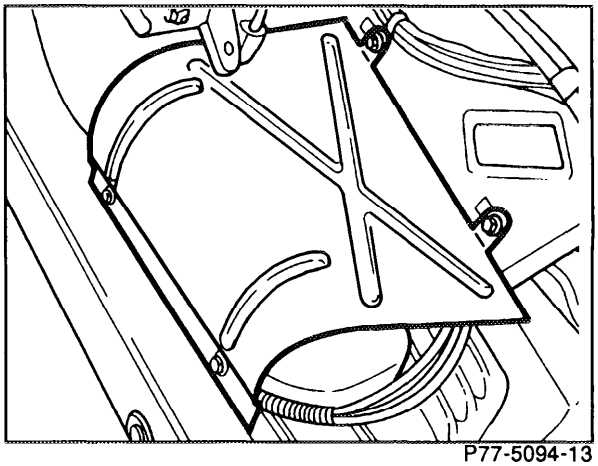
Models 124.066 129

Oil grade/quantity	
Oil grade	MB hydraulic fluid P/N 000 989 91 **03** Refer to MBNA Factory Approved Service Products list
Quantity	1.25 liter

- Lower soft top and retract roll bar.

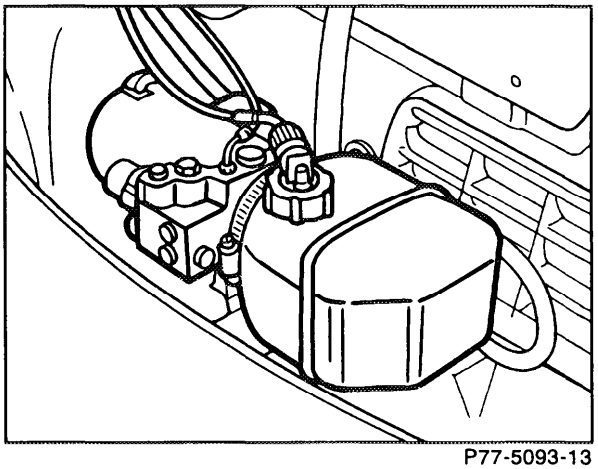
Model 124.066

- Remove cover from right side trunk well.



P77-5094-13

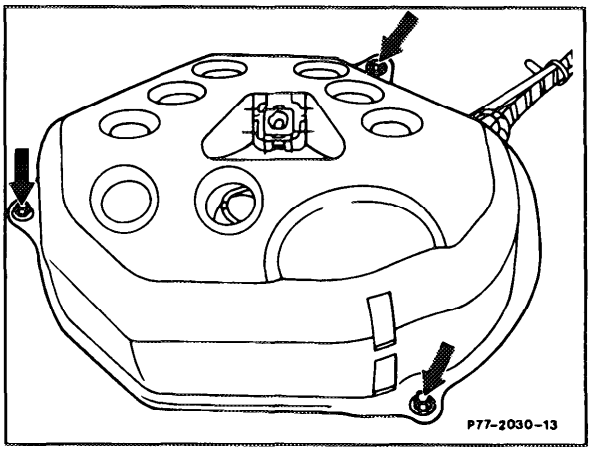
- Fluid level should be between max. and min. marks.



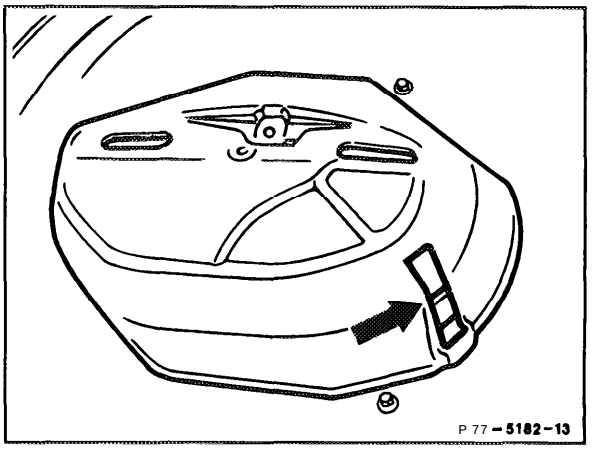
P77-5093-13

Model 129

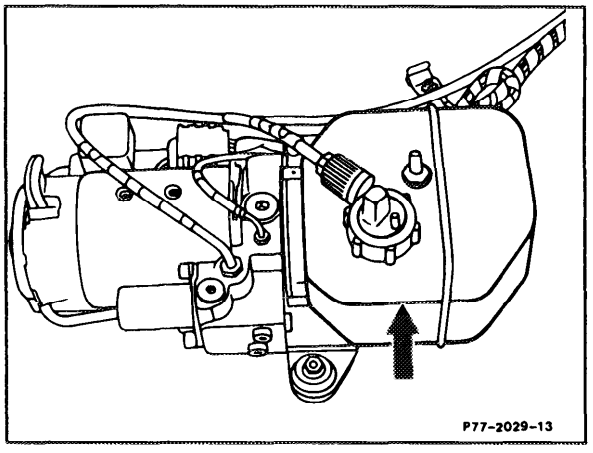
- Remove spare tire.
- Remove cover.



- Starting with chassis end number 029941, the cover has an opening for checking the fluid level (arrow).



- Fluid level should be between max. and min. marks.



Sun roof, clean and grease rails

7730.1

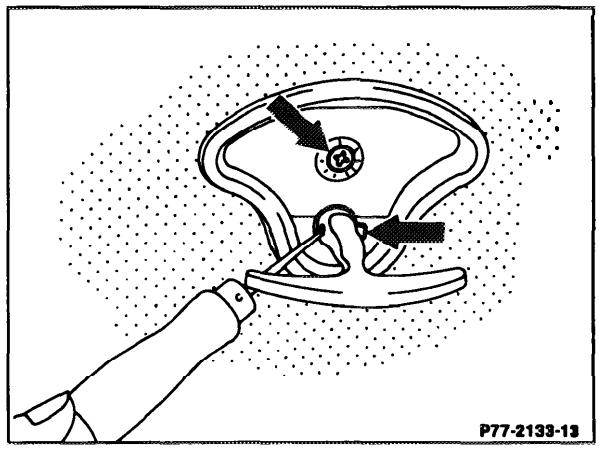
Mechanical sunroof

Type of lubricant

MB slide paste	001 989 1451

Unlock sunroof and remove locking handle as well as bezel.

Open sunroof 3/4 and unclip roof headlining at front and remove from above.



Open sunroof completely and remove sliding rails on left and right side.

Remove sunroof from above.

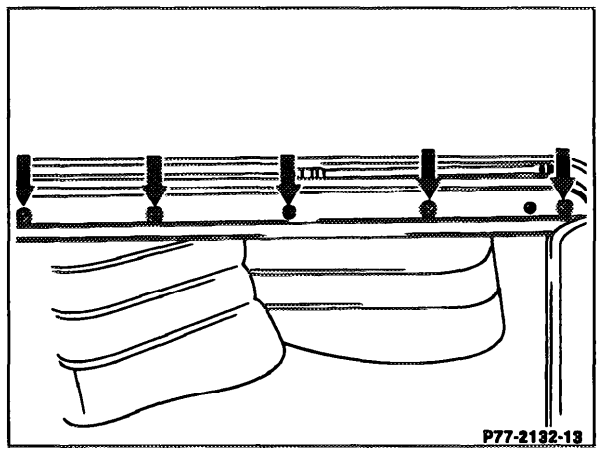
Clean out water drains at right front and left front from above with compressed air.

Replace damaged sliding jaws.

Clean rubber and plastic sliding jaws and thoroughly grease.

Clean sliding rails and thoroughly grease in area of contact surface.

Install sunroof and adjust.



Electrical sunroof

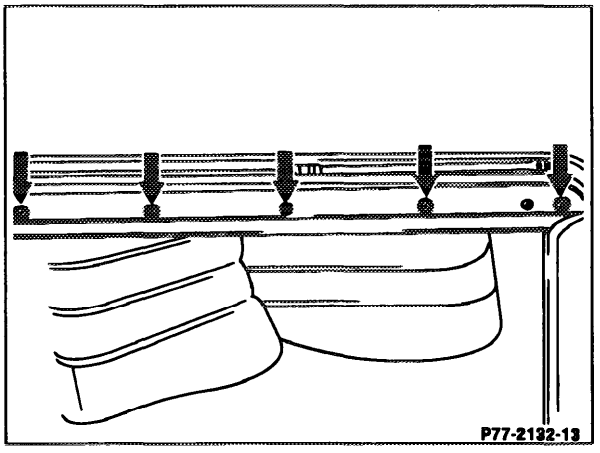
Type of lubricant

MB slide paste	001 989 **14 51**

Open sunroof 3/4 and unclip roof headlining at front and remove from above.

Open sunroof completely and remove sliding rails on left and right side.

Clean out water drains at right front and left front from above with compressed air.

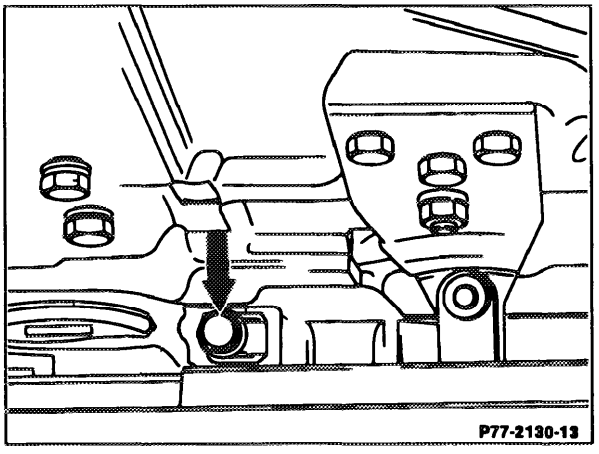


Close sunroof and unscrew locking bolt on left and right side.

Unscrew guide plate on roof frame at front and press out connecting clamp at cable (arrows).

Run control cable back.

Remove sunroof cover from above.

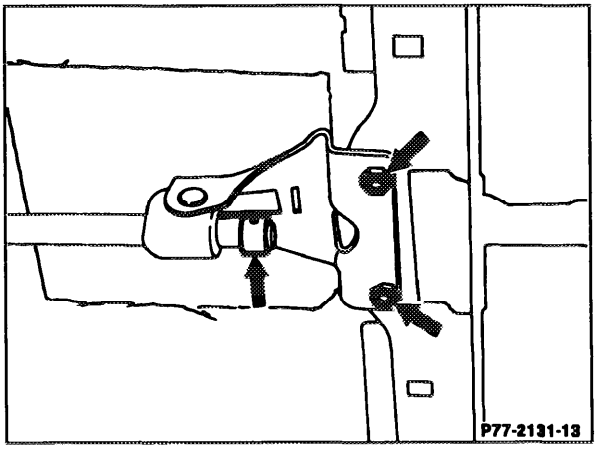


Replace damaged sliding jaws.

Clean and thoroughly grease rubber and plastic sliding jaws.

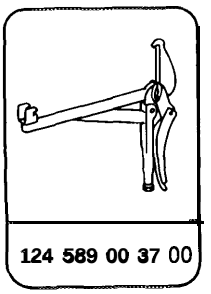
Clean sliding rails and thoroughly grease in area of contact surface.

Install sunroof and adjust.



Sliding lifting sunroof

Special tools



Type of lubricant

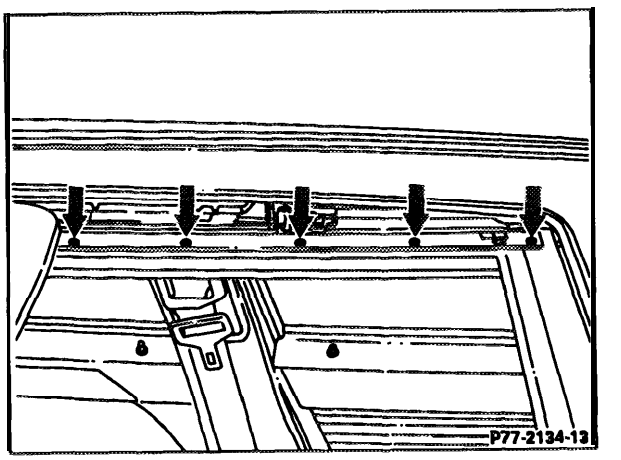
MB slide paste 001 989 14 51

Open sunroof 3/4 and unclip roof headlining at front, fully open sunroof and remove headlining from above.

Remove sliding rails on left and right side.

Close sunroof.

Unscrew nuts on right and left.



Unscrew nuts on right and left.

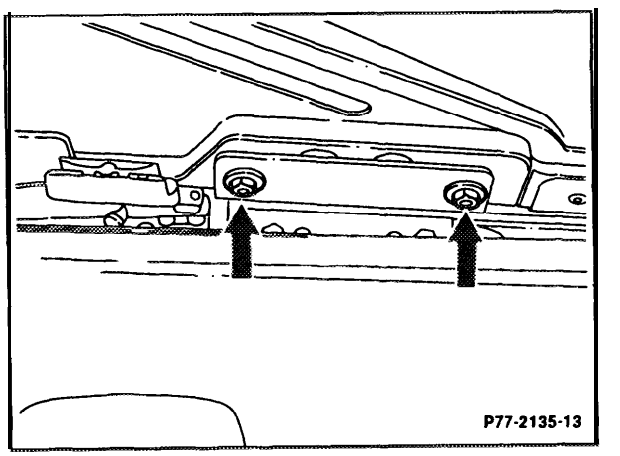
Remove sunroof panel from above.

Clean out water drains at right front and left front from above with compressed air.

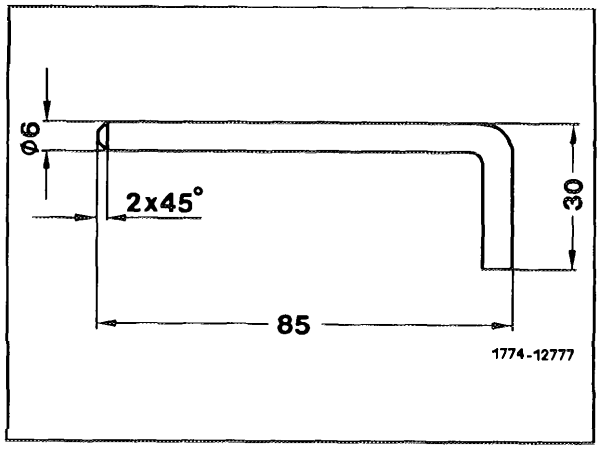
Replace damaged sliding jaws.

Clean and thoroughly grease rubber and plastic sliding jaws.

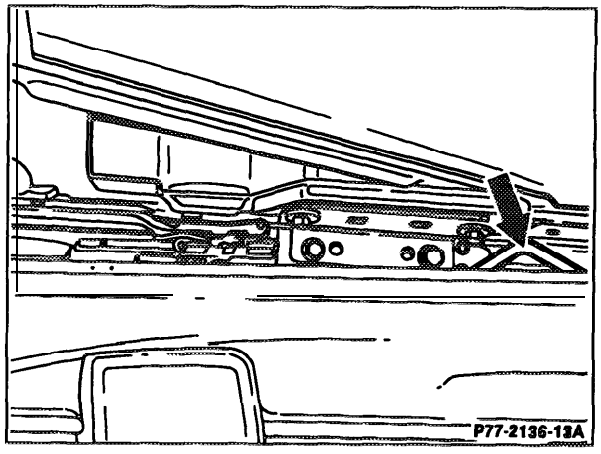
Clean sliding rails and thoroughly grease in area of contact surface.



Make 2 centering pins (if not already available).

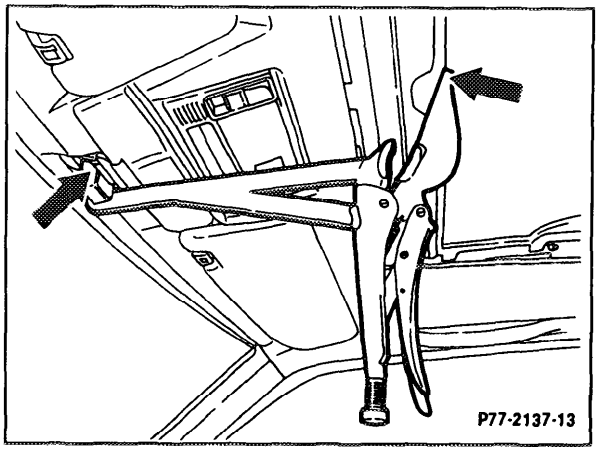


insert centering pins in centering bores on left and right side.



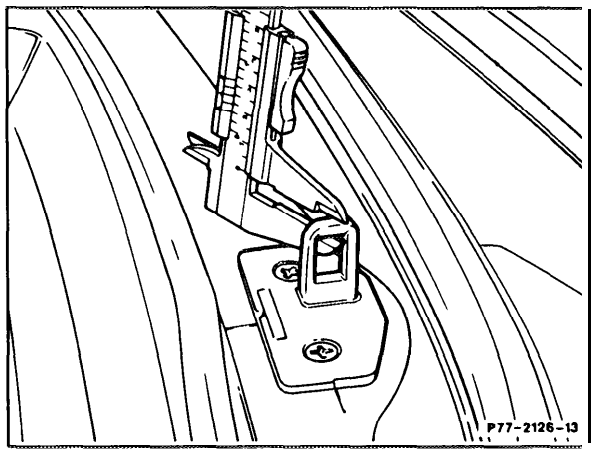
Insert sunroof panel from above, start nuts, preload sunroof panel using tool 124 589 00 37 00 and tighten nuts.

Complete assembly in reverse order of disassembly.



Model 129

- Open soft top.
- Using caliper, measure locking tab at worn area and at unworn area.
- If the measured wear difference between the worn and unworn areas is 0.5 mm or greater, replace the locking tab.



All **models**

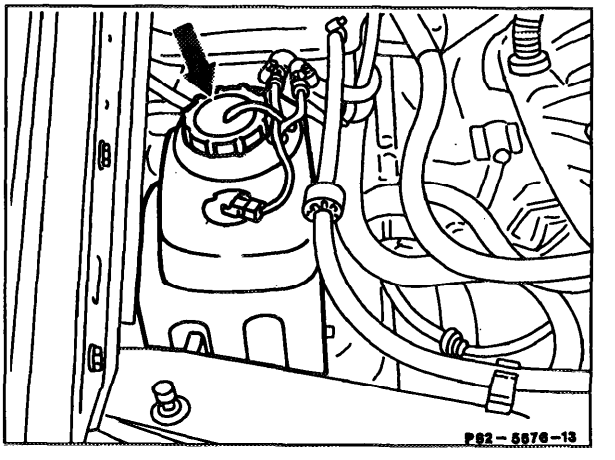
Washer fluid

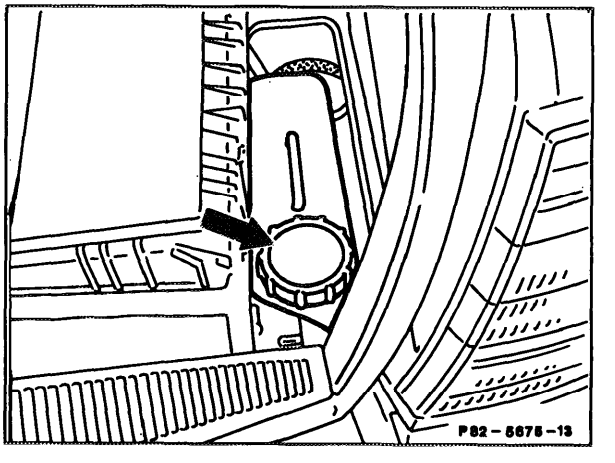
Water and approved MB concentrate

Fill washer reservoir with water. Add specified quantity of MB windshield washer concentrate.

Refer to table on package for mixing ratio.

Note the differing concentrations for summer and winter usage.

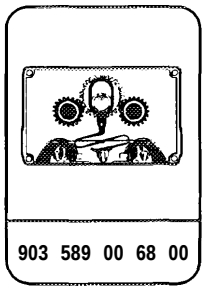




Cleaning cassette deck tone head

All models

Special tools



903 589 00 68 00

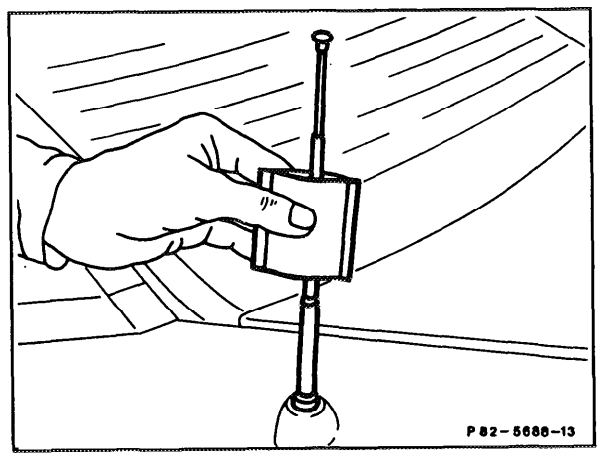
Soak felt parts of cleaning cassette with cleaning solution.

Insert cleaning cassette and play for about 30 seconds.

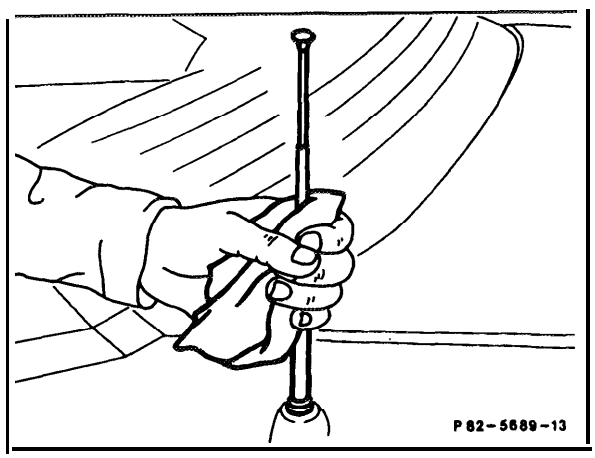
On units with auto reverse, turn cassette over and play for another 30 seconds.

All models

- Switch radio on.
- Clean antenna mast with cleaning pad.
- Switch radio off.
- Repeat procedure several times.



- **Wipe mast** dry with a clean rag.

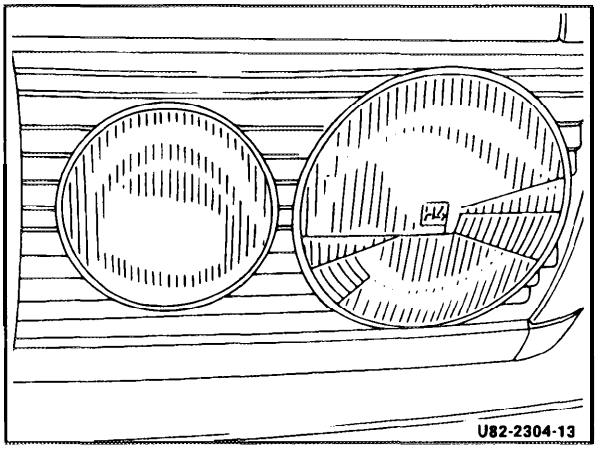


All **models**

Note: A mirror can be used instead of an assistant when checking external lamps.

The following operations can be checked by turning the rotary lamp switch:

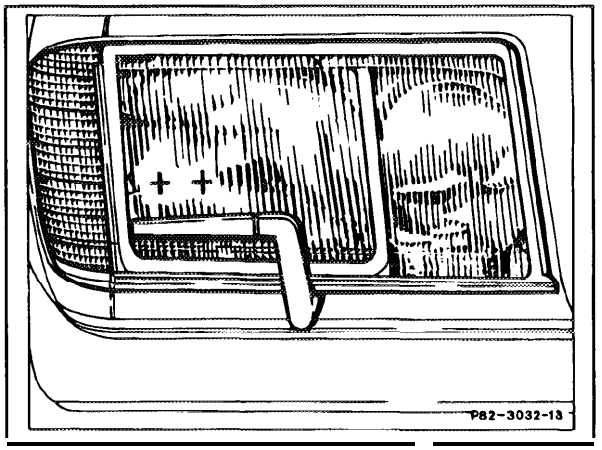
Right and left side standing lamp
Parking lamps/tail lamps/instrument lamps
Low beam headlamps
High beam headlamps and high beam indicator lamps
Fog lamps/rear fog lamps and indicator lamp



Key in ignition in position 0

Operational check of:

Warning flashers and indicator lamp

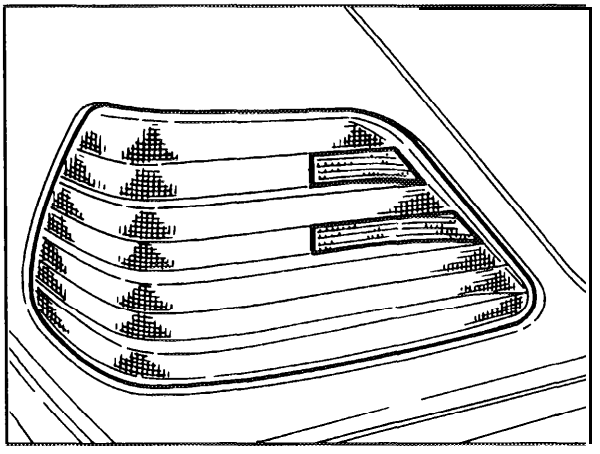


Key In position 2

Engine switched off, parking brake engaged.

Operational checkup of:

Stop lamp (including center high mounted stop lamp[as of model year 1986]) by depressing brake pedal.
Backup lamps by selecting reverse gear.



All models

Windshield wiper

Check edge of wiper blade for signs of hardening or cracks.

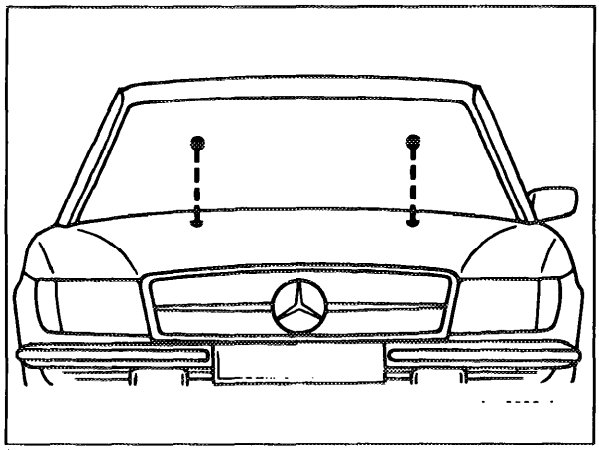
Also check that the edge of the wipe blade turns over when changing direction. If necessary, correct wiper arm offset so that end of wiper arm is parallel with wiping field. ‘This can be easily checked by making a wooden gauge.

Operate windshield wiper and washer briefly. Wiping field should be wiped clean.

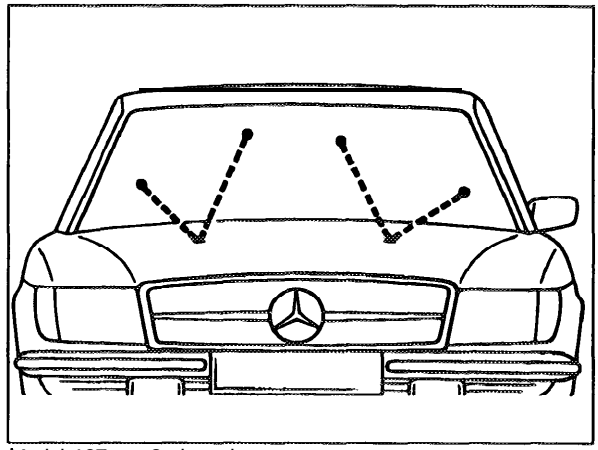
Windshield washer

Clean nozzles with suitable needle.

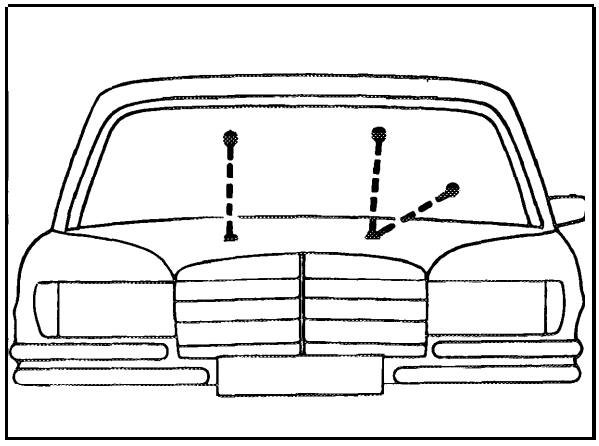
Check adjustment of nozzles.



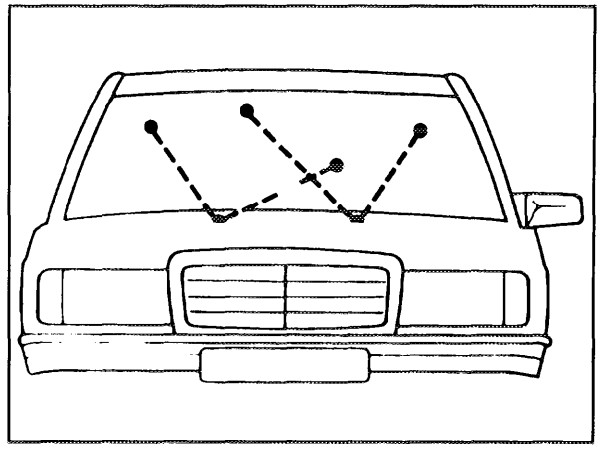
Model 107 1st version

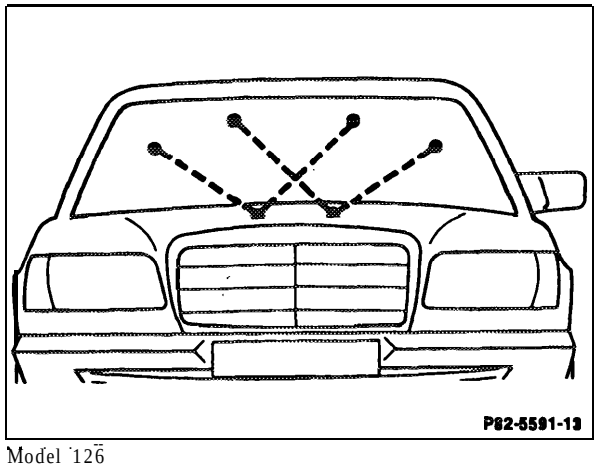


Model 107 2nd version

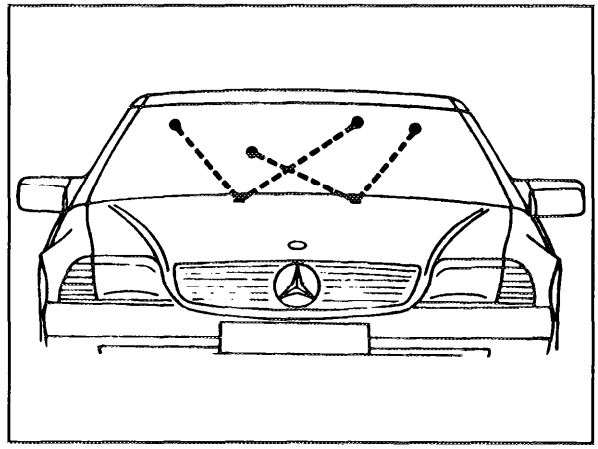


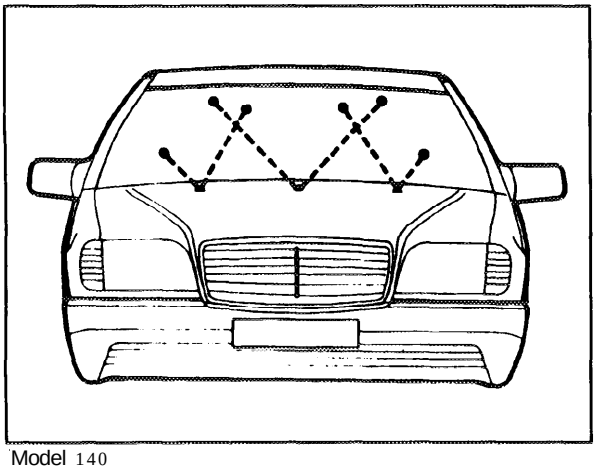
Model 123



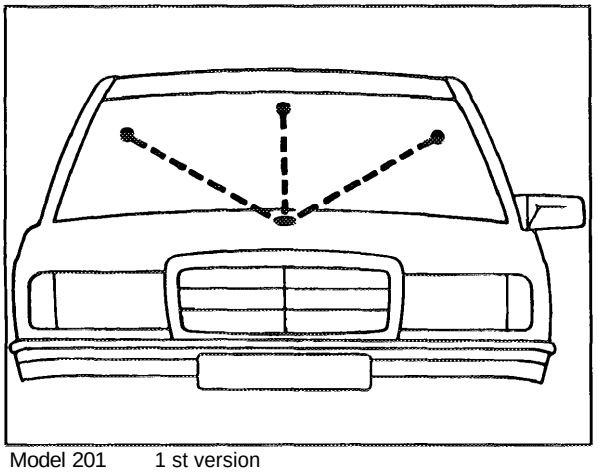


Model 126

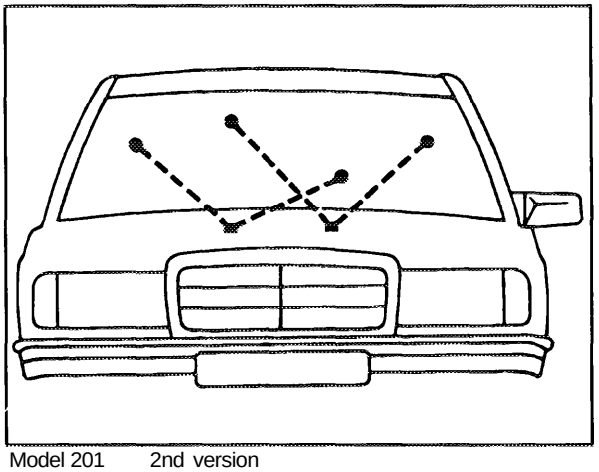




Model 140



Model 201 1 st version



Model 201 2nd version

Headlamp cleaning system

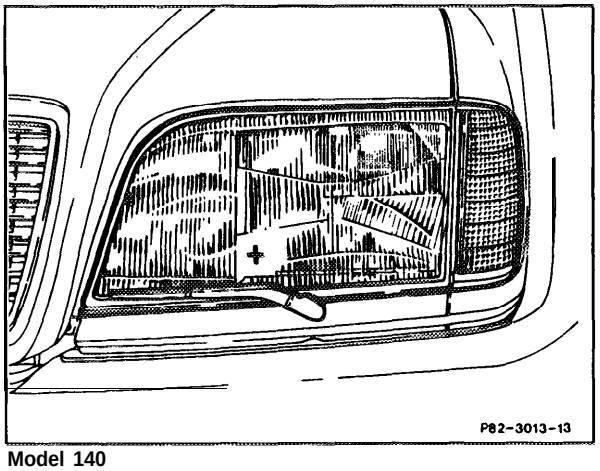
Check edge of wiper blade for signs of hardening and cracks.

Check adjustment of wiper blades.

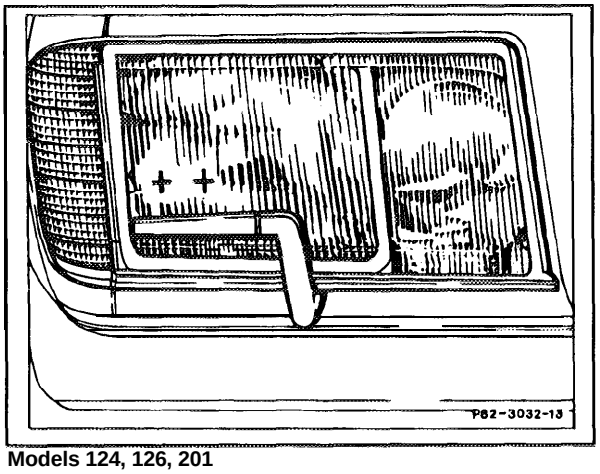
Switch on parking lamp and operate headlamp cleaning system.

The water spray should hit the area just above the parked wiper blade (crosses) on the headlamps.

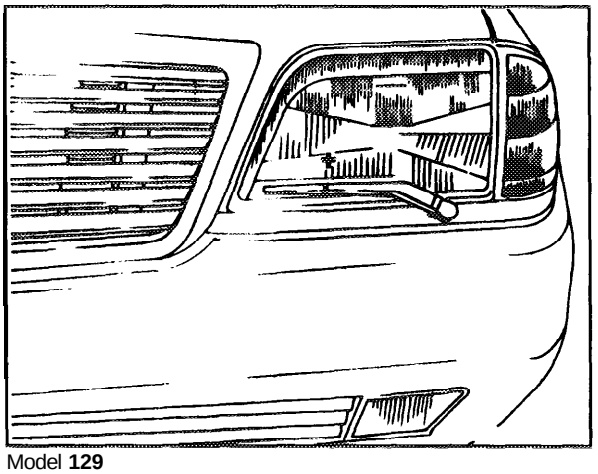
Clean jets with suitable needle or adjust as necessary.



Model 140

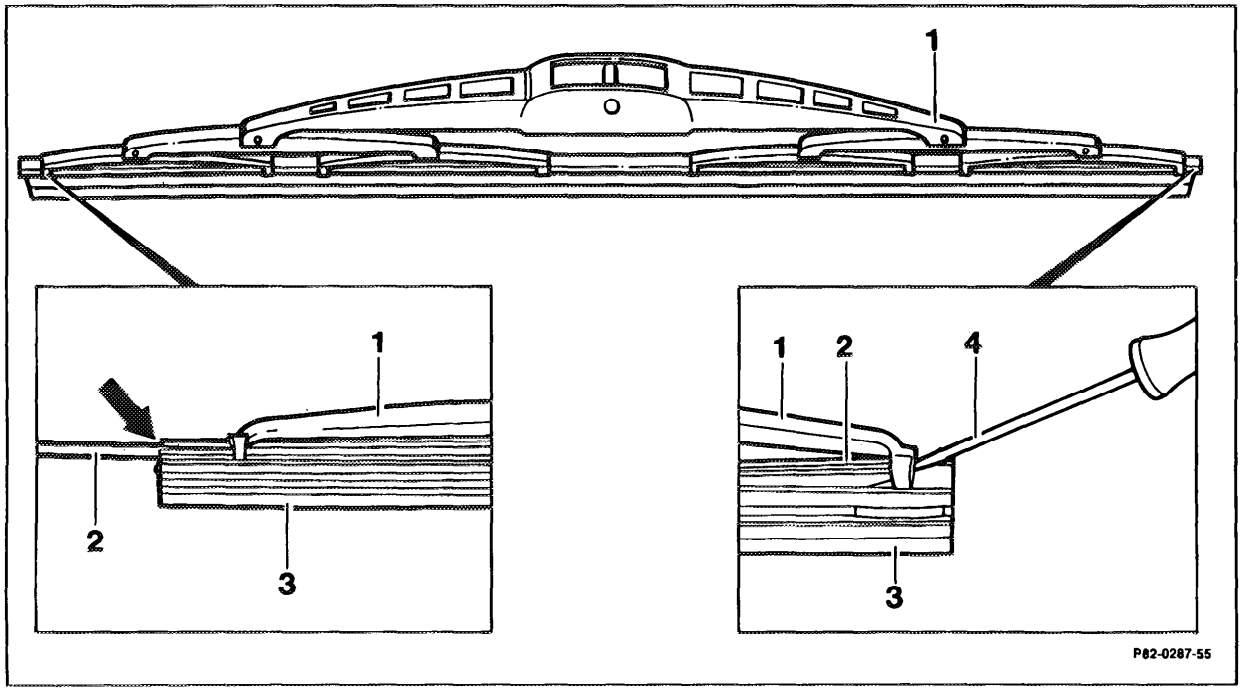


Models 124, 126, 201

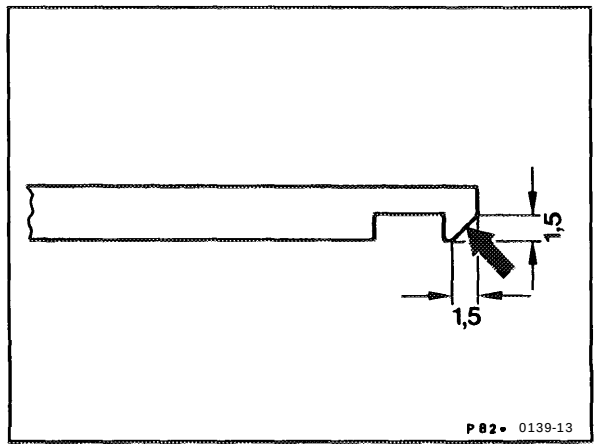


Model **129**

All models



- Remove wiper assembly (1) from arm.
- Pull retaining springs (2) out from the open profile end of the wiper blade (3).
- Disengage wiper blade (3) from wiper assembly brackets.
- Engage new wiper blade into wiper assembly brackets.
- Slide retaining springs into wiper blade from open profile end with curvature facing toward windshield. The retaining springs will engage more easily if the front corners are angled off (arrow) and coated with soapy water. Position retaining springs against solid surface and press into wiper assembly (1).
- Operate windshield wiper(s) and washer system. The wiped area should be cleared. Extremely dirty windshields should be cleaned on separate order.



All **models**

R 12 Refrigerant capacity

Models	**107** **129** **201.02** **201.1**	**123** **126**	**124**	**201.034**
Capacity	1000 g	**1300 g**	**1100 g**	**950 g**

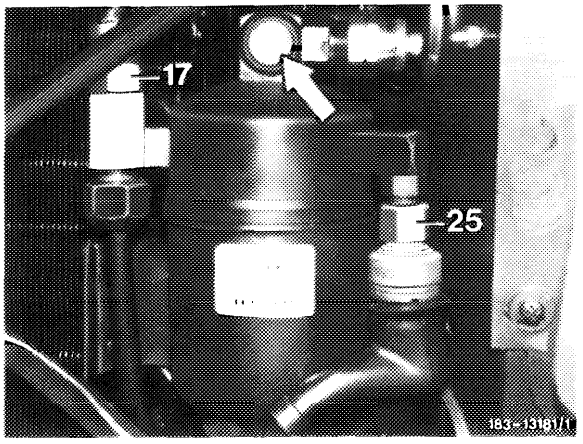
R 134a Refrigerant capacity

Models	**124**	**129**	**140** w/o rear A/C	140 w/ rear A/C
Capacity	1000 g	950 g	**1200 g**	**1400 g**

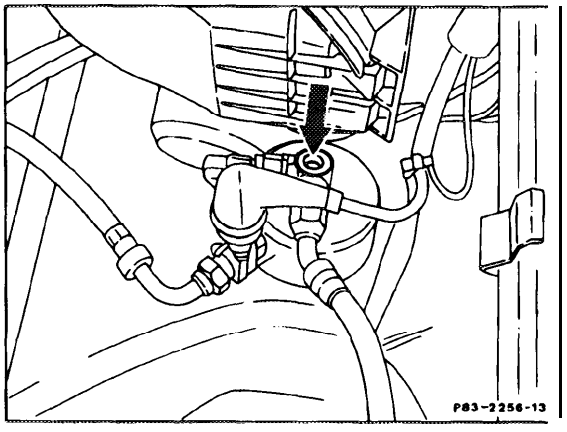
All models except model 140

- Clean sight glass (arrow) on receiver/drier.
- Disconnect wire from pressure switch (25).
- With engine idling, turn on air conditioning or automatic climate control (“DEF”)
- Observe sight glass (arrow) and at the same time reconnect wire to pressure switch (25). Refrigerant should rise shortly after the electromagnetic clutch engages. Flow should be free of bubbles or foam (refrigerant is clear).

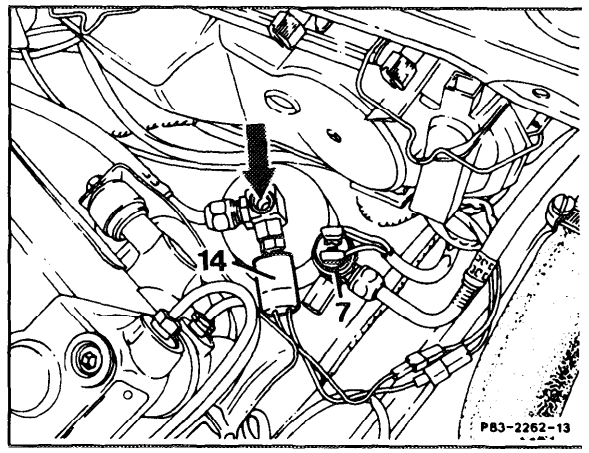
Note: An accurate check of the charge is not possible using the sight glass. At higher ambient temperatures (greater than 35°C) some bubbles may be visible with correct filling quantity.



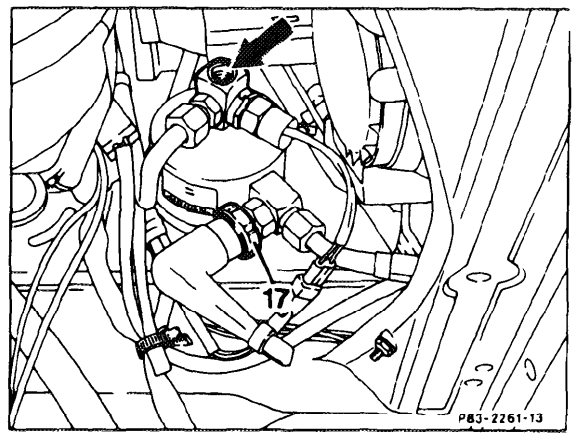
Model 107



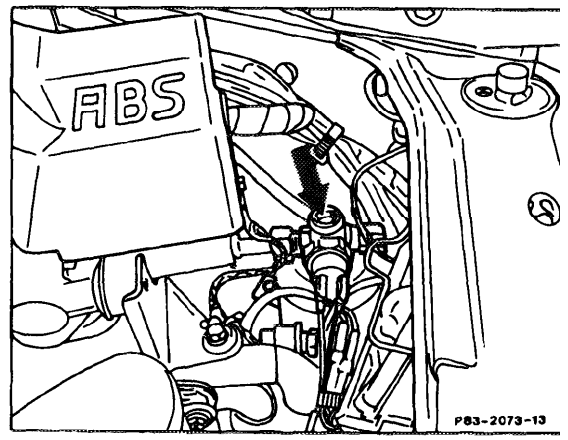
Model 123



Model 124, 201



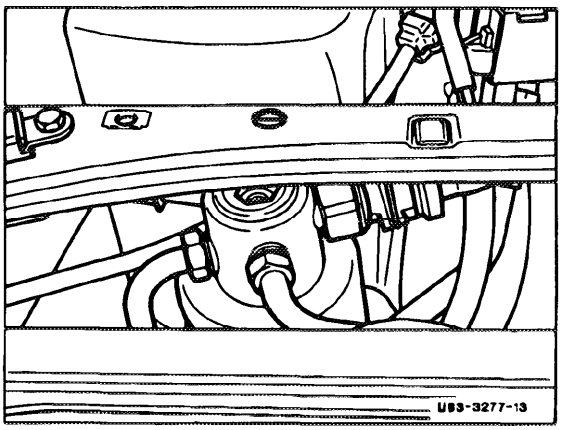
Model 126



Model 129

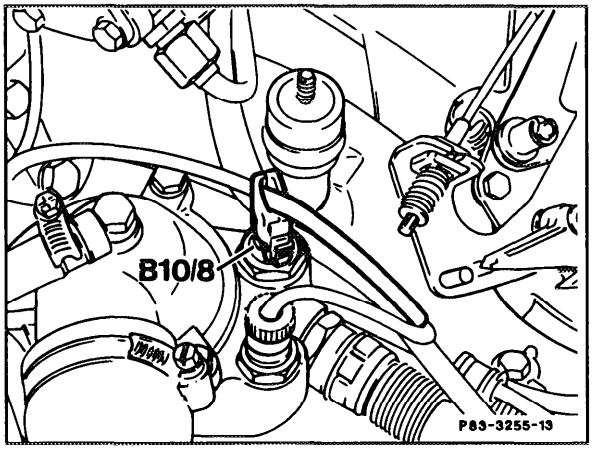
Model 140

- Clean sight glass on receiver/drier. Additonal access can be obtained by removing the left headlight bulb access cover.

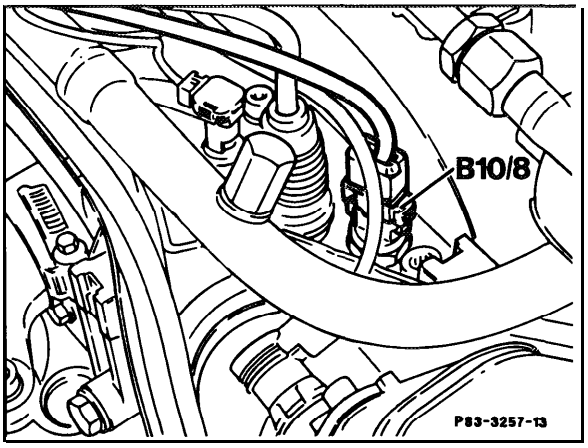


Model 140

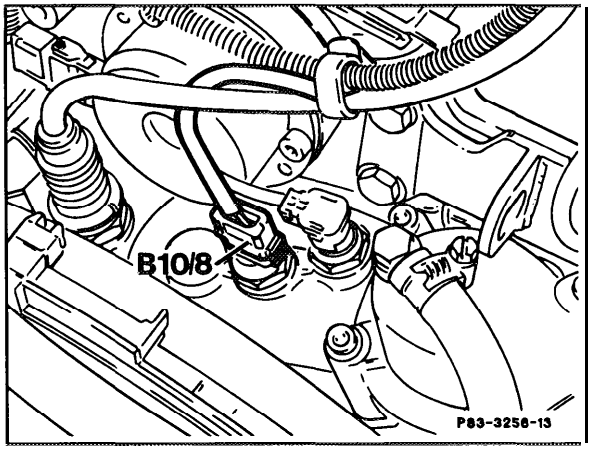
- Disconnect connector from coolant temperature sensor B10/8 and bridge connector terminals with jumper wire.



Location of coolant temperature sensor B10/8, M104 engine



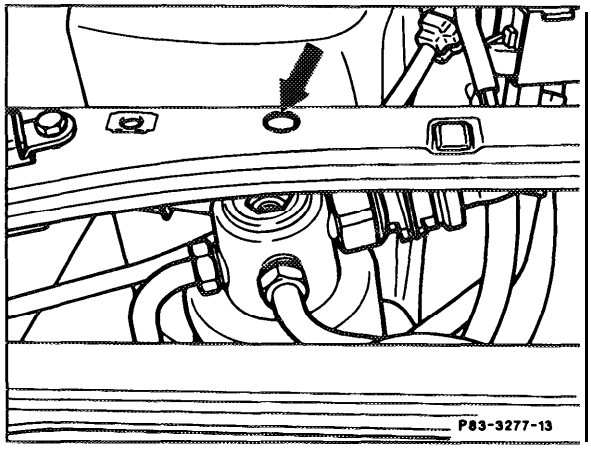
Location of coolant temperature sensor B10/8, MI 19 engine



Location of coolant temperature sensor B10/8, MI 20 engine

- With engine idling, switch on automatic climate control (DEF).

- Observe sight glass and simultaneously remove jumper wire from connector.



Location of sight glass observation opening (headlamp bulb access cover shown removed)

Refrigerant should rise shortly after the electromagnetic clutch engages. Flow should be free of bubbles or foam (i.e., refrigerant is clear).

Note: An accurate check of the charge is not always possible using the sight glass. At higher ambient temperatures (greater than 35°C) some bubbles may be visible with correct filling quantity.

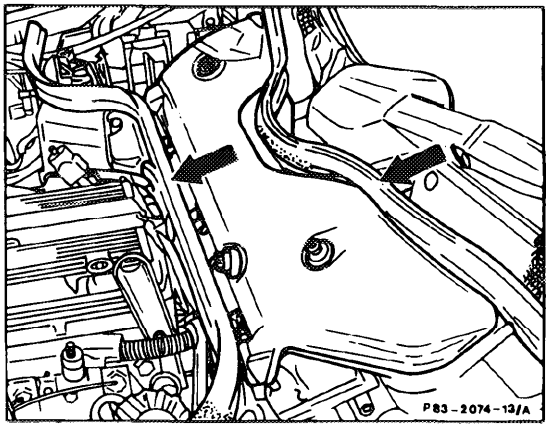
With refrigerant loss or suspected system leaks , the correct charge can only be ensured by completely evacuating (recycling) and refilling system. System should first be checked for leaks. The correct charge can only be established by weighing the refrigerant or by using a recharging cylinder or automatic air conditioning recharging station.

Refer to the latest information concerning correct charge for each model in the introduction manuals and repair instructions.

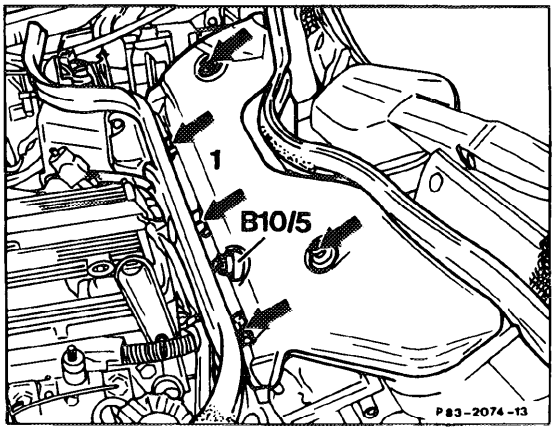
Model 129 140

Model 129

- Pull out lip seals (arrows).

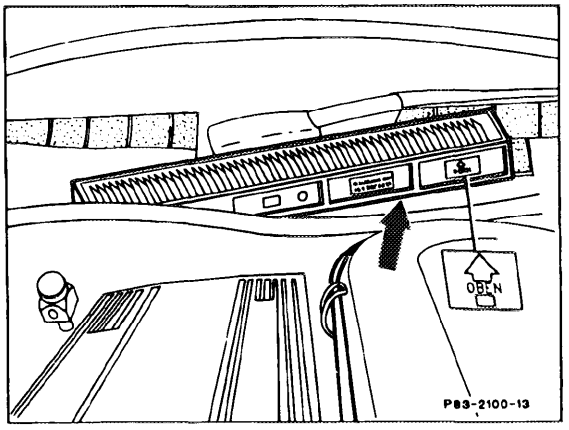


- Unscrew both screws and unclip 3 clips (arrows).
- Pull out temperature sensor B10/5.
- Remove cover (1) and filter box from above.
- Clean filter housing and filter cover.



Note:
Do not attempt clean dust filters, they should only be replaced.

- Insert dust filter as shown.

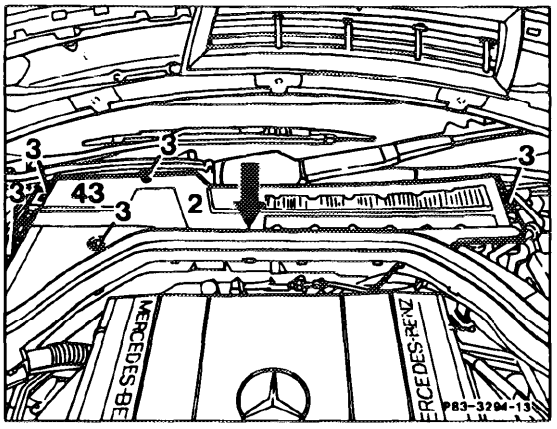


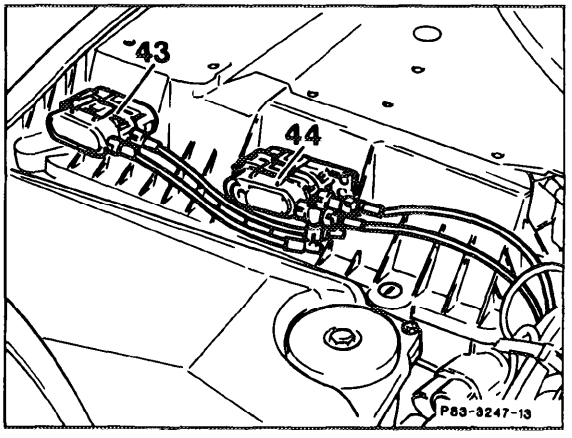
Model 140

- Pull out rubber lip seal (arrow).

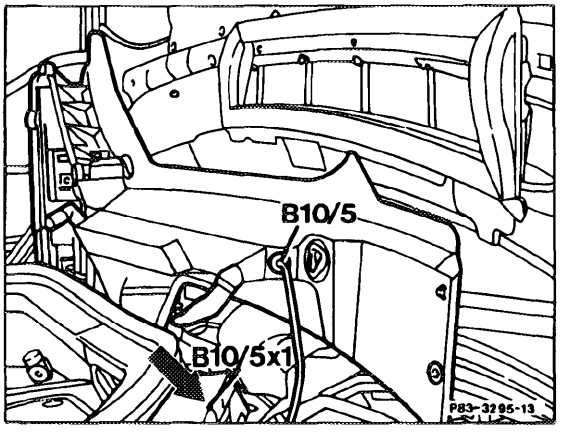
- Disconnect pneumatic lines from main air flap actuators (43, 44).

- Remove 6 screws (3) and lift air plenum (2).





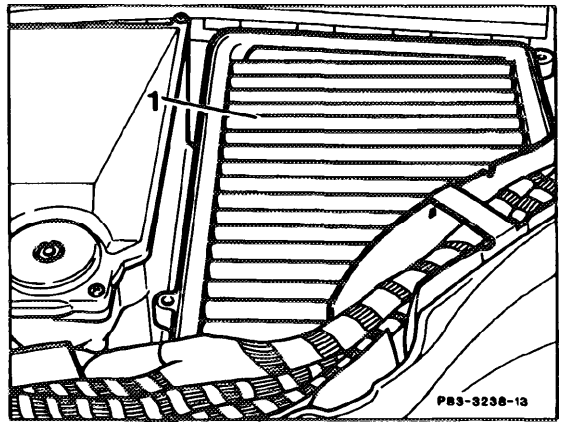
- Pull out temperature sensor (B10/5).



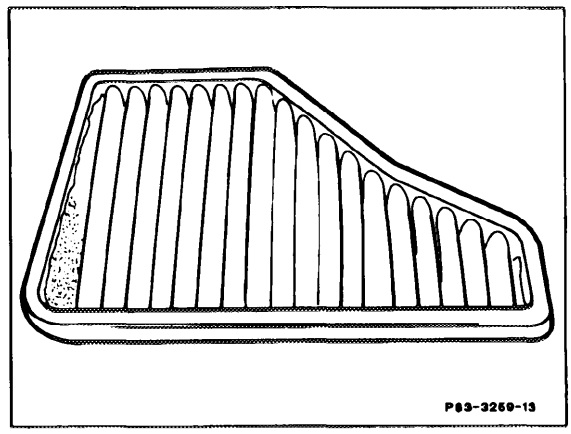
- Lift cover and lift filter cartridge out.
- Clean filter housing and cover.

Note:
Do not attempt clean dust filters, they should only be replaced.

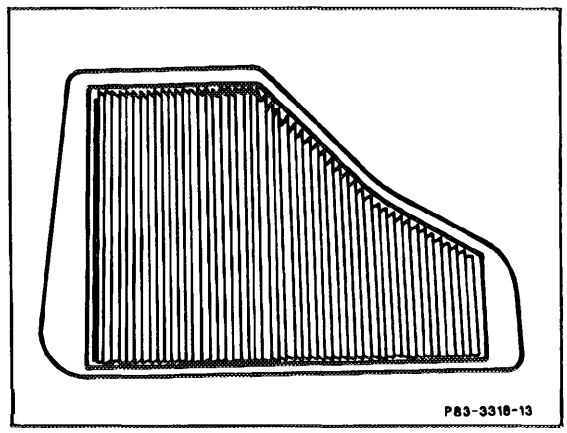
- Install new dust filter (1) according to illustration.



Note:
On vehicles equipped with active charcoal filter, the dust filter is designed as a active charcoal pre-filter. The underside of the filter has a layer of active charcoal. Do not install the simple dust filter intended for vehicles without the active charcoal filter.



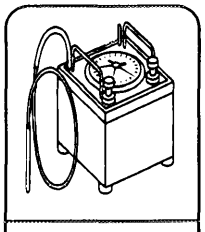
Dust filter for vehicles equipped with active charcoal filter system



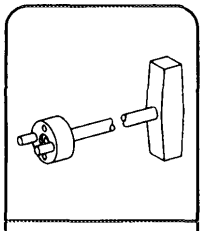
Dust filter for vehicles not equipped with active charcoal filter system

Model 140

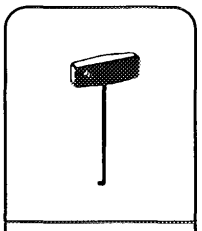
Special tools



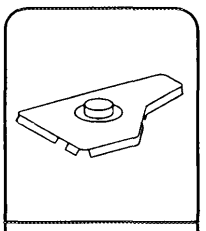
201 589 13 21 00



140 589 00 07 00

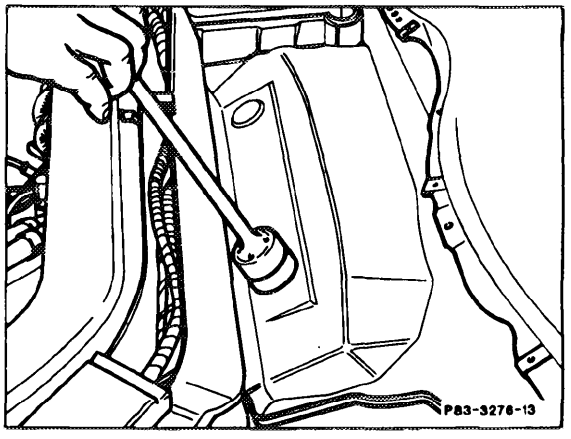


126 589 03 33 00

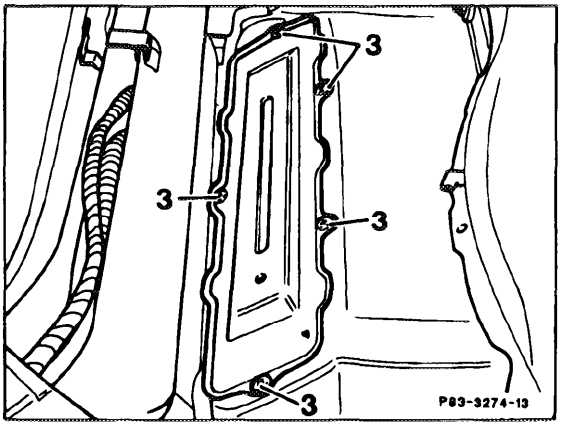


140 589 00 98 00

- Remove windshield wiper assembly (job no. 82-680).
- Remove water collector (4 screws).
- Cover dust filter with protective cover 140 589 00 98 00.



- Remove 5 screws (3) and lid.
- Remove lid inside heater box (5 screws).

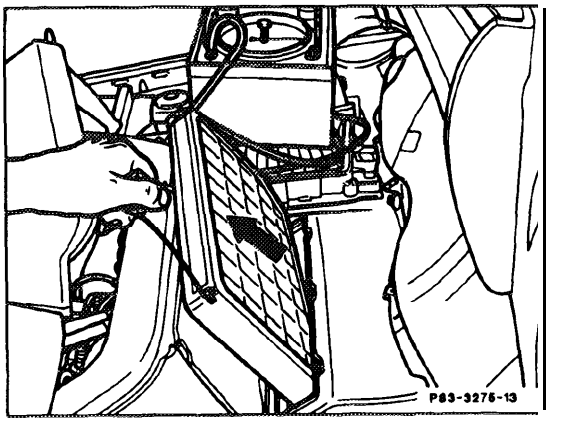


- Using vacuum/pressure tester, apply vacuum to pneumatic seal of active charcoal filter.

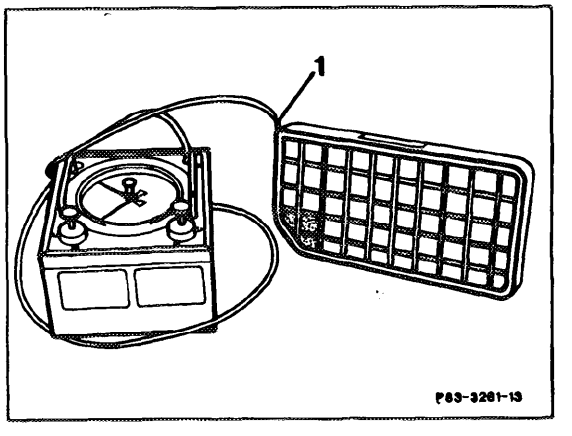
- Pull active charcoal filter up (tester remains connected)

- To install, apply vacuum to seal on new filter and insert in opening with pneumatic seal facing toward front of vehicle.

- Remaining components are installed in reverse order of removal.



Note:
The active charcoal filter can not be cleaned.

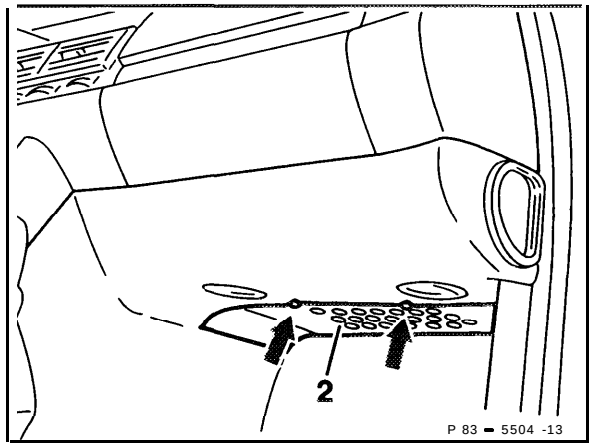


Vacuum connection (1)

Model 140

- Using screwdriver, turn latches (arrows) 90° to left.
- Lower cover with recirculating air filter (2).
- Unclip recirculating air filter from cover.
- Open recirculating air filter housing and remove filter.

Note:
Recirculating air filters can not be cleaned, they must be replaced.



Lubricating folding side mirror

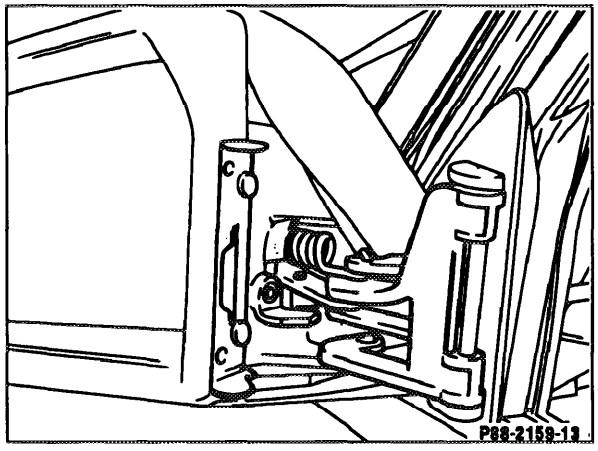
8820

Model 107 123
except maintenance-free side mirrors

Grease type	
Lubricating grease	Multipurpose grease

Note: Maintenance free mirrors can be recognized by the revised mount.

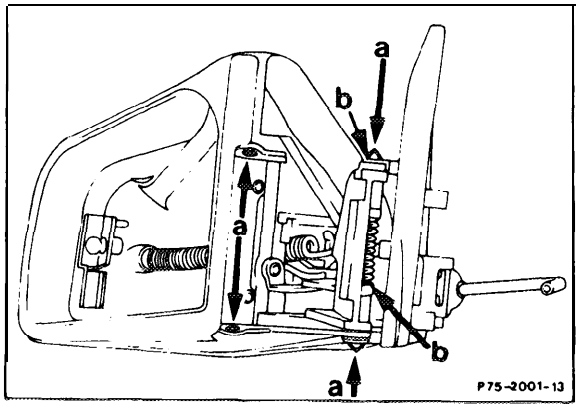
Standard on model 107 and 123, starting January 1984.



Disengage mirror from rear in forward direction by means of a light blow with the ball of the hand.

Lubricate bearings of both locking pins (arrows b) and move mirror back and forth several times.

Grease holding bracket and locking pin (arrows a) at both bearing points.



Lubricating hood

8821

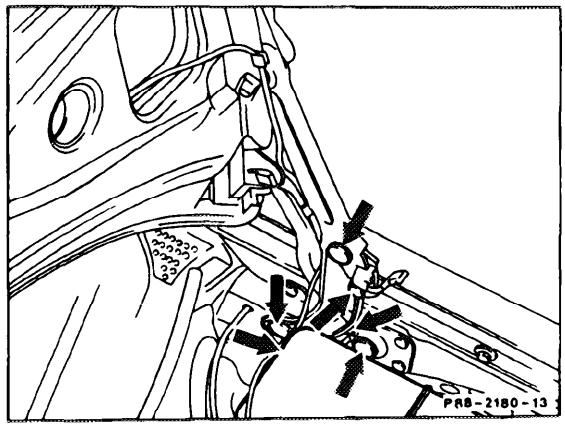
All models

Grease type

Lubricating grease	Multipurpose grease Refer to Factory Approved Service Products list

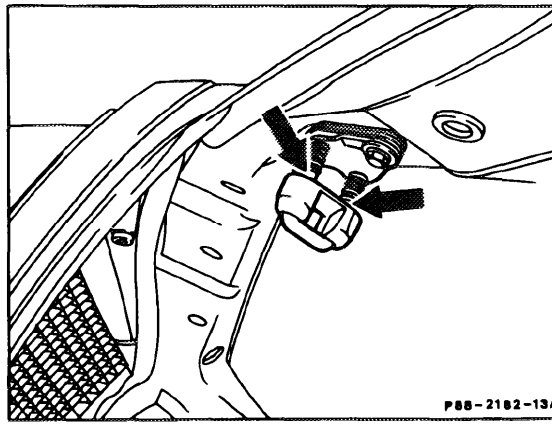
Oil (can)

- Hood support (except models 124, 129, 140).



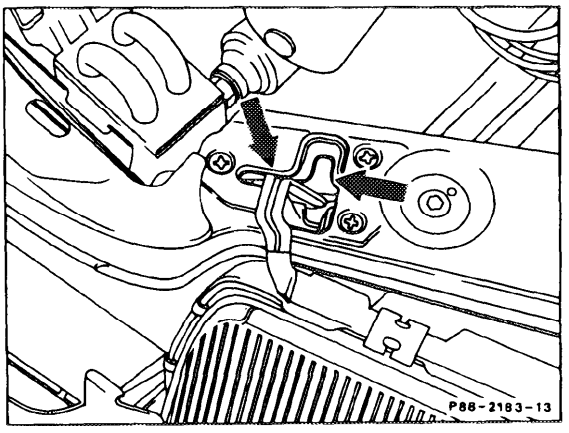
- Hinge bearings (except models 124, 129, 140).

- Hood latch.



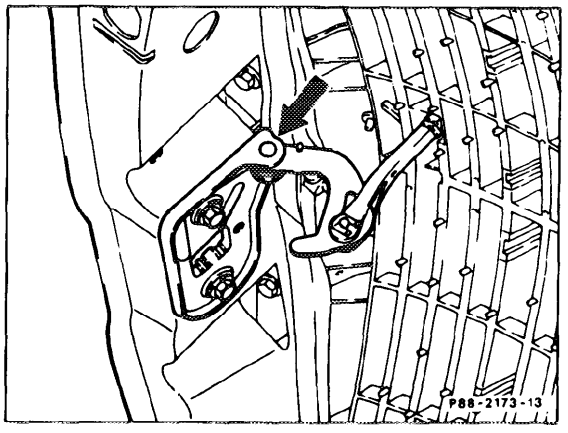
Grease

. Hood lock.



Oil (can)

- Safety catch.



Inspecting safety belts for damage

9150

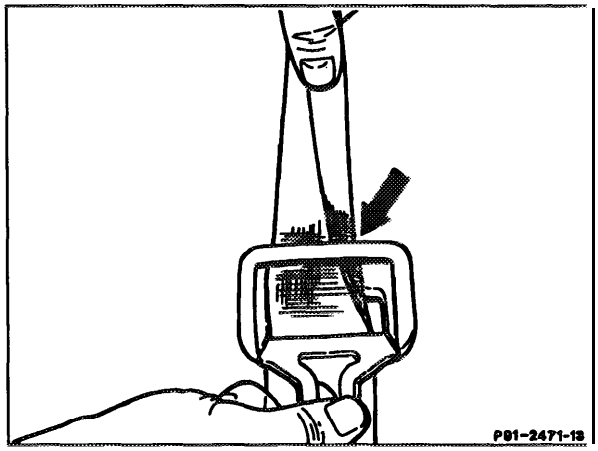
All **models**

Pull belt out completely and check for cut fibers and other damage such as burnt spots caused by cigarettes.

Check that automatic reel functions correctly.

Check locking function by pulling belt out quickly.

Check belt strap for twisting.



Note: If customer complains that belt does not roll up neatly, check whether belt is guided back manually as specified or whether it is twisted 180° behind panel caused by improper handling. Remove panel for this purpose.

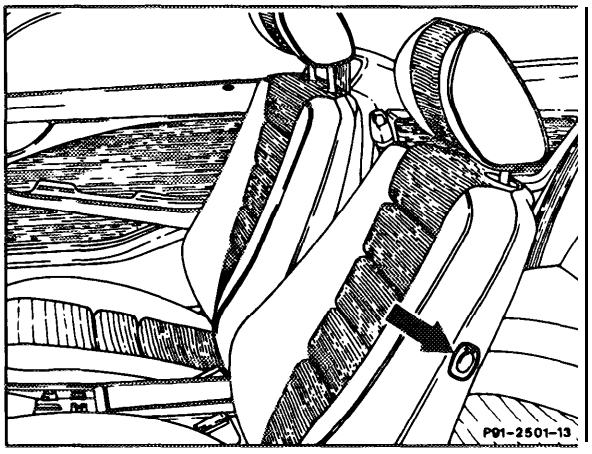
If customer refuses replacement of damaged belt, this should be noted on repair order.

Backrest lock - check operation

9151

All cabriolet and coupes

- With engine idling and doors open, check that backrests are free to move forward.
- Close doors. Backrests should now be locked.
- With doors closed, backrest lock should release when pushing button (arrow) on side of backrest.

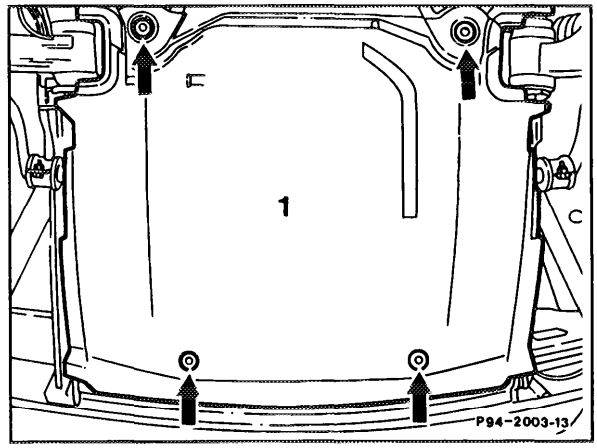


Model 124.1
126.1 starting 1986
201.1
140.1

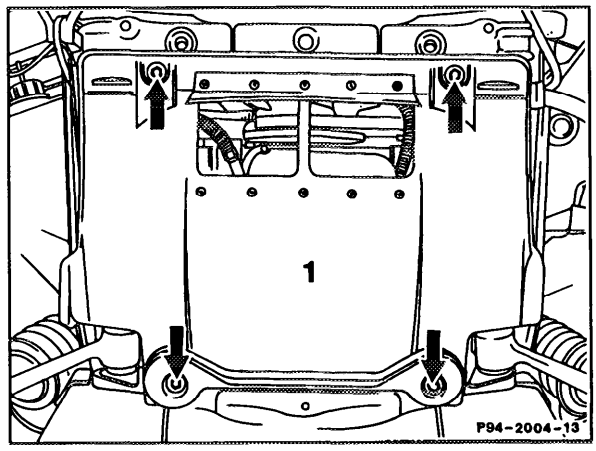
Front noise encapsulation panel

Removal

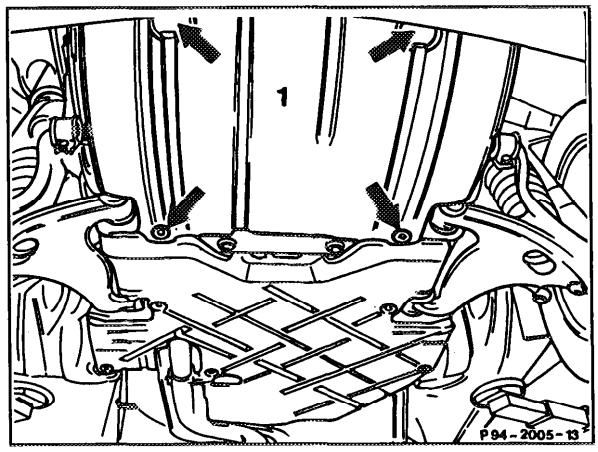
- Unscrew small bolts (arrows) and remove front noise encapsulation panel.



Models 124.1, 140.1



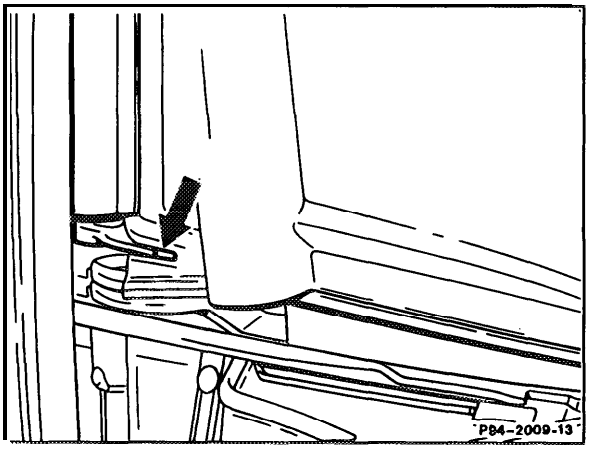
Model 126.1



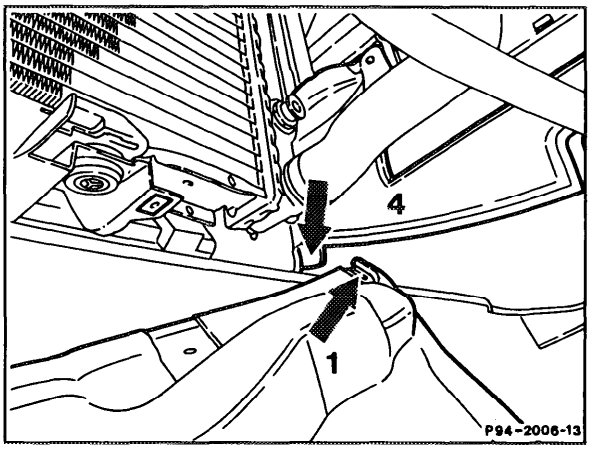
Mode1201.1

Installation

- On model 124 and 201 engage the slots on the lower noise encapsulation panel (1) with the tabs of the side panels (4).

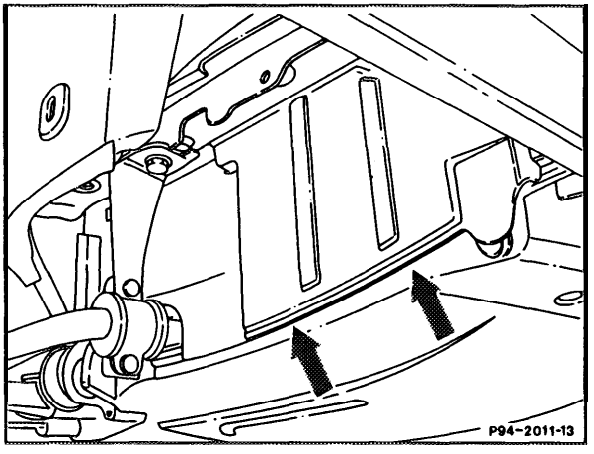


Model 124.1

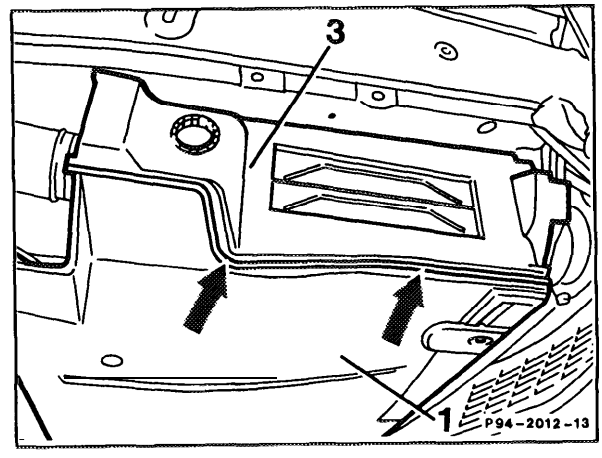


Mode1201.1

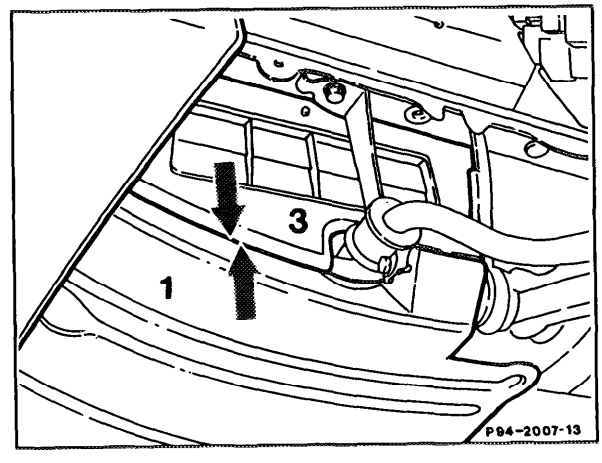
- Push lower noise encapsulation panel (1) up; edges of side panels (3) must engage over lower panel (1).
- Bolt lower noise encapsulation panel (1) in place.



Models 124.1, 140.1



Model 126.1



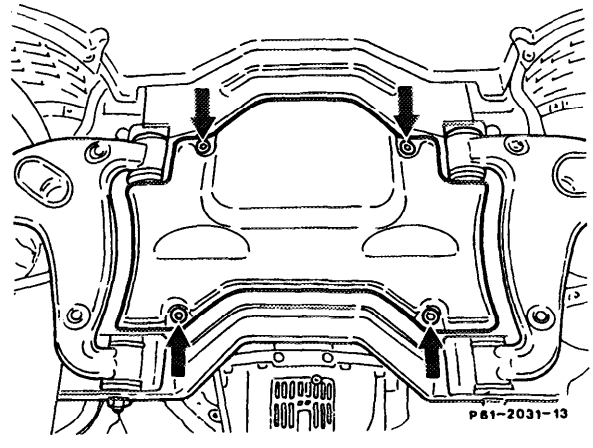
Model 201.1

Center noise encapsulation panel
Model 140.1 only

Removal/Installation

- Screw out small bolts (arrows) and remove noise encapsulation panel (2).

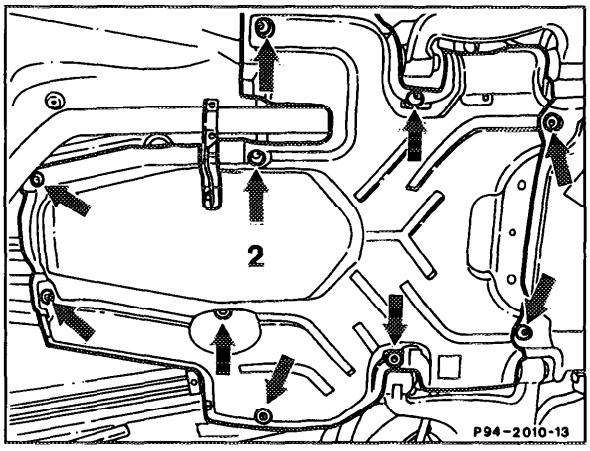
- Install in reverse oder.



Rear noise encapsulation panel

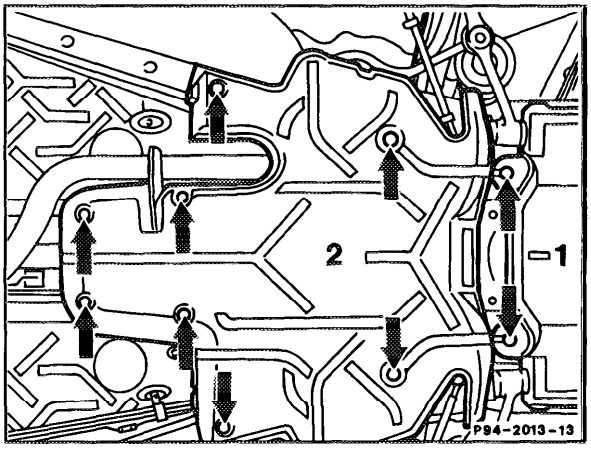
Removal

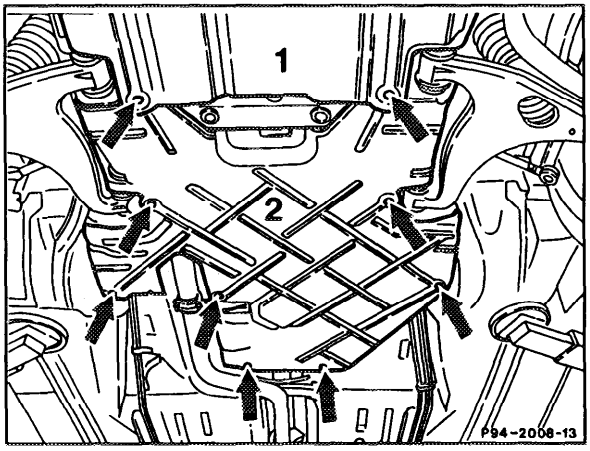
- Screw out small bolts (arrows) and remove noise encapsulation panel (2) toward rear.



Installation

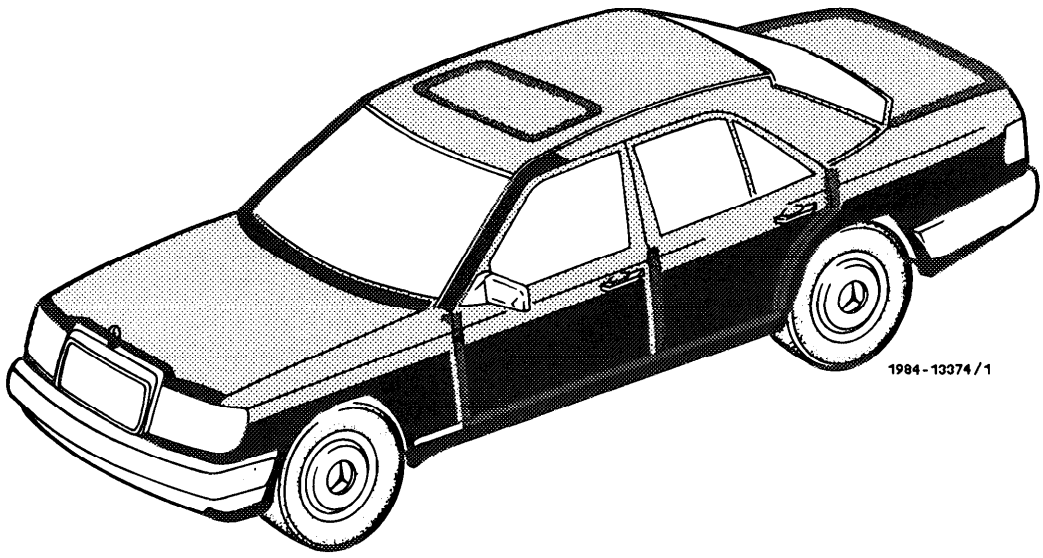
- Insert rear noise encapsulation panel (2) between front axle cross member and front noise encapsulation panel (1).
- Bolt lower noise encapsulation panel (1) in place.





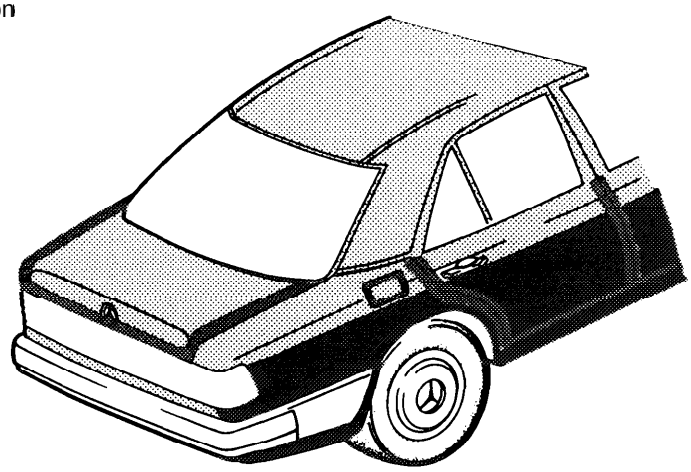
Mode1201.1

All **models**



Condition of corrosion protection

- Painted outer surface
- Edges and folded lips
- Area exposed to stone damage



Righthand side mirror image

Mercedes-Benz

Owner's Manual

1993

190 E 2.3
190 E 2.6

Kindly observe the follo wing in your own best interests:

We recommend using Mercedes-Benz original parts as well as conversion parts and accessories explicitly approved by us for your vehicle model.

We have subjected these parts to a special test in which their reliability, safety and their special suitability for Mercedes-Benz vehicles have been determined.

We are unable to make an assessment for other products and therefore cannot be held responsible for them, even if in individual cases an official approval or authorization by governmental or approval agencies should exist.

Mercedes-Benz original parts as well as conversion parts and accessories approved by us are available at your Mercedes-Benz service station where you will receive comprehensive information, a/so on permissible technical modifications, and where expert installation will be performed.

Printed in Germany

We reserve the right to modify the technical details of the vehicle as given in the data and illustrations of this Owner's Manual. Reprinting, translation and copying, even of excerpts, is not permitted without our prior authorization in writing.

Press time 09.11 92
VP/P 12K

Our company and staff congratulate you on the purchase of your new Mercedes-Benz.

Your selection of our product is a demonstration of your trust in our company name. Further, it exemplifies your desire to own an automobile that will be as easy as possible to operate and provide years of service.

Your Mercedes-Benz represents the efforts of many skilled engineers and craftsmen. To ensure your pleasure of ownership, we ask you to make a small investment of your time:

- *Please read this manual carefully before putting it aside.*
- *Please abide by the recommendations contained in this manual. They are designed to acquaint you with the operation of your Mercedes-Benz.*

We extend our best wishes for many miles of safe, pleasurable driving.

Mercedes-Benz Aktiengesellschaft

Introduction

This Owner's Manual contains a great deal of useful information. We urge you to read it carefully and familiarize yourself with the vehicle before driving.

For your own safety and longer service life of the vehicle, we urge you to follow the instructions and warnings. Ignoring them could result in damage to the vehicle or personal injury.

Your vehicle may have some or all of the equipment described. Therefore, you may find explanations of equipment not installed in your vehicle. If you have any questions about the operation of any equipment, your authorized Mercedes-Benz dealer will be glad to demonstrate the proper procedures.

Owner's Service and Warranty Policy

The Owner's Service and Warranty Policy Booklet contains detailed information about the warranties covering your Mercedes-Benz, including:

- New Car Limited Warranty
- Emission System Warranty
- Emission Performance Warranty
- California Emission Control System Warranty (California Only)
- State Warranty Enforcement Laws (Lemon Laws)

Important Notice for California Retail Buyers of Mercedes-Benz Automobiles

Under California law you may be entitled to a replacement of your vehicle or a refund of the purchase price, if Mercedes-Benz of North America, Inc. or its authorized dealer fails to conform the vehicle to its express warranties after a reasonable number of repair attempts during the period of one year or 12 000 miles from original delivery of the vehicle. A reasonable number of repair attempts is presumed for a retail buyer (1) if the vehicle is out of service by reason of repair of substantial nonconformities for a cumulative total of more than 30 calendar days or (2) the same substantial nonconformity has been subject to repair four or more times **and you have at least once directly notified us in writing of the need to repair the nonconformity and have given us an opportunity to perform the repair ourselves. Notifications should be sent to the nearest Mercedes-Benz Regional Office listed in the Owner's Service and Warranty Information Booklet.**

Maintenance

The Maintenance Booklet describes all the necessary maintenance work which should be performed at regular intervals.

Always have the Maintenance Booklet with you when you take the vehicle to your authorized Mercedes-Benz dealer for service. The service advisor will record each service in the booklet for you.

Roadside Assistance

The Mercedes-Benz Roadside Assistance Program provides factory trained technical help in the event of a breakdown. Calls to the toll-free Roadside Assistance number:

1-800-222-01 00 **(in the U.S.A. only)**

will be answered by Mercedes-Benz Customer Assistance Representatives 24 hours a day, 365 days a year.

For additional information refer to the Mercedes-Benz Roadside Assistance Program brochure in your glove box.

Change of Address or Ownership

If you change your address, be sure to send in the "Change of Address Notice" found in the Owner's Service and Warranty Policy Booklet. It is in your own interest that we can contact you should the need arise.

If you sell your Mercedes, please leave all owner's literature with the vehicle to make it available to the next owner.

If you bought this vehicle used, be sure to send in the "Notice of Purchase of Used Car" found in the Owner's Service and Warranty Policy Booklet.

Operating Your Vehicle Outside the U.S.A. or Canada

If you plan to operate your vehicle in foreign countries, please be aware that:

- unleaded fuels for vehicles with catalytic converters may not be available; the use of leaded fuels will damage the catalysts,
- fuel may have a considerably lower octane rating, and improper fuel can cause engine damage,
- service facilities or replacement parts may not be readily available.

Certain Mercedes-Benz models are available for delivery in Europe under our European Delivery Program. For details, consult your authorized Mercedes-Benz dealer or write to:

Mercedes-Benz of North America, Inc.
European Delivery Department
One Mercedes Drive
Montvale, NJ 07645

In Canada write to:

Mercedes-Benz Canada, Inc.
European Delivery Department
849 Eglinton Avenue East
Toronto, Ontario M4G 2L5

We continuous/y strive to improve our product, and ask for your understanding that we reserve the right to make changes in design and equipment. Therefore, information, illustrations and descriptions in this Owner's Manual might differ from your vehicle.

Optional equipment is also described in this manual, including operating instructions wherever necessary. Since they are special-order items, the descriptions and illustrations herein may vary slightly from the actual equipment of your vehicle.

If there are any equipment details that are not shown or described in this Owner's Manual, your authorized Mercedes-Benz dealer will be glad to inform you of correct care and operating procedures.

The Owner's Manual and Maintenance Booklet are important documents and should be kept with the vehicle.

Instruments and Controls
Starting the Engine, Driving Instructions

Operation

Driving

Practical Hints

Technical Data
Fuels, Coolants, Lubricants etc.
Consumer Information

Index

The First 1000 Miles (1500 km)

The more cautiously you treat your vehicle during the break-in period, the more satisfied you will be with its performance later on. Therefore, drive your vehicle during the first 1000 miles (1500 km) at moderate vehicle and engine speeds.

During this period, avoid heavy loads (full throttle driving) and high RPM (no more than 2/3 of maximum permissible speed in each gear as indicated on the speedometer).

Downshift at proper engine speed!

On vehicles with automatic transmission avoid accelerating by kick-down. It is not recommended to brake the vehicle by manually shifting to a lower gear. We recommend to select positions "3" or "2" only at moderate speeds (for hill driving).

After 1000 miles (1500 km) speeds may gradually be increased to the permissible maximum.

Check Regularly and Before a Long Trip

See Index

Maintenance

We strongly recommend that you have your vehicle serviced by your authorized Mercedes-Benz dealer, in accordance with the Maintenance Booklet.

Please note:

The Owner's Manual contained on this CD-ROM is an Owner's Manual for a model year 1993 190E 2.3/2.6. The Owner's Manual is displayed for general information only. Should you wish to obtain an Owner's Manual for your specific model year and model vehicle, please contact your authorized Mercedes-Benz passenger car dealer or call

1-800-FOR-MERCedes

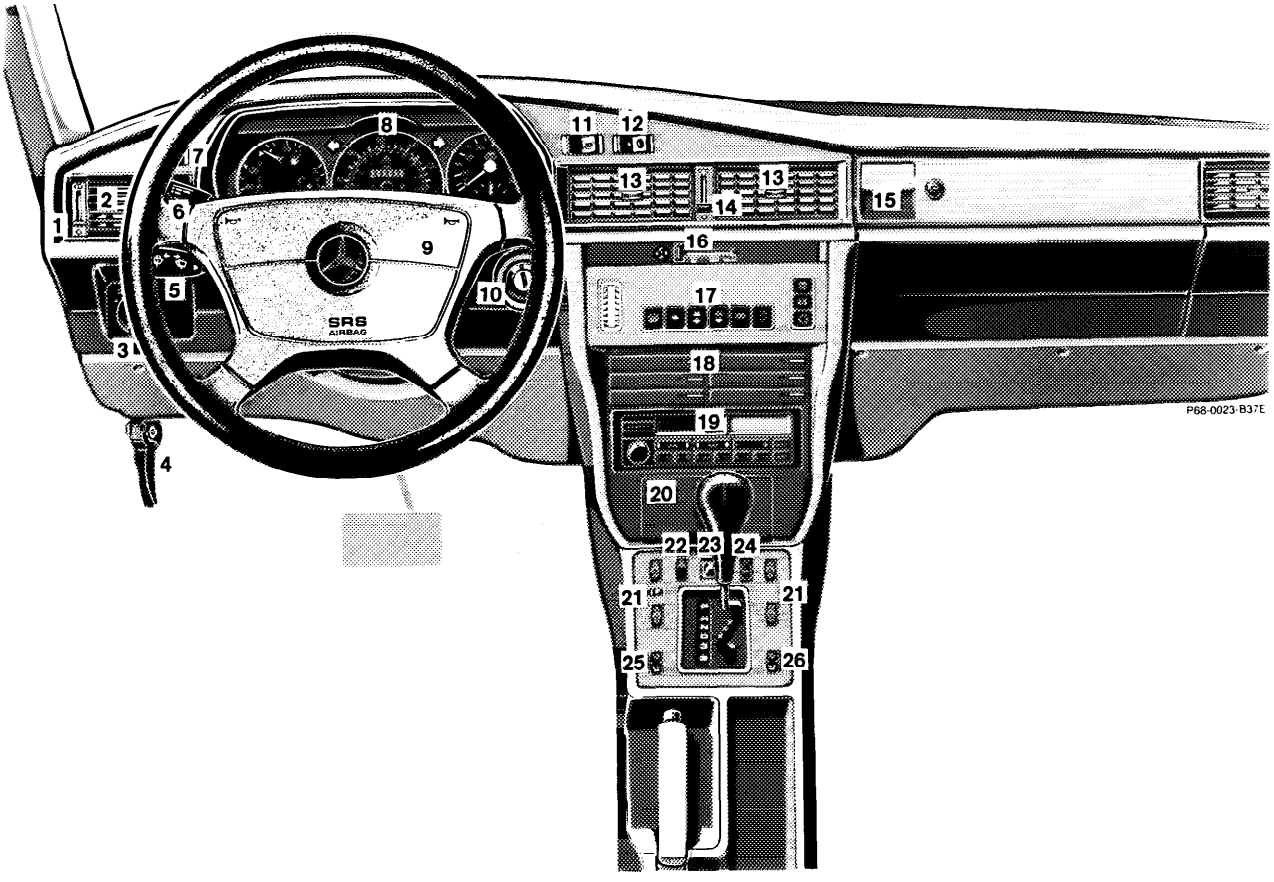
Instruments and Controls
Starting the Engine, Driving Instructions

Instruments and Controls	10
Instrument Cluster	12
Indicator Lamp Symbols	13
Catalytic Converter	14
Starting and Turning Off the Engine	15
Driving Instructions	16

Instruments and Controls

For more detailed descriptions see Index.

1 Air volume control lever for side air outlets
2 Adjustable side air outlets
3 Exterior lamp switch
4 Hood lock release
5 Combination switch
6 Cruise control
7 Rear passenger compartment lamp switch
8 Instrument cluster
9 Horn, airbag
10 Steering lock with ignition/starter switch
11 Rear window defroster switch
12 Snow chain switch
13 Adjustable center air outlets
14 Air volume control lever for center air outlets
15 Glove box, illuminated (only with key in steering lock positions 1 or 2)
16 Fan speed control lever
17 Tempmatic climate control
18 Cassette box
19 Radio
20 Ashtray with lighter
21 Power window switch group
22 Hazard warning flasher switch
23 Adjusting switch for exterior mirror on front passenger side
24 Loudspeaker front to rear fader control
25 Left front seat heater switch
26 Right front seat heater switch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AIRBAG
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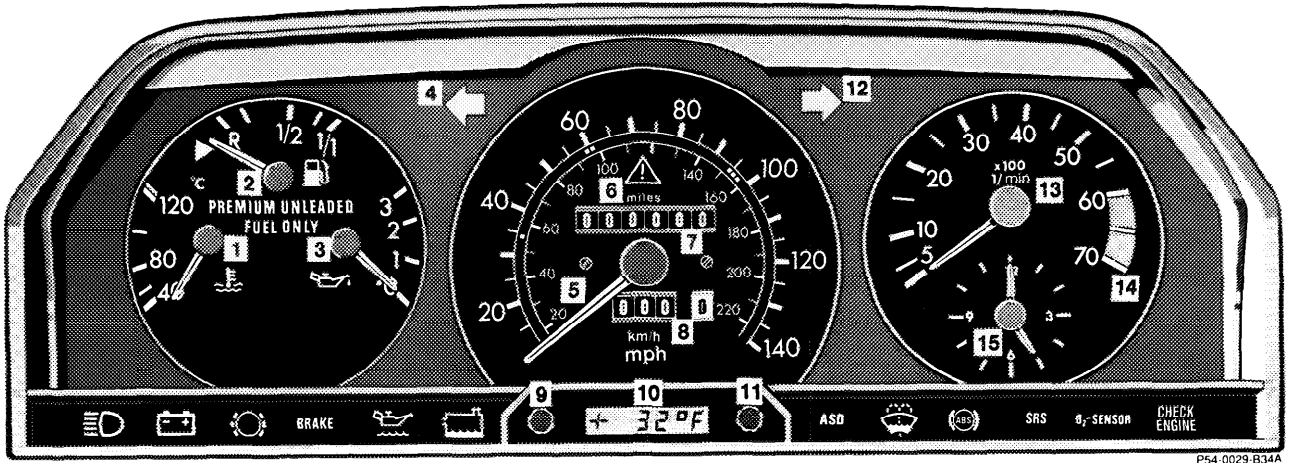


Instrument Cluster

1 Coolant temperature gauge. See Index

2 Fuel gauge with reserve warning lamp (yellow). See Index

3 Engine oil pressure gauge (bar). See Index

4 Turn signal indicator lamp, left (green)

5 Speedometer

6 ASR function indicator lamp (yellow). See Index

ASD function indicator lamp (yellow). See Index

7 Main odometer

8 Trip odometer

9 Knob for instrument lamps and trip odometer
Rotate knob: to vary intensity of instrument lamps
Depress knob: to reset trip odometer

10 Outside temperature indicator. See Index

11 Knob for clock adjustment (press in and rotate for adjustments)

12 Turn signal indicator lamp, right (green)

13 Tachometer

14 Red marking on tachometer: Excessive engine speed

15 Electric clock

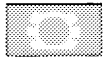
Indicator Lamp Symbols

Function Indicator Lamp

High beam

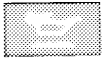
Warning Lamps
(should go out with the engine running unless)

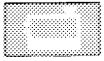
Battery not being charged.
See Index

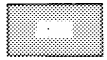

Brake pads worn down.
See Index

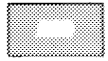
Brake fluid low (except Canada).
Parking brake engaged.
See Index

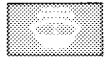
Brake fluid low (Canada only).
Parking brake engaged.
See Index

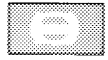

Engine oil level low. See Index


Coolant level low. See Index


ASR malfunction. See Index


ASD malfunction. See Index


Fluid level for windshield and headlamp washer system low.
See Index


ABS malfunction. See Index

SRS malfunction. See Index

190 E 2.3 (California version only)
Oxygen sensor replacement indicator lamp: When the indicator lamp comes on, the oxygen sensor must be checked and, if necessary, replaced.

Engine malfunction indicator lamp (California version only)
If the lamp comes on when the engine is running, it indicates a malfunction in the fuel injection system or emission control system. In either case, we recommend that you have the malfunction checked as soon as possible.
See Index

Catalytic Converter

Your Mercedes-Benz is equipped with monolithic catalytic converters, an important element in conjunction with the oxygen sensor to achieve substantial control of the pollutants in the exhaust emissions. Keep your vehicle in proper operating condition by following our recommended maintenance instructions as outlined in your maintenance booklet.

Caution!

To prevent damage to the catalytic converters, use only premium unleaded gasoline in this vehicle. Any noticeable irregularities in engine operation should be repaired promptly. Otherwise excessive unburned fuel may reach the converter causing it to overheat.

Warning!

As with any vehicle, do not idle, park, or operate this vehicle in areas where combustible materials such as grass, hay or leaves can come into contact with the hot exhaust system, as these materials could be ignited.

Starting and Turning Off the Engine

Before Starting

Engage parking brake and ensure gearshift lever is in neutral (selector lever position "P" or "N" on automatic transmissions). Turn key in steering lock to position 2. The charge indicator lamp should come on.

Cold Engine

Do not depress accelerator. Turn key in steering lock clockwise to the stop. Release key only when the engine is firing regularly.

Hot Engine

Do not depress accelerator. Turn key in steering lock clockwise to the stop. If the engine has not fired after approx. 4 seconds, depress accelerator and continue cranking until the engine is firing regularly. Release key and back off accelerator.

At very high coolant temperatures the engine starting time can be shortened if the accelerator is depressed slowly at the beginning of the starting process.

Turning off

Turn the key in the steering lock to position 0 to stop the engine.

Note:

Vehicles with automatic transmission: the key can only be removed with the selector lever in position "P".

If the coolant temperature is very high (e. g. after hard driving on mountain roads), do not shut off the engine immediately, but allow it to run for 1 – 2 minutes at increased idle speed with selector lever in neutral or position "P".

Important!

Due to the installed starter non-repeat feature, the key must be turned completely to the left before attempting to start the engine again.

Observe the oil pressure gauge immediately after starting the engine. In a very cold engine the oil pressure will rise slowly after the engine has started. Do not speed up the engine before pressure is registered on the pressure gauge. If you do not see the gauge register oil pressure, stop the engine and have it checked.

The charge indicator lamp should go out as soon as the engine has started.

In areas where temperatures frequently drop below -13°F (–25°C), we recommend that an engine block heater be installed. Your authorized Mercedes-Benz dealer will advise you on this subject.

Power assistance

Warning!

When the engine is not running, the brake and steering systems are without power assistance. Under these circumstances, a much greater effort is necessary to stop or steer the vehicle.

Brakes

Caution!

When driving down long and steep grades, relieve the load on the brakes by shifting into a lower gear (selector lever position “3” or “2” in the case of automatic transmission). This helps prevent overheating of the brakes and reduces brake pad wear. Do not exceed engine speed limits (see Index).

After hard braking it is advisable to drive on for some time so the air stream will cool down the brakes faster.

Warning!

After driving in heavy rain for some time without applying the brakes or through water deep enough to wet brake components, the first braking action may be somewhat reduced and increased pedal pressure may be necessary. Be sure to maintain a safe distance from vehicles in front.

The condition of the parking brake system is checked each time the car is in the shop for the required maintenance.

Between maintenance checks, it is a good practice to apply the parking brake once or twice while driving at approximately 30 mph (50 km/h) on a dry straight road. Raise parking brake lever lightly while holding the release button in until a slight drag on the wheels is felt. Keep applying brake for about 10 seconds while holding the release button in before releasing the parking brake completely. This practice will keep the parking brake at maximum efficiency.

Warning!

The stop lamps will not come on when applying the parking brake only. Perform the procedure in the previous paragraph only when the road is clear of other traffic.

Resting your foot on the brake pedal will cause excessive and premature wear of the brake pads.

It can also result in the brakes overheating thereby significantly reducing their effectiveness. It may not be possible to stop the car in sufficient time to avoid an accident.

All checks and maintenance work on the brake system should be carried out by an authorized Mercedes-Benz dealer.

If the parking brake is released and the brake warning lamp in the instrument cluster stays on, the brake fluid level in the reservoir is too low.

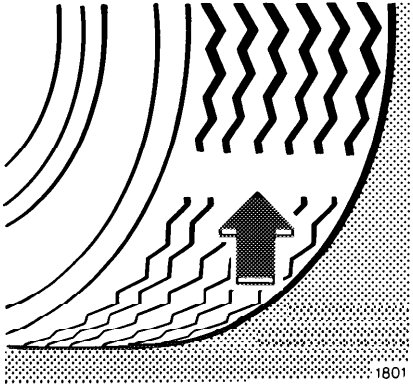
Brake pad wear or a leak in the system may be the reason for low brake fluid in the reservoir.

Have the brake system inspected at an authorized Mercedes-Benz dealer immediately.

Install only brake pads and brake fluid recommended by Mercedes-Benz.

Warning!

If other than recommended brake pads are installed, the braking properties of the vehicle can be affected to an extent that safe braking is substantially impaired.



Tires

Tread wear indicators (TWI) are required by law. These indicators are located in six places on the tread circumference and become visible at a depth of approximately 1/16 in (2 mm), at which point the tire is considered worn and should be replaced.

The tread wear indicator appears as a solid band across the tread.

Warning!

Do not allow your tires to wear down too far. With less than 1/8 in (3 mm) of tread, the adhesion properties on a wet road fall off sharply.

Depending upon the weather and/or road surface (conditions), the traction varies widely.

Specified tire pressure must be maintained. This applies particularly if the tires are subjected to high loads (e. g. high speeds, heavy loads, high ambient temperatures).

Warning!

Do not drive with a flat tire. A flat tire affects the ability to steer or brake the vehicle. You may lose control of the car. Continued driving with a flat tire or driving at high speed with a flat tire will cause excessive heat build-up and possibly a fire.

Aquaplaning

Depending on the depth of the water layer on the road, aquaplaning may occur, even at low speeds and with new tires. Avoid track grooves in the road and apply brakes cautiously in the rain.

Tire traction

The safe speed on a wet, snow covered or icy road is always lower than on a dry road.

You' should pay particular attention to the condition of the road as soon as the prevailing temperatures fall close to the freezing point.

Warning!

If ice has formed on the road, tire traction will be substantially reduced. Under such weather conditions, drive, steer and brake with extreme caution.

We recommend M + S radial-ply tires for the winter season for all four wheels to insure normal balanced handling characteristics.

On packed snow, they can reduce your stopping distance as compared with summer tires. Stopping distance, however, is still considerably greater than when the road is wet or dry.

Parking

Warning!

To reduce the risk of personal injury as a result of vehicle movement, before turning off the engine and leaving the vehicle always:

1. **Keep foot on brake pedal.**
2. **Pull up parking brake lever.**
3. **Engage first or reverse gear (selector lever position "P" in the case of automatic transmissions).**
4. **Slowly release brake pedal.**
5. **Turn front wheels towards the road curb.**
6. **Turn the key to steering lock position 0 and remove.**

Important!

It is advisable to set the parking brake whenever parking or leaving the vehicle. In addition, engage first or reverse gear (selector lever position "P").

When parking on hills, always apply the parking brake.

Clutch

Caution!

Resting your foot on the clutch pedal will cause excessive and premature wear of the clutch disc.

Winter Driving Instructions

The most important rule for slippery or icy roads is to drive sensibly and to avoid abrupt acceleration, braking and steering action. Do not use the cruise control system under such conditions.

When the vehicle is in danger of skidding, declutch, or in case of an automatic transmission move selector lever to position “N”. Try to keep the vehicle under control by corrective steering action.

Road salts and chemicals can adversely affect braking efficiency. Increased pedal force may become necessary to produce the normal brake effect. We therefore recommend depressing the brake pedal periodically when traveling at length on salt-strewn roads. This can bring road salt impaired braking efficiency back to normal. A prerequisite is, however, that this is done without endangering other drivers on the road.

If the vehicle is parked after being driven on salt treated roads, the braking efficiency should be tested as soon as possible after driving is resumed while observing the safety rules in the previous paragraph.

Warning!

If the vehicle becomes stuck in snow, make sure that snow is kept clear of the exhaust pipe and from around the vehicle with engine running. Otherwise, deadly carbon monoxide (CO) gases may enter vehicle interior resulting in unconsciousness and death.

To assure sufficient fresh air ventilation, open a window slightly on the side of the car that is out of the wind.

Please note:

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Operation

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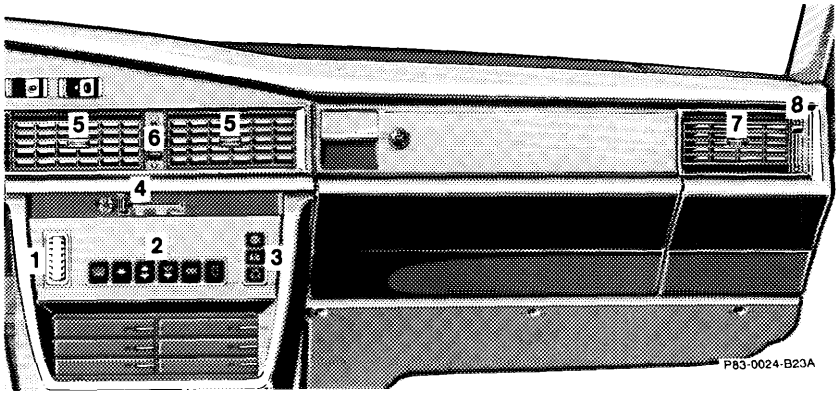


Tempmatic Climate Control

The engine must be running for the climate control system to operate.

1 Temperature selector

2 Pushbuttons for function selection (only press individually)

= Defrost

= Defog

= Heating and cooling

= Normal heating

= Normal cooling or fresh air ventilation

= Off (air supply off)

3 Air conditioning mode control

= Dehumidifying

= Normal setting

= Recirculated air switch (red indicator lamp in the button comes on. The button returns to initial position). If either button or are depressed, the air conditioning compressor is switched on.

4 Fan speed control lever

5 Adjustable air outlets

6 Volume control lever for adjustable air outlets (5)

7 Adjustable air outlets

8 Volume control lever for adjustable air outlets (7)

The button symbols light up when the vehicle's exterior lamps are turned on. The symbol is brighter when depressed.

Close all windows and the sliding roof to ensure proper operation of the system. Air outlet temperature is controlled automatically.

Note:

The air conditioner removes considerable moisture from the air during operation. It is normal for water to drip on the ground from the underbody.

Air Distribution

Air conditioned, warmed, or fresh air may be directed to the foot area, the windshield, and the side outlets (7). The center outlets (5) are for non-heated air only.

The air volume through the center outlets (5) and side outlets (7) can be varied with levers (6) and (8) respectively. Pushing the lever up opens the air outlets completely.

Temperature Selection

Use the temperature selector to set the desired temperature. The selected temperature is reached as quickly as possible and maintained. Use a basic setting of "72". Refine your setting only in small steps to avoid large temperature fluctuations.

Turning downwards (notched-in) = maximum cooling or fresh air dependent on push button selection of the air conditioning mode control.

Turning upwards (notched-in) = maximum heating.

A/C Mode Control Switch

Position A/C = Normal cooling, the air conditioning compressor is switched on.
The vehicle may be heated or cooled as desired. The compressor comes on if the vehicle's interior temperature exceeds the selected temperature. The selected temperature is then maintained by regulating the compressor's running time.

Position = Dehumidifying, the air conditioning compressor is switched on.

The climate control system works at maximum capacity, removing moisture from the air. This mode is recommended during humid weather and when windows must be defogged from inside.

Position = Recirculated air (buttons or must not be depressed).

Recirculated air switch pressed:

- Cooling Mode
  If the outside temperature exceeds approx. 59° F (15°C), the system will automatically change from recirculated air to fresh air after 30 minutes.
- Heating Mode
  If the outside temperature is less than approx. 59°F (15°C), the system will automatically change from recirculated air to fresh air after 5 minutes.

This setting can also be used if annoying odors or dust are entering the car's interior.

At high outside temperatures the air conditioning system is automatically in the recirculated air mode, providing increased cooling.

Fan Speed Selection

When pushing one of these buttons , , , or button , the fan speed will correspond to the particular position of the fan speed control lever (4).

The volume of fresh air supplied to the vehicle interior can be increased by pushing lever (4) to the right.

The fan speed may be changed by moving lever (4) to position “II”, “III” or “max”.

Function = Maximum fan speed engaged.

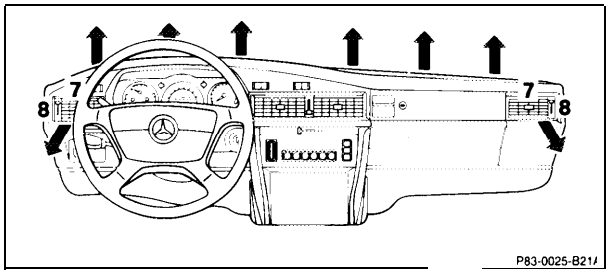
Fast Cooling

- Turn temperature selector wheel (1) and lock in the lower end position.
- Push button or in mode control (3).
- Push button.
- Move fan speed control lever (4) to far right “max” position.
- Open adjustable air outlets (5) and (7) completely by pushing up levers (6) and (8), respectively.
- Close windows and sliding roof completely.

Note:

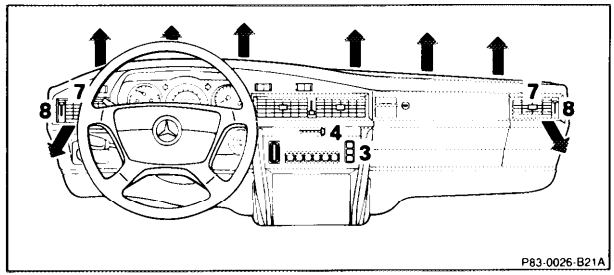
Open the windows and/or sliding roof long enough to let hot air inside the car escape. This helps reduce the time the air conditioner must run before the car cools. Then, close windows and/or sliding roof and allow air conditioner to operate to its full capacity.

Examples of Air Flow Adjustments



Press to defrost or quickly defog windows.

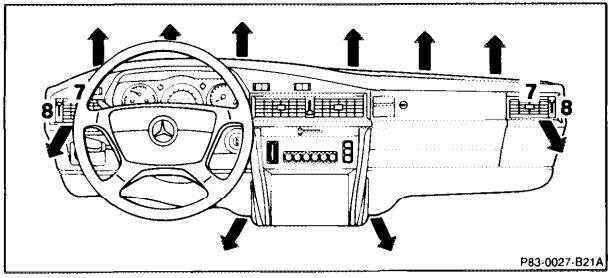
Maximum heated air is directed to the windshield and side windows, independent of the temperature setting (1), mode control (3) and fan speed control lever (4) position. The air volume through outlets (7) may be adjusted with levers (8) as desired.



Press to defog the inside of the windshield.

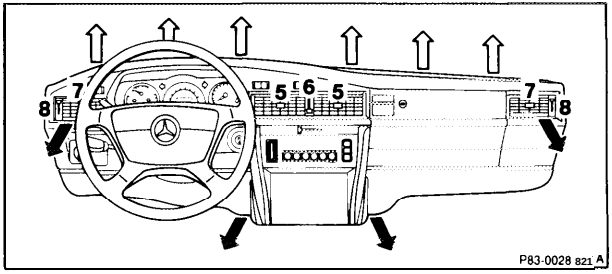
Air is directed to the windshield in the heating or cooling mode. Press button of mode control (3) and increase fan speed for a short period with lever (4). Adjust levers (8) for the desired air flow through outlets (7).

It is possible for condensation to form on the outside of the windshield in humid weather in this mode. If this happens, change the air flow or decrease the fan speed.



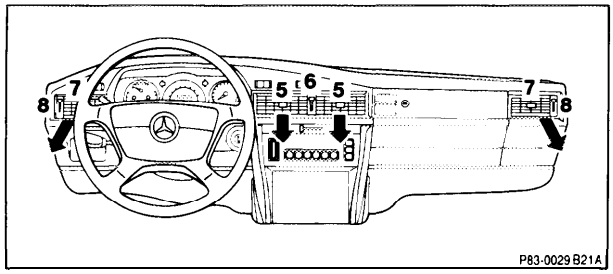
Press for heating.

In this type of operation, air is directed to the windshield and the foot area. The air outlets (7) may be opened or closed with levers (8) as desired.
If the ambient temperature is above 32°F (0°C) the air conditioning compressor may switch on automatically to dry the heated air.



Press for normal heater operation.

Most of the air is directed to the foot area during heater operation. A small amount of air is directed to the windshield, just enough to keep it from fogging up during normal weather conditions. The air outlets (5) and (7) may be opened or closed with levers (6) and (8) respectively as desired. Only non-heated air is directed through outlets (5).



Press for fresh air ventilation or air conditioning.

For taking in fresh air or during air conditioner operation, the air is directed to outlets (5) and (7). Adjust the air flow with levers (6) and (8) respectively as desired.

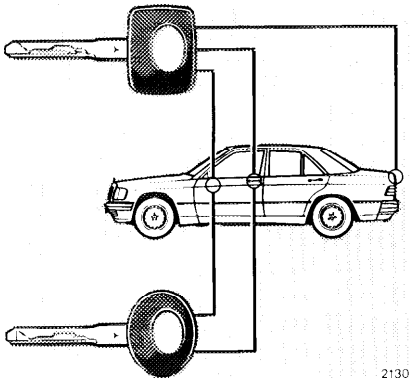
Off.

In this setting, the Tempmatic Climate Control is shut off, including the fresh air supply to the interior of the car (to prevent entrance of odors, i. e. while driving through tunnels etc. or to prevent the entrance of water from automatic car wash). Use this setting only temporarily while driving with windows and sliding roof closed since the vehicle's normal interior airflow will be disrupted.

Important!

Inappropriate repair work may cause refrigerant (CFC) to escape into the atmosphere and contribute to the depletion of the earth's ozone layer.

Repairs should always be performed by a qualified technician, and refrigerant should be collected in a recovery system for recycling.



Car Keys

Included with your vehicle are two master keys, one valet key and one flat (master) key.

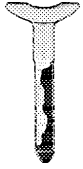
Master Key – square head **–** fits all locks on the car. Arms/disarms the anti-theft alarm system.

Note:

Do not give the master key to an unauthorized oerson.

Valet Key – round head **–** works only in the door locks and the steering lock. Arms/disarms the anti-theft alarm system. The valet key will not fit the trunk or glove box locks. This key should be used whenever the car is left with an attendant. Be sure to lock glove box and trunk with the master key.

Flat Key



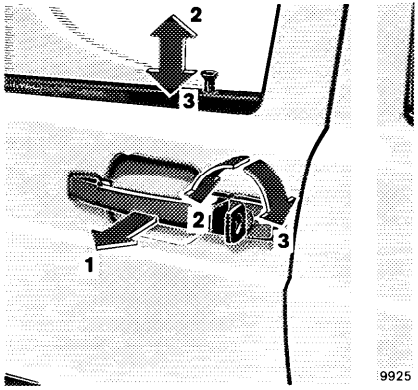
The flat key fits all vehicle locks. Arms/ disarms the anti-theft alarm system. We recommend that you carry the flat key with you and keep it in a safe place so that it is always handy. Never leave the flat key in the vehicle.

Obtaining Replacement Keys

Your vehicle is equipped with a theft deterrent locking system requiring a special key manufacturing process. For security reasons, replacement keys can only be obtained from your authorized Mercedes-Benz dealer.

Warning!

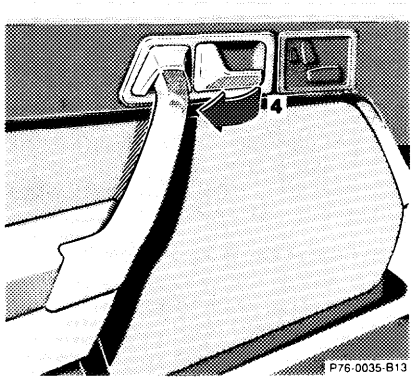
When leaving the vehicle always remove the key from the steering lock. Do not leave children unattended in the vehicle. Unsupervised use of vehicle equipment may cause serious personal injury.



Opening the Doors

From outside: pull handle (1) outwards.

From inside: pull handle (4) in door trim panel.



Locking and Unlocking of Doors

From the outside: turn key.

From the inside: actuate door lock button.

2 Unlocking
3 Locking

When the rear door lock buttons are down, the rear doors cannot be opened from the outside or the inside, unless the door lock buttons are first pulled up.

One cannot lock:

- the driver's door if it is open
- any door if the door latch has not engaged fully. In this case open the door and close it again.

Central Locking System

The entire vehicle may be locked or unlocked with the central locking system by:

- Using the master or valet key in either front door.
- Using the master key in the trunk lock.
- Pushing down or pulling up the interior door lock button at either front door.

The central locking system locks or unlocks all doors, trunk lid and fuel filler flap simultaneously.

Doors

When you lock the car, all door lock buttons should move down. If any one stays up, the respective door is not properly closed. You should then unlock the car, open and reclose this door, and lock the car again.

The central locking system can be engaged from the driver's door lock button, provided the door is completely closed. It can also be engaged from the front passenger door if the ignition key is removed, or the key is inserted in the steering lock without having been turned (key in position 0).

If the car has been locked from the outside, the anti-theft alarm (if so equipped) will come on if a door is opened from the inside.

Trunk

To unlock the trunk with the central locking system, turn the master key in the trunk lock completely to the left and return it to the vertical position. Push in trunk lock button and open the trunk. To lock the trunk, turn the master key completely to the right and return it to the vertical position.

The trunk can remain locked while the central locking system is unlocked (e. g. while driving or when leaving the car in a situation where it must be driven using the valet key but you wish the trunk to remain locked at parking lots, workshops etc.). Turn the master key completely to the right and pull it out in the horizontal position. Now the trunk can only be unlocked with the master key by turning it back completely to the left.

Important!

If the trunk is unlocked with the master key, the doors and fuel filler flap will also be unlocked. After closing the trunk, the central locking system must again be engaged using the key to relock the doors and fuel filler flap.

Note:

If the fuel filler flap cannot be opened, refer to *Manual Release of Fuel Filler Flap (see* Index).

Anti-Theft Alarm System

The anti-theft alarm is automatically armed or disarmed with the master key, valet key or flat key by locking or unlocking either front door or the trunk.

Operation

Once the alarm system has been armed, the exterior vehicle lamps will flash and the horn will sound intermittently when someone:

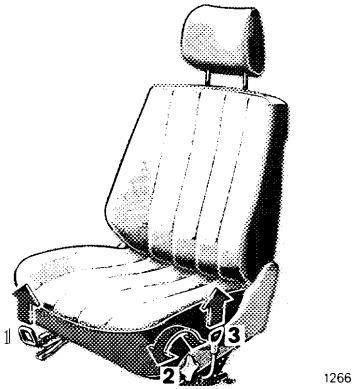
- opens a door,
- opens the trunk,
- opens the hood,
- removes the radio,
- switches on or bridges the ignition circuit,
- steps on the brake pedal.

The alarm will last approximately 150 seconds in the form of blinking exterior lamps. At the same time an additional horn will sound intermittently for 60 seconds, pause for 30 seconds, and repeat for another 60 seconds.

The alarm will stay on even if the activating element (a door, for example) is immediately closed.

Note:

We recommend that you carry the flat key safely with you so that it is always handy. This key has the same function as the master key.



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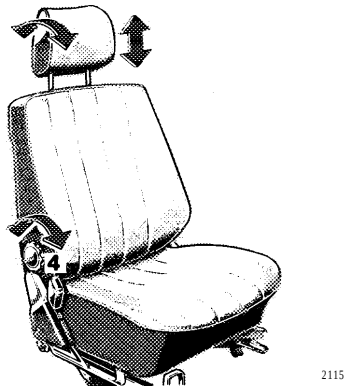

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Manual Seat Adjustment, Front

1 Fore/aft adjustment
2 Seat cushion inclination adjustment
3 Seat height adjustment
4 Seat back adjustment

Fore/aft adjustment: lift handle (1); slide seat to desired position and allow handle to re-engage. Check for proper engagement before driving.

Inclination of seat cushion: turn handwheel (2) forward or backward.

Height of seat: raise lever (3); to raise seat, slide seat forward; to lower seat, slide seat backward; allow lever to re-engage. Check for proper engagement before driving.

Seat back position: turn handwheel (4). For full reclining of backrest, seat should be moved to one of the forward-most positions and head restraint removed. For driving, return backrest to upright position and push seat back. Replace head restraint.

Head restraint: to adjust the height of the head restraint, pull it slightly forward while lifting or pushing down. Adjust head restraint to support the back of the head approximately at ear lever. However, do not pull up the head restraint past the detent.

Warning!

Do not adjust the driver's seat while driving. Adjusting the seat while driving could cause the driver to lose control of the vehicle.

Never ride in a moving vehicle with the seat back reclined. Sitting in an excessively reclined position can be dangerous. You could slide under the seat belt in a collision. If you slide under it, the belt would apply force at the abdomen or neck. That could cause serious or even fatal injuries. The seat back and seat belts provide the best restraint when the wearer is in an upright position and belts are properly positioned on the body.

Never place hands under seat or near any moving parts while a seat is being adjusted.

Caution!

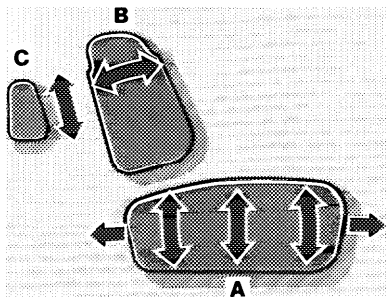
Do not remove head restraints except when mounting seat covers. For removal refer to *Head Restraints* in Index. Whenever restraints have been removed be sure to reinstall them before driving.

Important!

Prior to operating the vehicle, the driver should adjust the seat height for proper vision as well as fore/aft placement and seat back angle to insure adequate control, reach, operation, and comfort. The head restraint should also be adjusted for proper height.

Both the inside and outside rear view mirrors should be adjusted for adequate rearward vision. Fasten seat belts. Infants and small children should be seated in a properly secured restraint system that complies with U.S. Federal Motor Vehicle Safety Standard 213 and Canadian Motor Vehicle Safety Standard 213.1.

All seat, head restraint, and rear view mirror adjustments as well as fastening of seat belts should be done before the vehicle is put into motion.



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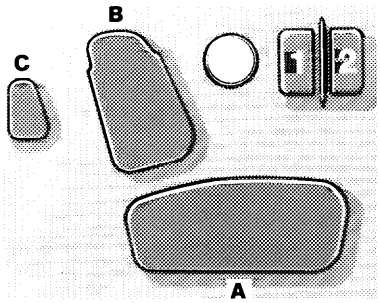

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Power Seats, Front

The switches are located in each front door, if your vehicle is equipped with front power seats.

Turn key in steering lock to position 1 or 2 (with the driver's or front passenger's door open, the power seats can also be operated with the key removed or in steering lock position 0).

Seat and head restraint adjustment:

A Seat cushion adjustment.

B Seatback adjustment.

C Head restraint adjustment. Adjust head restraint to support the back of the head approximately at ear level. The head restraint can also be tilted forward by hand.

Note:

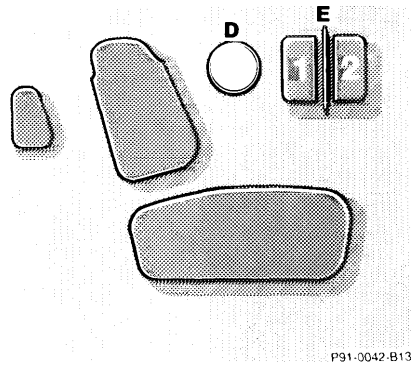
If the car is equipped with power head restraints, do not try to operate manually.

Warning!

Do not adjust the driver's seat while driving. Adjusting the seat while driving could cause the driver to lose control of the vehicle.

Never ride in a moving vehicle with the seat back reclined. Sitting in an excessively reclined position can be dangerous. You could slide under the seat belt in a collision. If you slide under it, the belt would apply force at the abdomen or neck. That could cause serious or even fatal injuries. The seat back and seat belts provide the best restraint when the wearer is in an upright position and belts are properly positioned on the body.

Never place hands under seat or near any moving parts while a seat is being adjusted.



Storing seat/head restraint positions in memory:

D Memory button.

E Position buttons "1" and "2".

Two sets of seat/head restraint positions may be programmed into memory. After the seat/head restraint are positioned, push memory button D, release, and within 3 seconds push position button "1". A second set of positions for the same seat/head restraint can be programmed into memory by pushing first button D and then "2".

Recalling seat/head restraint positions stored in memory:

To recall a seat/head restraint position, push position button "1" or "2" until seat/head restraint movement has stopped. For safety reasons, the seat/head restraint movement stops after releasing the position button.

Caution!

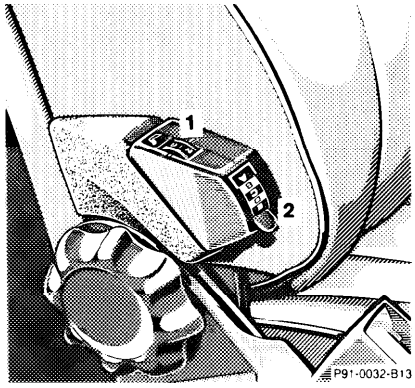
Do not remove head restraints except when mounting seat covers. For removal refer to *Head Restraints, Front, see* Index. Whenever restraints have been removed be sure to reinstall them before driving.

Important!

Prior to operating the vehicle, the driver should adjust the seat height for proper vision as well as fore/aft placement and seat back angle to insure adequate control, reach, operation, and comfort. The head restraint should also be adjusted for proper height.

Both the inside and outside rear view mirrors should be adjusted for adequate rearward vision. Fasten seat belts. Infants and small children should be seated in a properly secured restraint system that complies with U.S. Federal Motor Vehicle Safety Standard 213 and Canadian Motor Vehicle Safety Standard 213.1.

All seat, head restraint, and rear view mirror adjustments as well as fastening of seat belts should be done before the vehicle is put into motion.



Orthopedic Seat Backrest

1 Pressure regulator

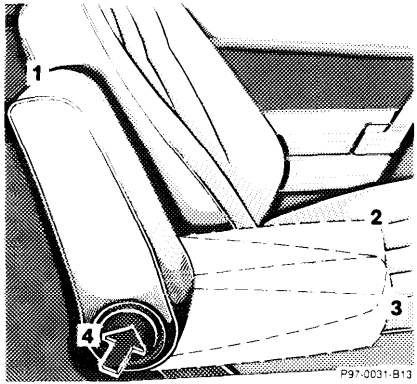
2 Height regulator

Some models may be equipped with orthopedic seats. These seats have inflatable air cushions built into the backrest to provide additional lumbar support. The amount of cushion height and curvature may be adjusted after turning the key in steering lock to position 2.

The inflation pressure of the air cushion can be varied continuously between position “0” = without pressure, and position “4” = maximum pressure, by changing the pressure regulator (1) setting.

In addition, the cushion height may be changed to five different settings between position “A” = lowest setting, and “E” = highest setting, by varying the height regulator (2) adjustment.

If the engine is turned off, the last cushion setting is retained in memory, and automatically adjusts the cushion to this setting when the engine is restarted.



Armrest (Front Seats)

1 Armrest folded up.

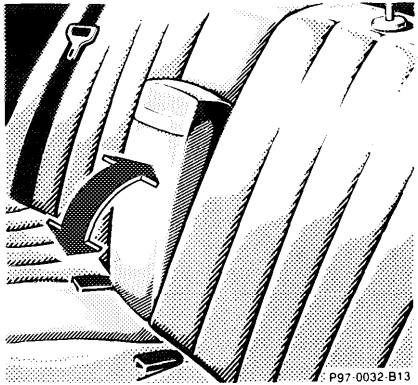
2 For normally inclined seat back.

3 For extremely inclined seat back.

4 To adjust armrest downwards, press release button.

Warning!

The arm rest does not suffice as a child restraint system. In case of a frontal collision a child can be catapulted forward over the locked arm rest.

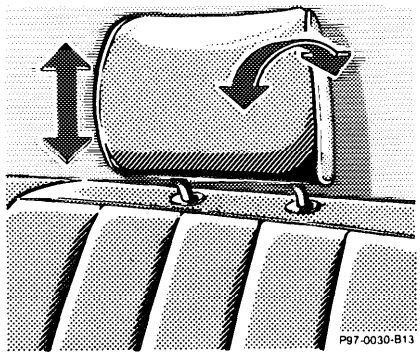


Infants and small children should always be seated in a properly secured restraint system that complies with U.S. Federal Motor Vehicle Safety Standard 213 and Canadian Motor Vehicle Safety Standard 213.1.

Armrest (Rear Bench Seat)

Pull down the armrest by its strap.

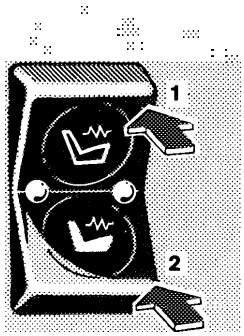
For removal of rear seat cushion, see Index.



Head Restraints, Rear

Adjust head restraint to support the back of the head approximately at ear level. Do not extend the head restraint past the stop.

For removal of head restraint refer to Head *Restraints* in Index.



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Heated Seats

1 Normal heating mode

2 Rapid heating mode

The seat heaters can be switched on with the key in steering lock position 2.

Heater operation:

Push in upper switch portion; position 1 = normal heating mode, one indicator lamp lights up.

Push in lower switch portion; position 2 = rapid heating mode, both indicator lamps light up.

After approximately 5 minutes in the rapid heating mode, the heater automatically switches to normal operation and only one indicator lamp will stay on.

Turning off heater:

If one indicator lamp is on, press in upper part of switch, position 1.

If both indicator lamps are on, press in lower part of switch, position 2.

The heater automatically turns off after approximately 30 minutes of operation.

Notes:

When in operation, the seat heater consumes a large amount of power. It is advisable not to use the seat heater longer than necessary.

The seat heaters may automatically switch off if too many power consumers are switched on at the same time, or if the battery charge is low. When this occurs, the indicator lamp in the switch will blink (both indicator lamps blink during rapid seat heating). The seat heaters will switch on again as soon as sufficient voltage is available.

If the blinking of the indicator lamps is distracting to you, the seat heaters can be switched off.

Seat Belts and Supplemental Restraint System (SRS)

Your vehicle is equipped with seat belts for all seats, emergency tensioning retractors for the front seats, and a driver airbag and knee bolster.

Seat Belts

Important!

Laws in most states and all Canadian provinces require seat belt use.

All states and provinces require use of child restraints that complies with U.S. Federal Motor Vehicle Safety Standard 213 and Canadian Motor Vehicle Safety Standard 213.1. We strongly recommend their use.

Warning!

Never ride in a moving vehicle with the seat back reclined. Sitting in an excessively reclined position can be dangerous. You could slide under the seat belt in a collision. If you slide under it, the belt would apply force at the abdomen or neck. That could cause serious or even fatal injuries. The seat back and seat belts provide the best restraint when the wearer is in an upright position and belts are properly positioned on the body.

Seat Belt Warning System

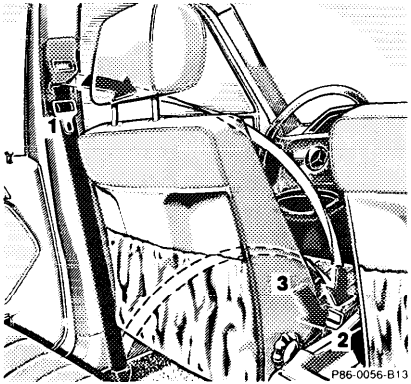
With the key in steering lock position **2,** an audible warning sounds for a short time if the driver's seat belt is not fastened.

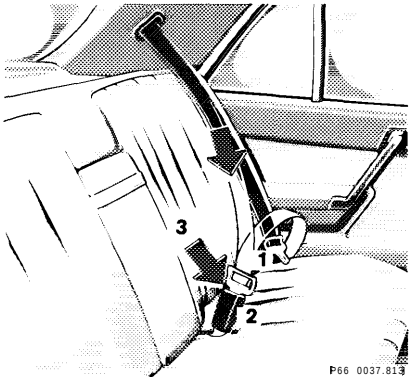
When someone enters the car (front) the reminder lamp, located below the front interior/reading lamp, flashes for a short time to remind all occupants to fasten seat belts.

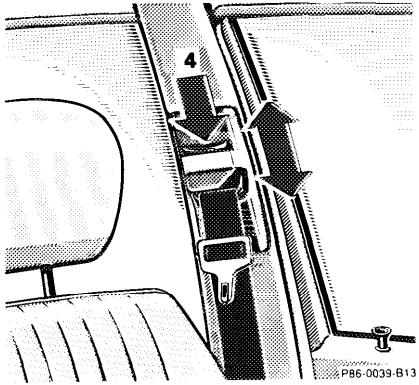
Warning!

If you are ever in an accident, your injuries can be considerably more severe without your seat belt properly buckled. Without your seat belt buckled, you can hit the interior of the vehicle or be ejected from it. You can be seriously injured or killed.

In the same crash, the possibility for injury or death is lessened with your seat belt buckled.







1 Latch plate

2 Buckle

3 Release button

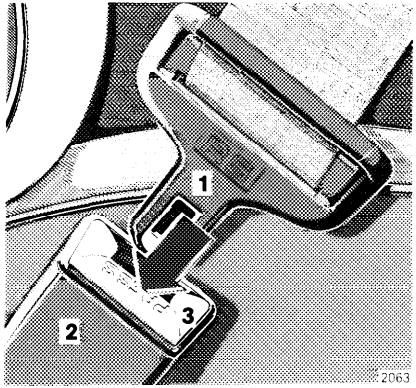
Fastening of Seat Belts

Pull belt with latch plate (1) across shoulder and lap so that the lap belt is positioned as low as possible on your hips and not across the abdomen. Do not twist the belt. For safety reasons, avoid adjusting the seat or seat back into positions which could affect the correct seat belt position.

Push latch plate (1) into buckle (2) until it clicks.

Adjust front seat belts so that the shoulder portion of the belt is located as close as possible to the middle of the shoulder (it should not touch the neck). For this purpose, raise or lower the belt outlet (3 positions). To lower the belt outlet, press button (4).

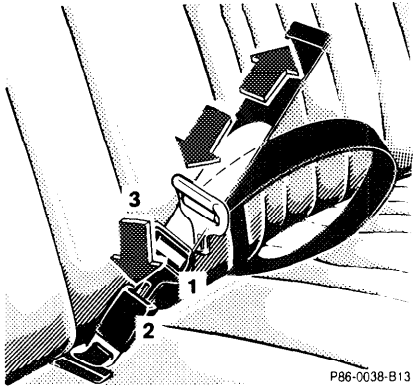
The shoulder portion of the seat belt must be pulled snug and checked for snugness immediately after engaging it and during driving. Tighten the lap portion to a snug fit by pulling shoulder portion up.



Unfastening of Seat Belts

Push in the red button (3) in the belt buckle (2).

Allow the retractor to completely rewind the seat belt by guiding the latch plate (1).



Operation:

The inertia reel stops the belt from unwinding during sudden vehicle stops or when quickly pulling on the belt.

The locking function of the reel may be checked by quickly pulling out the belt.

The emergency tensioning retractors tighten the fastened front seat belts during frontal and front-angled impacts exceeding the first threshold of the SRS (see Index).

Lap Belt for Center Seating Position of the Rear Seat

Pull belt with latch plate (1) over lap so that the belt is positioned as low as possible on your hips and not across the abdomen. Push latch plate (1) into buckle (2) until it clicks. Do not twist the belt but keep it tight.

To tighten the belt: With the latch plate engaged, pull the loose end of the belt.

To lengthen the belt: With the belt unfastened, turn the latch plate so that it is a little more than 90° perpendicular to the belt, then extend the belt. Fasten the belt and tighten as stated above.

To disengage the belt, push red button (3) in the buckle.

If the center seat is not occupied, the belt buckle and rolled-up seat belt can be stored in the space next to the rear arm rest (to the left or right of armrest).

Note:

For cleaning and care of the seat belts, see Upholstery in Index.

Warning!

USE SEAT BELTS PROPERLY.

- **Each occupant should wear their seat belt at all times. Together with the "SRS" (driver airbag, ETR's, driver – side knee bolster), the seat belt offers the best conditions for protection of the body in case of major frontal impact.**
- **Improperly positioned seat belts do not provide maximum protection and may cause serious injuries in case of an accident.**
- **Never wear the shoulder belt under your arm, against your neck or off your shoulder. In a crash, your body would move too far forward. That would increase the chance of head and neck injuries. The belt would also apply too much force to the ribs, which could severely injure internal organs such as your liver or spleen.**
- **Position the lap belt as low as possible on your hips and not across the abdomen. If the belt is positioned across your abdomen, it could cause serious injuries in a crash.**
- **Each seat belt should never be used for more than one person at a time. Do not fasten a seat belt around a person and objects.**
- **Belts should not be worn twisted. In a crash, you wouldn't have the full width of the belt to take impact forces. The twisted belt against your body could cause injuries.**
- **Pregnant women should also use a lap-shoulder belt. The lap belt portion should be positioned as low as possible on the hips to avoid any possible pressure on the abdomen.**

USE CHILD RESTRAINTS PROPERLY.

- **Infants and small children must be seated in an infant or child restraint system, which is properly secured by a lap belt or lap belt portion of a lap-shoulder belt. Children could be endangered in an accident if their child restraints are not properly secured in the vehicle.**
- **According to accident statistics, children are safer when properly restrained in the rear seating positions than in the front seating positions.**
- **Children too big for child restraint systems should ride in rear seats using regular seat belts. Position shoulder belt across chest and shoulder, not face or neck. A booster seat may be necessary to achieve proper belt positioning.**

Supplemental Restraint System (SRS)

The SRS uses two crash severity levels (thresholds) to activate either the ETR or airbag or both. Activation depends on the direction and severity of the impact, exceeding the thresholds and fastening of the seat belt.

Seat belt fastened

- first threshold exceeded: ETR activates
- second threshold exceeded: airbag also activates

Seat belt not fastened

- first threshold exceeded: airbag activates, but not ETR

Driver and front passenger systems operate independently from each other.

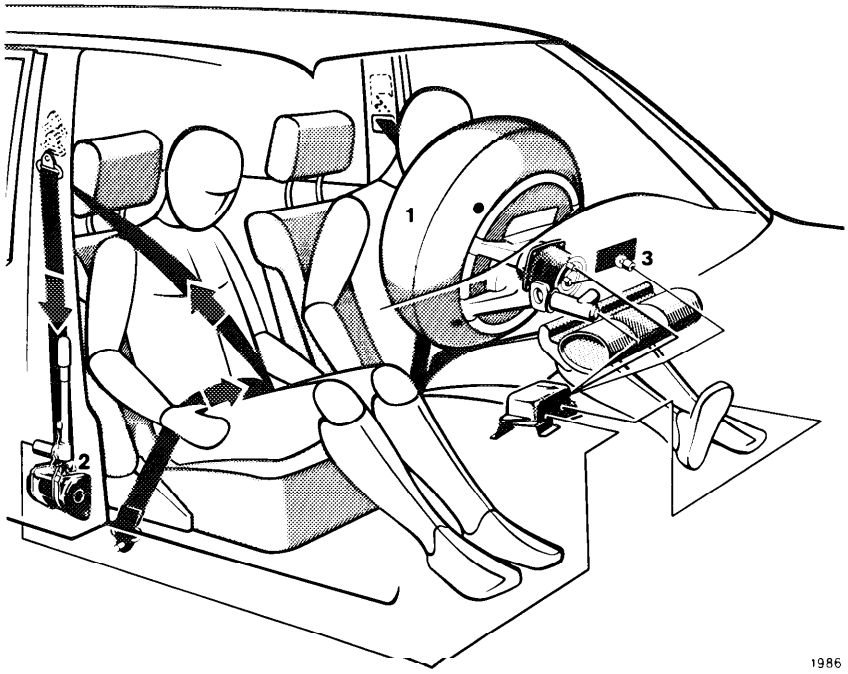
Emergency Tensioning Retractor (ETR)

The seat belts for the front seats are equipped with emergency tensioning retractors. These tensioning retractors are located in each belt's inertia reel and become operationally ready with the key in steering lock position 1 or 2.

The emergency tensioning retractors are designed to activate only when the seat belts are fastened during frontal and front-angled impacts exceeding the first threshold of the SRS. They remove slack from the belts in such a way that the seat belts fit more snugly against the body restricting its forward movement as much as possible.

In cases of other frontal impacts, roll-overs, certain side impacts, rear collisions, or other accidents without frontal forces, the emergency tensioning retractors will not be activated. The driver and passengers will then be protected by the fastened seat belts and inertia reel in the usual manner.

For seat belt and emergency tensioning retractor safety guidelines see Safety *Guidelines* in Index.



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Driver Airbag

The most effective occupant restraint system yet developed for use in production vehicles is the seat belt. In some cases, however, the protective effect of seat belts can be further enhanced by an airbag.

The driver airbag (1) is located in the steering wheel hub and, in conjunction with wearing the seat belts with emergency tensioning retractors (2), provides increased protection for the driver.

The operational readiness of the airbag system is verified by the indicator lamp "SRS" (3) in the instrument cluster. If no fault is detected, the lamp will go out after approximately 4 seconds; after the lamp goes out, the system continues to monitor the components and circuitry of the airbag system and will indicate a malfunction by coming on again.

The following system components are monitored or undergo a self-check: crash-sensor, airbag ignition circuit, driver and front passenger seat belt buckles. Initially, when the key is turned from steering lock position 0 to positions 1 or 2, malfunctions in the crash-sensor are detected and indicated (the "SRS" indicator lamp stays on longer than 4 seconds).

In the operational mode, after the indicator lamp has gone out following the initial check, interruptions and short circuits in the airbag ignition circuit and in the driver and front passenger seat belt buckle harnesses, and low voltage in the entire system are detected and indicated.

In the event a malfunction of the "SRS" is indicated as outlined above, the "SRS" may not be operational. We strongly recommend that you visit an authorized Mercedes-Benz dealer immediately to have the system checked; otherwise the "SRS" may not be activated when needed.

Important!

The airbag is designed to activate only in certain frontal and front-angled impacts. Only during these types of impacts will it provide its supplemental protection. The driver should always wear the seat belt, otherwise it is not possible for the airbag to provide its intended protection.

In cases of other frontal impacts, roll-overs, certain side impacts, rear collisions, or other accidents without frontal forces, the airbag will not be activated. The driver and passengers will then be protected by the fastened seat belts.

Important!

The "SRS" is designed to reduce the potential of injury in certain frontal and front-angled impacts which may cause injuries, however, no system available today can totally eliminate injuries and fatalities.

The activation of the "SRS" temporarily releases a small amount of dust from the airbag. This dust, however, is neither injurious to your health, nor does it indicate a fire in the vehicle.

The service life of the airbag extends to the date indicated on the label located on the driver-side door latch post. To provide continued reliability after that date, it should be inspected by an authorized Mercedes-Benz dealer at that time and replaced when necessary.

Warning!

It is very important for your safety to be in a properly seatinged position and to wear your seat belt.

For maximum protection in the event of a collision always be in a normal seated position with your back against the seat back. Fasten your seat belt and ensure that it is properly positioned on the body.

Since the airbag inflates with considerable speed and force, a proper seating position will keep you a safe distance from the airbag:

- **Sit properly belted in an upright position with your back against the seat back.**
- **Do not lean with your head or chest close to the steering wheel or dashboard.**
- **Adjust the passenger seat as far as possible rearward from the dashboard, especially if a child restraint is installed.**
- **Infants and small children should only be seated in a rear seat and be properly secured in a child restraint system.**

Failure to follow these instructions can result in severe injuries to you or other occupants.

Safety Guidelines for the Seat Belt, Emergency Tensioning Retractor and Airbag

Warning!

- **Damaged belts or belts that were highly stressed in an accident must be replaced and their anchoring points must also be checked. Use only belts installed or supplied by an authorized Mercedes-Benz dealer.**
- **Do not pass belts over sharp edges.**
- **Do not make any modification that could change the effectiveness of the belts.**
- **The "SRS" is designed to function on a one-time only basis. An airbag or emergency tensioning retractor (ETR) that was activated must be replaced.**
- **No modifications of any kind may be made to any components or wiring of the "SRS". This includes the installation of additional trim material, badges etc. over the steering wheel hub and installation of additional electrical/electronic equipment on or near "SRS" components and wiring.**
- **Several airbag system components at the steering wheel get hot after the airbag has inflated. Don't try to touch them.**
- **Improper work on the system, including incorrect installation and removal, can lead to possible injury through an uncontrolled activation of the "SRS".**
- **In addition, through improper work there is the risk of rendering the "SRS" inoperative. Work on the "SRS" must therefore only be performed by an authorized Mercedes-Benz dealer.**
- **When scrapping the airbag unit or emergency tensioning retractor, it is mandatory to follow our safety instructions. These instructions are available at your authorized Mercedes-Benz dealer.**

When you sell the vehicle we strongly urge you to give notice to the subsequent owner that it is equipped with an "SRS" by alerting him to the applicable section in the Owner's Manual.

Infant and Child Restraint Systems

We recommend that all infants and children be restrained at all times while the vehicle is in motion.

Important!

The use of infant or child restraints is required by law in all 50 states and all Canadian provinces.

Infants and small children should be seated in an infant or child restraint system, which is properly secured by the lap belt or lap belt portion of a lap-shoulder belt, and that complies with U.S. Federal Motor Vehicle Safety Standard 213 and Canadian Motor Vehicle Safety Standard 213.1. A statement by the child restraint manufacturer of compliance with this standard can be found on the instruction label on the restraint and in the instruction manual provided with the restraint.

When using any infant or child restraint system, be sure to carefully read and follow all manufacturer's instructions for installation and use.

Warning!

According to accident statistics, children are safer when properly restrained in the rear seating positions than in the front seating positions.

Infants and small children should never be held on the lap while the vehicle is in motion. During an accident they would be almost impossible to hold, and could be crushed between the adult and the dashboard.

Infants and small children should never share a seat belt with another occupant. During an accident, they could be crushed between the occupant and seat belt.

Children too big for child restraint systems should ride in rear seats using regular seat belts. Position shoulder belt across chest and shoulder, not face or neck. A booster seat may be necessary to achieve proper belt positioning.

When the child restraint is not in use, remove it from the car or secure it with the seat belt to prevent the child restraint from becoming a projectile in the event of an accident.

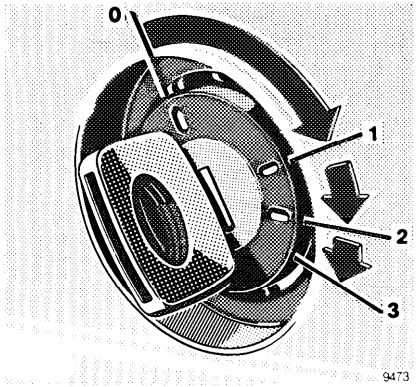
U.S.A. Models only

Since 1986 all U.S. child restraints comply with U.S. regulations without the use of a tether strap.

Canada Models only:

This vehicle can be equipped with tether anchorages for a top tether strap. Consult your authorized Mercedes-Benz dealer for installation of these anchorages.

In compliance with Canadian Motor Vehicle Safety Standard 210.1, child restraint tether anchorage hardware is attached to the tool kit located in the trunk.



Steering Lock

0 The key can be withdrawn in this position only. The steering is locked with the key removed from the steering lock.

In models equipped with automatic transmission, the key can be removed only with the selector lever in position "P". After removing the key or with the key in steering lock position 0, the selector lever is locked in position "P".

Warning!

Models with manual transmission: Do not remove key from the steering lock while the vehicle is in motion as this will cause the engagement of the steering lock thus rendering the vehicle impossible to steer.

1 Steering is unlocked. (If necessary, move steering wheel slightly to allow the key to be turned clockwise to position 1.)

2 Driving position.

3 Starting position.

Refer to Index for *Starting and* turning *off* the engine.

Warning!

When leaving the vehicle always remove the key from the steering lock. Do not leave children unattended in the vehicle. Unsupervised use of vehicle equipment may cause serious personal injury.

Notes:

The following items can be operated with the key in steering lock position 1:

Wiper,

windshield washer system, headlamp cleaning system (only in exterior lamp switch positions or)

headlamp flasher,

lighter,

glove box lamp,

sliding roof,

rear window defroster,

power windows,

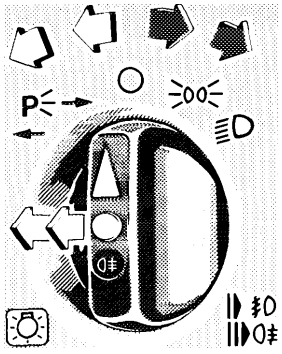
power seats.

An audible warning will sound when the driver's door is opened with the key in steering lock position 1 or 0.

With the engine at idle speed, the charging rate of the alternator (output) is limited.

It is therefore recommended to turn off unnecessary electrical consumers while driving in stop-and-go traffic. This precaution helps to avoid draining of the battery.

Unnecessary strain on the battery and charging system may be minimized by turning off the following power consumers, for example: Heated seats, rear window defroster.



Exterior Lamp Switch

Canada only:
When the engine is running, the low beam (includes parking lamps, side marker lamps, taillamps, license plate lamps and instrument panel lamps) are automatically switched on.

Note:

For nighttime driving the exterior lamp switch should be turned to position to permit activation of the high beam headlamps.

Off

Parking lamps (includes side marker lamps, taillamps, license plate lamps, instrument panel lamps)
Canada only:
When the engine is running, the low beam is additionally switched on.

Parking lamps plus low beam or high beam headlamps (combination switch pushed forward)

Standing lamps, right (turn left one stop)

Standing lamps, left (turn left two stops)

Fog lamps (pull out one stop) with parking and/or headlamps on

Rear fog lamp (pull out to 2nd detent) In addition to fog lamps. Indicator lamp in lamp switch comes on.

Standing Lamps

When the vehicle is parked on the street the standing lamps (right or left side parking lamps) can be turned on, making the vehicle more visible to passing vehicles.

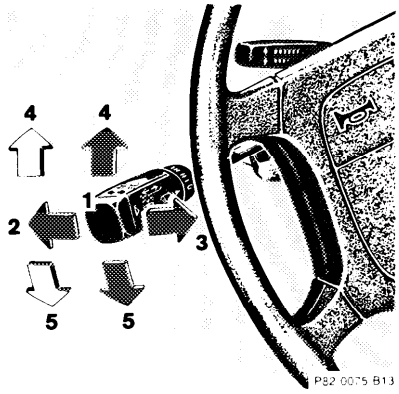
The standing lamps can only be operated with the key in steering lock position 0 or 1.

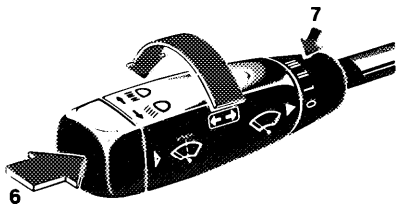
Notes:

With the key removed and the driver's door open, an audible warning will sound if the vehicle's exterior lamps (except standing lamps) are not switched off.

Fog lamps will operate together with the parking lamps and the low or high beam headlamps. Fog lamps should only be used in conjunction with low beam headlamps. Consult your state Motor Vehicle Regulations regarding allowable lamp operation.

Fog lamps are automatically switched off when the exterior lamp switch is turned to position .





Combination Switch

1 Low beam (with exterior lamp switch turned to position ≡D)

2 High beam (with exterior lamp switch turned to position ≡D)

3 Wigh beam flasher (high beam available independent of exterior lamp switch position)

4 Turn signals, right

5 Turn signals, left

To operate the turn signals, move the combination switch past the point of resistance (up or down). The switch is automatically canceled when the steering wheel is turned to a large enough degree.

To signal minor directional changes, such as changing lanes on a highway, move combination switch to the point of resistance only and hold it there.

6 Control for

- windshield washer system
- headlamp cleaning system (will work only with exterior lamp switch in position ≡D or ≡D .
  Canada only:
  Also in position O when the engine is running)

When the washer system is activated, the wiper also operates for a limited time.

The windshield washer nozzles are automatically heated.

7 Windshield wiper control
0 Wiper off
I Intermittent wiping
II Normal wiper speed
III Fast wiper speed

Note:

If one of the turn signals fails, the turn signal indicator system flashes and sounds at a faster rate than normal.

If the windshield wiper smears the windshield, even during rain, activate the washer system as often as necessary. The fluid in the washer reservoir should be mixed in the correct ratio.

Windshield Washer Fluid Mixing Ratio

For temperatures above freezing:

MB Windshield Washer Concentrate "S" and water

1 part "S" to 100 parts water (40 ml "S" to 1 gallon water).

For temperatures below freezing:

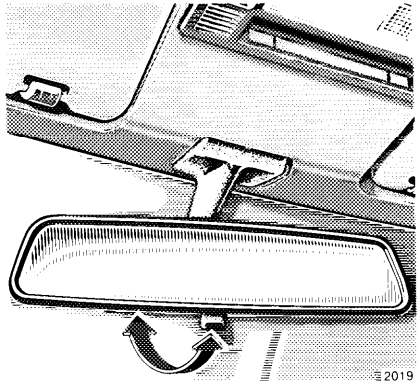
MB Windshield Washer Concentrate "S" and commercially available premixed windshield washer solvent/antifreeze

1 part "S" to 100 parts solvent (40 ml "S" to 1 gallon solvent).

Shelf below Rear Window

Warning!

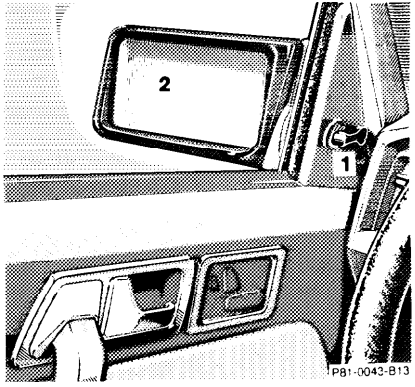
The shelf below the rear window should not be used to carry objects. This will prevent such objects from being thrown about and injuring vehicle occupants during an accident or sudden maneuver.

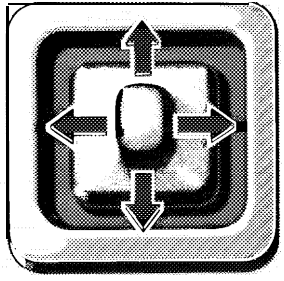


Inside Rear View Mirror

The mirror can be tilted to the antiglare night position using the lever at its lower edge.

Use your inside mirror to determine the size and distance of objects seen in the passenger-side convex mirror.





Exterior Rear View Mirrors

1 Adjusting lever
2 Exterior mirror

The exterior mirrors have electrically heated glass. The heater switches on automatically, depending on outside temperature.

Driver's side:

The exterior mirror (2) can be adjusted from inside the vehicle by moving adjusting lever (1) in the desired direction.

Passenger-side:

The passenger-side exterior mirror is convex (outwardly curved surface for a wider field of view).

To adjust the mirror:

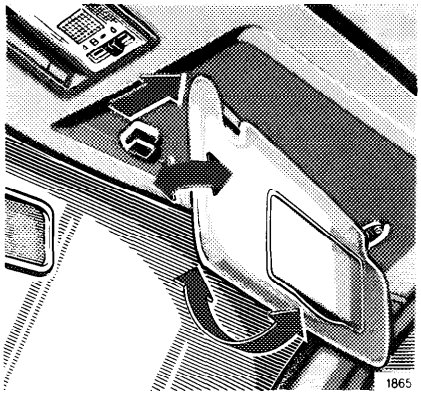
Turn key in steering lock to position 2. The exterior mirror can be adjusted using the switch located in the center console. Adjust the mirror so you can just see the side of your vehicle in the portion of the mirror closest to the car.

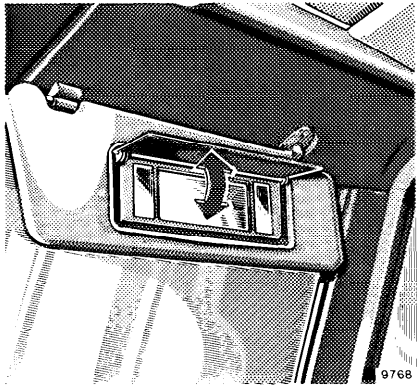
Warning!

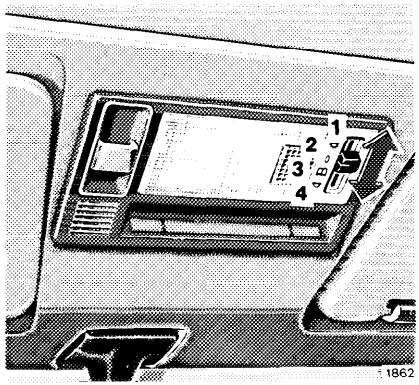
Exercise care when using the passenger-side mirror. The passenger-side exterior mirror is convex (outwardly curved surface for a wider field of view). Objects in mirror are closer than they appear. Check your inside rear view mirror or glance over your shoulder before changing lanes.

Note:

If the mirror housing is forcibly pivoted from its normal position, it must be repositioned by applying firm pressure until it snaps into place.







Sun Visors

Swing sun visors down to protect against sun glare.

If sunlight enters through the side window, disengage visor from inner mounting and pivot to the side.

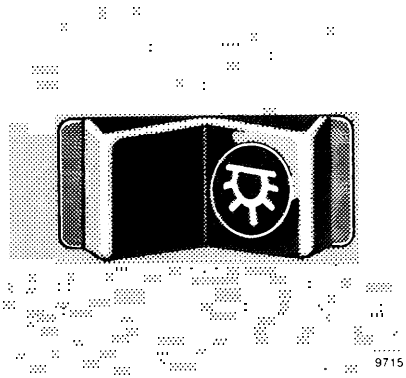
Vanity mirror:

With the visor engaged in its inner mounting, the lamp can be switched on by opening the cover.

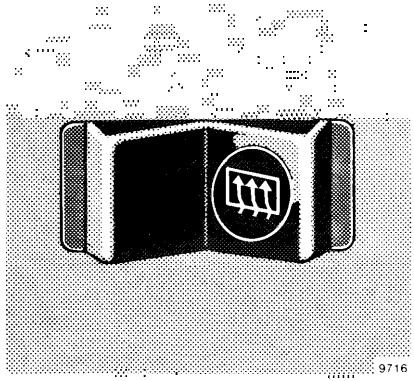
Interior Lamps

The switch for the front lamp (combination interior and reading lamp) has 4 positions.

1 Interior and reading lamp switched on continuously.
2 Interior and reading lamp switched off.
3 Reading lamp switched on continuously.
4 Interior lamp is switched on, and off delayed, by the front door contact switches. However, there will be no delay when the key is in steering lock position 2.



The rear courtesy lamp is switched on and off by the rear door contact switches or by the rocker switch on the left side of the instrument panel.



Rear Window Defroster

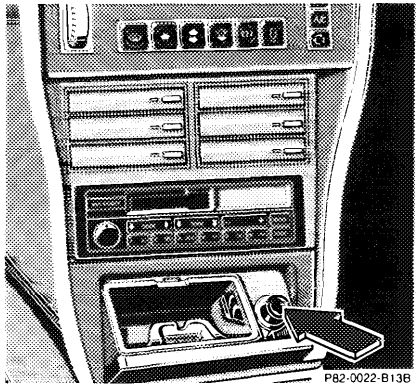
With engine running, press symbol side of rocker switch to turn on, press left side to turn off.

When activating the rear window defroster, the indicator lamp in the switch will come on.

Note:

The rear window defroster uses a large amount of power. To keep the battery drain to a minimum, turn off the defroster as soon as the window is clear. The defroster is automatically turned off after a maximum of 20 minutes of operation. Heavy accumulation of snow and ice should be removed before activating the defroster.

If several power consumers are turned on simultaneously, or the battery is only partially charged, it is possible that the defroster will automatically turn itself off. When this happens, the indicator lamp inside the switch starts blinking. As soon as the battery has sufficient voltage, the defroster automatically turns itself back on.



Lighter

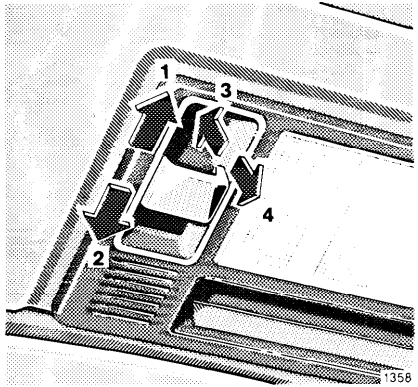
Turn key in steering lock to position 1 or 2.

Touch the ashtray lid. The ashtray opens automatically.

Push in lighter; it will pop out automatically when hot.

Warning!

Never touch the heating element or sides of lighter, hold at knob only.



Sliding Roof with Rear Pop-Up Feature

Turn key in steering lock to position 1 or 2. Activate switch.

1 to slide roof open

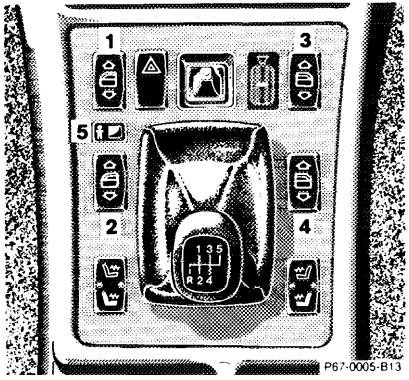
2 to slide roof closed

3 to raise roof at rear

4 to lower roof at rear

The switch is illuminated when the exterior lamps are switched on (except standing lamps).

The sliding roof can be opened or closed manually should an electrical malfunction occur, refer to Emergency Operation in Index.



Power Windows

Switch group for power windows:

1 left, front

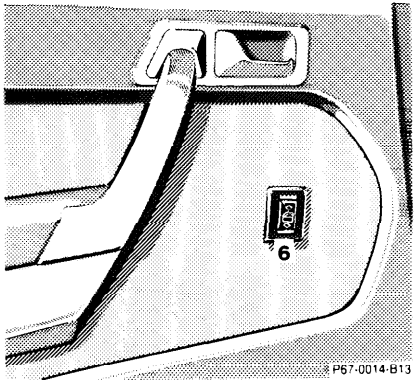
2 left, rear

3 right, front

4 right, rear

5 safety switch

6 individual switches (rear doors)



The power windows can only be operated with the key in steering lock position 1 or 2.

All four windows can then be operated using the switches in the center console. The rear door windows can also be operated using the switches (6) in each rear door panel. If inadvertent operation of the rear windows by switch (6) (for instance by children) is to be prevented, push safety switch (5) to the right (symbol becomes visible).

Warning!

When leaving the vehicle, always remove the key from the steering lock. Do not leave children unattended in the vehicle. Unsupervised use of vehicle equipment can cause serious personal injury.

Antenna

The antenna extends when switching on the radio and/or telephone.

Note:

To retract the antenna (e.g. when entering a car wash) both radio and telephone must be switched off.

Cellular Telephone

The vehicle is prepared for the installation of a cellular telephone. For further information and installation contact your authorized Mercedes-Benz dealer.

Warning!

Some jurisdictions prohibit the driver from using a cellular telephone while driving a vehicle. Therefore, for safety reasons, the driver should not use the cellular telephone while the vehicle is in motion. Stop the vehicle in a safe location before answering or placing a call.

Please note:

The Owner's Manual contained on this CD-ROM is an Owner's Manual for a model year 1993 190E 2.3/2.6. The Owner's Manual is displayed for general information only. Should you wish to obtain an Owner's Manual for your specific model year and model vehicle, please contact your authorized Mercedes-Benz passenger car dealer or call

1-800-FOR-MERCedes

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Driving Off 60
Manual Transmission 61
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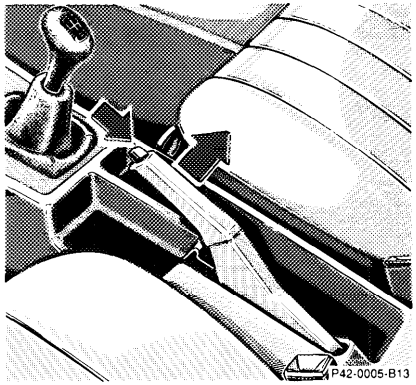
Drinking and Driving

Warning!

Drinking and driving can be a very dangerous combination. Even a small amount of alcohol or drugs can affect your reflexes, perceptions and judgement.

The possibility of a serious or even fatal accident is sharply increased when you drink and drive.

Please don't drink and drive or allow anyone to drive after drinking.



Parking Brake

To engage, pull up parking brake lever. When the key is in steering lock position 2, the brake warning lamp in the instrument cluster should come on brightly.

To release the parking brake, slightly pull up lever, push in release button at the grip, then lower it completely. The brake warning lamp in the instrument cluster should dim, when the lever is down.

Also see *Brake Warning Lamp* Test in Index.

Driving Off

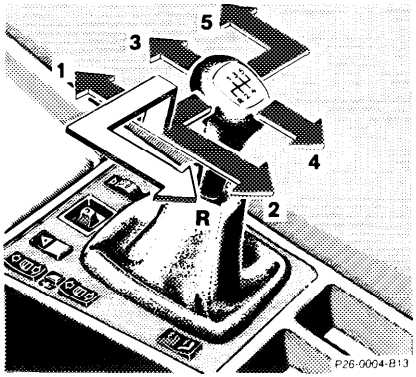
Test the brakes briefly after driving off. Perform this procedure only when the road is clear of other traffic.

Warm up the engine smoothly. Do not place full load on the engine until the operating temperature has been reached.

When starting off on a slippery surface, do not allow one driving wheel to spin for an extended period.

Warning!

Keep driver's foot area clear at all times. Objects stored in this area may impair pedal movement.



Manual Transmission

See illustration for gearshift lever positions corresponding to the individual gears.

Stop the vehicle completely before shifting into reverse; to shift into reverse, pull the shift lever up.

Do not exceed the maximum speed in the individual gears. See line markings on the speedometer.

Important!

When vehicle is parked, be sure to engage first or reverse gear and firmly set parking brake.

When parking on an incline, also turn front wheel against curb.

Recommended Shift Points for Manual Transmission

For good fuel economy, the following shift points are recommended:

Shift

from 1st to 2nd at
15 mph (24 km/h)

from 2nd to 3rd at
25 mph (40 km/h)

from 3rd to 4th at
40 mph (64 km/h)

from 4th to 5th at
45 mph (72 km/h).

Automatic Transmission

The automatic transmission selects individual gears automatically, dependent upon selector lever position, vehicle speed and accelerator position.

Important!

When parking the car and before working on the vehicle with the engine running, firmly engage the parking brake and shift the selector lever to position "P".

Driving

The selector lever is automatically locked while in position "P". To move the selector lever out of position "P", the service brake pedal must be firmly depressed before the shift lock will release.

Shift selector lever to the desired driving position only when the engine is idling and the service brake is applied. Do not release the brake until ready to drive. The vehicle may otherwise start creeping when the selector lever is in drive or reverse position.

Warning!

It is dangerous to shift the selector lever out of "P" or "N" if the engine speed is higher than idle speed. If your foot is not on the brake pedal, the car could accelerate quickly forward or in reverse. You could lose control of the car and hit someone or something. Only shift into gear when the engine is idling normally.

Important!

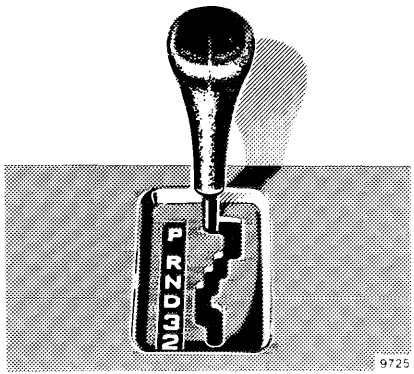
After selecting any driving position from "N" or "P", wait a moment to allow the gear to fully engage before accelerating, especially when the engine is cold.

Accelerator position

Partial throttle = early upshifting = normal acceleration

Full throttle = later upshifting = rapid acceleration

Kickdown (depressing the accelerator beyond full throttle) = downshifting to a lower gear = maximum acceleration. Once the desired speed is attained, ease up on the accelerator – the transmission shifts up again.



Selector lever positions

The automatic gear shifting process can be adapted to specific operating conditions using the selector lever.

P Parking lock.
The parking lock is an additional safeguard to the parking brake when parking the vehicle. Engage only with the car stopped.

Note:
The key can be removed from the steering lock only with the selector lever in position "P".

The selector lever is locked in position "P" with the key removed.

R Reverse gear.
Shift to reverse gear only with the car stopped.

N Neutral.
No power is transmitted from the engine to the rear axle. When the brakes are released, the vehicle can be moved freely (pushed or towed). Do not engage "N" while driving except to coast when the vehicle is in danger of skidding (e.g. on icy roads, see Winter Driving *Instructions* in Index).

Important!

Coasting the vehicle, or driving for any other reason with selector lever in "N", can result in transmission damage that is not covered by the Mercedes-Benz Limited Warranty.

D The transmission automatically upshifts to 4th gear. Position "D" orovides ootimum driving characteristics under all normal operating conditions.

3 Upshift to 3rd gear only.
Suitable for medium range up- or downgrades.

2 Upshift to 2nd gear only.
For driving in mountainous regions. Since transmission will not shift up further, this gear selection will make use of the engine's braking power.

Important!

With selector lever in position "D" or "3", upshifting from 1st to 2nd to 3rd gear is delayed depending on vehicle speed and engine temperature. This allows the catalytic converter to heat up more quickly to operating temperatures.

During the brief warm-up period this delayed upshift and increased engine noise might be perceived as malfunction. However, neither the engine nor transmission are negatively affected by this mode of operation.

The delayed upshift is effective for:

Model **190 E** 2.3
with vehicle speeds below 31 mph **(50** km/h) at partial throttle and

engine temperatures below 86" F (30°C).

Model 190 E 2.6
with vehicle speeds below 31 mph (50 km/h) at partial throttle and engine tempertures below 95" F (35°C).

Important!

Do not exceed the vehicle speed limits for individual gear selections, which are indicated by marks (I, II, III etc.) on the circumference of the speedometer.

Do not downshift to a lower gear (for example from "D" to "3") unless the speedometer needle is below the speed limit mark of that particular gear range. Overrevving could result in serious damage to the engine.

Warning!

On slippery road surfaces, never downshift in order to obtain braking action. This could result in rear wheel slip and reduced vehicle control. Your vehicle's ABS will not prevent this type of loss of control.

To prevent the engine from laboring at low RPM, do not allow the engine speed to drop too low on uphill gradients.

Depending on the degree of the incline, shift selector lever to position "3" or "2" early enough to maintain engine RPM within the best torque range.

Maneuvering

To maneuver in tight areas, e. g. when pulling into a parking space, control the car speed by gradually releasing the brakes. Accelerate gently and never abruptly step on the accelerator.

To rock a car out of soft ground (mud or snow), alternately shift from forward to reverse while applying partial throttle.

Rocking a car free in this manner may cause the ABS warning lamp to come on. Turn off and restart the engine to clear the malfunction indication.

Stopping

For brief stops, e.g. at traffic lights, leave the transmission in gear and control vehicle with the service brake.

For longer stops with the engine idling, shift into "N" or **"P"**.

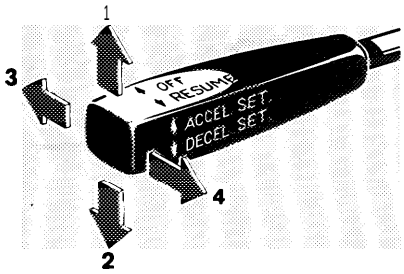
When stopping the car on an incline, do not hold it with the accelerator, use the brake. This avoids unnecessary transmission heat build up.

Warning!

Getting out of your car with the selector lever not fully engaged in position "P" is dangerous. When parked on a steep incline, position "P" alone may not prevent your vehicle from moving, possibly hitting people or objects.

Always set the parking brake in addition to shifting to position "P".

When parked on an incline, also turn front wheel against curb.



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Cruise Control

Any given speed above approximately 25 mph (40 km/h) can be maintained with the cruise control by operating the lever.

1 Accelerate and set:
Lift lever briefly to set speed.
Hold lever up to accelerate.

2 Decelerate and set:
Depress lever briefly to set speed.
Hold lever down to decelerate.

Normally the vehicle is accelerated to the desired speed with the accelerator.

Speed is set by briefly pushing the lever to position 1 or 2. The accelerator can be released.

The speed can be increased (e. g. for passing) by using the accelerator. As soon as the accelerator is released, the previously set speed will be resumed automatically.

If a set speed is to be increased or decreased slightly, e. g. to adapt to the traffic flow, hold lever in position 1 or 2 until the desired speed is reached, or briefly tip the control lever in the appropriate direction for increases or decreases in 0.6 mph (1 km/h) increments. When the lever is released, the newly set speed remains.

3 Canceling
To cancel the cruise control, briefly push lever to position 3. When you step on the brake or clutch pedal or the vehicle speed falls below approx. 25 mph (40 km/h), for example when driving upgrade, the cruise control will be canceled.

4 Resume
If the lever is briefly pushed to position 4 when driving at a speed exceedin approximately 25 mph (40 km3h), the vehicle resumes the speed which was set prior to the cancellation of the cruise control. The last memorized speed is canceled when the key in the steering lock is turned to position 1 or 0.

Note:

If the engine does not brake the vehicle sufficiently while driving on a downgrade, the speed you set on the cruise control may be exceeded and you may have to step on the brake pedal to slow down. As soon as the grade eases, the cruise controlled speed will again be maintained as long as the brakes were not previously applied, or the lever may be used to resume the previously set speed if the brakes were applied.

Warning!

Only use the cruise control if the traffic and weather conditions make it advisable to travel at a steady speed.

- **The use of cruise control can be dangerous on winding roads or in heavy traffic because conditions do not allow safe driving at a steady speed.**
- **The use of cruise control can be dangerous on slippery roads. Rapid changes in tire adhesion can result in wheel spin and loss of control.**

The "Resume" function should only be operated if the driver is fully aware of the previously set speed and wishes to resume this particular preset speed.

Caution!

In the case of manual transmissions, the vehicle maximum speed in the individual gears should not be exceeded. See line markings on the speedometer. In the case of automatic transmissions, the transmission selector lever must not be shifted to position "N" when driving with the cruise control engaged as otherwise the engine will overrev.

Brake Pad Wear Indicator Lamp

The brake pad wear indicator lamp in the instrument cluster comes on when the key in the steering lock is turned to position 2 and it goes out when the engine is running. If the indicator lamp lights up during braking, this indicates that the front wheel brake pads are worn down (vehicles equipped with ASR front and/or rear wheel brake pads).

Wave the brake system checked at your authorized Mercedes-Benz dealer as soon as possible.

Brake Warning bamp

The brake warning lamp will come on if insufficient brake fluid is in the reservoir (key in steering lock position 2 and parking brake released).

When the minimum mark on the reservoir is reached, have the brake system checked for brake pad thickness and leaks.

To test the brake warning lamp, turn key in steering lock to position 2. The brake warning lamp comes on dimly, and should go out when the engine is running.

Warning!

Driving with the brake warning lamp on, can result in an accident. Have your brake system checked immediately if the brake warning lamp stays on. Don't add brake fluid before checking the brake system. Overfilling the brake fluid reservoir can result in spilling brake fluid on hot engine parts and the brake fluid catching fire. You can be seriously burned.

Antilock Brake System (ABS)

The ABS prevents the wheels from locking up above a vehicle speed of approximately 2 mph (3 km/h) independent of road surface conditions. It is necessary, however, that the vehicle speed reaches at least 5 mph (8 km/h) before commencing to brake.

At the instant one of the wheels is about to lock up, a slight pulsation can be felt in the brake pedal, indicating that the ABS is in the regulating mode.

On slippery road surfaces, the ABS will respond even with only slight brake pedal pressure. The pulsating brake pedal can be an indication of hazardous road conditions, and it functions as a reminder to take extra care while driving.

The ABS warning lamp in the instrument cluster comes on with the key in steering lock position 2 and should go out with the engine running.

If the charging voltage falls below 10 volts, the indicator lamp comes on and the ABS is switched off. When the voltage is above this value again, the warning lamp should go out and the ABS is operational.

If the ABS warning lamp does not go out or comes on while driving, it indicates that the ABS has detected a malfunction and has switched off. In this case, the brake system functions in the usual manner, but without antilock assistance. Have the system checked at your authorized Mercedes-Benz dealer as soon as possible.

Warning!

Even the ABS cannot prevent the natural laws of physics from acting on the vehicle. The ABS cannot prevent accidents, including those resulting from excessive speed in turns, following another vehicle too closely, or aquaplaning. Only a safe, attentive, and skillful driver can prevent accidents. The capabilities of an ABS equipped car must never be exploited in a reckless or dangerous manner which could jeopardize the user's safety or the safety of others.

Note:

To alert following vehicles to slippery road conditions you discover, operate your hazard warning flashers as appropriate.

Automatic Locking Differential (ASD)

The automatic locking differential engages when there is a difference in speed (slip) during acceleration between the front and rear wheels of over 1.2 mph (2 km/h) and the vehicle speed is less than 15.6 mph (25 km/h). It will disengage at speeds above 16.2 mph (26 km/h).

The yellow function indicator in the speedometer comes on whenever there is a difference in speed between the front and rear wheels of over 1.2 mph (2 km/h), warning of slippery road conditions.

In steering lock position 2, the yellow function indicator lamp and the yellow ASD warning lamp in the instrument cluster should come on and then must go out with the engine running.

If the ASD warning lamp comes on with the engine running, a malfunction has been detected. We recommend that you visit an authorized Mercedes-Benz dealer as soon as possible to have the ASD checked.

Caution!

If the vehicle is towed with the front axle raised, the key must not be in steering lock position 2. Otherwise, the automatic locking differential control will immediately be engaged, which may cause loss of towing control.

Notes:

The automatic locking differential will not engage at speeds above 15.6 mph (25 km/h). However, above this speed, a limited-slip effect of up to 35% is always present.

When testing the parking brake on a brake test dynamometer, turn off the engine to avoid engaging the automatic locking differential.

In winter operation, the maximum efficiency of the automatic locking differential can only be achieved with Mercedes-Benz recommended M + S radial-ply tires on all four wheels.

Acceleration Slip Control (ASR)

The acceleration slip control will engage at all vehicle speeds, if one or both drive wheels begin to lose traction and spin due to excessive acceleration. While engaged, the yellow function indicator in the speedometer lights up.

With the acceleration slip control engaged, the brake is applied to the spinning drive wheel until it regains sufficient traction. If both drive wheels lose traction and spin, the brake is applied to both drive wheels and simultaneously, engine torque is limited.

As traction on the road surface increases, the allowable engine torque also increases again and the brake is no longer applied to drive wheels.

Caution!

If the vehicle is towed with the front axle raised, the key must not be in steering lock position 2. Otherwise, the acceleration slip control will immediately be engaged and will apply the rear wheel brakes.

Notes:

With the key in steering lock position 2, the yellow function indicator lamp and the yellow ASR warning lamp in the instrument cluster come on. They must go out with the engine running.

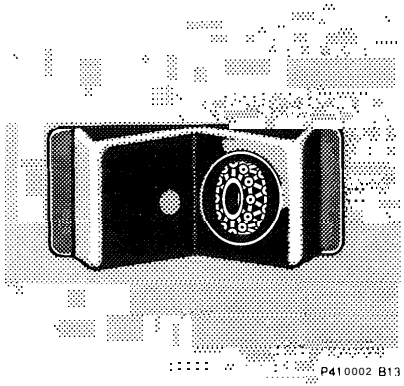
If the ASR warning lamp comes on with the engine running, a malfunction has been detected. Pressing the accelerator pedal will require greater effort. Only partial engine output is available.

Have the acceleration slip control checked at your authorized Mercedes-Benz dealer as soon as possible.

Driving the vehicle with varied size tires will cause the wheels to rotate at different speeds, therefore the acceleration slip control will activate (yellow ASR function indicator lamp in instrument cluster comes on). For this reason, all wheels, including the spare wheel, must have the same tire size.

In winter operation, the maximum effectiveness of the acceleration slip control can only be achieved with M + S radial-ply tires recommended by Mercedes-Benz.

On vehicles equipped with acceleration slip control, the brake pad wear warning lamp indicates brake pad wear for the front as well as the rear brakes.



Snow chain switch

Driving with Snow Chains

When driving with snow chains, press the symbol side of the snow chain switch, located on the instrument panel (the indicator lamp in the switch comes on) to obtain maximum possible traction.

This mode is effective at speeds up to 25 mph (40 km/h). It remains stored in memory up to 37 mph (60 km/h) and automatically engages again when the vehicle speed drops below 25 mph (40 km/h).

The mode is canceled in memory above 37 mph (60 km/h) and the indicator lamp in the switch goes out.

To switch off: press the left side of the switch (the indicator lamp in the switch goes out).

Charge Indicator Lamp

Should the charge indicator lamp fail to come on prior to starting when the key is in steering lock position **2** or should it fail to go out after starting or during operation, this indicates a fault which must be repaired at an authorized Mercedes-Benz dealer immediately.

If the charge indicator lamp comes on while the engine is running, this may indicate that the poly-V-belt has broken. Should this condition occur, the poly-V-belt must be replaced before continuing to operate the vehicle. Otherwise, the engine will overheat due to an inoperative water pump which may result in damage to the engine.

Engine Oil Consumption

Engine oil consumption can only be determined after a certain mileage has been covered. During the break-in period, higher oil consumption may be noticed and is normal. Frequent driving at high engine speeds results in increased consumption.

Engine Oil Pressure Gauge

The oil pressure at idle speed may drop to 4.4 psi (0.3 bar) if the engine is at operating temperature. This will not jeopardize its operational reliability.

Pressure must, however, rise immediately upon acceleration.

Low Engine Oil Level Warning Lamp

The warning lamp comes on with the key in steering lock position 2 and should go out when the engine is running.

If the warning lamp comes on with the engine running and at operating temperature, the engine oil level has dropped to approximately the minimum mark on the dipstick. When this occurs, the warning lamp will first come on intermittently and then stay on if the oil level drops further. If no oil leaks are noted and there is no loss in engine oil pressure, continue to drive to the nearest service station where the engine oil should be topped to the “full” mark of the dipstick (see Index).

In addition to the warning lamp, the engine oil level should be periodically checked with the dipstick, for example during a fuel stop, or before a long trip (see Index).

Coolant Temperature Gauge

If the antifreeze mixture is effective to -22°F (–30°C), the boiling point of the coolant in the pressurized cooling system of your vehicle is approx. 266°F (130°C).

During severe operating conditions and stop-and-go city traffic, the coolant temperature may rise close to the red marking.

The engine should not be operated with the coolant temperature in the red zone.

Warning!

- **Driving when your engine is badly overheated can cause some fluids which may have leaked into the engine compartment to catch fire. You could be seriously burned. Turn off the engine and get out of the car until it cools down.**
- **Steam from an overheated engine can cause serious burns and can occur just by opening the engine hood. Stay away from the engine if you see or hear steam coming from it. Turn off the engine and do not stand near the car until it cools down.**

Low Engine Coolant Level Warning Lamp

The warning lamp comes on with the key in steering lock position 2, and should go out when the engine is running.

If it comes on with the engine running, the coolant has dropped below the required level. If no leaks are noticeable and the engine temperature does not increase, continue to drive to the nearest service station and have coolant added to the coolant system (see Index).

Fuel Reserve Warning Lamp

The fuel reserve warning lamp should come on when the key is turned to steering lock position 2, and should go out after the engine is running.

If the warning lamp stays on after the engine starts, or comes on while driving, it indicates that the fuel level is down to the reserve quantity of 1.6 US gal (6.0 l).

Low Windshield and Headlamp Washer System Fluid Level Warning Lamp

The warning lamp comes on with the key in steering lock position 2 and should go out when the engine is running.

If the warning lamp comes on with the engine running, the level of the reservoir has dropped to 1/4 of the total volume. The reservoir should be refilled with MB Windshield Washer Concentrate "S" and water (or commercially available premixed windshield washer solvent/antifreeze, depending on ambient temperature - see Index) at the next opportunity. The reservoir for the windshield and headlamp washer systems is located in the engine compartment (see Index).

Outside Temperature Indicator

The temperature sensor is located in the front bumper area. Due to its location, the sensor can be affected by road or engine heat during idling or slow driving. This means that the accuracy of the displayed temperature can only be verified by comparison to a thermometer placed next to the sensor, not by comparison to external displays (e.g. bank signs etc.).

Adaptation to ambient temperature takes place in steps and depends on the prevailing driving conditions (stop-and-go or moderate, constant driving) and amount of temperature change.

Warning!

The outside temperature indicator is not designed to serve **as an Ice-Warning-Device and is therefore unsuitable for that purpose. Indicated temperatures just above freezing point do not guarantee that the road surface is free of ice.**

Emission Control

Certain systems of the engine serve to keep the toxic components of the exhaust gases within permissible limits required by law.

These systems, of course, will function properly only when maintained strictly according to factory specifications. Any adjustments on the engine should, therefore, be carried out only by qualified Mercedes-Benz technicians. The engine should not be altered in any way. Moreover, the specified service and maintenance jobs must be carried out regularly according to Mercedes-Benz servicing requirements. For details refer to the Maintenance Booklet.

Warning!

Inhalation of exhaust gas is hazardous to your health. All exhaust gas contains carbon monoxide, **and inhaling it can cause unconsciousness and lead to death.**

Do not run the engine in confined areas (such as a garage) which are not properly ventilated. If you think exhaust gas fumes are entering the vehicle while driving, have the cause determined and corrected immediately. If you must drive under these conditions, drive only with at least one window fully open.

On-Board Diagnostic System (California models only)

The Continuous Fuel injection (CFI) control module monitors emission control components that either provide input signals to or receive output signals from the control unit. Malfunctions resulting from interruptions or failure of any of these components are indicated by the “CHECK ENGINE” malfunction indicator lamp in the instrument cluster and are simultaneously stored in the CFI control module.

If the “CHECK ENGINE” malfunction indicator lamp comes on, have the system checked at your authorized Mercedes-Benz dealer at the first opportunity.

An on-board diagnostic connector with pushbutton and light emitting diode (LED) is located on the engine compartment firewall, allowing the accurate identification of system malfunctions through the readout of diagnostic trouble code.

Traveling Abroad

Abroad, there is a widely-spread Mercedes-Benz service network at your disposal. If you plan to travel into areas which-are not listed in the index of your dealer directory, you should request pertinent information from your authorized Mercedes-Benz dealer.

Winter Driving

Have your car winterized at your authorized Mercedes-Benz dealer before the onset of winter.

- Change the engine oil if the engine contains an oil which is not approved for winter operation. For viscosity (SAE class) and filling quantity, see *Fuels,* Coo/ants, Lubricants etc. in Index.
- Check engine coolant anticorrosion/antifreeze concentration.
- Additive for the windshield washer and headlamp cleaning systems: Add MB Concentrate "S" to the premixed windshield washer solvent/antifreeze which is formulated for below freezing temperatures (see Index).
- Test battery: Battery capacity drops with decreasing ambient temperature. A well charged battery ensures that the engine can always be started, even at low ambient temperatures.
- Tires: We recommend M + S radial-ply tires on all four wheels for the winter season. Observe permissible maximum speed for M + S radial-ply tires and the legal speed limit.

Note:

In winter operation, the maximum effectiveness of the automatic locking differential or the acceleration slip control can only be achieved with M + S radial-ply tires recommended by Mercedes-Benz.

Snow Chains

Use only snow chains that are tested and recommended by Mercedes-Benz. Your authorized Mercedes-Benz dealer will be glad to advise you on this subject.

Chains should only be used on the rear wheels. Follow the manufacturer's mounting instructions.

Snow chains should only be driven on snow at speeds not to exceed 30 mph (50 km/h). Remove chains as soon as possible when driving on roads without snow.

For tips on driving on slippery winter roads refer to Index.

Vehicles with Acceleration Slip Control (ASR):

When driving with snow chains, press the snow chain switch, refer to Index.

Important!

Use of snow chains on Model 190 E 2.6:

Standard model (without Sportline option) – permissible only on standard equipment tire size 185/65.

Sportline model with rear axle level control – permissible on tire size 205/55 or winter tire size 185/65 R 15 87T M+S.

Sportline model without rear axle level control – not allowed on tire size 205/55, but permissible on winter tire size 185/65 R 15 87 T M + S.

Refer to "Rims – Tires" in section Technical Data (see Index).

Please note:

The Owner's Manual contained on this CD-ROM is an Owner's Manual for a model year 1993 190E 2.3/2.6. The Owner's Manual is displayed for general information only. Should you wish to obtain an Owner's Manual for your specific model year and model vehicle, please contact your authorized Mercedes-Benz passenger car dealer or call

1-800-FOR-MERCedes

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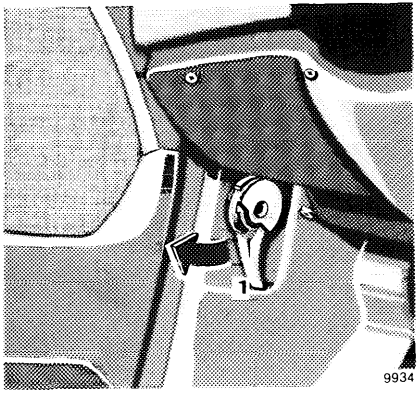
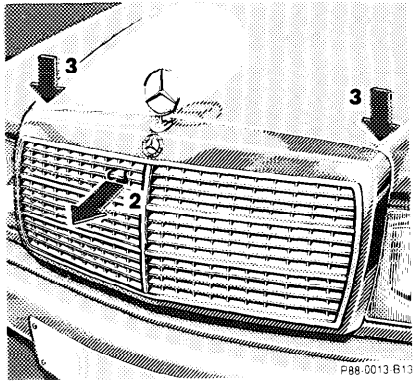




Hood

To open:

To unlock the hood, pull release lever (1) under the driver's side of the instrument panel. At the same time handle (2) will extend out of the radiator grill (it may be necessary to press the hood down slightly).

Important!

To avoid damage to the windshield wiper or hood, open the hood only with wiper in the parked position.

Pull handle (2) completely out of radiator grill and open hood (do not pull up on handle).

To close:

Lower hood and let it drop into the latch from a height of approx. 1 ft (30 cm), assisting with flat hands placed only on edges of hood (3).

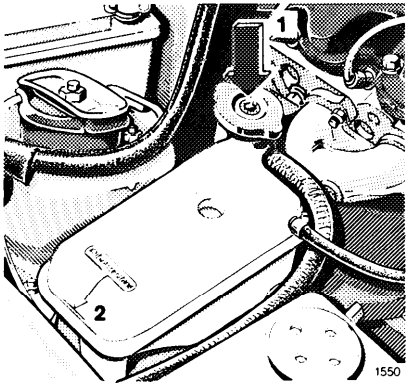
To avoid hood damage, if hood is not fully closed, re-open and repeat closing procedure. Do not push down hard on hood surface.

Warning!

To help prevent personal injury, stay clear of moving parts when the hood is open and the engine is running. Be sure the hood is properly closed before driving.

The engine is equipped with a transistorized ignition system. Because of the high voltage it is dangerous to touch any components (ignition coil, distributor, spark plug sockets, ignition cables, diagnostic socket) of the ignition system:

- **with the engine running**
- **while starting the engine**
- **if the ignition is "on" and the engine is turned manually.**



Checking Coolant Level

1 Coolant reservoir cap

2 Marking for coolant level

The coolant level can be checked visually at the transparent coolant reservoir.

To check the coolant level, the vehicle must be parked on level ground.

The coolant level must reach:

The marking (2, arrow) on the **reservoir when the engine is** cold.

Approx. 0.4 in (1 cm) higher when the engine is at operating temperature.

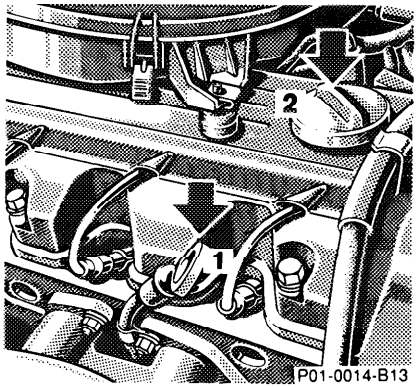
Adding Coolant

If coolant has to be added, a 50/50 mixture of water and MB anticorrosion/antifreeze should be used.

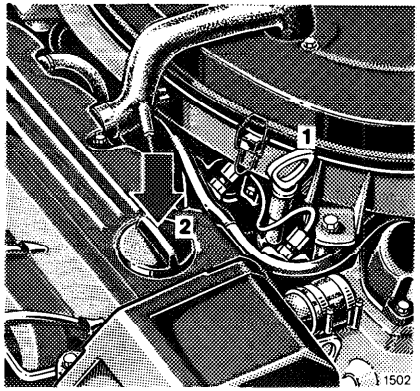
The drain plugs for the cooling system are located on the right-hand side of the engine block and at the bottom of the radiator.

Warning!

- **Use extreme caution when opening the hood if there are any signs of steam or coolant leaking from the cooling system.**
- **Do not remove pressure cap on coolant reservoir if engine temperature is above 194°F (90°C). Allow engine to cool down before removing cap. The coolant reservoir contains hot fluid and is under pressure.**
- **Using a rag, turn cap to first notch to relieve excess pressure. If opened immediately, scalding hot fluid and steam will be blown out under pressure possibly causing personal injury.**
- **Do not spill antifreeze on hot engine parts. Antifreeze contains ethylene glycol which may burn if it comes into contact with hot engine parts. You can be seriously burned.**



190 E 2.3



190 E 2.6

Checking Engine Oil Level

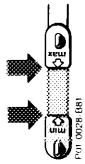
1 Oil dipstick

2 Oil filler cap

To check the engine oil level, park vehicle on level ground, with engine at normal operational temperature.

Check engine oil level approximately 5 minutes after stopping the engine, allowing for the oil to return to the oil pan.

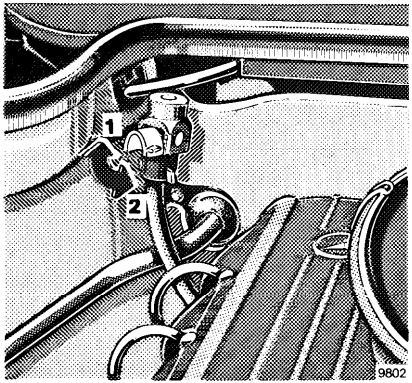
Wipe oil dipstick clean prior to checking the engine oil level.



Oil level must be between the lower (min) and upper (max) mark of the dipstick.

Do not overfill the engine. Excessive oil must be drained or siphoned.

For low engine oil level warning lamp, see Index.



Checking Automatic Transmission Fluid Level

Dipstick locking lever

1 Release
2 Engage

Check transmission fluid level with the engine idling, parking brake engaged and selector lever in position “P”. The vehicle must be parked on level ground. Prior to the check, allow engine to idle for approx. 1 to 2 minutes. Measure fluid level with the dipstick completely inserted and the locking lever released (1).

Extreme cleanliness must be observed! To wipe the dipstick, use a clean, lint-free cloth. To fill the transmission with fluid, pour it through a fine-mesh filter into the dipstick opening. Even the slightest impurity may cause operational troubles.

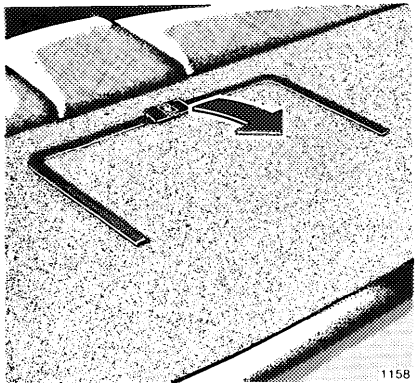
The fluid level in the transmission is dependent upon its temperature. The maximum and minimum fluid level marks on the dipstick are applicable references only if the transmission fluid has reached its normal operating temperature of 176°F (80°C).

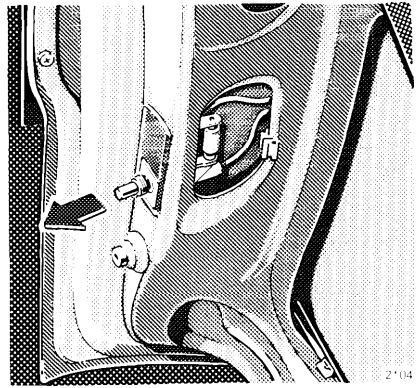
Important!

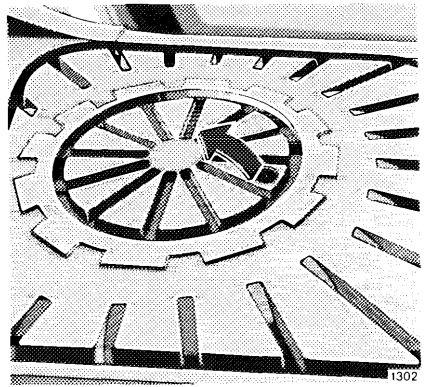
If the transmission fluid cools down to 68 – 86°F (20 – 30°C), which is the normal shop temperature range, then the maximum fluid level will be approximately 0.5 in (12 mm) below the minimum mark on the dipstick. We stress this point because a fluid change is normally performed when the transmission fluid has cooled down to shop temperature.

The fluid level must not exceed the dipstick maximum mark with the fluid at operating temperature. Drain or siphon off excess fluid, if required.

Then push dipstick all the way in and swing locking lever downwards (2).







First Aid Kit

The first aid kit is stored in the shelf below the rear window.

Stowing Things in the Vehicle

Warning!

To help avoid personal injury during a collision or sudden maneuver, exercise care when stowing things.

Put luggage or cargo in the trunk if possible. 50 not pile luggage or cargo higher than the seat backs. 50 not place anything on the shelf below the rear window.

Trunk Lamp

When keeping the trunk lid open for a longer period of time, the trunk lamp can be switched off by pulling out the plunger in the switch (arrow).

When the trunk lid is closed, the switch will reset and turn on the lamp the next time the lid is opened.

Note:

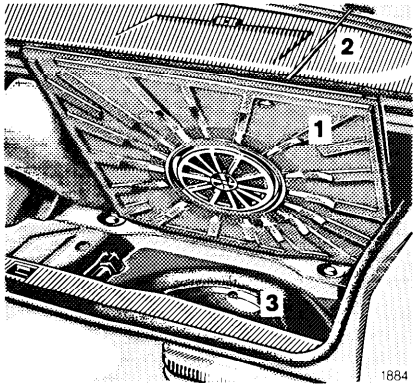
On vehicles equipped with anti-theft alarm system it is not possible to pull out the plunger in the switch to turn off the trunk lamp.

Storage Compartment Below Trunk Floor

Roll back the trunk floor mat. Reach into the cut-out and lift up cover.

Vehicle Tools

The vehicle tools are stored in a compartment below the hinged trunk floor.



Spare Wheel

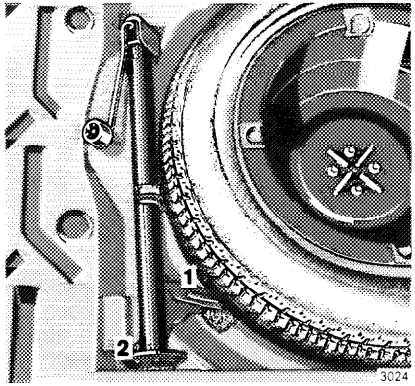
1 Trunk floor

2 Strap

3 Luggage bowl

Roll back the floor mat, lift the trunk floor (1) and engage strap (2) in the trunk lid.

To remove the spare tire, turn luggage bowl (3) to the left and remove.



Vehicle Jack

1 Jack arm

2 Jack base

See illustration for proper storage of jack.

Before storing the jack, the jack arm (1) must be lowered almost to the base (2) of the jack and should rest on the felt in the spare wheel well.

Warning!

The jack is designed exclusively for jacking up the vehicle at the jack tubes built into either side of the vehicle. Use the jack only to lift the vehicle during a wheel change. Never get beneath the vehicle while it is supported by the jack. Keep hands and feet away from the area under the lifted vehicle. Always firmly set parking brake and block wheels before raising vehicle with jack.

Do not disengage parking brake while vehicle is raised. Be certain that the jack is always vertical when in use, especially on hills. Always try to use the jack on level surface. Be sure that the jack arm is fully inserted in the jack tube. Lower the vehicle onto sufficient capacity jackstands before working under the vehicle.

Wheels

Replace rims or tires with the same designation, manufacturer and type as shown on the original part. See your authorized Mercedes-Benz dealer for further information.

Warning!

Do not mix different tire construction types (i. e. radial, bias, and bias-belted) on your car because handling may be adversely affected and may result in loss of control.

See your authorized Mercedes-Benz dealer for information on tested and recommended rims and tires for summer and winter operation. They can also offer more advice concerning tire service and purchase.

Tire replacement:

Front tires should be replaced in sets. Furthermore – in the event of tire replacement – the spare wheel, if possible, should be used on the rear axle.

Rims and tires must be of the same size. For dimensions see "Technical Data".

We recommend that you break in new tires for approx. 60 miles (100 km) at moderate speed. It is imperative that the wheel mounting bolts be retightened after approximately 60 – 300 miles (100 – 500 km).

On new vehicles retightening is carried out during the 1st inspection. Retightening is also necessary whenever wheels are fitted, e.g. when the spare wheel is used for the first time or when a set of wheels with M + S tires is installed

Tightening torque:
80 ft.lb. (1 10 Nm).

For rim and tire specifications, refer to "Technical Data".

Warning!

Worn, old tires can cause accidents. If the tire tread is badly worn, or if the tires have sustained damage, replace them.

When replacing rims, use only genuine Mercedes-Benz wheel bolts (identified by Mercedes star) specified for the particular rim type. Failure to do so can result in the bolts loosening **and possibly an accident.**

Rotating wheels:

The wheels can be rotated according to the degree of tire wear while retaining the same direction of travel.

Rotating, however, should be carried out, at a mileage of 3000 – 6000 miles (5000 – 10 000 km), before the characteristic tire wear pattern (shoulder wear on front wheels and tread center wear on rear wheels) becomes visible, as otherwise the driving properties deteriorate.

Important!

Unidirectional snow tires must always be mounted with arrow on tire sidewall pointing in direction of vehicle forward movement.

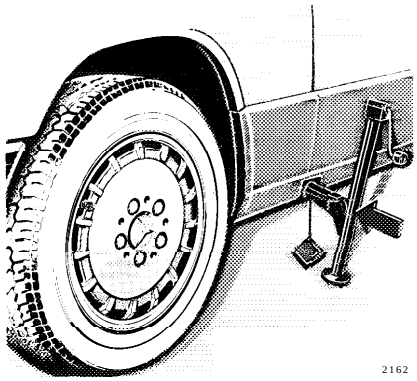
Notes:

Thoroughly clean the inner side of the wheels any time you rotate the wheels or wash the vehicle underside.

The use of retread tires is not recommended. Retread tires may adversely affect the handling characteristics and safety of the vehicle.

Dented or bent rims cause tire pressure loss and damage to the tire beads. For this reason, check rims for damage at regular intervals.

The rim flanges must be checked for wear before a tire is mounted. Remove burrs, if there are any.



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Changing Wheels

1. Move vehicle to a level area which is a safe distance from the roadway.
2. Set parking brake and turn on hazard warning flasher.
3. Turn off engine. Select 1st or reverse gear in vehicles with manual transmission, or position "P" in vehicles equipped with automatic transmission.
4. Prevent vehicle from rolling away by blocking wheels with wheel chocks (not supplied with vehicle) or sizeable wood block or stone. When changing a wheel on a hill, place chocks on the downhill side of each wheel of the other axle. On a level road, place one chock in front of and one behind the wheel that is diagonally opposite to the wheel being changed.
5. Using the combination wrench, loosen but do not yet remove the wheel bolts.
6. Remove the protective cover from the jack support tube opening by inserting a screwdriver in the opening and prying it out. (The tube openings are located directly behind the front wheel housings and in front of the rear wheel housings.)
7. Insert jack arm fully into the tube hole up to the stop.
8. Place jack on firm ground. Position the jack so that it will always be vertical (plumb-line) as seen from the side (see arrow), even if the vehicle is parked on an incline. Jack up the vehicle until the wheel is clear off the ground. Never start engine while vehicle is raised.

Warning!

The jack is designed exclusively for jacking up the vehicle at the jack tubes built into either side of the vehicle. Use the jack only to lift the vehicle during a wheel change. Never get beneath the vehicle while it is supported by the jack. Keep hands and feet away from the area under the lifted vehicle. Always firmly set parking brake and block wheels before raising vehicle with jack.

Do not disengage parking brake while vehicle is raised. Be certain that the jack is always vertical when in use, especially on hills. Always try to use the jack on level surface. Be sure that the jack arm is fully inserted in the jack tube. Lower the vehicle onto sufficient capacity jackstands before working under the vehicle.

9. Unscrew wheel bolts completely. Keep bolt threads protected from dirt and sand. While removing last bolt, hold wheel against hub to avoid paint damage on rim.
10. Remove wheel.
11. Screw the alignment bolt (supplied in tool kit) into the upper-most threaded hole.
12. Adjust the jack height so that the wheel can be slipped on without being lifted.
13. Install spare wheel on wheel hub. Insert wheel bolts and tighten them slightly.

    To avoid paint damage, place wheel flat against hub and hold it there while installing first wheel bolt. Unscrew the alignment bolt to install the last wheel bolt.
14. Lower car, remove jack.
15. Engage jack tube cover hooks on top and snap bottom into place.
16. Tighten the five bolts evenly, always skipping one, until all bolts are tight. Observe a tightening torque of 80 ft.lb. (110 Nm).
17. Correct tire pressure.

Warning!

Incorrect mounting bolts or improperly tightened mounting bolts can cause the wheel to come off. This could cause an accident. Be sure to use the correct mounting bolts.

Important!

When installing new wheels the mounting bolts must be retightened after approx. 60 – 300 miles (100 – 500 km). Observe a tightening torque of 80 ft.lb. (110 Nm).

Tire Inflation Pressure

A table (see fuel filler flap) lists the tire inflation pressures specified for Mercedes-Benz recommended tires as well as for the varying operating conditions.

Important!

Tire pressure differs by approx. 1.5 psi (0.1 bar) per 18° F (10%) of air temperature change. Keep this in mind when checking tire pressure inside a garage – especially in the winter.

Example:

If garage temperature = approx. 68°F (+ 20°C) and, ambient temperature = approx. + 32°F (0°C) then the adjusted air pressure = specified air pressure + 3 psi (0.2 bar).

Tire pressures listed for light loads are minimum values offering high driving comfort.

Increased inflation pressures for heavy loads produce favorable handling characteristics with lighter loads and are perfectly permissible. The ride of the vehicle, however, will become somewhat harder.

Tire temperature and pressure increase with the vehicle speed. Tire pressure should therefore only be corrected on cold tires. Correct tire pressure in warm tires only if pressure had dropped below the pressure listed in the table and the respective operating conditions are taken into consideration.

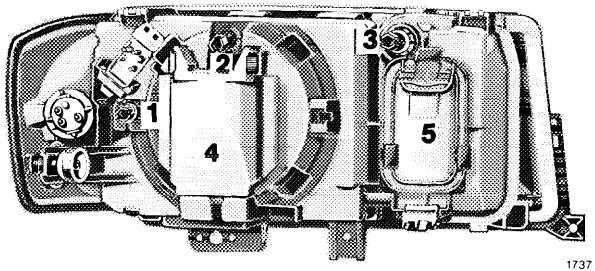
An underinflated tire due to a slow leak (e. g. due to a nail in the tire) may cause damage such as tread separation, bulging etc.. Regular tire pressure checks (including the spare tire) at intervals of no more than 14 days are therefore essential.

If a tire constantly loses air, it should be inspected for damage.

Warning!

Do not overinflate tires. Overinflating tires can result in sudden deflation (blowout) because they are more likely to become punctured or damaged by road debris, potholes etc.. Follow recommended inflation pressures.

Do not overload the tires by exceeding the specified vehicle capacity weight (as indicated by the label on the driver's door latch post). Overloading the tires can overheat them, possibly causing a blowout.



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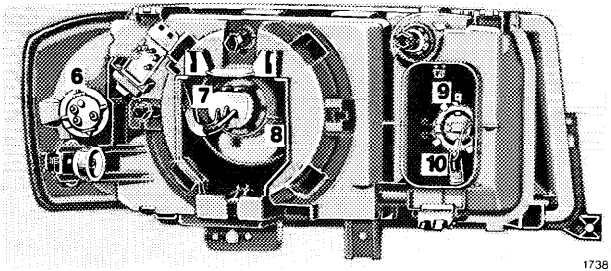

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Headlamp Adjustment

Correct headlamp adjustment is extremely important. Check and readjust headlamps at regular intervals and when a bulb has been replaced.

Replacing Bulbs

Do not touch glass portion of bulb with bare hands. Use plain paper or a clean cloth.

Install only 12 volt bulbs with the specified watt rating.

Headlamp Assembly

1 Headlamp horizontal adjustment screw

2 Headlamp vertical adjustment screw

3 Fog lamp adjustment screw

4 High and low beam headlamp cover

5 Fog lamp cover

6 Turn signal, parking, side marker and standing lamp bulb

7 Electrical connector for high and low beam headlamp bulb

8 Clamping ring for high and low beam headlamp bulb

9 Fog lamp bulb

10 Electrical connector for fog lamp bulb

Warning!

Halogen lamps contain pressurized gas. A bulb can explode if you

- **touch or move it when hot,**
- **drop the bulb,**
- **scratch the bulb.**

Replacing bulbs:

Bulb for turn signal, parking, side marker and standing lamp (21/5 W/32/3 cp):

Turn bulb socket (6) with lamp bulb to the left and pull out socket.

Push lamp bulb into socket and turn to the left and pull out bulb.

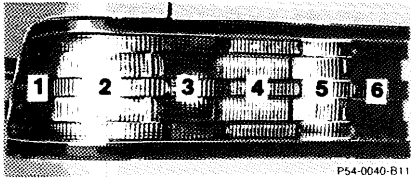
Bulb for high and low beam (Halogen type 9004):

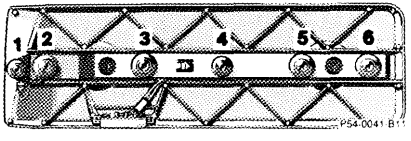
Compress cover (4) at the top and remove upwards. Turn clamping ring (8) counterclockwise and detach. Take out bulb and pull off electrical connector (7).

Insert new bulb (flat side facing up), mount clamping ring (8) (with tab facing down) and turn clockwise. Push electrical connector on securely.

Fog lamp bulb (Halogen type H 3):

Compress the retaining clip of the cover (5) at the top while removing it upwards, Pull off electrical connector (10). Disengage retaining clip and remove bulb (9). When replacing cover (5), make sure it clicks into place.





Taillamp Assemblies

1 Side marker lamp (10 W/6 cp bulb)

2 Turn signal lamp (21 W/32 cp bulb)

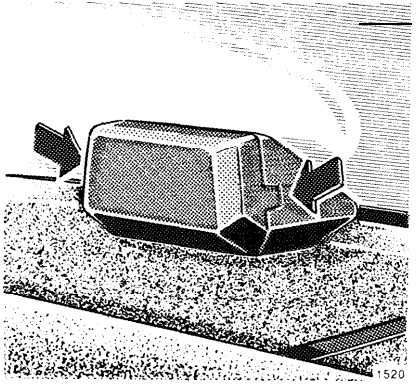
3 Stop lamp (21 W/32 cp bulb)

4 Tail, parking and standing lamp (10 W/6 cp bulb)

5 Backup lamp (21 W/32 cp bulb)

6 Rear fog lamp (21 W/32 cp bulb) (driver's side only)

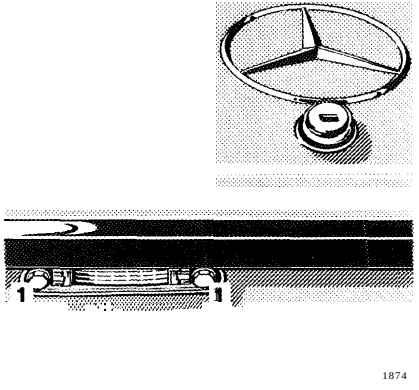
Turn both bulb carrier locks in the trunk all the way to the left and remove bulb carrier. To replace a bulb, push bulb in, turn to the left and remove.



High Mounted Stop Lamp
(21 W/32 cp bulb)

To replace the bulb, pull tabs on both sides (arrows) – using a screwdriver – to release cover.

Press bulb down, turn counter-clockwise and remove.



License Plate Lamps
(5 W bulb)

Loosen both the securing screws (1), remove lamp and take out bulb.

Spark Plugs

Remove and install spark plugs (provided with sealing cone) only with combination wrench from the vehicle tools or with a recommended spark plug wrench.

Tightening torque:
8 – 15 ft.lb. **(10 –** 20 Nm).

For approved spark plugs see “Technical Data”.

Battery

The battery is a low maintenance type. Check electrolyte level in each cell every 15 000 miles (24 000 km) or once a year, whichever comes first.

Remove filler caps and refill battery with distilled or tap water to full mark on inside of filler hole. Do not use a metal funnel.

Keep battery dry and clean.

The service life of the battery is also dependent on its condition of charge. The battery should always **be kept** sufficiently charged, **in order** to last an optimum length of time.

Therefore, we strongly recommend that you have the battery charge checked frequently, and corrected if necessary, especially if you use the vehicle less than approximately 200 miles (300 km) per month, mostly for short distance trips, or if it is not used for long periods of time.

Only charge a battery with a battery charger after it has been disconnected from the vehicle electrical circuit.

When removing and connecting the battery, always make sure that all electrical consumers are off and the key is in steering lock position 0.

While the engine is running the battery terminal clamps must not be loosened or detached, otherwise the alternator and other electronic components would be damaged.

Battery Recycling

Batteries contain materials that can harm the environment with improper disposal.

Recycling of batteries is the preferred method of disposal.

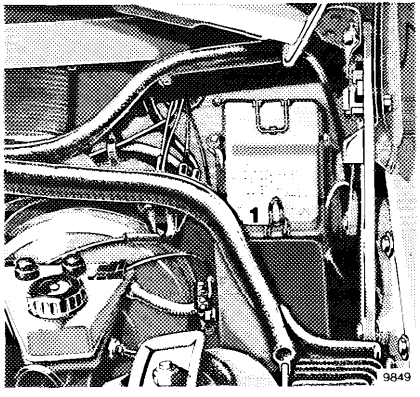
Many states require sellers of batteries to accept old batteries for recycling.

Warning!

Never lean over batteries while connecting, you might get injured.

Battery fluid contains sulfuric acid. Do not allow this fluid to come in contact with eyes, skin or clothing. In case it does, immediately flush affected area with water and seek medical help.

A battery will also produce hydrogen gas, which is flammable and explosive. Keep flames or sparks away from battery, avoid improper connection of jumper cables, smoking etc..



Fuses

The fuse box is located in the engine compartment.

All equipment protected by fuses is listed by number and letter on a label in the lid of the fuse box. The numbers and letters above the fuses correspond to the ones on the label.

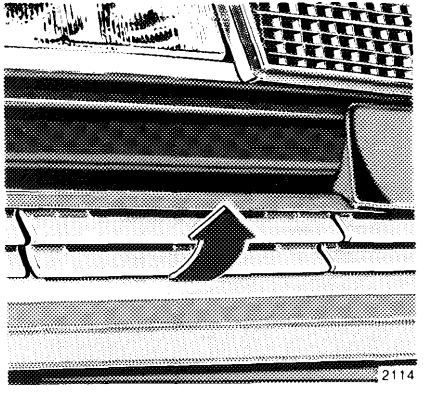
To exchange a fuse, release clamp (1) and raise fuse box cover.

Before replacing a blown fuse, determine the cause of the short circuit.

Spare fuses are furnished inside the fuse box. Observe amperage and color of fuse.

Always use a new fuse for replacement. Never attempt to repair or bridge a blown fuse.

After replacing a fuse, close fuse box cover and secure with clamp (1).



Towing the Vehicle

The rear towing eye is located below at the right, below the bumper. The front towing eye is located on the passenger side behind a flap in the bumper panel.

Flap removal: Insert finger in bottom recess of flap and pull flap out. Remove flap by pulling downward.

Flap installation: Engage the flap at the top and press in the bottom securely.

We recommend that the vehicle be transported using flat bed equipment. This method is preferable to other types of towing.

The vehicle may be towed with all of the wheels on the ground and the selector lever in position "N" for distances up to 30 miles (50 km) (or gearshift lever in neutral position for distances up to 75 miles [120 km]) and at a speed not to exceed 30 mph (50 km/h).

To positively avoid a possibility of damage to the transmission, however, we recommend to disconnect the drive shaft at the rear axle drive flange on any towing beyond a short tow to a nearby garage.

Do not tow with sling-type equipment. Towing with sling-type equipment over bumpy roads will damage radiator and supports.

Use wheel lift, dolly, or flat bed equipment, with key in steering lock turned to position 0.

Warning!

With the engine not running, there is no power assistance for the braking and steering systems. In this case, it is important to keep in mind that a considerably higher degree of effort is necessary to brake and steer the vehicle.

Vehicles with Acceleration Slip Control (ASR)

Caution!

If the vehicle is towed with the front axle raised, the key must not be in steering lock position 2. Otherwise, the acceleration slip control will immediately be engaged and will apply the rear wheel brakes.

Jump Starting

If the battery is discharged, the engine should only be started with jumper cables and the (12 V) battery of another vehicle.

Warning!

Failure to follow these directions will cause damage to the electronic components, and can lead to a battery explosion and personal injury.

Read all instructions before proceeding.

Proceed as follows:

1. Position the vehicle with the charged battery so that the jumper cables will reach, but never let the vehicles touch. Make sure the jumper cables do not have loose or missing insulation.
2. On both vehicles:
   - Turn off engine and all lights and accessories, except hazard flashers or work lights.
   - Apply parking brake and shift selector lever to position "P" (neutral for manual transmission).

Important!

3. Clamp one end of the first jumper cable to the positive (+) terminal of the discharged battery and the other end to the positive (+) terminal on the charged battery. Make sure the cable clamps do not touch any other metal parts.
4 Clamp one end of the second jumper cable to the grounded negative (-) terminal of the charged battery and the final connection to a grounded heavy metal bracket in the engine compartment or on the engine of the disabled vehicle. Make sure the cables are not on or near pulleys, fans or other parts that will move when the engine is started.
5. Start engine of the vehicle with the charged battery and run at high idle. Then start engine of the disabled vehicle in the usual manner.
6. After the engine has started, remove jumper cables by exactly reversing the above installation sequence, starting with the last connection made first. When removing each clamp, make sure that it does not touch any other metal while the other end is still attached.

Important!

A discharged battery can freeze at approx. + 14° F (-1 0°C). In that case it must be thawed out before jumper cables are used.

Jumper cable specifications:

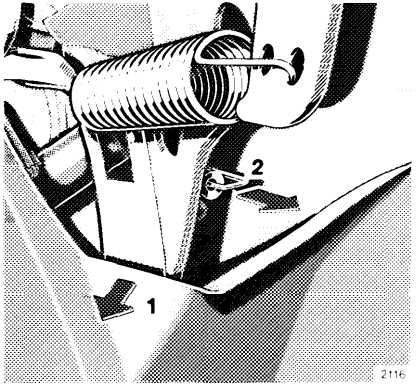
- Minimum cable cross-section of 25 mm^2 or approx. 2 AWG
- Maximum length of 11.5 ft (3.5 m).

Warning!

Never lean over batteries while connecting or jump starting, you might get injured.

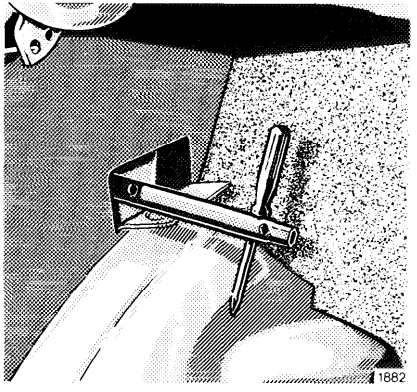
Battery fluid contains sulfuric acid. Do not allow this fluid to come in contact with eyes, skin, or clothing. In case it does, immediately flush affected area with water, and seek medical help.

A battery will also produce hydrogen gas, which is flammable and explosive. Keep flames or sparks away from battery, avoid improper connection of jumper cables, smoking etc..



Manual Release of Fuel Filler Flap

Bend the top of the right trunk panel (1) down slightly. Pull the manual release knob (2) while simultaneously opening the fuel filler flap.



Emergency Operation of Sliding Roof

The sliding roof can be opened or closed manually should an electrical malfunction occur.

Fold back access cover in left side panel of trunk with a screwdriver. Insert socket wrench (from tool kit) through opening in panel and place on the hex-drive of the electric motor. Turn socket wrench (manually) to open or close roof as desired.

To slide the roof closed or to raise the roof at the rear: turn clockwise.

To slide the roof open or to lower the roof at the rear: turn counterclockwise.

Cleaning and Care of the Vehicle

Warning!

Many cleaning products can be hazardous. Some are poisonous, others are flammable. Always follow the instructions on the particular container. Always open your car's door or windows when cleaning the inside.

Never use fluids or solvents that are not designed for cleaning your car.

In operation, your vehicle is subjected to varying external influences which, if gone unchecked, can attack the paintwork as well as the underbody and cause lasting damage.

Such damage is caused not only by extreme and varying climatic conditions, but also by air pollution, road salt, tar, gravel and stone chipping. Grease and oil, fuel, coolant, brake fluid, bird droppings, tree resins etc. should be removed immediately to avoid paint damage. Frequent washing, however, reduces and/or eliminates the aggressiveness and potency of the above adverse influences.

More frequent washings are necessary to deal with unfavorable conditions; for example, near the ocean, in industrial areas (smoke, exhaust emissions), or during winter operation.

You should check your vehicle from time to time for stone chipping or other damage. Any damage should be repaired as soon as possible to prevent the start of corrosion.

In doing so, do not neglect the underside of the car. A prerequisite for a thorough check is a washing of the underbody followed by a thorough inspection. Damaged areas need to be reundercoated.

Your vehicle has been treated at the factory with a wax-base rustproofing in the body cavities which will last for the lifetime of the vehicle. Post-production treatment is neither necessary nor recommended by Mercedes-Benz because of the possibility of incompatibility between materials used in the production process and others applied later.

We have selected car-care products and compiled recommendations which are specially matched to our vehicles and which always reflect the latest technology. You can obtain MB car-care products at your authorized Mercedes-Benz dealer.

Scratches, corrosive deposits, corrosion or damage due to negligent or incorrect care cannot always be removed or repaired with the car-care products recommended here. In such cases it is best to seek aid at your authorized Mercedes-Benz dealer.

The following topics deal with the cleaning and care of your vehicle and give important "how-to" information as well as references to recommended MB car-care products.

Engine Cleaning

Corrosion protection, such as MB Anticorrosion Wax, should be applied to the engine compartment after every engine cleaning. Before applying, all control linkage bushings should be lubricated. The poly-V-belt and all pulleys should be protected from any wax.

Car Washing

Before washing your vehicle, remove insect residues. MB Insect Remover is recommended. Do not use hot water or wash your car in direct sunlight. Use only a mild car wash detergent, such as MB Autoshampoo.

Thoroughly spray the car with a diffused jet of water. Direct only a very weak spray towards the ventilation intake. Use plenty of water and rinse the sponge and chamois frequently.

Rinse with clear water and thoroughly wipe dry with a chamois. Do not allow cleaning agents to dry on the finish.

If the vehicle has been run through an automatic car wash – in particular one of the older installations – rewipe the recessed sections in the taillamps (designed to prevent soiling) if necessary. No solvents (fuels, thinners etc.) must be used.

In the winter, thoroughly remove all traces of road salt as soon as possible.

When washing the underbody, do not forget to clean the inner sides of the wheels.

Note:

It is advisable to lock the trunk lid before using an automatic car wash. The wash brush could inadvertently open the trunk lid.

Tar Stains

Quickly remove tar stains before they dry and become more difficult to remove. MB Tar Remover is recommended.

Window Cleaning

Use a window cleaning solution on very dirty or oil-stained windows.

Wiper Blade

Clean the wiper blade rubber with a clean cloth and detergent solution.

Replace blade twice a year; once before and once after winter.

tieadlamp Cleaning System

The condition of the wiper blades is important for satisfactory cleaning of the headlamp lenses. We therefore recommend that the blades be inspected regularly.

Replace damaged wiper blades.

Plastic Parts, Headliner and Rubber Parts

Do not use oil or wax on these parts. See following page for additional information.

Seat Belts

The webbing must not be treated with chemical cleaning agents. Use only clear, lukewarm water and soap. Do not dry the webbing at temperatures above 176°F (80°C) or in direct sunlight.

Warning!

Do not bleach or dye seat belts as this may severely weaken them. In a crash they may not be able to provide adequate protection.

Instrument Cluster

Use a gentle dish-washing detergent or mild detergent for delicate fabrics as a washing solution. Wipe with a cloth moistened in lukewarm solution. Do not use scouring agents.

Steering Wheel and Gear Shift Lever

Wipe with a damp cloth and dry throughly or clean with MB Leather Cleaner.

Hard Plastic Trim Items, Shelf Below Wear Window, Headliner etc.

Pour MB Plastic Cleaner onto soft lint-free cloth and apply with light pressure.

Upholstery

Using aftermarket seat covers or wearing clothing that have the tendency to give off coloring (e. g. when wet etc.) may cause the upholstery to become permanently discolored. By lining the seats with a proper intermediate cover, contact-discoloration will be prevented.

MB Tex Upholstery
Pour MB Plastic Cleaner onto soft lint-free cloth and apply with light pressure.

Leather Upholstery
Wipe leather upholstery with a damp cloth and dry thoroughly or clean with MB Leather Cleaner. Exercise particular care when cleaning perforated leather as its underside should not become wet.

Paintwork, Painted Body Components

MB-Paint Protector and Sealer should be applied when water drops on the paint surface do not "bead up"; normally in 3 – 5 months depending on climate and washing detergent used.

MB-Paint-Polish should be applied if paint surface shows signs of dirt embedding (i. e. loss of gloss).

MB-Fine Polishing Paste must be used when the paint surface shows signs of excessive fading/ chalking due to lack of care etc..

Do not apply any of these products or wax if your car is parked in the sun or if the hood is still hot.

Use the appropriate MB-Touch-Up Stick for quick and provisional repairs of minor paint damage (i. e. chips from stones, car doors etc.).

Automatic Antenna

For trouble-free operation of the automatic antenna, we recommend to clean the antenna mast periodically.

Ornamental Moldings

For regular cleaning and care of very dirty chrome-plated parts, use a chrome cleaner.

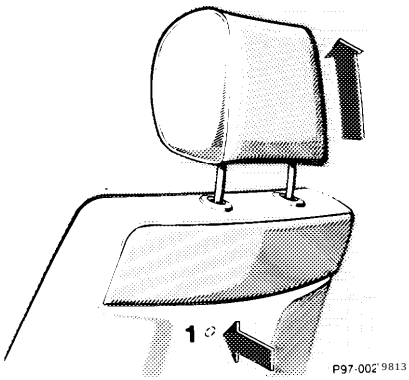
Light Alloy Wheels

MB-Autoshampoo should be used for regular cleaning of the light alloy wheels.

If possible, clean wheels once a week with MB-Autoshampoo, using a soft sponge and an ample supply of lukewarm water.

If the MB-Autoshampoo does not satisfactorily clean the wheels, use MB-Protective Agent for Light Alloy Wheels for normal cleaning and MB-Cleaner for Light Alloy Wheels for heavier dirt accumulation.

Follow instructions on container.



Head Restraints

Removing front seat head restraints:

Move the manually adjustable head restraint slightly forward and pull up to the stop.

Bring the power adjustable head restraint to it's highest position.

Depress release button (1) beneath the seatback covering material and pull head restraint up sharply, holding it by the left head restraint post (viewed in driving direction). Then pull out head restraint completely with both hands.

The release button (1) is located below the left head restraint post on both front seats.

Installing front seat head restraints:

Insert the head restraint and push it down.

With power head restraint it may be necessary to first push up adjustment switch for 5 seconds.

Adjust head restraint to the desired position.

Removing rear seat head restraints:

Pull head restraint up until detent is felt. Then pull it out sharply using both hands.

Installing rear seat head restraints:

Insert the head restraint and push it down.

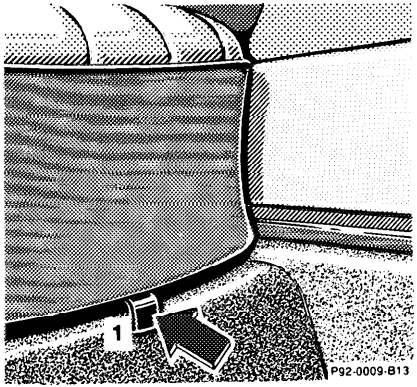
Adjust head restraint to the desired position.

Warning!

For your protection, drive only with properly positioned head restraints.

Do not drive the vehicle without the seat head restraints. Head restraints are intended to help reduce injuries during an accident.

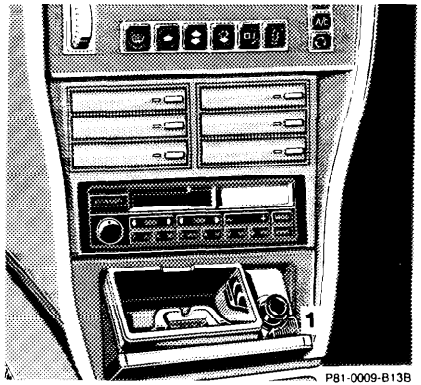
For positioning of head restraints refer to sections *Head Restraints, Front,* and Head *Restraints, Rear* in Index.



Rear Seat Cushion

Removal: Push tabs (1) (left and right side of seat) down and pull up the front of the seat cushion.

Installation: Slide rear edge of cushion under the backrest so that both wire loops under the backrest engage at the seat cushion. Push front of cushion down until it locks in place.



Ashtrays

By touching the cover lightly, the ashtray opens automatically.

Removal of front ashtray:

Prior to removing the ashtray insert move gear selector lever to position "N".

Warning!

With the gear selector lever in position "N", turn off the engine and set the parking brake. Otherwise the vehicle might move unintentionally.

Push the sliding knob (1) toward the right to eject the insert.

Installation:

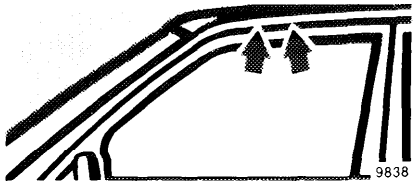
Install insert into ashtrav frame and push down to engage.

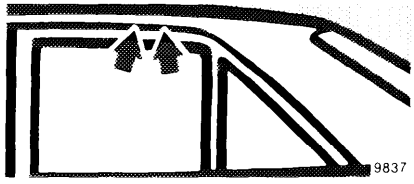
Removal of rear ashtray:

Open ashtray against stop. Press down center spring and remove ashtray.

Installation:

Insert ashtray bottom into frame, push down release spring and close ashtray.

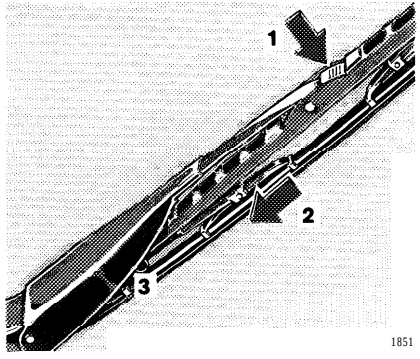




Roof Rack

Use only those roof racks approved by Mercedes-Benz to avoid damage to the vehicle. Follow manufacturer's installation instructions.

Mount supports only between markings on border of roof which are visible when doors are opened.



Replacing Wiper Blades

For safety reasons, remove key from steering lock before replacing a wiper blade, otherwise the motor can suddenly turn on and cause injury.

Windshield Wiper Blade

Removal:

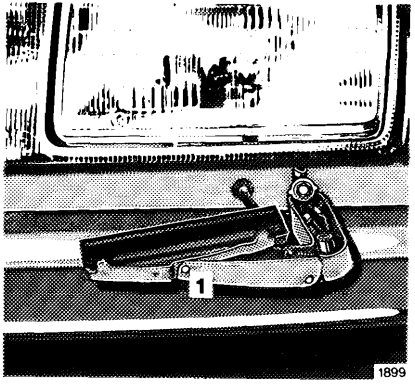
Fold wiper arm forward. **Press** safety tab down (1), push wiper blade downward (2) and remove.

Installation:

Press safety tab of new wiper **blade down. Insert wiper blade** between the tabs (3) on the wiper arm and slide into end of wiper arm. Then press safety tab upward until it locks in place.

Note:

Do not open engine hood with wiper arm folded forward.



Headlamp Wiper Blades

Removal:

Fold wiper arm forward. Lift safety spring tab, press out pin (1) and remove wiper blade.

Installation:

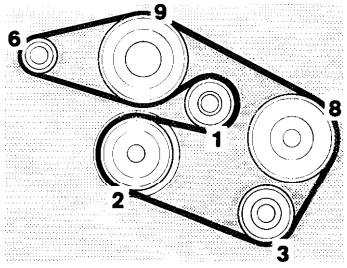
Place wiper blade in the wiper arm and insert pin **(1).**

Spare Parts Service

All authorized Mercedes-Benz dealers maintain a stock of original spare parts required for maintenance and repair work. In addition, strategically located parts distribution centers provide quick and reliable parts service. More than 300,000 different spare parts, even for older models, are available.

Mercedes-Benz original spare parts are subjected to the most stringent quality inspections. Each part has been specifically developed, manufactured or selected for and adapted to Mercedes-Benz vehicles.

Therefore, Mercedes-Benz original spare parts should be installed.

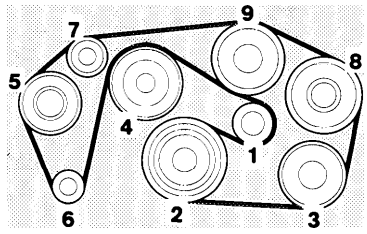


P13-0010-B13A

190 E 2.3

Layout of Poly-V-belt Drive

1 Automatic belt tensioner
2 Crankshaft
3 Air conditioning compressor
4 Fan
5 Air pump
6 Alternator



P13 0001-B13

190 E 2.6

7 Idler pulley
8 Power steering pump
9 190E2.3:
Fan, coolant pump
190 E 2.6:
Coolant pump

For dimensions of the poly-V-belt, see Technical Data in Index.

Please note:

The Owner's Manual contained on this CD-ROM is an Owner's Manual for a model year 1993 190E 2.3/2.6. The Owner's Manual is displayed for general information only. Should you wish to obtain an Owner's Manual for your specific model year and model vehicle, please contact your authorized Mercedes-Benz passenger car dealer or call

1-800-FOR-MERCedes

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Fuels, Coolants, Lubricants etc.
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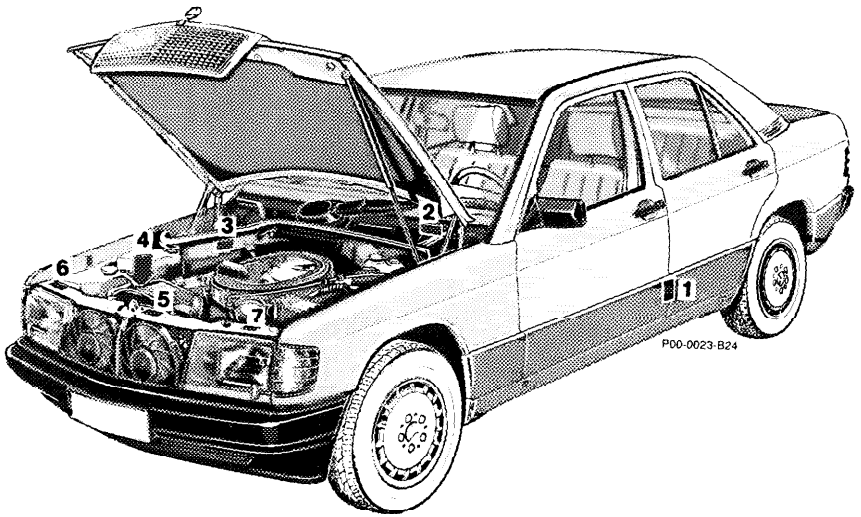


Identification Plates

When ordering spare parts, please specify vehicle identification and engine numbers.

1 Certification Tag (left door pillar)

2 identification Tag

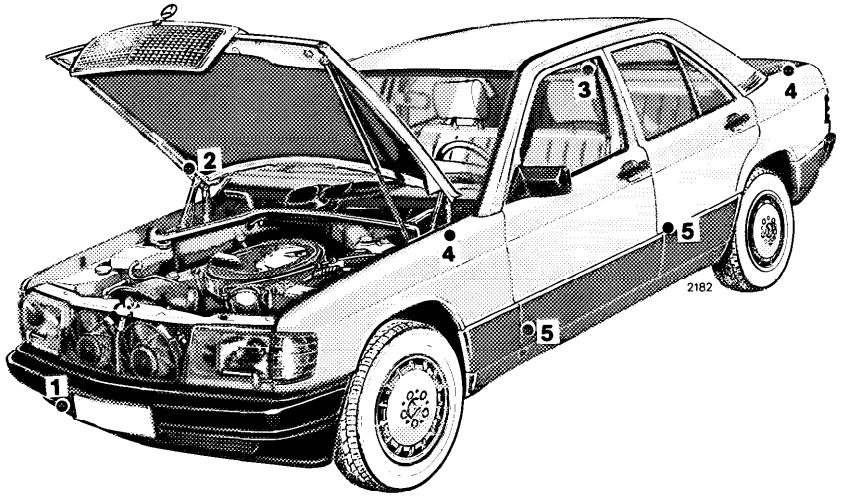
3 Vehicle Identification No.

4 Engine No. (190 E **2.3:** front left)

5 Body No. and Paintwork No.

6 Information Tag California version Vacuum line routing for emission control system

7 Emission Control Tag



Location of labels

1 Bumper front/rear

2 Engine hood

3 Trunk lid

4 All fenders

5 All doors

Engine*: on engine block, rear

Transmission*: on transmission, left front

* not shown in illustration

Theft Prevention

This vehicle complies with the U.S. Federal Motor Vehicle Theft Prevention Standard (49 CFR Part 541). Engine, transmission and certain body parts (see illustration) are labeled at the factory, the labels show the VIN-number of this vehicle.

Spare parts are similarly labeled at the factory in a different location. The labels show the letter R (for replacement) instead of the VIN number

Note:

Do not remove these labels. These labels are intended for parts identification in case of theft. When replacing parts subject to labeling, please make sure that the parts you receive are labeled properly. This is especially important when work is performed outside of the United States.

Warranty Coverage

Your car is covered under the terms of the “warranties” printed in the Owner’s Service and Warranty Policy Booklet, and your authorized Mercedes-Benz dealer will exchange or repair any defective parts in accordance with the terms of the following warranties:

1. New vehicle limited warranty
2. Emission system warranty
3. Emission performance warranty
4. California emission control systems warranty.

Loss of Owner’s Service and Warranty Policy

Should you lose your Owner’s Service and Warranty Policy Booklet, have your authorized Mercedes-Benz dealer arrange for a replacement. It will be mailed to you.

Technical Data 190 E 2.3

Model	190 E 2.3 (201 028)'
Enaine	**102**
Mode of operation	4-stroke engine, gasoline injection
No. of cylinders	4
Bore	3.76 in (95.50 mm)
Stroke	3.16 in (80.20 mm)
Total piston displacement	140.2 cu.in (2298 cm^3)
Compression ratio	9.0
Output acc. to SAE J 1349	130 hp/5100 rpm (97 kW/5100 rpm)
Maximum torque acc. to SAE J 1349	146 ft-lb/3500 rpm (198 Nm/3500 rpm)
Maximum engine speed	6000 rpm
Firing order	I - 3 - 4 - 2
Polv-V-belt	1980 mm

Rims – Tires

Rims (light alloy rims)	6 J × 15 H 2
Wheel offset	1.9 in (49 mm)
Summer tires: Radial-ply tires	185/65 R 15 87 H
Winter tires: Radial-ply tires	185/65 R15 87 T M + S

Electrical System

Alternator	14 V/70 A
Starter motor	12 V/1.4 kW
Battery	12 V/62 Ah
Spark plugs	Bosch H 8 DCO Beru 14 K-8 DUO Champion S 10 YCC
Electrode gap	0.032 in (0.8 mm)

Weights	**See** certification tag
Roof load max.	220 lb (100 kg)
Trunk load max.	220 lb (100 kg)

Main Dimensions

Overall vehicle length	175.1 in (4448 mm)
Overall vehicle width	66.5 in (1690 mm)
Overall height	54.1 in (1375 mm)
Wheel base	104.9 in (2665 mm)
Track, front	56.7 in (1441 mm)
Track, rear	55.9 in (1421 mm)

[1] The quoted data apply only to the standard vehicle. See an authorized Mercedes-Benz dealer for the corresponding data of all special bodies and special equipment.

Technical Data 190 E 2.6

Model	190 E 2.6 (201 029)'
Engine	**103**
Mode of operation	4-stroke engine, gasoline injection
No. of cylinders	6
Bore	3.26 in (82.90 mm)
Stroke	3.16 in (80.20 mm)
Total piston displacement	158.5 cu.in (2597 cm^3)
Compression ratio	9.2
Output acc. to SAE J 1349	158 hp/5800 rpm (118 kW/5800 rpm)
Maximum torque acc. to SAE J 1349	162 ft-lb/4600 rpm (220 Nm/4600 rpm)
Maximum engine speed	6450 rpm
Firing order	1 - 5 - 3 - 6 - 2 - 4
Polv-V-belt	2415 mm

[1] The quoted data apply only to the standard vehicle. See an authorized Mercedes-Benz dealer for the corresponding data of all special bodies and special equipment.

Rims – Tires

Standard model (without Sportline option):

Rims (light alloy rims)	6 J × 15 H 2
Wheel offset	1.9 in (49 mm)
Summer tires:	
Radial-ply tires	185/65 R 15 87 V
Winter tires:	
Radial-ply tires	185/65 R 15 87 T M + S

Sportline model:

Rims (light alloy rims)	7 J × 15 H 2
Wheel offset	1.7 in (44 mm)
Summer tires:	
Radial-ply tires	205/55 ZR 15
Winter tires:	
Radial-ply tires	205/55 R 15 87 T M + S

or:

Rims (light alloy rims)	6 J × 15 H 2
Wheel offset	1.9 in (49 mm)
Winter tires:	
Radial-ply tires	185/65 R 15 87 T M + S

Technical Data 190 E 2.6

Electrical System

Alternator	14 V/80 A
Starter motor	12 V/1.7 kW
Batterv	12 V/62 Ah
Spark plugs	Bosch H 9 DCO Beru 14 K-9 DUO Champion S 12 YCC
Electrode gap	0.032 in (0.8 mm)

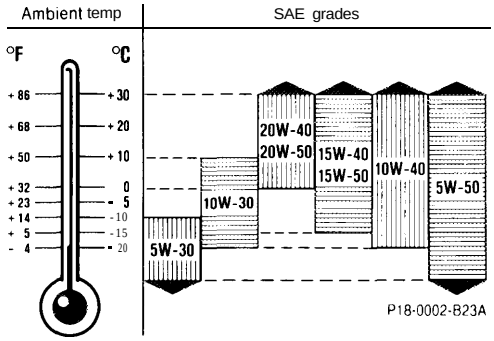
Weights	**See** certification tag
Roof load max.	220 lb (100 kg)
Trunk load max.	220 lb (100 kg)

Main Dimensions

Overall vehicle length	175.1 in (4448 mm)
Overall vehicle width	66.5 in (1690 mm)
Overall height	54.1 in (1375 mm)
Wheel base	104.9 in (2665 mm)
Track, front	56.7 in (1441 mm)
Track, rear	55.9 in (1421 mm)

Fuels, Coolants, Lubricants etc. - Capacities

Vehicle components and their respective lubricants must match. Therefore use only brands tested and recommended by us. Inquire at your authorized Mercedes-Benz dealer.

	Capacity	Fuels, coolants, lubricants etc.
Engine with oil filter		Recommended engine oils
190 E 2.3	5.3 us qt (5.0 l)	
190 E 2.6	6.3 US qt (6.0 l)	
Manual transmission	1.6 US qt (1.5 l)	MB Manual transmission fluid
Automatic transmission	Initial fill: 7.5 us qt (7.1 l) Fluid change: 6.3 US qt (6.0 l)	Automatic transmission fluid

	Capacity	Fuels, coolants, lubricants etc.
Rear axle	1.2 us qt (1.1 l)	Hypoid gear oil SAE 90, 85 W 90
Rear axle with automatic locking differential (ASD)	1.2 us qt (1.1 l)	Hypoid gear oil SAE 90 for limited slip differential
Hydraulic system for automatic locking differential (ASD)	approx. 2.1 US qt (2.0 l)	MB Hydraulic fluid
Power steering	1.1 us qt (1.0 l)	MB Power steering fluid
Accelerator control linkage		Hydraulic fluid
Front wheel hubs	approx. 2.1 oz (60 g) each	High temperature roller bearing grease
Brake and (with manual transmission) clutch reservoir	approx. 0.5 US qt (0.5 l)	MB Brake fluid (DOT 4)
Windshield washer system	approx. 3.2 US qt (3.0 l)	MB Windshield washer concentrate "S"[1]
Windshield washer system and headlamp cleaning system	approx. 5.3 US qt (5.0 l)	
Fuel tank including a reserve of	approx. 14.5 US gal (55 l) approx. 1.6 US gal (6.0 l)	Premium unleaded gasoline: Posted Octane 91 (Average of 96 RON/86 MON)
Cooling system	approx. 10.0 US qt (9.5 l)	MB Anticorrosion/antifreeze

[1] Use MB Windshield Washer Concentrate "S" and water for temperatures above freezing or MB Windshield Washer Concentrate "S" and commercially available premixed windshield washer solvent/antifreeze for temperatures below freezing Follow suggested mixing ratios, see Index

Engine Oils

Engine oils are specifically tested for their suitability in our engines. Therefore, use only engine oils recommended by Mercedes-Benz. Information on recommended brands is available at your authorized Mercedes-Benz dealer.

Brake Fluid

During vehicle operation, the boiling point of the brake fluid is continuously reduced through the absorption of moisture from the atmosphere. Under extremely hard operating conditions, this moisture content can lead to the formation of bubbles in the system thus reducing the system's efficiency.

The brake fluid must therefore be replaced every two years, preferably in the spring.

It is recommended to use only brake fluid approved by Mercedes-Benz. Your authorized Mercedes-Benz dealer will provide you with additional information.

Premium Unleaded Gasoline

Caution!

To maintain the engines durability and performance, premium unleaded gasoline must be used. If premium unleaded is not available and low octane fuel is used, follow these precautions:

- have the fuel tank filled only partially with unleaded regular and fill up with premium unleaded as soon as possible,
- avoid full throttle driving and abrupt acceleration,
- do not exceed an engine speed of 3000 rpm, if the vehicle is loaded with a light load such as two persons and no luggage,
- do not exceed 2/3 of maximum accelerator pedal position, if the vehicle is fully loaded or operating in mountainous terrain.

Fuel Reauirements

Use only 'Premium unleaded meeting ASTM standard D 439:

The octane number (posted at the pump) must be 91 min. It is an average of both, the Research (R) octane number and the Motor (M) octane number: [(R + M)/2]. This is also known as ANTI-KNOCK INDEX.

Unleaded gasoline containing oxygenates such as Ethanol, IPA, IBA and TBA can be used provided the ratio of any one of these oxygenates to gasoline does not exceed 10%, MTBE not to exceed 15%.

The ratio of Methanol to gasoline must not exceed 3% plus additional cosolvents.

Using mixtures of Ethanol and Methanol is not allowed. Gasohol, which contains 10% Ethanol and 90% unleaded gasoline, can be used.

These blends must also meet all other fuel requirements such as resistance to spark knock, boiling range, vapor pressure etc..

Gasoline Additives

A major concern among engine manufacturers is carbon build up caused by gasoline. Mercedes-Benz recommends to use only quality gasoline containing additives that prevent the build up of carbon deposits.

After an extended period of using fuels without such additives, carbon deposits can build up especially on the intake valves and in the combustion area, leading to engine performance problems such as:

- warm-up hesitation,
- unstable idle,
- knocking/pinging,
- misfire,
- power loss.

Do not blend other specific fuel additives with fuel. They only result in unnecessary cost, and may be harmful to the engine operation.

Damage or malfunctions resulting from poor fuel quality or from blending specific fuel additives are not covered by the Mercedes-Benz Limited Warranty.

Coolants

The engine coolant is a mixture of water and anticorrosion/antifreeze, which provides:

- corrosion protection
- freeze protection
- boiling protection (by increasing the boiling point).

The cooling system was filled at the factory with a coolant providing freeze protection to approx. –22° F (-30” C) and corrosion protection.

The coolant solution must be used year round to provide the necessary corrosion protection and increase in the boil-over protection. You should have it replaced every 3 years.

To provide the important corrosion protection, the solution must be at least 45% anticorrosion/antifreeze (equals a freeze protection to approx. –22° F [–30° C]). If you use a solution that is more than 55% anticorrosion/antifreeze (freeze protection to approx. -49°F [–45° C]), the engine temperature will increase due to the lower heat transfer capability of the solution. Therefore, do not use more than this amount of anticorrosion/antifreeze.

If the coolant level is low, water and MB anticorrosion/antifreeze should be used to bring it up to the proper level (have cooling system checked for signs of leakage).

The water in the cooling system must meet minimum requirements, which are usually satisfied by normal drinking water. If you are not sure about the water quality, consult your authorized Mercedes-Benz dealer.

Anticorrosion/antifreeze

Your vehicle contains a number of aluminum parts. The use of aluminum components in motor vehicle engines necessitates that anticorrosion/antifreeze coolant used in such engines be specifically formulated to protect the aluminum parts. (Failure to use such anticorrosion/antifreeze coolant will result in a significantly shortened service life.)

Therefore the following product is strongly recommended for use in your car: Mercedes-Benz Anticorrosion/Antifreeze Agent.

Before the start of the winter season (or once a year in the hot southern regions), you should have the anticorrosion/antifreeze concentration checked. The coolant is also regularly checked each time you bring your vehicle to your authorized Mercedes-Benz dealer for maintenance service.

Approx. freeze protection	Anticorrosion/ antifreeze
-35°F (-37°C)	4.8 US qt (4.50 l)
-49°F (-45°C)	5.5 US qt (5.25 l)

Consumer Information

This has been prepared as required of all manufacturers of passenger cars under Title 49, Code of U.S. Federal Regulations, Part 575 pursuant to the "National Traffic and Motor Vehicle Safety Act of 1966".

Uniform Tire Quality Grading

Refer to the tire sidewall for the specific tire grades for the tires with which this vehicle is equipped.

All passenger car tires must conform to federal safety requirements in addition to these grades.

Treadwear

The treadwear grade is a comparative rating based on the wear rate of the tire when tested under controlled conditions on a specified government test course. For example, a tire graded 150 would wear one and one-half (1 1/2) times as well on the government course as a tire graded 100. The relative performance of tires depends upon the actual conditions of their use, however, and may depart significantly from the norm due to variations in driving habits, service practices and differences in road characteristics and climate.

Traction "A", "B", "C"

The traction grades, from highest to lowest, are "A", "B" and "C" and they represent the tire's ability to stop on wet pavement as measured under controlled conditions on specified government test surfaces of asphalt and concrete. A tire marked "C" may have poor traction performance.

Warning!

The traction grade assigned to this tire is based on braking (straight ahead) traction tests and does not include cornering (turning) traction.

Temperature "A", "B", "C"

The temperature grades are "A" (the highest), "B" and "C", representing the tire's resistance to the generation of heat and its ability to dissipate heat when tested under controlled conditions on a specified indoor laboratory test wheel. Sustained high temperature can cause the material of the tire to degenerate and reduce tire life, and excessive temperature can lead to sudden tire failure. The grade "C" corresponds to a level of performance which all passenger car tires must meet under the Federal Motor Vehicle Safety Standard No. 109. Grades "B" and "A" represent higher levels of performance on the laboratory test wheel than the minimum required by law.

Warning!

The temperature grade for this tire is established for a tire that is properly inflated and not overloaded. Excessive speed, underinflation, or excessive loading, either separately or in combination, can cause excessive heat build up and possible tire failure.

Problems with your Vehicle

If you should experience a problem with your vehicle, particularly one that you believe may affect its safe operation, we urge you to immediately contact your authorized Mercedes-Benz dealer to have the problem diagnosed and corrected if required.
If the matter is not handled to your satisfaction, please discuss the problem with the dealership management, or if necessary contact the Owner Service Manager at the Mercedes-Benz Regional Office nearest you (see Owner's Service and Warranty Information booklet for addresses). You may also write directly to us at the following addresses:

In the U.S.A.:
Owner Service Department
Mercedes-Benz of North America Inc.
One Mercedes Drive
Montvale, NJ 076450350

In Canada:
Owner Service Department
Mercedes-Benz Canada Inc.
849 Eglinton Avenue East
Toronto, Ontario, M4G 2L5

For the U.S.A. only.

The following text is published as required of manufacturers under Title 49, Code of U.S. Federal Regulations, Part 575 pursuant to the "National Traffic and Motor Vehicle Safety Act of 1966".

Reporting Safety Defects

If you believe that your vehicle has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Mercedes-Benz of North America Inc..

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Mercedes-Benz of North America Inc..

To contact NHTSA, you may either call the Auto Safety Hotline toll-free at l-800-424-9393 (or 366-0123 in Washington, D.C. area) or write to: NHTSA, U.S. Department of Transportation, Washington, D.C. 20590. You can also obtain other information about motor vehicle safety from the Hotline.

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Service and Literature

Your authorized Mercedes-Benz dealer has trained technicians and original Mercedes-Benz parts to service your vehicle properly. For expert advice and quality service, see your authorized Mercedes-Benz dealer.

If you are interested in obtaining service literature for your vehicle, please contact your authorized Mercedes-Benz dealer.

We consider this to be the best way for you to obtain accurate information for your vehicle.

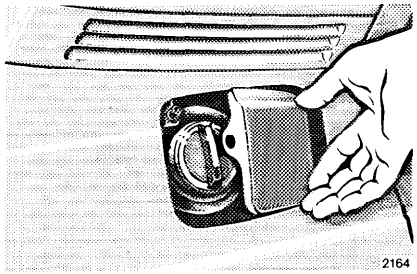
Warning!

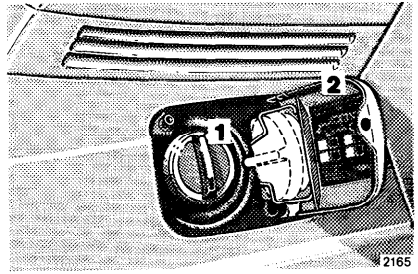
To help avoid personal injury, be extremely careful when performing any maintenance work or repairs. Improper or incomplete service may damage the vehicle or its equipment, which may in turn result in personal injury.

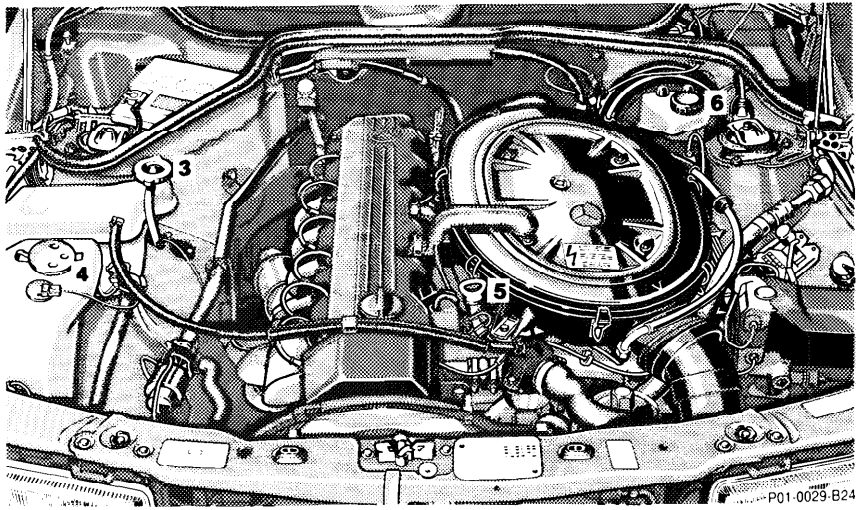
If you have any question about carrying out some service, turn to the advice of an authorized Mercedes-Benz dealer.

NOTES:

Check Regularly and Before a Long Trip







The engine compartment of model 190 E 2.6 is illustrated.

1 **Fuel Supply: To** add fuel turn cap to the left and hold on to it until possible pressure in tank has been released, then remove the cap.

2 **Tire Inflation Pressure:** Check at least every two weeks. For details see Index.

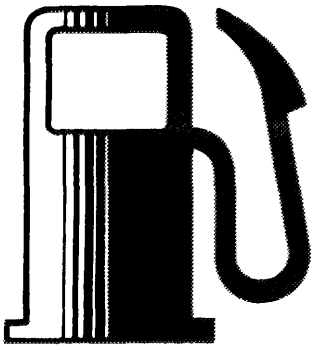
3 **Coolant Level: See** Index.

4 **Windshield Washer System, Headlamp Cleaning System: See** Index.

5 **Engine Oil Level: See** Index.

6 **Brake Fluid: See** Index.

Vehicle Lighting: Check function and cleanliness. For replacement of light bulbs, see Index.



What You Should Know at the Gas Station

See last page

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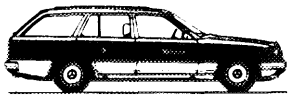

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P98-0002-B12

Drive Sensibly – Save Fuel

Fuel consumption, to a great extent, depends on driving habits and operating conditions.

To save fuel you should:

- keep tires at the recommended inflation pressures,
- remove unnecessary loads,
- remove ski racks or roof-mounted luggage racks when not in use,
- allow engine to warm up under low load use,
- avoid frequent acceleration and deceleration,
- shift manual transmission to next highest gear whenever possible,
- have all maintenance work performed at regular intervals by an authorized Mercedes-Benz dealer.

Fuel consumption is also increased by driving in cold weather, in stop-and-go traffic, on short trips and in hilly country.

What You Should Know at the Gas Station

- **Fuel:**

  Use premium unleaded gasoline: Posted Octane 91 (Average of 96 RON/86 MON).

  Fuel tank capacity approx. 14.5 US gal (55 l). This includes approx. 1.6 US gal (6.0 l) reserve.

  Only fill fuel tank until the discharge nozzle unit cuts out – do not overfill.

Warning!

Gasoline vapor is highly flammable. It burns violently and can cause serious injury. Whenever you are around gasoline, extinquish all smoking materials. Never allow sparks, flame or smoking materials near gasoline!

- **Engine Oil:**

  Engine oil level check, see Index.

  Quantity differential between upper and lower dipstick marking level: 2.1 US qt (2.0 l).

  Recommended engine oils, see Index.

- **Automatic Transmission:**

  Automatic transmission fluid.

  For level checks refer to Index.

- **Coolant:**

  For normal replenishment, use water (potable water quality).

  For further information (e. g. anticorrosion/ antifreeze), refer to Index.

- **Spark Plugs:**

  Approved spark plugs refer to “Technical Data”, (also see Index).

- **Bulbs:**

  High and low beams: Halogen type 9004,
  fog lamps: Halogen type H 3,
  tail, parking and standing lamps 10 W/6 cp,
  turn signal, parking, side marker and standing lamps, front 21/5 W/32/3 cp,
  turn signal lamps, rear 21 W/32 cp,
  stop lamps 21 W/32 cp,
  rear fog lamp 21 W/32 cp,
  license plate lamps 5 W.

- **Tire Pressure:**

  For tire pressure refer to tire pressure chart on fuel filler door.

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